The purpose of this document is to describe the Medical Center’s technology and library architecture including a detailed current inventory. The description is organized into eight layers.

1. Customer Access, Resources and Services
2. Applications
3. Software Architecture
4. Databases
5. Servers
6. Directories
7. Network Architecture
8. Information Policies
Customer Access, Resources, and Services

- Library Resources
- Desktops
- Handheld Devices
- Office Application Software Products
- Outlook/Exchange
- Help Desk
- Videoconferencing
- Internet II
- Home CD
- Desktop Purchases
- Remote Access
- Affiliate Services
- Automated Accounts
Customer Access, Resources and Services

Customer Access
- Laptop
- RIM Pager
- PDA
- Wireless Access Point

Services
- Video Conferencing H.323
- Training

Resources
- Internet
- Cisco Switch with DHCP
- Electronic Journals (Publishers)
- OhioLINK

Office Applications
- e-mail
- UCLID
- PDA Applications

Workstation with Infrared

Customer Access, Resources and Services
Customer Access, Resources, and Services

Library Resources

Academic Information Technology & Libraries (AIT&L) Collections
AIT&L consists of the Health Sciences Library, the Nursing Library, the Cincinnati Medical Heritage Center, and the information technology units that support academic and administrative computing at the University of Cincinnati Medical Center. The libraries’ collections include 286,238 print volumes, 2186 current print journal subscriptions, and over 3000 full-text electronic journal subscriptions in the health sciences. Library customers also have access to a vast array of databases and electronic texts in the health sciences. [See attachment 1 for lists of electronic journals and databases, e-texts, and e-media]. AIT&L libraries have aggressively pursued acquiring electronic resources. Links to available full-text electronic journal articles are available from both PubMed and OhioLINK bibliographic databases. The chart below demonstrates the growth of AIT&L unique electronic full-text serials.

The University of Cincinnati Libraries Information Database, UCLID, is the primary source of information about all of UC’s library collections. UCLID is available via the Web or telnet. UCLID is the local gateway to OhioLINK, a union database of university library collections throughout the State of Ohio.

Collaborations
AIT&L has a wealth of health sciences information resources. This is due, in part, to collaborations with the other libraries at the University of Cincinnati (UC) as well as AIT&L’s participation in the Ohio Library and Information Network (OhioLINK).

UC libraries have collaborated on the shared catalog system, UCLID, since the early 1980s. UC libraries have established a committee structure that allows for input and cooperation on a number of levels within the libraries, ranging from a Collection Access Committee to the Policy and Planning Committee made up of heads of the five UC library jurisdictions (administrative units). This committee structure has resulted in the integration of the current needs of all parties into one
shared vision for the future and has facilitated resource sharing at UC. The UC libraries Electronic Resources Committee, with representation from all five library jurisdictions, makes recommendations on electronic resources that would be useful to the UC libraries collectively. If a resource is purchased, each of the five UC library jurisdictions pays a percentage of the cost of the resource.

OhioLINK is a consortium of Ohio's college and university libraries and the State Library of Ohio. OhioLINK serves over 500,000 students, faculty, and staff at 79 institutions, including 17 public universities, 23 community/technical colleges, 38 private colleges and the State Library of Ohio. OhioLINK provides access to more than 31 million library items, 91 research databases, and 4300 full-text electronic journals. The searcher can easily follow a link from a citation in an OhioLINK database to the full-text article, when available. OhioLINK also has a Digital Media Center, which contains thousands of digital images available for use by the OhioLINK community.

Customers
Primary customers include the four medical center colleges, the Hoxworth Blood Center, and University Hospital. In addition, AIT&L serves the faculty, students, and staff of other UC campuses; staff from medical center affiliates such as the Veterans Administration Medical Center, Children’s Hospital Medical Center, and Shriners' Burns Institute; alumni; community health professionals; and researchers worldwide. As the Medical Center continues to expand geographically to the Genomics Research Institute and UC Physicians North, remote access to information resources becomes increasingly important. Electronic resources are available for remote customers and can be customized according to each customer's needs. Educational resources are available on-line for faculty and students. Researchers will soon have on-line access to data sources that support their research efforts. For print or interlibrary loan document requests, the Interlibrary Loan/Document Delivery Department is now using Prospero, a software package that allows customers to view and print interlibrary loan articles via the Web.

Services
AIT&L is the physical and virtual information "commons" for the Medical Center. The Health Sciences Library is the hub of AIT&L activity and services, and is the library and information center for the Colleges of Medicine, Pharmacy and Allied Health Sciences, and is the technology center for the College of Medicine. AIT&L provides the following services to Medical Center students, faculty, and staff:

- Training programs on library tools, web development, and office productivity tools
- Instructional technology program
- Reference and customized information searching
- Reserves and presentation support

| Ranking among Medical School Libraries in the U.S. and Ohio* |
|-----------------|-----------------|-----------------|
| Category        | United States  | Ohio            |
| Computers       | 1               | 1               |
| Education       |                 |                 |
| Total Education | 1               | 1               |
| Attendance      | 3               | 1               |
| Contact Hours   | 6               | 1               |
| Number of Sessions | 3       | 1               |
| Electronic Books| 9               | 2               |
| Endowment Value | 11              | 2               |
| Gate Count      | 12              | 1               |
| Grants and Contracts | 4          | 1               |
| Journals        |                 |                 |
| Electronic      | 5               | 1               |
| Total Journal Count | 12          | 1               |

* 118 Institutions Reporting
Association of Academic Health Sciences Libraries, 2002
• Interlibrary loan and document delivery
• Collections of books, journals, audiovisuals, and electronic publications
• Medical/health history collections with emphasis on regional legacies
• Archives of prominent Cincinnati biomedical professionals
• Consumer health information via the Internet
• Computer lab and customer support
• Classroom and office technology support
• Email and remote access support
• Web and database development
• Data center (server) support

Facilities
Library facilities are found in three separate locations. The Health Sciences Library occupies 51,682 sq. ft. on three floors of the Medical Sciences Building:

• The R-level houses the print journal collection, photocopiers, Serials/Photocopier Help Desk, Cataloging/Collection Services department, Interlibrary Loan/Document Delivery department, and study space
• The E-level houses the computer lab, three service desks (circulation, information, and computers/multimedia), a leisurely reading area, the Circulation and Presentation Services department, the IT Customer Services department, and the Information Services department, Reserves collection, Reference collection, and two special collections
• The G-level houses the book collection, media collection, Electronic Classroom, Conference Room, Administrative Offices, and study space

The Nursing Library is located with the College of Nursing in Procter Hall. It occupies 10,000 sq. ft. on two floors of the building.

The Cincinnati Medical Heritage Center is located in Wherry Hall. Its 7,124 sq. ft. house the Medical Center archives, rare books collections, and other history collections of the health sciences.

Southwest Ohio Regional Storage Depository
The Southwest Ohio Regional Depository (SWORD) is specially designed for the remote storage of permanently held but little used library materials from the library collections of Miami University, the University of Cincinnati, and Wright State University. The depository, located on Miami University's Middletown Campus, is one of five such facilities to be constructed in the State of Ohio with funding from the Ohio Board of Regents. SWORD is designed and constructed to provide the cooperating libraries with an excellent preservation environment for storing materials in an economical, high-density shelving system. The depository has about 13,700 square feet of space of which about 8,000 square feet are allotted for storage of materials. The additional space is used for offices, material
preparation and research. The 30 foot tall windowless storage module can accommodate over one million volumes.

Academic Information Technology & Libraries has sent 26,300 volumes to SWORD, including:

- Pre-1960 journals
- Older, duplicate monographs
- Journals from JSTOR collections if older than 10 years

**Training Program**

**Regularly Scheduled Training Classes**
AIT&L teaches over 40 classes per month on library, office, web, and course development software. Class topics include introductory, intermediate, and advanced levels of Microsoft Office XP applications, Adobe Acrobat, Adobe Photoshop, Blackboard, Digitizing Images, EndNote, Flash, and hands on Palm Pilot training. These classes are offered free of charge to UC employees and students with preference being given to Medical Center faculty, staff, and students. [See attachment 2 for an inventory of classes taught by AIT&L trainers.]

**Faculty Development Instructional Technology Workshops**
Academic Information Technology & Libraries and University Libraries Training and Educational Services partnered to submit three successful proposals to the UC Faculty Development Council to fund instructional technology workshops for UC faculty. From Spring Quarter, 1998 through Spring Quarter 2001, Academic Information Technology & Libraries and Training and Educational Services staff taught 286 workshops with 1397 faculty in attendance. In addition, three intensive weeklong workshops were offered in 2000 and 2001. [See attachment 3 for the final report to the Faculty Development Council.]

**Clinical Informatics Elective**
Information Services staff coordinate and teach most of the Internal Medicine department’s Clinical Informatics elective for fourth year medical students. This elective is designed to enhance a student's biomedical literacy. It provides an introduction to computing, information management, and clinical decision-making skills associated with the clinical sciences. See attachment 4 for additional information about the elective.

**Training for the Internal Medicine Department Students and Residents**
Information Services staff participate in the third year Ambulatory Care rotation by providing instruction and support for the students in literature searching and applying evidence-based medicine principles to case studies the students have been assigned.
Information Services staff work one-on-one with Internal Medicine interns during their Primary Care rotation. These sessions are designed to develop and enhance the interns’ skills in literature searching and using presentation software (e.g. PowerPoint). Library staff conduct additional training sessions several times a year as part of Internal Medicine residents’ journal club meetings.

**Blackboard Support**

Academic Information Technology & Libraries training staff and University Libraries Training and Educational Services staff have partnered with UCiT to provide Blackboard training and support. AIT&L and University Libraries regularly offer workshops for UC faculty on the effective use of Blackboard.

**College of Nursing**

AIT&L staff co-teach Nursing Informatics for Advanced Nursing Practice in the College of Nursing. This two-credit course is taught every quarter as a required course for all graduate students in the College. In addition, nursing library staff routinely conduct formal training sessions in several classes in the College of Nursing curriculum, including Foundations of Nursing Research and Nursing Ethics.

**College of Pharmacy**

Library staff have historically collaborated with a faculty member from the College of Pharmacy to teach the 'Drug Literature Evaluation' course. In 2002, an Information Services librarian taught eight sessions on searching the medical literature to second year PharmD students in the Pharmacy Skills Lab 3 course. The sessions were designed to introduce the students to the principles of effective and efficient literature searching.

**Other Training Courses**

Customized classes are developed and taught in response to requests by UCMC departments, e.g. Pathology department training in Photoshop.

**Instructional Technology Center/Support for Faculty**

The Faculty Instructional Technology Center’s primary mission is to provide instructional support to the faculty of the University of Cincinnati College of Medicine. As a support unit within AIT&L and the College of Medicine, the staff of the FITC provide a wide range of instructional services in direct support of classroom instruction on a no-charge basis.

The services offered include assisting faculty with:

- Developing web-based instructional materials
- Determining which instructional technologies could be useful within their courses
- Converting images to an electronic format via flatbed and slide scanners
- Developing multimedia presentations
• Selecting and using software and media
• Creating and editing graphics, audio, and video files for web courses

The FITC has hardware and software available for faculty use by appointment. One-on-one assistance is available by appointment as well.

**Consumer Health Information Initiatives**

**NetWellness®**
NetWellness is a consumer health web service provided by the University of Cincinnati, The Ohio State University, and Case Western Reserve University. This is a knowledge source that is available to anyone who has access to the Internet. A wide range of topics is covered, including most of the highest profile medical conditions, with additional topics being added on a periodic basis. Over 200 health professional faculty contribute their expertise by answering consumer questions in NetWellness’s nationally recognized “Ask an Expert” service. To date, faculty members have answered over 18,000 questions. They answer all legitimate questions. *Forbes* magazine recognized NetWellness as one of six health sites in a “Best of the Web” issue. AIT&L began NetWellness in 1994 with a grant from the U.S. Department of Commerce. Since then, Federal, State, and local grants and contracts exceeding $5 million have supported NetWellness’s expansion. In 1997 Case Western Reserve University and The Ohio State University joined the program in a unique collaboration among Ohio’s Carnegie Research I universities.

**MEDLINEPlus**
In 1999, AIT&L was awarded a contract from the National Library of Medicine to help develop and maintain the MEDLINEPlus site (www.medlineplus.gov). Three AIT&L librarians and four free-lance librarian contractors are currently part of the Cincinnati-based MEDLINEPlus project staff. Staff regularly review MEDLINEPlus health topics pages, evaluate interactive health tutorials, and monitor health and news web sites for up-to-date health information.

**Historical Materials**
The Cincinnati Medical Heritage Center houses collections of 35,000 volumes of books and journals, over 60 archives, 5,000 photographs, 1,500 medical instruments and equipment, and medical artifacts, international in scope, but with a focus on the history of medicine in Cincinnati. Its 19th century collection is one of the best in the Midwest. Its rare book collection includes publications dating from the 16th century. Its most renowned archive is that of Albert B. Sabin, MD, developer of the live oral polio vaccine, who spent most of his career at the University of Cincinnati. His archive alone occupies over 400 feet of shelving.

