



The bridge to possible

Pack it up with Cloud Native Buildpacks

Luis Manuel de Vries, Software Engineering Technical Leader,
ONEx Platform and Services
ludevrie@cisco.com

Cisco Webex App

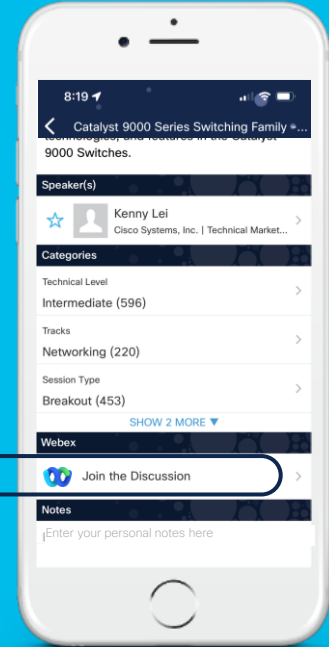
Questions?

Use Cisco Webex App to chat with the speaker after the session

How

- 1 Find this session in the Cisco Live Mobile App
- 2 Click “Join the Discussion”
- 3 Install the Webex App or go directly to the Webex space
- 4 Enter messages/questions in the Webex space

Webex spaces will be moderated until February 24, 2023.





Agenda

- Introduction
- Dockerfile Hurdles
- Cloud Native Buildpacks Overview
- Demo
- CNB Lifecycle
- Advanced CNB Capabilities
- Conclusion & QA

Introduction

Luis Manuel de Vries



Software Engineering Technical Leader,
ONEx Platform and Services, Cisco

ludevrie@cisco.com

www.linkedin.com/in/luis-manuel-de-vries

Experience

- 15+ years of ICT Experience
- Focused on Cloud Native technologies, approaches, and patterns.
- Currently working within Cisco's Customer and Partner Engineering organization on a wide range of projects, from PoCs to automated generation of developer cloud sandbox.
- Originally from Holland, living in Barcelona and working with a US based team.

Docker != Dockerfile

Dockerfile Hurdles

```
FROM debian
COPY . /app
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
CMD ["java", "-jar", "/app/target/app.jar"]
```

Dockerfile Hurdles

Order Matters for Caching

```
FROM debian
COPY . /app
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
COPY . /app
CMD ["java", "-jar", "/app/target/app.jar"]
```

Dockerfile Hurdles

```
FROM debian
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
COPY . /app
CMD ["java", "-jar", "/app/target/app.jar"]
```


Dockerfile Hurdles

More Specific COPY to limit cache busts

```
FROM debian
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
COPY . /app
COPY target/app.jar /app
CMD ["java", "-jar", "/app/target/app.jar"]
```

Dockerfile Hurdles

```
FROM debian
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
COPY target/app.jar /app
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Identify caching optimizations

```
FROM debian
RUN apt-get update
RUN apt-get -y install openjdk-8-jdk ssh vim
RUN apt-get update \
    && apt-get -y install \
        openjdk-8-jdk ssh vim
COPY target/app.jar /app
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Reduce Image Size

```
FROM debian
RUN apt-get update \
    && apt-get -y install \
        openjdk-8-jdk ssh vim
COPY target/app.jar /app
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Reduce Image Size

```
FROM debian
RUN apt-get update \
    && apt-get -y install -no-install-recommends \
    openjdk-8-jdk ssh-vim \
    && rm -rf /var/lib/apt/lists/*
COPY target/app.jar /app
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Official Images

```
FROM debian
RUN apt-get update \
    && apt-get -y install -no-install-recommends \
        openjdk-8-jdk \
    && rm -rf /var/lib/apt/lists/*
COPY target/app.jar /app
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Official Images

```
FROM debian  
RUN apt-get update \  
&& apt-get -y install --no-install-recommends \  
openjdk-8-jdk \  
&& rm -rf /var/lib/apt/lists/*  
FROM openjdk:8  
COPY target/app.jar /app  
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Building with Docker

```
FROM openjdk:8  
COPY target/app.jar /app  
CMD ["java", "-jar", "/app/app.jar"]
```


Dockerfile Hurdles

Building with Docker

```
FROM openjdk:8  
FROM maven:3.6-jdk-8-alpine  
WORKDIR /app  
COPY target/app.jar /app  
COPY pom.xml .  
RUN mvn -e -B dependency:resolve  
COPY src ./src  
RUN mvn -e -B package  
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Multi-Stage Builds

```
FROM maven:3.6-jdk-8-alpine
WORKDIR /app
COPY pom.xml .
RUN mvn -e -B dependency:resolve
COPY src ./src
RUN mvn -e -B package
CMD ["java", "-jar", "/app/app.jar"]
```

Dockerfile Hurdles

Multi-Stage Builds

```
FROM maven:3.6-jdk-8-alpine AS builder
WORKDIR /app
COPY pom.xml .
RUN mvn -e -B dependency:resolve
COPY src ./src
RUN mvn -e -B package
CMD ["java", "-jar", "/app/app.jar"]
```

```
FROM openjdk:8-jre-alpine
COPY --from=builder /app/target/app.jar /
CMD ["java", "-jar", "/app/app.jar"]
```

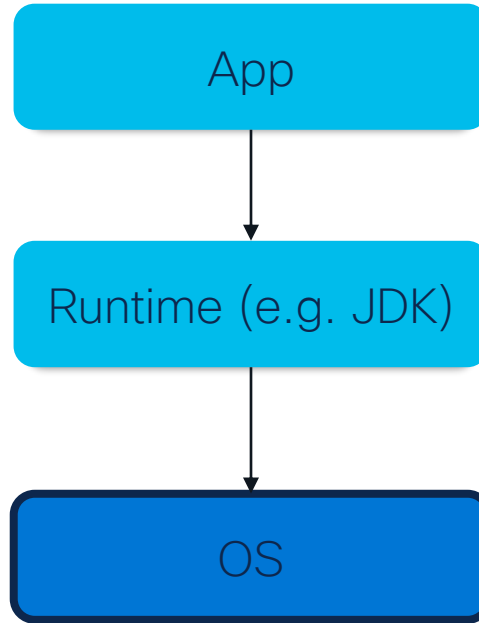
Dockerfile Hurdles

Optimized Multi-Stage Dockerfile

```
FROM maven:3.6-jdk-8-alpine AS builder
WORKDIR /app
COPY pom.xml .
RUN mvn -e -B dependency:resolve
COPY src ./src
RUN mvn -e -B package

