Common Tasks - Developing gaming and graphics software

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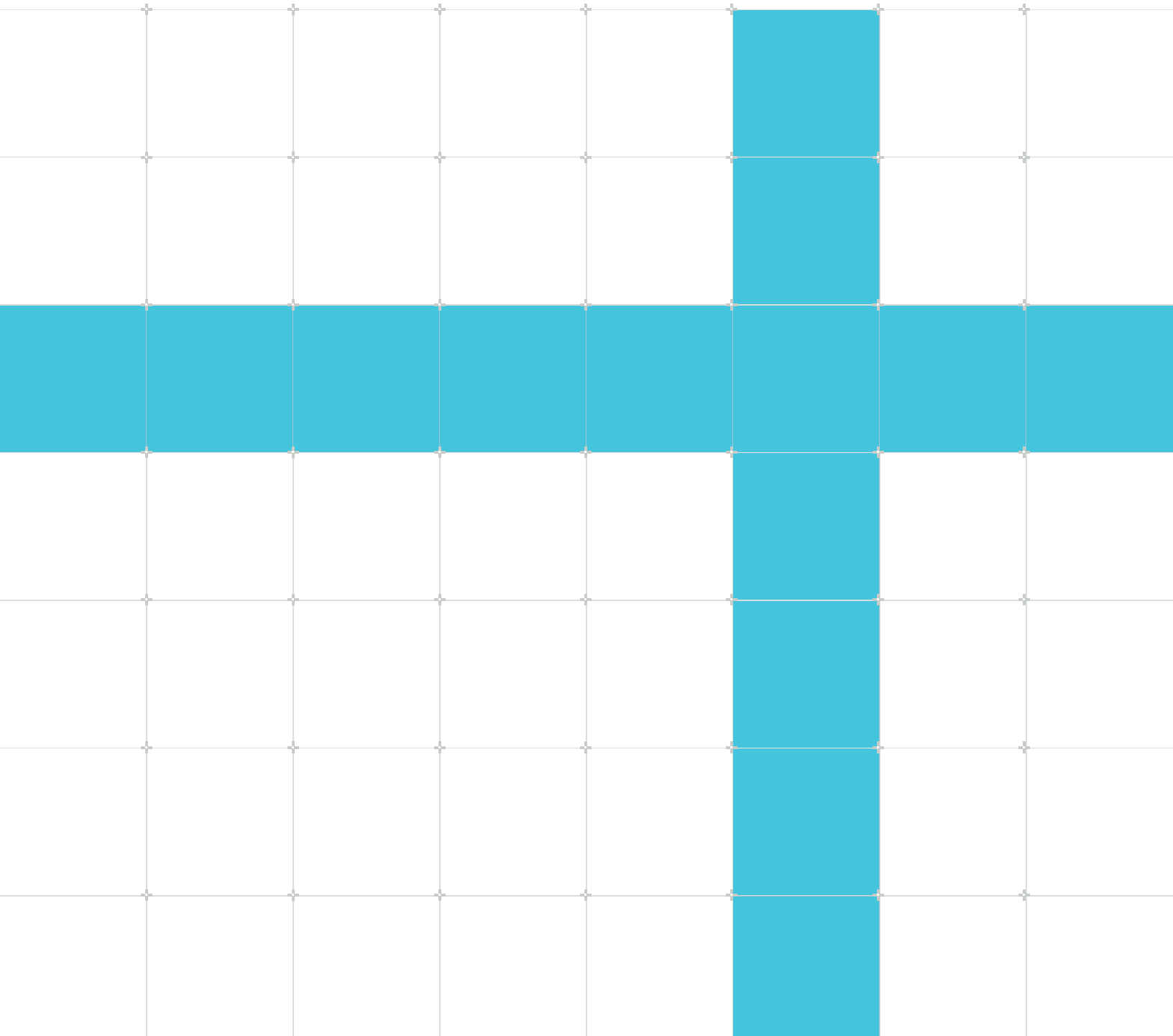

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0100-02	31 March 2021	Non-Confidential	Initial release

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Contents

1. Overview

Arm Mali technologies have been developed to allow ever-increasing graphics complexity within the thermal limits of mobile devices. These technologies provide significant system-wide bandwidth savings across all formats, to ensure that end users can experience the latest in graphics quality on any device.

This guide contains a comprehensive collection of resources develop by Arm and others to help developers optimize their applications for Arm Mali technology.

Whether developing for a proprietary game engine, or a commercially available one like Unity or Unreal Engine, these resources will provide you with techniques and best practices that you can use to improve the performance of your applications.

If you are new to developing for Mali, use these resources to learn the basics of Mali software development:

- Principles of High Performance
- Understanding Render Passes
- Understanding Pipelining
- Understanding Tile-Based Rendering
- The Midgard Shader Core
- The Bifrost Shader Core

If you are familiar with the basics, these additional resources will be useful:

- Mali FAQs provide answers to frequently asked questions.
- The Mali GPU Best Practices Guide provides recommendations for efficient API usage.
- Learn about the development tools for graphics and compute applications that Arm provides. These applications help you to deploy graphics applications and content on Mali GPU based systems.
- Some Arm training courses cover Mali software development, including Arm Mali Graphics Software Development.
- Arm Community provides a Graphics and Multimedia forum. On this forum, you can ask questions, collaborate on projects, and discuss the latest Mali tools, drivers and development platforms.

