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Buildpacks: Pragmatic Solutions to Quick and Secure Image Builds

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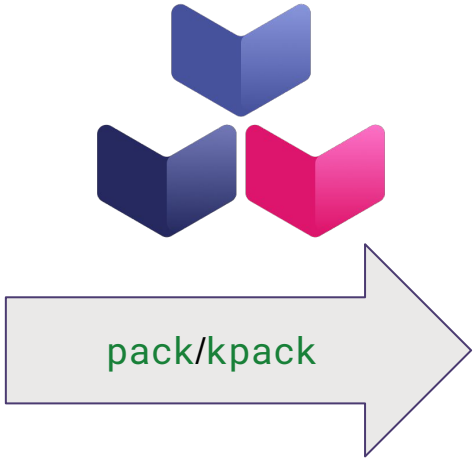
Overview

- Demo
- Buildpacks for End Users
- Buildpacks for Buildpacks Authors
- Buildpacks for Platform Operators
- Fast Rebuilds
- Secure Images

Buildpacks

- Create **production** images directly from your source project

- Go project
- Maven project
- PEP-518 project
- setup.py project
- Node.js project
- Rust project



OPEN CONTAINER INITIATIVE

Application Layer

Dependency Layer

Runtime Layer

Run Image Layer

Demo

- Go back-end
- Node.js front-end in TypeScript
- Paketo collection of Buildpacks
- ```
  pack build example \
  --builder paketobuildpacks/builder-jammy-base
  ```
  ```

Demo: Go & Typescript

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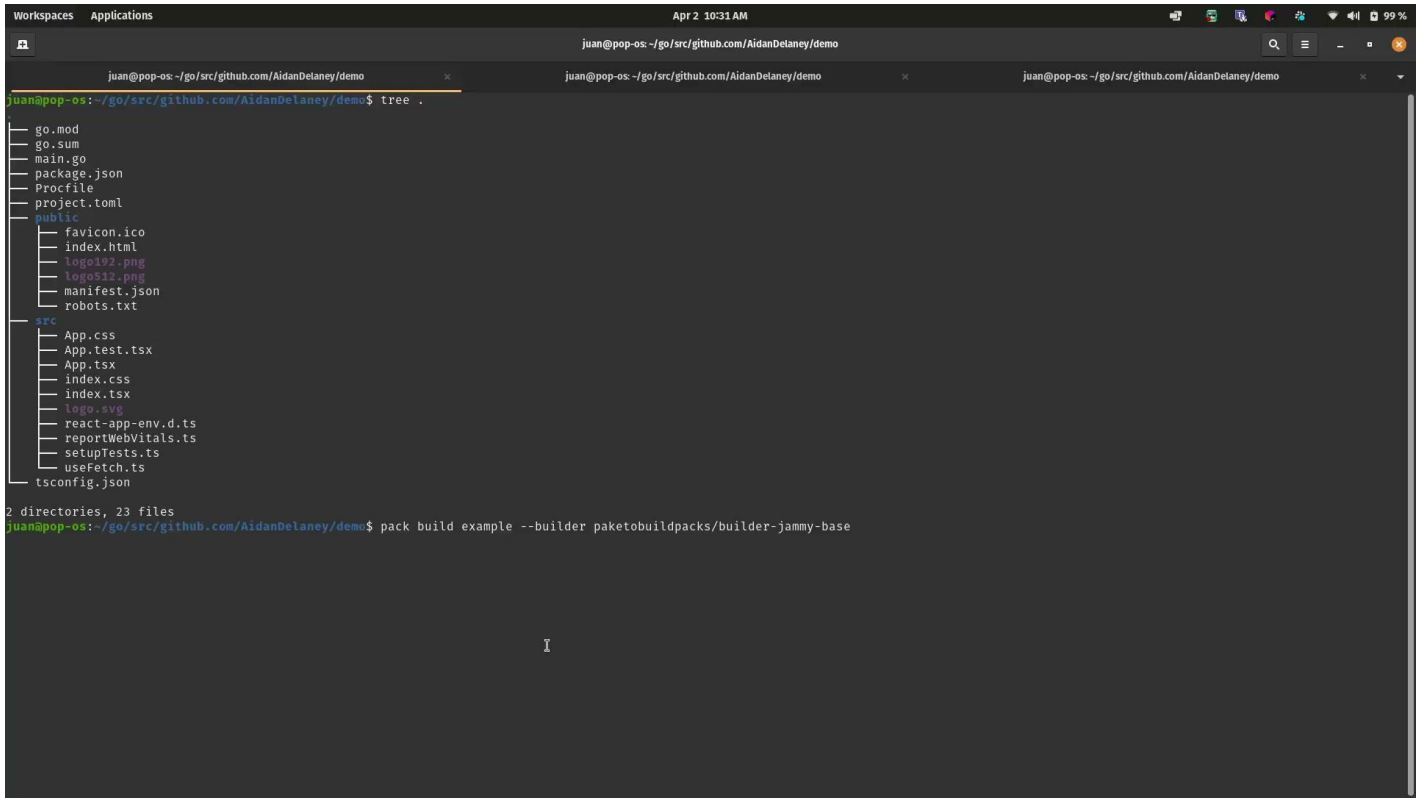
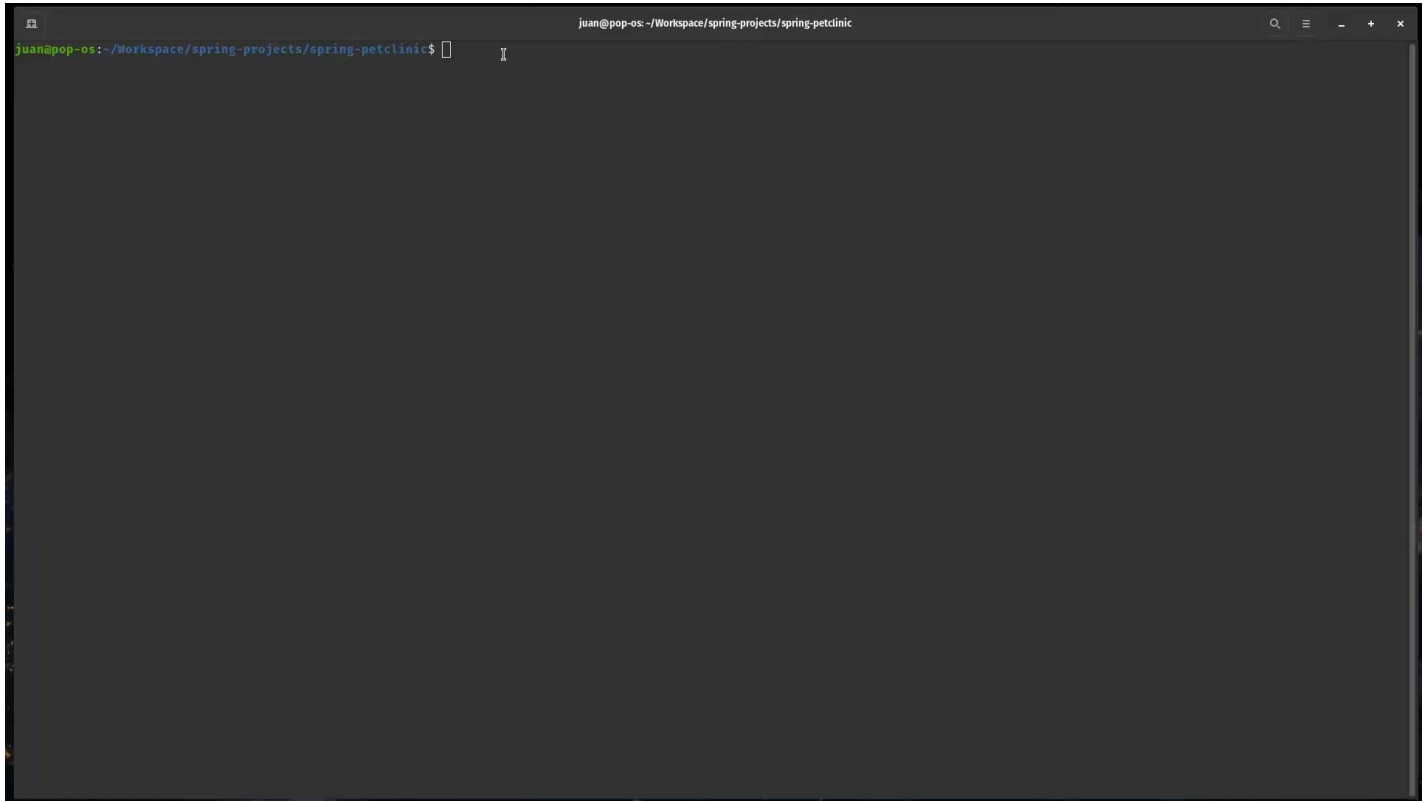


Demo: spring-boot `petclinic`

- `pack build petclinic`

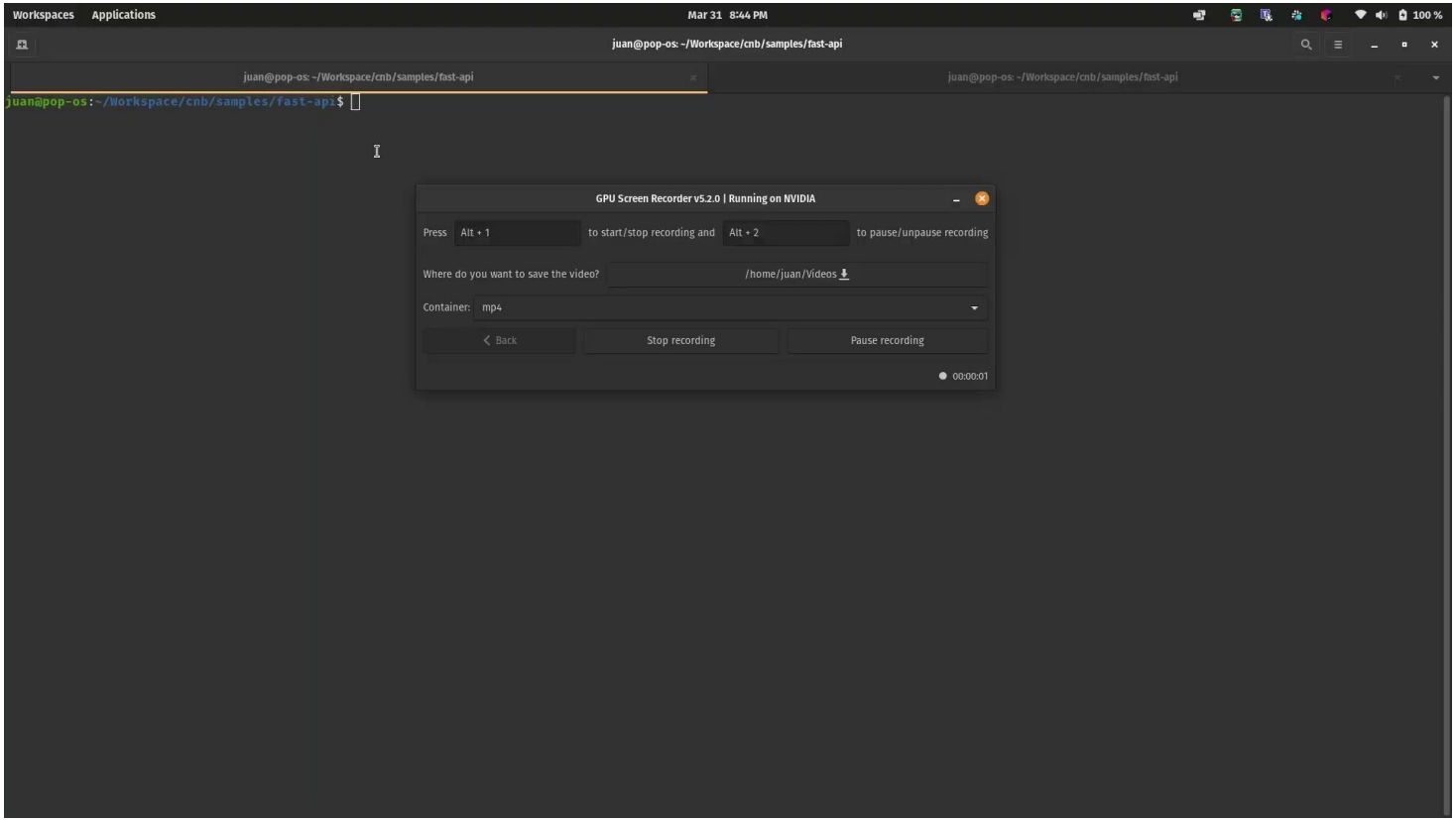
Demo: spring-boot



Demo: Python FastAPI

- ?

Demo: Python FastAPI



Buildpacks for End Users

- buildpacks.io is the specification
  - https://github.com/buildpacks/spec/
