CI for ASAP Applications: Using Github Actions for Rapid Development

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Motivation

What is CI:

- Continuous Integration (CI) refers to the process of automatically building and testing code every time a team member commits changes to version control system.

Life without CI:

- Integration Hell
- Late Bug Detection
- Slow Feedback Loop
- Unclear Understanding of Project State
- Slow Delivery

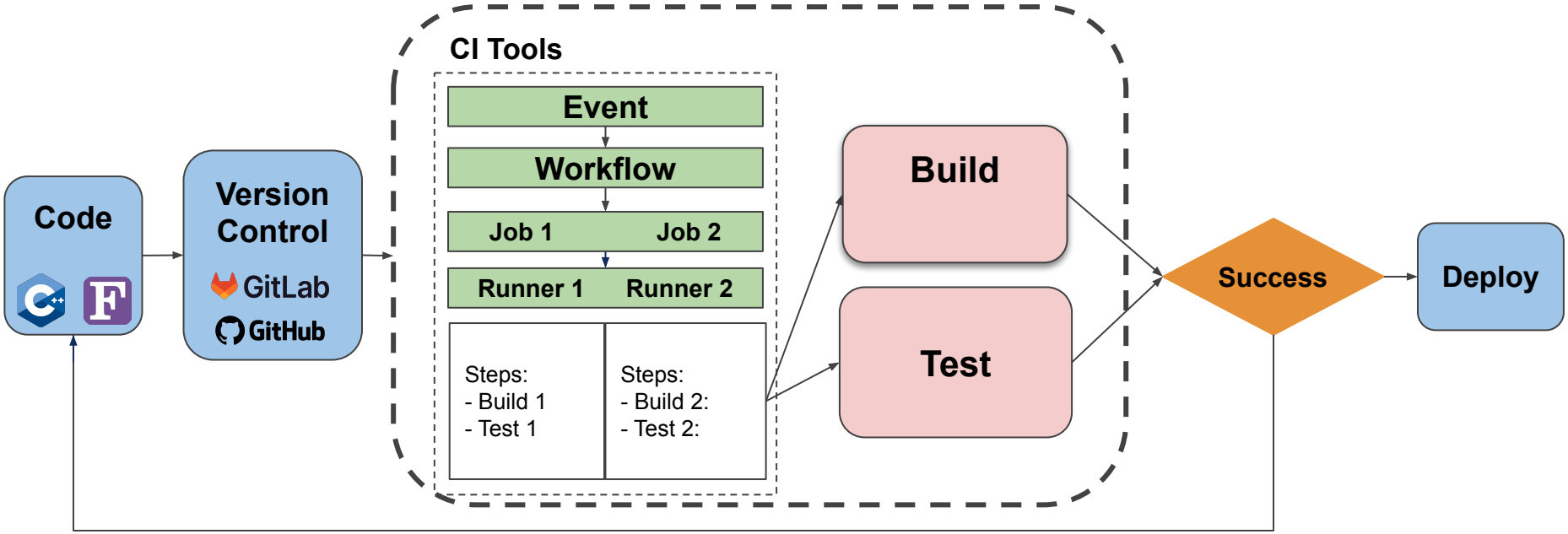
CI Benefits for Parallel Applications

Application Scalability And Performance Group: Leverage the parallel power of GPUs and CPUs with MPI communication for higher performance.

CI for CUDA and MPI applications:

- Dependency management
- Library versions: Dealing with CUDA and OpenMPI versions
- GPU compatibility
- Frequent automated testing
- Early detection of bottlenecks
- Speedy Development

CI Pipeline


CI Tools
Event
Workflow
Job 1
Job 2
Runner 1
Runner 2
Steps:
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GitHub
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Success
Deploy

