
Office of Telecommunications

1999/2000 Annual Report July 1, 1999 to June 30, 2000

Acknowledgments:

This report was produced by the Office of Telecommunications,
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A copy is available at <http://www.otc.psu.edu>, under "About OTC"

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At a Glance... Some of the Years' Highlights and Numbers

PSU.EDU Registered Hosts	89,238	Voice Mailboxes	
Commodity Internet Bandwidth	75 Mbps		99/00 4,815
VBNS/Internet2 Bandwidth	155 Mbps		98/99 4,265
Residence Hall Data Services		\$15.8M Project at UP	
UP Connections 99/00	11,952	Phase A	Complete
UP Connections 98/99	9,229	Phase B	Complete in 9/00
Total advance requests for fall 00 semester	~4,500	Phase C&D	In Construction
		Phase E	In Design
Local Area Networks		Penn State Call Center	
Designs Completed	220	Calls Handled	570,000
Installations 99/00	18	Videoconf. Events in OTC Rooms	200
Total OTC-installed & Supported LANs	230	Video Bridged Events	749
Integrated Backbone			
Designs Completed	53		
Installations 99/00	42		
Total OTC-installed & Supported Integrated Backbone Connections	386		

I Summary

This report summarizes the achievements, activities, and ongoing projects of the Office of Telecommunications (OTC) for the fiscal period covering July 1, 1999 to June 30, 2000.

The year saw its share of expected--and unexpected--challenges. In addition to maintaining adequate levels of service as demand continued to grow at rates equal to or exceeding those projected, and the investment in substantial preparation time to make "Y2K" the non-event it proved to be, the announcement of the National Governor's Association meeting stimulated an additional substantial effort to satisfy the needs of that extraordinary undertaking. In addition, the change in association between Penn State and the Geisinger Health System likewise led to a flurry of unanticipated activity to prepare for changes needed during the last quarter of the academic year.

For the longer term, substantial progress was made in resolving the continuing issue of establishing a sustainable telecommunications budget model, with the committee of Deans and other executives now engaged in this endeavor, working diligently to assess options, and to pursue innovative directions. Optimism remains that a revised financial structure can be implemented by the end of the upcoming academic year.

Relations with strategically important partners continued, with AT&T, Verizon (Bell/GTE), Adelphia, Lucent, 3COM, Cisco, Marconi, CEI (Conestoga/Telebeam), and others maintaining important roles in providing both goods and services, as well as defining vision and innovative approaches to meeting mutual future needs. The office continued its role in support of programs focused upon minorities and other groups, and upon maintaining a pleasant work environment, including plans for relocation of a substantial portion of office personnel to space made available in University Support Building 2 (USB2).

In all, the year was yet another reflecting the hard work and substantial pride of those in OTC, to meet the needs of the University community.

II. CQI

Budget Model

During the past year a committee appointed by the Provost has been reviewing the current budget model used by OTC. The current model was established in 1985 at a time when analog, voice-centric services were dominant. This model was based, in part, on using revenue from traditional telephony services in support of new services. Now those traditional services are declining causing a new model to be developed in order to provide a sustainable budget for telecommunications and networking services. The Committee will continue its work into the new fiscal year with changes to be implemented in January or July 2001.

Process Improvements

A variety of internal process improvements have been implemented to promote greater efficiency and effectiveness in the office environment. These improvements have not only saved time and money, but have also enhanced the quality of service provided to the Penn State Community.

a. Telecommunications Management System

The continued implementation of an automated telecommunications management system included improvements such as:

- Electronic confirmations of Telecommunications Service Requisitions (TSR) to supply work order information more quickly and accurately. This process also eliminated the costs associated with paperwork.
- Web distribution of monthly billing statements provides for faster distribution and access to these statements and allows for money and staff time involved in the paper billing process to be reallocated to more pressing needs. Effective July 2000, paper billing statements will no longer be produced.
- Improvements made at Bell Atlantic have helped to enable OTC's usage re-billing systems to more accurately and effectively provide usage billing for Penn State long distance phone calls placed from University Park.
- The process of performing seasonal telephone disconnects/reconnects in University Park residence halls was significantly improved by converting a former manual process to an electronic process. This reduced overtime costs.

b. Review of Bills

The program to review and explain the telecommunications bills has been completed at over 50% of non-University Park locations. The program has helped customers to gain an improved understanding in how to read and interpret their billing statements. A similar service was made available for University Park areas at the specific request of the department/college.

c. Electronic Forms

Improvements to the OTC Web site have better enabled customers to find information they need. In an effort to streamline procedures, both for customers and internally, most of OTC's design-related forms were placed on the Web in an electronic format. Upon completion, these forms can be sent as an e-mail attachment to the assigned OTC Communications Analyst for quicker processing.

d. Customer Listserv Established

A listserv for those customers having most direct interaction with OTC was established to allow the sharing of information, announcements of new services, alerts, notices and reminders of deadlines, and other important announcements.

e. Customer Satisfaction Survey

Approximately 2000 OTC customers were invited to partake in a Web-based customer satisfaction survey and answer questions related to OTC's level of knowledge, responsiveness, courtesy, technical competence, quality, training, Web site and billing. With the help of CAC, the responses will be analyzed and the results should be available in fall 2000.

f. Staffing Reallocations

In response to evolving needs, various staffing reallocations were implemented. Staff duties were either eliminated or combined in an effort to maintain current service levels. As a result, Engineering functions were consolidated into a single group (design and engineering functions for voice systems were transitioned from the Client Services area to the Network Planning and Integration group); the Business and Accounting Offices were combined under a single Manager resulting in the elimination of the Business Manager position; an Administrative Staff Assistant position was eliminated; a Call Center position was upgraded, resulting in the elimination of the Call Center Supervisor position, which was then transferred to the Business/Accounting Office.

As a result of the process improvements listed above, OTC has been able to reduce many labor-intensive processes significantly. Benefits, such as reduction of paper flow, faster routing of Telecommunications Service Requests, and more efficient use of staffing and technology has increased timeliness and customer service.

III. Events and Notable Corporate Endeavors and Alliances

National Governors Association

OTC and the Center for Academic Computing (CAC), worked in a cooperative partnership to serve the diverse computing and communications needs of the NGA Conference held in July 2000. OTC provided the vital Internet connectivity and network infrastructure by installing network cabling in the meeting rooms, installing network switching equipment, and providing routing and domain name service. In addition, OTC also provided video and voice services in the form of two video connections in support of satellite uplink and Webcasting services, more than 200 dial tone lines in support of telephones, fax machines and dial-out modems, and 400 cellular phones, 75 two-way radios, and 50 pagers in support of immediate communication needs. Both the PSU host staff and the NGA staff relied upon these services for critical communications, document preparation, event coordination and scheduling. The support team encountered no significant problems during the conference, and thus quietly made a major contribution to the outstanding success of NGA 2000.

