

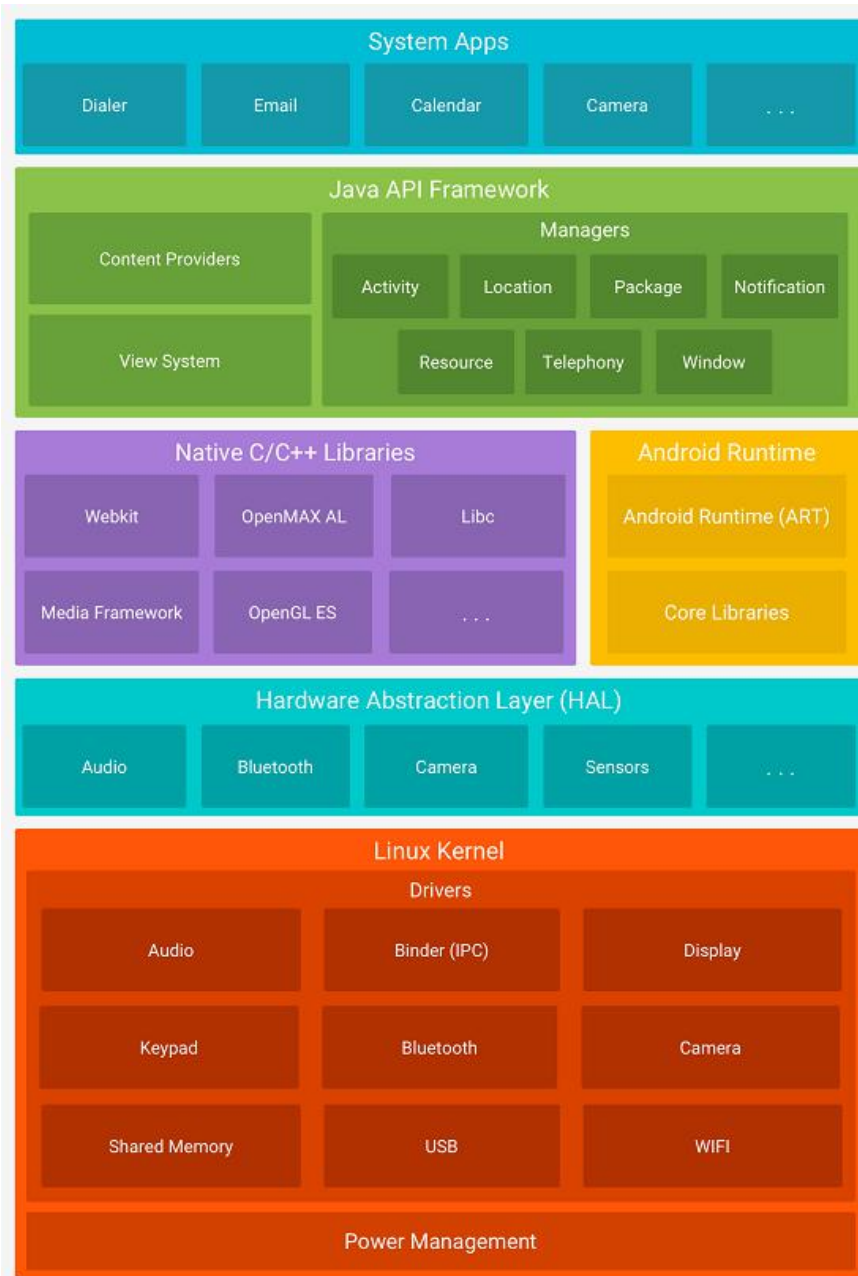


2021 AOSP RISC-V 社区开源进展报告

中科院软件所智能软件中心 PLCT 实验室 汪辰

- **2020 年 8 月**，中科院软件所 PLCT 实验室开始尝试基于 AOSP 10 实现 RISC-V 的移植工作并于 2020 年 12 月完成 bionic 的移植并实现了一个 第一个 RISC-V 上的 “Android 最小系统” (<https://zhuanlan.zhihu.com/p/302870095>) 。
- **2021 年 1 月**，阿里巴巴旗下的平头哥半导体 (T-Head) 成功将 AOSP 10 移植到自己的 RISC-V 芯片上，并开源部分代码，开源仓库地址在：<https://github.com/T-head-Semi/aosp-riscv> 。
- **2021 5 月 20 日**，RVI Android SIG 成立 - Han Mao (Alibaba), Zheng Zhang (Imagination) 担任 acting chairs . <https://lists.riscv.org/g/sig-android/message/1> 。
- **2021 7 月 20 日**，第一次 RVI Android SIG 会议，建立 RVI Android SIG 的官方主页 <https://lists.riscv.org/g/sig-android>，并制定了初步的开发任务列表：<https://lists.riscv.org/g/sig-android/message/5> 。
- **2021 10 月 20 日**，RVI Android SIG 的官方源码仓库建立，<https://github.com/riscv-android-src>。中科院软件所 PLCT 实验室同时宣布加入，并贡献了第一个 PR：https://github.com/riscv-android-src/toolchain-llvm_android/pull/1 。