**Desktops**
AIT&L provides access to online library resources, productivity software, instructional materials and the Internet via 131 desktop computers. One hundred
units are located in the Health Sciences Library; 22 are located in the Electronic Classroom; and 9 are located in the Nursing Library. There are two color printers and 9 B/W printers in the Health Sciences and Nursing Libraries that are used for network printing. Network logins, print queues, instructional materials and various instructional websites for the College are managed through 5 Novell, 5 Windows 2000 and 14 NT servers. Up-to-date versions of anti-virus (McAfee and Innoculan) and 3rd tier firewall (Black Ice) software are loaded on desktop computers and servers to maintain a secure computing environment. The Health Sciences Library provides 120 additional wireless network connections. Customers can check out wireless network cards to use with their personal laptop computers in the library. Additionally AIT&L maintains 121 public access computers located outside the library. These units are located in study rooms, the medical student lounge, 10 lecture halls, the College of Medicine’s Center for Competency Development and Assessment, and the College of Allied Health Sciences computer lab. In addition, AIT&L supports 175 laptop computers housed in Department of Pathology teaching labs.

Handheld Devices
Handheld devices supporting Windows CE and Palm OS are growing in use throughout the Medical Center. These devices can be enabled with wireless technology now in place at key locations in the Health Sciences Library and student areas. The integration of the handheld devices and the wireless network enables mobile customers to readily access network resources. AIT&L began sponsoring a “PDA Users Group” in February 2001, comprised of interested AIT&L staff, medical students, and faculty. AIT&L hosts a web site maintained by medical students devoted to handheld devices and applications, http://www.med.uc.edu/meded/pda/.

Office Application Software Products
The University of Cincinnati, together with 14 other Ohio institutions, has signed a major licensing agreement with the Microsoft Corporation. The 3-year Enterprise License Agreement (or ELA) permits the University to distribute the following software products to matriculated UC students, UC departments, faculty and staff:

- Microsoft Windows or Windows NT Workstation (or successor desktop operating system product)
- Microsoft Office Professional for Windows
- Microsoft Office Professional for the Macintosh
- Microsoft FrontPage for Windows
- Microsoft FrontPage for the Macintosh
- Microsoft Visual Studio Professional for Windows
- Microsoft BackOffice Client Access License

In addition, the Microsoft agreement provides server licenses to the UC community. The Agreement's end date is September 30, 2003.
Outlook/Exchange

The University of Cincinnati Information Technologies unit (UCiT) manages two mail servers for the UC community: the Microsoft Exchange server and the Bearcat Online server. Microsoft Exchange/Outlook is the primary e-mail/calendaring application in use at the Medical Center. There are several ways to access e-mail from the Exchange Server:

- Outlook client
- Outlook Express
- Any POP client such as Eudora
- Web Browser

Help Desk

UCiT runs the Help Desk for the University of Cincinnati. The Help Desk provides desktop support to University faculty, staff, and students, is responsible for software distribution, e-mail account management, hardware and software scheduling of site visits, and has overall responsibility for problem management and coordination.

UC uses a number of variations of a multi-tier customer service support model. Level 1 (first line of support) is typically a local UCiT technician or the help desk), level 2 is a higher-level UCiT Technician and level 3 is the manufacturer. If a call to the help desk for a medical center staff member cannot be resolved over the phone, the call is transferred to an AIT&L IT Customer Services technician.

AIT&L IT Customer Services staff provide desktop support to Medical Center personnel for all supported applications, including LastWord, the clinical information system used at University Hospital.

Videoconferencing

The Medical Center has a number of videoconferencing facilities ranging from low-end desktop units to distance learning classrooms. See attachment 6 for details.

Internet II

The University of Cincinnati is an Internet II member. For more details, see the Network Architecture section of this document.

Home CD

In order to keep home systems up-to-date and secure, staff at the College of Nursing’s Center for Academic Technologies and Educational Resources created a CD that contains software needed for remote access to UC resources, virus protection, and the latest service packs. AIT&L is now partnering with the College of Nursing to update and create copies of the CD for all Medical Center
personnel and students. The CD can be checked out at the Health Sciences and Nursing Libraries.

**Desktop Purchases**
UCiT has negotiated special pricing for UC Faculty, Students, and Staff on Dell computers for departmental and personal purchases. Dell offers a three-year warranty included with the purchase. AIT&L provides baseline hardware and software configurations to assist departments and individuals in selecting the right system.

**Remote Access**
UC Remote Access is a free service provided to any UC student, faculty, and staff. It provides the UC community with home access (from the local Cincinnati calling area) to the UC Network and the Internet using a computer and a standard telephone line.

UCiT maintains the dial-up access modem pool that includes modem and network equipment from Bay Networks and digital phone lines. Twenty-two digital T1 circuits provide simultaneous connections to 528 modems that are divided into two separate partitions: a student partition and a faculty/staff partition.

UC has also negotiated special pricing with two local high-speed providers ZoomTown (DSL), and Road Runner (Cable), for high-speed connectivity to the Internet. More details are provided in the network architecture section of this document.

**Affiliate Services**
An e-mail service is provided to individuals who are affiliated with UCMC but are not UC employees. Affiliates include UC Physicians employees, Children’s Hospital Medical Center employees, fellows, residents, visiting scholars, and employees of the central clinic. For a nominal fee, affiliates are able to obtain a UC email account and take advantage of directory services available to the UC community.

**Automated Accounts**
At the beginning of each school year AIT&L creates accounts for UCLID (library system), Novell logins, a-mail, and remote access for all students. Account information and relevant software are provided to the students on electronic media.
Applications

University Applications
- Human Resource Management System
- College and University Financial System
- UniverSIS
- Facility Center/Space Management
- Blackboard Web Courseware
- Electronic Personnel Action Form System
- Electronic Position Description Questionnaire

Research Administration Applications
- Sponsored Programs
- Institutional Review Board
- Contract Approvals
- Grant Applications Online
- Research Assistant Resume
- Clinical Trials Online
- Sponsored Program Award Action
- Ask an Expert
- Institutional Animal Care and Use Committee/Lab Animal Medicine
- Research Training System
- Radiation Safety
- Web Based Information Resource Centers

Administrative Applications
- Applications Online
- Projects on Demand
- Document Management System

Educational Applications
- Health Careers Information Center
- Continuing Medical Education Registration
- Student Pathway Lottery
- Student Directory
- Alumni Directory and Tracking
- Center for Competency Development and Assessment

Other Applications
- Security Management System
- Electronic Journals and Resources Database
Applications

The University of Cincinnati research, administration, planning, and IT team has been working together closely for the last six years and has developed the vision, trust, commitment, and tools to fully integrate the research administration enterprise.

Integrating research administration systems requires multiple organizational entities agreeing to share data and integrate systems; relational database technology to manage the data; web tools to organize, manipulate, display, and report the data; and leadership to set priorities and get timely results. The systems required for full digital integration of the research administration enterprise include the following:

University Applications
- Human Resource Management System (HRMS)
- College and University Financial System (CUFS)
- University Student Information System (UniverSIS)
- Facility Center/Space Management System
- Blackboard Web Courseware
- Electronic Personnel Action Form System
- Electronic Position Description Questionnaire (ePDQ)

Research Administration Applications
- Sponsored Programs
- Institutional Review Board
- Contract Approvals
- Grant Applications Online
- Research Assistant Resume
- Clinical Trials Online
- Sponsored Program Award Action (A-323)
- Ask an Expert
- Institutional Animal Care and Use Committee/Lab Animal Medicine
- Research Training
- Radiation Safety
- Web Based Information Resource Centers

Administrative Applications
- Applications Online
- Projects on Demand (POD)
- Document Management System
Educational Applications

- Health Careers Information Center
- Continuing Medical Education Registration
- Student Pathway Lottery Application
- Student Directory
- Alumni Directory and Tracking
- Center for Competency Development and Assessment

Other Applications

- Security Management System (SCM)
- Electronic Journals and Resources Database

The interaction of these systems and the use by these systems of the Integrated Database provides an integrated knowledge management data source that is available to all University staff, faculty, researchers and students. The relationship of these systems to the Integrated Database is addressed in the Databases section of this document.

University Applications

Human Resource Management System

Overview
The purpose of Human Resource Management System (HRMS) is to manage employee information for the University. The employee’s history in the HRMS system begins with the initial payroll form (PAF) that reflects changes in the employee’s title, salary, primary department, and accounting sources for payroll as well as other pertinent information regarding employment. HRMS also produces payroll checks and W-2’s. The HRMS system integrates with the College and University Financial System (CUFS) so that salary and benefits can be can be recorded against budgets in the financial system.

Underlying Technology
HRMS runs on an IBM 9672-R14 processor and is written in COBOL. The file structure is Virtual Storage Access Method (VSAM).

Major Features
- Personnel management
- Produces payroll
- Provides tax information
- Provides data retrieval (ledgers)
• Provides on-line access to personnel information
• Operated by UCiT

**College and University Financial System**

**Overview**
The College and University Financial System (CUFS) was implemented is a mainframe-based financial system that was originally purchased in 1985 from American Management Systems. It has undergone numerous upgrades, including a core model upgrade for Y2K and a technical update in 2000. The Purchasing Department and the Office of the Controller support the functional data management with over 770 departmental users updating or using the system. CUFS interfaces with HRMS, UniverSIS, term contact management system, investment pool system, and various service department systems.

**Underlying Technology**
CUFS runs on an IBM 9672-R14 processor and is written in COBOL. The file structure is Virtual Storage Access Method (VSAM).

**Major Features**
- Budgeting
- Financial planning
- Payroll
- Procurement accounting including encumbrance control, disbursements
- Financial accounting
- Internal monthly financial reports
- External reports for audits, State, and Federal
- Operated by UCiT

**History**
The CUFS system maintenance on the core modules has been committed through Spring 2002.

**UniverSIS**

**Overview**
The main purpose of the system is to integrate and support student admissions, financial aid, records, registration, curriculum, billing and receivables. The major users of the system are students, faculty and staff. Information is available on-line, via the web, touch-tone, and through the data warehouse. The system is currently in a phased implementation cycle with the first modules produced (Financier and Course Master Catalog) on line in March 1997.
Currently, the average number of transactions per day is 100,000. Daily transactions will continue to rise as additional modules of UniverSIS are implemented. Most modules in UniverSIS are capable of being continuously updated as new needs are identified. A major system upgrade is not necessary—enhancements will be ongoing.

**Underlying Technology**
UniverSIS is a mainframe database in ADABAS files from a company called SoftwareAG. Programs were written in NATURAL, a fourth-generation language. The dictionary is a product called “Predict” and the code generator is “Construct.” A brokering software called “EntreX” also resides on the mainframe.

**Major Features**
Several modules of UniverSIS are still in the development and early production phases. Modules have been on line from 6 months (transcripts) to 4 years (curriculum- courses & classes). The development of web-enabled, self-help functions for students and faculty have increased the student and faculty satisfaction with the system.

With these factors in mind, the major features of the system are:
- Integrated student system
- Web capability
- Real time information
- Accessible to students, faculty and staff
- Direct data input that allows students to receive awards immediately
- Developed and operated by UCiT

**Facility Center (Space Management)**

**Overview**
The main purpose of the Facility Center system is to serve as a central reference source for all space information for the University. The system has been in operation for less than 2 years and has components in production and under development. Portions of the system are available to the general University community while Provostial and space management staff members are beta-testing other portions. There are two components in production. One is the 1997 web interface development component, which provides limited data to the University community about existing space. The other component in production is the University baseline development that is a repository for the basic building and room data elements that were previously housed on the University’s mainframe system. The component that is currently in development is the Research Space Utilization Module that will provide data used to measure space utilization.
Currently the system is maintaining records for 200 buildings and data on more than 27,000 rooms. It also contains records for departments and functions for each room, as well as personnel data, representing approximately 1,200 records for the Medical Center. The CAD system contains approximately 650 files representing over 12 million gross square feet of space. The web component is averaging 100 hits a day.

**Underlying Technology**

Facility Center is a vendor product that runs on an Oracle database. Facility Center is written in PowerBuilder and its desktop graphic user interface is in Visual Basic. The space management office has developed a web interface that is written in ASP, HTML, Java, JavaScript, and Visual Basic.

**Major Features**

- The system is useful for seeking space information, for viewing CAD drawings, and for data retrieval.
- Provides information for the Facilities & Administrative Cost Study
- Responds to ad hoc queries University of Cincinnati/University Hospital Inc. rental studies, practice plan leases
- Provides an area inventory used to produce the Class/Lab Utilization state report
- Identifies departmental space and room types by function
- The system is currently linked to the following systems: SPOTS, asset system, and AutoCAD drawings
- Has a web interface
- Developed and operated by the UC Finance department

The development of the system is underway and the system overall has the capability to link with other systems.

**Blackboard Web Courseware**

**Underlying Technology**

The Bb Learning System provides an open platform that provides flexibility for integrating tools, content and external applications with the Bb platform. It, therefore, can be integrated with current UC applications and systems. The Bb Learning System utilizes relational databases and supports Microsoft SQL 7, Microsoft SQL Server 2000, and Oracle8i. The supported operating systems and web servers are Microsoft Windows NT 4.0, Microsoft Windows 2000, Sun Solaris 2.8 and Red Hat Linux 6.2.
Major Features
- Creation of course materials spanning the spectrum of syllabi creation and assignments
- Supplementary audio slide lectures
- Animations
- Student progress tracking
- Student management tools
- Grading tools and quiz creators to complete course materials
- Operated by UCiT

Blackboard Web Courseware

Overview
Blackboard Inc. offers a suite of e-Education solutions to provide a higher education enterprise portal solution. The Blackboard e-Education suite includes the following products:
- Blackboard Learning System (LMS)
- Blackboard Community Portal System
- Blackboard Transaction System

The University of Cincinnati currently has licenses for all three products and uses all three in some form as part of its day-to-day operations.