AT&T Alliance

Some of the original programs established when the AT&T alliance was created (in 1994) have been completed. Many of them continue, but evolutions in the telephone and long distance markets are rapidly forcing changes. Accordingly, Penn State and AT&T have started discussions about ways to take the alliance in new directions. One of the avenues being considered is to form joint programs in cellular services. AT&T acquired Vanguard Cellular Services, with whom the University had an existing partnership. Although discussions have just begun, we hope that joint cellular projects will be identified within the next fiscal year.

Verizon (Bell Atlantic/GTE)

Mergers and acquisitions in the telecommunications industry continue to affect the companies that provide services to Penn State. Verizon was recently formed as a result of the merger between GTE and Bell Atlantic. As part of this merger, ALLTEL Cellular swapped its Centre County license to Verizon (i.e. Verizon Wireless) in exchange for other geographic coverage areas. It is too early in the

formation of Verizon to project what impact it will have on University service. Verizon will serve as the local exchange carrier to all but three of Penn State's campus locations, and its wireless group will provide coverage to all campus locations.

Adelphia Business Solutions

Penn State has worked to foster competition in the telecommunications marketplace, believing that with increased competition, prices – particularly for broadband services – would decline. One of the emerging companies we have worked with is Adelphia Business Solutions (Adelphia). In the fall of 1998, many of the lines serving University Park's modem pool were shifted to Adelphia. Since then, all the University Park modem pool lines (over 2,000) have been provided by Adelphia, as well as a number of PBX trunks at various campus locations. As detailed in section IV of this report, Adelphia was awarded the contract to upgrade all intercampus circuits (circuits that connect each campus to University Park) for high speed networking services.

In addition, Adelphia Business Solutions was also awarded a contract by the Commonwealth to provide voice, video and data services to the State. This will require Adelphia to construct an even larger state-wide network than it already has, and may provide additional opportunities to consider Adelphia for meeting Penn State's networking needs.

Lucent Technologies

Penn State's relationship with Lucent is a good example of the value of developing and maintaining strong corporate relationships. During the 1999-2000 academic year Lucent conducted a resume-writing seminar and was an active participant in the Career Fair Week. Lucent hired 32 Penn State graduates, which represents the largest number of employees hired from any of the campuses where Lucent recruits. This was the second year in which Penn State graduates topped Lucent's hiring list (in 1998-99, 41 graduating students were hired by Lucent).

In addition to student recruitment efforts, Lucent also provided two executives who spoke at University events. Chief Information Officer, Larry Kittelberger, spoke at a Total Quality Forum, and Chief Strategist, Gerry Butters, gave a presentation to the MBA students.

In the coming year, Lucent plans to continue its recruiting efforts, develop internships and scholarships, and again make executives available for speaking opportunities.

Within technology development, OTC will continue to work with Lucent to improve network security for use with wireless local area networks, share information about "Voice over IP" (VoIP) plans, and perhaps develop a funded research project within OTC.

3Com

The announcement of 3COM's commitment of \$1.25M in support of the School of Information Sciences and Technology (IST) magnified the value of the interaction between OTC and 3COM. Leveraging the independent selection of 3COM as provider of OTC-specified "edge switches" for use in OTC-designed LAN's, non-disclosure and other discussions were held which focused upon high-end network-based voice services (e.g., "VoIP"), wireless computing, adoption of new network addressing specifications (e.g., "IPv6"), and Penn State's participation in 3COM's Technical Advisory Committee (TAC). While the March announcement by 3COM, of their discontinuation of support of large, high-end, enterprise networks consequently limited our long-term interest in their edge switch, and 3Com's commensurate suspension of TAC activities postponed our entry into that group, interest continues on the VoIP, wireless, and network addressing aspects. Plans are being made for additional corporate interaction regarding these, and perhaps other, areas of mutual interest.

Cisco

Capped by a visit in October to University Park by Cisco's Chairman, John Morgridge, and a subsequent corporate visit to Cisco's headquarters to focus upon the Network Academy and other academic themes with IST personnel in late November, the relationship with Cisco was re-energized during this period. A corporate executive, Rob Adams, was identified and enmeshed in follow-on discussions, and a purchasing arrangement was consummated which provides very attractive pricing for Cisco products. Strategic discussions about high-end networking technology, and VoIP (Cisco purchased Celsius, manufacturer of the VoIP system being evaluated by OTC) helped identify common areas of interest. Use of Cisco's products continues, and the relationship is ongoing.

Marconi Communications

Shortly after a corporate visit by Penn State in July to FORE Systems, FORE was merged into Marconi Communications, in turn part of Marconi p.l.c (formerly GEC). Following that flurry of corporate activity, efforts were redoubled to not only continue the relationship cultivated with FORE, but to further leverage the broader scope that Marconi offers. An initial meeting involving senior executives of both Marconi Communications and Penn State was planned for July 2000 at University Park. It is anticipated that philanthropic, joint development and research, and other programs may enhance the ongoing business relationship, which is currently focused upon router and other networking technology in which FORE's expertise was focused.

Conestoga Enterprise, Inc.

Continuing the theme of corporate acquisitions and partnerships, Conestoga Enterprises, Inc., (CEI) acquired Telebeam, Inc., in late 1999 expanding the potential for mutually beneficial endeavors to be undertaken. During the year, the Metropolitan Internet Exchange (MIX) was activated by Telebeam. Encouragement was given to other local internet service providers to join the MIX in order to improve services to their clientele in the State College area, but with little immediate interest shown by AT&T, and little more by Bell Atlantic (now Verizon). Efforts continue to expand the MIX, as well as to investigate other areas of mutual interest, both in State College, as well as elsewhere within CEI's coverage area within the Commonwealth.

IV. University Wide Activities

Inter-campus Bandwidth (Circuit) Upgrade

OTC released a competitive Request for Proposal (RFP) in April requesting bids to upgrade the current inter-campus circuit capacity from a few (generally 3 or 4.5) million bits per second (Mbps) circuits connecting each campus, to a single 45 Mbps circuit for each of Penn State's 24 campuses. Responses to the RFP were evaluated, and Adelphia Business Solutions was awarded the contract.

