Linux SPINOR
开发指南

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版本历史

版本号	日期	制/修订人	内容描述
1.0	2021.12.21	AWA1669	初始版本
1.1	2022.02.22	AWA1669	增加 uboot shell 使用
1.2	2022.11.10	AWA1669	增加 linux5.10 配置说明

目　录

插　图

1 引言

1.1 编写目的

此文档描述 Sunxi NOR 模块的使用方法，为相关人员调试提供指导

1.2 适用范围

boot0: 适用于 brandy-2.0

u-boot: 适用于 u-boot-2018

kernel: 适用于 linux-4.9/linux-5.4/linux5.10 内核

1.3 相关人员

BSP 的开发人员、测试人员

2 模块介绍

2.1 模块功能介绍

Linux 中 SPINOR 体系结构如下图所示：

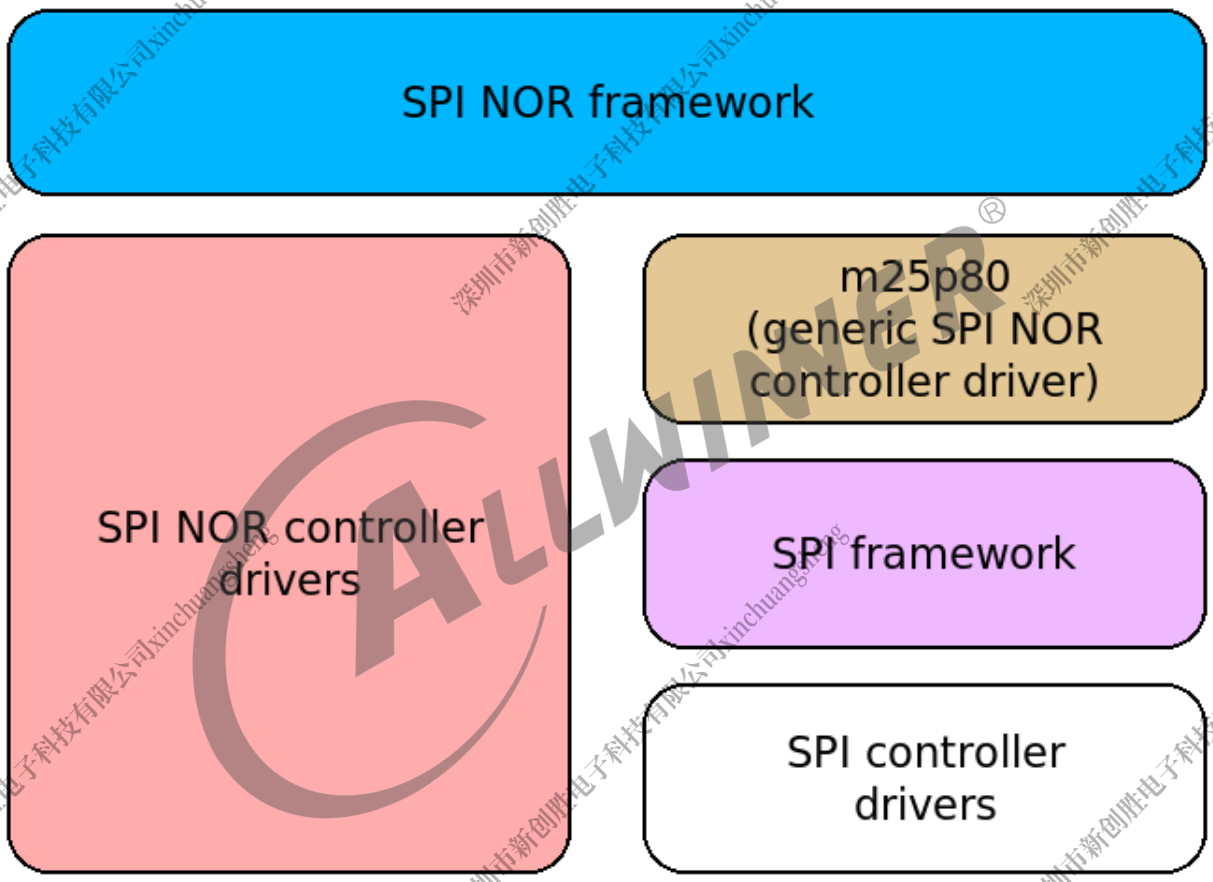

图 2-1：SPINOR 软件框架

SPI NOR Framework：这层主要是处理不同厂家的 NOR 物理特色差异，初始化 SPINOR 的工作状态，如工作线宽（1 线、2 线、4 线、8 线）、有效地址位（16M 以上的 NOR 需要使用 4 地址模式），为上层 MTD 提供读写擦接口。

对应代码目录：drivers/mtd/spi-nor/spi-nor.c

M25P80（generic SPI NOR controller driver）：这层主要对 SPI NOR Framework 层传下来的数据封装成 msg，传递给 SPI framework 层。

