CTR NintendoWare

Effect Development Environment Overview

Introduction to the NintendoWare Effect Development Environment

Version 1.0

PROVISIONAL TRANSLATION

The content of this document is highly confidential and should be handled accordingly.

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Table of Contents

Tables

Figures

1 Introduction

This document provides an overview of the effect development environment provided by NintendoWare for CTR.

The effect development environment is a group of tools and libraries for effect development for CTR.

NintendoWare for CTR has been developed to provide CTR software developers with tools and libraries for handling 3D graphics used in many games so they can focus on game creation itself.

With the effect development environment, developers can create and edit particles using special GUI tools and display the results on a CTR system using the graphics library.

The effect development environment consists of the following group of tools and libraries.

- GUI application
- Graphics library
- Viewer environment

In this document, NintendoWare for CTR is referred to either as NintendoWare or NW4C, except when it's important to emphasize that development is for CTR systems.

2 Overview of the Effect Development Environment

2.1 Workflow Inherited from the Development Environment for the Wii

The effect development environment inherits most of its workflow from the development environment for Wii, *NintendoWare for Revolution* (hereafter abbreviated as “NW4R”).

The effect development environment:

- Provides a plug-in for Photoshop for specifying the texture format.
- Provides NW4C Effect Maker, an easier-to-use version of the GUI tool for editing based on the NW4R version.
- EffectMaker and Viewer communicate with each other, allowing edited content to be viewed in real-time on Viewer.

2.2 Linking with the 3D Development Environment

The effect development environment shares scene graph and resource management features with the 3D development environment.

This allows for the following:

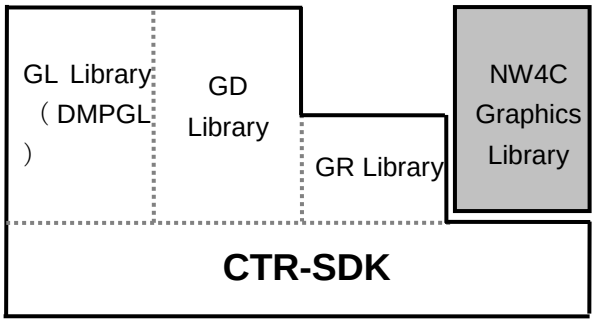
- Effect processing and rendering management in the same layer as a 3D model by using scene graphs
- Easier linking between a 3D model and effect by using scene graphs
- The use of material animations output from 3D Editor
- Material expressions equivalent to the 3D development environment

2.3 Positioning of the Graphics Libraries

NW4C provides a graphics library that integrates 3D rendering and effects rendering.

The relationship between the graphics libraries included in CTR-SDK and the NW4C graphics library is depicted below.

Figure 2-1 Positioning of the Graphics Libraries



GL Library (DMPGL)

This is the basic graphics library for CTR. It provides rich functionality including OpenGL/ES-compatible functions, error handling, and state difference management. Since processing by the library itself entails a heavier burden than for other libraries, it can place a large load on the CPU. We do not recommend the use of this library when performance is required.

GD Library

This is a lighter-weight library than GL. It is functionally equivalent to GL and provides functions in a form that's easy to use by developers. (There is no mutual compatibility with GL.) Its internal processing requires it to place a certain degree of processing load on the CPU.

GR Library

This graphics library supports the direct issuance of 3D commands. Because state management is not performed internally, this library not only executes more quickly than GL or GD, it also uses less memory. However, to use this library you must have a full and thorough understanding of each GPU register and how they are set, as described in *DMPGL 2.0 System API Specifications*. It is also comparatively more difficult to use because finely detailed processing such as error checking must be handled by the user.

NW4C Graphics Library

NW4C is middleware for application development provided by Nintendo. It provides both sound and graphics functionality. NW4C graphics functions internally generate direct commands, without using other graphics libraries. The NW4C graphics library has therefore been implemented to offer optimized performance right out of the box, with no modification necessary.

If you use the GL library in conjunction with the NW4C graphics library, be sure to strictly observe all notes and precautions given in the *NintendoWare for CTR Function Reference Manual*.
(See `NintendoWare/CTR/documents/API/nw/combine_nw_with_gl.html`)

3 Folder Organization and Setup

3.1 Folder Organization

The folder organization for GUI tools and libraries provided by the effect development environment is shown below.

