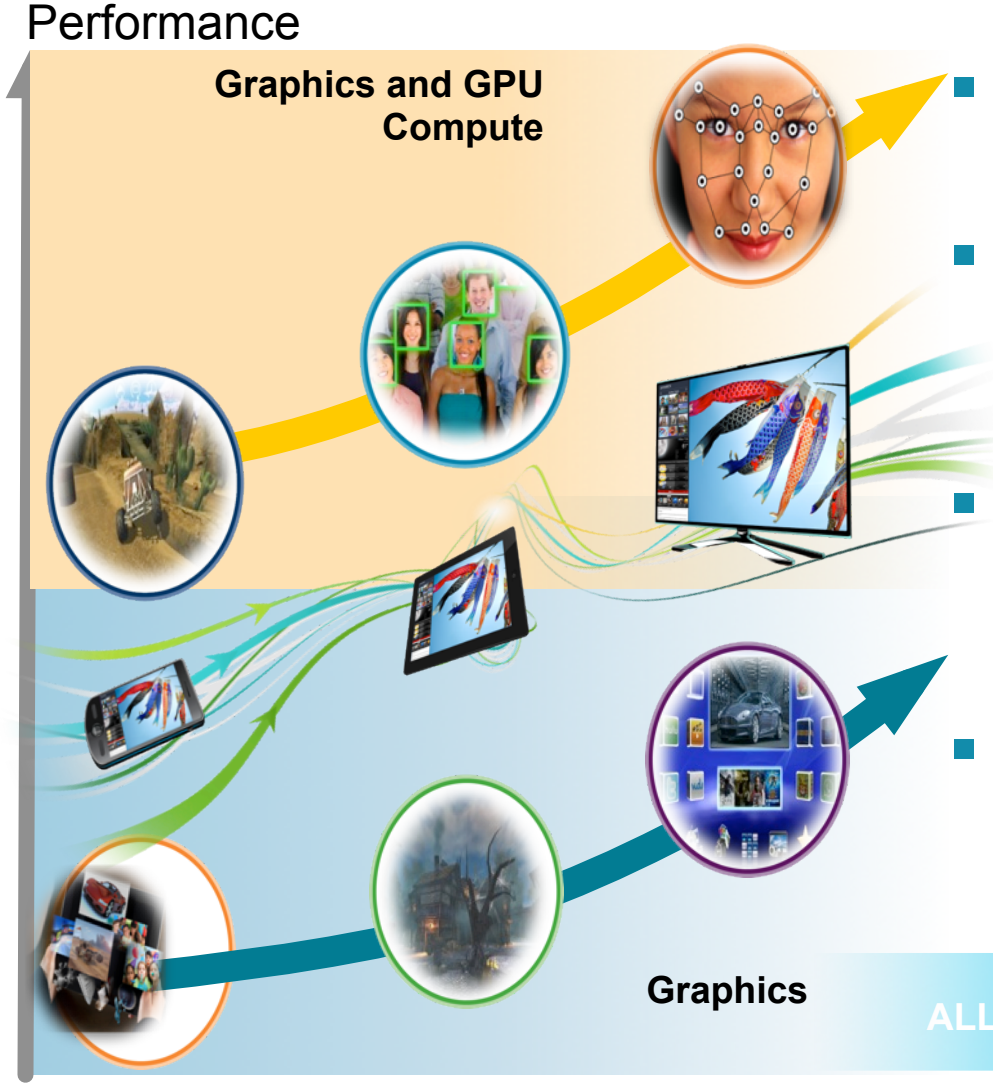
Mali GPU Developer Resources

Akshay Agarwal
Ecosystem Director, North America
Media Processing Division
May 2013

Agenda

- Mali GPU Overview
- Mali Developer Tools
  - Overview
  - DS-5 toolchain & streamline
  - Mali Graphics Debugger

Bridging Graphics Canyon – Mali GPUs



- Higher resolution displays (1080p → 4k)
- Enhanced performance for gaming with next generation Graphics API OpenGL ES 3.0 from Khronos
- New efficient texture compression standard – Adaptive Scalable Texture Compression (ASTC)
- First to market with Full Profile OpenCL™ & Renderscript for mobile

