
Los Alamos
NATIONAL LABORATORY
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LA-UR-25-28195
ROSY Submission ID: #88f75a72

Optimizing Shared Programming Environments on Tri-lab HPC Resources: Standardizing Uenv

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8/7/25

Motivation

“The Cray Programming Environment is like an onion. It has layers, and you cry when opening it.”

- Almond Heil and Ever Dominquez (SI 2024)

- Significant problems maintaining Cray Programming Environment (CPE).
- Spack is poorly utilized in the Tri-lab Computing Environment (TCE).
- Can’t “break” a piece of software once it’s been built.
- Modular workflow for users.
- Can be deployed on bare metal, *as* a container, or *inside* an existing container.

Tri-lab Computing Environment (TCE)/Cray Programming Environment (CPE)

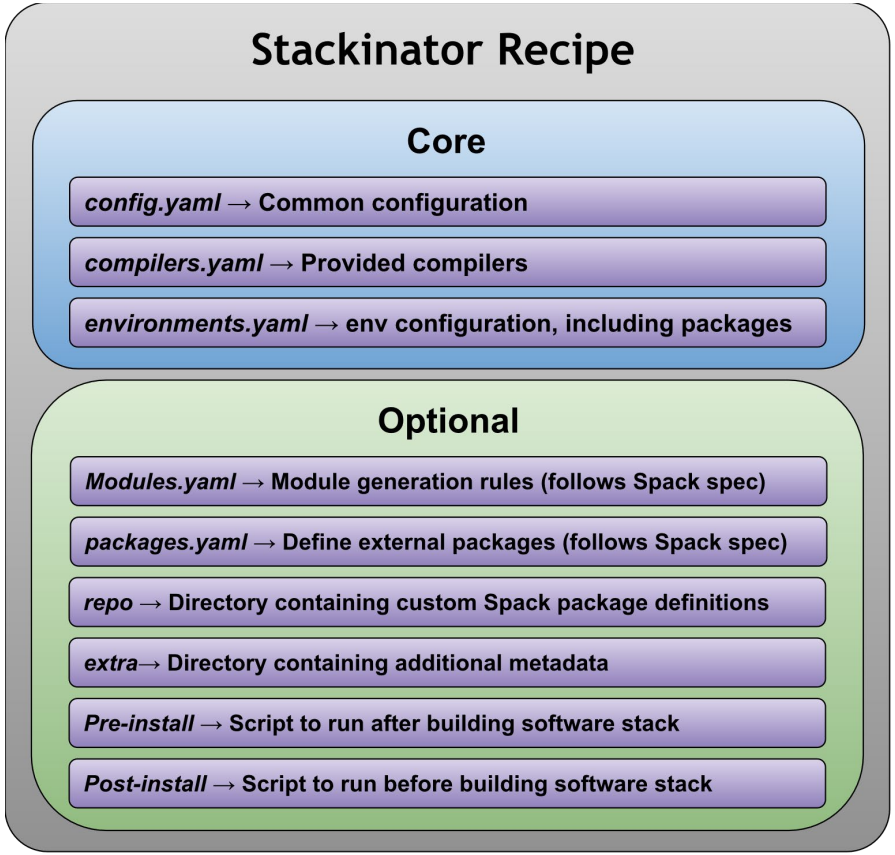
What is Uenv?

- User environments containing scientific software stacks (applications, libraries, and tools).
- Pseudo-containerized.
- A single Squashfs file (compressed directory tree).
- Builds using Stackinator.
- Stored inside a shared OCI (Open Container Initivate) artifact registry.
- Deployed using Squashfs-mount.

Stackinator

- Builds Spack software stacks from a YAML “recipe”.
- Similar functionality to LANL’s TCE scripts
- Generates the Spack configs and make files.
- Outputs a single Squashfs file containing the stack and its meta data.
- Minimal Core Components.

