

N I N T E N D O  
**NITRO**-System

## G3D Library

### Overview of 3D Graphics Library

Version 1.0.1a

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## Revision History

Version	Date	Description
1.0.1a	2007/04/27	Corrected typographical errors. Changed Revision History dates to international format.
1.0.1	2005/01/19	Added descriptions of environmental and projection mapping.
1.0.0	2005/01/18	Changed some instances of "NITRO" to "Nintendo DS."
0.8.0	2004/11/10	<ul style="list-style-type: none"><li>Improved and expanded the overview and introduction.</li><li>Put all the details in the reference manual.</li></ul>
0.1.2	2004/09/16	<ul style="list-style-type: none"><li>Modified "Special Characteristics of G3D Library" to support ima and ita.</li><li>Corrected Table 3-1.</li><li>Unified the spelling of "flag" in the Japanese edition.</li></ul>
0.1.1	2004/09/02\	Added description on limiting the number of nodes, materials, and shapes.
0.1.0	2004/08/12	Initial Version.

# 1 Introduction

The G3D Library is a 3D graphics library developed to allow simple and effective display and movement of 3D models and animation created for game development on Nintendo DS.

G3D library offers the following features:

- Supports drawing of models which have joints.
- Supports playback of joint animation, material color animation, texture pattern animation, texture SRT animation, and visibility animation.
- Supports environmental mapping and projection mapping.
- Supports drawing models and playing animations that were created with common CG tools such as Maya, SOFTIMAGE|3D, SOFTIMAGE|XSI, and 3ds max.
- Since the NITRO-Viewer's 3D drawing engine uses G3D, the characters edited with NITRO-Viewer can be output to the game as is.
- Is optimized for Nintendo DS, so it works fast.
- Is capable of managing model and animation data as XML-format text files (NITRO intermediate files).
- Uses names specified by the user to access joints, materials, and texture palettes.
- Supports motion blending and partial joint animation.
- Simplifies sharing textures and palettes between multiple sets of model data.
- Allows you to play the same joint animation with different shapes as long as the joint structure is the same.
- Does not allocate or release the dynamic memory that is not specified explicitly, which makes it possible to avoid risks such as fragmentation or unexpected performance reduction.
- Is provided in separate modules and it allows the user to customize the operation of the G3D library.

This document explains the operation of the G3D library. For details on G3D library and 3D binary converter, see the release notes and Function Reference manual.

## 2 Overview of G3D Library

### 2.1 Characteristics of G3D Library

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Using the G3D library can take advantage of the hardware features of Nintendo DS to make 3D game development more efficient. This section explains the advantages of using the G3D Library for game development.

#### 2.1.1 Manage Resources by Text Format (XML) File

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Model data and animation resources are managed in text file (NITRO intermediate file) format. Since they are text files in XML, they are easy to manage.

#### 2.1.2 Binary Data

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A NITRO intermediate file is converted to a binary data file by the 3D binary converter (`g3dcvtr`). The G3D library can load binary data files from a DS Card and playback the file. Compared to the method that converts to C source code, models can be replaced more easily during execution.

#### 2.1.3 Mix Data Sets Created with Different CG Tools

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G3D can handle data created with different CG tools, allowing you to mix data sets created with different CG tools in a single program. Therefore, it is possible to develop games while getting the most out of each CG tool.

#### 2.1.4 Output from NITRO-Viewer to the Game Screen As Is

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NITRO-Viewer uses G3D to draw 3D models, so the characters edited with NITRO-Viewer can be output to the game as is.

#### 2.1.5 Less Likely to Cause Memory Fragmentation

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G3D library does not perform implicit allocation or release of dynamic memory in the API. Loaded binary data can be used for drawing without any changes, so it does not perform dynamic memory allocation even during the initialization. Additionally, it is possible to collect multiple sets of model and animation data into one binary file by using `g3dcvtr`. By doing so, projects that use G3D can reduce the probability of memory fragmentation or performance reduction.

### **2.1.6 Access Resources by Name**

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Joints, materials, and texture palettes can be accessed by name specified with 16 characters or less by the user when the resource was created. This decreases the degree of dependency on the data in the program code.

### **2.1.7 Textures and Models in the Palette Can be Shared Easily**

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3D binary converter (`g3dcvtr`) can convert multiple models into one binary file. When doing so, identical textures and models in the palette are made to share data. Also, models and texture can be converted into different binary files and associated during execution.

### **2.1.8 Play Back the Same Animation Data with Models of Different Shapes**

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As long as the joint structure is the same, the same animation data can be shared among the models with different sizes or shapes. This saves you time you would otherwise use to re-create animation data and reduces the amount of memory usage.

