TRANSFORMING patient diagnostic services

Fujitsu delivers Picture Archiving and Communication (PACS) for the NHS
Fujitsu in Healthcare
PACS

Picture Archiving and Communication System, more commonly known as PACS, is enabling the vision of a filmless and paperless NHS. PACS allows images such as x-rays and scans to be captured, stored, distributed and viewed at the touch of a button, giving healthcare professionals quick and efficient access to patient information.

PACS is one of the lynchpins of the NHS Connecting for Health (NHS CFH) programme that is transforming the delivery of healthcare across England and giving patients more choice and control over their health and care. By 2008, the NHS wants no patient journey to exceed 18 weeks and PACS, underpinned by the Radiology Information System (RIS), plays a key role in diagnostic services to ensuring that the healthcare service meets this objective.

The primary goal of deploying PACS is to improve the quality and efficiency of patient care. The system helps clinicians to realise this ambition through:

- Increasing the use of clinical images through the retrieval of historical examinations.
- Increasing workflow and productivity – information is sorted into worklists which are then customised to each clinician.
- Decreasing repeat examinations.
- Changing service provisions – hospitals, trusts etc will no longer be reliant on one hard copy of an image.
- Increasing patient confidentiality, data protection and security.
- Reducing environmental hazards associated with traditional development methods.

PACS images can be viewed in two different ways and will depend on a member of staff’s job role. For example radiologists, radiographers and some clinicians will view images via a PACS Workstation. A PACS workstation is a high specification PC running specialist PACS software with one of a variety of monitor configurations. Each installation is customised to meet the specific site requirements.

Other users can access images via a Web Viewer. Images can be viewed on any PC within the hospital able to connect to the PACS Web Server using Microsoft’s Internet Explorer. Users are only granted access if they have correct identification and log in passwords.

**Introduction**

**WHAT IS A TYPICAL PRE-PACS WORKFLOW?**

1. Patient registered
2. Previous exams hung in reading room
3. Patient data re-entered at acquisition device
4. Exam performed
5. Transcribe and report approved
6. Radiologist dictate and un-hang films
7. Hang films
8. Quality assurance
9. Develop film
10. Send films and report to referring Clinician
11. Retrieve films and report from referring Clinician
12. Re-assemble film jacket
13. Return films to File Room

**WHAT IS A TYPICAL POST-PACS WORKFLOW?**

1. Patient registered
2. Exam performed
3. Radiologist read, dictate and approve
4. Quality assurance
5. Referring Clinician accesses report and films
Like the rest of the NHS CFH programme, PACS is being delivered to trusts and hospitals throughout England through regional Local Service Providers (LSP). Fujitsu is the LSP for the Southern Programme for IT and provides PACS linked back to duplicated central image stores.

In March 2007, ahead of all other LSPs, Fujitsu completed the deployment of PACS and RIS throughout the south. Local installations in x-ray departments serving A&E and other clinical services in 167 hospitals now means that 13 million patients and 256,000 NHS staff are ahead of schedule in beginning to realise the benefits of the programme.

Fujitsu has also implemented PACS at trusts outside the Southern region, stepping into the breach in Eastern, West Midlands and North West regions, also with great success.

PACS represents a whole new way of working for NHS staff and ends 100 years of film being the exclusive medium via which medical images are captured, stored and displayed. It is important to take this on board and ensure that the implementation of PACS isn’t just treated as a technology implementation, but as a business change programme. Tightly integrated with RIS, which supports the image management and reporting workflow, PACS is not just a collection of technologies – it supports a business process.

How is PACS being **DELIVERED**?

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“Certainly from my perspective, being the chair of the implementation of the project, it has been a huge investment of time. I have had a full time project manager working closely with me, but equally she has worked very closely with the project manager from our supplier, Fujitsu. That relationship has been excellent, they have interfaced well, flagged up any problems and worked as a very efficient two-way process.”

_Evelyn Barker_, Director, Clinical Services, Heatherwood & Wexham Park Hospitals NHS Trust

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**SOUTHERN PROGRAMME FOR IT KEY FACTS**

- 13m patients
- 256,000 NHS staff
- 31 Primary Care trusts (PCTs)
- 5 Ambulance trusts
- 43 Acute trusts (including 25 Foundation trusts)
- 18 Mental Health trusts
- 1 Care trust
A CHANGE in working practices

PACS will allow clinicians to provide a better quality of patient care. By no longer having to rely on one hard copy of the required medical image, staff will be able to access the right image, at the right time. This might sound simplistic but its impact is significant as it will support and ensure an efficient, accurate and well communicated diagnosis.

