

NetMenu: Experience in the Implementation of an Institutional Menu of Information Sources

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NetMenu is a program, developed at Yale, which enables straightforward access to online information systems. NetMenu has been deployed in several diverse settings within our medical center. In the hospital, NetMenu is functioning as a front-end for our clinical workstation providing access to the hospital information system, the clinical laboratory computer, a drug database and several bibliographic databases. The medical libraries are utilizing NetMenu for both medical education workstations and for scholarly information workstations. This paper describes our initial experience in the implementation, support, and maintenance of NetMenu as an institutional menu of information sources.

INTRODUCTION

One of the major challenges for medical informatics involves making online databases, information systems and computer services, e.g., electronic mail, easily accessible to clinicians and biomedical researchers. Most academic institutions have a variety of computer applications on different host computer platforms running under several operating systems. For example, at our institution the hospital information system is running on an IBM mainframe, miniMEDLINE and Current Contents are running on a DEC VAX, and the clinical laboratory information system is running on an HP mini-computer. Although technological advances in networking and communication software have made connection to computer information systems possible for the very sophisticated computer user, most users do not wish to confront the welter of details concerning network protocols, gateways, operating systems, communications and terminal emulation software, and logon procedures.

In addition, our medical center consists of two separate legal and administrative entities, the Yale-New Haven Hospital and Yale University School of Medicine, with separate computing resources. The hospital's computing infrastructure includes both an Ethernet and token ring network. The hospital has standardized on the IBM PS/2 family of computers attached to the token ring for both clinical and administrative workstations. In contrast, the medical school local area network includes both Ethernet and

LocalTalk components, to which are connected both Macintosh and DOS-based personal computers.

Several research groups have developed tools for integrating information resources [1,2,3], which run on specific computer platforms. However, we required a solution which runs on both PCs and Macintosh computers. In order to address the above challenges, we have developed NetMenu, a configurable menu program which provides a unified interface to online information systems. This paper discusses our experience with the implementation, support, and maintenance of this system in this diverse environment.

IMPLEMENTATION

NetMenu is a menu program which runs on Macintosh computers and PCs under Microsoft Windows. NetMenu allows users to connect to online information services via commercial communication and terminal emulation programs. There are two levels to the menu (Figure 1): 1) top level services, such as Clinical Laboratory, which are available on the first screen of NetMenu, can be launched simply by clicking on the item, and 2) second level services which are grouped by categories, such as "Library Services" and can be launched by pushing the "Connect" button.

The specific constituents of a menu are determined by a configuration file which is read when NetMenu is executed. The configuration file is a formatted ASCII file that specifies the top level services, category names, category icons, and the particular services that are included under each category in the second level menus. Each service is defined by 1) its name, 2) the communications program used for connecting to the service, 3) the script file needed for automated connection to the service, and 4) descriptive text about the information source which is accessible by pushing the "Info" button. There are also several options for configuring the appearance and behavior of the program such as the ability 1) to define a string for the menu header, 2) to log usage activity, and 3) to disable quitting the program, a feature which is particularly important in the library and hospital sites.



Figure 1 NetMenu Screens

The screen on the left shows the top level screen for the version of Netmenu which is implemented in the hospital. The first three items are information services which are connected to by clicking on the item. (CCSS is the hospital information system and Micromedex is a drug/toxicology database.) The last two items are categories which include lists of related services. The right hand screen shows the second level for library services. These services can be accessed by first selecting the specific service then pushing the "Connect" button. Pushing the "Info" button will give a short descriptive paragraph about the service.

NetMenu was written in C (Think C on the Macintosh and Borland C on the PC) utilizing XVT 3.0, a cross platform user interface programming tool kit. The same source code is compiled for both the Macintosh and Windows, however, there are a few conditional compilation directives which have been included to deal with launching applications in each of the environments. The process of porting NetMenu from the Macintosh to Windows required about three weeks of time due to the differences in memory management in the two systems. Nevertheless, we feel this was a significant time savings over the alternative of re-writing NetMenu from the native Macintosh to the Windows application programming interface.

