This chapter reflects facility requirements
for Instructional Computing, Distance Learning, the Faculty Computer
Training and Production Lab, and the Instructional Media Center

Chapter 11:
Overall Technology/Equipment Requirements

1. Overview of Current Technology / Equipment Districtwide and by Campus

The Instructional Media Center (IMC) provided classroom support with projectors, sound and video playback, public address systems, production of audiovisual materials for instruction, a learning resources center, and technical support for campus events. Until recently, **audiovisual** was the principal communication technology for instruction in the Riverside Community College District.

Television is used in classroom instruction. The campus has a satellite downlink and an interactive television system that works on digital telephone lines.

Distance learning distributes tape-recorded television lessons via local cable and wireless-cable. The broadcast lessons are complemented by 15 hours of on-campus instruction. Over 1,000 students enroll each semester in approximately 22 courses..

Computer laboratories have been developed to support interactive learning in applied technology, art, engineering, English, computer and information technologies, music, science, social science, and writing. Computers have become integral to teaching and learning in almost every area of the curriculum. The marriage of computers with telecommunications has created networks. The Internet, a global network of networks, has caused the computer to take center stage as an emerging educational technology.

1.1 Current Technology and Equipment

This section will deal with technologies under the organizational units that manage them and/or are proposed to manage them in the future.

Instructional Media Center (IMC)

The IMC is responsible for the following functions:

1) Acquire, manage, operate and maintain equipment and systems installed in classrooms and smart-classrooms
2) Check-out equipment and materials for classroom use – projectors, audio/video playback, public address systems, video equipment
3) Record events on videocassette; produce video lessons in collaboration with faculty

4) Produce media – design, produce and duplicate graphics, slides, overheads, videos, and multimedia

5) Schedule, downlink and connect satellite lessons to classrooms and conference rooms; setup and operate two-way interactive video between campuses and with external organizations

6) Record off-air; edit and/or copy audiocassettes and videocassettes

7) Operate Learning Resources Center – where students can listen to and watch prerecorded materials

8) Operate video library - select, acquire, catalog, store, loan, and maintain

Note: Discussion is underway with the Librarian to resolve which parts of functions 4), 6), 7) and 8) will be transferred to the library as part of the proposed Library–Learning Resources Center building in 2001.

The IMC supports classroom instruction with equipment such as television sets and overhead projectors, slide projectors, audiocassette and videocassette players, videodisc players, CD players, public address systems, and other items of equipment as needed. Some equipment is permanently installed in classrooms. The instructor must request equipment and media from the IMC.

With the exception of the newly purchased interactive video system, the equipment inventory is quite old. Many projectors and television sets are more than15 years old and breakdown of such equipment occurs with increasing frequency. In some instances parts are no longer available to repair the equipment.

The media library is approximately 6,000 videocassettes that include lesson materials previously supplied as 16mm films, slides and filmstrips. Some videos are reserved for students to view in the Learning Resources Center. To receive credit, students must log in at the Learning Resources Center, view the assigned video, and log out.

The IMC produces slides, graphics, audio, video, and multimedia. Other production services include media duplication, editing, sound mixing, and documentation of campus events.

IMC services include operator support for classroom use of media, public address systems for auditoriums and stadiums, satellite television downlink and recording, interactive video for classes and videoconferences, design and installation of *smart* classrooms (classrooms with permanently installed display and internet equipment) and equipment maintenance.

There are periodic training sessions for faculty in media production. There is also a laboratory to enable faculty to produce their own instructional materials using audiovisual and computer-based materials.

Distance Learning

Distance learning is a way to reach unserved segments of the population. It serves those who are geographically remote from the campus, those with schedules not compatible with class times, those physically unable to attend for a

variety of reasons, and non-traditional learners whose learning styles are not compatible with traditional methods of teaching.

Two technologies play a dominant role: television for group teaching, and the computer for individualized learning.

Broadcast television translates the classroom paradigm of group teaching into multiple classrooms, industries, and homes. Live television classes are a *synchronous* method of teaching and learning that link people together according to a fixed schedule. The focus is on teaching and the teacher. It has the advantage of low cost distribution and is accessible on broadcast or cable television. The "drop in" audience may be much larger than those enrolled for degree or certificate credit and should be considered as a community service and a promotional device for college programs.

Individualized learning is usually asynchronous. It can occur anywhere and at any time. It accommodates different learner preferences, schedules, and pace of learning. It can be interrupted and resumed at will. It opens educational opportunities for persons who travel, have families, or otherwise cannot participate according to a predetermined schedule.

Videotapes can be used for asynchronous learning, but the new knowledge media – computers and telecommunications – are powerful instruments for interactive learning. It is notable that ten of eleven distance learning institutions with enrollments over 100,000 focus on individual learning, not on group teaching (the exception is the Chinese Television University system).

Telecourses ands Teleconferencing at RCC

RCCD receives satellite teleconferences and courses on tape and distributes television lessons by supplying videocassettes to local cable companies. At this time RCCD cannot originate live broadcast or satellite programs. The RCC campus is a head-end for Cross County (Wireless) Cable. Moreno Valley is negotiating a head-end for TCI Cable. In the future, it will be possible to originate live and recorded programs via local cable from each campus.

