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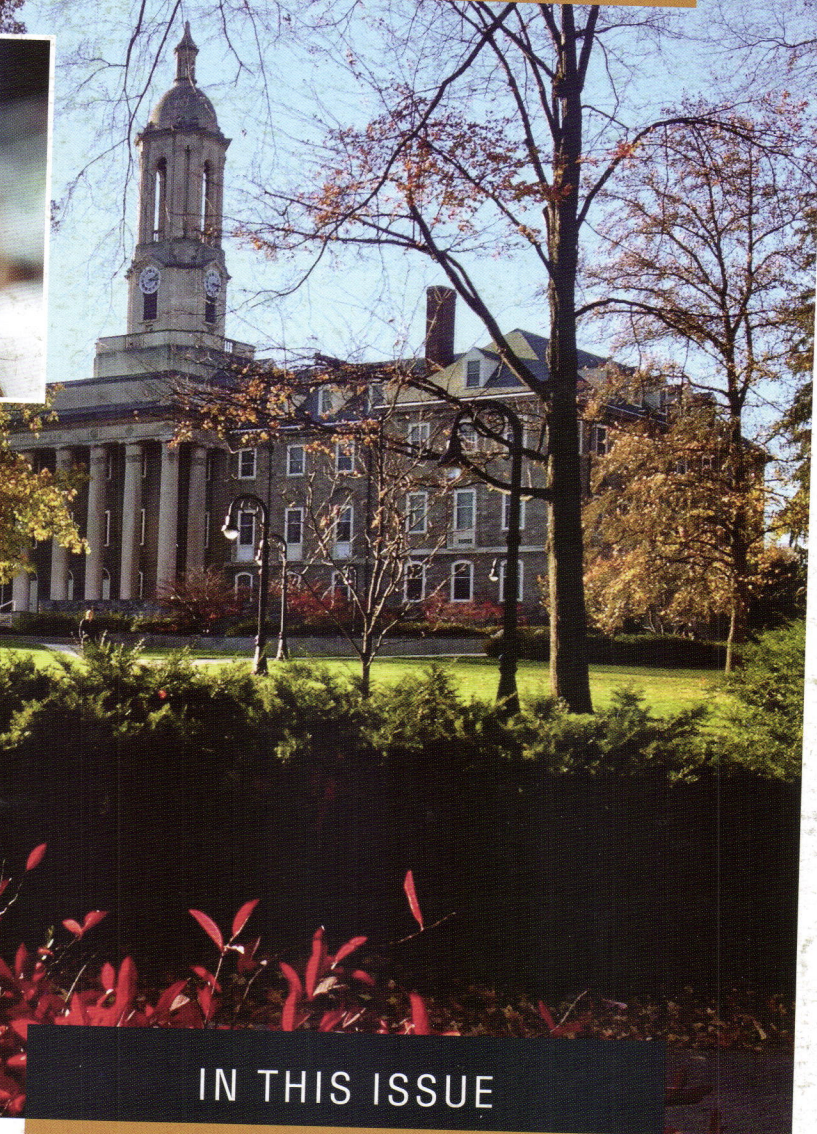
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Fall
Volume 18
Number 3

*Association for
College and
University
Technology
Advancement*



JOURNAL



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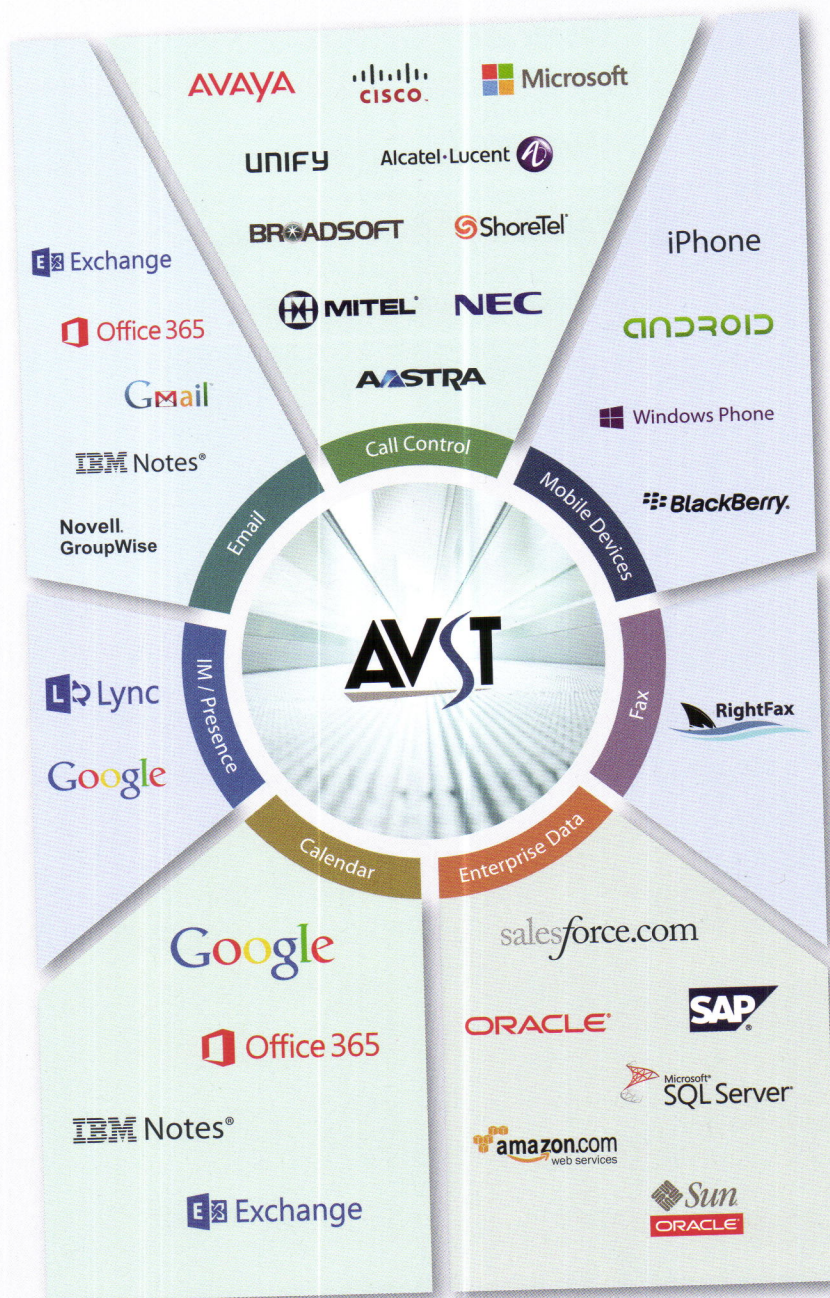
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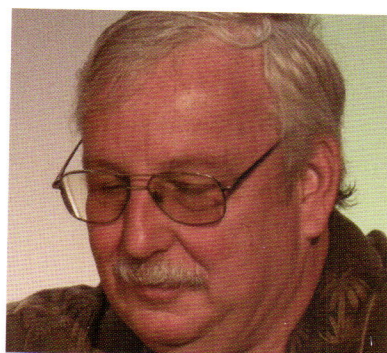
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Quotes of Note



As IT departments, we must plan far enough into the future (using our crystal balls) to ensure that we're ready to meet the ever-changing needs of our educational, research, and administrative units, without receiving from them a clear vision of their intentions for the future.

Michele Morrison
Client Services Manager
IT Services
British Columbia
Institute of Technology



We often find ourselves working on the leading—or even bleeding edge—of technology, which has inherent risk. But this risk can be minimized by leveraging the collective experience of the ACUTA Community through the Listserv. It's far better to learn from the mistakes of others than to make them yourself.

Walt Magnussen, PhD
Director of
Telecommunications
Texas A&M University

The Year Ahead

Fall Seminar	October 26 – 29, 2014	Park Plaza Hotel Boston, Massachusetts
Winter Seminar	January 25 – 28, 2015	Disneyland® Hotel Anaheim, California
44th Annual Conference	April 19 – 22, 2015	Hyatt Regency Hotel Atlanta, Georgia

Core Purpose and Values

ACUTA's mission is to advance the capabilities of higher education communications and collaboration technology leaders.

ACUTA's core values are to:

- encourage and facilitate networking and sharing of resources
- exhibit respect for the expression of individual opinions and solutions
- fulfill a commitment to professional development and growth
- advocate the strategic value of communications and collaboration technologies in higher education
- encourage volunteerism and contributions by individual members



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We need to build our campus network to support the sort of agnostic communications, device independence, and collaboration tools that will attract students to the program. Three of the highest priorities should always be speed, capacity, and security.

Neal Tilley, Alcatel-Lucent

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Creating a holistic Internet of Things platform that encompasses cloud computing, intelligent networking, mobility, and security will help fuel innovative solutions through the use of data analytics to optimize the impact and effectiveness of these inventive solutions.

Tamara Closs, Verizon

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PRESIDENT'S MESSAGE

UNM's 125th Anniversary

by Mark Reynolds
University of New Mexico
ACUTA President, 2014–2015

What is IS/IT doing technology-wise on campus? First you have to set the baseline and complexity of your environment, set the stage, and paint the picture.

The University of New Mexico (UNM) is that city within the city providing IT services 24/7/365. It's challenging, complicated, and yet rewarding. I have been in higher education for 31 years and in IT since the 1970s, watching and experiencing technologies from that era to today's unified, anywhere/anytime requirements.

The question begs, what has IS/IT been doing technology-wise since the '70s?

Let's Paint the Picture

UNM was founded in 1889 with the passage of House Bill 186 by the Legislative Assembly of

Grande, to the Sandia Mountains to the east, Albuquerque is a blend of culture and cuisine, styles and stories, people, pursuits, and panoramas.

The People

As a Hispanic-serving institution, UNM represents a cross section of cultures and backgrounds. In the spring of 2012, 27,278 students attended the main campus, with another 7,933 students at branch campuses and education centers.

UNM boasts an outstanding faculty that includes a Nobel laureate, two MacArthur fellows, 35 Fulbright scholars, and several members of national academies. UNM employs 21,595 people statewide, including employees of University Hospital. The university has more than 157,000 alumni, with Lobos in every state and 92 foreign countries. More than half choose to remain in New Mexico.

The Programs

Cutting-edge research and creative endeavors flourish at UNM, where research injects millions of dollars into New Mexico's economy, funds new advancements in healthcare, and augments teaching, giving students valuable hands-on training in state-of-the-art laboratories. Offering more than 215 degree and certificate programs, UNM has 87 bachelor's degrees, 72 master's degrees, and 38 doctoral programs. The Health

Sciences Center (HSC) is the state's largest integrated health care treatment, research, and education organization

The Lobo Nickname

When the university began playing football in 1892, the team was simply referred to as "The University Boys" or "Varsities" to distinguish the players from the prep school kids.

The Lobo is respected for his cunning, feared for his prowess, and seen as the leader of the pack. It is the ideal name for the Varsity boys who go forth to battle for the glory of the school.

Awards and Achievements

The University of New Mexico Hospital was among 375 organizations nationwide that were given Hospitals and Health Networks' 2014 Most Wired award. The list is based on a survey looking at infrastructure, business and administrative management, clinical quality and safety, and clinical integration.

In 2013, UNM IT was one of eight organizations to receive Piñon Recognition for excellence.

IS/IT Strategies and Plans

IS/IT identified the following areas of focus for the months ahead:

- Academic technologies
- Applications services
- Campus network services
- Computing platforms
- Customer service
- Governance and service portfolio
- Project management standards (ITIL)

The Network Snapshot

- Over 1,000,000 voice calls per month (auto attendant, voicemail, IVR, station, long distance, local, and international)
- 1,000+ miles of network fiber
- 10,000+ miles of telephone copper infrastructure
- 55,000+ wired connections per day
- 18,000+ wireless connections per day
- 150+ monitored fire-alarm systems
- 300+ monitored intrusion systems
- 100+ IP CCTV cameras on the network

The reliability and importance of IT services, expertise, and direction are key to the mission of the university, Health Sciences, and the hospital. Because we are aware of this dependency, we continue to raise the bar on the level of services we provide.

the Territory of New Mexico. In 2014, UNM looks back at 125 years of history and accomplishments, while also looking forward and planning for what lies ahead.

Founded as New Mexico's flagship institution, the University of New Mexico now occupies nearly 800 acres along old Route 66 in the heart of Albuquerque, a metropolitan area of more than 900,000 people.

From the magnificent mesas to the west, past the banks of the historic Rio

- Emergency E911 system supporting the university, HSC, and University Hospital for life and safety
- Reduction in staff with attrition, retiring baby boomers, and private industry salary competition

The Network Team

The network team includes subject matter experts in voice, data, infrastructure, and physical security. The different divisions provide a host of services to multiple branches or, in many cases, the entire UNM system.

- **The IT Construction Management** team serves the entire UNM system, as well as other educational entities requesting assistance.
- **RCDD Services** provides information transport design services to the entire system and more. UNM IT also provides professional training opportunities that are open both internally and to the public.
- **IT Communications and Network Infrastructure Maintenance and Repair Services** serves the entire UNM system with one-call monitoring, cable repair, emergency restorations, and IT infrastructure modifications, remodels, renovations, and daily adds, moves, and changes.
- **IT Networks Procurement Services** provides the ability to manage RFPs, estimates and quotes for network services, and products serving the entire UNM system to ensure the best value is achieved for the university.
- **IT Networks Utility Infrastructure Planning Services** provides input, design on the University Utility Master Planning Sessions, and other planning sessions related to utility infrastructure throughout the UNM system.
- **IT Networks provides long-haul transport**, such as point-to-point radio and other systems related to information transport statewide networks, including the design, installation, and maintenance of optical fiber.
- **Research Connectivity:** Network Services provides connectivity and a member of Internet2 (I2). UNM receives

connectivity to I2 from ABQG, which also provides multiple Internet connections to UNM for business continuity. UNM also peers with the national labs (Los Alamos National Labs and Sandia National Labs) to their research network (ESNet) via the ABQG GigaPop. In this way, UNM researchers can collaborate with the labs more easily.