The Blackboard Learning System
UC students and faculty currently use the Blackboard (Bb) Learning System as their course management system in their teaching and learning environment. The Bb Learning System can support thousands of courses and tens of thousands of users. Since its pilot at UC in the Fall Quarter of 2000, more than 2,984 courses have used it.

Blackboard Community Portal System
Blackboard's Community Portal unifies academics, commerce, communities, and administrative services through one integrated interface as an enterprise portal that can accommodate specific audiences including students, faculty, administrators, alumni, prospective students and guests. Currently, UC is utilizing only a small portion of the Community Portal System. Today, the use of Bb's Community Portal at UC consists of 38 academic organizations. It is not currently being used outside the academic environment.

Blackboard Transaction System
UC's one-card system or better known as the Bearcat Campus Card is using the Blackboard Optim9000 commerce and access system. The Bearcat Campus Card is both an ID card plus commerce (debit) and access card. The card is currently being used for vending, laundry, student meal plans, library authorization, athletic ticket disbursement, bookstore operations, non-UC
merchants and other services. Additional services are continually being added to this system.

**Electronic Personnel Action Form System (ePAF)**

**Overview**
The Electronic PAF system has been created as an alternative to using paper PAFs. The system was designed to simplify and expedite the routing and submission of personnel action forms. The system is designed to support dynamic routing or the ability to route to a given business administrator in real time. The system is also programmed to support structured routing in cases where the action form must follow a predefined path in order to be processed. All action forms and related documentation routed through this application are stored in a media repository and easily retrievable by authorized users for reporting and other purposes.

**Underlying Technology**
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion / ASP
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat, Verisign Digital Signature

**Major Features**
- Increased turnaround time for the processing of personnel information
- Uses dynamic and static workflow to integrate all needed parties electronically in the process
- Each business administrator has the ability to view a history of all processed information for resubmission or other purposes.
- Data Retrieval (Reports)
- Online Access of Information
- Web-based browser/relational database implementation
- Paper to Electronic document management system
- Integration with HRMS system to provide needed personnel information maintained within this system.
- Use of a 3-tiered security model to handle authentication and access control.
- Digital Signature Implementation
- Developed and operated by AIT&L
Electronic Position Description Questionnaire (ePDQ)

Overview
Position Description Questionnaires are used to process employee hires, reappointments, raises, etc. This process has been done manually for several years. The process involves filling out a several forms and mailing the information to various locations for review and approval. The EPDQ system automates this process by making it fully electronic. Dynamic routing is used to route the PDQ to identified groups and individuals.

Underlying Technology
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion / ASP
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat, Verisign Digital Signature

Major Features
- Increased productivity by digitizing the PDQ management process.
- Workflow Implementation
- Status Report Management
- Data Retrieval (Reports)
- Online Access of Information. All information is stored in a media repository for easy access to authorized groups or individuals.
- Web-based browser/relational database implementation
- Electronic document management system
- Integration with HRMS
- Use of a 3-tiered security model to handle authentication and access control.
- Digital Signature Implementation
- Developed and operated by AIT&L
Research Administration Applications

Sponsored Programs

Overview
The Medical Center’s sponsored awards database is called Sponsored Programs On-line Tracking System (SPOTS). The database tracks proposals that have been submitted and awarded. This database is used to coordinate internal and external reporting efforts on a monthly to annual reporting basis.

Underlying Technology
SPOTS is written using Microsoft SQL Server with a user interface written in PowerBuilder 7. Cognos’ Impromptu Reports is used as the reporting tool.

Major Features
- Maintains history on all sponsored proposals and awards.
- Produces internal annual sponsored-awards reports
- Produces reports by researcher, department, or year
- Interacts with the University space system to provide information for space utilization reports
- Provides reports for ad hoc queries and data requests
- Developed and operated by AIT&L

History
In the 1990's, the Medical Center’s sponsored holdings increased substantially, requiring an accurate and timely tracking system for proposals and awards. The system is integrated with the FacilityCenter database (University space system) and has the capabilities to be integrated with other systems.

The current system has the capacity to accommodate the anticipated growth due to awards for the Millennium faculty and the increased funding available from federal agencies.

Institutional Review Board

Overview
The purpose of the Institutional Review Board (IRB) system is to manage information on the human research protocols for the University. The system assigns protocol numbers as the protocols are entered into the system; generates progress reports for researchers; provides a variety of reports; and serves as an on-line reference for the IRB Office, the two Offices of Sponsored Programs, and other university departments.
Underlying Technology
The IRB system is written in SQL 7 and has a user interface written in Cold Fusion. Seagate’s Crystal Reports is used as the reporting tool.

Major Features
- Protocol Management
- Adverse Event Management
- Progress Report Management
- Data Retrieval (Reports)
- On-Line Access of Information
- Web-based browser/relational database implementation
- Use of a 3-tiered security model to handle authentication and access control
- Developed and operated by AIT&L

History
This system was developed by first conducting a due diligence process that reviewed build vs. buy alternatives. Since there were no viable off-the-shelf products on the market, the system was developed starting in early 2000 by a team comprised of the IRB office and AIT&L. This new web-based system replaced a system that utilized the AS/400.

Contract Approvals System

Overview
The e-Contract System is designed to efficiently route contracts processed through the Office of Sponsored Programs. Prior to the implementation of the e-Contract System, the processing of a contract that did not require any changes, would take a minimum of 4-5 days. With the e-Contract System a contract can be processed in 1-2 days. The e-Contract System will generate a variety of management reports within a few minutes for reporting and compliance. Prior to the implementation of e-Contract, these same reports would have taken several days to generate.

Underlying Technology
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion / ASP
- Scripting /Content Standards/Protocols: HTTP, Web-based Distributed Authoring and Versioning (WebDAV), DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat, Verisign Digital Signature
**Major Features**

- Increases the turnaround time for the processing of contracts
- Uses dynamic and static workflow to integrate all needed parties electronically in the contract management process
- Gives PI’s, Departments, and contract administrators the ability to view and retrieve contract information in various ways.
- Provides a Reporting mechanism that can be used to transfer needed information to both external and internal agencies
- Online Access of Information
- Web-based browser/relational database implementation
- Paper to Electronic document management system
- Use of a 3-tiered security model to handle authentication and access control.
- Digital Signature Implementation
- Integration with email system
- Developed and operated by AIT&L

**Grant Applications Online (eAPPS)**

**Overview**
eAPPS is a user friendly, interactive, electronic process for the submission of NIH 398 Grant applications. The process is controlled from the department level to the office of sponsored programs (OSP) and back. Modules are currently being added to this system. Departmental administrators or Principal investigators will have increasing ability to log into a workbench environment where they can manage the following information:

- PHS398 Form
- Budget
- Abstract Information
- Gold Sheet
- Budget Detail
- NIH Bio
- Checklist
- Resources
- Personnel Data

**Underlying Technology**

- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion / ASP
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat, Verisign Digital Signature, Excel
Major Features
- Grant Application Management
- Workflow Implementation
- Centralized work area that brings several pieces of the grant submission process together in one location.
- Bio Generation
- Status Report Management
- Data Retrieval (Reports)
- Online Access of Information
- Web-based browser/relational database implementation
- Electronic document management system
- Integration with several existing databases and applications for validation and information purposes (IRB, IACUC, SPOTS)
- Use of a 3-tiered security model to handle authentication and access control.
- Digital Signature Implementation
- Developed and operated by AIT&L

Research Assistant Resume System

Overview
The Research Assistant Resume System was built to facilitate recruitment of researchers in various specialties throughout the University. Before the adoption of this system, resumes were mailed to the Faculty Affairs Office for review. Anyone looking for a research assistant would have to go to the Faculty Affairs Office to view the resumes. Under the new system potential Research Assistants have the ability to submit their resumes electronically via the College of Medicine website. Information is stored in a database for administrative review by members in the Faculty Affairs Office. The Faculty Affairs office also has the ability to add, modify, or delete any information that appears in the resume system via an administrative interface. Any office at the University can then view the information via a restricted web based interface.

Underlying Technology
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting/Content Standards/Protocols: HTTP, HTML, DHTML, and JavaScript
- Client Side: 3rd generation browsers and above
Major Features
- Online submission of research assistant resumes
- Automatic categorization by specialty, date, and name
- Restricted access for University viewing and recruitment purposes
- Streamlines the research assistant recruitment process migrating it from paper to electronic
- Varying levels of access depending on permissions
- Web-based browser/relational database implementation
- Developed and operated by AIT&L

Clinical Trials Online

Overview
Clinical Trials Online is the administrative side of the Office of Clinical Trials web site. Office of Clinical Trials staff members can go on-line to complete and submit form(s) in order to add/modify/delete trial information for public view.

Underlying Technology
- Server: Windows NT, IIS 4.0
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Most browsers 3rd generation and above

Major Features
- Add/modify/delete trial information for public viewing
- Centralized repository for Medical Center Trial Information
- Developed and operated by AIT&L

History
The Office of Clinical Trials web site was created as an information resource for patients as well as investigators. The user-friendly administrative side was created so that the Office of Clinical Trials could easily keep its on-line information up-to-date on its own.

Sponsored Program Award Action (A-323)

Overview
The Sponsored Program Award Action (A-323) System is designed for the Medical Center Management, Financial and Support Services to streamline the workflow for the A-323 form. The system, used for program award administration, automatically routes the A-323 to various responsible departments hence reducing the total time for the process. This user-friendly form incorporates
dynamic calculations and automatically checks for various conditions as required by the system.

**Underlying Technology**
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7.0
- Middleware: Cold Fusion / ASP
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat, Verisign Digital Signature

**Major Features**
- A-323 management
- Workflow Implementation
- Use of a 3-tiered security model to handle authentication and access control
- Automated calculations and checks for required conditions
- Web-based RDBMS implementation
- Developed and operated by AIT&L

**Ask an Expert**

**Overview**
The Ask an Expert system is a part of the NetWellness Consumer based health information network. It is a system that facilitates the communication between health professionals and the community by providing a mechanism where people from all over the world ask health questions in a wide range of topic areas. The system is completely database driven and has been in production since 1995.

**Underlying Technology**
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 6.5 (migrating to SQL 2000)
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript, and POP
- Client Side Software: Most browsers 3rd generation and above

**Major Features**
- Centralized repository for close to 18,000 health related questions and answers
- Questions and answers are indexed on a regular basis to provide an easily searchable application
- Accessible from anywhere
• Uses a 3-tiered security model to handle authentication and access control for all experts and expert coordinators.
• Close integration with all pop compliant email systems for easy retrieval and answering of questions
• Email option available to consumers when the question is answered
• Follows current privacy and guideline standards as defined by the Health Summit Working Group.
• Online CV Generation and administration for all participating experts
• Developed and operated by AIT&L

Institutional Animal Care and Use Committee/Lab Animal Medicine (IACUC/LAM)

Overview
The purpose of the IACUC/LAM application is to manage and support animals used for research. The application has two major components: the Institutional Animal Care and Use Committee component and the Lab Animal Medicine Services component.

- The Institutional Animal Care and Use Committee (IACUC) system is used to record and report animal research protocol information for the University
- The Laboratory Animal Medicine Services Office (LAMS) processes animal purchase orders for the researchers, provides animal care and housing services, and provides veterinary services for the University and affiliates

The application is able to assign protocol numbers as the protocols are entered into the system; provide on-line reference for the IACUC/LAMS Offices as well as the two Offices of Sponsored Programs; process animal purchase orders; invoice the researchers for animal purchases and housing; and generate reports in various formats as required.

Underlying Technology
The IACUC/LAMS system is a product Sirius from the NTM Company. It is written in Fox Pro and will soon be migrated to Visual Fox Pro. Seagate’s Crystal Reports will be used as an additional reporting tool.

Major Features
- Protocol Maintenance
- Animal Ordering
- Animal Inventory
- Cost Accounting (Per diem rate maintenance)
- Data Retrieval (Reports)
- Operated by AIT&L
History
After conducting a due diligence process, an off-the-shelf product was purchased to replace an existing legacy system that runs on an IBM mainframe. This new product is named Sirius. The existing legacy system could not support an increasing set of needs for compliance. Currently the new system is being tested and the personnel who will use the system are being trained. The legacy system will be used until the new system is fully operational and all the data is migrated to the new system.

Research Training System

Overview
The purpose of the Research Training System is to deliver required training using web-based technology and to track who is participating and who is not participating in the programs. The training requirements for each person will be derived from the person's job titles and roles at the university, and will be automatically updated as the titles and roles change. When people log in to the system they can view their current training requirements and complete these requirements on-line, or register on-line for courses satisfying their requirements. The IACUC and IRB Offices can use the system to verify that people submitting a protocol for review are in compliance with the appropriate training requirements. Reports have been developed that can provide the training status by person, department, or college. For additional information on this system, see attachment 7 (Tracking Training and Certification for the Med Center).

