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# Enabling RISC-V Support in Android

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## Status of Android on RISC-V

**Android can build and run in an emulator using the same mechanisms as any other platform.**

- Android Common Kernel is now on 6.6
- Vector crypto, bit manipulation (Zba/b/s) landed, Vector in progress
- NDK canaries are available
- Cuttlefish now uses QEMU 8.1 with vector
- GFXStream support added for better local graphics performance
- Work is ongoing to land performance optimizations upstream first for various libraries





## ***What's up with the Android ABI???***

The short answer: it's still a work in progress.

There are some important decisions in the extension space that have not converged on a consensus yet, so we don't want to lock in an ABI too soon.

***The long answer....***



Supported ABI will be added to the CDD list per top-right (“riscv64”, with no 32-bit equivalent); Will be linked to the descriptive text in the NDK Supported ABIs.

- All “supported instruction sets” will be a **combination** of
  - A RISC-V profile (still probably RVA22)
  - Ratified extensions (probably vector + vector crypto)
  - Intentional omissions: SIMD, Scalar Crypto

Will require Android-compatible devices to be **conforming** hardware

- Must correctly implement the RISC-V ISA
- Must not misuse elements of the encoding space reserved for future extensions

Android will only support ratified RISC-V extensions.

- [C-0-3] MUST be source-compatible (i.e. header-compatible) and binary-compatible (for the ABI) with each required library in the list below.
- [C-0-5] MUST accurately report the native Application Binary Interface (ABI) supported by the device, via the `android.os.Build.SUPPORTED_ABIS`, `android.os.Build.SUPPORTED_32_BIT_ABIS`, and `android.os.Build.SUPPORTED_64_BIT_ABIS` parameters, each a comma separated list of ABIs ordered from the most to the least preferred one.
- [C-0-6] MUST report, via the above parameters, a subset of the following list of ABIs and MUST NOT report any ABI not on the list.
  - `armeabi` (no longer supported as a target by the NDK)
  - `armeabi-v7a`
  - `arm64-v8a`
  - `x86`
  - `x86_64`
- [C-0-7] MUST make all the following libraries, providing native APIs, available to apps that include native code:

Supported ABIs		
Table 1. ABIs and supported instruction sets.		
ABI	Supported Instruction Sets	Notes
armeabi-v7a	<ul style="list-style-type: none"><li>• armeabi</li><li>• Thumb-2</li><li>• VFPv3-D16</li></ul>	Incompatible with ARMv5/v6 devices.
arm64-v8a	<ul style="list-style-type: none"><li>• AArch64</li></ul>	
x86	<ul style="list-style-type: none"><li>• x86 (IA-32)</li><li>• MMX</li><li>• SSE/2/3</li><li>• SSSE3</li></ul>	No support for MOVBE or SSE4.
x86_64	<ul style="list-style-type: none"><li>• x86-64</li><li>• MMX</li><li>• SSE/2/3</li><li>• SSSE3</li><li>• SSE4.1, 4.2</li><li>• POPCNT</li></ul>	





Interesting boards are starting to become available now.

- Example: [Kendryte K230](#) which supports Vector 1.0  
(Useful for library work but not to run Android)

More boards are on the horizon in 2024;  
RISE is working on a board farm for developers to use for testing.



## How to participate

- Visit <https://github.com/google/android-riscv64>
  - Try it out
  - Check out the [issues list](#)
  - Check out this [Google Open Source Blog post](#) for more info
- For RISC-V generally:
  - Subscribe to the Android SIG mailing list: <https://lists.riscv.org/g/sig-android>
  - Check out RISE: <https://riseproject.dev>
    - The [wiki](#) has more info on the working groups
  - Also: help your favorite open source project optimize for RISC-V
    - QEMU improvement in particular will help everyone





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# Q&A