

KubeCon



CloudNativeCon

North America 2024





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North America 2024

Container Image Workflows at Scale with Buildpacks

Terence Lee (Heroku)
Jesse Brown (Heroku)

Agenda

- What are Buildpacks?
- Build Efficiencies
- Software Supply Chain
- Buildpack Ecosystem



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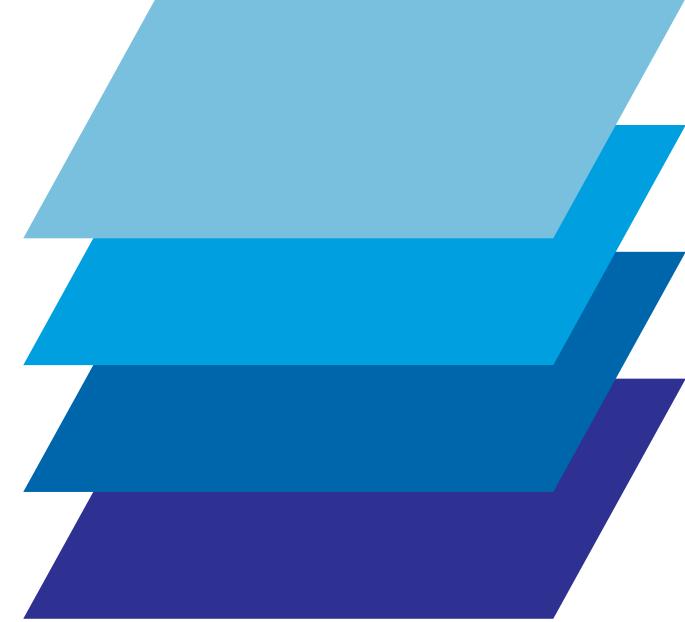
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What are Buildpacks

What are Buildpacks?

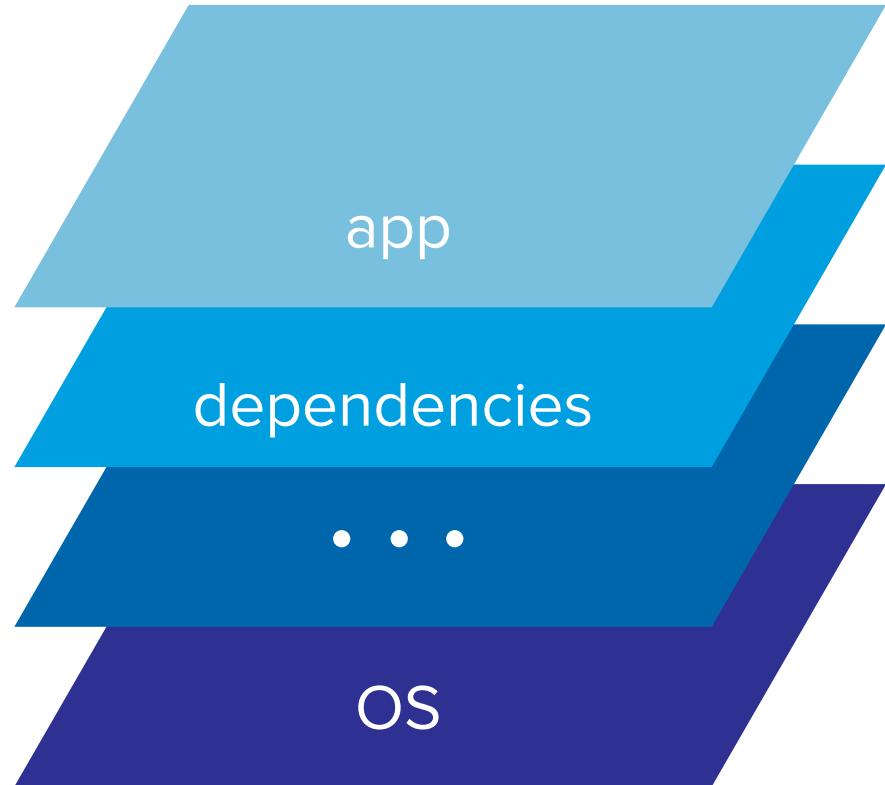


source



OCI image

What are Buildpacks?



App image that has

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

What it looks like

```
$ pack build example --B heroku/heroku:24
```



Resulting OCI Image

Production Application Images

| Layers | | |
|--------|--------|---|
| Cmp | Size | Command |
| | 78 MB | FROM blobs |
| | 379 MB | |
| | 182 MB | Layer: 'dist', Created by buildpack: heroku/nodejs-engine@3.3.0 |
| | 9.6 kB | Layer: 'node_runtime_metrics', Created by buildpack: heroku/nodejs-engine@3.3.0 |
| | 604 kB | Layer: 'web_env', Created by buildpack: heroku/nodejs-engine@3.3.0 |
| | 2.1 MB | Layer: 'bundler', Created by buildpack: heroku/ruby@3.0.0 |
| | 1.2 MB | Layer: 'cache_public_assets', Created by buildpack: heroku/ruby@3.0.0 |
| | 584 kB | Layer: 'cache_tmp_cache_assets', Created by buildpack: heroku/ruby@3.0.0 |
| | 131 B | Layer: 'env_defaults', Created by buildpack: heroku/ruby@3.0.0 |

| Layer Details | | |
|---------------|--|--|
| Tags: | (unavailable) | |
| Id: | blobs | |
| Digest: | sha256:2f937b76082366e7b805d33b63102f8644ae57085dc103aad98f8fd87d4fc78 | |
| Command: | | |
| Layer: | 'bundler', Created by buildpack: heroku/ruby@3.0.0 | |

