LF NETWORKING

Developer & Testing Forum

GitHub Actions

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Release Engineering

The Linux Foundation

https://lfnetworking.org

Personal Introduction

- BSc Degree, Physics with Astrophysics, York University
- Graduated in 1997 and moved to Cambridge
- Accidentally became an Internet network engineer
- Lots of data centre work; routers, switches and firewalls
- Worked for a number of Internet Service Providers
- Sun Solaris, Linux system administration
- 25 Years in networking business, recent pivot into software
- Two years working for the Linux Foundation

Presentation Overview

- **Brief Review of Existing LFN/Project Tooling**

(Gerrit, Jenkins, JCasC, JJB, Global JJB, Sandbox Access)

- **GitHub and GitHub Actions Overview**
- **Digging into GHA Details**

(Workflow Files, Linting/Verification, Triggers, Variables/Secrets)

- **Advanced Features**

I/O, Artefacts, Signing, Trusted Publishers, Matrix Operations, Apps

- **Composite Actions, Reusable Workflows**
- **Interactive Demonstrations throughout!**

Mission Statement

DevOps Statement of Intent

“The mindset we should carry is that we always want to automate ourselves into a better job. We want to make sure that the task we’re doing manually today becomes mostly automated”

Review Existing Tooling

Gerrit <-> GitHub

- GIT backend with web portal/interface
- Considered best in class for code review purposes
- Not going anywhere anytime soon for LFN projects
- In most cases, code is already replicated to GitHub
- Integration was held back for some time by missing APIs/features
- Last round of Gerrit updates unlocked integration capability
- This means there is an opportunity to deploy GitHub Actions
- However, if replication is performing poorly, problems can arise

Review Existing Tooling

Jenkins, JCasC, JJB, Global JJB

- Jenkins hosted in VEXXHOST and jobs run on an isolated network
- Executor nodes exist in a pool; if not available spin-up is slow
- GitHub Actions uses containers and jobs deploy/execute quickly
- Potentially easier to tap pre-built images, e.g. Docker Hub, etc.
- Puppet is used for server management
- Jenkins configuration not defined using interface; JJB and JCasC
- Job templates in global-jjb (sub-repo), ci-management contains jobs

GitHub Actions Workflows

Features:

- Configuration files authored in YAML format
- Located in the directory: .github/workflows
- Sit alongside the repository code
- Can pull/execute actions from other repositories
- YAML and GHA linting tools are available

GitHub Actions Workflows

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Triggers

Documentation: Events that trigger workflows

- Can be triggered manually
- Can be triggered automatically on a variety of events
- Can be run on a schedule (CRON)

Workflow Triggers

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Useful Examples

Manual

```
 workflow_dispatch:
```

Schedule

```
 schedule:
    - cron: "0 0 * * MON”
```

Repository actions

```
 pull_request:
    types: [opened, reopened, edited, synchronize]
```

Pushing tags

```
push:
    # Only invoked on release tag pushes
    tags:
      - v*.*.*
```

Matrix Operations

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Example Workflow Configuration

```
jobs:
  build:
    name: "Audit Python dependencies"
    runs-on: ubuntu-latest
    strategy:
      fail-fast: false
      matrix:
        python-version: ["3.9", "3.10", “3.11"]
```

