Strategic Planning Report of the Information Policy Advisory Committee

Supplement

September 1998
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**Attachment A**

**VMG Informatics Committee: Formation, Membership, Process, Priorities**

**Attachment B**

**Information Technology: Opportunity and Strategy**

**Attachment C**

**The Networked Health Enterprise: A Vision for 1008**
I. Introduction

This report supplements the Vanderbilt University Medical Center (VUMC) 1995 strategic plan for information management (Strategic Planning Report of the Information Policy Advisory Committee, 1995). Since that report was published, each major organizational unit within the Medical Center has completed a strategic plan and the individual patient care centers have developed business plans. The 1997-1998 meetings of the VUMC Information Policy Advisory Committee (IPAC) were focused upon incorporating needs and priorities expressed through these diverse organizational strategic planning processes into its strategic plan for information management. The Informatics Center has also developed a series of plans and proposals to address specific institutional priorities.

This report documents the following:

- Enterprise information management needs and priorities of the:
  - Schools of Medicine and Nursing, Vanderbilt Medical Group, and Vanderbilt Health Services based on presentation and discussion of their strategic plans with IPAC in 1997.
  - Clinical Enterprise based on the participation of IPAC members in 1997 retreats that integrated the plans of the components of that enterprise.
  - Vanderbilt Medical Group’s Informatics Committee based on presentation and discussion by the committee chairman with IPAC in early 1998.

- Informatics Center plans to address key institutional priorities:
  - Division of Biomedical Informatics Academic Program
  - Networked Computer User Support Program
  - Information Policy Formulation Process
  - Decision Support Infrastructure
  - Medical Records Strategy
  - Eskind Biomedical Library 5-Year Plans
  - Grant Preparation and Submission Process

- Priority projects currently underway or incorporated in the 1998-99 budget to support these priorities and continuing information management requirements throughout VUMC.
II. Background

A. Mission

In July 1991, the Vanderbilt University Medical Center (VUMC) launched a strategic initiative to establish a Medical Center-wide Integrated Advanced Information Management System (IAIMS)\(^1\).

The 1995 strategic plan defined the mission for the information management function within VUMC:

- To support the highest standards in health care education, biomedical research, and patient care through the provision of an integrated advanced information management system (IAIMS) as a strategic resource for VUMC. The IAIMS will support:
  - Management of information as a shared resource,
  - Use of communication to integrate activities across organizational and geographical boundaries, and
  - Provision of tools for process redesign and improvement.
- To fuse scholarly research in biomedical informatics with the dissemination of the resultant knowledge to individuals and to operational use in the IAIMS infrastructure.

B. Information Policy Advisory Committee (IPAC)

IPAC was formed in 1992 to oversee VUMC’s ongoing planning and policy formation processes in the broad arena of information management. The desired outcome for this group’s work is the development of shared visions that are then reflected in the plans of individual operating units. Members of IPAC are key institutional stakeholders appointed by the Vice Chancellor for Health Affairs.

Planning for information management requires both top-down (how to develop the plan and implement the infrastructure) and bottom-up (new ways of doing work) input. An ongoing planning process is an essential component of an opportunistic strategy. It helps direct investment of central funds at the margin to generalize individual initiatives so they result in reusable infrastructure. Planning reports give faculty, staff, and students a glimpse of what outcomes are possible if they work together toward the objectives in the plan. They also show individuals when the functionality they need to do a task will become available, allowing them to decide if they need to adopt interim solutions to meet their business needs.

The 1995 strategic plan was developed in a series of iterative steps. It began with a visioning process to identify external pressures for change, internal change initiatives, attributes that would be desirable in the future, and scenarios of how VUMC’s work might be accomplished in the future. The next phase identified the mission, goals, and objectives for the information management function at VUMC. The final phase involved the creation of a five-year road map for providing end user function. This phase identified desired capabilities, collapsed those capabilities into potential projects, and finally developed three distinct views of those projects:

- Organized by user perception of priority to emphasize overlapping need across user domains
- Organized by the type of work required, such as enabling access to new information resources, creating new integrative resources, enabling changes in work processes, developing new products, supporting management and leadership decision making, or formulating policy and strategy
- Organized by how the projects might be sequenced over time to identify inter-project dependencies.

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\(^1\) Our planning process was supported, in part, by a two-year IAIMS planning grant from the National Library of Medicine, awarded in early 1993, and a five-year IAIMS operations phase grant, awarded in 1995. We gratefully acknowledge the NLM’s continuing support.
This set of views has guided decision making about which projects to undertake each year. Priority has been given to projects that meet critical business needs, leverage infrastructure put in place through prior work, and establish infrastructure for subsequent tasks.

In July 1995, IPAC initiated a follow-on planning process to identify strategic opportunities for use of information services to support affiliates in our rapidly expanding health services network. That process is documented in a July 1996 report, *Affiliate Information Services Planning*.

In 1996, IPAC established two broadly representative groups to support planning and policy development. The Information Policy Support Team develops and coordinates VUMC-wide review of new and revised polices concerning confidentiality, security, and other information management issues. The Web Advisory Committee recommends and publishes policies and standards related to VUMC World Wide Web presence.

IPAC’s tactical counterpart is the Information Management Steering Committee (IMSC). IMSC assists in developing shorter term (6-19 months) project plans and in making resource allocation decisions. IMSC members are selected by IPAC and include the operational officers of units within VUMC and representatives of other key user groups. IPAC and IMSC jointly receive physician input from the VMG Informatics Group.

IMSC has established three additional sources of input. The Organizational Unit Support Committee designs and advises on workable, cost-effective approaches to equipping and supporting individual users of computing services. The Financial Users Forum reviews, prioritizes, and recommends resource allocation for Customer Service Requests and proposes alternative solutions for VMG, Admitting, Patient Accounting, Medical Information Services, and Financial Management. The Patient Processing Forum gives users in clinical areas a voice to recommend priorities, makes decisions on priorities based on the strategic plan, makes recommendations on system issues impacting users, acts as a forum for system issues that need to be communicated, assesses readiness and makes recommendations for major implementations, and provides assistance in evaluating systems.

In 1997-1998, IPAC focused on updating the 1995 plan to reflect additional needs and priorities expressed through a variety of organizational strategic planning processes. The sequence of IPAC’s development and updating of the strategic plan for information management is illustrated in Figure 1 on the following page.

Members of IPAC during 1997-1998 included:

- John Chapman, M.D., Dean, School of Medicine
- Colleen Conway-Welch, Ph.D., R.N., Dean, School of Nursing
- George Forsyth, Chief Financial Officer
- James Geraughty, M.D., Associate Vice Chancellor for Health Affairs
- Joel Hardman, Ph.D., Associate Vice Chancellor for Health Affairs, Research
- Joel Lee, Executive Director, Communications
- John Sergent, M.D., Chief Medical Officer, Vanderbilt Medical Group
- William Stead, M.D., Associate Vice Chancellor for Health Affairs, Informatics
- Norman Urmy, Executive Vice President, Clinical Affairs
Figure 1: Development of Strategic Plans for Information Management

Input from IPAC's Domain Committees

Patient Care Domain

Research Domain

21st Century Task Forces

Collaborative Organization Design

Major Project Plans (EPIC, PACS, Collaborative Care)

School of Nursing Strategic Plan (1994-97)

Input from Other Institutional Planning Processes

Affiliate Information Services Planning (1996)

Information Policy Development (1996-98)

Clinical Enterprise Group Strategic Plan (1997)

VMG Informatics Committee (1997-98)

Informatics Center Planning Projects: Division of Biomedical Informatics Academic Program; Decision Support Systems; Medical Records Strategy; Eskind Library 5-Year Plans; Grants Management

New Visioning Process

Information Policy Advisory Committee (1993-95)

Strategic Plan for Information Management (1995)

VMG Strategic Plan (1997)

Strategic Plan for Clinical Enterprise Group Strategic Plan (1996)

VUMC Managed Care Strategic Plan (1996)

Strategic Plan for the Academic Enterprise – School of Medicine (1996)

Information Policy Advisory Committee (1995-98)

Strategic Plan for Information Management – 1998 Supplement


Strategic Plan for Information Management (2000)

New Institutional Planning Efforts

Informatics Center Planning Projects: Division of Biomedical Informatics Academic Program; Decision Support Systems; Medical Records Strategy; Eskind Library 5-Year Plans; Grants Management

New Visioning Process
III. Enterprise Strategic Plans

A. Process

In 1997, four key operating units of the Medical Center presented their strategic plans and informatics needs to IPAC.

- School of Medicine (VSM): The Strategic Plan for the Academic Enterprise of the School of Medicine was developed in 1996 with broad-based participation of faculty, fellows, students, and staff. It proposes initiatives to enhance biomedical research, biomedical education, technology transfer, and academic life. The Council of Class Officers initiated a formal student response (VSM-s) to the final draft; this response was submitted in mid-1997.

- School of Nursing (VSN): VSN faculty began a comprehensive strategic planning process in 1994 to determine the future direction for the School and to position VSN as one of the top three private schools of nursing in the country.

- Vanderbilt Medical Group (VMG): VMG conducted a strategic planning process in 1996-1997 to identify core strategic goals with supporting strategies and objectives. The four goals are to develop and implement business systems and other infrastructures for success, for VMG to be responsible and accountable for all clinical activities, to increase market share, and to provide a patient-focused system of care.

- Vanderbilt Health Services (VHS): VHS coordinated development of the VUMC Managed Care Strategic Plan in 1996. This plan establishes goals for product, place, promotion, partners, price, and process.

An IPAC meeting was devoted to each of the four strategic plans. Leaders of the operating units presented key aspects of their plan: a summary of the strategic themes that emerged in the plan, in-depth focus on strategies dependent upon informatics or information technology infrastructure, and their priorities for institution-wide informatics support and/or infrastructure. Discussion was used to clarify the strategies and requirements, to consider how the plan interacts with others, and to identify additional strategic opportunities in which enterprise information management support would be beneficial.

Each operating unit was asked to review the minutes of their session to ensure that the presentation and discussion were captured appropriately. In addition, Informatics Center staff independently reviewed each of the four plans. Once all of the presentations were complete, Informatics Center staff consolidated the key aspects of the plans across the four operating units.

B. Findings

The operating unit strategic plans outline the following fundamental strategies:

1. Foster interdisciplinary research that leverages Vanderbilt’s strength in linking the bench to the bedside. (VSM,VSN,VHS)

2. Utilize technology transfer as a revenue source for facilitating research and education and as a source of good will in the region and nationally. (VSM,VSN)

3. Establish Vanderbilt University as our students’ lifetime “anchor” for their professional careers. (VSN)

4. Develop communication and informatics based learning environments to enhance on-site learning experiences, to support on-site/off-site linkages, and to provide new revenues through licenses to other institutions. (VSM, VSN,VHS)

5. Establish a high quality, patient/customer-focused, evidence-based integrated delivery system. (VSN,VHS,VMG)
6. Increase market share and establish VUMC as an essential component of any network. (VHS, VMG)

7. Hold each person and organizational unit accountable for quality and productivity. (VSM, VHS, VMG)

8. Partner with other institutions in national and international endeavors. (VSM, VSN)

9. Improve awareness of and preference for VUMC services among payers/brokers, employers, referring physicians, patients, students, staff and faculty. (VSM, VHS)

These elements of the plans require enterprise informatics support:

1. Target the area of informatics as a key competency. (VSN)

2. Target the area of computational biology as one of the areas of enrichment. (VSM)

3. Establish an informatics core facility devoted to the research enterprise. (VSM, VSN)

4. Develop an enhanced VUMC grants management office that uses information technology to streamline processes. (VSM, VSN)

5. Support innovative methods to enhance learning (e.g., both pre-clinical and clinical). (VSM-S)

6. Provide information management support for on-site and off-site practices that enable integrated patient care across the continuum and best of class business processes. (VSN, VHS, VMG)

7. Provide information to providers to understand the market and manage accountability for service levels, outcomes, productivity and financial risk. (VHS, VMG)

8. Develop the capacity to predict and monitor the impact of a contract on each component of our institution: physicians, hospital, health plan, etc. (VHS, VMG)

9. Develop meaningful ways to demonstrate quality and prove our effectiveness to payers (VHS), students and potential students (VSM-S).

