HNET - A National Computerized Health Network

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ABSTRACT

The HNET system demonstrated conceptually and technically a national text (and limited bit mapped graphics) computer network for use between innovative members of the health care industry. The HNET configuration of a leased high speed national packet switching network connecting any number of mainframe, mini, and micro computers was unique in it's relatively low capital costs and freedom from obsolescence. With multiple simultaneous conferences, databases, bulletin boards, calendars, and advanced electronic mail and surveys, it is marketable to innovative hospitals, clinics, physicians, health care associations and societies, nurses, multi-site research projects libraries, etc.. Electronic publishing and education capabilities along with integrated voice and video transmission are identified as future enhancements.

INTRODUCTION

In the last three years or so, several phenomena have been observed in health care and the general business and scientific community: 1) Thousands of major new innovations have been developed, from genetics to lasers, and with them a wealth of new information; 2) relatively little communication about these innovations or the innovators involved exists, as measured by the amount of information received by the average health industry worker; 3) many new (and old) huge sources of important and useful information dispersed around the country have been made available online for the first time, completely overwhelming our paper based systems; and 4) artificially intelligent systems that require very large databases are now being used, some designed to be accessed nationally.

A need for portable access to information through fast, simple to use national communication and database systems has been stimulated by the recent advent of personal computers, allowing relatively low cost data storage, retrevial and processing to make practical large volume but personal resource sharing, manipulation, & storage. There has also been slow but increasing cooperation and communication between the health care and other industries, based on the evolving and emerging computer ICE (information, communication, and education) technologies. Yet no single system exists today that begins to meet all these needs. We explored the potential market for such a national communication system, including present and future demand for services. In a survey undertaken before the HNET demonstration project was begun, over 700 hospitals nationwide indicated a strong interest in a network such as HNET. Table one lists the sites and groups that the project has identified as potential users of HNET.

Table 1 - Potential Users Of HNET

Hospitals, Clinics
Physician Offices
Physicians (individual use)
Medical schools
Foundations
Nurses (individual use)
Nursing Schools
Health Care Management Schools
Health Care Vendors (businesses)
Health Care Associations, Societies
Health researchers
Public Agencies
Health Care Magazines And Journals
Educational Programs And Seminars
Libraries, Including Medical
Consultants
Government
Patients

Some of the major health care oriented computer networks presently available are the AAMSI and other CompuServe Forums, AMA Net, BMEDSS (Akron City Hospital), and The Source medical areas. Unfortunately, none of them meet all the needs described above, nor have we seen any stated plans to do so. Accessing them personally will allow the reader to make an objective analysis of their strengths and weaknesses relative to HNET.

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DESCRIPTION OF HNET

HNET, a demonstration study project developed in 1985 at what was then Presbyterian/Saint Luke's Medical Center Research and Development Group (now AMI Central Region), Denver, Colorado, was designed as a national network for innovative people, businesses, and institutions in the health care industry. The three month demonstration pilot outlined one practical method of providing the badly needed communications "backbone" (through personal computers linked to mainframes) that would link the health care industry together. Being device independent - accessible through dumb terminals, personal computers, mainframe or mini computer communication programs - it allowed access by almost any system an organization might have. It also allowed easy remote access from any telephone in the U.S..

HNET is based on a combination of two elements: 1) the private network system of CompuServe Inc., the leading commercial long distance private network carrier (and also the largest value added network [VAN] in the U.S.), and 2) our research group, which designed, implemented, and maintained HNET (including programming the custom PC and mainframe software). This combination allowed a fairly complex system to be built quickly (five months).

The network can serve pre-planned periodic demand loads, as well as ad hoc usages. It can support up to 15000 simultaneous users, depending on the system configuration. Only a short system development time is needed - six months to begin, two years for complete initial development. Upgrades of basic system software and hardware on the mainframe computers, along with generous technical support to the system operators, is included in the cost of the packet switching network port service.

The network can support development of user based and HNET-owner systems (the leased network and mainframes can be replaced at any time by HNET-owned equipment and programs developed later). This would give the owners of HNET the ability to deliberately build their technological expertise while at the same time quickly going on - line with a relatively sophisticated system. If decisions were made later to re-configure the system, it could be done at any time with a minimum of disruption. A 99.9% uptime system reliability of the network and mainframe databases ensure consistent service.

