FUJIFILM and SGI Partner to Deliver Synapse® 3D PACS Server Solution

Interactive, Volume Exploration on Your Laptop or PDA

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As with so many revolutionary technologies that change society, it is hard to imagine the world of radiology today without picture archiving and communications systems, or PACS. While the first digital, filmless hospital was created just seven years ago, PACS is now accepted as a mature technology, offering radiologists and other clinicians the ability to retrieve, share, and remotely access complex, two-dimensional scan data.

When it comes to the ability to remotely examine scanned PACS imaging, the goal is "any image, anytime, anywhere". Thanks to dramatic advances in diagnostic systems and PACS technology, that is a goal that will soon be within reach.

Managing the Data Explosion

Next-generation PACS must adapt to the evolving technologies in the entire radiology workflow- most significantly, the large increase in the complexity of scan data from advances in acquisition modalities. With each new generation of Computed Tomography (CT) and Magnetic Resonance (MR) technology, spatial resolution has dramatically improved. For example, while eight slice CT scanners were once the best that could be achieved, data sets have increased as slices have narrowed; today, every CT scanner manufacturer now offers a 64-slice system. 128- and 256-slice CT scanners are emerging, pushing the boundaries of temporal and spatial resolution to a new level.

Yet, the unprecedented image quality and detail from the latest scanning systems mean that the amount of information that must be processed has grown exponentially, taxing the ability of standard commodity desktop workstations to process and display the data in a timely fashion.

November 2005

Web-based PACS Becomes Critical

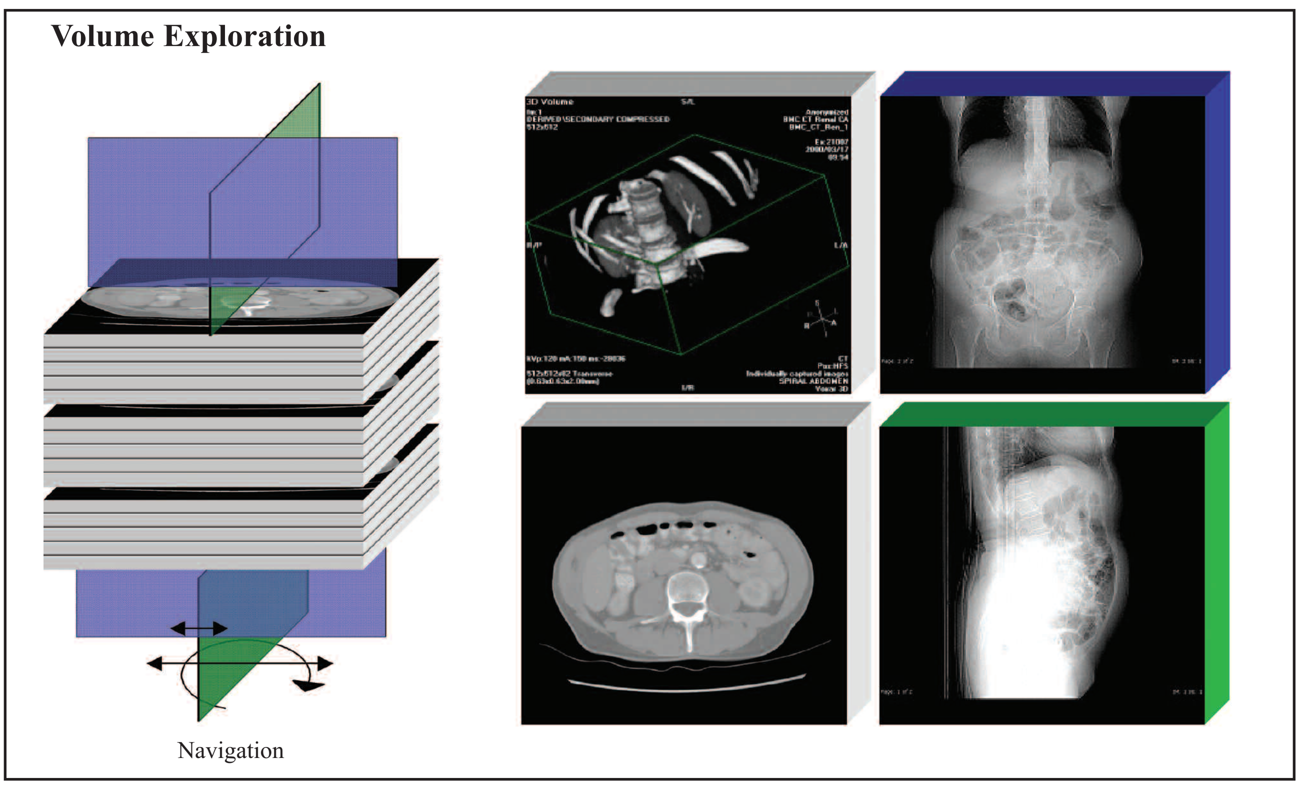
Modern radiology's latest scanner technology has produced an explosion of data; as a result, viewing the data efficiently on multiple workstations has become a challenge. Due to a shortage of radiologists, more outpatient diagnoses must be performed at multiple hospital locations, increasing the need for viewing patient data over the Web. Therefore, PACS vendors are increasingly employing thin client viewing applications that allow data to reside on the hospital server.