Best for Graphics AND GPU Compute

Designed for GPU Compute

- Uncompromised support for OS / API choice
- Full Profile, 64-bit Compute

Closer CPU-GPU links

- Efficient use of all device resources
- Maximize performance and battery life
- Coherent memory links
- Right task in the right place

Protecting partner investments

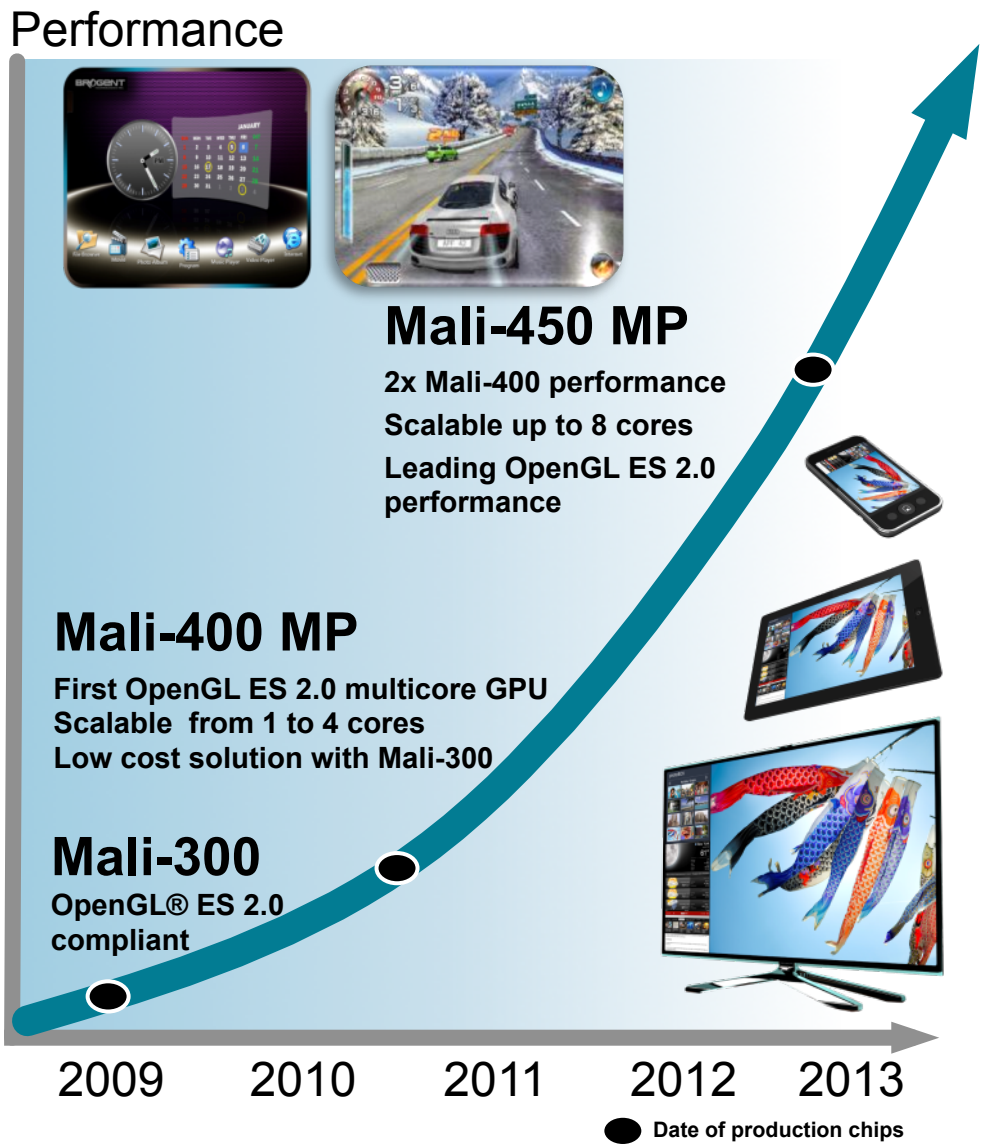
- Common software platform reduces costs and TTM
- Multicore delivers performance scalability over multiple form factors

Advanced products in market early

- Mali-T604 silicon shipping now in consumer products

Product is based on a published Khronos Specification, and is expected to pass the Khronos Conformance Testing Process. Current conformance status can be found at www.khronos.org/conformance