FROM openjdk:8-jre-alpine
COPY --from=builder /app/target/app.jar /
CMD ["java", "-jar", "/app/app.jar"]
```

Application Images with Dockerfiles



FROM debian

...

COPY target/app.jar /app

...

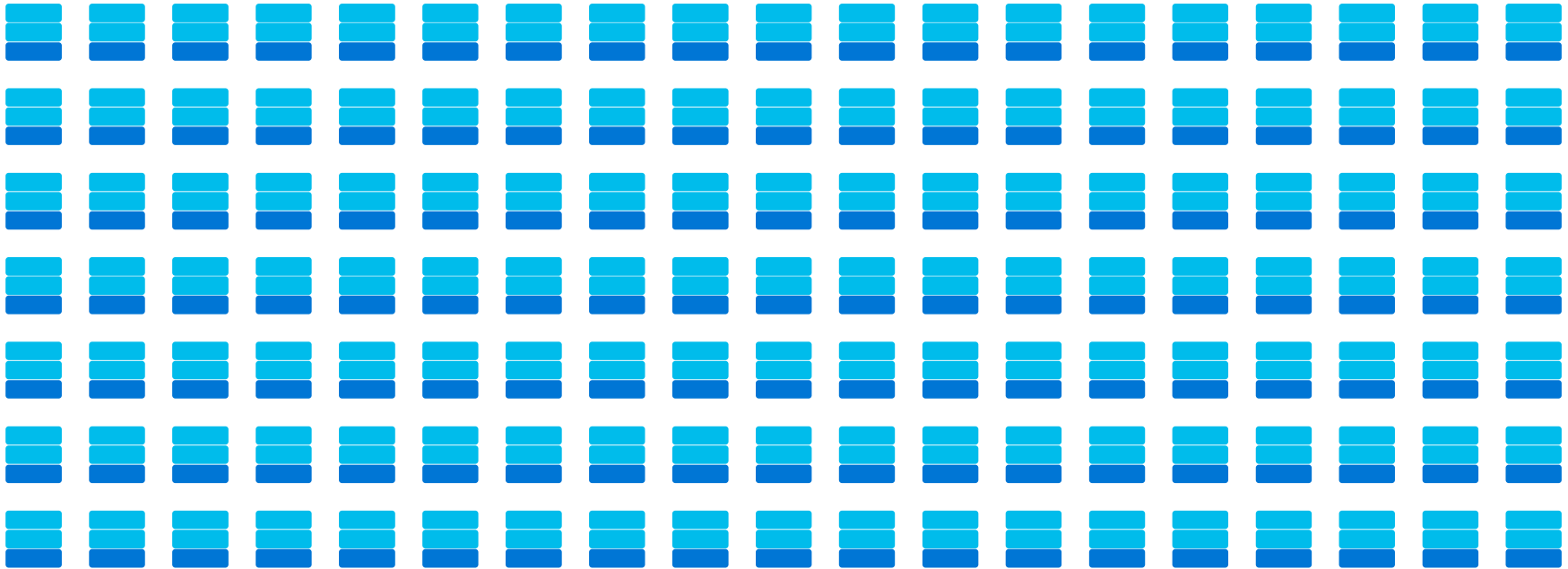
FROM debian

RUN apt-get install openjdk-8

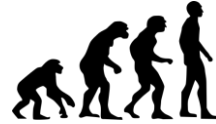
...

FROM scratch

How many images are in your container registry?



Challenges of Manual Dockerfile creation



Images (and dev envs)
change over time



Non-
reproducible



Reproducible, secure
builds

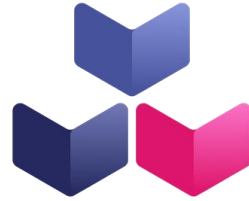


