

## TECHNOLOGY INFRASTRUCTURE INITIATIVE

The Technology Infrastructure Initiative (TII) of the Integrated Technology Strategy (ITS) focuses on upgrading the campus telecommunications infrastructure and on improving the personal productivity of faculty, students, and staff. One goal of the TII is to ensure that every CSU campus has a telecommunications infrastructure capable of meeting current and anticipated information technology demands for academic programs and institutional operations. Another major goal is to ensure that on every campus in the CSU system all members of the university community have access to a level of information technology resources and services that meets or exceeds baseline capabilities.

To guide implementation of this initiative, ITS planners described the target environment for five components:

- ◆ the intra-campus telecommunications network
- ◆ individual workstation environment (hardware and software)
- ◆ individual network connectivity
- ◆ user training
- ◆ user support

*Measures of Success* reports the progress the CSU is making toward achieving these baseline infrastructure capabilities as percentages for the system as a whole and for each campus. “Baseline capability” for each component is achieved when the standards for access and quality reach 90 percent or more for members of all three constituency groups: students, faculty, and staff.

### Baseline Telecommunications Infrastructure

The physical telecommunications infrastructure comprises the combination of intra- and inter-building pathways, closets, hubs and routers, and media (cables) that link individual workstations to the campus backbone, and the campus backbone to the inter-campus network and the Internet. The campus pathways, network electronics, and network media are the unseen, behind-the-faceplate prerequisites that ultimately determine when, or whether, the outcomes of the Integrated Technology Strategy can be achieved.

The benefits of access to current generation computing resources and services can be realized only if workstations are linked to each other and to campus information systems, and to the Internet, by a high-capacity, high-speed telecommunications infrastructure. Interactions over the Internet or the World Wide Web cannot be accomplished faster than the intra-campus and the inter-campus backbone networks allow, regardless of the capabilities of end-user equipment or applications. For this reason, the TII is a prerequisite for achieving the outcomes of the academic, student services, and administrative initiatives.

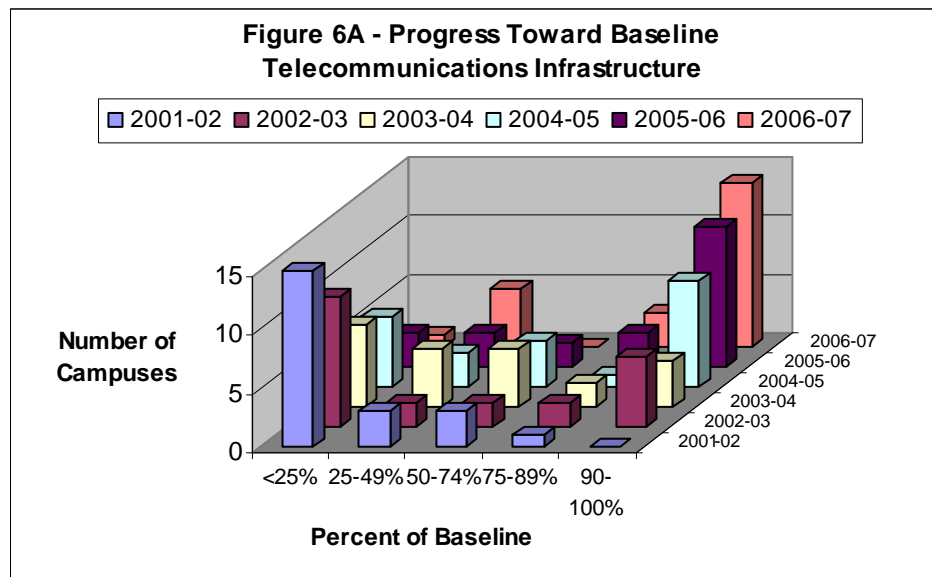
### Intra-Campus Networks

By the early 1990s, it was clear to CSU campus and system leaders that the limitations of the telecommunications infrastructures on almost all CSU campuses constituted an impediment to maintaining and improving the quality of academic programs and the efficiency of institutional operations. Unless improvements across the system were made, the technology gap among campuses in the system, and occasionally between the CSU system and the national higher education community, would very soon have a negative affect on the entire CSU. Demands for bandwidth associated with the explosive growth of multimedia and network applications, the transition from stand-alone to integrated information systems and their conversion to Web-based architecture, and the transition to electronic commerce far exceeded available resources. Upgrading campus telecommunications infrastructures to meet these demands thus became an urgent priority for the system. The TII was the solution adopted to accomplish this goal.

**Baseline Telecommunications Infrastructure Standards**

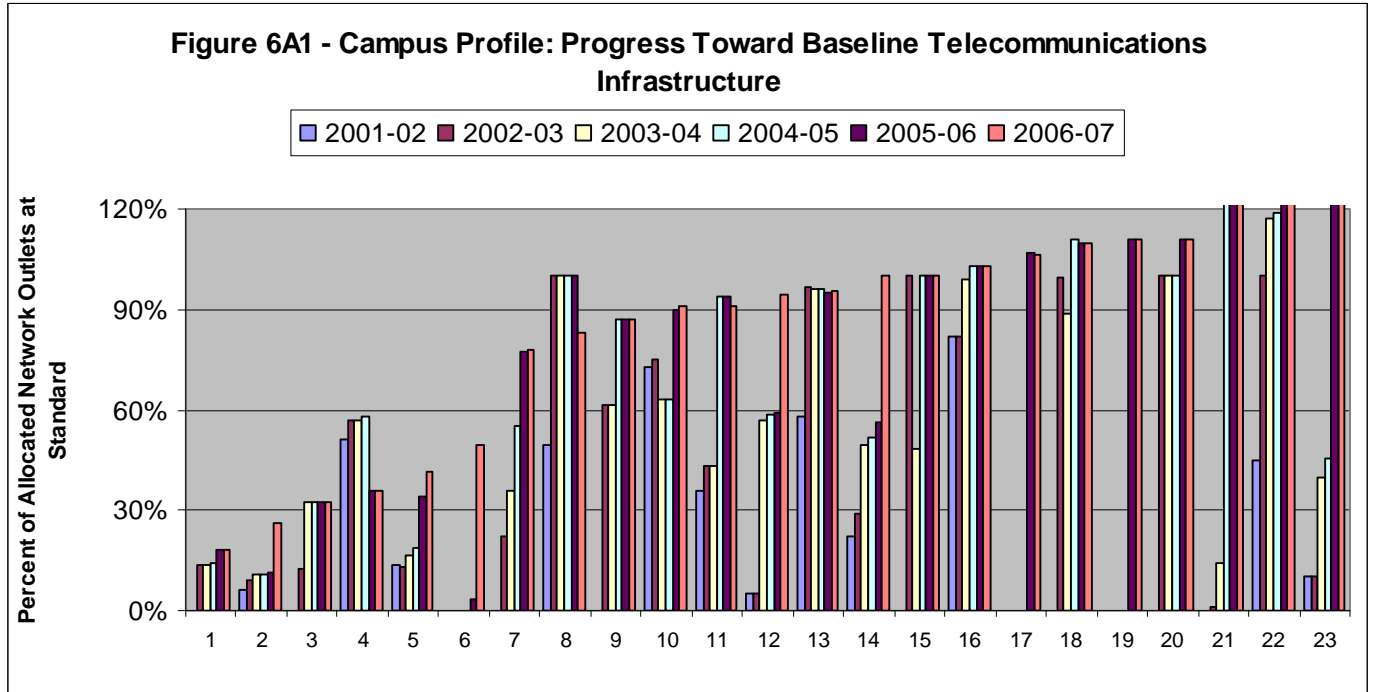
A common set of network performance specifications was adopted to ensure that each campus would have, at a minimum, a baseline telecommunications infrastructure capability adequate to meet the bandwidth demands of the present and near-term future. The progress made to date in upgrading the campus telecommunications networks is shown in Figures 6A and 6A1.

Figure 6A depicts the progress campuses have made in upgrading physical communication pathways and media to provide reliable, high-speed network connectivity from the individual network outlet (faceplate) to the campus backbone network and from the campus network to the Internet. The columns represent the number of campuses on which the percentage of network outlets meeting CSU standards (see Appendix B) falls into the range shown at the base of the chart. For example, in FY 2001–02 (front row of columns), less than a quarter of the network outlets on 13 of the campuses were up to standard. (In fact, on 10 campuses, *none* of the outlets met these criteria!) Between one-quarter and one-half of the outlets on three campuses were at standard. On only one campus did the number of network outlets meeting baseline expectations exceed 75 percent. Between one-quarter and one-half of the outlets on three campuses were at standard. On only one campus did the number of network outlets meeting baseline expectations exceed 75 percent.



Improvements that have occurred over the six-year period since TII implementation began can be seen in the changes from the front row (2001–02) to the back row (2006-07). Variation in column height (i.e., the number of campuses at a given level of compliance) from left to right depicts the shift away from lower to higher percentages of outlets meeting baseline-level standards. As of June 30, 2007, 14 campuses were at baseline (i.e., 90 percent or higher), and three were above 75 percent of baseline. At the other extreme, the number of campuses with less than 25 percent of standards-compliant outlets fell from 15 to 1. The remaining nine campuses are either very close to baseline or the target completion dates for their TII projects have been delayed due to construction interruptions. Baseline telecommunications capability for the CSU system will have been achieved when a single column at a height of 23 appears in the rightmost column.

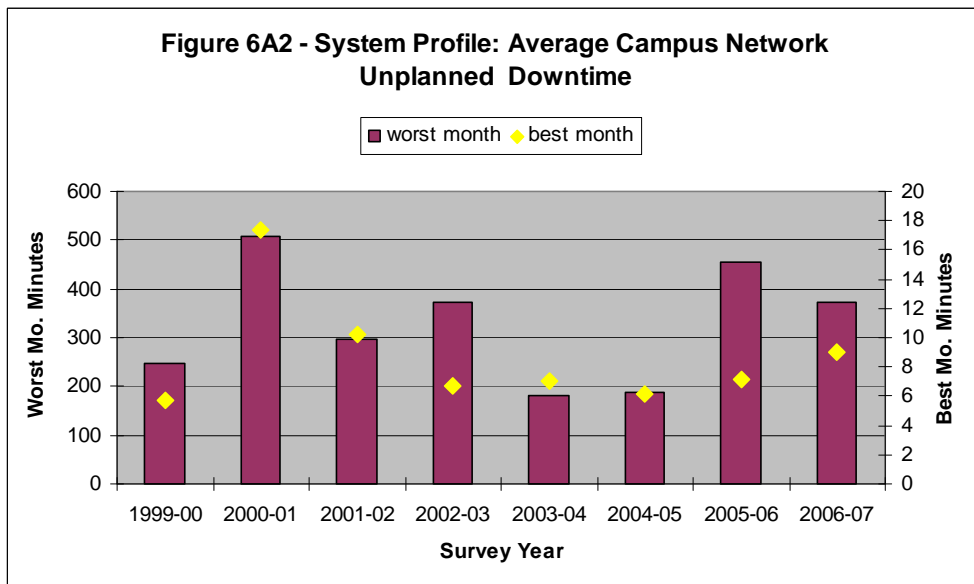
Figure 6A1 illustrates the progress toward baseline that has occurred on each campus over the past six years. The apparent regression indicated for campus 4 is a consequence of the campus decision to reclassify outlets installed prior to implementation of the TII as substandard pending official certification by the contractor. It is anticipated that the outlets in question will be found to comply with CSU standards. The drop in number of standards-compliant outlets on campus 8 is attributable to the tearing down of a building to make room for new construction. Roughly one-third of the campuses have devoted local resources to upgrade their telecommunications infrastructures beyond baseline.



**Intra-Campus Network Performance**

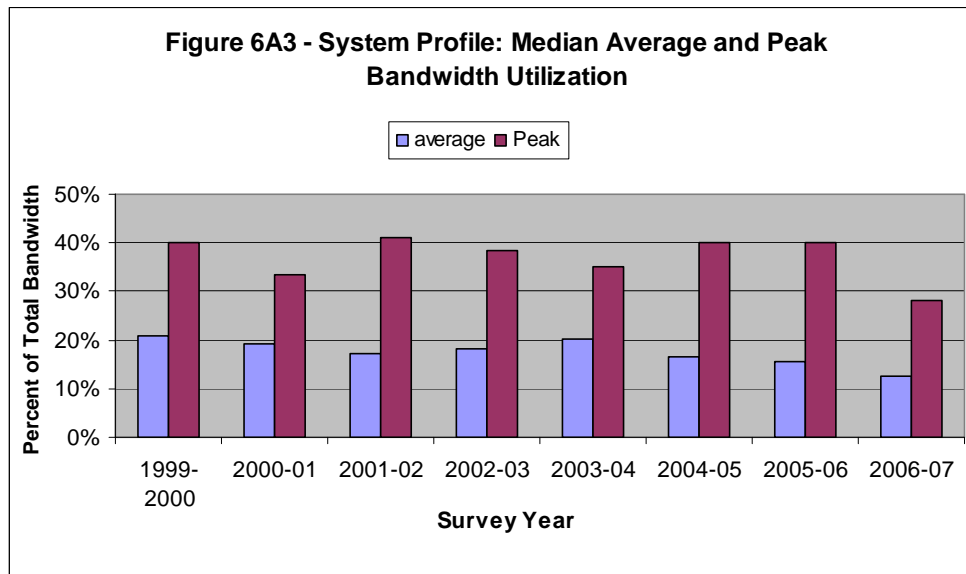
Two measures serve as indicators of campus network performance for this report: 1) the greatest number of minutes of *downtime* for a campus network in the best and worst months during the 12-month fiscal year; and, 2) the average and the highest (peak) *utilization* of the campus network capacity expressed as a percentage of total bandwidth.

