

Meridian Rendering Software

User Guide

January 10, 2012

Version 2.0.1

Copyright © 2011 Sunfish Studio, LLC

All rights reserved.

Meridian™, MeridianSL™ and RXF™ are trademarks of Sunfish Studio, LLC.

Protected by one or more of the following patents, or by other patents in the United States or other countries, or by patents pending:

US 7949700
US 7554540
US 7250948

AU 2003294327
NZ 563047
NZ 540742

JP 4643271

Autodesk® and Maya® are registered trademarks of Autodesk, Inc. in the United States and other countries. Sentinel HASP® is a registered trademark of SafeNet, Inc. in the United States and other countries. Microsoft® and Windows® are registered trademarks of Microsoft Corporation in the United States and other countries. Intel® is a registered trademark of Intel Corporation in the United States and other countries. AMD® is a registered trademark of Advanced Micro Devices, Inc. in the United States and other countries.

Contents

Introduction	1
About this Document	1
System Requirements	2
Installation	2
Licensing.....	3
License Model	4
Maximum Number of Processors	4
Sentinel HASP.....	4
Sentinel HASP Runtime	5
Activation	6
Free 30-Day Trial	6
Meridian Console	8
Rendering RXF Data	8
Many Files	10
Streaming Mode	10
Display a Picture.....	11
Commands	12
Create a Texture (TXR) or Displacement (TXD) File	12

Introduction

Thank you for choosing Meridian.

Nathan T. Hayes

Meridian is a rendering engine developed by Sunfish Studio, LLC that represents a new approach to computer graphics rendering.

Parallel to its core, Meridian has been designed to harness the full theoretical capacity of computers with hundreds of processor cores. Based on a new patented rendering method that uses interval arithmetic, Meridian analytically renders geometry like NURBS directly into perfectly anti-aliased pixels. Since there is no longer any need to tessellate geometry into dense polygon meshes of tiny pixel-sized polygons, each tile in an image can be processed using only a very small and constant amount of memory regardless of the scene size and complexity.

Due to these special properties of the Meridian interval arithmetic rendering engine, the number of concurrently rendered tiles is practically limitless. Even the most demanding scenes with features such as transparency and motion blur should not reduce the ability of Meridian to take advantage of a large number of processing cores.

About this Document

This document explains how to install, configure and operate the Meridian software. For a more in-depth technical look at Meridian, or if you are a developer and wish to learn how to program and integrate Meridian into your custom production pipeline, please see the [Meridian Rendering Software Developer Guide](#).

Meridian is a stand-alone console application. This document assumes the reader has some basic knowledge of how to work at the command prompt in a console window. To learn more about command prompts and console windows, consult your operating system documentation.

System Requirements

Meridian runs on the following operating systems:

- Windows XP Service Pack 2
- Windows XP Professional x64 Edition
- Windows Server 2003 Service Pack 1
- Windows Server 2008
- Windows Server 2008 R2
- Windows Vista
- Windows 7

Meridian requires the following minimum hardware:

- Genuine Intel or Authentic AMD processor with SSE2 instructions
- 1 GB RAM
- 100 MB of disk space

For optimal performance, the following hardware is recommended:

- Genuine Intel or Authentic AMD processors with multiple cores
- 1GB RAM plus 100 MB of system RAM per processor core
- 1 TB of disk space for rendering large scenes and animations
- Gigabit Ethernet for fast network rendering

Installation

Table 1 is a summary of installers included in the Meridian distribution media.

Installer	Description
Meridian.msi	Meridian for 32-bit supported operating systems
Meridian-x64.msi	Meridian for 64-bit supported operating systems

Table 1. Installers included in the distribution media.

Before installing Meridian, be sure to choose the appropriate installer for your supported operating system. For example, use the 64-bit installer on a 64-bit operating system.

How to install Meridian

- Locate the appropriate Installer in the Meridian distribution media
- Double-click on the Installer
- Follow the on-screen instructions to complete the installation procedure

Once Meridian is installed, please be sure to follow the instructions in the next section of this document to ensure Meridian licensing is configured properly and then activated.

