

N I N T E N D O
NITRO-System

G3D Library

Overview of 3D Graphics Library

Version 1.0.1

**The contents of this document are strictly
confidential and the document should be
handled accordingly.**

Confidential

These coded instructions, statements, and computer programs contain proprietary information of Nintendo of America Inc. and/or Nintendo Company Ltd. and are protected by Federal copyright law. They may not be disclosed to third parties or copied or duplicated in any form, in whole or in part, without the prior written consent of Nintendo.

Table of Contents

1	Introduction	5
2	Overview of G3D Library.....	6
2.1	Characteristics of G3D Library	6
2.1.1	Manage Resources by Text Format (XML) File.....	6
2.1.2	Binary Data	6
2.1.3	Incorporate Data Created with Different CG Tools	6
2.1.4	Port the Output of NITRO-Viewer As Is.....	6
2.1.5	Less Likely to Cause Memory Fragmentation	6
2.1.6	Access Resources by Name	7
2.1.7	Textures and Models in the Palette Can be Shared Easily	7
2.1.8	Play Back the Same Animation Data with Models of Different Sizes or Shapes	7
2.1.9	High Modularity and Easy Customization	7
2.2	Organization of G3D Library	8
3	NITRO-System 3D Development Environment	9
3.1	Flow of 3D Development.....	9
3.2	Binary Converter (<code>g3dcvtr.exe</code>).....	10
3.3	G3D Binary File	10
3.3.1	Resource Management in the Project.....	10

Tables

Table 3-1 G3D Binary Format Types	10
---	----

Figures

Figure 2-1 G3D Library Organization.....	8
Figure 3-1 G3D Development Flow	9

Revision History

Version	Date	Description
1.0.1	01/19/2005	Added descriptions of environmental and projection mapping.
1.0.0	01/18/2005	Changed some instances of "NITRO" to "Nintendo DS."
0.8.0	11/10/2004	<ul style="list-style-type: none">Improved and expanded the overview and introduction.Put all the details in the reference manual.
0.1.2	09/16/2004	<ul style="list-style-type: none">Modified "Special Characteristics of G3D Library" to support ima and itaCorrected Table 3-1.Unified the spelling of "flag" in the Japanese edition
0.1.1	09/02/2004	Added description on limiting the number of nodes, materials, and shapes
0.1.0	8/12/2004	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 file).
- 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 G3D library.

This document explains the operation of G3D library. For details on G3D library and 3D binary converter, see the release note and online reference manual.

2 Overview of G3D Library

2.1 Characteristics of G3D Library

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 G3D Library for game development.

2.1.1 Manage Resources by Text Format (XML) File

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

NITRO intermediate file is converted to a binary data file by 3D binary converter (`g3dconvtr`). 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

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 the Output of NITRO-Viewer to the Game Screen As Is

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

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 `g3dconvtr`. By doing so, projects that use G3D can reduce the probability of memory fragmentation or performance reduction.

2.1.6 Access Resources by Name

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

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

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

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.

