HiKey970

GPU Development Guide

Issue 01

Date 2018-03-11

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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.

Contents

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

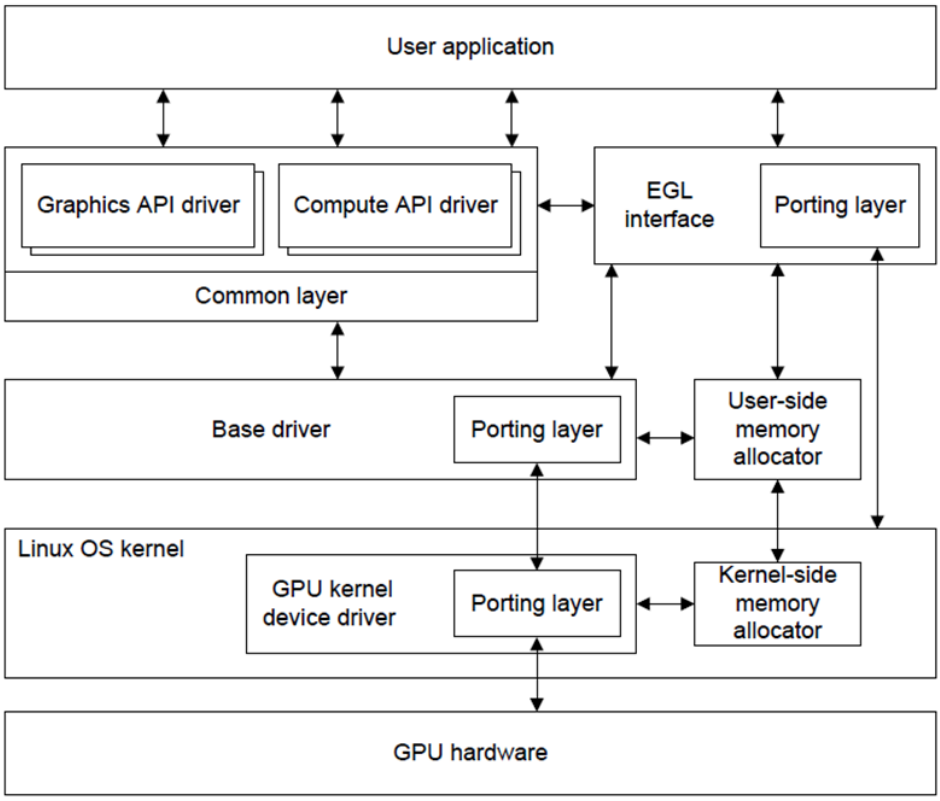
1. Support OpenGL ES 1.1, 2.0, 3.0, 3.1, 3.2