Licensing

The following terms are used in Meridian licensing:

- **Logical processor.** One logical computing engine from the perspective of the operating system. In effect, a logical processor is a thread.
- **Core.** One processing unit, which can consist of one or more logical processors.
- **Processor.** One physical processor, which can consist of one or more cores. A processor is the same as a package, a socket, or a CPU.

Figure 1 is a graphical depiction of the relationships between the physical objects these terms represent.

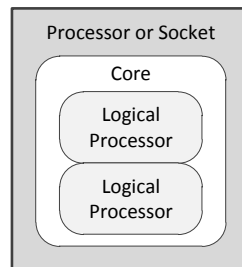


Figure 1. Meridian licensing is based on the relationship between these various processor objects and terminology.

If a processor only has one core, then the processor and the core are the same physical object. Likewise, if a core only has one logical processor, then the core and the logical processor are the same physical object.

Each core on a processor usually has its own execution and cache resources, but logical processors within a single core share these resources. So the relative computational value of two logical processors is much greater when the logical processors are not on the same core.

Some processors, such as all current AMD processors, do not have multiple logical processors per core. Intel processors with Hyper-Threading Technology, on the other hand, usually have two logical processors per core.

License Model

Meridian is licensed by the core, and each core requires one license. Meridian tries to use the maximum number of available cores on a computer by requesting a license for each core.



Example. A dual-core computer requires two licenses. A quad-core computer requires four licenses, and a computer with four sockets each containing a quad-core processor requires a total of sixteen licenses.

If there are not enough licenses, Meridian will not use all of the available cores on the computer.

If a core has more than one logical processor, the extra logical processors in that core do not require a license. However, the extra logical processors are used if and only if licenses are available for all cores on the computer.



Example. If four licenses are available, Meridian will use all eight logical processors on a quad-core computer that has two logical processors in each core. But if only three licenses are available, Meridian will only use three logical processors. In this latter case, Meridian tries to use logical processors that belong to different cores.

Maximum Number of Processors

Meridian supports a maximum of 256 logical processors on the following operating systems:

- Windows 7
- Windows Server 2008 R2

On all older 64-bit supported operating systems, Meridian supports a maximum of 64 logical processors. All other 32-bit supported operating systems support only a maximum of 32 logical processors.

Sentinel HASP

Sentinel HASP is a security and licensing program by SafeNet, Inc. which is used by Meridian. Sentinel HASP allows licenses for an entire network of computers to be managed very easily.

Here are a few critical facts about Sentinel HASP:

- Sentinel HASP uses software keys to license Meridian
- Keys may be obtained from the Sunfish sales team

- Only one key is required to provide licenses for every computer on a network

Figure 2 is a typical configuration of a computer network for Meridian. The Sentinel HASP software key is activated on one computer on the network designated as a License Server, and this computer provides licenses to all other rendering computers on the network.

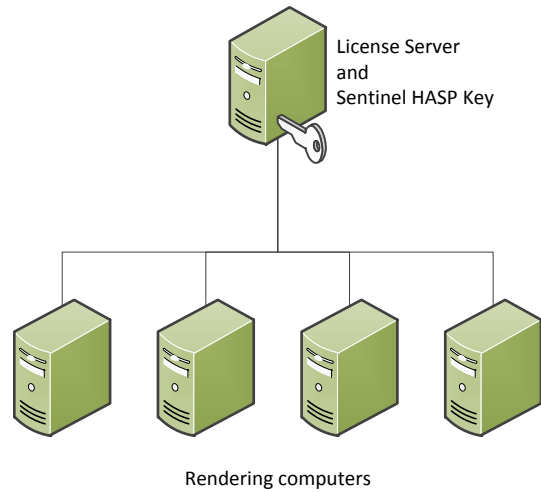


Figure 2. Sentinel HASP allows licenses for an entire network of computers to be managed very easily.

Usually the License Server is dedicated to license management: although it is possible to run Meridian on the License Server, this can consume processor time and may cause the License Server to become unresponsive to other rendering computers on the network.

Sentinel HASP Runtime

Sentinel HASP Runtime is the driver provided by SafeNet, Inc. that is required for proper operation of the Sentinel HASP licensing system.

The Meridian distribution media includes a file called [HASPUserSetup.exe](#). This is the Sentinel HASP Runtime installer.