RCCD has interactive video (teleconferencing) equipment on each campus. Interactive video requires ISDN telephone lines and a multi-point connection where more than two sites are to be connected. Picture quality is improved when multiple ISDN lines are used. Each campus has purchased three ISDN lines (384K) under the Education First program from Pac Bell. An internal multi-point bridge can connect up to four sites using a single ISDN line (128K). External bridging can be rented for connection at higher data rates. All participating campuses must use the same data rate. *RCCD equipment was recently upgraded to meet the current standard for the community college system and the California State University.*

Interactive video connections for RCCD campuses can be accessed from one of the following classrooms on each campus:

Riverside City Campus (patched by RCC IMC):

AD 122 (Board Room), Administrative Conference Room, BE 10, LB 102, LS 108, Quad 134, Quad 144, (Hall of Fame is yet to be installed).

Moreno Valley Campus (Patched by IMC Office in Hum 220): Hum 120, Hum 129, Hum 209

Norco Campus (patched locally): ATec 114, Hum 111, Student Services 101, (Little Theatre is yet to be installed)

Under the Pac Bell *Education First* initiative, three ISDN lines are provided to each campus at a flat rate of $75 per campus per month for the local area ($2,700 year unlimited use for the three campuses). It is possible for RCCD to connect to any educational organization in the Greater Riverside area including: California State University, San Bernadino; University of California, Riverside; Riverside Unified School District; California School for the Deaf; and similarly equipped classrooms and conference rooms in adult education centers, government and community agencies throughout the United States.

Computer Labs and Networks

In 1996 the RCCD Academic Senate set up two goals for computer technology:

- Open computer labs on each campus to provide students in all disciplines access to computer technology in order to complete academic assignment and projects.
- Acquisition and implementation of adequate and current technology for support of student access to word processing, computers, lab equipment, current software, in-class computer demonstration equipment, and student access to the Internet.

In March of 1997 a Dean of Learning Technologies was recruited to develop a technology plan and manage the development of instructional computing.

Computer labs are attached to teaching departments except for large general-purpose labs recently installed at Moreno Valley and Norco. The facilities at Moreno Valley and Norco are relatively new, and new labs were constructed and new computers procured in 1997 as a result of secondary effects funding. On the City Campus the only shared lab is on the first floor of the Business Education building. The City Campus has a computer inventory dating back to 1983 (8088) along with 286, 386, 486 and some older Macintosh computers

Table I
Computers and Computer to FTES Ratios

Campus	Obsolete Macintosh	Macintosh	Obsolete 8088-486	Pentium	Total < 5 years old	Est. 1997-98 FTES	Ratio
City Campus	14	60	107	180	220	11000	1:50
Moreno Valley			38	242	242	2600	1:11
Norco	21		17	280	280	3000	1:11
Total	35	60	163	700	740	16,600	1:23

Table 1 shows the number of computers for instructional use by Campus as of October 1997. After eliminating the obsolete computers in the shaded columns, there are 740 computers to support 16,000 Full-Time Equivalent Students (FTES) – a ratio of one computer for every 23 FTES.

Computing this statistic separately for each campus gives a different picture. The computer to FTES ratio at Moreno Valley and Norco is of the order of 1:11 while on the City Campus it is about 1:50.

If labs are open for an average of 60 hours/week, that equates to an average of 14 minutes per course per week for students on the City Campus and one hour and ten minutes per course per week at Moreno Valley and Norco.

1.2. Anticipated or Already Scheduled Additions

Instructional Media Center. The greatest immediate change in IMC function is installation of new television monitors and digital video projectors in classrooms, and possible addition of computers or computer connections to some of these devices to make *smart classrooms*. To provide flexibility, digital video projectors will also be available on carts for checkout or supplied with an operator. This will be standard on all three campuses, although the level of video and computer support is much higher at Moreno Valley and Norco.

Part of the IMC space on the City Campus will be the site of the proposed Faculty computer training and production lab described later in this section. Equivalent spaces will be identified at Moreno Valley and Norco. At Moreno Valley the IMC will house the head end for cable television. Similar spaces will be identified for cable head-ends at City Campus and Norco. It is expected that graphic and video production capabilities of the IMCs will increasingly be used to support development of World Wide Web pages for campus instruction.

One-time capital funds have been released for instructional technology needs. About 90% will be used for computer related purchases and 10% for television related equipment and classrooms.

Faculty computer training and production lab. Instructor training is a prerequisite to effective use of the new student computer labs. All three campuses will promote use of student and faculty labs starting with computer literacy and basic skills with word processing, spreadsheets, and databases.

Specifically, the Faculty computer training and production lab will train faculty to:

- Use computers, computer applications, networks and the Internet.
- Design, produce, implement and evaluate computer developed printed materials, instructional presentations, and interactive teaching and learning media.
- Acquire or develop, implement and evaluate lessons segments, lessons and courses that involve text and graphics, presentation graphics, color overhead projectuals, desktop publishing, 3-dimensional graphics, digital audio and video, animations, interactive multimedia, CD-ROMs, Web pages

- Teach advanced workshops and assist individual faculty to design, produce, implement and evaluate lessons and courses.
- Test, demonstrate, implement and evaluate new and emerging learning technologies

Advanced workshops will be conducted on scanning, optical character reading, creating graphics, digital photography, digital image processing, digital audio and digital video editing and conversion, PowerPoint presentations, creating interactive multimedia, creating CD-ROMs, authoring multimedia programs using Authorware, Netscape and Explorer, and authoring techniques for the World Wide Web.

The faculty lab on the city campus will Have 12 networked Pentium II computer stations with Internet access, a WWW server, flatbed scanner, slide/negative scanner, color printer, high speed B&W production printer, and an extensive variety of applications software and authoring programs. This model will be replicated with smaller numbers of computers at Norco and Moreno Valley.

