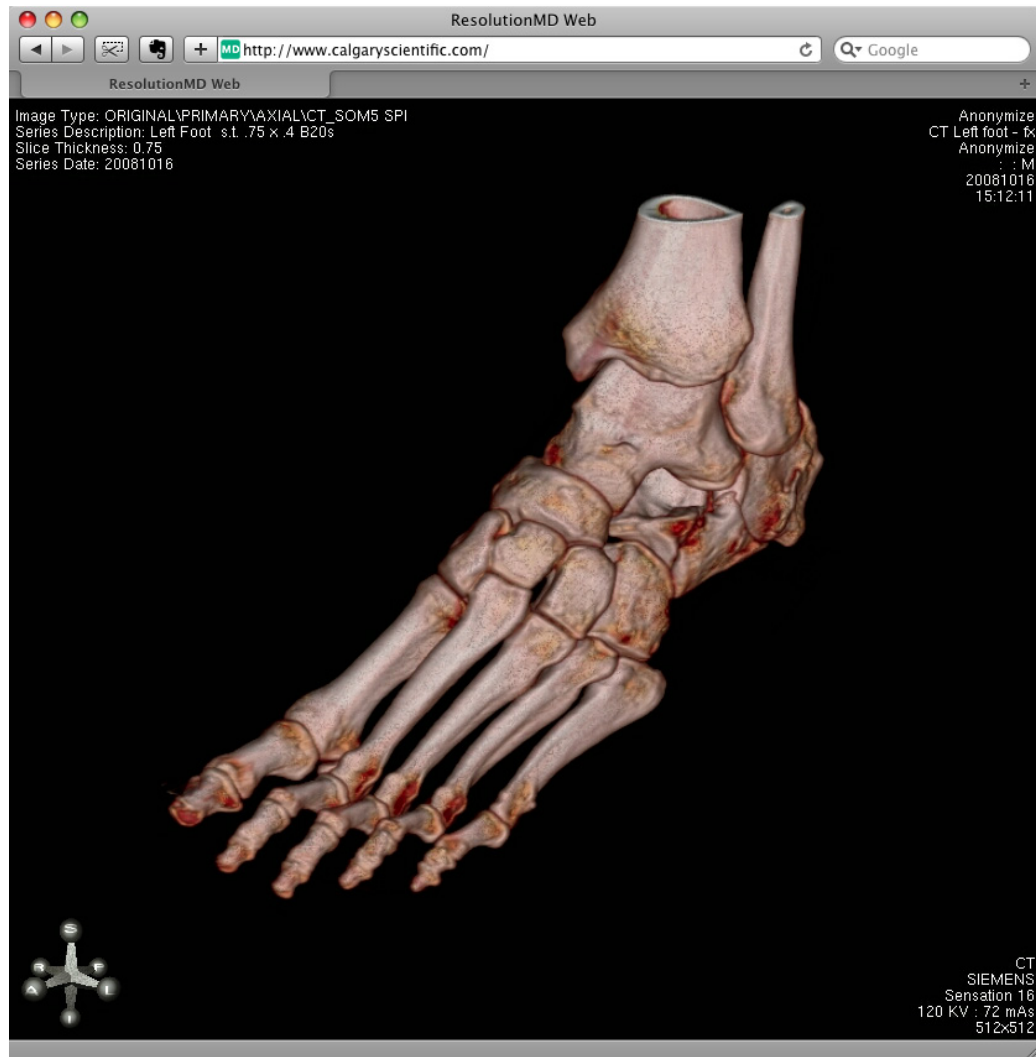


Defining the Zero-Footprint Client

Separating the Wheat from the Chaff



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INTRODUCTION

Over the past half-decade radiology has been inundated with the message: “thin is in.” This message applies to the transformation of advanced visualization (AV) from a world dominated by noisy, heavy duty dedicated AV workstations to one dominated by AV windows that pop up on PACS workstations as well as general purpose desktops, laptops and even smartphones. Currently this message is being replaced by “Zero-Footprint Client” as the go-to technology for AV, but what does Zero-Footprint Client (ZFC) really mean and who really has it?

WHY A CLIENT IN THE FIRST PLACE?