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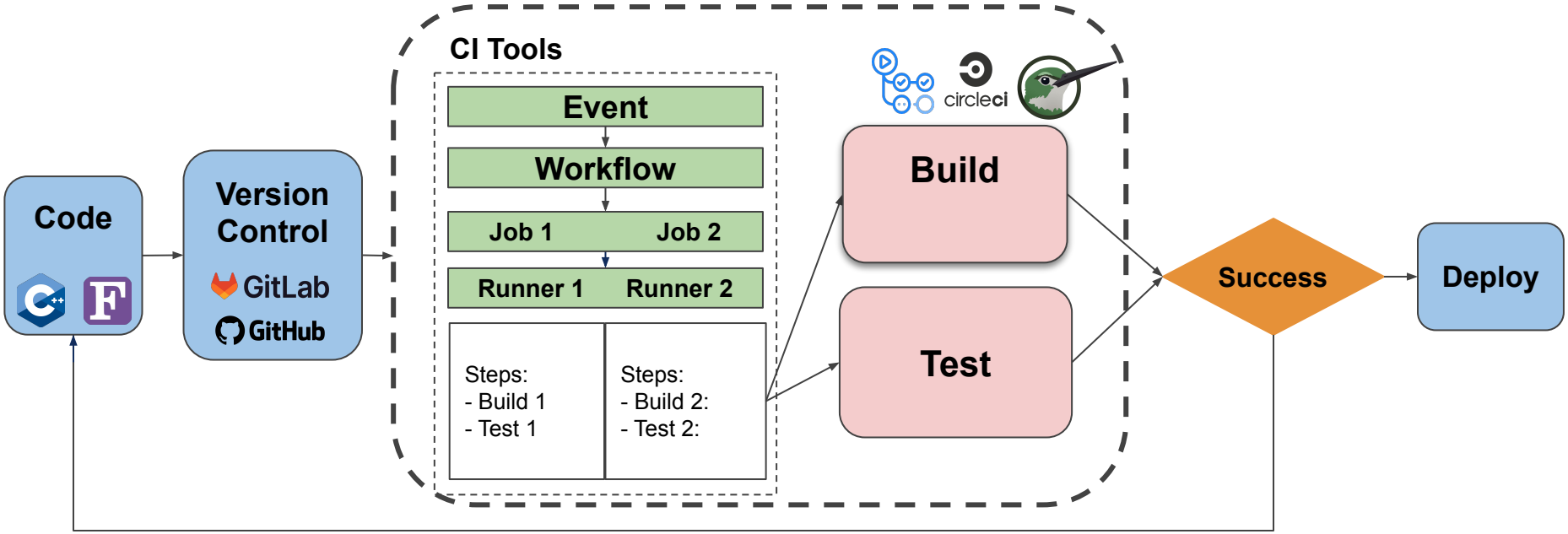
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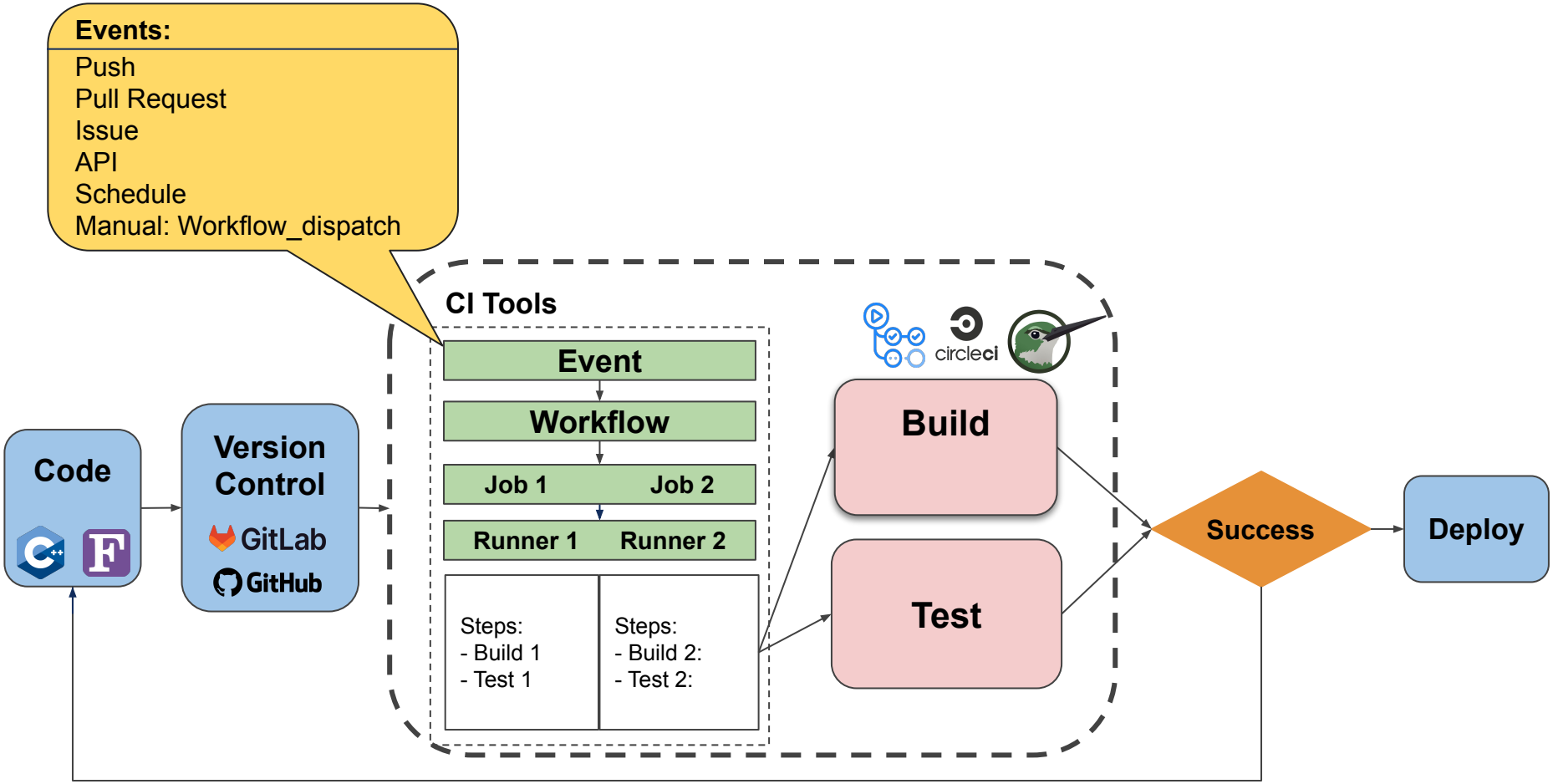
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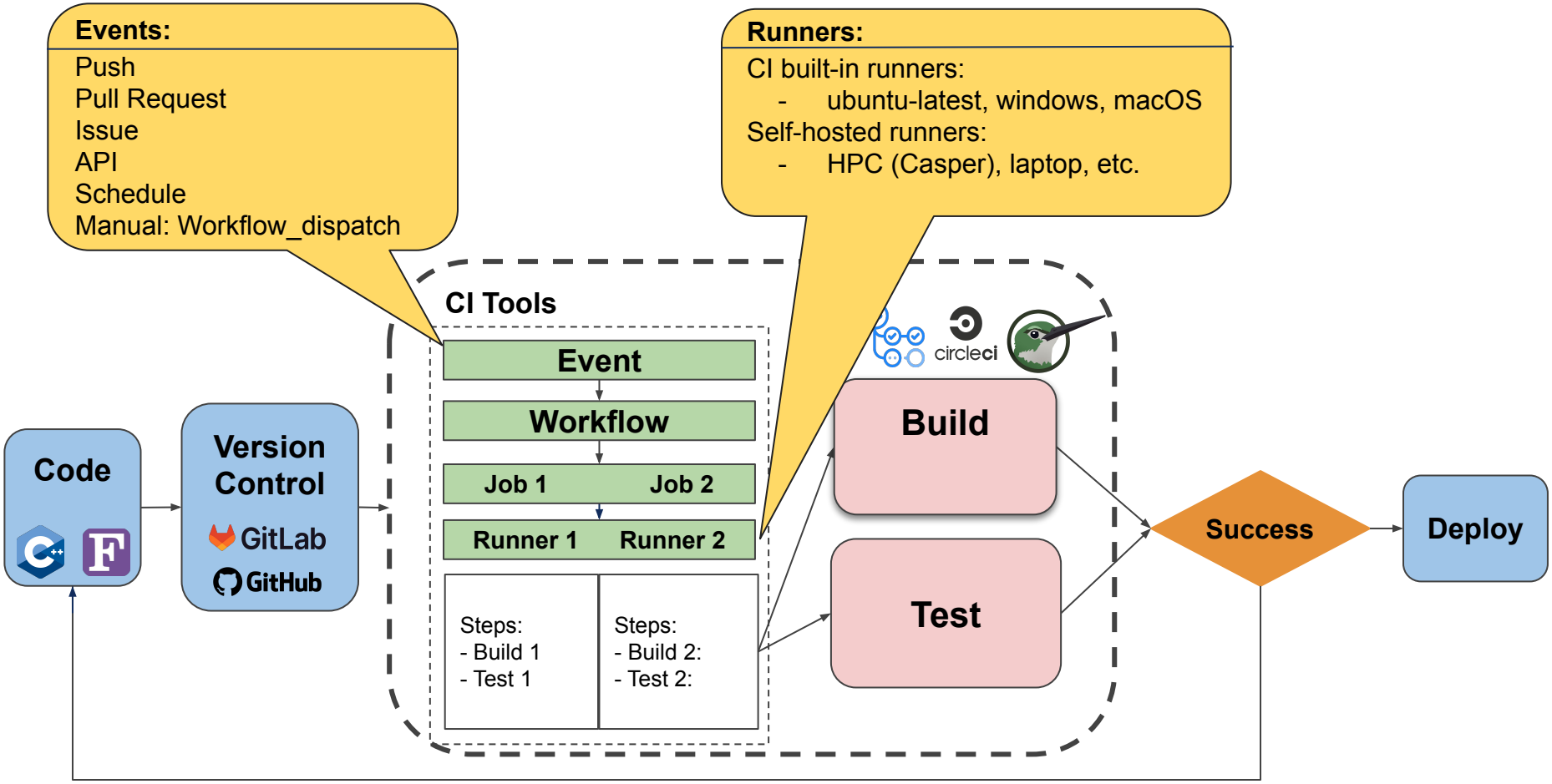
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Self-hosted runners:
- HPC (Casper), laptop, etc.
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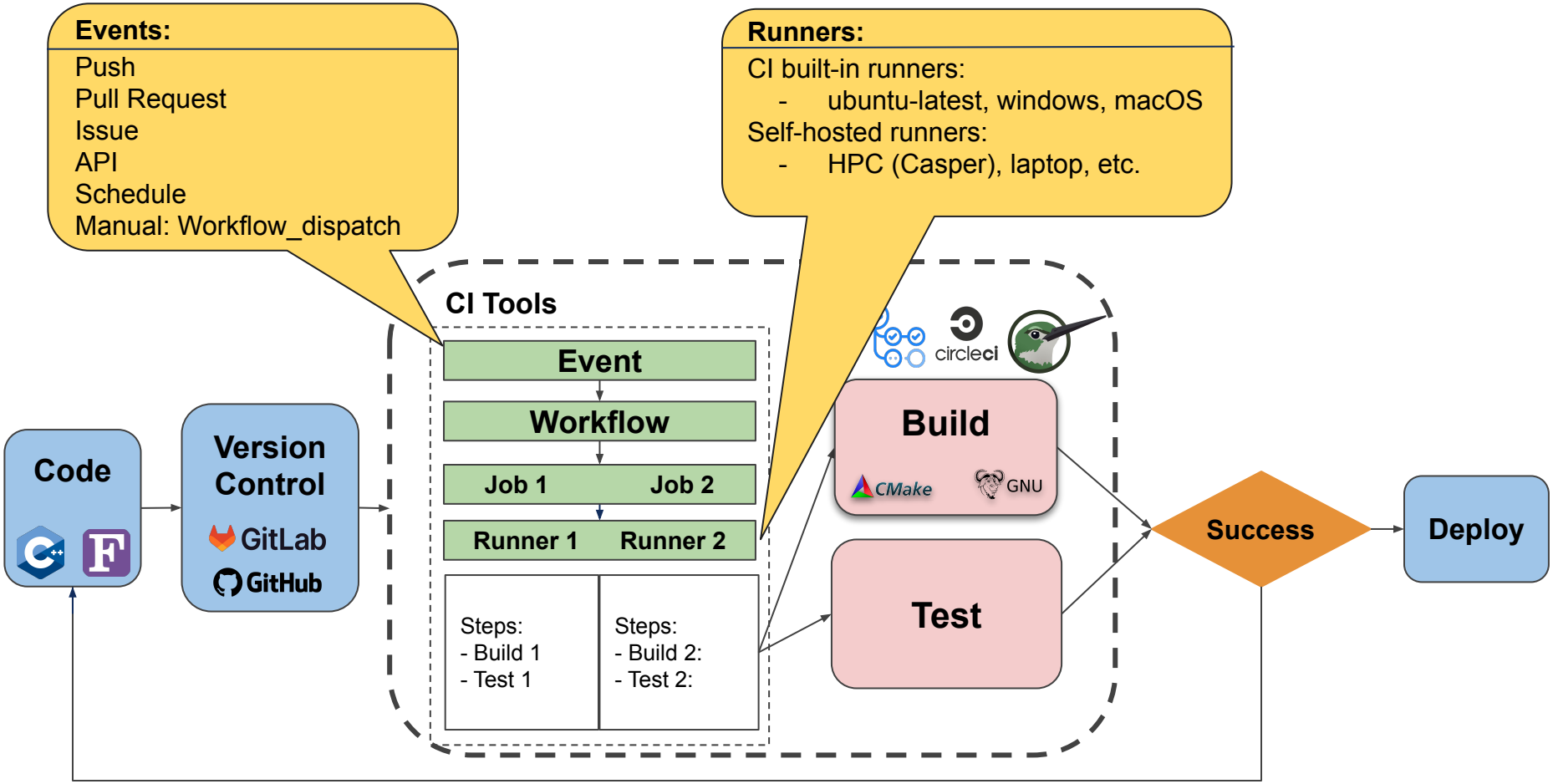
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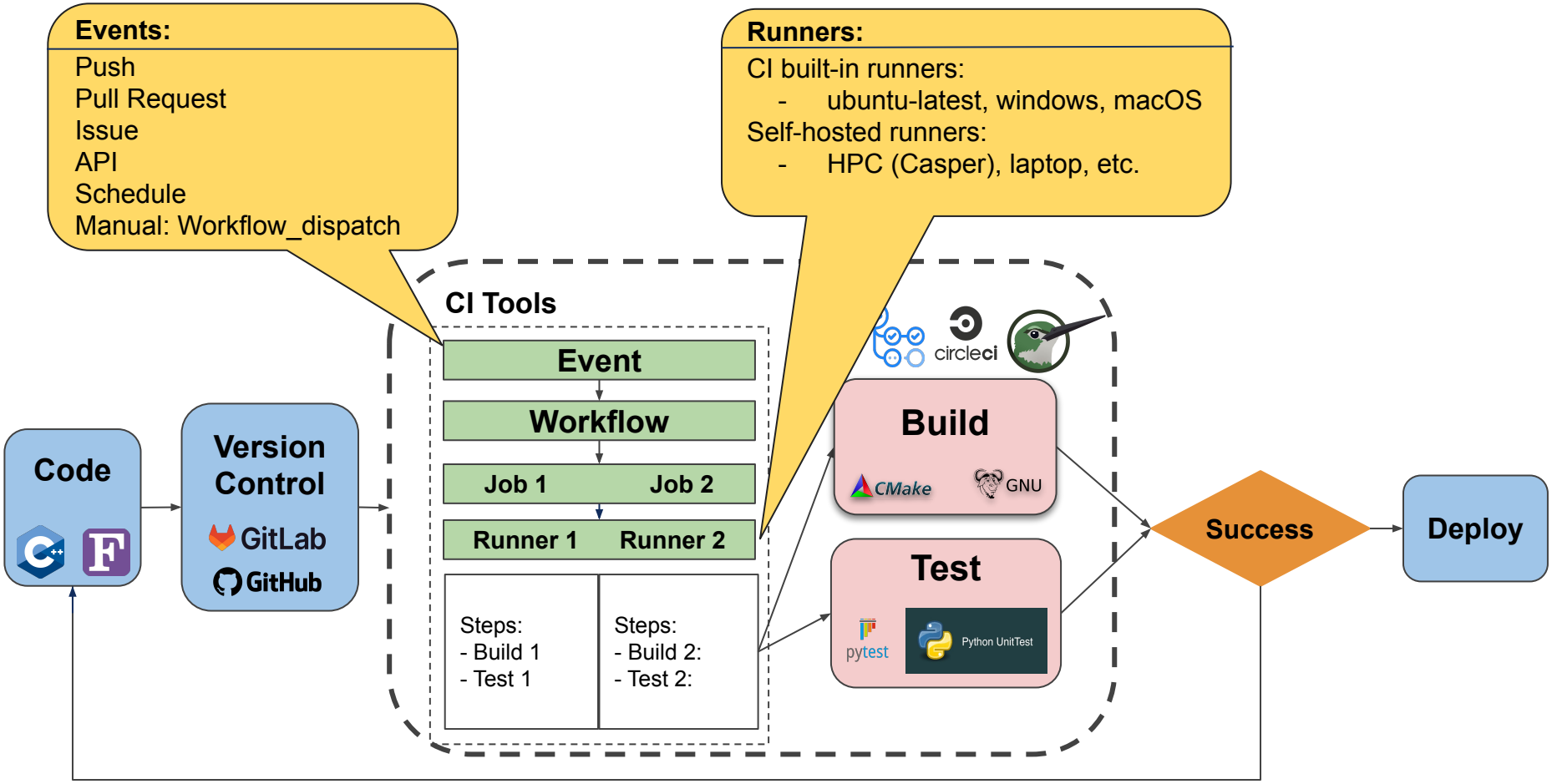
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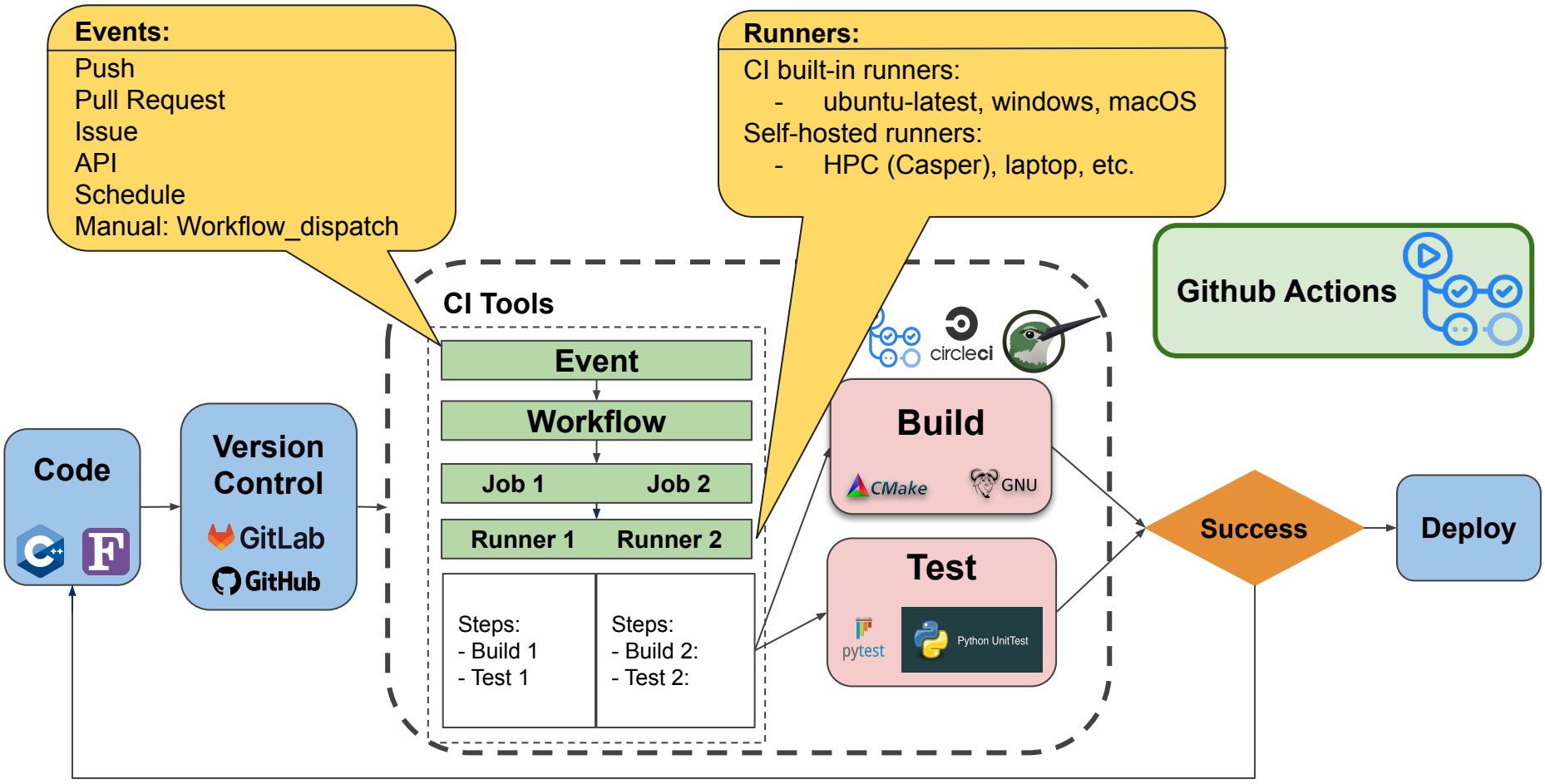
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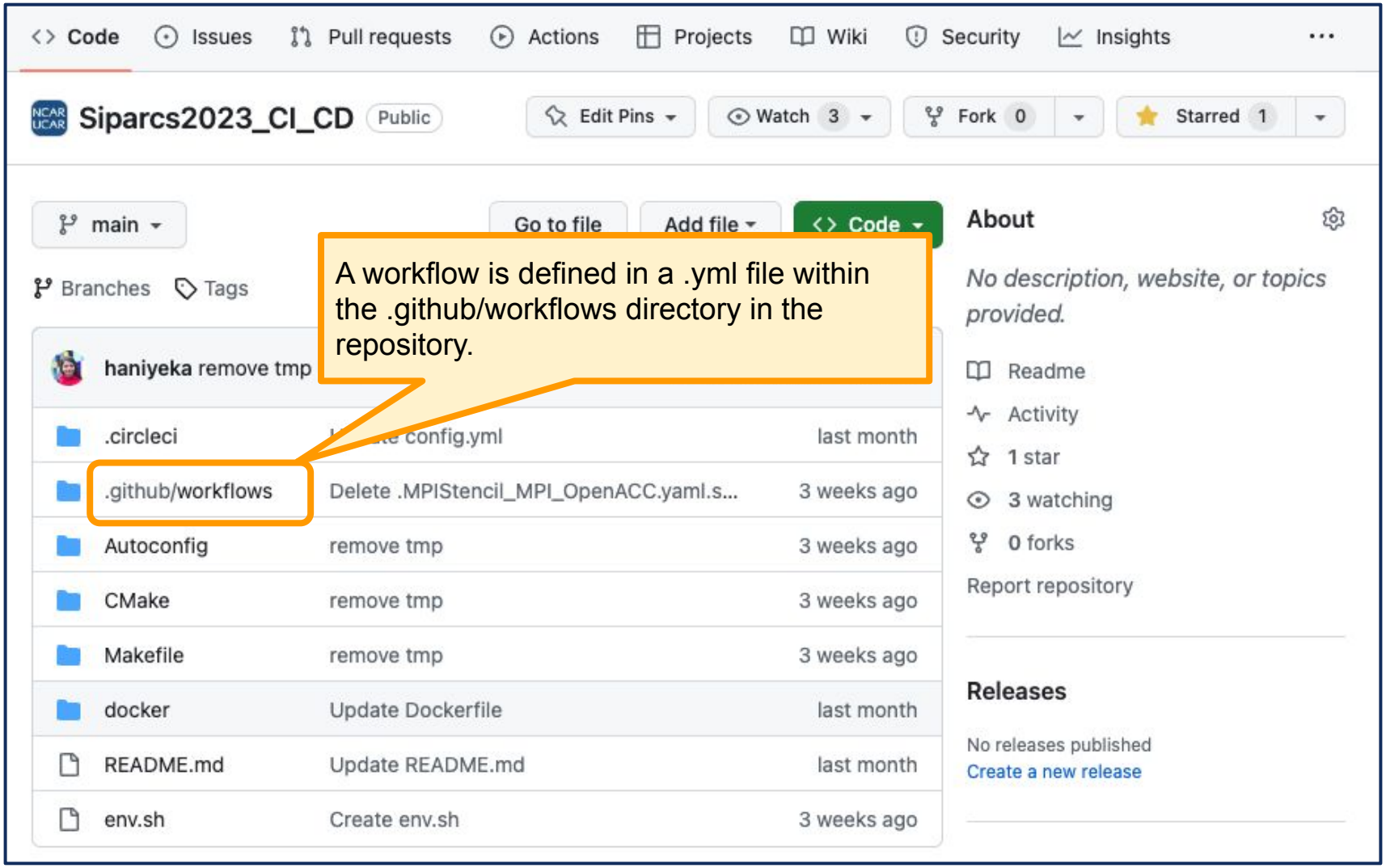


