

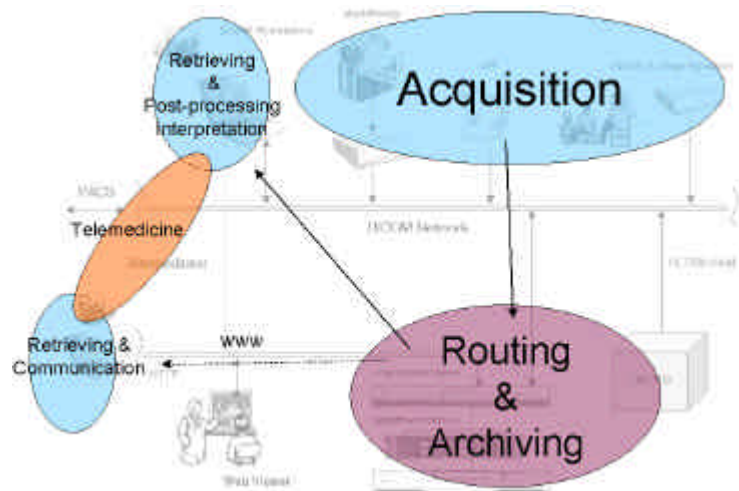
Concept of the Sony Medical Imaging network

Target market

The demand for digital acquisition, management and electronic archiving of medical images and video clips is increasing rapidly. Started some years ago within the radiology and cardiology departments this technology has now emerged to specialisation's like Gastro-Enterology, Bronchoscopy, Laparoscopy, Orthopaedics, Ophthalmology and Gynaecology. Backed by experience on product development, support and workflow knowledge in these areas, Sony will now introduce Networked technology as a logical evolution from video based systems.

Workflow

Looking at the Workflow of images and video clips within the targeted specialisation's, we recognise several phases as there are the acquisition phase, the routing- and archiving phase and the retrieving/post-processing- and interpretation phase. Additionally physicians will more and more use the possibility of sending images and video clips outside their conventional area of usage. Considering authorisation and security, patient data can be retrieved by



physicians outside the hospital, or send to a specialist for second opinion. By using up-to-date communication technology a consultation can start supported by diagnostic quality images or video clips, audio and live videoconferencing images. This technology called Telemedicine is outside the scope of this paper, but is inseparably connected to the described proposal.

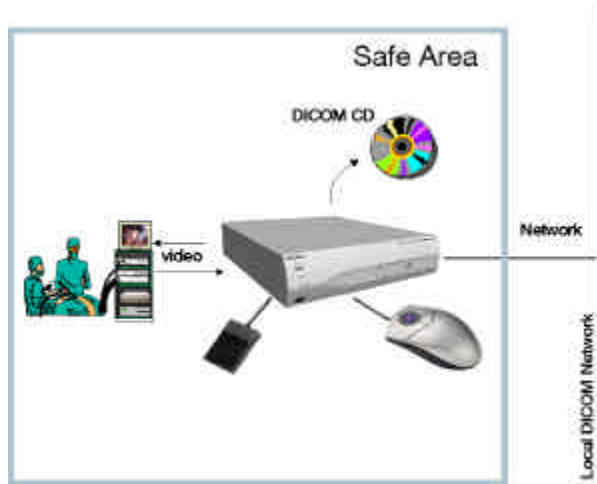
Building Blocks

Looking at the different stages in the workflow we like to describe briefly the separate blocks like the acquisition equipment and the Routing- and archiving system.

P500MD DICOM Image Acquisition System

Concept of this product is a DICOM compliant Image Acquisition 'box' that will be added to existing video based systems. The main feature for the user is the simple operation. Crucial for medical images is that the

patient information is 100% reliable. Therefore this patient data is received over the network from the DICOM Worklist server in the hospital or by 'interpreting' the HL7 data from the Hospital Information System (HIS/RIS).