Best for Graphics



Market leading performance density

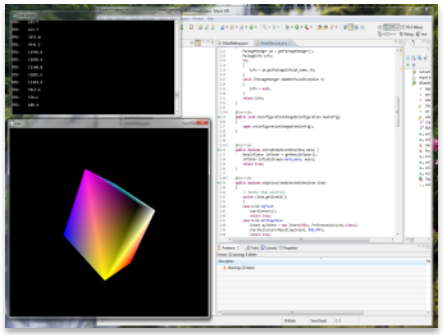
Multicore delivers performance scalability over many form factors

Common software platform reduces costs and TTM

Large, dynamic and vibrant ecosystem built on the success of over 150M Mali GPUs

Complete solution from ARM Hardware, Software & Support enabling fastest TTM for graphics IP

Mali Developer Tools



Software Development

- SDKs for OpenGL ES & Open CL
- OpenGL ES Emulators
- Fast Models
- Shader Development Studio
- Shader Library

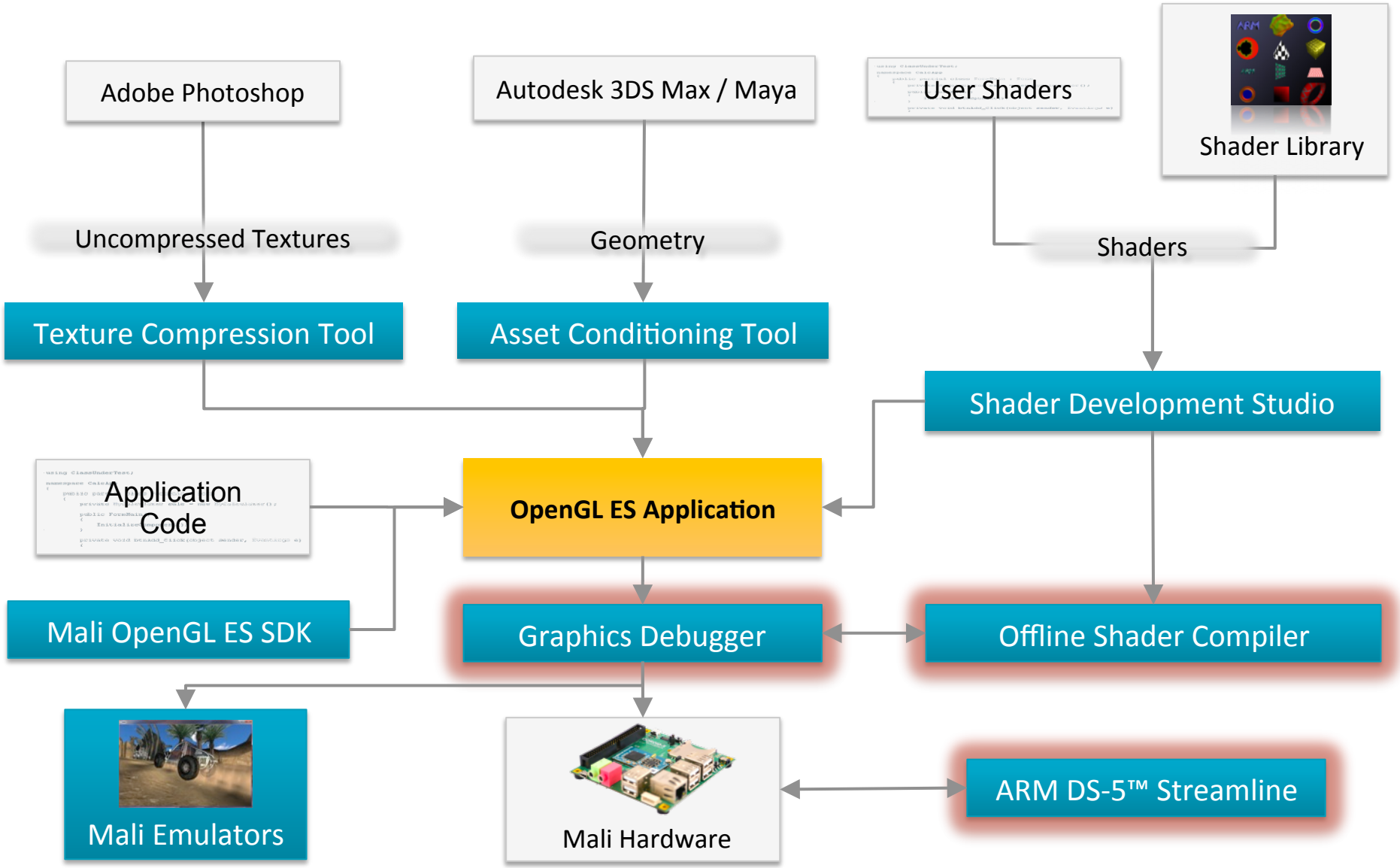
Asset Creation

- Texture Compression Tool (includes ASTC)
- Asset Conditioning Tool
- Binary Asset Exporter