### **2.1.9 High Modularity and Easy Customization**

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Animation calculation, animation blending, and codes that support individual CG tools are made into modules which can be added or removed easily. Modules to use can be switched dynamically.

## 2.2 Organization of G3D Library

The G3D Library is organized as shown in Figure 2-1.

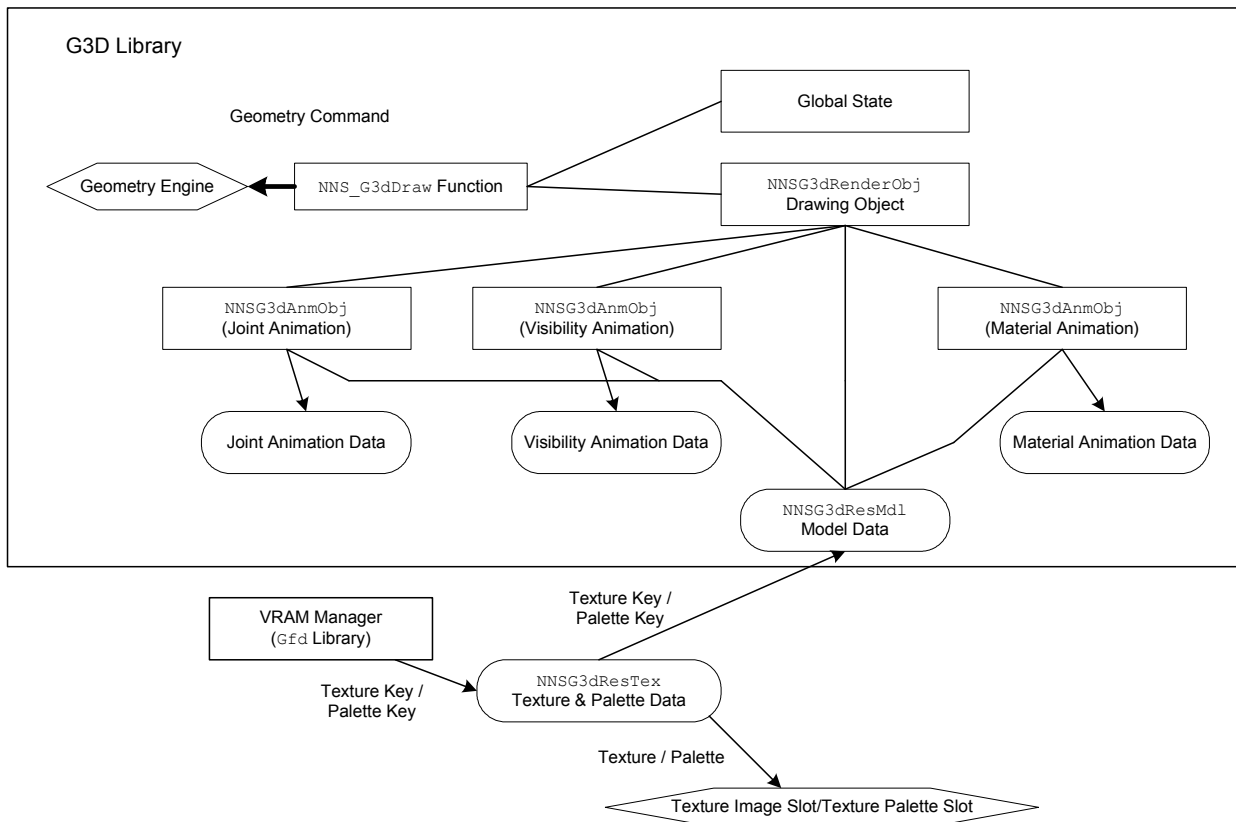


Figure 2-1 G3D Library Organization



## 3 NITRO-System 3D Development Environment

### 3.1 Flow of 3D Development

The flow of 3D development for the NITRO-System is shown in Figure 3-1. The designer designs a 3D model and animation using a 3D modeling tool, and then uses a plug-in to output it as an XML file called the NITRO intermediate file.

Nintendo DS specific materials that cannot be edited with the 3D-modeling tool can be edited with the 3D Material Editor. With the 3D Material Editor, the material portion of the model data in the NITRO intermediate file can be edited and output.

Using the 3D binary converter, the programmer converts the NITRO intermediate file to a binary file format which can be used with the G3D Library, and uses it in the application.

