4.0 OSL Vision Statement

The fundamental purpose of the OSL is to develop and promote open, distributed approaches for health care information systems that will carry us into the 21st century. To this end the OSL will have to serve a number of functions. The OSL will serve as a focal point for the development and testing of the interoperating distributed systems that enable the implementation of regional health care information systems, it will serve in a marketing and education role, and may also provide a prototype environment for the HOST sites.

4.1 Regional Health Care Information Systems Architecture and the Role of the OSL

There is tremendous potential utility and synergy in connecting regional groups of physicians, nurses, medical researchers and students, as well as connecting the information systems of the provider organizations. The goal of a long term and flexible health care information systems architecture is to provide significant new capabilities in order to increase the effectiveness and efficiency of regional health care providers, and to provide a wide variety of communications and educational services to enhance the human environment. The geographic dispersion of the people and information dictates a highly distributed information systems architecture reflecting the mobility of patients, the provider organization human resources, the potential for economies of scale in centralizing certain aspects of the systems, and the need for location independent access to information for education and training. The architecture should address:

- Homogeneous, universally available patient records (CPR)
- Multimedia data as part of the CPR environment, to provide:
  - + audio and video clips from diagnostic and consulting sessions
  - + laboratory results, including instrument “trace” records
  - + X-ray, and other sorts of imagery
- Access to lectures, workshops, and source material for on-going professional and patient education
- On-line source material such as reference image libraries for X-ray and pathology diagnosis
- Tele-presence type of access for emergency, traveling, outlying, and other remote and / or mobile users of all aspects of the regional facilities

The architecture involves several major elements: human resources, electronic information resources, the users (health care practitioners and patients, provider and payor organizations, and researchers), the computing, communications, and data storage infrastructure (information repository). The concept is illustrated in the figure (Health Care Information Architecture Overview).

This architecture provides a completely distributed information infrastructure, with levels of access depending primarily on the volume of data that must be moved among the communicating elements. In other words, everybody from the radiologist at a large hospital to the nurse-practitioner at a rural clinic, to the paramedic in the field, potentially has access to the same information (patient records, x-rays, lab results, etc.), but the bandwidth of access will vary by the circumstance. (Actual access is conditioned on, among other things, the “right” of access; i.e. the authorization of that person to access the information.)

Elements of the Architecture

The systems and communications infrastructure of regional health care information systems will support a variety of data, information, and medical services. Many of these services are characterized in the Hub concept[1]. The Hub is a logically central (though potentially geographically dispersed) facility that is a repository for, and gateway to: medical information in the form of numerous databases; medical consulting, educational material, etc., together with shared computing and data handling services for community health care providers. The network provides uniform access to these services, and the issues of physical centralization may be decided on the basis of economic efficiencies (i.e. economies of scale for hardware operation and maintenance), security, reliability, etc. The elements of an implementation needed to support this architecture, and therefore the elements that need to be present in the OSL are as follows.

(1) Large, secure, data archives:

The shared mass storage system (MSS) is a key element for many aspects of the information architecture. Some of the functions supported by this MSS are:

i) Tele-radiology
(Probably the largest consumer of bulk storage, the cache and tertiary storage capacity will be sized to accommodate the digital radiology activity of the region.)

ii) Multimedia record storage
(The DBMS that handles the CPR system will likely not be able to deal efficiently with large audio, video, and instrumentation trace records that are, none-the-less, part of the patient record. These records will be stored on the MSS.)

iii) Digital libraries
While many library functions will be provided via resources in the National Information Infrastructure (NII) / Internet, locally developed material, material accessed with sufficient frequency as to warrant "local" storage, image based teaching materials, etc., may reside on the regional MSS.

iv) Data integrity
The CPR DBMS servers, as well as departmental computer systems, may choose to use the MSS as the repository for backups of local disks, databases, etc.

(2) Shared Computing Resources:

As experimental technologies like computer assisted radiation treatment planning, MRI 3D analysis and visualization, etc., move into medical practice, the computational requirements are very likely to exceed those available locally. A central facility connected to providers organizations by high-speed networks could provide compute servers for these functions in a very transparent way.

