



Arm® Mobile Studio 2023.3

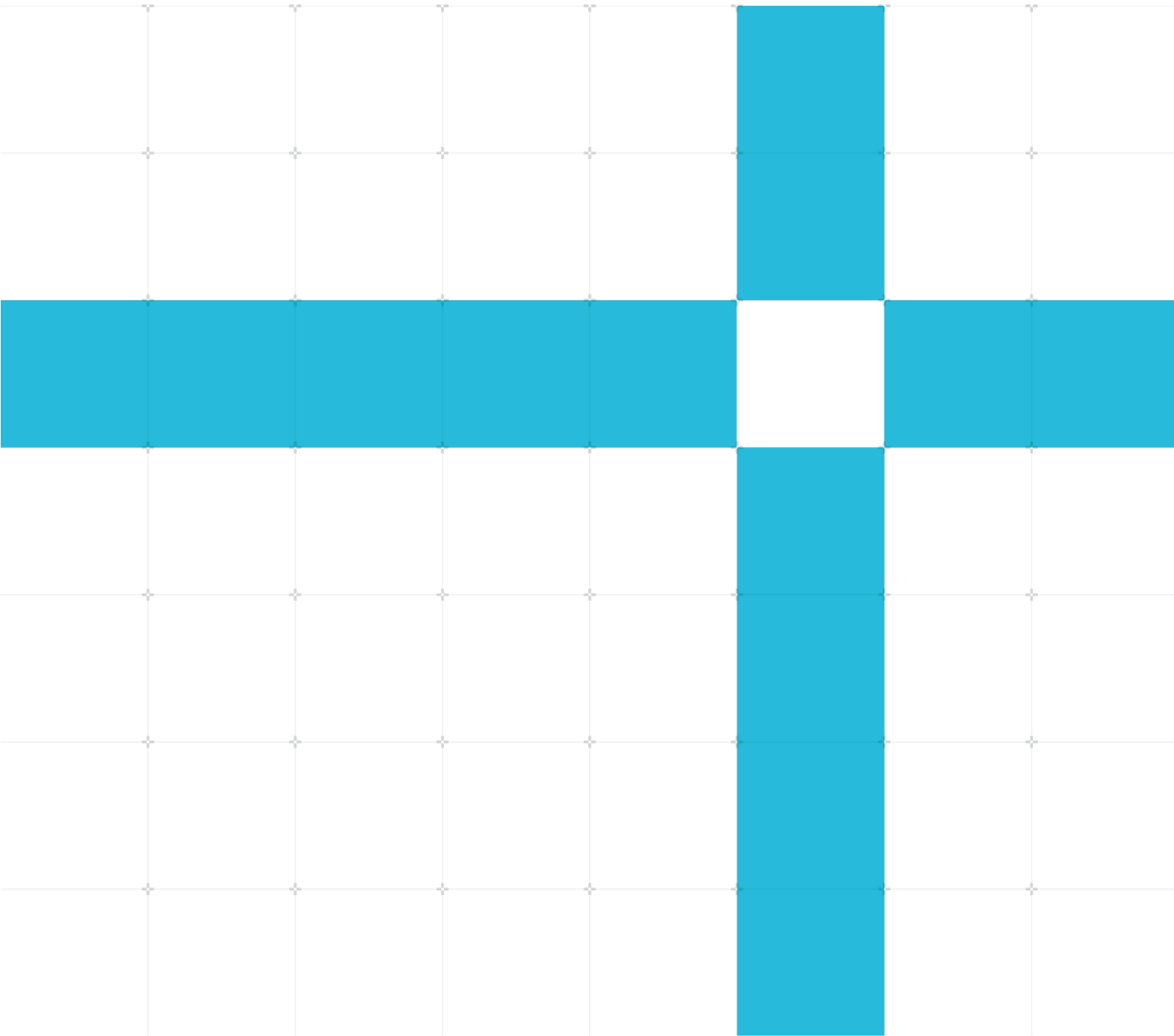
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Release Note

Non-Confidential

Issue 00

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Arm Mobile Studio 2023.3

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1 Release overview

The following sections describe the product and its quality status at time of release.

1.1 Product description

Arm® Mobile Studio is a tool suite enabling Android application developers to detect performance bottlenecks in their Arm CPU software and Arm Immortalis™ and Arm Mali™ GPU rendering. Profiling is provided through analysis of performance counters from the hardware, and the target application's graphics API usage.

This release of Arm Mobile Studio includes:

- **Streamline**, for profiling application software and rendering performance. Streamline now integrates **Performance Advisor**, a reporting tool used for automating rendering performance analysis and reporting in continuous integration deployments.
- **Graphics Analyzer**, for debugging and inspecting usage of graphics APIs.
- **Mali Offline Compiler**, for static analysis of shader programs and compute kernels.

