

Purpose: PACS tech refresh and upgrade with zero downtime and minimal rollout delay

Introduction:

- SingHealth is a large health system. Our Radiology division
- services 4 major hospitals, 3 community hospitals, 3 specialist centers and 9 primary healthcare facilities
- performing 1.6 million radiology exams a year
- with 2360 PACS users (2000 clinicians & technologists and 360 radiologists)

PACS is our **Image distribution system** and **Radiology reporting system**. With 4 hospitals providing inpatient and emergency services, **24/7/365 PACS uptime** is critical.

Methods/Materials:

Our PACS architecture is designed for **high availability (HA)** and **disaster recovery (DR)** (Fig. 1).

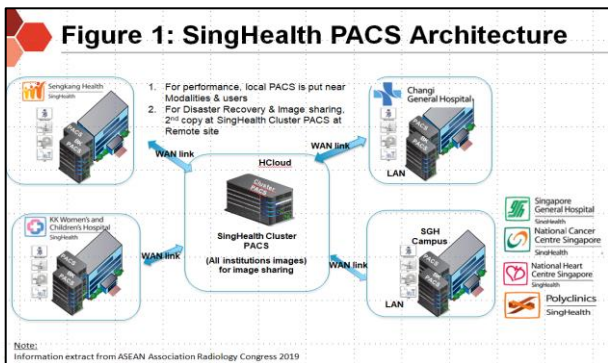
Setup at each of the four major PACS sites comprises:

- production (Prod) PACS and
- backup (BK) PACS for HA

Our DR site concurrently serves as:

- the cluster central archive and
- image distribution system for clinical teams to access images

Direct connections between each sites' Prod PACS caters for DR downtime.



Note: Information extract from ASEAN Association Radiology Congress 2019

Due to tight restrictions on access to our hospitals by non-medical personnel during the pandemic, new PACS servers were initially set up **remotely** and only shifted to **onsite working model before go-live**.

Decentralized user acceptance testing was performed concurrently at all sites. The DR site was upgraded first, followed by each site's BK PACS. **Comprehensive end-user testing of the upgraded BK systems** was followed by transitioning selected users onto the BK system to surface any remaining software bugs or configuration issues. Finally, the Prod PACS were upgraded sequentially.

Three teams worked on the project: the PACS vendor, SingHealth IT team (IHIS) and radiology PACS system administrators (SA).

Effective communication between the teams was essential:

- Weekly meetings for updates and discussion by videoconference
 - WhatsApp chats or email were additional communication channels
- During go-live cutover, a **virtual command center** was set up using:
- Group chats to quickly disseminate progress updates and issues
 - Checkpoint meeting by videoconferencing

Results

The main project ran in 2020 during the on-going COVID-19 pandemic. As planned, the **new PACS servers were set up remotely**. **Go-live cutover was managed remotely**. A few staff came onsite for support and client verification before go-live. This strategy proved highly successful.

Staged upgrades starting with DR PACS, then each BK site followed by the Prod sites proceeded as planned.

During the **DR upgrade**, image forwarding to the central archive (DR) was disrupted. During DR downtime,

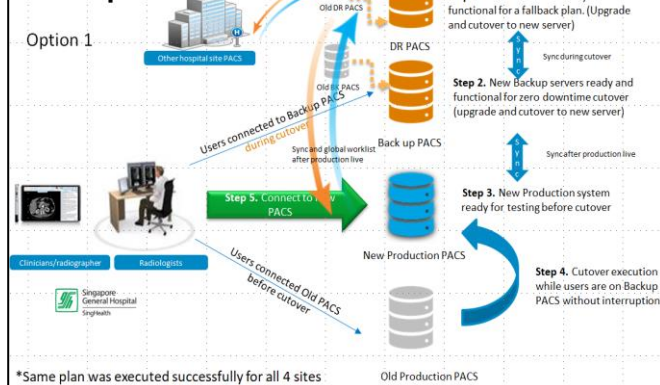
- clinical teams accessed local images from Prod PACS and cross-site images using Federated search
- Radiology users accessed cross-sites studies using direct cross-site PACS access.

During **Prod PACS upgrades**, radiology users accessed BK PACS for a seamless transition with near zero effective downtime (Fig. 2).

Effective downtime at each site during Prod PACS upgrades was about **two blocks of 15 minutes** each; the time taken for the to and fro swing between Prod and BK PACS. Radiology reporting continued uninterrupted using BK PACS during the Prod PACS downtime.

The **total project duration was 20 months** and from hardware readiness to completion was 12 months; **this was within project expectation**.

Figure 2: Zero downtime cutover plan



Conclusions

The COVID-19 pandemic despite disrupted in many aspects of life and work; a major cluster PACS upgrade and tech refresh was **successfully executed remotely**.

Keys to our success were:

- Detailed preparation, extensive pre-upgrade testing and careful stepwise execution.
- Offsite setup of the servers to circumvent restrictions to hospital access.
- Effective communication between the teams using videoconferencing, Whatsapp chat groups and email.
- Leveraging on our PACS architecture, using the high availability BK PACS and centralized DR PACS during the system transitions.

We achieved **near zero PACS downtime, uninterrupted radiology reporting and minimal disruption to image viewing** in SingHealth and the other cluster institutions.

References

<https://medical.sectra.com/resources/sectra-upgrades-migrates-uhs-pacs-no-server-downtime/>

Acknowledgements

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