Performance Analysis & Debug

- DS-5 Toolchain & Streamline Performance Analyzer
- Mali Graphics Debugger
- Offline Shader Compiler

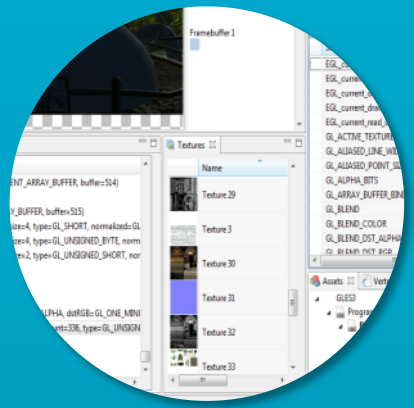
Mali Developer Tools Flow



Performance Analysis & Debug

DS-5™ Streamline

- System-wide performance analysis
- Combined Cortex-A CPU and Mali GPU visibility
- Optimize for performance & power



Mali Graphics Debugger

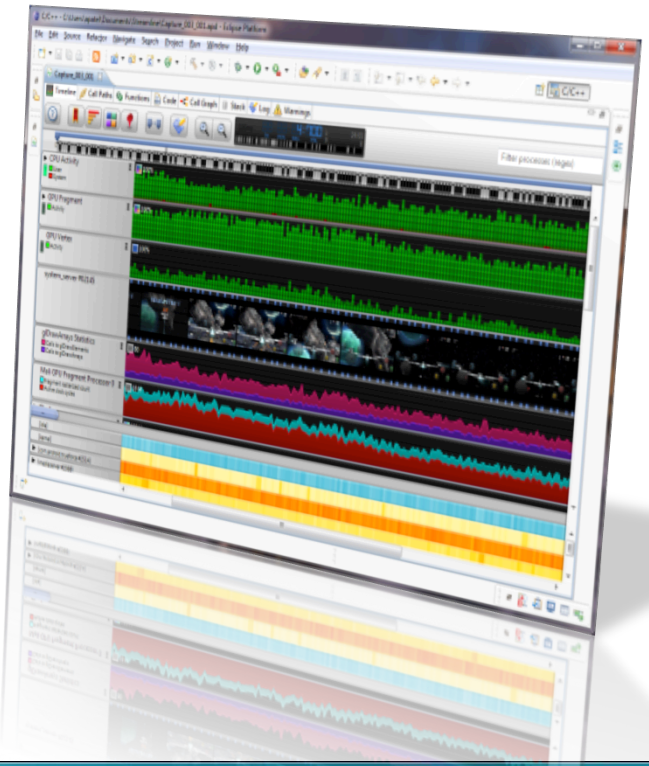
- API Trace & Debug Tool
- Understand graphics and compute issues at the API level
- Debug and improve performance at frame level
- Support for OpenGL ES 1,1, 2.0, 3.0 and OpenCL 1.1

Offline Compilers

- Understand complexity of GLSL shaders and compute kernels
- Support for Mali-4xx and Mali-T6xx GPU families