对应代码目录：drivers/mtd/devices/m25p80.c

注：linux4.9 后将 m25p80 整合到 spi-nor.c 中

SPI Framework：这层主要是将 msg 加入 ctl 的工作队列中，启动内核线程队列，处理队列中的 msg。

对应代码目录：drivers/spi/spi.c

SPI controller driver：这层初始化 SPI 控制器频率、时钟模式、cs 有效电平、大小端等配置，同时处理上层传下来的 msg，通过 CPU/DMA 方式传输数据到 FIFO，再传输给外设 SPINOR。

对应代码目录：drivers/spi/spi-sunxi.c

2.2 相关术语介绍

术语	解释说明
Sunxi	指 Allwinner 的一系列 SOC 硬件平台
SPI	Serial Peripheral Interface，同步串行外设接口
NOR Flash	NOR Flash 是一种非易失闪存技术，是 Intel 在 1988 年创建
MTD	MTD(memory technology device 内存技术设备) 是用于访问 memory 设备（ROM、flash）的 Linux 的子系统

2.3 模块配置介绍

2.3.1 longan 的配置和打包

```
./build.sh config
All available platform:
   0. android
   1. linux
Choice [linux]: 1
...                        //配置根据需求选择
All available flash:       //flash类型，只区分nor和非nor方案，Android方案无此选项，默认非nor
   0. default
   1. nor
Choice [default]: 1
```

1. 打包普通固件

```
#./build.sh clean
#./build.sh
#./build.sh pack
```

2. 打包卡打印固件

```
#./build.sh clean
#./build.sh
#./build.sh pack_debug
```

在配置的过程中会把平台目录下的 BoardConfig.mk 的信息拷贝到.buildconfig 中。

2.3.2 sys_config 配置

SPINOR 的 boot0 启动阶段，部分参数是从 boot0 头部获取的，而这些参数是我们在打包固件时，通过工具 update_boot0 将 sys_config.fex 中 [spinor_para]，更新到 boot0 头部的，sys_config.fex 的 [spinor_para] 配置参数如下：

```
[spinor_para]
;readcmd              =0x6b
;read_mode            =4
;write_mode           =4
;flash_size           =16
;delay_cycle          =1
;frequency            =100000000
;erase_size           =64
;lock_flag            =0
;sample_delay         =0
;sample_mode          =2

spi_sclk             = port:PC00<4><0><2><default>
spi_cs               = port:PC01<4><1><2><default>
spi0_mosi            = port:PC02<4><0><2><default>
spi0_miso            = port:PC03<4><0><2><default>
spi0_wp              = port:PC04<4><0><2><default>
spi0_hold            = port:PC05<4><0><2><default>
```

其中：

readcmd：boot0 用于读取数据的命令，不填默认用 uboot 传递过来的 readcmd
read_mode、write_mode：boot0 的工作线宽（1、2、4），不填默认更加 readcmd 决定线宽
flash_size：flash 的大小
delay_cycle：boot0 的采样延时配置，大于 60MHZ 配置为 1，小于 24MHZ 配置为 2，大于 24MHZ 小于 60HZ 配置为 3
frequency：boot0 的 SPI 工作频率，不填使用默认值 50M
erase_size：boot0 的擦除单位
lock_flag：锁功能是否打开
sample_delay：boot0 的细调采样的采样延时，uboot、kernel 也会用到，默认不填等于 0xaaaaffff
sample_mode：boot0 的细调采样的采样模式，uboot、kernel 也会用到，默认不填等于 0xaaaaffff

spi_sclk、spi_cs、spi0_mosi、spi0_miso、spi0_wp 和 **spi0_hold** 用于配置相应的 GPIO。

2.3.3 UBOOT 配置

2.3.3.1 编译和配置

```
#make clean
#make sun8iw19p1_nor_config ----启动的uboot  (#make sun8iw19p1_config----烧写uboot)
#make -j32
```

2.3.3.2 Menuconfig 配置

```
#cd brandy/brandy-2.0/u-boot-2018
#make menuconfig
```

- 进入 Device Drivers

```
Device Drivers ---->
    [*]SPI Suppport ---->
    [*]Sunxi flash support ---->
```

```
                                    Device Drivers
elects submenus ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Press
 for Help, </> for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module

            ^(-)
            [ ] Bit-banged ethernet MII management channel support
            [ ] Marvell 88E6352 switch support
            [ ] Ethernet PHY (physical media interface) support  ----
            [ ] NXP PFE Ethernet driver  ----
            [ ] TI Common Platform Ethernet Switch
            [ ] Network device support  ----
            [ ] PCI support  ----
                PHY Subsystem  ----
            [ ] ComPhy SerDes driver
                Pin controllers  ----
                Power  --->
            [ ] Enable support for the sandbox PWM
                PWM_SUNXI  --->
                Remote Processor drivers  ----
                Reset Controller Support  ----
                Real Time Clock  --->
            [ ] Support SCSI controllers
                Serial drivers  --->
                Sound support  --->
            [*] SPI Support  --->
                SPMI support
            [ ] Sunxi power device support  ----
                System reset device drivers  --->
            [ ] Driver support for thermal devices
                Timer Support  ----
                TPM support  ----
            [ ] USB support  ----
                Graphics support  --->
                Watchdog Timer Support  --->
            -*- Sunxi flash support  --->
            [*] Sunxi usb divice support  --->
```