- Downstream implementations
  - Paketo project
  - Heroku
  - Google

Changes in 2024

- Deprecated support for Windows Containers on Windows
- Support OCI Image annotations
- Clarified deprecation of CNB_STACK_ID
- Roadmap for 2025 H1

Paketo

- Dependency Mirrors
- New RHEL UBI builder
- New Ubuntu core builder
- Clearer maintenance status
  - Looking for more maintainers

Heroku

- New support for .Net
- Poetry support in Python Buildpack
- New support for installing Debian packages
- All Buildpacks are multi-arch

Buildpacks for Buildpack Authors

- Features added to the specification in 2024
  - Extensions became non-experimental
- Changes to tooling
  - Improved support for insecure registries

Buildpacks for Platform Operators

- kpack
  - Supply Chain Software Security: SLSA level 3
- pack integrates with common workflows
  - CircleCI
  - GitHub Actions
  - GitLab
  - Jenkins
  - Tekton

Pragmatic Large-Scale Build Policies

- Control over base images
  - `pack build example --builder my-custom-builder`

- Our samples demo Ubuntu and Alpine based builders
- Change your base image by updating
  - `[build]` or `[run]` images
  - Support specified architecture targets for your organization

Pragmatic Large-Scale Build Policies

- Control over versions of tools
  - Updating buildpack versions bumps toolchains used

- Example
  - Bumping from paketo-buildpacks/go-dist v2.6.21 to v2.6.33 updates the Go toolchain from `1.23.6` to `1.23.7`

Pragmatic Large-Scale Build Policies

- Control over the build workflows
  - Add or drop support for language groups

- Example
  - Modify `builder.toml` to support only .Net and Node.js

Pragmatic Large-Scale Build Policies

- Control over the build environment

- Example
  - Define `/cnb/build-config/env/PIP_INDEX_URL.override` to ensure all builds used the provided `PIP_INDEX_URL` value

Pragmatic Large-Scale Build Policies

- Custom buildpacks

- Examples:
  - KubeCon EU 2023 talk
    - Customizing Your Buildpacks Build – Yes You Can! (Natalie Arellano & Aidan Delaney)
  - KubeCon EU 2020 talk
    - Building Docker Images with Cloud Native Buildpacks (Ben Hale, Terence Lee)

Anatomy of an Output Image

- Small layers
- Composable

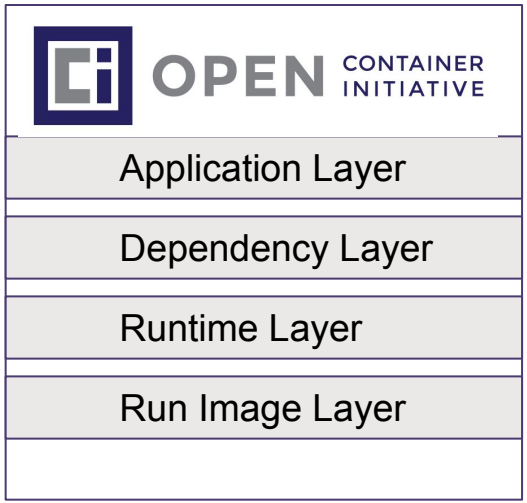
```
| • Layers
Cmp    Size  Command
     78 MB  FROM blobs
     51 MB
    1.4 kB
     505 B
    4.5 MB  Layer: 'helper', Created by buildpack: paketo-buildpacks/ca-certificates@3.10.0
