

DRAFT - Overview of IT Infrastructures and Services

I. Cost Estimate Assumptions

The document uses the following replacement cycles: 3 years for software, 5 years for networking equipment, 10 years for wiring connectors, and 10 years for intra-building wiring. Staffing costs are calculated using the salary midpoint of the range plus benefits at 24.96% of salary.

II. Infrastructure & Connectivity

A. Campus Data Backbones

1. Next Generation Backbone :

Switched Gigabit Ethernet (1000 Mb/s) between buildings and switched Fast Ethernet (100 Mb/s) connections to individual departments. The current estimate for one-time expense is \$1.4M. The current estimate for annual hardware and software maintenance is \$100K. An estimate for running single-mode fiber to all buildings is \$300K (based on a '94 estimate). The estimate for staffing to support this backbone is adding 2 CNT III FTE to the existing NOC at \$158K. Assuming a 5-year replacement cycle for the backbone networking equipment, the campus needs to save or defer \$280K/year. There are no estimates yet for the cost of connecting departments, or backbone operations.

2. CalREN-2 :

A Gigabit Ethernet Backbone (1000 Mb/s) with switched Gigabit Ethernet (1000 Mb/s) connections to Research Groups. Initial funding was from Communication Services & 98/99 Network Augmentation and Maintenance Core Funding. Ongoing annual equipment maintenance is \$22K/year, connecting remaining research groups is \$4.6K one-time, and operation and staffing costs have not yet been estimated. Assuming the Next Generation Backbone is implemented, there would be no additional replacement costs for the existing campus CalREN-2 backbone equipment.

3. FDDI :

A FDDI ring backbone that provides either shared FDDI (100 Mb/s) or Ethernet (10 Mb/s) connections to departments. Backbone Maintenance \$32K/year - 98/99 funded via 98/99 Network Augmentation and Maintenance Core Funding. Operation of this backbone is being provided by the Network Operations Center (NOC) consists of two Campus Network Programmers and _ FTE from Communication Services. Assuming the Next Generation Backbone is implemented, there would be no additional replacement costs for the existing campus FDDI backbone equipment.

4. Broadband :

The final units were migrated off the Broadband (5 Mb/s) to the FDDI backbone in 98/99 and the Broadband was shutdown in July 1999. The migration was funded via 98/99 Network Augmentation and Maintenance Core Funding.

Approximately \$45K remains from the 98/99 Network Augmentation and Maintenance Core Funding and \$44K remains from Communication Services CalREN-2 funding. None of the 99/00 \$150K has been allocated. Funds were also allocated and spent last year to complete Fiber Ring 4 and to split Fiber Ring 2.

B. External campus connection - these are currently funded through a combination of the \$9/telephone line/month Data/Networking Surcharge and three-year core funding from the Budget Office.

1. UCN Net Circuits: \$105K/year
2. CalREN-2 Circuits: \$140K/year
3. CalREN-2/UCN Net ISP: \$72K/year (FY 00/01 cost)

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10Mb/s connection at \$600/Mb/s per month Each additional 10Mb/s increases the cost by \$72K/year.

4. UCAID/CalREN-2/Abilene connection \$59K/year (FY 00/01 cost)
This consists of the following three items that have been paid by UCOP and will be recharged to the campuses, and it assumes no UCOP subsidy and that our share is 1/17th of the total cost:
 - UCAID/CalREN-2 "connectee" @ \$20K/year
 - UCAID/CalREN-2 "connector" @ \$344/OC12/year x 2
 - CalREN-2/Abilene Circuits @ \$144K/year x 2
5. Campus UCAID (Internet2) Membership: \$25K/year.

C. Dial-up Modems

In February, 1996, the Campus Network Committee recommended to the Senior Officers that the primary source of remote access to the campus networks from off-campus locations should be via a commercial dial-up modem pool operated by an Internet Service Provider (ISP). Based on this recommendation, the Senior Officers asked Communications Services to develop and issue a Request For Proposal for commercial dial-up modem and Internet access services, which was done. The vendor selected is GTE Intelligent Network Services and a description of their service is available on the Communication Services webserver at the URL <http://www.commserv.ucsb.edu/hpage/hot/remote/commann.htm>

Although commercial dial-up services are expected to provide the bulk of off-campus access, Communications Services continues to provide a public modem pool, which is available to campus members at no charge. However, the number of modems will not be increased. The public modems should therefore be viewed as a "safety net" service that provides access to UCSB hosts for those faculty, students and staff who are unable to afford or unwilling to use an ISP.