The project will yield an approximately ten-fold increase in the effective bandwidth available at each campus, compared to that presently available, with only a modest increase in cost. Orders have been placed for the first set of circuits to serve the Behrend, Berks, Harrisburg and Hershey campuses. The final schedule for all other locations is still being developed; however, it is planned that all locations will be completed during the 2000/2001 fiscal year. Although the upgrade will use the same general network topology which has proven to be cost-effective in the past, all four of the campuses above will be directly connected to University Park, including the Hershey campus, which was previously connected through Harrisburg. While evolution of the Penn State network has been

ongoing, only recently was change of this magnitude financially feasible. The upgrade is primarily the direct result of increased competition in the telecommunications arena that enabled the deployment of advanced facilities to the entire Penn State campus system, and cooperative efforts by Penn State, the Commonwealth of Pennsylvania, and new providers of telecommunications facilities.

Included in the RFP was a request for the conversion of the two circuits (currently one at 45Mbps and one at 155Mbps) between University Park and the Pittsburgh Supercomputing Center that are utilized to connect Penn State to the Internet and Internet2. In order to maximize redundancy in these circuits, the current intent is to award one 155Mbps contract to each of two different vendors. The conversion to the new circuits will be completed during the fall 2000 semester.

Abilene/Internet2

Penn State obtained additional Internet2 backbone connectivity with the completion of the connection to the Abilene Network through the Pittsburgh Supercomputing Center "gigaPoP" in December. A primary goal of Abilene is to support the efforts of the Internet2 project. A related article is available at http://www.psu.edu/ur/archives/intercom_2000/Jan13/internet2.html.

Bandwidth Pricing Group

Increasing use of large amounts of bandwidth, and expectations of ever-greater demand for bandwidth, are causing serious financial concerns for many colleges and universities. In early November, Penn State hosted a forum at The Penn Stater to address these broadband networking issues and pricing concerns. Net@Edu, a sub-group of EDUCAUSE members, created the Bandwidth Pricing Group (led by Gary Augustson) to explore this topic. The two-day forum brought together college and university network leaders and representatives of service providers and transmission equipment manufacturers. Most in attendance expect that bandwidth prices will eventually decline; in an effort to help speed this process along, the forum created three task groups.

The three task groups are:

- Exploring ways institutions are coping with the broadband costs.
- Attempting to define the value of the higher education community to the broadband carrier industry.
- Developing alternative organizational strategies for future national networking initiatives such as:
 - UCAID-gigaPoP-campus model,
 - State-based model similar to that of Network Virginia,
 - Education-Corporate partnership model,
 - Regional gigaPoP/State-wide network cooperative.

Papers produced by these task groups are available on the Net@EDU Web site at <http://www.educause.edu/netatedu/groups/pricing/>.

A report on the activities of the Broadband Pricing Group will be delivered during the October EDUCAUSE meeting.

Access Modem Project/Internet Access Services

OTC, in conjunction with the Center for Academic Computing (CAC), has upgraded the dial-up capabilities and quantities of modems at many campuses. These upgrades allow faster access, and decrease the possibility of getting a busy signal. Changes during this reporting year focused on replacing analog modems with those having digital capability and increasing quantities.

In order to support dial-up modems, 56 additional ISDN "PRI" lines were added at University Park campus, for a total of 84. With this, the dial-up service can now support over 2000 simultaneous calls.

The table in **Appendix A** lists the current quantities of access modem pools at Penn State campus locations and outlines the changes that were made at these campuses.

Year 2000 Readiness

OTC completed its Year 2000 (Y2K) remediation efforts and, as a result, all telecommunications systems made a successful transition to the new millennium. OTC's Y2K preparations are documented at <http://www.otc.psu.edu/projects/y2k/y2k.html>.

V. Student-Focused Services

Residence Hall Internet Services

Student residence hall Internet connections reached an all time high during this reporting period partially as a result of significant improvements made to the Web-based "Student Internet Connection Request Form." The form is available at <http://www.otc.psu.edu/services/student/data/sibc/sibc.html>. With this Web-based form, students can apply for a residence hall Internet connection and have it activated almost immediately. Other options, such as student inquiries, moves, changes, and disconnects, are also available on this form. The improvements have avoided problems that likely would have come up as a result of the high volume of requests received via the Web-based form, especially during the busy period that takes place during the first few weeks of the fall semester. At the end of spring semester, over 11,900 Internet connections were activated in Penn State residence halls (9,000 University Park connections, 2,952 Non-University Park connections). This number is expected to be quickly exceeded during fall 2000 semester.

The charts in **Appendix B** illustrate the growth in use of residence hall connections.

VI. Support Services

A. General Activities

Penn State Call Center

In addition to providing all types of information, scheduling use of interactive video services, and accommodating other call management services, the Call Center handled over a half-million requests for directory assistance during this reporting period. This reflects an average of approximately 2 calls per minute on weekdays and an average of 1 call per minute on weekends to request telephone numbers, fax numbers, e-mail addresses, and other information about Penn State or its faculty, staff, students, and educational, research, and public service programs.

As evidenced in the chart in **Appendix C**, the Audio Conference services ("Meet Me" and Operator Assisted Conference Calling) continued to be utilized by Penn State faculty and staff. OTC's public Videoconference rooms (rooms 106 and 120, University Support Building 2) and the Penn State Video Bridge continue to also be heavily utilized. To further assist users of the Penn State Video Bridge, a Video Bridge Web page was implemented at <http://www.otc.psu.edu/services/staff/vidconf/VideoBridge.html>.

The page provides information on scheduling, technical and certification requirements, and guidelines for the Bridge, in addition to other useful information.

An arrangement with the Undergraduate Admissions Office (Admissions) entered its final phase in December 1999 and full production on March 1, 2000. This new service, within the set of Call Center's Call Handling and Message Phone Services ("C.H.A.M.P.S."), has the Call Center taking calls from prospective students who are requesting Admissions applications and informational brochures. The Call Center's assistance has greatly improved turn-around time on such requests, and allows the prospective student to speak with a live operator rather than leaving a recorded message. More information on the Call Center's "C.H.A.M.P.S." services is available at <http://www.otc.psu.edu/services/staff/callcenter/messageservice.html>.