Underlying Technology
The Research Training System is written in Microsoft SQL Server and utilizes a user interface written in Cold Fusion. Seagate’s Crystal Reports is used as the reporting tool.

Major Features
- The web interactive training component contains content like Training in Blood Borne Pathogens and Training in Use of Human Subjects. The content components are independent of the application. There are two components that are completed: Human Subjects and Blood Borne Pathogens/Universal Precautions
- Web Registration (identification of the person and the required courses) and the ability to let corporate employees self-register for training.
- Web Administration (tracking compliance, course management, profile management and reporting)
- System reports that provide the training status by person, department, or college.
- A database that contains all staff, faculty, students and relevant corporate employees. The database includes a master catalog and calendar
- Web-based relational database implementation
- Developed and operated by AIT&L
History
A due diligence process was conducted to determine if there were any viable off the shelf products on the market that met the current and future needs. It was determined that there were none. This web-based Research Training Application was then developed in collaboration between the Distributed Learning Collaboratory, the Office of the Senior Vice President and Provost for Health Affairs, and the following colleges: Medicine, Nursing, Pharmacy and Allied Health Sciences.

Radiation Safety Application

Overview
The purpose of the Radiation Safety System is to manage the purchase, receipt, and usage of isotopes; the storage of isotopes; audits; the facilities and equipment involved and security for authorized users. This system allows customers to view and maintain all information related to radiation safety information at the University and affiliates. Authorized staff is able to update the system. All other staff uses the system on a read-only basis. Authorized users are now able to view their own reports through a Web interface.

Underlying Technology
The Radiation Safety Application is written Microsoft SQL Server and uses Microsoft Access as both the user interface and the reporting tool. Seagate’s Crystal Reports is used as an additional reporting tool.

Major Features
- Inventory/Purchasing of Radionuclides
- Waste Management of Radionuclides
- Authorization Amount Management for Researchers
- Radionuclide Violations
- Training Tracking
- Radiation badge billing (and Interface with CUFS)
- Equipment (Metering/XRAY) Management
- Licensure
- Personnel Management
- Reporting
- Relational database implementation
- Developed and operated by AIT&L
History
The Radiation Safety Computer System was installed in September 15, 1999. The original project was to redesign the Gamma system first developed in 1992. The Gamma system was not Y2K compliant. In addition it was necessary to replace the system to meet new requirements and utilize a proper database system. Its scope was expanded to include the Badge Billing function of the Radiation Safety Office installed October 27, 1999 (Version 2). The system has been incrementally improved since then and is now on version 7.

Web Based Information Resource Centers
The University of Cincinnati Medical Center (UCMC) continually develops and upgrades a large number of information centers. These centers are used for mass communications, sharing of information, and marketing purposes. Efforts are ongoing to adapt the web to new needs and changes. Web sites are highly customer centric requiring close attention to customer needs. A web committee is currently going through the process of adopting several information center standards that range from look/feel to underlying technology standards and implementation. These systems are developed, operated, and maintained by AIT&L.

<table>
<thead>
<tr>
<th>Resource Center</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIT&amp;L</td>
<td>Information regarding Academic Information Technology &amp; Libraries resources, services, hours, Electronic Journals and support services.</td>
</tr>
<tr>
<td>Clinical Skills</td>
<td>Information on the College of Medicine Clinical Skills lab including: curriculum and equipment descriptions, future plans, and calendars.</td>
</tr>
<tr>
<td>Clinical Trials</td>
<td>Patient and Investigator repository for clinical trial information</td>
</tr>
<tr>
<td><strong>CME</strong></td>
<td>Continuing Medical Education course information, registration and office information</td>
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<tr>
<td><strong><a href="http://cme.uc.edu/">http://cme.uc.edu/</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>College of Allied Health Sciences</strong></td>
<td>Student and applicant oriented center containing information about the degree programs, faculty, classes, and application process and requirements</td>
</tr>
<tr>
<td><strong><a href="http://www.med.uc.edu/cahs">http://www.med.uc.edu/cahs</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>Electives</strong></td>
<td>Fourth year student rotation electives and registration information</td>
</tr>
<tr>
<td><strong><a href="http://www.med.uc.edu/meded/academics/electivesonline/">http://www.med.uc.edu/meded/academics/electivesonline/</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>Faculty Affairs</strong></td>
<td>Information regarding initial appointments, reappointments, academic leaves, salary increases, faculty performance, collateral employment and Emeriti.</td>
</tr>
<tr>
<td><strong><a href="http://www.med.uc.edu/facultyaffairs/">http://www.med.uc.edu/facultyaffairs/</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>Forms Center</strong></td>
<td>Financial, Personnel, and Sponsored Programs forms, as well as, quality service information.</td>
</tr>
<tr>
<td><strong><a href="http://www.med.uc.edu/formscenter/">http://www.med.uc.edu/formscenter/</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>Graduate Education</strong></td>
<td>Graduate Education in Biomedical Research: graduate programs, admissions, student services, virtual video tour, student organization</td>
</tr>
<tr>
<td><strong><a href="http://www.med.uc.edu/graded/">http://www.med.uc.edu/graded/</a></strong></td>
<td></td>
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<tr>
<td><strong>HealthCourseSource</strong></td>
<td>Centralized resource repository for training and other materials.</td>
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<tr>
<td><strong><a href="http://healthcoursesource.uc.edu/">http://healthcoursesource.uc.edu/</a></strong></td>
<td></td>
</tr>
<tr>
<td><strong>IACUC</strong>&lt;br&gt;<a href="http://www.med.uc.edu/iacuc">http://www.med.uc.edu/iacuc</a></td>
<td>Regulatory Mandates, Protocol Submissions, Literature Searching, Policies, Veterinary Resources, Training</td>
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</tr>
<tr>
<td><strong>Institutional Review Board</strong>&lt;br&gt;<a href="http://www.med.uc.edu/irb/">http://www.med.uc.edu/irb/</a></td>
<td>IRB approvals, forms, training materials, rules and regulations, membership listing</td>
</tr>
<tr>
<td><strong>MCMFSS (Medical Center Management, Financial and Support Services)</strong>&lt;br&gt;<a href="http://mcmfss.uc.edu/">http://mcmfss.uc.edu/</a></td>
<td>Information regarding community outreach, sponsored programs, human resources, and general accounting, and general office information</td>
</tr>
<tr>
<td><strong>Medical Center</strong>&lt;br&gt;<a href="http://medcenter.uc.edu/">http://medcenter.uc.edu/</a></td>
<td>About the Medical Center, News &amp; Events, Colleges, Academic Services, Affiliates, Consumer Health information.</td>
</tr>
<tr>
<td><strong>Medical Education</strong>&lt;br&gt;<a href="http://www.med.uc.edu/meded/">http://www.med.uc.edu/meded/</a></td>
<td>Information regarding academics, admissions, financial aid, Student services, special programs. A detailed course schedule is also available.</td>
</tr>
<tr>
<td><strong>NetWellness</strong>&lt;br&gt;<a href="http://www.netwellness.org/">http://www.netwellness.org/</a></td>
<td>Consumer based health information network. Features an Ask an Expert service with close to 200 health professionals participating.</td>
</tr>
</tbody>
</table>
| Office of Research  
http://www.med.research.uc.edu/ | Information regarding funding opportunities, applications deadlines, core facilities, literature resources, NIH resources and other research information. Up to date information on active grants is also available. |
|-----------------------------|-------------------------------------------------------------------------------------------------|
| Post Doc Resource Center  
http://www.med.uc.edu/postdoc/ | Information regarding appointments, training, advisory Committees and Job opportunities |
| Research CV's Online  
http://www.med.uc.edu/about/introduction.cfm | Research Assistant applicants can submit resumes on-line. Also contains an administrative function where faculty affairs staff add/modify applicant data. Public access is restricted to the University. |
| Residency Programs  
http://ucmcl-distlrn2.uc.edu:90/residency/ | Residency Program information |
| Student/Faculty Questionnaires (Handheld, General)  
http://aitl.uc.edu/survey/  
http://aitl.uc.edu/survey/handheld.cfm | On-line questionnaires for participants to complete and submit electronically. Results are also available on-line to questionnaire administrators. |
Administrative Applications

Applications Online

Overview
The Applications Online System is designed to improve the efficiency of the applicant review process. Authorized members can manage position information, search committees and applicants. The members can also view all the resumes, rate the applicants and view listings of applicants contacted or scheduled for interviews. The system, completely integrated with the database, stores the resumes in the centralized media repository. It provides a complete efficiently managed system for tracking position descriptions, applicants and search committees.

Underlying Technology
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7.0
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer 5th generation and above, Acrobat

Major Features
- Online Application management
- Complete applicant tracking system
- Use of a 3-tiered security model to handle authentication and access control
- Position information management
- Applicant information management and interview scheduling management
- Search committee management
- Web-based RDBMS implementation
- Developed and operated by AIT&L

Projects on Demand

Overview
The purpose of the Projects on Demand system is to give our web team the power to interactively manage projects via a web browser. The system provides E-mail notifications, task assignment history, status editing, availability, web address fields, and a timeline scope with its use of projected start and completion dates. The systems flexibility allows for future growth and a host of other features that improve team collaboration, reduce confusion, and facilitate time management.
Underlying Technology
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting/Content Standards/Protocols: HTTP, HTML, DHTML, and JavaScript
- Client Side: Most browsers 3rd generation and above

Major Features
The system’s greatest attribute is the personal view that a user has when they log-on. The ability to see when projects are due, their priority levels, any information that the originator of the project might have, and how it relates to the other projects that the developers have waiting for them.

- Calendar of Projects
- Complete Project Overview
- Viewable Personal Project Management
- Viewable Personal Timeline Management
- Reports (Completed Tasks, etc.)
- Priority Listings
- On-Line Access of Information
- Web-based browser/relational database implementation
- Developed and operated by AIT&L

Document Management System

Overview
The College of Medicine utilizes an integrated document management system that is shared throughout the Medical Center.

The document imaging system is shared by Faculty Affairs, Admissions, Management Finance and Support Services, Sponsored Programs, IRB, UC Physicians Billing Office, and UC Physicians Administration. Typically it is used as an archival system where various documents can be stored and retrieved through either client server or web type application interfaces. Typical types of storage would personnel records, billing reviews, contracts, pension reports, personal action forms, timesheet, tax records, letters of recommendations, grant and protocol information.

Each department maintains its own centralized scanner and has localized security. Images are scanned and then sent to the image server and in turn stored on an optical disk.

Underlying Technology
The scanning is done at workstations that are running either Ascent from Kofax or Keyfile. The data is then stored for a temporary period of time on a Dell
PowerEdge 4300 Pentium 3 server that is running on Windows NT4. The final storage is done on one of two Hewlett-Packard jukeboxes (HP40 gb and HP660ex gb) that are controlled by Keyfile.

**Major Features**
The major feature of the system is that it allows offices to greatly reduce their paper storage. Instead of maintaining banks of filing cabinets with years of archived files, the information can be scanned into an electronic system. The system also allows users to “archive” their files sooner rather than storing them as active files. Where closed files were previously retained for 3-5 years before going to storage, they can now be scanned and stored within six months and still provide easy retrieval. Operated by the College of Medicine’s Dean's Office.

**Educational Applications**

**Health Careers Information Center**

**Overview**
The Health Careers system is an on-line version of the AHEC Center for the Area Health Education Center Program of the University of Cincinnati representing Region VI of the Ohio Statewide AHEC Program. The AHEC Program is a multi-disciplinary project that seeks to improve the availability of healthcare professionals and improve access to quality health care in Ohio. The system allows users to select from a variety of careers. After selecting a career the customer will receive a description of the career, the educational requirements, salary ranges, and the universities offering the career in study.

**Underlying Technology**
- Database: SQL
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTP, DHML, HTML, and JavaScript
- Client Side: Most browsers 3rd generation and above

**Major Features**
- Selection of a multitude of careers
- Career Information Management
- Organizational Information Management
- University Information Management
- Relationship Interface to manage the university and their related careers
- On-Line Access of Information
- Web-based browser/relation database implementation
- Developed and operated by AIT&L
Continuing Medical Education Registration System

Overview
The Continuing Medical Education Registration System handles the online registration for various courses, forums and seminars offered or managed by the Department of Continuing Medical Education. The users can view a dynamically generated listing of the courses and their details and can register for it online through a secure server. This system integrates with the Integrated database to get demographic information of people already in the database. Authorized users can add courses to the system; approve, decline or waitlist registrants and can modify inaccurately entered information. Authorized users use an Access front-end that connects to the database to perform the administrative functions.

The system streamlines the registration process while making it always available and reducing administrative functions. A third-party real-time credit card processing provider is being integrated into the system to make the system more efficient. The credit card processing will be adopted university wide once successful here.

Underlying Technology
- Server: Windows NT 4.0, IIS 5.0, SSL, Verisign Server Digital Certificate
- Database: SQL 7.0
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTPS, HTTP, DHTML, JavaScript
- Client Side Software: Most browsers 3rd generation an above, Access front end for administrative purposes

Major Features
- Automated Web Registration that lets students register immediately at any time
- Easy access to course information as this is completely integrated with the database
- Automated management of available spaces for the course
- Web Administration of registrant information, course information and registration processing
- Real-time credit card processing
- Automated notifications to registrants, administrators
- Web-based RDBMS implementation
- Developed and operated by AIT&L

Student Pathway Lottery Application

Overview
The Student Pathway Lottery system is a password secured application that allows medical students to choose the order of the clinical elective courses they
would like to take in their second year. By using collected data, an AS 400 system generates the best match for each student, and a web-based report is generated. Eventually the students are able to view the lottery results online.

