

# RenderWare Graphics

**RenderWare Graphics 3.7** is the world-leading, high performance, open & extensible, truly multi-platform, 3D graphics toolkit, empowering developers like never before to focus their talents on creating great content and gameplay. The focus of **RenderWare Graphics 3.7** has been to ensure that we are compatible with recent updates to our partner products and to align all of the components of RenderWare Platform to ensure that our customers have all the necessary functionality they need to make AAA titles throughout 2004.

Our underlying development in **RenderWare Graphics 3.7** also has an eye on the future, making sure that best-practices are being used on the current hardware platforms that can then powerfully and effectively translate onto the next generation of games machines.

## **RenderWare Graphics 3.7 Core Features**

- **Multi-Platform, Portable API**

**RenderWare Graphics** multi-platform, portable API allows high level functionality to be the same for **PlayStation®2, SONY PSP™, Xbox™, Nintendo GameCube™, PC & N-Gage™ platform**, whilst being optimized to get the best from each consoles rendering hardware.

**RenderWare Graphics'** architecture uses a component-based approach based around a thin-layer, core library supplemented by a number of Plugins and Toolkits. Plugins are the key to **RenderWare Graphics'** power; they can extend existing objects and add new objects of their own that can also be further extended.

- **Intuitive Art Path Tool Chain**

Our simple to use, yet comprehensive art path tool chain consists of both standard and advanced options. The user interfaces are implemented with ActiveX controls and are common between art packages. It benefits from context sensitive menus, informative output window and message logs. It also includes the following tools:

- ❑ Powerful asset **Visualizer**, enabling real-time previewing on the console from 3ds max™ & Maya™
- ❑ **Pre-instancer tool**, that prepares art assets to be platform ready
- ❑ **Lightmap toolkit**, that reprocess and optimizes the output of the 3ds max & Maya generated data
- ❑ **Generic Animation toolkit**, for both hierarchical and non-hierarchical animations
- ❑ **Compressed Animation Toolkit**, allowing 40% memory reduction on key-framed data occupancy
- ❑ **Geometry Conditioning Tool**, designed to optimize vertex and polygon configurations

- **Powerful Exporter Framework**

The **Exporter Framework** allows you to make a whole range of modifications and additions to our art asset export process from 3ds max and Maya. Consisting of a series of modular libraries and custom code hooks, you can introduce new common classes to the modeler, changing behaviors or create new object handlers following our plugin architecture. **RenderWare Graphics 3.7** is easy to use, with even more examples, better documentation and detailed error handling.

- **Advanced Multi-Texturing Capability**

**RenderWare Graphics** ships with a range of multi-texture effects across all platforms. These include environment mapping, bump mapping<sup>†</sup>, light mapping and toon rendering<sup>†</sup>. An offline tool also provides the creation and editing of multi-texture effects.

- **Asynchronous File Loading<sup>†</sup>**

The **RenderWare** file system supports Asynchronous file loading as well as fast, synchronized data streaming. The file system toolkit is composed of a high-level interface manager and a set of custom file systems for each specific platform.

- **Comprehensive Range of Fast Graphics Options**

Our fast graphics options include **optimized tri-stripping**, **Bézier geometry<sup>†</sup>** and **texture projections** on all platforms. Plus essential platform-specific features such as VU code, pixel and vertex shaders and TEV support.

- **Optimized Skinning**

Written in hand-optimized assembler, our skinning pipes support up to 4 weight skinning on appropriate models (triangle and patch primitive). The maximum bone limit is 256.

- **UV Transformations**

Keyframe animation of UV transforms is supported in the art tools, driving texture matrix transformation of up to 2 rendering passes, allowing the creation of animated texture effects.

- **Native Geometry Support**

Support for all the native geometry formats reduces upload time and the memory needed for rendering.

- **Latest Art Packages**

Including support for Maya 5, Character Studio 4 and 3ds max 6 compatibility.

- **Stability proven in over 250 SKU** hitting the stores to date.

- **World-class support and thorough documentation.**

(† = not available in RenderWare Graphics 3.7 for the N-Gage™ platform)

# PlayStation®2

## RenderWare Graphics for PlayStation 2

**RenderWare Graphics** for the PlayStation 2 helps game developers exploit the full potential of this multiprocessor console. Game code running on the EE core can pass geometry to RenderWare, which will make use of the vector units and the DMAC to maximize parallelism. However, all processors can be used by PlayStation 2 experienced developers for any purpose.

