Bridging the communication gap between public and private radiology services

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ABSTRACT

- The delay in transfer of imaging studies when a patient moves between hospitals and between public and private systems has been a barrier to expedient and safe patient management.
- There is also suboptimal reporting when patients have serial imaging undertaken partly in the private sector and partly in the public sector, because of inability to access previous imaging for comparison.
- Availability of a DICOM (Digital Imaging and Communications in Medicine) server enables sharing of health information, including imaging data, across various sites and jurisdictions.
- In Perth, Western Australia, we have successfully introduced electronic image transfer between five public teaching hospitals and three large private practices with different picture archiving and communication systems.

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In Australia it is common for patients to move between public and private hospitals for their care. Patients are seen in the private practice environment for follow-up and ongoing treatment and management after discharge from public hospitals. The reverse is also true — patients who have diagnostic imaging studies in private clinics are referred to public hospitals for further management.

The current system of transferring imaging studies from one location to another as hard copies or on compact disc leads to delays in management and occasionally adverse outcomes for the patient concerned. The need for a solution to this problem was precipitated by two cases.

Patient A, who was taking warfarin therapy, presented with a large spontaneous subdural haemorrhage. The patient was referred to the neurosurgeons at a neurosurgical centre, but deteriorated while waiting for computed tomography (CT) images to accompany the transfer.

Patient B presented with haematemesis. A contrast CT study revealed an aortoduodenal fistula. While waiting for CT images, the patient had another massive haematemesis and deteriorated and died while being transferred.

Background

Five major teaching hospitals in Perth and several of the smaller general metropolitan public hospitals are serviced by a single centralised picture archiving and communication system (PACS). Each hospital can view patient images across the entire system, an ability seen as extremely advantageous to patient care across the Perth metropolitan area.

Two major private providers of diagnostic imaging in Perth and one large provider in a rural area each have their own PACS environment. Although they use different radiology information systems, they coincidentally use the same PACS application as each other (but not the same as the public hospital PACS).

Setting up the system

In May 2008, the Western Australian Department of Health (DoH) and the private radiology provider Perth Radiological Clinic (PRC) undertook a pilot project to see whether a public–private PACS link could be established to facilitate electronic transfer of images between the Armadale–Kelmscott Memorial Hospital (a public outer metropolitan hospital that outsources its radiological imaging to PRC) and the metropolitan tertiary hospital PACS.

The brief was to expedite patient management, allow specialist opinion without physical patient transfer, and reduce repeat examinations (and hence radiation exposure) of patients transferred to public hospitals for tertiary-level management. Additionally, the system was to allow bidirectional image transfer to enable private sector radiologists to access public sector images for patients under their care. Members of the project team included representatives of the DoH's Information and Communications Technology group, representatives of two major private radiology providers, PACS administrators from the Perth tertiary hospitals, and ourselves.

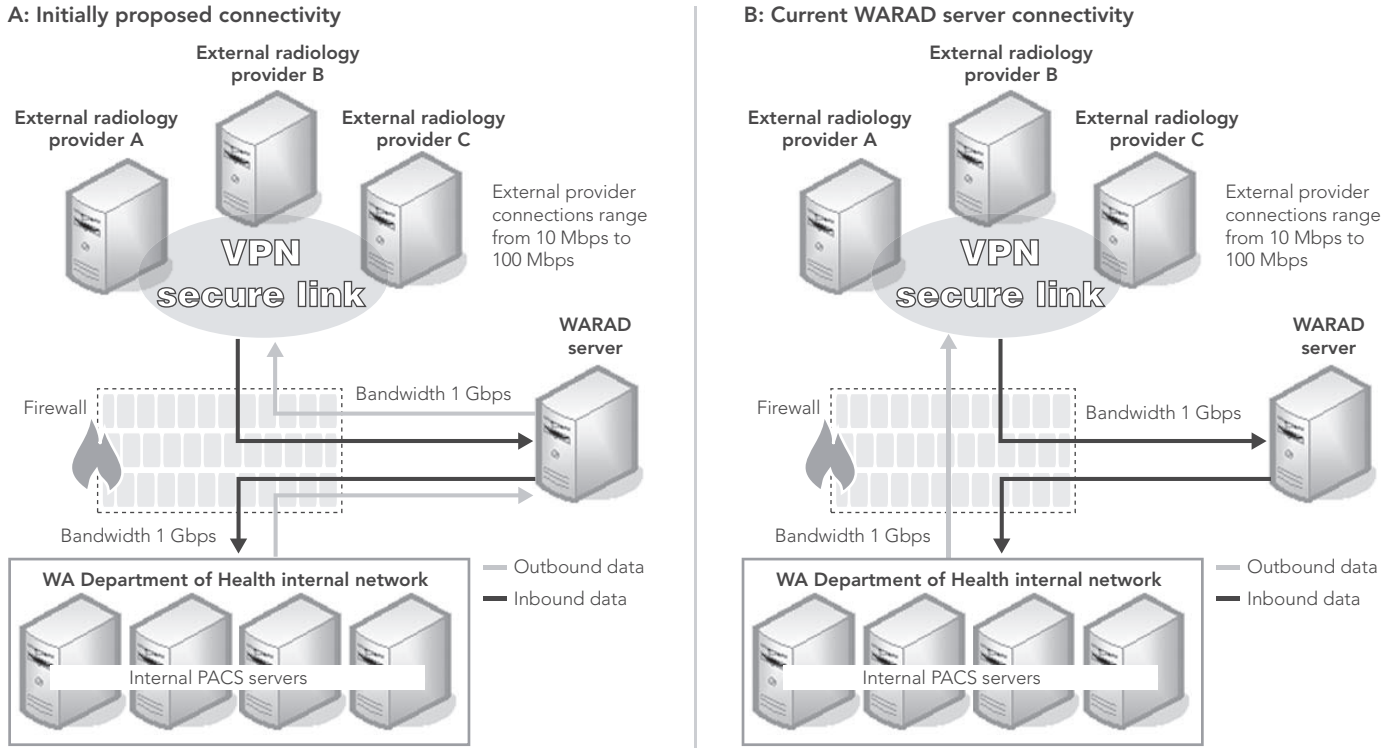
The pilot project was funded by an initial grant of $100 000 from the DoH. To implement the project, the working group initially proposed to set up a dedicated server, the Western Australian Radiology (WARAD) server outside the DoH firewall (in the "demilitarised zone" [DMZ]) that could receive images from the private sector for retrieval by the public hospital PACS. Similarly, the public hospital PACS could send images to the WARAD server for retrieval by the private sector (Box, A). However, because of security issues, an alternative model was developed whereby the WARAD server could receive images from the private sector for the public system but images for the private sector would be sent directly to the private provider's network via secure virtual private network (VPN) links (Box, B). The VPN provides an exclusive link to the WARAD server, which is more secure than transferring data via a public internet connection.