Distance Learning. Distance learning will facilitate off-campus learning using print, computers, audiotapes and videotapes and CD-ROM, and instructional telecommunications.

Instructional telecommunications includes:

Broadcast courses and programs –
- commercial, public and educational broadcast courses
- live and videotaped (videocassette) courses
- satellite and digital satellite courses and and teleconferences
- Instructional Television Fixed Service and wireless cable
- cable television
- videos on CD-ROM
- two-way interactive video

Interactive Internet courses and programs
- Email, bulletin boards, listservs, chat rooms, computer forums and conferences
- MOOs, MUDs, and three-dimensional graphic Worlds
- Internet information resources and electronic libraries
- World Wide Web and interactive multimedia

Distance learning will be a major area of future growth for the RCCD. It substitutes telecommunications and virtual classrooms for brick and mortar costs. It is the only practical way for many people to attend College because of their complex lifestyles, time barriers, and geographic barriers.

The British Open University is the largest Distance Learning organization in the world. It attributes its success to four key elements:

1. <u>High quality multi-media learning materials</u> produced by multi-skilled academic teams. Study materials are excellent and varied to make the campus in the home or workplace a congenial experience.
2. <u>Dedicated personal academic support</u>. Each Open University student has his own tutor for each course, one of Open University's 7,000 adjunct faculty.

They comment on and mark the student's assignments, hold group meetings, and give support by phone, email, and computer conference.

3. Effective logistics. Each individual student receives the right materials and information at the right time. With over 150,000 students around the world, that requires attention to detail.
4. A strong research base. When thousands of students use the material for each course and millions of people view each TV program, the content must be academically up-to-date and presented clearly. Thanks to economies of scale, the Open University has resources to move the academic paradigms steadily forward.

RCCDs approach to distance learning will increase courses taught live on television and strengthen interaction and support by telephone, email, chat room and forums on the Internet.

RCCD will initiate distance learning that can be shared on a statewide basis. The CCC will shortly fund a pilot project for Statewide Delivery of Distance Education that is designed to select, purchase or site-license, revise and/or produce distance education courses for statewide delivery.

Television courses. Developments already underway include courses taught K-College and telecourses available on local broadcast and cable channels. It is important to note that RCCD assigns instructors to distance learning students, but not with the level of mentoring offered by the British Open University.

Computer and Internet Courses. As computer and telecommunications infrastructure is installed, RCCD will make courses available on the World Wide Web. This will be a large enterprise in the future are requires a comprehensive plan, staff, production areas, and production oriented hardware, software and authoring programs. It is projected that secondary effects after construction of the new library will convert the second floor of the existing library building for distance learning classrooms, teleconferencing, and production of World Wide Web pages for instruction.

Computer Labs and Networks

For the foreseeable future, the major focus of activity will be installation of computer labs and development of computer based courses. It is important that every graduate of RCCD be computer literate and skilled in the use of the Internet to maximize his or her job opportunities. This will be an expensive venture. However, it can be successfully accomplished through careful planning, good teamwork and community / industry collaboration.

How many computers are needed?

There are several ways to determine the required number of computers. One is to total the number of computer laboratory hours needed to support each course. This method is subject to error because many more classes will use computers when they are available.

Another approach is benchmark against similar organizations that use computers to offer comparable courses and programs. This produced some interesting statistics shown in Table 2.

Table 2
Computer:FTES Ratios for Selected Schools and Colleges

Institution	Number of Computers	FTES	Ratio
Ngee Ann Polytechnic-Singapore	4,500	12,000	1:2.7
California State University, San Bernadino	4,000	12,000	1:3
Goal for State of California K-12			1:4
Redlands East Valley High School	400	2,000	1:5
RCC Norco	280	3000	1:11
RCC Moreno Valley	240	2600	1:11
State of California K-12 – current ratio			1:14
RCC City Campus	220	11,000	1:50

For planning purposes, a goal is 1:4 as proposed for the RCCD, the ratio proposed for the State of California K-12. This would require 4,150 computers compared to the present inventory of 740, a difference of 3,410 computers. The majority of these are needed on the City Campus because of its higher FTES.

Doing more with less

Computers are a scare resource and will continue to be so. It will take five years to build the inventory assuming that sufficient dollars are available. Since the goal is five years in the future at best, it is imperative to explore ways to maximize use of the existing inventory. It mandates shared access for faculty for the time being in a faculty lab or shared office environment. The exception will be power users who can justify a state-of-the-art computer for personal use, or who will accept an older computer because their primary need is word processing and Internet access.

Scarcity mandates against departmental labs open a few hours a week and teaching labs where the primary use is demonstration and discussion. Priority will be given to large open labs with extended hours each day and on weekends, shared labs for disciplines such as the physical sciences with specific requirements, and consolidation of small labs to extend lab hours and minimize supervision cost.

A further multiplier would be Internet access to programs used in campus labs to enable students to do lab assignments at home or in the workplace. This will require changes in policies and procedures. For example, performance measures should replace seat time as a way to measure learning. Mentoring and the equivalent of line-of-sight supervision can be provided online using email, bulletin boards, chat rooms, forums, and programs that enable instructor and student to share the same screen and control it from his or her local keyboard and mouse.