How to install the Sentinel HASP Runtime

- Locate the [HASPUserSetup.exe](#) file in the Meridian distribution media
- Double-click on the [HASPUserSetup.exe](#) file
- Sentinel HASP Runtime Setup displays a welcome page
- Follow the on-screen instructions to complete the installation procedure

Please be sure to install the Sentinel HASP Runtime on the License Server as well as every computer that needs to run Meridian.

Activation

Sentinel HASP software keys must be activated before they can be used to provide licenses to Meridian. Typically the software key should be activated on the License Server.

Meridian includes an Activation Wizard, a program which provides a friendly user interface and allows a software key to be activated over the internet in just a few mouse clicks. If no internet connection is available, the activation procedure can be completed offline.

How to activate a Sentinel HASP software key

- Choose one computer on the network to be a License Server
- Install Meridian on the License Server
- Install Sentinel HASP Runtime on the License Server
- Select [All Programs > Sunfish Studio > Meridian > License > Activation Wizard](#) from the [Start](#) menu of the License Server
- Select the [Activate a product key](#) option and enter the key number
- Click [Next](#)
- Follow the on-screen instructions to activate by internet or file

Please note that activation on any computer requires the Sentinel HASP Runtime drivers to be installed on that computer.

Free 30-Day Trial

If you do not have a Sentinel HASP software key, a free 30-day trial of the Meridian software can still be activated.

How to activate a free 30-day trial of Meridian

- Choose a computer to run the free trial on
- Install Meridian on the trial computer
- Install Sentinel HASP Runtime on the trial computer
- Select [All Programs > Sunfish Studio > Meridian > License > Activation Wizard](#) from the [Start](#) menu of the trial computer
- Select the [Start a free trial](#) option
- Click [Next](#)
- Click [Finish](#)

Please note the free 30-day trial requires the Sentinel HASP Runtime drivers to be installed on the trial computer.

The free 30-day trial is a fully functional version of Meridian, but the license is locked to the trial computer and cannot be shared over the network. So there is

no License Server when running the free 30-day trial. For this reason, we recommend installing the free trial on the most powerful computer at your facility.

Please note that once the free 30-day trial expires, it will never be possible to activate another trial on that computer. You may run the trial on other computers, but when you run out of computers a software key will be needed to keep using Meridian.

Meridian Console

Meridian is a console application that runs at the command prompt.

How to open a Meridian command prompt

- Select [All Programs > Sunfish Studio > Meridian > Console](#) from the [Start](#) menu of the computer

Once the Meridian console window is open, you may see the following command prompt:

```
Welcome to Meridian console.  
FISH      Render picture(s) from RXF data  
DISPLAY  Display a picture or rendering in progress  
FF       Create a texture file  
C:\Users\Nate>
```

Enumerated in the short list of commands above the command prompt are the various Meridian programs. Rendering is performed by using the [fish](#) command. The [display](#) and [ff](#) commands are described later in this chapter of the document.

Rendering RXF Data

[Render Exchange Format](#) (RXF) describes the contents of a scene to Meridian. In order to render a picture, Meridian must be supplied with valid RXF data.

Here are a few critical facts about RXF:

- Sunfish Studio, LLC is the author of RXF
- Permission is granted for anyone to write, develop or sell software that creates RXF data
- All rights to render RXF data are reserved by Sunfish Studio, LLC

The RXF specification can be found in the [Meridian Rendering Software Developer Guide](#).

Sunfish also distributes a plugin for Autodesk Maya that exports the contents of a Maya scene as a RXF file, so this is an easy way to create RXF data if you are using Autodesk Maya.