When reviewing the four plans, IPAC discussed additional informatics-based strategies that should be fully incorporated into the operating unit plans:

1. Utilize asynchronous learning networks to provide Vanderbilt branded degrees and certificates to students distributed across the region or even in remote international sites.

2. Support “just in time” learning. For example, systems which interact with the provider of care at the time decisions are being made can identify “teachable moments.” Instruction can then be delivered synchronously or via store and forward mode over the network.

3. Develop modularity across our various curricula. A library of reusable simulations and learning models and materials might assist faculty to incorporate information technology into courses.

4. Facilitate collaborative work within and across organizational and geographic boundaries. Collaborative work or groupware products might enable distance collaboration in a way that reduces the number of investigators that Vanderbilt needs to retain in an area to have the critical mass necessary to establish a leadership position.

5. Utilize new publishing methods. New publication models may allow the reader to see the actual data upon which a paper is based and to perform computation on that data. VUMC may want to retain ownership of the copyright of the intellectual property it produces.

A complete list of the 46 desired informatics capabilities expressed through the four plans is provided in Table 1.
<table>
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<tr>
<th>Table 1: Informatics Capabilities from Enterprise Strategic Plans</th>
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<tbody>
<tr>
<td><strong>Investigator Resources</strong></td>
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<tr>
<td>1. A WWW page with links to important on- and off-campus biomedical research informational services.</td>
</tr>
<tr>
<td>2. Searchable database of faculty research interests, expertise, important publications, and unique sharable reagents (faculty in all Schools of Vanderbilt University whose research activities are even remotely related to biomedical research initiatives).</td>
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<tr>
<td>3. A searchable database of research grant support in place for current faculty and trainees.</td>
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<tr>
<td>4. A searchable database of available extramural research funding from government and private resources.</td>
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<tr>
<td>5. Training for use of patent databases to minimize “replication of discovery.”</td>
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<tr>
<td><strong>Research Administration and Technology Transfer</strong></td>
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<tr>
<td>6. Streamline grants submission &amp; management processes including access to a database of Other Support, Animal Care approval dates, IRB approval dates, CRC approvals, and other information essential for preparing grants and renewals.</td>
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<tr>
<td>7. Electronic grant proposal routing and submission (internal and external).</td>
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<tr>
<td>8. Streamlined interface between grants management and technology transfer processes.</td>
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<td><strong>Support for Use of Informatics Resources</strong></td>
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<td>10. Provide data management expertise and support to assist clinical investigators in performing clinical research, including data managers.</td>
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<tr>
<td>11. Access to computers and software expertise to assist clinical investigators in developing and maintaining important patient databases and in facilitating information flow among multi-institutional research sites.</td>
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<tr>
<td>12. Integrate medical informatics skills in curricula - database skills, coping with information explosion, informatics competency exercise.</td>
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<tr>
<td>14. Computational and analytic resources to enable faculty to access programs that compile information and make it accessible to research scientists; that provide computational means for identifying sequences and motifs; that scan the genome for sequence context, i.e., proximity to known genes, intron/exon boundaries, and cis-regulational motifs.</td>
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<tr>
<td>15. Recruit an investigator team with specialties in informatics innovation in support of biomedical research.</td>
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<td>16. User evaluation and team planning for support services, including bioinformatics, provision of network and desktop services, and Medical Center library.</td>
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<tr>
<td><strong>Management of Health Care Services</strong></td>
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<td>17. Support for management of patients and operational processes within and across practice sites.</td>
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<td>18. Coding standards for clinical data and resource consumption to allow aggregation of VUMC data with that of other institutions for population research, practice bench marking and market share analysis.</td>
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<td>19. Patient data to support clinical research including a registry of patient information regarding syndromes, complex traits, or other clinical enigmas that may represent single or multifactorial inherited defects.</td>
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<td>21. Support for consultations to rural or suburban physicians and other health care providers in their practices.</td>
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<td>22. Support for credentialling.</td>
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<td>23. Models to handle severity adjustment, costs, costs of practice, costs of education, productivity and market forecasts.</td>
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<td>25. Data to support outcomes research within and across sites.</td>
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<td>26. Track utilization by patient, employer, payer, and plan.</td>
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<td>27. Support for contract management.</td>
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<tr>
<td>28. Market data to identify site requirements, manpower requirements and feasibility of new products.</td>
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<tr>
<td><strong>Table 1: Informatics Capabilities from Enterprise Strategic Plans</strong></td>
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<tr>
<td><strong>Management of Learning Services</strong></td>
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<tr>
<td>29. Enable cradle to grave relationship management (from first inquiry to last bequest).</td>
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<tr>
<td>30. Identify best practice learning and teaching strategies.</td>
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<td>31. Develop standardized method to evaluate teaching effectiveness as input to the tenure /promotion process.</td>
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<td>32. Integrate across disciplines in the pre-clinical curriculum and align it with the goals of the clinical years.</td>
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<td>33. Foster student faculty partnerships in learning.</td>
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<td>34. Develop remote and international learning sites.</td>
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<td>35. Facilities to support computer-assisted teaching methods.</td>
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<td>36. Distance learning and network-based health education programs.</td>
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<td>37. Support for educational outreach -- to K-12, other higher education programs, CME, etc.</td>
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<tr>
<td>38. Support for clinical education in off-site settings.</td>
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<td>39. Support for bringing students into contact with members of the community throughout the curriculum.</td>
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<td>40. Support for increased interaction with Meharry Medical College.</td>
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<th><strong>Internal &amp; External Communications</strong></th>
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<tr>
<td>41. A WWW page of Vanderbilt research news, postdoctoral positions, and other opportunities for those outside the institution interested in our research programs.</td>
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<td>42. Career development web site.</td>
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<tr>
<td>43. Database linking faculty research activities to potential applications to link investigators with commercialization opportunities.</td>
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<tr>
<td>44. Computer-Based Science Kiosks that would be established within the institution to emphasize the breadth of exciting science advances that are occurring institution-wide, the clinical advances we are achieving, and the opportunities for technology transfer that basic and clinical research discoveries are fostering.</td>
</tr>
<tr>
<td>45. A WWW page describing clinical research initiatives at VUMC, alerting the national public about patient populations uniquely served at our institution.</td>
</tr>
<tr>
<td>46. Clinical research opportunities web page for patients and providers.</td>
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IV. Related Enterprise Planning Efforts

A. Clinical Enterprise Goals

VUMC’s Clinical Enterprise Group (CEG) initiated an integrated strategic planning process in 1997. CEG now has a detailed vision framework and has identified a manageable set of eleven critical initiatives required to move toward the vision and to close apparent gaps. Two of these initiatives are informatics-related: (1) support for analysis of profitability and quality and (2) expanded MIS network capacity and reliability.

Support for Analysis of Profitability and Quality.
The long-term goal is to provide access to an integrated decision support system for the leadership of the Patient Care Centers, the Vanderbilt Medical Group, Medical Center Department Heads, Financial Management, and other appropriate individuals. This system will support interactive review and analysis of data related to market share, productivity, cost, profitability, satisfaction, and clinical outcomes for the segments of the enterprise for which each of its users is held accountable.

The first phase is to provide patient encounter data combined with a sophisticated cost accounting algorithm that allows profitability analysis for the Patient Care Centers and more finite clinical programs. Each center will be able to integrate inpatient and outpatient databases to determine the total cost of the management of a case and model the output against planned changes in clinical practice. The opportunity exists to evaluate the impact of volume on staffing and supply requirements through a flexible budgeting module. An English language variance analysis will provide a narrative explanation of a center’s financial performance.

Purchase of the Transitions Systems Incorporated (TSI) Transitions II system was chosen as the best way to complete this first phase as rapidly as possible. This software is based upon an Oracle database, and uses an extensible data model. Through subsequent projects, it will therefore be possible to incorporate data from any operational system (e.g. Marketing, OR scheduling, satisfaction, clinical parameters, etc.) so that they can be analyzed with the financial data. We are now in the process of implementing the TSI system.

Expand MIS Network Capacity and Reliability.
The long-term goal is to provide enterprise-wide “one stop shopping” for services and information based upon need and authorization. The network infrastructure should integrate distributed sites so that they have the same data and communication services as sites at home base. It should support access to VUMC services by affiliated physicians, research partners, patients, and off-campus students. It should support telecommuting by faculty, staff, and students whether at home or on the road.

Three projects must be completed in parallel as the first step to achieve this goal:

• **Strengthening the backbone data network to provide physical redundancy and protocols that support guaranteed quality of service.** Network re-engineering is a continuous process that leverages advances in technology to keep pace, “just in time,” with an exponential increase in demand for capacity and reliability. The core of a network usually requires the latest technology, and that technology has a 1-2 year life expectancy in that role. It can then be re-used at the periphery of the network where it has a 3-5 year life expectancy. Historically, the increase in demand has been a function of adding users. We are at a critical stage now because the majority of the increased demand is coming from new application architectures (such as the Web) that link resources from across the network to support a task. If any element causes a bottleneck or breaks, the entire system fails. The migration from a network architecture based upon protocols that share bandwidth to one that provides dedicated virtual paths for each user will take place in phases through FY01.

• **Acquisition of scaleable wide area network (WAN) services.** Our users have varying needs, ranging from e-mail, through Internet access, to massive file transfers. They will be
best served by having choices that allow them to match their access technology to their need and budget. It is increasingly common for faculty and staff to have a personal account with a retail Internet Services Provider (ISP) to give their family access to the Internet. We can expect most homes to be connected to the Internet in the future. Vanderbilt should begin to shift from providing a stand-alone facility for remote access and toward providing the infrastructure needed to access the Medical Center and University-Central resources via the Internet.

Currently, a major element of the cost of supporting remote access comes from helping people install access software on their personal computers and in solving problems related to wiring in the home and region. It is cost-effective to outsource that service to organizations that do nothing else, reserving Medical Center talent for help with Medical Center applications.

For people who need only the Internet Protocol (IP), a retail ISP is the most cost-effective solution. This solution is also the most flexible in that bandwidth and price can be adjusted at the individual level based upon need. Cost allocation can be split between the individual (for personal services they would have independent of VUMC) and VUMC (for services such as encryption and authentication needed for sensitive applications).

We are working with University-Central to increase the bandwidth on the path between the Internet and Vanderbilt University, to explore the possibility of providing a direct link to Vanderbilt University from one or more retail ISPs, and to arrange discounts for the Vanderbilt community for services such as Intermedia @Home.

An outsource contract with a virtual private network (VPN) is the most cost-effective way to support users who need multi-protocol access or who have repetitive trouble accessing VUMC applications. The VPN is private network that actually extends the VUMC network to the remote site. The connection can be funded at the departmental level if used exclusively for business and if the business use justifies the expense; or as a direct expense of a grant if special features of the service are required for the funded work. If the use is mixed personal and business, the department should be reimbursed for the difference between the cost of a retail ISP and the cost of the VPN. The goal would be to phase out the VPN as the multi-protocol requirement is eliminated and as VUMC applications become Web-based. The VPN invokes a cost per subscriber, as contrasted with a cost based upon number of simultaneous users. Departments should be aware that use of the VPN to support occasional users is not cost-effective and should be avoided where possible.

VUMC should not outsource encryption and authentication services, even for users of the VPN. These services should be applied at the level of the application instead of at the level of access to the network and that can best be done by VUMC.