In general, we have chosen commercial communications applications for connection to online information services and terminal emulation. (For a discussion of the pros and cons of buying versus building communication applications see [4].) On the Windows platform, we have chosen Dynacomm Async for asynchronous communications and Dynacomm Elite for 3270 emulation. These two products offer robust scripting capabilities and support a variety of network connections and protocols. On the Macintosh, we have chosen PacerTerm since Dynacomm on the Macintosh does not currently support direct network communications.

Versions of NetMenu are currently running on three different networks, the hospital token ring with the IBM LAN Support Program, the university Ethernet with the TCP/IP kernel from FTP Software, and an AppleTalk network with MacTCP from Apple Computer.

Network file servers are used for storing the communication scripts and settings. (The communications programs themselves could also be stored on the file server with appropriate licensing arrangements.) The NetMenu application itself is also stored on the server along with "generic" configuration files which can be accessed by all users.

The incremental software costs of a NetMenu workstation are primarily the cost of the communications programs and the underlying network access drivers. For both the Macintosh and Windows versions of NetMenu this cost is in the \$100 to \$200 range depending on the quantities of software purchased.

LOCAL NETWORK ENVIRONMENTS

NetMenu is currently implemented at over twenty public locations throughout the medical center, including specific configurations for the hospital as a clinical workstation, the medical school library, and the Epidemiology and Public Health library. Each of these implementations has special needs and requirements which will be discussed below. NetMenu is also currently implemented on the desktop of fifteen individuals and its use is expanding.

Hospital

The hospital network includes two major components. A token ring network links IBM PC XT class machines to the hospital information system running on the mainframe and a hospital Ethernet links terminals and PCs to departmental computers. (In addition, the hospital network is connected to the