How to render RXF data stored in a file

- Open a Meridian command prompt
- Change the current directory, if necessary, to the folder where the RXF file you wish to render is located
- Type `fish` followed by the name of the RXF file
- Press `Enter`

Suppose you have a file named `scene.rxf` on the `D:` drive in a folder called `Render`. First, open a Meridian command prompt and change the drive by typing `D:` and then pressing `Enter`. You may see something similar to this:

```
Welcome to Meridian console.

FISH      Render picture(s) from RXF data
DISPLAY   Display a picture or rendering in progress
FF        Create a texture file

C:\Users\Nate>D:
D:>
```

Next, change the current directory to the `Render` folder by typing `cd Render` and then pressing `Enter`:

```
Welcome to Meridian console.

FISH      Render picture(s) from RXF data
DISPLAY   Display a picture or rendering in progress
FF        Create a texture file

C:\Users\Nate>D:
D:>cd Render
D:\Render>
```

Finally, type the command `fish scene.rxf` and press `Enter`. This will cause Meridian to render the file:

```
Welcome to Meridian console.

FISH      Render picture(s) from RXF data
DISPLAY   Display a picture or rendering in progress
FF        Create a texture file

C:\Users\Nate>D:
D:>cd Render
D:\Render>fish scene.rxf
=====
[      N      ] Meridian Rendering Software
[      |      ] Release 2.1.8.10, 64-bit
[ W---E ] Copyright 2010 Sunfish Studio, LLC
[      |      ] U.S. and foreign patents granted. Patents pending.
[      S      ] Using 2 of 2 active processing core(s)
=====
[08/19 17:39] scene.rxf
[08/19 17:39] Compiling shaders...
[08/19 17:39] 0:00:00.10 elapsed time for compiling
[08/19 17:39] Starting program...
[08/19 17:39] Frame: 1
[08/19 17:39] Raster: 0 0 640 480
[08/19 17:39] Grid: 64
[08/19 17:39] Granules: 16
[08/19 17:39] Rendering tiles...
[08/19 17:39] 4/80 complete
```

Many Files

If you type the names of many RXF files after the `fish` command and then press `Enter`, Meridian will render all of the files.

How to render RXF data stored in many files

- Open a Meridian command prompt
- Change the current directory, if necessary, to the folder where the RXF files you wish to render are located
- Type `fish` followed by the name of each RXF file, separating the name of each file by a space
- Press `Enter`

For example, suppose you have three files named `scene1.rxf`, `scene2.rxf` and `scene3.rxf` and you wish to render all of them. Type the names of the files after the `fish` command and then press `Enter`:

```
D:\Render>fish scene1.rxf scene2.rxf scene3.rxf
=====
[   N   ] Meridian Rendering Software
[   |   ] Release 2.1.8.10, 64-bit
[ W--+--E ] Copyright 2010 Sunfish Studio, LLC
[   |   ] U.S. and foreign patents granted. Patents pending.
[   S   ] Using 2 of 2 active processing core(s)
=====
[08/19 19:38] scene1.rxf
[08/19 19:38] Compiling shaders...
[08/19 19:38] 0:00:00.01 elapsed time for compiling
[08/19 19:38] Starting program...
[08/19 19:38] Frame: 1
[08/19 19:38] Raster: 0 0 640 480
[08/19 19:38] Grid: 64
[08/19 19:38] Granules: 16
[08/19 19:38] Rendering tiles...
[08/19 19:38] 4/80 complete
```

Meridian renders each file typed at the command prompt after the `fish` command in the order entered.

Rendering multiple files in this manner ensures Meridian will not release the acquired licenses for any processor cores until all of the files are done rendering.

Streaming Mode

If the `fish` command is run without any arguments, Meridian reads from the standard input stream:

```
D:\Render>fish
=====
[   N   ] Meridian Rendering Software
[   |   ] Release 2.1.8.10, 64-bit
[ W--+--E ] Copyright 2010 Sunfish Studio, LLC
[   |   ] U.S. and foreign patents granted. Patents pending.
[   S   ] Using 2 of 2 active processing core(s)
=====
[08/19 19:43] Reading input stream...
```

Now you could manually type the RXF data and Meridian would render it. Of course, that would be rather tedious!

The real purpose of this mode is to allow other software programs to stream RXF data directly to Meridian. This allows Meridian to render very large quantities of RXF data “on the fly” without ever needing to store it all in a file on the hard drive.

Since RXF files can become very large for complex scenes and animations, streaming can be an important option.

Display a Picture

The `display` command is an application to view pictures and renderings in progress. Figure 3 is a depiction of the `display` application.



Figure 3. The `display` command is an application to view pictures and renderings in progress.

There are two ways to run the `display` application.