Github Actions

Events

Workflow files can define one or more jobs

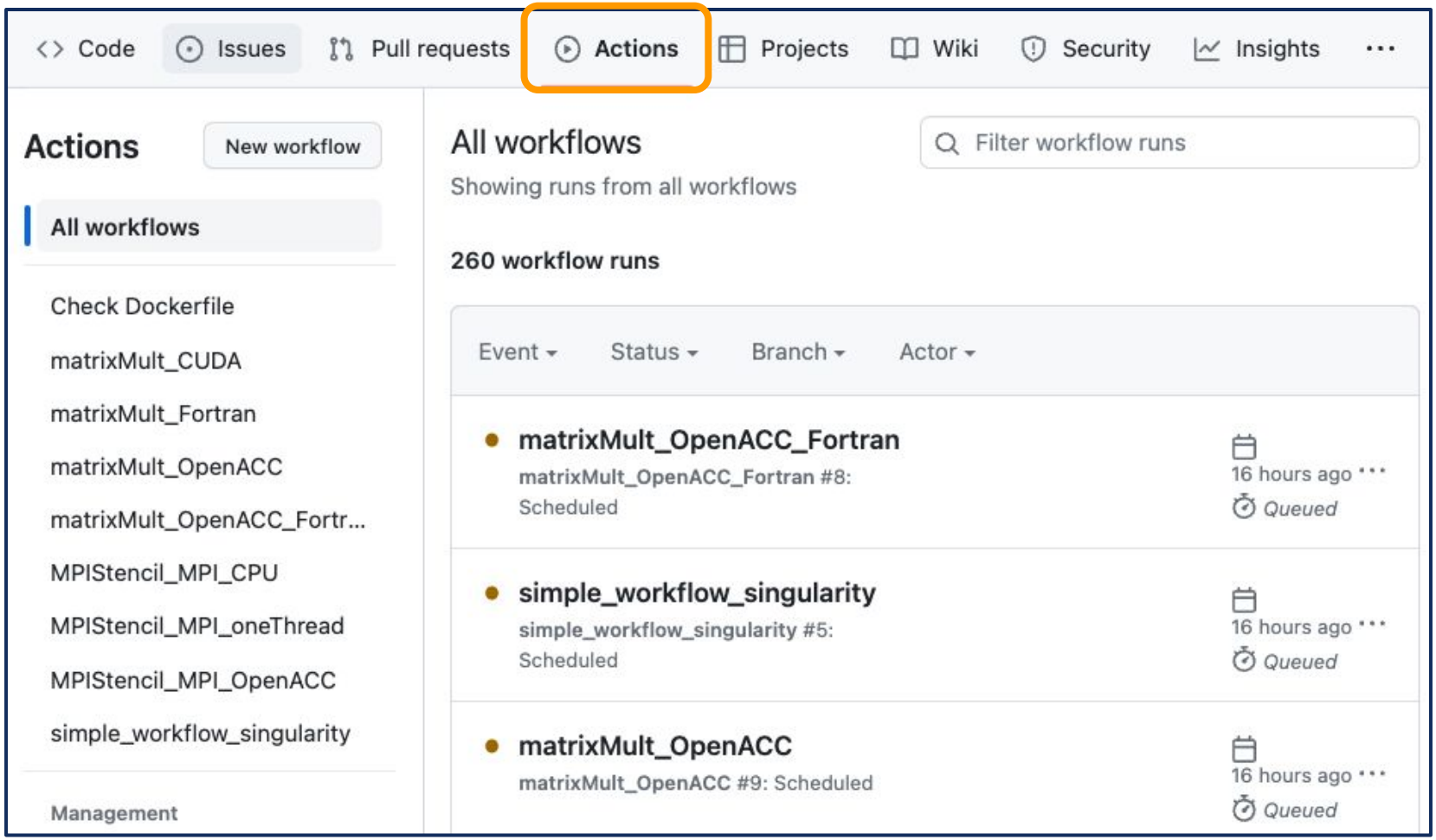
Runner Label

```
container:
  image: node:14.16
```