The workflow is simple,

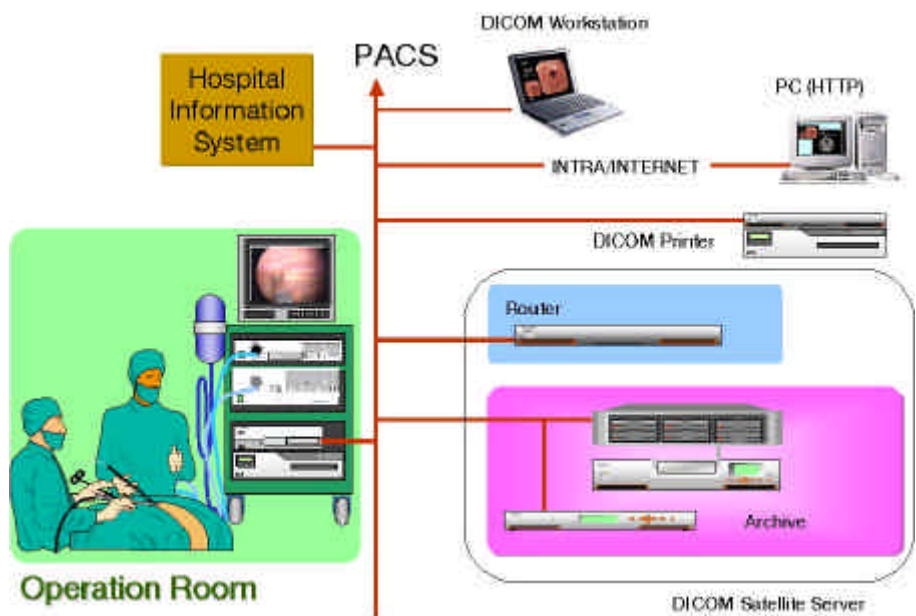
Step one is to select the patient data

Step two is to push a single button to 'grab' images

Step three is to send the DICOM images to the final destination, which can be a DICOM CD with simple viewer, the physicians PC or the system described below.

DICOM Satellite Server

The Sony DICOM satellite Server can be fully integrated as Router- and Archiving System into the hospital environment with- or without existing PACS systems. By using this 'Satellite' concept, workload and responsibility is taken away from the PACS System. If there is no PACS system in use, or for technical or political reasons it is preferred to have a stand-alone system, it is assured by



the applied DICOM standard that later integration in PACS Systems can be easily done. The DICOM Satellite Server supports many DICOM SOP Classes as well as the most recent DICOM Web features.

Because of the DICOM standard, valuable information such as procedure date, patient's birth date, patient name and unique ID are always stored with each image or video clip. It contributes largely to the quality process in Healthcare, knowing the fact that 6-8% of the physical patient files is lost today.

Router part

The Router is the part of the Satellite Server that is taking care of the routing of medical images or video clips and complies fully with the DICOM and HL7 standards. The Router accepts any DICOM image coming from Visible Light modalities like gastro-enterology, bronchoscopy, laparoscopy, orthopaedics, ophthalmology or gynaecology but also accompanying radiology or cardiology images like from MRI, CT or Ultrasound. It accepts still images as well as MPEG video clips images in colour or B&W, uncompressed or lossless or lossy compressed.

Any DICOM compatible equipment can store or retrieve images from the archive by using the Router. Authorised users can have web access to images of the patients he or she is taking care of. The consultation can be at the patient or study level. Images can be visualised with thumbnails or full size images. If necessary the images or video clips can be send in diagnostic quality to the DICOM workstations. Remote access to the system can be fully secured by using the Router's capabilities.

Additionally to control the manual access to images, the Router offers enhanced automatic routing features. DICOM Image sources are sending all the images to the Router. Depending on easily configurable filters, the images can be forwarded to other DICOM equipment like workstations, local servers, CD-R writers, the central PACS server or to the Sony Archiving system. Filters can be based on many DICOM header fields including modality, physician, and time.

Because of the software interface between the Router and the Archiving System there is intelligent control of the archive. Depending on manual requests or newly added information about a certain patient, the Router can communicate with the Archive to 'reload' old patient files. Deletion of files, in the case a patient has died or moved elsewhere, should be done in close co-ordination between the Hospital Information System (HIS), the Router and the Archive. But even deleted files can be recovered within some timeframe.