In the Southern Programme for IT, completion of digital imaging enables radiologists and clinicians to benefit from:

- Greater availability of images, leading to results being available within a quicker time frame.
- A rapid transfer of images. No longer reliant on one hard copy of an image, staff are able to view it at any PACS workstation in their place of work.
- Greater availability and access is resulting in timely reporting, decreasing a patient’s stay.
- Increased patient satisfaction in referral and attendance times.
- No lost or misplaced images as they are all stored centrally.
- Increased image quality which allows for better analysis and for comparison images to be viewed in a synchronised fashion.
- Greater collaboration as one image can be viewed via multiple PACS terminals allowing for discussions about diagnosis.
Essentially PACS helps staff in their roles and alleviate many of the frustrations that were previously experienced, such as misplaced and lost images.

PACS also brings distinct benefits for the management team of hospital, trusts and GP practices – all of which are under pressure to ensure that the Government’s vision of a modern NHS becomes a reality.

- The better management of images will mean that they are not mislaid and will reduce the number of complaints and claims.
- Increased PACS support for the strategic plan for electronic patient records.
- Increased communication between clinicians and patients.

“PACS in Gloucestershire is a huge project because it encompasses two general hospitals and eight community hospitals’ x-ray departments. To replace all hard copy film with electronic files for image viewing required us to upgrade the infrastructure across the whole county and ensure IT could support this level of functionality. We were one of the first to go-live and have been for 18 months. We were well versed in the requirements of PACS before the project started and were a good site to take on early. Other sites in the south hadn’t even thought about PACS and to get every trust on board within a two year timescale was seemingly impossible. But it has been done; hats off to Fujitsu and the NHS staff who’ve adapted and put in the required energy to make it happen.”

Dr Frank Jewell, Consultant Radiologist, Gloucestershire Royal Hospital
What systems and equipment are involved?

PACS is made up of the following components:

- PACS Database – the Image Management System.
- DICOM Application Server – DAS, the interface unit where images are compressed before reaching PACS.
- Short Term Storage – provides on-site/on-line storage of approximately one year’s image production.
- Long Term Store – holds all images captured and verified by a hospital at the replicated Fujitsu Data Store.
- PACS Broker – providing connections to Patient Administration System (PAS) and Radiology Information System (RIS).

“From a personal point of view, by changing to the new electronic system we have limited the true ‘on-call’ period where we are required to provide a consultant only service for interpreting images. By reducing that on-call period I have actually made my life a lot easier in terms of not being harassed in the middle of the night or late in the evening to give an opinion about images and x-ray films. All my colleagues agree that we could never go back to a film based system.”

Dr Michael Creagh, Consultant Radiologist, Ashford & St Peter’s Hospitals NHS Trust
Radiology Information System (RIS)
The RIS is a key element of the programme supporting the image management and reporting workflow. The RIS and PACS are tightly integrated and communicate via standard HL7 communication protocols. RIS sends new and updated reports to PACS, providing demographic and exam request information.

Image Management System (IMS)
The IMS is the PACS database. Designed for high (on-demand) performance, it manages both image and database data. Hosted on a highly scalable UNIX server it maintains patients’ folders and worklists as well as managing user preferences.

DICOM Application Server (DAS)
DAS provides modality work load balance. By performing compression it introduces multiple points of entry for fault tolerance.

PACS Broker
Both the HIS and RIS interface with PACS via the PACS Broker. PAS and RIS use HL7 protocol to send messages to the Broker, which in turn sends SQL messages to the PACS database. In addition the Broker also sends the Modality Worklist to Modality (a list of patients to be examined on that modality).

The Short Term Store (STS)
The STS holds images recently acquired by a hospital on-line for immediate retrieval. These images are also sent to the Fujitsu Data Store. The STS has been sized by NHS CFH to hold approximately one year of exams on-line on-site, based on the rate of image generation in 2002. The Short Term Store is technically implemented as the PACS Image Storage Unit (ISU).

The Long Term Archive
The Fujitsu Data Store provides a central long term store of images captured across the Southern Programme for IT. It takes the physical form of two data centres which provide duplicated copies of the images for data resilience. Stored on spinning disc systems, the Fujitsu Data Store provides rapid access to data previously held on AIT Tape/DVD/MOD media on site. Following acquisition the images are sent in real-time from the hospital to the Fujitsu Data Store over a wide area network. Exams can then be accessed from anywhere in the Southern region. All images are preserved, even when no longer stored in the hospital’s short-term store and can be retrieved for scheduled or ad hoc usage.

