

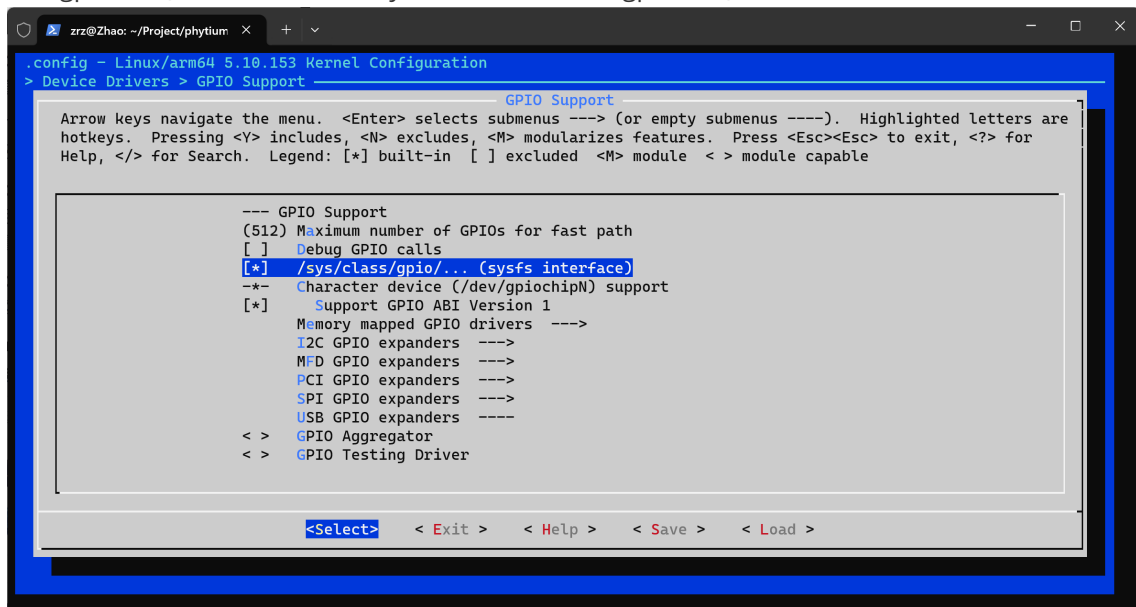
编译内核

配置和编译Rt 内核:

```
zrz@Zhao:~/Project/phytium_kernel$ git clone
git@gitee.com:phytium_embedded/phytium-linux-kernel.git
zrz@Zhao:~/Project/phytium_kernel$ cd phytium-linux-kernel/
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ make
phytiumpi_firefly_defconfig
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ make menuconfig
```

自定义内核

- 开启gpio模块(解决Linux开发板/sys/class/目录下没有gpio目录)



- 开启HDMI支持, 防止GUI无法登录

```
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ make -j12
```

生成ko 的安装目录和文件:

由于内核很多模块编译成ko, 所以需要手工生成ko 的安装目录和文件:

```
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ mkdir build
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ export
INSTALL_MOD_PATH=`pwd`/build
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ make modules_install
zrz@Zhao:~/Project/phytium_kernel/phytium-linux-kernel$ ls build/lib/modules/
5.10.153-phytium-embedded-2023-v1.0-GA
```

其中, 模块名称分2 部分:

- 第一部分“5.10.153-rt76-phytium-embedded”不会变化

- 第二部分“-v1.0-GA”会随着版本的不断更新而持续更新，本章节后续章节描述内核模块以不变部分为准。

替换内核：

- 将SD卡插到USB 读卡器上，然后插到交叉编译机上，假设读卡器的设备节点为sdc，将内核和设备树安装到SD 卡的/boot 目录(注意提前备份旧的内核和设备树以及内核模块)。

```
$ sudo mount /dev/sdc1 /mnt
$ sudo cp arch/arm64/boot/Image /mnt/boot/
$ sudo cp arch/arm64/boot/dts/phytium/phytiumpi_firefly.dtb /mnt/boot/
```

- 然后将配套的内核模块安装到/lib/modules：

```
$ sudo cp build/lib/modules/5.10.153-rt76-phytium-embedded /mnt/lib/modules -R
$ sudo umount /mnt
```