The problems associated with reading the rapidly increasing number of slices per volumetric imaging study have only multiplied since the SCAR-TRIP report of 2004. While the TRIP report identified hundreds to thousands of slices per study as the future, today’s dynamic volumetric cardiac 3D ultrasound and functional magnetic resonance imaging series are generating tens of thousands of slices per study. Because the existing infrastructure can become overburdened as slice count increases, radiologists and their institutions are adopting new approaches to the reading of multidetector computed tomography (MDCT) studies and investigating new paradigms for temporarily and permanently storing the original high resolution, sub-millimeter thin section slices (“thins”).

There are several common approaches to managing the multislice studies. Institutes themselves are still split on whether to keep thins or discard them. Commonly, teaching hospitals and other large well funded institutes archive thins in perpetuity while others preserve only thick slices for the record. Many radiologists “scan thin, read thick” by reconstructing series that are ten or more times the thickness of the acquisition slice thereby reducing the number of slices to be read. Others institute a policy of moving thins to a temporary location – a “modality cache,” storage on one or more

AV is defined here as the computational treatment of tomographic imagery to produce secondary views or metrics that require more than one original image as input. For example, filtering a single slice or transmission image (CR, DR) for sharpening is not advanced visualization whereas presenting MIP projections, MPR reformats or automatically determining maximal stenosis in a CTA vessel is.

Morin, 2004.

3D workstation(s) or even into a dedicated secondary “3D miniPACS.”

Regardless of the approach to reading and managing thin slice studies; their massive size is a burden on healthcare IT in many ways. For instance: storage demands are increased, the hardware requirements for viewing platforms are increased but most significantly; the time to move, load and read these studies is increased.

By and large, radiologists expect an image to be retrieved for reading from a PACS in less than 2 seconds. This is widely achieved in modern settings for the majority of vendors and the majority of modalities. However, this is rarely achieved for MDCT. A modern PACS can retrieve 60-100 slices per second, but MDCT studies may contain 2000 or significantly more images with retrieval times of minutes. Adoption of client-server systems helps to solve this problem by caching the MDCT studies on a high performance server that can load them extremely rapidly. The radiologist or imaging specialist then interacts with the application remotely which is a huge savings in her time and the hospital’s infrastructure. The dominance of the “thin is in” approach to reading MDCT and other large slice count studies is a testament to the success of this approach.

FIVE DEGREES OF THINNESS

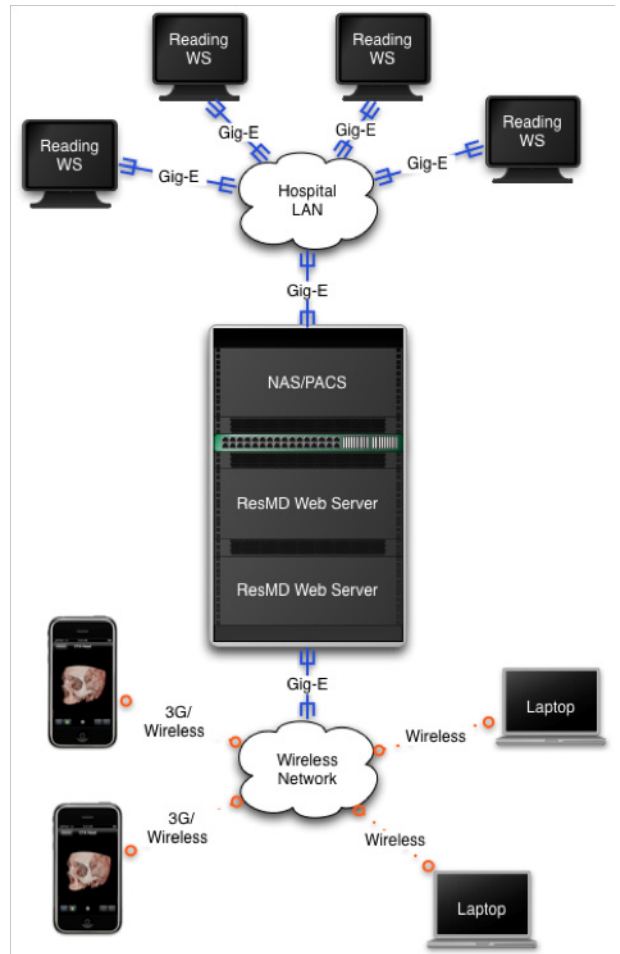
In their 2006 paper, Toland et al suggest five categories of thin client for medical imaging: true thin clients, enhanced browsers, virtual machines and smart clients, web-deployable thick clients, and thick clients. They differentiate these categories on the complexity, download size and capability of the client software. By their definitions there are no “true thin clients” on the market today and the majority of the offerings available that may market themselves as “thin clients” are largely smart machines (using downloaded Java to run on the client) or thick clients. In common practice special versions of these remote applications are downloaded on first use which often must be performed by administrative staff with special privileges. Updates and other maintenance must also be applied by these staff. In fact, Toland et al claim that “thin client” is among the most misused and overloaded terms in computing.