- Small Attack Surface
- Software Bill of Materials
- Default to non-root user
- Reproducible builds

Buildpacks Authors



Application Developers



Platform Developers





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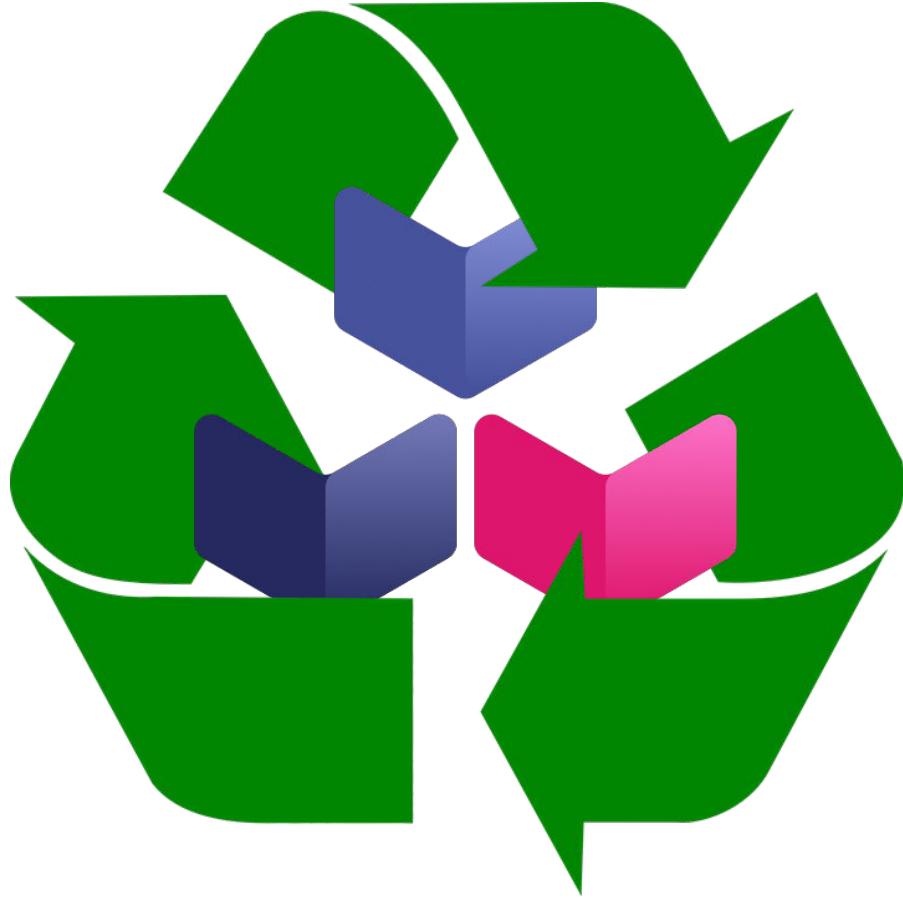
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Build Efficiencies



Speed! Scale! Reduce, Reuse, Rebase



```
$ pack build example --B heroku/heroku:24
```



Buildpack Efficiency

- Layer Reuse
- Per-Layer Caches
- Reproducibility

Only bust caches that are required



Grow Efficiently

- Only build what has changed
- Skip redundant work
- High customizable

```
$ pack build example -b heroku/go -b heroku/nodejs -b heroku/ruby
```