Synapse®, from Fujifilm Medical Systems, offers radiologists an easy to manage and use, multi-site, web-based PACS installation. Using the IP network, the Windows operating system (OS), and a standard browser interface, the Synapse solution simplifies workflow, providing a system that can be utilized by multiple reading groups. Patient data can be accessed on virtually any Windows-based thin client, running a recent version of the Microsoft OS.

Volume Exploration Mitigates "Slice Overload"

Also struggling to keep up with the increasingly larger and more complex data generated by the new scanner technology, radiologists are experiencing "slice overload". It is simply not possible to efficiently view thousands of single two-dimensional images in a reasonable amount of time. As a result, more clinicians are now looking toward volume exploration, rather than a multitude of static scans, as an efficient and more constructive use of scan data.

"The revolution in exam size and complexity, especially from Multi-dector CT, is requiring us to re-think the way radiologists will diagnosis an exam," explains Bob Cooke, Fuji's executive director of marketing, network systems. "The diagnostic process is already evolving from a 2D, slice-based method to 3D being regularly used as an 'assist'. We believe that there will be a requirement to completely integrate high quality, interactive visualization directly into the diagnostic process. We term this new class of technology 'Volume Exploration'."



Volume exploration allows better reading protocols with IntelliNav that allows you to explore the volume and navigate. IntelliSync allows you to compare previous and current studies with a consistent user interface using the Web.

With volume exploration capabilities, radiologists will be able to examine scans much more accurately and faster, discovering anomalies that would not be apparent through two-dimensional analyses.

Thanks to this dramatic increase in spatial resolution, today the image of a single heartbeat can be interactively visualized and examined. Radiologists are capturing extraordinary images of previously hard-to-capture anatomy, such as coronary arteries.

In the past, as interactivity increased, volume exploration lost diagnostic image quality. And with multiple radiologists working with hundreds of patient scans, existing PACS could quickly become overloaded, unable to render volumetric images and distribute them rapidly throughout the institution.

That's due to the fact that, with traditional PACS, data is downloaded to the desktop. While that is a practical solution for storing smaller-sized two-dimensional scans, the multiples of data generated by next-generation scanners and volume rendering make this impractical. Comparisons are also critical to the diagnostic process; as new diagnostic protocols emerge, radiologists will have to interact with multiple high-resolution volumes simultaneously, further challenging the desktop rendering model.

Workstations have a limited capacity to store and process data; adding advanced processing capabilities can quickly become cost prohibitive. Upgrading the computing power on each radiologist's workstation means raising expenditures, which is not an option for hospitals and research centers operating under restrictive budgets. Moreover, these upgrades result in the loss of valuable time by physicians and radiologists who need to work through these changes to learn and adapt to the new interfaces and systems.

Similarly, scans need to be available to multiple clinicians within just seconds. And if the data resides on a workstation, the file size may be impractical or impossible to send over an IP-based data network, clogged with other patient data.

Cognizant of the difficulties involved in volume rendering on a desktop, Fujifilm Medical Systems has taken a unique approach by creating a web-based system that will eliminate the digital bottlenecks, making rapid, economical volume exploration a reality.

Developing a Better 3D PACS Server

In developing its new Synapse PACS solution, Fuji looked at both the current and future needs of PACS users, and how the radiology industry is evolving.

"We believe that one of the most important ways that Fuji can maintain our market leadership position is to deliver a steady stream of innovation into the market," explained Bob Cooke. "Of course the new technology is only as good as the implementation and utilization of the technologies by our Synapse users. We rely on our Synapse users to help us identify and prioritize subsequent improvements and further innovations that are critical for their ongoing success."

Delivering a web-based, volume-capable, interactive PACS with diagnostic quality that is based on industry standards would involve partnership between Fuji and SGI. The new volume exploration Synapse product combines Fuji's multi-site Synapse PACS with the award-winning, scalable Silicon Graphics Prism™ visualization system.