Also within this reporting period, the Call Center replaced their proprietary, 15-year-old, consoles and associated paper directories with an on-line computer-based integrated console and electronic directory. The conversion was done during normal business hours without the need for interruption of any Call Center services. The new integrated console/directory system allows for access to more timely and accurate faculty, staff, and student listings; an updated copy of the directory is downloaded from official University records on a daily basis. With the new technology, the Operator enters the requested listing into a computer database that automatically searches for the requested listing. The technology also enables the listing to be searched by a variety of previously unavailable methods, such as Department Name, College Name, or Phone Number, in addition to the (straightforward) faculty, staff, or student name. If the caller is not sure of exact spelling, the system is also capable of providing a "sounds-like" search for the listing. In order to maintain the same degree of reliability of the prior manual system, the new computer-based system has been equipped with several backup/fail-safe mechanisms that enable continuation of Call Center functions in the event of a power outage or computer malfunctions.

Network Management Center Help Desk

The Network Management Center (NMC) Help Desk provides support for trouble calls related to the University's telecommunications services. Questions and inquiries range from restoring simple dial-tone service to solving complex "network" problems. "Trouble tickets" are issued for all trouble calls received and are submitted to correct problems that cannot be rectified over the phone or that require additional service. During the reporting period, the NMC received over 15,900 trouble calls, with half of those calls being evaluated and resolved over the phone by the NMC staff.

Voice Mail

The demand for voice mail service continues to increase steadily. The number of voice mailboxes at University Park has grown to over 4,800 as illustrated in the chart in **Appendix D**. Currently, the Voice Mail system handles approximately 10,000 calls per day, with approximately 1/3 of those calls being forwarded to the recipient's mailbox greeting as a result of a busy signal.

The Undergraduate Admissions Office (Admissions) was able to eliminate the use of their non-Y2K-compliant Interactive Voice Response (IVR) system and replace it with a Single Digit Menu (SDM)¹ custom-designed and developed by OTC using the University Park voice mail system. The SDM at Admissions includes the "Time of Day" feature that allows callers to be routed to an appropriate mailbox greeting based on the time of day that they are calling (e.g. during normal business hours vs. after business hours). Maintenance costs for the voice mail system are significantly less than those of the original IVR system.

¹ A Single Digit Menu is a special voice mailbox that is made up of several mailboxes that allows the caller to choose and hear various recorded options.

In addition to providing custom-designed SDM's, "Outcalling" services have also been implemented on many voice mailboxes during this reporting period. With "Outcalling," when a message comes in to a mailbox, the voice mail system notifies the user of the new message by "beeping" a pager or by calling the user's cell phone or extension number. Due to the high demand for this feature, 8 additional ports (a port is an entrance to, and/or an exit from a network) have been added to the University Park voice mail system bringing it up to a total of 64 ports. As a result, 64 calls can be answered simultaneously by the voice mail system, transferring callers to SDMs, individual mailboxes, extension numbers, or enabling the "Outcalling" feature.

Next Generation Ethernet Switches

Switches are electronic devices that open or close the flow of data through a network. A strategy of having all LAN designs using only newer-technology switch-based components was adopted and, as a result, a new next generation device, called Ethernet Switching, is being used to connect local area networks (LANs). This strategy will ensure that all OTC-designed Penn State LANs used by students, and faculty and staff members will be able to handle the higher speeds and new protocols supported by the Integrated Backbone.

Laptop Access Ports

As part of a previous year's strategic plan funding request to accommodate use of laptop computers, both temporary and permanent dollars were received to expand mobile computing ports at Penn State campuses. "Mobility ports" enable students, faculty, and staff with laptop computers to connect to Penn State's Integrated Backbone from different areas on campus, making it possible for them to quickly access University computing resources and the Internet. More than 450 mobile computing ports have been installed (or are planned) at the Berks, DuBois, Harrisburg, Hazleton, McKeesport, University Park, Worthington Scranton, and York campuses. Information on Penn State's Mobile Computing Service for faculty and staff members is available at <http://www.otc.psu.edu/services/staff/data/lan/mobilecompadmin.html> and at <http://www.otc.psu.edu/services/student/data/mobilecomp.html> for Students.

Integrated Backbone (IB)

Designs for over 53 IB connections were completed, and 42 IB connections were installed during this reporting period. This brings the total number of backbone connections designed and installed by OTC to 386. The number of Penn State Integrated Backbone connections and hosts are shown in **Appendix E**.

Knowledge of the traffic flow (capacity) to and from, and within Penn State's Integrated Backbone is an important component of LAN management. In an effort to assist LAN Administrators, a tool, called Multi-Router Traffic Generator (MRTG), was provisioned during this reporting period to enable Administrators to view the traffic flowing through their IB connections in graphical forms, over various time periods, in real-time.

Replacement of Network Architecture

Replacement of the old networking architecture used to transmit data within Penn State's Backbone, (Fiber Distributed Data Interface – FDDI), was completed. All services supported by FDDI were transferred to the newest architecture, Asynchronous Transfer Mode (ATM), which was introduced at Penn State three years ago. As a result, ATM has enabled Penn State's Integrated Backbone to keep pace with the ever-growing demands for increased network capacity and capabilities. Due to the frequent changes required to maintain service levels in conjunction with information technology advancements, ATM is the fourth type of network transport technology used within Penn State's network in the past 12 years. Although it has only been 3 years since ATM was adopted, OTC is engaging with major vendors in assessing and influencing the next generation of technology, to

assure that Penn State's expanding needs for network performance, functionality, and security can be met. In fact, another upgrade of the IB at University Park is already planned for fall 2000. This upgrade will increase both the capacity and capability of the core network as well as prepare it for the replacement of the ATM architecture.

Videoconferencing Initiatives

Substantial progress has been made in implementing the first half of a comprehensive two-year plan that was developed for evolution of Penn State's video-related services. The plan addresses satellite, baseband video, cable television, and interactive videoconferencing services and is available at <http://www.otc.psu.edu/services/staff/video/vidplan.html>. One objective of the plan is to bring all Penn State videoconferencing room systems to a minimum standard of speed and quality. As a result, all bridged conferences are now using the new standard rate of 128Kbps. Of the Penn State interactive video systems maintained by OTC, all but two have been upgraded to support the BONDED² protocol at 384Kbps speed and 30 frames per second.

In the early part of the fiscal year, a demonstration of video-over-IP was successfully conducted between Penn State Harrisburg and University Park. The communications link involved the first use of a technique often referred to as "Quality of Service" to create a path between the two devices that guaranteed the conference would sustain whatever network resources were needed. The creation of this path involved the use of both the IP network layer and the ATM transport underneath. Consequently, the first production IP interfaces were installed in Hershey's Lecture Hall D and University Park's 108 Wartik to be used for classes between those rooms. Upgrades to add IP interfaces at other Penn State videoconference sites have also begun. A list of rooms that have IP video capability is available at <http://www3.otc.psu.edu/isdn/vidodb.asp>. These accomplishments constitute a significant step toward the integration of voice, video and data traffic over a common internal network.

