



Production CI/CD with Buildpacks

Tekton and GitLab and CircleCI (plus), Oh My!

Natalie Arellano & David Freilich, VMware

Welcome

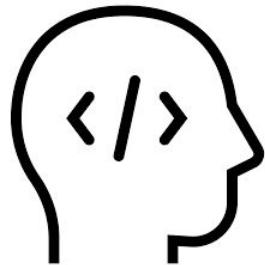


Virtual

- What are Cloud Native Buildpacks (CNBs)?
- Buildpacks in action
 - pack cli
 - GitLab
 - CircleCI
 - Tekton
 - kpack
- Resources

Who this talk is for

- App Developers



- Platform Operators





What are Cloud Native Buildpacks?

What are CNBs?



Virtual



source



runnable image

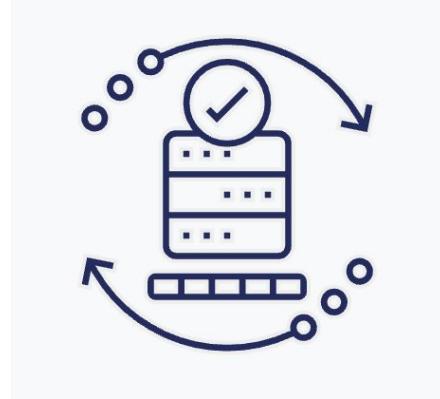
Why CNBs?



Let application
developers
focus on
development



Give operators
control over
build inputs



Enable fast
patching of OS
vulnerabilities

What is a buildpack?



Virtual

detect

- Runs against source to determine buildpack applicability
- Examples:
 - A Java CNB might look for `.java` files or a `.jar`
 - An NPM CNB might look for `package.json`

build

- Downloads build-time and run-time dependencies
- Compiles source (if needed)
- Sets start command

Builders



Virtual



buildpack A

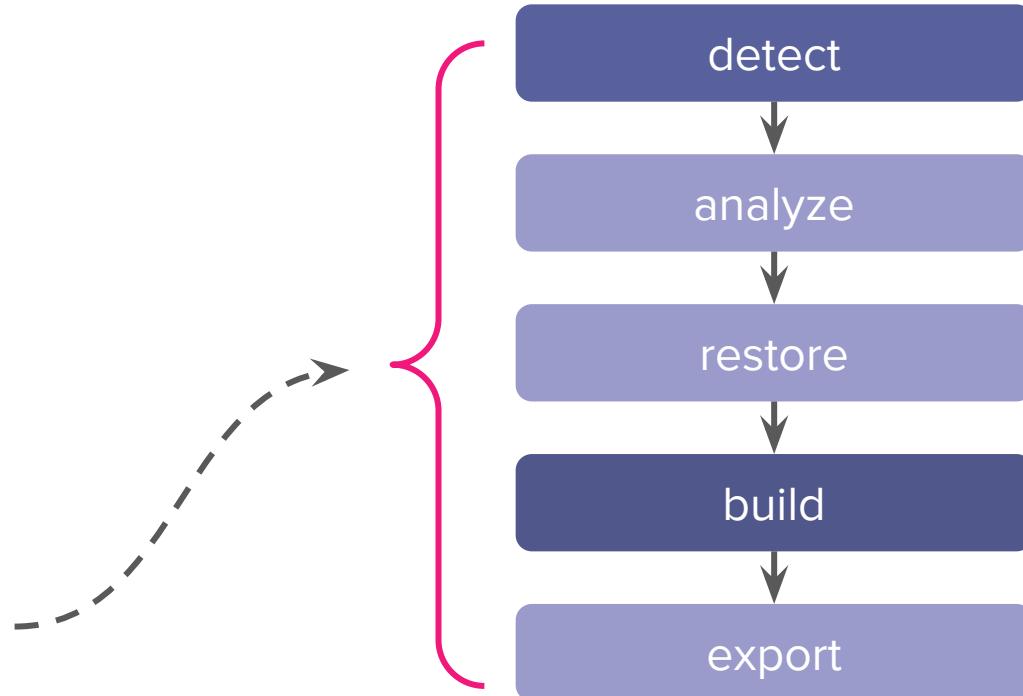
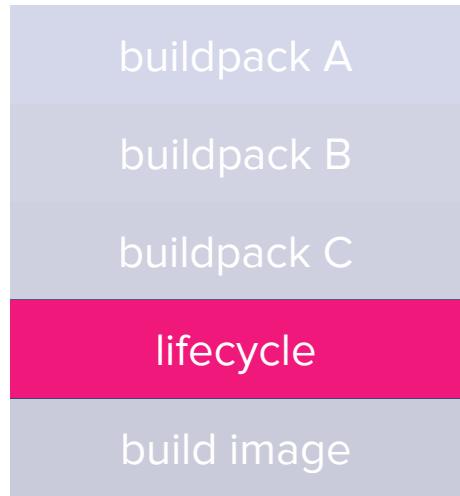
buildpack B