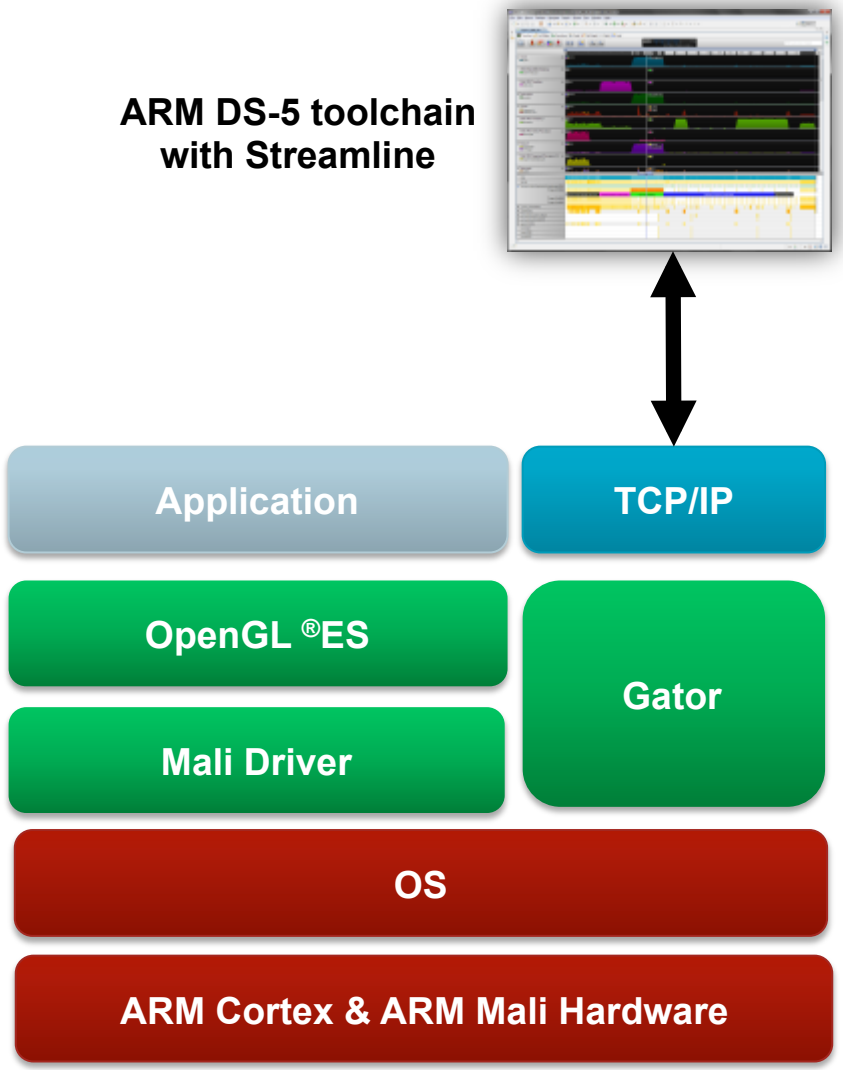
DS-5 Toolchain & Streamline

- **ARM DS-5 toolchain** with support for Mali GPUs
- **System wide performance analysis** Simultaneous visibility across Cortex™ processors + Mali GPUs
- **Technology Leadership** with first available system level tool in mobile
- **Optimize performance and power efficiency** of graphics and GPU compute applications across the system

