



# Medical marvel

**W**hile the most common method for early detection of breast cancer is mammography, critics believe the procedure is not the most effective tool for detecting tumours.

Traditional ultrasound technology is another option and uses sound waves that travel through water, bouncing off tissue to create a mirror image. However, ultrasound images can often be fuzzy, making it difficult to detect small and subtle tissue variations. In addition, ultrasound only identifies a possible mass, without being able to distinguish its type.

TechniScan Medical Systems has attempted to address the issue by developing a scanning system to differentially characterise amongst normal, benign and malignant tissue.

The company's Ultrasound CT system is designed to provide physicians with a diagnostic, non invasive imaging tool that may provide detailed information about the physical structures and bulk tissue properties of the breast.

Unlike traditional breast ultrasound, which measures the echo of sound waves as they reflect off tissue to produce images, Ultrasound CT uses transmission ultrasound to produce two sets of images – one based on the speed of sound and one based on the attenuation of sound. The images from these two different measurements can be displayed in many orientations for review by a radiologist.

Ultrasound transducers take pictures at 180 positions, with each cycle creating an image 'slice'.

*Could the latest technologies provide more accurate breast cancer screening?*

*By David Pursley.*

About 30 to 50 slices are required to complete the full image. The transducers are connected in a seven node Linux cluster to stream the raw ultrasound data onto a 2Tbyte RAID system. As data from each slice is transferred to storage, the remaining nodes in the cluster start computing the image from the raw data.

This distributed data uses TechniScan proprietary algorithms to create 3d images representing the physical structures within the breast and their spatial relationship.

Additionally, it provides information about the speed and attenuation of sound values of tissues registered in all three spatial directions. This supplies data about tissue properties not previously available to physicians and radiologists.

The application requires an immense amount of computational power to process the huge amount of data quickly, with a typical scan generating about 60Gbyte of data per patient. Once the data has been transformed into an image, the final 3d image is reduced to around 16Mbyte, but a large amount of computing effort is still required to create this image.

The early development of the Ultrasound CT breast imaging system focused on producing the highest quality images to obtain the most accurate data. Following a redesigned of the data acquisition system, data could be captured about 100 times faster, although designers were unable to reduce the time needed to compute and produce the 3d images needed for diagnosis.

The current system incorporates a seven node Linux cluster built with seven Kontron CP6011 single board computers that feature a 1.8GHz Intel Pentium M processor with 2Gbit memory and connected by a fibre channel host adapter to a 2Tbyte RAID data storage system. However, it was decided that the

system needed to be speeded up to reduce discomfort for patients, so Techniscan asked Kontron and Intel to work together to decrease the time to create an image.

TechniScan employed Intel's compilers and optimisation tools to obtain the best possible scan to image conversion time using this platform – about 2.5 hours. Even with a