Each job consists of a set of steps that perform individual tasks such as running a script or a command.

```
1   name: matrixMult_Fortran_Autoconfig
2
3   on:
4     push:
5       branches:
6         - main
7     pull_request:
8       branches:
9         - main
10    workflow_dispatch:
11
12  jobs:
13    Makefile:
14      runs-on: ubuntu-latest
15      steps:
16      - uses: actions/checkout@v3
17
18      - name: Navigate to directory and autoconfig
19        run: |
20          cd Autoconfig/matrixMult/FORTRAN/
21          pwd
22          autoconf
23          ./configure
24          make
```

Github Actions



Self-hosted Runners

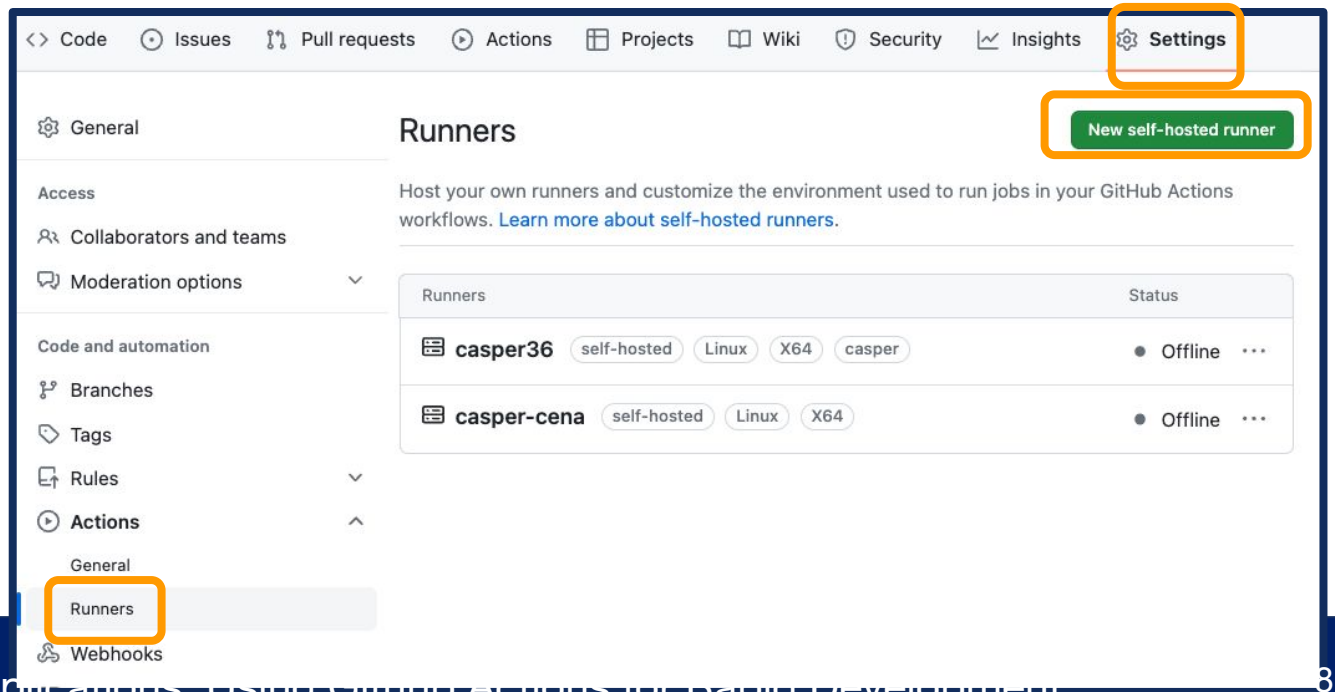
Built-in runners: No GPU software and hardware support, no MPI communication support

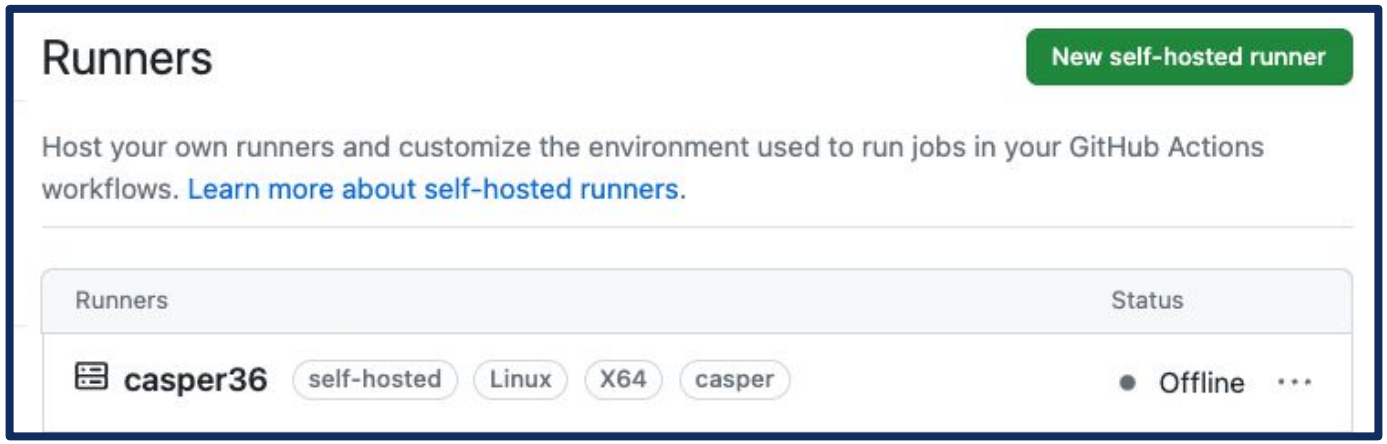
Self-hosted runners:

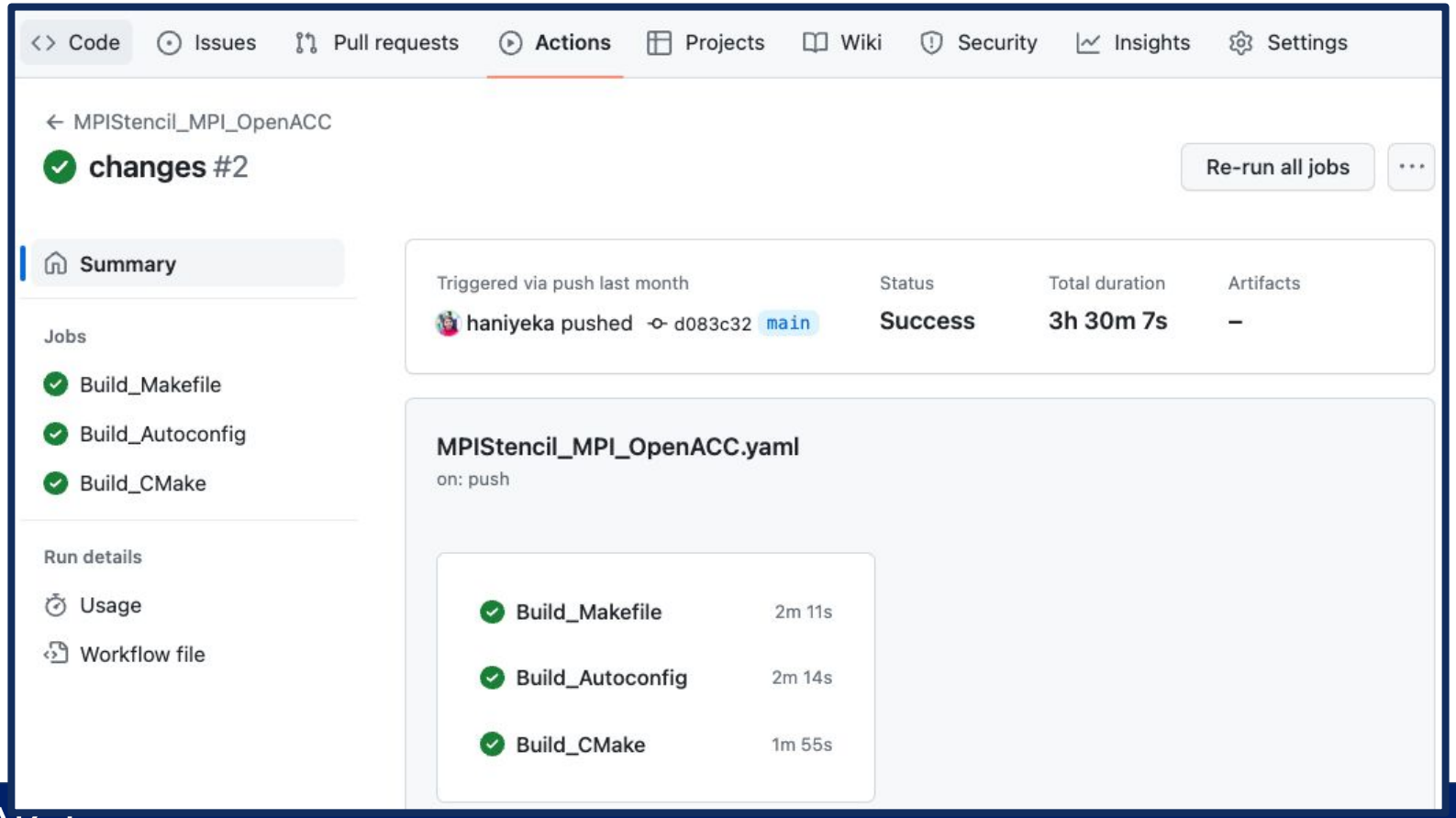
- Login to HPC: `ssh username@casper.ucar.edu`
- Follow step-by-step instructions provided in the repository's settings
- Prepare your environment and Run the provided **run.sh** by github

```
execcasper -A NTDD0005 -l walltime=05:00:00 -l
select=1:ncpus=1:mpiprocs=1:ngpus=1:mem=50GB -l gpu_type=v100
```

- Add labels to yml file: `casper, self-hosted, Linux, X64`
- Trigger an event
  - **Push**
  - **Pull Request**