1.1.1 Component versions

This release of Arm Mobile Studio includes the following tool versions:

- Streamline 8.7
- Graphics Analyzer 5.12.1
- Mali Offline Compiler 8.1

1.2 Release status

This is the REL quality release of the Arm Mobile Studio 2023.3 (r23p3-00rel0) software.

1.3 Changes in this release

This release of Arm Mobile Studio contains the following changes.

1.3.1 Streamline

Streamline has the following changes:

- Streamline now supports the Cortex™-X4, Cortex-A720, and Cortex-A520 CPUs.

- The Arm GPU shader core performance counters in the Timeline are now presented as the sum over all shader cores, instead of the average over all shader cores. This makes it easier to visualize the absolute application workload size in a device agnostic manner.
- The Arm GPU counter template now enables the Arm GPU scheduling timeline data source, if supported on the target device.
- The Timeline visualization now automatically uses all templates used during counter configuration, ensuring developers get the intended template data presentation by default without a manual selection step.
- The templates used at configure time are automatically saved into the captured data. These embedded templates can be selected from the Timeline template menu. This ensures that the data can always be correctly visualized, even if a future Streamline release updates a template in an incompatible way.
- The **gator** debug log generated during capture is automatically saved into the captured data, making it easier for us to support users remotely when captures are not working as expected.
- The Arm GPU scheduling timeline CAM view workload labelling has been simplified to improve readability.
- The Performance Advisor light-weight interceptor now reports the number of compute dispatches and trace rays dispatches per frame as a software counter.
- The **streamline_me.py** automation support script now supports specifying a package activity to start and activity command-line options.
- The **streamline_me.py** automation support script now requires Python 3.8 or higher.
- The timestamp in the Timeline CSV data exports is now formatted as a decimal number of seconds, instead of a variable format **hh:mm:ss** time string. In addition, value cells no longer contain any form of unit postfix. This makes exported data easier to parse and consume in downstream tooling.
- **Fix:** The Performance Advisor light-weight interceptor software counters and CAM channel names now strip any [Arm Memory Tagging Extension](#) tags when using application addresses as presentation strings in data visualizations.
- **Fix:** The Performance Advisor light-weight interceptor now correctly counts render passes using the **vkCmdBeginRenderPass2[KHR]()** functions.
- **Fix:** Arm GPU templates now correctly pattern match Vulkan software counters generated by the Performance Advisor light-weight interceptor.
- **Fix:** Software annotations using the default color rotation now rotate colors on a per-channel basis, rather than using a global rotation. This ensures that neighboring annotation boxes in a channel will always use a different color.

1.3.2 Graphics Analyzer

Graphics Analyzer has the following changes:

- No changes in this release.

1.3.3 Mali Offline Compiler

Mali Offline Compiler has the following changes:

- Mali Offline Compiler now supports the Immortalis-G720, Mali-G720, and Mali-G620 GPUs, and the 5th Generation GPU architecture.
- The compiler backend for the Bifrost, Valhall, and 5th Generation architecture GPUs has been updated to the r44p0 DDK.
- The Vulkan SPIR-V **SPV_GOOGLE_decorate_string** and **SPV_GOOGLE_user_type** extensions are now stripped from SPIR-V binaries prior to compilation.
- Compilation error messages for OpenGL ES and OpenCL have been simplified.
- Compilation error messages for OpenGL ES now show a few lines of source context around each error.

1.4 Known issues in this release

This release of Arm Mobile Studio contains the following known issues.

1.4.1 Streamline

Streamline has the following known issues:

- **SDDAP-12290:** The Mali DDK can fail to emit the Perfetto data required for the scheduling timeline visualization. This can result in entries with unidentified processes and queues. It can also result in time ranges which show as idle in the scheduler timeline when the GPU is clearly active in the counter data. This is fixed in the Mali r44p1 driver.
- **SDDAP-11607:** macOS host installs do not show Arm disassembly views.
- **SDDAP-11426:** High DPI display scaling has been disabled by default on Linux hosts, due to persistent reliability issues across multiple distributions and graphics drivers. If desired, display scaling support can be re-enabled by setting the environment variable **STREAMLINE_ENABLE_HIDPI** to 1 and restarting the tool.

2 Support

To help you get started we provide a number of quick start guides available online:

- [Get started with Streamline](#)
- [Get started with Performance Advisor](#)
- [Get started with Graphics Analyzer](#)
- [Get started with Mali Offline Compiler](#)

Technical support for Arm Mobile Studio is provided via our developer forums:

- [Developer forums on community.arm.com](#)

2.1 How-to videos

Refer to the following videos to learn how to use Arm Mobile Studio tools.