3.1.1 Tool-Related Folder Organization

The group of tools primarily used by designers and planners to create data is organized as follows.

```
NintendoWare
└ CTR  (Environment variable: NW4C_ROOT)
  ├ documents                          // Various documents and manuals
  │  ├ EffectMaker                     // EffectMaker manual
  │  ├ CreativeStudio                  // CreativeStudio  manual
  │  ├ DccPlugin                       // Plug-in manual for DCC tools
  │  │  └ Photoshop                    // Photoshop plug-in manual
  │  ├ Graphics
  │  │  ├ Effect_terms.html            // Effect terminology
  │  │  └ TextureAdditionalInfo.pdf    // TGA format with additional information
  │  ├ IntermediateFileFormat          // Intermediate file format
  │  ├ Overview
  │  │  ├ Effect_Overview.pdf          // Overview of the effect development environment
  │  │  └ NintendoWare_Overview.pdf    // Overview of NW4C
  │  ├ ReleaseNotes                    // Release notes
  │  └ Viewer                          // Viewer manual
  └ tools
    ├ CreativeStudio                   // CreativeStudio
    ├ CreativeStudioStarter            // CreativeStudioStarter
    ├ DccPlugin                        // Plug-in for DCC tools
    │  └ Photoshop                     // Photoshop plug-in
    ├ EffectMaker                      // EffectMaker
    └ Viewer                           // Viewer
```

3.1.2 How to Read the Manuals (to Understand the Tools)

Designers and planners seeking to master use of the effect development environment should read through the documentation in the order shown below.

1. Overview

   Read this document first for an overview of NW4C.

   `NintendoWare/CTR/documents/Overview`

2. CTR Graphics Primer
   Read this document ahead of time to get an even deeper understanding. Note that the *CTR Graphics Primer* is not included in the NW4C package and must be obtained separately.

3. EffectMaker Manual Tutorial
   This manual teaches you how to create basic effects. You can display sample data using EffectMaker, the main tool in the effect development environment. The results of edits can be confirmed in real-time by setting up communication between EffectMaker and the Viewer.

   ```
   NintendoWare/CTR/documents/EffectMaker/EffectMaker.html
   ```

4. Viewer Manual
   Many features have been implemented for the viewer. Data loaded into EffectMaker can also be displayed on Viewer so you can try out all the various features available.

   ```
   NintendoWare/CTR/documents/Viewer/Viewer.html
   ```

5. Effect terminology
   Refer to the effect terminology list if you encounter hard-to-understand terminology.

   ```
   NintendoWare/CTR/documents/Graphics/Effect_terms.html
   ```

3.1.3 Library-Related Folder Organization

The main libraries used by programmers are located as follows.

```
NintendoWare
└ CTR  (Environment variable: NW4C_ROOT)
  ├ demos                                  // Demo programs
  │  ├ gfx                                 // Graphics demos
  │  └ Nw4cDemo                            // NW4C integrated demos
  ├ documents                              // Documents
  │  ├ API                                 // API reference
  │  ├ Graphics
  │  │  ├ Effect_terms.html                // Effect terminology
  │  │  └ TextureAdditionalInfo.pdf        // TGA format with additional information
  │  ├ Overview
  │  │  ├ Effect_Overview.pdf              // Overview of the effect development environment
  │  │  └ NintendoWare_Overview.pdf        // Overview of NW4C
  │  └ ReleaseNotes                        // Release notes
  ├ include                                // Include files
  ├ libraries                              // Library files
  ├ SampleData                             // Sample data files
  ├ shaders                                // Shader files
  └ sources                                // Graphics library source files
    ├ libraries                            // Graphics library source files
    └ shaders                              // Shader code source files
```

3.1.4 How to Read the Documents (to Understand the Libraries)

For first-time users of NW4C, we recommend reading the documents below in the order shown and studying the sample programs to gain a deeper understanding of the tool.

1. Overview
   Read this document first for an overview of NW4C.

   `NintendoWare/CTR/documents/Overview`

2. NintendoWare for CTR Programmer's Guide
   This guide includes procedures for building sample programs and information about runtime library configuration. It is specifically intended for programmers who will be using the NW4C runtime library.

   `NintendoWare/CTR/documents/ProgrammersGuide/NintendoWare_ProgrammersGuide.pdf`

3. NintendoWare for CTR Function Reference Manual
   See the documents in the **Graphics Documents** section of the NW4C Function Reference to study implementation methods, and also refer to the included demo programs.

   `NintendoWare/CTR/documents/API/index.html`

4. CTR Graphics Primer
   This document can help you better understand CTR graphics expressions. Note that the *CTR Graphics Primer* is not included in the NW4C package and must be obtained separately.

5. Effect Terminology
   Refer to this effect terminology list if you encounter hard-to-understand terminology.

   `NintendoWare/CTR/documents/Graphics/Effect_terms.html`

3.2 Setup

This section describes the setup procedure. Perform the required setup steps.

3.2.1 CTR Development Environment Setup (Required)

Configure PARTNER-CTR and CTR-SDK according to their included documentation.

3.2.2 NW4C Setup (Required)

Install the NW4C package in a suitable location on your PC.

Set the environment variable `NW4C_ROOT` to match the path in which the `NintendoWare/CTR` folder has been placed.