串口连接启动新内核

启动开发板，然后在Uboot 启动阶段敲击键盘的回车键，这时系统会停留在Uboot 的Shell 界面，如下所示。

```
AHCI 0001.0301 32 slots 1 ports 6 Gbps 0x1 impl SATA mode
flags: 64bit ncq stag pm led clo only pmp pio slum part ccc apst
SATA link 0 timeout.
AHCI 0001.0301 32 slots 1 ports 6 Gbps 0x1 impl SATA mode
flags: 64bit ncq stag pm led clo only pmp pio slum part ccc apst
Hit any key to stop autoboot: 0 // 红颜色打印信息回显后键入回车字符
E2000# // 这时进入Uboot 的Shell 界面
E2000#setenv bootargs console=ttyAMA1,115200 earlycon=p1011,0x2800d000
root=/dev/mmcblk0p1 rootwait rw
E2000#ext4load mmc 0:1 0x90100000
home/user/test/5.10.153-phytium-embedded-rt/Image
28692992 bytes read in 6293 ms (4.3 MiB/s)
E2000#ext4load mmc 0:1 0x90000000
home/user/test/5.10.153-phytium-embedded-rt/phytiumpi_firefly.dtb
25125 bytes read in 13 ms (1.8 MiB/s)
E2000#booti 0x90100000 - 0x90000000
```

在Uboot 的shell 菜单按照如下步骤引导内核和设备树启动。

- 设置启动参数，其中，嵌入式Linux 文件系统：

```
E2000# setenv bootargs console=ttyAMA1,115200 earlycon=p1011,0x2800d000
root=/dev/mmcblk0p1 rootwait rw;
```

- 加载内核到内存：

```
E2000# ext4load mmc 0:1 0x90100000 boot/Image;
```

这时，串口会打印如下信息提示加载成功：

```
[ OK ] Started bt firmware process.
        Starting Load/Save RF Kill Switch Status...
[ OK ] Finished Remove Stale Onli...ext4 Metadata Check Snapshots.
[ OK ] Started Load/Save RF Kill Switch Status.
[ OK ] Started System Logging Service.
[ OK ] Started LSB: automatic crash report generation.
[ OK ] Finished Save/Restore Sound Card State.
[ OK ] Reached target Sound Card.
[ 11.540950] Bluetooth: : Non-link packet received in non-active state
[ OK ] Started LSB: Load kernel m...ded to enable cpufreq scaling.
        Starting Bluetooth service...
        Starting LSB: set CPUFreq kernel parameters...
[FAILED] Failed to start Wait for Network to be Configured.
See 'systemctl status systemd-networkd-wait-online.service' for details.
[ OK ] Started Network Name Resolution.
[ OK ] Reached target Host and Network Name Lookups.
[ OK ] Started LSB: set CPUFreq kernel parameters.
[ OK ] Started Login Service.
[ OK ] Started Avahi mDNS/DNS-SD Stack.
[ OK ] Started WPA supplicant.
[ OK ] Started Bluetooth service.
[ OK ] Reached target Bluetooth.
[ OK ] Started Make remote CUPS printers available locally.
[ OK ] Started Authorization Manager.
```

```
[ OK ] Started Hostname Service.
[ OK ] Started OpenBSD Secure Shell server.
[ OK ] Started xrdp session manager.
        Starting xrdp daemon...
[ OK ] Started Light Display Manager.
        Starting Network Manager Script Dispatcher Service...
[ OK ] Started Network Manager Script Dispatcher Service.
[ OK ] Started Disk Manager.
[ OK ] Started Accounts Service.
[ OK ] Started Snap Daemon.
        Starting Wait until snapd is fully seeded...
        Starting Time & Date Service...
[ OK ] Started Dispatcher daemon for systemd-networkd.
[ OK ] Started xrdp daemon.
[FAILED] Failed to start Network Manager Wait Online.
See 'systemctl status NetworkManager-wait-online.service' for details.
[ OK ] Started Modem Manager.
[ OK ] Reached target Network is Online.
        Starting Tool to automatic...mit kernel crash signatures...
        Starting /etc/rc.local Compatibility...
[ OK ] Started crash report submission daemon.
[ OK ] Finished Wait until snapd is fully seeded.
[ OK ] Started Time & Date Service.
[ 17.145744] rtw core: version magic '5.10.153-phytium-embedded-2023-v1.0-GA+ S
```