“Downtime” means that a user cannot send or receive information because of a problem in the network itself, not because of problems originating within the user’s desktop equipment or because of interruptions of service provided by local power and telephone utilities. For all campuses in the system, the average “best-month” unplanned downtime has, with the exception of FY 2000-01, ranged between six to ten minutes since Measures of Success reporting began in 1999–2000. Unplanned downtime for the “worst-month” continues to fluctuate around 300 minutes (Figure 6A2).



## MOS IX: Information Technology Infrastructure Initiatives

The percentage of available bandwidth utilized at peak and non-peak periods is another important measure of network capability. Generally, the lower the percentage of available bandwidth required to support network uses, the better will be the performance of the network and the lower the risk of interruptions to network access.\* The trend toward lower bandwidth utilization shown in Figure 6A3 is a direct consequence of the campus infrastructure improvements made through TII implementation. The declines in median average and peak utilization indicate that campus network performance continues to keep pace with growing demand for bandwidth. During FY 2006-07, the highest average utilization rate, reported by two campuses, was 35 percent. Peak utilization rates were the lowest since tracking began in 1999-2000. The median peak utilization of 28 percent in 2006-07 marks a significant improvement over the 40 percent reported in the two previous surveys.

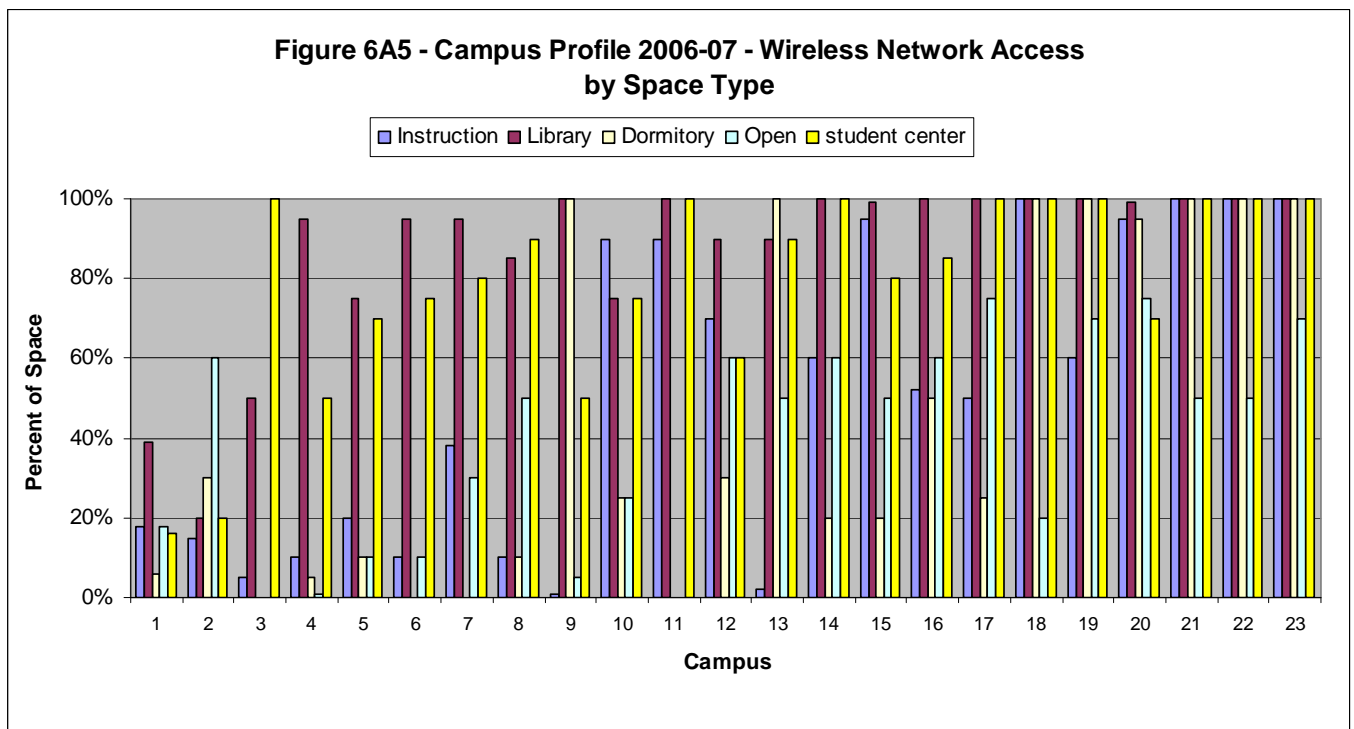
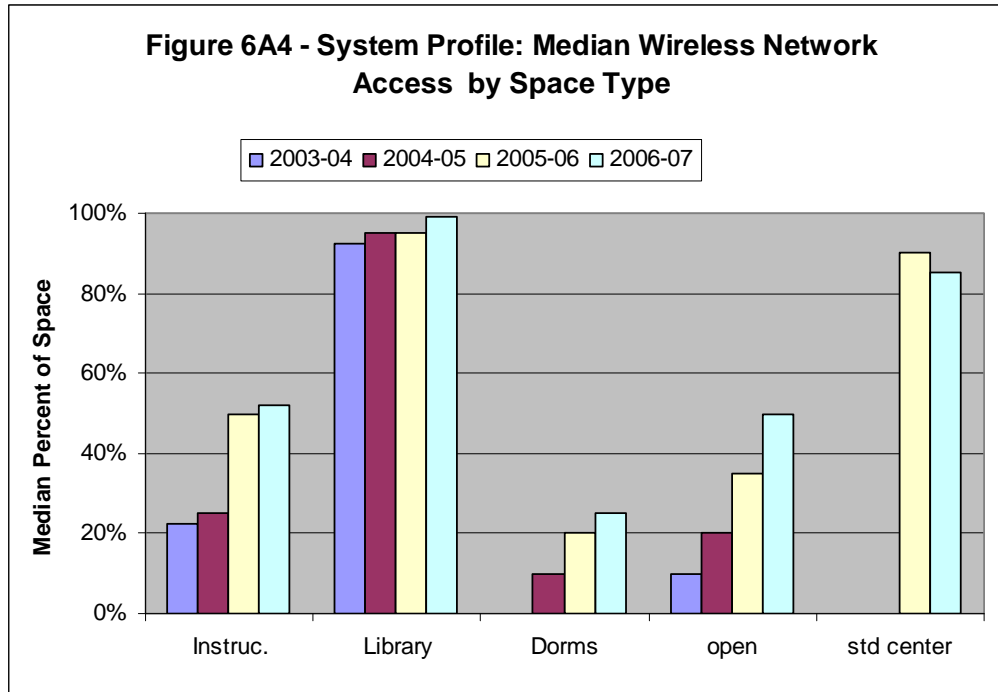


### Wireless Network Access

The importance of providing wireless access to campus computing networks has increased dramatically in the seven years since the *Measures of Success* report was initiated. In the spring 2005 technology survey, about a quarter of CSU students said that they regularly accessed their campus networks via wireless connections. Over one half of the students reported using the wireless network in 2007 survey. Faculty use of wireless roughly parallels student use. In the 2004 survey 13 percent of faculty respondents said they used the campus wireless network. Almost half said they did so in the 2006 survey.

Figure 6A4 shows for the CSU system as a whole the expansion in wireless access that has occurred over the past two years. The current status of wireless access on CSU campuses is profiled in Figure 6A5. Seventeen campuses report full or almost full availability of wireless connectivity in their libraries and eleven campuses provide full wireless connectivity in student centers. Eight campuses provide wireless access to all or almost all classrooms and other instructional sites. Seven campuses report wireless coverage for 95 percent or more of dormitory space.

\* Individual campus methods for calculating these indicators may differ. Utilization rates are usually established by sampling network traffic on a specific day(s) and time(s) of the week associated with average usage patterns and with high usage patterns.



CSU campuses are somewhat ahead of comparison institutions nationally in planning wireless networks. The 2007 Campus Computing Survey showed that 96 percent of CSU campuses had a strategic plan for wireless networks versus 79 percent for comparison institutions nationally (i.e., the 93 Public Master’s 1 universities). Deployment of wireless networks is roughly equal to comparison institutions with about one-half of CSU classrooms covered by wireless access and 62 percent of the campus overall.

The telecommunications infrastructure upgrade is nearing completion on all campuses. The Infrastructure Terminal Resource Project (ITRP) is providing funds to upgrade each campus to a minimum baseline of 36 Mb/s wireless

## MOS IX: Information Technology Infrastructure Initiatives

capacity in all state owned buildings. The next electronics refresh cycle, ITRP 2, will provide additional access points up to 48 Mb/s wireless capacity in all state owned buildings.

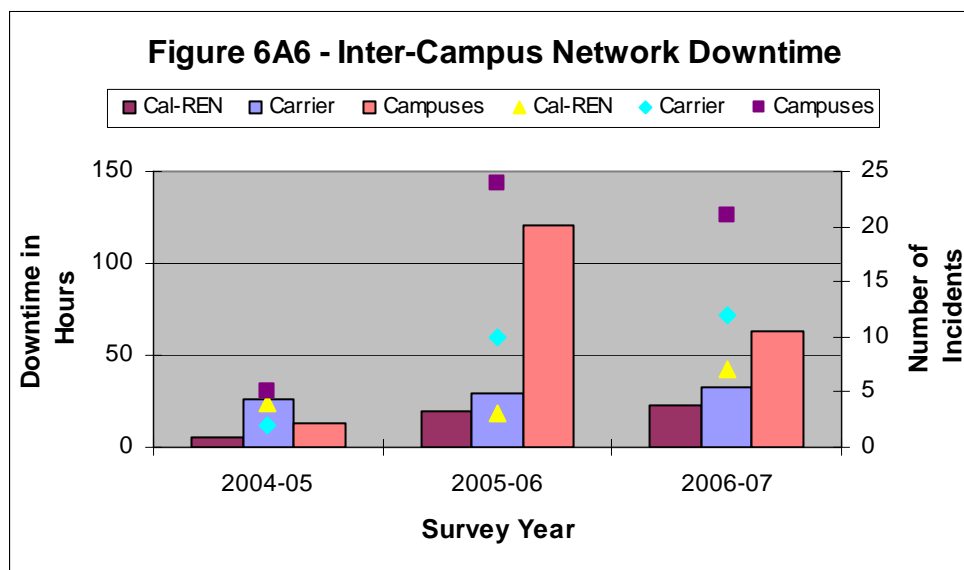
### Inter-Campus Network

Funding to maintain and improve the CSU inter-campus network is outside the scope of the Technology Infrastructure Initiative. However, because inter-campus and Internet connection are vital to achieving the outcomes of the ITS, and because campus network capacity and traffic directly impact the operations of intra-campus networks, pertinent information about the inter-campus network is included in *Measures of Success*.

Prior to the 2003–04 academic year, the CSU provided inter-campus network connectivity through the operation of its statewide educational network, 4CNet. This high-speed statewide backbone connected CSU campuses to one another and also supported connectivity among the campuses of the California Community Colleges and over 30 K–12 sites. In addition, 4CNet provided network services for five CSU off-campus centers, the office of Government Affairs, and the Chancellor’s Office. Tables 13.2a and 13.3 in Appendix A summarize the network performance of 4CNet from the baseline year (2000–02) through 2002–03.

During 2003–04, 4CNet operations were phased out, and connectivity was acquired through membership in the Corporation for Education Network Initiatives in California (CENIC). The CENIC statewide backbone, known as CalREN (California Research and Education Network), provided CSU sites with reliable, high-capacity service since that transitional year. Network performance metrics and the mechanisms to monitor them put in place under 4CNet have been superseded by a global measure of non-availability of network connectivity to users. For purposes of this report, CENIC defines a service interruption or downtime as a period when computers on a campus are unable to send or receive data from sources external to the campus network.

During the period July 2006 through June 2007, 40 service interruptions occurred. Twenty-one of the interruptions—totaling just over 60 hours—were attributable to outages on campuses, seven caused by power outages. Commercial carrier disruptions accounted for 12 service interruptions totaling 33 hours. Seven instances amounting to 23 hours occurred due to CalREN downtime unrelated to routine maintenance. A single hardware failure accounted for most (fifteen hours) of this. Figure 6A6 summarizes the number of incidents and consequent hours of inter-campus network downtime during 2006-07.



While information security, identity management and accessible technology are not part of the formal reporting process of the MOS, they have been mentioned in previous editions as emerging technologies that have become a de facto part of the baseline infrastructure. Status reports have, therefore, been included in this MOS.

## Information Security

For the past few years, security concerns have rated highest in importance among senior IT administrators across several national surveys. In the 2007 Campus Computing Survey, respondents were asked to identify the "single most important IT issue over the next two or three years." Among CSU campuses, 'upgrading network and data security' ranked first (30 percent) followed by "financing replacement of aging hardware and software (22 percent), "hiring and retaining qualified IT staff" and "assisting faculty integrate technology into instruction" (each at 17 percent). On questions of importance rankings for security, disaster recovery, identity management, and disaster communications capacity, each item received ratings above 6 on a 7-point scale.

Fully 91 percent of CSU campuses had strategic plans for network security and 83 percent for disaster recovery, far ahead of national peer institutions at 77 and 69 percent, respectively. However, only 22 percent of CSU campuses had strategic plans for emergency notification and communications compared to 43 percent nationally, and when asked if a campus-wide emergency notification system would be operational in September 2007, the response from 35 and 26 percent of CSU and peer institutions respectively was "no." When given a list of 12 types of security incidents that might have occurred in the past year, the top three for the CSU were attacks on the campus network (57 percent), exposure or loss of sensitive data in distributed server environments (26 percent), and theft of computers containing confidential data files (22 percent).