Human Error



Manual Security
Updates

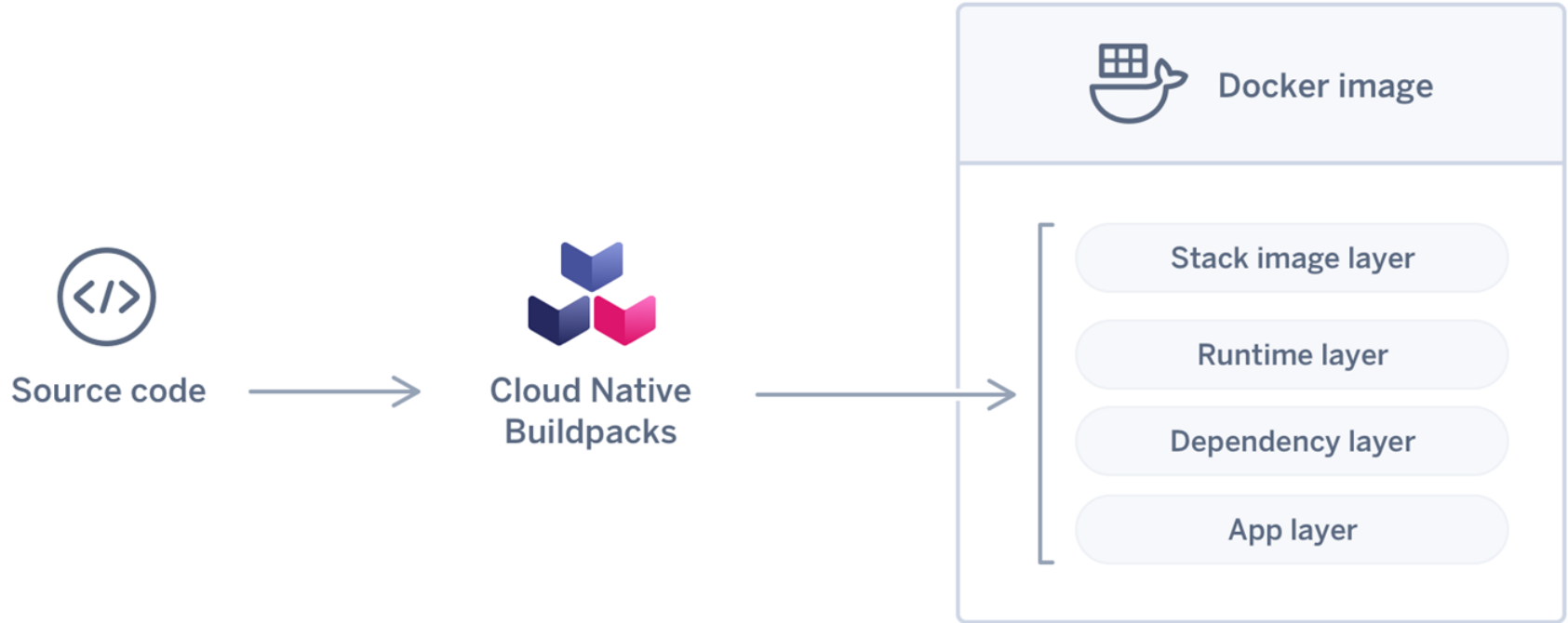
Cloud Native Buildpacks



Buildpacks.io



What are Cloud Native Buildpacks?



Cloud Native Buildpacks are...

Reusable

Use the same
buildpack on many
apps

Fast

Only re-builds and
uploads layers
when necessary

Modular

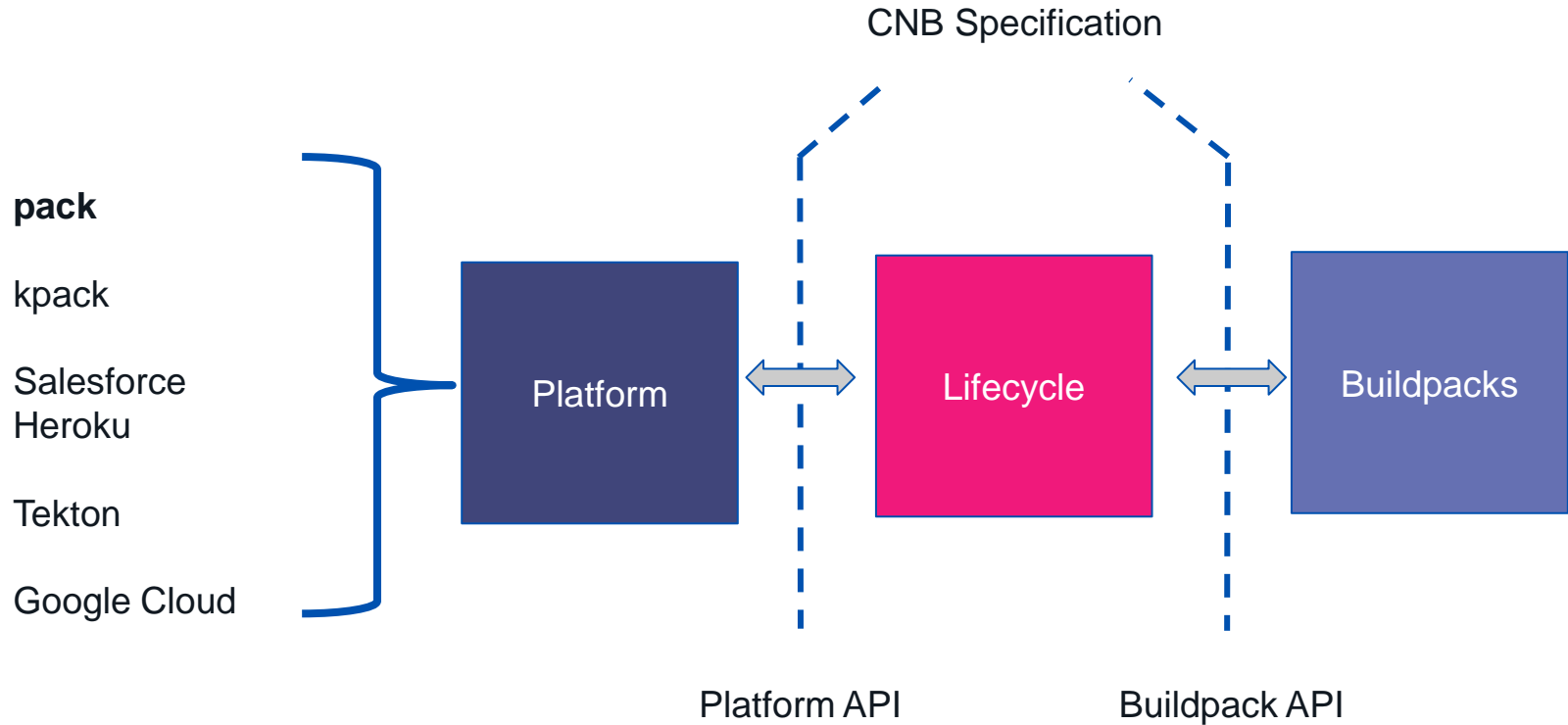
Combine buildpacks
to create composite
images

Safe

Apps meet security
requirements w/o
developer
intervention

Cloud Native Buildpacks

An Open Standard

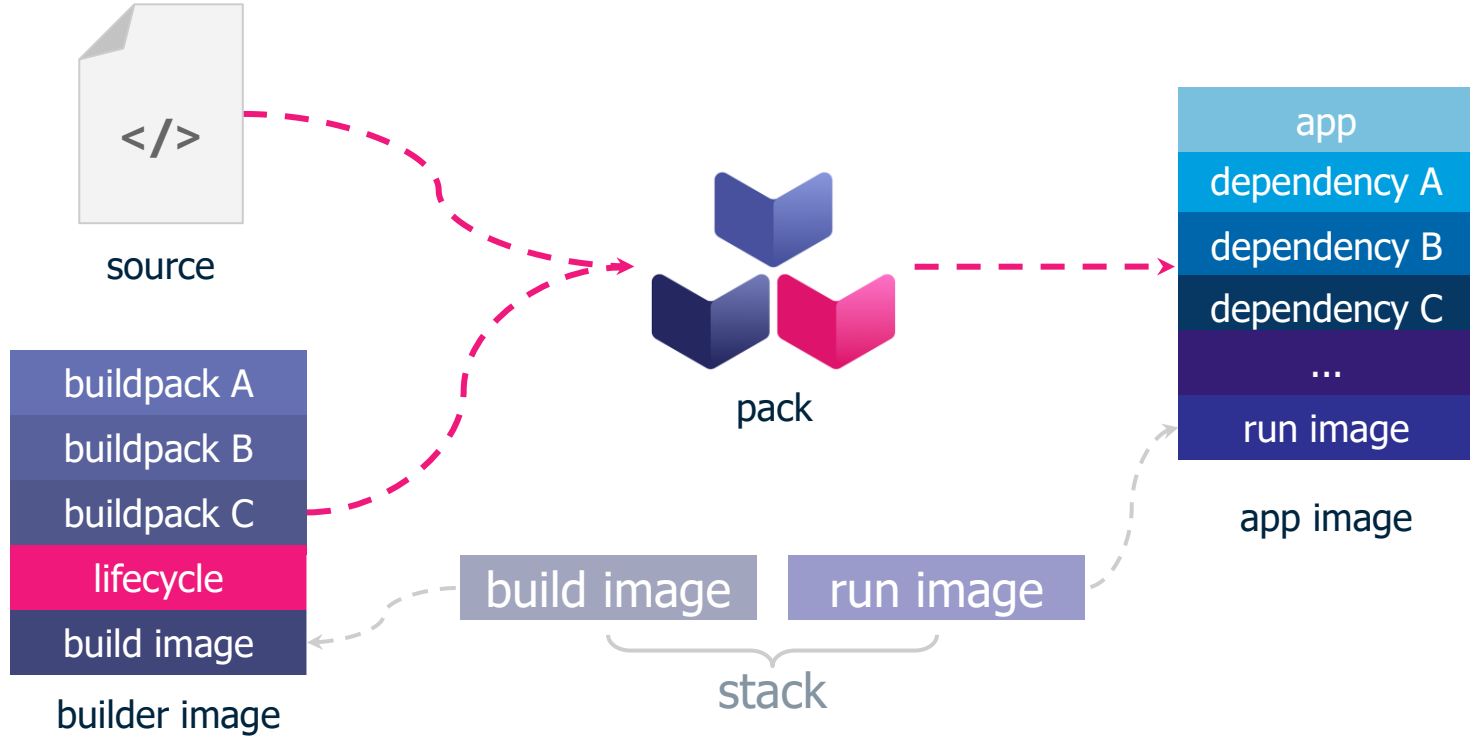


Components of Cloud Native Buildpacks