图 2-2: uboot_menuconfig1

- 进入 SPI Support

```
Device Drivers ---->
    [*]SPI Suppport ---->
        [*]Sunxi SPI driver
```

```
                                    SPI Support
s submenus ---> (or empty submenus ----).  Highlighted lett
Help, </> for Search.  Legend: [*] built-in  [ ] excluded


      --- SPI Support
      [ ]   SPI memory extension (NEW)
      [ ]   Soft SPI driver (NEW)
      [ ]   ColdFire SPI driver (NEW)
      [ ]   Freescale eSPI driver (NEW)
      [ ]   Freescale QSPI driver (NEW)
      [ ]   SuperH SPI driver (NEW)
      [ ]   Renesas Quad SPI driver (NEW)
      [ ]   TI QSPI driver (NEW)
      [ ]   Marvell Kirkwood SPI Driver (NEW)
      [ ]   LPC32XX SPI Driver (NEW)
      [ ]   MPC8XXX SPI Driver (NEW)
      [ ]   MXC SPI Driver (NEW)
      [ ]   MXS SPI Driver (NEW)
      [ ]   McSPI driver for OMAP (NEW)
      [*]   Sunxi SPI driver
      [ ]   SPI use dma driver (NEW)
```

图 2-3: uboot_menuconfig2

- 进入 sunxi_flash_support

```
Device Drivers ---->
    [*]Sunxi flash support ---->
        [*]Support sunxi spinor devices
```