Local Area Networks (LAN)

Two hundred and twenty LAN designs were completed, and 18 LANs were installed, during this reporting period, bringing the total number of OTC-designed, installed and supported LANs to 230. The chart in **Appendix F** illustrates the continued growth trend for requests for OTC LAN installation.

Training

Penn State faculty and staff continued to take advantage of the no-fee telecommunications training services offered by OTC. As evidenced in the chart in **Appendix G**, a total of 1,220 people received training on Merlin, Centrex/Meridian Business Sets (MBS), Voice Mail, and Videoconferencing systems. One hundred and twenty-five people attended the fall 1999 Telephone, Voice Mail, and Videoconferencing Workshops that were offered. To make it easier for people to sign up for these workshops, a Web-based form was used for the fall workshop registration.

Minimum Standards for Telecommunications

A document that sets forth the minimum standards and requirements for Penn State telecommunications facilities was updated during this reporting period. This document, entitled "Minimum Standards for Telecommunications Facilities," contains requirements for physical layer infrastructure such as wire, fiber optic cable, duct banks, termination equipment, testing and identification, and labeling and records of such facilities. The document is available at <http://www.otc.psu.edu/projects/MinTelecomStandards.pdf>.

² The "BONDING" protocol was developed by the Bandwidth ON Demand Interoperability Group. It is a protocol that supports aggregation of multiple ISDN B channels.

B. University Park Activities

Telecommunications Infrastructure Project (\$15.8M Project)

Construction and purchase of building electronics, interactive video equipment, hub upgrade equipment, and other items associated with Phase B, the second phase of the five-phase \$15.8M Telecommunications Infrastructure project at University Park, are underway. This phase of the project will provide telecommunications wiring and approximately 5,200 new outlets within 25 buildings and is expected to be completed before the start of fall 2000 semester.

One notable part of Phase B has been the rewiring of Old Main. This took place over a period of approximately six months and resulted in the replacement of all of the existing telecommunications cable in the building. The new telecommunications installations included approximately 1620 jacks³ (jacks are used to connect cords or lines to telecommunications systems) on 685 outlets (faceplates), and required 47 miles of enhanced performance Category 5e cable. Approximately 4 tons of old cable was removed from the building. The work in this building exemplifies the extent of the work that is taking place in the 100-plus University Park buildings that are part of the \$15.8M project. Work in approximately 39 other buildings is complete, with another 38 to be completed by the end of the 2000/2001 fiscal year.

Design for Phases C and D of the project was completed and approved by DGS in November. Phases C and D were combined into a single bid package to save on administrative costs and time. Release of funds from DGS for this phase of the project was received in January. Construction for this phase of the project began in June and includes another 40 buildings. Design has been started for Phase E, the final phase of the project. More information on the Telecommunications Infrastructure project is available at <http://www.otc.psu.edu/projects/dgsproject/dgsproject.html>.

Interactive Video Rooms Funded by the \$15.8M Project

Room 310 Rider II building was converted to a unique, flexible-use interactive video room. This room is designed to support the needs of the World Campus initiative, the Schreyer Institute for Innovation in Learning, and the new School of Information Sciences and Technology. In addition, final touches were completed for a new videoconferencing facility in room 371 Willard building. Fall 2000 semester classes have been planned for both of these new facilities. The full room characteristics of these classrooms, and others, are outlined at <http://www.otc.psu.edu/projects/dgsproject/videorooms.html>.

Cable TV

All University Park Cable TV connections have been upgraded to 750 MHz, with the exception of the Foods Building and Schreyer House. The upgrade will allow for the capability of expanding the channel lineup from 36 channels to 116 channels and was begun in spring 1999. The project involved the addition of upgraded fiber receivers and 750 MHz distribution amplifiers as well as the replacement of splitters and other passive components.

Single Mode Fiber

A significant change was made during the past year pertaining to the standards for inter-building fiber. To remain affordable and control technological risk, Penn State's inter-building cabling infrastructure has relied primarily upon the use of "multi-mode" fiber optic cabling. However, as demands for higher speed connections to the Integrated Backbone continue to grow, and support of

³ This number, resulting from the demands expressed, represents a significantly higher density of jacks than is normally provided in University Buildings. It greatly exceeds Penn State's minimum standards.

more advanced applications (such as those associated with Internet2) is needed, broader use of a type of fiber known as "single mode" is warranted. To help address this need, a group of 25 Penn State buildings had single mode fiber installed during this reporting period, doubling the number of those so equipped. Installation of this type of fiber allows connection speeds several times faster than is possible using multi-mode fiber. It will also enable continued expansion of the Cable TV system upgrade, which will ultimately support additional digital video channels. Further details are available at <http://www.otc.psu.edu> under "Special Projects." Currently, all new fiber extensions will include both single and multi-mode fiber, and design is underway for extension of single mode fiber to 12 additional buildings

Additional Telecommunications Projects

OTC has been actively involved in the planning, design, and construction of the telecommunications systems for the many projects underway at University Park during this reporting period. Major projects that have been completed include:

- The new Lasch Football Training Facility.
- The new Penn State Visitors Center.
- The Schreyer Honors College at Atherton Hall.
- The new Paterno Library.
- HUB Renovations and Addition.

In addition to these projects, infrastructure upgrades have been ongoing to provide for these new facilities and the increased demands for Integrated Backbone connections in existing buildings.

<p>Additional Major Telecommunications Design Projects underway at University Park</p> <ul style="list-style-type: none">• The new Career Services Building.• The new Alumni Center.• Beaver Stadium Expansion.• The new Information Sciences and Technology Building.• The new Chemistry Building.
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West Campus

Work has been completed for two new academic buildings, infrastructure upgrades and a central Chiller Plant building on the West Campus. The new Chiller Plant building houses a new Integrated Backbone hub to serve the West campus buildings. The infrastructure upgrades included single and multi-mode fiber optic cable for data and Cable TV services, and copper pairs for telephone service.

C. Non-University Park Activities

Telephone Switch Enhancements

OTC spearheaded the activities involved with a major upgrade of the telephone switch at Behrend. Over 1,200 telephone stations were rewired into the new voice communications system that was installed as part of the upgrade. In addition to the voice system upgrade, OTC, in concert with Lucent Technologies, worked with the local telephone companies to reconnect over 200 campus network trunks to the newly upgraded system. Concurrent with the upgrade, Behrend also doubled the size of its telecommunications room to allow for further expansion of the telephone switch and for continued expansion of the data communications network.