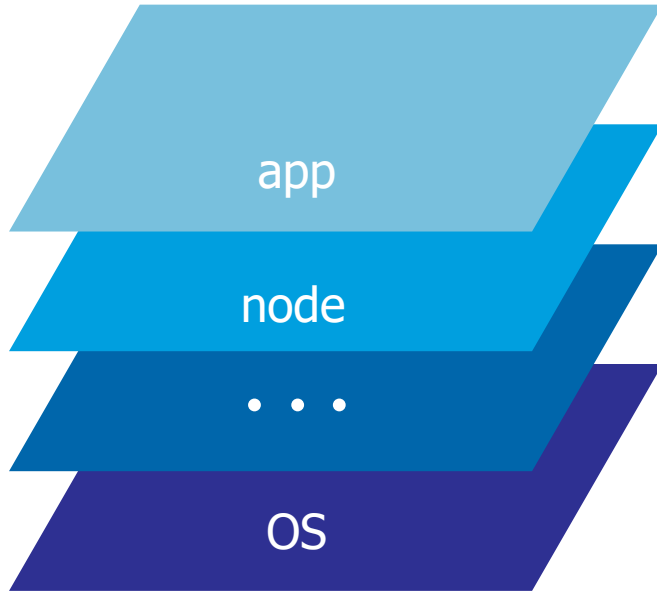
- **Buildpacks** represent the fundamental unit of work. This is what performs the operations of building and packaging of source code or artifacts into a Docker image.
- **Stacks** are the underlying environment. This is what defines the execution environment for the buildpack and the base image for the final result.
- **Builders** are the combination of one or more stacks and buildpacks. This is where the framework configuration and processing definition live.

Cloud Native Buildpacks

Overview



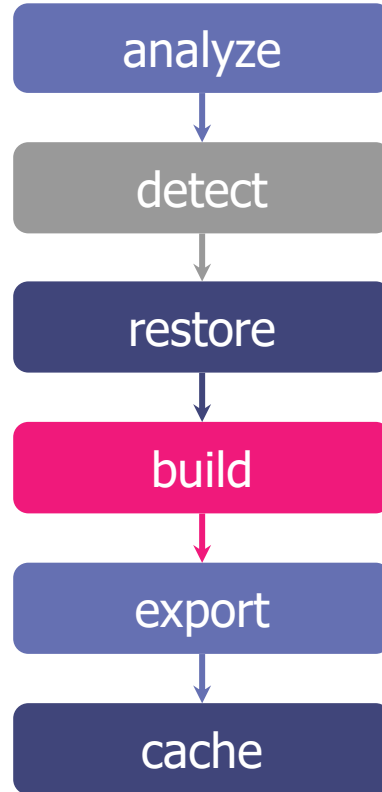