Release Job Example

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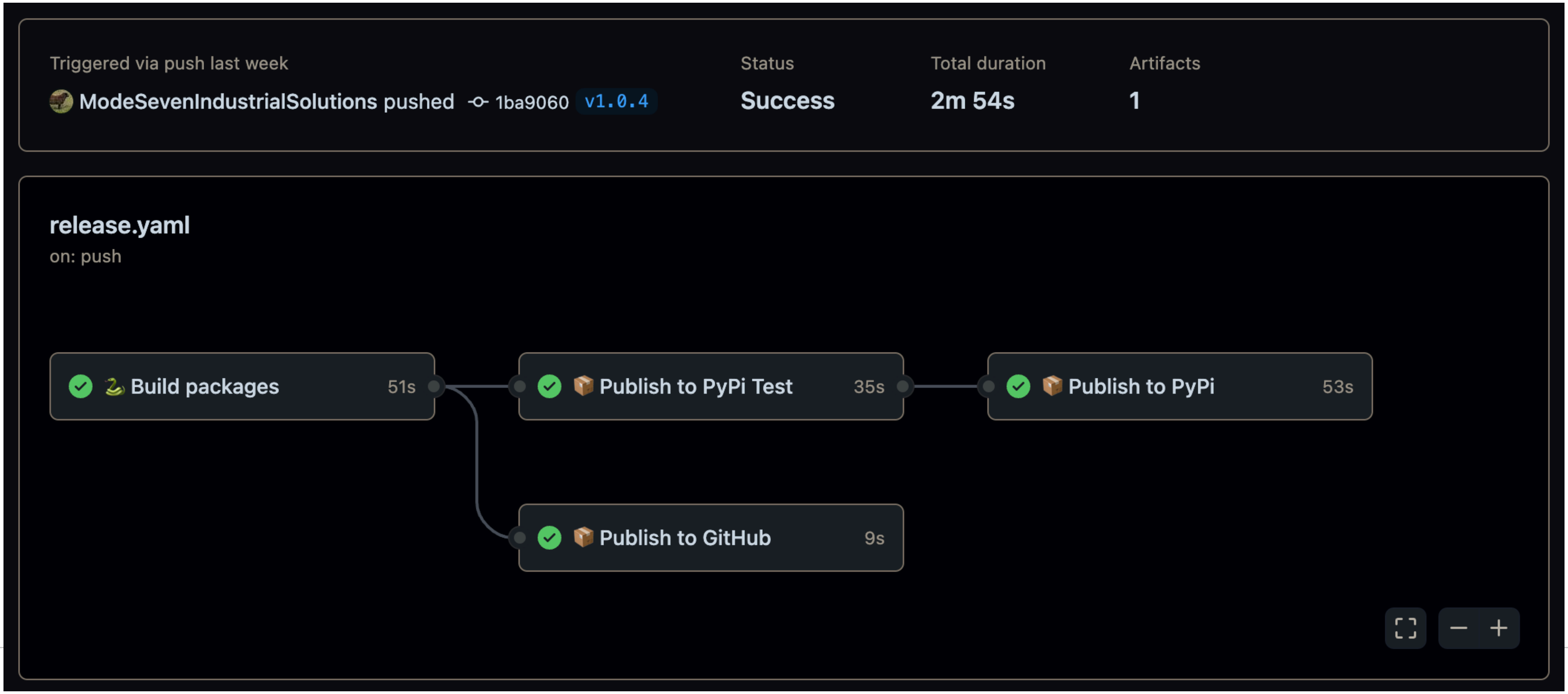
Release Job for Python Project

https://github.com/os-climate/ITR-examples/actions/runs/6787713863



Triggered via push last week
ModeSevenIndustrialSolutions pushed -o- 1ba9060 v1.0.4