`NW4C_ROOT` Example: `C:\NintendoWare\CTR`

3.2.3 EffectMaker Setup (Optional)

To use EffectMaker, you must have the following.

- Microsoft .NET Framework 4.0
- Microsoft Visual C++ 2010 Redistributable Package

For details, see the installation method described in the CTR EffectMaker manual.

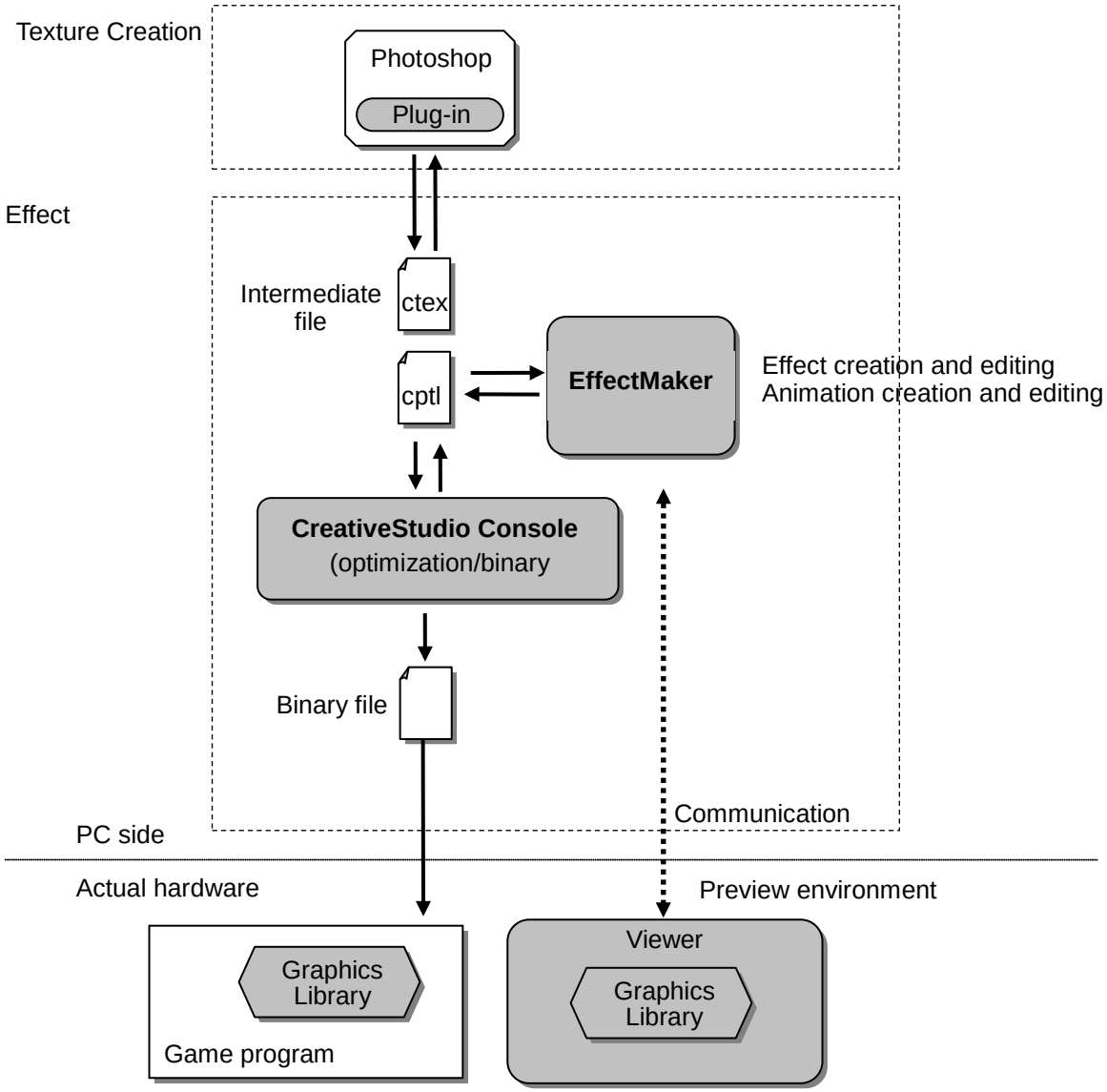
4 Configuration of the Effect Development Environment

This chapter describes the workflow from creating data to putting it in a form that can be used by the graphics library.

4.1 Workflow Centering on EffectMaker

The effect development environment is structured around a workflow centering primarily on EffectMaker.

Figure 4-1 Workflow Centering on EffectMaker



4.2 Migrate from CreativeStudio to EffectMaker

Development of CreativeStudio, provided for a long time as an integrated graphics development tool for CTR, has ended.