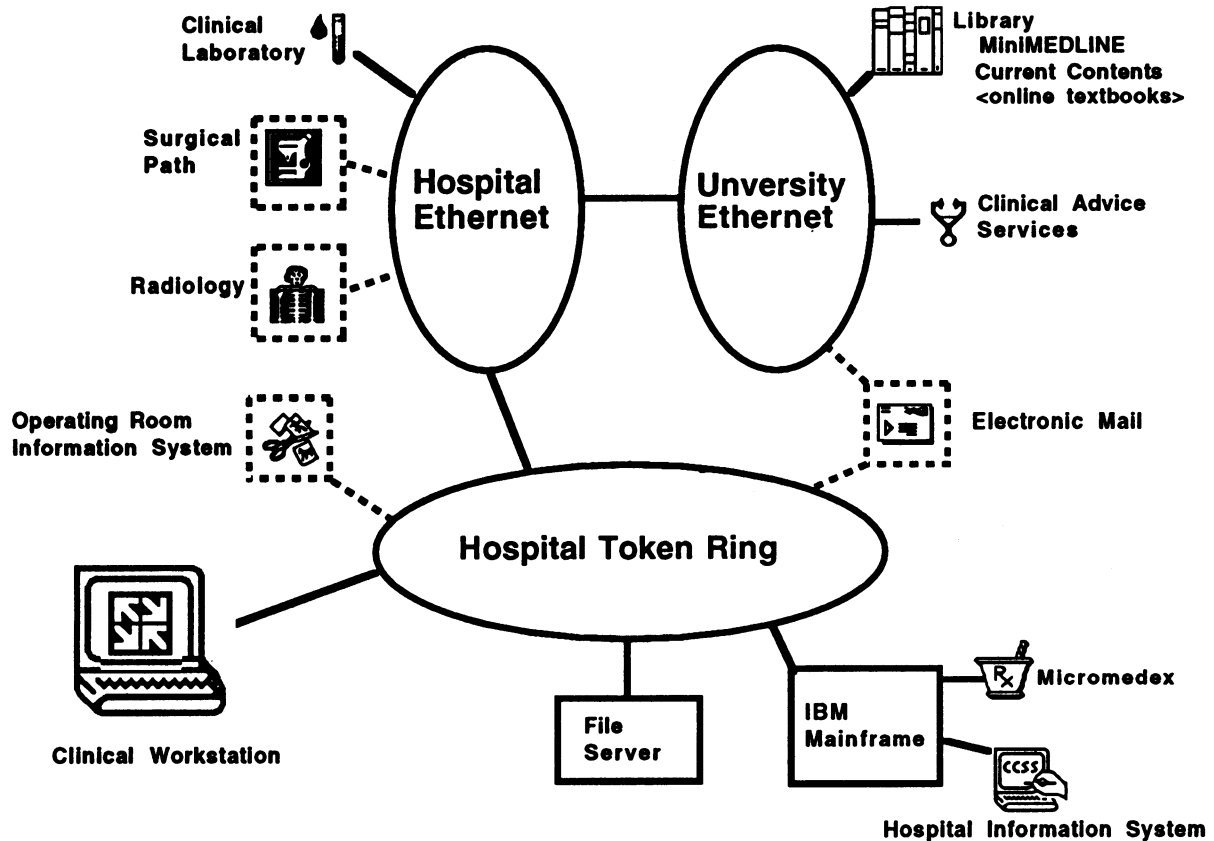


Figure 2 Network Overview of the Clinical Workstation at Yale-New Haven Hospital

This figure gives an overview of the services currently available using NetMenu as a clinical workstation. The workstation allows transparent access to information services on three different networks. Icons enclosed in dashed boxes denote services which we are planning to incorporate into the workstation in the near future.

university network and thus to the services at the medical library.) The goal of NetMenu in the hospital is to create a clinical workstation which will provide easy, transparent access to information sources throughout the medical center.

The clinical workstation software is installed on IBM PS/2 Model 35 (386sx) PCs with at least 4 Meg of memory. The current environment of the clinical workstation (Figure 2) includes facilities for connecting to: 1) CCSS, the hospital information system, 2) Micromedex, an online drug and toxicology database, 3) the Clinical Laboratory, 4) Library Services and 5) Clinical Advice Services. CCSS, Yale-New Haven Hospital's implementation of the TDS hospital information system, runs on an IBM mainframe computer. Connection to CCSS is made via proprietary communications software which is part of the TDS system. Micromedex also runs on the mainframe and is accessed using Dynacomm Elite. The clinical laboratory is accessed using a communication program developed by the clinical laboratory programming staff. Library Services and Clinical Advice Services are accessed using

Dynacomm Async in conjunction with communication scripts which are stored on a Novell NetWare file server. Library Services currently include miniMEDLINE and Current Contents; the Clinical Advice Services category includes Coagulation Advisor and Hepatitis Advisor, two advice programs developed at the Yale Center for Medical Informatics.

School of Medicine Library

We have implemented two configurations of NetMenu in the library with somewhat different emphases: Macintosh-based medical education workstations, and Windows-based workstations to access scholarly information. Both sets of computers provide access to bibliographic retrieval, biomedical full text and molecular biology databases, bulletin boards, electronic mail, the clinical advice programs, and information on research funding. On the PCs, Dynacomm Async is used as the communications application with the communication scripts residing on a Microsoft LAN Manager server. The Macintosh computers are also used to run medical education software which resides on an AppleShare file server. In this case, NetMenu launches the applications

directly off the file server, rather than launching a communications program to access an information service based on a remote computer.

Epidemiology and Public Health Library

The epidemiology and public health version of NetMenu is currently a standalone application running Windows on an IBM PC clone. (All applications, configuration and communication files are stored locally.) This workstation is configured with many of the same services offered on PCs in the Medical Library. Additionally, this machine offers Silverplatter MEDLINE, a CD-ROM based application, and Legi-Slate, a database containing current and pending health care legislation.