There are three basic HNET components: 1) the national packet switching network and supporting mainframe computers, which run the basic network program; 2) the end user's machines, usually personal computers (which run both terminal and macro programs); and 3) any storage capabilities "gateway-ed" at up to 9600 baud to HNET itself (such as a large database). Anything from another network to laser discs to a large artificial intelligence program could be gatewayed to the main network. All this results in a cost efficient "dial - up" telecommunications network, providing multiple services with truly portable national coverage.

HNET can also be configured to provide 9600 baud access to other computer networks such as MEDLINE, BRS, Compuserve, etc., or any other telecommunications-equipped computer system (such as the office system of an association or hospital, with complete data security). In addition, HNET can offer individual secure private networks, acting as a network sub-leaser. This would allow several organizations to band together and support one large network center.

HNET software consists of private custom mainframe network programs maintained and upgraded by CompuServe, along with both standard terminal programs (such as VidTex, SmartComIII, CrossTalkXVI) and custom HNET programs for the end users. Error checking ensures data integrity, and selective record lock out allows complete network control and usage information for analysis and billing. HNET is completely secure, with password protection and controlled multiple privlege levels. Call-back and encryptation features can be added for especially sensitive applications, if needed.
Access is location-independent, with local phone dial-up from over 500 cities nation wide (and, remotely, worldwide). Features include automatic up/down loading (using micro macros); combination menu and command driven user friendly interfaces; immediate changes by system operators (sysops); and the ability of the system to prompt the user for information. In addition to uses within an organization, HNET can provide travelling executive/physician support - allowing a direct link to the home office, modem-accessible databases, or other people on HNET (including conference links). This allows people to communicate directly with their home offices in real time, exchanging files either way (by uploading or downloading files to the network). They can also receive electronic mail from remote phones, such as hotel rooms, client offices, or display areas of conferences.

A complete description of each of the areas within HNET is not possible in such a short paper as this one. Table 2 that follows lists some of the various defined areas of HNET, as developed in the pilot project study. We are sure there are many more that we could add as the network grows.

Electronic Mail W/Auto Reply And Tracking
Computer Conferences (10 conf. at one time)
Electronic Surveying,Auto Reply & Tracking
Bulletin Boards
Meeting Schedules (on & off line)
Technical Industry Updates
Professional Forums (MDs, RNs, etc.)
Special Interest Groups (many kinds)
Vendors: Commercial Services, Products
Shared Research Projects Section
Innovation Exchange
Physicians' Listing
Emergency Calls For Drugs, Body Parts
Nurses' Listing and Nursing Research
Selected Biomedical Research Section
Allied Health Section
Organizational Management Sections
MD Education Section (GME & CME info.)
Weekly NewsClips For In-house News
"White paper" production and sales
Databases W/Subject & Article Indexes
Hard Technology Information Databases
Computer Systems Hardware Info:
Educational Systems
I/O (CATscans, lasers, etc.)
Communication Systems
Decision Support
Computer Software Information
Computer Aided Instruction
Hospital/Clinic/Office Automation
Artificial Intelligence
Management/Clinical Systems
Soft Technology Info. Databases
Technology Development
Management Style And Development
Strategic Planning And Evaluation
Systems Analysis
Delivery Systems
Human Interfacing
Innovation Functions And Support
Hospitals, Offices, Etc. Issues
Custom Searches (fee added)
Tracking And/Or Analysis
Technology, Market, Industry
Clipping Files (some fee added)
Problem Forums - Online "Rooms"
Non Profit vrs. For Profit
Project Structure/Funding/Management
Appropriateness Of A Project To An Organization's Mission/Strategy
New Product/Service Development
Innovation Commitment, Structure
Marketing Innovative Products/Services
Entrepreneur/Intrapreneur Support
Joint Ventures
Solution Archives From Problem Forums
Survey Archives (from HNET surveys)
Specific Areas for MDs, RNs, CEOs, etc.
Legal Information: Government, etc.
HNET member listings and analysis
Classified Ads - Private, Professional
Feedback To The Network SysOp

Table 2 - Areas Of HNET

PROCESS

In a typical user scenario, physicians with a terminal or personal computer call a local number, connecting to the national HNET system. Macro files in the MDs' computers then automatically search and download specific information (chosen beforehand by them), after downloading any messages and/or surveys in their electronic "mailboxes". A variety of activities are now possible - they might automatically send letters to collegues (written beforehand on a word processor program, or written directly on - line), or perhaps connect to MEDLINE for a search or two.