- **Development of security policies and services.** This will involve multiple levels of network firewall, elimination of dial-in access to individual workstations, and a means of strong authentication of user identity.

In addition, the processes of the clinical enterprise will need to evolve to capture information about who needs access to which information to do their job (e.g., authorization to allow a referring physician to access a patient's record). Without this information, we cannot handle concerns about confidentiality adequately. Construction of the satellite data center is a prerequisite to eliminating single points of failure. The University's participation in Internet 2 and Project Abileen are related efforts. Use of the network to support electronic commerce will require additional components.

**B. Clinician Priorities -- VMG Informatics Group**

(Contact the Informatics Center at (615) 936-1424 for a copy of the VMG Informatics Group report.)
In parallel with the development of its comprehensive strategic plan in 1997, the Vanderbilt Medical Group established an informatics committee to provide clinician evaluation of current informatics programs that support the delivery of clinical care and to provide input as new projects are initiated or developed. This VMG Informatics Group reports to the VMG Board, IPAC, and IMSC. Members are primarily active clinicians representing all major areas of clinical practice. Informatics Center personnel have also been members from the start. The VMG Informatics Group presented its 27 highest priority recommendations to IPAC in early 1998. The recommendations were organized in five categories: Medical Information, Physician Ordering and Scheduling, Clinical Charting, Communications with Informatics, and Practice Management. A complete listing is included in Table 2.
<table>
<thead>
<tr>
<th>Priority</th>
<th>Capability</th>
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<tbody>
<tr>
<td><strong>Medical Information</strong></td>
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</tr>
<tr>
<td>1</td>
<td>All transcribed clinical notes and testing reports in electronic form are available in MARS.</td>
</tr>
<tr>
<td>2</td>
<td>Physician emergency room records are available in MARS.</td>
</tr>
<tr>
<td>3</td>
<td>MARS accessibility for physicians.</td>
</tr>
<tr>
<td>13</td>
<td>Ability to search MARS for patient records by physician, diagnosis, etc.</td>
</tr>
<tr>
<td>21</td>
<td>Records in MARS from support services such as Nutrition, Physical Therapy, &amp; Occupational Therapy.</td>
</tr>
<tr>
<td><strong>Ordering and Scheduling</strong></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>“Rounding sheets” are created and printed automatically in advance for attending physicians.</td>
</tr>
<tr>
<td>7</td>
<td>Increased use of WizOrder by attending physicians by improving interface.</td>
</tr>
<tr>
<td>10</td>
<td>Schedule all appointments and tests, outpatient and inpatient, through a single system.</td>
</tr>
<tr>
<td>12</td>
<td>Ability to make a referral to another provider within Vanderbilt using a computerized mechanism.</td>
</tr>
<tr>
<td>14</td>
<td>WizOrder use in the outpatient setting.</td>
</tr>
<tr>
<td>16</td>
<td>WizOrder training processes/systems which do not require significant time commitments.</td>
</tr>
<tr>
<td>24</td>
<td>Support standing orders before admissions through WizOrder.</td>
</tr>
<tr>
<td>25</td>
<td>Support individualized pre-admit orders for physicians.</td>
</tr>
<tr>
<td>26</td>
<td>Develop customized templates for different services for WizOrder.</td>
</tr>
<tr>
<td><strong>Clinical Charting</strong></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Non-redundant, core clinical data is stored in a shared database.</td>
</tr>
<tr>
<td>8</td>
<td>Develop/implement standardized computerized office patient record.</td>
</tr>
<tr>
<td>18</td>
<td>Develop universal database and terminology for both clinical research and patient care.</td>
</tr>
<tr>
<td><strong>Communications with Informatics</strong></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Good communications with attending physicians regarding upgrades and changes to Informatics Center systems.</td>
</tr>
<tr>
<td><strong>Practice Management</strong></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Provide outcomes analysis tools (VOICE Project).</td>
</tr>
<tr>
<td>11</td>
<td>Improve speed of patient registration in EPIC.</td>
</tr>
<tr>
<td>15</td>
<td>Customized templates for different services in EPIC.</td>
</tr>
<tr>
<td>17</td>
<td>Patients receive only one bill for physicians and all ancillaries for a given encounter at Vanderbilt.</td>
</tr>
<tr>
<td>19</td>
<td>Labs and other tests are coordinated with clinic visits through a computerized system.</td>
</tr>
<tr>
<td>20</td>
<td>Individualized pre-clinic visit orders from physicians.</td>
</tr>
<tr>
<td>22</td>
<td>Support point of service billing.</td>
</tr>
<tr>
<td>23</td>
<td>Provide mechanism for standing orders before outpatient visits through WizOrder.</td>
</tr>
<tr>
<td>27</td>
<td>Ability to generate a single bill that covers multiple patients (e.g., when groups of patients are being worked up simultaneously after occupational exposure.</td>
</tr>
</tbody>
</table>
V. Informatics Center Planning Efforts

Additional planning efforts initiated by the Informatics Center to address key institutional priorities are described below.

A. Division of Biomedical Informatics Academic Program

(Contact the Informatics Center at (615) 936-1424 for a copy of the complete plan.)

The Division of Biomedical Informatics (DBMI) has developed a plan to fulfill its primary missions in 1997-2000:

- **Educational Mission:** To educate undergraduate, graduate, and postgraduate trainees in the theory and practice of biomedical informatics;
- **Research and Service Missions:** To develop and evaluate innovative technologies for the storage, retrieval, dissemination, and application of biomedical knowledge, in order to support clinical practice, research, life-long learning, and administration, and as a result, to contribute to the professional body of knowledge regarding biomedical informatics;
- **Professional and Ethical Missions:** To maintain cooperation and collegiality with all those who learn and work with us locally, nationally, and internationally; and, to develop and disseminate ethical and professional standards for the conduct of biomedical informatics research and for the utilization and evaluation of health care informatics applications.

**Plan for Educational Mission**

**Undergraduate Medical Education**

- Integrate education in biomedical informatics into the undergraduate medical school curriculum.
  - Ensure that undergraduates develop core competencies in using biomedical informatics applications as tools for life-long learning.
    - VMS I students will have lectures and workshops to introduce biomedical informatics and provide initial experiences in using applications as tools in biomedicine.
    - VMS I & II electives will introduce students to basic and advanced topics in biomedical informatics, including clinical information systems, systems to support biomedical research, legal and ethical issues related to biomedical and clinical computing, and logical analysis of cognitive processes in clinical medicine.
    - VMS III-IV training in MARS/Order Entry and successful use of these tools during clerkships.
    - Consideration of “Informatics competency exercise” as a requirement for graduation from VMS. The exercise would demonstrate sufficient mastery of this technology to use it productively for lifelong learning.
- Advanced electives for VMS III & IV students with greater interest in the work of professional biomedical informaticians.
  - For students with appropriate technical backgrounds, 4-12 week electives in system development and evaluation, under the tutelage of a faculty investigator.
  - An elective geared toward critical, analytic review of selected topics in the biomedical literature, for inclusion as part of educational programs or biomedical knowledge bases.

**Postgraduate Medical Education**

- Conduct training of house staff on use of clinical software that enables progressive use of decision support for their education (drug interactions, MEDLINE linked to charts, order sets as vehicles for representing faculty-determined “best practice” guidelines; cost-effective care, others).
- House staff can spend “research year” in biomedical informatics as Fellows.
- Design and teach 1 or 2 month electives in biomedical informatics for residents in medicine, pediatrics, surgery, OB/GYN, and/or psychiatry.

**Postgraduate Education in Biomedical Informatics**

- Establish a formal degree-granting Program in Biomedical Informatics at Vanderbilt.
• Offer primary DBMI graduate courses cross-listed with other departments. E.g., Introduction to Biomedical Informatics; Medical Expert Systems; Clinical Information Systems and the Electronic Medical Record; Biomedical Informatics Systems Development; Library-based Informatics Resources and Methods.
• Apply to Graduate Faculty to create formal DBMI-based Biomedical Informatics Masters and Ph.D. degree programs by 1999. Utilize DBMI-sponsored courses/faculty and existing graduate courses at Vanderbilt in Computer Science, Biomedical Engineering, Electrical and Computer Engineering, Cognitive Psychology, Education, Biostatistics, Management, and the new MPH program within the School of Medicine.
• Develop the Vanderbilt Training Program in Biomedical Informatics to a position of national prominence and leadership. Provide stipend and tuition support for postdoctoral trainees:
  • One new M.D. (or equivalent) fellow, preferably Board Eligible/Certified, per year
    • Estimated duration of training: 2-5 years (Applied vs. Ph.D. tracks)
    • Estimated steady state: 2-3 persons directly supported at any given time
      (after year 2, trainees obtain NIH NRSA fellowship support)
  • One new Ph.D. Student from Vanderbilt (BME/CS) supported during thesis, per year
    • Estimated duration of training: 3 years
    • Estimated steady state: 1-2 persons supported at any given time (after year 1, trainees expected to obtain NIH NRSA fellowship support)
• Consider developing a 1-2 week informatics CME course for 1-2 dozen local and national clinical personnel, to be given by DBMI faculty each summer at VUMC.

Visiting Professorships
• Have two Visiting Professorships per year (Spring/Fall) of 3-5 days each.

Educational Conferences
• Hold regular Educational Conferences at VUMC on Biomedical Informatics
  • Biomedical Informatics Research Conference, to be held weekly during academic year, offered for credit to students; to include research project presentations and journal club.
  • Biomedical Informatics Clinical Conference to be held weekly with house staff, and faculty over lunch, with focus on installed systems at Vanderbilt (planning, development, trouble-shooting).
  • Fellows/Trainees Conferences: One group conference on a bi-weekly or monthly basis, to discuss and review fellows’ research and history of biomedical informatics; once-monthly hourly meeting with Division Chief and Fellows/trainees to review individual progress.

Plan for Research Mission

Current Funded Grant Projects
• IAIMS, 1995-2000, $2.75M, NIH/NLM
• Knowledge Base Acquisition, 1996-98 (2 yrs), $100,000, NIH/NLM
• Telemedicine in support of Primary Care, 1995-97 (1 year total, extended 1 year), $45,000, NIH/NLM
• PC-POETS, 1997-99 (3 years), $1M, NIH/NLM

Other Ongoing or Anticipated Projects
• Research to develop model for local clinical software process quality review committees.
• Structured vocabularies and natural language processing.
• Institutional externalized repository databases.
• SIMON Project for integrated physiological monitoring.
• Plan to develop funded training and research grants at VUMC.
• Plan to develop prototypic institutional review and oversight processes for clinical software as part of national demonstration project.
• Evaluation of clinical impact of informatics systems; outcome database development.
• Training of future biomedical librarians.
• Library and biomedical informatics outreach projects.

Plan for Service Mission

Support of Educational Programs of Schools of Medicine and Nursing
• Support for non-DBMI VUMC faculty: continued workshops on use of E-mail, Web tools, new technologies for course directors.
Continuing Medical Education (CME): participation in VUMC CME committee; plans to pilot Web-based CME in 1997-98 with extended use thereafter, if successful.

Support of Hospital, Clinics, and Affiliates
- Order Entry Project.
- MARS.
- SIMON.
- Primary care affiliates/telemedicine.
- Service line support per developments at VUMC.
- Library outreach projects: AIDS, librarianship.
- Outcomes efforts: databases, MARS.

Support of Biomedical Investigators
- Increased emphasis on bioinformatics by Library.
- Clinical data analysis.

Plan for Faculty and Staff Recruitment
- Evaluation of impact of clinical applications: 1 faculty member, 1 biostatistician, 1 research coordinator.
- Database repositories, vocabularies, and natural language processing: 1 faculty member.
- State of the art clinical systems development: 1 faculty member.
- Bioinformatics development: 1 faculty member, 1 programmer.
- Biomedical informatics support for educational activities of the School of Medicine: 1 faculty member.
- Replacement of any departing faculty.
- Clinical application programmers to be supported through the Department of Information Management.

