

Research Findings and Formation of Planning Assumptions

I. Global Technical Environment:

Technology and computing is on the cusp of a transformation that will change the technical landscape and the way we perceive technology, much the way that the advent of the personal computer revolutionized computing in the 1980s. Institutions that hope to thrive and support student access and success must plan for these changes, which will impact not just the actual computing devices but also the operations and management of computing services. Effective technology plans for educational institutions must consider, as their foundational planning assumptions, the following trends acknowledged by technology leaders around the globe (sources are provided in the Appendix):

1. The arrival of mobile computing devices, including Smartphones, tablet computers like the iPad, and mobile readers, will begin to make laptop and desktop computers obsolete by the year 2014.
 - a. College technology plans should recognize that purchases of desktop and laptop computers will drastically decline and begin to be phased out in favor of more flexible computing devices that are unrestricted in their operating system requirements and software/application compatibility.
 - b. Software and textbook publishers, in recognition of this sea change, are scaling back on development of educational materials tied to PCs and particular operating environments. Hardware vendors (Dell, HP, Lenovo) will begin to scale back manufacture of laptops and desktops, and are already beginning to make plans to scale back the practice of working with

educational institutions to develop devices to the institution's specifications. Predictions are that by 2014, K-12 school districts will have reduced their hardware (laptop and desktop) purchases by at least 30%. Also by 2014, educational institutions will be purchasing twice as many tablet computers (IPads, etc.) as laptops or desktops.

2. Handheld and mobile computing devices provide access to technology at a more affordable price and with greater versatility than the desktop or laptop.
 - a. Low-income students who cannot afford a laptop or Internet service in their homes most often consider a Smartphone a necessity. For one monthly fee they can access the same services, applications, and coursework on their phones, without the investment in a computer or payment of another monthly bill to an Internet service provider. Smartphones are increasing access to information and educational services to segments of the global and national population that have not had this access before.
 - b. The prevalence of Smartphones is changing traditional notions of the learning environment and the role of the teacher. Formerly, to access and use technology, the student had to either come to the college campus to use a computer lab, or, more recently, have access to a computer and the Internet at home. Instructional resources, course materials and exams, and distance education courses are now accessible anywhere the student has his/her phone. The new technology has untethered the consumer from a fixed computing platform, meaning that the world has now become the potential learning environment for any class.

3. The arrival of mobile computing devices and their anticipated revolutionary effect on the way we use and perceive technology has significant implications for the design and administration of a technology infrastructure on a college campus, requiring a shift in planning, operational, and management assumptions. Support services must also change.
 - a. In a traditional technological environment, colleges had a strong incentive to standardize computing hardware, operating systems, and software applications to achieve efficiency in services and infrastructure design. A standard specification for desktop PCs was developed to satisfy the majority of user needs, and a standard operating system (such as Windows) was uniformly supplied. Software applications utilized by faculty had to be compatible with the hardware and operating systems determined to be the campus standard.
 - b. To support and adapt to this sea change in technology, IT departments will be forced to move away from the centralization and standardization practices that brought efficiencies in the past. Mobile technologies and their supplanting of the desktop or laptop mean that campuses will move away from providing fixed computing labs and computing devices for students and instructors.
 - c. A campus infrastructure will need to be configured with the flexibility to support multiple operating systems and platforms. IT personnel accustomed to tight control of the academic and technical environment are losing that control as the world of software applications and tools explodes in response to the newer mobile technologies.

- d. The coming focus on mobile technologies, with most users having access to these devices and purchasing them for their own use, combined with the growing prevalence of tablet computing devices, will diminish the need for campuses to provide laptops and desktops for students, and, ultimately, faculty and staff. Future technology expenditures will shift from being heavily weighted toward expenditures on computers and computing devices, toward a much greater emphasis on infrastructure and support services.
4. As the technical world accommodates the move toward mobile computing, applications, software, and information are being made available for these mobile devices, with a declining emphasis on “fixed” (PC-based) software and applications. Technology developers no longer focus on developing applications that conform to a Windows or Mac platform, but rather that will function on any platform and are globally compatible, in recognition of the diversity of user devices.
 - a. Infrastructures and IT leadership will need to transition to a philosophy of decentralization and “device-agnosticism” (not tied to a single device or platform).
 - b. As the technical world moves toward a “device-agnostic” environment, campuses will shift from housing software applications on each classroom and office computer to a virtualized environment, first, which houses all applications on servers and permits individual users and classrooms to access all applications from the server. The virtualization of the computing environment introduces new efficiencies in this environment by:

- i. Drastically reducing the man hours required from IT services to construct a customized “image” of software applications for each instructional area’s classrooms and labs.
- ii. Significant reductions in an institution’s software licensing costs. By housing all software on the servers in the network operating center, each individual user machine in classrooms and labs does not have to be individually licensed.
- iii. Increase student access to courses and instructional materials, while also reducing their textbook costs for many courses by between \$50 and \$400. Currently, students taking courses which involve the use of software must purchase a textbook bundle which either includes a trial license for the software or a code to access publishers’ instructional materials online. In a virtualized environment, course software and applications can be accessed through the student’s Smartphone (or a remote PC at home or a public library) without being required to purchase a supplemental license (because they are accessing the virtualized software through the college network, which is already licensed). Many students today cannot afford the software (or frequently even a textbook). Access to instructional resources will increase through virtualization, as will, by extension, student success.
- iv. Cloud Computing – As the variety of user devices and their configurations multiply, technical companies and innovators are shifting from supplying licensed software packages to users, to

providing the software and applications on their own servers, with users able to access any desired application from the remote “Cloud.” The Cloud is the next logical progression in technology as an outgrowth of mobile computing. It removes the need for institutions to host software and their applications, and instead creates the need for a robust and flexible infrastructure architecture that provides a reliable access point to the “Cloud” (remotely accessed, openly available applications). Nationwide, almost half of colleges and universities have already moved to the cloud for universal applications such as email, no longer providing a campus email utility but electing to use providers like Google’s gmail.

5. The proliferation of mobile devices and their related applications will create an explosion in distance education offerings, the demand for them, and the applications available to be integrated into this instruction. These technologies, many of which were previously relegated to use in distance education courses, will begin to permeate every aspect of instruction and every delivery mode.
6. The growing prevalence of mobile computing devices dictates the presence of a wireless environment that is robust, reliable, and accessible from all points on campus.

Global Summary:

Technological trends and innovation indicate that plans for educational technology that cover the coming five years must take into account the following trends to be viable and to help guide colleges into the future:

- The growing prevalence of mobile computing devices, which will continue to transform the technical landscape.
- Previously accepted principles of operating efficiency for IT services. A philosophy of standardization will no longer be congruent with the operating environment.
- Future plans for technology support, including the nature of devices being supported and their configuration, requiring a “device-agnostic” approach. Laptops and desktops will become obsolete in another five years.
- The design of the infrastructure and its fundamental purpose, with an initial move toward virtualization. (A layman’s explanation of virtualization is provided in the Appendix to this plan).
- The ultimate transition to “Cloud Computing,” already underway.
- A shift in the distribution of expenditures on technology from computing devices to an emphasis on infrastructure and support services.
- The necessity of a completely wireless environment that is reliable and robust.
- The need for support personnel to engage in life-long learning and training, to be able to provide support and services in a drastically altered environment from the one in which they were hired and trained.

II. Fullerton College Technical Environment:

In addition to considerations of changes in the global technical environment, a technology plan needs to consider the local environment of Fullerton College and the needs and constraints of that environment, as well as the perceptions of local users. Fundamental planning assumptions for the college include the following observations, gleaned from surveys of campus users and past operating practices:

- The college has not had a consistent practice of funding technology purchases on an ongoing basis, through a devoted budget line-item for technical hardware purchases and infrastructure. Instructional departments that are heavy users of technology have had to rely on soft funding sources to purchase technological equipment, often, as a consequence, purchasing equipment that does not fully address needs. Hardware purchases have been postponed for years, with the result that some areas of the college are using computers more than ten years old which are unable to accommodate current versions of Office software and Microsoft operating systems.
- Infrastructure needs have not been addressed for several years, resulting in capacity constraints and “pipeline” restrictions that cannot accommodate the demand for resources that has significantly increased in the last five years. Switches that feed capacity to classrooms are below required capacity to accommodate increased traffic and software capacity needs, and cabling capacity needs to be increased.
 - Current FC IT practices, policies and procedures, built on a philosophy of standardization that prevailed in the early years of technology, increasingly conflict with instructional demand for technology and the usage of increasingly diverse applications in the educational environment. Instructors are urged to become more versatile and adaptable in their use of technology, to reach a student population to whom technology is second nature, at the same time that IT practices require standardization. IT practices need to be developed that support instructional innovation

and are responsive to instructional needs. The time to address service issues and problems needs to be significantly reduced so that instruction does not halt while waiting for IT support. A manual of best practices for IT departments, operating policies and procedures needs to be developed to ensure uniform application of service and support practices, as well as operating assumptions.

- Inadequate funding and planning for the college infrastructure has produced unreliable network connections and support.
 - Students and instructional faculty, with the necessary increasing reliance on technology in the classroom, need a fully supported network with sufficient capacity and proper configuration to assure, as much as possible, reliable connectivity to all aspects of the network which serve student and faculty.
 - Infrastructure funding and support also affect reliability and connectivity with administrative and student services. Managers and office staff have become accustomed to periodic outages, loss of access to financial systems and student records, and/or remote access to college network and email services.

Fullerton College Environment Summary/Recommendations:

- I. Fullerton College needs to develop a comprehensive technology plan that provides for the periodic replacement of hardware, with the acknowledgement that hardware and infrastructure needs, along with operating procedures and practices, will change dramatically in the next three years.

1. Fullerton College needs to evaluate the implementation of a virtualized operating environment, which will accrue to the college and its students considerable savings in operating costs, and introduce multiple efficiencies. The college's Business/CIS division is currently implementing a pilot virtualization program, which could conceivably provide a model for collaboration and "test-drive" of the system before campus-wide implementation.
2. The college needs to develop a computing hardware replacement plan that provides for the replacement of primary computing hardware every three years, and server/infrastructure equipment every five years, to ensure a reliable access to computing applications for faculty, staff, and students. This plan needs to take into consideration the probable and imminent obsolescence of the desktop and laptop computer.
3. A significant investment needs to be made in upgrading the configuration and equipment of the network's infrastructure, on which all technical operations rely. Before this investment is made, an investment in consulting services to evaluate current network and infrastructure configuration should be made, to ensure optimal configuration and operation in the changing environment.
4. The college needs to fully fund distance education operations with the recognition that specialized technical skills are required to administer and support distance education courses and faculty. This includes the investment in at least one full-time technical support person who will also work with faculty in instructional design and delivery.

5. The college needs to develop and support a wireless environment that can be accessed from anywhere on campus, with reliable connectivity that is “device-agnostic.”
6. Fullerton College’s IT department, in collaboration with instructional, administrative, and student service personnel, needs to develop a handbook of operating procedures, best service practices, and policies that will guide their approach to support and services and establish a service-oriented philosophy.
7. Technological structure and applications must support the growing integration of technical applications available through the Cloud into all learning modalities and delivery modes.

The remainder of this plan will address these recommendations, with consideration to the current operating environment at the college, its current inventory of hardware, and the state of its infrastructure.

1. Virtualization

Virtualization is the implementation of technology that allows servers and clients to be hosted on a networked system and accessed remotely. This technology allows highly flexible computer environments to be configured to meet the needs of individual subject matter and faculty members. It also allows off-campus access to computing resources for both students and faculty. The benefits of virtualization include:

- a. The ability to create and easily deploy a variety of computer desktop images for demo systems, labs, faculty and staff office systems, and for remote access over the Internet.
- b. Reduction of software licensing costs since the licensing follows the user and not the hardware.
- c. Access to on-campus computing resources through remote connections which will allow more online classes to be offered and improve student access to computer resources from off-campus.
- d. Scalability of resources to meet demands which means that back-end resources can be adjusted to meet the demands of particular situations (for example, increasing storage or processing on demand).
- e. Allow the use of various kinds of client systems to access virtual environments, which means that less powerful client computers can be used to run high-end software.