buildpack C

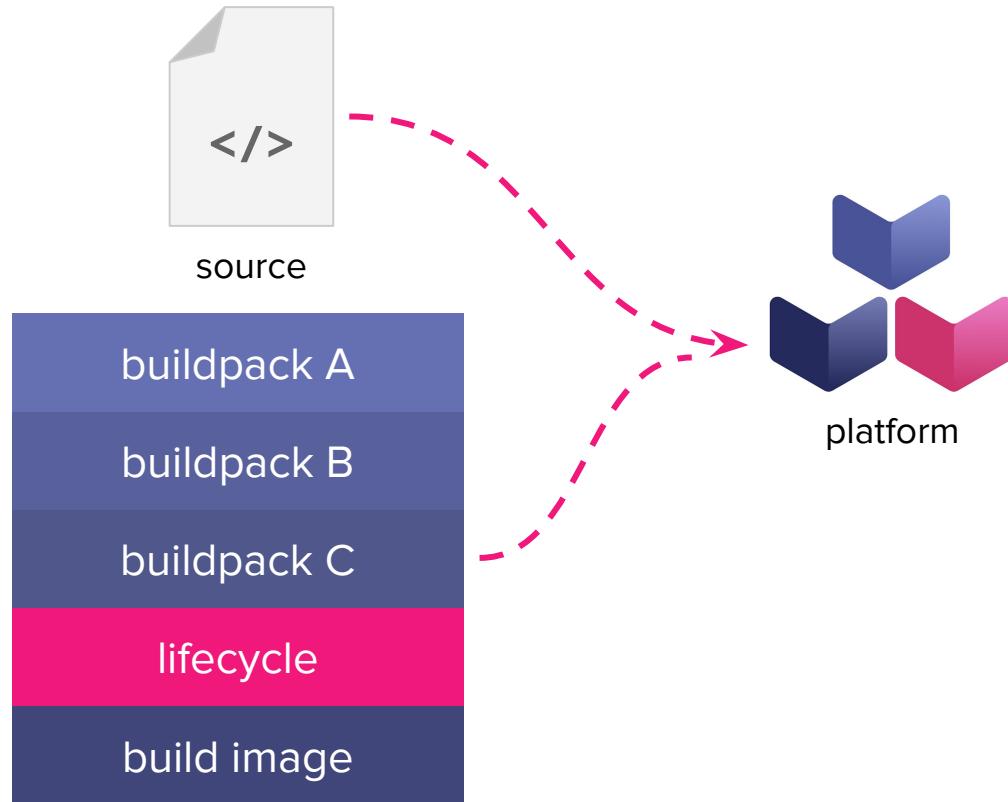
lifecycle

build image

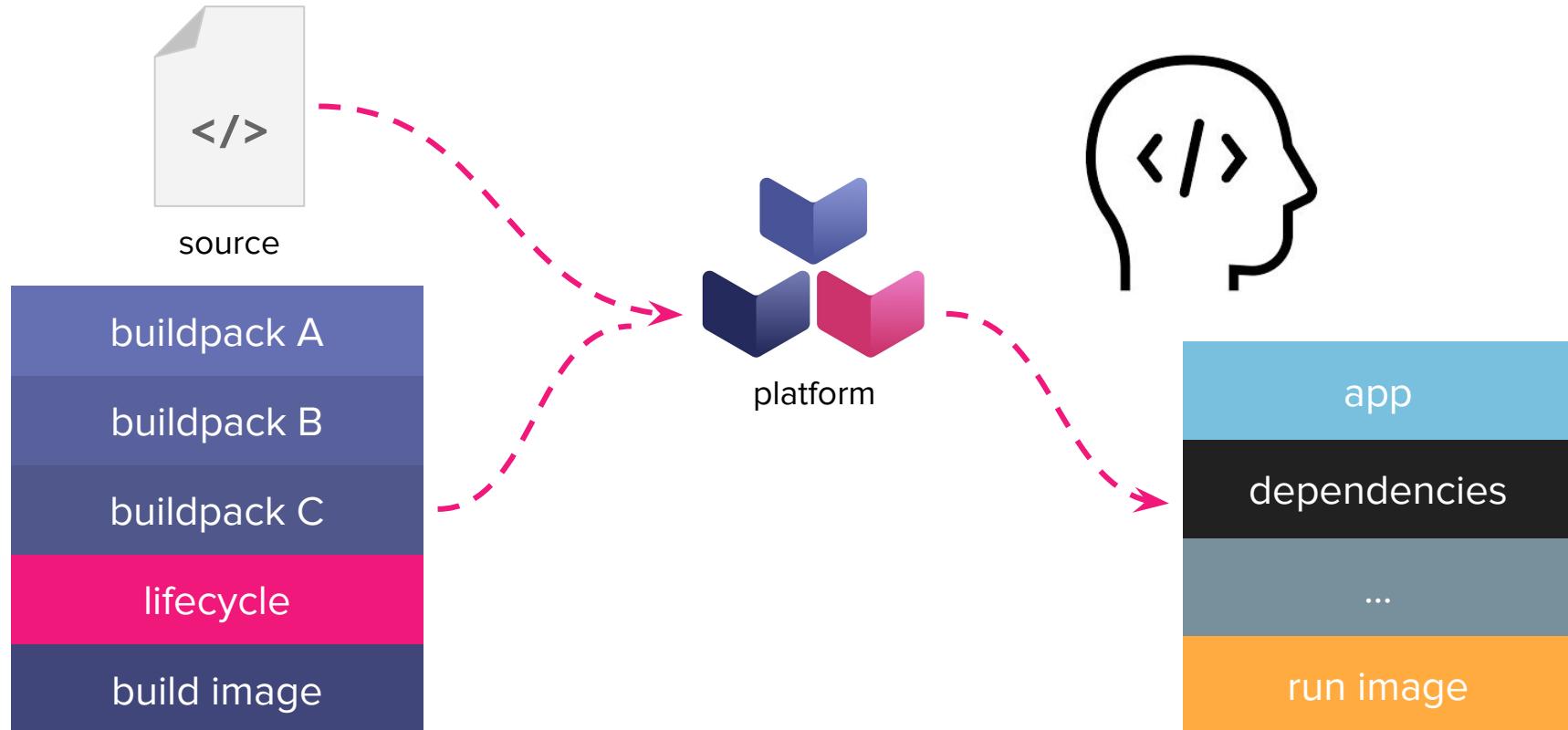
Lifecycle



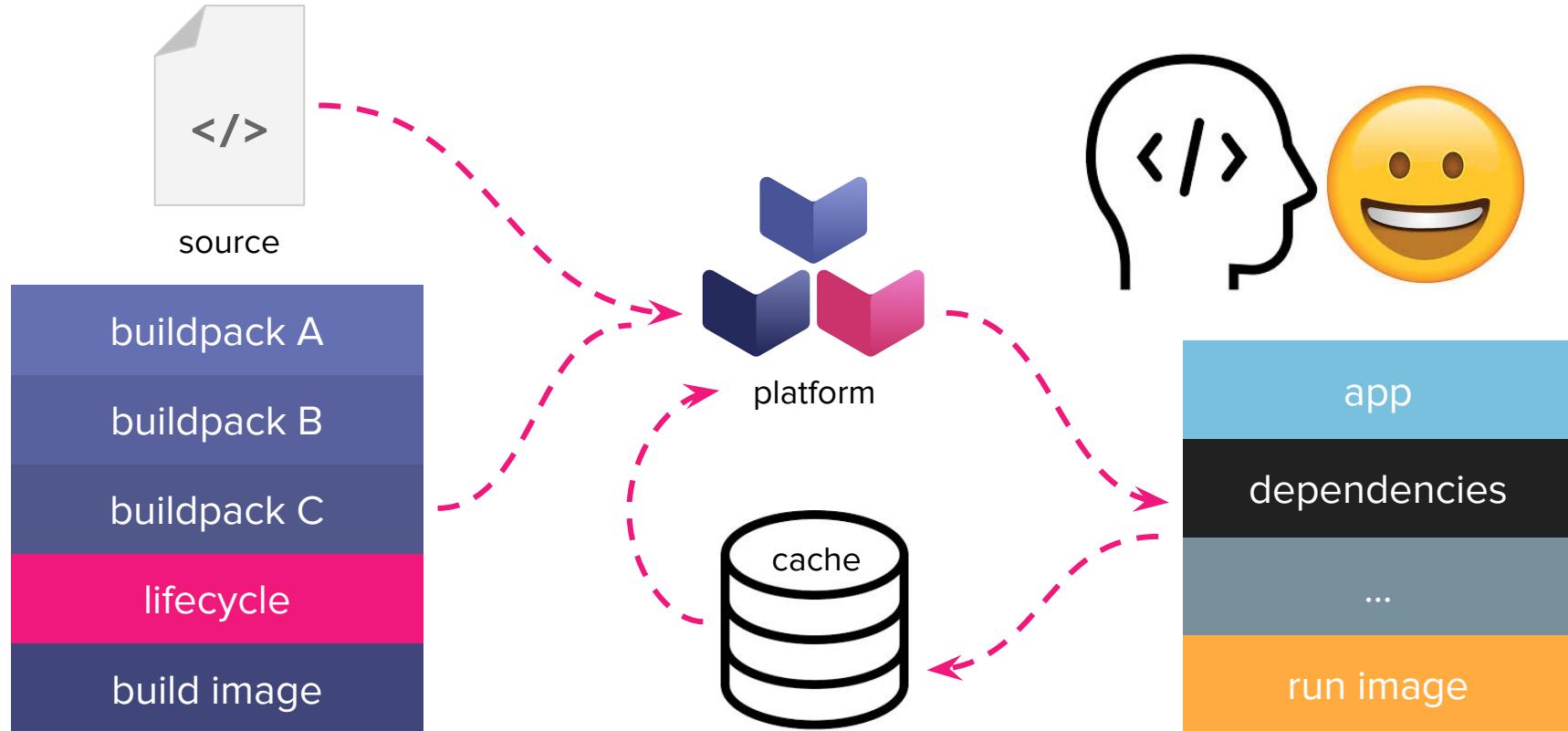
Platform