Campuses reported that they spent a total of just over \$2 million for information security tools and services in each of the past two fiscal years (Figure 6A7). Three quarters of the expenditures were to purchase or license network security tools. Staff training accounted for around 15 percent, with the balance spent for security and related services.

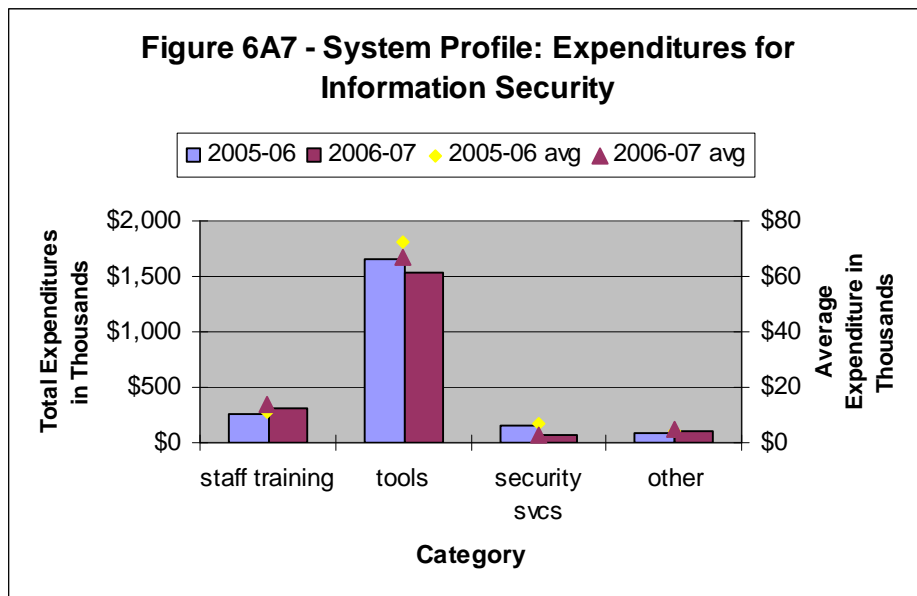


Figure 6A8 ranks information security technologies employed by CSU campuses according to the number of campuses reporting their use. The cost of acquiring and maintaining the currency of these tools contributes to the wide disparity among campuses in the level of expenditures noted above and depicted in the campus profile below.

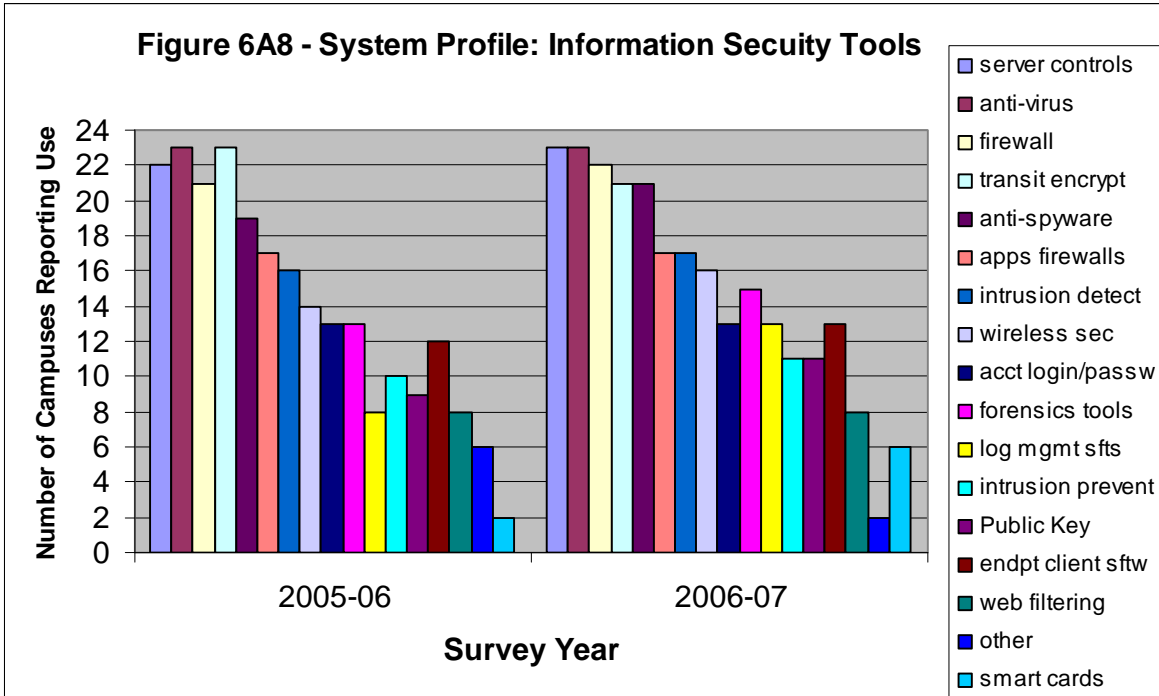
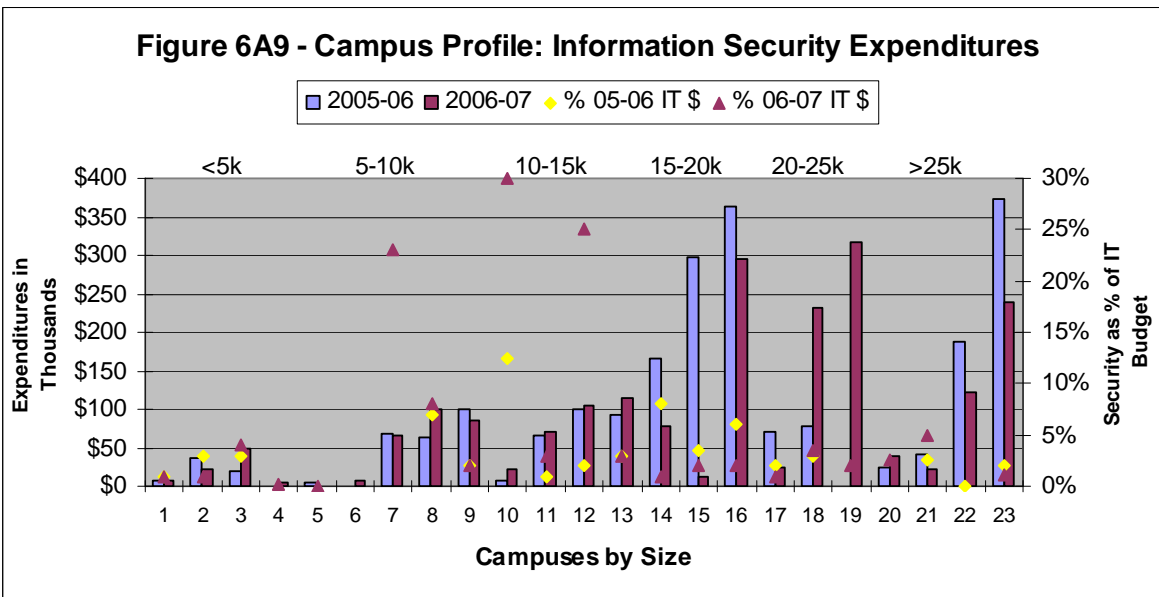


Figure 6A9 displays expenditures for information security reported by each campus. Predictably, larger campuses generally incurred greater costs for information security. Surprisingly large differences are evident in the level of funding among campuses of similar size (defined by annual Full Time Student Equivalency). Within the group of campuses with enrollments over 25,000, for example, information security spending at two of the four campuses was well under \$50,000 annually, while the other two reported expenditures two to six times that amount. The median percent of the annual campus IT budget consumed by security costs was two percent; however, three campuses reported expenditures in the 20 percent to 30 percent range.



In 2007 Unisys completed a consulting engagement which detailed gaps in the CSU Information Security environment. This analysis will be used in the development of a systemwide information security management plan. A contract was awarded to a consulting firm to develop systemwide information security policies and to provide guidance to CSU in how to best implement them. In addition, CSU has developed a request for proposal to develop

an awareness program that will inform faculty, students and staff about the importance of information security and provide guidance on best practices.

### Identity and Access Management (IAM)

Since it first emerged as a concern about five years ago, identity theft and protection of personal data have become highly visible as public policy issues. The CSU Identity and Access Management Initiative is a system-wide policy and technology infrastructure that will enable CSU campuses to manage digital identity information and to ensure efficient and secure network-mediated transactions that fully respect individual privacy.

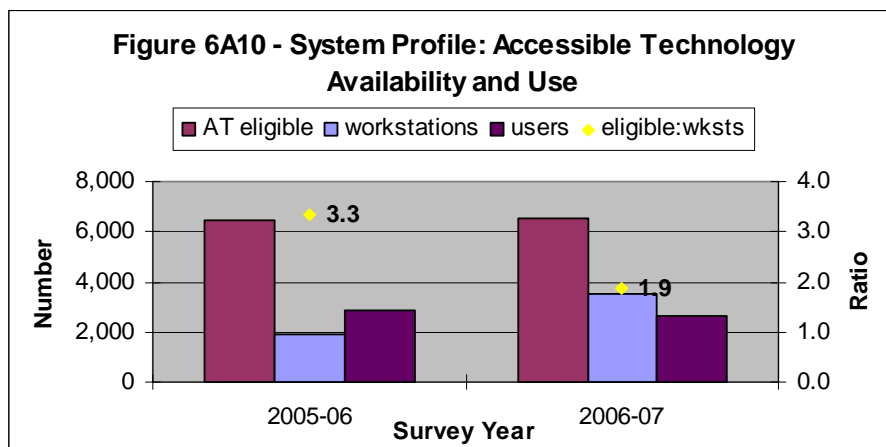
The major goals of IAM are to: reduce, but not eliminate, the use of SSN for tracking and reporting; reduce number of repositories of confidential information and enhance their security; reduce number of user ids and passwords; increase electronic mobility between CSU locations; improve enrollment management tracking and reporting; reduce costs while increasing productivity and usability through more streamlined account management capabilities.

IAM is a shared responsibility of the Chancellor’s Office and individual campuses and a coordinated planning effort is under way. The IAM Technical Architecture Group is developing common database schema, common data elements, and data definitions. Plans call for implementation of a central registry at the Chancellor’s Office to provide a unique identity for each individual throughout their CSU life cycle (e.g., applicant > accepted > registered student > alumni > donor).

### Accessible Technology

Last year’s MOS reported that in 2005-2006 CSU began an Accessible Technology Initiative to implement the policy established by Executive Order 926 issued January 1, 2005. The policy of the CSU is to make its programs, services, and activities accessible to students, faculty, staff, and the general public with disabilities who visit or attend a campus-sponsored event. After considerable constituency consultation, campuses and the Office of the Chancellor now have a three-year timetable for accessibility compliance with focus on three areas: accessible procurement, accessible web services, and accessible instructional materials. Interim milestones have been accomplished and CSU is developing a national reputation as a leader in this critical field. The California Emerging Technology Fund has awarded the CSU \$250,000 for Fiscal Year 2007-2008 to develop an accessibility testing center for software. CSU is eligible to apply for two renewals of the grant at \$250,000 each in FY 2008-2009 and 2009-2010.

Figure 6A10 provides a system overview of the student population eligible to receive accessible technology support, the number of workstations equipped to meet their needs, and the number of actual users. With the increased emphasis on accessible technology, CSU campuses have improved by more than a third the ratio of available accessible workstations to eligible students over the last two years.



CSU campuses appear to be far ahead of comparison institutions in "508 accessibility and compliance for Web pages and resources." The 2007 Campus Computing Survey found that 78 percent of CSU campuses have a strategic plan

in place, and 23 percent are currently preparing a plan versus 48 and 33 percent, respectively, for peer institutions nationally.

### Baseline Access, Training, and Support

The TII seeks to improve personal productivity by providing CSU faculty, staff and administrators, and students with a baseline quantity and quality of computing and network technologies, and with related training and support services. This section of *Measures of Success* tracks progress in providing end-user access to baseline technology resources and services in four areas: workstations (hardware and software); network connectivity; technical support; and technology training.

#### Workstations

##### Access and Quality

The indicator for hardware and software access (quantity) is the percentage of workstations assigned to each user group. Purchase date was selected as a surrogate measure for workstation quality or currency: hardware and software purchased within three years of the reporting period are deemed to meet CSU *quality* standards.

