PACS: What radiologists need to consider

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Back in 2004 the ambitious but oft-maligned National Programme for IT provisioned Picture Archivng and Communications (PACS) systems throughout the NHS in England with a series of Local Service Provider (LSP) contracts. One of the core benefits of this approach was that it allowed the ubiquitous roll-out of PACS across the NHS; the use of centrally provisioned suppliers and networks managed to cut through many of the local barriers to implementation we perceive in the implementation of IT systems in hospitals, even in current times.

Financial and contractual considerations apart, an unfortunate legacy of this approach was that not only did it result in limited engagement with hospital IT services – a schism between radiology and other hospital IT services that lasts to this day – but, the author would argue, it has been the root of the learned helplessness that has pervaded radiologists' limited involvement with PACS systems and suppliers until recently.

The thrust of this article, therefore, is not to introduce radiologists to the mechanics of systems they have already been using for over a decade, broadly unchanged despite the evolving medical landscape they have been deployed into, but to explore the core requirements of modern PACS systems to make them fit for modern practice purposes and to, perhaps, stimulate mindset from "get what we are given" to an era where we interact and DRIVE changes to meet our reporting needs.

The initial efficiency gains when transitioning from film to digital systems have been marginalised by the year-on-year 10% increase in volumes of complex imaging, while (wo)manpower has remained broadly static, patient care and hospital geopolitics have likewise evolved from single sites to multi-site environments, with strategic transformations that require regional clinical pathways needing to be underpinned by improved and more diverse image sharing. Thus, PACS is moving radiology towards the concept of a single enterprise-wide single medical imaging archive.

The radiologist needs to consider the requirements of the solution – both functional and technical – as well as what improves its ease of use and quality. We should concentrate on the frustrations and deficiencies, real or perceived, in current solutions that need to be addressed. To become the informed customer, we should also seek to discover what aspects clinicians want in place to enhance patient care by their interactions with imaging. We also need to engage with and seek to *challenge* suppliers, learning what mechanisms they propose to address these gaps, but equally to not settle for such proposals. It is these interactions that will drive innovation.

In broad principles we should seek to explore:
· Features that make reporting more efficient
· Ways to make MDT workflows, which are an increasing time sink, more efficient;
· Ways to modernise and improve teaching methodology and put radiologists back in the heart of one of their core traditional strengths;
· Flexible working capabilities such as home reporting and cross-site reporting not only to try to bridge the gap between increasing demand and flat capacity but also to

· **Fully standards-based**
· Best of breed throughout
· Open APIs
· Fully deconstructable components:
  – Fully interoperable with other solutions
  – Seamless integration invisible to user (single sign-on)
· Workflows:
  – support efficient modern working
  – provide business intelligence
· Support home working and multi-site working
· High resilience within technical infrastructure
· Collaborative approach:
  – Best solution for the trust/region NOT best sale for the supplier

TABLE 1

improve morale and wellbeing with the application of flexible working capability in a pressurised workforce.

Table 1 summarises the principles, in the views of the author, of a modern, fit for purpose imaging system.

From a technical perspective, it is no longer acceptable for solutions to have a proprietary architecture. We should insist on standards-based solutions that conform to recognised industry standards, which in turn would promote suppliers developing them. Moving beyond DICOM and HL7 that we are already familiar with to XDSi, FHIR and the alphabet soup that constitutes the standards for Vendor Neutral Archives (VNA) such as ATNA, PIX, PDQ, IOCM, LCM[1] etc.

The concept of open APIs means we can incorporate future proofing with "deconstructable" solutions, meaning that as systems refresh we don't need to replace a whole monolithic piece of software but instead can swap in or out individual components to fit our needs, leaving the overall product in place for familiarity and cost benefit.

Suppliers increasingly adopting web-based architecture means we no longer need to be chained to bespoke workstations, shackling us to specific locations.

While this article does reference PACS, increasingly the use of labels such as PACS, VNA and RIS is becoming less meaningful as the boundaries between these industries are blurred by encroachment and consolidation of functionality. You may wish instead to consider this as a solution of three components:
1. The "viewer" with advanced visualisation features (the PACS)
   – This provides features to support efficient diagnosis and reporting.
2. The enterprise image archive (the VNA)
   – Stores objects in their native file format
   – Can support multiple 'ologies not just radiology.
3. The workflows. Features to make the following more efficient and effective:
   – MDTs
   – Teaching
   – Discrepancy and audit
   – Business and image analytics.
Taking these in turn, what were previously considered "advanced visualisation" features such as 3D, MPR, MIP, virtual colonography etc are now all standard features of a modern system. Instead, advanced features include CAD integrated workflows (we can't really get through a health

IT article without mention of AI) such as automatic nodule detection and measurement, fracture and lung shadow identification, automatic detection of mammography lesions. Decision support is currently a growth battleground also. At scanner level these also include tools such as workflow management (prioritising scans with pathology on them).

The archive allows storage and display of objects such as endoscopy, ECG, medical imaging, PDFs alongside DICOM imaging. This extends what was a previous digital radiology journey from filmless now to paperless imaging. It allows us to store and display images and documents across the clinical networks in real time in a unified display, with developments being made into context-launching of relevant documents in one solution.

In many ways the most important developments are related to the workflows: More efficient working is an important benefit of any new system. Do not seek to replicate the same old way of working. Indeed when looking to new systems rather than dictating a "solution" it would promote better dialogue with suppliers to instead concentrate on the overall goals, you can build clinical scenarios to facilitate this, and allow suppliers to suggest solutions. Concentrate on *overall* pathways as sometimes the time saved might lie between cases, not just time to report. Remember also not to over-specify questions (and avoid "can you do" type questions as the answer is almost invariably "yes") and resist the temptation to solutionise.

Let us from the outset deal with the elephant in the room currently of PACS vs RIS-based reporting. The simple answer is: "Who cares and why should it matter?" If solutions are fully standards-based and allow seamless integration invisible to users it should matter not a jot if you report in the PACS or the RIS as long as the report is synchronised to the patient.

However a modern reporting solution should support:
· Media-rich reporting (hyperlinks to key images, thumbnails);
· Auto-insertion of measurements and tables for lesion-tracking;
· Template reporting – in turn an enabler for machine learning tools.

More efficient streaming technologies support cross-network and home reporting, so-called "location agnostic reporting". This is augmented with better communication tools included advanced red dot functionality and instant messenging to collaborate on cases with peers, trainees and clinicians.

MDTs, which are a huge and rather inefficient time sink, benefit from features including diary functionality case management at the time of reporting (directly add cases to MDT list, work-up MDT presentation states while reporting) and collaboration with other MDT members.

Teaching packages allow more than simply digitising our cases, including features that anonymise and export images, create multiple choice questions and short response cases and even the ability to export and email whole quizzes to trainees.

With better dialogue and engagement with suppliers we can look to shape improved workflows, better service quality and technology integration – breaking down the silos.

If we don't, then future procurements may not enable us to provide the efficient services we desire.

Reference

1, www.IHE.net