There are several common characteristics of these tools that call themselves “thin” that cause them to fail the test. Chief among these is the need to download and maintain software onto the client itself. This may not be a great challenge for a small radiology department

with only a handful of PACS workstations to manage but it is for today's rapid expansion of imaging into the enterprise. Outside the reading room, the thought of deploying and managing an application with such special features and sophistication as an advanced visualization viewer is problematic for the already overstretched healthcare IT that will rarely have the imaging, PACS and DICOM know-how of the radiology department. As image-enabled electronic medical records (EMR) become commonplace the problems will grow from the purely logistical to bureaucratic and legal. When individual referring physicians and general practitioners need to access multiple EMRs and PACS, who will select the thin client viewer? Will there be one or several? Who will install and administer them? Who will control and audit access and track usage? Who will pay for the various client applications? These questions and more describe the failings of any thin or thick client approach to remote visualization and point out that any requirement for hospital specific downloads at all ought to be unacceptable.

Zero-Footprint CLIENT-SERVER

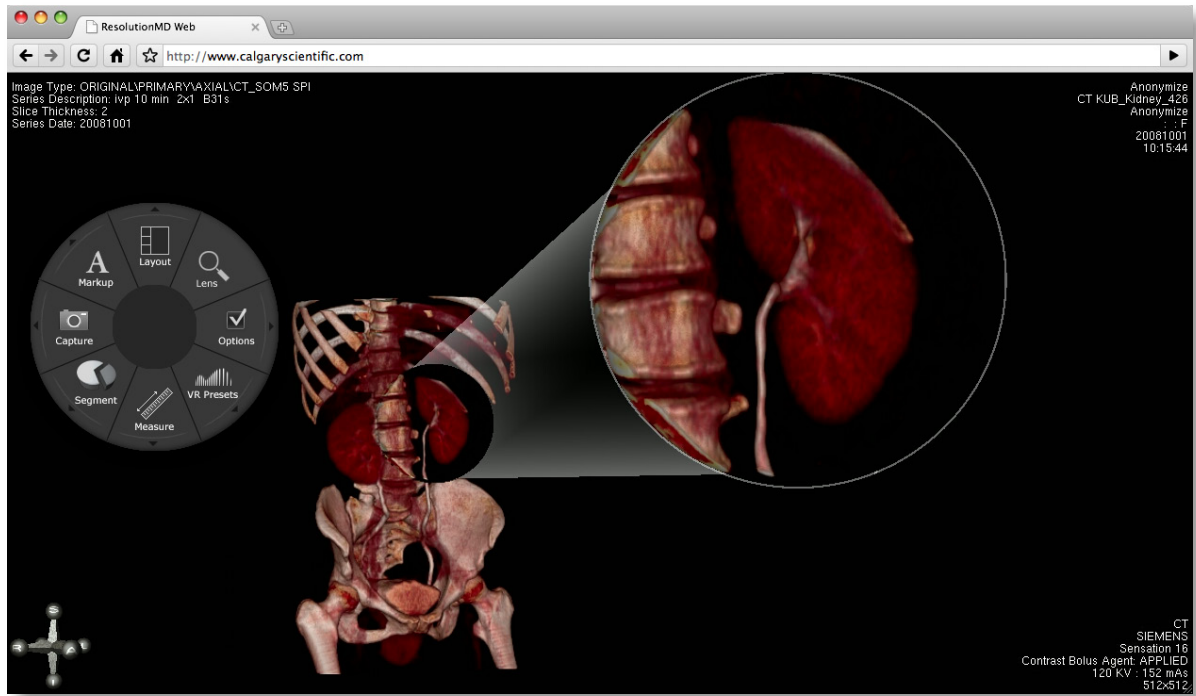
To address these challenges, Calgary Scientific Inc. (CSI) has released its PureWeb™ Zero-Footprint Client technology that truly addresses the needs for client-server visualization in radiology and the extended healthcare enterprise. Toland et al state that “True thin clients utilize standard browsers and standard plug-ins... These clients should leave no files or changes on the host computer.” CSI's Zero-Footprint Client achieves this goal as it operates through industry standard browsers using standard graphics enablers such as Flash™ or Silverlight™. By using the term Zero-Footprint Client, CSI means that there is no initial download at all. Users see an ordinary web browser window. Within the browser window, however, is a complete representation of complex clinical applications such as vessel analysis tools, cardiac function tools or virtual colonoscopy workstations. This is possible because the PureWeb technology separates the “business logic” of the application from its user interface and replicates that interface in the browser. A component of the PureWeb technology, the ResolutionMD™ Web server is the device to which studies are sent and on which the actual work gets done, so no raw patient data ever crosses the network to the client device. This is especially important for mobile clients such as smartphones which can be easily misplaced or stolen. The workstation functions, completed on the server, are delivered using standard web protocols to the end-users Zero-Footprint Client.