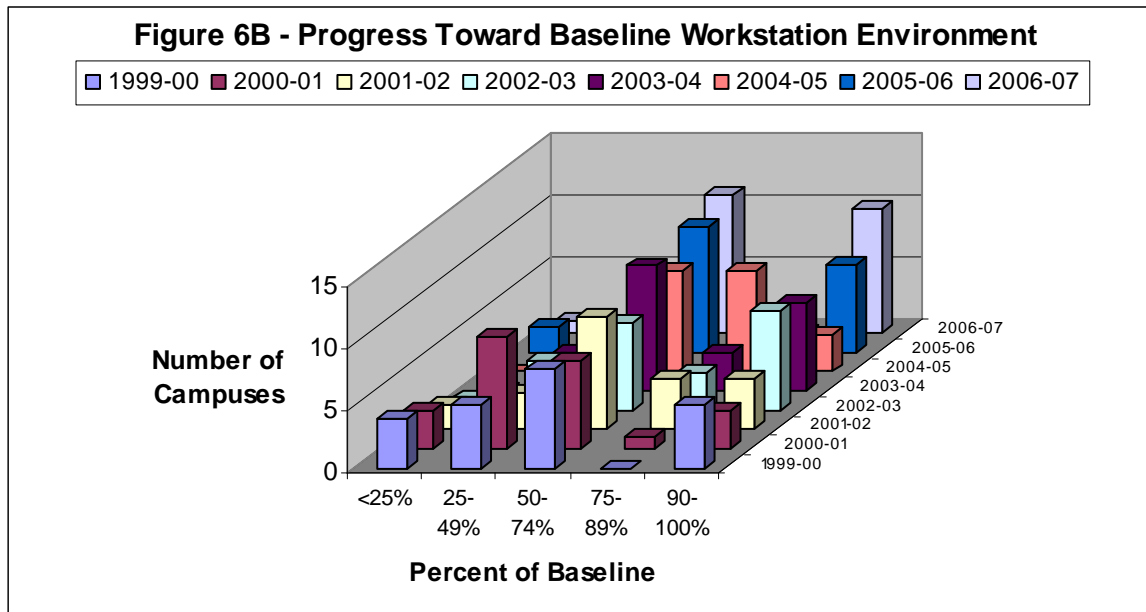


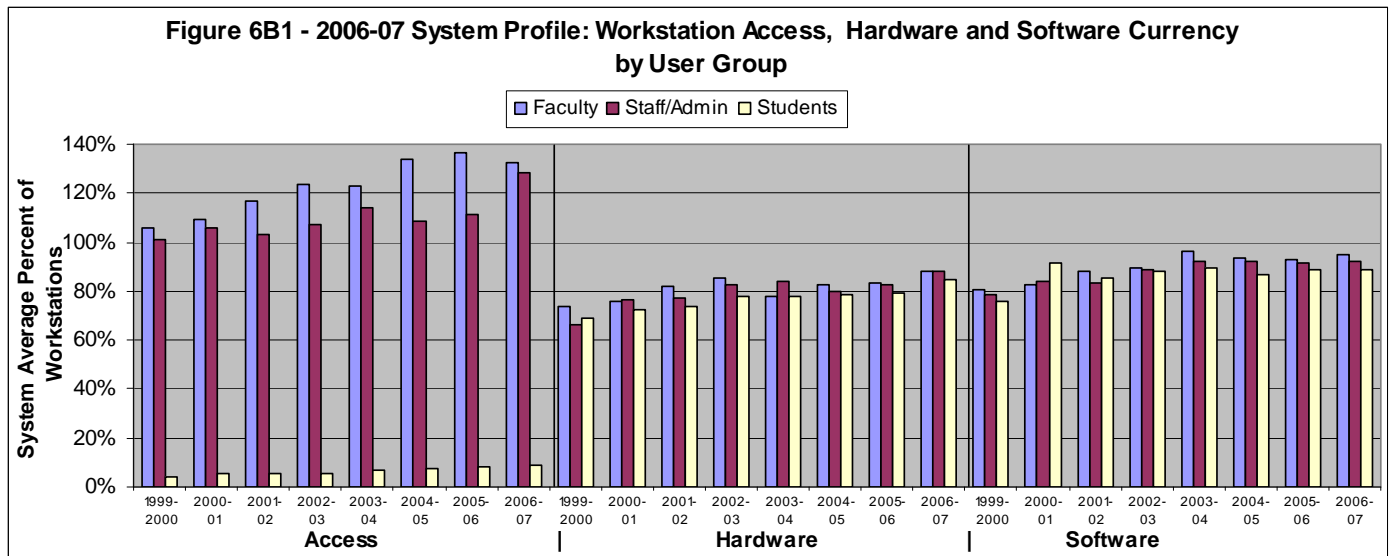
Figure 6B provides an overview of the progress campuses have made toward achieving the workstation environment described in the baseline infrastructure standards (see Appendix B). Improvements in access to computer hardware and software that meet ITS standards for currency are reflected in the greater number of campuses at baseline (90–100 percent, represented by the file of columns on the far right in the chart below) or near baseline (75–89 percent) in 2006-07 than in 1999–2000 (the baseline year). In 1999-2000, represented by the first row of bars, four campuses reported that less than 25 percent of the workstations provided for the use of faculty, staff, and students met the baseline standards; five claimed to be between 25 and 49 percent compliant; eight between 50 and 74 percent; none between 75 and 89 percent; and only five campuses said that 90 percent or more of the workstations met currency standards. Over the years, workstation accessibility and quality have improved. As of 2006-2007 (the last row of bars) only two campuses reported less than 50 percent of workstations below hardware and software standards, and 10 campuses said three quarters or more of their workstations were at standard in both respects.

The profiles of individual campuses closely parallel the picture for the system as a whole. (See Tables 12.2–12.7 in Appendix A.) Typically, the number of workstations available to faculty, staff, and administrators equals or exceeds somewhat the total number of personnel, owing in part to increasing demand of faculty and staff for laptops.

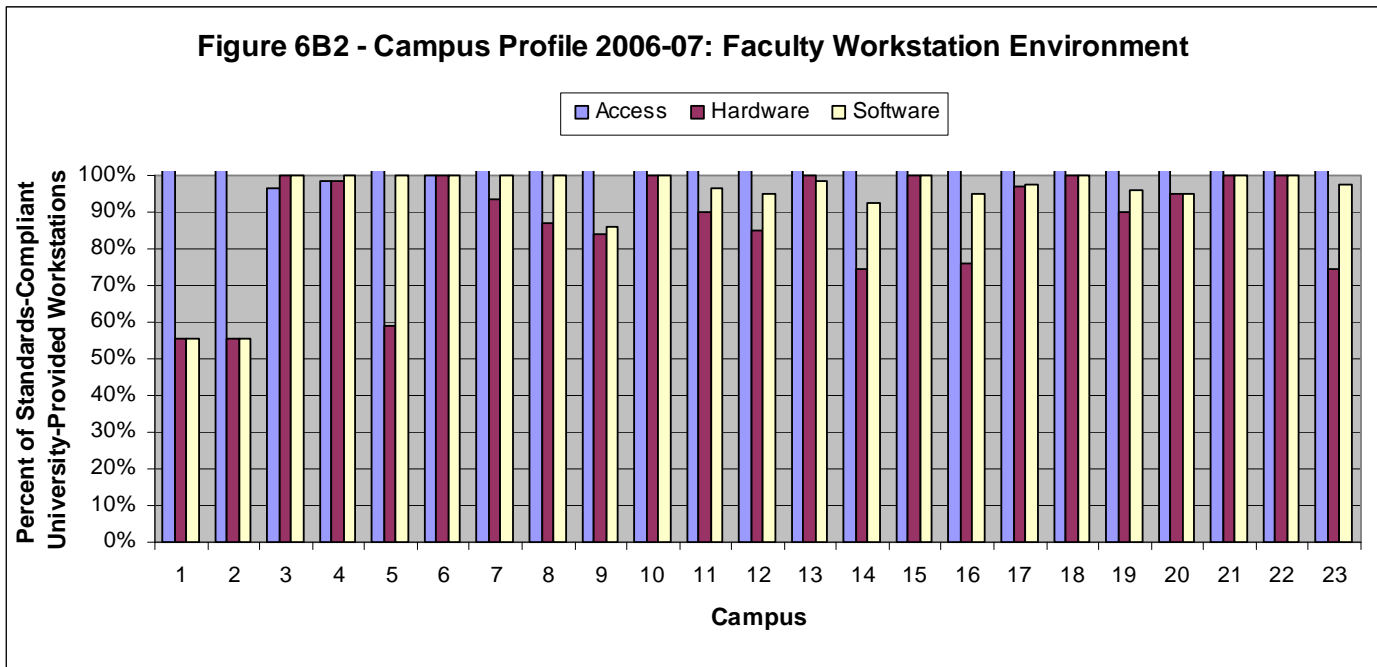
## MOS IX: Information Technology Infrastructure Initiatives

Workstation quality rather than accessibility accounts for the high number of campuses remaining in the range of 50 to 75 percent of baseline. Maintenance of workstation currency is a major challenge for campuses, particularly with respect to the computers and peripherals (referred to as “hardware”) used by faculty and staff. Although the ratio of price to computing power continues to fall, the rate at which this equipment becomes obsolete has remained constant. The same is generally true for software applications, although the updating or replacement costs are lower than for hardware. Campuses thus face the challenge of funding the replacement of computing hardware and software on a three- to four-year cycle. In any given year, therefore, the profile of workstation quality (i.e., the currency of hardware and software) across the system will vary depending on the availability of resources to “refresh” equipment and software.

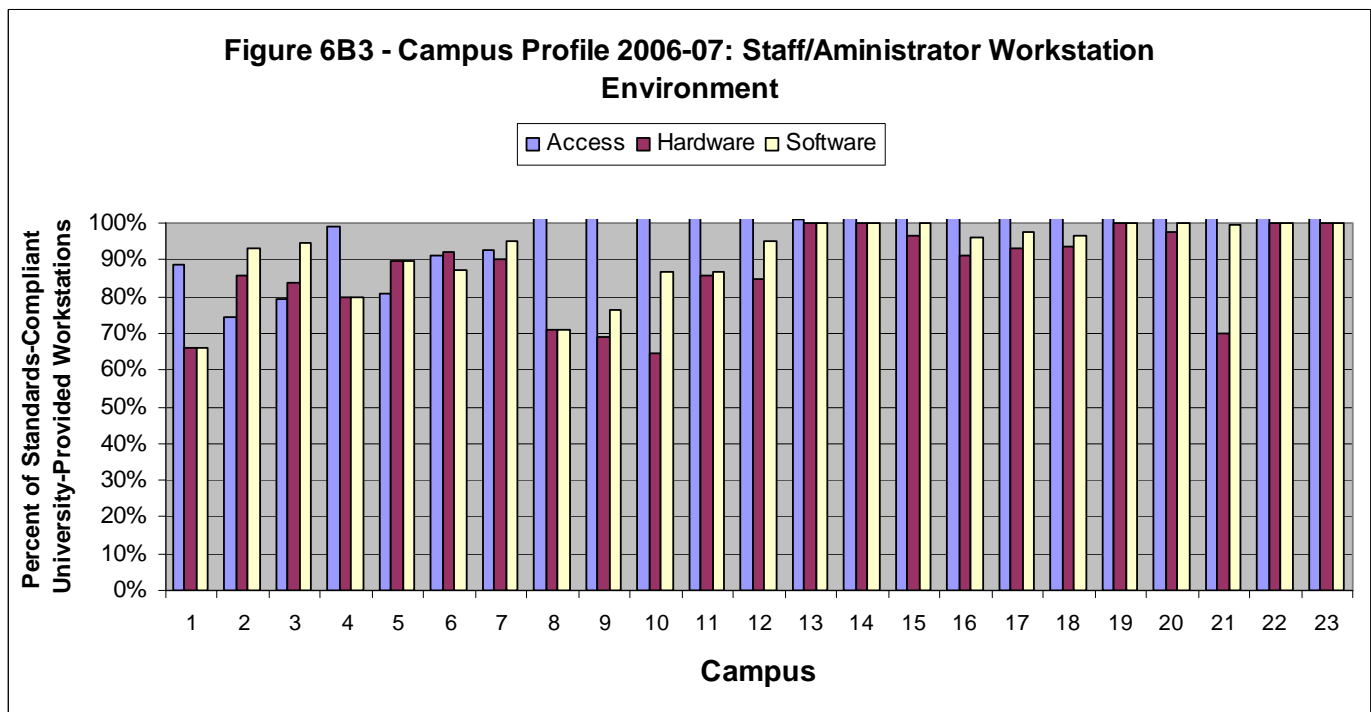
Figure 6B1 displays the status of workstation access and quality for faculty, staff and students in 2006-07. Almost all faculty and staff have access to a computer workstation. The number of university provided computer workstations available for general student use doubled over the baseline year, assuring computer and network access to the small number of students (less than ten percent) who do not personally own their own computer. (The 2003 student technology survey found that 95% of students owned and used a current-generation computer. The 2007 survey revealed that 93% of CSU students had broadband connectivity from their residences.)



As shown in the campus profiles in Figure 6B2, most CSU campuses provided the baseline workstation environment envisioned in the ITS in 2006-07. Full-time faculty on *all* campuses had baseline access to a university-provided workstation, and on all but three campuses the software on these workstations met quality standards. On fourteen campuses, workstations available to faculty met hardware currency standards, while on the percent of computers meeting hardware currency standards ranged from 75 to 89 percent on four campuses and between 50 and 75 percent on the remaining five.



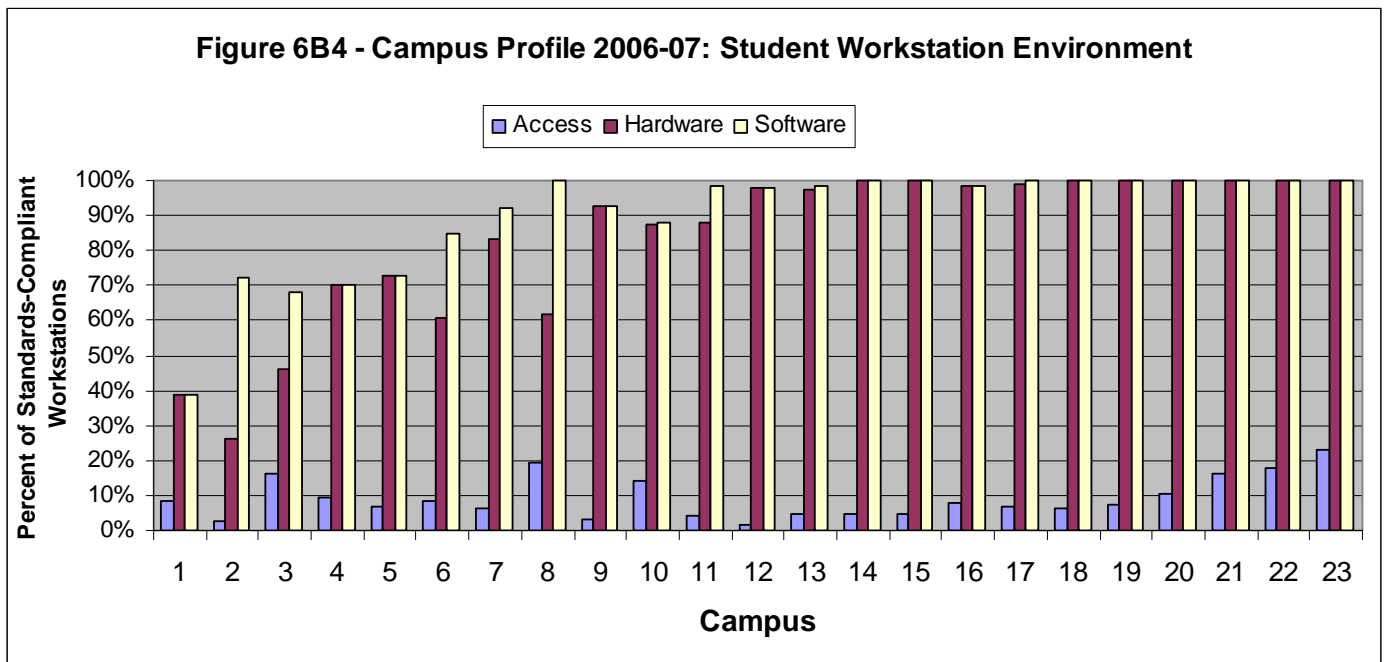
Nineteen campuses provided staff and administrators baseline access to a computer workstation (Figure 6B3). Of the four remaining campuses, three fell marginally short of baseline. Software on eight campuses was below baseline, marginally so on half of them. Twelve campuses reported that 90 percent or more of the workstations used by staff in 2006-07 met hardware currency standards. About a third of the staff workstations on five campuses were below standard, and on six campuses the number of aging workstations ranged from 75 to 90%.



