

# RenderWare Graphics

## **White Paper**

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## **Processor Usage**

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# 1. Processor Usage

The following text might prove useful when making submissions to Sony.

*RenderWare Graphics on PlayStation 2 makes extensive use of the multi-processors that the architecture provides. RenderWare Graphics routes 3D primitives through the scratchpad to system memory, through the VIF and into VU1. VU1 implements transform, lighting, projection, clipping and culling routines. Careful balancing ensures that processors are kept as busy as the data stream permits. The suppliers of RenderWare Graphics have made extensive use of the performance analyzer to ensure maximum parallelism.*

*In more detail, RenderWare Graphics uses the SPR when building DMA packets. The very fast read-write capabilities of the SPR mean that we can construct DMA packets more rapidly. The SPR remains free for application use at other times.*

*VU0 is used in macro mode for matrix multiplication, especially relevant when skinned characters are used in the immersive experience.*

*Vertex data (representing tri-strip models) are DMA-ed from system memory through the VIF to VU1. A variety of highly tuned microcode pipelines execute on this processor. Double-buffering of the VU1 memory is used to ensure that DMA transfers do not block immediately when processing starts. Double buffered input, and triple buffer output techniques are employed when multi-pass rendering effects are enabled.*

*Textures are DMA'd to GS local memory using either path2 or path3. Extensive performance tuning has led to efficient use of DMA bandwidth for this activity. Textures are "twiddled" in system memory to permit all transfers to proceed in PSMCT32 mode.*

*Metrics builds of the title have enabled optimization of the various processor usage. The Metrowerks CATS tool has been used thoroughly to improve CPU-side performance and reduce the effects of cache misses. Critical parts of the graphics management have been re-written, and data-structures redesigned to make efficient use of the caches.*

*RenderWare Graphics does not use the IOP.*

*RenderWare Graphics is an authorized Sony middleware product, and has been used numerous successful submissions.*