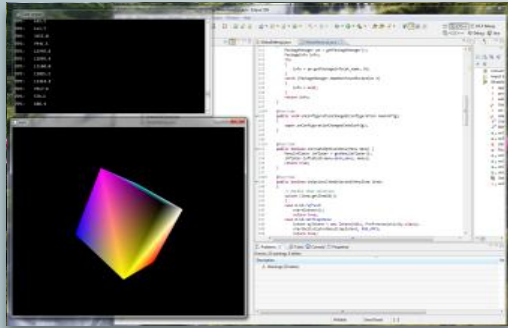


Mali Developer Resources

Jon Kirkham
Senior Software Engineer, ARM

ARM Mali Developer Tools



■ Software Development

- SDKs for OpenGL[®] ES & OpenCL[™]
- OpenGL ES Emulators
- Shader Development Studio
- Shader Library



■ Asset Creation

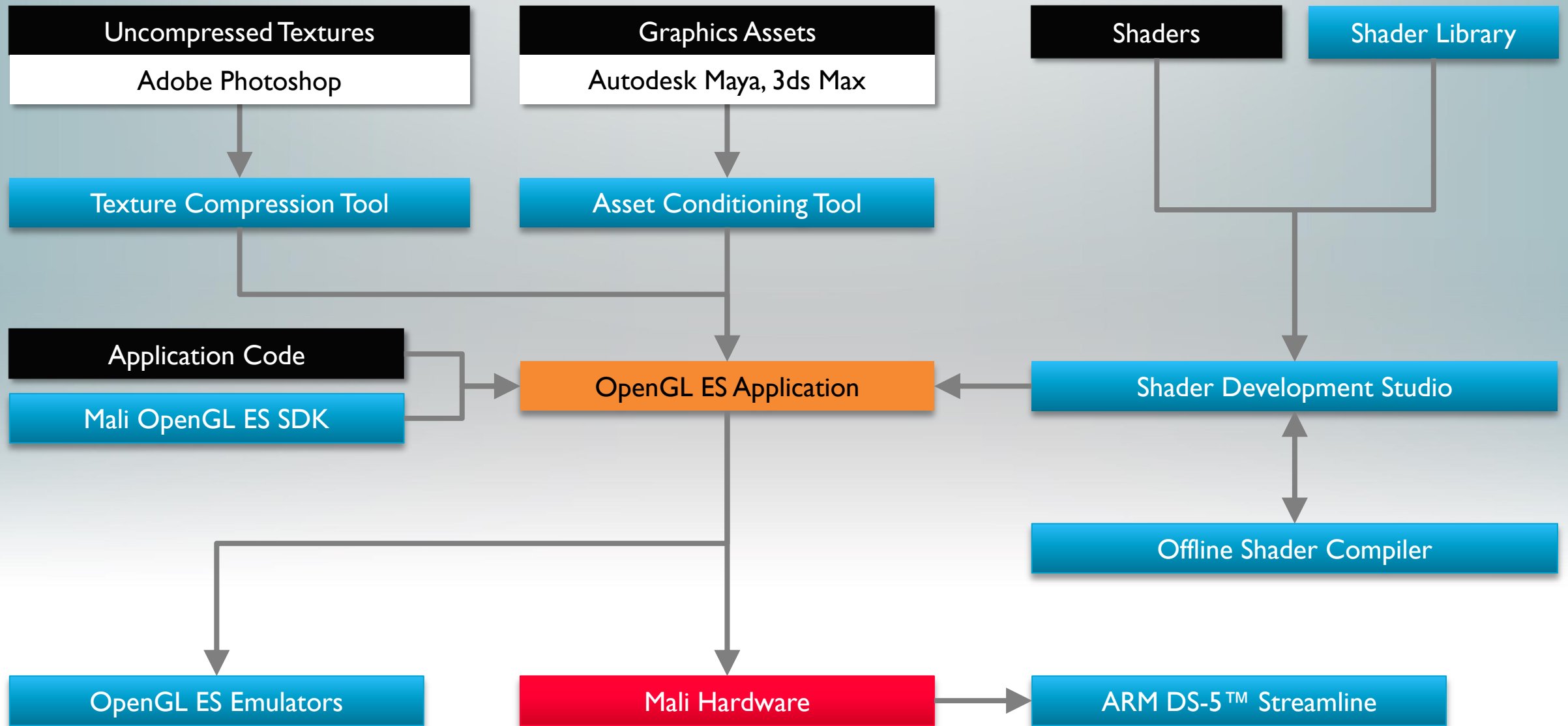
- Texture Compression Tool
- Asset Conditioning Tool
- Binary Asset Exporter