**Underlying Technology**
- Server: Windows NT 4.0, IIS 5.0, AS 400
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting/Content Standards/Protocols: HTTP, DHTML, JavaScript
- Client Side Software: Internet Explorer or other HTML 4.0 compliant browsers

**Major Features**
- Password secured log in
- The ability to collect data from a wide range of sources for data processing
- Data transformation
- Web based report
- Before using the student pathway lottery system, the data was collected manually. Since the development, this system has shown a drastic improvement on efficiency and accuracy
- Developed and operated by AIT&L

**Student Directory**

**Overview**
The Student directory is a password secured application that provides current medical student E-mail addresses, home addresses, and telephone numbers. The data is retrieved from the Integrated database and dynamically updates as soon as the database changes. This application provides students with access to the student directory information at any time.

**Underlying Technology**
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting/Content Standards/Protocols: HTTP, HTML, DHTML, and JavaScript
- Client Side Software: Internet Explorer, Acrobat Reader

**Major Features**
- Password secured log in
- Student directory information is retrieved from the database dynamically.
- Student directory information along with the student pictures can be listed in various ways (class, alphabetically, etc.)
- Developed and operated by AIT&L
Alumni Directory and Tracking System

Overview
The Alumni Directory and Tracking System is a password secured application that provides Alumni E-mail addresses, telephone numbers, resident addresses and an interface that allows the user to update his/her information. The data is retrieved from the integrated database and dynamically updates as soon as the databases are changed. This application makes access to the alumni directory information more convenient at anytime or place.

Underlying Technology
- Server: Windows NT 4.0, IIS 5.0
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting /Content Standards/Protocols: HTTP, DHTML, and JavaScript
- Client Side Software: Most browsers 3rd generation and above, Acrobat

Major Features
- Password secured application
- Alumni’s directory information is retrieved from the database dynamically, so the information is always the most recently updated
- Alumni’s directory information can be constantly updated
- Developed and operated by AIT&L

Center for Competency Development and Assessment

Description
The University of Cincinnati’s College of Medicine has developed a Center for Competency Development and Assessment (CCDA). This facility is used to train students in clinical interview skills and to support the administration to medical students of Clinical Assessment Exams. The exam is a performance-based examination of clinical skills, utilizing standardized patients (i.e. actors portraying patients presenting with various clinical symptoms) at multiple stations.
The CCDA consists of the following:

- Sixteen patient exam rooms equipped for audio and video monitoring of interviews between student examinees and patients
- A central area for individual faculty members monitoring the interviews
- A conference/viewing room for live or delayed group monitoring and evaluation of the interviews
- An equipment room to house the central equipment supporting the above activities, together with facilities to make and store recordings of the interviews for delayed viewing, evaluation and documentation. The central equipment room may also be required to provide for remote monitoring and evaluation of interviews from multiple locations via computer network.

**Underlying Technology**

The Center for Competency Development and Assessment utilizes a digital data (audio and video) capture and storage management system. The data capture is triggered using card swipe data, interacting with the integrated database, and controlling video acquisition in conjunction with the VSOFT software, a commercial product.

Each of the 16 rooms has two cameras that are connected to 8 servers that contain 4 MPEG1 or MPEG2 encoding cards. As video(s) are recorded, they are assigned attribute data that will allow them to be retrieved and viewed using these attributes. These videos are organized within the VSOFT manager software in folders in a manner that allows only authorized users to retrieve the attribute data and view the videos. Videos are organized by student to provide the most expedient access.
Other

Security Management System (SCM)

Overview
The Security Management system is used to control authentication and level of access to various applications. The security management system is a web based interface and database backend built upon a 3-tiered security model that enables administrators to control users, groups, and roles. Each user has a unique username and password that is stored in the Integrated database. Groups are used to identify what areas or applications the users have access to. Roles or permissions define the type of access a given group has to a given application.

Underlying Technology
- Database: SQL 7
- Middleware: Cold Fusion
- Scripting/Content Standards/Protocols: HTTP, HTML, DHTML, and JavaScript
- Client Side: Internet Explorer 5th generation and above

Major Features
One of the systems greatest attributes is the ability to define levels of authentication or access control for multiple applications. This enables people to have one username and password and moves us further in the direction of true “Single Sign On”.
- Permission breakdown by function, screen, and application are possible.
- Access control down to the field level
- On-Line access for administrators
- Web-based browser/relational database implementation
- Scalable and can be integrated with other technologies such as LDAP
- Developed and operated by AIT&L

Electronic Journals and Resources Databases

Overview
AIT&L staff have developed a database to provide alphabetic access to electronic journals in the health sciences from the AIT&L electronic resources web page. AIT&L has access to electronic journals from a number of publishers and from the OhioLINK Electronic Journal System. The database maintains the subscription information for electronic journals and then dynamically updates the web listing as a record is added or deleted in the database. A similar database provides access to electronic databases from the AIT&L electronic resources web page.
Underlying Technology
The databases were created in Microsoft Access and use ASP programming to pull the data (titles and hyperlinks) into the alphabetic list of web journals available from the AIT&L Electronic Resources web page.

Major Features
- Electronic journals database: reports that summarize subscription and account information, hits and download data, and various other collection development features
- Electronic resources database: reports that summarize subscription and licensing information, forms of access, IP address information, use statistics and various other management features
- Developed and operated by AIT&L
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Software Architecture

- Server Software
- Development Software
Software Architecture

UC is committed to implementing open standards that benefit its customers. By incorporating technologies based on best practices, open standards and progressive technologies into its strategic planning process, UC has created building blocks that will enable it to integrate a heterogeneous environment and provide long term integration, interoperability and cost management.

Server Software
Cold Fusion Server Professional and Cold Fusion Server Enterprise Edition – A robust and flexible middleware application environment; the enterprise version supports clustering and enhanced security features.

Seagate Crystal Enterprise – A robust service that enables enhanced reporting capabilities via the Internet.

Microsoft Internet Information Services 4.0/ 5.0 – Web server software for Windows NT and Windows 2000.

Microsoft SQL Server 2000 – Relational database server

Microsoft Windows 2000 Advanced Server – Server based operating system.

Real Video Server – Streaming video software. Currently supports 100 concurrent streams.

Windows Media Streaming Server – Streaming video software from Microsoft.

ActivePDF Toolkit – Enables server side execution of various acrobat functions such as Form-fill, merge, append, stamp, extract, stitch and more.

ActivePDF Spooler – Enables IP based printing of PDF documents from your server to any network or direct connected printer.

ActivePDF Server – Enables you to dynamically generate server-based PDF from virtually any Windows NT/2000 application.

Web Trends – Server based statistical analysis software package.

Development Software
Cold Fusion Studio – A robust development environment for building Web applications. It supports development in different environments including Cold Fusion, ASP, JavaScript and more.
Seagate Crystal Reports – Rich report generation tool used to generate reports for several applications.

Real Producer Pro – An easy to use streaming video creation tool that supports both the development and publishing process.

Alive E-Show – Streaming video publishing tool that integrates PowerPoint slides using SMIL technology.

Sybase PowerBuilder – An application development toolset that is currently used for systems that are running under a client/server environment and have not yet been converted to a web based architecture.

Sybase PowerDesigner - An all-in-one modeling and design solution for enterprises that need to build or re-engineer business applications quickly, cost-effectively, and consistently. It is currently used for some database management functions.


Adobe Acrobat – A tool that allows the creation and editing of documents in PDF (Printable Document Format). Acrobat enables anyone with free Adobe Acrobat Reader® software to open documents regardless of hardware, software, or software version.

Adobe Photoshop – Digital Image editing software.

Adobe Premiere – Video editing software that is currently used in a PC environment.

Final Cut Pro 3 – Video editing software for the Macintosh environment.

Adobe Illustrator – Vector based image editing software.

Macromedia Flash – Enables the creation of rich Internet content using powerful video and multimedia. This tool is used primarily in the creation of online course materials or virtual tours.

Macromedia Director – Also enables the creation of rich Internet content. This tool is being replaced with Macromedia flash. We currently use director on virtual tour segments of the University.

Poser – Used for 3D modeling of the human body. This is currently used in instructional venues.
Databases

- Integrated Database
- Local Databases
- Legacy Databases
- Affiliates Databases
Web Applications

Server

Integrated Database

Databases

MainFrame

HRMS

UniverSIS

Identity Management

COM SIS

Faculty and Staff

Students
Databases

Background
Advanced database technology and architecture provide the foundation for many diverse applications at the University of Cincinnati. Over the past several years we have made strides in the area of database technology and data integration. Before 1995 most databases and applications at the university were separate and, in most cases, were not designed to share data. Consequently, demographic and other information was duplicated across university and departmental systems. The inability to centrally manage demographic and other data has lead to errors, inaccurate information, and numerous applications used to update the same sorts of information.

Today, many applications at the university share data. A Data Warehouse has been established which contains much of the demographic information needed for most people affiliated with the University. The Medical Center has also spent the last several years developing an Integrated Database.

Integrated Database
The Integrated Database supports applications such as Institutional Review Board, Research Training, Contract Approvals, Electronic PAF, and more. The overall design of the database provides a framework for delivering applications and giving different users access to the parts of each application relevant to their needs. The database has a Person Core of key demographic information for UC faculty, students, staff, and other people connected in various ways with the University. The database design uses the flower metaphor. Each system stores and maintains its own information in petals of the database; data entered by one system may be totally private, or parts of the data may be shared with other systems as appropriate. We are using this design to improve the sharing of information across the Medical Center and to reduce the amount of data that is entered many times for use in different systems.
For information about data updating in the integrated database, see attachment 8 (Data Updating in the UCMC Shared Database).

**People and Security Core**
Along with the demographic information for UC faculty, students, staff, and other people connected in various ways with the University, the core also contains a security component. The security component is designed to control authentication and level of access to various applications. It is built using a 3-tiered model that has the ability to control access for users and groups down to the field level. Access rights, such as “Read Only”, “Single Department”, or “Suppress SSN Display”, can be defined by each application as required. Similarly, each application can define groups of users, such as “Administrator”, “Reports Only”, or “Business Administrator”, as required. This 3-tiered security environment was first prototyped and used as a part of the NetWellness “Ask an Expert” system circa 1996.

Most of the demographic data for the people and security core is managed by legacy systems at the university. Synchronization programs periodically refresh demographic data in the Person Core from the legacy systems. If a department manages data for a small group in a manual system, we are providing web components that the department can use to edit and update the corresponding data in the Person Core.

**Media Repository Petal**
The Media Repository section of the integrated database provides a method for cataloging and providing on-demand access to a wide variety of resources. Various types of resources can be included such as video clips, other types of multimedia files, or any other resource that may be accessed from a given application.

**Institutional Review Board Petal**
This section stores data from the IRB application. Data dealing with protocols, adverse events, and principal investigator information is stored within this section of the database.

**Research Training Petal**
This section stores information specific to the Research Training application as well as the Continuing Medical Education Application. Compliance data, course information and requirements for a given individual are all contained within this area.

**Contract Approvals Petal**
This section stores information specific to the contract administration process. All data required for contract submission and approval is contained within this area.
Grant Applications Petal
This section stores information specific to the Grants Online (E-Apps) application. All data required for grant proposal submission, generation and reporting are stored within this area.

Electronic PAF Petal
This section stores information specific to the Electronic Personnel Action Form Application. Some data required for this application is also pulled directly from the Human Resources Management System (HRMS).

Local Databases
The university contains many systems that are based on relational database platforms and reference Person data, yet are not integrated with the Person Core. These external systems store their data locally or within their own system or environment.

Radiation Safety
The Radiation Safety system is not part of the integrated database, yet it must refer to people listed in the Person Core, and must provide training requirement information to the Research Training compliance system. Radiation Safety is built using a SQL database. This will become a part of the integrated database. See the Databases section of the Technology and Resources 5-Year Projection document for additional information.

Institutional Animal Care and Use Committee (IACUC)
The IACUC system is a stand-alone system based on FoxPro. This system cannot use ODBC connections to SQL Server databases. As a result, this system uses the Independent Integration approach. In this specific case, new person records are created via an external web interface and copied into the system for its use. Data in the system are periodically refreshed to ensure consistency with the Person Core.

Sponsored Programs Tracking System (SPOTS)
The Sponsored Programs Tracking System is another system based on SQL Server, yet not fully integrated with the Person Core. This system is used in the pre and post award phases. SPOTS will be added to the Integrated Database as a part of the Research Administration System. See the Databases section of the Technology and Resources 5-Year Projection document for additional information.

Center for Competency Development and Assessment
The CCDA (Center for Competency Development and Assessment) system is a complex system used for clinical training and testing of Medical Students. It employs video technology to record sessions between students and sample patients, and then stores the video clips digitally. The video clips are linked to student information and are cataloged for retrieval by many criteria. For
example, a single student’s or sample patient’s sessions can be viewed, or all sessions of a particular type can be viewed. This system will not become part of the integrated database but will be used in conjunction with the database via an Application Programming Interface. As a student signs in, an Application Programming Interface is used to retrieve minimal person data from the Person Core, which is stored in the CCDA system following the virtual interface model.

