

Cloud-Based Binary Artifactory for RISC-V Software

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Abstract

As the RISC-V ISA evolves with new extensions, optimizing its software ecosystem is crucial. Unlike ARM and x86, where precompiled binaries for popular applications and libraries are widely available, RISC-V developers often need to build software from source due to missing dependencies. A centralized, cloud-based application store can address this gap by providing readily available, up-to-date binaries. Leveraging RISC-V cloud computing platforms like Cloud-V, automated CI pipelines can execute scheduled builds, ensuring the latest versions of applications are compiled and stored in the cloud. Some of the application types that are included in the build system are Linux essentials, build tools, compilers, and CI runner packages. This approach streamlines development, reducing the time and effort required to find or manually compile software.

Background

As RISC-V hardware matures, the need for optimized software grows. Applications available on ARM and x86 should also be accessible on RISC-V, but porting them can be challenging due to the unavailability of the compiled dependencies and development tools on the internet. These obstacles hinder adoption, limiting the ecosystem's growth and usability.

Currently, software maintainers host standalone binaries and OS-specific packages on their download pages, allowing users to access the latest versions. However, the RISC-V software ecosystem is still developing, and only a few maintainers provide official RISC-V builds. As a result, developers often need to compile dependencies and essential tools from source, adding unnecessary time and effort to their workflow. A centralized, cloud-based application store is needed to address this, offering readily available binaries for most applications. This would enable developers to quickly access the necessary software, eliminating the hassle of searching for compatible builds or compiling from source, ultimately accelerating RISC-V adoption in the software community.

What is Cloud-V

Cloud-V is a vendor-agnostic RISC-V cloud computing platform designed to provide developers with access to a diverse range of physical and emulated RISC-V compute instances. These instances include the latest and most recently released RISC-V hardware such as the Milk-V Pioneer Box, VisionFive 1 and 2, and Milk-V Jupiter, alongside fully configurable QEMU-based virtual machines supporting all ratified RISC-V extensions. By offering a flexible and scalable environment, Cloud-V enables developers to test, optimize,

and deploy software across various RISC-V architecture without requiring local hardware. This platform plays a crucial role in accelerating the adoption and development of the RISC-V ecosystem by simplifying software validation, cross-platform compatibility testing, and continuous integration workflows.

RISC-V cloud-based application store

A cloud-based application store or artifact repository is online cloud storage where all the application binaries are stored for a specific architecture or computer. The RISC-V cloud-based application store under discussion works in such a way that there are the latest versions of all the applications that are available on the cloud.

It consists of a continuous-integration web server (such as Jenkins) that employs RISC-V compute instances as slave agents to build the open-source software from version control systems such as GitHub, GitLab, and Savannah at 15 or 30-day intervals. The log of the application compile process is available on the CI dashboard and the scripts for building the applications are available in an open-source repository. This ensures that the whole build process for each open-source application is transparent to the developers. Developers no longer need to compile the software manually, reducing setup time and effort. They just have to visit the cloud store, download the tarball of the binaries, and add them to the environment. Newly ported software applications are incorporated into the regular build process, ensuring up-to-date availability.

Workflow and Integration

The RISC-V compute instances in Cloud-V run Linux and support both continuous integration (CI) pipelines and remote development via SSH access. These compute instances allow developers to compile, test, and optimize RISC-V applications in a cloud-based environment without requiring physical hardware. The CI platform assigns these instances as worker nodes, scheduling automated build pipelines that efficiently compile software. Once built, binaries are seamlessly transferred to publicly accessible cloud storage, ensuring easy access and distribution. This cloud-based approach streamlines development, automates software maintenance, and eliminates the need for manual intervention to maintain up-to-date RISC-V software. This setup is managed by the administrator of the Cloud-V and new CI builds for RISC-V or pipelines can be added free of cost by contacting the Cloud-V administrator at <https://cloud-v.co>.

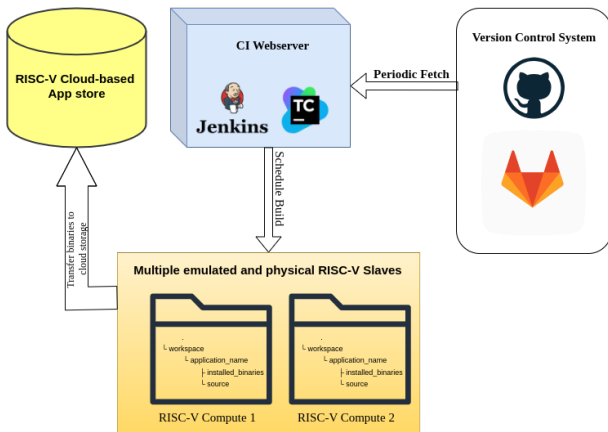


Figure 1: *RISC-V automated builds workflow*

How Can It Drive Greater Adoption of the RISC-V ISA?

Making RISC-V applications easily accessible to developers and general users will accelerate its adoption in the market. As software availability improves, more individuals and organizations will adopt RISC-V-based systems, creating a positive feedback loop that encourages further software porting. This expanding ecosystem will enhance RISC-V's competitiveness against established architectures like ARM and x86, driving industry acceptance and long-term growth.

Available Software

Following are some of the software available as of February 04, 2025.

Package Name	Package Version
cmake	3.31
coreutils	Built on Jan 19, 2025
rust	1.86.0
cpython	3.14.0a4+
go	1.24
gcc	15.0.1
nodejs	24.0.0-pre
Openjdk-jdk	25-internal
Gitlab CI runner package	17.8.1

Conclusion

A cloud-based application store for RISC-V tackles one of the ecosystem's biggest challenges — software availability. By leveraging automated CI pipelines on Cloud-V, developers gain seamless access to pre-compiled binaries, eliminating the need for manual compilation and dependency resolution. This accelerates software development, simplifies onboarding for new users, and ensures consistency across different RISC-V environments. Beyond accessibility, a centralized cloud repository enhances maintainability, security, and long-term support by providing verified and regularly updated binaries. Developers can retrieve software via a web interface, CLI, or API, integrating seamlessly into various workflows. As more applications are integrated into the cloud repository, the RISC-V ecosystem will continue to mature, making it a more viable and competitive alternative to established architectures like ARM and x86.

References and Links

RISC-V Software Resources Page
Cloud Storage
CI Build Status Dashboard
GitHub repository
Cloud-V Page