

华中科技大学
HUAZHONG UNIVERSITY OF SCIENCE AND TECHNOLOGY



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零阶段引导程序



Bouffalo loader

主讲人：董庆 朱俊星

Crossing this mountain, they will hear your story

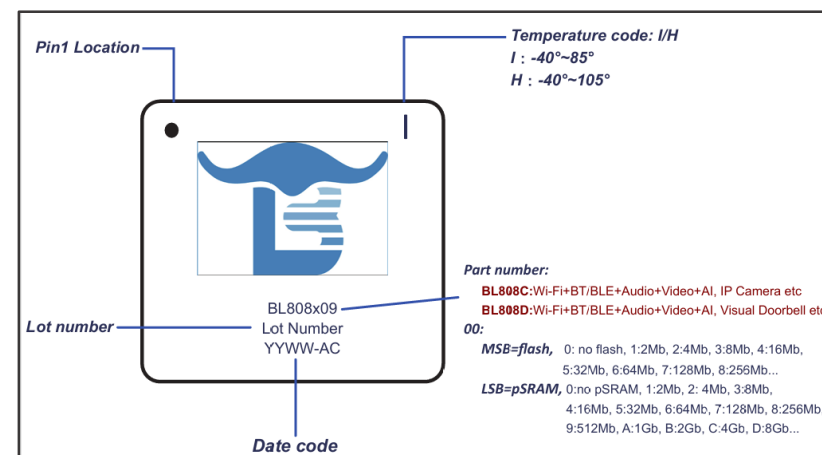


Bouffalo loader 简介



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Bouffalo loader是RustSBI社区为博流芯片设计的零阶段引导程序产品，早期它将支持BL808芯片。Bouffalo loader位于RISC-V芯片的M态，具有固件镜像头，可直接由ROM代码启动。





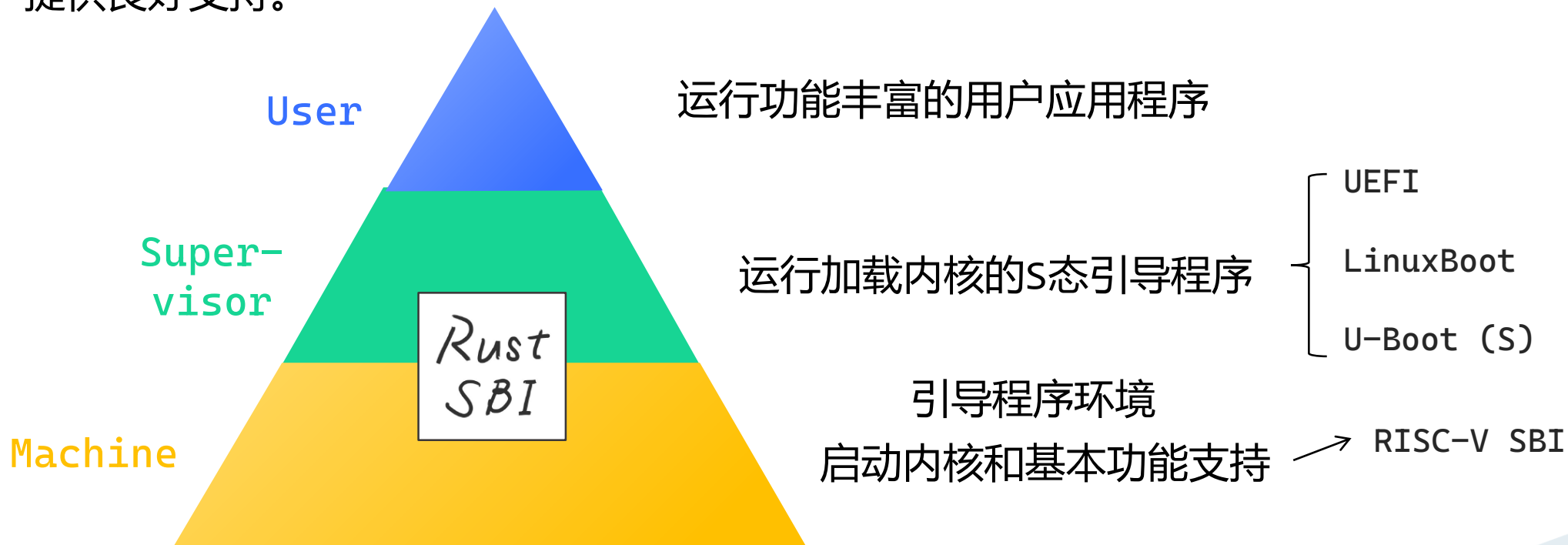
RISC-V生态与RustSBI



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SBI(Supervisor Binary Interface): RISC-V定义的一组规范, 用于在S态下的操作系统与运行在M态的系统固件(如引导程序)之间进行交互。