**Facility Center/Space Management System (SPAN)**
The Facility Center/Space Management System (SPAN) manages the space assignments. An ODBC connection between SPOTS, running on SQL Server, and SPAN, running on Oracle, allows users of SPOTS to access Space data from SPAN, and lets users of SPAN see Sponsored Program information for each room in the SPAN system. The separate systems appear, to users of both systems, to be a single integrated system.

**NetWellness Ask an Expert**
The Ask an Expert database runs on a SQL Server and is used to manage the backend of a health information website. The database stores and manages thousands of questions and answers from health professionals at three universities (University of Cincinnati, Case Western Reserve University, The Ohio State University). The database also stores topic and site information in a media repository. This system became the prototype for the 3-tiered security model and the media repository as described above. The Ask an Expert database will become a part of the integrated database. See the Databases section of the Technology and Resources 5-Year Projection document for additional information.

**Legacy Databases**
For additional information on Legacy Databases, see the Applications section of this document.

**Human Resources Management System (HRMS)**
Data for employees, including student workers, is managed by the Human Resources system (HRMS), a modified commercial product operating on an IBM series 9672 main-frame under CICS.

**UniverSIS**
The Student System, UniverSIS, manages data for students, including employees who are using the tuition-remission program to take one or more courses. UniverSIS runs on the IBM mainframe, and was developed in-house using the Natural language, running under CICS.

**College and University Financial Database (CUFS)**
The University Purchasing Department and the Office of the Controller support the functional data management with over 770 departmental users updating or using the system. CUFS interfaces with HRMS, UniverSIS, Term Contact
management system, investment pool system, and various service department systems. CUFS runs on an IBM 9672-R14 processor and is written in COBOL. The file structure is Virtual Storage Access Method (VSAM).

**Affiliates Databases**

Children’s Hospital, one the institutions affiliated with the Medical Center, has recently established a Division of Pediatric Informatics. This division operates several large Sparc-based SUN computers, running Oracle databases.
Servers

- File and Print Servers
- Web Servers
- Database Servers
- Multimedia Streaming Servers
- Hardware Components
- Backup Systems
- Security
- Data Center
- Medical Center Servers
Servers

The University of Cincinnati has a heterogeneous server operating system environment. Server operating systems provide comprehensive sets of services including file and print sharing, database, web and application support for the latest Web technologies (i.e. streaming media). Reflecting the continuing rapid progress in microprocessor speeds, most operating systems support n-way symmetric multiprocessing systems with up to 64 gigabytes of physical memory. Server technology is necessary for high availability clustering, network, and component load balancing to provide excellent system and application availability. The three principal operating systems in use are Linux, Microsoft Windows, and Novell Netware.

The University has in place a schedule for replacing all hardware, including servers, on a regular basis. In addition, AIT&L monitors advances in software design and operation in order to upgrade software packages when necessary. This allows AIT&L to remain as close as possible to the cutting edge of software development.

File and Print Servers

Most colleges and departments at the University of Cincinnati utilize Novell Netware as their primary file and print sharing server operating system. Historically each of these units would maintain its own Novell server, bearing all of the associated overhead costs. Within the past two years there has been a movement to fewer, larger servers that service multiple units. AIT&L operates and maintains five such servers, supporting the colleges of Medicine, Pharmacy, Nursing, Allied Health as well as the Office of the Senior Vice President and Provost for Health Affairs. While AIT&L actually operates the servers, policies and a partnership committee promulgate procedures governing their use. This committee is composed of representatives from each of the units. The actual costs of maintaining the servers are distributed back to each of the units. Such an arrangement provides significant costs savings to each unit in both capital and personnel costs.

Web Servers

Web servers provide Internet services that allow applications to take advantage of the latest Web technologies. Web servers are designed for high availability clustering and load balancing to provide excellent system and application availability. Most of the colleges and departments within the University operate their own web servers. AIT&L operates a total of eight web servers for itself as well as units of the College of Medicine and the Office of the Senior Vice President and Provost for Health Affairs.
Database Servers
Database servers provide the structured query language and relational database management system that include a broad spectrum of capabilities including: indexing; concurrency management; automated database tuning and administration tools for complex operations; a fast and simple programming model for developers; locking; active backup; and backup and recovery. Database systems from several different vendors are utilized at the University of Cincinnati. AIT&L has chosen Microsoft SQL Server as its primary database management system. SQL Server is available on five different AIT&L servers.

Multimedia Streaming Servers
Multimedia streaming servers enable the delivery of audio and video at every bandwidth across the Internet/intranet. Streamed content is available to multiple clients (multicast) or a one-to-one connection (unicast). Streamed content allows information to be viewed and listened to normally without delay. Streaming products work to overcome delays by transmitting the information from the server to the client in advance, using buffering to overcome bandwidth constraints. Multimedia streaming servers include tools that allow the audio and video to be converted and compressed for efficient transmission over networks. Streaming servers from both Microsoft and Real Networks have been deployed by AIT&L and work in conjunction with their respective media players on the desktop.

Hardware Components
Server hardware components incorporate 32-bit Pentium® processors running at from 133 MHz to 1.0 GHz. The servers are implemented with a composite of fault-tolerant technology including clustering, load balancing, and redundant data storage. Redundant data storage helps prevent system failure and protects valuable data in the event of system error. Redundancy currently utilizes RAID (Redundant Array of Inexpensive Devices) fault-tolerance that distributes data to easily inter-changeable storage devices.

Backup Systems
All storage on servers managed by the Medical Center is backed up to tape on a regular basis. Each server is backed up in its entirety weekly (usually Saturday or Sunday morning). Between these full backups, incremental backups are utilized to protect files/tables that have changed most recently. Backup tapes are rotated offsite on a regular basis to provide for mission continuity should the data center not be available for an extended period of time.
Security
AIT&L has been charged with the responsibility to operate and maintain servers providing file, print, database and web services to the Medical Center of the University of Cincinnati. An important aspect of that maintenance is the protection of these servers from external and internal probing and hacking leading to penetration and possible compromise of University strategic assets. AIT&L has implemented a multi-faceted plan to deal with such threats. This plan includes:

- Anti-Virus software on all servers with regular virus signature updates.
- Hardware and software firewalls to prevent TCP/IP penetration.
- Both manual and automated operating system upgrades to ensure patches, upgrades and hotfixes have been properly applied.
- Regular security audits of AIT&L servers by a non-AIT&L security specialist. These audits are reviewed on a regular basis and any problems detected are promptly fixed.

Data Center
The servers and related components managed by AIT&L are currently located in a secure data center. This data center is managed by the University’s information technology group (UC IT). It is operated 24X7 and includes fire and theft prevention and all related features. Co-located with Medical Center servers are University computing resources (both server and mainframe) that provide file and print sharing, email and other University core data systems (registration, grades, finance, HR).

Medical Center Servers
Novell
AIT&L utilizes Novell Netware, Version 5.1, as the server operating system for general file and print sharing. In the Novell environment information about servers, users and other associated computing resources (objects) are stored in a proprietary database, Novell Directory Services. An organization utilizing Novell Directory Services may have a single database or many. Each database is called a tree. The University of Cincinnati has several Novell Directory Services trees. The two largest trees are maintained by UCIT (primarily for West Campus) and AIT&L (for East Campus). The AIT&L tree currently contains almost 10,000 objects. Five of these objects are the servers themselves.

UCEAST-P1: Dell PowerEdge 6300, (2) Pentium II Xeon 400MHz Processors, 1GB memory, 90GB RAID 5 online storage. Provides file and print sharing to the Dean’s Office, the College of Medicine and the Office of the Senior Vice President and Provost. Maintains read/write Replica of the Novell Directory Services database.

UCEAST-P2: Dell PowerEdge 6300, Pentium II Xeon 400 MHz Processor, 512 MB memory, 90 GB RAID 5 online storage. Provides file and print sharing to
Students of the Colleges of Medicine, Nursing, Allied Health Sciences and Pharmacy. Maintains read/write replica of Novell Directory Services database.

UCEAST-P3: Dell PowerEdge 6300, Pentium III Xeon 500 MHz Processor, 512MB memory, 108GB RAID 5 online storage. Provides file and print sharing to faculty and staff in AIT&L and the Colleges of Medicine, Nursing, Allied Health Sciences and Pharmacy. Maintains read/write replica of Novell Directory Services database.

UCEAST-P4: Dell PowerEdge 4400, Pentium III 866 MHz Processor, 512MB memory, 72GB RAID 5 online storage. Maintains Master replica of the Novell Directory Services database and provides time synchronization services to other Novell AIT&L servers. Provides backup file and print sharing services to UCEAST-P1 in case of failure.

UCEAST-P5: Dell PowerEdge 4400, Pentium III 1GHz Processor, 1GB memory, 72GB RAID 5 online storage. Provides primary backup and restore capability for other AIT&L Novell production servers via externally attached Dell PowerVault 128T LTO tape library. Provides backup file and print sharing services to UCEAST-P2 and UCEAST-P3.

Windows

AIT&L utilizes servers running Windows NT Server and Windows 2000 Advanced Server for application, web and database services. In the Windows server environment there are two different methods for storing and managing information about users, servers and other computing resources. Active Directory Services is Microsoft’s database product analogous to Novell Directory Services. Several departments and Colleges within the University are utilizing Active Directory Services. Others, like AIT&L, still maintain Windows NT domain structures. In the Windows NT domain model each server maintains its own separate database of information with one or several “domain controllers” maintaining a master set that can be used by all of the members. AIT&L currently manages a total of 18 NT/2000 servers.

UCMCL: Generic Pentium 133, 64MB memory and 4GB online storage running Windows NT 4.0 Server. This server functions as the Primary Domain Controller for the AIT&L domain.

UCMCL-BDC: Dell PowerEdge 2200, Pentium II 333 MHz Processor, 320MB memory, 9GB mirrored online storage running Windows NT 4.0 Server. This server functions as a Backup Domain Controller for the AIT&L domain.

UCMCL-BDC2: Dell PowerEdge 2200, Pentium II 300 MHz Processor, 256MB memory, 9GB mirrored online storage running Windows NT 4.0 Server. This server functions as an additional Backup Domain Controller for the AIT&L domain.
UCMCL-ICECAP: Dell PowerEdge 2450, Pentium III 1GHz Processor, 1GB memory, 108GB RAID 5 online storage running Windows 2000 Advanced Server. This server runs the Network Ice/ISS Icecap Intrusion Detection and Management System.

UCMCL-DBPROD: Dell PowerEdge 2450, Pentium III 1GHz Processor, 1GB memory, 108GB RAID 5 online storage running Windows 2000 Advanced Server. This server currently runs Microsoft SQL 7 and will be upgraded to SQL 2000. This server will contain all production databases developed and maintained by AIT&L.

UCMCL-DBTEST: Dell PowerEdge 2450, Pentium III 1GHz Processor, 1GB memory, 108GB RAID 5 online storage running Windows 2000 Advanced Server. This server also runs Microsoft SQL 7 and will be upgraded to SQL 2000. This system provides developers with a test database environment.

COMDB: Dell PowerEdge 2200, Pentium II 266MHz Processor, 128MB memory, 8 GB online storage running Windows NT 4.0 Server. This server currently runs an application called RadNET. RadNET is an online collaboration application that helps to facilitate project work across distant locations.

UCMCL-INTMED: Dell PowerEdge 2450, Pentium III, 667MHz Processor, 512 MB memory, 18GB RAID 5 online storage running Windows NT 4.0 Server. This server runs an ADP developed payroll application for the Department of Internal Medicine.

UCMCL-DISTLRN: Dell PowerEdge 4400, Pentium III 667MHz Processor, 1GB memory, 180GB RAID 5 online storage running Windows 2000 Advanced Server. This server is utilized for a variety of web and distance learning applications. It also provides backup services for all of the other NT and 2000 servers through the externally attached PowerVault 120 DLT tape library.

AITL_COMWEB: Dell PowerEdge 4200, Pentium II 333 MHz Processor, 128MB memory, 18GB RAID 5 online storage running Windows NT 4.0 Server. This server is the primary web server for the University of Cincinnati College of Medicine.

AITL_COMWEB2: Dell PowerEdge 6400, Pentium III Xeon 550 MHz Processor, 512 MB memory, 60GB RAID 5 online storage running Windows NT 4.0 Server. This server provides additional web services for AIT&L. Most applications on this server are Intranet/Extranet based systems for Human Resources and Research Administration.

UCMCL_EXPERT: Dell PowerEdge 4200, Pentium II 300MHz Processor, 128MB memory, 18GB RAID 5 online storage running Windows NT 4.0 Server. This server runs SQL Server and houses the “Ask an Expert” system for NetWellness.
UCMCL_VIDEO: Dell PowerEdge 4200, Pentium II 300MHz Processor, 128MB memory, 45GB RAID 5 online storage running Windows NT 4.0 Server. This server provides streaming video services.

EXPERTWEB: Dell PowerEdge 2200, Pentium II 266 MHz Processor, 128MB memory, 8GB mirrored storage running Windows NT 4.0 Server. This server is a test server used for application development in the NT environment.

UCMCL-TEST: Dell PowerEdge 2450, Pentium III 1GHz Processor, 1GB memory, 108GB RAID 5 online storage running Windows 2000 Advanced Server. This server provides AIT&L developers with a platform to test new applications.