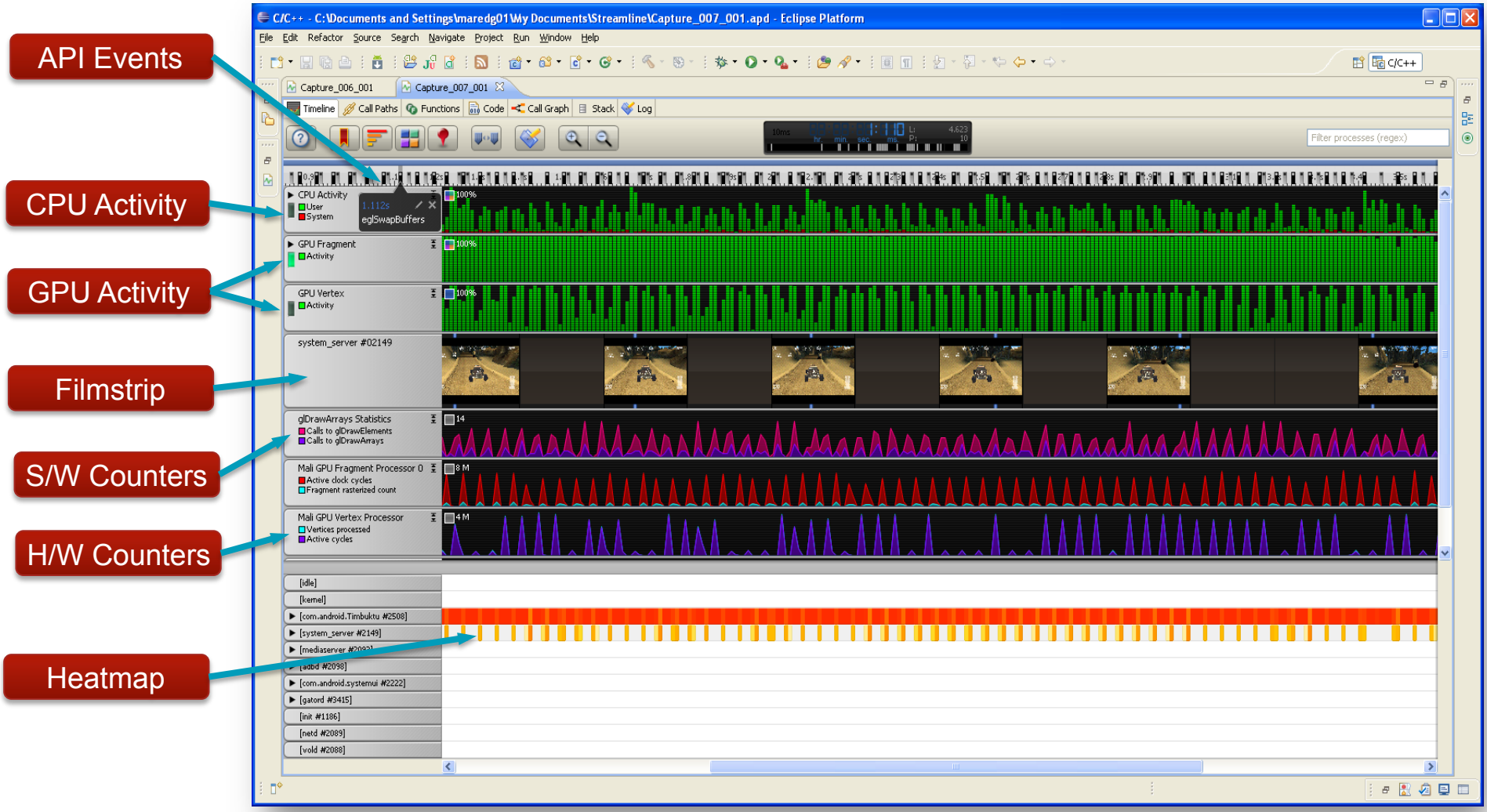


DS-5 Streamline Architecture

- Gator interfaces with Kernel & Mali Drivers
  - Extracts H/W & S/W counters
  - Extract frame buffer
  - Passes through events & annotations
  - Transmit data over TCP/IP to DS-5 tools
- Transparent to user application
  - Option to add annotations to user application for more advanced debugging
- Negligible performance impact
  - Zero impact when profiling disabled
  - Minimal impact in performance when enabled