After this, one MD might participate in a short online conference (notice of the conference having being posted on HNET the week or month before). Another MD might send a broadcast message (letter) or post a note on the electronic bulletin board, looking for help or cooperation on a research project (or business venture). At the end of their sessions, the MDs might search the HNET membership database for people interested in a specific discipline, or download an article or two (possibly to be duplicated by them for distribution at their next staff or business meeting).

Activities such as these are a direct result of the available technology, and they in return demand a significant and unprecedented change or shift in the mental models of information and communication used by most health care providers. Studies have bourne this out, and research soon will be moving to fill this need.

BENEFITS

The majority of the benefits of advanced information and communication systems have yet to be realized (because of needed changes such as the ones mentioned above, among other reasons), yet the non-trivial benefits we have identified that could be immediately realized include: reduced long distance voice phone costs, mailing costs, overnight mail courier costs, paper and printing costs, secretarial labor costs (along with increased productivitiy), and some face-to-face meeting costs. Increased communication and decreased transmission error, though hard to quantify, are still very important benefits. Electronic mail, now comparable in cost to written surface mail (if all aspects of preparing, transmitting, and receiving are considered), increases the number of contacts between people as well as the "window" between national time zones.

Databases with both static and dynamic information available online to end users (depending on their network privlege

levels), along with computer conferencing, have already been used extensively on other networks. All of these benefits can result in very significantly increased cooperative activities between health care and other professionals and innovators around the country - with a decrease in duplication of effort and uninformed ICE decision making that sometimes seems to occur. Increases in the information flow in and out of health care locations and schools nation-wide should bring better use of new (and old) information, including the development of more efficient, cost-effective care, as well as raise profits.

The above paragraph deals basically with the structural aspects of the system, rather than the subject matter contained in the network itself. The benefits from having and using this information (not easily available from other source, and not available at all from one source) can be enourmous. Gaining knowledge of the state of the art in an area of interest, sophisticated economic analysis, technological developmental trends, and access to most of the available information on a given subject or knowledge area through computer-based ICE systems are business skills that will soon be demanded by industries - and HNET can make them possible in health care. In addition to all the above defined benefits, listed below in Table 2 are projected additional benefits of specific market sectors.

HOSPITALS Databases,Assn. Access,Product Info. Access To AI programs,Conferences Research,Emergencies,Meeting schedules	PHYSICIANS AND OTHER HEALTH CARE PROVIDERS Contact With MDs,RNs, Practice Mgmt. Info. Access To Vendors,Assns.,& Networks,Meeting Sched.,Service Dev.,Job Recruit.,Journals
EDUCATIONAL INSTITUTIONS Courses,Degrees,Software Lists,Databases Conferences,Research,Meeting sched.Surveys Support Groups,Interested MDs,RNs,Assns.	ASSOCIATIONS (PROF.,INSTITUTIONAL.,BUSINESS) Surveys,Mtg.Schedules,Conferences,Journals Contact:Members(present/potential),Publish.
VENDORS New Channel For Prod/Ser. Advertisemnets Assns.,HNET users,New prod./Ser. Ideas	MEDIA PUBLISHERS Electronic Publishing,Author Communications Advertisement/Sales Of Their Products Surveys,Info.For Articles,Conferences
RESEARCHERS Access:Resources,Other Researchers,Data Subjects,Publishing,Business Dev. of Project	LIBRARIES Databases/Schedules/People Lists/Indexes Conferences/Patron Article Del./Vendors
GENERAL PUBLIC Access:Newest Innovation,Ads For MDs,PhDs &Hosp.,Ads For MDs (travel,products,etc.)	PUBLIC INSTITUTIONS IN GENERAL Links:Govt.,Univ.,Hosp,MDs,RNs,Vendors,Media Info About Health Care Pgms. & Services
FOUNDATIONS Grant:Solicit-Mgmt.-Reports,Gift Solicit.	HEALTH INDUSTRY WORKERS AT HOME Links:Each Other,Offices,Databases,Assn.,