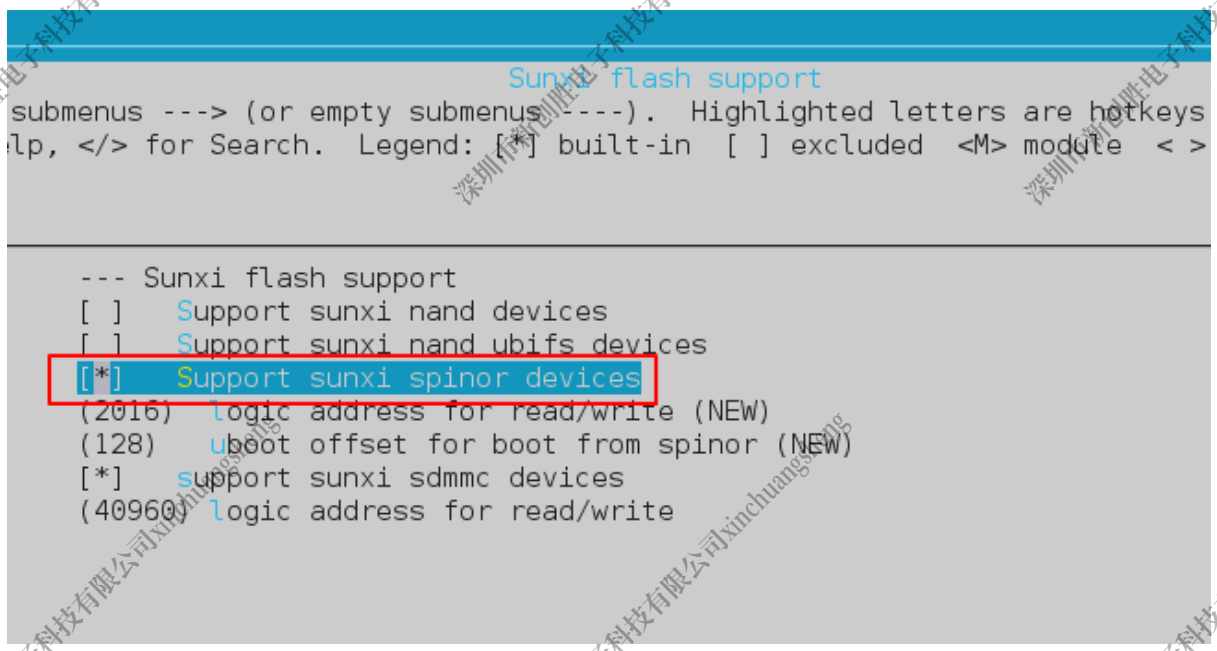

图 2-4: uboot_menuconfig3

2.3.4 KERNEL 配置

2.3.4.1 SPINOR-驱动配置

2.3.4.1.1 linux4.9/5.4

```
#cd kernel/liunx-4.9
#make ARCH=arm menuconfig
```

- 进入 Device Drivers

```
Device Drivers ---->
    <*>Memory Technology Device (MTD) support ---->
    [*]SPI support ---->
```

```
                                    Device Drivers
menu.  <Enter> selects submenus ---> (or empty submenus ----).  Highlighted letters are hotk
s features.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*] built-in


                    Generic Driver Options  --->
                    Bus devices  --->
                < > Connector - unified userspace <-> kernelspace linker  ----
                <*> Memory Technology Device (MTD) support  --->
                -*- Device Tree and Open Firmware support  --->
                < > Parallel port support  ----
                [*] Block devices  --->
                < > NVMe Target support
                    Misc devices  --->
                    SCSI device support  --->
                < > Serial ATA and Parallel ATA drivers (libata)  ----
                [ ] Multiple devices driver support (RAID and LVM)  ----
                < > Generic Target Core Mod (TCM) and ConfigFS Infrastructure  ----
                [*] Network device support  --->
                [ ] Open-Channel SSD target support  ----
                    Input device support  --->
                    Character devices  --->
                    I2C support  --->
                [*] SPI support  --->
                < > SPMI support  ----
                < > HSI support  ----
                    PPS support  --->
                    PTP clock support  --->
```

图 2-5: kernel_menuconfig1

- 进入 Menory Technology Device(MTD) support

```
Device Drivers ---->
    <*>Memory Technology Device (MTD) support ---->
        <*>SUNXI partitioning support
        <*>Direct char device access to MTD devices
        <*>Caching block device access to MTD devices
        Self-contained MTD device drivers ---->
        SPI-NOR device support ---->
```

```
                    Memory Technology Device (MTD) support
omenus ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Pressing
 </> for Search.  Legend: [*] built-in  [ ] excluded  <M> module  < > module capa

      -*- Memory Technology Device (MTD) support
      < >   MTD tests support (DANGEROUS)
      < >   RedBoot partition table parsing
      < >   Command line partition table parsing
      < >   ARM Firmware Suite partition parsing
      <*>   OpenFirmware partitioning information support
      < >   TI AR7 partitioning support
      <*>   SUNXI partitioning support
      [ ]     SUNXI Uboot Disp Enable
            Partition parsers  --->
            *** User Modules And Translation Layers ***
      <*>   Direct char device access to MTD devices
      <*>   Caching block device access to MTD devices
      < >   FTL (Flash Translation Layer) support
      < >   NFTL (NAND Flash Translation Layer) support
      < >   INFTL (Inverse NAND Flash Translation Layer) support
      < >   Resident Flash Disk (Flash Translation Layer) support
      < >   NAND SSFDC (SmartMedia) read only translation layer
      < >   SmartMedia/xD new translation layer
      < >   Log panic/oops to an MTD buffer
      < >   Swap on MTD device support
      [ ]   Retain master device when partitioned
            RAM/ROM/Flash chip drivers  --->
            Mapping drivers for chip access  --->
            Self-contained MTD device drivers  --->   5.4内核不需要选择此项
      < >   OneNAND Device Support  ----
      < >   Raw/Parallel NAND Device Support  ----
      < >   SPI NAND device Support  ----
            sunxi-nand  --->
            LPDDR & LPDDR2 PCM memory drivers  --->
      <*>   SPI-NOR device support  --->
      < >   Enable UBI - Unsorted block images  ----
      < >   HyperBus support  ----
```

图 2-6: kernel_menuconfig2

- 进入 Self-contained MTD device drivers（5.4 内核不需要选择此项）

```
Device Drivers ---->
    <*>Memory Technology Device (MTD) support ---->
        Self-contained MTD device drivers ---->
            <*>Support most SPI Flash chips (AT16DF, M25P.....)
```

```
nfiguration
Device (MTD) support > Self-contained MTD device drivers
                        Self-contained MTD device drivers
nter> selects submenus ---> (or empty submenus ----).  Highlighted
s.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legen

      < > Support for AT45xxx DataFlash
      <*> Support most SPI Flash chips (AT26DF, M25P, W25X, ...)
      < > Support SST25L (non JEDEC) SPI Flash chips
      < > Uncached system RAM
      < > Physical system RAM
      < > Test driver using RAM
      < > MTD using block device
          *** Disk-On-Chip Device Drivers ***
      < > M-Systems Disk-On-Chip G3
```

图 2-7: kernel_menuconfig3

```
Boot opttions ---->
```

```
                    Linux/arm 4.9.118 Kernel Configuration
<Enter> selects submenus ---> (or empty submenus ----).  Highlighted lett
res.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*

        (8) Maximum PAGE_SIZE order of alignment for DMA IOMMU buffers
        [*] Patch physical to virtual translations at runtime
            General setup  --->
        [*] Enable loadable module support  --->
        [*] Enable the block layer  --->
            System Type  --->
            Bus support  --->
            Kernel Features  --->
            Boot options  --->
            CPU Power Management  --->
            Floating point emulation  --->
            Userspace binary formats  --->
            Power management options  --->
        [*] Networking support  --->
```

