



## OpenGL ES Emulator Release Note

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### Abstract

This document contains notes relating to the version 1.3.1 of the OpenGL ES Emulator. This is an EAC release of version 1.3.1.

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# 1 PREFACE

This document contains general release information about the OpenGL ES Emulator 1.3.1 EAC deliverables and covers the following topics:

- Deliverables summary.
- Details of external tools required.
- Build instructions.
- Changes and fixes in this release.
- Known issues.
- Details of testing prior to release.

Note that release 1.3.1 is for Linux only. The changes between releases 1.3.0 and 1.3.1 are irrelevant for Windows, so Windows users should continue to use release 1.3.0.

## 2 PRODUCT DELIVERABLES

### 2.1 Parts

#### 2.1.1 Windows

The OpenGL ES Emulator for Windows is made available via a Microsoft Installer Package,

```
OpenGL_ES_Emulator_vm.vn.vp.vr_Win32.msi
```

Where `vm` is the major version number, `vn` is the minor version number, `vp` is a patch level and `vr` is the build number of the package.

#### 2.1.2 Linux

The OpenGL ES Emulator for Linux is made available via a gzipped tar archive,

```
OpenGL_ES_Emulator_vm.vn.vp.vr_Linux.tar.gz
```

Where `vm` is the major version number, `vn` is the minor version number, `vp` is a patch level and `vr` is the build number of the package.

## 3 DOCUMENTATION

Additional documentation for the OpenGL ES Emulator is available from <http://www.malideveloper.com/>. This documentation comprises:

### 3.1 OpenGL ES Emulator Errata

This document describes the errata discovered in the implementation of the OpenGL ES Emulator, categorised by level of severity. Each description includes:

- a description of where the implementation deviates from the specification,
- the conditions under which erroneous behaviour occurs,
- the implications of the erratum with respect to typical applications,
- the application and limitations of a work-around where possible,
- the status of corrective action.

### 3.2 OpenGL ES Emulator User Guide

The integration guide provides user information for OpenGL ES Emulator. It describes how to install and operate the emulator software.

### 3.3 Release Note

This document contains general release information about the OpenGL ES Emulator product.

## 4 REFERENCE PLATFORM

ARM Limited recommends the use of the same platform that was used to develop and test the OpenGL ES Emulator. This section lists the additional hardware and software that is required.

In general, the OpenGL ES Emulator requires a desktop computer with an OpenGL 2.x capable graphics card. ARM recommends that you upgrade to the latest drivers from your graphics card vendor. Additionally, for Linux platforms, the graphics card and drivers must support GLX 1.4.

On platforms without hardware support for OpenGL 2.x, it may be possible to use the Mesa software OpenGL implementation as an alternative. For more information on this, see section 7.

### 4.1 The reference platform

The reference platform for the OpenGL ES Emulator is an x86 PC running Microsoft Windows XP SP3 or Ubuntu 10.04 LTS, with an NVIDIA GeForce 210 graphics card using driver version 197.45 (Windows) and 195.36.15 (Linux).

### 4.2 Installing the system on the reference platform

To install the system on the reference platform, the following are required:

- For Windows, an up to date version of Windows Installer is needed. This should be kept up-to-date by your operating system and separate installation is highly unlikely to be necessary.
- For Linux, a version of GNU tar 1.13 or greater is required.

## 5 INSTALLATION

### 5.1 Installation Procedure

On Windows, installation is achieved via the Windows Installer mechanism. Run the installer package and follow the on-screen instructions. On Linux, installation is performed via extracting the gzipped tarball to a location on disk.

For complete installation information on both platforms, consult the OpenGL ES Emulator User Guide.

### 5.2 Directory Structure

By default, the OpenGL ES Emulator will install the following files:

- OpenGL ES Emulator libraries
- Example application
- Development libraries and header files.

For a complete list of the installed components, consult the OpenGL ES Emulator User Guide.

## 6 BUILDING APPLICATIONS TO USE THE EMULATOR

### 6.1 Required Tools

To build applications that use the OpenGL ES Emulator, you will need:

- Microsoft Visual Studio 2005 or higher (Windows only)
- GCC version 4.1.3 and GNU make version 3.80 or later (Linux only)

For information about building applications on your platform (including building the example application), consult the OpenGL ES Emulator User Guide.

**Note:** The Emulator libraries have been built for 32-bit systems. To build OpenGL ES applications using 64-bit systems, an appropriate flag should be passed to the compiler (for example, `-m32` for GCC).

## 7 MESA SOFTWARE OPENGL IMPLEMENTATION

This section details how to use the OpenGL ES Emulator with Mesa.

Mesa (<http://www.mesa3d.org/>) is an open-source, cross-platform software implementation of OpenGL. In cases where there is no available OpenGL 2.x hardware support, Mesa can be used as an alternative. The OpenGL ES 2.0 Emulator has been tested with Mesa version 7.10.3 on Windows.

To run an OpenGL ES application against Mesa on Linux you need to ensure that the directories containing the OpenGL ES Emulator shared libraries (`libGLESv2.so`, `libGLESv1_CM.so` and `libEGL.so`) the Mesa OpenGL shared libraries (`libGL.so` and `libGL.so.1`) are in the shared library search path at run time. To do this set the `LD_LIBRARY_PATH` environment variable to include these directories.