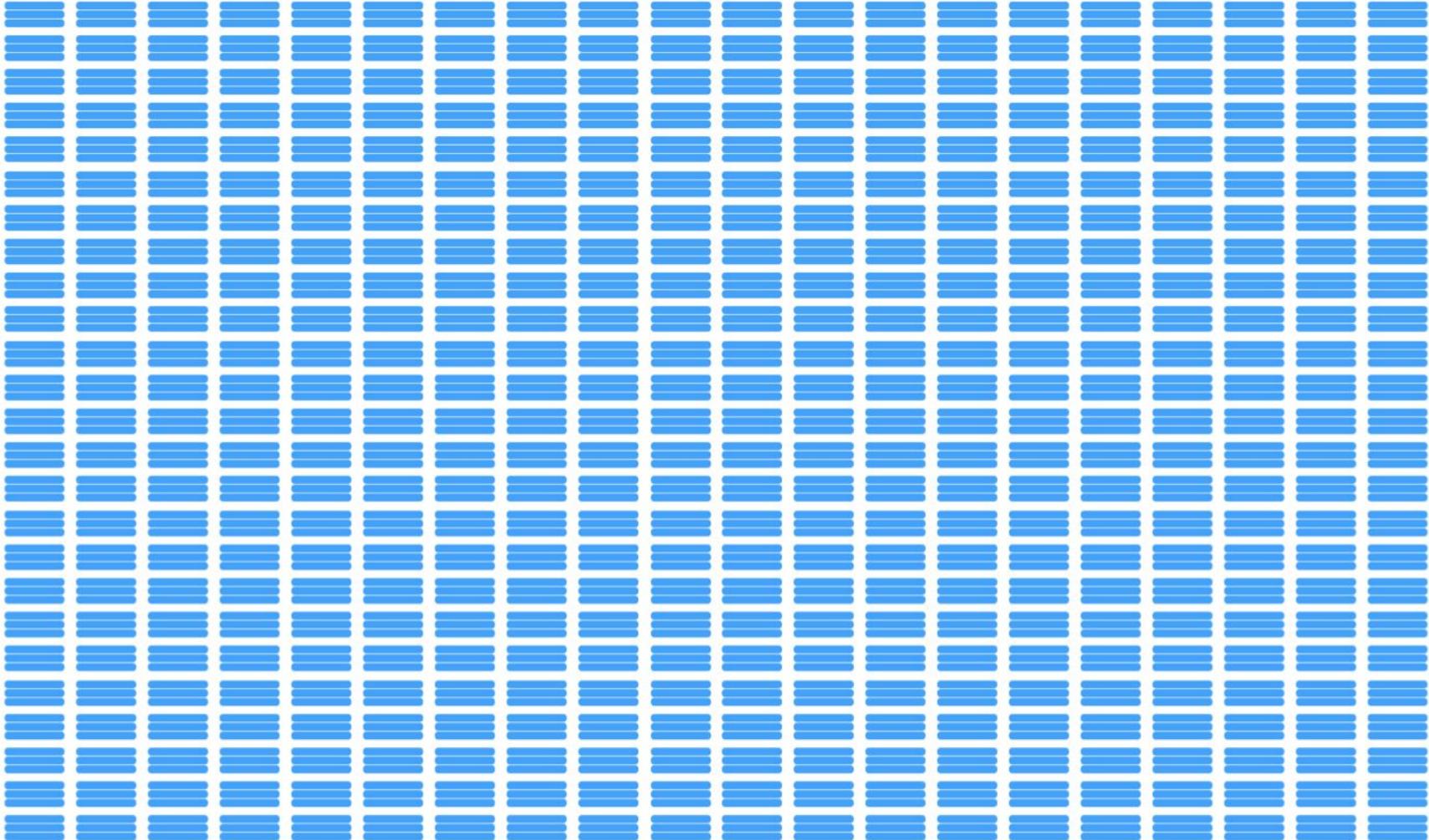
Reduce, Reuse, Rebase



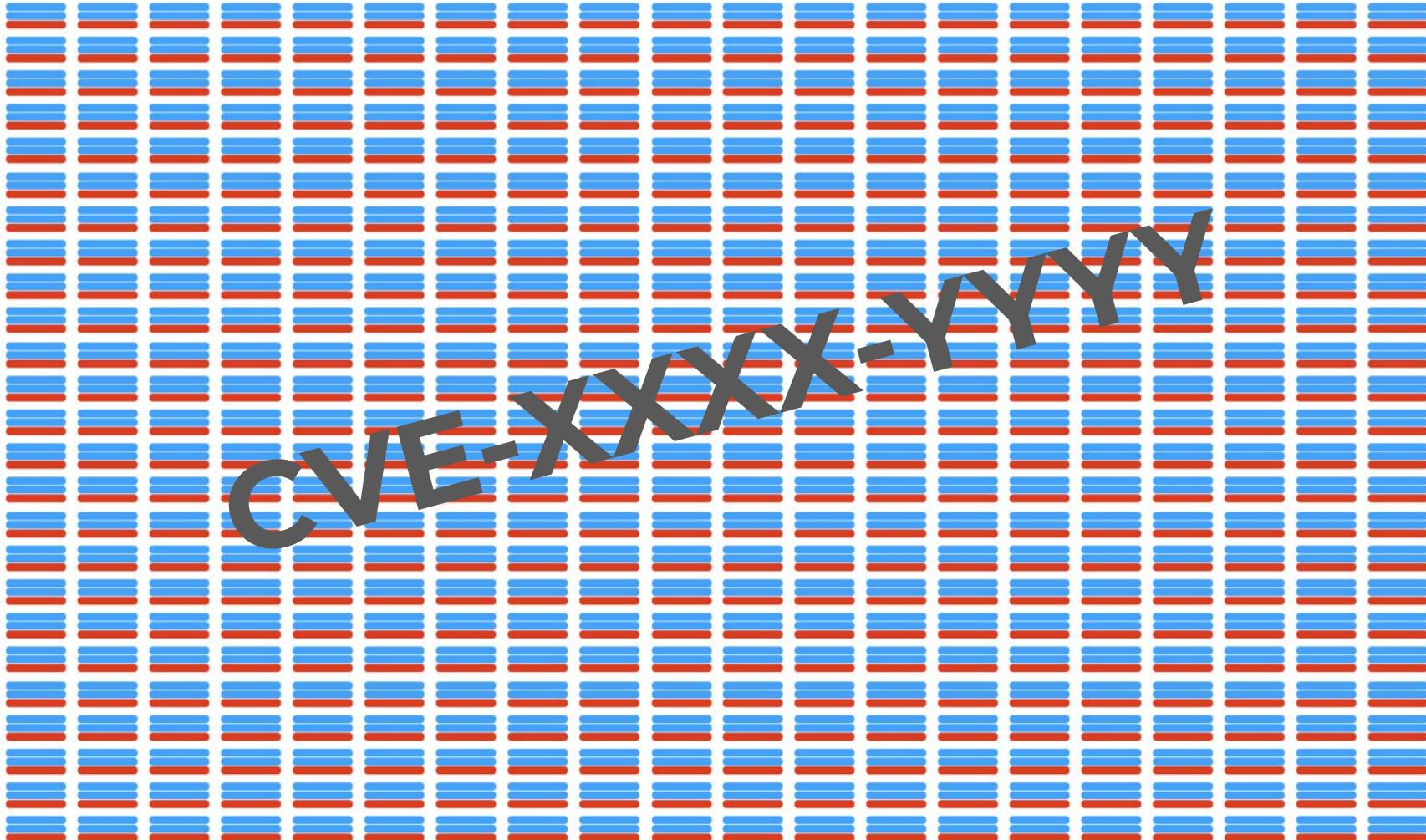
Rebase



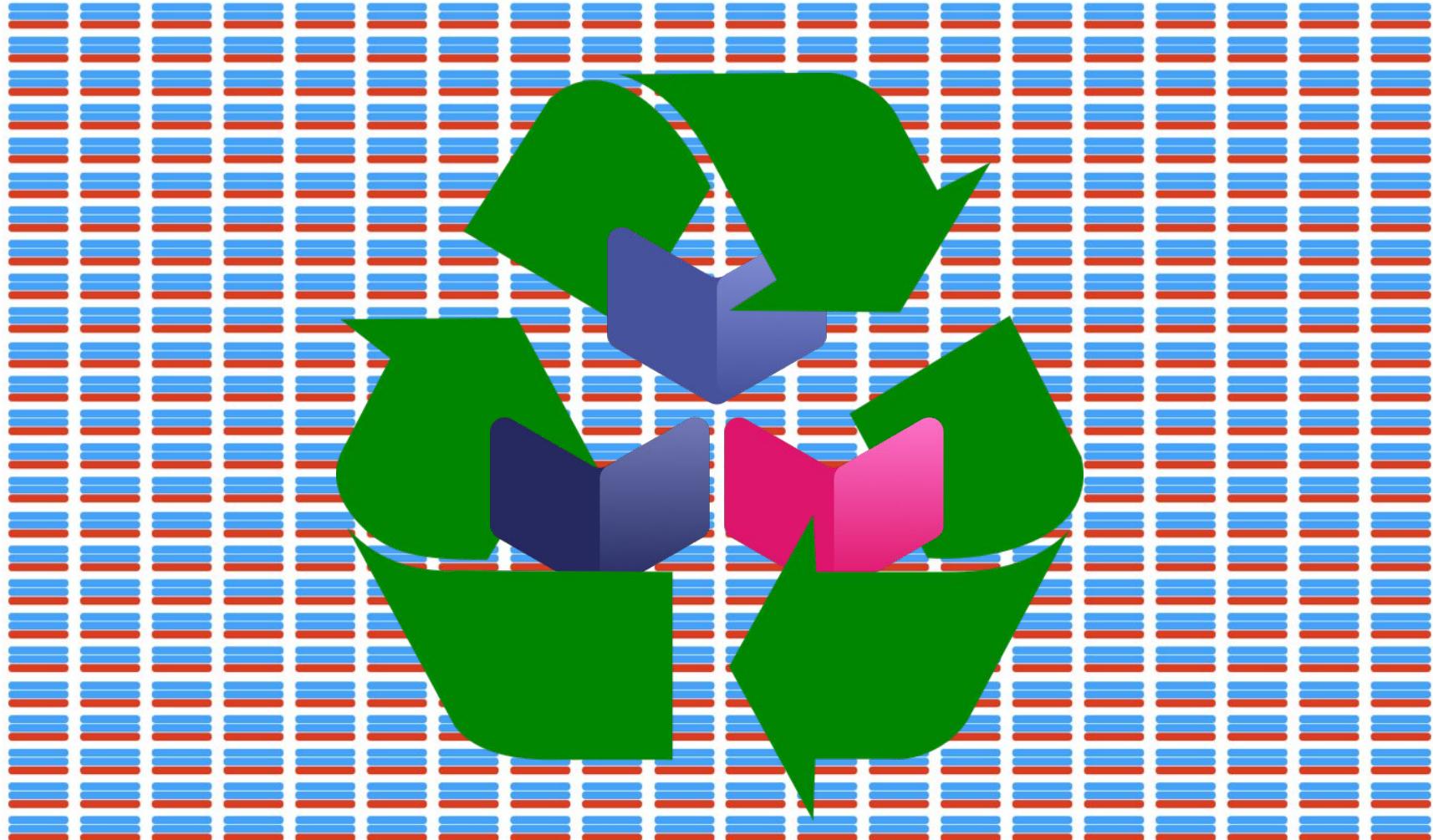