图 2-8: kernel_menuconfig5

- 进入 Boot options

```
Boot opttions ---->
    Kernel command line type ---->
```

```
                                Boot options
ter> selects submenus ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Press
.  Press <Esc><Esc> to exit, <?> for Help, </> for Search.  Legend: [*] built-in  [ ] exclude

      [*] Flattened Device Tree support
      [ ]   Support for the traditional ATAGS boot data passing
      [ ] Build a concatenated zImage/dtb by default
      (0) Compressed ROM boot loader base address
      (0) Compressed ROM boot loader BSS address
      [*] Use appended device tree blob to zImage (EXPERIMENTAL)
      [*]   Supplement the appended DTB with traditional ATAG information
            Kernel command line type (Use bootloader kernel arguments if available)  --->
      ()  Default kernel command string
      [ ] Kernel Execute-In-Place from ROM
      [ ] Kexec system call (EXPERIMENTAL)
      [ ] Build kdump crash kernel (EXPERIMENTAL)
      [ ] Auto calculation of the decompressed kernel image address
```

图 2-9: kernel_menuconfig6

- 进入 kernel command line type

```
Boot opttions ---->
    Kernel command line type ---->
        (X)Use bootloade kernel arguments if available
```

```
                        Kernel command line type
  Use the arrow keys to navigate this window or press the
  hotkey of the item you wish to select followed by the <SPACE
  BAR>. Press <?> for additional information about this

      (X) Use bootloader kernel arguments if available
      ( ) Extend with bootloader kernel arguments

                <Select>        < Help >
```

图 2-10: kernel_menuconfig7

2.3.4.1.2 Linux5.10

```
Allwinner BSP --->Device Drivers --->Memory Technology Device(MTD) support
```

```
e (AW_MTD) support
                    Memory Technology Device (AW_MTD) support
s ---> (or empty submenus ----).  Highlighted letters are hotkeys.  Pressing
end: [*] built-in  [ ] excluded  <M> module  < > module capable

        --- Memory Technology Device (AW_MTD) support
        < >   MTD tests support (DANGEROUS)
              Partition parsers  --->
              *** User Modules And Translation Layers ***
        <*>   Caching block device access to MTD devices
        < >   FTL (Flash Translation Layer) support
        < >   NFTL (NAND Flash Translation Layer) support
        < >   INFTL (Inverse NAND Flash Translation Layer) support
        < >   Resident Flash Disk (Flash Translation Layer) support
        < >   NAND SSFDC (SmartMedia) read only translation layer
        < >   SmartMedia/xD new translation layer
        < >   Log panic/oops to an MTD buffer
        < >   Swap on MTD device support
        [ ]   Retain master device when partitioned
              RAM/ROM/Flash chip drivers  --->
              Self-contained MTD device drivers  --->
              LPDDR & LPDDR2 PCM memory drivers  --->
        <*>   SPI NOR device support  --->
        -*-   Enable UBI - Unsorted block images  --->
        < >   HyperBus support  ----
        < >   Allwinner MTD SPINAND Device Support
        <*>   Allwinner MTD RAWNAND Device Support
        [ ]   Kernel images are stored on physical partitions
        [ ]   create pstore mtd partition for aw ubi rawnand
        [*]   enable simulate multiplane
        [ ]   upload boot0 to check after download boot0 img
        [ ]   upload uboot to check after download uboot img
```

图 2-11: spinor-config

```
Allwinner BSP --->Device Drivers --->SPI Drivers
```

```
                    SPI Drivers
-> (or empty submenus ----).  Highlighted letters are hotkeys.  Pre
 [*] built-in  [ ] excluded  <M> module  < > module capable

   <*> SPI Support for Allwinner SoCs
```

图 2-12: menuconfig-spi

```
Allwinner BSP --->Device Drivers --->DMA Drivers
```

```
                                DMA Drivers
> (or empty submenus ----).  Highlighted letters are hotkeys.  Press
[*] built-in  [ ] excluded  <M> module  < > module capable

  <*> DMA Support for Allwinner SoCs
```

图 2-13: menuconfig-dma

2.3.4.2 文件系统配置

- 进入 File systems

```
File system ---->
    [*]Miscellaneous filesystems ---->
```

```
        [ ] Filesystem wide access notification
        [ ] Quota support
        < > Kernel automounter version 4 support (also supports v3)
        < > FUSE (Filesystem in Userspace) support
        <*> Overlay filesystem support
            Caches  --->
            CD-ROM/DVD Filesystems  --->
            DOS/FAT/NT Filesystems  --->
            Pseudo filesystems  --->
        [*] Miscellaneous filesystems  --->
        [*] Network File Systems  --->
        [*] Native language support  --->
        < > Distributed Lock Manager (DLM)  ----
```