Economy can also be achieved through specialization. If present trends continue, Norco and Moreno Valley will be high tech campuses that require a

large numbers of computers compared to their FTES. Norco will specialize in engineering, computer science, computer-assisted design, graphics and multimedia. Moreno Valley will specialize in high-tech medical sciences. If the mission of the City Campus is to support more traditional types of courses, it may need fewer computers. The gap analysis between needs and available resources (space, infrastructure and budget) suggest that it is impractical to achieve the 1:4 ratio on the City Campus prior to construction of the proposed LLRC in 2001. For this reason, it is proposed that a more realistic short-term goal for RCC City Campus would be "50% in five years."

First Steps

In 1997, RCCD is upgrading infrastructure for computer labs and networks as follows:

1) Token ring networks at Norco and Moreno Valley instructional labs and library were replaced by Ethernet in as part of Secondary Effects – *completed.*
2) A large (120 station) General-Purpose lab was setup at Norco (Secondary effects) – *completed*
3) A large (120 station) General-Purpose lab was setup at Moreno Valley (Secondary effects) – *near complete*
4) District standards were setup for computers, networks, servers, and printers. Pentium II computers using Windows 95 or Windows NT will be purchased until replaced by a newer technology – *completed*
5) District Standards were setup for networks. 3Com switched networks with ATM backbone were selected – *installation in process*
6) A bid was initiated in Summer 1997 to purchase computers and related equipment – *completed.*
7) A *band aid* action added 30 state-of-the-art computers on City Campus at the beginning of the Fall Semester so that Office 97 could be taught on all three campuses. An additional 30 computers were added in October – *completed.*
8) Departments on City Campus and the Senate Technology and Equity Committee are meeting with the Dean of Learning Technologies to establish needs that can be satisfied within this year's budget and initial priorities for next year's budget – *ongoing.*
9) Grant applications were generated for multimedia, distance learning, and faculty computers– *completed.*

Standards, Policies and Procedures

Steps have been taken to ensure reliable equipment operation, reduce service requirements, and assure prompt service when needed:

a. Standardize on one type, make and model of computer. This simplifies purchase, service, operation, and ultimately, replacement. It minimizes the number of makes and models for technical support and facilitates identical configuration.

b. Buy the most current model. The average useful life of a computer is five years. Buying last-years model reduces useful life to four years and lacks the features and power of the newer technology. When installation cost is added and cost is amortized over four years, last year's model is more expensive.

c. Have the manufacturer configure hardware and software. This requires planning and ensures a common configuration. Opening a new computer to install hardware doesn't make sense since it violates the integrity of the configuration determined by the manufacturer. Also, technician time is expensive. Technical support should be *lean and mean*, yet responsive when needed.

d. Have the manufacturer unpack and test equipment on-site. ***Note:*** *This was tried, found* ***not*** *cost effective, and discontinued.* The intent was to accelerate installation of hundreds of new computers in Fall 97

e. Replace token ring networks with Ethernet. Token-ring networks are unreliable and difficult to maintain. Instructional labs now have Ethernet.

f. Use *Switched* Ethernet so that multimedia does not overload networks. Two or three multimedia programs can overload a *shared* network. *Switched* Ethernet provides each user with up to ten-megabits of data per-second compared to a total of ten-megabits per-second for all users on a *shared* network.

g. Use Asynchronous Transmission Mode (ATM) for the network backbone. The backbone must support all of the traffic on the network so its collective bandwidth must be substantially greater than bandwidth to the desktop.

h. Standardize networks, servers, printers, and lab procedures. Labs will be similarly equipped and one network will serve administrative and instructional use across all three campuses. Computer systems and operating procedures will be standardized and optimized to ensure a uniformly high *Quality of Service*.

i. Establish policies and procedures for faculty training. Faculty training will be supported by one trainer position shared between three campuses.

j. Establish policies and procedures for lab support, procurement, maintenance and replacement of equipment and software. One lab technician per campus will be recruited to support the general-purpose lab, networks and other instructional uses of computers. Instructional computing will have a technical team separate from administrative computing to ensure responsive support for the academic mission. It will collaborate closely with the administrative computer support team.

k. Growth of inventory. Computers will be purchased in sufficient numbers to achieve the desired inventory in a five-year period.

l. Replacement policy. Obsolete computers will be replaced, usually when they are about five years old. Over a period of time, a pattern will be established where annual replacement will be 20% of the current inventory plus a margin for growth.

m. Software purchases. Site licenses will be purchased wherever possible to reduce cost, simplify management, and facilitate software upgrades. Site

licenses will be purchased and managed through the Office of the Dean, Learning Technologies.

n. Lab Management. Software will be obtained to log student activity and time in computer labs.

o. Lab Security. Equipment will be locked down and virus protectors will be installed on all equipment. Security of administrative data will be assured using Virtual Local Area Networks (VLANS).

p. Energy Saving. All equipment will be setup to use energy saving features when the equipment is not in use.

q. Illegal Use. A condition of use *for all patrons* will be a signed agreement to refrain from illegal or unethical use of computers, networks, and the Internet. Access will be declined to persons who break this agreement.

Resource Requirements

Computers, networks and software are only part of the cost of computer installations. Space must be assigned for labs, classrooms; technician work areas, and telecommunication equipment such as network hubs and servers, storage; offices for instructors, counselors, and support personnel; a central service desk to monitor and support lab activities; and a help desk to provide campuswide support for computer users.

Electricity and air conditioning must be sized to the room capacity and the electrical requirements of computers, color monitors, printers and servers, hubs and routers. Network wiring must be enclosed in raceways separate from power, with a patch bay to connect each computer via a hub to servers, the Intranet and the Internet.

Personnel cost needs to be considered also.