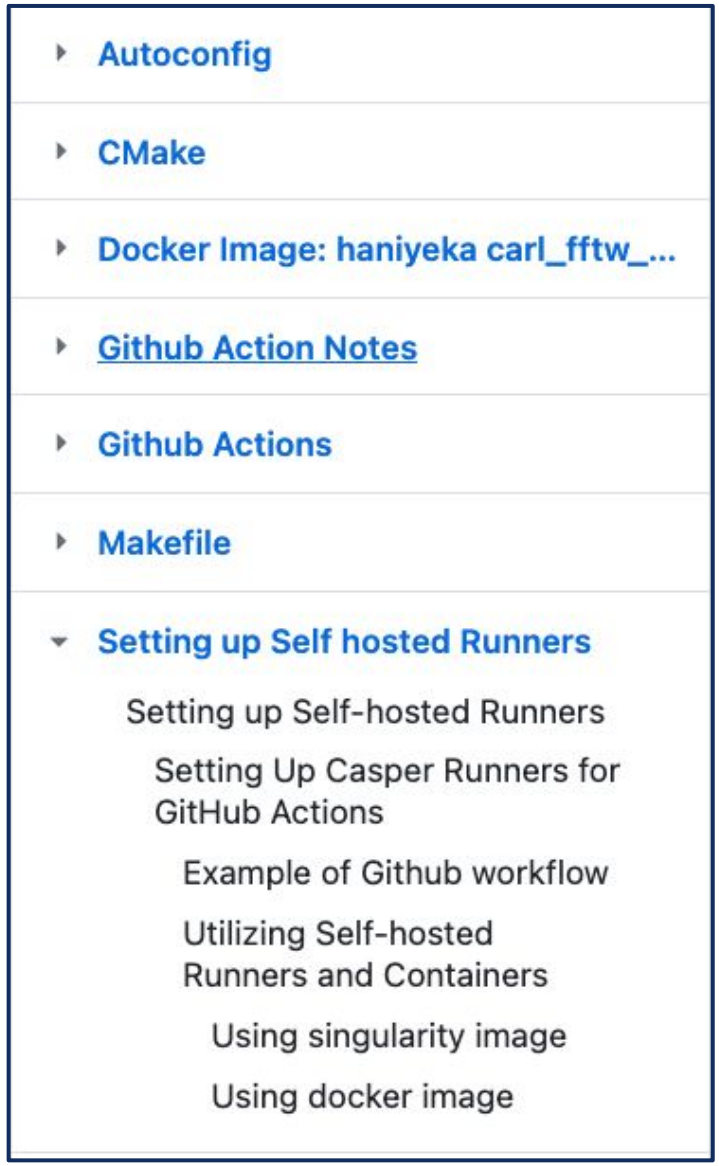

Runners
New self-hosted runner
Host your own runners and customize the environment used to run jobs in your GitHub Actions workflows. Learn more about self-hosted runners.
Runners
Status
casper36
self-hosted
Linux
X64
casper
Offline


Code
Issues
Pull requests
Actions
Projects
Wiki
Security
Insights
Settings
MPIStencil_MPI_OpenACC
changes #2
Re-run all jobs
Summary
Jobs
Build_Makefile
Build_Autoconfig
Build_CMake
Run details
Usage
Workflow file
Triggered via push last month
haniyeka pushed d083c32 main
Status
Success
Total duration
3h 30m 7s
Artifacts
–
MPIStencil_MPI_OpenACC.yaml
on: push
Build_Makefile 2m 11s
Build_Autoconfig 2m 14s
Build_CMake 1m 55s

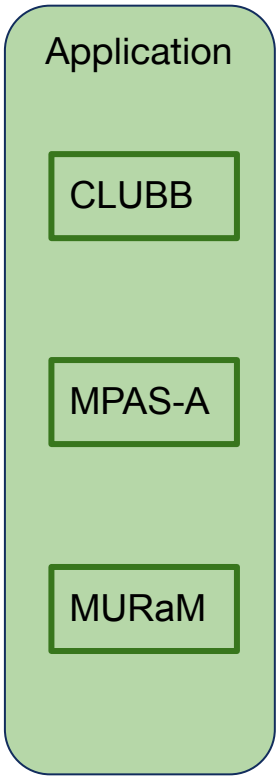
Documentation and Examples

https://github.com/NCAR/Siparcs2023_CI_CD/

- DockerCheck.yaml
- MPIStencil_MPI_CPU.yaml
- MPIStencil_MPI_OpenACC.yaml
- MPIStencil_MPI_oneThread.yaml
- matrixMult_CUDA.yaml
- matrixMult_Fortran.yaml
- matrixMult_OpenACC.yaml
- matrixMult_OpenACC_FORTRAN.yaml
- simple_workflow_docker.yaml



ASAP Applications



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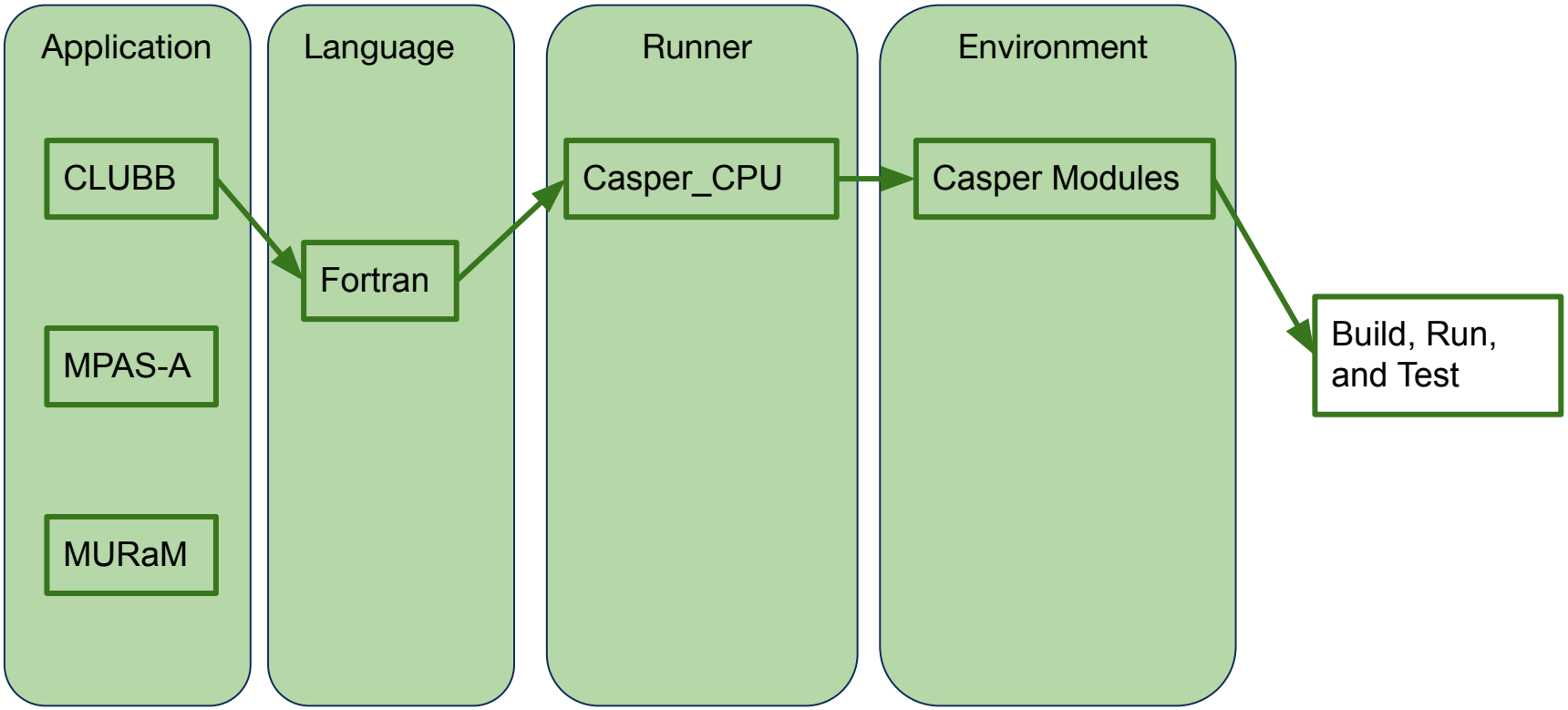

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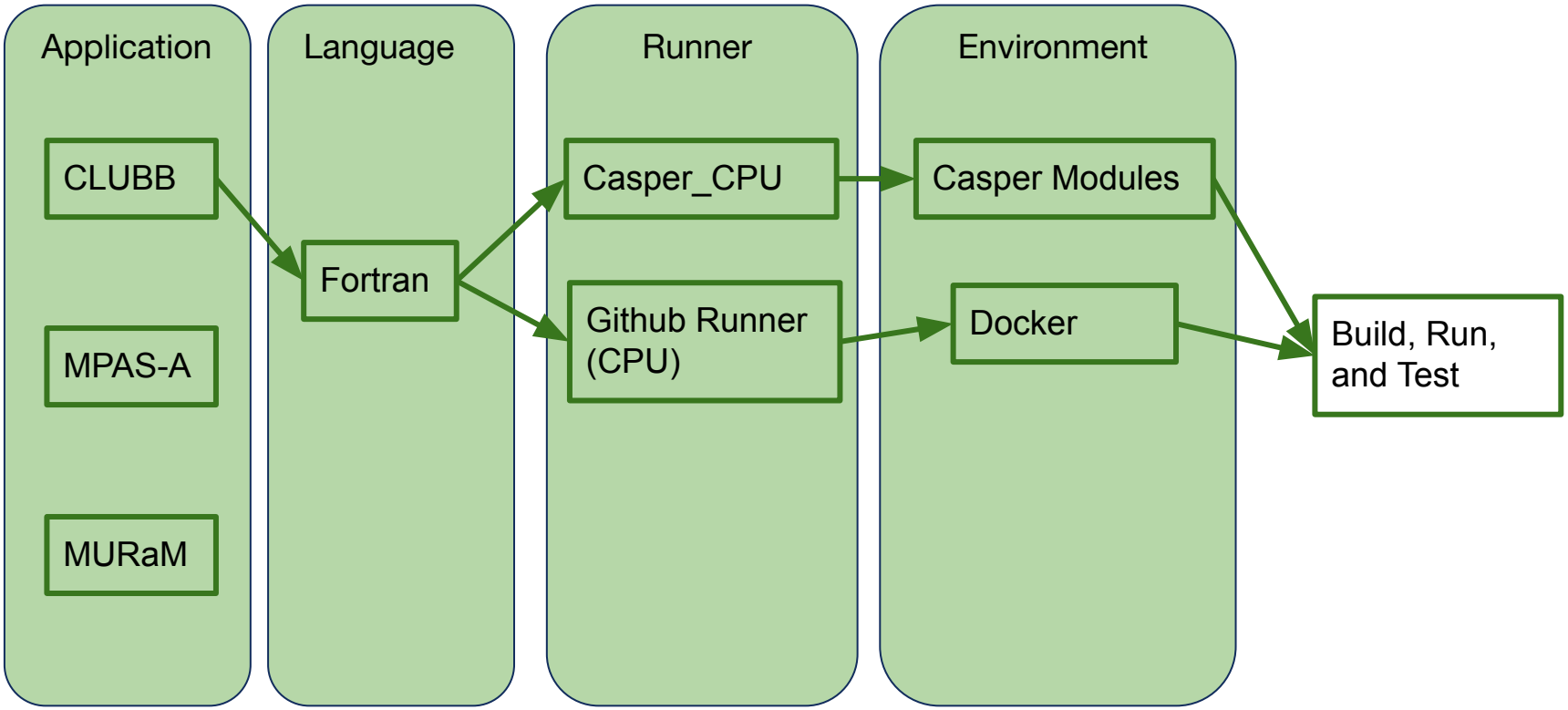