图 2-14: kernel_menuconfig8

- 进入 Miscellaneous filesystems
- Incluede support for ZLIB compressed file systems (NEW)
- Incluede support for LZ4 compressed file systems (NEW)
- Incluede support for LZO compressed file systems (NEW)
- Incluede support for XZ compressed file systems (NEW)

```
File system ---->
    [*]Miscellaneous filesystems ---->
        [*]Incluede support for XZ compressed file systems (NEW)(压缩方式选择如下)
```

```
          JFFS2 default compression mode (priority)  --->
  < >   LogFS file system
  < >   Compressed ROM file system support (cramfs) (OBSOLETE)
  <*>   SquashFS 4.0 - Squashed file system support
          File decompression options (Decompress file data into an intermediate buffer)  --->
          Decompressor parallelisation options (Single threaded compression)  --->
  [ ]     Squashfs XATTR support
  [ ]     Include support for ZLIB compressed file systems
  [ ]     Include support for LZ4 compressed file systems
  [ ]     Include support for LZO compressed file systems
  [*]     Include support for XZ compressed file systems
  [ ]     Use 4K device block size?
  [ ]     Additional option for memory-constrained systems
  < >   FreeVxFS file system support (VERITAS VxFS(TM) compatible)
```

图 2-15: kernel_menuconfig9

以上的压缩方式（ZLIB/LZ4/LZO/XZ）具体选择哪一种需要根据 longan/build/mkcmd.sh 中如下代码使用的压缩方式而定，如下代码使用的是 gzip 压缩方式，则内核 File systems 中配置需选择 LZO 压缩方式，若使用的是 xz, 则需选择 XZ 压缩方式。

```
${ROOTFS} ${LICHEE_PLAT_OUT}/rootfs.squashfs -root-owned -no-progress -comp gzip -noappend \
```

2.4 源码目录介绍

2.4.1 UBOOT 源码目录

```
\u-boot-2018\drivers
├──sunxi_flash        ---sunxi_flash的初始化/退出/读/写/擦除等flash接口
├─mmc                 ---mmc接口代码
├─nand                ---nand接口代码
├─spinor              ---spi nor接口代码
├─sunxi_flash.c       ---sunxi_flash操作接口
└──其他
├── spi               --sunxi_spi的接口代码
├─sunxi_spi.c         ---具体代码的实现
├──mtd
├─spi
├─sf_probe.c          ---nand接口代码
├─spinor              ---spi nor接口代码
├─sunxi_flash.c       ---sunxi_flash操作接口
└── makefile          ---编译文件
```

2.4.2 KERNEL 源码目录

2.4.2.1 Linux4.9/5.4

```
\longan\kernel\linux-4.9\drivers\
├── mtd
├─spi-nor
├─spi-nor.c      ---spi nor驱动代码
└──其他
├── spi          --spi的接口代码
└── makefile     --编译文件
```

2.4.2.2 Linux5.10

```
bsp/drivers/mtd/spi-nor/
├── atmel.c
├── catalyst.c
├── controllers
│   ├── aspeed-smc.c
│   ├── hisi-sfc.c
│   ├── intel-spi.c
│   ├── intel-spi.h
│   ├── intel-spi-pci.c
│   ├── intel-spi-platform.c
│   ├── Kconfig
│   ├── Makefile
│   └── nxp-spifi.c
├── core.c
├── core.h
├── eon.c
├── esmt.c
├── everspin.c
├── fujitsu.c
├── gigadevice.c
├── intel.c
├── issi.c
├── Kconfig
├── macronix.c
├── Makefile
├── micron-st.c
├── sfdp.c
├── sfdp.h
├── spansion.c
├── sst.c
├── winbond.c
├── xilinx.c
└── xmc.c
```

3 接口描述

3.1 驱动物理层接口

3.1.1 spi_nor_erase

```
static int spi_nor_erase(struct mtd_info *mtd, struct erase_info *instr)
```

description： mtd erase interface

@mtd： MTD device structure

@instr： erase operation descrition structure

return： success return 0，fail return fail code

3.1.2 spi_nor_read

```
static int spi_nor_read(struct mtd_info *mtd, loff_t from, size_t len,
                        size_t *retlen, u_char *buf)
```

description： mtd read interface

@mtd： MTD device structure

@from： offset to read from MTD device

@len： data len

@retlen： had read data len

@buf： data buffer

return： success return max_bitflips，fail return fail code

3.1.3 spi_nor_write

```
static int spi_nor_write(struct mtd_info *mtd, loff_t to, size_t len,
                         size_t *retlen, const u_char *buf)
```

description: mtd write data interface

@to: offset to MTD device

@len: want write data len

@retlen: return the writen len

@buf: data buffer

return: success return 0, fail return code fail

3.1.4 spi_nor_lock

```
static int spi_nor_lock(struct mtd_info *mtd, loff_t ofs, uint64_t len)
```

description: check block is badblock or not

@mtd: MTD device structure

@ofs: offset the mtd device start (align to simu block size)

