DICOM based PACS and its application in the education

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A Picture Archiving and Communication System (PACS) is under development at the University of Szeged, called SZOTE-PACS. The aim of the development is to provide an archiving system, which can be used for education and for the routine consultation discussions.

The modalities at the University are in different clinics and buildings. They are working on different computational platforms and use different output formats. The university network (Token ring backbone, Ethernet LANs with bridges) seemed to be good enough for the data transfer at expected rate. We could solve the problems originated from the different platforms and formats by using converter stations (mostly PCs) between the modalities and the university network. In this way SZOTE-PACS can collect studies from CT, MR, NM, US and SPECT modalities, from X-film scanners and from any station able to communicating according to the DICOM standard.

On the converter stations the studies are automatically converted from Interfile 3.3, ACR-NEMA 2.0 or TIFF formats into DICOM 3.0 format. On these computers, the study headers can be edited by our graphic editor programs. It means that the operator can include new data or modify the study parameters in the header if the modality is not able to collect all the necessary information.

SZOTE-PACS can also collect information from the Radiology Information System (RIS) of the Department. Since most of the modalities are not suitable for direct connection with RIS, we have to include the parameters into the DICOM headers after acquisition on the converter stations. The constant parameters of the studies (e.g. place of study, name of modality etc) are included automatically. The DICOM studies prepared in this way are sent and stored in the data server of the system.

The data server of SZOTE-PACS collects the DICOM studies not only from the stations of the system but also from Internet. There are two ways to send studies: via NFS or DICOM. The first can be applied mostly in the case of Medical University clinics. The other, if the station has DICOM protocol capability, may be used for every other client. Such public domain clients are available world-wide on anonymous ftp archives.

The studies are built in the archive automatically. The disk capacity (26 GB) is presently enough to store the studies of the last 15 days. After 15 days the system gives the possibility to store the data on external devices (cartridge) or to delete the image data (the headers are stored in the archive for unlimited time).

For searching at a good response time in the archive, the users may use the Oracle database system to retrieve, present or modify data. Clients can reach the data by using the Oracle SQL server. Data protection is solved by the Oracle system and can be used to avoid unauthorized connections.

The processing stations (PC-s, UNIX workstations or X-terminals) can request the studies from the DICOM server. Here, the users can process and present studies and as a special feature, they can edit text and images into HTML format to create educational material for graduate and postgraduate medical students. This educational material can also be stored in the system or CD-ROMs and can be used in the training of medical students.

Our PACS system is modular, flexible and based on a 4th-generation functional programming language Tcl/Tk. This language is an interpreter, has Oracle connection and easy to make graphical interfaces with it. Since Tcl/Tk is implemented on UNIX and Pc as well, the same source code runs on each type of clients.

SZOTE-PACS continues to undergo development. The system operates soon in an experimental mode and it will be available for each user by the end of this year.