AOSP RISC-V 移植现状



社区当前官方仓库地址: <https://github.com/riscv-android-src>, 该版本当前基于 AOSP 10, 主要修改涉及:

- **工具链**: gcc; clang-tools
- **内核**: linux
- **模拟器**: emulator/qemu
- **核心库**: bionic; ndk; vndk
- **文件系统**: system/apex; system/core; system/libxxx.....
- **Framework**: frameworks/av; frameworks/base; frameworks/native;
- **构建系统**: build/make; build/soong
- **其他**: cts (Compatibility Test Suite)

AOSP RISC-V 移植现状

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u@u18:~/ws/aosp-thead-10/aosp-riscv/aosp\$ export ANDROID_PRODUCT_OUT="/home/u/ws/aosp-thead-10/aosp-riscv/aosp/out/target/product/generic_riscv64"

u@u18:~/ws/aosp-thead-10/aosp-riscv/aosp\$ emulator -shell -selinux permissive -qemu -smp 2 -m 3800M -bios /home/u/ws/aosp-thead-10/aosp-riscv/aosp/p

rebuilds/qemu-kernel/riscv64/ranchu/fw_jump.bin

emulator: WARNING: encryption is off

kernel@80200000, initrd@88200000

qemu-system-riscv64: plic: invalid register write: 000001fc

OpenSBI v0.7-3-g6585fab

OpenSBI

Platform Name : QEMU Virt Machine

Platform HART Features : RV64ACDFMSU

Current Hart : 0

Firmware Base : 0x80000000

Firmware Size : 128 KB

Runtime SBI Version : 0.2

MIDELEG : 0x0000000000000222

MEDELEG : 0x0000000000000b109

PMP0 : 0x0000000000000000-0x0000000000000000

PMP1 : 0x0000000000000000-0xffffffffffffffff

emulator: ERROR: AdbHostServer.cpp:102: Unable to

qemu-system-riscv64: plic: invalid register read

qemu-system-riscv64: plic: invalid register write

qemu-system-riscv64: plic: invalid register read

qemu-system-riscv64: plic: invalid register write

[0.000000] OF: fdt: Ignoring memory range 0x0

[0.000000] Linux version 5.4.48-00598-g1457c

11.0.3 (https://android.googlesource.com/toolcha

lvm-project/lll cc96790d85f5928e236eb3158491a2bc8

[0.000000] Initial ramdisk at: 0x(____ptrval)

[0.000000] Zone ranges:

[0.000000] DMA32 [mem 0x0000000000000000-0x0000000000000000]

[0.000000] Normal [mem 0x0000000000000000-0x0000000000000000]

[0.000000] Movable zone start for each node

[0.000000] Early memory node ranges

[0.000000] node 0: [mem 0x0000000000000000-0x0000000000000000]

[0.000000] Initmem setup node 0 [mem 0x0000000000000000-0x0000000000000000]