@len: The length of the operating

return: success return 0, fail return code fail

3.1.5 spi_nor_unlock

```
static int spi_nor_unlock(struct mtd_info *mtd, loff_t ofs, uint64_t len)
```

description: check block is badblock or not

@mtd: MTD device structure

@ofs: offset the mtd device start (align to simu block size)

@len: The length of the operating

return: success return 0, fail return code fail

3.1.6 spi_nor_is_locked

```
static int spi_nor_is_locked(struct mtd_info *mtd, loff_t ofs, uint64_t len)
```

description： check block is badblock or not

@mtd： MTD device structure

@ofs: offset the mtd device start (align to simu block size)

@len： The length of the operating

return： Is lock return 1, else return 0

3.1.7 spi_nor_has_lock_erase

```
static int spi_nor_has_lock_erase(struct mtd_info *mtd, struct erase_info *instr)
```

description： mtd has lock erase interface，First unlock to operate space, after the completion of the flash lock up

@mtd： MTD device structure

@instr： erase operation descrition structure

return： success return 0，fail return fail code

3.1.8 spi_nor_has_lock_write

```
static int spi_nor_has_lock_write(struct mtd_info *mtd, loff_t to, size_t len,
                                  size_t *retlen, const u_char *buf)
```

description： mtd has lock write data interface，First unlock to operate space, after the completion of the flash lock up

@to： offset to MTD device

@len： want write data len

@retlen： return the writen len

@buf： data buffer

return： success return 0, fail return code fail

3.2 Uboot 应用接口

3.2.1 sunxi_flash_spinor_probe

```
static int sunxi_flash_spinor_probe(void)
```

description： SPINOR initialization，Set the storage type。

return： zero on success, else a negative error code.

3.2.2 sunxi_flash_spinor_init

```
static int sunxi_flash_spinor_init(int boot_mode, int res)
```

description： SPINOR initialization。

@boot_mode： Working mode

@res： The default is 0

return： zero on success, else a negative error code.

3.2.3 sunxi_flash_spinor_exit

```
int sunxi_flash_spinor_exit(void)
```

description： Release registration is a resource for applications.

return： zero on success, else a negative error code.

3.2.4 sunxi_flash_spinor_write

```
static int sunxi_flash_spinor_write(uint start_block, uint nblock, void *buffer)
```

description： mtd write data interface.

@start_block： want write start sector

@nblock： want write sectorcount

@buffer： data buffer

return： zero on success, else a negative error code.

3.2.5 sunxi_flash_spinor_write

```
static int sunxi_flash_spinor_write(uint start_block, uint nblock, void *buffer)
```

description： mtd readdata interface.

@start_block： want read start sector

@nblock： want read sector count

@buffer： data buffer

return： zero on success, else a negative error code.

3.2.6 sunxi_flash_spinor_erase

```
static int sunxi_flash_spinor_erase(int erase, void *mbr_buffer)
```

description： erase boot || partition data.

@erase： erase flag

@buffer： The default is NULL

return： zero on success, else a negative error code.

3.2.7 sunxi_flash_spinor_force_erase

```
int sunxi_flash_spinor_force_erase(void)
```

description： erase boot & partition data.

return： zero on success, else a negative error code.

3.2.8 sunxi_flash_spinor_flush

```
int sunxi_flash_spinor_flush(void)
```

description： Flush physical cache data to flash.

return: zero on success, else a negative error code.

3.2.9 sunxi_flash_spinor_download_spl

```
static int sunxi_flash_spinor_download_spl(unsigned char *buf, int len, unsigned int ext)
```

description: write boot0.

@buf: boot0 data buffer

@len: boot0 data len

@ext: storage type

return: zero on success, else a negative error code.

3.2.10 sunxi_flash_spinor_download_toc

```
static int sunxi_flash_spinor_download_toc(unsigned char *buf, int len,  unsigned int ext)
```

description: write uboot.

@buf: uboot data buffer

@len: uboot data len

@ext: storage type

return: zero on success, else a negative error code.