This modem pool currently consists of ninety-six 14.4 kbps modems and thirty-two 2.4 kbps modems. There is an RFP out to get bids for upgrading the 128 modems to 56Kbps modems. One-time costs for purchasing the new modems are estimated at \$86K. Annual recurring expense for equipment maintenance is estimated to be \$8K/year. Annual recurring expense for the modem telephone lines is \$35,600. The funding source for equipment acquisition has not yet been identified. The funding source of the recurring expenses is the telephone line Data/Networking Surcharge.

D. Intra-building wiring

1. Background.

The demarcation point for the campus backbone is currently the Fiber Building Termination Panel (BTP), which is usually located in the basement of fiber connected buildings. There has been no campus responsibility assigned to the wiring and equipment that must exist between the BTP and a person's desktop system in order for the person to be functionally on the network. There are at least 6 types of wiring media that are currently being used for intra-building wiring: Thick ethernet (10Base5), thin ethernet (10Base2), Category 2 UTP, Category 3 UTP, Category 5 UTP, and Multimode Fiber. The current campus wiring standard specifies using Category 5 UTP which is capable of running Fast Ethernet (100Mb/s) to the desktop. The current UTP wiring standard is Category 5e and Category 6 is in the process of becoming a standard. In June 1999 the standard for 1000Base-T (IEEE 802.3ab Gigabit over Copper) was approved.

2. Estimating the cost of intra-building wiring.

The Campus Wiring Standard (last updated July 1997) specifies the number of workstation outlets or drops, where each drop consists of 3 Category 5 UTP ports, based on the usage type and assignable square footage of a room. The specifications are 1 drop per 80 square feet for space used for Classrooms,

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Lecture Halls, Conference Rooms, Laboratory, Support / Workroom, or Office, and 1 drop per 60 square feet for space used for or Modular Office or Storage/Files. The main campus (including both the permanent and temporary buildings, and excluding IV Theater, Engineering Research Building, or the Hollister Research Building) is 2,225,751 assignable square feet. This number includes the following usage types: Office, Classroom, Laboratory, Research, Library and Service.

The estimated cost per drop is \$500. This cost includes materials & labor for: Category 5e wiring & cable, wiring closet racks, multimode fiber risers, and wiring closets. **Important caveats:** the \$500 cost could be lower or slightly higher based on such factors as:

- a) the number of drops placed in a common building at one time,
- b) the start-up additional cost of Category 5e,
- c) the addition of single-mode fiber into the riser cabling,
- d) wiring closets are included where sufficient space is available to either add the new wiring and hardware along side of the existing wiring, or that the existing must be "hot-suspended" or cut in order to make room for the new cabling, otherwise the Wiring Closet cost could be as high as \$10,000 if new closet space had to be created or converted because of major start-up expenses, electrical lighting, ceiling, duct or tray entrance, etc., and
- e) if more "lay-in" cable route structures are used such as "cable hooks" or "across the roof tiles" instead of conduit.

The cost of conduit, cable tray, wiremold, and other cable route structures or "paths" are covered under construction costs (electrical) in new buildings and are NOT included in the \$500 cost/drop nor even considered a cost factor for the communications wiring.

Although the functional life of wiring may be less, the physical life of wiring is 10 - 15 years and the life of the connectors is 10 years. Under the following assumptions: 2,225,751 asf, 1 drop per 80 sf, \$500 per drop, and a 10 year replacement cycle, the campus should plan on spending \$1.4M/year for intra-building wiring to support 27,821 drops.

Please note that these costs estimates don't include the cost of a new Network Interface Card for the systems that would be plugging into new cabling.

6. Estimating the cost of Intra-building Networking Equipment

The other required component is networking equipment to interconnect the workstations. In Fiscal Year 98/99 there were 13,730 IP addresses recharged which includes approximately 3,000 ResNet hosts. A cost effective 10/100 switch is the HP Procurve 4000M, which costs \$40/port. The outside replacement cycle for networking equipment is 5 years. Under the following assumptions: taking the average number of non-ResNet IP addresses over a 10 year period, starting with the current number and use a 5% growth rate, \$40/port, and a 5 year replacement cycle, the campus should plan on spending \$108K/year for intra-building networking equipment to support an average number of 13,496 hosts.

Please note that these cost estimates do not include the cost of a building router. The design of the Next Generation Backbone provides centralized routing, so building routers would no longer be required to connect to the backbone. They also don't include the cost of a UPS for each wiring closet.