- **Internet and Campus Connectivity:** Network Services manages the UNM main campus network and provides access to the Internet for UNM branches, hospitals, and clinics. Wired network services include high-speed Internet connections to classroom buildings, branch campuses, researchers, and residence halls. Voice and video are transmitted on the same network. The wireless network was redesigned and upgraded in 2012. Network Services also provides low-voltage cabling infrastructure to support UNM capital projects and to enable the delivery of IT services.
- **Telephone Services:** Network Services provides voice services to the main campus, the HSC, and University Hospital and its clinics, as well as branch campuses and university agencies. Telephone services include a suite of technology for analog, VoIP, and digital phone services, including telephones, carrier support, voicemail, voicemail automated attendants, conference calling, and automatic call distribution—call center functional-

ity. Emergency 911, code blue, elevator, ring-down notification systems.

• **Electronic Security and Alarms**

Services: Network Services provides installation, maintenance, inspection, and 24-hour monitoring of intrusion alarm (keypad/code-operated burglar, hold up, and panic alarm systems); special condition alarm (flood, liquid level, freezer, temperature, and maintenance alert notification); and CCTV systems (closed circuit IP “camera” systems).

Summary

The reliability and importance of IT services, expertise, and direction are key to the mission of the university, the Health Sciences Center, and the hospital. Because we are aware of this dependency, we continue to raise the bar on the level of services we provide.

As a cost center, we continue to look for efficiencies in providing services and try to be competitive for the staff, faculty, and students. At the most basic level, our challenge is to keep the lights on with funding reduced each year, but in that we are no different from other higher-education institutions.

Our IT organization was integrated years ago, and that was the start of our efficiencies. We continue today to work together efficiently and provide a robust, reliable network for now and the future.

Reach Mark at reynolds@unm.edu.

*Join me for some great networking at the
Fall Seminar in Boston, October 26–29!*

Our two topics —

*Trends in Service and Technology Delivery and
Securing Our Connected Environments—
will be interesting, enlightening, and practical.*

—Mark



FROM THE CEO

What's Important on Campus

by Corinne M. Hoch, PMP
ACUTA CEO

Standing in front of you at the Annual Conference

and addressing a crowd of several hundred intelligent, hard-working professionals always makes me feel proud and humble at the same time.

I am humbled just knowing that you are investing your time and resources to come to our event and that you, rightfully, expect to take home plans and strategies. But I am proud to be the CEO of an organization of people who care about each other and who willingly share the information and experiences that have brought each of us success.

At the business meeting in Dallas at last spring's annual conference, I caught the electric buzz in the room as you shared your projects, budgetary status, and cloud computing efforts and described the impact of BYOD. True to my promise to let everyone know what's happening at other schools, I'm happy to share the following snapshot of what is going on today at campuses large and small, public and private, with and without residence halls.

Top Technology Issues

DAS, wireless, and WiFi continue to be the most important IT initiatives on your campuses, followed closely by the **increasing importance of information security, minimizing the risk of cyber security breaches, promoting PCI compliance, and identity management**, which tells me that the ACUTA Program/Content Committee and the Environmental Scanning Committee have an excellent grasp on ACUTA membership needs. For example, the 2014 State of

ResNet survey results were revealed immediately following the Annual Conference in Dallas (available at www.acuta.org and printed in the 2014 summer journal), and the June and July webinars were devoted to security.

In 2012, unified messaging/unified communication (UM/UC) was reported to be the most important initiative. In 2013 it moved to fourth place, and this year it has moved to third place, which may substantiate my thought that many implementation efforts have been initiated and are ongoing.

Unified messaging/unified communication and VoIP migrations share third place with SIP, and President Mark Reynolds piloted a video conference in July to share PRI-to-SIP conversion stories. Look for more of these opportunities for informal networking with ACUTA colleagues in the future.

Numerous other initiatives or challenges that were mentioned are listed on page 7. We will look next at other high-priority issues—cloud services, BYOD, and budgets.

Cloud Services

When asked to what extent cloud services have come to your schools, the responses indicate much growth in areas other than just e-mail, although this year faculty and staff e-mail in the cloud eclipsed student e-mail in the cloud. Perhaps we

learned from moving the students over, so we initiated more faculty/staff e-mail projects in 2014.

Google Apps for Education led the list of cloud projects, followed by Box and Dropbox for storage, followed by WiFi. There was a 20 to 30 percent annual growth in bandwidth, which explains the demand for the expansion of access points and the need to evolve WiFi.

Other cloud-based projects on campuses everywhere are:

- PBX to cloud
- Microsoft Office 365
- Student information system
- VMware
- Course management
- Learning management

It is not surprising to note that some schools look first to the possibility of cloud sourcing when faced with the need to implement new technologies. Some schools are looking into the development of providing internal cloud services. And some schools are not interested at all. Everyone shares concern about privacy and security with cloud management.

BYOD

When asked what impact BYOD is having on your campus, the following were your responses:

- Security/risk management—there is a greater focus on security policies (data ownership, registration, etc.).
- WiFi is impacted. One campus cited the driving force for the need to evolve WiFi is the 20–30 percent annual growth in the demand for bandwidth.
- Greater demand for bandwidth and a greater demand for the expansion of access points
- Moving toward centralization of authorization devices
- BYOD usurps available funding, which keeps us in the networking department on our toes trying to predict what students will bring to campus.
- Struggles with onboarding and how to connect devices
- MDM discussions

- Eduroam deployment
- Stadiums

Other responses include BYOD resulting in minimal impact due to the implementation of a network access control system, the presence of competing philosophies, and the assertion that your campus is already “BYOD recognized.” My translation? You have dealt with BYOD for years and are confident that you have it under control.

Budgets

When asked how the economic recession of the past few years affected IT department spending, **the majority of schools responded that their budgets are starting to increase**, followed by the schools that reported that budgets are flat with some project dollars available, followed by the schools that reported no change. And then there are always the schools that continue to live with budgetary constraints.

It should come as no surprise that there are ongoing discussions to prioritize spending, but it is the first time that I saw the interesting comments below:

- “Economic growth and marijuana tax will allow higher funding.”
- “Budget is protected because our strategic plan includes globalization. There is much work going on behind the scenes, preparing each campus to support the ever-changing needs of higher education.”

I encourage you to continue to use ACUTA as a resource for benchmarking and for sharing information about technology within your environment. Let me know if there are questions for which you seek answers, and we will do our best to connect you with the experts in your field.

Reach Corinne anytime at choch@acuta.org or at the ACUTA office: 859/278-3338.

Big Issues on Campus

At the business meeting in Dallas last spring, we asked attendees to identify the initiatives and challenges that were requiring attention on their campuses. The following are their replies:

DAS	Nurse call
Wireless	Library/classroom technology
WiFi	WiFi in classrooms
Information security	IPTV
Cybersecurity	Apple TV
PCI compliance	e-learning
Identity management	Interactive white boards
UM/UC	Outsourcing resnet
SIP	New stadium
Voicemail and PBX upgrades	CIO search
Consolidation of services	Strategic plan review
Revamping how you provide services	PMI/strategic planning
Cloud/private cloud	Reorganizations
External partnerships	Analytics
Help desk	New data centers
24/7 support center	Replacing fiber
Virtualized servers	Backbone redesign
Digitizing spaces	Network infrastructure
Office 365	Service model/SLAs
Videoconferencing	Exploring the future beyond our legacy systems to support all of the above
Building projects	Disaster recovery to test all of the above
RTLS (real-time locator service)	

Fall Seminar • Boston • October 26–29

• Sunday Pre-Session 1: Secrets for a Successful Security Program

This pre-session will cover essential practices for planning, designing, budgeting, implementing, maintaining, and assessing a comprehensive information security program.

• Sunday Pre-Session 2: ITSM Experiences and Implementation Workshop

Join us as we hear from universities that have or are currently implementing ITSM strategies in improving their services. What works, and more important, what doesn't? Following the discussion, our panel will host practical exercises designed to introduce multiple facets of ITSM, such as service catalog creation and change management policy.

• Track 1: Trends in Service and Technology Delivery

The Trends in Service and Technology Delivery track will explore how the “as a service” trend is offering new avenues for service delivery; how virtualization in the data center, in the network, and at the desktop is operating new opportunities for service delivery; how delivery of services doesn't depend on physical assets; and how these delivery options are changing hiring practices within technology service departments.

• Track 2: Securing Our Connected Environments

The Securing Our Connected Environments track will explore methods institutions are utilizing to educate their faculty, staff, and students about securing their devices, technology solutions, appropriate access to and use of technology or data, and best practices employed to enable ease of access without compromising security.

Register today! www.acuta.org/fs14



Winter Seminar

January 25–28 • Anaheim, California

Track 1. Exploring Identity and Access Management Strategies

Authentication and authorization are functions that touch almost every system and solution leveraged by universities. The Exploring Identity and Access Management Strategies track will examine various elements associated with moving to a unifying identity solution for access, roles, and rules enforcement. In addition, the track will highlight federated approaches to include resources outside institutional data centers.

Track 2. The Ever-Evolving Realm of Mobility

Devices, WiFi network standards, and cellular networks have experienced multiple generational changes over the last five years, and this rate of change doesn't appear to be waning anytime soon. This track will explore the implications of this constant state of change that influences budgets, projects, teaching practices, staffing requirements, learning outcomes, and strategic plans.

Watch for Details! www.acuta.org

Tips for Presenters and Panelists

Avoid Presentation Anxiety

- From your first hint of tightness, breathe deeply. Smile!
- Design some flexibility into your presentation to anticipate the unexpected.
- Visit the room where your session will be held. Check out the view from the lectern or table.
- Greet the audience as soon as possible. Make eye contact on a regular basis with people in different sections of the room.
- Remind yourself that ACUTA audiences enjoy hearing about one another's experiences and support one another.

Put Yourself in the Participants' Shoes

- Be sure that your content reflects the description in the printed brochure and the slides. If you have updated your material, acknowledge that to your audience.
- In most cases, you should stand for your presentation.
- Anticipate questions and seek audience feedback during your presentation.
- Verify that everyone can hear you and see your slides, especially fine print and the material at the bottom of the screen.

- The attention span of adult learners is about 20 minutes. Structure your presentation so that you refocus attention every 15 or 20 minutes.
- It is very helpful for presenters to define acronyms and technical terms.
- Avoid promoting products/services or unfairly criticizing vendors.

Please Use a Microphone

- Use a microphone, even if you believe you have a voice that carries well.
- Repeat questions from the audience. This will help the audience as well as people who will listen to the tape recording of this session.

Use of PowerPoint Slides

- Most ACUTA presenters project PowerPoint slide shows while they are speaking, and ACUTA posts copies of presenter materials in PDF format on the conference app and on a website for attendee access.
- A corporate logo may appear on the first slide only. Copyright notations are permissible on every slide.

- Avoid using font sizes less than 28 points in slide shows. Enlarge drawings where possible. Limit the text to about six lines per slide.
- Attendees lose interest when presenters read from their slides.

Make It Interactive

Sessions that are interactive and informative are the most fun. Some hints:

- Encourage and leave sufficient time for questions and audience discussion.
- To get the discussion going, rather than asking, "Are there are any questions?" ask, "How many of you have been faced with a similar situation?"
- Have participants work in pairs for a couple of minutes to discuss a specific problem or to share experiences.
- Have fun and enjoy the important contribution you are making!

To present a session at an ACUTA event, talk to Michele West at 859/721-1655 or mwest@acuta.org.

Cables and the Cloud

How IT is transforming Penn State

by Katie Jacobs

Information technology isn't a luxury on campus anymore—it's a necessity. Students, faculty, and staff members need the most up-to-date technologies to facilitate learning, teaching, and research. As one of the largest public universities in the United States, Penn State has to tackle the challenges that come with serving its more than 98,000 students across 24 campus locations (plus its online virtual campus, the Penn State World Campus), while accommodating the needs of a long roster of faculty and staff. With the university's reach constantly expanding, IT staff have to work hard to keep everyone and everything connected. And Penn State IT includes a huge group of people as well—with more than 1,400 staff in multiple units, it provides services that help the whole university function, from the computer clusters used by researchers to the course management system used by students and faculty.

That also means staff are using a whole lot of different applications, software, and systems to provide their services. "Last year, the university had an assessment by an external company that discovered that many of the apps being used overlap—many of them are different but do the same things," says Brian Ladrado, software implementation coordinator. "We wanted to see if we could consolidate. If we can get everyone working on the same apps and move them onto the cloud, staff can spend more time focusing on Penn State IT's goal: providing the best IT services."

Consolidation

To consolidate applications and promote collaboration and unity within all of

Penn State IT, the university is working with cloud company ServiceNow to incorporate its service management program across units. ServiceNow gives access to cloud services that can be used across multiple units, allowing all the services offered by a department—or, potentially, a university—to be managed in the same place.

If everyone uses ServiceNow, it will become a single record-keeping system. Instead of each office having its own ticketing system, for example, there could be one for the whole university. This would give everyone access to records and bring everyone onto the same page, particularly useful if two units are working with the same ticket.

With everything tracked in the same place, it also becomes easier to identify common problems and pinpoint where more attention is needed. Maintenance becomes easier with less infrastructure to maintain, and staff can spend more time providing services.

This also opens up more time for collaboration, both among units and between Penn State and other universities. ServiceNow has users at other universities working to improve services by, for example, writing code to improve a feature or remove a glitch. Penn State can take advantage of their work and then give back by building on it.