4 使用例子

4.1 访问 nor flash 接口介绍

4.1.1 BOOT0 读取数据

```
/* 头文件依赖 */
#include <arch/spinor.h>

int spinor_read(uint start, uint sector_cnt, void *buffer)
```

参数说明：

start：起始扇区，一个扇区等于 512byte

V853 快起方案我们约定好数据偏移 112 扇区（这个需要注意，要求 boot0 size 要小于 112 个扇区大小，即 56k）

sector_cnt：要读取的扇区数

V853 快起方案预留 4 个扇区给 ISP

buffer：存放数据的缓存

4.1.2 用户访问 flash

4.1.3 内核访问 flash

```
/* 头文件依赖 */
#include <linux/fs.h>
#include <linux/uaccess.h>

char part_name = "/dev/mtd0";
struct file *fp;
mm_segment_t fs;

fp = filp_open(part_name, 0_RDONLT, 0444);
if (IS_ERR(fp)) {
    printk("open %s error\n", part_name);
    return -1;
}
```

```
fs =get_fs();
set_fs(KERNEL_DS);

ret = vfs_read(fp, buf, len, pos);
ret = vfs_write(fp, buf, len, pos);

filp_close(fp, NULL);
set_fs(fs);
```

下面注意说明一下 vfs_write 接口

```
vfs_write(struct file *file, const char __user *buf, size_t count, loff_t *pos)
```

file：传入 filp_open 的返回值

buf：要写入的数据 buf

count：要写入的数据大小，byte 为单位

pos：要写入的数据偏移，byte 为单位

4.2 uboot shell 使用

4.2.1 sunxi_flash

mem_addr：内存地址，0x40000000 之后可以随便选取如：0x45000000，0x46000000

part_name：分区文件名，boot-resource、env、boot、rootfs

size：可以省略，默认读取整个分区文件

1. sunxi_flash read [size] 读取 flash 中的分区文件到内存中

例：使用 sunxi_flash read 命令将 boot 分区读入到 0x49000000 中，然后使用 md 命令读取 0x49000000 中的内容。

```
=> sunxi_flash read  0x49000000 boot
partinfo: name boot, start 0x2620, size 0x3c80
=> md 0x49000000
49000000: 52444e41 2144494f 003b52b0 40008000    ANDROID!.R;....@
49000010: 003cfac7 41000000 00000000 40f00000    ..<....A.......@
49000020: 40000100 00000800 00000000 00000000    ...@............
49000030: 386e7573 72615f69 0000006d 00000000    sun8i_arm.......
49000040: 00000000 00000000 00000000 00000000    ................
49000050: 00000000 00000000 00000000 00000000    ................
```

图 4-1：sunxi flash read

验证方法：

1. 0x49000000 读入前与读入后数据有没有发生变化
2. 在 **out/pack_out** 目录下找到对应的分区文件，使用 **hexdump -Cv boot.fex -n 500** 命令输出分区文件的数据，对比一致即读入成功。

```
guanyanfei@AwExdroid100:~/workspace/longanV853/out/pack_out$ hexdump -Cv boot.fex -n 500
00000000  41 4e 44 52 4f 49 44 21  b0 52 3b 00 00 80 00 40  |ANDROID!.R;....@|
00000010  c7 fa 3c 00 00 00 00 41  00 00 00 00 00 00 f0 40  |..<....A.......@|
00000020  00 01 00 40 00 08 00 00  00 00 00 00 00 00 00 00  |...@............|
00000030  73 75 6e 38 69 5f 61 72  6d 00 00 00 00 00 00 00  |sun8i_arm.......|
00000040  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000050  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000060  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
00000070  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  |................|
```

图 4-2: hexdump

2. sunxi_flash write [size] 将内存中的数据，写入到分区中

例：

1）使用 mm 命令修改内存内容

```
=> mm 0x44000000          修改内存中数据
44000000: fedcba98 ? 123
44000004: fedcba99 ? 456
44000008: fedcba9a ? 789
4400000c: fedcba9b ? ?    ? 退出编辑
=> md 0x44000000    查看内存
44000000: 00000123 00000456 00000789 fedcba9b    #...V...........  修改后数据
44000010: fedcba9c fedcba9d fedcba9e fedcba9f    ................
44000020: fedcbaa0 fedcbaa1 fedcbaa2 fedcbaa3    ................
44000030: fedcbaa4 fedcbaa5 fedcbaa6 fedcbaa7    ................
```

图 4-3: mm - md

2）使用 sunxi_flash write 0x44000000 env 将内存中的数据写入 env 分区

```
=> sunxi_flash  write  0x44000000  env
guanayfei::start: 0x2d00, len: 0x100
```

图 4-4: sunxi flash write

3）重新将 env 分区读入内存中，对比一致表示写入成功

```
=> sunxi_flash  read  0x45000000  env        读env分区
partinfo: name env, start 0x2520, size 0x100
=> md 45000000                                显示内存数据
45000000: 00000123 00000456 00000789 fedcba9b    #...V...........
45000010: fedcba9c fedcba9d fedcba9e fedcba9f    ................
45000020: fedcbaa0 fedcbaa1 fedcbaa2 fedcbaa3    ................
45000030: fedcbaa4 fedcbaa5 fedcbaa6 fedcbaa7    ................
```

图 4-5: sunxi flash read2

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