    165 MB  Layer: 'node', Created by buildpack: paketo-buildpacks/node-engine@5.3.1
    257 MB  Layer: 'launch-modules', Created by buildpack: paketo-buildpacks/npm-install@1.8.6
     40 B  Layer: 'git', Created by buildpack: paketo-buildpacks/git@1.0.42
     12 MB  Layer: 'targets', Created by buildpack: paketo-buildpacks/go-build@2.2.28
    6.4 MB  Software Bill-of-Materials
     23 MB  Application Layer
    2.7 MB  Buildpacks Application Launcher
    2.1 kB  Buildpacks Launcher Config
      0 B  Buildpacks Process Types
```

Fast Image Rebuilds

- Cached layers
- Rebase
- Use Cases
  - Fast iteration on production platforms
    - testing batch jobs
    - Apache Spark
    - PaaS platform

Secure Images

- Small and focused
- SBOMs
- Integrates with
  - `cosign`
  - `in-toto`



Conclusion

- The buildpacks.io project is in a stable and healthy state
  - Small updates to the spec from multiple parties
- Buildpacks implementations are in a stable and healthy state
- Organizations have a lot of control over buildpacks workflows

Online


https://github.com/buildpacks


https://buildpacks.io/


https://buildpacks.io/community/


#buildpacks in CNCF Slack Workspace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