Ultimately, there's hope that ServiceNow will streamline the university's IT



processes and give staff more time to work together, develop new skills, and do their jobs better.

"A university's IT staff essentially exists to enable teaching, learning, and research, and we need to strive to do that in the best and most efficient way," says Ladrado. "When we have more time to do our jobs, we can be a better IT provider."

Collaboration

ServiceNow isn't the only way Penn State is encouraging cross-university collaboration. Cooperation among education and research institutions is something the university has been investing in since 1996, when it joined several other institutions in forming Internet2, a network built and designed to allow easier collaboration among its member organizations.

In 2011, Internet2 started to focus on cloud services as the next step in bringing value to its members. Its NET+ initiative focuses on collaborating with cloud applications and service providers to enable better education and research.

"IT is constantly evolving. When Penn State established its campus locations, before the Internet came into play, each campus had to develop its own IT systems. But now, many services are centrally located at University Park," says Jeff Reel, strategic IT programs director at Penn State. "Moving forward, we're looking to subscribe to certain cloud-based services so we don't have to build them at all. It's about leveraging services through Internet2 intelligently."

Reel works hard to determine the right sourcing of systems and services, deciding whether services should be built here at Penn State and managed inter-

nally or subscribed to from the cloud.

A recent example is Box, a cloud storage service. By subscribing to the service through Internet2, Penn State saved money and didn't have to worry about managing the individual contracts—an advantage Internet2 brought to the table. But Reel says it's not just about how Penn State can benefit from Internet2.

"We don't just consume," he says. "We believe in the initiative and working collaboratively because it's the right thing to do. Penn State is on Internet2's Program Advisory Group, where we advise NET+ staffing and governance. It's something we're invested in."



Going Wireless

Cloud services aren't the only things floating above our heads—people and technology are relying less and less on physically plugging a computer into an Ethernet port, and wireless service is becoming ubiquitous.

Ten years ago, people on campus were mostly accessing the Internet through their desktop computers, which were stationary. Now, students are bringing laptops, smartphones, video game consoles, and other gadgets that are always trying to connect to the Internet.

To accommodate the growing need for WiFi, Penn State is working on a series of upgrades, including infrastructure

improvements, making free visitor wireless available across the campuses, and providing wireless Internet in the dorms.

Visitor wireless has been established at University Park and its campus locations, WiFi is currently being phased into the dorms, and other upgrades are set to be completed by 2016.

The new upgrades will support current demand—allowing students to connect their devices to services like Netflix and Hulu, faculty to work anywhere on campus, and visiting researchers to access their own work and collaborate while visiting Penn State.

While wireless Internet for the common good of students, faculty, staff, and

visitors is important, there is still a need for a sturdy wired infrastructure backbone for support.

Even though there's a lot of emphasis on having WiFi everywhere these days, wireless Internet stops at the access point. After that, it comes down to the infrastructure, and keeping it maintained and updated is essential.

Infrastructure is everywhere. Even The

Arboretum at Penn State—a garden, park, and research facility at University Park campus—has WiFi and central systems for irrigation.

To get Internet to the university, Penn State purchases service through Pittsburgh and Philadelphia. But a lot can happen over miles of fiber running up and down mountains, along highways, over creeks, and through the forest. To provide redundancy, there are multiple circuits running between the university and its service providers, just in case something happens to one.

But Penn State doesn't have just one campus to provide service to; it has 24, including its centrally located campus

at University Park. This necessitates a huge network spanning Pennsylvania. Originally, each campus was connected directly only to University Park. This usually worked, but if a line went down, the campus was cut off from service.

To prevent this, Penn State is in the middle of a project, called Mountain Laurel, that is providing redundancy to all campuses.

"We're splitting the campuses into groups of three, with the third point always being University Park," says Ron Dodson, director of special projects. "Then we run a circuit between the other two, creating a triangle. If one of the connections to University Park goes down, the connection is rerouted the other way, providing redundancy in a budget-friendly way."

Penn State has a 25th campus: the World Campus, which provides online degrees and certificates, educating

students from 50 states, 60 countries, and seven continents, and bringing its own challenges to the table.

It used to be common practice for scheduled maintenance hours to take place during times of least traffic. For example, ANGEL, the university's course-management software, was taken offline between four and six in the morning every day for maintenance. This may have worked in the past, but with people from time zones across the globe logging onto Penn State systems at all hours of the day, this isn't a possibility anymore. Now, the expectation is to provide all access, all the time.

So a router may serve 80 to 100 buildings, while also powering World Campus systems, and can't just be shut off. Dodson says Penn State is now building systems that are able to be updated without being completely shut down.

When they're designed, they're built with redundancy so it can always stay powered and connected.

"No one sees you doing the maintenance—that's the goal. These days there's little room for downtime; it's not an option," says Dodson. "Everyone has different times when they need the network, and we have to make it available for them."

Conclusion

So while IT staff may strive to be invisible, the results of their efforts certainly aren't. As Penn State continues to expand and increase its influence globally, Penn State IT is working to bring faculty and students closer together, bettering itself and the university at the same time.

Katie Jacobs is public relations specialist at Penn State. You can reach her at kej5009@psu.edu.

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Snapshot

U.S. Campuses Spending \$4 Billion Annually on Unmanaged, Unmeasured Investments

Higher-ed IT pros point to cloud- and software-defined as keys to progress. According to "Cloud Campus: The Software-Defined College," a report issued in August 2014 by MeriTalk, the size of the higher-education (HED) cloud market is \$4.4 billion, and 19 percent of HED IT spending, or \$4 billion per year, is done outside of the central IT function. The study further reveals that HED IT pros estimate 18 percent of their IT systems are redundant, costing U.S. HED institutions \$3.8 billion annually.

At the same time, institutions are struggling to keep up with growing IT requirements. According to the survey, 82 percent of HED IT executives say their network is more complex today than it was two years ago, and there is no additional IT budget to support new requirements. HED IT pros note that the primary factors driving the increased network complexity include increased use of mobile devices and mobility requirements (61 percent), an increase in diversity of IT needs among end users (57 percent), and an increased number of applications (50 percent).

As institutions turn to the cloud, their IT pros give current deployments mixed grades. When asked to rate their satisfaction with services they have deployed using a cloud model, 69 percent were satisfied with their learning management systems, 67 percent with their blended learning environments, 54 percent with their massive open online courses (MOOCs), and 47 percent with their open educational resources (OERs).

Additionally, HED IT execs report a collaboration chasm between IT and academic departments—81 percent say it is not standard operating procedure for IT and academic departments to jointly develop plans for future IT-related initia-

tives. This disconnect is directly reflected in the working relationship between the two tribes: 57 percent believe end users view their department as the "fix it" folks, and just 22 percent say they are viewed as a trusted ally.

As they face these challenges head-on in an effort to enable their institutions' academic missions, HED IT executives recognize the cloud opportunity: 53 percent say the cloud is vital to their institution's future competitiveness, and more than one-third say the cloud will help improve student retention rates. While they currently face IT roadblocks, the cloud is proving to be the key to progress.

"IT can help transform and evolve the student learning experience," said Tim Merrigan, vice president of state/local/education at VMware. "Institutions must eliminate silos, increase agility, and effectively support varied educational missions—including computer-intensive R&D and online course offerings. Cloud- and software-defined environments are the keys to getting them there—quickly, easily, and, very importantly, on budget."

HED institutions are taking action, as many are deploying cloud computing. HED IT pros say that 54 percent have migrated e-mail, and 30 percent offer conferencing and collaboration.

Considering the flavors of the cloud, 35 percent have deployed software-as-a-service, 20 percent infrastructure-as-a-service, and 17 percent platform-as-a-service. Despite these steps forward, IT departments continue to face barriers to cloud migration—namely, security, cost, and culture.

Additionally, institutions recognize the power of software-defined environments. Though just one in five have deployed software-defined technology, more than twice as many see it as an

effective solution for their IT challenges. To address growing IT requirements, the primary enterprise benefits they see to a truly centralized, software-defined campus include increased operational efficiency (54 percent), improved continuity of operations (48 percent), improved security (45 percent), decreased operating expenditures (41 percent), and decreased capital expenditures (40 percent).

Institutions need to take the key steps necessary to centralize IT and make the most of the cloud, software-defined technology, and "as-a-service" solutions. Today:

- 58 percent are not surveying academic and research staff on IT needs.
- 64 percent are not offering a catalog of IT services.
- 77 percent are not offering service-based pricing/chargeback models.

HED IT pros recommend steps to improve IT value, including greater collaboration between IT and academic departments (59 percent), reducing redundant systems (40 percent), and increased investment in key solution areas including virtualization (38 percent), the cloud (27 percent), and software-defined data centers and storage (26 percent).

"The cloud campus has no boundary and no curfew," says Steve O'Keeffe, founder of MeriTalk. "If we're going to maximize progress, we need to break down the divide between IT and the business functions on campus."

"Cloud Campus: The Software-Defined College" is based on an online survey of 152 higher-education IT executives in June 2014. The report has a margin of error of +/- 7.92 percent at a 95 percent confidence level. To download the full study, please visit www.meritalk.com/cloudcampus.

High Expectations for the Campus Network

Get your network ready—the games are about to begin

by Neal Tilley

In my travels as a director of education technology across North America, I have always been keen to understand what sort of market insight would help the many dedicated people in the information technology departments of universities and colleges. How can I help lift IT and communications decisions to a strategic level to ensure that they are viewed at the head table as a crucial element of a successful university mission?

In higher ed today we are seeing lots of changes and threats to the status quo. Previously, IT may have been seen as a customer service and IT departments as a service provider. But I believe things are about to change, and technology will be pivotal to, if not the most important element inside, a university's makeup.

Studies¹ show that over 89 percent of universities are now accommodating BYOD, by standardizing policies to meet student demand for access, especially Web access, and to support technology in the classroom. BYOD forces change in campus network technology that can then be used to implement powerful new educational methodologies such as *gamification*. Surely, we are well on our way to covering our student needs for the future.

Unfortunately, this rise in BYOD is just part of the story for universities; this boom in wireless devices is just the start

of the evolution of our next-generation students and the teaching environment. In fact, reacting to that rise in mobile devices across a campus is the first step in building the next-generation campus network.

Because the pool of traditional students seems to be shrinking, the competition for attracting new students and retaining them for the full term of a program has become fiercer, and a major concern for many institutions is the lack of change in their strategies to deal with this development. This evolving recruitment opportunity may be influenced by two main factors: the increase in online courses/online universities and the increased importance of what technology is immersed in the courses the student experiences.

In a recent study, 63 percent of current college students stated that technology on the campus was *critical* to choosing which college they attended. A similar study of high school students indicated that 93 percent said campus technology was an important criteria in their choice of a university.

Part of this can be attributed to the change in digital resource expectations and the acceptance of blended learning across all of education. The move to an environment that balances online and face-to-face engagement and utilizes more collaboration and multimedia is more akin to personal learning and its benefits. This may be the best and most popular route for universities to attract those undecided students.

Gamification?

Interest is growing in the use of gamification, and many are recognizing its potential to revolutionize the next-generation education environment. This has potential to be education's killer app, and yet most organizations and their IT departments have yet to grasp the potential or understand the impact of adapting their existing traditional teaching environment in this way. What we do know is that new students have grown up with this phenomenon and are very attracted to any school or college that uses it.

Gamification (or gamerfication) has been growing in acceptance across all levels of education for the past few years.

In particular, education has the most to gain from the simple application of gaming techniques to training and knowledge transfer. Historically, we can see that game consoles and simulations

have become realistic and ingenious. From the introduction of Wii to the use of gaming software to "smarten up" curriculum design and course development, the journey is still a relatively short one. Today, role playing and massively multiplayer engines offer educators a

[Gamification] has the potential to be education's killer app, yet most organizations and their IT departments have yet to grasp the potential or understand the impact of adapting their existing traditional teaching environment in this way.

¹ Much of the statistical information for this article comes from Alcatel-Lucent. See their excellent slide collection online at www.slideshare.net/Alcatel-Lucent_Enterprise/the-game-of-zones-the-future-of-the-converged-campus.

hugely innovative and powerful tool in driving a student's learning forward. I am sure that conversations about Minecraft, Luminosity, ClassDojo, and many others are becoming more and more relevant to the education field.

Understanding what can be done with gamification and its effect on the campus network will grow in importance for any IT department, network manager, or communications team. A great source of information is from one of the leading lights in gamification, Yu-kai Chou at Stanford University. He has created a complete framework for gamification and deep dives on the power and potential across all levels of education. His TED presentation is a great insight into this and the success gamification has had on many areas of life.

Chou points out that the average gamer is 35 years old, there are as many women as men, and 68 percent of gamers are between 18 and 35 years old—the age of the majority of today's college student pool!

Chou's framework, called Octalysis, provides a comprehensive way to research and prepare for the potential of this technology evolution. As this trend grows in significance, it is likely that online universities will utilize its potential first. Logically, this will have a domino effect as the traditional campus universities try to compete and adapt their education technology. So not only is gamification potentially being used to attract students, but it will also start to influence networking strategies.

What Do We Do Next?

How can we prepare for the future and help IT decisions become strategic to any university's future? First, we can build a new learning foundation that will support a service level in BYOD and digital-learning methods across any device. We need to build our campus

network to support the sort of agnostic communications, device independence, and collaboration tools that will attract students to the program. Three of the highest priorities should always be speed, capacity, and security.

We need to show that new ways to interact with students on campus and online are available in the classroom and that our network is able to ensure that instructional technology is not restricted by physical borders but rather is unified and accessible anywhere.

We should build the campus network to support and promote the use of personal learning tools, empower teachers,

So, What Is Gamification?