B. Networked Computer User Support Program
(Contact the Informatics Center at (615) 936-1424 for a copy of the complete proposal.)

In 1996, the End User Support Task Force (now known as the Organizational Unit Support Committee) developed a conceptual framework for support of networked computer end-users. Their purpose was to provide responsive, high-quality, operating-unit-specific, cost-effective support services for networked Medical Center computer users and their hardware and software systems.

Three fundamental principles will provide the basis for implementation and ongoing service operations:
- Operating unit choice of service models, including use of operating unit employees, external consultants, and the Networked Computing Support group within the Informatics Center;
- Participation in team processes, integrated problem tracking, and benchmark assessments; and
- Representative committee oversight.

Facilitative Assistance Support Team (FAST)
Networked computer users will receive support from a Facilitative Assistance Support Team (FAST). The FAST is a matrix organizational structure. It brings together Networked Computing Support (NCS) staff, operating unit employees and outside contractors who provide support for desktop computers, network connections, and file servers. The FAST objective is to provide responsive, operating unit specific service, while taking advantage of institution-wide scale to enhance reliability and cost effectiveness.

Individual FAST members report to either the manager of NCS or the Operating Unit Business Officer, or equivalent, depending upon the hiring or contractual relationship. In either case, priorities for service and funding levels are established by the operating unit. In the interest of optimal collaborative effort, operating units will make time for FAST members' participation in team processes.
FAST is managed through shared and integrated processes in lieu of a direct reporting structure. The key ingredients that will enable distributed decision making while steering in a common direction include: consensus standards, shared training and documentation, integrated problem tracking, and use of benchmarks for assessment of performance and efficiency.

NCS will be staffed to allow operating units, as well as the institution as a whole, to meet organizational goals. A full "skill set" will be developed (over time), or made accessible through contracts with outside resources. Since NCS is planned to have the capacity to deal with problems as they arise, operating units can experiment with the level of skills required for internal employees and with the balance between owning support vs. outsourcing it to NCS.

**Oversight**

Oversight will be provided by the Operating Unit Support Committee (OUSC) and the Technical Advisory Group (TAG). OUSC makes recommendations and provides input to the Information Management Steering Committee (IMSC). For example, OUSC will review utilization, costs, charges, and performance annually, and compare them to internal and external benchmarks. Based upon this review, the committee will recommend modification in NCS' structure, processes, contract options and terms for the next period. OUSC includes representatives of the operating units of the School of Medicine, School of Nursing, Hospital, Vanderbilt Medical Group, Medical Center Other offices, and the chairperson of the Technical Advisory Group. The Director of Networked Computing Support and the Administrative Officer of the Informatics Center will provide staff support. TAG is a representative group of technical opinion leaders charged with recommending consensus standards and processes for the FAST.

**Problem Management**

Each operating unit or other organization within VUMC will have a primary service provider (PSP). The PSP has primary responsibility within that operating unit for issues related to desktop computers, network connections, and file servers. In addition, the PSP will be a member of the FAST to ensure that networked computer users receive coordinated, responsive, quality, and cost-effective support.

An operating unit may obtain a PSP through a contract with NCS (see contract options below), through direct employment of a PSP in the operating unit, or from an outside contractor. In addition, operating units may have other employees who are able to resolve some questions quickly without interrupting or waiting for the PSP. These 'Technically Advantaged Neighbors (TAN)' may be expert on software (installation and maintenance) and/or applications (function and shortcuts).

NCS will support an integrated FAST Reporting System (FASTRS) database. This database will be used by all members of the team (employees of NCS, operating unit employees, and outside contractors) to monitor and escalate problems to resolution. It will provide a record of solutions of prior problems as a decision support tool, identify recurrent problem patterns as a quality improvement tool, and identify time spent by area as a cost-allocation, billing, and benchmarking tool. Data about performance, utilization and cost will permit comparison of operating units to one another, and VUMC as a whole to external benchmarks as a tool to guide iterative refinement of the FAST strategy.

**Contract Support Programs**

Operating units within VUMC may contract with NCS for support of desktop computers, network connections, and file servers through four support programs.

- **Managed Support Program (MSP).** The MSP contract provides service on a “per-workstation” basis. A participating operating unit selects an NCS PSP as their point of contact. The PSP will either provide services directly, or obtain those services from a subject expert within NCS. The contract specifies covered services, performance requirements, and unit responsibilities. Services not covered by the MSP can be obtained through the hourly support program (see below).
Operating Units which participate in the MSP will work together to minimize the cost of providing quality service by accepting the following responsibilities:

- Work stations set up according to the mass customization program;
- Use of hardware and software from the “recommended” list;
- Hardware configuration and backup from a network server where feasible; and
- Basic user literacy training or a operating unit contact who is computer literate (Technically Advantaged Neighbor, or TAN).

- Hourly Support Program (HSP). The HSP contract provides for service on an as-needed, hourly basis. This service can be used to obtain basic support as an alternative to participating in the MSP; to supplement the MSP for support of configurations designed to meet a special need; or to supplement the availability or expertise of operating unit employees. This “cost-plus” service is provided according to a published rate schedule. Rates will be based on the level of technical expertise of the person required to address the issue or to solve the problem.

- Personnel Support Program. This contract provides for one or more full-time PSPs to be located in the operating unit. Hardware and software would be selected from the recommended or supported list if practical, but other configurations would be supported subject to the operating unit’s providing the necessary technical training.

- Outsourced Consulting. Expertise for some installations may not be available from within NCS. NCS will contract for these services and pass along the cost to the user areas that create the requirement.

C. Information Policy Formulation Process

In 1996, IPAC created a cross-functional Information Policy Support Team (IPST) to focus on development of policies to address the need for policies governing the management and use of information and information technologies. IPST includes representatives of the key stakeholders within VUMC: School of Medicine, School of Nursing, Biomedical Sciences, Vanderbilt Medical Group, Vanderbilt University Hospital, and Vanderbilt Health Services. Key staff functions are also represented: Financial Management, Risk Management, Human Resource Services, General Counsel, and the Informatics Center.

As its first task, this Information Policy Support Team (IPST) outlined a set of policy objectives, which provides a framework for our overall information policy needs. The IPST started with a draft compiled using the JCAHO standards, policy documents obtained from a wide variety of institutions, and current understanding of VUMC’s needs. Our current set of policy objectives provides high-level statements of intent within each of the following areas:

- Information Policy Formation
- Information Management Processes and Applications
- Information Management Architecture
- Protection of Data and Systems
- Informed Consent
- Data Stewardship, Accuracy, & Sharing
- Dissemination of Information
- Processes, Outcomes, & Evaluation
- Knowledge-based Resources & Intellectual Property
- Facilitating Use
Another key task of the group was to develop an understanding of the various policy-making processes within the major organizational units of the Medical Center, and to develop a new process for review and endorsement of a single set of information policies across all of those units. As a result, we now have a process for building enterprise-wide consensus on information policy. For each policy, members of the IPST work together to understand our current situation and needs, to learn about statutory and regulatory requirements, applicable JCAHO standards, and practices in other organizations, and to solicit initial input from their organizational units. One member of the group takes responsibility for drafting the policy. It is then circulated within IPST for comment and revised in an iterative fashion. Once the IPST is reasonably satisfied with its draft, a formal review process begins.

Each of the stakeholder and staff units identified above has a liaison within the IPST. The liaisons go to key groups within their organizations to present, advocate for, and obtain input on the draft policy. The policy author then consolidates and responds to the individual comments, by making appropriate changes to the draft or by preparing written responses. A new draft is circulated with the comments and discussed within IPST. Once a final draft is created, another formal process of policy endorsement is initiated. In this process the liaisons again present the final drafts, pointing out key changes and showing their constituencies how their original input has been addressed. The goal at this stage is to have each organizational unit endorse the final draft. If fundamental disagreement exists among the organizational units, the issues can be discussed and negotiated within the IPAC. This process is illustrated by Figures 2 & 3 above.

D. Decision Support Infrastructure

The Information Technology Integration group within the Department of Information Management has worked with key customers within VUMC to develop a plan for providing them with increasingly sophisticated information support. The key goals for information support are to:

- Provide quality of care analysis. We need information support to compare our current practices with external standards of care documented in data from sources such as UHC, MEDPAR, HCIA, and others. We want to be able to track our own variance from locally
established clinical pathways using PathworX. We need better capabilities to analyze outcomes along many dimensions.

- Provide financial and marketing decision support. We want to be able to compare our resource allocations on a severity adjusted basis. We need to be able to perform comparative analyses of operations, productivity, and staffing among our patient care centers. We must be able to make comparisons internally and using data from other hospitals from proprietary databases. We also need support for modeling and strategic planning.
- Provide clinical data for research and education. We need a central repository for clinical studies and a source for outcomes and exploratory data analysis. We need information support for educational interventions and educational evaluation. We need the ability to allocate costs among patient care, research, and educational programs, and we must be able to provide centralized hardware support for research databases.
- Integrate capabilities described above.

Figure 4 below illustrates the data repository architecture that will allow us to access data from multiple applications in meeting our decision support requirements. Data from our many information systems (e.g., Lab, EPIC, MEDIPAC) will be stored in well-specified formats in the various databases that constitute VUMC's business data warehouse. This data will be aggregated into useful information for decision support through the interaction of authorized users with specialized applications (e.g., Transition Systems Inc. (TSI) products for financial information).

The plan calls for a phased approach illustrated by Figure 5:
- Initial rapid deployment of tools to ramp up functionality. We deployed the VOICE system in early 1998 to provide on-line web-based patient care center-based reporting.
- Concurrent selection of more sophisticated tools for financial outcomes analysis. We began implementation of TSI products in early 1998 with planned project completion late 1998. TSI will support ad hoc reporting.
- Start collection of additional outcomes indicators and clinical data.
- Develop on-line analytical processing (OLAP) and relational on-line analytical processing (ROLAP) capabilities using both web-based and more powerful applications.
- Develop sophisticated data mining capabilities. Data mining tools can spot trends we don’t even know to look for.
Figure 6 illustrates how users of web-based applications and users of more powerful drill down applications will have access to multiple data marts for both summary data and more detailed data from the repository. The Oracle-based data repository on the RS-6000 server will be used to generate the historical summary data required for comparative analysis over time. This data will be stored in specialized data marts on WindowsNT servers. Transaction level repository data will also be downloaded to WindowsNT servers to allow on-line analytical processing queries without degrading response times for users of transaction processing systems. Users of web-based decision support applications will have access to both the summary data and detailed data, as will users of the OLAP drill down applications.

Several issues must be resolved as we provide increasing levels of information support:
- Confidentiality. Our current approach is to encrypt patient identifiers and physician identifiers for those users who do not need access to this information. Supporting increased levels of privacy reduces ease of access and increases the implementation effort.
Relative value unit (RVU) assignments. Universal deployment of RVU's is costly and difficult. Since major variances are found mainly in Lab, Radiology, and Operative Services, our current approach is to focus on these and approximate the rest.

Implementation of indicator vendor(s). We've decided to adopt a new comparative database to benchmark our performance. It will be challenging to implement the system and train users while doing the same for the repository described above.

Training. To date, tools have been underutilized despite significant support efforts. A growing family of capabilities will require a new approach to training.

E. Medical Records Strategy

The Medical Records Visioning Team was formed in 1997 to develop a strategy for substituting electronic records for manual processes. The following are members of this team: Marilyn Dubree, M.S.N., R.N., Sue Erickson, M.P.H., R.N., Drew Gaffney, M.D., Dario Giuse, Dr.Ing., Mary Reeves, Racy Peters, R.N., Bill Stead, M.D., Lynn Webb, Ph.D..