RustSBI: Rust实现的RISC-V SBI库, 可在M或HS模式下运行, 为嵌入式Rust生态系统提供良好支持。



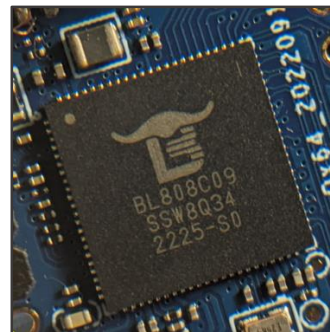


■ 三核异构RISC-V芯片

D0: T-Head C906 480MHz 64位RISC-V CPU

M0: T-Head E907 320MHz 32位RISC-V CPU

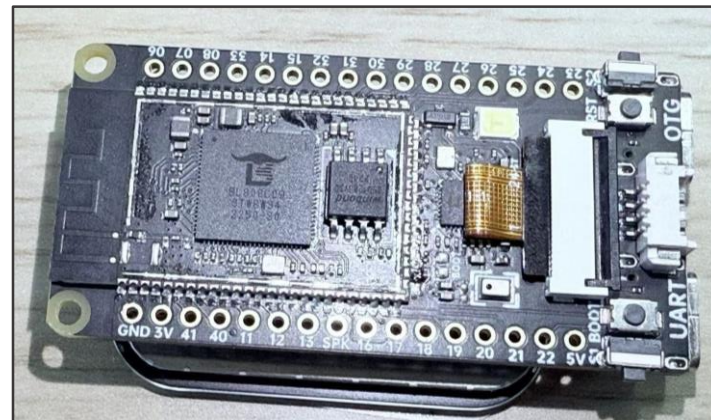
LP: T-Head E902 150MHz 32位RISC-V CPU



■ 部分固件调试

首先编译程序为单核固件，再融合三个固件为多核。单核固件可独立运行，易于按处理器核单独划分和调试

■ 开发板: Sipeed M1s Dock

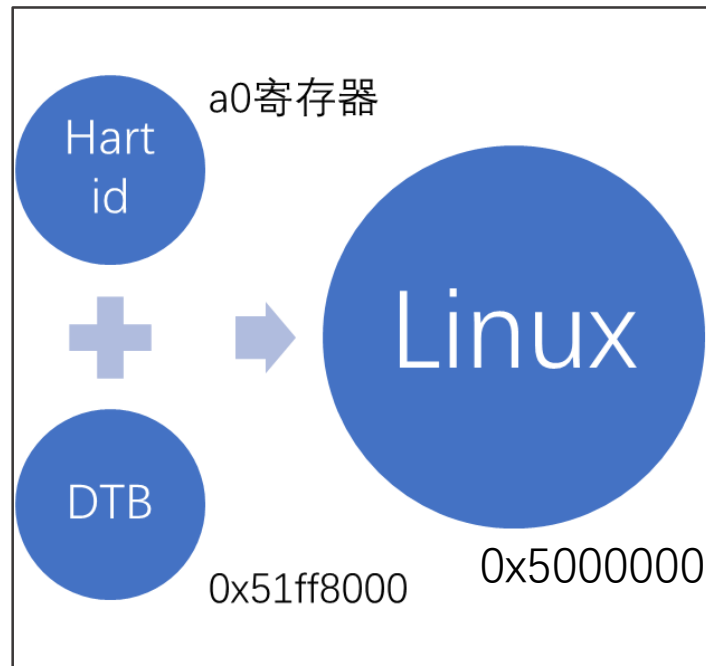
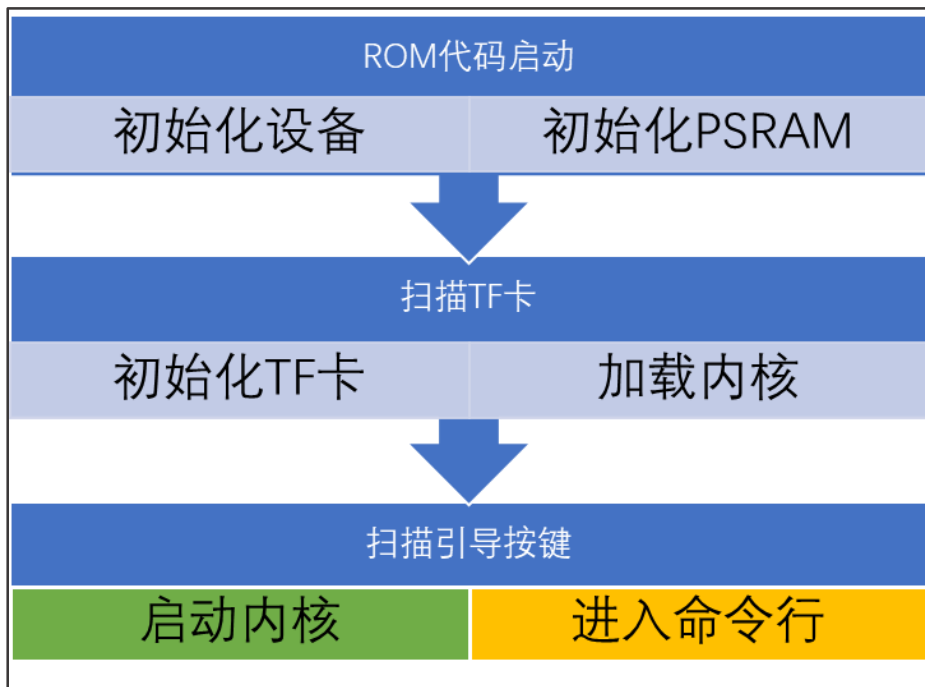




Buffalo设计与实现



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- 1) 初始化PSRAM内存
- 2) 启动Linux内核: 扫描TF卡, 加载DTB和bootargs.txt文件
- 3) 提供命令行界面, 支持引导程序的基本调试功能



Buffalo loader Cli



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- 1) print: 打印环境信息, 目前只需configs.bootargs变量信息
- 2) Bootargs get: 打印内存中的bootargs变量
- 3) Bootatgs set <arg>: 将内存中的bootargs变量设置为参数内容
- 4) Reload: 扫描TF卡并重新读取DTB和Image内核
- 5) Boot: 在M态启动Linux
- 6) Read <address>: 读取指定内存地址的数据
- 7) Write <address> <value>: 向指定内存地址写入数据值



ZhengLongBing commented

- reload: scan TF card and
- read <address> : read data from a specified address.
- write <address> <value> : write a value to a specified address



xiaobor123 commente

This PR implements the

print: Print the information about the configs.bootargs variable



Plucky923 commented 3 weeks ago

This PR implements the `bootargs` command, which has been tested and works fine.

The specific functions are as follows:



闭源走向开源：

- 以bouffaloader为代表的零阶段引导程序生态，会从目前的封闭为主走向开源为主

Bouffaloader启动各类RTOS和RustSBI等固件：

- 各个厂商的引导程序将在包含服务器、pc机、移动设备等不同场景下发挥作用

Bouffaloader作为信任根：

- 在系统启动的最初阶段建立安全基础。初始化硬件，设置安全启动流程，确保后续加载的软件是可信的。





开源项目维护



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提交信息指南：

- 一个优秀的提交应该只解决一个问题，即使只有一行代码
- 遵循项目的提交信息风格，确保提交信息一致
- 标题清晰简短，准确反映变更内容



The screenshot displays a commit history interface with the following entries:

- Commits on Nov 25, 2024**
 - `main: add reload, read and write commands in serial console for basic memory debug` (b160025) by ZhengLongBing and Placebo27, 3 weeks ago.
 - `build: add target configuration for "riscv64imac-unknown-none-elf"` by ZhengLongBing and Placebo27, 3 weeks ago.
- Commits on Nov 20, 2024**
 - `main: add run_payload function for booting linux` by Placebo27, committed last month.
- Commits on Nov 29, 2024**
 - `main: add print command in cli for boot debug` by xiaobor123 and Placebo27, committed 3 weeks ago.
- Commits on Nov 27, 2024**
 - `main: add boottrags command in cli for boot debug` by Plucky923 and Placebo27, committed 3 weeks ago.
 - `main: add boot command for linux kernel` by Placebo27, committed 3 weeks ago.
 - `psram: modify from psram initialization demo of buffalo-hal project` by ZhengLongBing and Placebo27, committed 3 weeks ago.
- Commits on Nov 17, 2024**
 - `main: implement the basic architecture of the project` by jakezhu9 and Placebo27, committed on Nov 17.
- Commits on Nov 2, 2024**
 - `main: add embedded-cli based serial command line console support` by Placebo27, committed on Nov 2.



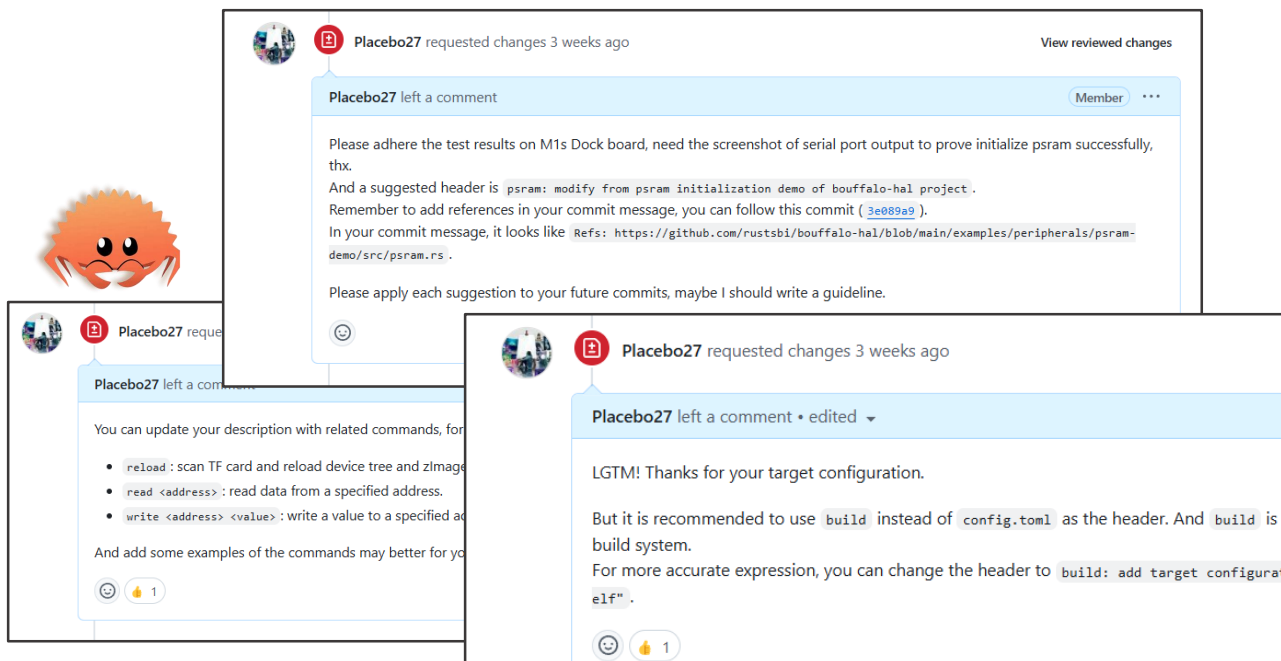
开源项目维护



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拉取请求审核:

- 真实环境测试于开发板和TF卡
- 给予审核意见
- 附带测试结果截图



Placebo27 requested changes 3 weeks ago

Placebo27 left a comment

Please adhere the test results on M1s Dock board, need the screenshot of serial port output to prove initialize psram successfully, thx.

And a suggested header is `psram: modify from psram initialization demo of buffalo-hal project`.

Remember to add references in your commit message, you can follow this commit ([3e089a9](#)).

In your commit message, it looks like Refs: <https://github.com/rustsbi/buffalo-hal/blob/main/examples/peripherals/psram-demo/src/psram.rs>.

Please apply each suggestion to your future commits, maybe I should write a guideline.