Gamification is the use of game thinking and game mechanics in nongame contexts to engage users in solving problems. Gamification has been studied and applied in several domains, with some of the main purposes being to engage (improve user engagement, physical exercise, return on investment, flow, data quality, timeliness), teach (in classrooms, in public, or at work), entertain (enjoyment, fan loyalty), measure (for recruiting and employee evaluation), and improve the perceived ease of use of information systems. A review of research on gamification shows that most studies on gamification find it has positive effects.

Taken from Wikipedia, August 8, 2014

and give the enrollment team a unique perspective. We should build a campus network that, even if it cannot embrace gamification, is at least ready for the unsolicited innovations that are coming.

By building a pervasive wireless campus with unified access for all, we can support the increase in multimedia content (both instructional and student created) and support the media-sharing tools that are replacing projectors and

allowing air grouping and Digital Living Network Alliance (DLNA) to prosper.

This type of network will allow new levels of customization in the classroom setting, plus more widespread integration of video, online-learning management tools, and instant retrieval of information via any device. This network will maximize the impact of lecture capture and live webcasting of classes.

Alcatel-Lucent Enterprise researched the challenges and created a blueprint for the campus network that consists of four main areas of focus: LAN Core, Unified Access, Pervasive WLAN, and LAN Edge Evolution. They also created guidelines for planning and building a strategy for shaping the campus network—the next-generation network for the next-generation students.

These guidelines help universities take stock of their existing environment and consider how best to direct the network to support what is coming in terms of expectation and requirements by each of the schools and students. The guidelines ask questions such as:

- Do you need the ability to prioritize various learning streams and specific applications on both wired and wireless networks?
- Are your priority applications getting the right share of the network?
- Is your network ready to support next-generation classroom applications?
- Do you have or need next-generation wireless across the campus?
- What sort of density and bandwidth needs do you need to support?
- Are virtualization and cloud-based services going to work seamlessly with your existing environment?
- How do you enforce legal and integrity compliance for all BYOD users?
- Do you need to enforce differentiated access to the network as an innovation?
- Can you explore alternatives to pro-

jectors and the use of media sharing?

- Is gamification in your future? And what is the effect on your network?

SLA for BYOD

Policy management is one area that is vital, and it can be the first step toward enhancing any BYOD deployment.

By drilling down to a user profile and adapting based on the user, location, device, application, and even time of day, we can start to create service level agreements (SLAs) for the constituents of the campus. This takes a vanilla BYOD and turns it into a strategic asset that can enable a university to offer a pathway for students to personal learning. Ultimately, it can satisfy the needs of today's student without affecting the faculty or the delivery of education.

By using device fingerprinting, onboarding, and policy enablement in both wired and wireless zones, a college can adapt service levels per user to meet the different demands of the many departments and the innovations they are trying to offer. In fact, based on the nuances of each part of a functioning college, the ability to create what appears to be an "open" campus network—but one that can also be completely controlled holistically—will be extremely powerful when aligned with the course and instructional elements.

If these "zones" of education can be mapped to technology zones, this would immediately mean that the converged campus would be able to handle multiple requirements at any time. The inherent ability to adapt to real-time activity would ensure that there would be no restriction to the innovation these departments crave, whether that is just in being prepared to give the best experience to a student or allowing successful delivery of education using new technologies.

Conclusion

Gamification may be a relatively new motivational methodology, but it's a good pulse point to see how a university

is preparing for the future. Hopefully this article and the many forums that are talking about gamification will help all of us prepare for a new era in higher-education technology—an era that will be defined by universities putting IT at the front of the class and embracing these innovations to attract students and deliver new levels of education. If not, then the battle inside the faculty and academic landscape outside of technology will be for nothing, as enrollment is passed by because the signs were not recognized soon enough.

By forearming ourselves with these capabilities now, we can prepare our schools, our executives, and our stakeholders and ensure that they understand the benefits and the impact not just at the student level but also at the university brand level. Where schools and depart-

ments are autonomous today, they will need to be able to assist and strengthen the external view of a university's brand in the future. As IT people, we need to help them understand that they can still have their academic differentiators, but that everything needs to be underpinned with a holistic and supportive network across the entire campus, if not even further across the online campus environment.

In short, preparing your network for this new era should be about the "Game of Zones" and not turn into a "Game of Thrones™"!

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NMSU Builds a Better VoIP LAN

New approach saves \$1 million

by Gary Audin

Most institutions are moving from a TDM PBX platform to an IP PBX that communicates via an Ethernet LAN to the desktop IP phone. They do not have a choice because the TDM systems are at end-of-life and support is being terminated. The telecom staff has to contend with LAN switches and cabling. Alternately, the IT and networking staff take over the migration to IP phones connected over Ethernet. The existing voice cable—Category 3—is abandoned because it does not support Ethernet. This was the situation faced by Ray Cadena, manager of telecommunications systems, and Piyasat Nilkaew, assistant director of telecommunications and networking, at New Mexico State University (NMSU).

NMSU is a major public, land-grant, research university in Las Cruces, New Mexico. Founded in 1888, it is the oldest public institution of higher education in the state of New Mexico. As of 2011, NMSU is the second largest four-year university in the state, in terms of total enrollment across all campuses as of 2011. There are five NMSU locations, with the main campus situated in Las Cruces as well as campuses in Alamogordo, Carlsbad, Doña Ana County, and Grants, with extension and research centers across New Mexico. It has a total undergraduate enrollment of 14,276, its setting is urban, and the campus size is 3,500 acres.

Traditional Voice/Data LAN

Voice over IP has existed long enough to have a traditional approach to supporting IP phones. The IP phones usually derive

their power from the LAN switch. There are five power categories for power over Ethernet (PoE). (See Figure 1.) Most IP phones are Class 2. A few are Class 3 in their power consumption. The lower the class number, the more IP phones can be supported by the LAN switch power supplies.

In order to save cabling and LAN switch ports, the common approach is to install an IP phone with dual Ethernet ports. The desktop connects to the IP phone, which then connects to the LAN switch port over Category 5 or better cable. A LAN switch in the IP phone delivers preferential treatment to voice packets, with data packets receiving a lower priority to ensure that voice quality is not compromised. This is the initial approach employed by NMSU. In their first voice/data LAN installation, Cadena said it took two to three weeks to implement the traditional approach for a

an alternative solution. The proposed solution would have these advantages:

- Use the existing legacy phone cable connecting the existing legacy RJ21 connector to the LAN switch.
- Isolate the voice traffic from the data traffic on a separate LAN, creating an IP-voice-only LAN.
- Connect to endpoints as far as 1200 feet from the closet, four times farther than standard 330-foot Ethernet cable installation.
- Centralize the power backup in the main distribution frame (MDF) rather than in multiple IDF closets.

Cadena estimates that using this approach saved over \$1 million for the institution, and the installation was less risky and less disruptive. A larger building with about 200 phones took two to three days for installation using the existing legacy cabling.

How the Technology Works

The technology NMSU deployed was from Phybridge (www.phybridge.com/). It is called Power over Long Reach Ethernet (PoLRE). The design employs a LAN switch with a different cabling system. It uses a single-

pair, Category 3, voice copper cable that is already deployed for legacy phones. No cable modifications are required at the closet or desktop. The PoLRE LAN switch can connect to the installed legacy cabling using the existing RJ21 connector, so no rewiring is necessary.

Figure 1. Power Categories for PoE

Class	Plain Language Description	Power Range (Watts)
0	Unclassified (Not implemented)	0.44–12.94
1	Very Low Power	0.44–3.84
2	Low Power	3.84–6.49
3	MidPower	6.49–12.95
4	PoE+/Type II Devices	>12.95

100 IP-phone installation. Their existing LAN switches with added PoE were used. Backup power had to be located in the intermediate distribution frame (IDF).

NMSU Tries Another Technology

The NMSU IT and telecom staff was approached by their VAR, Black Box, with

PoLRE delivers Ethernet signals with no modems employed, supporting full-duplex 10 Mbps Ethernet. The LAN switch delivers Ethernet and PoE on the single copper pair for up to 1,200 feet of cable. A media adapter—for example, an IP phone—is required at the endpoint. The media adapter converts RJ11 input to a standard RJ45 Ethernet connection. The LAN switch can support Class 1 and Class 2 IP phones and Class 3 phones that consume less than 10 watts. For shorter reaches, more power can be delivered to the endpoint.

The PoLRE LAN switch connects to a standard Ethernet uplink on copper or fiber operating at 1 Gbps. The PoLRE LAN switch is agnostic to the uplink

device and can connect to any standard LAN switch or router.

An Unexpected Benefit

The benefits of the PoLRE approach produced significant budget savings in capital expense and labor time and shortened the implementation time. Because no new cables were needed, the existing legacy cable documentation was all that was needed. Nilkaew said that if they had initially known about the PoLRE products, their planning would have changed considerably.

He also discovered another benefit. His telecom and networking staffs worked together on the installation, which fostered a good working relationship between the two groups. It produced

a more integrated workforce, especially during the initial installation but also when troubleshooting problems.

Other institutions have embraced the same solution NMSU chose, including Virginia Tech, Texas A&M, Arizona State University, Florida State University, and Wagner College in New York.

For more information about this installation, watch the video interview with Ray Cadena and Piyasat Nilkaew at NMSU at www.phybridge.com/support/phybridgetv.html.

Consultant Gary Audin is principal at Delphi, Inc. He has many years of experience in communications technology and is a frequent contributor to ACUTA publications. Reach Gary at delphi-inc@att.net.

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Harvard Turns to Technology for Teacher Evaluations

Observation becomes unobtrusive with new technology

by Tim Root

Think back to the old days when your elementary school principal would slip into the back of the classroom and make mysterious jottings on a yellow pad. Your teacher appeared nervous. No matter how quiet the principal tried to be, it seemed the door always slammed as she bustled her way out of the classroom.

Evaluating educators has traditionally been an intrusive, subjective process. One person could determine a teacher's fate. Good day or bad day—new material or review—the evaluation of those few minutes became part of the teacher's permanent record (yes, teachers had one, too!).

Flash forward to this past year. Researchers at the Center for Education Policy Research (CEPR) at Harvard Uni-

versity wanted to know if teacher evaluations have to be done the old way, and the answer is No. Instead, they gave teachers cameras in classrooms across the country to learn whether video technology allows for better teacher evaluations. The study is called the Best Foot Forward project.

"The goal is to identify whether video technology can make observations fairer and more reliable, easier to implement, and more preferable to teachers and administrators," says Mark Nelson, a coordinator for the study.

The Best Foot Forward project is a three-year research study based at CEPR. The study was conceived by CEPR faculty director Tom Kane, principal investigator for the MET project, and is directed

by Miriam Greenberg, who previously helped roll out video observations for nationwide teacher certification programs.

In 2012–2013, Harvard ran a limited pilot study to test equipment and procedures. The study team hopes to share data that show whether video technology will help improve the way classroom observations are implemented and ultimately improve teacher quality.

"During the 2013–2014 school year we implemented a controlled study, and we will continue to expand our treatment for the 2014–2015 school year," Nelson says. From there, the team plans to share findings with researchers and practitioners interested in improving classroom observations.

"School systems are struggling to make classroom observations fair and useful," Nelson says. "There is a tremendous need for evidence on ways to improve the process for both teachers and principals. The study team hopes to share data that show video technology will help improve the way classroom observations are implemented and ultimately improve teacher quality."

The study team is working with school districts in Colorado, Delaware, Georgia, and California, including rural, suburban, and urban sites. Approximately 120 K–12 administrators and 500 teachers have participated in either the pilot year or first year of study implementation. According to Nelson, "What makes our study unique is that we are examining the use of digital video for teacher evaluation." What is interesting about the

Figure 1. The original Harvard setup used a GoPro camera and Revolabs Dual Channel wireless microphones to allow researchers to study classroom activity. (Students' faces blurred for privacy.)



program is that, with some modification, it could be applied in many university—or even corporate—settings where it is necessary to evaluate performance.

Project Goals

Classroom observations and teacher evaluations vary around the country, but they typically include in-person observations—announced and unannounced.

Observers, usually school administrators or sometimes district staff, go into a classroom and take “objective” notes. This can range from coding to descriptions to scripting a lesson word for word. These observations are then used to rate the teacher based on a standardized rubric (varies by district or state) and contribute to the teacher’s final evaluation. Critics of traditional evaluations say they are time-consuming and subjective and leave teachers nervous about surprise visits.

The Harvard study is called the Best Foot Forward project because it allows teachers to videotape themselves and submit classroom footage for observation; in other words, it allows them to put forth their best work to their principals and not worry about unscheduled evaluations. The concept of teacher-manned evaluations was developed based on findings in the Measures of Effective Teaching (MET) project, one of the largest studies of teachers in the United States to date. In the MET study, teachers in Hillsborough County, Florida, were allowed to select self-taped lessons for observation. Researchers, however, could rate the chosen and unchosen videos. They found that while the chosen videos were of higher quality, the order ranking of teachers was the same on the unchosen videos. This caused researchers to ask, if measurement reliability is preserved while allowing teachers control, are surprise evaluations necessary?

Similar evaluations are performed in many areas outside of education—call centers, sales pitches, and theater arts performances all must be evaluated without being intrusive in the actual job going on.

Taking technology from the XYZ College of Education and putting it under the teacher’s control, as Harvard’s CEPR is doing, is revolutionary. At present, video technology is mostly used in teacher education and professional development. For example, some alternative teacher certification programs use videotaped classroom lessons for coaching purposes. Additionally, many higher-education institutions use video for distance learning.

The Best Foot Forward project uses multiple forms of technology to solve

Figure 2. The iPad and Swivl kit are the latest iteration of technology used in Harvard’s Best Foot Forward study.



those conundrums. An interesting array of technology makes the program tick.

Technology Deployed

In the first phase of the project, dual wireless microphones from Revolabs (Sudbury, MA) were placed in each classroom. A wearable mic was given to each teacher, and an omnidirectional microphone was placed to allow all the other sounds in the classroom to be heard clearly.