Operating cost

Operating cost is a composite of equipment and software amortization and maintenance cost; personnel cost including technicians, lab managers, lab aides, help desk, instructors, and security personnel; electrical power and telecommunication cost; contracted services such as Internet Service Provider and the telephone company; and supplies such as toner and printer paper.

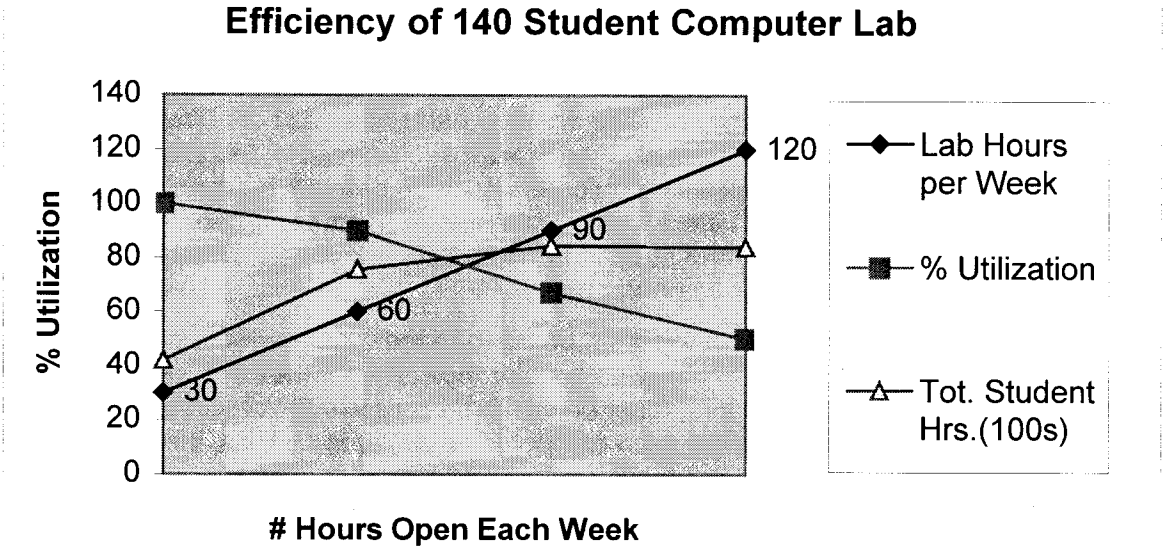
So long as computer labs are a necessary expense for the College, the question is how to contain or avoid costs on the one hand, and how to maximize cost-benefits and results on the other.

Based on the level of utilization from hour to hour, the greatest cost benefit will be achieved by having large labs (to spread supervision cost over a larger number of users) and keeping labs open for an extended number of hours each day.

Example: A 30-station lab with server and networking, including network hub, cost of the order of $185,000. A 120-station networked lab with multiple servers and expended networking costs $750,000. The number and size of labs should be optimized to serve the largest number of students at the lowest possible cost.

Amortizing Equipment Cost. Consider the following hypothetical example. The installed cost of each computer, including servers and networks, is $6,000. A lab is kept open for 30 hours per week for 50 weeks and the life of the equipment is four years, the amortized cost of equipment is $1 per computer per hour if the lab is utilized 100%. If the lab is open 90 hours per week and utilization is 67%, cost averages 50c per hour.

If the lab is open 120 hours a week and utilization averages 50%, the cost is 50c per hour. For a 140 station lab open 30, 60, 90, and 120 hours the actual hours of student use is 4,200, 7,560, 8,400, and 8,400 respectively. In other words, there is no increase in the number of student hours of use beyond 90 hours.



Personnel cost. Large labs are less expensive to supervise and maintain. Assuming the people needed to support a 140-station lab are: one classified full-time, one classified hourly, and 0.5 technician and .25 janitor, cost with benefits is less than $70 per hour or 50 cents per station per hour. If the same level of support is needed for a 70-station lab, then the large lab is twice as efficient. In practice this tends to be a logarithmic scale, particularly when multiple labs and large numbers of students are involved. Lab support and lab size should be optimized to meet the educational need and the desired quality of service.

Other Operating Cost. This includes electrical power for computers, printers, peripherals and room lights, telecommunication services, and Internet Service for a total of $1.00 per station per hour.

Ways must be devised to augment funding or to significantly increase the use of computer resources. External funds and partnerships will be needed to augment State budgets. Effective utilization of computer resources is crucial – large labs reduce supervision cost and extended lab hours give greater value for each equipment dollar. Policies need to be changed to allow students to use computers at home or in the workplace to reduce the load on computer labs.

Administrative Network

Key administrative offices and approximately 15% of faculty offices are connected with Shared Ethernet to the mainframe, Intranet and Internet services for administrators, faculty and staff. The network connects all three campuses via T1 telephone lines.

Data Security

Administrative and instructional computers are connected to the network as separate Virtual Local Area Networks (VLANs). The VLAN allows the physical sharing of the network infrastructure yet provides absolute protection against students accessing administrative data or the administrative VLAN.

Networks and operating systems

10Mbps Switched Ethernet is the standard selected for workstations on the RCCD Instructional Network. The backbone connecting computer labs, faculty offices, and classrooms will use ATM, 100Mbps Ethernet, or 10 Mbps Ethernet depending on data requirements and location with respect to the backbone. All computer stations are wired with Category 5 wire to support data rates up to 100 Mbps. The campus backbone is fiber optic cables with multiple pairs of fiber including unused (dark) fibers for future system expansion.

Student labs constructed or refurbished in the second half of 1997 have switched Ethernet. All student labs will eventually have switched Ethernet to permit network intensive activities involving graphics, sound, video, multimedia, and transfer of files and overlays.