- [Streamline](#)
- [Performance Advisor](#)
- [Graphics Analyzer](#)
- [Mali Offline Compiler](#)

To learn more about Mali GPUs and how to develop optimized graphics content for mobile devices, refer to the [Mali GPU Training Series](#).

2.2 Host OS support

This release has been developed for the following host operating systems:

Table 2-1: Host operating system used in developing this release

Operating system	Version
Windows	10 or newer
macOS	10.15 (Catalina) or newer
Ubuntu Linux	20.04 (Focal Fossa) or newer

2.3 Target OS support

This release has been developed for the following target operating systems:

Table 2-2: Target operating system used in developing this release

Feature	Version
Streamline	Android 8 or newer

Streamline Performance Advisor for OpenGL ES applications	Android 8 or newer with manual annotation Android 10 or newer to use the Light-weight Interceptor
Streamline Performance Advisor for Vulkan applications	Android 9 or newer
Graphics Analyzer OpenGL ES	Android 8 or newer
Graphics Analyzer Vulkan	Android 9 or newer

2.4 Related projects

Arm provides several open-source projects that can be used by application developers as part of their application development.

2.4.1 Mobile Studio for Unity package

Current version: 1.5.0 (September 2022)

The Mobile Studio for Unity package provides an open-source Unity game engine integration for Streamline and Performance Advisor. The package provides:

- C# bindings for Streamline's annotation API, allowing users to export custom software counters, and event annotations.
- Integration with the Unity profiler data source, exporting Unity object counts and memory allocations as custom software counters.

The annotation API provides a generic means to markup a Streamline capture. It can be used to emit the semantic tags that Performance Advisor reports use to denote interesting gameplay regions.

Recent changes:

- None.

The package is available on GitHub and can be imported directly into your Unity project using the Unity package manager. See the GitHub project documentation for more details.

- <https://github.com/ARM-software/mobile-studio-integration-for-unity/>

2.4.2 ASTC Encoder texture compressor

Current version: 4.5.0 (June 2023)

The Arm ASTC Encoder (astcenc) is an open-source texture compressor for the Adaptive Scalable Texture Compression (ASTC) texture format. It supports all block sizes, all color profiles, as well as both 2D and volumetric 3D textures. The astcenc compressor can be built as either a standalone command line application or a library that can be integrated into an existing asset creation pipeline.

4.5.0 release changes:

- Improved compiler handling, reinstating invariant image output for builds that use Clang-14 or newer compilers.

- Improved universal binary support for macOS, supporting x86-64 SSE4.1 and AVX2, as well as Arm64 NEON from a single compressor binary.
- Improved performance using vectorized color endpoint packing.
- Improved image quality for LDR RGB and RGBA endpoints using a more exhaustive endpoint packing search.

The source code is available on GitHub, in addition to binary releases of the command line utility for Windows, macOS, and Linux.

- <https://github.com/ARM-software/astc-encoder>

2.4.3 HWCPipe library

Current version: 2.1.0 (August 2023)

The Hardware Counter Pipe (HWCPipe) library is an open-source utility that allows applications to select and sample a set of Arm GPU performance counters. This library provides access to the same counter data that can be visualized in the Streamline tool, allowing integration of Arm GPU data into custom tooling.

2.1.0 release changes:

- Added support for generation of user-friendly derived expressions for all supported GPUs.

The source code is available on GitHub:

- <https://github.com/ARM-software/HWCPipe>

2.4.4 libGPUInfo library

Current version: 1.0.0 (June 2023)

The libGPUInfo library is an open-source utility that can be integrated into an application to query the configuration of the Arm GPU present in the system, including the GPU model, shader core count, shader core performance characteristics, and cache size. This information can be used to adjust the application workload at runtime to match the capabilities of the device being used.

1.0.0 release changes:

- Added an option for emitting YAML output to the command-line support utility.
- Added dynamic IP configuration query support for the Mali-G310 and Mali-G510 GPUs, as the arithmetic and texturing performance of each shader core can be configured by the chipset manufacturer.

The source code is available on GitHub:

- <https://github.com/ARM-software/libGPUInfo>

3 Installation

This section describes how to install and configure Arm Mobile Studio to run on 64-bit Windows, macOS®, and Linux.

Mobile Studio requires [Android Debug Bridge \(ADB\)](#) and [Python 3.8](#) (or newer), to enable connection to your device. Make sure you have [these tools](#) installed and that you have configured your environment to use them.

3.1 Install on Windows

Arm Mobile Studio is provided with an installer executable. Double-click the **.exe** file and follow the instructions in the setup wizard.