Because almost all CSU students own and prefer to use their own computers, there is no common standard for defining and measuring access to a university-provided workstation. A ratio of one open-access computer for every

ten students has been quoted as a general target, but with acknowledgment that the socio-economic profile of student populations should guide decisions about how many computers campuses must provide to meet the access needs of their students. Systemwide, the ratio of computer workstations to students has improved steadily over the eight years since tracking began for this report. The median ratio has been cut in half over this period, from 1 computer for every 28.3 students in 1999-2000 to 1 computer for every 14.3 students.

As noted in Figure 6B4, campuses differ in the number of open-access computers they make available to students. One small campus (annual FTES below 5,000) provides a university owned workstation or laptop at the rate of 1 for every 4 students. At the opposite extreme, the ratio at one of the larger campuses (FTES between 15,000 and 20,000) is 1 to 50. With respect to the quality of the computing environment, sixteen campuses reported that open-access workstations used by students met baseline software standards; thirteen campuses said their student-use computers met hardware standards.



Faculty, staff and student have generally expressed a rather high level of satisfaction with the workstation hardware and software available to them. All three groups have given ratings between 7.5 and 8.5 on the zero-to-ten scale in surveys administered since 2000. These findings are reported in previous editions of *Measures of Success*.

**“Smart Classroom” Access**

At the institutional level, availability of “smart” classrooms is one indicator of progress toward providing the level of information technology support for academic programs sought by ITS planners. “Smart classrooms” are instructional spaces permanently equipped with screen/monitor(s); projector; network connections to voice, video and data; and computer workstation(s) or provision for attachment of a laptop computer. The need to equip classrooms for instruction that employs network resources and multimedia presentations has grown with the increased availability of technology-mediated instructional materials and with greater reliance on Web-based learning activities. Figure 6B5 depicts the conversion of conventional instructional spaces to “smart” classrooms that has taken place since *Measures of Success* reporting began. As of the end of fiscal year 2006-07, some eight out of ten classrooms in the CSU are equipped to support the use of multimedia instructional resources.

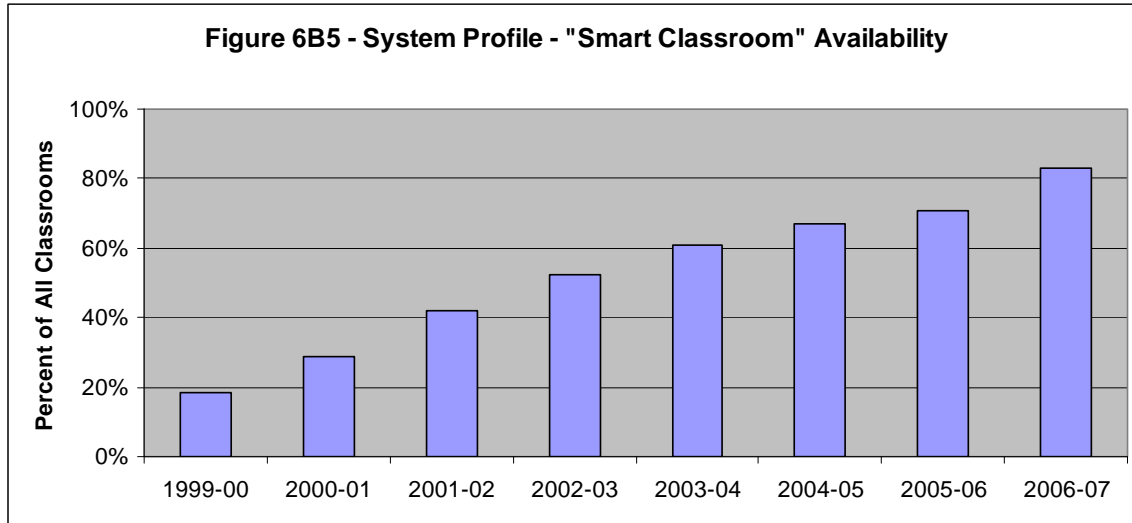
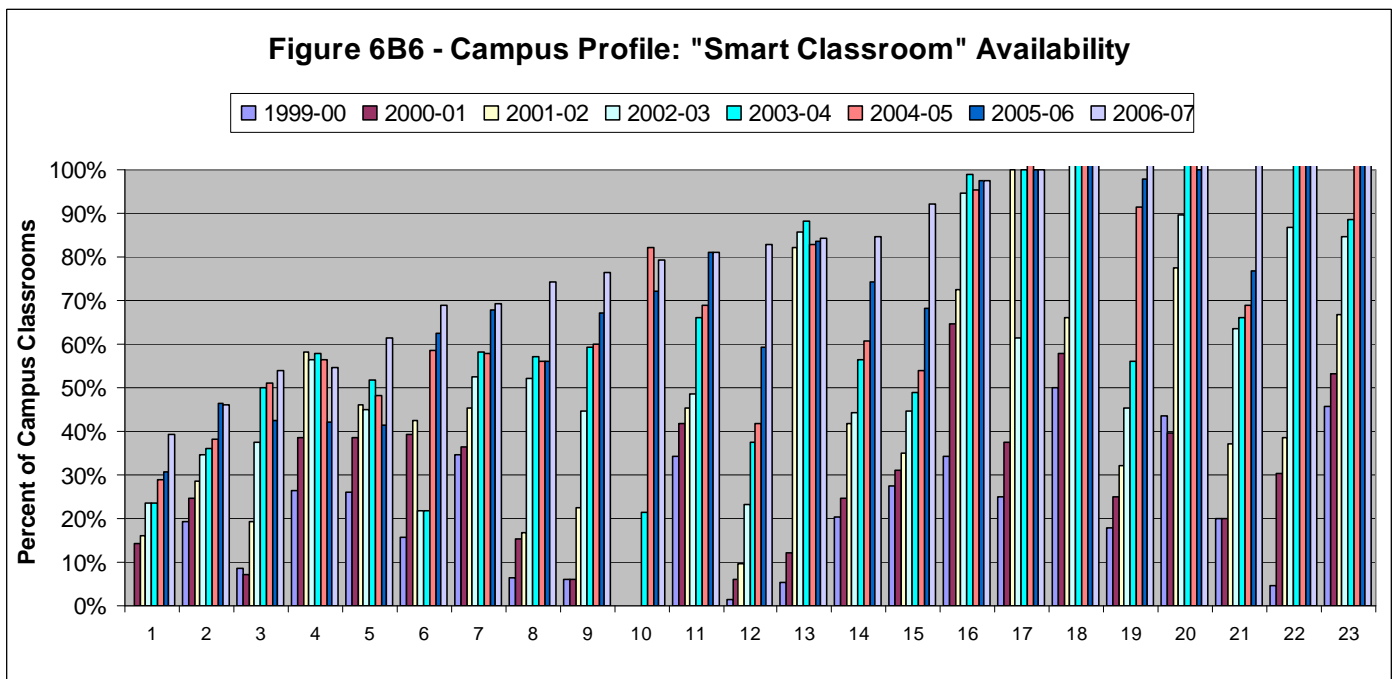
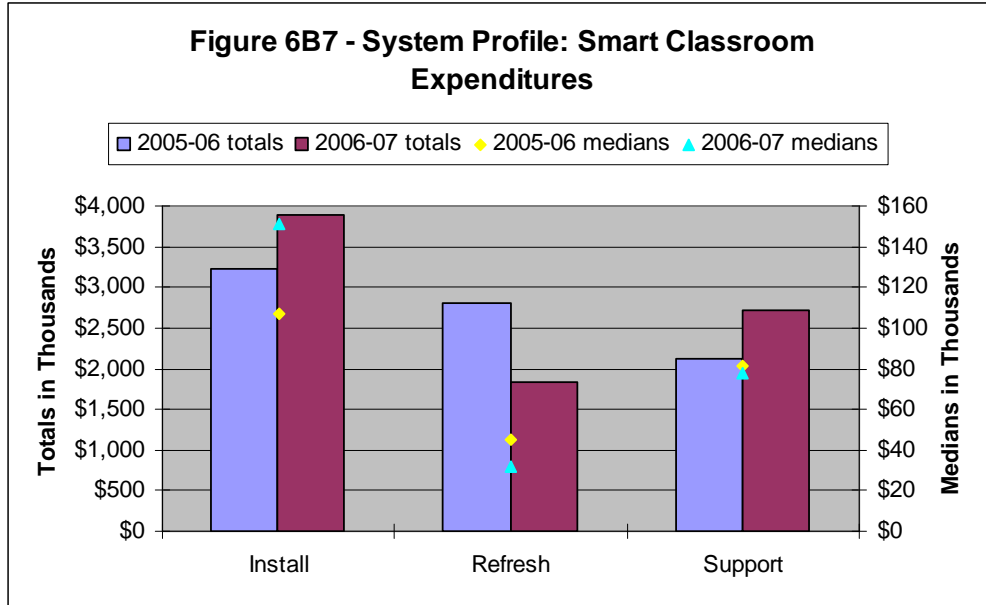


Figure 6B6 shows the steady increase in the number of smart classrooms that has occurred on CSU campuses in the seven years since MOS reporting began. All of the classrooms on five of the smaller campuses are smart; no campus reports that fewer than a quarter of its classrooms have such capability. Four campuses undergoing rapid expansion reported that more than 100 percent of their classrooms were smart, an anomaly attributable to delays in matching actual space use with space inventories.



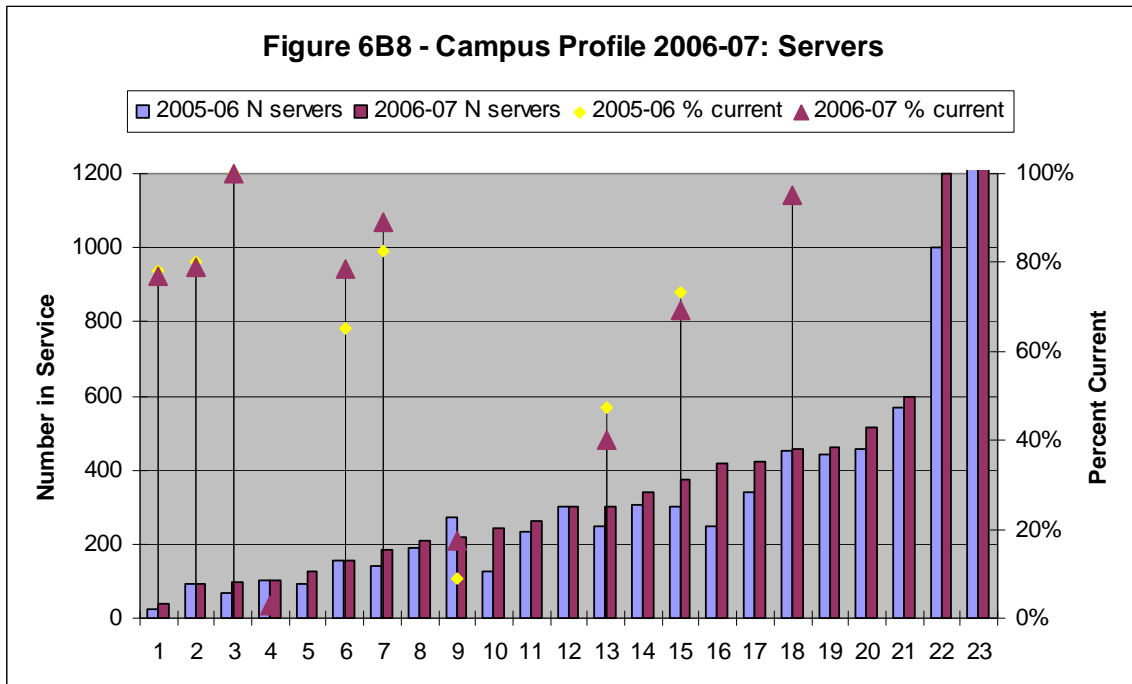
Smart classrooms stand at the intersection between online and traditional teaching and learning. Equipping and maintaining such classrooms was one of the most important unmet needs in the CSU funding gap study conducted in 2004-05. Construction, refresh cycles, and technical support needed to achieve baseline for smart classrooms ranked very high in unmet need costs. Campuses reported spending \$8.1 million in 2005-06 and \$8.5 in 2006-07 to equip (install), update (refresh) and support the use of "smart" classrooms (Figure 6B7).