The team’s current plan will accomplish the transition to electronic records in three phases:

**Phase I:** (Full-scale implementation over 3-6 months)

1. Port notes, summaries and reports that are in computer-readable form into the Medical Archival System (MARS) repository.
   - All clinical results and all notes that are transcribed or generated by systems will be ported to MARS and any corrections will be reflected in MARS. Any unit that charges for a clinical test will produce that result in computer readable form. Clinical notes may continue to be handwritten unless communication to other sites is essential (e.g., Emergency Department).
   - Provide a mechanism to track status of a note or report to insure all steps take place (e.g., transcription, shadow chart, medical records, MARS, referring physician). Track rejection by Quality Control because of incomplete patient identification and correct on-line. Re-link records to the correct patient if identification errors are discovered. Educate physicians regarding identification issues.

2. Migrate to on-line edit and electronic signature
   - Indicate by provider and report type if electronic signature is to be utilized. Create an inbox, by provider, of reports awaiting edit/signature. Reports will be final after being edited and signed on-line. Will need a function to allow a second user to take over an inbox for coverage, etc., and a process for handling compliance issues related to countersigning for someone else. Will need to report overdue signatures to medical records.

**Phase II:** (Pilot in 3-6 months with full-scale implementation in 6-12 months)

3. Monitor actions that must follow an episode of service.
   - Classify types of episode of service by required follow-up actions (e.g., procedure, note, bill), time before action is expected, and escalation point. Track each episode of service in a database, monitor follow-up actions for completion and escalate as required.

4. Select chart components interactively before the encounter.
   - Develop a display that allows an assistant or provider to browse an appointment schedule, toggle the chart request flag on or off, and select which MARS-based reports should be printed as part of the pre-encounter package. A “Wiz-to-go” look alike is an alternative.
Phase III: (Pilot in 3-6 months with full roll out over 3 years)

5. Clinical Notes template.
6. Compliance editing.

Figure 7 below illustrates VUMC’s electronic patient record strategy. Text reports from systems, text editing applications, and specialty-specific structured data capture applications are archived by MARS on an array of parallel servers. This archive provides a single point for signature, reporting, and browsing. Every word and number in every document is indexed and a combination of parallelism and caching is used to achieve adequate retrieval response. A relational database host supports development of common terminology across applications developed by specialties, core data tables such as the enterprise identifiers and encounter information, and tables of data from the specialty applications.

Figure 8 below illustrates how we might migrate to electronic signature and capture of structured data. The steps in the current process (1) include dictation, transcription, transfer to MARS as a draft, manual signature, and correction/finalization in MARS. On-line edit and signature (2) will replace the last three steps of that process. Automated voice to text translation (3) will replace dictation/transcription. Automated voice to text translation (3) requires on-line edit and signature (2). An entirely new process (4) will include direct creation, editing and signature of a note with template-based structured data capture. This new process can be used by some providers while others use a mixture of (1)-(3).

F. Eskind Biomedical Library 5-Year Plans

EBL’s key goals for 1998-99 are to:
- Refocus our collections to take advantage of electronic publishing and other new media.
- Develop and refine a world class World Wide Web presence for the Medical Center.
- Create a comprehensive Research Centers Assistance Program.
- Expand the existing Clinical Informatics Consult Service.
- Empower VUMC patients and their families through provision of a Patient Information Service.
- Evaluate and refine our programs and services through iterative planning and benchmarking strategies.

The Eskind Biomedical Library (EBL) has developed six five-year business plans that propose new services or expansion of current services. These plans are summarized in this section. Each plan provides confidential detailed projections of service volume, expenses, and revenues, which are not provided below.

Clinical Informatics Consult Service
The proposed Clinical Informatics Consult Service is based on VUMC’s innovative Clinical Medical Librarianship (CML) program. This program brings librarians directly into the clinical setting, where they provide “just-in-time,” patient-specific information when and where it is needed for
effective clinical decision-making. Innovative features of VUMC’s program are designed to improve on traditional CML’s relatively low rate of positive impact on patient care:

- **In-depth Training.** EBL has introduced rigorous, ongoing training for clinical librarians. In-depth training prepares the librarian to be more proactive in the clinical environment, to search more effectively, and -- crucially -- to interpret the medical literature. Just as caseworkers, nutritionists, pharmacists, and others are acknowledged as experts in vital patient care areas, clinical librarians at VUMC establish themselves as legitimate partners in the provision of high-quality health care and contribute expertise in areas such as evidence-based medicine. Clinicians routinely rate VUMC librarians’ clinical understanding, as well as the utility of the information they provide, very highly.

- **Quality Filtering.** Beyond the added value of their expanded medical knowledge, clinical librarians at VUMC have a non-traditional view of the concept of “quality-filtering.” Traditionally, the word “filtering” refers to the literature search itself, and involves the systematic, programmatic, and sometimes intuitive use of specialized controlled vocabularies and other search parameters. Clinical librarians filter all of their CML searches in this way to retrieve an initial group of articles for review, and then filter the results of the search, hand-picking the most relevant articles. EBL librarians go beyond this step and read the full-text of the two or three most appropriate articles, highlighting passages that are highly relevant to the individual clinical case at hand. Librarians synthesize all of the highlighted information into a concise, informative written summary, which they deliver along with the articles on rounds. Senior librarians provide support and mentoring at every stage of this process.

- **CML Knowledge Repository.** To capture the expertise, time and effort librarians put into CML activities, VUMC’s CML program incorporates the ongoing creation of a searchable electronic database of all clinical questions librarians receive on rounds. Librarians enter each question, along with its filtered references and written summaries, into a relational database that has a World Wide Web interface. In the near future, this web-based database will be made available directly to rounding teams, bringing evidence-based learning directly into the settings where clinical teaching occurs.

Eskind’s CML program began in November 1996 with one librarian rounding on the Medical Intensive Care Unit (MICU). Currently, four librarians attend clinical rounds in the MICU, the Neonatal Intensive Care Unit (NICU), the Hematology/Oncology Myelosuppression Unit, and the Clinical Research Center (CRC). Clinical librarians spend about thirty percent of their time on CML activities. A librarian with ten months of experience spends only 1.5 hours per question. Their remaining time is spent pursuing educational activities, covering the reference desk, training patrons and colleagues, participating in collection development activities, and attending library meetings and other professional gatherings.

The CML business plan discusses the costs involved in expanding the existing CML program into a more comprehensive Clinical Information Consult Service. EBL estimates show that there are about 24 clinical units in the medical center that could include a clinical librarian on rounds. One experienced full-time clinical librarian can handle up to five clinical units.

**Research Centers Assistance Program**

The Eskind Library is also actively engaged in designing innovative programs to support biomedical research at VUMC and to meet the ever-increasing demand for library services by “outsourcing” their expertise, abilities, and resources. Working as information brokers for a research center, librarians can provide current, high-quality information tailored to the needs of the research center as a whole and to the needs of individual investigators. EBL’s services may include using electronic reference and customized web pages to provide information at the desktop, training investigators on various databases, and providing assistance with grants.

Given the importance of research to VUMC, EBL has established a pilot project for investigator assistance. Initially targeting two centers, VUMC’s top-ranked Center for Pharmacology and Drug Toxicology and the Clinical Nutrition Research Unit, the library has organized teams of librarians to work with each center. Core components of an assistance plan were identified from models of
assistance developed by EBL for the department of molecular biology and the HIV/AIDS Outreach Project. These components include the utilization and packaging of resources currently available within and outside VUMC and, crucial to the plan, the development of an interactive component that will eventually allow investigator acquisition of resources and information from the desktop. Proposed services fall into the broad categories of Current Awareness, Training, Information Delivery, Grants Assistance, and Database Resources.

During the pilot phase, teams of librarians will identify and, employing information needs assessment questionnaires, interview key individuals in the targeted research centers. From the results of these interviews, information needs profiles will be developed and resources implemented. The initial phase of the program will require substantial person-to-person contact as team members interview investigators, set up electronic access, and refine information needs profiles. After this start-up phase, investigator requests should primarily reach the teams asynchronously via a dedicated electronic reference resource mail account located on the web page customized for each center’s needs. Investigators can simply e-mail any questions or requests for assistance to the team assigned to their center. At this point, most of the librarian’s time will be devoted to monitoring new web sites, database or other resource training, periodic literature searches, and answering reference questions received from the investigators. In the CML program, gains in librarians’ familiarity with the terminology and culture of a particular unit lead to decreases in the time spent on questions. Similarly, we expect start up time at each added research center to decrease as librarians become more familiar with typical information needs of investigators.

Given a positive experience and valid use of resources in the pilot phase of the program, five additional centers will be added to the research assistance program in the first year. Banking on the experience gained in the pilot phase and the CML program, we can anticipate an increased understanding of investigators’ information needs and, consequently, less start-up time in the new centers.

The second year of the program should see the addition of 8 more research centers. Eight centers represent a substantial increase; however, by this phase of the program, communication with centers targeted in the pilot phase and first year should be mostly asynchronous. Moreover, librarians and support staff will be familiar with implementing the program in new settings, thereby reducing the time needed to execute a slate of resources. In the third year the remaining VUMC research centers will be incorporated into the project.

**Consumer Health/ Patient Information Service**

In order to position themselves to participate in decisions regarding health care, consumers must have access to medical information. A 1991 study of health sciences library directors conducted by the American Medical Association Library and Information Management Division found that 78 percent (239 out of 307) of survey respondents allowed patient access, with or without restrictions, to their respective libraries. Further, 67 percent (206 out of 307) reported that their institutions maintained a separate, non-technical library to which consumers were referred. Other Nashville-area health care institutions (e.g., St. Thomas, Baptist, Columbia Hospitals) are developing consumer health information services of their own.

Eskind currently maintains a limited consumer health web site that contains Vanderbilt-specific information about parking, directions to the Medical Center, clinics, and physicians and a small library of carefully selected links to other sites. EBL has also sponsored an HIV/AIDS Web site as part of the library’s initial attempt at community outreach. This consumer health service provides unrestricted access to a variety of Internet-based information resources and includes an interactive component whereby consumers may pose HIV-related questions to which VUMC experts respond. Use logs and the volume of electronic queries substantiate the service’s popularity.

EBL’s proposal for a multi-site consumer health/patient information service at VUMC details a 5-year plan for creating and maintaining the service, organized around physical facility, collection, equipment, and staffing needs. In year one (1998-99), EBL plans to convert a small conference room on the first floor of EBL to house the service. The service will use existing equipment,
purchase core print and audiovisual collections, obtain a 5-user license for Health Reference Center (a full text, multi-source database including information from consumer health magazines and newsletters, selected medical journals, nursing and allied health journals, pamphlets, reference books, newspaper articles, and topical overviews; also has links to select Web resources), and create a web site with links to resources and an interactive component. The service will initially be staffed by one full-time Health Information Analyst (HIA) and .2 FTE of a librarian as an expert consultant and to respond to consumer/patient-generated electronic queries. By year five (2002-03), the plan calls for the addition of one satellite site, possibly located in the lobby of the hospital or the lobby of Medical Center North, and workstations in five Vanderbilt Hospital locations and 20 outpatient waiting areas. The core collections will grow by 50% and we will have a 10-user license for Health Reference Center. Staffing will grow to two full-time HIA’s and .35 librarian FTE.

**Electronic Information Access**

Electronic publishing is a relatively recent development, and librarians, publishers, and vendors are still struggling with how to incorporate its challenges and opportunities. Electronic publishing’s potential for transforming the way clinicians and investigators do their work and for changing the method and level of service libraries provide is only slowly being realized. Electronic publications will allow users to access information where and when they want or need it, even if the library is closed and regardless of whether the library physically owns the material. Electronic resources also go beyond the confines of print and greatly enhance the usability of information. While many of the electronic versions now available are just electronic duplicates of print publications, some now have enhanced features such as links from database citations to actual articles with further links to articles cited in references or the inclusion of graphics, multimedia, and simulations.