New and upgraded student labs are concurrently installing 300 Mhz Pentium II computers, Compaq Proliant file servers, and Hewlett Packard 5SiMX printers. Software includes the Windows 95 operating system, Office 97, and either Novelle Netware or NT Workstation for the network operating system. Manufacturers, model and versions will be periodically changed and updated to ensure a high quality learning environment.

Older labs on the City Campus will be upgraded, as budget is available. Student stations in some labs installed prior to 1997 have no hard disks and run from the file server. Some computers still use the DOS operating system and Windows 3.11 as the user interface. Instructional labs that are not refurbished with new equipment will be upgraded to PCs with hard disks and extended RAM memory, Windows 95 or Windows NT for the operating system, and switched Ethernet for networking. Similarly, shared network hubs will be replaced by switched hubs, and network printers will be upgraded as necessary.

Computer Communications and The Internet

Computers communicate with other computer via Local Area Networks (LANs). LANs communicate with other networks across a wide area via Wide Area Networks (WANs). WANs connect LANs through telephone lines, fiber, cable, microwave or satellite based on availability and cost. The Internet is a global network of networks.

Routing of Internet data is transparent to the user. Multiple telephone and telecommunication companies are dynamically linked wire, cable, fiber, microwave and satellite to make a coinnection. Telecommunication company computers select the preferred path, and for practical reasons this anonymous linkage is called a "cloud." Control is shared dynamically between multiple telephone companies and Internet Service Providers (ISPs) so that no single organization controls the flow of information.

Access to the Internet

Communications via the Internet have become as important as computing itself. It provides almost instantaneous access to information resources of every conceivable kind in more than 100 countries. It supports email, electronic libraries, chat rooms, computer forums, multimedia, electronic libraries, electronic publishers, the World Wide Web, and distance learning in a variety of interactive formats. It is used by tens of millions of students worldwide and by business, industry, government, military; international, regional and community organizations; and by public and private foundations and research organizations.

Quality of Internet Access

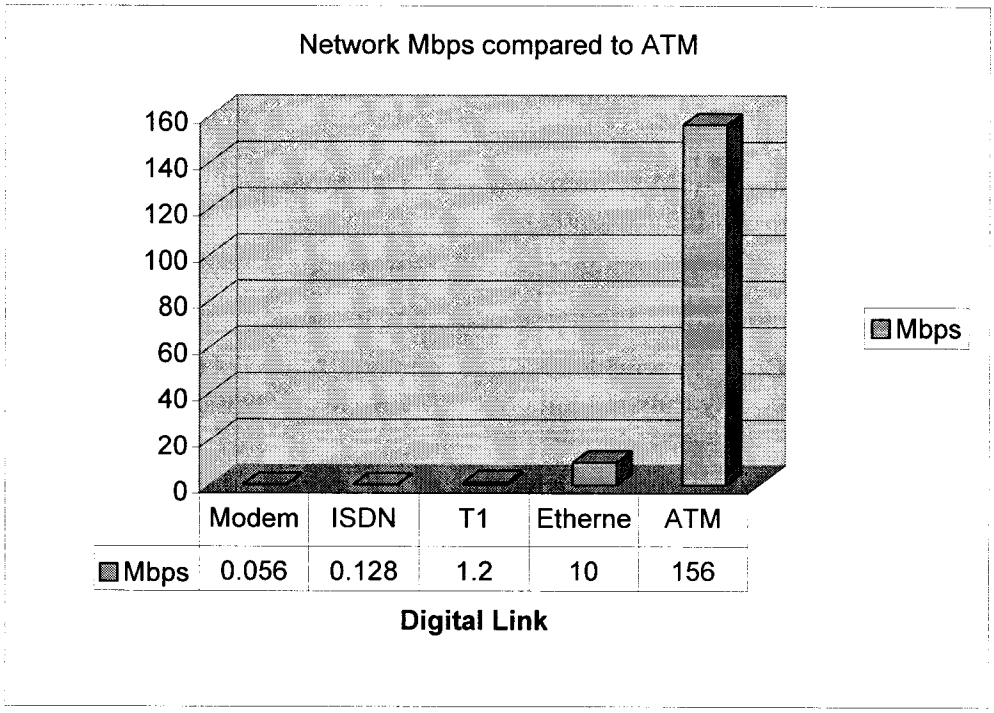
For electronic libraries and text-based systems, shared networks can support a large number of users. As traffic increases, the system slows down. Substantial delays may occur, or even failure to make a connection.

The bandwidth of the Internet connection must be sized to the volume and nature of use. Home users have telephone modems up to 56 Kilobits per second (56 KBPS) or ISDN digital telephone lines up to 128Kbps. Institutional connections require one or more T1 lines with a capacity of 1,200 Kbps, usually described as 1.2 Megabits per second (1.2Mbps). Eight T1 lines are equivalent to 10Mbps Ethernet. Digital satellite is offering delivery up to 200Kbps for home use, and may provide an economic means of supporting some college operations. Large information technology users such as the Library of Congress and Microsoft Corporation use ATM lines with a capacity of 156Mbps or 624Mbps

In the College environment, it is anticipated that hundreds of users may be accessing the same timeframe. Just as 10Mbps Ethernet can be overloaded by data intensive tasks such as downloading files and graphics and interactive viewing of multimedia, one T1 line with one eighth of the capacity of Ethernet will not provide an adequate quality of service. At the discounted education rate of $800 per month for a dedicated T1 line, cost rather than *Quality of Service* may be a determining factor.