### Server Environment

As noted, applications of information technology have become essential tools in all core areas of university operations (academic programs, administration and student services). The new burden this has placed on universities to make access to information in these systems secure is described above. Providing adequate and secure data storage and access poses a companion burden. Much of the data generated in the divisions and departments of the university is stored and/or secured on servers, rather than on mainframe systems. The cost of acquiring, updating and operating servers was identified as a significant IT funding issue in the 2005-06 funding gap study.

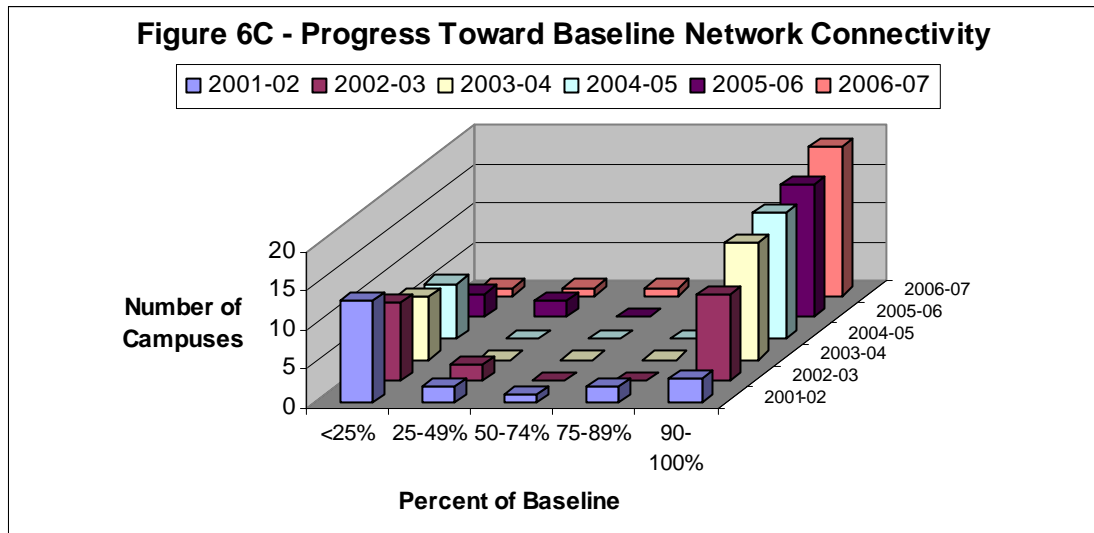
CSU campuses report owning about 8,500 servers in 2006-07, a thousand more than in the previous year. Many of the older servers are near the end of serviceability. On the ten campuses that have adopted server currency standards, the mean percent meeting those standards is 78 percent.



**Workstation Network Connectivity**

The baseline workstation standards established in the ITS call for network connectivity capable of supporting full-motion video (a minimum speed of 100 to 150 Mbps). Such high bandwidth enables multimedia applications routinely used in science, visual arts, and music instruction; it also meets the high data transmission demands required for the operation of administrative information systems. Based on data from the Annual Campus Computing Survey, levels of broadband capability for video, voice, and gigabit ethernet for CSU campuses are roughly similar to comparison institutions nationally.

Figure 6C illustrates the dramatic, systematic progress that has been achieved in providing CSU students, faculty, and staff with network connectivity at a level consistent with current and anticipated technological demands. In 2001–02, only three campuses were able to provide connectivity at the speed defined in the CSU baseline technology infrastructure standards (see Appendix B). By the end of 2006-07, 19 campuses were doing so, a gain attributable largely to the campus backbone network improvements funded through the TII. By the end of June 2007, only four campuses—those that have not completed implementation of their telecommunications infrastructure projects—report workstation network connectivity below baseline standards.

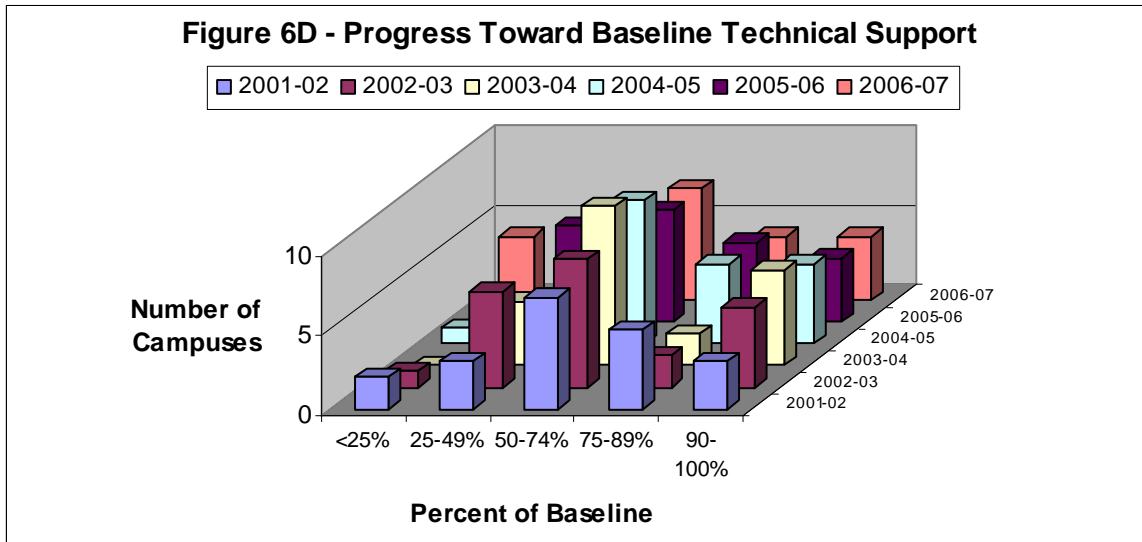


Satisfaction with on-campus network connectivity has remained generally high (mean score above 7.5 on the zero-to-ten scale) for faculty, staff and students since systematic surveying began in 2000. Findings from the biennial student survey are reported in Appendix C. Ratings of faculty and staff satisfaction with access to the campus network were reported in the 2000 and 2004 editions of *Measures of Success*. Patterns of network access, use and satisfaction were so stable for all three user groups that the decision was made to eliminate questions about on-campus network use in the 2006 and 2007 surveys. Questions about wireless and remote access, however, were retained. Use of wireless networks is increasing as access to them becomes available. Remote access of campus networks continues to rise as broadband connectivity becomes ubiquitous. Not surprisingly, satisfaction ratings have also gone up for wireless and remote access.

**Technical Support**

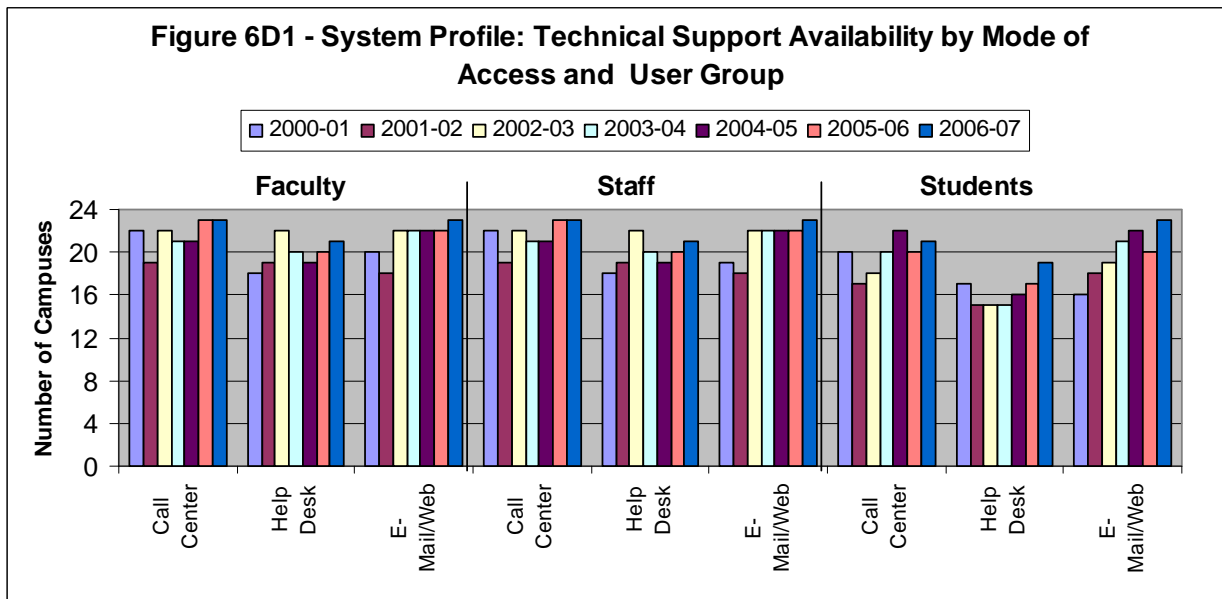
Technical support is an essential component of the ITS baseline information technology infrastructure. Gains in quality and efficiency cannot be expected from the acquisition of new technologies if people cannot use them effectively. Although no dedicated funding sources for this purpose exist, all campuses provide at least basic technical support to user communities for university-provided equipment and software.

Figure 6D profiles changes in the level of baseline technical support for all user groups since 2001–02. The uplift of the columns from left to right and from front to back from 2001-02 through 2003-04 mirrors the modest growth in availability of support services over those three years. For the past three years, however, the distribution more closely resembles the classic bell curve pattern of the baseline year. Institutional survey data afford no insight as to whether the lack of sustained expansion of support services is due to resource constraints, to demand levels, or to a combination of these and other factors.



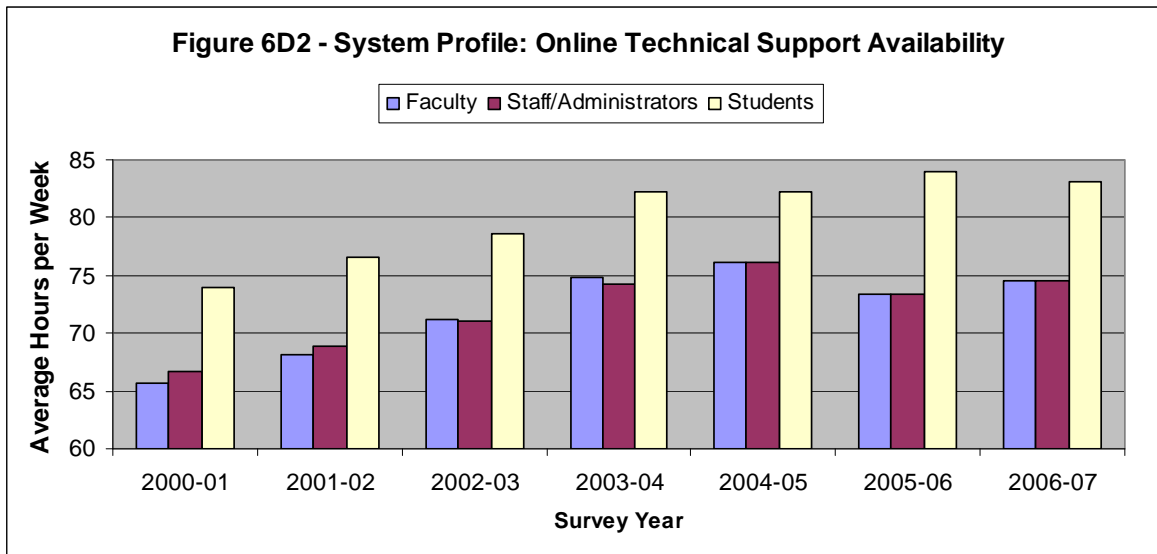
**Access**

On most campuses, faculty, staff/administrators, and students have a choice in the way they request help. Figure 6D1 depicts the options available to each principal user group over the past seven years. These include telephoning a central campus call center, visiting a central or a divisional help desk, or using e-mail/Web.



In addition to the modes or sources of assistance listed above, students often receive help from staff in computer laboratories or the library. Faculty, staff, and administrators on some campuses can receive support from technicians in their own divisions or departments.

Call centers are a widely available means of dealing with computing and network problems. There has been a steady increase in the average hours per week that call-center help is available to faculty, staff/administrators, and students (Figure 6D2). No campus reports providing less than 40 hours per week of access to call-center support for all user groups. Three campuses make call center support accessible 24/7.



### Quality of Service

In 2001–02, metrics for gauging the quality of support services were incorporated into *Measures of Success*. These metrics are a set of institutional policies and practices that, when adhered to in total, suggest the campus is providing support services of the quality envisioned in the Integrated Technology Strategy.\* Baseline capability in the area of end-user technical support is attained when a campus meets all five policy/practice standards for all three user groups.

Figure 6D3 profiles the extent to which campuses are meeting quality-of-service goals for the three user groups in the area of technical support. For the second year, four campuses reported that they have achieved baseline in the area of technical support.