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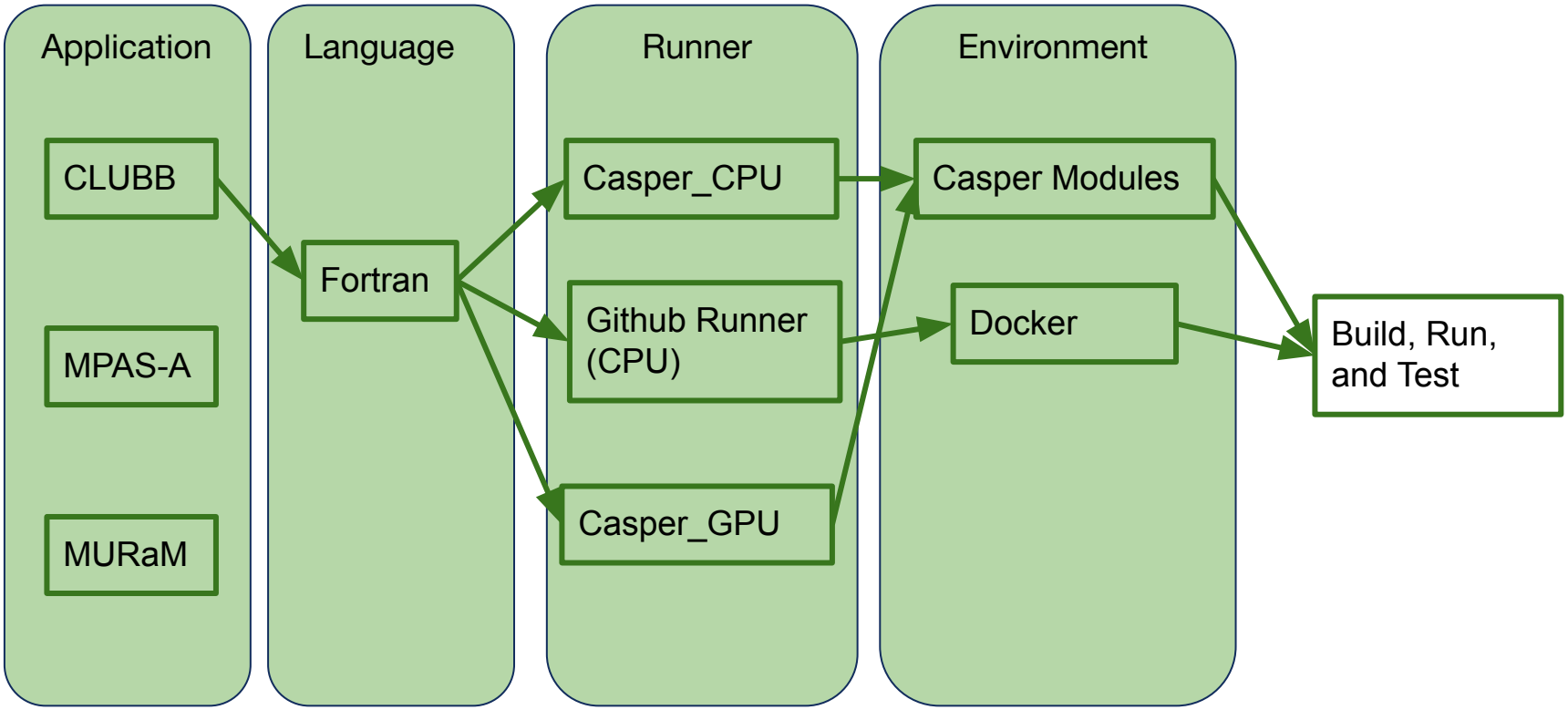

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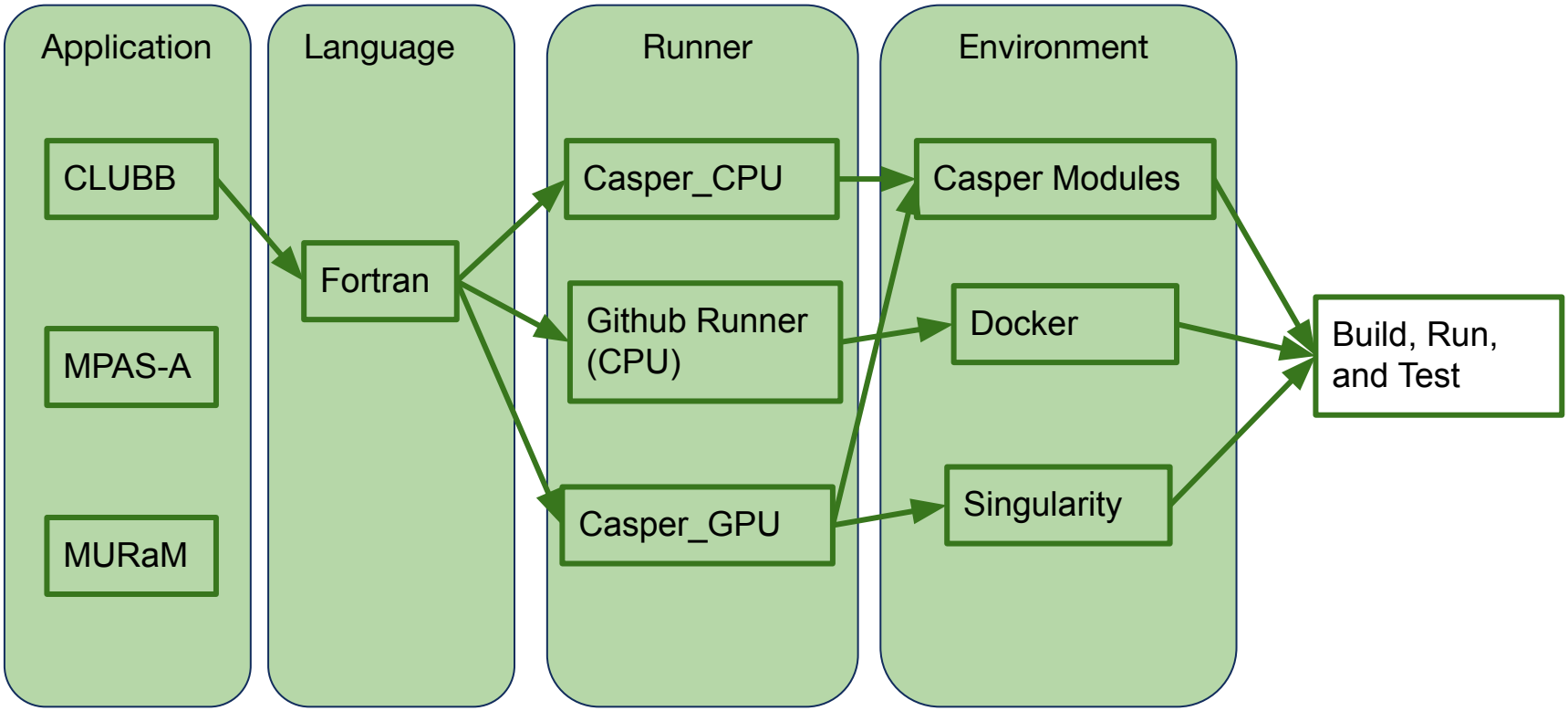

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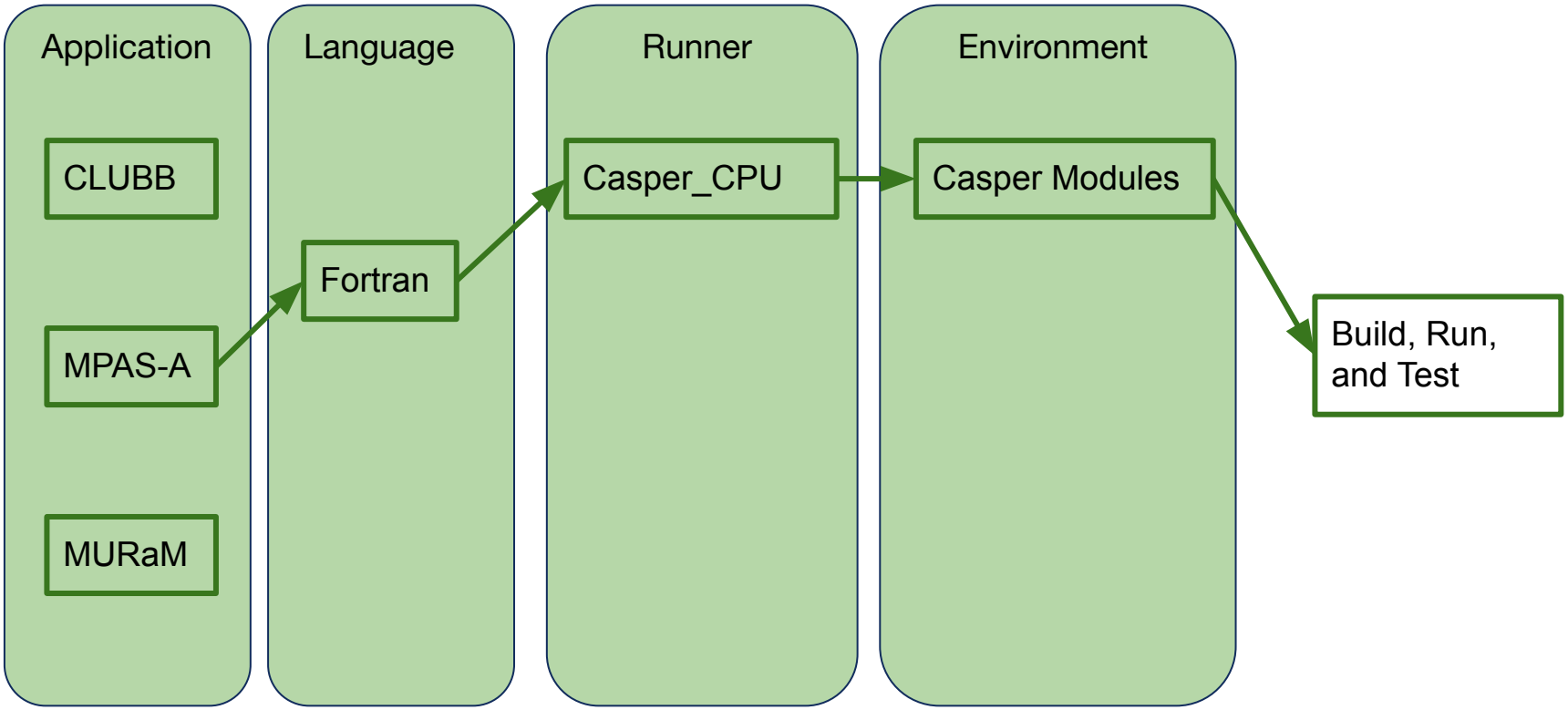