In addition to the core features, **RenderWare Graphics 3.7** key features on PlayStation 2 include:

- **Pipeline Delivery System (PDS)**

The PDS is a uniform and customizable way of handling the graphic pipelines, giving the experienced developer much more control over how all the generic & custom pipelines get deployed. With over 140 different pipes now available on PlayStation 2, the PDS is essential for advanced developers to exploit all avenues of optimization. Source customers also benefit from customizable VCL pipelines for Generic, Skin, Dual-pass and UV Transformations.

- **G3x Rendering Pipelines**

These custom, 3<sup>rd</sup> generation **G3x rendering pipelines** are significantly faster alternatives to the generic G3-pipelines. They get their increased speed by operating under specific lighting conditions, so you will need to choose the configuration that closely meets your application needs in order to fully benefit. The vertex formats are also tuned to further improve overall system performance.

- **Cloning Pipes**

As part of the PDS, we provide cloning pipelines. These specialized pipes facilitate the **fast cloning** of simple objects such as traffic cones, power-ups, or any other which appear in a scene multiple times.

- **ADC Functionality**

An offline tool can analyze 3D geometry and add ADC flags. Combined with a complete set of G3xd rendering pipelines which merge the features of the G3x rendering pipelines and ADC degeneration support, this can further accelerate tri-strip rendering performance by an amazing 25%.

- **Asynchronous Texture Upload**

Interrupt-free, **fast texture upload** using path 3 is available, with no extra development needed.

- **Exposed Texture Cache**

Developers can now gain access to the texture cache and precisely place textures in memory.

- **Mipmap K & L**

**API for getting/setting/calculating mipmap K and L values** – an interface to help coders calibrate and track the dimensions of dynamic, range-dependant textures.

- **Render-To-Texture**

Additional **viewpoints can be** dynamically calculated and **targeted to texture** memory instead of the frame buffer. These can then be used as conventional textures in subsequent frames for real-time shadow maps, mirrors, televisions, etc.

- **Video Playback**

RenderWare Graphics works effectively with Sony MPEG 2 video playback, being able to render into a texture with other graphics on screen at the same time.



## RenderWare Graphics for Xbox

**RenderWare Graphics** for Xbox helps games developers take full advantage of available CPU and GPU processing power. Game code passing geometry to RenderWare will make use of hand-optimized SSE assembler to accelerate CPU intensive operations, and vertex and pixel shaders to free the CPU for your game's other needs. Developers can further customize their game by making use of the Direct3D API through **RenderWare Graphics**. In addition to the core features, **RenderWare Graphics 3.7** key benefits on Xbox include:

- **Fast Rendering Performance**

The optimized RenderState cache checks for new/updated RenderStates. It supports both custom built and all current pipelines for Xbox, VertexShader skinning and MatFX etc.

- **Optimized Pixel and Vertex Shaders**

Pixel shaders and vertex shaders are exposed, and used, where applicable. You can set a pixel shader per material and specify the constants values passed to the pixel shader.

- **Efficient Lightmaps**

Uses multi-texturing to render the material and lightmap in a single pass.

- **Improved Memory manager**

Efficient memory manager for textures and vertex buffers.

- **Xbox Normal Map Support**

Xbox specific normal maps can be set up within the RenderWare Material in 3ds max and Maya. The 3ds max built in normal maps are also exported.

- **Dynamic Vertex Buffer Allocations and Locks**

The vertex buffer manager helps the application achieve better performance by removing CPU stalls when vertex buffers are locked.

- **Compressed Vertices**

There is support for compressed vertex formats.

- **Cube Texture support**

We support cube textures from DDS files and from texture dictionaries. The MatFX plugin detects cube textures and automatically sets the appropriate texture stage states.



## RenderWare Graphics for Nintendo GameCube

**RenderWare Graphics** for GameCube helps game developers exploit the full potential of this console.

Support for compressed vertex formats and heavily reconditioned geometry exploits the unique per-attribute indexing of the hardware, giving rise to massive memory savings.

In addition to the core features, **RenderWare Graphics 3.7** key benefits on Nintendo GameCube include:

- **Asynchronous Rendering**

RenderWare Graphics uses a triple buffered rendering solution that allows parallelism between the CPU and GPU to gain maximum performance.

- **Compressed Vertex Formats**

RenderWare Graphics supports all compressed vertex formats supported by Nintendo's GameCube.

- **Advanced Multi-Texturing Capability**

RenderWare Graphics also includes indirect texturing that takes full advantage of the TEV. The offline tool exploits the creation/editing of multi-texture effects using indirection, for the fully integrated advanced pipelines, including skinning & morphing. Supports up to 8 textures and 8 individual sets of UV co-ordinates.