Look what's created



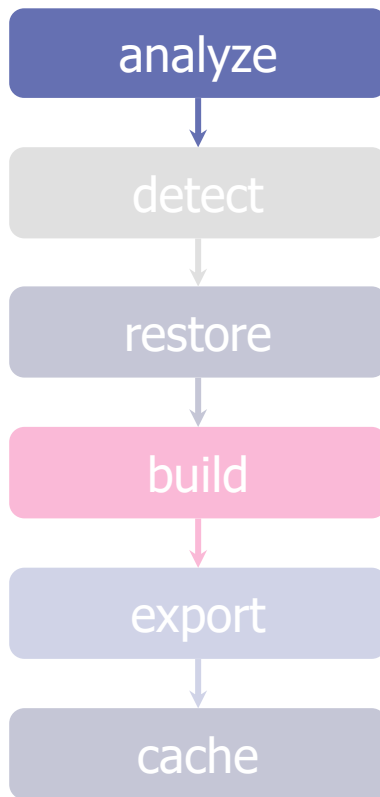
App image that has

- a reproducible build
- metadata that can be inspected
- logical mapping of layers to components

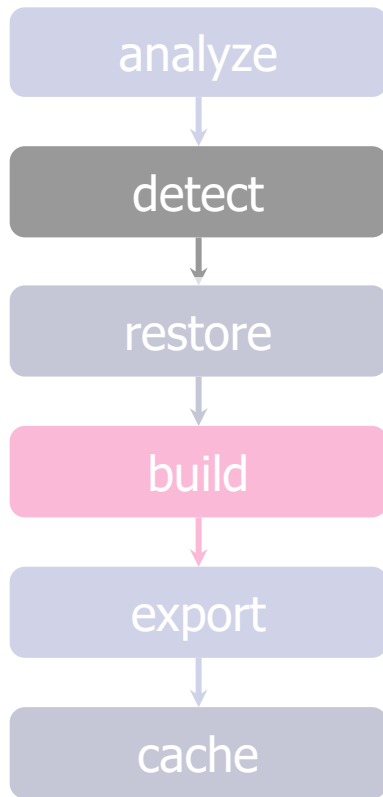
Lifecycle



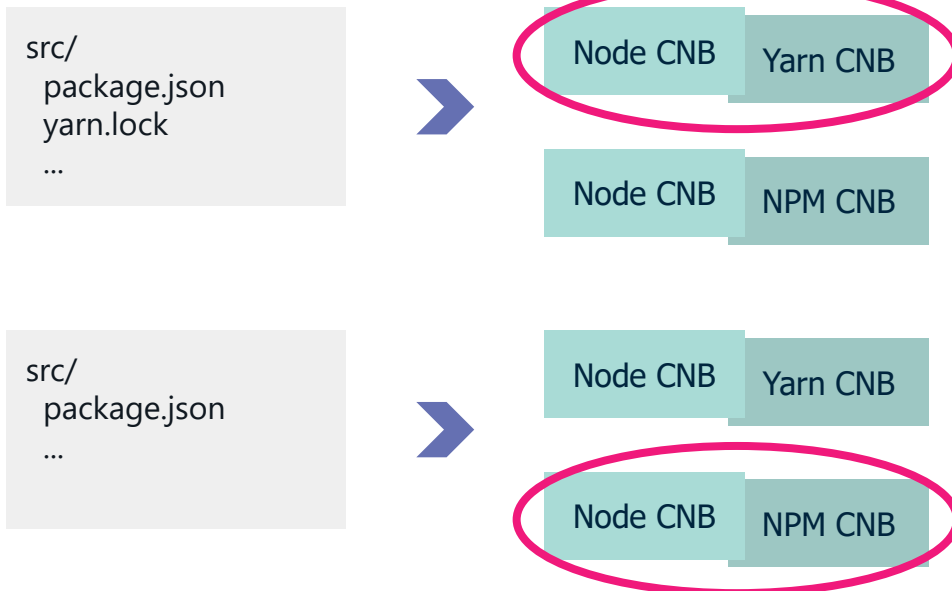
Lifecycle: Analyze



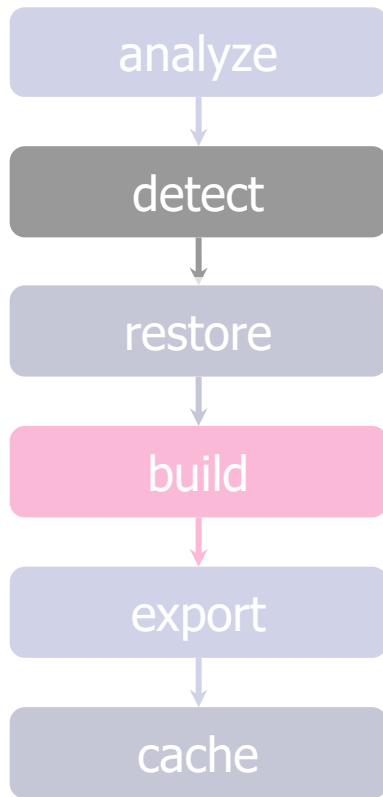
Lifecycle: Detect



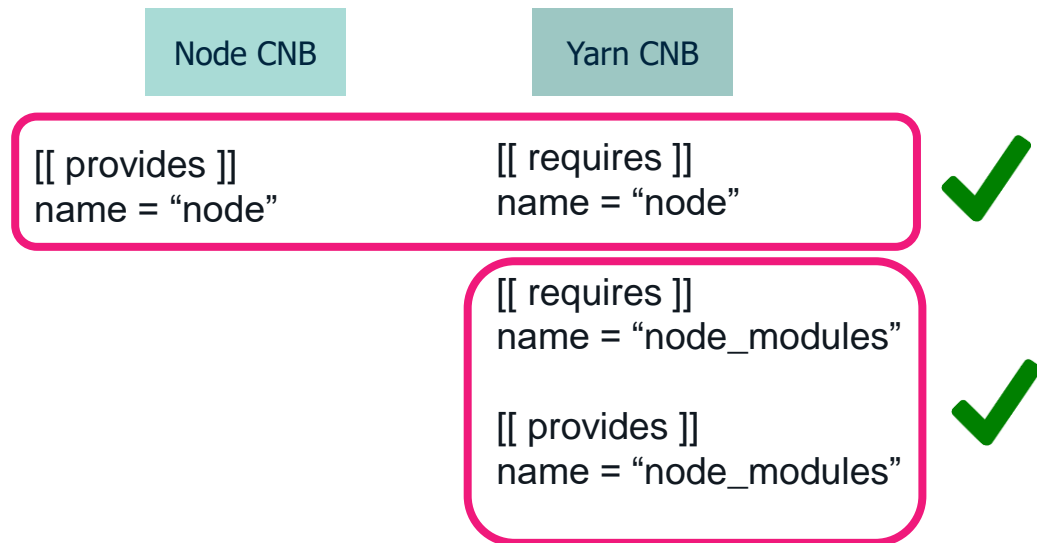
- Tests groups of buildpacks against source, in order (via each buildpack's **detect** binary)
- First group that passes is selected



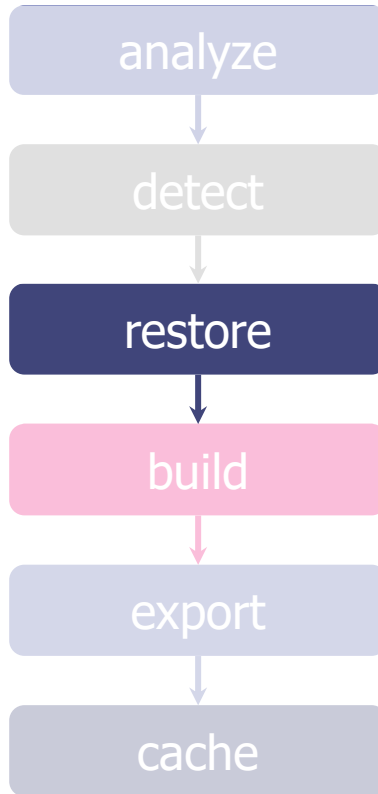