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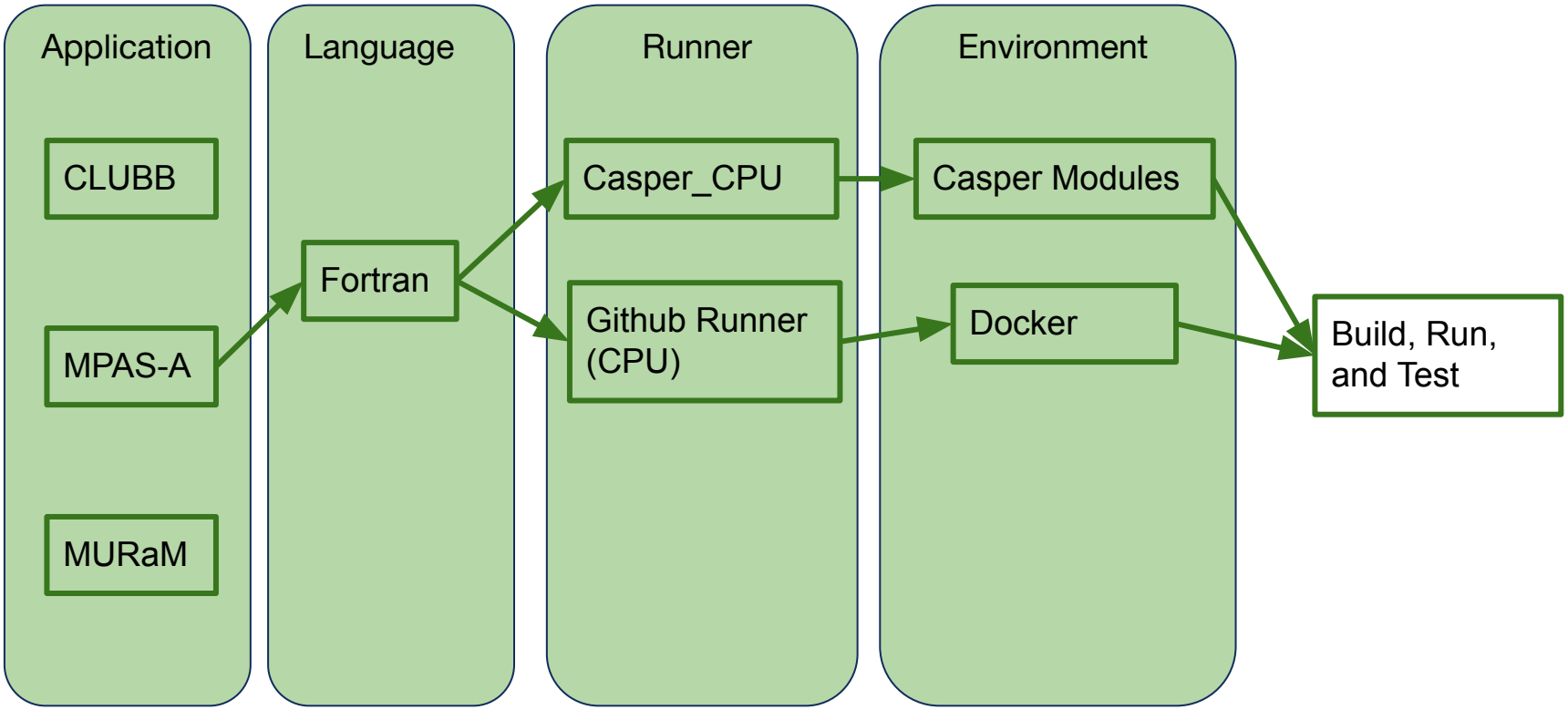

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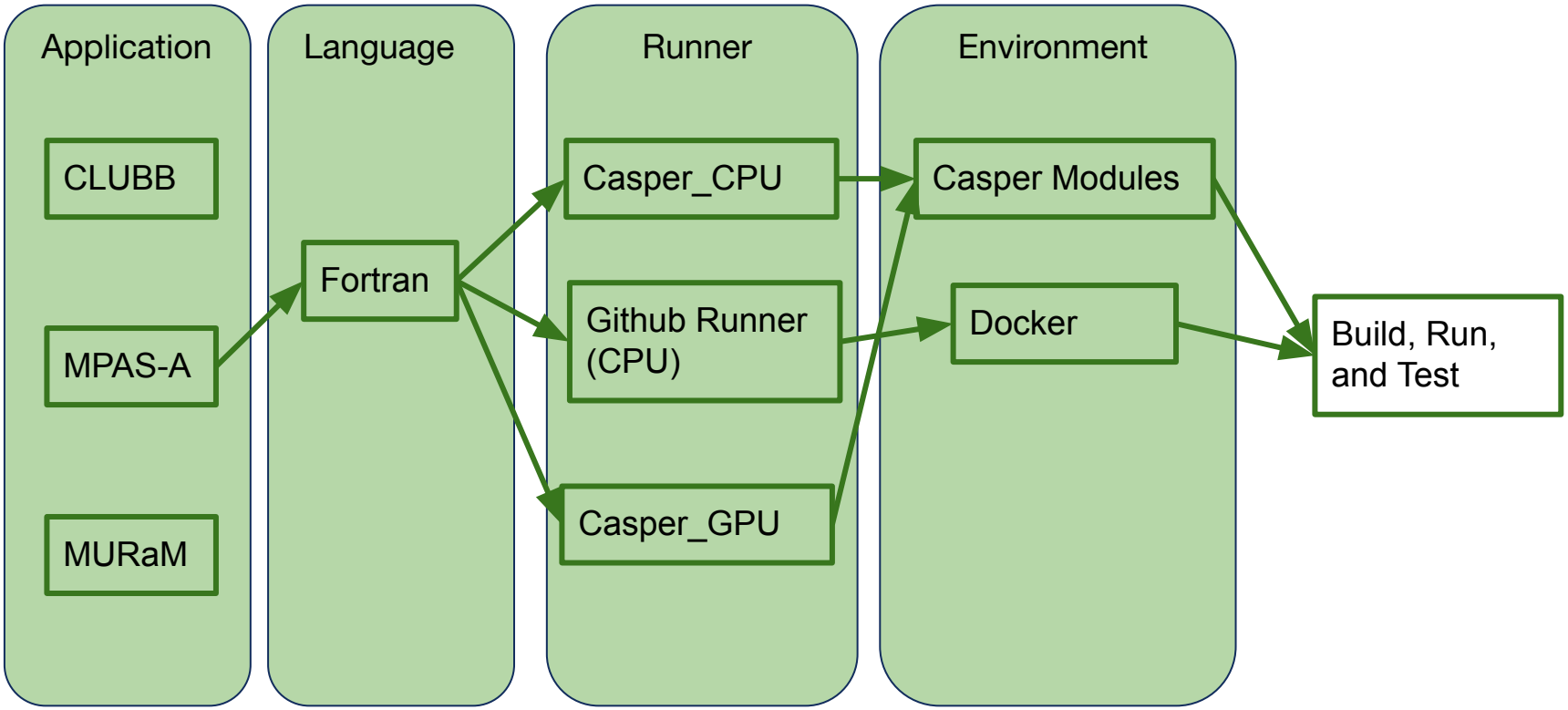

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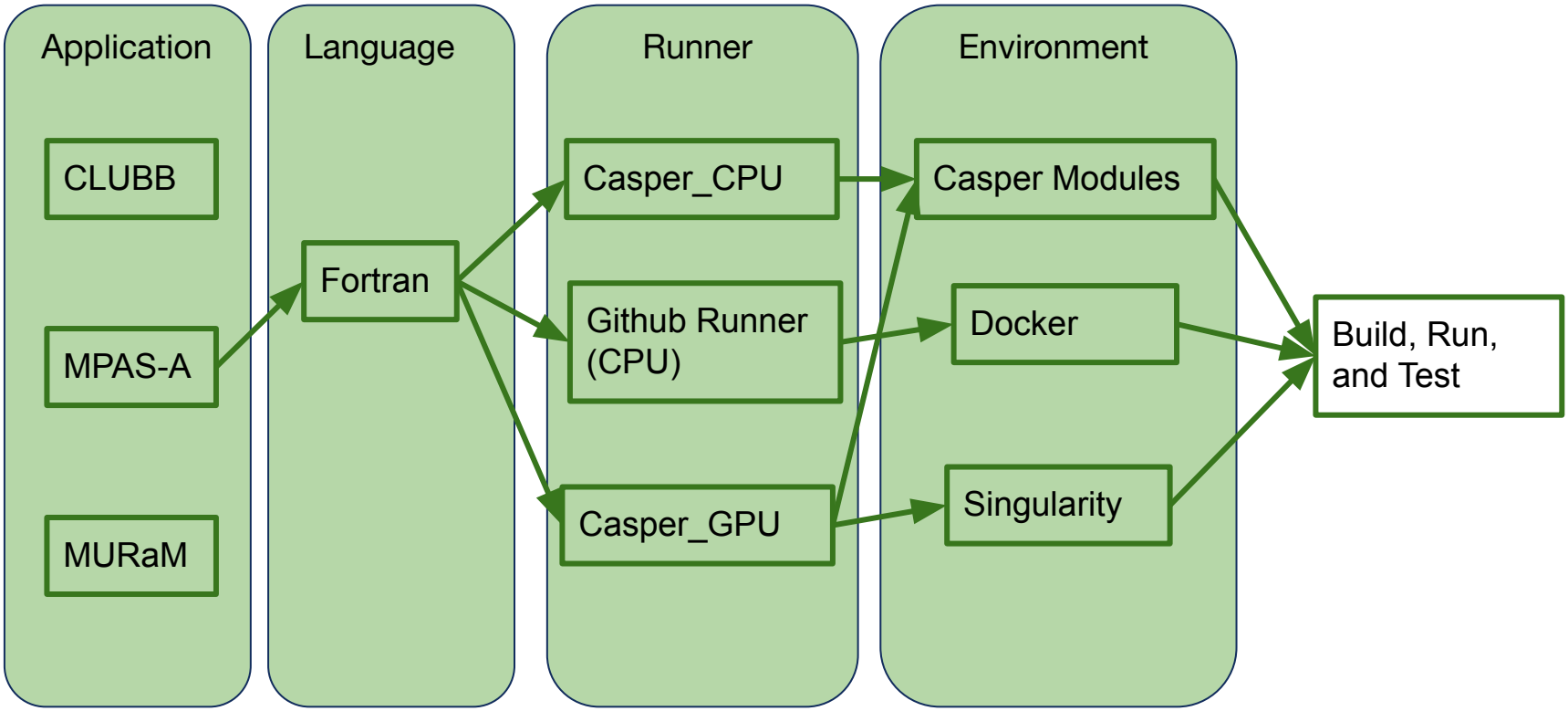