- To launch Streamline, open the Windows Start menu, navigate to the Arm Mobile Studio folder, and select the “Arm MS Streamline 2023.3” shortcut,
- To launch Graphics Analyzer, open the Windows Start menu, navigate to the Arm Mobile Studio folder, and select the “Arm MS Graphics Analyzer 2023.3” shortcut.
- Performance Advisor is a command-line tool that is part of the Streamline application. To use it to generate a performance report, you must first run the provided Python script to enable Streamline to collect frame data from the device. This process is described in detail in the [Get started with Performance Advisor tutorial](#).

Once you have captured a profile with Streamline, run the `Streamline-cli -pa` command on the Streamline capture file. This command is added to your PATH environment variable during installation, so it can be used from anywhere.

```
Streamline-cli.exe -pa <options> my_capture.apc
```

- To launch Mali Offline Compiler, open a command terminal, navigate to your work directory, and run the `malioc` command on a shader program. The `malioc` command is added to your PATH environment variable during installation, so can be used from anywhere.

```
malioc.exe <options> my_shader.frag
```

3.2 Install on macOS

Arm Mobile Studio is provided as a **.dmg** package. To mount it, double-click the **.dmg** package and follow the instructions. The Mobile Studio directory tree is copied to the **Applications** directory on your local file system for easy access.

Launch the tools directly from the Arm Mobile Studio directory tree in your Applications directory.

- To launch Streamline, go to the `<installation_directory>/streamline` directory, and open the **Streamline.app** file.
- To launch Graphics Analyzer, go to the `<installation_directory>/graphics_analyzer/gui` directory and open the **Graphics Analyzer.app** file.

- To launch Performance Advisor, go to the `<installation_directory>/streamline` directory, and double-click the **Streamline-cli-launcher** file. Your computer will ask you to allow Streamline to control the Terminal application. Allow this.

The Performance Advisor launcher opens the Terminal application and updates your PATH environment variable so you can run Performance Advisor from any directory.

Performance Advisor is a command-line tool that is part of the Streamline application. To use it to generate a performance report, you must first run the provided Python script to enable Streamline to collect frame data from the device. This process is described in detail in the [Get started with Performance Advisor tutorial](#).

Once you have captured a profile with Streamline, run the **Streamline-cli -pa** command on the Streamline capture file to generate a performance report:

```
Streamline-cli -pa <options> my_capture.apc
```

- To launch Mali Offline Compiler, go to the `<installation_directory>/mali_offline_compiler` directory, and double-click the **mali_offline_compiler_launcher** file.

The Mali Offline Compiler launcher opens the Terminal application and updates your PATH environment variable so you can run the **malioc** command from any directory.

To generate a shader analysis report, run the **malioc** command on a shader program:

```
malioc <options> my_shader.frag
```

On some versions of macOS, you might see a message that Mali Offline Compiler is not recognized as an application from an identified developer. To enable Mali Offline Compiler, cancel this message, then open **System Preferences > Security and Privacy**, and select **Allow Anyway** for the **malioc** application.

3.3 Install on Linux

Arm Mobile Studio is provided as a gzipped tar archive. Extract this tar archive to your preferred location, using a recent version (1.13 or later) of GNU tar:

```
tar xvzf Arm_Mobile_Studio_2023.3_linux.tgz
```

Launch the tools directly from the location where you extracted the package.

- To launch Streamline, go to the `<installation_directory>/streamline` directory and run the **Streamline** file.

```
cd <installation_directory>/streamline  
./Streamline
```

- To launch Graphics Analyzer, go to the `<installation_directory>/graphics_analyzer/gui` directory and run the **aga** file.

```
cd <installation_directory>/graphics_analyzer/gui  
./aga
```

- Performance Advisor is a command-line tool that is part of the Streamline application. To use it to generate a performance report, you must first run the provided Python script to enable Streamline to collect frame data from the device. This process is described in detail

in the [Get started with Performance Advisor tutorial](#).

Once you have captured a profile with Streamline, go to the `<installation_directory>/streamline` directory and run the **Streamline-cli** -pa command on the Streamline capture file to generate a performance report:

```
cd <installation_directory>/performance_advisor  
./Streamline-cli -pa <options> my_capture.apc
```

- To launch Mali Offline Compiler, go to the `<installation_directory>/mali_offline_compiler` directory and run the **malioc** command on a shader program.

```
cd <installation_directory>/mali_offline_compiler  
./malioc <options> my_shader.frag
```

You might find it useful to edit your PATH environment variable to add the paths to the **Streamline-cli** and **malioc** executables so that you can run them from any directory. Add the following commands to the `.bashrc` file in your home directory, so that they are set whenever you initialize a shell session:

```
PATH=$PATH:/<installation_directory>/streamline  
PATH=$PATH:/<installation_directory>/mali_offline_compiler
```