The Silicon Graphics Prism visualization system and Visual Area Networking (VAN) technology bring the following benefits to the Fujifilm volume exploration capabilities of Synapse PACS:

Dramatically Shorter Response Time

When developing its volume rendering PACS solution, Fuji understood that rapid access to data was essential. By bringing VAN to diagnostic scan analysis, it is possible to rapidly render and transmit volume exploration data to virtually any desktop without sending the volumetric data across the network. Because only the pixels are shipped to the radiologist's desktop, the

rendered scan data is available to be interacted with and analyzed literally within seconds. In comparison, other PACS solutions send the raw scan data to the radiologist's workstation for rendering, taking several minutes before the radiologist can begin looking at the scans.

VAN enables the transfer of rich data between the Silicon Graphics Prism system and a thin client. To keep the data transfer small, VAN technology transmits only the pixels of the rendered volumetric data, rather than the raw data itself. The actual large data sets continue to reside on and are visualized on the Silicon Graphics Prism graphics server. As a result, VAN technology can operate on virtually any type of client, including laptops, workstations and, eventually, even on PDAs.

Consequently, as ever-more complex data sets are created in the coming years, Fuji's volume exploration solution for Synapse will be able to speedily process and transmit them to a diagnosing physician.

Integrating the Best Technologies for Cost-Effective, High-Image Quality Results

The technology behind the new Synapse solution utilizes the Silicon Graphics Prism system's 64-bit shared-memory architecture that can load entire volumetric datasets into main memory at once. They can then be rapidly processed using scalable rendering, in conjunction with dynamic load balancing over multiple graphics processor units (GPUs). This is done because the data might not fit on a single GPU texture memory (also known as 'GPU video memory'). For example, each volume can be 512MB, and then a radiologist might compare one current study with two or more historical studies. Using dynamic load balancing, the radiologist is not limited to the texture capacity of a GPU and can utilize the scalability of the Silicon Graphics Prism architecture to load as many studies as needed for the best diagnosis. Dynamic load balancing does not limit radiological studies to the capacity of modern day GPUs.

The other benefit of using multiple GPUs for a single study is to achieve the best interactivity that is required with for 3D volume exploration. Even if one GPU has enough texture memory to fit a study, it might not have enough pixel fill power to render the data with full interactivity. Using multiple scalable GPUs brings both larger texture capacity and interactivity to the end user.

Thanks to the Silicon Graphics Prism system's high degree of scalability, system resources such as CPUs, I/O, memory, storage, and graphics, can be independently expanded as the size and quantity of data increases. Multiple scans can be delivered to a large number of physicians within seconds since the system can easily be reconfigured to keep pace as the number of users increases.

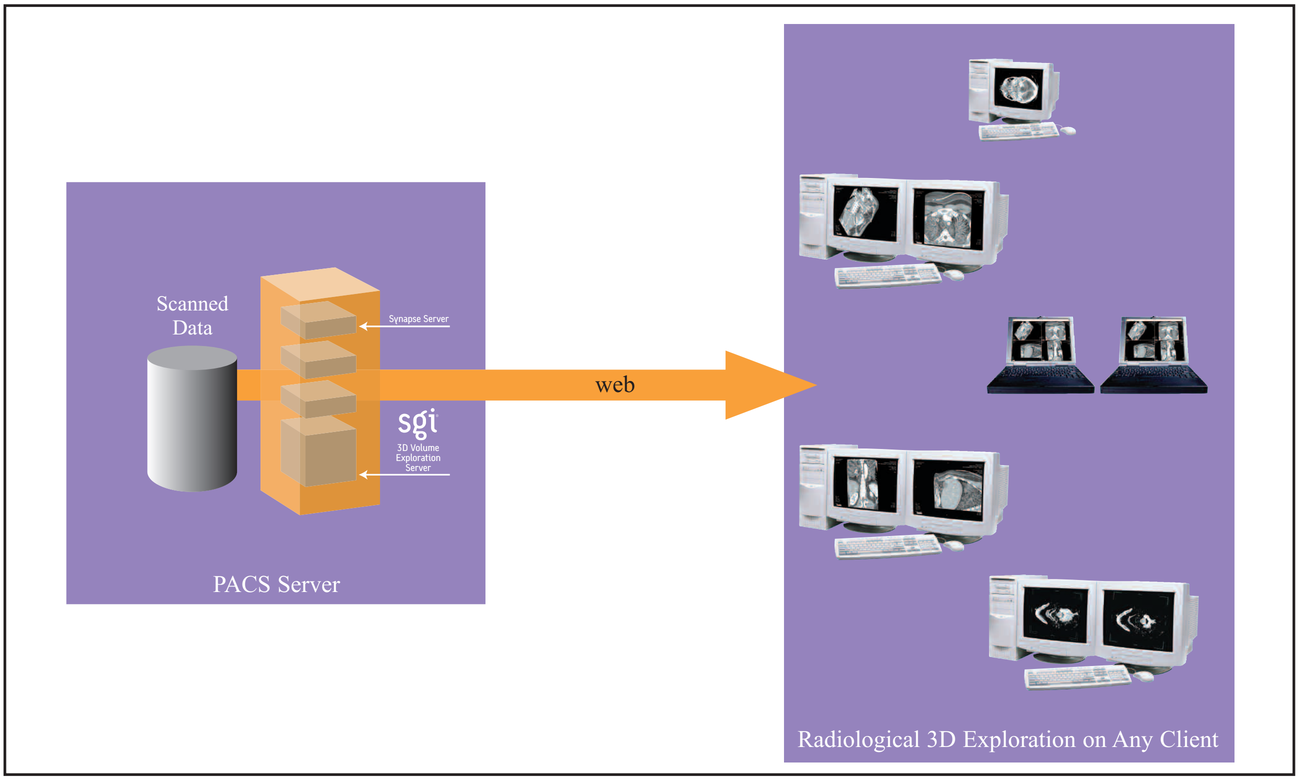
Modern GPUs coupled with SGI scalability allow high-quality rendering algorithms to be deployed. While a typical eight-GPU system can manage the data requirements of up to four radiologists at once, additional users can be accommodated by adding up to a total of 16 GPUs for single system scaling. For even more users, the system can be incorporated into a cluster of 16-GPU Silicon Graphics Prism systems.