■ Performance Analysis

- Streamline Performance Analyzer
- Offline Shader Compiler

Mali Developer Tools Flow



Mali Software Development Kits

- Simplify writing, porting and optimizing OpenGL ES & OpenCL code for Mali GPU based platforms
- Demonstrate key differentiating features to developers and programmers
- **Contents**
 - Environment for quickly developing OpenCL and OpenGL ES applications
 - Tutorials and advice on developing good OpenCL & OpenGL ES code for Mali GPUs
 - Sample code



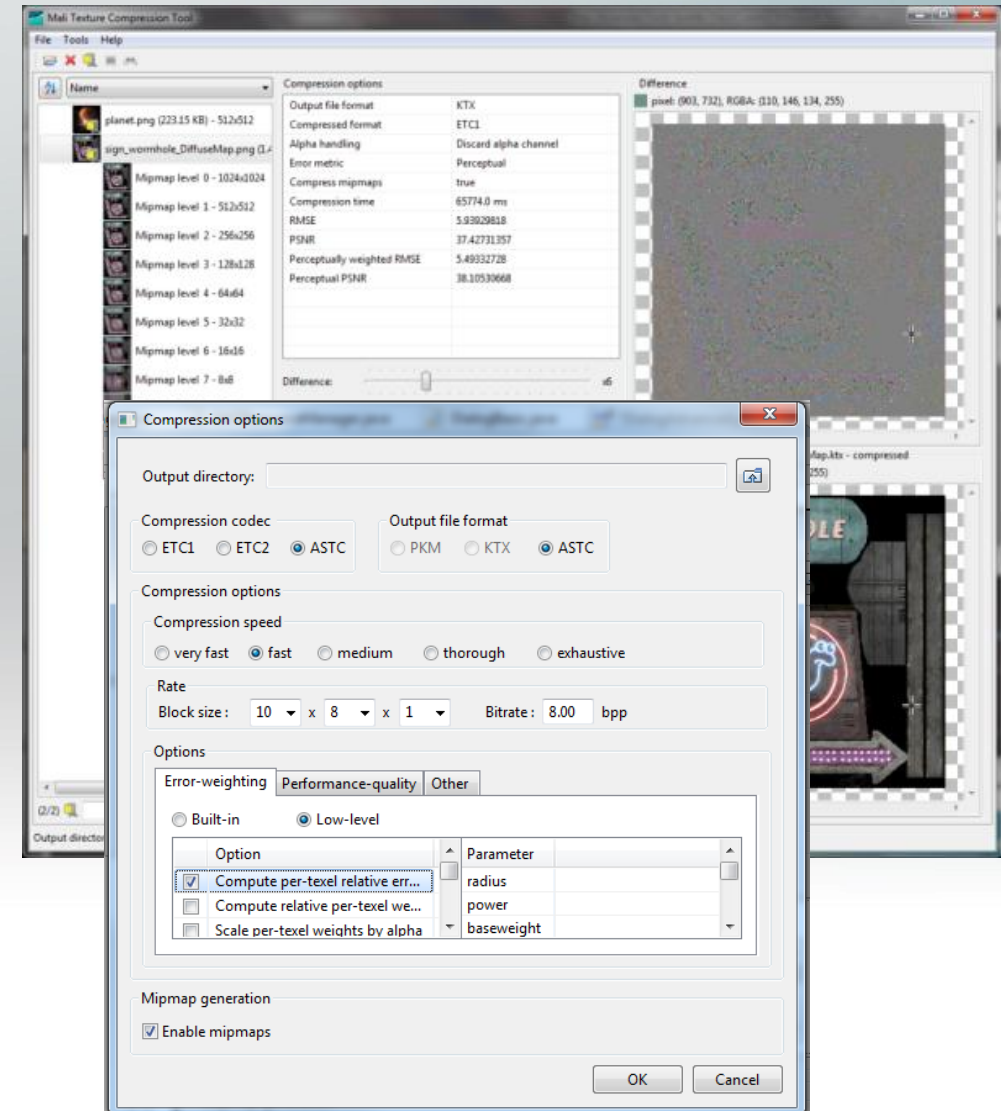
Emulation

- **OpenGL ES 1.1/2.0 Emulator**
 - Khronos Conformant
 - MESA software rendering support
- **OpenGL ES 3.0 Emulator**
 - Khronos Conformance Test Submitted
 - ATSC support
- Includes EGL emulator
- Run OpenGL ES content on desktop systems
 - Easier setup/running/debugging
 - “WYSIWYG”