Upon first-time setup during initial installation, the wireless microphone on the teacher requires pressing just two buttons to pair a microphone to the receiver. Afterward, the teacher only has to pick up the mic from the charger and it’s active.

Obviously, sound quality and the ability to hear voices coming from all points in the room were critical to the success of the project. The real challenge with many wireless systems is not only the ability to clearly record voices from various distances, but also to handle interference from others using the wireless technology outside the classroom. Since the microphones use the DECT protocol, they are impervious to GSM noise from other wireless electronic devices.

Battery life can also be a concern. But in this case, each wireless mic provides up to eight hours of talk time and saves the expense of battery replacement.

Each classroom also has a GoPro camera—yes, the same unit used to film downhill skiers and surfboarders—in the back of the room. The GoPro has a very wide angle of view with minimum distortion at the edges, which makes it ideal for viewing everything from classroom activity to kayaking.

In a Harvard University study, the institution does not back or promote any particular technology; however, project officials say that, over the past few years, they have learned a lot about what various devices have to offer. “Ultimately, we look for equipment that is easy to operate (in setup, capture, and uploading to a platform), does not interfere with classroom activity or behavior, and provides the best view(s) of the classroom,” Nelson says. In its pilot year, Harvard deployed GoPro HERO3 cameras paired with Revolabs Dual Channel wireless microphones. Harvard used the 02-HDDUAL-NM model microphone.

Revolabs’ 128-bit encryption means fewer privacy concerns because the signal sent between the microphone and base station is encrypted. Although this provided great sound and a clear, wide-angle view of the classrooms, it proved difficult for teachers to set up and operate.

In the first study year, Harvard implemented thereNow’s Insight DUOMini,

which afforded teachers two distinct views of the classroom. This coming study year they will be using thereNow units that are already in the field, supplemented by a tablet device operating on a Swivl base. The Swivl tracks the teacher as he or she walks around the room and captures two audio streams with remarkable clarity.

Harvard expects the tablet will be more successful because it is familiar to most educators and allows teachers to film, review, and upload from a single device.

Consistently throughout the study, the Harvard researchers used the online platform BloomBoard as the hub for sharing videos, scoring, and feedback. BloomBoard allows a teacher to share a video with his or her administrator to observe. The observer can then watch the video and tag specific moments using the district rubric, even adding comments.

"So when a teacher does a great job giving students adequate time to think and respond, the observer can tag 'Standard 3C: you provided 15 seconds of

wait time and 23/26 students had raised hands before calling on a single student for response," Nelson says. "This ability to target feedback is very popular with both administrators and teachers," he adds.

The thereNow cameras use an Ethernet cable for smooth and secure upload. The tablet-based kit can be entirely battery operated, and videos can be uploaded via a school's WiFi network. No college, not even Harvard, has the budget to send an IT technician scurrying around the country to 100 locations to rig up the systems needed to make the program work. Thus, every classroom site needs to be as close to "plug and play" as possible.

Handling the Data

The Best Foot Forward project collects multiple forms of data for analysis. "First, we are collecting observation data from teachers and administrators through BloomBoard," Nelson says. "We download teacher videos directly from the encrypted thereNow server and store them in a level 4 data security room."

The involved technology vendors ensure user privacy beyond the research team. Once Harvard's CEPR receives data, they "anonymize" it for analysis. "Privacy and confidentiality are our top priority as researchers."

The team also administers surveys throughout the year to learn about the experience of teachers and principals. Additionally, administrators complete a weekly one-minute survey detailing how much time was spent on observations that week.

"The team also surveys students in the classes of our teachers to explore whether teachers using video can more effectively identify student needs," Nelson says.

Tim Root is CTO at Revolabs. Reach him at troot@revolabs.com.

Learn more about the Best Foot Forward project and other CEPR projects at www.gse.harvard.edu/cepr. Learn more about the technology deployed at www.revolabs.com or the Best Foot Forward's website, <http://bffproject.org/technology/>.



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Online Education: Interesting but Is It Transformational?

Cost and organizational barriers inhibit adoption

by Paul Korzeniowski

Online education, at one time envisioned as the next wave in higher education, is having a subtle, rather than dramatic, impact on education and academic networks. The number of students taking advantage of this option continues to grow: More than three million students opt for an online degree (where more than 80 percent of their classes are virtual) rather than follow the traditional classroom route, and that number is expected to grow by 7 percent this year, according to Eduventures, Inc., an educational market research firm.

But online education is having less of an impact than some might have expected. The online student is the exception rather than the rule: Only 13 percent of the nation's 22 million college students choose online, according to Eduventures. This option seems to be embraced by nontraditional learners (older adults, military personnel, individuals who have spent time in jail) rather than the more typical high school-to-college student.

There are many reasons online courses have garnered only niche acceptance. On many campuses, the technology has been viewed as an outcast, one having trouble finding a home on campus and seldom being totally integrated into campus learning. The underlying technology is costly, complex, and ever changing, so schools have struggled to keep pace with evolving requirements. As a result, it looks like the early boom days have faded, and academic institutions should

find slow, steady, manageable growth in online education in the future.

New Choices Emerge

Traditionally, students traveled to campus, sat in lecture halls, took notes, completed tests, eventually graduated, and moved on. The educational experience was largely face-to-face, and pupils spent the bulk of their time on campus. Early in the millennium, they gained another option as MOOCs appeared and online education reached one of its evolutionary steps up. Today, students have to weigh a series of factors to determine whether this approach makes sense for them, with the trade-off typically centering on convenience versus more personal interactions (see sidebar on page 22).

Online has gained a solid foothold on almost every campus. "It is unusual to find a school that does not offer at least a few online courses," stated Kathleen Ives, D.M., acting chief executive officer/executive director at The Sloan Consortium.

While online learning is widely available, it has struggled to gain a more significant foothold for a number of reasons. Skepticism is one issue. Initially, the impression was that online is easier than traditional classes. A few high-profile cases involving the early online providers hardened that belief, but recently, the picture has been changing. A Gallup poll of online classes versus traditional classes found that Americans like online courses for the value they deliver.

Education: Still a Local Experience

While online means students are no longer geographically bound to any schools, they seem to follow virtual dividing lines. "The notion that online would enable colleges to expand their student body into new territories and take students away from other schools has largely not occurred," said Brian Fleming, senior analyst at Eduventures. Instead, online students tend to be located in close proximity to the school's main campus.

In addition, colleges struggle to integrate online into the organization chart. Where to put the online group and how much power it has varies dramatically from school to school. In fact, there is no consensus about whom they should report to. Oversight responsibilities are divvied up in a hodgepodge fashion: the CIO (42 percent) typically has some responsibility but so do provosts (19 percent), vice presidents or deans of continuing education (18 percent), associate and assistant vice presidents (15 percent), other institutional officers (4 percent), and university presidents (1 percent), according to a survey from the Campus Computing Project, which studies the role of IT in higher education.

Academic institutions, such as the University of Kentucky, establish a separate online department. The Distance Education Graduate Certified Distance Learning Programs and undergraduate Office of eLearning work with college departments and faculty to create online

Online Classes: A Good Fit or Not?

In a classroom or online is a decision that potential students now have to make. Depending on the student's age, economics, and personal situation, one is often a better fit than the other.

Advantages

- Rolling admissions allow students to begin class throughout the year.
- Students attend class at any time. They can work full time or part time, spend time with family and friends, and still study—at a time that is convenient to their schedule.
- Attend classes from anywhere. All the student needs is a computer and Internet access
- Work at their own pace. If students need more time to absorb course content, they can reread the materials until it is understood. If they grasp concepts quickly, they do not have to spend extra time as the teacher reviews the material.
- Equal learning environment for all students: They are not judged by age, physical appearance, personality, health, social status, gender, or economic status.
- Shy students speak up. They are not pressured to match more talkative students. Everyone has a chance to be heard, even those who might never speak in a traditional classroom.
- Expenses are reduced. Books cost about the same, but students cut down on travel expenses and the need for child care when going to class.
- Students improve their technical skills. They learn how to use the latest computers, software, social media, and Internet technologies.
- Students work in virtual teams, which provides them with valuable skills needed in today's global economy.
- Supplement traditional education options: If a desired class is not offered locally, the student may be able to find it online.

Disadvantages

- Absence of traditional classroom structure may cause students lacking self-discipline and good study habits to fall behind in their work.
- Requires a good working knowledge of computer hardware, software, file management, and the Internet.
- A feeling of isolation can arise from a lack of live contact with instructors and classmates. Interaction with other students is a learning opportunity in itself.
- Technical issues: Older hardware and software may not support some of the current classroom functions, so students may not be able to access needed items. Sluggish Internet connections can make downloading course materials tedious.
- Students lack the opportunity to improve their oral communication skills.
- Classes with labs or other types of hands-on work may not be available.

courses, according to Ashley S. Tabb, marketing manager, analytics and technologies, at the University of Kentucky. The university has three online masters programs, 768 online course sections, and more than 5,000 pupils taking at least one online course.

In Search of an Advocate

But this approach is not optimal. At most universities, the various colleges have their own way of developing courseware and integrating online into the curriculum. Creating successful online education offerings today requires a more structured approach; the days of scattered, disparate courses created by instructors working in isolation are over. Because of the complexity and costs entailed, schools need to ensure that they are using best practices and have a coherent approach to distance education. They need a consistent look and feel, along with consistent ways in which information is displayed and by which students access it.

Online departments often lack the clout to put centralized delivery mechanisms in place. The faculty may also resist adopting online courses. Without a strong advocate, distance learning tends to flounder, but an advocate can be difficult to find since online education doesn't always have a natural place to sprout in the institution.

Frequently, schools have to sell the idea of online internally to faculty. In 2011, Utah State University, which has 27,000 students, made a major push into virtual education. The process included having online course consultants meet optionally one-on-one with faculty members and talk about course possibilities. "We tried to make it easy for faculty to adopt online," explained Eric Hawley, CIO and associate vice president for information technology at the university.

The process proved successful. The school, which has 400 acres on its main campus and manages 7,000 more acres from three regional centers, provides classes in 28 of 29 of the state's counties. In 2011, Utah State University offered 59 online courses and had trained 98 faculty members; those numbers are now up to 2,590 courses and 1,456 faculty members.

Show Me the Money

As they sort out the organizational issues, academic institutions encounter other barriers, with cost being a major hurdle. Creating a raft of online classes requires a significant investment by the school. Unless they are working from the cloud, they will need to install online learning systems, content management systems, and courseware and then connect them to applications, such as a college's student information system, library system, and human resources solution.

Often schools turn to multimedia teaching aids to deepen the student experience. Podcasts, course-based wikis, and various video components are included. Some schools purchase video-conferencing systems to promote more face-to-face interaction. Faculty and students need quick and easy network access to their courses from any place on campus, which means significant network upgrades. In certain cases, the online system lives on after graduation. For instance, ePortfolios enable students to store vocational information in a secure manner for future use. To put all the pieces in place, schools often need help from consultants and systems integrators, an additional cost.

In sum, online education is a significant investment. To do it right often requires tens of millions of dollars for network upgrades, new applications, and additional processing power. Typically, the money is not in the IT budget. Justifying such investments can be tricky. Utah State received grants that helped pay for the software as well as the needed IT infrastructure upgrades.

Getting All the Pieces to Work Together

As the system moves to production, additional hurdles arise for communication managers. To comply with various privacy laws, they must put checks in place that authorize users as they enter the campus network, secure their data, and monitor who accesses it. Network bandwidth needs may fluctuate. During finals week, exams will be delivered online, students will study more, and

How Did We Get to the MOOC?

Distance learning has been around for more than 100 years in different forms. As Wikipedia reports, as early as the 1890s, correspondence courses on specialized topics, such as civil service tests and shorthand, were promoted by door-to-door salesmen. Over four million Americans—far more than attended traditional colleges—were enrolled in correspondence courses by the 1920s, when broadcast radio brought free programs to audiences of any size. In 1922, New York University began operating its own radio station, with plans to broadcast practically all of its courses. Students read textbooks and listened to broadcast lectures while mailing in answers to tests.

By the 1940s, radio courses had virtually disappeared in the United States. Universities offered televised classes, starting at the University of Louisville. At many universities in the 1980s, classrooms were linked to a remote campus to provide closed-circuit video access for some students.

In 1994, James J. O'Donnell of the University of Pennsylvania taught a seminar over the Internet, using gopher and e-mail, attracting over 500 participants from around the world.

Today's version of distance ed is the MOOC. The term MOOC was coined in 2008 to identify a massive open online course—an online course aimed at unlimited participation and open access via the Web. In addition to traditional course materials such as videos, readings, and problem sets, MOOCs provide interactive user forums that help build a community for students, professors, and teaching assistants.

Early MOOCs often emphasized open access features, such as connectivism and open licensing of content, structure, and learning goals, to promote the reuse and remixing of resources. According to *The New York Times*, 2012 became "the year of the MOOC," as several well-financed providers, associated with top universities, emerged, including Coursera, Udacity, and edX.

Source: Wikipedia, September 9, 2014

information will flow freely. This would not be a good time to have the network crash (there never is, of course), but it is something that could happen.

The technology is continually changing. "We have found it difficult to support all of the different variations of mobile devices that users work with," admitted Utah State's Hawley. Seemingly minor system inconsistencies can result in students being unable to access needed resources. The result is the communications department fields more help desk calls and has to take more time troubleshooting system configurations.

Many schools are still in a feeling-out process and trying to determine best practices because change seems to be never ending. According to *Campus Computing*, 44 percent of U.S. academic

institutions restructured their online education programs in the last two years. Yet, 59 percent will restructure them in the coming two years, including 30 percent of those who just finished a revamp within the last two years.