Fuji embraced the concept of open, industry standards, which allows the system to incorporate key technologies, regardless of manufacturer, in a price effective manner. The Silicon Graphics Prism system's differentiated architecture delivers unrivaled performance and scalability of best of breed industry standard components- Linux® operating system, Intel® Itanium® 2 processors and ATI® FireGL™ GPUs. Therefore, both component costs and system down-time are minimized, insuring that your data will be available when you need it.

There are several benefits to using Intel Itanuim 2 processors. The large memory addressability of the Itanium 2 processor allows large data sets to be present in main memory and shared by the rest of the system. Additionally, Intel Itanium 2 processors have a very high floating point performance with deep pipelines and other features built into the processor.

Maintains Existing Workflow

Unlike proprietary systems from other providers, the FujiFilm/SGI volume exploration solution brings no changes to the standard workflow, as compared to the Fuji two-dimensional Synapse systems. Radiologists can leverage volume exploration capability immediately.



The FujiFilm/SGI volume exploration solution is integrated with the Synapse server, providing no disruption to the end-user.

The SGI visualization hardware resides alongside the Fuji's (two-dimensional) Synapse PACS Server hardware. Scans are accessed through the standard Internet Explorer web browser interface, and data is transferred through the IP network. Physicians use their existing monitors and thin clients; no equipment upgrade or system re-education is necessary.

The Result: Volume Exploration on Laptops in Seconds

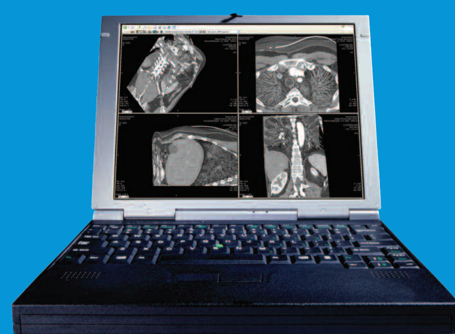
The combination of Silicon Graphics Prism visualization system and Fujifilm's Synapse PACS solution will deliver unprecedented power to the desktop, providing a cost-effective volume exploration solution that can be easily tailored to fit any size operating environment.

Seamless integration of the Silicon Graphics Prism system alongside Fujifilm's Synapse PACS will offer today's radiologists the ability to efficiently access the growing 3D volumetric data explosion at hospitals around the world.

*** All products, dates, and information are preliminary estimates and subject to change without notice. The Synapse Volume Exploration Feature requires 510K and FDA reviews and is not yet available for commercial sale in the US.**

FujiFilm Medical Systems 3D PACS Server

SGI has developed a Silicon Graphics Prism-based volume visualization back-end for Fuji's next generation PACS systems. A high-performance scalable volume rendering back-end is engineered by combining OpenGL Volumizer™ API, OpenGL Multipipe™ Software Development Kit (SDK), and OpenGL Vizserver™ software products along with web technologies like SOAP/XML. This system aims at providing seamless access to volumetric visualization over the internet through Fuji's Synapse PACS.



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Images courtesy of Fujifilm Medical Systems, Volume Graphics and NASA/Stanford BioComputational Center, and SGI.

3886 [November 2005] J15076