   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



1.3 Kernel Driver Introduction

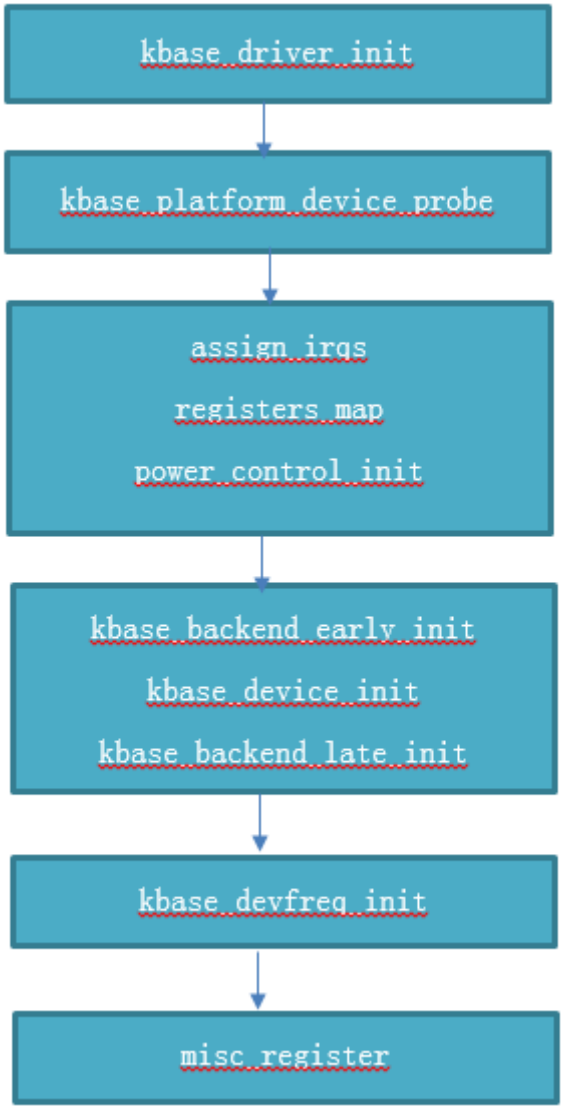
1.3.1 General

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
```

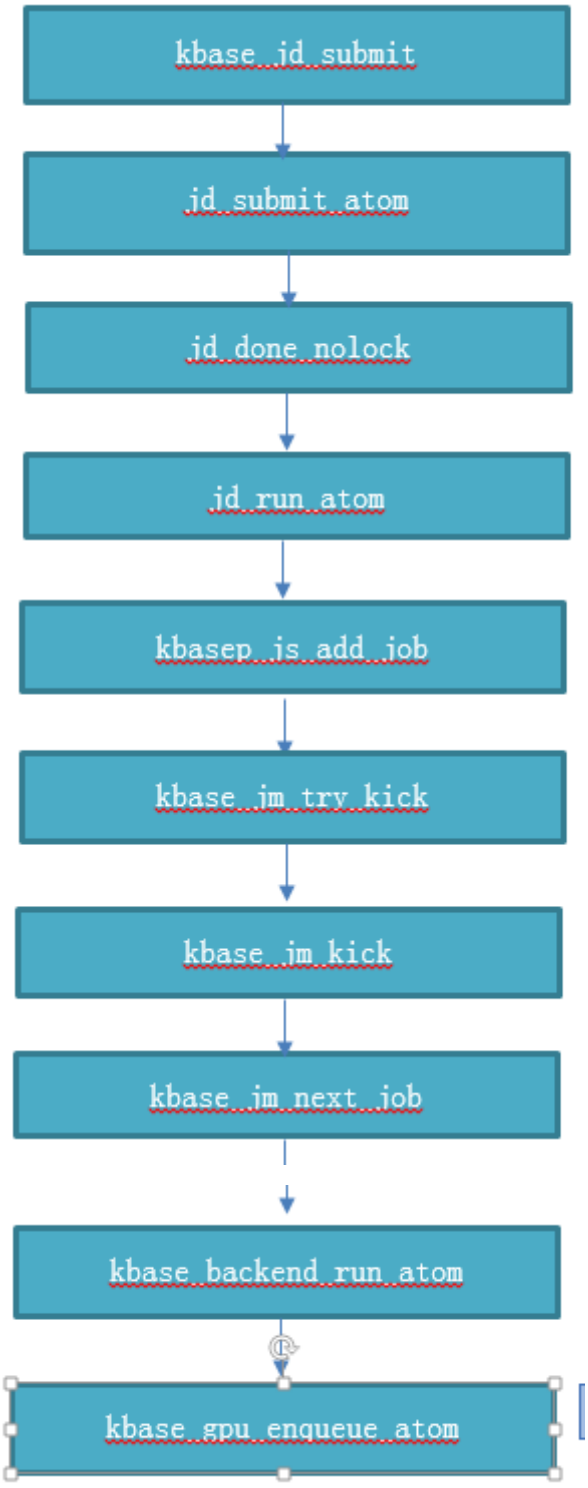
1.3.2 Register Device

The following figure shows how driver register device:



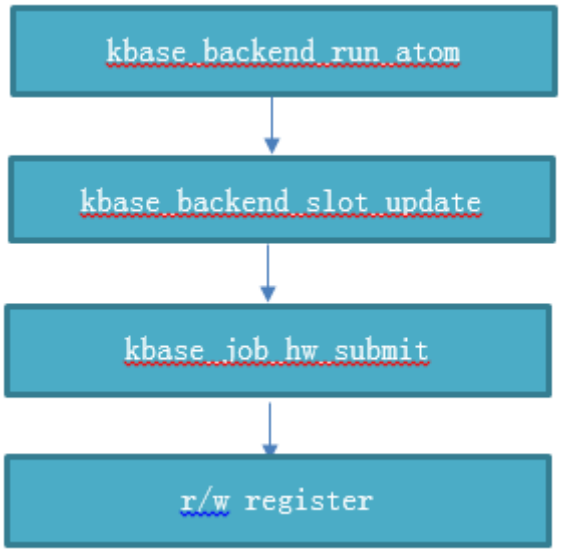
1.3.3 Submit Jobs

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。

lib(64)/libGLES_mali.so	OpenGL ES， Open CL ， Vulkan
lib(64)/libRSDriverArm.so lib(64)/libmalicore.bc lib64/libmalicore.bc	RenderScript

1.4.2 Kernel Driver

1. DTS Config：

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

```
        gpu: mali@E82C0000 {
                compatible = "arm,malit6xx", "arm,mali-midgard";
                gpu_outstanding = <0x0>;
                reg = <0x0 0xE82C0000 0x0 0x4000>;
                interrupts = <0 258 4 0 259 4 0 260 4>;
                interrupt-names = "JOB", "MMU", "GPU";
                clocks = <&stub_clock KIRIN970_CLK_STUB_GPU>;
                clock-names = "clk_mali";
                ipa-model = "mali-simple-power-model";
                operating-points = <
                        /* <frequency> <voltage>*/
                        103750  550000
                        150909  650000
                        237143  650000
                        332000  650000
                        415000  750000
                        550000  750000
                        667000  850000
                        767000  950000
                >;
                cooling-min-level = <7>;
                cooling-max-level = <0>;
                #cooling-cells = <2>; /* min followed by max */
                system-coherency = <1>;

                gpu_power_model: power_model {
                        compatible = "arm,mali-simple-power-model";
                        static-coefficient = <723>;
                        dynamic-coefficient = <7555>;
                        ts = <48020 2120 (-50) 1>;
                        thermal-zone = "cls0";
                        temp-poll-interval-ms = <100>;
                };
        };
};
```

2. Kconfig ：

```
 CONFIG_CRYPTO_CRC32_ARM64=y
 CONFIG_HI_VCODEC_VENC=y
 CONFIG_HI_VCODEC_VDEC=y
-# CONFIG_MALI_PLATFORM_HIKEY970 is no
-# 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
```