Spack



HIGH PERFORMANCE COMPUTING

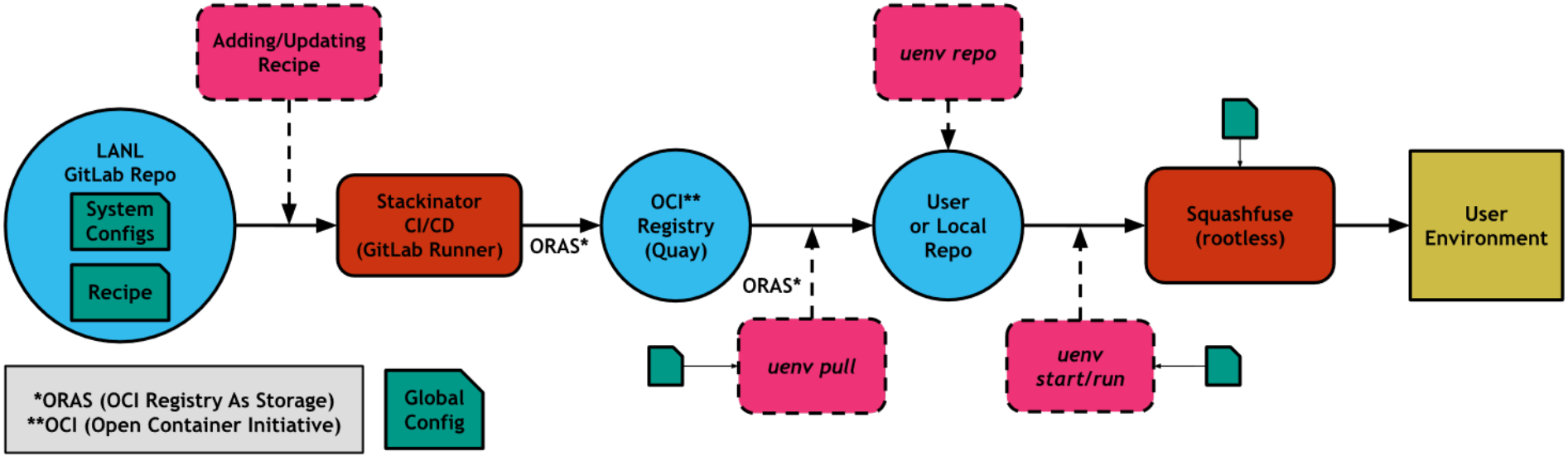
Standardizing Uenv

```
auto cicd_endpoint = fmt::format("https://cicd-ext-mw.cscs.ch/ci/uenv/build"
                                 "?{}",
                                 fmt::join(vars, "&"));
auto res = util::curl::upload(cicd_endpoint, recipe_tar_path);
```

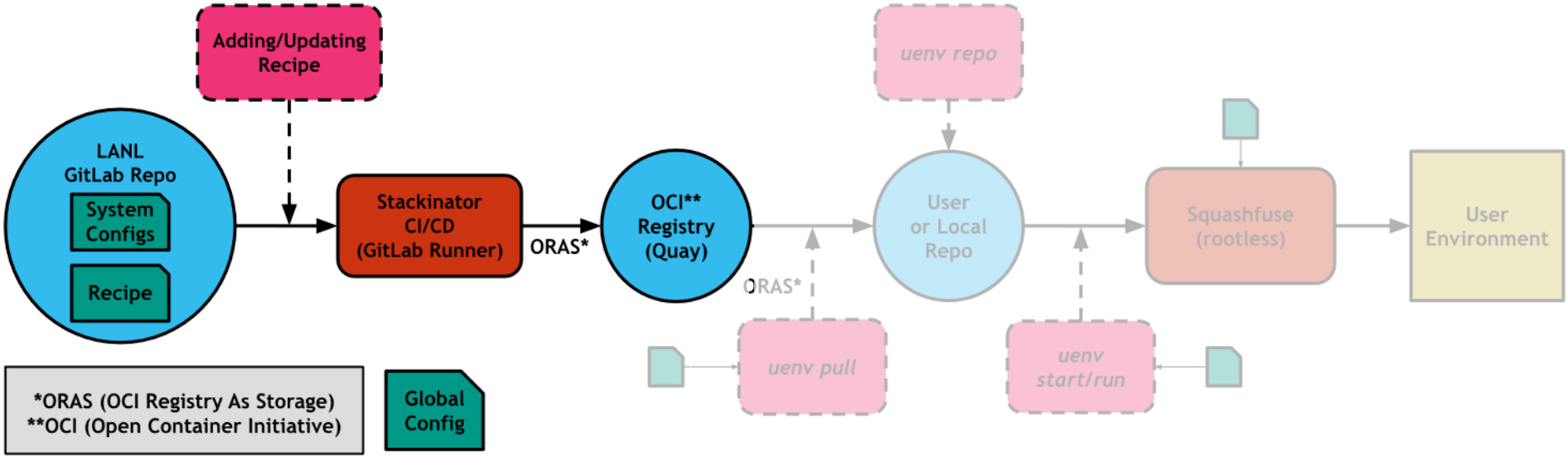
```
const auto url =
    fmt::format("https://uenv-list.svc.cscs.ch/list?namespace={}", nspace);
spdlog::debug("registry_listing: {}", url);
```

```
for (auto& record : *matches) {
    auto url = fmt::format(
        "https://jfrog.svc.cscs.ch/artifactory/uenv/{}/{}/{}/{}/{}/{}",
        nspace, record.system, record.uarch, record.name, record.version,
        record.tag);
```