District Net

Connection between campuses within the District requires T1 lines for the administrative network, the instructional network, 4Cnet and the Internet. To have sufficient capacity will require the purchase of several T1 lines for each campus. Assuming four T1 lines per campus, this would cost of the order of $120,000 per year. Expansion for better Internet service could double this amount by the year 2,000 and continue to expand.



Several alternatives were explored. 1) leasing dark fiber. This would require connection through multiple vendors that would include telephone companies from whom we procure these services at a highly discounted rate. No benefit could be expected from this approach. 2) Bury RCCD fiber between campuses. Even if we had the right of way, this is impractical because of high construction cost. 3) Use ITFS frequencies. Unfortunately RCCD does not have any ITFS and no more frequencies will be available in this area. Pac Bell (the new owner of Cross Country Cable) has secured available bandwidth on the University of California Riverside ITFS frequencies. 4) Connect via microwave. Northern Arizona University (NAU) uses this for its statewide network. The system links multiple two-way television programs, campus telephone, and Internet between sixteen campuses.

Microwave requires line-of-sight connections between transmitters and receivers. One mountain site new Flagstaff AZ can see all Northern Arizona campuses. The system was constructed primarily with grant money is very cost affordable.

A preliminary consultant study showed that direct connection between the three RCCD campuses is not possible due to geographic barriers. City Campus and Moreno Valley have a clear view of microwave towers on Box Spring Mountain; another mountain site such as Jurapa Mountain or Radio Hill may be required to connect Norco. An additional study is needed to determine the most cost-effective option.

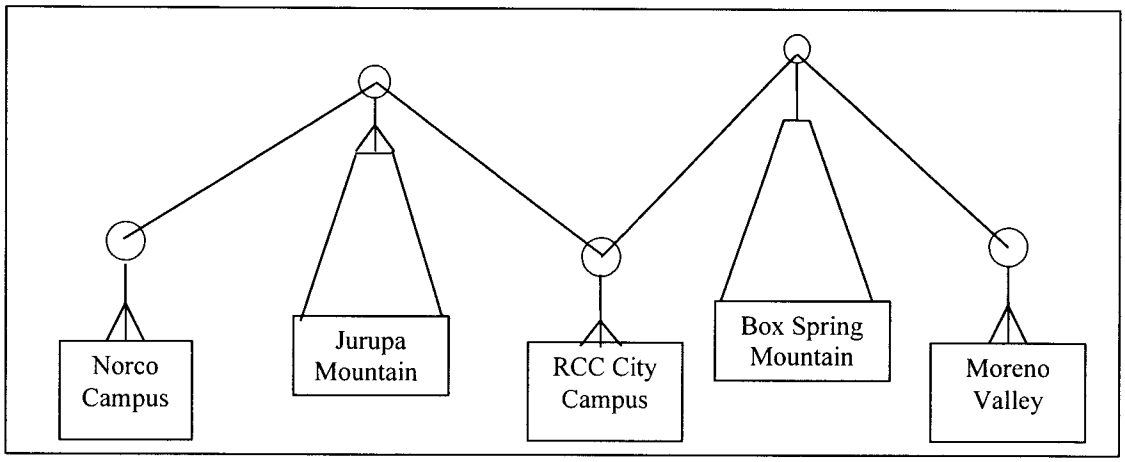
It is proposed that the RCCD district-wide network will be linked by microwave towers on each campus relaying their signals via mountain top transponders. For the cost of T1-level services for the next three years, RCCD can construct a microwave link with extended capacity for future growth. An operational fully redundant DS3 (56 Mbps) link between all three campuses would cost of the order of $600.000. This would have the capacity of 28 T1-lines connecting each

campus. ATM would triple this capacity for an additional $400,000. (A non-redundant ATM system would cost $600,000. However, in the event of technical problems there may be interruption of service.)

A fully redundant ATM system, with *hot-swappable* components, is recommended for the following reasons:

1) the redundant system assures reliable 24-hour 7-day service year after year.
2) ATM would provide the same backbone technology across three campuses.
3) Using 3-Com Corebuilder 7000 technology, the ATM link would simultaneously transmit telephone, video, two-way interactive video, computer data and the Internet.
4) The system would operate without major upgrades for 20 years. It would pay for itself, based on the projected telecommunications cost, in four years.
5) For the next several years there will be excess capacity. This could be used as leverage for partnerships or as a source of income for RCCD.
6) The broadband ATM link would qualify RCCD to received Internet II support.

Proposed RCCD ATM Microwave System



Connectivity on each campus is an integral part of the network plan. Some parts of the infrastructure for Moreno Valley and Norco was supplied as part of secondary effects funding. For the most part, it will be an entire new network. 3Com Engineers have designed a system that will extend the ATM backbone across each campus to support instructional and administrative computing, video, and campus telephone and fax.

Appendix A includes design information and some initial cost projections. The costs provided are retail and will be heavily discounted. However, there will be additional equipment needed to support the projected number of computers and service points for the network.

Priorities for Equipment Budget

1. General Purpose Student Labs $1,000,000
   a. Computers and software
   b. Networks
   c. Servers
   d. Printers
   e. Internet Service

   Rationale: *Students and learning are the focus of the Community College System. The large General Purpose lab on each campus will be staffed with assistants and technicians. They will be kept open for at least 60 hours each week and can be extended to 24 hour X 7 day labs in the future. These labs will maximize utilization of both technology and personnel.*

   If all items cannot be funded initially at the 100% level, consider the possible reduction in the number of servers and printers and installation of Internet service to the minimum number of computers necessary to support course requirements.