Status
Success

Total duration
2m 54s

Artifacts
1

release.yaml
on: push

Dev Release Job Demo

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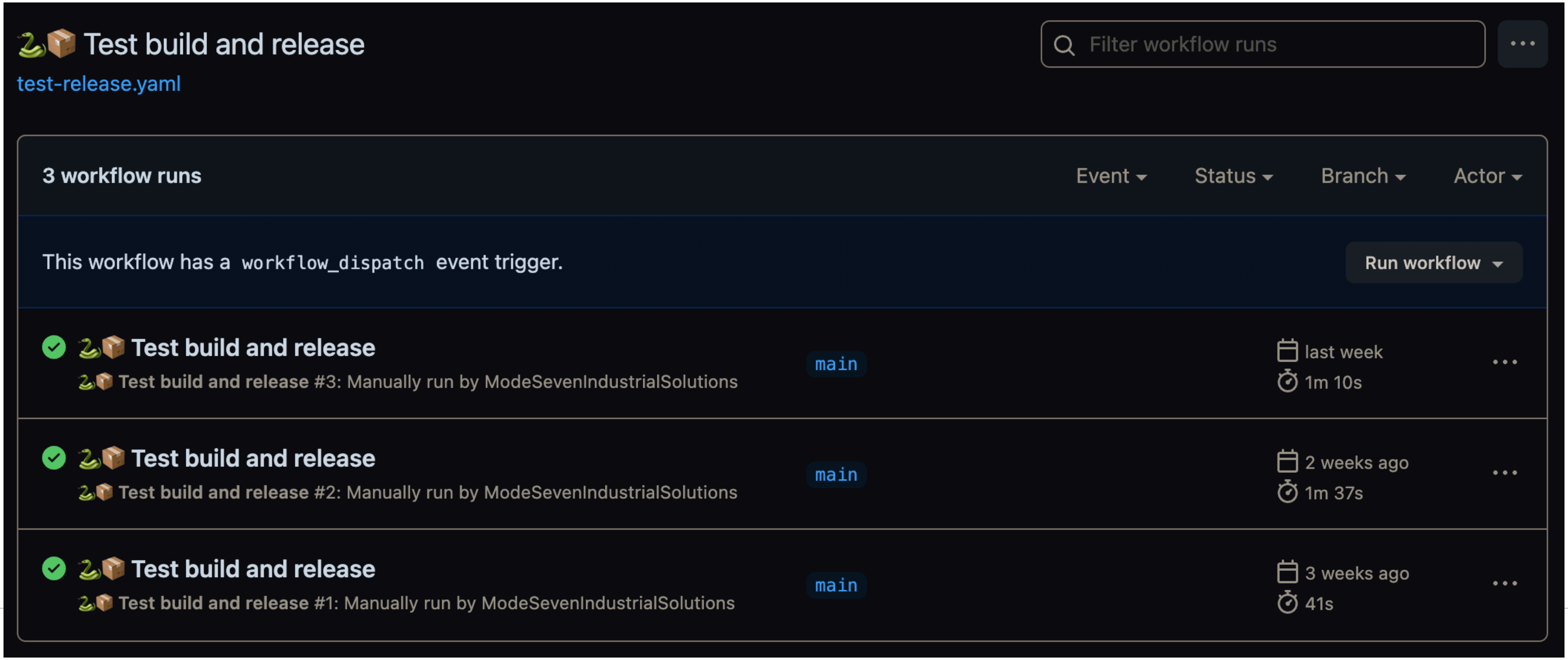
Development Release Job Demo

https://github.com/os-climate/ITR-examples/actions/workflows/test-release.yaml



🐍📦 Test build and release
test-release.yaml

3 workflow runs

This workflow has a `workflow_dispatch` event trigger.

✓ 🐍📦 Test build and release 🐍📦 Test build and release #3: Manually run by ModeSevenIndustrialSolutions	main	last week 1m 10s	...
✓ 🐍📦 Test build and release 🐍📦 Test build and release #2: Manually run by ModeSevenIndustrialSolutions	main	2 weeks ago 1m 37s	...
✓ 🐍📦 Test build and release 🐍📦 Test build and release #1: Manually run by ModeSevenIndustrialSolutions	main	3 weeks ago 41s	...