Lifecycle: Detect - Build Plan



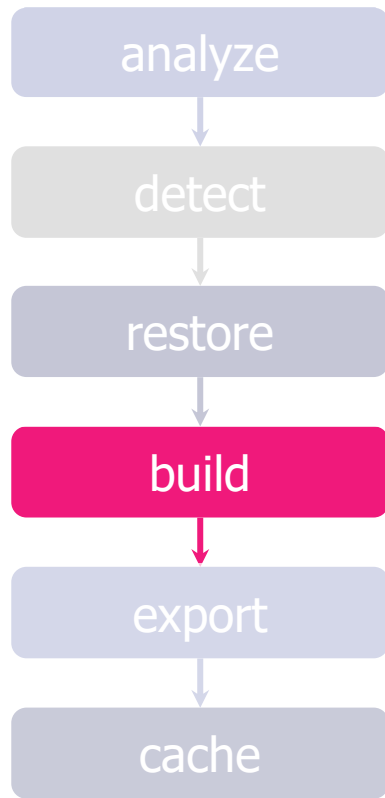
- Buildpacks detect in parallel
- The build plan allow buildpacks to coordinate during detection
- Composability allows for easy customization or extension



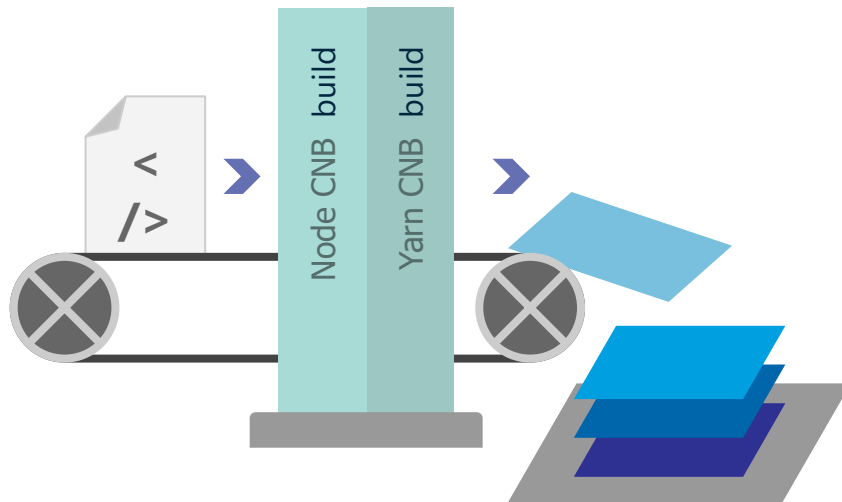
Lifecycle: Restore



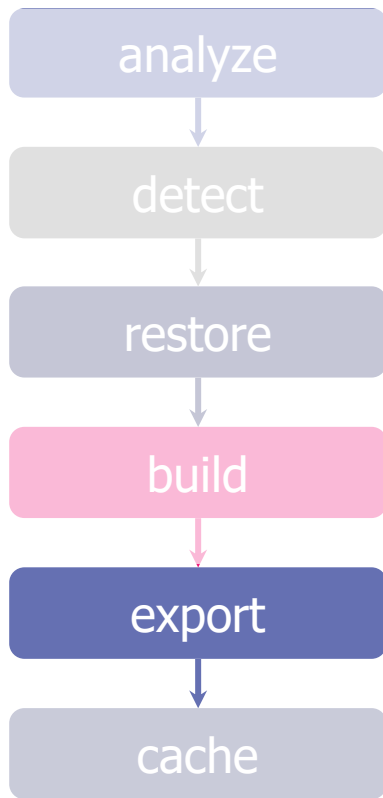
Lifecycle: Build



- For previously-selected group, executes each buildpack's **build** binary, in order
- *Recall:* **build** gathers dependencies, compiles app (if needed), and sets launch command



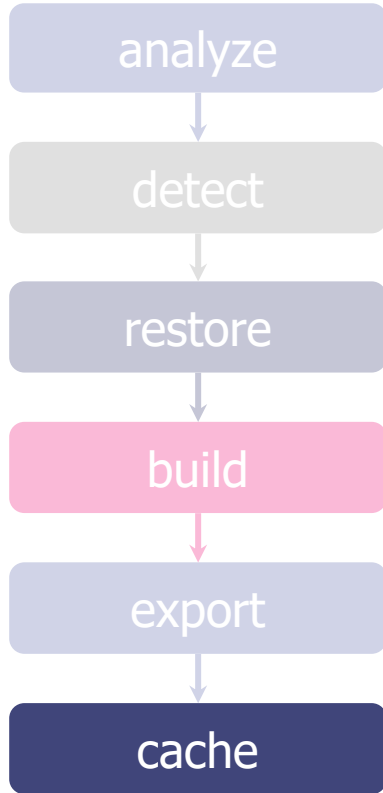