Streamline Performance Analyzer

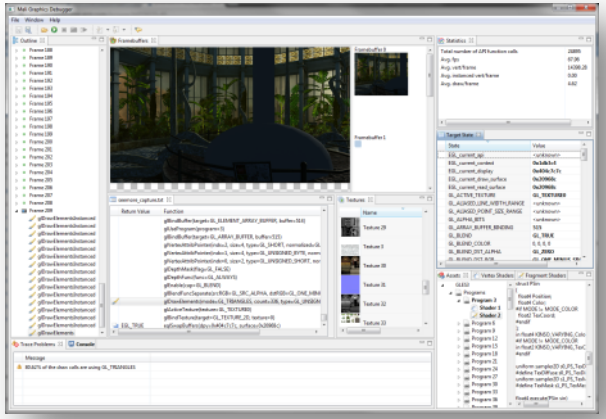


Offline Shader Compiler

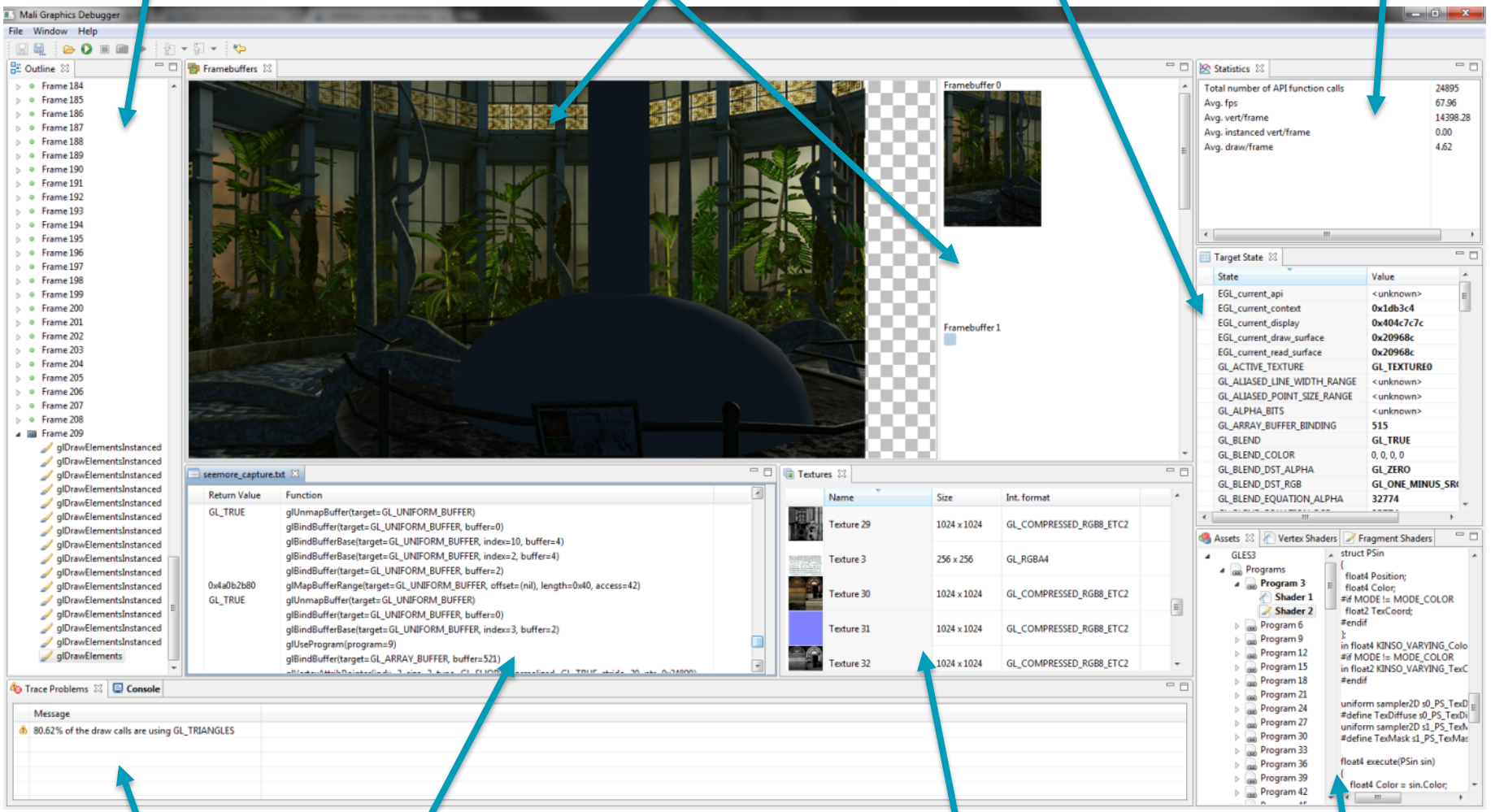
- **Offline Shader Compiler**
  - Compiles shader code written OpenGL ES Shading Language (ESSL) in offline mode
  - Provides verbose shader performance & error messages for optimization and debug
  - Support for:
    - Mali-200, Mali-400 and Mali-450,
    - Mali-T6xx
  - Integration with Shader Development studio and Online Shader Editor
  - **Release : v4.0 Available Now**

Mali Graphics Debugger

- **Mali Graphics Debugger**
  - Graphics debugging and performance debugging for content developers
  - Understand issues and causes at frame level
  - Support for OpenGL ES 2.0, 3.0, EGL & OpenCL 1.1
  - Complimentary to DS-5 Streamline
  - **Available NOW**