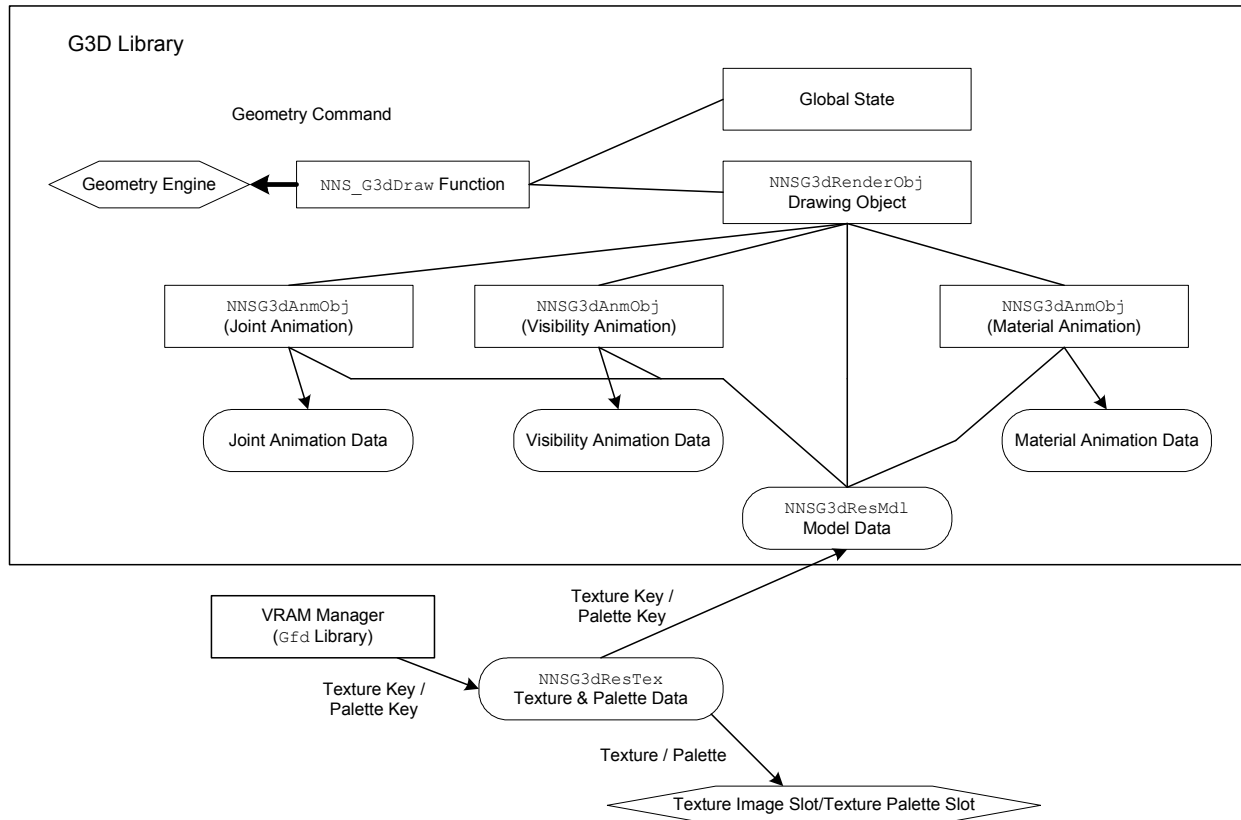


Figure 2-1 G3D Library Organization

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.

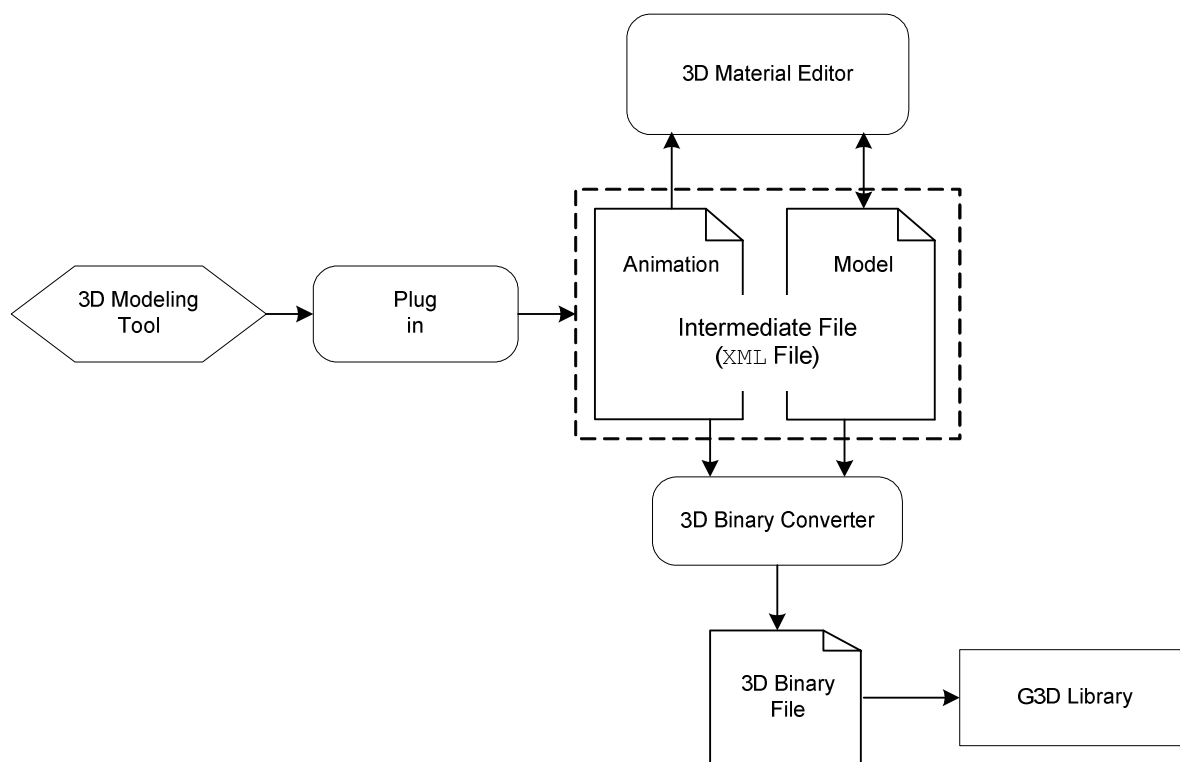


Figure 3-1 G3D Development Flow

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

Windows is a registered trademark or trademark of the Microsoft Corporation in the U.S. and in other countries.

Other company names, product names, etc. are the registered trademarks or trademarks of each company.

© 2004-2005 Nintendo

The contents of this document cannot be duplicated, copied, reprinted, transferred, distributed or loaned in whole or in part without the prior approval of Nintendo Co. Ltd.