Because both publishers and librarians lack experience in electronic publications, neither group understands how they should be fairly priced. Currently, each publisher is grappling with pricing issues and attempting to formulate individually beneficial economic models.

Archiving is another critical issue. As we move into the electronic age, we need assurance that content we can access today can be accessed in the future. When we purchase a subscription to print resources, we “hold” that volume or volumes. The material fits on our shelves, and we determine whether we bind it or throw it away. With electronic materials, the publisher and/or aggregator controls the resource.

Eskind currently includes electronic journals, bibliographic databases, electronic textbooks, and educational software in its collections. In our 5-year plan, we anticipate moving toward the purchase of more electronic materials when the benefit of these materials to the work of the Medical Center justifies their additional cost. Initially, we must explore new approaches to electronic publishing, collect additional data, and plan the best strategies for the future. Our general strategy is to gradually decrease print expenditures while steadily increasing funding for electronic information access. This strategy will lessen the impact on our budget as we improve our electronic holdings, collect the data necessary to refine our strategies, and establish a position to respond to changing policies and new opportunities.

Our initial strategy will be to provide access to titles that are linked to bibliographic databases such as OVID and PubMed, since these add value to the research process by allowing users to go directly from a citation to the full text. Next, we plan to enhance electronic access in those instances when the benefits are high and the pricing models are reasonable. The initial investment will require experience with different models including using some of our present collection funds to subsidize document delivery.

Here are key questions that will be monitored as we proceed:

- How does the model in our business plan affect Document Delivery?
- What is the effect of electronic information on the use and growth of the print collection?
- What is the level of patron acceptance and how much patron education is needed?
- What developments must occur before the print subscriptions can be eliminated?
• How will the demand for electronic products change as new trends in VUMC programs and technological changes emerge?

**Archives and Records Management**
The role of the Archives is to collect, preserve, organize, and describe archival records, regardless of format, that have *permanent* informational and evidential value about the activities of Vanderbilt University Medical Center and the history of medicine. The Archives optimizes accessibility to archival records for scholarly, historical, and administrative research and reference endeavors for faculty, staff, students, and the community. The Archives comprises records collected from faculty, other medical scientists of note, other institutions, and Vanderbilt's hospital, schools, and other administrative units of the Medical Center.

Historically, VUMC's Archives focused on collecting the personal papers of noted faculty and other medical scientists. More recently, the Archives began offering records management services:

• Storing inactive records for departments and retrieving them upon demand as quickly as possible. (Records to be stored in the records center are inactive records that need to be retained for audit (accreditation/certification) or legal reasons, but do not have to be retained permanently.)

• Aiding departments in the systematic retention of needed records and the timely disposal of useless records through the use of records retention and disposition schedules.

These services have also benefited the Archives program while reducing records storage costs. Institutional records are prepared and preserved and those of permanent and historical value are earmarked for transfer to the Archives.

For the past year and a half, the Archives has focused on developing its records management customer base within the School of Medicine, the School of Nursing, the Hospital, and the Clinic. The Archives has now begun to attract additional records management customers on a cost-plus basis by soliciting various associations, hospitals, clinical practices, and health care services in Middle Tennessee.

As the volume of managed records increased, the Archives has begun using a combination of on-site (in Medical Center North) and off-site (Chestnut Street warehouse) storage. The space in MCN facilitates rapid retrieval of more frequently requested, newer records. Within the next five years, it may become advantageous to move the records center to a separate warehouse facility or transfer the records to an electronic format.

**Strategic Web Architecture**
The goal of the Eskind Web Administrative Group is to produce an enterprise-wide system, based on the Web concepts of distributed computing, platform independence, and multi-tier architectures, that revolutionizes some aspect of the use of information and communication to improve health and health care processes.

Success will require:

• Strategic partnerships with other organizational units in the Medical Center, other universities, other medical centers, and other corporations;

• Evolution of the VUMC Web development community into a self-sufficient entity, through education, training, and a scaleable support architecture;

• Ruthless focus by the Web Administrative Group on only the most meaningful projects and strict adherence to deadlines and project timelines; and,

• A way to measure success.

This plan proposes four broad strategies:

• **Planning and evaluation.** The phenomenal pace of development that accompanies the Web has led to the term "Internet time," where technologies are born, dominate the market, and die in as little as a few months. Technology forecasting has become nearly impossible, and any long-term strategy that relies on specific products or platforms will most likely fail. The same pace that induces uncertainty also ensures that waiting will be disastrous. We must make quick decisions and move forward with them even more rapidly than the technology
landscape can change. We must frequently evaluate our progress toward long-term goals and be adamant about setting and meeting short-term project deadlines.

- **Education of the developer community.** The best tools and processes will be useless if VUMC developers do not know how to use them. Educating developers must be a priority. The new tools we are deploying build most the Hypertext Markup Language (HTML) code automatically, and training in these tools must be provided for our developers. A more important, and more difficult to implement, educational path follows: teaching our developers to think with an enterprise-wide focus; to build reusable and repurposeable content; and to use the tools and systems to advance development without intensive support from the Web Administrative Group.

- **Partnerships.** An effective Web strategy requires expertise in a variety of disciplines. The International Webmaster’s Association offers membership in 33 specialty areas. USWeb, in association with the Association of Internet Professionals, provides certification in six major areas: Web Project Management, Web Graphics and Multimedia, Web Administration, Programming and Database Integration, Internet Security, and Internet Integration of Legacy Systems. This does not mean that we must hire dozens of people. The VUMC Web strategy will be built on strategic leveraged partnerships and will be directed and enabled by a few key personnel. Obvious examples of such partnerships include graphic design from Biomedical Communications and University Publications and Design, content from News and Public Affairs, and training from the Learning Center. The most important partnerships will be those that are not at all obvious today and will likely involve organizations outside Vanderbilt. The groundwork for the first corporate partnership has already been laid with the pending implementation of New Order Media’s Training Navigator. Our success depends on building more such partnerships, and will be a critical focus beginning late in the first year of this plan.

- **Research and continuing education for the Web Administrative Group.** The rapid changes in Web technologies, coupled with the immaturity of the industry, make research and continuing education essential. The Web market place changes so quickly that we need research not just to make an appropriately informed choice, but to even define our choices. The immaturity of the industry, and the wide range of skills possessed by those drawn to it, means there has been no formal education program dedicated to training Web professionals. What is learned, therefore, is often learned on an as-needed basis. An effective Web architecture must emphasize continuing education. This education will not always come in the form of conferences and tutorials. Often, Web professionals merely need time dedicated to studying books, journals, and online sources in order to maintain adequate currency. Table 3 below outlines the key support roles played by the Web Administrative Group.

### Table 3: Web Administrative Group Focus Areas

<table>
<thead>
<tr>
<th>Planning</th>
<th>One of the most important aspects for the future of the Web at VUMC; includes building long-term strategies, making technology choices, encouraging specific individual development initiatives, and measuring and evaluating success</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Interaction with both the consumers of information and services delivered via Web technologies, and those who deliver this information and these services; as partnerships develop and the VUMC Web development community grows in size and sophistication, the importance of effective communication will grow.</td>
</tr>
<tr>
<td>Policies and Guidelines</td>
<td>Development and maintenance of institutional policies related to delivering services, information, and communication via Web technologies; the Web Advisory Committee is the primary vehicle for this process.</td>
</tr>
<tr>
<td>Editorial and Approval</td>
<td>Inspection of VUMC Web sites, checking for compliance with institutional requirements; an extensive check is provided before new sites can go “live,” accompanied by a report detailing needed changes and recommended improvements; existing sites are inspected occasionally, as time permits.</td>
</tr>
<tr>
<td>Training</td>
<td>Teaching VUMC Web developers to use the VUMC Web tools and other technologies related to Web development; as the plan progresses, will</td>
</tr>
<tr>
<td><strong>Tools</strong></td>
<td>Applications or systems that enable or facilitate some Web-related activity; tools are usually built or configured for reusability; sometimes developed in-house, sometimes adapted from another source.</td>
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<tr>
<td><strong>Individual Content Support</strong></td>
<td>Advice, suggestions, and assistance building content for individual organizational units; does not include reusable and repurposable content, innovative content-related projects that are part of the critical path defined by this plan, VUMC-wide content, or the tools and systems that enable production of this content.</td>
</tr>
<tr>
<td><strong>System Administration</strong></td>
<td>Primarily support of UNIX systems, but currently includes support of the Virgil Lab and computer system.</td>
</tr>
<tr>
<td><strong>Technical Consulting</strong></td>
<td>Participation in working groups and committees; any instance of providing specialized assistance to others in the Informatics Center or the Medical Center, especially related to Web technologies, though not limited to those.</td>
</tr>
<tr>
<td><strong>Research</strong></td>
<td>Initially, exploration of technology choices and development strategies. Within a few years, could expand into true Informatics or Computer Science research.</td>
</tr>
<tr>
<td><strong>Projects</strong></td>
<td>Development efforts done primarily, or with significant contribution from, member(s) of the Web Administrative Group. Once complete, responsibility for the ongoing maintenance of a project usually lies with another group.</td>
</tr>
</tbody>
</table>

**G. Grant Preparation and Submission Process**

The Informatics Center sponsored development of a proposal for a pre-award grants management system for VUMC. While here at Vanderbilt as an IAIMS Leadership Apprentice, Jim Harrison, Ph.D., M.D., developed a high-level model of the processes for preparing and submitting the most common types of grant applications based on interviews with faculty, administrative staff, and representatives of the Office of Biomedical Sciences. He then developed a model for a simplified grants management workflow process enabled by:

- A standard relational database (e.g., Oracle) to manage and track key grant application information.
- An associated document management system and standard file format for the administrative and scientific portions of applications. (Since most grant applications will continue to be submitted on paper in the short term, and required paper formats continue to be specific to funding agencies, the proposal recommends creation of standard format templates as necessary for each funding agency.)
- Standard Web browsers as a primary mechanism to access the database and to browse and retrieve templates and documents from the document management system.

The proposed process would support the workflow of the administrative components of grants management, including the interactions between investigators, departmental administrators, and Office of Biomedical Science staff. The underlying information system would initially consist of a database containing face sheet and funding status information with pointers to the administrative and scientific portions of applications in a document management system. In a second phase, the database could be expanded to create a searchable information resource that included the application abstract and specific aims, and research environment/equipment list. IRB and animal care documents could be included in the document management portion of the system at that time. A third development phase, coinciding with the initiation of widespread electronic submission, could incorporate the external document management system into the database, and provide decision-support and electronic signatures.

Potential benefits derive from:
• increased efficiency for faculty and administrators in the preparation and submission of applications,
• reduced duplication of paperwork,
• reduced errors in application preparation,
• availability of a shared information resource that can be searched (e.g., by Vanderbilt faculty to find other faculty with common areas of interest or needed equipment, or by administrators needing information on current or past funding),
• having a streamlined pathway from the management of grant applications on paper to electronic submission in the future.
VI. FY1999 Alignment of Information Technology and Enterprise Strategies

The Informatics Center’s FY1999 Budget addresses key goals from the various plans, as summarized below. A listing of major on-going projects by application area is shown in Table 4. Table 5 shows major on-going infrastructure projects.

Four enterprise plans (VSM, VSN, VMG, VHS): Nine of 46 desired informatics-related capabilities:
- Searchable database of faculty methods and expertise
- Assist clinical investigators in developing patient databases
- Support patient management across practice sites
- Coding standards for clinical data
- Support for disease management
- Models to handle severity adjustment, costs, productivity
- Data to support outcomes research
- WWW page of VU research news, postdoctoral positions
- WWW page of clinical research initiatives

VMG Informatics Group: Eight of the top ten priorities
- All clinical notes and testing reports in electronic form are available in MARS
- Emergency room clinician notes are available in MARS
- MARS accessibility by physicians
- Core clinical database
- WizOrder printout
- Improved WizOrder interface
- Computerized office patient record
- Outcomes analysis tools

Clinical Enterprise: Two of two informatics-related goals in the top ten
- Support for analysis of profitability and quality
- Expand MIS network capacity and reliability

Education initiatives within VSM and VSN:
- The Informatics Center will support these initiatives outside of the shared funding.