Trusted Publishers

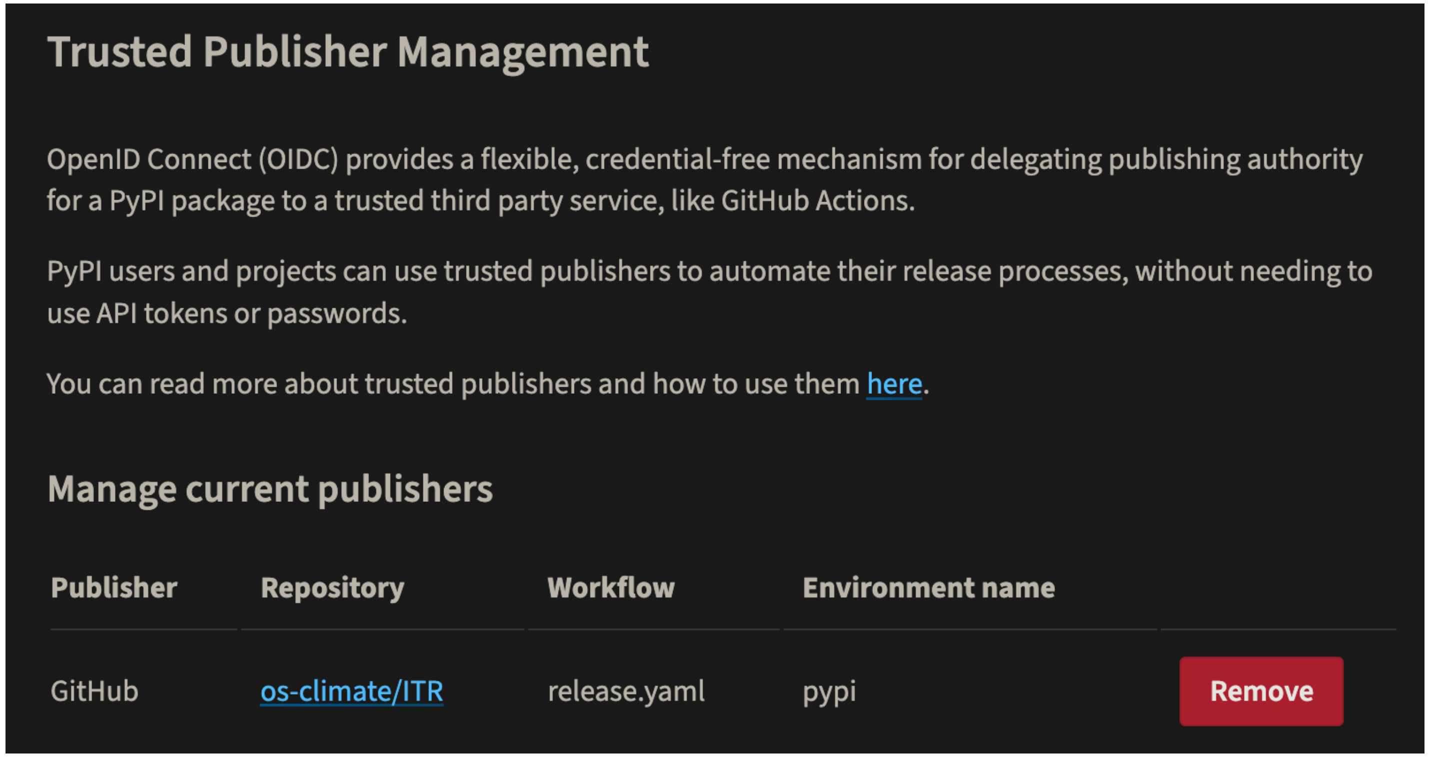
Allows interactions between sites without use of fixed authentication tokens

Links:

[OpenID]

[PyPI]

[GitHub]



Trusted Publisher Management

OpenID Connect (OIDC) provides a flexible, credential-free mechanism for delegating publishing authority for a PyPI package to a trusted third party service, like GitHub Actions.

PyPI users and projects can use trusted publishers to automate their release processes, without needing to use API tokens or passwords.

You can read more about trusted publishers and how to use them here.

Manage current publishers

Publisher	Repository	Workflow	Environment name	
GitHub	os-climate/ITR	release.yaml	pypi	Remove

Trusted Publishers

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Example Implementation in workflow:

```
jobs:
   pypi-publish:
     name: upload release to PyPI
     runs-on: ubuntu-latest
+    permissions:
+      # IMPORTANT: this permission is mandatory for trusted publishing
+      id-token: write
     steps:
       # retrieve your distributions here

       - name: Publish package distributions to PyPI
         uses: pypa/gh-action-pypi-publish@release/v1
-        with:
-          username: __token__
-          password: ${{ secrets.PYPI_TOKEN }}
```