How to run the `display` application from the Start menu

- Select `All Programs > Sunfish Studio > Meridian > Display` from the Start menu of the computer

How to run the `display` application from the Meridian command prompt

- Type `display` and press `Enter` to run the application

- If you type the name of a picture after typing `display` and before pressing `Enter`, the application runs and displays the picture you typed at the command prompt

Commands

Table 2 is a summary of toolbar buttons and keystroke commands for the display application.

Button	Keystroke	Description
Open	Ctrl+O	Open a new picture
Previous	Left Arrow	Advance to the previous picture in a sequence
Next	Right Arrow	Advance to the next picture in a sequence
Refresh	Space	Refresh the picture
Auto	Enter	Refresh the picture automatically every 5 seconds
	Page Up	Make the transparent background brighter
	Page Down	Make the transparent background darker

Table 2. Toolbar buttons and keystroke commands.

You may drag a new picture into the window with the mouse or use the `Open`, `Previous` and `Next` buttons to change pictures.

To watch a rendering in progress, open a picture and press the `Refresh` button. Each time you press `Refresh`, changes to the picture are displayed. If the `Auto` button is depressed, changes to the picture are automatically displayed every 5 seconds.

If a picture contains transparency information, a checkerboard pattern will appear in the background. Pressing the `Page Up` and `Page Down` keys adjusts the brightness of the pattern.

Create a Texture (TXR) or Displacement (TXD) File

Texture and displacement files are often needed by Meridian at render time. Meridian employs an efficient caching mechanism that allows gigabytes of texture data to be accessed very efficiently using only a very small and constant amount of memory. To accomplish this, all texture and displacement files used by Meridian must be converted into a special format prior to rendering.

The `ff` command (affectionately known as the “fish food” command) is a utility to create Meridian texture and displacement files in this special format. Sunfish recommends using TXR and TXD as the file extension for these special texture and displacement files, respectively. For example, TXR files should contain color images and TXD files should contain displacement maps.

TXR or TXD files can be created from standard picture files such as TIFF, BMP, JPG, PNG, WMF and EMF. The `ff` command can be used to convert these picture files into the TXR or TXD formats used by Meridian.



Note. The `ff` command uses Microsoft Windows Imaging Component (WIC) to decode picture files. This means new picture formats can be automatically supported by installing an appropriate WIC decoder on the computer. Please consult the appropriate Microsoft technical references if you are developer, or contact your vendor if you are a user.

The `ff` command has a built-in help screen. To display help, type `ff` at the Meridian command prompt and press `Enter`:

```
welcome to Meridian console.

FISH      Render picture(s) from RXF data
DISPLAY   Display a picture or rendering in progress
FF        Create a texture file

C:\Users\Nate>ff
FISHFOOD! Texture file conversion utility 2.0.11.28
Copyright 2011 Sunfish Studio, LLC
Converts an image to Sunfish texture format.

FF [/R | /M | /D] [/T:n] filename1 filename2

/R        Create a ripmap texture (default).
/M        Create a mipmap texture.
/D        Create a displacement texture.
/T:n      Specify the maximum tile size used for image decoding.
           The size of a tile is 2^(2*n) pixels and n must be an
           integer in [4,16]. Large tiles provide fast image decoding
           at the cost of increased memory consumption. The default
           is 10.

filename1 Name of the image file to convert.
filename2 Name of the output texture file.

C:\Users\Nate>
```

Typically the default options are sufficient.

How to create a texture file with the `ff` command

- Open a Meridian command prompt
- Type `ff` and a space
- Type the name of the picture file to convert and a space
- Type the name of the texture file to create
- Press `Enter`

For example, to convert a file called `arecibo.jpg` into a texture `arecibo.txr`:

```
C:\Users\Nate>ff arecibo.jpg arecibo.txr
FISHFOOD! Texture file conversion utility 2.0.11.28
Copyright 2011 Sunfish Studio, LLC
Converts an image to Sunfish texture format.

JPEG Decoder by Microsoft
9649x4101 pixels, 24bpp BGR

Decoding image...
100% complete

Conversion was successful.
0:00:54.57 elapsed time for conversion.

C:\Users\Nate>
```