UCMCL-WHATUP: Dell PowerEdge 2450, Pentium III 1GHz Processor, 1GB memory, 108GB RAID 5 online storage running Windows 2000 Advanced Server. This server runs the “What's Up Gold” server health utility that monitors the online status of other servers and server processes managed by AIT&L.

NETDEVELOPMENT: Dell PowerEdge 2200, Pentium II 266 MHz Processor, 128MB memory, 18GB mirrored online storage running Windows NT 4.0 Server. This is the main web server for the NetWellness consumer health information service.

STATS-2000: Dell PowerEdge 4300, Pentium III 500 MHz Processor, 512MB memory, 18GB RAID 5 online storage running Windows 2000 Advanced Server. This server collects and processes log data. It provides detailed statistical analysis of all of the major resource centers.
Directories

- Microsoft Active Directory
- Novell Directory Services
- Lightweight Directory Access Protocol
- Domain Name System
- Dynamic Host Configuration Protocol
- Authentication Directories
Directories

Identity Management System

Exchange

Active Directory

Netware NDS

Linux

Applications

Web Access Directory

MainFrame

Update Loop (Potential)

Primary Data Sources

Secondary Data Sources

HRMS Warehouse

UniverSIS Warehouse

SEAM Warehouse

Other COM SIS SPACE

Colleges

Colleges

Colleges

Research Administrative Systems

Blackboard, Card Systems Directory, Print Quota System

Radius
Directories

Simply stated, directories are organized repositories of information. Typical network architectures today may incorporate several different types of directories, each utilized for different purposes. The following directories can be found in use at the University of Cincinnati.

Microsoft Active Directory Services
Utilized primarily by Microsoft 2000 Servers to provide authentication services. It has a hierarchical structure and can support a virtually unlimited number of objects. It also supports Lightweight Directory Access Protocol requests. As mentioned in the previous section, it is one of two authentication methods used by Microsoft servers.

Novell Directory Services
Utilized primarily by Novell Netware to provide authentication services. Like Microsoft Active Directory Service, it has a hierarchical structure and can support a virtually unlimited number of objects and supports Lightweight Directory Access Protocol. As mentioned in the previous section, it is the main authentication method utilized by Netware servers.

Lightweight Directory Access Protocol
A protocol (or set of rules) developed to access X.500 directories. It is based on the X.500 Directory Access Protocol but is less complex. It is not an actual directory, but is sometimes confused with one. Other directory services support queries in this protocol.

Domain Name System
A TCP/IP protocol that searches for resources using a database distributed among multiple servers. The Domain Name System allows you to specify a symbolic name instead of a numeric IP address. The University of Cincinnati maintains two different sets of DNS servers; one for intranet (internal) network traffic and one for Internet (external) network traffic.

Dynamic Host Configuration Protocol
The protocol used for automating the configuration of computers that use TCP/IP. It is used to automatically assign IP addresses and assign and deliver configuration information, such as Domain Name Service server address and Windows Internet Naming Service server addresses. The University of Cincinnati maintains two servers dedicated to this protocol.
**Authentication Directories (Radius Server)**
The Radius Server is the primary authentication server for dial-in and wireless connectivity. Radius is an open standard that supports a security profile. Radius compliance means that it supports the latest Internet Engineering Task Force (IETF) protocol definitions (RFCs): 2865 – RADIUS; 2866 - RADIUS Accounting; and 2869 - RADIUS Extensions. The security profile contains attributes that define what the customer may actually do.

At the University of Cincinnati, there are separate sets (primary and replicate) of Radius Servers. One set of Radius Servers (primary and replicate) is used to authenticate both wireless devices via their closest Access Point (used to transmit radio signals between the network and the device) and virtual private network connections. Another set of Radius Servers is used to authenticate dial-in connections.
Network Architecture

- Network Architecture
- Network Description
- Network Features
- Internet2
- Remote Access Internet Connection
- Wireless Technology
Network Architecture

Networking technology is a vital utility function at the University. Networking technology is used to support faculty, staff and students in the areas of teaching, learning, research, administrative services and management. Network usage and network capabilities are monitored constantly to determine whether network capacity can meet the current and future needs of the University community. This document addresses the following areas:

- Network Description
- Network Features
- Internet2
- Remote Access Internet Connection
- Wireless Technology

Network Description
The UC network architecture is a Gigabit Ethernet network backbone to ensure that student learning, faculty research and institutional services can keep pace with the accelerated rate of information and knowledge growth. This new network spans 73 buildings, 252 telecommunication closets, 5 major network nodes and over 22,000 network connections.

The UC network architecture utilizes products from Cisco Systems, a worldwide leader in networking for the Internet with the majority of market share in its business segment. Cisco's technology allows people to access or transfer information regardless of the time, place, or type of computer system. Cisco provides a broad range of hardware products that use the Cisco Internet Operating System, IOS® software, which provides network services and enables networked applications.

The network infrastructure is comprised of building blocks based on the following types of equipment:

- Routers to route data between local area networks;
- Switches to forward data between local area networks and provide connectivity to end-user devices;
- Firewalls to filter packets for protection of assets;
- Remote Access Services to enable dial-in connections;
- Directory Servers to manage the authentication and management of network addresses.

Network Features

- Gigabit per second bandwidth with switched connections to desktop.
  - The network utilizes Gigabit Ethernet, a 1000 Mbps extension of the Ethernet standard based on the Gigabit Ethernet 802.z specification.
- Redundancy to provide high availability.
The network can achieve the "five 9s of reliability," a system that is up and running 99.999 percent of the time.

The reliability is possible because of the redundancy built into the network. The network has a redundant networking component for every major device throughout the core and distribution layers.

- **Network Address Translation (NAT).**
  - NAT is a mechanism to provide internal IP addresses that reduces the need for globally unique IP addresses. NAT allows an organization with addresses that are not globally unique to connect to the Internet by translating those addresses into globally routable address space. The new addresses start with the number 10. The 129 addresses previously used are only available externally since the number 10 used internally gets translated to a 129 number whenever Internet traffic leaves the new network.

- **Dynamic Host Configuration Protocol (DHCP)**
  - DHCP provides a mechanism for allocating IP addresses dynamically so that addresses can be reused when hosts no longer need them. This dynamic addressing system makes it easier to move computers from one office or building to the next. A laptop can be moved from one building to another and never have to be reconfigured for network access. It will also be easier to add new computers. They only need to be plugged in and they work.

- **Domain Name System (DNS).**
  - DNS is used on the network to locate and translate names of network nodes into addresses.

- **Security**
  - A firewall (Cisco PIX) is a router or access server, or several routers or access servers, designated as a buffer between any connected public networks and a private network. A firewall router uses access lists and other methods to ensure the security of the private network. The firewall is configured to block outside traffic inbound and to permit inside traffic outbound.
  - Intrusion detection is a security service that monitors and analyzes system events for the purpose of finding (and providing real-time or near real-time warning of) attempts to access system resources in an unauthorized manner.

**Internet2**

UC is a partner in Internet2, which is an advanced network that is led by over 180 U.S. universities working in partnership with industry and government. Internet2 is developing and deploying advanced network applications and technologies, thus accelerating the creation of tomorrow's Internet.

The use of Internet2 is "automatic" for UC users. Whenever any Internet traffic of any type is destined for another Internet2 site, it will automatically be routed...
over Internet2/Abilene. The reverse is also true for traffic destined for UC from another Internet2 site. The primary goals of Internet2 are to:

- Create a leading edge network capability for the national research community
- Enable revolutionary Internet applications
- Ensure the rapid transfer of new network services and applications to the broader Internet community.

The University of Cincinnati has been a member of the Internet2 consortium since December of 1997. In 2001, the Office of the Vice President for Information Technologies established an Internet2 Steering Committee to cultivate greater University awareness and participation in Internet2 activities. UCAID (University Corporation for Advanced Internet Development) is the organization responsible for implementing and promoting next generation networks, as well as Abilene, the backbone network supporting Internet2.

The University of Cincinnati also became a member of Internet2/UCAID in December of 1997. UC subsequently prepared a grant application to the NSF under the High Performance Connections for Research and Education Institutions and Facilities program, more commonly referred to as the HPC program. The application was submitted in July of 1997, and approved, with funding actually made available on September 1, 1998.

Several applications are ready or are under development to take advantage of the increased bandwidth and VBNS connection. These include:

- Heterogeneous computing with geographically distributed systems;
- Parallel/distributed computing with networks of workstations. Potential collaborators on these applications include Ohio State University, University of California-Davis, Los Alamos, Oak Ridge, Brown University, Lawrence Livermore National Laboratory and the Naval Research Laboratory;
- Multi-media access including full color images, virtual reality, audio and video;
- Distance learning application development and experimentation;
- The Computer Engineering Research Consortium (CERC) of Ohio’s Mechatronics distributed design system. Participants in this research include four other Ohio universities.

**Remote Access Internet Connection**

Connecting to the Internet from home, a UC dorm room, or any other off-campus location, is important to the UC community. The UC network provides two in-source services as follows:

- UC Remote access modem pool for faculty, staff, and students who live within the local Cincinnati calling area. Connecting to the UCNet modem pool (to access the Internet and the UCNet) or the main campus
telephone and voice mail systems from outside the local Cincinnati calling area is possible through the Long Distance Remote Access (LDRA) service. LDRA is available to any UC faculty and staff member who has an active UC long distance authorization code. LDRA is the most cost effective way to call a UC campus phone, access voice mail, or connect to the UCNet modem pool (for Internet or UC e-mail access) when traveling.

- ResNet for students and faculty who live in UC apartments and resident halls.

UC also provides discounted services to UC registered students, faculty and staff. These services are: ZoomTown, an ADSL service; and, Road Runner, a cable service for connecting to the Internet and the UCNet from home.

- ZoomTown provides a high-speed connection to the Internet and the UC network. ZoomTown uses ADSL (Asymmetric Digital Subscriber Line) that converts existing twisted-pair telephone lines into access paths for multimedia and high-speed data communications. ADSL is called asymmetric because most of its two-way or duplex bandwidth is devoted to sending data downstream, to the user. Only a small portion of bandwidth is available for upstream messages.

- Road Runner provides high-speed cable modem connectivity to the Internet. Cable or broadband has the capability of supporting data flow in both downstream (provider to consumer) and upstream (consumer to provider) directions, at a speed in excess of 200 Kbps per second. Cable requires a cable modem designed to operate over cable TV lines.

**Wireless Technology**

**Wireless LANS**
The current wireless LAN environment at UC is 802.11b compliant. This standard allows for data transmission between the workstation and wireless access points at 11MB. When signal strength diminishes due to distance between the workstation and the access point, speeds of 5.5MB, 2MB and 1MB are also supported. The access point connects to the UC network via 10/100MB Ethernet.

**Standards for Wireless**

**Hardware**
The Access point standard is Cisco Aironet 350 Series Access Points. All new PCMCIA cards must support 128-bit encryption, with the recommended card being the Cisco Aironet 350 Series Client Adapter, part number AIR-PCM352. There are many external antennas available for use with the access points. Antenna extension cables 25 feet or longer must be constructed using LMR-600 coaxial cable. Antenna extension cables of less than 25 feet can be constructed using either LMR-600 or LMR-400 cable.
Authentication
Authentication is the validation that a customer is who they say they are. Access points will authenticate all customers by means of the wireless RADIUS servers. The primary server's address is 10.27.5.248 with authentication port set to 1812. The secondary server's address is 10.25.5.248 with authentication port set to 1812. The user id is the hex MAC address of the PCMCIA card, e.g. 000000000000. The password is also the MAC address.

Dynamic Host Configuration Protocol (DHCP)
All wireless users will obtain their IP address dynamically. It is required that the access points be set to pass DHCP requests to the central DHCP servers. To connect to a wireless access point and obtain an IP address via DHCP, the user's MAC address must be registered in the RADIUS database.

Wireless Technology

Encryption
Wireless encryption provides "Wire Equivalent Protection" (WEP) for transmitted data. All wireless transmissions will be encrypted using 64 and 128-bit encryption. All access points will transmit using a 64-bit key and accept both 64 and 128-bit transmissions. Encryption keys to be used will be given to the customer during the web MAC address registration process.

Channel Assignments
The 802.11b specification provides 11 channels, but these overlap. So at most three channels can be used in the same space. On UC campuses, channels 1, 6, and 11 will be used and will be assigned to access points. Channels other than 1, 6, and 11 should not be used at the University, as they might interfere with compliant infrastructure.