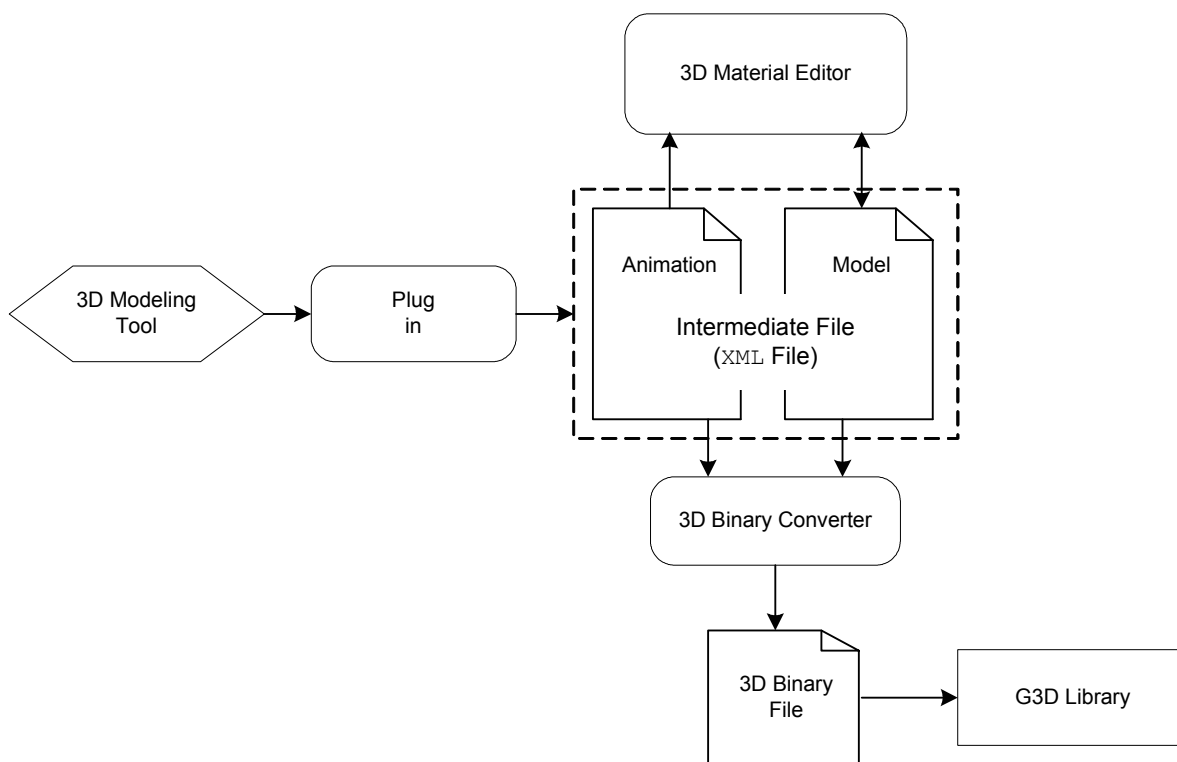


Figure 3-1 G3D Development Flow

## 3.2 Binary Converter (g3dcvtr.exe)

The binary converter (g3dcvtr.exe) is a Windows application for converting the XML-format (text) NITRO intermediate file to binary data used by the G3D Library. g3dcvtr.exe can convert all types of NITRO intermediate file.

For detailed information about the binary converter g3dcvtr.exe, refer to the g3dcvtr manual (NitroSystem\docs\G3D\g3dcvtr\_UsersManual.pdf).

## 3.3 G3D Binary File

The G3D binary file is converted from the NITRO intermediate file by g3dcvtr.exe. The G3D binary file types correspond to the NITRO intermediate file types. The six file types are shown below.

**Table 3-1 G3D Binary Format Types**

Extension	Intermediate File Type	File Description
nsbmd	Model data (imd)	Model data including polygons, parent/child structure, materials, and textures.
nsbtx	Texture data (imd)	Texture-only data.
nsbca	Character animation data (ica)	Animation data that operates the node matrix.
nsbva	Visibility animation data (iva)	Animation data that operates the node visibility.
nsbma	Material color animation data (ima)	Animation data that operates the material colors.
nsbtp	Texture pattern animation data (itp)	Animation data that cycles through multiple textures.
nsbta	Texture SRT animation data (ita)	Animation data that operates the texture matrix.

## 3.4 Resource Management in the Project

Instead of placing binary resource files that were converted individually in the project tree, we recommended that you place the NITRO intermediate files in the project's build tree and convert the files during the program build because the operation of binary files converted with different releases of the binary converter is not supported. Different releases of the converter are not supported because:

- Including support for older versions of binary files would make the library code and binary sizes much larger than necessary.
- Oversized libraries can create increased burden on game programs and have detrimental effects on game production in terms of both time and cost.

Also, even if the previous binary files are working, the newly converted binary files will work faster due to the improvement on the data conversion in the new version of g3dcvtr.

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