OTC also assisted the Harrisburg, Hazleton, and Worthington Scranton campuses with the addition of new ISDN PRI service into their telephone systems and also assisted with telephone switch software upgrades at the Altoona and Berks campuses. These upgrades provide for more digital arrangements for the campuses' telecommunications services.

Additional Telecommunications Projects

OTC has also been actively involved in planning, design and construction of the telecommunications systems for many projects underway at Non-University Park locations during this reporting period.

Major projects that have been completed include:

- Phase I of the Lares Renovations at Abington campus.
- The new residence hall, Ohio Hall, at Behrend.
- The new residence hall construction at Berks campus.
- New housing facilities at Harrisburg and the completion of the "high-tech" Library at that campus (detailed below).
- A new Computer Center at Schuylkill campus.

Harrisburg Library

In addition to completion of major underground cable maintenance and assisting the Department of General Services with the planned relocation of all overhead telecommunications facilities to now being underground, OTC was also instrumental in providing telecommunications services for the new "high-tech" Library at the Harrisburg campus. The LAN electronics and high-speed data circuits installed by OTC will allow the library to employ high bandwidth technologies.

Students have the ability to connect their portable machines to the data network by the use of mobility ports throughout the building. There are over 900 data connections available in the new library complex.

Additional Telecommunications Projects underway at Non-University Park Location

Altoona: Health and Wellness Center and the Continuing Education Center.

Behrend: A new Multi-Purpose Building design and Nick Building phase II design.

Berks: Perkins Student Center expansion, and Information Commons at Thun Library.

DuBois: Infrastructure expansions.

Fayette: Eberly building renovations.

Great Valley: Safeguard Scientific Building renovations.

New Kensington: Addition to Science and Technology Center.

VII. Investigations into Potential New Services

Wireless LAN Testing

Testing has begun for a form of wireless LAN technology that will provide secure LAN-style connectivity within buildings. It is important to note that wireless LAN technology is *not* expected to be used as a replacement for wired connections. If the technology meets all of Penn State's requirements, the new wireless LANs should become available for wide scale deployment during the 2000/2001 fiscal year.

Voice over IP Trial

An earlier trial of "VoIP" (Voice over Internet Protocol) has ended, and the next testing phase has begun. This phase will be expanded in scope and capability, but will still remain within OTC. All components used in the earlier trial will be replaced with next generation gear, and its suitability and scalability will be evaluated. These tests constitute a significant step toward the integration of voice, video and data traffic over a common internal network.

VIII. Community Initiatives

Take Our Daughters to Work Day

For the second year in a row, OTC participated in the University-sponsored *Take Our Daughters to Work* program. Participants experienced how staff members use modern telecommunications tools, such as cellular telephones, voice mail, and the Internet, to communicate and collaborate with each other.

IX. Internal Activities

Departmental Server Upgrade

OTC's departmental servers have been upgraded to multiple servers that will isolate service functionality to single hardware platforms. This new architecture will protect services from each other so that a problem with one service should not affect another service. The hardware can be maintained, re-booted, and tested independently, with minimum impact on other services. All communications for departmental servers is being upgraded from 10BaseT to 100BaseT.

Satellite Uplink Scheduler

A new application to schedule the satellite uplink was developed by OTC, to replace DOS-based non-Y2K-compliant software. New features include an automated confirmation email message that includes satellite coordinates and estimated cost information. The client/server application also features time saving searching and reporting functions. The satellite uplink operated by OTC is used by Penn State to deliver teleconferences, sporting events and news feeds via satellite.

X. Appendices

Appendix A Penn State Access Modem Quantities

Appendix B Penn State Student Residence Hall Internet Connection Statistics

Appendix C Penn State Call Center Statistics (Audio Conference Calling/OTC Videoconference Rooms)

Appendix D University Park Voice Mail Statistics

Appendix E Penn State Integrated Backbone Statistics

Appendix F Penn State OTC-Installed Local Area Networks (LANs)

Appendix G Penn State Training Summary

APPENDIX A
Penn State, Non-University Park Campus Access Modem Quantities

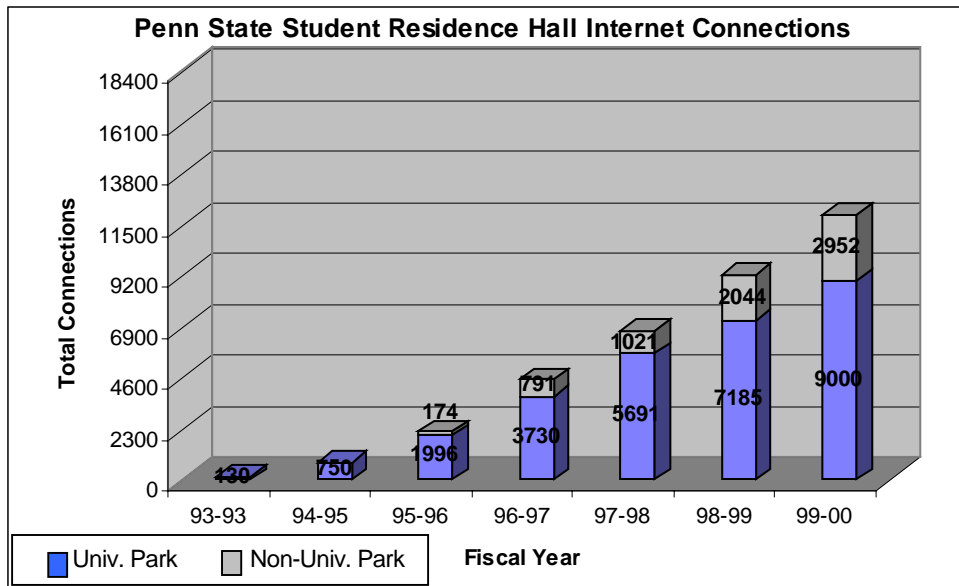
As of June 30, 2000

Campus Location	Quantity of Modems
Abington (ISDN)	94
Altoona (ISDN)	189
Beaver (ISDN)	47
Behrend (ISDN)	142
Berks (ISDN)	94
Delaware (ISDN)	47
Dickinson (ISDN)	47
DuBois (ISDN)	47
Fayette (ISDN)	23
Great Valley (ISDN)	36
Harrisburg (ISDN)	94
Hazleton (ISDN)	70
Lancaster CE Center (Analog)	8
Lehigh Valley (ISDN)	23
McKeesport (ISDN)	47
Mont Alto (ISDN)	36
New Kensington (ISDN)	23
Schuylkill (ISDN)	47
Shenango (Analog)	20
Wilkes Barre (Analog)	20
Worthington Scranton (ISDN)	71
York (ISDN)	71