Apps

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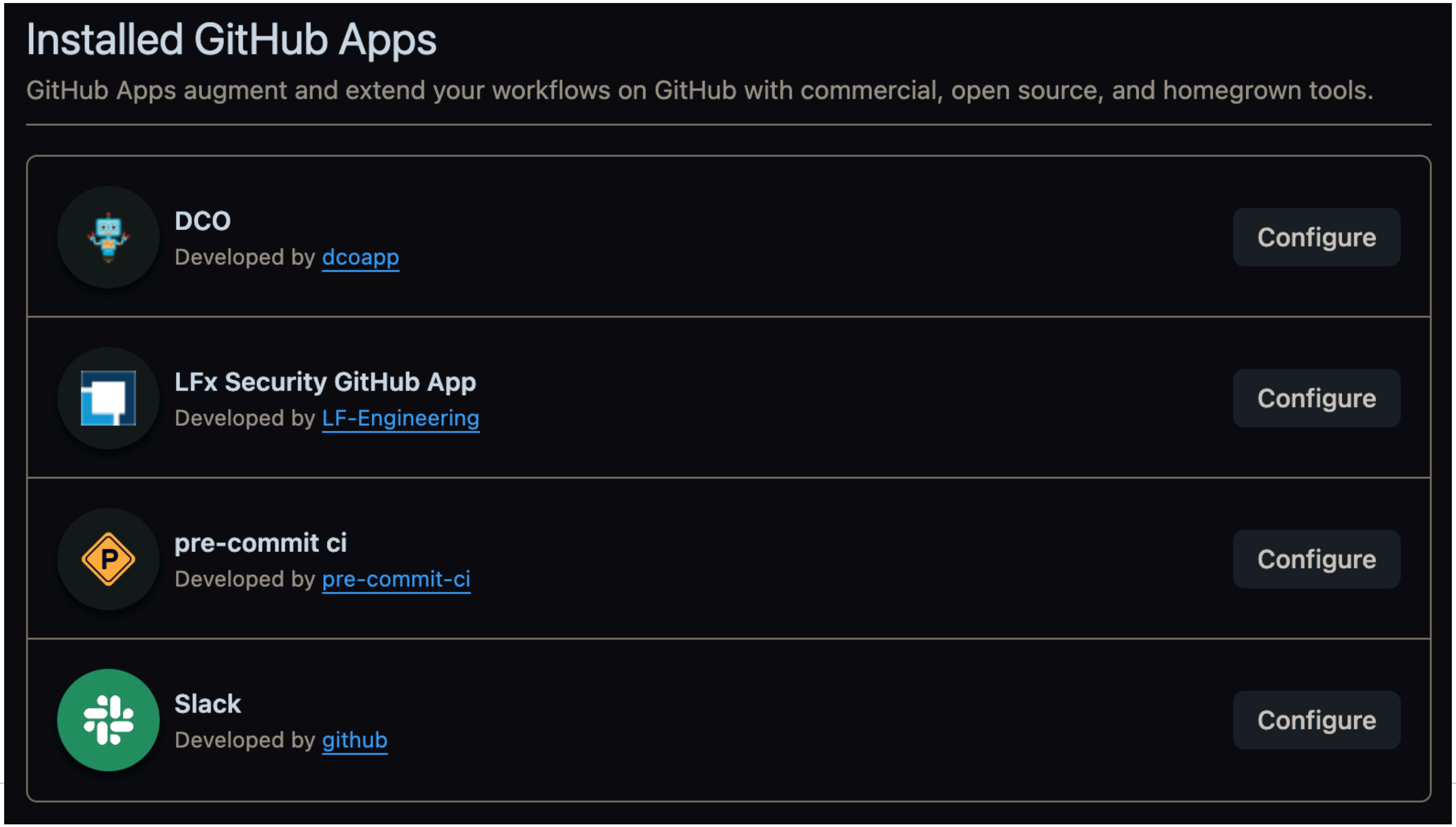

Installed GitHub Apps

GitHub Apps augment and extend your workflows on GitHub with commercial, open source, and homegrown tools.

DCO
Developed by dcoapp

LFx Security GitHub App
Developed by LF-Engineering

pre-commit ci
Developed by pre-commit-ci

Slack
Developed by github

Linting

Can work with pre-commit hooks!

Configure application:

https://github.com/organizations/os-climate/settings/installations/43027599

Take a look at a typical pull request:

https://github.com/os-climate/ITR/pull/298

Pre-commit output:

https://results.pre-commit.ci/run/github/384066937/1699962571.5gI3qZy5Q7aBzBj9J-fmgw

Can auto-update linting tools by raising a PR:

https://github.com/os-climate/ITR/pull/274

Dependabot

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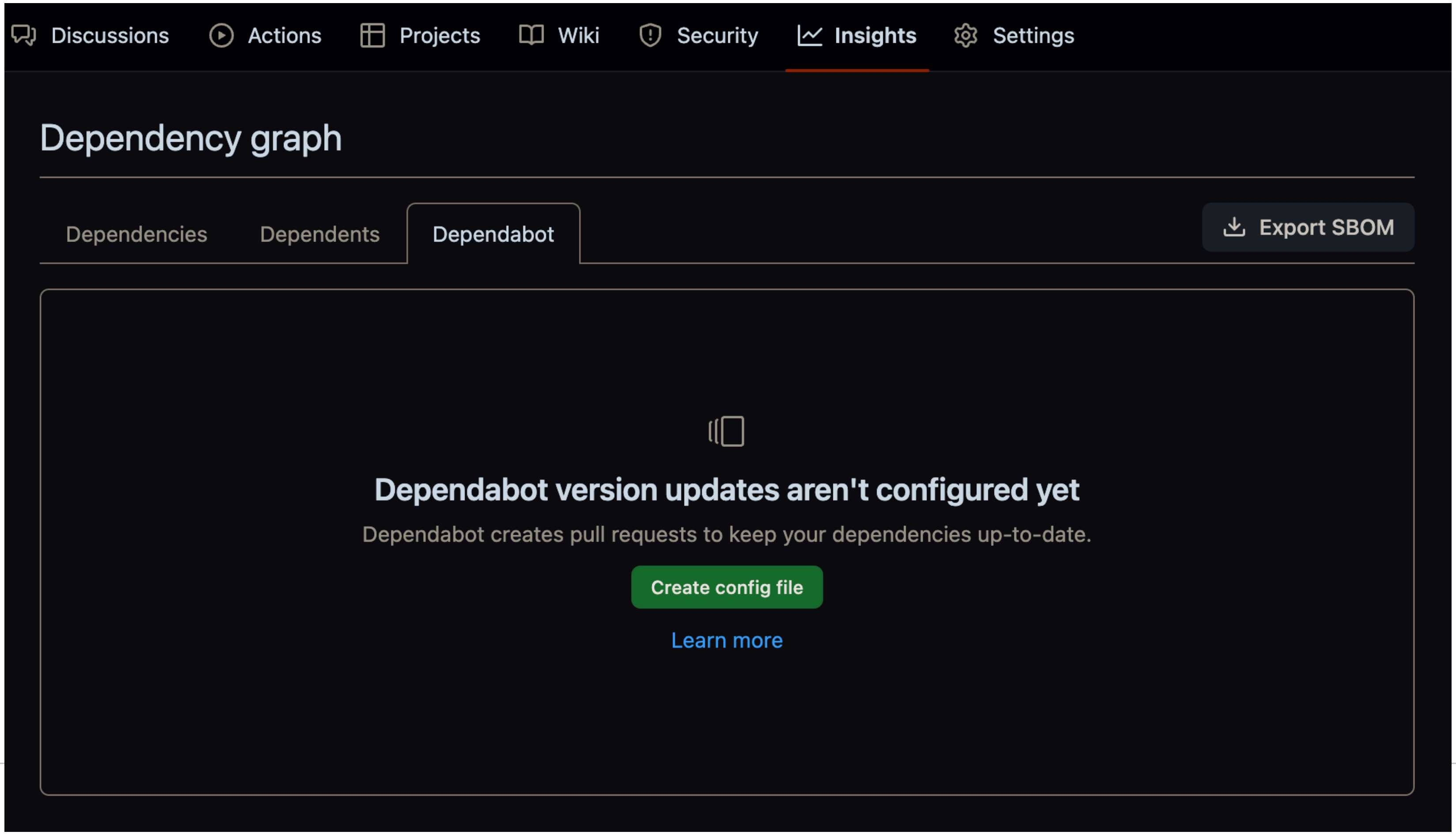
Documentation on configuration:
https://docs.github.com/en/code-security/dependabot/dependabot-version-updates/configuration-options-for-the-dependabot.yml-file



Dependency graph

Dependabot version updates aren't configured yet

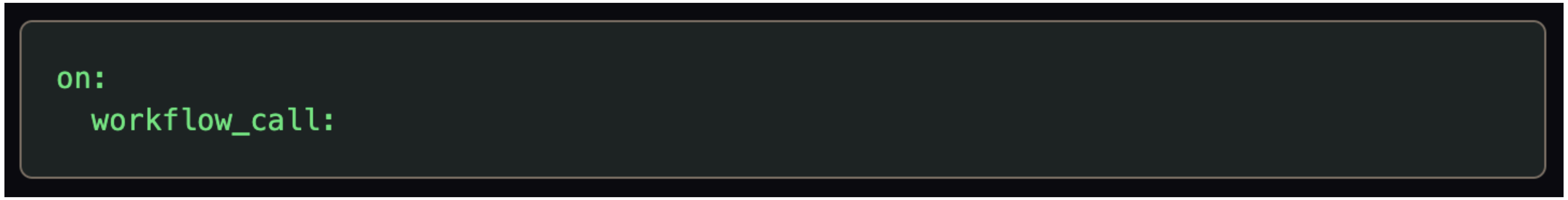
Dependabot creates pull requests to keep your dependencies up-to-date.