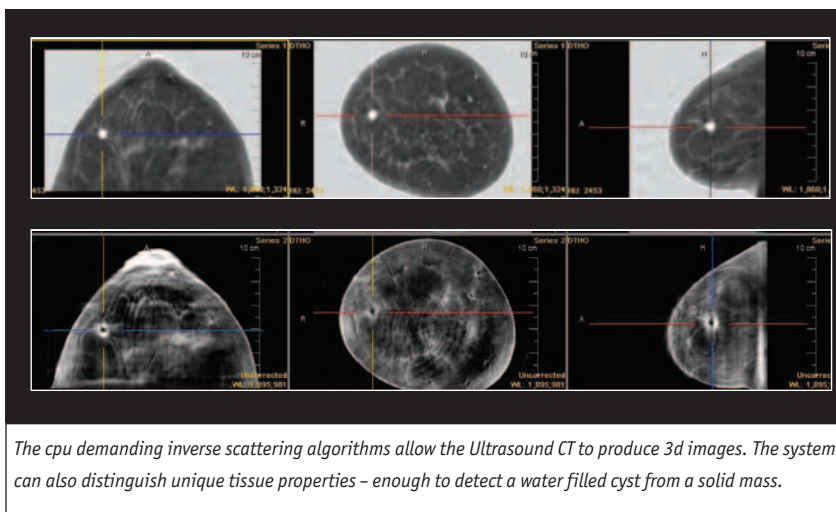




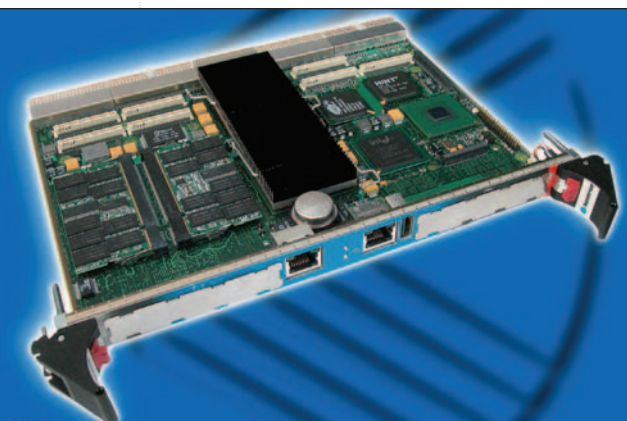
seven node distributed architecture and optimised software, the imaging was still too slow. It was determined that the system was limited by the computing capabilities of the system processors and therefore unable to satisfy the needs of its health care provider customers.

Industry expectation is to be able to review images with a patient immediately after an exam, so because image processing begins at the start of the exam, the initial goal is to produce complete images in less than one hour.

To decrease image processing performance time substantially, TechniScan engineers began working on changes to the algorithm that would



*The cpu demanding inverse scattering algorithms allow the Ultrasound CT to produce 3d images. The system can also distinguish unique tissue properties – enough to detect a water filled cyst from a solid mass.*



*“Even with a seven node distributed architecture and optimised software, imaging was still too slow.”* David Pursley, Kontron

further speed calculations. Once they reached the limits of Intel’s software tools, TechniScan looked to Kontron and Intel to find a more powerful processing platform.

After analysis, a multicore platform was selected to deliver the performance required.

Intel’s 65nm process technology makes it possible to integrate two cores in one physical package and, using Intel dual core processors, the Kontron boards showed an increase in floating point performance of more than 96.5%, an increase in integer performance of more

than 89.3% and double the 3d performance. To meet the requirement of the TechniScan Ultrasound CT application, Kontron built the CP6012 single board computer using a single Intel Core Duo processor T2500 at 2GHz with 2Gbit of system memory. This doubled the number of processing cores to 14.

The initial results are encouraging and show that with Kontron’s T7400 based CP6012, TechniScan should be able to achieve the initial goal of delivering images in less than 60 minutes.

The CP6012 is a 6U CompactPCI cpu board with Intel Core duo processor T2500 (2GHz) and is designed for applications calling for distributed high processing capabilities and I/O throughput. With its E7520 and 6300ESB chipset, it handles data throughput like a server.

The CP6012 boards support a configurable 64bit 66MHz, hot swap CompactPCI interface. In the system master slot, the interface is enabled and, if installed in the peripheral slot, is isolated from the CompactPCI bus. It also supports PICMG CompactPCI Packet Switching Backplane Specification 2.16. When

installed in a backplane that supports packet switching, the CP6012 can communicate via 2Gbit Ethernet interfaces with other peripherals. With a high degree of integration, it incorporates technologies such as PCI Express, up to 4Gbit/400MHz DDR2 SODIMM ram (6.4Gbit/s throughput) and a fast Serial ATA interface including hard drive or Compact Flash slot on board. It has four Gbit interfaces via PCI Express (two to the backplane/two front side) maximum 4 x USB 2.0, 1 x COM and rear I/O support round out the feature set.

TechniScan is working to ensure that its 3d Ultrasound CT breast imaging system can perform as well in the real world as it does in the test environment. Kontron and Intel, meanwhile, are continuing to work with it to ensure that the performance will stand up to the rigours of the daily environment. For now, the final decision on the efficacy of this new diagnostic tool is being evaluated in clinical trials and will ultimately be reviewed for clearance by the US FDA.

By using the latest advanced technologies based on open standards and working in close collaboration, Kontron and Intel were able to help TechniScan deliver an application that they claim could revolutionise breast cancer detection. ■

#### Author profile:

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