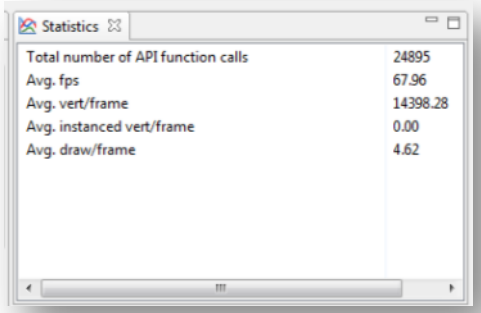


Mali Graphics Debugger

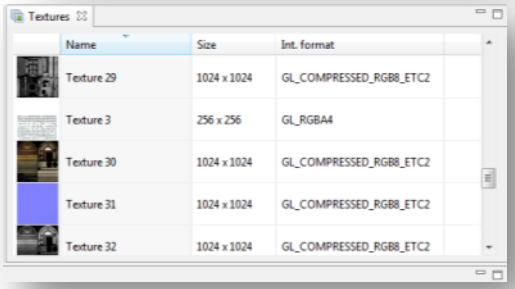


Identify Issues

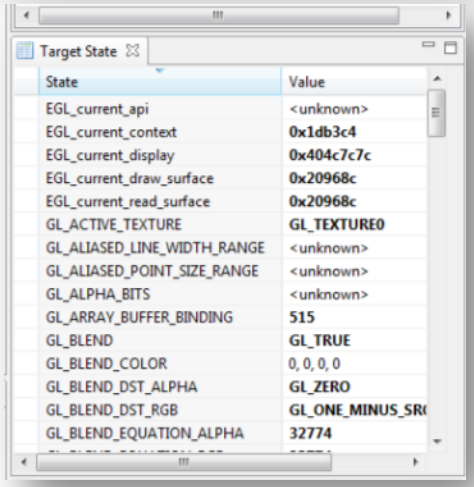
- **Statistics View to identify :**
  - High vertex count,
  - Large number of draw calls



- **Texture View to identify :**
  - Frames where compression is not being used
  - Unnecessarily large texture dimensions
  - Unnecessary pixel format being used

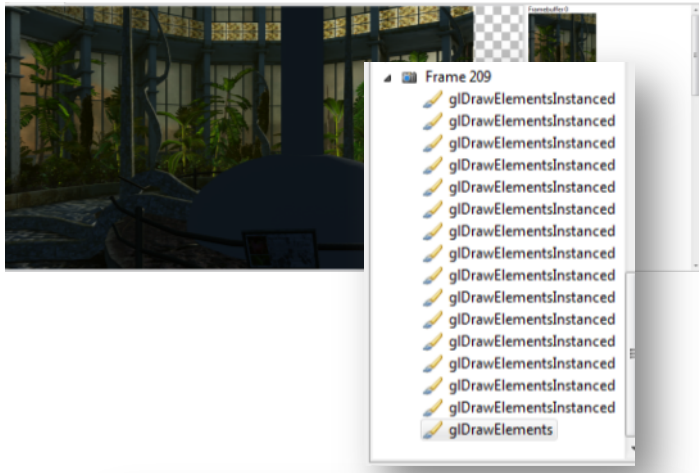


- **Target State View to identify :**
  - Surprise changes to state
  - Unnecessary changes

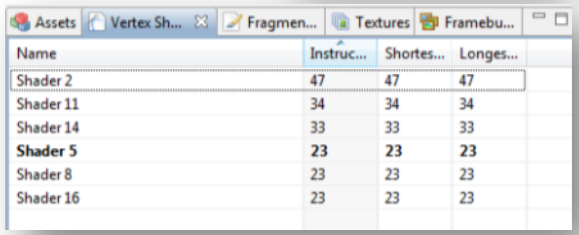


Identify Issues

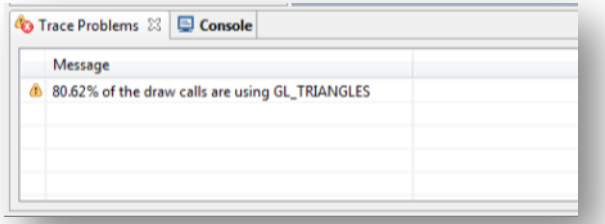
- **Draw-Call stepping to identify** :
  - Redundant draw-calls
  - Potential opportunity for batching



- **Shader Statistic View to identify :**
  - Expensive shaders by cycle count



- **Dynamic Help to highlight optimization opportunity**



For More Details, visit us at:
http://malideveloper.arm.com