Developing a Framework for Worldwide Image Communication

Alan H. Rowberg and William B. York Jr

The increasing mobility of the population and frequent changes in healthcare coverage, in both the government and private sectors, require integration of medical records not only longitudinally, but also across a variety of healthcare providers. Early in 1998, the federal government decided to solve this problem by constructing a framework for access to medical records by all of the government's health care facilities, called the Government Computer-Based Patient Record (GCPR). The government consortium chose a proposal by Litton PRC, a partnership of 11 companies with complementary areas of expertise. The framework is based on open systems, which use publicly available standards, and includes a Master Patient Information Locator that allows access to medical information from remote facilities, based on creating a unique identifier for each and every individual patient. PRC will use the Digital Imaging and Communications in Medicine (DICOM) imaging standard for radiology, supplemented by Health Level Seven (HL7).

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BECAUSE OF THE INCREASING mobility of the population and frequent changes in healthcare coverage, whether in the government or the private sector, it has become necessary to integrate medical records not only longitudinally, but also to integrate access to medical records across a variety of healthcare providers. For example, in the aftermath of the Gulf War, when a variety of medical syndromes were thought to be possibly service-related, the US military health services recognized a greater need to preserve and integrate medical records as military personnel moved from one duty station to another. They also often need to exchange medical records with other government agencies, such as the Veterans Affairs (VA) hospitals, because retired members of the armed services are more likely to go to VA hospitals for health care. Patients' previous records are necessary for historical healthcare information, as well, but may be maintained at several different locations. The need for such integration has been widely recognized^{1,2} and extended into radiology,^{3,4} including both private and government facilities.⁵

THE GOVERNMENT COMPUTER-BASED PATIENT RECORD FRAMEWORK

Early in 1998, the government decided to solve this problem by constructing a framework for access to these medical records by all of the

government's healthcare facilities, as needed. They began by forming a consortium of affected departments to explore the clinical requirements for such a system, and documented their conclusions in a Statement of Objectives. The Department of Defense had previously established a process for the procurement of healthcare information systems, so they used this to solicit proposals for the development of this new framework, called the Government Computer-Based Patient Record (GCPR). This procurement process is the Defense Medical Information Management/Systems Integration, Design, Development, Operations and Maintenance Services (D/SIDDOMS) procurement process.

From the proposals submitted, the government consortium chose the plan proposed by Litton PRC, a partnership of 11 companies with complementary areas of expertise. The framework that PRC proposed is based on open systems, which use publicly available standards, and includes a Master Patient Information Locator that allows access to medical information from remote facilities, based on creating a unique identifier for each and every individual patient. Although the GCPR framework that PRC proposed was intended to be expanded to all clinical and administrative areas eventually, the plan for the first year was to include the following four areas: patient demographics, clinical laboratory, radiology, and internal medicine. Delays in establishing the contract and beginning work, coupled with the government's need to stay within a single fiscal year, have required that PRC compress the scope of work to what can be completed within the 8 months remaining in 1999. As a result, the effort will focus on patient demographics and infrastructure in the first year, then be expanded to radiology and other clinical departments in subsequent years.

PRC will use the Digital Imaging and Communications in Medicine (DICOM) imaging standard for radiology, supplemented by Health Level Seven (HL7), as necessary. Although workstations con-

From Litton PRC, McLean, VA.

Address reprint requests to Alan H. Rowberg, MD, Rowberg & Associates, 201 Galer St, Ste 420, Seattle, WA 98109-3194.

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nected to the GCPR system will have a variety of capabilities, only some of them will actually be able to display images. Others will be able only to access the list of radiology examinations that have been performed on a given patient and the reports on these examinations. The computer architecture of the GCPR framework is based on a virtual database, which is a concept of making data stored in disparate physical or logical databases available from a user location by using specialized software that integrates those databases. The software uses a lexicon specific to each information system to map data elements into a set of terms common to all the systems and understandable to users.

Messaging, in the sense of transfer of information between different information systems, will use several internationally recognized, compatible information system standards, as appropriate in each area. For example, radiology image exchanges will be based on the DICOM standard, while other data structures, such as patient demographics, will use the common object request broker architecture (CORBA). Data tables will be used to describe the capability of each workstation and the preferences of each user. Thus, when a user requests radiology information for a patient, the data table for that user and workstation will reflect

what type of information the user's is likely to want and the capabilities of the user's workstation.

FRAMEWORK DESIGN AND IMPLEMENTATION

Some workstations may offer only a limited capability, such as a VGA display that can handle only small grayscale images. In such situations, the image will be reduced in spatial resolution to fit the screen and in contrast resolution to fit in the display palette. In other circumstances, when the workstation is of full diagnostic quality, the entire image can be transmitted for display. Image objects can be encapsulated within a CORBA wrapper, which means a large DICOM image object can be transmitted over the network using CORBA to transmit it, then reconstituted into a DICOM image at the receiving workstation.

The entire implementation of GCPR is envisioned as a 5-year project, and the initial phase involves approximately 80 full-time-equivalent (FTE) engineers and managers who will design the system and implement the first prototype. This effort began in March 1999 and will lead to the demonstration of a functional prototype in September of 1999.

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