- **NBT Generation**

RenderWare Graphics supports automatic NBT generation for use with the multi-texturing extension. NBT generation is supported on all pre-instance geometry types and works with compressed vertex formats and pre-instanced geometry.

- **User Configurable Texture Cache**

RenderWare Graphics allows developers to implement their own texture cache implementation that is optimal for each application.

- **Texture Level Of Detail (LOD)**

RenderWare Graphics exposes additional texture LOD controls such as Anisotropic filtering and LOD bias.

- **Hardware Skinning**

All single weight skinning is performed in hardware, resulting in significant performance improvement.

- **CPU Skinning**

Fast skinning performance is achieved, thanks to the handcrafted 'Gekko' assembler implementation on the CPU.

- **Particle Systems**

Uses hand-constructed 'Gekko' assembler to maximize particle processing performance.

- **Lightmaps**

RenderWare Graphics takes advantage of the multi-texturing capabilities of GameCube in our lightmap pipelines.

- **Optimized Geometry when Pre-Instancing**

RenderWare Graphics benefits from vertex and display list optimizations when pre-instancing. The optimizations include removal of duplicate vertex data and removal of degenerate triangles due to tri-stripping. These optimizations can lead to massive memory savings when using pre-instanced geometry.





## RenderWare Graphics for PC

**RenderWare Graphics** for PC helps games developers take full advantage of available CPU and GPU processing power on Direct3D and OpenGL. Game code passing geometry to RenderWare will make use of hand-optimized assembler and SSE code paths to accelerate CPU intensive operations, and vertex and pixel shaders on Direct3D compatible graphics hardware to free the CPU for your game's other needs. Developers can further customize their game by making use of the Direct3D or OpenGL API through **RenderWare Graphics**. In addition to the core features, **RenderWare Graphics 3.7** key benefits on PC include:

### Common features

- **Greater Performance**

From optimized vertex caching when hardware T&L supported hardware is available to process the triangle lists.

- **Texture Stages**

**RenderWare Graphics** supports up to 8 texture stages on PC.

- **Efficient Lightmaps**

Uses multi-texturing to render the material and lightmap in a single pass.

### Direct3D9 specific features

- **Shader Hardware Optimizations**

Optimizations for hardware supporting vertex and pixel shaders.

- **Hardware Skinning**

Skinning is done in hardware, when available. The skin plugin uses vertex shaders version 1.1 and 2.0 when possible.

- **Plugin Effects**

Our normal mapping plugins allow you to create realistic effects such as metal and plastic. They come with special support of pixel shaders version 1.4, for better environment map calculations per pixel.

- **Hardware Mip Generation**

Platform independent texture dictionaries provide support for hardware mip generation, such as on D3D9 on supporting video cards.

- **Optimized Pixel and Vertex Shaders**

Pixel shaders and vertex shaders are exposed, and used where applicable, on supporting hardware.

- **Vertex Buffer Manager**

The vertex buffer is dynamically managed and optimized for rapid access by the graphics cards.

- **Optimized TeamFX Plugin**

The TeamFX plugin pipeline is optimized for video cards with vertex shader support.

- **Pre-Instanced Geometry Support**

We support pre-instanced geometry from static atomics and world sectors.

### OpenGL specific features

- **OpenGL 1.x support**

Support provided for OpenGL 1.2 and above.

- **Wide support for Extensions**

Our OpenGL renderer supports many extensions available in OpenGL 1.x including multi-texturing, useful texture environments, and hardware accelerated texgens.

- **Hardware accelerated Vertex Arrays**

Vertex arrays on server side memory are available on supporting NVIDIA and ATI hardware to reduce upload costs and improve performance.



## RenderWare Graphics for N-Gage™ platform

**RenderWare Graphics** for the N-Gage™ platform makes maximum use of the N-Gage™ processor by using hand optimized assembly where performance is critical. Built on top of OpenGL ES, **RenderWare Graphics 3.7** allows the developer to concentrate on higher level design and content generation while still allowing access to the underlying platform to enable custom effects and optimizations.

In addition to the core features, **RenderWare Graphics 3.7** key benefits on the N-Gage™ platform include:

- **Flexible Geometry Formats**

Geometry can be stored in several different formats depending on precision versus performance and memory considerations.

- **Fixed Point Optimizations**

The best use of the N-Gage™ platform hardware is achieved via several fixed point optimizations of key components.