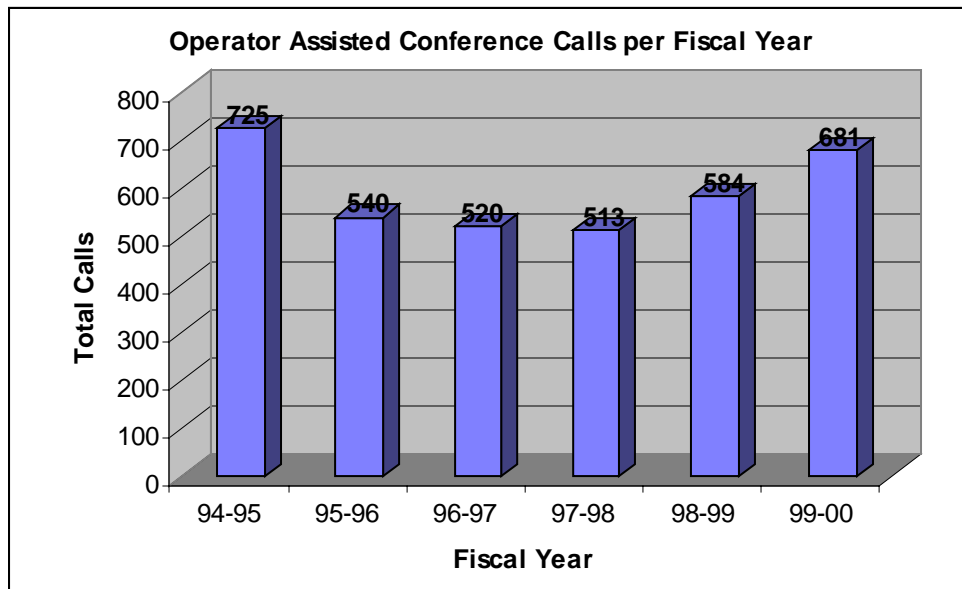
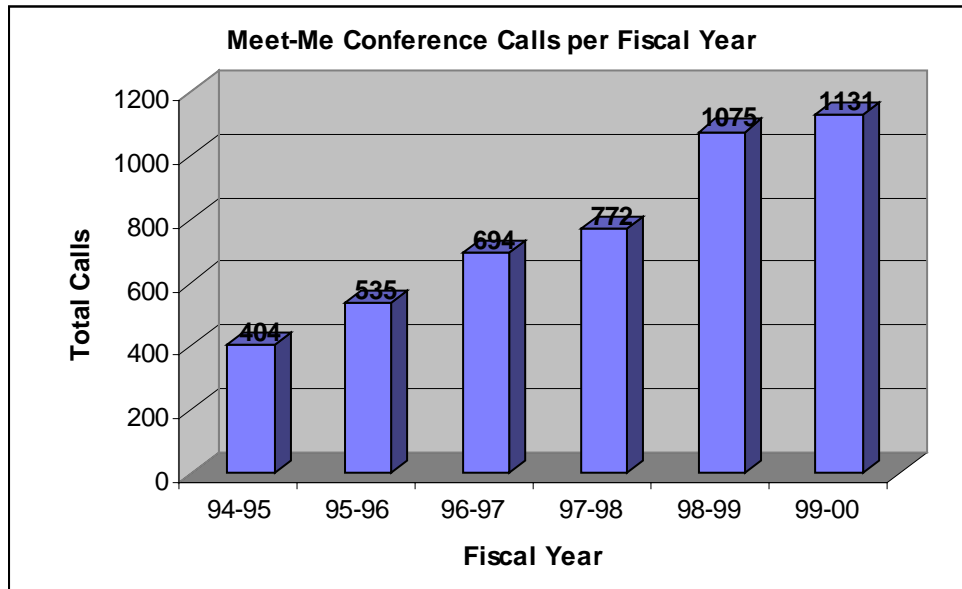
The ISDN modems at some non-University Park locations were increased and upgraded to support V.90 (industry standard for 56Kbps). Changes include:

- Increased Abington's capacity by 47 modems to a total of 94
- Increased Altoona's capacity by 81 modems to a total of 165
- Beaver's 19 analog modems were replaced by 47 ISDN
- Increased Behrend's capacity by 24 modems to a total of 118
- Increased Dickinson's capacity by 24 modems to a total of 47
- DuBois' 20 analog modems were replaced by 23 ISDN
- Fayette's 20 analog modems were replaced by 23 ISDN
- Increased Harrisburg's capacity by 24 modems to a total of 94
- Increased Hazleton's modem count by 12 to a total of 47
- Lehigh Valley's 8 analog modems were replaced by 23 ISDN
- New Kensington's 19 analog modems were replaced by 23 ISDN
- Schuylkill's 16 analog modems were replaced by 47 ISDN
- Increase Worthington Scranton's capacity by 12 modems to a total of 46

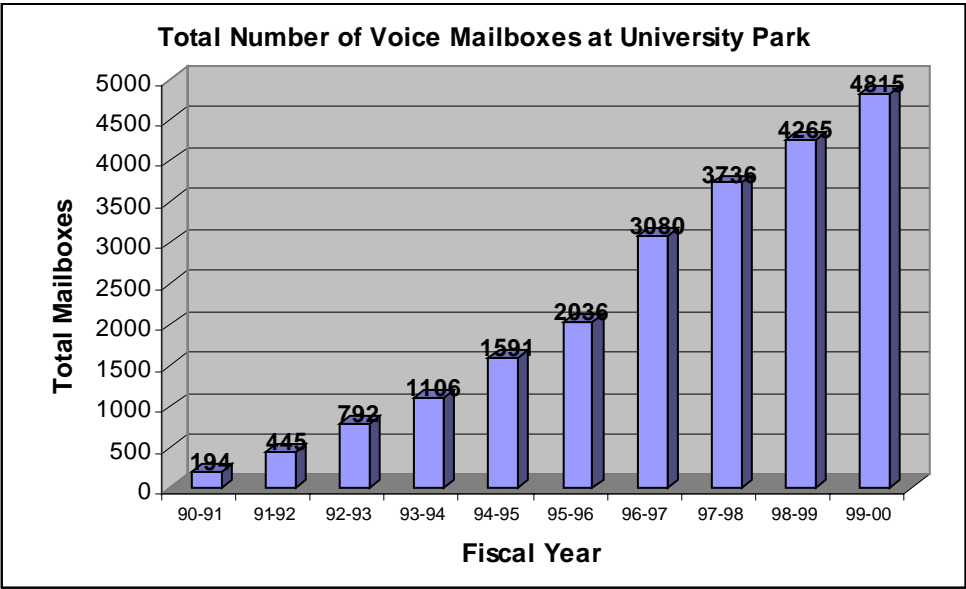
APPENDIX B
Penn State Student Residence Hall Internet Connection Statistics