Virtualization requires additional software and hardware, as well as upgrading the campus networking infrastructure.

Preliminary Requirements to Implement Virtualization:

- a. Survey current campus networking infrastructure and resources to determine virtualization needs. This will require hiring a network consultant.
- b. Upgrade network infrastructure to support campus level virtualization.
- c. Acquire virtualization hardware and software.
- d. Train ACT personnel on implementing campus-wide virtualization.
- e. Roll out virtualization over two semesters.

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2. Computer Replacement Plan

In order to ensure a consistent technology platform for the campus, a computer replacement plan must be implemented. This plan will ensure that desktop systems and server systems will be replaced and reused in a food-chain process every three (desktop systems) to five (servers) years. In addition to desktop and server replacements, this plan should include plans to transition to the use of portable devices such as tablet computers, in recognition of the changing technical landscape.

Requirements to Implement Computer Replacement Plan:

- a. Survey current desktop and server resources and grade each device for usability based on the current campus software image (for example from 1 to 5, with 1 being useless). A total score by area will be computed based on this usability number.
- b. Create a configuration model for replacement computers that includes several categories, with the recognition of imminent changes in technology hardware, including:
 - * Demo Station System
 - * Open/Classroom Lab System
 - * Faculty Office
 - * Administrative Office
- c. Create a replacement plan by campus area indicating which systems need to be replaced, with the emphasis on those areas with the lowest usability score.

Systems below a certain score will be removed rather than send into the food-chain system.

- d. Make an initial purchase of enough new systems to replace 1/3 of the campus systems, remove obsolete systems, and food-chain salvageable systems.

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3. Integrating Distance Education, Training, and Future Technology with Academic Computing, and Fully Funding Distance Education Personnel/Technical Needs

To fully support Instruction, Distance Education must be included in the ongoing technology budgets and be funded to provide on-campus training and support for online classes. Adequate support and technical assistance must be provided for faculty and students. In addition, training must be integrated with campus technology so that Faculty and Staff can effectively use new technology. As technology is implemented on campus, training on the technology must be automatically included or made available. In addition to distance education and training, instructional best-practices and investigation into new technologies should be a part of Academic Computing.

General Steps to Integrate Distance Education, Training, and Future Technology with Academic Computing:

- a. Create a Distance Education plan to outline the ongoing needs and direction of distance education (reportedly complete).
- b. Create an ongoing budget for Distance Education to support on-campus technical support and course development.
- c. Integrate distance education training with staff development training.
- d. Hire a full-time distance education coordinator, qualified to address technical support issues and provide assistance with instructional design.
- e. Create/upgrade staff development training lab to support new campus technology.

4. Improving/extending Campus Wireless and Portable Computing

As student learning increasingly moves to a mobile environment, a robust campus wireless environment has become a necessity. Students using their own devices in the classroom can benefit from connection to online resources. Faculty can use wireless devices in the classroom to enhance instruction, and administrative tasks can be more flexible when supported by a wireless environment. The campus must establish a robust wireless environment that allows students from any location on campus to access campus and internet resources.

General Steps to Create a Robust Campus Wireless Environment:

- a. Review current wireless infrastructure and establish load capabilities and coverage area.
- b. Survey faculty, staff, and students to establish what type of wireless infrastructure to develop.
- c. Extend wireless coverage campus-wide.
- d. Deploy in-classroom wireless hubs to provide in-class coverage (this can be done before the build-out of the campus wireless infrastructure).

5. Create a Future Technology Center that will investigate new technology trends and how these can be used on campus to support instructional and administrative needs, with supplemental funding through a Technology Dynamic Fund.

Technology and the process for using technology in the classroom constantly changes. In order to ensure that our campus continually makes the best use of technology, an ongoing fund should be established that will foster innovation in this area, and accept proposals for using technology to improve student success both in and outside the classroom. Each year, a shared-governance committee would accept proposals and award enough resources so that the recipients can do an effective investigation of new technology trends and new uses of technology for student success.

General Steps for Creating Technology Dynamic Fund

- a. Create an ad-hoc committee to establish the guidelines and requirements for the Technology Dynamic Fund. This will include the selection committee's makeup.
- b. Create a shared governance selection committee.

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