Radio Frequencies
The 802.11b wireless local area networking uses the FCC unlicensed 2.4 GHz Industrial, Scientific, Medical (ISM) band. The 802.11a wireless uses the FCC unlicensed 5 GHz unlicensed National Information Infrastructure (U-NII) band. Certain other "wireless" devices exist in the market place that also employ the same 2.4 or 5 GHz frequency band and can cause interference to users of the wireless service. These devices include, but are not limited to: other wireless LAN devices, cordless telephones, cameras, and audio speakers.
Current Wireless Locations
Wireless access points are currently installed in the following locations:

- Campus Service Building - 1st floor
- Campus Green - full coverage
- Aronoff Center for Design and Art (DAAP) - 4th, 5th and 6th floors
- College of Engineering – full coverage for the Engineering Research Center, Baldwin and Rhodes Halls
- Kingsgate Conference Center - 1st and 2nd floors and green space
- Langsam Library - 6th floor
- Health Sciences Library - all floors
- College of Law - library 4th floor
- Lindner Hall - 2nd floor lounge area
- McMicken Hall - student lounge
- Medical Sciences Building - 1st floor classrooms
- Old Chemistry - room 520 and adjacent area
- University Hall - 2nd and 4th floors
- Wherry Hall - College of Pharmacy
Information Policy

- History of Policy Formulation
- Information Technology Policies
  -- General Policy
  -- Management Policy
- Security Architecture
Information Policy

Information Technology policies specify what information is shared, when information can be accessed, which organizational units share information, where information can be distributed and accessed, and who has responsibility for updating and maintaining the information. The security architecture is the primary mechanism describing how the policy has been implemented.

- History of Policy Formulation
- Information Technology Policies
  - General Policy on the Use of Information Technology
  - Information Technology Management Policy
- Security Architecture

History of Policy Formulation
In 1997, the UCMC Integrated Information Steering Committee, chaired by Donald Harrison, M.D., initiated a project to conduct an analysis into the existing information policies. This analysis was undertaken to evaluate the completeness of our existing information principles and policies. It resulted in a conclusion that the information policies were outdated and incomplete. Accountability for information policies at the University and departmental level needed to be improved.

Information Technology Policies

General Policy on the Use of Information Technology
In January of 1999, Fred Siff, Vice President of Information Technology, created a new Computer Policy Task Force. The framework developed by UCMC was used as the basis of a new information policy. The resulting policy titled General Policy on the Use of Information Technology was adopted in September of 2000 [see attachment 9].

Information Technology Management Policy
After the completion of the General Policy on the Use of Information Technology, a companion policy was developed titled Information Technology Management Policy [see attachment 10]. This more detailed policy assigned specific responsibilities that addressed the following:

- Developing and implementing, when appropriate, additional IT policies, guidelines or procedures specific to academic or administrative units.
- Maintaining the functionality of the IT systems within academic or administrative units.
- Facilitating training and the dissemination of information.
- Maintaining the security of the IT systems and the network to which those systems are connected.
- Preventing unauthorized access to University information, personal files and email.
• Promoting IT policy adherence.
• Creating and maintaining a plan for recovery of mission critical data and systems if loss is sustained.

Security Architecture
The University of Cincinnati has developed a security architecture that is comprised of three tiers. Each tier contains a set of interconnected components that operate together. The tiers are:

• Tier 1 Firewall-Entry Point
• Tier 2 Firewall-Network Switch
• Tier 3 Servers (server firewalls, server anti-virus protection)

     Local Desktops (desktop firewall, desktop anti-virus protection),
     Remote Desktops (virtual private network, desktop firewall, desktop anti-virus protection)

Tier 1- Firewall – Entry Point (Internet Perimeter)
Tier 1 includes the following elements:

• Software for detecting and stopping a significant number of security breaches/intrusions.
• An intrusion detection system to scan for incoming threats (scans/probes).
• Encryption between the university and clients located anywhere in the world.

Tier 1 consists of a perimeter firewall, intrusion detection software, and the VPN (Virtual Private Network) concentrator, which enables UC to configure, administer, and monitor an Internet connection from the outside world to the University. The firewall is a combination of hardware and software implemented at the main Internet gateway. It enforces security policies by restricting access to specific University resources. The firewall is configured to allow outbound traffic and to prevent incoming traffic unless instructed otherwise. An intrusion detection system provides surveillance by automatically countering unauthorized activity and vulnerabilities that a firewall alone cannot address. Virtual Private Network (VPN) technology is deployed to protect data being transported over the Internet by establishing a secure tunnel from a remote site to the University.

The focal point of the security architecture is the firewall. Firewalls are networking devices that monitor and filter traffic and control access to assets of the University. A firewall is a system or combination of systems that manages the boundary between networks to prevent access by unauthorized persons. Firewalls are located between the internal network and an external network. Network traffic coming from the Internet must pass through the firewall before entering the network.

The "Open Zone" is an unsecured "barrier" network (meaning that traffic does not go through the firewall) between the University's internal network and an external connection to the Internet. The "Open Zone" is neither part of the internal UC
network nor directly part of the Internet. The "Open Zone" can be used for open access from the Internet to web pages and servers owned or affiliated with the University.

The Cisco PIX Firewall is positioned at the entry point to the network. Since the network has multiple entry points, there are additional firewalls implemented by University affiliates at the entry point of their networks. Affiliates include the Health Alliance of Greater Cincinnati, the Veterans Administration Medical Center (planned), University of Cincinnati Physicians and the Children's Hospital Medical Center.

Cisco IOS software provides a set of configurable security features. The Cisco PIX Firewall delivers strong security with little to no network performance impact. The product line enforces secure access between an internal network and Internet, extranet, or intranet links. The Cisco PIX Firewall can expand to meet a range of customer requirements and network sizes.

**Tier 2- Firewall – Network Switch (Subnet/router layer)**

The purpose of Tier 2 is to do the following:

- Protect college, organizational unit and University assets, primarily information in servers.
- Provide an intrusion detection system to help identify and prevent harm to internal University machines or external computers, in real time.

Tier 2 consists of firewall features, an intrusion detection system and a network analysis capability. Tier 2 operates within the UC Network (UCnet) at the router and switch subnet layer. Tier 2 is designed to benefit internal colleges, organizational units, and University infrastructure servers. Tier 2 limits access to some or all of the same ports and services as Tier 1. Additional ports may be blocked or opened to permit access for specific purposes. The intrusion detection system performs real time monitoring of internal UC network connections. When unauthorized activity is detected, an automated response will interrupt the connection and log the incident. The network analysis feature performs electronic analysis of networked systems, detects vulnerabilities, and enables system administrators to correct security weaknesses. The Tier 2 firewall has the same features that are available on the Tier 1 firewall.

In response to the increasing danger of attacks from viruses and other security threats, server administrators need to take responsibility for maintaining the currency of their servers. This includes: keeping them correctly configured; installing only applications that are needed; removing or tightening unnecessary services; keeping abreast of current hardware and software issues; and restricting access to sensitive areas. The system administrator needs to be familiar with the diagnostic tools available, including system logging.
Tier 3-Server and Desktop Firewall

The purpose of Tier 3 is to perform the following:

- Increase the level of awareness of the importance of security. This includes training each person to know what he or she can do to protect information assets, prevent damage to those assets and detect security breaches that are a threat to those assets.
- Provide for desktop firewalls and anti virus software to protect the desktop.
- Ensure that the technical staff takes responsibility for installing all security updates on a regular basis.

Tier 3 is the responsibility of each person who is connected to the network, in conjunction with the departmental system administrator. Each person who has a desktop is expected to take responsibility for maintenance and currency of their desktop operating system, virus scanning software and personal firewall software. To ensure the effectiveness of the software, each person must frequently update the definitions and install the latest patches. Email servers connected to UCnet will be configured with anti-virus software and kept up-to-date. Server and desktop software firewall products are installed in key servers and desktops to further protect UC assets. UC has selectively deployed the following security software:

- ICEpac Security Suite is used to provide intrusion protection and to protect servers, segments, VPN clients and workstations in each organization’s network.
- BlackICE Defender is a system that protects remote desktops. It scans DSL, cable modem, or dial-up Internet connections looking for hacker activity. When it detects an attempted intrusion, it automatically blocks traffic from that source, keeping intruders from accessing the person’s system.

A VPN securely transports IP packets across the Internet backbone by establishing tunnel endpoints that negotiate a common encryption and authentication scheme prior to transport. A VPN inexpensively connects networks together across the WAN and allows remote access to network services transparently and securely with the same degree of convenience and security as if users were locally connected to remote networks and hosts. VPNs are implemented through encryption and authentication features within firewalls, routers, and appliances. VPN provides an encrypted connection (secure tunnel) from outside networks to the University’s internal network. Encryption is a technique for scrambling the data so that only the recipient can decode it. The University installed a Cisco VPN concentrator that allows authorized users of the UCnet to access servers and services from off campus, from home or by using their laptops. With today's Internet security issues along with regulations on privacy issues, the new network design included the VPN outside access design. This allows the University's research data, employee data, student records, etc., to remain secure and only available to authorized users.
Tier 3-Server and Desktop Firewall
The University of Cincinnati has an agreement with Network Associates (NAI) for the Total Virus Defense package. This agreement includes, but is not limited to: McAfee Desktop VirusScan for Windows 95, Windows 98, Windows NT, Windows 2000, UNIX; Virex for Macintosh; and NetShield for NT and NetWare. These UC site licenses provide McAfee anti-virus products for all active faculty, students, and staff of the University of Cincinnati. The anti-virus software will automatically detect known types of viruses and remove them from desktops and servers. See attachment 11 for the AIT&L server security plan.

University of Cincinnati Medical Center Information Policy Checklist
The following checklist was developed by AIT&L and is the model for defining the current and future state of information policy at the departmental level.
# UCMC IT Policy Checklist

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<th>Desired Future State</th>
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<tr>
<td>General Policy on the Use of Information Technology</td>
<td>UC Policy</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td><a href="http://www.uc.edu/ucit/itgenpolicy.html">http://www.uc.edu/ucit/itgenpolicy.html</a></td>
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<tr>
<td>General Policy on IT Management (ITM)</td>
<td>UC Policy</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td><a href="http://www.ucit.uc.edu/department/genpolicy.asp">http://www.ucit.uc.edu/department/genpolicy.asp</a></td>
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<tr>
<td><strong>University-Wide IT Management and Security Issues (Tier 1 and 2)</strong></td>
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<tr>
<td>Tier 1 Firewall</td>
<td>UCit</td>
<td>UC Policy</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Tier 2 Firewalls</td>
<td>UCit</td>
<td>UC Policy</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Single point of entry in network</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Single sign on/authentication</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Network monitoring</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>Intruder detection</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>Encryption</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>Digital certificates/signature</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Eliminate “backdoors” (dialing into servers)</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>Security architecture, policies and procedures</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>University-wide security training</td>
<td>UCit</td>
<td>Best Practice</td>
<td>UC Policy</td>
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<tr>
<td>Security testing (External Probe Risk Assessment)</td>
<td>UCit</td>
<td>Best Practice</td>
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<tr>
<td><strong>Administrative</strong></td>
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<tr>
<td>Assign Information Technology Coordinator (ITC)</td>
<td>Dean/Chair</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td>Assign “Technology Managers” (TM)</td>
<td>Dean/Chair</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td><strong>Physical Security</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Turn off all desktops when not in use or in emergency</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td>Mission critical production servers in secure location</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
<td>UC Policy</td>
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<tr>
<td>Mission critical production servers will be fault tolerant</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
</tr>
<tr>
<td>Mission critical production servers maintenance (battery+)</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
</tr>
<tr>
<td>Lock down PCs, TVs, VCRs in unsecured areas</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Mark/Engrave all items of value</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td><strong>Protection of information</strong></td>
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<tr>
<td>Mission critical production servers backed up</td>
<td>TM</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td>Mission critical production servers on UPS support</td>
<td>TM</td>
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<td>Mission critical production servers w/failure alerts</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
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<tr>
<td>Rotate production backups off-site</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
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<tr>
<td>Disaster recovery plan</td>
<td>TM</td>
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<tr>
<td>Consolidate servers for ease of Administration</td>
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<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td>Prevention of unauthorized access</td>
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<tr>
<td>Enforce password changes every 60 Days</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
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<tr>
<td>Follow password change procedures if not enforced</td>
<td>TM</td>
<td>Best Practice</td>
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Detection of security breaches

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<td>Install/maintain desktop anti-virus Software</td>
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<tr>
<td>Automation of desktop anti-virus files</td>
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<td>Install/maintain server anti-virus Software</td>
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<td>Automation of server anti-virus files for currency</td>
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<td>Tier 3 firewalls for mission critical production servers</td>
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Change Control

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<tbody>
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<td>Maintain desktop software baseline w/patches</td>
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<td>UC Policy</td>
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<tr>
<td>Automate currency of desktop software baseline</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td>Maintain currency of server software w/patches</td>
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<td>AIT&amp;L Policy</td>
<td>UC Policy</td>
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<tr>
<td>Maintain desktop/server hardware Baseline</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
<td>UC Policy</td>
</tr>
<tr>
<td>Maintain software updates image/CD-ROM</td>
<td>TM</td>
<td>AIT&amp;L Policy</td>
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<td><strong>License Management</strong></td>
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<tr>
<td>Maintain records of software licenses and hardware</td>
<td>TM</td>
<td>UC Policy</td>
<td>UC Policy</td>
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<tr>
<td>Software metering to manage licenses</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td><strong>Remote Security</strong></td>
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<tr>
<td>Dial-in, Cable modem, XDSL, Wireless</td>
<td>TM</td>
<td>Best Practice</td>
<td>Best Practice</td>
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<tr>
<td><strong>Affiliate Issues</strong></td>
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<tr>
<td>Children’s Firewall</td>
<td>Children’s</td>
<td>In Place</td>
<td>In Place</td>
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<tr>
<td>Alliance Firewall</td>
<td>Alliance</td>
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<td>Vet Admin Firewall</td>
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<tr>
<td>UC Physicians</td>
<td>UCP</td>
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