PureWeb's client/server architecture enables anywhere access to medical imaging

Along with the administrative burden and logistical issues for the IT department, so-called “thin” or thick clients cause problems such as “dll hell” and “upgrade-itis” where different libraries needed for the client application conflict with other software needed by the operating system or other applications. Managing user permissions, installing the latest software, upgrading older software all become a challenge. This is made even worse by the hardware requirements demanded in advanced visualization: extra memory, faster disks and robust hardware graphics support.

In comparison, CSI's Zero-Footprint Client approach uses the existing resource of the workstation and relies only on extremely common browser extensions such as Flash, which exists on over 98% of PCs in use today. No application download at first use is required, no application installation is required, no high end hardware is required – all of which combine to increase the number of places a person can access patient studies using state of the art tools while minimizing the



CSI's PureWeb-enabled ResolutionMD software runs in a web browser

administrative cost of providing this capability. Access to the ResolutionMD Web server is constrained by the PACS into which the PureWeb enabled application is integrated. With a shared central audit trail the requirement to secure and monitor access to advanced visualization can be met while still expanding the reach of the existing infrastructural investment.

The advent of PureWeb technology leads to the surprising conclusion that for the thinnest of thin clients, there is no client at all: it's just a browser. Any provider that points to a piece of software that they claim as a "Zero-Footprint Client" has clearly missed the point that for true Zero-Footprint Client technology, there exists NO proprietary software client at all: any standard PC, Mac, or web-enabled device with a standard browser is sufficient. No amount of marketing "spin" can alter the fact that any download at all will incur significantly higher overhead, as well as substantial directly related IT support costs, while reducing the effectiveness of remote visualization solutions for the broader healthcare enterprise.

of a significant portion of existing products and consolidation through web servers. Combined with the Zero-Footprint Client, PureWeb integrated products become fully web enabled, unified on a highly scalable enterprise-class server-based system, gain access to a fully 64 bit server side and can be used immediately on the vast majority of desktops and workstations in the enterprise.

SUMMARY

The medical industry has seriously misused the term "thin client" to the point it is difficult to know what is and what is not truly "thin." With any "thin client" approach that requires a download of any kind there are significant logistical and business problems that become enormous in the context of the image enabled EMR. Calgary Scientific's PureWeb alone solves these problems by providing the only truly Zero-Footprint Client and technology to deliver existing applications over the web.

WEB ENABLEMENT OF WORKSTATION APPLICATIONS

Combined with the Zero-Footprint Client, Calgary Scientific has developed a patent pending process that allows for the rapid integration of just about any workstation applications into the ResolutionMD Web environment. This process eases the web enablement

SOURCES AND ADDITIONAL READING

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