Rebase



Rebase



Rebase





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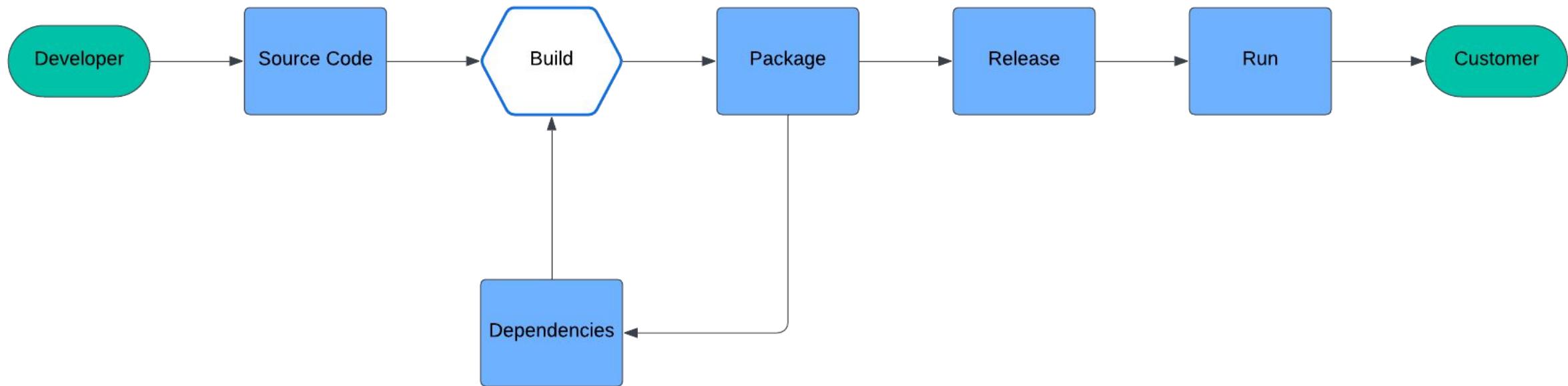