One problem in this implementation is that Silverplatter takes about 45 seconds to start. This length of time is prohibitive if many services are to be used. The NetMenu program was slightly modified to address this problem by starting Silverplatter once when NetMenu is started and then hiding the Silverplatter window until the service is requested via a menu selection. The window is also hidden when the user "exits" the service. This strategy could be utilized for any application which is frequently used but has an excessive start-up time.

MAINTENANCE

As various configurations of NetMenu go into production, we are beginning to address a number of issues concerning the maintenance of the NetMenu at an institutional level. Besides maintaining the program itself, there are several areas which require attention including: NetMenu configuration files, and communication scripts.

We have developed an editor to help create and modify valid configuration files. The NetMenu Editor is a HyperCard stack which runs on the Macintosh but can construct configuration files for both Macintoshes and PCs. The program allows the user to interactively create and view a NetMenu configuration file. By pointing and clicking, the user can select information for the top level menu including icons, menu categories, and information services. Various parameters such as the server name, log file name, and whether the configuration should be generated for a PC or Macintosh, are easily set. The tool will then present a graphical mock-up of the resulting menu on request. The stack also contains a database of information services which can be selected in constructing different menus.

Standard configuration files have been constructed for a limited number of needs such as the clinical

workstations, medical education workstations, and scholarly workstations. These configurations are stored on a server, where they can be maintained by support personnel without the need for visiting individual workstations. Each workstation then stores its own one line configuration file which points to the appropriate configuration file on the server. NetMenu and the communications scripts for accessing online information are similarly stored and maintained on servers so that they may readily be changed as NetMenu is upgraded or as new communications scripts are required due to changes in networks or to logon procedures. We feel that limiting NetMenu to a small number of standard configurations and using servers to facilitate changes is essential to providing reliable and supportable service to users, especially as the number of users increases from tens to hundreds.

Each of the NetMenu workstations is labeled with a phone number and electronic mail address to use in reporting problems. These problems are resolved by support staff and the NetMenu developers, usually by making changes to the NetMenu files on the server.

CURRENT STATUS and USAGE

At the present time there are fourteen NetMenu workstations installed in the Medical Library (10 PCs and 4 Macintoshes), six in the Hospital (PCs), one in the Epidemiology and Public Health Library (PC) and twenty three workstations in individuals offices (6 PCs and 17 Macintoshes). The Medical Library utilization is currently logging over 10500 connections to information sources per month with 74% of these connections to bibliographic databases and 18% to electronic mail services. The hospital is logging 500 connections with 24% to bibliographic databases, 32% to the hospital information system, and 31% to the clinical laboratory computer system. Having completed a pilot project in the Hospital, we are planning to install NetMenu workstations on each of the forty patient care units.

FUTURE DIRECTIONS

The first phase of this project has focused mainly on the implementation of publicly accessible NetMenu workstations for the hospital and libraries. The next phase will involve bringing NetMenu into faculty offices and research laboratories. The maintenance of the system will inevitably increase in complexity as we deal with different services and user preferences. One option for managing this complexity would be to extend our NetMenu Editor into a network accessible database of information sources and

configuration options. This database could contain all the information necessary for constructing specific NetMenu configurations, i.e., the computer type, the menu structure, and data on the information services/applications that are available. In fact, this database could contain comparable information to the National Library of Medicine's UMLS Information Sources Map [4, 5] and be viewed as a functional extension of the Information Sources Map. A centralized database would also make it possible to easily individualize configurations for specific users. Configuration files and their maintenance could be dispensed with since NetMenu could perform a database query to retrieve the configuration data when it begins execution. Client programs could also be developed to allow users to design their own configurations. Maintenance would also be facilitated since specific configuration information, such as a server name, would be stored in one place rather than in several configuration files.

In summary, NetMenu has evolved from a prototype into a fully functional program for our integrated information environment. This paper discusses our initial experiences in implementing this system for providing a unified interface to online information services.

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