Lifecycle: Export



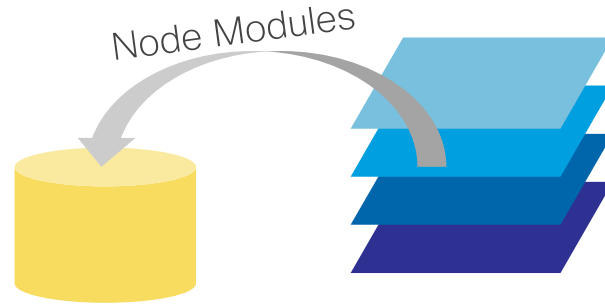
- Assembles final layers into image
- Combines information from *analyze* phase to ensure only changed layers are updated



Lifecycle: Cache



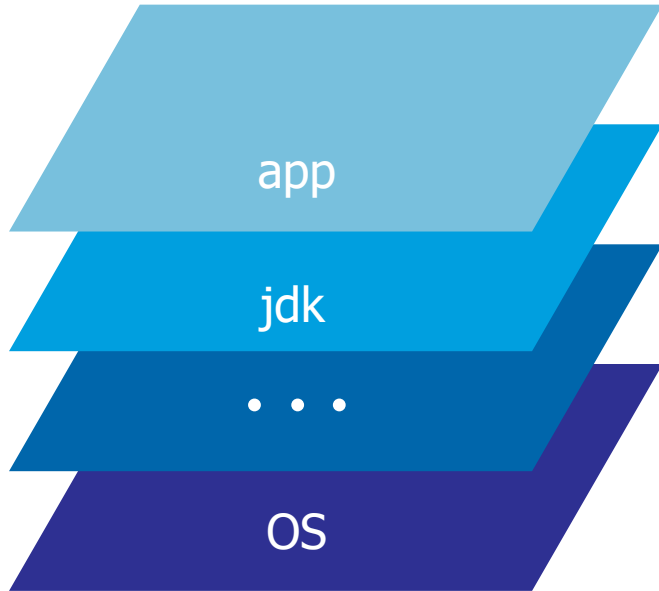
- Caches any necessary dependencies
- Retrieved on next build's **restore** phase



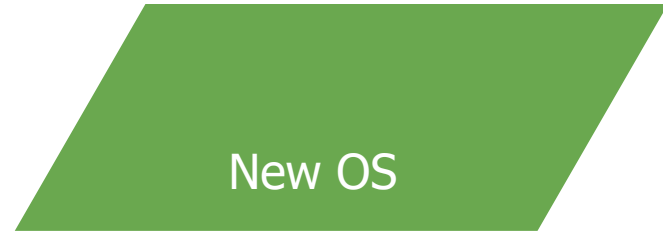
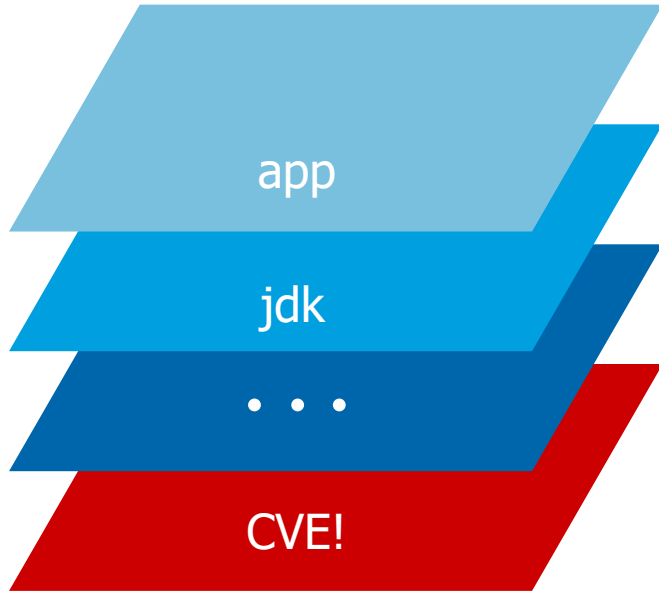
Demo

Advanced Cloud Native Buildpacks

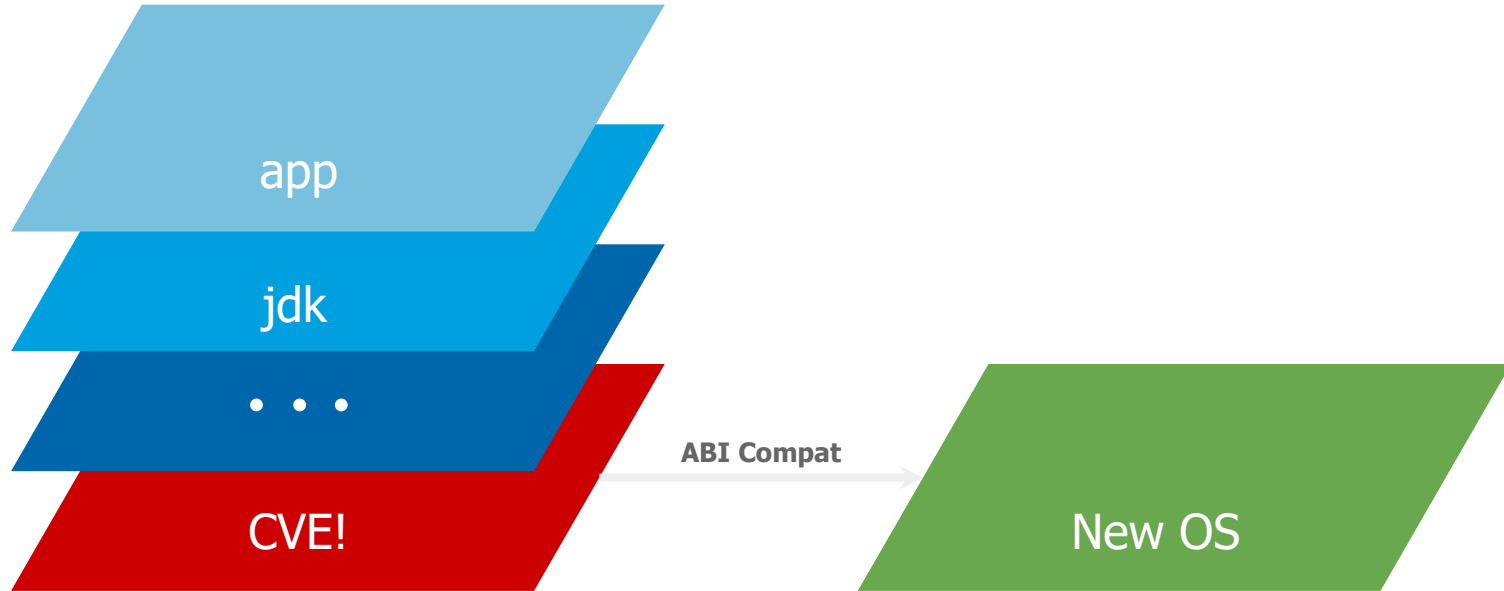
Rebase



Rebase

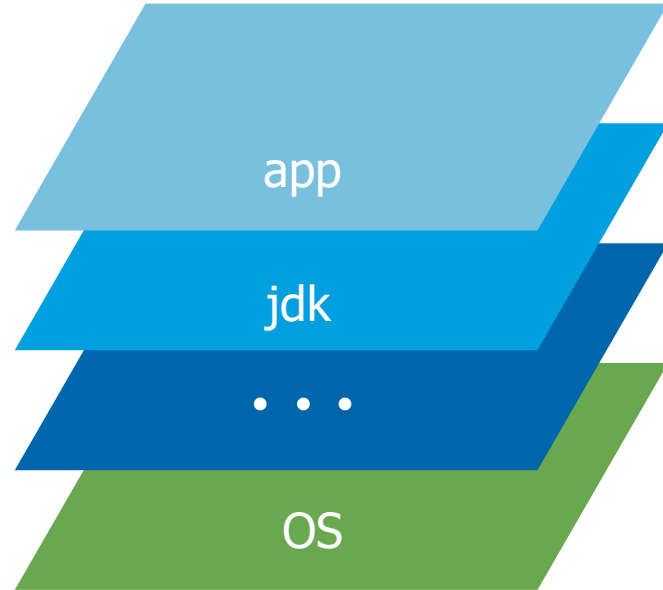


Rebase



Rebase