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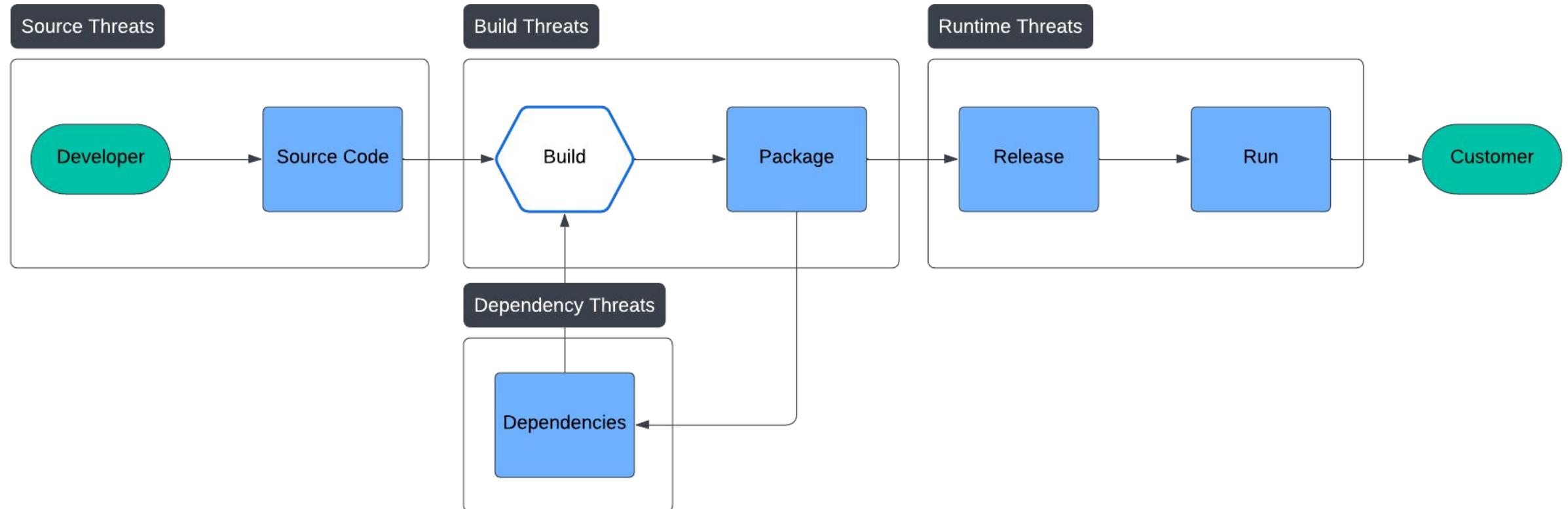
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Software Supply Chain

Software Supply Chain Security



Supply Chain Attacks



Executive Order 14028



MAY 12, 2021

Executive Order on Improving the Nation's Cybersecurity

[BRIEFING ROOM](#) > [PRESIDENTIAL ACTIONS](#)

By the authority vested in me as President by the Constitution and the laws of the United States of America, it is hereby ordered as follows:

Section 1. Policy. The United States faces persistent and increasingly sophisticated malicious cyber campaigns that threaten the public sector, the private sector, and ultimately the American people's security and privacy. The Federal Government must improve its efforts to identify, deter, protect against, detect, and respond to these actions and actors. The Federal Government must also carefully examine what occurred during any major cyber incident and apply lessons learned. But cybersecurity requires more than government action. Protecting our Nation from malicious cyber actors requires the Federal Government to partner with the private sector. The private sector must adapt to the continuously changing threat environment, ensure its products are built and operate securely, and partner with the Federal Government to foster a more secure cyberspace. In the end, the trust we place in our digital infrastructure should be proportional to how trustworthy and transparent that infrastructure is, and to the consequences we will incur if that trust is misplaced.

EU Cyber Resilience Act



English

Shaping Europe's digital future

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[Home](#) > [Policies](#) > EU Cyber Resilience Act

EU Cyber Resilience Act

New EU cybersecurity rules ensure safer hardware and software.

From baby-monitors to smart-watches, products and software that contain a digital component are omnipresent in our daily lives. Less apparent to many users is the security risk such products and software may present.

The [Cyber Resilience Act \(CRA\)](#) aims to safeguard consumers and businesses buying or using products or software with a digital component. The Act would see inadequate security features become a thing of the past with the introduction of mandatory cybersecurity requirements for manufacturers and retailers of such products, with this protection extending throughout the product lifecycle.