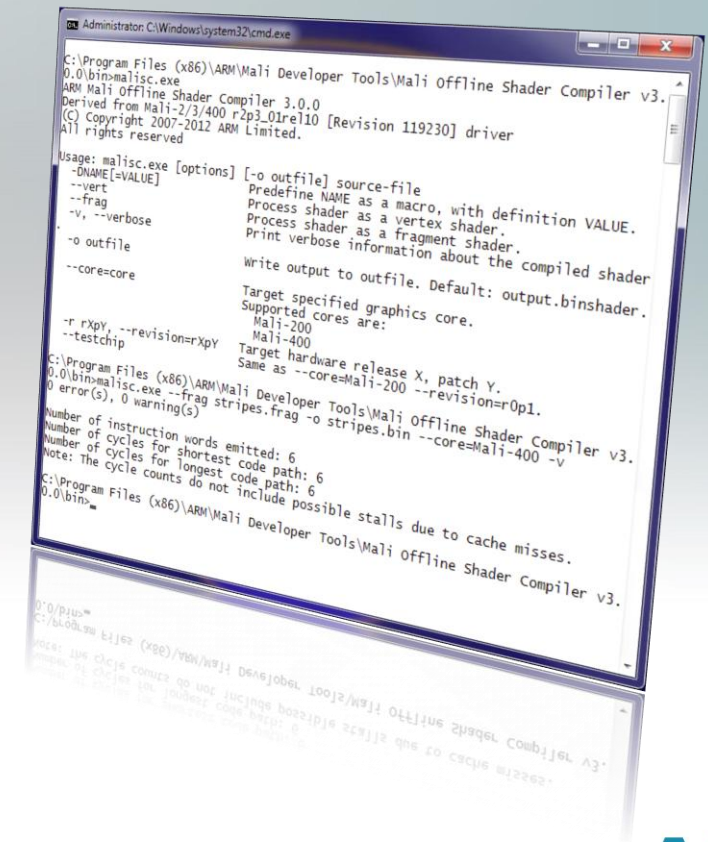
Texture Compression Tool

- ETC1 Texture compression
 - **600x** speed up compared to existing reference encoder
- ETC2 / EAC texture compression
 - Multiple new formats and support for alpha channel
- ASTC Texture Compression
 - LDR and HDR image support
 - Bitrates from 0.89 bits/pixel to 8bits/pixel in fine steps
- Visualization of compressed output
- Reporting of compression statistics
- Automatic Mipmap generation