\* The five support standards are:

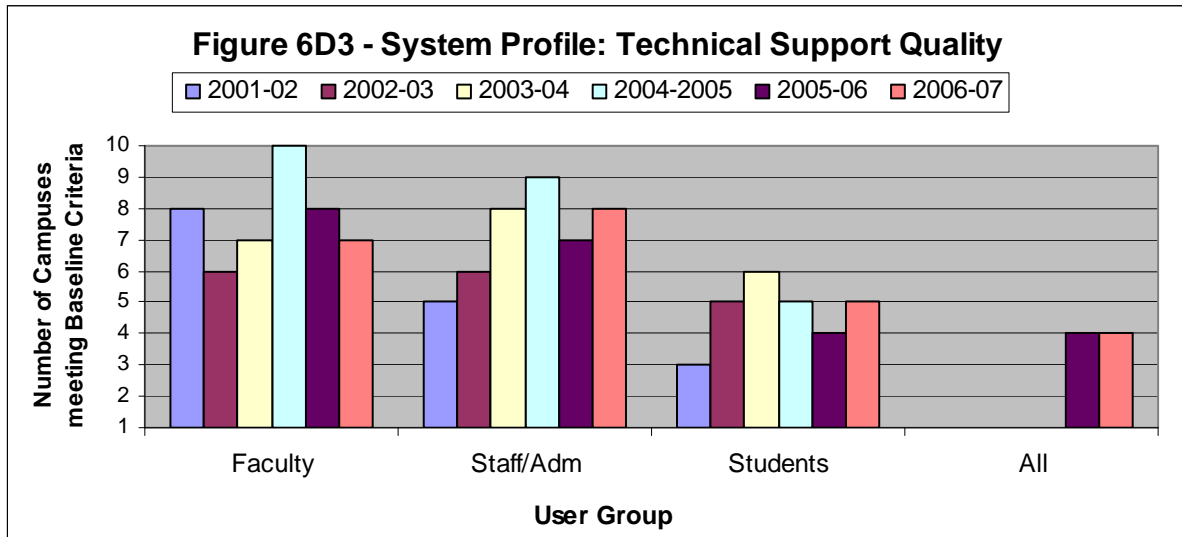
The campus has policy or guidelines defining the kind and level of end-user technical support to which members of each user group are entitled.

The campus has, and periodically employs, a mechanism for assessing the baseline technical support needs of faculty, staff/administrators, and students.

The campus communicates effectively to members of each user group comprehensive information about the technical support services available to them.

The campus has, and periodically employs, a mechanism for measuring the satisfaction of user group members with the technical support they receive from the campus.

The campus tracks the use of technical support services by members of each user group.

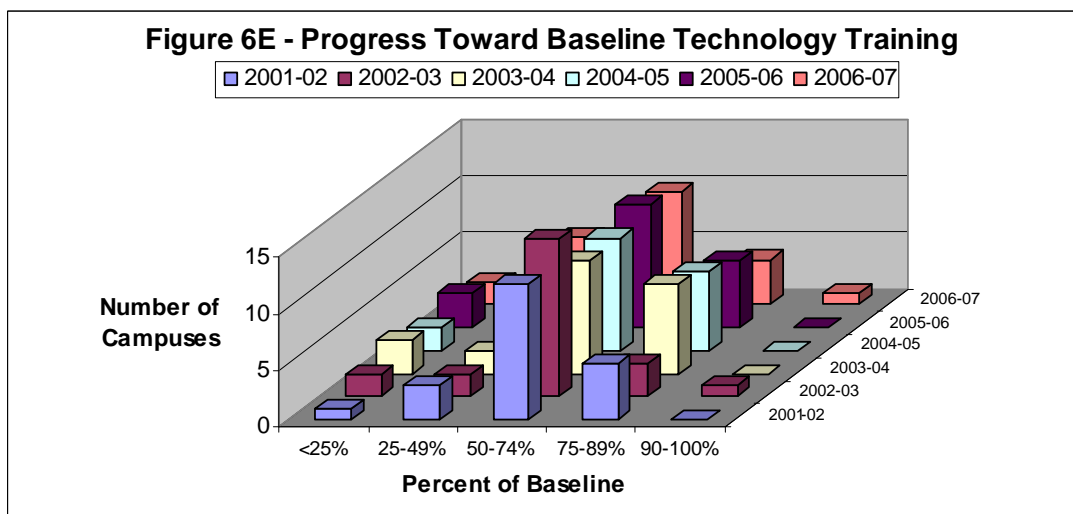


In all four of the surveys conducted since 2000, a strong majority of faculty and staff report having access to technical support for resolving problems with university-provided computers or software and express a rather high level of satisfaction with the support they have received. Detailed summaries of these survey results are presented in the appended reports.

### Technology Training

Availability of end-user training in the use of computer workstations, common personal productivity software, and basic network applications is an integral component of the ITS baseline technology infrastructure. Included in the scope of the initiative is training to upgrade and maintain the knowledge and skills' currency needed by the information technology staff who support end users.

There has been little change since 1999-2000 in the overall level of training activity on CSU campuses (Figure 6E). Training opportunities offered to faculty, staff and students have fluctuated modestly from year to year on individual campuses, as have participation and support levels, depending on evolving training needs and resource availability.



### Access

Figure 6E1 shows that there has been only modest change in the training opportunities campuses have made available to all user groups since 2000-01.

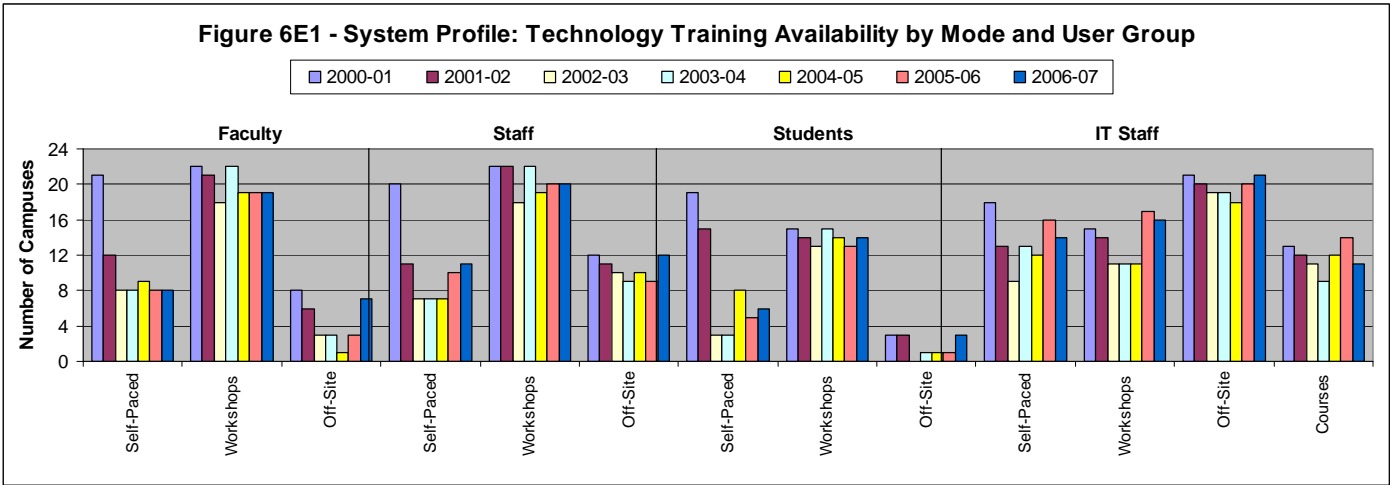
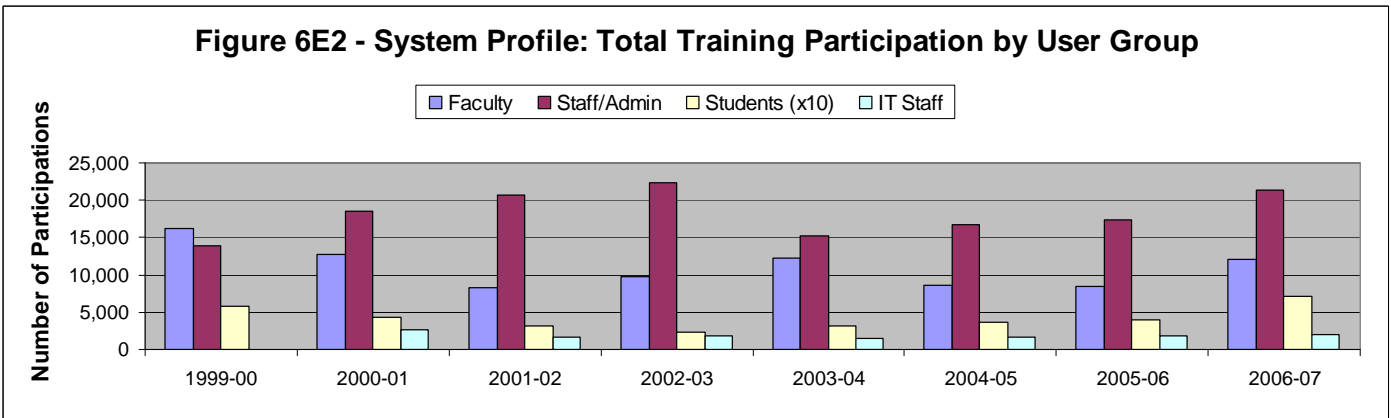


Figure 6E2 traces changes in participation in technology training activities by members of the three user groups and IT staff over the past six years. (The number of participations does not equate to the number of participants since individuals may engage in multiple activities.) Demand for technology training varies based on the changing needs of each constituency group, and on campuses' ability to provide support. In 2006-07 participation in training activities experienced a modest increase compared with levels reported in the past three surveys.



Campuses support technology training in two principal ways: through the allocation of personnel positions and through the direct purchase of materials and services. In 2006-07, average campus spending to provide training rose somewhat for all four constituencies, though total spending declined slightly. Figure 6E3 summarizes the changes in direct support. . The columns trace total annual training expenditures for all campuses; system average expenditures appear as lines. Note that the actual dollar amounts in the figure have been adjusted for purposes of display: total expenditures are 1,000 times the values on the chart; average expenditures are 10 times the graphed values.

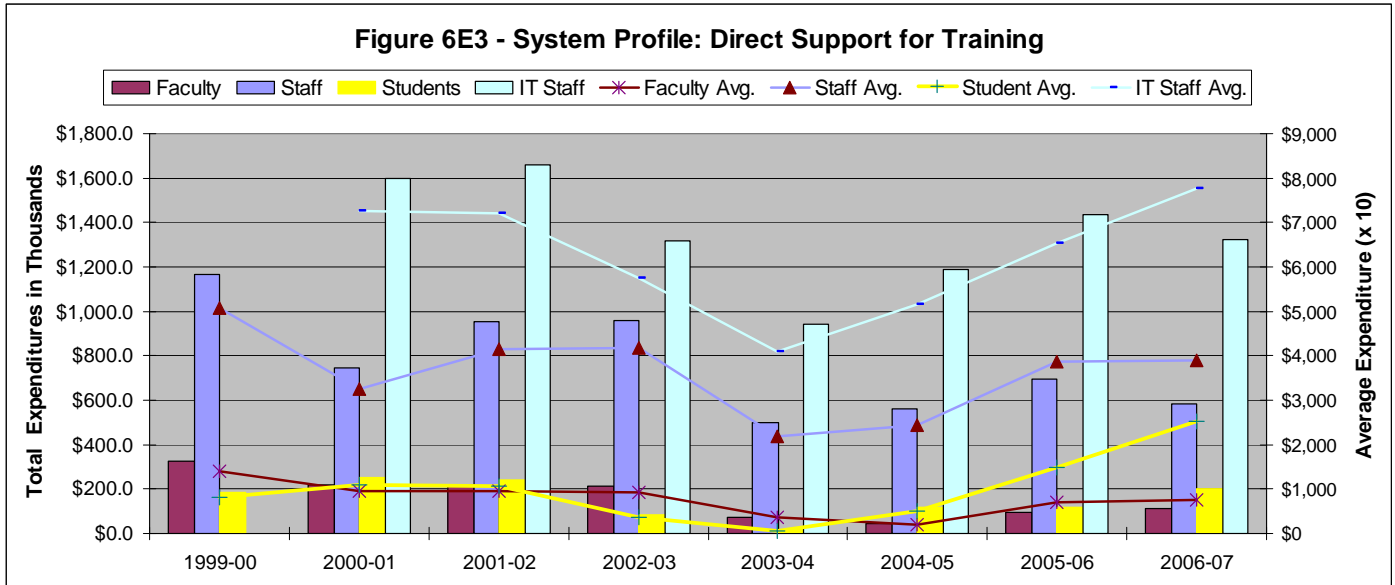
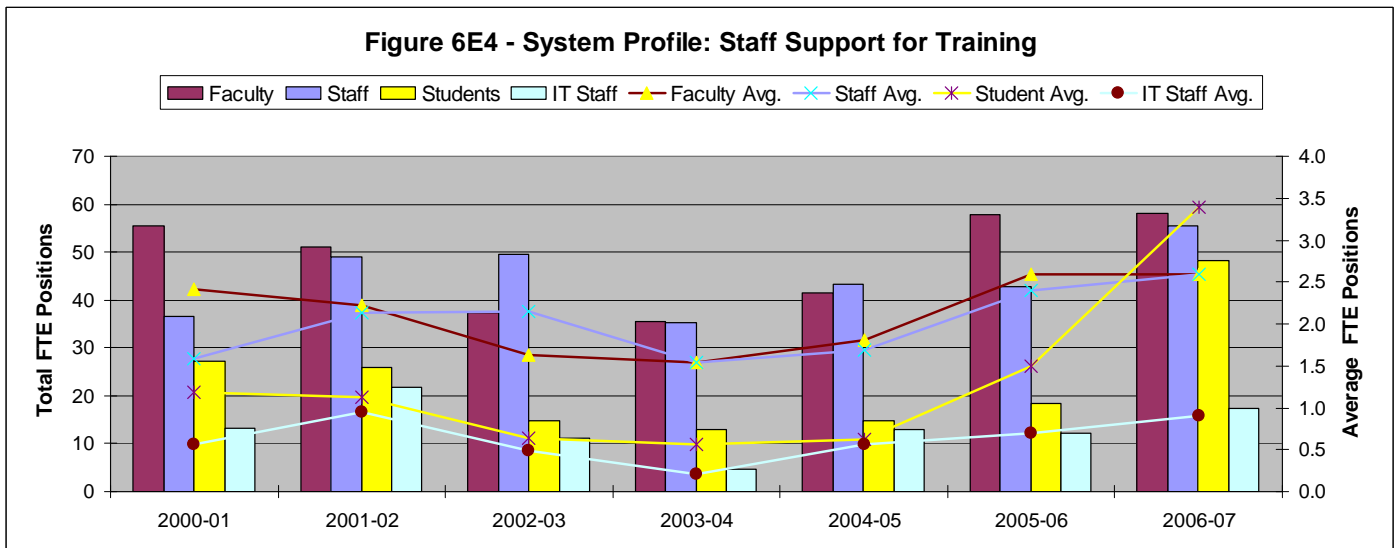


Figure 6E4 traces changes in the level of staff support for training. Total full-time equivalency personnel positions dedicated to training for each user group are represented by the columns; the average number of positions is indicated by lines. The sharp increase in staff support for students is attributable in part to more training in the use of learning management systems. Increases in the number of personnel positions assigned to LMS training were reported by about half of the campuses. The rise in the number of positions associated with training for faculty and for staff and administrators is largely due to implementation of upgrades to the Common Management System. About half of the campuses reported significant increases (ca. 75 percent) in levels of staff support for CMS training.



