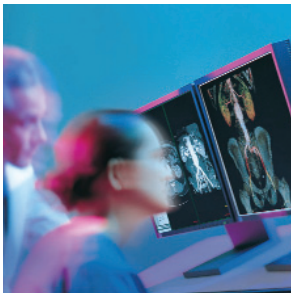
HP and GE Healthcare Technologies

How raw processing power and speed delivers some of the best medical images available



GE Healthcare Technologies

- $11 billion global supplier of integrated systems for healthcare monitoring and diagnosis
- Key global centers in Milwaukee, Paris, Shanghai and Tokyo

The challenge

Provide accurate real-time 3D rendering of the human anatomy using advanced ray-tracing techniques, as scanners continue to increase in speed and sophistication

The solution

- HP Workstation xw8200 with dual 3.4 GHz processors, running Fedora Core 2 Linux
- GE Advantage Workstation software, using advanced ray-tracing techniques

We talked to Jerome Descheirder, Paris-based Global Marketing Manager for Advantage Workstation about the challenges of keeping up with rapid changes in medical scanning technology.

Q. Tell us about your company and your products.

A. GE Healthcare Technologies sells devices for Diagnostic Imaging like CT scanners, MR scanners, X-Ray and PET Scanners. The one you might know best is the CT scanner, which in a few seconds can make a picture of your entire body—a human X-ray tomography—and deliver that information in a 3D format. The product I am responsible for, the Advantage Workstation, is the software package running on top of HP hardware that is used to perform the visualization of those 3D images.

Q. How big is this market segment?

A. The overall business at GE Healthcare Technologies is like an $11B business globally. Diagnostic imaging represents the largest portion of that. We don't publish detailed numbers on a specific product line, because it is usually sold as a bundle with CT or MR scanners. Even though the scanners themselves are quite expensive, the radiologist will spend most of his time in front of the Advantage Workstation itself. Each year we ship 2,500 to 3,000 workstations globally. In fact, this year, we celebrated the 10,000th unit installed worldwide.

Q. What are the technical challenges that you have faced over time?

A. The CT scanner has been through a revolution that started back in 1998, which was the first time a scanner was able to generate images with a pixel size in the millimeter range. Before, people were doing images in about 5 mm slices, so the size of the objects you could see were about 5mm. That sounds quite small, but actually it's not small enough to detect all the details of the anatomy. In 1999 we introduced the first CT scanner under our LightSpeed brand, which really changed the medical practice from looking at slices of data, and actually moving to a volume of data. This revolution continues: We are about to release a new version called the LightSpeed VCT, which stands for "volume CT."

Q. But you still have to do slices, don't you?

A. You are still doing slices, but those slices are so thin (sub-millimetric) that actually it's no longer possible to review each slice individually. The only way to review the data is to perform a 3D rendering of it, and it is really looking more like a virtual man in front of you. When you spot something that looks pathological, that's when you move to a more detailed analysis.

Q. Why did you select HP workstations for this work?

A. We originally shipped on Silicon Graphics and Sun workstations, but we increased our 3D rendering speed two or three times when moving from what was, at that time, the best possible Sun workstation to the best possible HP Intel Linux box. Another important factor is the disk access speed. The amount of data we handle for 3D rendering is huge. A typical

CT exam now is about 1 GB, so you need to load all that data from the disk into memory. Our users expect that loading should take less than a minute, or even less than 30 seconds. And the data manipulation itself should be done in real-time.

Q. What kind of technology gives you that speed?

A. Ray-tracing. The rendering algorithms we use are very close to what a company like DreamWorks would use for animation in movies like Shrek. But when you do Shrek, you can do a week of batch processing to generate the image on film, whereas our algorithms do it on the fly. When you put that in perspective, it is quite an amazing achievement. That's basically what led to our partnership with HP.

Q. What resolutions do you generate?

A. The resolution correlates to the amount of rays that we have, but typically we can render at a resolution of 512x512 in real-time and up to 1024x1024.

Q. Do you have any idea what the frame count is?

A. Our software operates in two modes. In one mode, where we ensure that resolution is constant, we reach something like 3 to 4 frames/second. In the other mode, where we allow for some degradation in the resolution as you move the object, we usually reach almost 10 frames/second.

Q. You use ray-tracing for accuracy, is that correct?

A. For accuracy and image quality. Clearly if you ask the industry which product has the best image quality, they would say ours. This is due to the technology choice we made a long time ago.

Q. What choice was that?

A. To do 3D rendering you have all these different techniques you can use. When Silicon Graphics came up with OpenGL technology, we could have used that, but we decided to rely on pure CPU performance and getting the maximum out of the hardware, without relying on a specific graphics accelerator. We load everything into RAM and transform the whole computer into a super-3D rendering board. Once the data is loaded into memory, the CPU and memory interact at the highest speed possible. So using this technique is like having a video card with 4GB of RAM. It is all about pure CPU performance and the speed of the RAM itself. Also, the algorithm we use scales beautifully. If you have four CPUs, it will go four times faster; if you have eight CPUs it will go eight times faster. It's quite amazing.

Q. What are the specs for the HP Workstation xw8200 that you are shipping?

A. The 8200 basically has a dual processor with 3.4 GHz CPUs. We use 2 GB RAM standard, but there's an increasing number of customers who buy the full 4 GB. On the disk subsystem we are running a RAID configuration. All disks are Ultra320 SCSI running at 15,000 RPM. We have a dedicated disk for the OS and application software that is a 36GB disk. Then we have two disks that work in parallel, on which we do virtual data striping. Those discs are each 73 GB, so we have a total image disk size of 144 GB. On the graphics board, we have an inexpensive product, because all the rendering is on the CPU.

Q. What kinds of new things does all this processing power allow you to do with the software?

A. Just to give an example, one clinical application that is really taking off is heart imaging. Scanners are becoming so fast that it is now possible to image the heart moving, rather than just in a still position. So all of sudden the size of the data set is 3 GB and you need to be able to render that also with motion. That was all made possible because the processing speed we were getting from the HP workstation is good enough to perform ray-tracing and rendering in 4D. That is where we are headed…

And that's just the beginning. We foresee dynamic examinations that take into account the function of the organ. We are moving from medical imaging as an anatomy book toward medical imaging that shows how the body actually works. And we will need the processing power to handle that.

Q. What is the timeline for getting to that point ?

A. That might become a reality by the end of 2005. We have some early adopters who are using some of today's scanners to do the type of exam I am talking about. With the introduction of the new LightSpeed VCT scanners, we will bring this into the mainstream by providing the same type of easy-to-use interactivity with the same manipulation of data in 4D as you see today in 3D. So we need a workstation to handle that. We will start moving to the next performance level with 64-bit and also looking at new processing techniques coming down the road, either from Intel or AMD. There are some things that could be interesting that are really crossing the frontier between what you might expect of a dual processor 32-bit workstation—actually breaking that barrier and going to a 4-way or 8-way workstation, capable of addressing more than 4GB of RAM.

For more information, visit www.hp.com/workstations

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