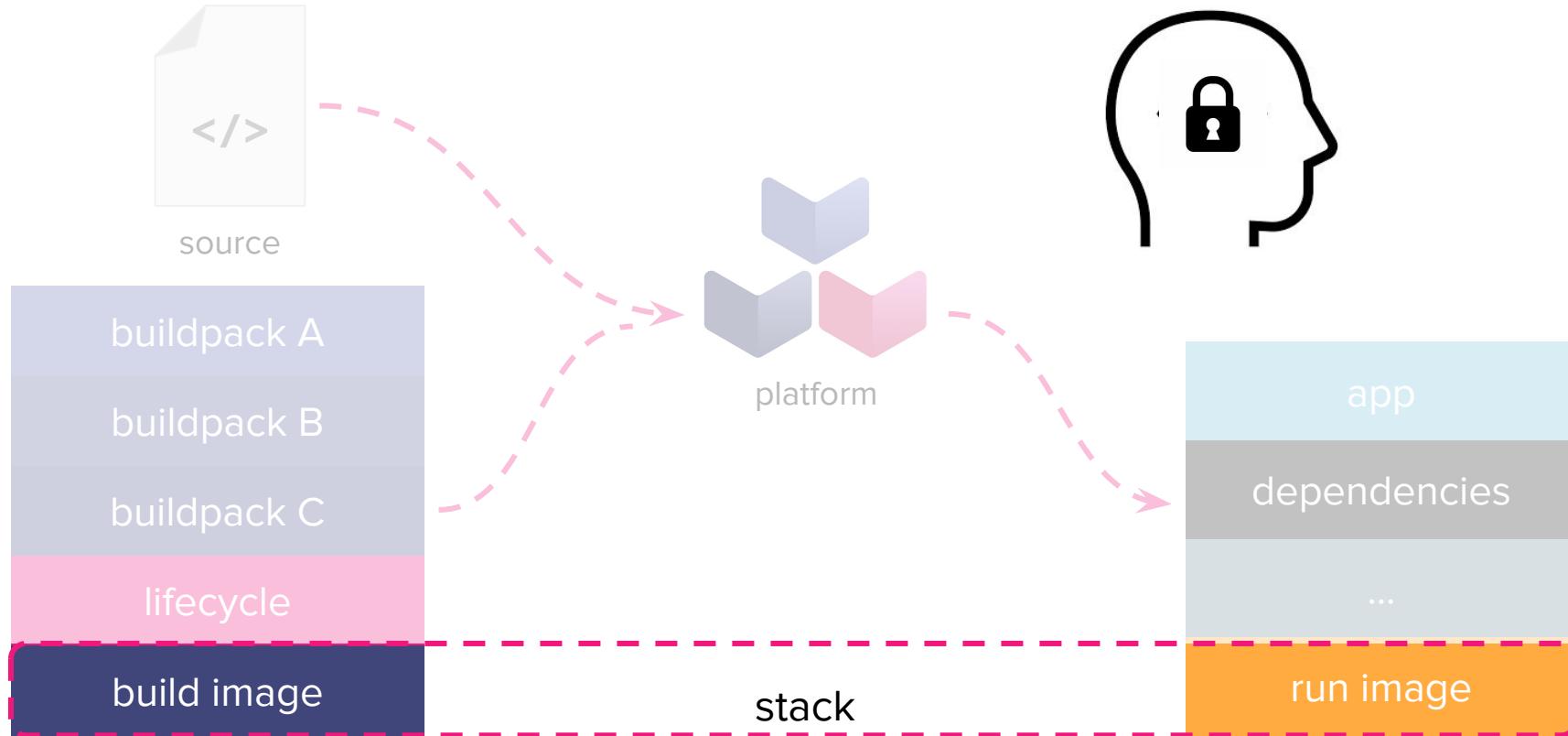
Platform

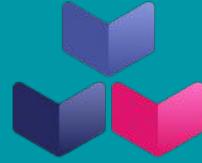


Cache



Stacks





Buildpacks in action

See it in action: pack



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- Maintained by: CNB Project
- Highlights:
 - Can be run locally
 - Uses docker daemon to run lifecycle
- Target persona: app developer

