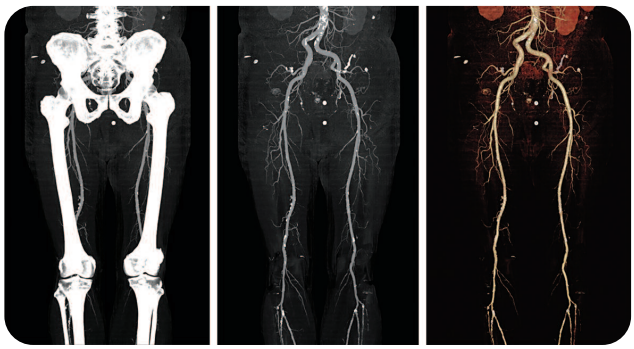
'Thinnovation'

Boosting your PACS workflow with thin-client technology

By Hartmut Schirmacher, PhD, and Keith Dreyer, MD, PhD

The gap between the "2-D world", e.g. a traditional PACS, and the "3-D world", usually consisting of a number of specialized workstations, is widening in many places due to a lack of true integration. An increasing need for archiving and viewing thin-slice images widens this gap even further.

A paradigm shift is needed to address these issues – moving away from thinking in two separate categories "PACS" and "advanced visualization", and, instead, using a single-solution platform for enterprise-wide diagnostic imaging. Three-dimensional thin-client technology is the key for winning that challenge, and for truly integrating thin slices and an advanced visualization application into a streamlined diagnostic workflow.



Visage CS Thin Client/Server provides powerful tools for CT and MR angiography throughout the enterprise, at the click of a mouse. Left: 3-D maximum intensity projection (MIP) of a contrast-enhanced CT study, with the bone included. Center: 3-D MIP of the same study with the bone removed automatically by Visage CS. Right: Volume rendered image of the same study, with the bone removed.

THE ISOLATED WORKSTATION PARADIGM

Currently, many hospitals have a centralized PACS, along with a number of loosely integrated 3-D review and post-processing workstations. Data is sent from the modalities to the PACS, then forwarded to (or pre-fetched by) selected workstations.

This "isolated workstation" paradigm, however, creates many problems. Original data is not always available where needed, and moving all the thin slices between the servers and different workstations takes too long. Also, additional quality control is needed to ensure all diagnostic images generated are correctly archived and transferred to all recipients. Furthermore, user preferences and work results are lost when switching to a different workstation because workstations do not have enough main memory to process a large multiphase thin-slice dataset, such as cardiac CT. Or, another problem could be the graphics hardware is not up-to-date in order to do 3-D visualization efficiently. Other problems include: versions and optional application packages must be installed and monitored, but they're not always consistently available across workstations; and referring physicians and clinicians can only review snapshot images.

INTEGRATED DIAGNOSTIC WORKFLOW REQUIREMENTS

It is important to look closely at the current PACS offerings – many solutions offer some sort of 3-D capabilities, but only very few can truly archive, distribute, and visualize all the data generated by the modern diagnostic imaging modalities, especially thin slices and large 3-D and multiphase ("4-D") volumes.

Advanced visualization solutions, on the other hand, usually focus entirely on some specialized 3-D applications, but lack enterprise-wide deployment, efficient access to a central thin-slice archive, decent "2-D" functionality for the day-to-day radiology tasks, and the architecture and scalability needed to serve a modern, distributed healthcare enterprise.

Radiologists and clinicians need access to all diagnostic imaging data and clinical applications throughout the entire hospital with the click of a mouse, including a thorax or mammography image, as well as a CT cardiac study. Two-dimensional, 3-D, and 4-D studies all need to be displayed using different preset protocols, and these protocols should be adaptable for an individual site, group or user. All images should reside in a single, central archive, and they should not be distributed arbitrarily depending on different applications. This includes prior datasets that should automatically be made available as far back as the archive capability goes.

Furthermore, remote access is playing an increasingly important role. As hospitals and even practices become more distributed, outsourcing and remote services grow stronger, and diagnostic imaging professionals turn into "roaming experts" that need to be enabled to work in multiple locations and for multiple institutions.

PERFORMANCE MATTERS

In order to match the workflow and integration requirements mentioned above, performance is of the essence. When you think about the current size of image volumes for a single patient and even a single study, and observe the fast evolution of diagnostic imaging technology, one can clearly see the trend toward processing even larger amounts of data. A CT runoff can easily consist of 3,000 slices, multiphase cardiac CTs are already done at 8,000 slices, etc. With the current CT in-plane resolution of 512 x 512, this amounts to 1.5 GB and 4 GB, respectively, just for fast image display out of main memory. Once the in-plane resolution is doubled in each dimension, these numbers will go up by a factor of four.

When this happens, hospitals and imaging centers need to have a thin-client PACS solution installed. If not, all workstations on which that data is to be viewed or processed will need to be

updated accordingly.

The key differentiator of a thin-client-enabled PACS is a truly central, high-performance thin-slice and 3-D processing paradigm, along with efficient streaming technology to enable any client computer to act as fully capable front-ends to all basic, advanced viewing, and processing functions of the PACS. This includes thin-slice viewing, thick-slice viewing (where thick slices are generated on the fly based on the user's requirements), and advanced 3-D and 4-D applications.

With a thin-client architecture, all DICOM data remains on the server (no data transfer prior to launching the thin-client viewer), all operations are performed directly on the server, and all functions can be accessed instantly from anywhere in the enterprise via thin clients. Thin-client PACS can be accessed anywhere, including off-site locations, from any PC with access to the network.

IMPLEMENTING ENTERPRISE-WIDE VISUALIZATION

Hospitals can deploy modular thin-client solutions on top of their existing PACS, or look for a PACS that is based on a thin-client architecture – but be aware that these are still very rare.

If you choose a modular thin-client solution alongside an existing PACS, make sure to choose a fully scalable system that grows with your demands – and does not stop at a certain number of concurrent users or concurrently viewed images. The system must be scaled in a transparent fashion, behaving like a single central system with one database and one portal to the user.

If you are looking for such a solution, be sure to get a demo of the actual performance of the system – including large 3-D image volumes (runoff, cardiac), large 2-D image resolutions (thorax, mammography), and full remote access to 2-D, 3-D, and thin slices. There are significant differences, since many systems have originally been designed either for only 2-D or 3-D.

If hospitals are looking for a new PACS, they should consider a one-stop solution: the unique combination of PACS, advanced visualization tools, comprehensive clinical applications, and a fast thin-client platform for optimizing the entire clinical workflow. One-stop solutions are modular, scalable, and configurable to the needs of different user roles, such as radiologists, technologists, and referring physicians.

IMPROVED PATIENT CARE

From the hospital's point of view, a thin-client PACS removes technical barriers between different modalities and departments and creates a much more homogeneous and manageable IT infrastructure. This, in turn, allows for more efficient diagnosis and patient treatment.

Furthermore, clinical applications, such as CT cardiac analysis and surgical planning, can be integrated directly within the clinical workflow, thereby providing access to state-of-the-art image quality and manipulation for all departments inside and outside the hospital network.

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