Additional funding may be requested prior to the end of FY1999 to support use of the EPIC systems to support MSO functions and to implement plans for continuous availability. Support for managed care and capitation and support for grants management are not included in the proposed FY1999 budget.
<table>
<thead>
<tr>
<th>Application Area</th>
<th>Projects</th>
</tr>
</thead>
</table>
| **Patient Management/Billing Systems** | • EPI C Middleware enhancements  
• Replace SMS/ Invision ADT with HBOC Patient Management  
• Upgrade Hospital billing, chart abstracting to Medipac 3.0 |
| **Orders/Pathway Management**   | • Window-NT based version of Wiz  
• Transition from paper notification to notification engine/acknowledgement  
• Pathway database, pathway costing, standard charting  
• Externalize service master and health terms dictionary |
| **Electronic Patient Record**   | • Fault tolerant data feeds and storage  
• Problem list roll out  
• Anesthesia: Pre/Peri-operative charting  
• Cardiology databank  
• H&P and progress note templates, ED, Simon |
| **Decision Support**            | • Data model/clean-up, reimbursement proxy  
• Long-term repository, decision models, query interface |
| **Clinical Support Areas**      | • Lab reporting & cumulative summaries to MARS  
• Replace lab system, anatomic path, blood bank  
• Intelligent orders/pharmacy interface  
• Outpatient pharmacy  
• Radiology PACS - ED, Ortho, Nsurg |
| **University Administrative Systems** | • Human resources  
• Accounts payable  
• Purchasing  
• Year 2000 upgrades |
<table>
<thead>
<tr>
<th>Table 5: Major Current Infrastructure Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Information Management Components</strong></td>
</tr>
<tr>
<td>• Enterprise patient index, patient look-up algorithm</td>
</tr>
<tr>
<td>• Clinical universal work station desk top, remote configuration and management</td>
</tr>
<tr>
<td>• Single sign-on directory services, subscription function</td>
</tr>
<tr>
<td>• Hardware token for authentication, remote access</td>
</tr>
<tr>
<td>• Database middleware, graphical query environment, database host</td>
</tr>
<tr>
<td>• Notification engine, generalized external tables, terminology server</td>
</tr>
<tr>
<td>• WWW server framework</td>
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<tr>
<td><strong>Infrastructure Development</strong></td>
</tr>
<tr>
<td>• Network capacity, redundancy, security, Internet II</td>
</tr>
<tr>
<td>• System software upgrades</td>
</tr>
<tr>
<td>• Print management</td>
</tr>
<tr>
<td>• Server management, E-mail migration, redundant processors and disks</td>
</tr>
<tr>
<td>• End-to-end monitoring, groupware, web-based documentation</td>
</tr>
<tr>
<td>• Data center re-engineering, disaster recovery, satellite data center</td>
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<tr>
<td><strong>Planning/Process Development</strong></td>
</tr>
<tr>
<td>• End user Managed Support Program (MSP)</td>
</tr>
<tr>
<td>• Change control, help desk, problem tracking, unit-based support team</td>
</tr>
<tr>
<td>• Medical record visioning</td>
</tr>
<tr>
<td>• On-line library resources</td>
</tr>
<tr>
<td>• Consumer health information</td>
</tr>
<tr>
<td>• Learning network</td>
</tr>
<tr>
<td>• Policy formulation: confidentiality, access, security</td>
</tr>
<tr>
<td>• Software Oversight Committee</td>
</tr>
<tr>
<td>• Year 2000</td>
</tr>
<tr>
<td>• Methodologies: process documentation, application development, architecture</td>
</tr>
<tr>
<td>• Staff development</td>
</tr>
</tbody>
</table>
VII. New Visioning Initiative

In 1993, IPAC initiated a vision-based planning process as the foundation for the 1995 plan. That process called for “out of the box,” creative thinking about VUMC’s future and the informatics capabilities needed to support that vision. The 1993-1995 planning resulted in recommendations for how information technology could enable established methods of meeting our missions. Now that we’ve succeeded with the basics of our IAIMS and VUMC has more experience in its use, it is time to begin another round of visioning. This 1998-2000 process will identify new ways of meeting our missions that would be impossible without information technology. Attachments A & B provide examples of the kind of vision we may develop next.
Attachment A

Information Technology: Opportunity and Strategy

White Paper for Presentation and Discussion with the Vanderbilt University Board of Trust, February 5, 1998, by William W. Stead, M.D., for the Information Technology Strategy
Information Technology: Opportunity and Strategy
William W. Stead, MD for the Information Technology Strategy Group

What will Vanderbilt look like in an era when information technology has matured? To answer that question, the Chancellor established a University-wide Strategy Group in 1993 to define the strategic purpose of information technology at Vanderbilt. Will our students be resident full-time, will they reach into the campus from their homes, or will it be some combination of the two? Will we teach facts or teach how to find facts? What is the role of the university in nurturing “research groups without walls?” How will new scholarly research be peer-reviewed and distributed? What is the impact on patient care and public service? How will Vanderbilt prepare for this new world?

I. The Vision

Vanderbilt is fundamentally in the information business. Among its core purposes is to develop, archive and disseminate information, through scholarly research, education, and service.

At the same time, the business of information has changed dramatically. The previously distinct industries of computing and data processing, communications (telephones, satellites and wireless), and content (print publishing, media) are converging to provide a new fused information technology industry. The World-Wide-Web is an example of this fusion. It now allows all types of information to be shared on campus, or around the world, in an instant. Meanwhile, processing power, or the speed of technology – one common measure of performance – has been doubling every 18 months, and the price has declined about 35 percent a year relative to the power, since experts predicted exponential growth more than three decades ago.

These two trends are merging to support new forms of networked human intelligence with vast intellectual and financial implications. Since the ancient Greek academies, this network of human intelligence has always focused on a place, a point where learners, teachers and books converged. We are fast approaching a time when the academy can become place-less. So, what does a university without “place” look like? Do we want to build one?

Teaching and Learning

We see the university shifting from providing as a product the education of an individual at a point in time, to providing products that support a lifetime learning process.

Electronic conferencing will support distributed learning communities. Teams will work on problems together, but without having to do the work at the same time or place. Students will answer each other’s questions. Information will be pulled in from anywhere over the network. Simulation and modeling tools will be used to make concepts or choices clearer.
Learning will be self-paced and adaptive. When learners think they understand a point, they will branch into an exercise that tests whether they are ready to go on or need to loop back for more work. The teacher will monitor what is done, help when things seem to be getting off track, and respond to questions.

Teachers will self select a balance of three primary roles. Expert coaches will interact directly with learners in person or across the network as facilitators and mentors. Course designers will select learning objectives and link in content modules. Others will develop content such as an explanation, simulation, or problem.

Mentorship, course design, and content each will be products of the university. They will be mixed and matched with like products of other universities or industry, provided on or off campus, and continue to support the learner for their lifetime.

Although the quality of the residential Vanderbilt experience will improve as we utilize this technology, that gain alone would not justify the investment. The real return on the investment will come from opening up new markets and from continuation of the university-student interaction beyond a short dedicated education period.

Research and Scholarly Communication

We see the university shifting from enabling a research focus by bringing a critical mass of talent into close geographic proximity, to providing its faculty with connectivity to the others who are grappling with similar problems, wherever they are in the world.

Research data will be archived on accessible database hosts permitting comparison or combination of the work of individual investigators. Interpretations will include links to the source material or data and be posted on-line for peer commentary. Records of posting and access will determine precedence and provide an automated record of citation.

Information producers such as the university will receive a credit each time someone accesses one of their original information resources. The credits could be used to obtain access to original information from elsewhere. A dollar payment will be received when the resources are used by net information consumers. Revenue that currently goes to publishers would come to the university or be used to decrease the barrier to access to information.

Challenges to be Overcome

The above are just a sample of the types of changes that can be expected as the fused information technology industry changes the way in which the university meets its mission. The ideas are not blue-sky; examples of them can be found on the Vanderbilt campus. Nonetheless, the barriers to moving rapidly in these directions are significant.

First, many investments in information technology by higher education institutions have led to disappointing results. The majority of the successes have come from enabling new
approaches to research and instrumentation. Some progress has been made in improving administrative processes with technology. Efforts to improve teaching have been less rewarding. These mixed results give people the right to be skeptical that the outcome will be different now.

The results can be much better today. Prior investments were in computing and data processing, only one of the three components of the fused information technology industry. The power that we see today comes from adding the leverage that communication and content bring to the mix.

Second, the vision requires a complete change in how people, process, and technology come together to do the work of the university. If we use the technology to work the way we do today, the result will be inferior. If we use the technology to enable us to do things that we could not do without it, the result can be remarkable.

The radio is an example. It was originally developed to send Morse code without the cost of wire. It was designed as a point-to-point technology. The power of radio did not become apparent until people discovered that it could be used to broadcast to many points. The camera provides another example. When the camera first came out, people used it to take pictures of still life, because that was what artists had traditionally painted. The camera could not capture still life scenes that were as engaging as those the artist could paint. The new technology was being used to do something that was already done quite well with paint. Then people began to discover that the camera could catch light and motion, and a whole new art form emerged, one that could not be achieved with paint.

Although there is increasing consensus about the type of change we face, neither higher education nor the information technology industry have a clear recipe for success. The intellectual task of designing and testing new models for education and research that leverage information technology is as challenging as any of the university's areas of research. It might be considered more important than any other area of scholarly work because its results will determine what can be achieved in the other areas.

Third, the resistance of the status quo will have to be overcome before the vision can be fully implemented. Implementation of the vision will dislocate intermediaries ranging from middle level administrators to those faculty who are neither mentors nor creators. The rest of the faculty and staff will have to learn new skills. The students will not be a problem since they have grown up with this technology.

There will also be a significant tension between publishers and universities that try to retain ownership of their intellectual property. Faculty will need to have a joint economic stake with the university if change is to occur.

Fourth, information technology is expensive. The required expenditures cannot be supported as additive costs in our existing revenue base. To be affordable, the technology must substitute for current costs and support new products and markets.
II. Vanderbilt Initiatives and Capabilities that Provide a Foundation for Success

We have established international leadership for technological applications that have been developed by faculty, staff and students.

Arts and Science:

Among the first major initiatives undertaken in the use of interactive information technology in teaching was the “Classroom of the Future” developed in conjunction with Apple Computer by the College of Arts and Science. This classroom, which includes a networked computer workstation at each student seat and additional presentation technology at the instructor station, is located in Wilson Hall. Several senior faculty have led teams in the development of new technology-based teaching modalities using this facility.

The largest effort, led by Professor Phil Crooke, has been the teaching of differential and integral calculus using Mathematica, one of the first computer algebra systems designed specifically for the interactive teaching of mathematics in the sciences and engineering. Vanderbilt was a “Beta” site during the development of this system. These initial efforts have evolved into a system developed by faculty in the Department of Mathematics and the Owen School of Management that provides a user-friendly interface to Mathematica over the World Wide Web. This system is called MathServ and can be viewed at the URL: http://www.math.vanderbilt.edu/mathserv.

Peabody College:

Peabody’s internationally recognized accomplishments in teaching, learning and technology provide another example. This effort is now more than a decade old and began with the establishment of the Learning Technology Center (LTC), an R&D center that brings together cognitive psychologists, regular educators, special educators, content specialists, and instructional design and technology specialists.