Reusable Workflows

What Are they?

Reusable workflows are YAML-formatted files, very similar to any other GitHub Actions workflow files. As with other workflows, you locate reusable workflows in the ".github/ workflows" directory inside a repository. Subdirectories of this folder are **NOT** supported.

For a workflow to be reusable, the values for on must include "workflow_call":



```yaml
on:
  workflow_call:
```

Reusable Workflows

Why should you use them? 💭

- **Reduces redundancy**

  If you have multiple repositories deployed the same way, reusable workflows can help you keep them in sync

- **No Duplication, modularity**

  We already know that by referencing workflows in another GitHub Action workflow, you reproduce the same work

- **Easy to create**

  All you need to have is a trigger and a workflow_call to prompt it. This simple and effortless process is documented here

Reusable Workflows

Features of Reusable Workflows

Three primary features:

1. Inputs: variables/other data passed in by the calling workflow
2. Secrets: credentials that can be consumed by the workflow
3. Outputs: artefacts or other data created by the workflow

Inputs/secrets can be mandatory requirements!

e.g. required: true

Reusable Workflows

Release Engineering: Reusable Workflows

We have a new repository, it's public, and you can find it here:
https://github.com/lfit/releng-reusable-workflows/tree/main/.github/workflows

LF GHA Workflows

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Release Engineering are porting our jobs!

You may have already seen them in Gerrit!

e.g.

https://git.opendaylight.org/gerrit/c/releng/builder/+/108980

…and here:

https://github.com/opendaylight/releng-builder/actions/runs/6878770145

Run Workflows Locally

Useful for debugging; it can be done!

The tools is here: https://github.com/nektos/act

Prerequisites:

- A local Docker install
- A suitable base image to execute the workflows with

Obviously, there are some limitations…

Mainly, the lack of full GitHub environment/context
e.g. Missing secrets/tokens, trusted publishing support

Run Workflows Locally

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Running Actions Locally

User documentation: https://nektosact.com/

Configuration file specifies the container image: ~/.actrc

e.g.

```
    -P ubuntu-latest=catthehacker/ubuntu:full-latest
```

Have encountered some issues with Apple Silicon…

Run Workflows Locally

Docker Image Requirements

- Choose same baseline OS image(s) as your workflows
- Modern NodeJS required
- Python3 and related tools (pyenv/pip/venv)

Apple Silicon issues: some third party workflows
download x64 binaries and ignore the underlying platform!