(3) Internet Router:

The Internet is a rich source of information, communication, collaboration, and innovation. Health care professionals should be able to exchange large data sets, explore and retrieve

1· The term "Hub" as applied to an information center that serves as an on-line library and consulting service for the medical community, is due to Dr. Ace Allan, University of Kansas Medical Center.

information from important Internet resources like the National Library of Medicine and the various genetic and protein databases, teaching hospitals around the country and the world, participate in network based teleconferences, etc. Modern, versatile, high speed, routers provide many of the mechanisms to implement these levels of access needed to maximize the information flow and minimize the risks.

(4) High Speed (ATM) Multimedia Data Network:

The general architecture of the telecommunications system is that a high speed fiber based metropolitan ATM network provides the high speed inter-site data communication for large scale users. ATM data streams serve as the link level transport for the Internet protocol suites that carry the computer data between high speed systems like the MSS and the radiology workstations, of the multimedia file servers and the workstations. ATM networks also provide a multimedia stream for high resolution video and audio.

(5) Backup Communications:

In addition to the primary access to the metropolitan area network, there must be a backup communication gateway. This gateway would connect to the same Internet router that is the primary gateway, but it would provide an alternate, low bandwidth access to the outside world.

(6) Security Domain Server:

Depending on the level of security, privacy, and authentication required for the various types of information, an independently administered and highly secure system is typically responsible for holding the information used to authenticate users, grant access permission, provide encryption keys, etc.

(7) Multimedia File Server:

If libraries of multimedia material have to be delivered to a multiplicity of end users, then a system specifically designed for this purpose will be needed. (This system is not unlike the video file servers being developed for use in video-on-demand commercial applications.)

These services match with various functions at the provider sites in order to provide location transparent access to information, and need to be present in the OSL in order to validate and test architectures and components. The Figure (Regional Health Care Information System) illustrates the relationship and connectivity of these elements.

4.2 Functions of the OSL

In order to support the rich collection of capabilities envisioned by the health care information systems architecture, the OSL will provide a variety of functions and services.

Information Infrastructure

The information infrastructure at the OSL is designed to build on the flexibility and access provided by twenty years of Internet experience and infrastructure building, and to address the needs of regional consortia of hospitals and educational institutions to deal with many different types of information residing at many different locations.

The OSL will provide a laboratory environment in which prototype databases, instrumentation

systems, communications systems, and software components will be maintained as a model of a health care information environment. This model environment will provide a testbed in which the proposed architectures and systems can be evaluated. Within the OSL model environment, vendors of open systems components can test and demonstrate their software for functionality and interoperability. As a software development environment, engineers at the OSL can identify "missing" pieces of the overall architecture and, if necessary, develope these pieces as prototypes for commercial software.

To support these roles the OSL will provide a rich and secure software development environment. Private development areas with secure systems and storage facilities will be provided for the protection of intellectual property rights. The OSL will be a distributed facility in order to provide a complete model environment for the regional health care scenario. Network communication and information services will be provided in this capacity for the use and testing of system components. Instrumentation systems will be provided so that instrument interface, control, data collection - analysis - storage functions can be developed, tested, and demonstrated.

Presentation and Education

Many of the system and architecture concepts developed and or demonstrated at the OSL will be new to the health care provider's information technology organization. The OSL will provide the infrastructure for educational presentations on the architecture, implementation, and functionality concepts for health care provider ITO staff. These same facilities can be used by OSL contractors to make presentations on their commercial offerings in order to demonstrate concepts and interoperability.

The physical facilities to support this OSL function will include classroom environments equipped with multiple workstations, workstation screen projection equipment, lecturer support services (publication, binding, view graph production, etc.), and video tape and multimedia production support.

Demonstration and Concept Familiarization

In addition to the development and educational aspects of the OSL, it will serve as a resource for concept familiarization for executives. In this role the OSL will provide high quality presentation and meeting facilities for executive presentations on the overall architectural concepts and capabilities.

The physical facilities might include small auditorium presentation areas for high quality, multi-screen projection, conventional AV facilities, high quality monochrome and color printers for material preparation, access to technical graphics artists, video tape and multimedia production support will be provided, etc.