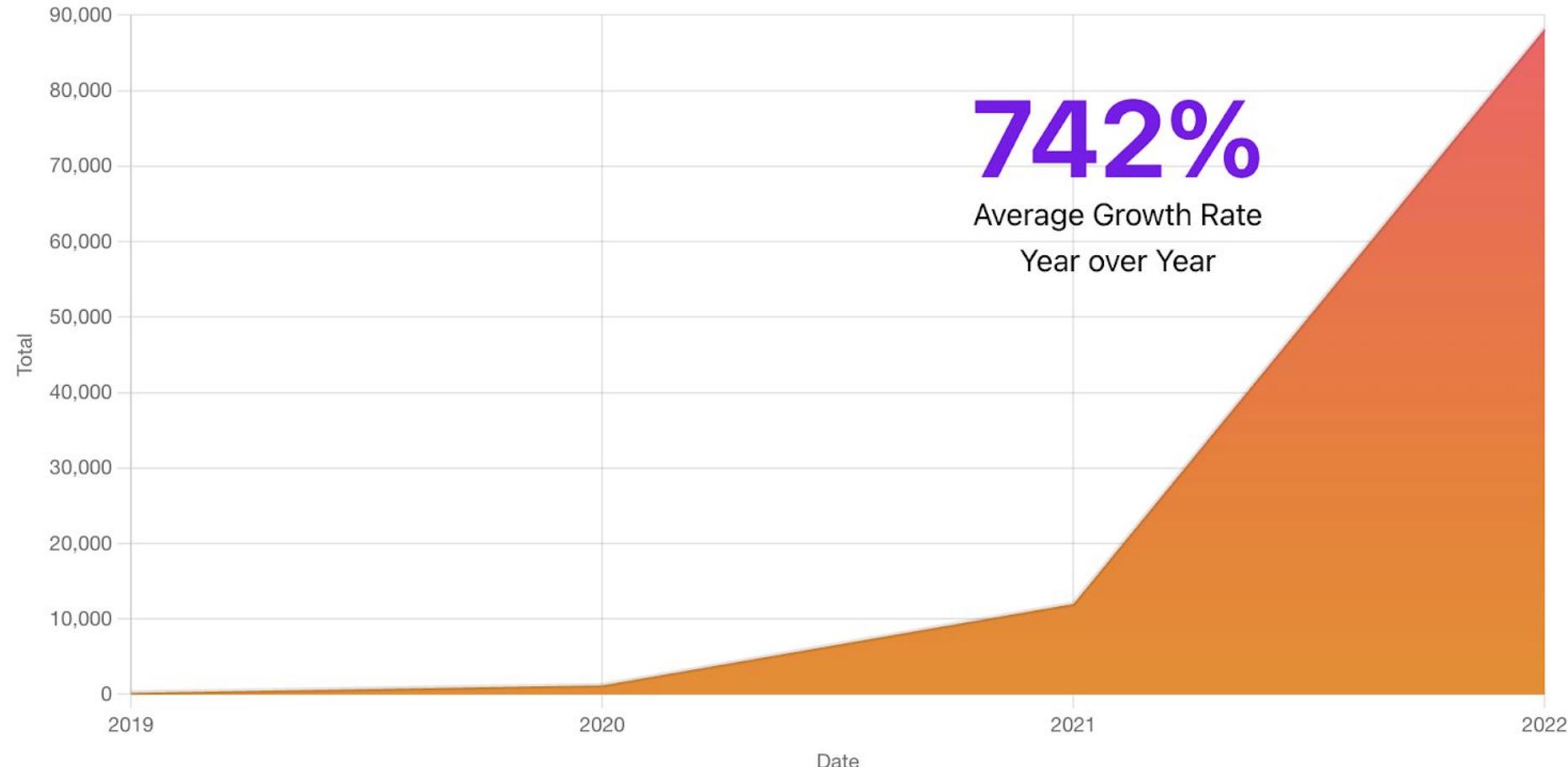
The problem addressed by the Regulation is two-fold.

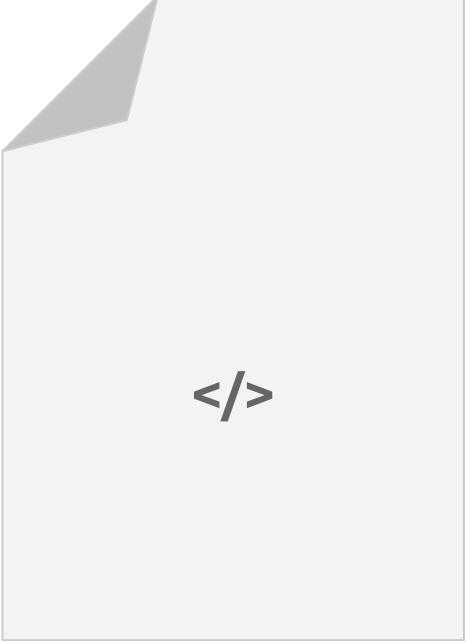
First is the inadequate level of cybersecurity inherent in many products, or inadequate security updates to such products and software.

Second is the inability of consumers and businesses to currently determine which products are cybersecure, or to set them up in a way that ensures their cybersecurity is protected.