[0.000000] software IO TLB: mapped [mem 0xfbf

[0.000000] elf_hwcap is 0x112d

[0.000000] percpu: Embedded 26 pages/cpu s67

console:/ \$ ls -l

ls -l

total 132

dr-xr-xr-x 24 root root 0 1970-01-01 00:00 acct

drwxr-xr-x 14 root root 280 1970-01-01 00:00 apex

lrw-r--r-- 1 root root 11 2021-10-08 06:53 bin -> /system/bin

lrw-r--r-- 1 root root 50 2021-10-08 06:53 bugreports -> /data

drwxrwx--- 2 system cache 4096 2021-10-08 06:12 cache

lrw-r--r-- 1 root root 19 2021-10-08 06:53 charger -> /system/

drwxr-xr-x 3 root root 0 1970-01-01 00:00 config

lrw-r--r-- 1 root root 17 2021-10-08 06:53 d -> /sys/kernel/de

drwxrwx--x 42 system system 4096 1970-01-01 00:00 data

drwxr-xr-x 2 root root 4096 2021-10-08 06:12 debug_ramdisk

lrw----- 1 root root 23 2021-10-08 06:53 default.prop -> sys

drwxr-xr-x 17 root root 2860 1970-01-01 00:00 dev

lrw-r--r-- 1 root root 11 2021-10-08 06:53 etc -> /system/etc

lrwxr-x--- 1 root shell 16 2021-10-08 06:53 init -> /system/bin

lrwxr-x--- 1 root shell 1653 2021-10-08 06:12 init.environ.rc

lrwxr-x--- 1 root shell 33632 2021-10-08 06:36 init.rc

lrwxr-x--- 1 root shell 7690 2021-10-08 06:35 init.usb.configfs.r

lrwxr-x--- 1 root shell 5649 2021-10-08 06:35 init.usb.rc

lrwxr-x--- 1 root shell 563 2021-10-08 06:35 init.zygote32.rc

lrwxr-x--- 1 root shell 959 2021-10-08 06:35 init.zygote32_64.rc

lrwxr-x--- 1 root shell 981 2021-10-08 06:35 init.zygote64_32.rc

drwx----- 2 root root 16384 2021-10-08 06:53 lost+found

drwxr-xr-x 2 root root 4096 2021-10-08 06:12 metadata

drwxr-xr-x 12 root system 260 1970-01-01 00:00 mnt

drwxr-xr-x 2 root root 4096 2021-10-08 06:12 odm

drwxr-xr-x 2 root root 4096 2021-10-08 06:12 oem

dr-xr-xr-x 121 root root 0 1970-01-01 00:00 proc

lrw-r--r-- 1 root root 15 2021-10-08 06:53 product -> /system/

lrw-r--r-- 1 root root 24 2021-10-08 06:53 product_services ->

drwxr-xr-x 3 root root 4096 2021-10-08 06:36 res

drwxr-x--- 2 root shell 4096 2021-10-08 06:12/sbin

lrw-r--r-- 1 root root 21 2021-10-08 06:53 sdcard -> /storage/

drwxr-xr-x 3 root root 60 1970-01-01 00:00 storage

dr-xr-xr-x 12 root root 0 1970-01-01 00:00 sys

drwxr-xr-x 13 root root 4096 2021-10-08 06:53 system

lrw-r--r-- 1 root root 2608 2021-10-08 06:12 ueventd.rc

drwxr-xr-x 8 root root 4096 2021-10-08 06:36 vendor

console:/ \$

Android Emulator - <build>:5554

ot1' fo

Search

Email

Phone

App Drawer

Home

Back

Recent Apps

Power

Volume

Rotation

Camera

Microphone

Headset

Bluetooth

Wi-Fi

Mobile Data

Settings

Notifications

App Store

Play Store

Google

YouTube

Maps

Gmail

Calendar

Contacts

Messages

Browser

Music

Photos

Files

Weather

News

Sports

Finance

Health

Education

Tools

Utilities

Security

Privacy

Accessibility

Developer Options

System Updates

Device Health

Security Center

Parental Controls

Screen Time

App Management

System Settings

Device Settings

Network Settings

Storage Settings

Display Settings

Sound Settings

Accessibility Settings

Developer Settings

System Settings

Device Settings

Network Settings

Storage Settings

Display Settings

Sound Settings

Accessibility Settings

Developer Settings

AOSP RISC-V 移植计划

Item	Current Owner
github setup and init	
Android 10 RISC-V code repositories in github	Mao Han
Android 12 RISC-V upgrade and basic boot	Chen guoyin
Chrome browser with V8	Liang yuning Xia Lifang
bionic optimization	
art optimization	
Audio libs optimization :libaudioprocessing, libaudioeffect, mp3dec, aac, flac, libopus, amrwb, amrnb, sbc and etc	
Image libs optimization :libjpeg-turbo, libpng, libvpx, skia, swiftshader and etc	
Graphics libs enablement and optimization: skia, libyuv, swiftshader, angle and etc	
Video libs optimization: libavc, libhevc, libaom, m4v_h263, libmpeg2 and etc	
Neural network enablement and optimization: <ul style="list-style-type: none">• float16 in clang• software nn optimization• tflite build with ndk	
misc libs optimization: boringssl, lzma, pdfium, and etc	

谢 谢

欢迎交流合作