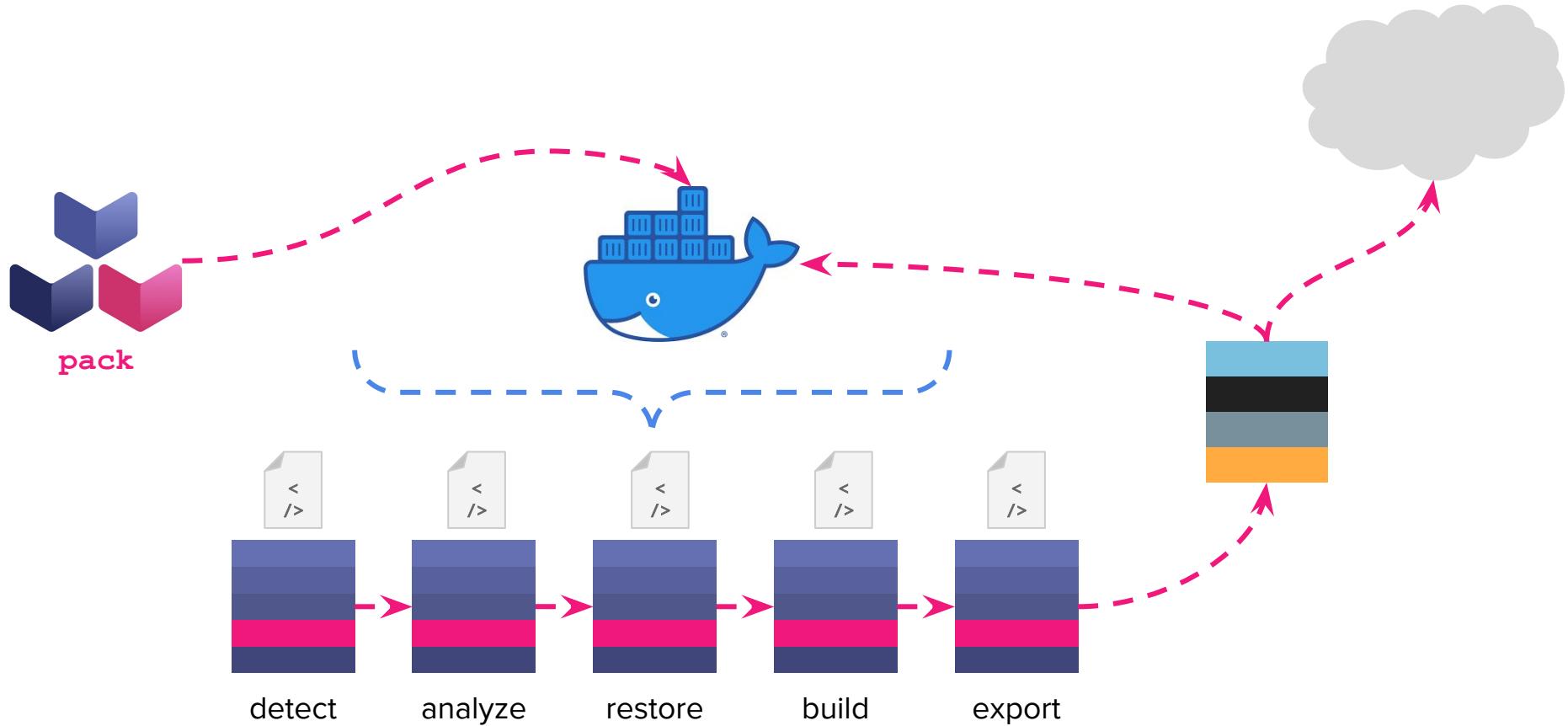
See it in action: pack



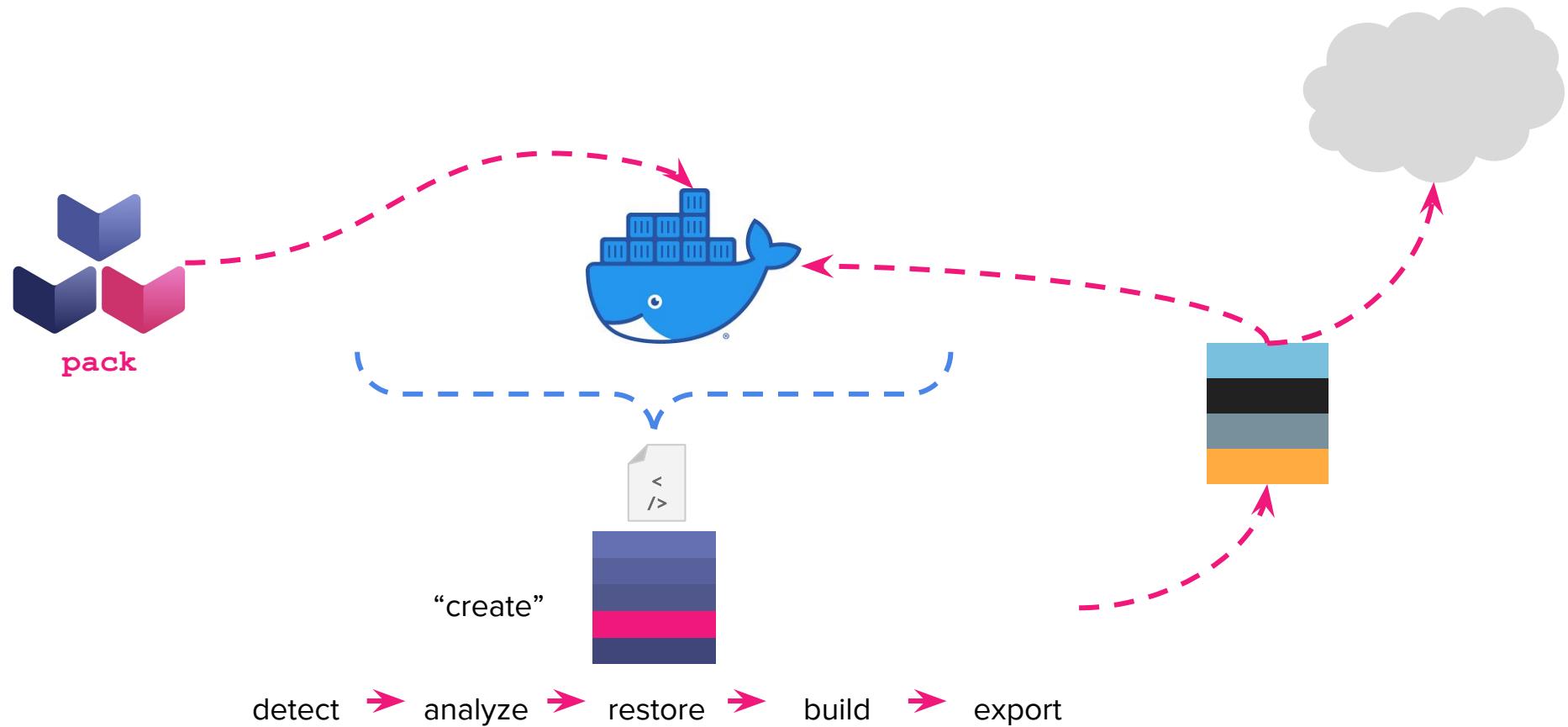
KubeCon | CloudNativeCon

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See it in action: pack



See it in action: pack



Virtual

pack CLI

Install

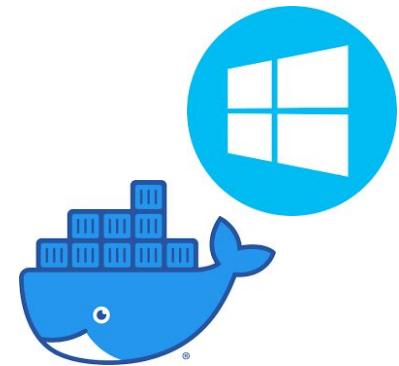
You can install the most recent version of the [pack](#) CLI (version 0.14.2) on the following operating systems:

Linux macOS Windows

[Container](#) [Homebrew](#) [Manually](#)

[pack](#) can be installed via [Homebrew](#):

```
brew install buildpacks/tap/pack
```



<https://buildpacks.io/docs/tools/pack/>

See it in action: pack



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What about automation?