Arm also provides Arm Mobile Studio, a suite of graphics development tools to help developers get the best out of their applications.

- Use Performance Advisor to generate an easy-to-read performance summary from an annotated Streamline capture, and get actionable advice about how to optimize your game or app.
- Use Streamline to capture a performance profile for deep-dive analysis, using all of the performance data in the system. Measure peaks in performance for the CPU, GPU and bandwidth and then see which code was being executed during that time.

- Use Graphics Analyzer to debug Open GL ES and Vulkan API calls in your application, to identify rendering defects and investigate problem scenes to improve performance. Analyze overdraw, shaders, textures and fragment counts, draw call by draw call.
- Use Mali Offline Compiler to check how your shader programs would perform on a range of Mali GPUs. Get an approximate cycle cost breakdown for the major functional units in the design.

2. Developing with Unity for Arm

Unity software is one of the most popular development environments used to create games and applications across multiple platforms.

These resources will provide you with techniques and best practices that you can use to improve the performance of your applications:

- Arm Guide for Unity Developers covers topics from VR to global illumination and is intended for beginner to intermediate level developers.
- Arm provides Unity Project Files to help developers learn directly from working projects.
- Unity presentations cover a number of subject areas, including enhancing your Unity mobile games and profiling Unity games on mobile platforms.
- Unity Tools shows how to build a Unity application with Arm Mobile Studio.
- Tracking mobile app activities using our Unity SDK library. Use the library to send data from your Unity app to Treasure Data.
- Enhancing Your Unity Mobile Games (Presented by Arm) is a video presentation that shows developers how to get the most out of Unity when developing under the unique challenges of mobile platforms.
- Getting started with Graphics Analyzer shows how to use Arm Graphics Analyzer with your Unity project.

3. Developing with Unreal Engine for Arm

Unreal Engine is a game engine developed by Epic Games. The current release is Unreal Engine 4, designed for a range of mobile applications such as Android, Linux, iOS and virtual reality, including Google Daydream, and Samsung Gear VR. With the best support for Vulkan and Metal rendering APIs, Unreal enables you to deliver console quality content on mobile devices.

- Arm Developer Unreal Engine] page on Arm Developer provides links to key resources.
- The Arm Guide for Unreal Engine 4 Optimizing Mobile Gaming Graphics helps you to create applications and content that make the best use of Unreal Engine 4 on mobile platforms, especially those with Arm Mali GPUs.
- Unreal Engine presentations provide an introduction to many of the features and benefits of Arm Mali GPU architectures and Unreal Engine 4.
- Getting started with Graphics Analyzer shows how to use Arm Graphics Analyzer with your Unreal Engine project.

4. Developing VR on Arm

Mobile Virtual Reality requires high performance and efficiency from a GPU for the highest quality experience. Arm Mali GPUs are leading the way, powering devices from the mobile phone-based Samsung Gear VR to standalone headsets such as the Deepon M2 VR.

- The Ice Cave VR demo running on the Samsung Gear VR shows what is possible with VR on Arm.
- Virtual Reality presentations cover several subject areas including how to get the most out of mobile VR in Unity, and how to achieve high quality mobile VR with Unreal Engine for Oculus devices.
- Arm Developer Virtual Reality page provides links to a number of useful resources.
- Mali VR SDKs provide resources to help you build VR applications for Mali based platforms.
- How to... achieve inside-out tracking in mobile VR using only Unity and AR SDKs

5. Developing with Vulkan for Arm

Vulkan is a new generation graphics and compute API that provides high-efficiency, cross-platform access to modern GPUs used in a wide variety of devices from PCs and consoles to mobile phones and embedded platforms.

- Vulcan 101 provides a video introduction to the Vulkan API, including the history of the API and how it compares to OpenGL .
- What is Vulkan? provides a number of introductory resources.
- Vulkan API presentations cover a number of subject areas, including Vulkan's key features on Arm Architecture and 9 tips for Vulkan development.
- The Mali Vulkan Software Development Kit is a collection of resources to help you build Vulkan applications for a platform with a Mali GPU and an Arm processor.
- Vulkan Integration in Unity explores some of the benefits of Unity's built-in Vulkan renderer.
- Vulkan demos provides a selection of demos running on Arm Mali architecture. These demos have been created by Arm and our partners.

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6. Developing with OpenGL ES for Arm

OpenGL for Embedded Systems is the world's most deployed 3D graphics API, providing a cross-platform API for full-function 2D and 3D graphics on embedded systems – including consoles, phones, appliances and vehicles. It consists of well-defined subsets of desktop OpenGL , creating a flexible and powerful low-level interface between software and graphics acceleration using the OpenGL ES shading language.

- The Android OpenGL ES 3.0 and 3.1 tutorials introduce some of the features of OpenGL ES, explain what they can be used for, and show you how to use them.
- The OpenGL ES 3.X Developer Programming Guide introduces the key OpenGL ES 3.x API features and extensions, as well as best practices on how to optimize your OpenGL ES 3.x application for the Arm Mali architecture.
- The Mali OpenGL ES Software Development Kit provides a collection of resources to help you build OpenGL ES 2.0 and OpenGL ES 3.0 applications for Mali based platforms.
- Arm's graphics development tools help you to develop and analyze your OpenGL ES graphics and compute software.