Many of the information technology designs that Peabody has effectively incorporated into its teacher education program were derived from the LTC’s technology-based projects originally directed at K-12 classrooms. Examples of the latter include the award winning *The Adventures of Jasper Woodbury* mathematics problem solving series and the *Little Planet Literacy Series*. From projects such as these, Peabody faculty have developed models for the design of learning and teaching environments and multimedia materials. These have subsequently proven to be extremely effective and highly applicable to the higher education environment. Most recently Peabody has focused on further expanding the impact of technology-based learning and teaching resources throughout the Peabody undergraduate and graduate/professional curriculum. Thus, the College is further leveraging the investment in technology infrastructure and resources that was made in renovating and expanding the Social Religious Building.
Engineering School:

Asynchronous Learning Networks (ALNs) are on-line learning systems that support people-to-people learning anywhere and at any time. This new field was started by the Alfred P. Sloan Foundation’s "Learning Outside the Classroom" initiative. Vanderbilt University has become a major player in this initiative. Professor John Bourne’s Asynchronous Learning Network Group in the School of Engineering is on the leading edge of developing on-line courses and learning processes. It hosts the ALN Web, an Internet site that supports ALN worldwide. Started in 1996, this website is now widely regarded as the pre-eminent site for information about ALN in the world. The site contains the Journal of Asynchronous Learning Networks, the ALN Magazine, ALNTalk (a fortnightly online discussion forum about ALN) and workshops that can be taken online about ALN. The site has been extremely successful; over 35,000 individuals have used the materials in the last year. The work of the ALN Web is to spread the growth of ALN worldwide through education, research activities and publication.

Medical Center:

The Division of Biomedical Informatics in the School of Medicine has received international recognition for the use of technology to support decision making and learning in the patient care process.

Both the potential of the fused information technology industry and the barriers to delivering on its promise were understood when VUMC launched the biomedical informatics initiative in 1991. The factors in the organization and execution of this initiative that have proven critical to its success are presented here in detail as a model of what will be required to achieve our vision of the university’s future teaching and research environment.

The Informatics Center brings together responsibility for informatics research and education (School of Medicine's Division of Biomedical Informatics), with responsibility for provision of the operation and decision support infrastructure of the medical center (operational Information Management and the Eskind Biomedical Library). This center is the only biomedical informatics unit in the world with this degree of integration of academic and operational functions.

The essential nature of the link this structure creates between creativity, understanding the art of the possible, and support for operations is demonstrated by our effort to have physicians and other care providers record their orders for patient care directly into the computer. Other industries have demonstrated the clear benefit of capturing data at the source. In health, randomized trials have demonstrated that one reduces resource utilization by 10% when decision-makers are in touch with the information management infrastructure at the time when they enter orders. But how does one get the most educated and highest paid person on the working team to deal directly with the computer?
Hands-on practice by a person trained in medicine, who is creative, and who also knows the art of the possible with the technology, proved to be the way to get the answer. The Informatics Center recruited Randy Miller as Professor and Chairman of the Division of Biomedical Informatics. Randy is a first class general internist and a world class informatics specialist. He went onto the patient care unit as a unit receptionist and entered orders. Within hours he thought he knew what needed to be done. Still he could not tell someone else how to do it without first implementing and trying something. The solution was to involve the informatics research effort in an iterative process involving rapid prototyping in the operational settings. Real wins happened because medical informatics specialists had the skills and authority to use the system to identify what was needed, to make the necessary operational changes on the fly, and to redirect the research effort.

This multi-faceted role for the informatics specialist was possible because of the structure of the Informatics Center and the modular architecture of the VUMC information management infrastructure. When the decision support/order capture device was ready, it could be handled like a light bulb. It came to life as it was plugged into the pre-existing infrastructure as a light bulb does when plugged into a lighting system. When a change was needed, a component could be swapped in the same way that you would change a light bulb. This type of fit has been possible in the Informatics Center because of our collaborative planning between individuals responsible for the research program and those responsible for implementation of infrastructure. It would not be possible if we had a suite of monolithic information systems.

The informatics specialists also provided an essential human bridge between informatics and other disciplines that needed to use informatics in their work. Having an idea, and converting that idea into an informatics innovation that is at a stage where it can be tried in practice, was just part of the job. In some cases the informatics specialist had to use the innovation for others, or help them use it before it was ready for them to use it on their own. In other words, the combination of the system and the informatics specialist could be used before the system by itself was seen as a win by its non-informatics users. This is what Randy Miller means when he says, “Informatics is not a spectator sport - you have to get your hands dirty to make a difference.” When I interview a graduate of an informatics training program for a faculty position, and they tell me that they have built an application but that no one would use it, I ask whether they used it themselves in practice to understand what the problems were. If they say no, I do not offer them a job.

But what does entry of patient orders have to do with teaching or research? First, it is a model of just-in-time access to facts, changing what needs to be learned. Second, it is a model for identifying “teachable moments” in the workplace and for providing access to learning in that environment. Giving decision-makers feedback at the time that they are making a decision provides a powerful learning experience.
The wins achieved by linking academics and operations have been a two-way street. Innovation in informatics begins with hypothesis generation, and then moves through model development and implementation to evaluation. Research funding is available for the first and fourth stages. Support from operations is available for the middle two stages. A combined effort that joins research with the rapid translation of that research into practice allows the investigator to play different roles in the effort and to move back and forth between funding sources as the work evolves.

The model requires researchers who understand real world problems and constraints, and staff who understand both informatics and operations. In some instances they have been the same person, researcher/developer or champion/user. This combination of skills is unlikely to develop in isolated academic or operational settings. Linkage of the two settings provides the right environment for producing such individuals because a theoretical foundation is obtained in the classroom while requirements for translating theory into practice are learned from projects in the operational laboratory.

The creativity of the Division of Biomedical Informatics allowed VUMC to go from being a non-player in informatics, to being generally recognized as one of the top three academic centers in interacting with the provider of care at the time and place they are making decisions. VUMC has achieved a similar reputation for reducing the time and cost of implementing information management infrastructure. For example, a center-wide electronic patient record was put in place in less than a year and for less than $500,000, compared to industry averages of 2-4 years and 6-10 million dollars.

The paybacks are not just operational. The Division of Biomedical Informatics has emerged as one of VUMC's academic crown jewels. The Division is the editorial home of the major peer-reviewed scientific journal in medical informatics. It is the co-developer of the national strategy for quality assurance in clinical software and it has been awarded a grant to demonstrate the strategy. It is one of the four first-wave sites selected by the National Institutes of Health to implement an Integrated Advanced Information Management System. Its faculty of eight includes the past president of the American Medical Informatics Association and the president-elect of the American College of Medical Informatics. In 1997, the Division hosted the annual informatics scientific meeting in Nashville, the second time in the meeting's 21-year history that it has moved out of the Washington-Baltimore axis.

Development of the Division of Biomedical Informatics required a commitment of 4.3 million dollars, 2.8 for the Informatics Center space in the Eskind Biomedical Library and 1.5 for faculty start-up and backstop funding. To date, the faculty unit of eight has obtained 4.6 million dollars in extramural grant support.

During the period of FY1992-1997, VUMC information management infrastructure has required a capital investment of 29.6 million dollars, 3.8 for data center equipment, 4.8 for the network, and 21 for information systems. If we had not undertaken the informatics initiative, expenditures at other academic medical centers
suggest that this level of capital investment would still have been made in an attempt to meet the operational needs of the medical center, but with much less effect.

Vanderbilt has at least three core strengths as it seeks to exploit this new fused information technology industry. First, our residential education is known for strong, interpersonal relationships between and among faculty and students. Second, our compact campus fosters interdisciplinary collaboration. And third, the University’s internal budgeting (“every tub on its bottom”) encourages program diversity and entrepreneurship. Our campus therefore provides a laboratory to test strategies for improving what we already do well using technologies that can dramatically increase our reach.

III. The Vanderbilt Strategy

Vanderbilt has decided to set the goal of becoming the model for the new national university that the fused information technology industry makes possible. Success will have been achieved when students pick Vanderbilt faculty mentors over those available over the network from other universities; when any university’s course has to include original Vanderbilt material to be considered first class; and when a research team has to include a Vanderbilt component to obtain extramural support. These markers of success will also mean that the residential learning experience and research programs located on campus will be at the top of world class.

This goal is aggressive, but achievable with manageable risk. To achieve success, we will marshal our intellectual capital to generate the ideas and to develop the manpower to let us work through how our programs should function. We will plan for implementation of an industrial strength infrastructure, but build it out as needed. We will develop meaningful academic-industry and university-community partnerships.

Intellectual Capital

We will build a team around Peabody College, the Division of Biomedical Informatics, and the School of Engineering to form a critical mass of intellectual talent to focus upon information technology enabled models of teaching and research. The Team will help other units work through how to achieve their objectives in fundamentally new ways through information technology. They will also help the university understand how infrastructure should be put together to support the new way of working.

The education and research programs of Vanderbilt University will be a laboratory for prototype development and testing, much the same way that the medical center operation and decision support infrastructure has been the laboratory for the Division of Biomedical Informatics. Both the Team and the programs they help will gain a competitive edge, the Team
through access to the laboratory and a source of hard funding, the other programs through access
to manpower and research results in advance of their general availability.

Infrastructure

If we are to build a new business model for the university that leverages the potential of
the fused information technology industry, we must have an industrial strength infrastructure that
provides reliable quality service and can support electronic commerce. On the other hand, we do
not want to build infrastructure in advance of need because of the cost and rapid obsolescence.

The solution that has been tested by the Informatics Center involves design of a modular
infrastructure that will meet the predicted requirements, while only building out those portions
for which there is an immediate need. The rest is “shelled.” As each piece of the infrastructure is
implemented, lessons and changes in technology feed back to update the plan. With this strategy,
anything that is built will scale up to support full use, while providing immediate benefit.
Mistakes are made just once and usually on a small scale.

This is a plan big, but implement as needed, strategy that fits the Vanderbilt internal
budgeting model of “every tub on its own bottom.” The bulk of the cost can be borne by the
programs that need the infrastructure. They would spend that money whether or not it resulted in
generalized reusable infrastructure. Central moneys are invested at the margin to cover the cost
of the generalization.

Academic-Industry and University-Community Partnerships

Vanderbilt’s testing of various strategies for supporting learning and research, and
development or integration of technologies to support those strategies, will yield products that
would be of use elsewhere. Strategic industry partners will be needed to rewrite a shrink-
wrapped version and to handle marketing and distribution. This partnership will return a new
revenue stream to the university.

The industrial partner will be willing to turn over that revenue because they will begin
development with a proven prototype that shows exactly what is needed to enable a new work
process. This will shorten their development cycle while increasing the yield of their development
effort.

Another type of partnership will develop between Vanderbilt and communities that are close to or
far from the campus. Communities will be able to incorporate Vanderbilt learning components into their
own educational programs and share the students that they now have to give up to us. These relationships
should generate both new product based revenues and a new source of major contributions.

Resource Requirements

A continuing investment will be needed to seed this initiative by funding core planning
functions, faculty recruitment, and information technology infrastructure.
Seed funds will be used to create an environment within the university that redirects and coordinates the programs of the schools and administrative areas so that they come together to provide the requisite culture and infrastructure. Core planning functions will include strategic planning, envisioning the future, policy formulation, architecture definition, technology forecasting, and development of strategic alliances. The faculty recruitment funds will be used as start-up and backstop for 5 to 8 individuals who will both do research related to use of information technology to support learning and research, and show the way to their colleagues. The infrastructure funds will be used to generalize infrastructure that is being put in place by one school so that it is re-usable and expandable by another.

The seed funds for this initiative will be invested at the margin. Over time, the other budgets of the university together with additional investment from new markets and partnerships will come together to provide the massive funding that will be required to fully utilize information technology throughout our teaching and research activities.
Attachment B

The Networked Health Enterprise:
A Vision for 2008


Abstract found at:
http://www.amia.org/pubs/jamia/v05n05/412.htm