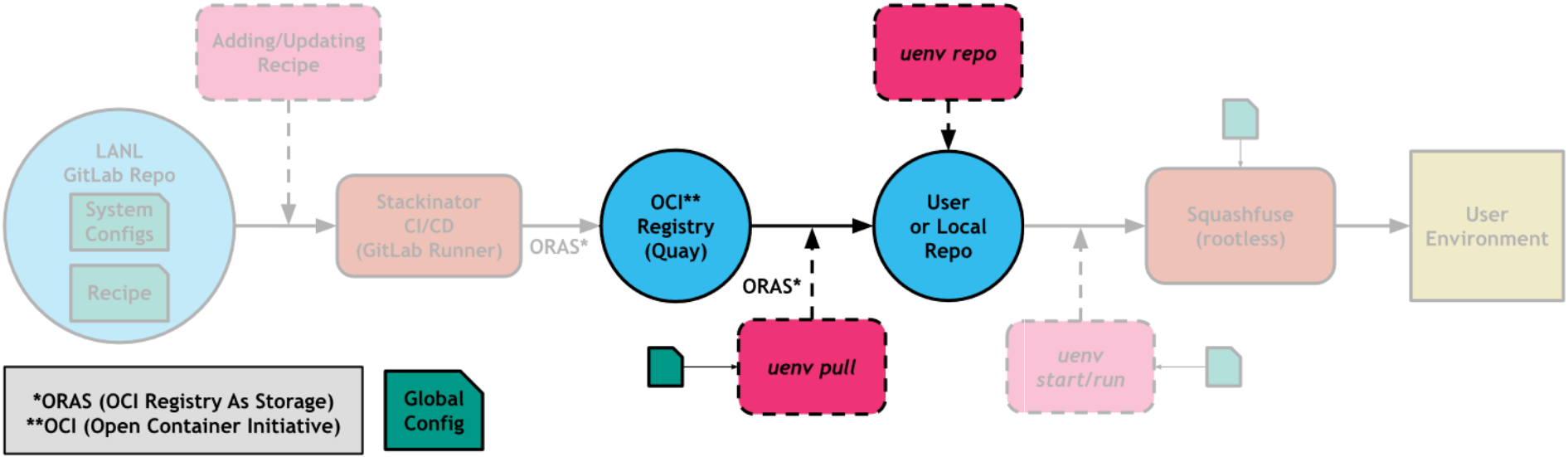
Standardizing Uenv



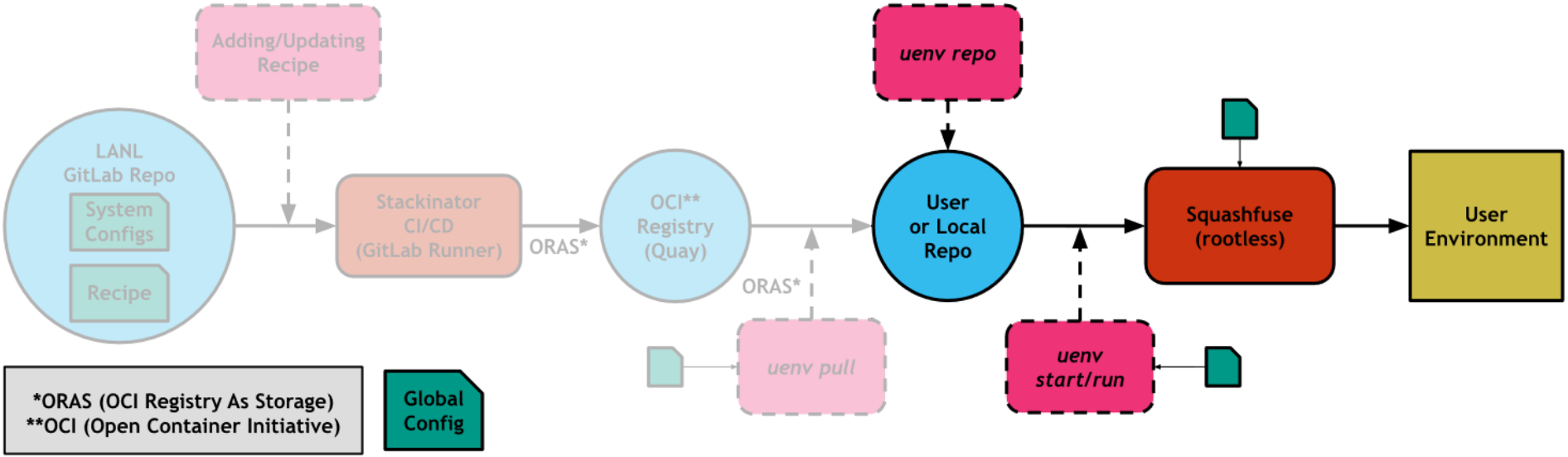
Standardizing Uenv – Building



Standardizing Uenv – Storing



Standardizing Uenv – Deploying



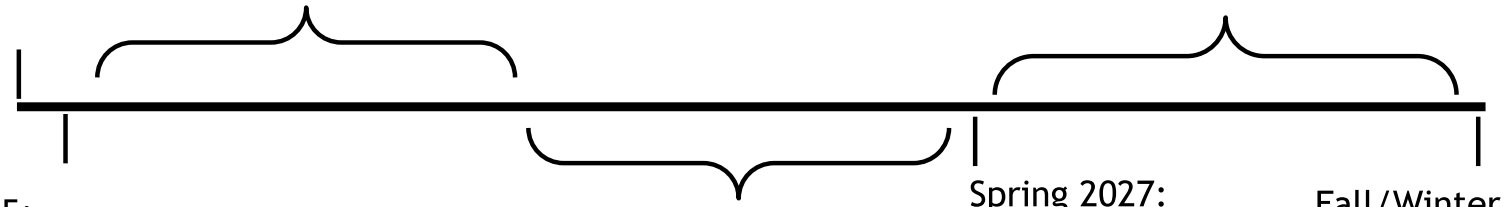
Future Work

Theoretical Timeline:

June 2025:
LANL Uenv proof of concept developed.

Fall 2025 - Summer 2026:
Continued development of and deployment of Uenv in production alongside TCE.

Summer/Fall 2027:
Standing up ATS-5. Deploying Uenv into production.



July 2025:
Development starts on standardizing Uenv for use in production on LANL HPC Resources

Fall 2026 - Spring 2027:
Uenv in production with TCE. Users get acquainted and are able to provide feedback.

Spring 2027:
ATS-5 hardware arrives.

Fall/Winter 2027:
ATS-5 released to Tri-lab users. Uenv deployed as primary programming environment.

Collaboration

Swiss National Supercomputing Center (CSCS):

- Working with Uenv developers to implement features that improve accessibility.

National Nuclear Security Administration (NNSA) Tri-labs:

- Los Alamos National Laboratory (LANL), Lawerence Livermore National Laboratory (LLNL), and Sandia National Lab (SNL).
- Collaborating with HPC teams at the Tri-labs to eventually replace CPE/TCE with Uenv

CSCS
Centro Svizzero di Calcolo Scientifico
Swiss National Supercomputing Centre

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Lawrence Livermore
National Laboratory

HIGH PERFORMANCE COMPUTING

Questions?

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Come talk to me at the poster session!

Citations

CSCS Logo
LLNL Logo
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Spack Logo
Cray Logo