Supply Chain Attacks

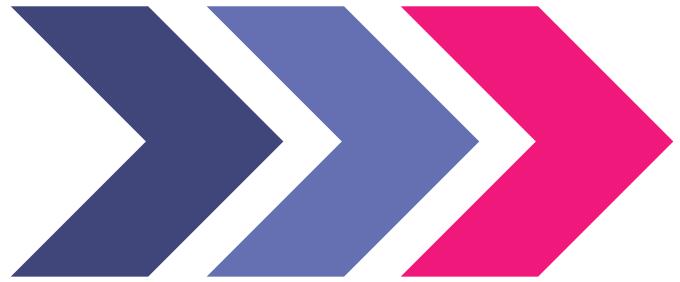
FIGURE 1.6. NEXT GENERATION SOFTWARE SUPPLY CHAIN ATTACKS, 2019–2022





</>

source



buildpacks



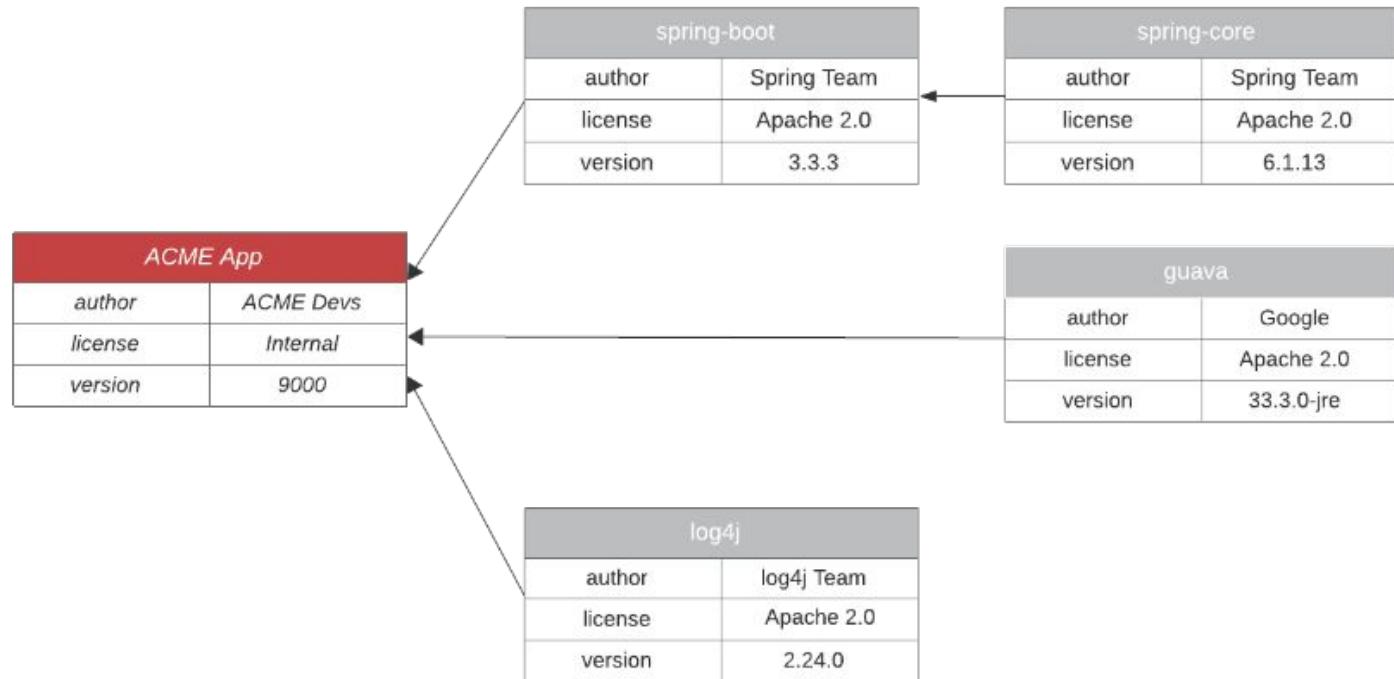
Application
Image

Software Bill of Material

Software Bill of Materials

Transparency for what's running in production.

- Components
- Dependencies
- License
- Versions



Software Bill of Materials

\$ pack sbom download example

Per-Layer SBOMs

Multiple Formats





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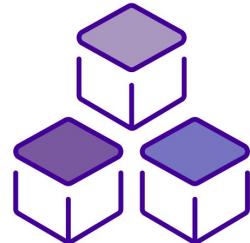
Buildpack Ecosystem

Buildpack Ecosystem

Heroku Buildpacks

github.com/heroku/buildpacks

heroku/builder:24



Paketo Buildpacks

paketo.io

paketobuildpacks/builder-jammy-full

paketobuildpacks/builder-jammy-tiny



Google Buildpacks

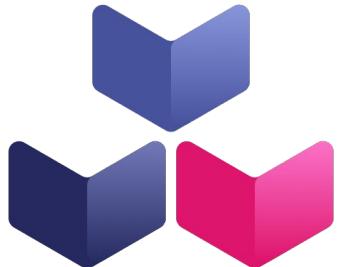
github.com/GoogleCloudPlatform/buildpacks