2. Department labs $400,000
   a. Computers and software
   b. Networks
   c. Servers
   d. Printers
   e. Internet Service

   Rationale: *Department labs serve specialized needs. They are justified where specialized software and courseware is used and specialized assistance is required. Departments must provide lab aides so the number of open hours will be limited by budget. Technician support will have lesser priority because the only available technician may be the person supporting the General Purpose lab.*

   If items cannot be funded at the 100% level, reduction should be tailored to specific needs. For instance, Internet may have lesser priority than the number of computers. If a lab can be kept open for more hours using volunteers or interns, fewer computers will be needed.

3. Faculty Labs $50,000

   Rationale: *Faculty labs on each campus will provide a place for training and faculty production. Assistance will be available from a lab aide for several hours each day. Computers will be properly maintained and have software, clip art, and resources to support development of print, graphic, audio, video, and multimedia lessons. Equipment will include scanners, high volume B&W printer, color printer for overhead projectuals, CD-ROM maker, digital camera, and conversion/editing equipment for digital audio and video.*

4. Faculty Office Computers $50,000

   Rationale: *Faculty need tools to develop lessons and lesson materials. A basic computer should be provided for word processing, email, and internet access.*

Power users (those developing graphics and multimedia) need state of the art hardware. Options such as helping faculty to buy their own computers, lease, or upgrading obsolete computers with new motherboard, memory and hard disk should be explored to maximize the number of faculty served. In subsequent years faculty who accepted minimal computers will have priority for new computers.

5. Smart Classrooms $80,000

   Rationale: *Smart classrooms may have permanently* installed *demonstration facilities such as cable television and videocassette player, audiotape and CD, and/or computer with LCD digital projector. Instructor time is saved and maintenance is reduced by scheduling classes into appropriately equipped classrooms.*

6. Library $60,000

   Rationale: The library provides training in accessing information resources and the Internet. The library is extensively used by faculty and student for research and study. Technology resources include computer databases, instructional CD-ROMs, information services, and the Internet.

7. Instructor-Led Labs $50,000

   Rationale: *Scheduled classes in the labs should be discouraged because the time used for teaching and demonstration may exceed 25% of the class time. Demonstration facilities (computer and LCD projector) are expensive and would receive higher utilization in a smart classroom. Student computers are not fully utilized and, during class times, are inaccessible to other students.*

8. Distance Learning $50,000

   Rationale: Distance learning is competing for the same technology dollars as computers. Except for videotape classes, there is no defined role for distance learning at RCCD. Video and multimedia production facilities are geared to training students and interactive video equipment needs to upgraded. Emphasis in the 1997-98 year will be to conduct a market survey and to develop a comprehensive plan for distance education in conjunction with RCCD faculty.

9. Instructional Media Center $100,000

   Rationale: Classroom television receivers, overhead projectors, and components for smart classrooms.

Total cost $1,840,000

Refer to chart – ***Organization Plan for Learning Technologies***

Academic Computing:

1.0 Manager, Computers and Networks – Mark Oliver
1.0 Technician – City Campus – new position
1.0 Technician – Moreno Valley Campus – new position
1.0 Technician – Norco Campus – new position
12.0 Lab Aides / Student Assistants

Note: This will not provide sufficient technical support for more than the general purpose labs, nor will it provide adequate support for the installation and testing of systems to be installed before and during the Fall Semester of 1997. The academic network will continue to be dependent on David Bell for system level support and direct support to special purpose labs and faculty.

Faculty Development:

1.0 Instructor
1.0 Lab Aide / Student Assistant

Note: The instructor will train faculty in the use of computers and production of instructional materials including desktop publishing, PowerPoint presentations, multimedia, and Web Pages. Training will be conducted in small groups on three campuses to guide/assist faculty in design, production, implementation and evaluation of computer based instructional materials. This person will also be responsible for developing a faculty newsletter for to keep them abreast of new teaching techniques, technologies and software.

The lab aide (two 20-hour positions) will keep the faculty lab open as needed for up to 40 hours each week and provide assistance for faculty to use hardware and software; design, produce and test materials; and implement presentations and multimedia in classrooms and labs.

Distance Learning

0.6 Distance Learning Coordinator – Sharon McConnell
0.5 Student assistant

Note: This position will coordinate existing courses delivered on tape to local cable companies; review available resources to expand the offerings via cable; prepare a plan for use of interactive video to link RCCD campuses and 4Cnet campuses; and explore the distance learning options for certificate programs taught at RCCD.

Audiovisual Production / Classroom Support / Technical Support

1.0 Coordinator and Media Specialist (Henry Bravo)
1.0 Media Clerk (Becky Soto)
1.0 AV Tech (Michael Prosser)
1.0 AV Tech (Amando Castro)
1.0 AV Tech – Evening Service (Harry Petty)
1.0 Media Specialist – Norco (0.5 Huy Ngyen + 0.5 ***new***)
1.0 Media Specialist – Moreno Valley (Gustavo Segura)

Proposed Operating Budgets (less salaries &equipment)

Academic Computing
Office supplies
Travel. 6,000
Consultant services 25,000
Software, site licenses, services, etc. (new) 25,000

Faculty Development (new)
Computer supplies – toner, paper, inks, transparency
materials, software, authoring programs, services 10,000

Distance Learning
Supplies and services, programs and royalties 15,000

Instructional Media Center
AV Lab Services 66,000
Production