Part of this infrastructure will already be in place in many trusts. For example, the Hospital Information System (HIS) comprising of the Patient Administration System (PAS) and Order Communications System (OCS) were implemented and networked whereas other components will need to be integrated. So what do they all do?
Supporting Teleradiology

Teleradiology is enabling radiologists to work from home or other remote locations whilst on call. Before PACS if a scan needed to be examined, the radiologist would have to travel to the hospital in person and view the scan in the radiology department. Thanks to PACS this can now be done remotely.

The minimum recommended connection for remote access is ISDN or cable/DSL broadband. Once the appropriate connections are in place, there are three options:

- Access image data from the PACS web server – given secure access to the hospital network, named users can access image data direct from the PACS web server from any PC at any location running IE5.5 or above. This is the simplest and most cost effective method of remote image access and is relatively tolerant of low bandwidth because users are able to choose to view images using higher or lower levels of compression.

- Remotely located PACS workstation – with a secure link to the trust network, a PACS workstation could be located at the radiologist’s on call location such as their home address. The workstation is then configured to temporarily cache data on the PACS workstation hard disc to help performance over the network link. The workstation must be logged on to the PACS system at the hospital in order for images to be viewed.

- Dedicated Teleradiology workstation – with secure access to the hospital network, a remotely located RA600 workstation with the appropriate software can pull PACS images or receive pushed PACS images for viewing and manipulation.

PACS online

The PACS Web provides a single point of access for the clinical review of medical images and related data, such as reports, on a hospital-provided PC linked to the hospital network. Complete with full clinical toolsets and integrated cardiology features, the PACS Web extends the ability for clinicians to view information from any location. In addition, because PACS Web shares the same database and image cache as PACS, staff can have remote access to all images as well as the ability to search for archived images.

Although the image viewed on the web workstation is the same as on the clinician’s PACS workstation, the quality will depend on the PC and monitor, and whether the high resolution option has been purchased. Images are stored on PACS using lossless compression and are read as such by the web application. The web does not apply any compression itself but displays the image according to the platform on which it is viewed. Images from the web are therefore not suitable for diagnosis unless they are viewed on a two or three megapixel monitor.
To ensure that Master Trainers are well equipped to pass the knowledge on, feedback is given during their training sessions and there is a minimum skills inventory that they all need to achieve before training other members of staff.

eLearning is available and every trust within the Southern Programme for IT has been supplied with a Web eLearning Application, which has complimented other forms of training. The eLearning has three levels from basic to advanced, which can be embedded on the PACS Web software if required. However, it is important to note that it cannot be tailored to meet specific trust or individual needs so should be used in conjunction with other training methods.

Support and training
Fujitsu offers comprehensive levels of training and support. The overall approach to the delivery of training has been developed in line with the needs of the customer in the Southern Programme for IT in order to meet their specific needs. Fujitsu has worked with hospitals to train key users and hospital trainers. For maximum success it is important that a hospital manager is deemed responsible for agreeing the training plan and co-ordinating training for all impacted staff.

Because the training is modular, it is flexible and can be adapted to each individual hospital. Hospital trainers, or ‘Master Trainers’, are then responsible for filtering training down to relevant staff members. Master Trainers are trained in all aspects of the system and the Fujitsu team work with Master Trainers to determine which content should then be passed down to other team members.
**Service**

Fujitsu understands that clinical staff are in the front line of the NHS and need to deliver a high level of service on a constant basis. There is no point in having a great day on Monday, only for your IT system to let you down on the following day. If NHS service is to improve and meet patient expectations, hospitals need to be assured that their PACS service provider is working to strict Service Level Agreements and has a good underlying, service orientated infrastructure in place.

Area Service Managers (ASMs) represent the overall Fujitsu service responsibility at trust level. Supporting the ASMs is a service management organisation that provides end-to-end service management, which includes:

- Incident management.
- Problem management.
- Configuration management.
- Change management.
- Release management.
- Availability management.
- Capacity management.
- Service level management.

“PACS is a very challenging project to manage and Fujitsu were able to manage both PACS and the Radiology Information System. The challenge comes when it impacts all aspects of hospital life as everybody interacts with radiology. What Fujitsu was able to do was work with us as a team – this was key from day one. By taking a team approach and by identifying where we want to get to, the barriers we would face and how to overcome them, we managed to deliver the programme on time and on budget.”

Tony Corkett, Programme Manager, Kent & Medway PACS