Online education presents a bit of a mixed message. Schools have made progress, so the technology is universally accepted. The reality is that online is used by a—growing—fraction of students in most schools but still faces some resistance from both students and administrators.

Paul Korzeniowski is a freelance writer who specializes in communications issues and is based in Sudbury, Massachusetts. He has been writing about these issues for more than two decades and can be reached at paulkorzen@aol.com.

Campus Innovation and the Internet of Things

Devices that communicate with each other are changing the landscape of the campus—and more changes are coming.

by Tamara Closs

There's a time for long-term planning and a time for immediate response to what the customer (student, faculty, administrator) needs in order to be productive. This message was among the insights and recommendations for unleashing the next wave of innovation highlighted in the presentation by James McQuivey of Forrester Research at ACUTA's annual conference in April.

McQuivey's message is particularly relevant in discussions related to the intelligent campus of the future. Developing a road map to build a platform for harnessing the power of machine-to-machine (M2M) solutions, also referred to as the Internet of Things, will enable real-time innovation. This innovation is critical to implementing ideas and effectively managing long-term changes that will help improve the campus experience, enhance security, and drive sustainability initiatives, as well as provide positive return on investment (ROI) through gains in productivity and more efficient use of resources.

Sounds great, but how do you get started? Are there Internet of Things solutions available today that can be deployed in a campus environment? Are there legacy telematics that are moving to M2M? Which departments are using them? How will data be shared? How will data sharing be enabled securely? How will the data be used and analyzed to help support real-time actions and longer-term planning? What impact will M2M solutions have on wired and wireless networks on the campus? What are the

technical components, and what is the role of the central IT department?

What Is the Internet of Things?

First, let's define the Internet of Things, and consider the current landscape and the possibilities within a connected campus.

At a high level, the Internet of Things is defined as a device that captures or monitors an event that is then routed over a network to a centralized application that captures the data to be analyzed and to derive meaningful and actionable information.

The Center for Digital Education Intelligent Campus Research Survey of 2014 notes that 21 percent of education leaders are using process automation, sensors, GPS, or M2M technologies to drive more effective decision making on campus. As the Internet of Things continues to grow and mature, the ability to automate and innovate will affect many parts of the campus and its operations. The Internet of Things will also drive the need to connect all campus stakeholders and systems to fully leverage its technological attributes and provide robust data analytics capabilities. Analytics in education will quickly be focused on prediction, with the aim of developing actionable insights, including:

- Adaptive testing, tracking, and reporting
- Tools for early alert, intervention, and collaboration
- Projects to support institutional efficiency and effectiveness
- Operational initiatives to enhance services and develop new ones, increase

automation, and drive cost savings

- Strategies to attract prospective students, grow enrollments, and enhance student success

What's the Impact of M2M?

Beyond campus-specific Internet of Things applications, consumer and other industry solutions may make their way to the campus with an impact on wired and wireless communications networks. From personal devices such as health and fitness monitors to solutions for tracking and managing infrastructure and assets, campuses will find ways to use these connections and the data they provide to improve services to the campus community. By focusing on the deployment of connected machine technologies to create the campus of the future, colleges and universities can drive operational efficiencies, enhance security, and improve the campus experience to the benefit of students, educators, administrators, and guests. (See Figure 1.)

You may already be aware of some campus-oriented connected solutions. Most physical plant operations have building management systems deployed at some level. Parking and transportation teams may also use M2M solutions. There are also many use cases related to environmental monitoring, such as tracking the temperature in laboratory environments or monitoring weather conditions. Public safety is another common area where connected machine solutions are deployed.

Here are a few examples of campus solutions:

- **Green Campus:** Tight budgets and green business practices are driving the need for smart systems that optimize resources. Utility management provides many opportunities to reduce a campus's carbon footprint and use electricity, gas, or water more efficiently. One example is LED lighting that turns on when motion is detected, thereby reducing electricity usage.
- **Secure Campus:** Campus security is enhanced through monitoring solutions that help you protect property, control costs, and enable effective emergency response. Secure campus includes a broad range of solutions, from keeping the lights on to dissuade inappropriate activities to video surveillance that monitors and protects the campus community in real time to panic buttons on lamp posts and other locations to alert security staff of unsafe situations.
- **Retail Campus:** Simplify transactions while providing services for students, faculty, and staff. Whether for food services, parking, special events, or other activities, M2M provides flexible, secure payment options for the campus community by leveraging solutions that use smartphone technology to interact with near-field communications or QR code readers. Many campuses are deploying M2M technologies to support bike rental or sharing programs.
- **Efficient Campus:** Using real-time location and wireless technologies such as M2M, GPS, and RFID, physical asset management systems help campuses track asset location, report costs against assets, manage inventory and service requests, and coordinate maintenance programs and reporting. For example, applications that enable bus tracking allow students to monitor the location of campus transportation and determine the estimated time of arrival. Other common use cases relate to food services, such as temperature monitoring, and even augmented reality where a mobile app on a smartphone can be used to display campus building information, including class schedules and teacher availability.

Once you have a good understanding of what solutions and technologies your campus is already using and those

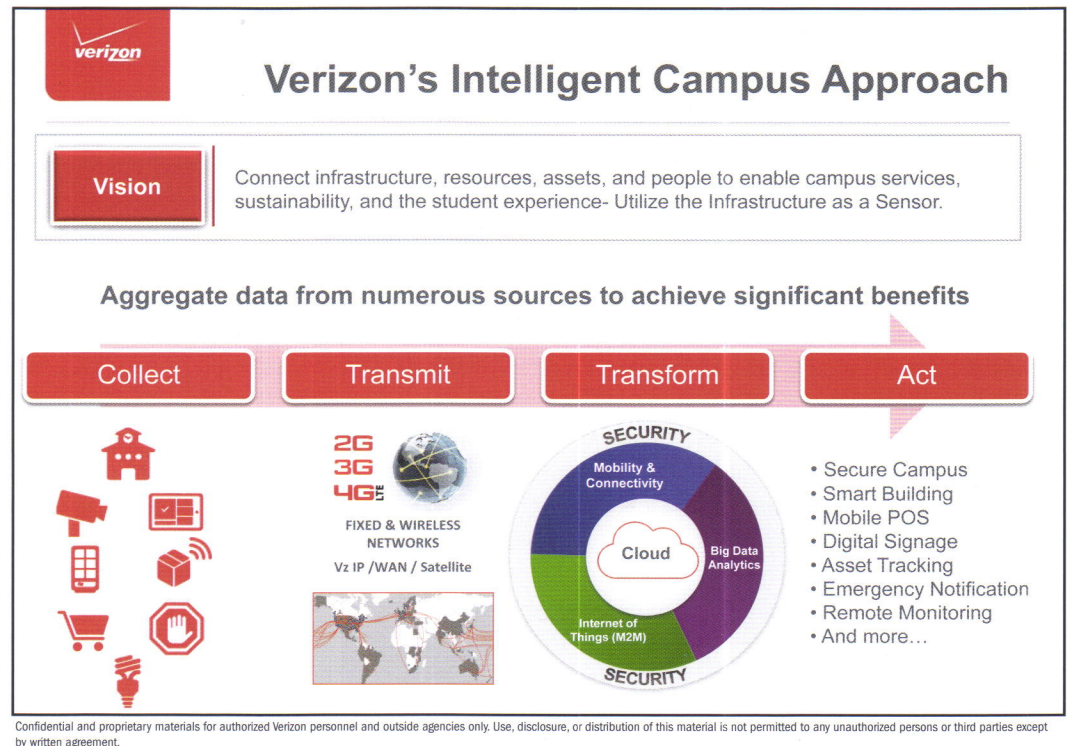
that are available in the market, it's time to create a road map that will guide the future deployment of intelligent campus solutions. Connected solutions is a nascent market evolving from point solutions to platforms that will help the campus make faster, more informed decisions with real-time data. It's expected that the number of M2M connections alone will more than triple by 2018; this does not account for personal devices or other legacy telematics solutions.

Product manufacturers are already building connectivity into everything from clothing and appliances to autos, HVAC systems, and even lighting and door locks. However, over time, these stand-alone point solutions will be superseded by data aggregators and systems integrators that pull together heterogeneous sets of assets. True intelligence begins when these technologies and systems are connected to cultivate an organization where multiple disparate departments and functions operate in a synergistic manner, achieving cross-

Figure 1. M2M solutions will drive efficiencies, enhance security, and improve the campus experience.



Figure 2.



organizational economies of scale and creating opportunities to shift resources.

The Internet of Things Platform

Let's look at the components of an Internet of Things platform. (See Figure 2.)

- **Collect:** More and more devices—from smartphones and personal health devices to utility meters and video cameras—will collect data. With greater numbers of data sources, the data increase and present opportunities to create new services, identify cost savings and operational efficiencies, and boost revenue. It also creates challenges for those who would effectively manage the data and turn it into actionable intelligence.
- **Transmit:** Design a platform that encourages the creation of innovative services and supports scalable growth and the protection of enterprise assets. As increasing numbers of devices and applications are connected to campus networks, special attention will need to be paid to network capacity, reliability, and security.
- **Transform:** It's important to know what data are being collected over what

technologies and how the data will be used. The data may be passive when gathered. However, when it's used to manage critical campus operations, such as security, asset management, cost containment, or other significant campus functions, it's important to protect and secure the data and make it available in standard format for delivery to and communications with devices and dashboards. Employing cloud solutions for storage, analytics, and accessibility enables the aggregation of collected data, which can then be analyzed and securely shared.

- **Act:** How many times have we heard that we are data rich but knowledge poor? As we gather more and more data, it is critical that we start with the end in mind and develop the ability to query data to support the desired outcome. In the near term, the action may be a real-time automation or response to a query. Longer term, data can be used to populate dashboards that show key indicators over a period of time to support longitudinal decision making to create safer, more efficient, and innovative campus environments.

The intelligent campus will make use of network automation and real-time systems to consistently deliver an exceptional campus experience. Strategic planning should include caring for the growing number of embedded sensors that will increase network traffic and the amount of data generated. Creating a holistic Internet of Things platform that encompasses cloud computing, intelligent networking, mobility, and security will help fuel innovative solutions through the use of data analytics to optimize the impact and effectiveness of these inventive solutions. By harnessing the power of the Internet of Things, colleges and universities will create value for the entire campus community.

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Face It...Google Glass Is Coming Your Way

With development will come adoption.

Do you know what Glass is all about?

by John Arkontaky

The next big addition in enterprise hardware isn't sitting under your nose, but it very well could be on top of it. Google Glass and the hands-free capabilities it brings can be a game-changer for companies in manufacturing, process control, healthcare, and retail, or any other company with boots on the ground. Google Glass sits out on the bleeding edge of enterprise mobility. But pioneering companies building business cases or pilots or deploying Glass show its promise—even while Glass is in its early days.

As with smartphones and bring your own device (BYOD), Glass not only presents powerful tools and access to information but also presents new challenges. Procurement, policy development, app development, app deployment, security, usage monitoring, and unlocking the full potential of this wearable technology are major challenges IT managers need to address. As with many nascent technologies, there's a lack of Glass best practices, but enterprises looking for a competitive edge should start building business cases to ready themselves for Glass's arrival. Bottom line: It may not be staring you in the face, but Glass is poised for rapid growth in the next 12 to 18 months.

The Issue

Although Google Glass is poised to begin making inroads in the enterprise, a few critical roadblocks sit between it and widespread enterprise adoption. First, Google hasn't launched an official Glassware app store. Second, no commercial purchasing channel exists for companies to procure Glass in volume. Third, only a

Compass Direction Points

- Enterprise use of Glass applications is beginning to emerge. Given the unique advantages of wearable technology, we expect rapid growth in 2014–2015.
- The Glass ecosystem—including developers, apps, and mobility-management vendors—is nascent and rapidly evolving. We anticipate growth and changes over the next 18 months as enterprises build business cases and seek vendors for apps, security, and best practice consultation.
- Enterprises are well served by exploring Glass and potentially other wearable technology in 2014 to hold a competitive advantage and enhance LOB (line of business) capabilities.

small sample of vendors deal with Glass, putting the onus largely on individual companies to strategize, develop, and deploy Glass and Glassware, with little guidance or assurances.

The aforementioned issues are substantial, but won't last long. Google announced that the Glass app store will launch in 2014. Afterward, we expect more independent app developers and large companies in the enterprise mobility management (EMM) space to join the fray. Further, Google built Glass so that Glassware apps take little more than Android development knowledge.

Window Shopping

Apps drive the mobile experience. As a nascent technology, Glass doesn't have a substantial app ecosystem at this point, which can be attributed to Glass being outside the mainstream and to a lack of an official Google Glass app store—al-

though there are now Glass apps at the Google Play app store. Those developing Glassware submit their apps to a handful of unofficial Glass app directories, and the apps are consumer oriented.

Until Google launches the Glass app store, the best enterprise apps will either come directly from Google or will be proprietary apps. Google built pictures and video services right into Glass, giving users hands-free image-capturing and video-recording capabilities. Hangout sessions can connect people to live video conferencing. The Directions app offers turn-by-turn directions. Search conducts real-time information searches or language translations.

These out-of-the-box apps only scratch the surface of Glass's potential, but some companies have already built pilots out of these basic features. For

example, Sullivan Solar Power uses Glass as a collaboration tool. The video-recording and conferencing tools allow technicians to remotely help each other while on their respective sites.

Proprietary apps built by early-adopting enterprises show what Glass can do when various lines of business can access data systems via Glass. For example, a proof of concept by Philips Healthcare shows how the Glass Search function integrates with a patient-monitoring system, offering instant patient diagnostic data.

Currently, Glass costs \$1,500 per unit, and Google has to approve each purchase. When Glass officially launches this year, we anticipate both a substantial price drop and potential discounts for volume (e.g., enterprise) purchasing. Further, Google promises to open the official Glass app store this year, which will give developers more confidence in developing and launching Glassware.

