The Use of Intranets and Extranets in Radiology

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DURING the last 5 years there has been a rapid advancement of Internet technology for the display of multimedia data and information.¹ These technologies allow access to diverse sources of information electronically. The use of these technologies within an organization (intranets) and to provide secure information access to people outside the organization (extranets) is rapidly expanding. The same technology that has been used on the Internet for display for multimedia information can also be applied to medical image information for the purpose of providing improved health care delivery.

An intranet is use of Internet technologies within an organization. This provides fast and easy access to information within the organization while maintaining integrity of the information and secure access to the information. The advance of cryptographic technology, digital signatures, digital certificates and compression techniques allows expansion of intranets to public networks, ie, extranets in a secure environment.²

This technology was developed to provide access to multimedia data over relatively slow networks. The technology relies on robust networking and the ability to effectively compress and decompress digital information. These same technologies can be applied to medical images and medical image information with only slight customization. This provides potential diverse access to images at a relatively low cost per user.

Internet technology is rapidly developing with significant improvements in speed of delivery and quality on a yearly basis. The technology "push" in nonmedical areas correspondence well with the problems related to accessing medical multimedia data and information.

BASIC COMPONENTS OF AN INTRANET OR EXTRANET

Intranets and extranets are made with the same three basic components: computer network or networks, client software, and server software. Figure 1 shows a logical diagram of the components of an intranet/extranet. The computer network is usually based on the TCP/IP standard but may include other types of networks. Client software is based on "standard" web browsers and email software. The basic standard web browser should support hypertext markup language 3.0, Java (SUN Microsystems, Mountain View, CA), Javascript (Netscape Communications, Mountain View, CA), plugins, secure socket layer, and Active X (Microsoft, Redmond, WA) components. E-mail software and news readers should support Internet standards such as Lightweight Directory Access Protocol (LDAP), HyperText Transfer Protocol (HTTP), Simple Mail Transfer Protocol (SMTP), Multipurpose Internet Mail Extensions (MIME), Internet Mail Access Protocol (IMAP4), and Post Office Protocol (POP3). On the server side the basic components include a web server, e-mail server, certificate server, directory server, relational database or object database and firewall. In addition, in medical imaging applications, Digital Imaging and Communications in Medicine (DICOM) and HL7 gateways may be needed. Interfaces to legacy systems are also helpful.

In a basic intra/extranet application, the internet servers interact with a image information data store (database) and send that information to the client using HTTP or other Internet standard (Fig 1). The data store acts as a temporary storage of pertinent information. Information is sent to the data store using present standards such as DICOM or HL7. The images and other information are retrieved by web browsers using HTTP or the information and images can be e-mailed.

In a more complex environment, the Internet servers may initiate DICOM query and retrieve functions through a DICOM gateway and reformat the images for display in a HTML page with the appropriate plugin or Java applet. In a different type

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Fig 1. Diagram showing components of an intranet or extranet.

of architecture, a Java applet or plugin may initiate true DICOM messaging through the browsers' secure socket layer to a DICOM image server for retrieval of images. In another architecture, security features such as the secure socket layer can be added to a DICOM compliant device to allow secure communication over public networks such as the Internet.

KEY TECHNOLOGIES

Three key developments are necessary before intranets and extranets can be implemented. The first is the acceptance of widely used standards for communication across networks. Many of these have been established for many years and others are just now being established. The second is the development of compression and decompression techniques to transmit large amounts of data over relatively slow networks. These technologies have seen rapid advancement in the last few years. Image compression and decompression technology in the form of Joint Photographic Experts Group compression and wavelet compression are a key in medical imaging applications.

The development of secure communications over public networks is the third key technology development. Secure public communication is not necessary if information is restricted to a private network (intranet). However, this restriction places severe

limitations on the distribution of information in a truly geographically diverse health care delivery system. For example, communication to the patient's home requires the patient to dial in to the health providers private network rather than through an Internet service provider. Many security concerns are now being worked out to enable secure financial transactions and secure email communication over public networks. These same technologies can be used to provide secure medical communications over public networks.

FUTURE PREDICTIONS

Internet technology is progressing at a rapid pace. These technologies will provide several enhancements to today's standard medical applications. Integrated health care delivery systems can benefit from the easy and rapid access to medical information and intranets and extranets will be an integral part of enterprise medical information systems. Intranets and extranets will become standard methods of implementing medical information systems just as database technology is today.

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