7. Buildings with most urgent need for Intra-building wiring upgrades

The following buildings or parts of buildings are not wired to the current campus standard and are therefore not capable of running Fast Ethernet to the desktop: Geology (Webb Hall, Noble, Woodhouse), Music (without Library, Theater), Arts, Snidecor (without Drama Theater), Noble Hall (Biology, without LSCF), Biology II (without animal spaces within Vivarium), Building 478 (Biology), Building 408 (Biology), Marine

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Biotechnology (Biology), Psychology (without animal spaces within Vivarium), Building 569 (Biology including Pharmacology which is within MCDB), Building 411 (Psychology), Building 429 (Psychology, no fiber or connectivity), Biology Instructional Facility (Bio III), Bio Sci Annex (No Fiber), Building 451 (Military Science). Using the estimate calculations described in the sections above, except not using a replacement cycle, the cost to upgrade the wiring in these buildings would be \$1.8M.

Intra-building wiring and networking equipment maintenance and upgrades are currently occurring through the following funding mechanisms: Core Funding, Recharges, New Building Projects, Renovated Building Projects and Extramural Grants, but the \$1.8M listed above for the urgent buildings is currently unfunded.

E. Classroom Data Network Expansion :

In fiscal year 98/99, 21 classrooms were added to the Classroom Data Network to bring the total number of general assignment classrooms that are on-line to 60.

1. Classroom Instructional Technology

Includes expanding the number of data projectors, computer lecterns, and classroom network ports. Also includes replacement of equipment purchased on one-time funds. (Note: former funding sources included special EVC projects funds, classroom renovation funds, system-wide IT funds) One-time expense: \$300K. Annual recurring expense: \$370K which includes 1 CRS II FTE position plus additional student GA to support classroom computer demands.

F. Possible Funding Models for Infrastructure & Connectivity:

A paper presented to the CNC (Alternatives for Funding UCSB's Internet Connectivity and Networking Infrastructure, April 21, 1998) identified eight potential alternatives for funding networking projects. These alternatives were:

1. IP address charges (currently \$11/system/year)
2. Data Networking Phone Surcharge (currently \$9/phone/month)
3. Core funding
4. Assess a charge on each division or department based on number of FTE.
5. Charge each person accessing the Internet based on the number of packets (or bytes) transferred.
6. Reduce existing communications expenses charged to the campus by vendors (e.g., long distance calling charges), leave recharge rates at their current levels, and use the net increase in income to pay for Internet connectivity.
7. Generate a new or increased external source of revenue, by developing a program that will redirect faculty, staff or students personal payments for goods or services from an off-campus vendor to the campus.
8. Use a portion of the new student technology fee.

III. Campus-Wide Services

A. OIT

The Information Technology Board is currently discussing whether the campus should form an Office of Information Technology. No costs estimate until the final structure is determined.

B. Security

The Campus Network Programmers are the current contact point for computer intrusion events. The campus response to security events has been limited to reactive efforts after root compromise intrusions have occurred or systems have been used as either sources for SPAM or distribution sites for pirated

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software. Since most of the root compromise attacks have occurred using well known publicized holes, a more proactive effort is called for.

A new FTE with the following tools could address these problems:

1. 1 FTE - CNT III Annual cost \$79K.
2. 1 desktop and 1 laptop for FTE - \$6K (amortized over 3 years)
3. Intrusion Detection Software (\$8-15K one time, no estimate for annual maintenance & upgrades)
4. System to run Intrusion Detection Software - \$3K (amortized over 3 years)
5. Software to proactively search for vulnerable systems (assume this runs on the FTE's desktop.) (\$6K one time, no estimate for annual maintenance & upgrades)
6. Annual training classes for NT server & Unix, and annual conference attendance

The campus should make use of existing filtering capabilities available in backbone equipment. Currently Firewall software could only be effectively implemented at the edge of the FDDI backbone. The estimated costs for this would be \$7K - 25K for the software license, no estimate for software maintenance and 6K for two Pentium II class systems to run it. Our assumption is that the firewall would be configured to let most everything through by default, but could be used to lock out attacks once they are discovered.

An office location has not been identified for this FTE.

C. Directories, Authentication & Authorization

The Directory Authentication and Authorization service is planned to consist of two mirrored servers running the Netscape LDAP server software. The estimated one-time cost for 25,000 entries is \$107K, with a recurring annual cost of \$27K. The estimated cost for 25,000 Authentication Certificates is a recurring annual cost of \$125K. No estimates have been made for the hardware or staff costs for supporting this service. Development of the campus LDAP Directory Service is in progress.

D. Services requiring authentication:

1. emailaddress@ucsb.edu

This service consists of three basic components. The first is a mail server that processes electronic mail that is sent to in the form emailaddress@ucsb.edu and re-writes the To: field on the envelope to forward the mail message to another email address. The second is an interface that allows authenticated and validated users to specify their desired emailaddress@ucsb.edu and also their actual email address and then stores this information on the mail server. The third is an LDAP directory server that contains all Faculty, Staff and Student records. The first two components have been developed and tested.