Run Workflows Locally

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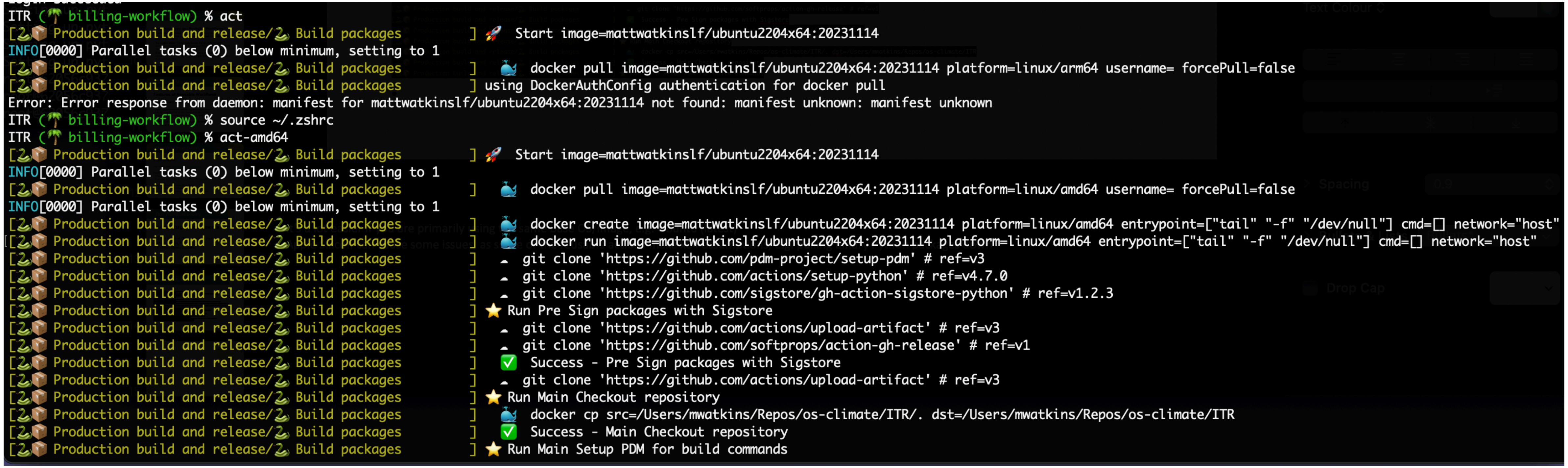
Example:



```
ITR (🌴 billing-workflow) % act
[🐍📦 Production build and release/🐍 Build packages        ] 🚀  Start image=mattwatkinslf/ubuntu2204x64:20231114
INFO[0000] Parallel tasks (0) below minimum, setting to 1
[🐍📦 Production build and release/🐍 Build packages        ]   🐳  docker pull image=mattwatkinslf/ubuntu2204x64:20231114 platform=linux/arm64 username= forcePull=false
[🐍📦 Production build and release/🐍 Build packages        ] using DockerAuthConfig authentication for docker pull
Error: Error response from daemon: manifest for mattwatkinslf/ubuntu2204x64:20231114 not found: manifest unknown: manifest unknown
ITR (🌴 billing-workflow) % source ~/.zshrc
ITR (🌴 billing-workflow) % act-amd64
[🐍📦 Production build and release/🐍 Build packages        ] 🚀  Start image=mattwatkinslf/ubuntu2204x64:20231114
INFO[0000] Parallel tasks (0) below minimum, setting to 1
[🐍📦 Production build and release/🐍 Build packages        ]   🐳  docker pull image=mattwatkinslf/ubuntu2204x64:20231114 platform=linux/amd64 username= forcePull=false
INFO[0000] Parallel tasks (0) below minimum, setting to 1
[🐍📦 Production build and release/🐍 Build packages        ]   🐳  docker create image=mattwatkinslf/ubuntu2204x64:20231114 platform=linux/amd64 entrypoint=["tail" "-f" "/dev/null"] cmd=[] network="host"
[🐍📦 Production build and release/🐍 Build packages        ]   🐳  docker run image=mattwatkinslf/ubuntu2204x64:20231114 platform=linux/amd64 entrypoint=["tail" "-f" "/dev/null"] cmd=[] network="host"
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/pdm-project/setup-pdm' # ref=v3
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/actions/setup-python' # ref=v4.7.0
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/sigstore/gh-action-sigstore-python' # ref=v1.2.3
[🐍📦 Production build and release/🐍 Build packages        ] ⭐ Run Pre Sign packages with Sigstore
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/actions/upload-artifact' # ref=v3
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/softprops/action-gh-release' # ref=v1
[🐍📦 Production build and release/🐍 Build packages        ]   ✅  Success - Pre Sign packages with Sigstore
[🐍📦 Production build and release/🐍 Build packages        ]   ☁  git clone 'https://github.com/actions/upload-artifact' # ref=v3
[🐍📦 Production build and release/🐍 Build packages        ] ⭐ Run Main Checkout repository
[🐍📦 Production build and release/🐍 Build packages        ]   🐳  docker cp src=/Users/mwatkins/Repos/os-climate/ITR/. dst=/Users/mwatkins/Repos/os-climate/ITR
[🐍📦 Production build and release/🐍 Build packages        ]   ✅  Success - Main Checkout repository
[🐍📦 Production build and release/🐍 Build packages        ] ⭐ Run Main Setup PDM for build commands
```

Further Reading

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Want to learn more?

Bookmarks for your GitHub Actions learning journey 🚀

Check out these protips from @talktopri

Get started learning GitHub Actions in 3️⃣ easy steps:

- More details on CI/CD 🔃
- Explore the GitHub Actions Documentation
- GitHub Actions public roadmap

</presentation>

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Thank You!