

Image conversion from Markcare PACS to Siemens PACS

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This is an overview from the conversion of images from Markcare PACS to Siemens PACS done at Ullevål university hospital. Which conversion methods that is used, DICOM challenges, organs, link between RIS and PACS and experiences about all this.

INTRODUCTION

Facts about Ullevål university hospital

Markcare PACS and Quadrat RIS were implemented in december 1999 at the children radiology department. The last department was the largest department and this was finished summer 2001. Heart/cardiology radiology department had their own PACS and was not a part of this project. Siemens RIS-PACS started up in September 2004. The heart/cardiology radiology department became now a part of the new PACS.

In the period from 1999 to 2004 it was produced about 12 million images in Markcare PACS. In this period there were produced images from the following modalities:

CT, CR, MR, DX, US, XA and OT. There was also made reconstruction of MR and CT images.

STORAGE OF IMAGES AT MARKCARE PACS

The SAN solution has a short term archive and a long term archive. In the period from 1999 to 15. december 2002 there were used a Taperobot ADIC 1000 as a long term archive. From 2003 to september 2004 there were used a HSM solution with a Storagetek taperobot as a long term archive. In the whole period there were used SAN disk for short term archive.

All images have an attributefile that have the last information about the image layout. (Window level, measuring, ...). It would not have the last information about the patient.

POSSIBLE METHODS FOR LOADING IMAGES FROM MARKCARE PACS

We had two possible methods to load images from

Markcare PACS.

1. Use the IMS to export images out of Markcare PACS.
2. FTP images out of archive.

We tested solution 1 and this gave us two drawbacks. The first was that this will take much more time to load images than solution 2 and we lost updated data in the images because it wouldn't update the header in the images with the newest information.

Solution 2 was faster and would have possibilities to update the header in the image with data from the attribute file, because both files would be loaded.

Solution 2 was preferred.

POSSIBLE METHODS FOR UPDATING THE DICOM HEADER IN THE IMAGES AND UNCOMPRESS IMAGES:

1. Uncompress image, update DICOM header with information from the database.
2. Uncompress image, update DICOM header with information from the attribute file.
3. Uncompress image, do not update DICOM header.

Solution 1 would give the most updated data for the image. We didn't have any documentation about the database and then it would be too complicated to find all the information and be sure that this was correct.

Solution 2 would be the second best solution. The information in the images would be updated, except patient information. This was solved by doing the RIS conversion first. Then RIS would be the master. When images were imported, we did a clean up job with sql scripting.

The last solution would give a loss of data and would not be preferred.

Solution 2 was preferred

POSSIBLE METHODS FOR SENDING IMAGES TO SIEMENS PACS:

1. Make a DICOM send program and let this appear as a DICOM modality and send examinations to PACS and let the IMS update the database.
2. Save images into the SAN and then update the database with scripting.

Solution 1 would use normal mechanism in Siemens PACS to save images and the possibilities for error and complexity would be reduced to a minimum.

Solution 2 would be much more faster, but the risk would be higher and the cost would be much more higher.

Solution 1 was preferred.

WORKFLOW OF CONVERSION:

See figure 1.

Application FTP checks Markcare IMS database for which images to get loaded. The database contents where the images are placed and status on the images. When the image is saved on the temporary image store the application will change status in the database. If the image where processed the application will ignore this file and do the next. The files will be saved at the temporary image store in directories based on examination id and date. Next step is that the next application uncompressing the file, update DICOM header if the values are different and make the file into a DICOM file and send it to Siemens PACS IMS. The DICOM send closes the session when all files in one directory is processed. The application will change the name on the file by adding OK in the file extension. This will make it possible to see what is processed and what is not processed.

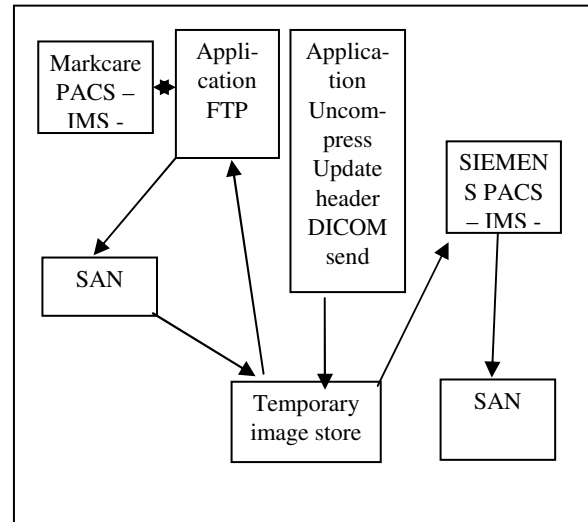


Figure 1. Conversion workflow

OVERVIEW OF LOGGING:

Application FTP updates the database when a file is loaded from the SAN and saved into the temporary image store. Here you can see if the file is processed or not.

Application for uncompressing, update header, and DICOM send has four log files.

- Application log where everything it does will be logged. This is an event log.
- Change log where every change in the DICOM header will be logged.
- Error log includes all files that is not been send to Siemens PACS.
- Succeed log.

Siemens PACS IMS:

- Regular system logs

MAPPING OF DICOM TAGS:

Markcare PACS uses a proprietary standard called Mark DICOM 2.1. This standard is related to the DICOM 3.1 and the differences are few. We didn't have any documentation on this, so we had to do it from scratch. The method that we used was to make a copy of the same image, but in different cases. So we started with an image with no changes of any case. Then we used the same image and added for example Region of interest and then checked how this was used in the tags. This was done for every 21 possible features in Markcare PACS. We saw that some of the same tags where

used for different cases. In this cases we had to combine these features and see how it appear in the tags. There where private tags that was used and this tags had to be remapped to Siemens private tags or when it was possible to public tags. After this it was done testing for all types of images. (CR, DX, MR etc)

ALLOCATION TABLES:

In some ultrasound images it was missing an allocation table for the images. This table had to reconstruct in some images.

LINK BETWEEN SIEMENS RIS AND SIEMENS PACS

Restore link between RIS and PACS examinations. In Quadrat RIS and Markcare PACS the link was made on accession number. This appeared in the DICOM header of the images and where converted in the RIS conversion. A sql script was made and the link was made on the same criteria as Siemens RIS-PACS system uses.

UPDATING ORGAN MATCH BETWEEN SIEMENS RIS AND SIEMENS PACS:

When we started with Siemens RIS-PACS we wanted to change the organ table. To do this we had to build a mapping tree based on the examination tree. This where done and with a sql script we changed the organs to the new setup.

CONCLUSIONS

More than 99.97% of the examinations are converted. The main reasons that the conversion was not 100%.

1. There are private tags in images that Siemens PACS don't support.

The conversion has been a success. There are only one thing we should have done different and that is:

1. ADIC 1000 taperobot was a very slow medium and loading of files from this should have been done different. The tape robot could only load from one tape drive at the same time and the images where not in chronological order on the tapes. We should have found a faster method for loading images from this tape robot.

There are several things we are very satisfied with and here are three highlights:

1. More than 99.97% of the examinations are converted.
2. Mapping of DICOM tags.
3. All images have kept full functionality for measuring, window level and other functionality. There is few differences between converted images and images produced and sent to PACS today.