Offline Shader Compiler

- Compiles shader code written in OpenGL ES Shading Language (ESSL) offline
- Provides verbose shader performance & error messages for optimization and debug
- Support for:
 - Mali-400 and Mali-450,
 - Mali-T604, Mali-T658
 - Integration with Shader Development Studio



```
Administrator: C:\Windows\system32\cmd.exe
C:\Program Files (x86)\ARM\Mali Developer Tools\Mali Offline Shader Compiler v3.0.0\bin>malisc.exe
ARM Mali Offline Shader Compiler 3.0.0
Derived from Mali-2/3/400 r2p3_01rel10 [Revision 119230] driver
All rights reserved

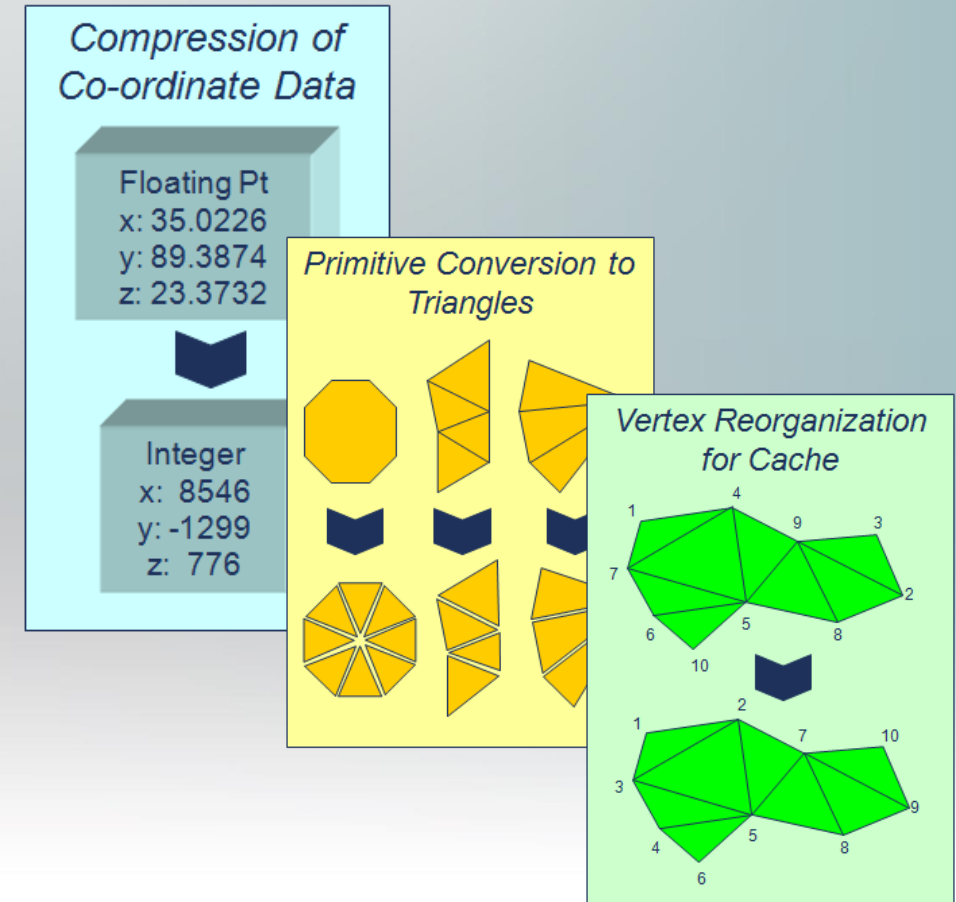
Usage: malisc.exe [options] [-o outfile] source-file
--define NAME=VALUE      Predefine NAME as a macro, with definition VALUE.
--vert                   Process shader as a vertex shader.
--frag                   Process shader as a fragment shader.
-v, --verbose             Print verbose information about the compiled shader
-o outfile               Write output to outfile. Default: output.binshader.
--core=core              Target specified graphics core.
                          Supported cores are:
                          Mali-200
                          Mali-400
-r rXpY, --revision=rXpY Target hardware release X, patch Y.
                          Same as --core=Mali-200 --revision=r0p1.
--testchip               Same as --core=Mali-200 --revision=r0p1.

C:\Program Files (x86)\ARM\Mali Developer Tools\Mali Offline Shader Compiler v3.0.0\bin>malisc.exe --frag stripes.frag -o stripes.bin --core=Mali-400 -v
0 error(s), 0 warning(s)
Number of instruction words emitted: 6
Number of cycles for shortest code path: 6
Number of cycles for longest code path: 6
Note: The cycle counts do not include possible stalls due to cache misses.

C:\Program Files (x86)\ARM\Mali Developer Tools\Mali Offline Shader Compiler v3.0.0\bin>
```


Asset Conditioning Tool

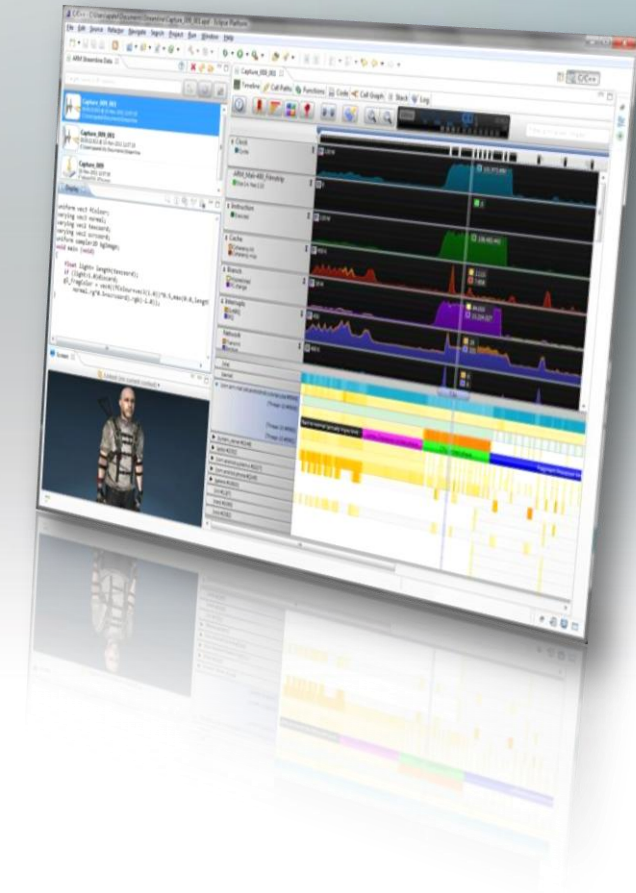
- Optimization of geometry data for Mali GPU-based devices
- Conversion of unsupported primitives to supported types
- Vertex reorganization for efficient cache utilization