The WARAD server is a proprietary DICOM (Digital Imaging and Communications in Medicine) server loaded with the same software as the existing public hospital PACS, for workflow and compatibility

Abbreviations

CT	Computed tomography
DICOM	Digital Imaging and Communications in Medicine
DoH	Department of Health, Western Australia
DMZ	Demilitarised zone
PACS	Picture archiving and communication system
PRC	Perth Radiological Clinic
VPN	Virtual private network
WARAD	Western Australian Radiology

Initially proposed Western Australian Radiology (WARAD) server system compared with current system*



PACS = picture archiving and communication system. VPN = virtual private network.

* In system A, firewall rules allow external providers to send to the WARAD server; internal PACS servers to send to the WARAD server; and the WARAD server to send to internal PACS servers and external provider servers. In system B, firewall rules allow external providers to send to the WARAD server; the WARAD server to send to internal PACS servers; and internal PACS servers to send to external providers. ◆

advantages. It was installed and configured for $40 000 and has an ongoing annual maintenance cost of $4000. The system set-up cost for PRC (borne by PRC) was $25 000, and the ongoing maintenance cost of the dedicated VPN link is $1500 per month. No other significant costs were incurred. WARAD server maintenance is now part of the DoH's PACS application support.

The bandwidths from the private providers and the DoH vary between 10 and 100 Mbps (megabits/second), while the DoH's network link from the WARAD server back to the DoH internal PACS servers has a bandwidth of 1 Gbps (gigabit/second).

No major compatibility issues were encountered other than minor network address translation issues, which were easily solved.

Patient consent and user authorisation

The agreed protocol requires that patients give consent, with the sending site obtaining and keeping a written consent form (or verbal consent in emergency cases). The patient consent procedure is a difficult area that is under constant review. The working group is currently discussing with the legal branch of the DoH the feasibility of developing an "implied consent" model that would allow patients an "opt out" option when they first present. This would reduce current heavy demand on the time of authorised personnel in both private and public systems.

Once images have been transferred to the receiving PACS, local protocols are implemented to make the images available for viewing by authorised users. In the public system, the images are viewable by any authorised PACS user with an appropriate username and password. Access in the private system is determined by the private providers' existing security models.

Access to the server infrastructure is limited to authorised system administration staff by way of specific firewall rules for that user and a unique username and password. All access is auditable.

To further protect patient privacy, images in the WARAD server are deleted after 2 weeks (this lag period is under review). If there is a requirement to have the images permanently stored in the receiving PACS, system administrators create radiology information system events to which the images can be linked.

A memorandum of understanding outlining the system concept, responsibilities of each party, timeliness of image exchange, and patient confidentiality and consent issues was signed by both the public and private parties. A process and protocol document was developed and distributed to clinical staff and radiographers.

Discussion

The pilot project was completed in May 2008. A similar exchange of digital images was introduced in Pennsylvania, United States, in 2006,[1] but, to our knowledge, the system described here is the first successful link between public and private PACSs in Australia.

In June 2008, imaging studies on 65 patients were successfully transferred between the public and private sector. Due to the success of the pilot project, two additional private providers

requested linkage and were connected by February 2009, and two additional independent practices now wish to join. Current traffic is approximately 150 studies per week in any one direction. Challenges include the resource-intensive nature of the transfer process: the personal intervention required by staff in both the public and private systems to obtain consent and the time spent on telephone communication each time a patient presents for imaging are substantial.

Since the implementation, there has been only one minor adverse incident, in which the images required were transferred in a timely fashion for a second opinion but were not reviewed until the next day. However, this did not affect the outcome for the patient.

An audit trail regarding use of the shared system and objective evidence of reduction in radiation exposure (by eliminating repeat examinations) is being collected and will hopefully be published within the next 2 years. However, there is anecdotal evidence of reduction in repeat examinations.[2]

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Competing interests

None identified.

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