Starting with NW4C 2.0, please migrate to 3DEditor and EffectMaker.

Intermediate files created so far using CreativeStudio can be used by EffectMaker.

For details, see the CTR EffectMaker manual.

5 Main Graphics Expressions Available in the Effect Development Environment

5.1 Main Graphics Expressions

The main graphics expressions available in the effect development environment are as follows.

- Particle emission and lifespan management
- Particle emission shape control by emitter
- Texturing expressions for particles
- High-level effect expressions using child particles
- Tracking control for emitted particles
- Various particle shape expressions such as billboards and polygon panels

5.2 Main Animation Expressions

The main animation expressions available in the effect development environment are as follows.

- Translate, rotate, and scale animation expressions
- Initial velocity and velocity animation expressions
- Color and alpha animation expressions
- Texture UV coordinate scroll animation expressions
- Animation expressions using texture UV coordinate switching
- Support for material animation files

5.3 Unsupported Graphics Expressions

The following graphics expression is not supported. It is currently unknown when this feature will be supported.

- Emitter animation feature

In contrast, there is no plan to support the following graphics expression in the effect development environment.

- Stripe expressions where polygons are rendered in the particle trajectory

If you want to implement these expressions, implement them within your application using the graphics libraries included with the CTR-SDK.

6 GUI Tools Introduction

6.1 GUI Tools

The effect development environment includes GUI tools for creating and editing intermediate files.

6.1.1 EffectMaker

EffectMaker is a GUI application for creating and editing effects that use particles. The main functions and features of EffectMaker are as follows.

- Creating and editing effects
- Managing effect projects
- Linking with Viewer
- Linking with 3D models

The following tasks cannot be performed using EffectMaker.

- Detailed editing of materials
- Free editing of hierarchical structures

6.1.2 CreativeStudio

CreativeStudio performs optimization and binary conversion of intermediate files.

The main functions and features of CreativeStudio are as follows.

- Conversion from intermediate files to binary files
- Preview of effects stored in intermediate files on a PC

6.2 Viewer

Viewer provides a viewer environment for displaying data created using tools and plug-ins provided by NW4C on a CTR system.

In addition to the effect development environment, Viewer can be used under the layout development environment and 3D development environment.

The viewer environment is configured using the tools given below.

- Viewer program for actual hardware

The main functions and features of Viewer are as follows.

- Preview of effects created using EffectMaker on actual development hardware
- Preview by loading binary files
- Display of performance measurement information and other data
- Capture of screen images for file output to PC

7 Data Files

This section describes the main data files used by the effect development environment.

7.1 Project Files

Project files are XML-formatted files that save composite effects, preview settings, textures, and other loaded file states.

Use of project files allows files to be edited to be batch-loaded.

7.2 Intermediate Files

Graphics intermediate files, also called intermediate files, are XML-formatted files that store particle information in data structures suited for use by CTR.

Several file extensions are used with intermediate files, and each extension represents information stored in a certain specific data structure.

Intermediate file format versions are sometimes updated to include features or changes in specifications. When out-of-date intermediate files are loaded into the most recent tools, the tools automatically update the intermediate file format to the latest version.

For details on intermediate file formats, see:
`NintendoWare/CTR/documents/IntermediateFileFormat/IntermediateFileFormat.html`

Table 7-1 Intermediate File Types

Extension	Description
cmdl	Model data. Stores 3D model information.
ctex	Texture data. Stores texture image information.
cptl	Particle data. Stores particle set information.

7.3 Graphics Binary Files

Graphics binary files (hereafter referred to as *binary files*) have the same file structure regardless of the resource type. Binary files can be given any extension, but if an output filename is not explicitly specified at time of conversion to binary, a file extension matching that of the intermediate file is automatically applied.

Binary file formats have not been publicly disclosed.

Table 7-2 Binary File Types

Extension	Description
bcres	This is a general-purpose file extension for binary formatted data representing multiple types of intermediate files.
bcmdl	This file extension is used for binary data when gathering together model data intermediate files only.
bctex	This file extension is used for binary data when gathering together texture data intermediate files only.

8 Graphics Library

8.1 Graphics Library

The graphics library has been created for high-efficiency rendering of 3D models, animations, and effects on a CTR system.

For detailed information on the main features and structure of the graphics library, see the **Graphics Documents** and **Sample Demos** sections of the NW4C Function Reference.

`NintendoWare/CTR/documents/API/index.html`

The graphics documentation includes:

- FAQ
- Optimization Tips
- Binary Converter
- Class Diagram
- Process Flow
- Particles
    - Easiest method of use
    - Creating and destroying
    - Hierarchical structure and coordinate system
    - Computational features
    - Rendering features
    - Shaders
    - Usage notes

Revision History

Version	Revision Date	Description
1.0	2011/02/28	Initial version.