Some versions of Mesa do not provide `libGL.so`. On such systems create a symbolic link called `libGL.so` in the `/usr/lib/mesa` directory to `libGL.so.1`.

To run an OpenGL ES application against Mesa on Windows you need to ensure that the folders containing the OpenGL ES Emulator DLLs (`libGLESv2.dll`, `libGLESv1_CM.dll` and `libEGL.dll`) and the Mesa OpenGL DLL (`opengl32.dll`) are in the DLL search path at run time. To do this set the `PATH` environment variable to include these folders.

To force any OpenGL ES application to use Mesa `opengl32.dll` one has to copy the `opengl32.dll` to the executable folder.

Note that, when running with Mesa, shaders must not depend on the definition of `GL_ES` macro, since this will not be defined when the shaders are compiled.

## 8 KHRONOS CONFORMANCE

The OpenGL ES Emulator has been verified for OpenGL ES 2.0 and OpenGL ES 1.1 conformance to the OpenGL ES 2.0 and OpenGL ES 1.1 specification via the OpenGL ES 2.0 Emulator Conformance Test Suite and OpenGL ES 1.1 Emulator Conformance Test Suite, published by the Khronos Group (<http://www.khronos.org/>).

### 8.1 Conformance Test Results

The Khronos Conformance Test Suite was run on the platforms described in section 4.1. The results are as follows:

#### *OpenGL ES 2.0 Conformance Tests Results*

<b>Platform</b>	<b>Driver Version</b>	<b>Test Result</b>
Windows XP SP3, NVIDIA GeForce 210	197.45	All tests pass
Ubuntu 10.04 LTS, NVIDIA GeForce 210	195.36.15	All tests pass
Ubuntu 10.04 LTS, NVIDIA GeForce 9500 GT	195.36.24	All tests pass

**Note:** The conformance tests were run after the installation of the Mali GPU Offline Shader Compiler, which is required to ensure conformant behavior. The Mali GPU Offline Shader Compiler is available from <http://www.malideveloper.com/>.

**Note:** The conformance tests have not yet been run on systems using Mesa.

### 8.2 OpenGL Driver Workarounds

A number of workarounds are present in the OpenGL ES Emulator to compensate for issues in some OpenGL drivers that would otherwise prevent the conformance tests from passing. A partial list of workarounds is presented below:

<b>Workaround</b>	<b>Platforms</b>
<code>glFramebufferRenderbuffer</code> with attachment <code>GL_STENCIL_ATTACHMENT</code> is unsupported	All platforms.
<code>glTexImage2D</code> with type as <code>GL_UNSIGNED_SHORT_5_5_5_1</code> is unsupported	All platforms
<code>glRenderbufferStorage</code> with internal format as <code>GL_RGB5_A1</code> is not supported	Windows and Linux reference platforms.

## 9 CHANGES IN FUNCTIONALITY FROM PREVIOUS RELEASES

### 9.1 Changes from version 1.3.0 EAC

- The OpenGL ES Emulator for Linux now successfully detects Mesa driver version 7.11 and 7.12-dev.

### 9.2 Changes from versions 1.3.0 Milestone 1

- The OpenGL ES Emulator now includes OpenGL ES 1.1 and OpenGL ES 2.0 support in the package. Both can be used in a single application.
- The OpenGL ES Emulator now has full Mesa support.
- The OpenGL ES Emulator now includes a high performance mode; in this mode the OpenGL ES Emulator skips some of the checks on argument values.

### 9.3 Changes between versions 1.2.0 and 1.2.1 and version 1.3.0 Milestone 1

- The emulator now contains preliminary Mesa support on Windows.
- The emulator now supports the `GL_OES_texture_npot` and `GL_EXT_texture_format_BGRA8888` OpenGL ES extensions.

### 9.4 Changes between versions 1.2.0 and 1.2.1 (Linux only)

- Fix for an issue where `glBindTexture` would fail in high-complexity applications on Linux platforms.

### 9.5 Changes between version 1.1.0 and 1.2.0

- Pixmap Surfaces are now supported by the EGL Library in Linux.
- `eglCopyBuffers` is now supported by the EGL Library in Linux
- Validated conformance to the OpenGL ES 2.0 specification via the Khronos Conformance Test Suite.

## 10 KNOWN ISSUES AND LIMITATIONS

### 10.1 Known Issues

The known issues affecting the OpenGL ES Emulator are documented in the OpenGL ES Emulator Errata document, available from <http://www.malideveloper.com>.

Any issues found subsequent to this release of the OpenGL ES Emulator will be documented in new versions of the errata document.

### 10.2 Support

Please contact [support@arm.com](mailto:support@arm.com) regarding any issues with the installation and content of this release.

It should be noted that Support of the product will only be provided by ARM if such support is covered by a current contract with the recipient.

## 11 APPENDIX A: GLEE LIBRARY LICENCE

The OpenGL ES Emulator, Windows version, makes use of GLEE. The notice below is reproduced in accordance with the redistribution conditions of GLEE in binary form.

```
Glee
GL Easy Extension Library
Version 5.21

By Ben Woodhouse
http://elf-stone.com

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```