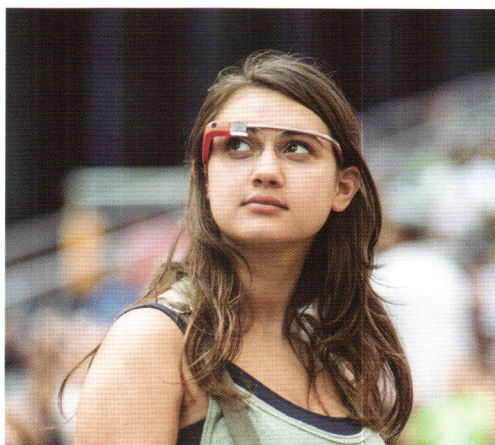
Privacy and security are major concerns. The ability to record audio and video or take pictures can create privacy and confidentiality concerns around appointments, meetings, and fieldwork situations. If you need an app that accesses corporate repositories or private data, you'll need a platform to create secure gateways into these repositories.

Many of the aforementioned concerns once applied to smartphones and tablets. Like them, Glass is poised to be the next big thing in productivity, with great potential to give field workers a competitive edge and position early adopters at the forefront of technology.

Glassware: Unlocking Glass's Potential

Developing apps for Google Glass is similar to developing apps for the Google Play market. In November 2013 Google released the Glass Development Kit (GDK) as an add-on to the Android SDK. With this add-on, developers can build so-called "Glassware"—applications that utilize Glass hardware. Web-based

applications (which also fall under the Glassware moniker) require the Google Mirror API. This cloud-based API doesn't require running any code directly on the device, making them lightweight applets. With a low barrier of entry for Glassware development, third-party developers and enterprises will likely develop apps to build out on Glass functionality. In our 2013 Benchmark Report, we found that 80 percent of companies had difficulty finding adequate app development talent. Google Glassware left out special-



ized training and skill sets for Glassware development, which will pay dividends when vendors and enterprises start building COTS (commercial off the shelf) and pilots.

Glass for Sale!

Generally speaking, app vendors aren't yet developing Glass solutions, since they don't see a market yet. However, a few vendors have adopted a Glass strategy even in these early days. These vendors offer—to varying degrees—strategy and infrastructural platforms to build and deploy apps:

- Silica Labs adopts a "wearable first" position. It develops apps for your needs and offers a cloud platform for hosting apps, configuration libraries, and APIs.
- Dito, an authorized Google app reseller, is currently building business cases for enterprise apps and has begun

building a Glassware library.

- Xamarin, an app-building platform, allows Glass app development utilizing C# and its Xamarin.Android platform, potentially eliminating the need for in-house Android development expertise. Also, Xamarin has an extensive partner network of development houses for enterprises lacking C# expertise.
- RustyBrick has experience building Glass apps for independent companies and online media publishers.
- AnyPresence leverages its backend-as-a-service to roll existing data and assets into Glassware.

Conclusion and Recommendations

When evaluating Google Glass in the enterprise, functionality, third-party support, cost, privacy, and security all must be taken into consideration. Glass may not be an ideal solution for every institution or company, but it's possible to build a compelling proof of concept for those with field workers or a need for hands-free access to assets and resources. Going beyond use-case development at this point could be problematic for several reasons. It's too early to tell which vendors will support Glass or how, which ripples out to the app ecosystem, APIs, security strategies, and monitoring and analytics systems that can measure Glass ROI and policy compliance.

We think it is the right time to invest time in building use cases. But the costs for procuring, securing, and developing for Glass won't be fully understood until Google launches the app store and more major EMM vendors build platforms to support this wearable technology.

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Bandwidth 101

Our networks are like our roadways. What can we learn to alleviate gridlock?

by Richard Kasslack

As I travel to cities across North America, I see one problem common to every urban area: gridlock. The snarls and frustrations of gridlock are becoming more and more difficult to manage as we add more and more vehicles to our roadways. In my part of Canada, we expect to spend upward of \$50 billion over the next 25 or more years to try to ease the gridlock issue in an initiative called "The Big Move."

Introductory material for "The Big Move" lists seven typical problems that result from gridlock:

- You are stuck on a 400-series highway for two hours because of a traffic accident.
- When a bus finally arrives, it is overcrowded.
- The train is 45 minutes late.
- Because of traffic congestion, you are late picking up your child from day care.
- The courier package does not arrive when it is supposed to.
- The critical electrical part your company needs is held up in traffic.
- Your commute, which used to take half an hour, now takes 45 minutes."

Sound familiar? As you consider this, do you see similarities in the wide area and local area networks supporting our business environments?

Just as urban areas struggle with traffic issues, our networks are being tasked with delivering more and more content and supporting more and more devices. How do we adapt to handle the demands? Do we build wider highways? Is light rail or carpooling the answer? What about dedicated lanes for trucks and special purpose vehicles?

For many years, complex algorithms have been developed to try to solve these problems. In each instance, a shortest path, point-to-point route is optimal.

What are our alternatives in networking? Today's customer chooses a service based not only on price but also on quality. So the three-dimensional factors—cost vs. quality vs. customer experience—will be a very important consideration for network management and design of both fixed networks and wireless networks. What options do we have? Let's clarify the problem and then consider our choices.

The Concept of Bandwidth

Bandwidth is the amount of information that can flow through a network connection in a given period of time. It is important to understand the concept of bandwidth for the following reasons:

- Bandwidth is finite. Regardless of the media used to build a network, there are limits on the network capacity to carry information. Bandwidth is limited by the laws of physics and by the technologies used to place information on the media.
- Bandwidth is not free. It is possible to buy equipment for a LAN that will provide seemingly unlimited bandwidth over a long period of time; however, this is not usually the reality.
- Bandwidth is an important factor that is used to analyze network performance, design new networks, and understand the Internet. We must understand the tremendous impact of bandwidth and throughput on network performance and design. Information flows as a string of bits from device to device throughout

our campuses and the world. These bits represent massive amounts of information flowing back and forth in seconds or less.

- The demand for bandwidth continues to grow. As soon as new network technologies and infrastructures are built to provide greater bandwidth, new applications are created to take advantage of the greater capacity. The delivery of rich media content, such as streaming video and audio over a network, requires tremendous amounts of bandwidth. IP telephony systems are now commonly installed in place of traditional voice systems, which further adds to the need for bandwidth. Events, such as football games, that occur on our campuses and introduce a massive increase in wireless users can adversely affect our networks and our ability, in some cases, to access critical services. We must anticipate the need for increased bandwidth and act accordingly.

Bandwidth is like the number of lanes on a highway. A network of roads serves every city or town. Large highways with many traffic lanes are joined by smaller roads with fewer traffic lanes. These roads lead to narrower roads that lead to the driveways of homes and businesses. When very few automobiles use the highway system, each vehicle is able to move freely. When more traffic is added, each vehicle moves more slowly. This is especially true on roads with fewer lanes. As more traffic enters the highway system, even multilane highways become congested and slow.

A data network is much like the highway system. The data packets are vehicles, and the bandwidth is the number of lanes

Open Networking Foundation Defines SDN

Software-defined networking (SDN) is an emerging architecture that is dynamic, manageable, cost-effective, and adaptable, making it ideal for the high-bandwidth, dynamic nature of today's applications. This architecture decouples the network control and forwarding functions, enabling the network control to become directly programmable and the underlying infrastructure to be abstracted for applications and network services. The OpenFlow™ protocol is a foundational element for building SDN solutions. The SDN architecture is:

- Directly programmable: Network control is directly programmable because it is decoupled from forwarding functions.
- Agile: Abstracting control from forwarding lets administrators dynamically adjust network-wide traffic flow to meet changing needs.
- Centrally managed: Network intelligence is (logically) centralized in software-based SDN controllers that maintain a global view of the network, which appears to applications and policy engines as a single, logical switch.
- Programmatically configured: SDN lets network managers configure, manage, secure, and optimize network resources very quickly via dynamic, automated SDN programs, which they can write themselves because the programs do not depend on proprietary software.
- Open standards based and vendor neutral: When implemented through open standards, SDN simplifies network design and operation because instructions are provided by SDN controllers instead of by multiple, vendor-specific devices and protocols.

Source: Open Networking Foundation, <https://www.opennetworking.org/sdn-resources/sdn-definition>

on the highway. When a data network is viewed as a system of highways, it is easy to see how low-bandwidth connections or an increase in bandwidth-hungry applications can cause traffic to become congested all over the network.

Planning a Better Network

What can we learn from highway congestion to help us better plan our networks of the future?

High-occupancy vehicle (HOV) lanes on highways have been introduced with some success. HOV lanes are designed to help move more people through congested areas. They offer users a faster, more predictable commute, while also easing congestion in regular lanes by moving more people in fewer vehicles. These dedicated lanes encourage carpooling, and users are rewarded by getting to their destination faster.

I remember my own experience when these lanes were first introduced. During my commute to the office, one particularly congested section would take 45 minutes or more. Upon introduction of the HOV lane, I began carpooling with a colleague, and that same section of highway took exactly 7 minutes. HOV lanes never seemed congested.

Similarly, dedicated bandwidth for critical applications will ensure that our networks deliver these applications in a timely manner. How this is accomplished takes many forms, from VLAN segmentation to physically separating network segments and dedicating them to critical applications. I have seen instances where a separate management ring network was built out to ensure critical access during sports events as thousands of additional users were accessing the network simultaneously. Dedicated physical paths

for delivery of critical content or services will ensure that those services are always available.

As on a road trip, a dedicated point-to-point path without any other vehicles on your route would ensure success and timeliness.

New technologies such as software-defined networking (SDN) show promise in addressing some of our concerns. Open Networking Foundation is a user-driven organization dedicated to the promotion and adoption of SDN through open standards development. Read their comprehensive definition of SDN in the sidebar on this page or visit their website (www.opennetworking.org) for more information.

The concept underpinning SDN is simple: If the data- or traffic-carrying plane and the control plane are decoupled, the formerly static network can become intelligent, responsive, programmable, and centrally controlled. All of that can then be automated according to logical rules in response to traffic patterns or types or emergencies.

Most industry leaders agree, it will be at least three years before SDN reaches any serious scale in the market. Data centers, cloud service providers, and some large global enterprises will lead the way.

Conclusion

The only constant in networking is change. We must adapt accordingly and keep ourselves informed and educated about new and emerging technologies to assist us in our constantly changing world. Look to techniques and initiatives being used to ease gridlock on our roadways and compare how some of those techniques can be used to effectively handle traffic on your network.

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Institutional Excellence Award 2014

A Mini Revolution in Learning and Teaching: Lynn University's iPad Mini Initiative

Seven years ago, Kevin M. Ross began his presidency of Lynn University in Boca Raton, Florida, with the goal of creating a new kind of learning center: an independent, innovative university unusually devoted to preparing young people for the future.

Central to Ross' vision was a redesigned core curriculum. "Dialogues of Learning" would focus young minds on the important core questions of self, belief, and justice. Who am I, what do I know, and why does it matter? Through robust and reasoned dialogues, Lynn University students are prepared for desirable futures not only for themselves, but for the world around them.

Showing its agility, Lynn implemented Dialogues of Learning in less than two years. Lynn's faculty abandoned the general education model of "intro 101" classes, rewrote whole curricula, and piqued students' curiosity and learning as never before. The Dialogues quickly drew national praise.

This was just the beginning. President Ross and CIO Christian Boniforti recognized that in order for Lynn University to truly transform learning and teaching, a more creative use of new technologies was necessary. So they asked themselves: What if Lynn faculty could deliver course content in new and more vibrant ways than in printed textbooks? What if Lynn could build upon its style of personalized education to more effectively engage students in learning? What if Lynn could empower faculty with exciting, new ways to teach and collaborate? What if Lynn

could redefine the notion of a "classroom" so that learning would no longer be confined to a particular room at a designated hour?

Around this time, Apple unveiled its first iPad. It was a revolutionary device that would soon help Lynn answer these questions.

In 2011, Lynn visited Apple and the two-like minded, forward-thinking organizations forged a partnership. For its January 2012 mini-term, Lynn introduced Apple's Challenge-Based Learning framework with iPads for participating students. The overwhelming success of these courses and Apple's subsequent launch of a smaller, faster, cheaper iPad mini set the stage for a bold, new direction in learning and teaching. From here forward, all new Lynn University students receive (and keep upon graduation) their very own iPad mini. Lynn's "mini revolution" has arrived.

Program Overview

Lynn University's tablet-based learning initiative puts a transformational learning device into the hands of its students and empowers faculty to more creatively deliver the school's Dialogues of Learning core curriculum. Here is a summary of results since the program's inception in January 2013:

- In January 2013, the school conducted a successful pilot during its January Term Citizenship Project. The result: Apple iPad-enriched classes showed a significantly higher level of learning than traditional classes.
- In August 2013, Lynn provided the



Accepting the award at the Conference was Lynn CIO Chris Boniforti, pictured with Mar'ia Adkisson, Windstream; Kevin Kerr, Lynn University; and Jennifer Van Horn, chair, ACUTA Awards Committee.

iPad mini to 735 incoming freshmen and transfer students. In addition, nearly 250 upperclassmen received iPad minis through a rental program. Students use the device for virtual tutoring, reading, dictation, and organizing course work.

- Lynn faculty-produced iBooks are saving students up to 50 percent off the cost of their core curriculum textbooks over a two-year period, and 73 percent of students surveyed said that the iBooks are more effective than traditional textbooks.
- The technology has already allowed Lynn to engage with the surrounding

community. Lynn chose the iTunes U platform to deliver a K-12 presidential debate curriculum to the Palm Beach County School System. The curriculum was viewed 173,867 times in the first year and will serve as a model for future community collaboration.