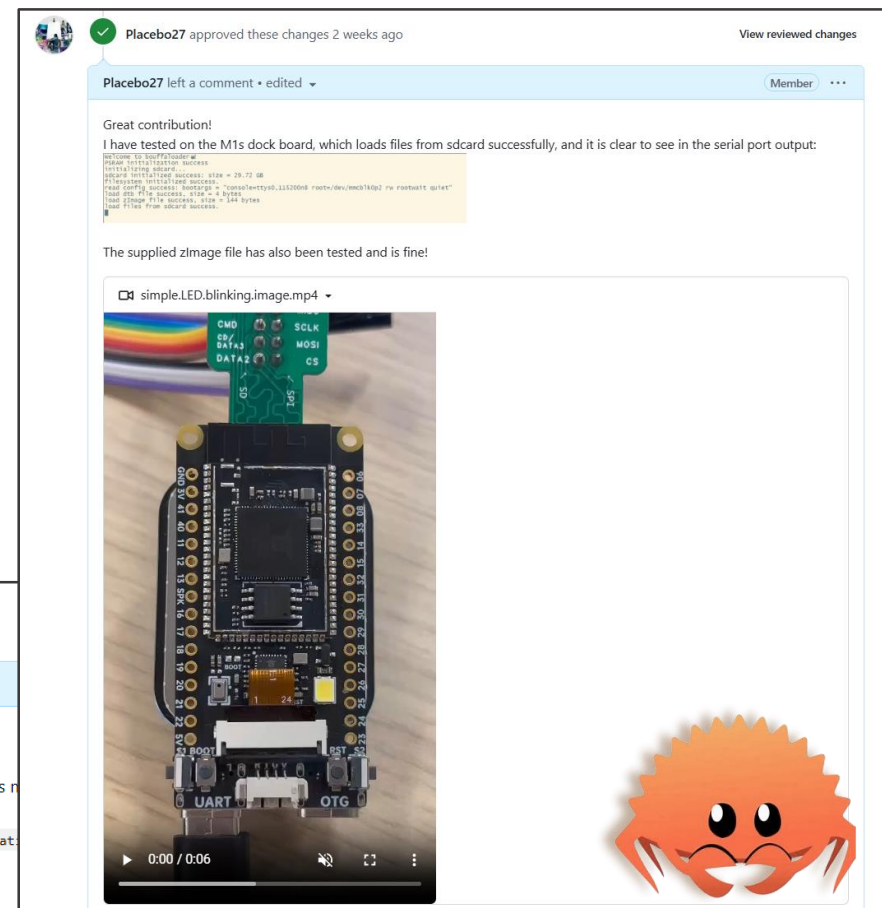
Placebo27 requested changes 3 weeks ago

Placebo27 left a comment • edited

LGTM! Thanks for your target configuration.

But it is recommended to use `build` instead of `config.toml` as the header. And `build` is not a build system.

For more accurate expression, you can change the header to `build: add target configuration`.



Placebo27 approved these changes 2 weeks ago

Placebo27 left a comment • edited


Great contribution!

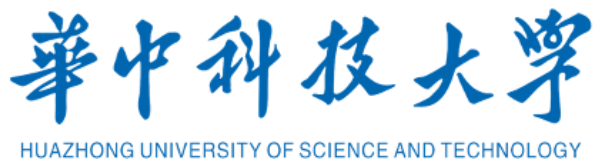
I have tested on the M1s dock board, which loads files from sdcard successfully, and it is clear to see in the serial port output:

```
booting to buffalo-hal...
psram initialization success
initializing board...
psram initialization success, size = 29.72 MB
psram initialization success
read config success: bootargs = "console=ttyS0,115200n8 root=/dev/mmcblk0p2 rw rootwait quiet"
load zImage success, size = 4 bytes
load zImage file success, size = 144 bytes
load first from second success.
```

The supplied zimage file has also been tested and is fine!

simple.LED.blinking.image.mp4





致谢

感谢指导老师：**付才老师，慕冬亮老师！**

感谢历次参与**开源工坊**的同学们和RustSBI社区的成员!

最后特别感谢洛佳（蒋周奇）对我的帮助和鼓励：@luojia65

Bouffaloader项目地址 (欢迎star!) :

<https://github.com/rustsbi/bouffaloader>

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