

RISC-V64 and Python

- Many Python projects include compiled code, but **riscv64** is not commonly supported (**yet**)
- This means that only pure Python "wheels" from **PyPI** can be used
- **Compiling** from scratch is **challenging/time-consuming** for end-users
- **Example:** building recent **NumPy** on **VisionFive 2** running **Ubuntu 24.04.1 LTS: 20 minutes** - many other modules require this!

Goals

1. Lay groundwork for default **riscv64 support** - Compatibility testing, bug reporting upstream, etc.
2. Enable **deep learning/LLM projects** by supporting modules like **pytorch**, **scikit-learn**, **vllm**

Some of the tools we are using (with modifications) include:

- **auditwheel**, **cibuildwheel**, **manylinux** (customized), and **maturin**
- **qemu-user-static** to help run **riscv64 container images** on **x86_64** systems
- **GitLab CI** pipelines, (usually based on the upstream equivalents)

Challenges

Some **obstacles** we encounter are:

- **Long build times:** Iterative development/test is also slow
- **Limited hardware:** Rely on emulation, extra layer of effort
- **Multiple Pythons:** Big test matrix
- **Bespoke Builds:** Each package requires a distinct solution

Three complexity levels for packages:

1. **Easy:** Add new version(s) in CI
2. **Medium:** Adjust custom patches, build environment (dependencies)
3. **Hard:** Major CI overhaul/manual test analysis/upstream work needed

RISE's Support Process

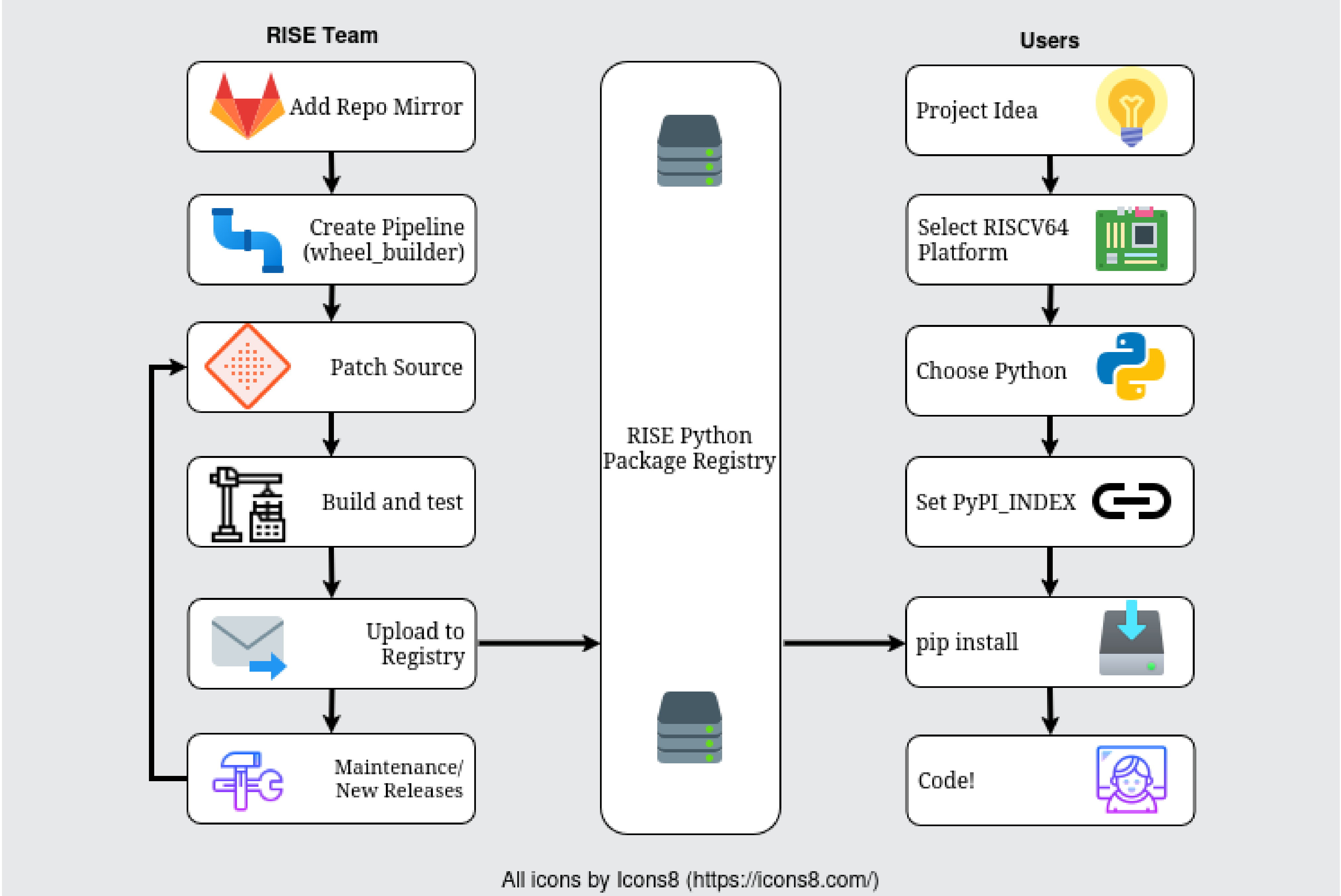


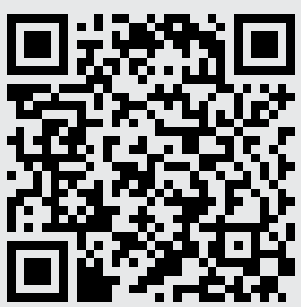
Figure 1: RISE Process vs RISC-V64 Python User Experience

Wheels for RISC-V64: The wheel_builder Repository

| Package | Rank | Package | Rank |
|---------------------------|------|------------------|------|
| charset-normalizer | 1 | sqlalchemy | 16 |
| numpy | 2 | frozenset | 17 |
| pyyaml | 3 | grpcio | 18 |
| cryptography | 4 | greenlet | 19 |
| cff | 5 | pillow | 20 |
| protobuf* | 6 | propcache | 21 |
| pandas | 7 | scipy | 22 |
| markupsafe | 8 | rpds-py | 23 |
| aiohttp* | 9 | pynacl | 24 |
| pydantic-core | 10 | lxml | 25 |
| wrapt | 11 | msgpack | 26 |
| pyarrow* | 12 | coverage | 27 |
| yaml | 13 | psycpg2-binary | 28 |
| psutil | 14 | regex | 29 |
| multidict | 15 | bcrypt | 30 |

Table 1: Top 30 PyPI Packages for Python 3.10, March 2025

- **Bold:** currently supported; asterisks (*): **planned**
- Many others supported/planned, e.g. **nh3**, **uv**, **contourpy**, **tornado**, **numba**, **sentencepiece**, and more
- Currently supports **Python 3.10, 3.11, 3.12, 3.13**
- Full package list and project documentation can be found at:



Acknowledgements

We would like to thank the RISE Project for sponsoring this work, along with the countless upstream project maintainers whose combined efforts have served as the baseline for us to take the next step with Python support for riscv64 platforms.



wheel_builder



RISE Project