- Starting in fall 2014, Lynn University will furnish all daytime undergraduates and new M.B.A. students with iPad minis. Twenty-five percent of M.B.A. courses will be taught using iBooks instead of traditional textbooks. In addition, all daytime undergraduate courses will be delivered using iTunes U, and the vast majority will utilize e-textbooks.



Students Carisa Cook and Jessica Wein are enthusiastic about Lynn's iPad mini initiative.

Planning, Leadership, and Management Support

President Kevin M. Ross and CIO Christian Boniforti are the driving force behind Lynn's iPad mini initiative. Their vision was to put a "transformational learning companion" into the hands of students, says Ross. "We want to deliver our core curriculum in a rich environment, allowing our students to engage with the content in interactive ways."

As a first, important step, Ross and Boniforti organized a team of leaders to visit Apple headquarters to evaluate the potential of the iPad and Apple ecosystem for transforming education at Lynn.

• Collaboration

In summer 2011, Lynn's senior management visited Cupertino to learn how Apple's innovative technologies could enhance student learning.

Apple specialists then visited Lynn in October to conduct an iPad pilot initiative using Apple's Challenge Based Learning (CBL) concepts. They taught 16 Lynn faculty members how to implement CBL in their classrooms for freshmen Citizenship Project courses to be taught during the 2012 January Term.

Faculty members each received an iPad along with hands-on training in applications and challenge-based concepts that included coming up with the big idea, narrowing to the essential questions, committing to the challenge, reflections from students and faculty, attainable solutions, and documenting evidence via creative videos. The participants provided assessments at regular intervals throughout the process.

Following the success of the initial January Term project, and in preparation for its iPad mini initiative, Lynn issued iPads to every faculty member in December 2012. Teachers were able to explore their new devices over the holiday break. When they returned in the spring semester, Lynn offered a series of iPad-specific training sessions. Lynn deans and faculty members embraced the technology, and in just a few short weeks over the summer break converted Lynn's 100-level courses to iTunes U and developed eight original e-textbooks.

Every department on campus rolled up their sleeves and contributed to the success of the program. The Board of Trustees understood and approved. Faculty, administration, and staff made multiple trips to meet with Apple in Cupertino. Members of the Lynn team spent nights and weekends and summer vacations developing plans, writing iBooks, creating videos, and revising lesson plans.

• Information Technology

In order to prepare for the iPad mini initiative, Lynn's IT department made

more than \$2 million in technological improvements campuswide. All work was completed during summer 2012 prior to Lynn's hosting the presidential debate on October 22, 2012.

"The huge technology requirements that came with the debate enabled us to 'leapfrog' into the iPad mini initiative," says CIO Chris Boniforti.

The timing and technology investment couldn't have been better for Lynn, says Boniforti. "The rollout of the iPad and iTunes U and the whole mobility movement meant more focus on flipping the classroom—that just came around the most opportune time for us, which was right before the presidential debate." IT first installed more than 20,000 feet of single-mode fiber connecting every building on campus. This allowed the backbone of the network to be increased from 1 GB to 10 GB throughout campus. This was a massive improvement and has allowed Lynn to take advantage of higher speeds and newer wireless technologies. IT also replaced the entire university switch network environment with over 60 new switches that allow network connection speeds of 10 GB.

In addition, IT replaced aging wireless infrastructure and more than doubled its coverage. In all, IT installed 315 access points across campus. Prior to this fall, the university had fewer than 150 access points. This increased Lynn's wireless coverage and capacity from 3,750 connections to 7,875 total wireless connections. The university's bandwidth also was increased from 200Mbps to 400Mbps.

All 40 of Lynn's learning spaces were equipped with Apple TVs, which allow faculty and students to take advantage of the increased connectivity to display and share content in the classroom.

• School Design and Facilities

The iPad mini initiative is already changing the way Lynn thinks about classroom design and configuration. Bringing mobile devices into a classroom changes the learning dynamics. Classes are no longer

just a one-way or a one-to-many conversation, but a true dialogue—just as Lynn originally intended with the Dialogues of Learning core curriculum.

With iPads and iPad minis, classes aren't confined to the classroom. They can take place outdoors on campus or in other locations with Wi-Fi such as museums. With the addition of Apple TVs in classrooms, teachers are free to move around the classroom and interact with students. Smaller classrooms with flexible seating are ideal for this way of teaching.

Now, the iPad mini initiative and related technologies have an impact on the design of future academic spaces at Lynn, starting with the new International Business Center, the future home for the College of Business and Management. The center has been designed with flexible seating in classrooms and adjacent collaboration rooms where students can work in groups or teams.

In addition, the classrooms' audiovisual design puts the iPad at the center of controls. Gone are the old, bulky media lecterns with audiovisual equipment. In their place are sleek, rolling podiums that faculty can use while moving about and having AV controls at their fingertips on their iPads.

Promotion of Technology and Maturity of Effort

The move to a mobile delivery platform has had a large impact on Lynn's entire IT department. Access and connectivity to the Internet has never been more important to the school's teaching and learning environment.

The Network Services division has implemented a state-of-the-art wired and wireless network so that students have a reliable, scalable, and fast wireless connection. Network Services also continually assesses the number of mobile devices, capacity, and throughput. By necessity,

IT has become expert in the management of mobile devices, as more than 1,000 university-owned mobile devices have been added to the university's network. Bringing in a mobile device management solution was crucial for making sure that the school had policies and procedures that could be enforced and executed. Lynn's Information Systems division and library have also joined in the mobile movement by focusing their efforts on mobile services. The teams are developing strategies to "think mobile" first when delivering online services like registration, grades, attendance, and LMS functionality.

• Key Benefits

The iPad mini initiative has enabled Lynn's entire campus to understand the priorities and future direction of IT. The school's mobile strategy is closely tied to the academic goals of providing a mobile-ready teaching and learning

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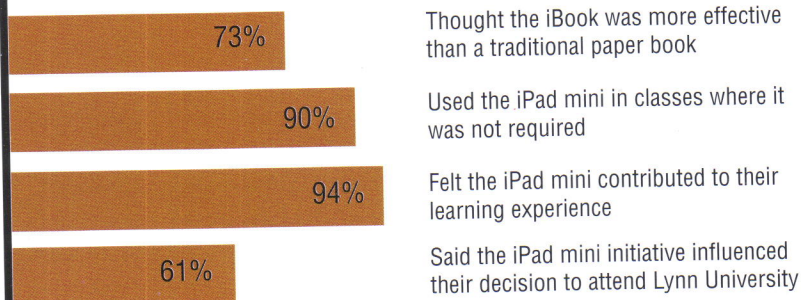


Figure 1. Results from the iPad mini initiative have been overwhelmingly positive.

environment. For constituents, Lynn is providing a state-of-the-art experience as well as a highly individualized and innovative approach to academic course work. Faculty now has an opportunity to deliver content and course work in a creative and novel way.

• *Integration with Other Services and Plans*
The iPad mini initiative is closely tied to the university's mission, vision, and strategic plan. While IT had begun examining how best to adopt mobile strategies, the iPad mini initiative intensified that effort.

Lynn planned very carefully before launching the initiative, including a pilot project where 16 faculty members incorporated iPads into lessons during the school's J-term mini-semester. School administrators used measurements and assessments from the pilot projects to guide decision-making for the future. The school provided every faculty member an iPad during fall 2012 so that they could become familiar with the technology and learn how to incorporate mobility into their curriculum. Apple played an important role by providing Apple Educators to instruct faculty. Those faculty members were, in turn, able to create the school's first digital courses using iTunes U and iBooks as the main delivery tools.

This led to a successful launch in fall 2013, when all freshmen and some

upperclassmen received iPad minis. Lynn will continue to assess and refine the program.

During the two-year development phase, the planning teams delivered numerous presentations to faculty, staff, and students to further help them understand the evolving program.

• Program Launch

Lynn launched the iPad mini initiative on August 25, 2013, during freshman orientation. Freshman, faculty, and staff attended a "mini revolution" kickoff event and heard from Lynn's president and CIO, along with Apple staff. Students then met in small groups with their freshman mentors, who distributed the iPad minis and instructed students on how to configure and download important apps for their course work.

In preparing for the iPad mini initiative, Lynn conducted discussions with other institutions including Seton Hill, but from the beginning, the school embarked on a different approach. Lynn's initiative is unique because of its focus on content and faculty collaboration to deliver that content.

Lynn's efforts have been university-wide and extensive. Faculty fully committed to the program, re-creating their syllabi and revamping courses. Educators have also participated in development workshops and opportunities, including

several on weekends and during the summer. Lynn's admissions, marketing, and development offices also have adopted the use of iPads and have become great ambassadors of the technology as they do business beyond campus. Fifty staff members serving as freshman mentors also received iPads and training, enabling them to communicate and collaborate on the same platform as students.

Quality, Performance, and Productivity Measurements

Lynn examined both academic and non-academic factors to gauge the program's success, measuring elements that affect four overall goals:

- (1) improve student engagement,
- (2) extend the learning environment beyond the classroom walls,
- (3) make a transformational academic change while improving competencies,
- (4) enable students to save on textbook purchases.

The school also considered its ability to provide good service and ensure that students had wireless accessibility wherever they required it. IT provided more than 50 access points in new locations or in locations needing better coverage. Lynn ensured that bandwidth was adequate for the 1,000 new iPads on campus, doubling bandwidth from 200mbps to 400mbps. Lastly, the team noted metrics on broken, lost, or stolen iPads. The school will continue to evaluate all of these metrics in order to ensure a high level of service to students.

Results, Challenges, and Solutions

Results from the iPad mini initiative so far have been overwhelmingly positive. Participating students and faculty have adopted the technology and platform quickly. The only complaint has come from students not participating in the initiative (non-freshmen) who want to be part of the program. Reports of breakage and loss have been surprisingly low. Of the more than 1,000 iPad minis issued, there have been 10 broken and 12 stolen or lost.

One issue Lynn did not anticipate was confusion among students over learning management systems. During fall 2013, students had to access course information on iTunes U or Blackboard, depending on the course. To simplify and create a common experience for all students, Lynn has determined that iTunes U, iBooks, and other academic apps will be used instead of Blackboard as the main system to host course content.

Cost, Benefit, and Risk Analysis

The cost of this program is derived from the academic package that the university purchases for each student. The package includes the following:

- iPad mini (2 iPad minis over 4 years)
- Apple Care (for both iPads)
- ePortfolio License (5-yr subscription)
- Insurance
- Paid Apps

Students are charged a technology fee to help pay for the iPad mini initiative. The technology fee permits this program to pay for itself. Students also save about 50 percent of what they would have paid toward their general core textbooks.

Lynn expects to provide students more textbook savings as more faculty create iBooks within discipline-specific courses.

The program's indirect costs are proving to be a great benefit for the university. The school has committed to supporting a robust mobile environment, with state-of-the-art wireless connectivity and a very large Internet connection. The university would have needed to invest in these items eventually, but the iPad mini initiative helped fast-track these technological needs.

Organizationally, this initiative has committed Lynn to one platform and one vendor—Apple, the current leading mobile-tablet leader. The school selected this platform specifically because of its integration of software and hardware. The people behind Apple and its offerings have been key supporters in making this technology work well for education.

Customer Satisfaction and Results to Date

The program has been measured through student surveys, student performance metrics, and cost analysis through each stage of deployment and has exceeded expectations. (See Figure 1.) As a result, Lynn will more than double deployment of devices from fall 2013 to fall 2014.

Results from the 2013 January Term Citizenship Project pilot were overwhelmingly positive. A Global Perspective Inventory was administered to 215 freshmen at both the beginning and end of the course. It consisted of 22 questions focusing on four factors of global citizenship: (1) value of citizenship, (2) political processes, (3) social responsibility and (4) global citizenship. The results were divided into two groups: classes that used the Challenge Based Learning (CBL) methodology with an iPad and classes that were taught in the traditional manner without any embedded technology. In all cases, classes using the CBL methodology with iPads showed a higher level of improvement over the traditionally taught classes with no embedded technology.

In August 2013, Lynn provided the iPad mini to 735 incoming freshmen and transfer students. In addition, nearly 250 upperclassmen received iPad minis through a rental program. Students use the device for virtual tutoring, reading, dictation, and organizing course work. Feedback was overwhelmingly positive from surveys conducted at the beginning and end of the semester: 89 percent said the iPad mini significantly contributed to their learning experience.

Lynn faculty-produced iBooks are saving students up to 50 percent off the cost of their core curriculum textbooks over a two-year period, and 73 percent of students surveyed said that the iBooks are more effective than traditional textbooks. There are early indications that the mini revolution is having a positive impact on enrollment, too. Fall 2013 was Lynn's

Comments from Faculty and Students

"It's fantastic for teaching science. Students are engaged by the technology, and it really has made my job as a teacher a lot easier."

Gary Villa, associate professor, biology

"The built-in Apple assistive technology is a big thing that a lot of students in the institute are learning and using and are really happy with."

Stacey Bauberger, senior coach and academic ADA specialist, Institute for Achievement and Learning

"I think the iPad mini was a bold and daring choice ... and will not only revolutionize the way we learn but also the way we interact with staff and advisors here at Lynn University."

Tyler Casey, freshman

"When I heard about Lynn doing the iPads, it made me want to come here. This is where education is going, and I want to be part of it."

Jerry Collender, freshman

largest incoming class since 2007, and 61 percent of students surveyed said that the iPad initiative influenced their decision to attend Lynn University.

For more information about this project, contact Chris Boniforti, CIO, Lynn University, at cboniforti@lynn.edu, or Sherrie Weldon, VP Marketing and Communication, Lynn University, at sweldon@lynn.edu. Or visit our website at lynn.edu/ipad or lynn.edu/ipadvideo.

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- **Winter: Maintaining Security and Privacy in a Very Public World**
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