Table 3 - Abbreviated List Of Specific Market Sector Benefits

COSTS AND RISKS

HNET is more expensive than building a complete system from scratch (even if only the national packet switching network was leased). On the other hand, three other parameters cause HNET to be more cost efficient: 1) HNET can offer advanced services and reliability (guaranteed on-time reliability and performance) that would take a start-up company an extended time to deliver (CompuServe has over 15 years experience in national networking); 2) the capital costs of a network such as HNET if bourne alone would be prohibitive. Only using CompuServe or a similar VAN would allow the initial cost to be manageable; and 3) upgrades to the network, the primary mainframe computers, and most network programs are provided by CompuServe at no extra cost - this alone amounts to several millions of dollars per year. In absolute dollar terms the network cost is fairly large, but as the network grows toward an estimated user pool of at least 100,000, the figures become quite cost effective. The size and complexity of the network determines many of the cost and use figures in a typical network, so a range of financial break-even points actually exist.

If a joint venture between an existing VAN or other network was undertaken, the network port costs would drop dramatically, perhaps by a factor of ten. Both the technology and logistics involved in a national public network are quite complex; any organization attempting such a venture must have sufficient business accumen in marketing to prosper in what is sure to become a very competitive marketplace.

Foresight vision and long term committment, the hallmarks of a good business, are critical to the success of a network like

HNET. A business that does not understand emerging technologies, or the entrepreneur base that drives them, will do badly. Techno-shock has kept many industries, including health care, from truly realizing the benefits of advanced information and communication systems. In the past, the cost of personal computing has also been a barrier, as in 1985 the cost of an average IBM-PC is over $3,000. Now, in late 1988, IBM compatibles can be had for as little as $400, and they are bound to drop even more as time goes by and technology improves.

Finally, the lack of desirable services on existing networks has kept them from being fully utilized. Only when a "critical mass" of services are available nationwide will the national networks be widely used (MEDLINE and BRS are a few exceptions). HNET, in the format described, would only be practical if used by a fairly large membership spread throughout the country.

The HNET project demonstrated that it was possible for a large hospital system to develop and maintain a large, national network providing communication and information services to the entire health care industry. This is a radical departure from most hospitals' product line strategy (which accounted for some of the difficulties we encountered in the demonstration project). It also showed the practicality of a customized, semi-leased system as an alternative to purchasing all systems components at the onset of service.

It was clear to us that a successful network would have to include, at a minimum, 1) a very astute business management team, 2) people with a firm understanding of both emerging technologies and the potential benefits of them, and 3) the superior marketing expertise seen in industries such as light manufacturing, retail food services, banking and financial services.

Most of the problems we encountered or predicted fall into three broad categories: system, market, and personnel. In the first category, lack of filled databases and activities (conferences, etc.) in each section of HNET prevented us from immediately marketing the network as a truly useful business tool. A full range of services and resources would have to be offered and supported. Secondly, the installed market base of terminals and personal computers will apparantly be large enough in 1988 or 1989 (at least two to three times the installed base of 1985, the year of the project). The average health industry worker's knowledge level of information and communication technologies, especially the usefulness of them in business and education, is just now starting to move up to the level that will stimulate the demand for a national network with services like those of HNET.

Lastly, the newness of the health care computer network industry and the small number of experienced public computer network users makes every experience a teaching and learning one. Finding network employees experienced in HNET-type activities was (and would be) difficult but not impossible. The value of HNET, both present and future, is difficult for many people to understand (especially those who don't deeply understand the basics of the underlying technology or near future market). A considerable investment in time and money would be necessary for HNET to succeed. We estimate a committment of three years and three million dollars per year would be necessary to fund a full scale national network, considerably less for a smaller one with less services.

THE FUTURE

To us there is no question that networks like HNET will soon proliferate in all industries, the real question being just when they will appear. The precipitous drop in the cost of computing and communicating that we have seen in the last year (and will see in the next 3-6 years) will finally bring personally computing within the range of almost every professional in health care. This is a major change that was not present in 1984-85, and will force all branches of health care to adopt extensive technology-based systems in order to just survive the competition from in and out of health care.

In addition, to all the services mentioned above, HNET could serve as an efficient facilitator and forum for the exchange of major ideas and solutions - areas once limited to face- to- face contact. Added services, such as advanced graphics transmission, electronic media publishing, extensive commercial vendor areas, expanded classifieds, a professional consultant registry, on line universities, and full motion - full color tele-conferencing would make HNET much more attractive, useful, and profitable.

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