```
$ pack rebase myimage
```



Software Bill of Materials (SBOM)

Advanced Cloud Native Buildpacks

```
$ pack inspect-image sample-nodejs
Inspecting image: sample-nodejs

REMOTE:
(not present)

LOCAL:

Stack: io.buildpacks.stacks.bionic

Base Image:
  Reference: 5d10637559ec14ba0c6795f10e975cb9d2896f138f9eb09570500cf052c0b00b
  Top Layer: sha256:3905f740ea0f0cbb7c10597d8f8abe5e50f092a1a3ee960915498811beec51c3

Run Images:
  index.docker.io/paketobuildpacks/run:base-cnb
  gcr.io/paketo-buildpacks/run:base-cnb

Buildpacks:


| ID                                | VERSION | HOMEPAGE                                                                                                                |
|-----------------------------------|---------|-------------------------------------------------------------------------------------------------------------------------|
| paketo-buildpacks/ca-certificates | 3.1.0   | <a href="https://github.com/paketo-buildpacks/ca-certificates">https://github.com/paketo-buildpacks/ca-certificates</a> |
| paketo-buildpacks/node-engine     | 0.12.3  | <a href="https://github.com/paketo-buildpacks/node-engine">https://github.com/paketo-buildpacks/node-engine</a>         |
| paketo-buildpacks/npm-install     | 0.9.0   | <a href="https://github.com/paketo-buildpacks/npm-install">https://github.com/paketo-buildpacks/npm-install</a>         |
| paketo-buildpacks/node-module-bom | 0.2.4   | <a href="https://github.com/paketo-buildpacks/node-module-bom">https://github.com/paketo-buildpacks/node-module-bom</a> |
| paketo-buildpacks/node-start      | 0.8.0   | <a href="https://github.com/paketo-buildpacks/node-start">https://github.com/paketo-buildpacks/node-start</a>           |
| paketo-buildpacks/npm-start       | 0.9.0   | <a href="https://github.com/paketo-buildpacks/npm-start">https://github.com/paketo-buildpacks/npm-start</a>             |
| paketo-buildpacks/procfile        | 5.1.0   | <a href="https://github.com/paketo-buildpacks/procfile">https://github.com/paketo-buildpacks/procfile</a>               |



Processes:


| TYPE          | SHELL | COMMAND   | ARGS |
|---------------|-------|-----------|------|
| web (default) | bash  | npm start |      |


```

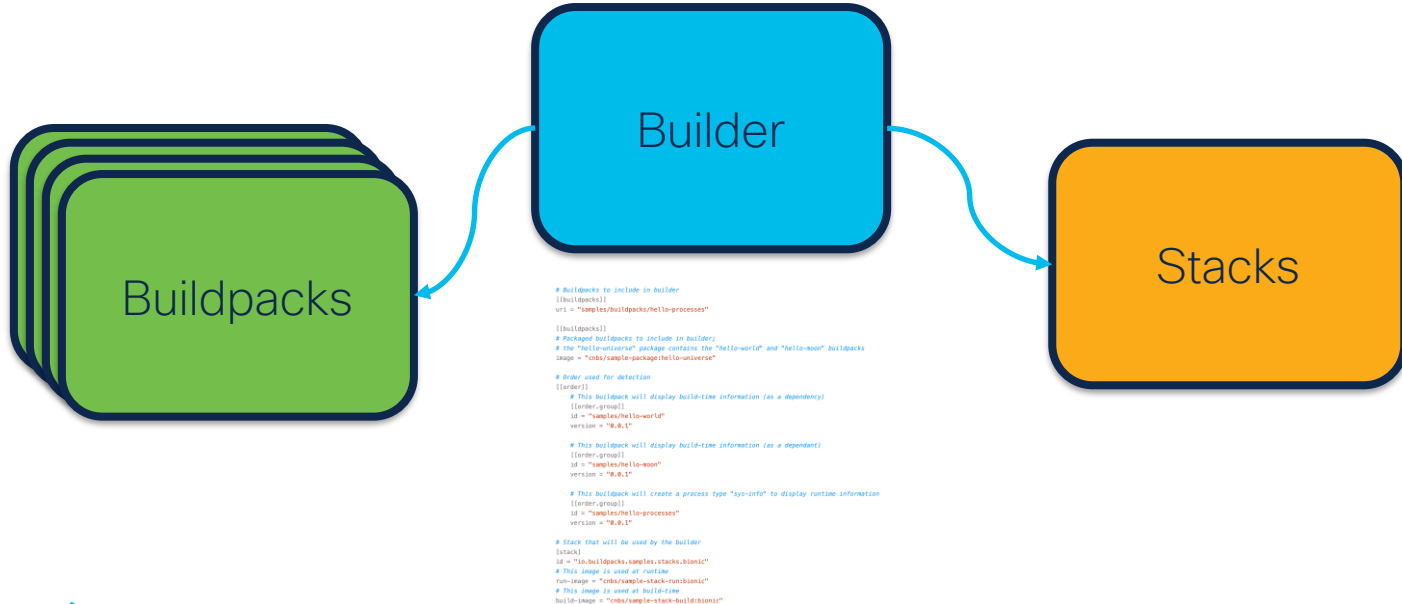
Software Bill of Materials (SBOM)

Advanced Cloud Native Buildpacks

```
→ sample-nodejs (main) ✕ pack inspect-image sample-nodejs --bom | jq .
```

Creating your own Builder

- Creating a custom builder allows you to control what buildpacks are used and what image apps are based on.



Complete your Session Survey

- Please complete your session survey after each session. Your feedback is important.
- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Session Catalog and clicking the "Attendee Dashboard" at <https://www.ciscolive.com/emea/learn/sessions/session-catalog.html>



Continue Your Education



Visit the Cisco Showcase for related demos.



Book your one-on-one Meet the Engineer meeting.



Attend any of the related sessions at the DevNet, Capture the Flag, and Walk-in Labs zones.



Visit the On-Demand Library for more sessions at ciscolive.com/on-demand.



The bridge to possible

Thank you

CISCO *Live!*

CISCO *Live!*

ALL IN