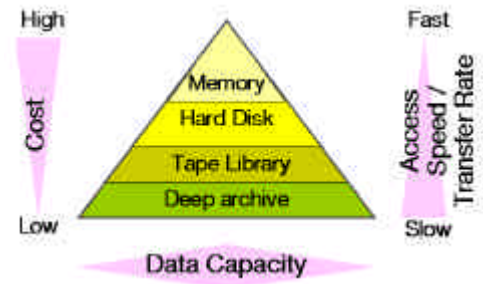


The Router logs any event in XML encoded audit trail files compatible with IHE (Integrating the Healthcare Enterprise) Technical Framework. This makes it possible to use the Satellite Server in the process to improve the efficiency in workflow in the hospital by using the IHE Framework later onwards.

Archiving part

Hierarchical Storage Management (HSM) software provides maximum storage operating by automatically and efficiently managing the storage system. In close co-operation with the Router software, HSM matches choice of recording media with the way that data is used, for example depending on the status of the patient, still under treatment or released after finishing the procedures and last visitation.

The HSM Migration and Reloading function of the software has been designed to achieve maximum storage performance on an overall throughput basis by transferring files between hard disk array (RAID) and the tape based library. Moving a file from hard disk to tape library is called “migration” and restoring that file to the hard disk is called “reloading”. This process is controlled by the Router software and depends on the status of the patient in hospital workflow.



The so-called Cache, consisting of an independent NAS file server, does the first level of storage. The Cache system, a kind of buffer, is taking care of the files that are in the transfer process between the library system and the users.

The second level of the archive consists of a hard disk part, actually contains three huge hard disks in a so-called RAID configuration. This assures maximum reliability. Lost data because of a defective hard disk is nearly impossible. On this hard disk are all the files that need immediate availability.



The third level is the tape based library system, a compact ‘tape juke-box’ unit that contains 16 tapes with a total maximum capacity of 1.6 TeraByte (1600 GigaByte). The build-in barcode reader identified the loaded tapes. The Router software can anticipate on ‘on-line’ availability of very old files that are outside the juke-box by sending an e-mail or SMS message to the archive operator on-duty to load a certain tape before the patient file has even been requested by the physicians.

The fourth level of archiving, the deep archive, for files older than several years, will depend on the hospital policy and sometimes on local laws. Nowadays this archive is often outsourced to an external company and the files are then even physically stored outside the hospital.

Other functions of the HSM software are the intelligent backup of the Cache and RAID Hard disks to the tape library and keeping control of the technical quality of the loaded tapes. If the quality of the tape is decreasing, an automatic back up will be made in the quiet periods of the system, mostly at night. Capacity of all the system components will be monitored continuously and an early warning will be given if capacity problems seem to appear in the near future.

Support

Developing and building this kind of systems is, from the technology point of view, not very difficult. Implementing networked imaging systems into the medical workflow and keeping them operational asks for more than just customised design and installation.

Precise analysis of the needs and expectations of all relevant users, and adapting the configuration to these needs is the first step.

After the installation the training of medical staff and responsible engineers is of course mandatory, but repeating these training's annually avoid that primary knowledge of the system leaked away over time because of replaced staff.

Clinical data of patients should be always available, but any hard- and software technology can stop working. Therefore support have to be available. Sony will provide telephone access to knowledgeable product specialists for advice on operation, issue management and act as first point of contact for support requests. The contact persons have the capability for English, German, Spanish, French and Italian languages. Another level of support is remote investigation and configuration of the supported system (Remote Diagnostics). A Loan Unit will be supplied to resolve hardware breakdowns where the problem cannot be resolved by telephone or remote diagnosis. All this will guarantee maximum availability of the clinical data over the depreciation period of the system.

Building Blocks

Having described briefly the functionality of the complete solution, we like to list the main used components and some budgetary prices.

DICOM Satellite Server

Material Number	SRP
DICOM Router Software	12,500.00
SLX-0178 Server	43,050.00
FSV-M3 Fileserver	11,716.00
Prime Support	7,590.94
Total System	74,856.94

DICOM Workstation

Material Number	T2_SRP
VAIO PCV-LX2	2,350.00
DicomEye Viewer	790.00
Query-Retrieve option	520.00
Prime Support	234.24
Total	3,894.24

If you are interested to discuss further about the concept of the Sony Medical Imaging Network, please contact your local Sony representative for medical solutions, send a e-mail to medical@sonybpe.com or call +31 20 44 99 270