Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 01 (2018-03-11)

The first version.
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1 Description

1.1 Introduction

1.1.1 General description

The GPU module uses the chip of the Arm Mali-G72 GPU. It provides standard interface implementations of OpenGL ES, OpenCL, and Vulkan for users to perform image processing and heterogeneous computing.

1.1.2 Features

1. Support OpenGL ES 1.1, 2.0, 3.0, 3.1, 3.2
   OpenCL 1.1, 1.2, 2.0
   Vulkan1.0
   RenderScript
2. Designed for High Fidelity Mobile Gaming & VR.
3. Improved Machine Learning efficiency.
4. Multiple Bifrost architectural optimizations.
5. Enables console quality gaming on mobile devices.
6. Provides sustained performance for complex graphics use cases.
7. 17% more efficient Machine Learning on device.
1.2 Software Architecture

![Software Architecture Diagram](image)

1.3 Kernel Driver Introduction

1.3.1 General

Kernel driver has source code path is drivers/gpu/arm

```
arm/
    bifrost-hikey960 ------->hikey960 gpu driver
    bifrost-hikey970 ------->hikey970 gpu driver
    built-in.o
    Kconfig
    Makefile
    modules.builtin
    modules.order
    utgard ------->hikey gpu driver
```

1.3.2 Register Device

The following figure shows how driver register device:
1.3.3 Submit Jobs

The following figure shows how driver handle jobs from user space
1.3.4 Run Jobs

The following figure shows how driver submit jobs to device:
1.4 Development

1.4.1 Userspace Driver

userspace driver is dynamic libraries.

<table>
<thead>
<tr>
<th>lib(64)/libGLES_mali.so</th>
<th>OpenGL ES, Open CL, Vulkan</th>
</tr>
</thead>
<tbody>
<tr>
<td>lib(64)/libRSDriverArm.so lib(64)/libmalicore.bc lib64/libmalicore.bc</td>
<td>RenderScript</td>
</tr>
</tbody>
</table>

1.4.2 Kernel Driver

1. DTS Config:

The dts file path: arch/arm64/boot/dts/hisilicon/kirin970-gpu.dtsi
2. Kconfig:

```c
CONFIG_CRYPTO_CRC32_ARM64=y
CONFIG_HI_CODEC_VENC=y
CONFIG_HI_CODEC_VDEC=y

-# CONFIG_MALI_PLATFORM_HIKEY970 is not set
-# CONFIG_MALI_MIDGARD is not set
-# CONFIG_MALI_EXPERT is not set
-# CONFIG_MALI_DEVFREQ is not set
+CONFIG_MALI_PLATFORM_HIKEY970=y
+CONFIG_MALI_MIDGARD=y
+CONFIG_MALI_EXPERT=y
+CONFIG_MALI_DEVFREQ=y
```