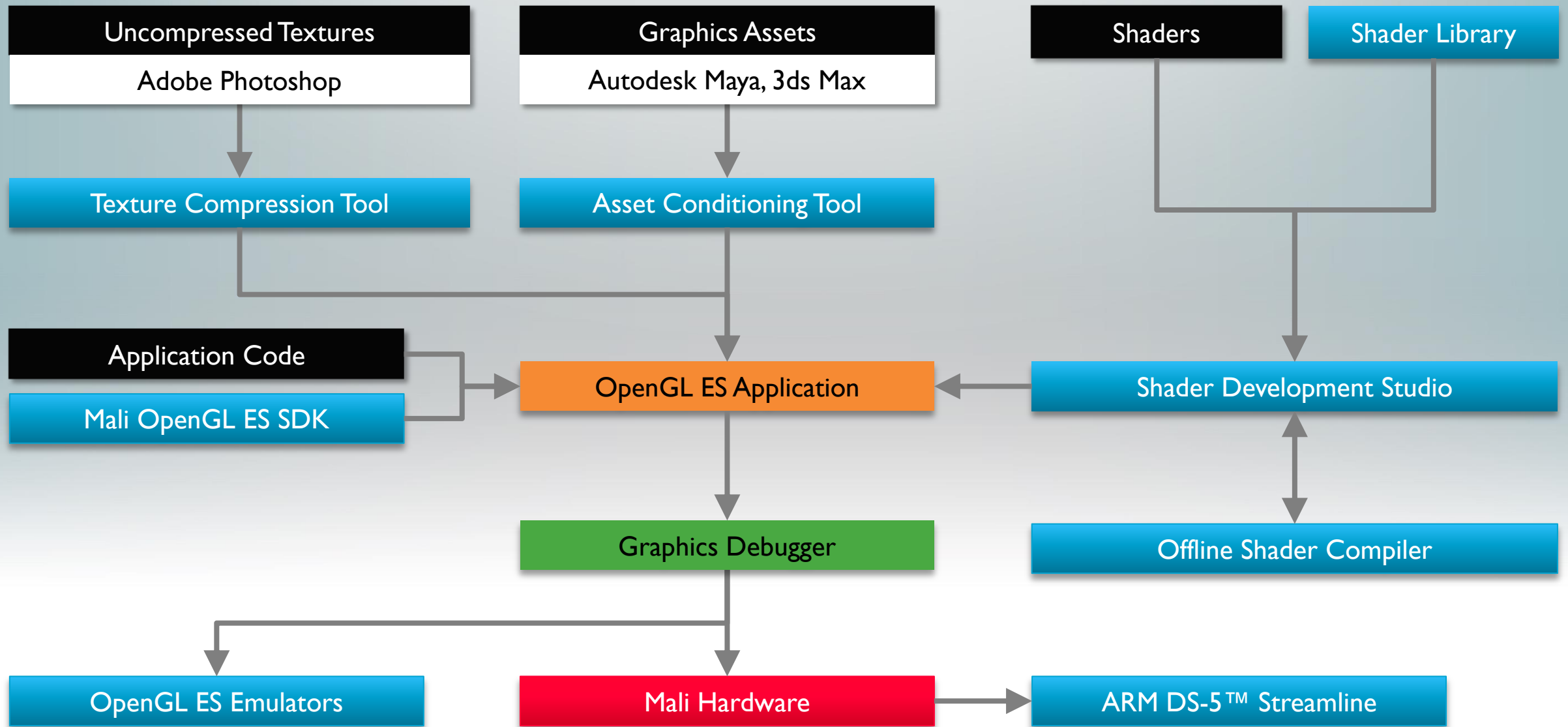
Streamline Performance Analyzer

■ System Wide performance Analysis

- Support for graphics and GPU compute performance analysis on Mali-T604/Mali-T658
- Timeline profiling of hardware counters for detailed analysis
- Software counter support for OpenGL ES 2.0 and OpenCL 1.1
- Custom counters
- Per-core/thread/process granularity
- Frame buffer capture and display



Mali Developer Tools Flow



Thank you!
Any questions?

malideveloper.arm.com