APPENDIX C
Penn State Call Center Statistics

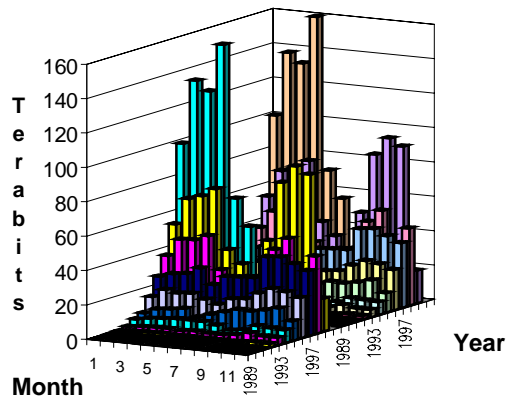


**APPENDIX D
Penn State University Park Voice Mail Statistics**

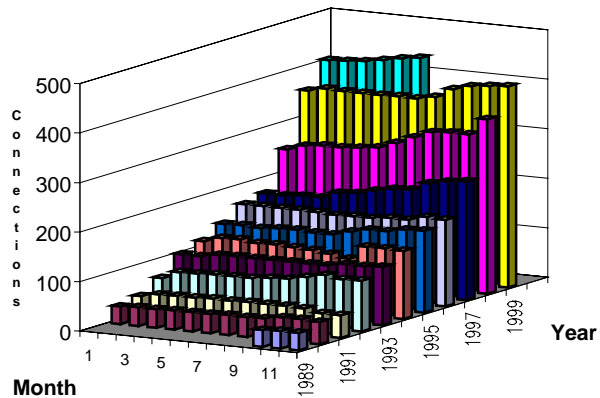


APPENDIX E Penn State Integrated Backbone Statistics

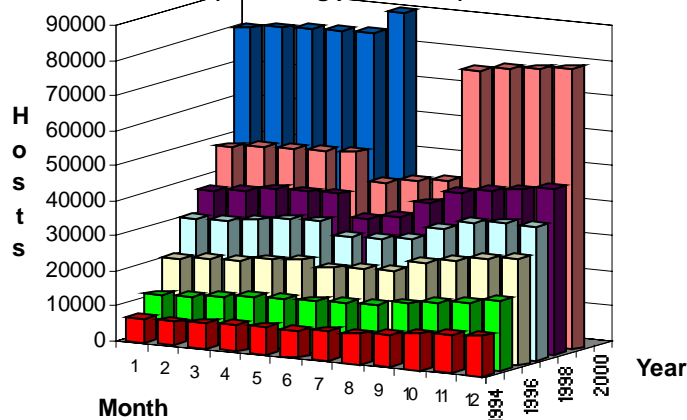
Monthly Traffic Through the PSU Integrated Backbone



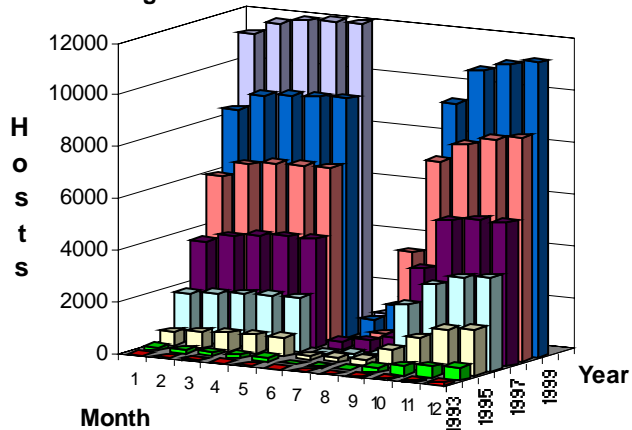
Connections to the PSU Integrated Backbone



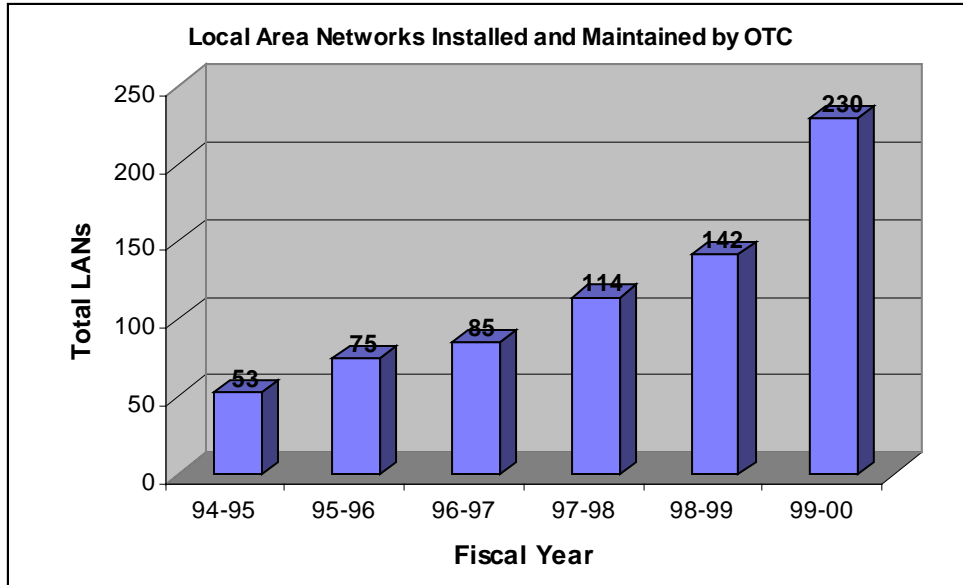
**Registered Hosts in PSU.EDU
(Excluding public labs)**



Registered Hosts in Residence Halls



APPENDIX F
Penn State OTC-Installed Local Area Network Statistics



APPENDIX G
Penn State Training Summary

