VolumePro 1000 Expands 3D Vision

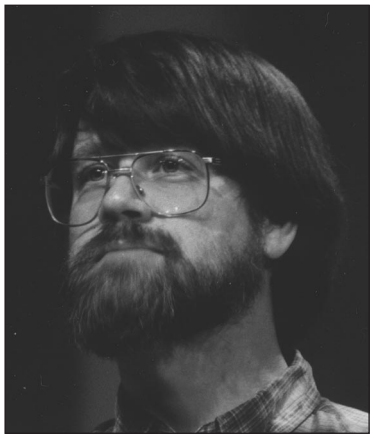
Second-Generation Device Speeds Up, Adds New Features

by Peter N. Glaskowsky

At this month's Microprocessor Forum, Larry Seiler of Mitsubishi Electric's Real-Time Visualization group disclosed the first details of the company's new VolumePro 1000 volume-rendering accelerator, successor to the VolumePro 500 announced at last year's Forum (see MPR 11/16/98, p. 22).

Mitsubishi has been shipping the VolumePro 500 since May. The company reports that independent software vendors are using the card to develop volume-rendering applications in areas including biomedical imaging, weather simulation, and oil exploration.

The new vg1000 chip at the heart of the VolumePro 1000 represents a significant advance over its predecessor. The most important new feature in the vg1000 is the addition of support for polygon-based surfaces, rendered by a separate 3D-graphics card and embedded within the rendered volume. Surfaces may be opaque or translucent, adding new information about the volume or denoting features of interest. For example, a medical team could define surfaces within a volumetric CAT-scan dataset of a human hip to indicate the planned location of an artificial hip joint.



MICHAEL MUSTACCHI

Mitsubishi's Larry Seiler describes the new VolumePro vg1000 volume-rendering chip.

Clipping regions can increase the effective speed of the vg1000 by reducing the amount of rendering effort required to create the final image. The vg1000 includes other new features with the same goal. For example, the new chip can recognize when the accumulated opacity of the current pixel exceeds an application-specific threshold, indicating that further rendering would not be visible anyway. The vg1000 can also supersample the volume dataset in all three dimensions, creating a new, smaller-volume dataset that can be used for subsequent rendering.

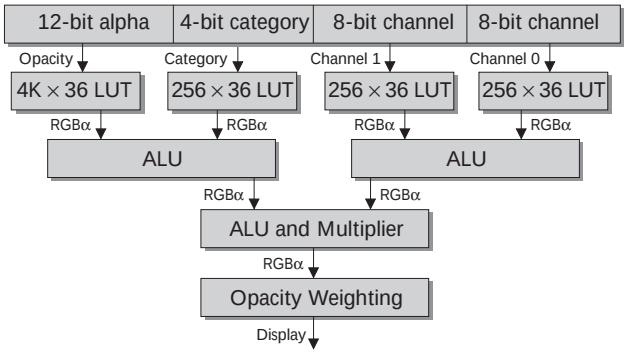


Figure 1. Up to four channels of voxel data can be stored in a single volume dataset. Lookup tables map channel values to colors.

The vg1000 boasts twice the raw performance of the VolumePro 500's vg500 chip, being capable of rendering one billion samples per second with trilinear interpolation and Phong shading. Mitsubishi Electric says this speed is sufficient to render a 512^3-element volume in real time. The 8-bit and 12-bit voxel formats of the vg500 are joined by 16-bit and 32-bit formats in the vg1000, increasing the dynamic range of the samples.

Figure 1 shows how up to four channels of voxel data may be represented in a single dataset. Each channel describes a voxel characteristic, such as opacity or category. Channel data is converted to RGB color plus alpha values in four lookup tables (LUTs). The RGBα values are mixed in three ALUs, and display opacity is calculated in a final multiplier unit. Voxel data is stored in up to 1G of local memory, implemented as a 192-bit array of 166-MHz DDR SDRAM. Mitsubishi expects a 512M array size to be the most common configuration.

The vg1000, like the vg500, requires a separate 3D graphics card to perform a final image-warp operation and display the results. The vg1000 is a PCI device; it sends its output over the PCI bus to a PCI or AGP graphics card.

New Chip Won't Be Cheap

Mitsubishi will pull out all the stops in the design of the vg1000. The chip will be built in IBM's SA-27 0.16-micron process, boosting pipeline speed to 250 MHz from the 0.35-micron vg500's 133 MHz. The 216-mm2 die will include 2.3 million gates of logic plus two million bits of SRAM and require a 1,247-contact ceramic BGA package.

Mitsubishi expects to ship the VolumePro V1000 in late 2000. Pricing has not been announced. More information is available online at *www.rtviz.com*.

The vg1000's improved speed and new features will allow developers to create more-complex and more-useful applications. The company is already working on future members of the VolumePro family with advanced perspective rendering and better scalability. Though it may eventually encounter direct competition from other 3D-chip companies, Mitsubishi Electric is today the only vendor to offer a volume-rendering accelerator for PCs, an enviable distinction in the overcrowded professional-3D market. M