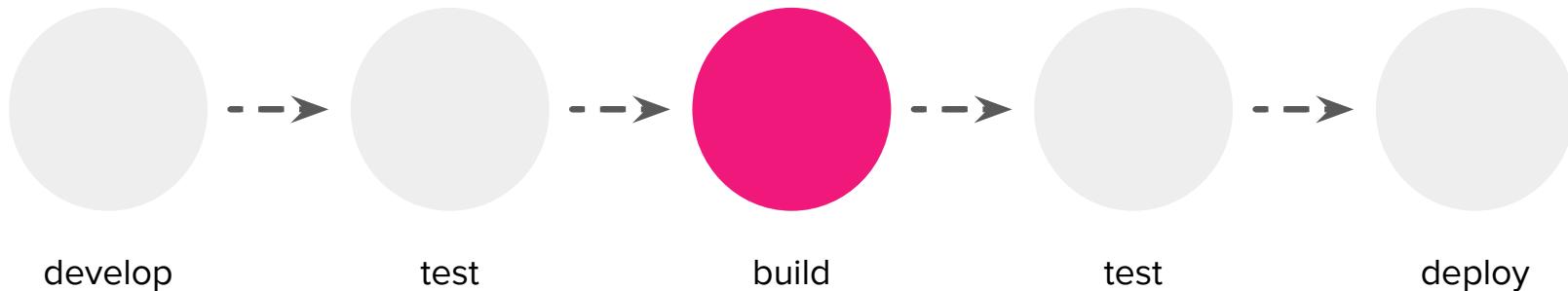
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GitLab **circleci** **TEKTON**



What about automation?



See it in action: GitLab



Virtual

- Maintained by: GitLab
- Highlights:
 - Used with Auto DevOps tooling (uses k8s)
 - Uses pack
- Target persona: app developer

See it in action: GitLab



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Set up Auto DevOps:

- Configure Google account
- Create GitLab project
- Create a k8s cluster with GitLab

A screenshot of the GitLab CI / CD Settings page for a project named "cnb > hello-buildpacks". The page has a header "CI / CD Settings" with a red box around it. Below the header, there are sections for "General pipelines" and "Auto DevOps". The "Auto DevOps" section contains a checkbox "Default to Auto DevOps pipeline" which is checked, and a note below it: "The Auto DevOps pipeline will run if no alternative CI configuration file is found. More information". There is also a "Deployment strategy" section with three radio button options: "Continuous deployment to production" (selected), "Continuous deployment to production using timed incremental rollout", and "Automatic deployment to staging, manual deployment to production". At the bottom of the page is a green "Save changes" button.

cnb > hello-buildpacks > CI / CD Settings

General pipelines

Customize your pipeline configuration, view your pipeline status and coverage report.

Auto DevOps

Auto DevOps can automatically build, test, and deploy applications based on predefined continuous integration and delivery configuration. Learn more about Auto DevOps or use our [quick start guide](#) to get started right away.

Default to Auto DevOps pipeline ⓘ
The Auto DevOps pipeline will run if no alternative CI configuration file is found. [More information](#)

Deployment strategy

Continuous deployment to production ⓘ
 Continuous deployment to production using timed incremental rollout ⓘ
 Automatic deployment to staging, manual deployment to production ⓘ

Save changes

https://docs.gitlab.com/ee/topics/autodevops/quick_start_guide.html

See it in action: GitLab

cnb > hello-buildpacks > Details

hello-buildpacks Project ID: 21762928 [Leave project](#)

0 Commit 1 Branch 0 Tags 625 KB Files 9.3 MB Storage

master hello-buildpacks / History Find file Web IDE Clone

Initial commit Natalie Arellano authored 11 minutes ago 6191d414

[Kubernetes](#) [CI/CD configuration](#) [Add README](#) [Add LICENSE](#) [Add CHANGELOG](#) [Add CONTRIBUTING](#)