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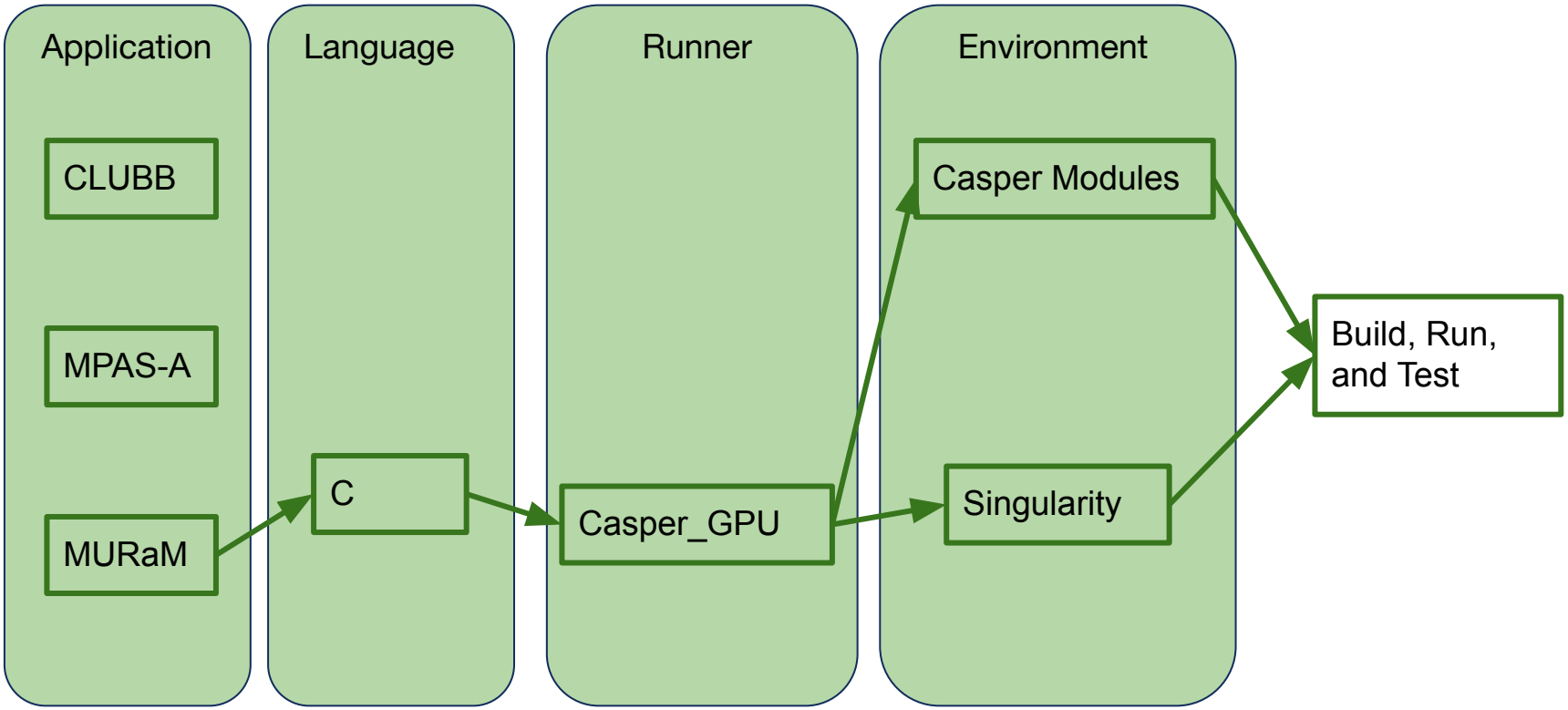


Summary of Achieved Goals

- Documentation and Examples

- Focus on implementing CI for multiple ASAP applications
  - CLUBB
  - MURaM
  - MPAS-A

Thank you!

Mentors: Supreeth Suresh, Cena Brown

Carl Ponder - NVIDIA

ASAP Team!

SIParCS Team!

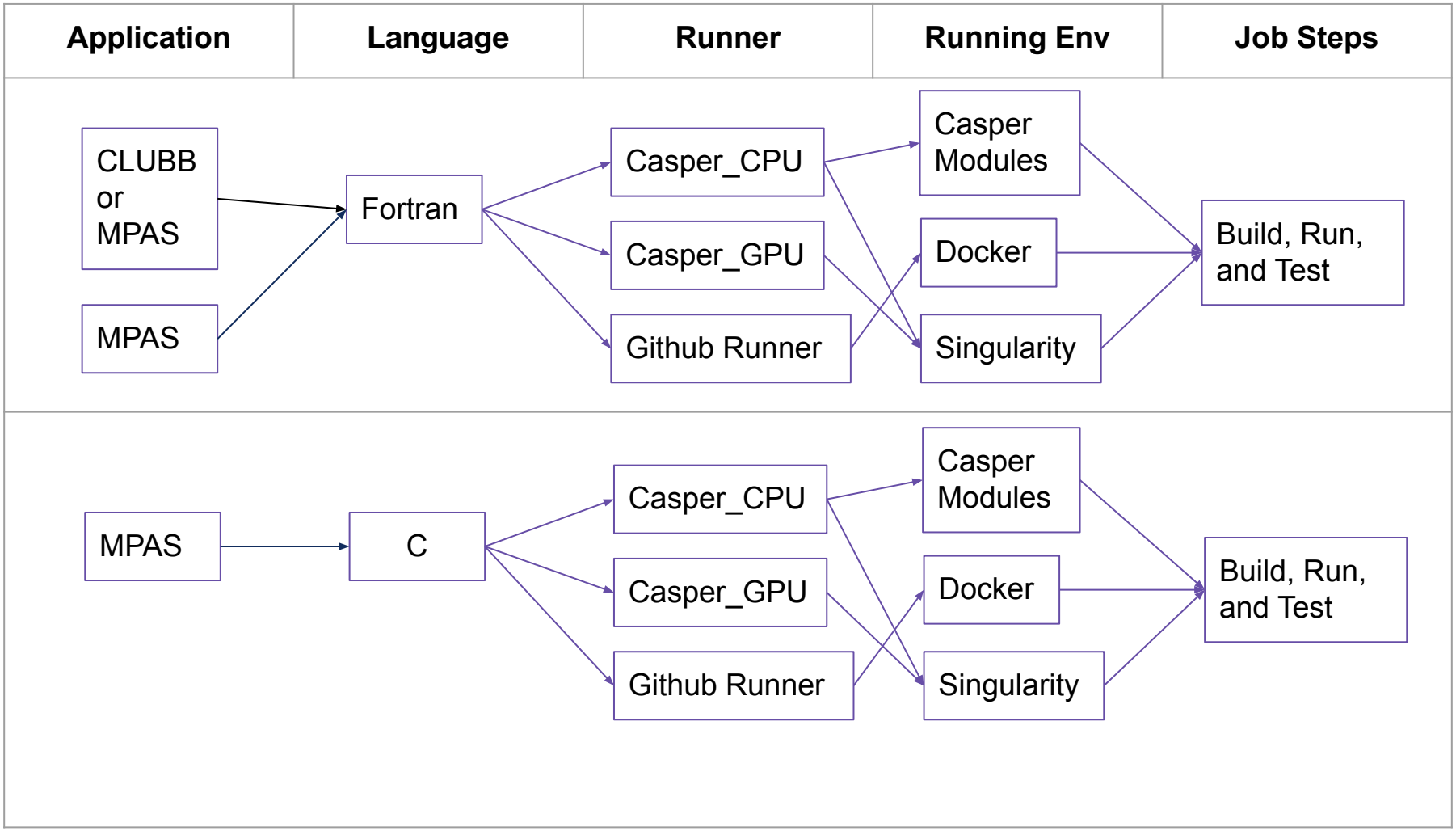
SIParCS 2023 Interns!

Questions?

CI/CD Examples and Documentations

hkashgar@uwyo.edu

Workflows


Application
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Runner
Running Env
Job Steps
CLUBB or MPAS
MPAS
Fortran
Casper_CPU
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Github Runner
Casper Modules
Docker
Singularity
Build, Run, and Test
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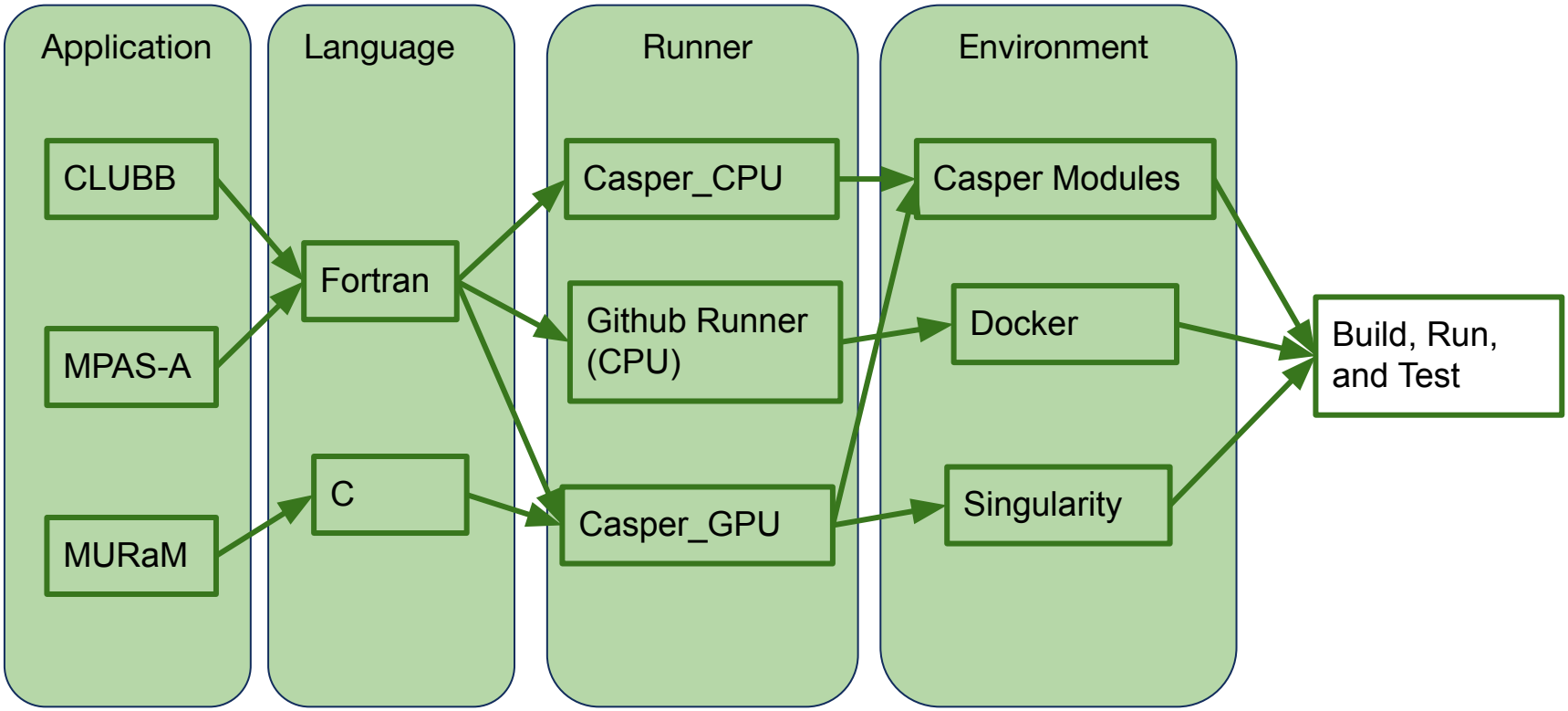

Application	Language	Runner	Environment
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		Casper CPU	Casper Modules
		Casper GPU	Singularity Container
			Casper Modules
MPAS-A	Fortran	Github Runner	Docker Container
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		Casper GPU	Singularity Container
			Casper Modules
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