2. Library Proxy-web Service

E. Software Licenses

1. Here is a list of site licenses that might possibly be included here and their costs per year:
 - Antivirus \$25K/year
 - SecureCRT \$5K (PC only, estimate \$15K to include all Macs too)/year
 - Microsoft Operating Systems & Applications: \$3M - 6M/year
 - Apple OS \$12K/year (maybe \$8.6K/year in subsequent years)
2. Fund for the Common Good - Sometimes those who commit to licenses don't end up buying the licenses once the license agreement has been completed - this would cover these gaps so the sponsoring organization wouldn't be stuck with the remainder. A similar problem exists when the campus commits to a

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larger number of licenses than actually needed in order to secure better costs per license.

F. CBT

UCSB has joined a UC system-wide site license of computer-based training courses from CBT Systems Ltd. This gives us access to more than 300 courses on a variety of topics including Win95, MS Office, Netscape Navigator, Solaris system administration, Windows NT, Netware, networking, Cisco router configuration, web development, Java, Oracle, MS Visual Basic and Visual C++, and many more. There are courses designed for technical support providers and programmers as well as end users. These courses are available to all UCSB faculty, staff, and students. The cost of this was \$25K/year and it was funded via "pass the hat".

G. EDUCAuse Membership \$6K/year. This was funded via "pass the hat".

H. GartnerGroup \$19K/year for seven "seats". This was funded via "pass the hat".

I. List-server Support

This service is provided to campus users for free by both IS&C and the Campus Network Programmers. No estimates have been made for the cost of providing this service.

J. Student Email

This service is provided by Instructional Computing for both undergraduate and graduate students. The estimated annual cost of this service is \$298K. This cost includes funding Software Depot.

K. CorporateTime

This service is funded by IS&C Simeon Email Customers.

L. Campus Domain Name System (DNS) Support

This service is provided by the Campus Network Programmers.

M. Campus Webserver Management

This service is provided by the Campus Network Programmers.

N. Campus News Server Management

This service is funded by the College of Engineering.

O. Web-based Instruction Systems

Several departments have developed their own web-based instruction systems. Notable examples are:

1. The Physics Classweb system <http://class.physics.ucsb.edu/insecure-class-list.phtml> which is used by over 2000 students per quarter in the Physics, Math, and Mechanical Engineering departments.
2. The Videoweb system <http://mentor.lscf.ucsb.edu> is used by over 1000 students per quarter in the Molecular, Cellular and Developmental Biology and Ecology, Evolution and Marine Biology Departments.
3. The Transcriptions system
<http://english.ucsb.edu/transcriptions/resources/index.html#overview>
used in English.

These systems are initially developed using existing department resources, but once a department embraces them, more resources are needed to fully implement them into the curriculum and to improve their functionality. For example the

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Physics Classweb system will be used by all of the Lower Division Physics courses beginning Fall 1999. This has necessitated creating an Academic Coordinator position at \$56K, with \$7K funded by Physics and \$49K funded by L&S, to support the operation of the system. There is still need for a CNT III programmer at \$79K to add functionality to the system. Development of the Videoweb system has been done by the faculty, but a CNT III at \$79K concentrating on programming functionality would allow those faculty to focus on content.

IV. Desktops & Support

A. Student Access Workstations

1. The ITPG estimates that it will cost \$800K/year, assuming a 4 year replacement cycle, to maintain the existing 1244 campus-based workstations used by students.
2. Currently 1.5 Instructional Computing FTE support 420 stations in 14 different locations. 35 new stations are being added to that support group and so another CNT II FTE at \$65K is needed to help support the 455 stations.

B. Student Multimedia Production Lab (SMPL)

Includes building 3 dedicated digital video post-production workstations based upon the Faculty Development Center prototype, upgrading the existing AT Lab in Kerr Hall (10 machines), and purchasing field production equipment. One-time expense: \$120K, Annual recurring expense: \$85K, which includes additional staffing required to support 3 new labs in Kerr Hall plus periodic equipment replacement in the SMPL.

V. Systems Integration, Datawarehousing & (Campus) Applications

A. Data Warehouse

The Data Warehouse contains financial transactions of all departments. It is available to all departments on campus. The yearly support costs are estimated to be \$75K which is paid for by IS&C Core funds and recharges to other AIX users.

VI. Department Specific Items:

- A. Faculty Workstations
- B. Staff Workstations
- C. Desktop Support Staff
- D. Departmental and Divisional Servers