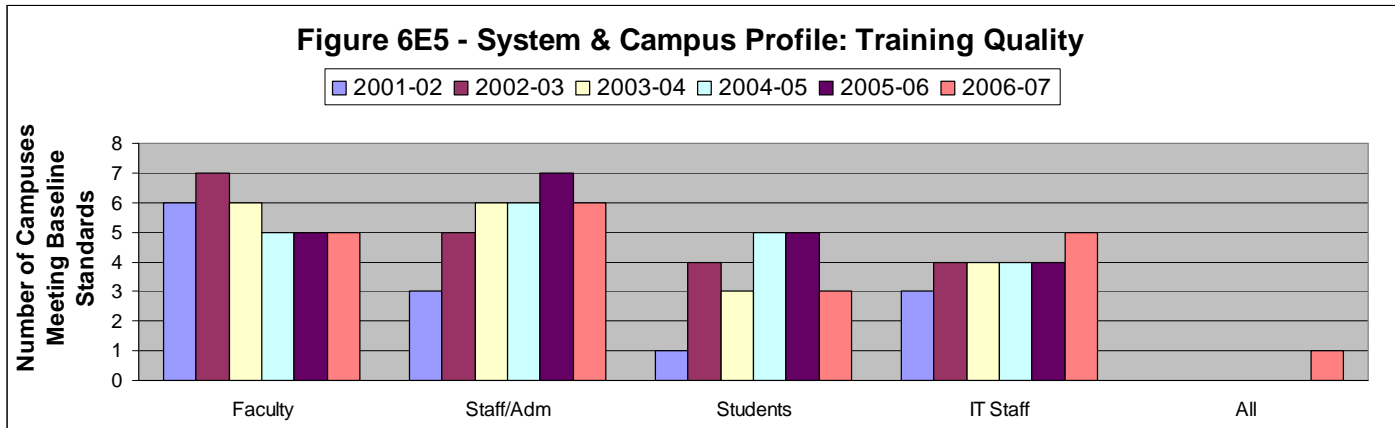
**Quality of Service**

Disparities among campuses are greater in the area of training than in any other component of the technology infrastructure. Large differences exist between the kinds and quantity of training opportunities available to members of the principal user groups on individual campuses, and between like user groups across campuses. Determination of training needs and how campuses organize to meet those needs differ widely from institution to institution, thus rendering impractical the collection of outcomes' data for technology training programs. In 2001-02, metrics for gauging the quality of technology training were incorporated into *Measures of Success*. These metrics are a set of institutional policies and practices that, when adhered to in total, suggest the campus is providing end-user training

## MOS IX: Information Technology Infrastructure Initiatives

services of the quality envisioned in the Integrated Technology Strategy.\* Baseline capability in end-user training is attained when a campus meets all five policy/practice standards for all groups.

Figure 6E5 depicts the status of campus progress toward meeting the quality-of-service goals for faculty, students, and IT staff. In 2006-07 for the first time since the baseline standards were adopted one campus reported meeting all of the qualitative measures for all four user groups.



In surveys administered biennially since 2000 faculty, students, and staff gave relatively high importance ratings to campus-based training programs. The small (and declining) number of students who actually did participate in training activities (under 10 percent) also expressed high satisfaction with the experience.

### Institutional Progress Toward Baseline Capability

#### Baseline Information Technology Infrastructure

The baseline technology infrastructure is the prerequisite for achieving all of the outcomes of the ITS. The system's overall progress in achieving that baseline on each campus is, therefore, an important benchmark for measuring success.

The essential components of the baseline technology infrastructure are the physical telecommunications infrastructure (pathways, spaces, media, outlets, and network electronics), workstations (hardware and software), network access, training, and support, *all* of which must meet established baseline standards for access and quality. These components are represented by bolded sections in the base of the following ITS pyramid. (Pictured in full on page two of the Introduction.)

\* The five training standards are:

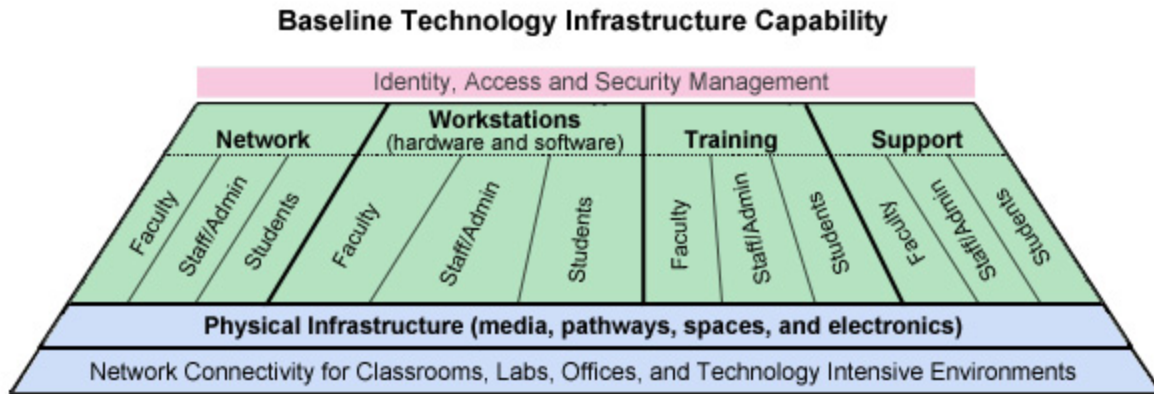
The campus has policy or guidelines defining "baseline" end-user technology training for faculty, staff/administrators, students, and IT professionals who provide end-user technical support.

The campus has, and periodically employs, a mechanism for assessing the baseline technology training needs for each user group.

The campus communicates effectively to members of each user group comprehensive information about technology training opportunities available to them.

The campus has, and periodically employs, a mechanism for measuring user satisfaction with the baseline technology training programs and activities provided by the campus.

The campus tracks participation by members of each user group in baseline technology training programs and activities.

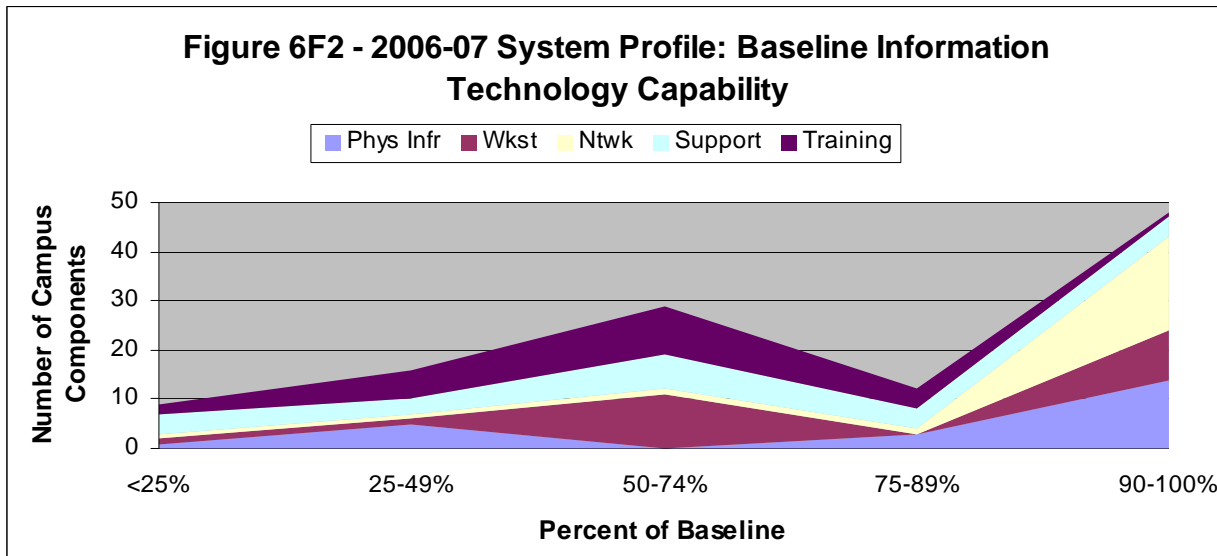
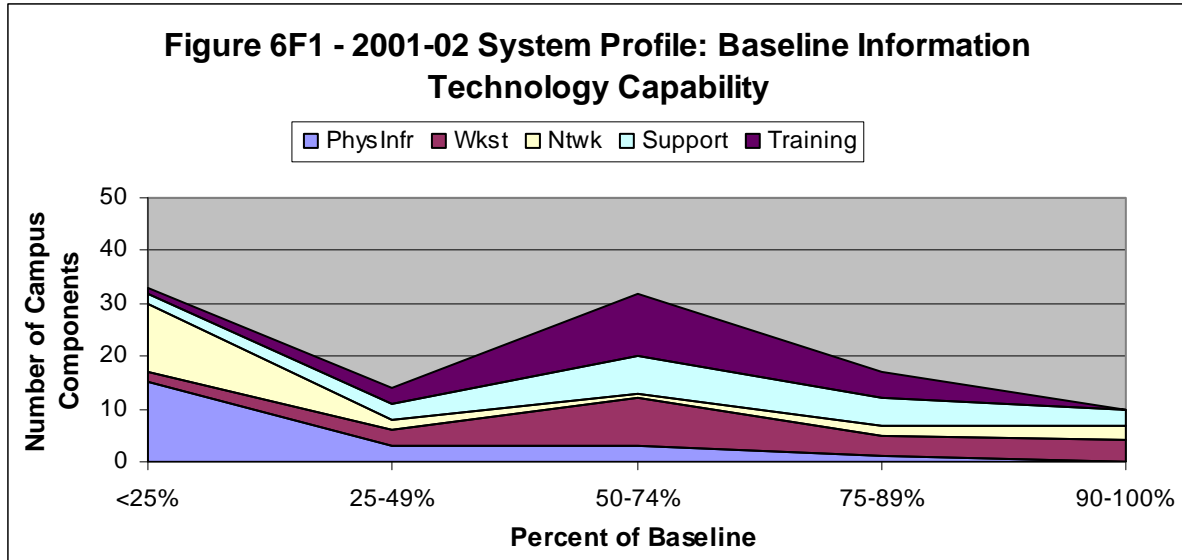


For purposes of conveying an overall sense of the progress the CSU is making toward baseline, *Measures of Success* has adopted a model based on the percentage of standards achieved on each campus in each of the five infrastructure components. For each component, “baseline capability” is defined as meeting standards at the level of 90 percent or higher. Progress toward baseline capability from 2001 to 2006 is illustrated by a comparison of two charts: the first, Figure 6F1, representing the status of the system with respect to baseline capability in 2001-02; the second, Figure 6F2 showing the status in 2006-07. The changes in the two figures reflect the data in Tables 12.20 through 12.24 (Appendix A).

These figures portray the overall progress that has been made toward providing all CSU campuses with the baseline IT infrastructure envisioned in the ITS. Information presented above in the three-dimensional bar graphs for each component is combined in the charts below. The percentage range (x-axis) represents the level of capability as measured by the baseline metrics for the respective infrastructure components. The width of each band depicts the number of campuses at the respective level. Figure 6F1, for example, shows that on 15 campuses the physical infrastructure was at 25 percent or less of baseline standards and no campus was at baseline. Only two campuses were at the 25 percent or lower level with respect to the standards for workstation access and quality, while four had achieved the target environment. Since the status of all 23 campuses is tracked for each of the five components, the total “number of campus components” (y-axis) is, therefore, 23 x 5 or 115.

Figures 6F1 and 6F2 profile the status of the five technology infrastructure components as of FY 2001–02 and 2006-07. It is strikingly apparent that the situation with respect to the telecommunications infrastructure (represented by the blue band at the bottom) and network connectivity (yellow band in the middle) in 2006-07 is the mirror image of the situation five years earlier. In 2001-02, no campus met the standards for the campus physical telecommunications infrastructure; in 2006-07, the telecommunications infrastructures on 14 campuses met or exceeded baseline capability. In contrast to the dramatic improvement in these two components, progress toward baseline in the workstation environment has been positive but more modest (from five to ten campuses), and there has been essentially no change in the level of technical support and training.

The modest progress in the workstation environment is a function of two main factors: a targeted infusion of new resources in 1998 that enabled campuses to upgrade workstations prior to the baseline year for the MOS, and the relentless pace of technological change with its attendant need to refresh equipment and software every few years. In the absence of designated sources or formulas for funding technical support and training remain competing priorities in campus budgets.



The system will have achieved a baseline technology infrastructure when all 23 campuses have reached 90–100 percent capability in all five TII components (23x5 = 115).