gcr.io/buildpacks/builder:google-22



pack

- CLI
- Invoked by CI/CD
 - GitLab
 - GitHub Actions
 - CircleCI



Tekton

- CI/CD Platform



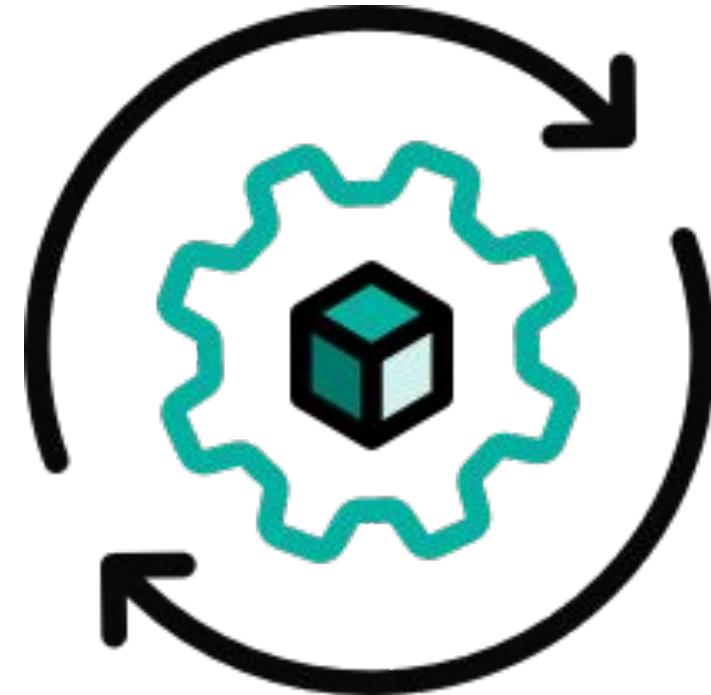
Spring Boot

- No Docker Needed



kpack

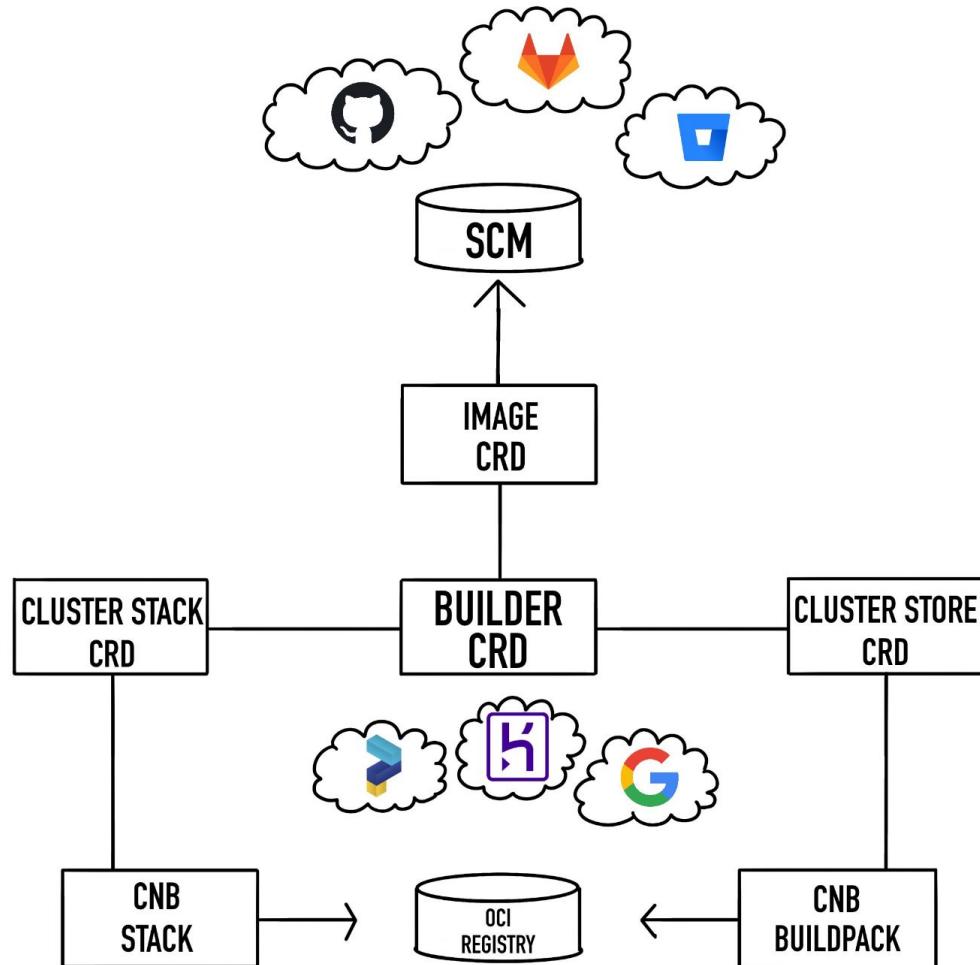
A buildpacks.io k8s operator



```
apiVersion: kpack.io/v1alpha2
kind: Image
metadata:
  name: ruby-image
  namespace: default
Spec:
  source:
    git:
      url: https://github.com/heroku/ruby-getting-started.git
      revision: main
  builder:
    name: default-builder
    kind: Builder
  tag: kubecon-na-2024-registry-.../org/my-ruby-app
```



- Declarative Resources
 - Image
 - Builder
- Automatic Rebuilds
 - on scm change
 - on base image change
 - on buildpack change
- Automatic Rebase
 - Continually patch base image



 kpack meets SLSA 3 compliance standard 

| Implementer | Requirement | Degree | L1 | L2 | L3 |
|----------------|--------------------------------------|-------------|----|----|----|
| Producer | Choose an appropriate build platform | | ✓ | ✓ | ✓ |
| | Follow a consistent build process | | ✓ | ✓ | ✓ |
| | Distribute provenance | | ✓ | ✓ | ✓ |
| Build platform | Provenance generation | Exists | ✓ | ✓ | ✓ |
| | | Authentic | | ✓ | ✓ |
| | | Unforgeable | | | ✓ |
| | Isolation strength | Hosted | ✓ | ✓ | |
| | | Isolated | | | ✓ |



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Buildpacks help your org
scale through reducing
cognitive load



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Buildpacks help your org
scale through
separation of roles



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Buildpacks help your org
scale through
build efficiencies



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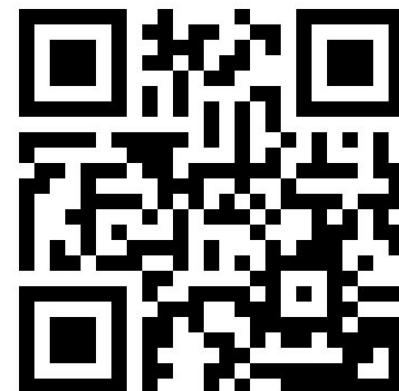
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Buildpacks help your org
scale through
day 2 operations

Come chat with us!

Buildpacks @ KubeCon NA 2024

- **Maintainer Track Session**
 - You are here!
- **Platform Engineering**
 - This Platform Goes to 11
 - Friday 2:55pm @ 251 AD
- **Solutions Showcase**
 - Staffed during these times:
 - Wed
 - 3:15-8
 - Thu
 - 1:45-5
 - Fri
 - 12:30-2:30



Online



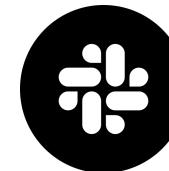
<https://github.com/buildpacks>



<https://buildpacks.io/>



<https://buildpacks.io/community/>



#buildpacks in CNCF Slack Workspace



@buildpacks_io



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Thank You!