Auto DevOps enabled

Name	Last commit	Last update
.mvn(wrapper)	Initial commit	11 minutes ago
src/main	Initial commit	11 minutes ago
.gitattributes	Initial commit	11 minutes ago
.gitignore	Initial commit	11 minutes ago
.gitlab-ci.yml	Initial commit	11 minutes ago
mvnw	Initial commit	11 minutes ago
mvnw.cmd	Initial commit	11 minutes ago
pom.xml	Initial commit	11 minutes ago

.gitlab-ci.yml 107 Bytes

```
1 include:
2   - template: Auto-DevOps.gitlab-ci.yml
3
4 variables:
5   AUTO_DEVOPS_BUILD_IMAGE_CNB_ENABLED: "true"
```

See it in action: GitLab



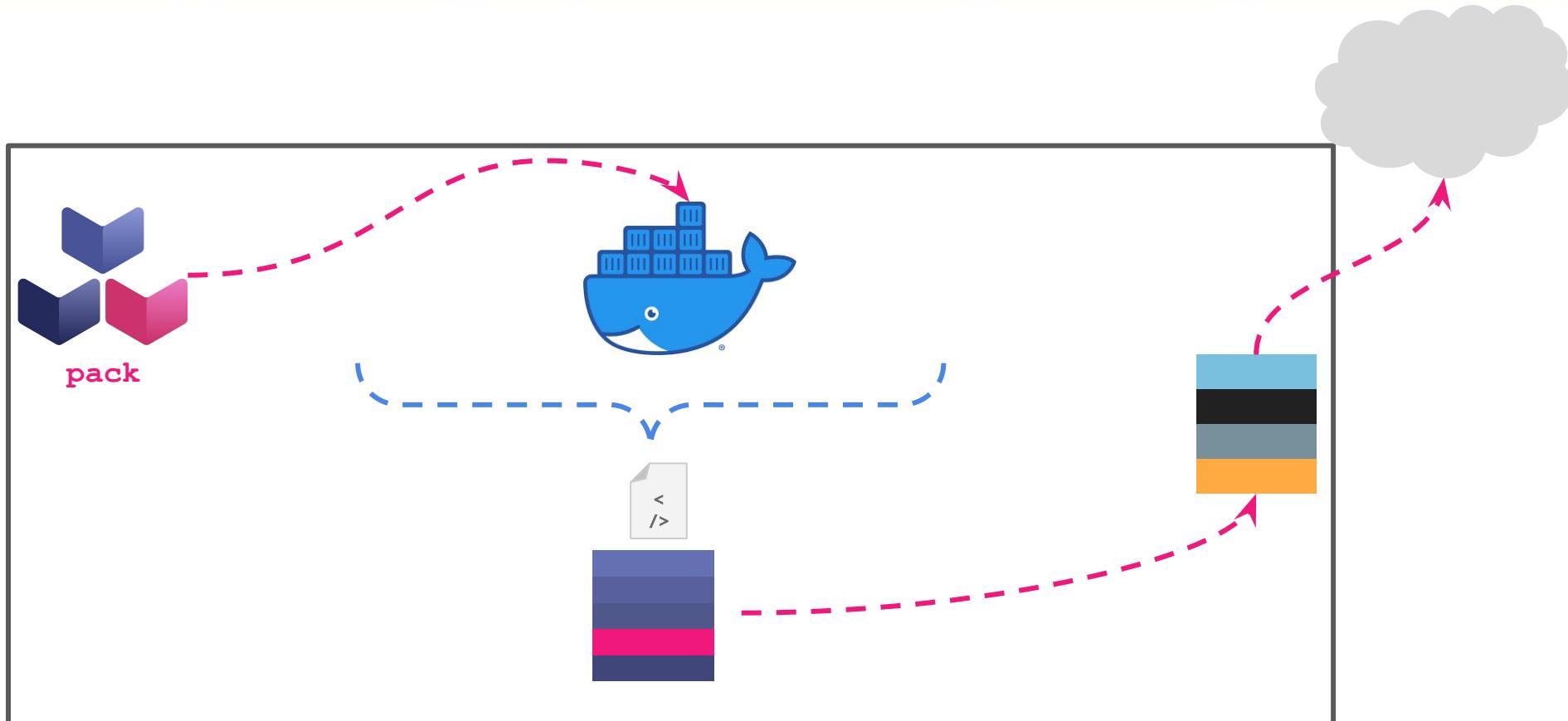
KubeCon



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See it in action: GitLab



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See it in action: CircleCI



Virtual

- Orb maintained by: CNB Project
- Highlights:
 - Uses pack
 - Uses caching
- Target persona: app developer & platform operator

See it in action: CircleCI



Virtual

.circleci/config.yaml

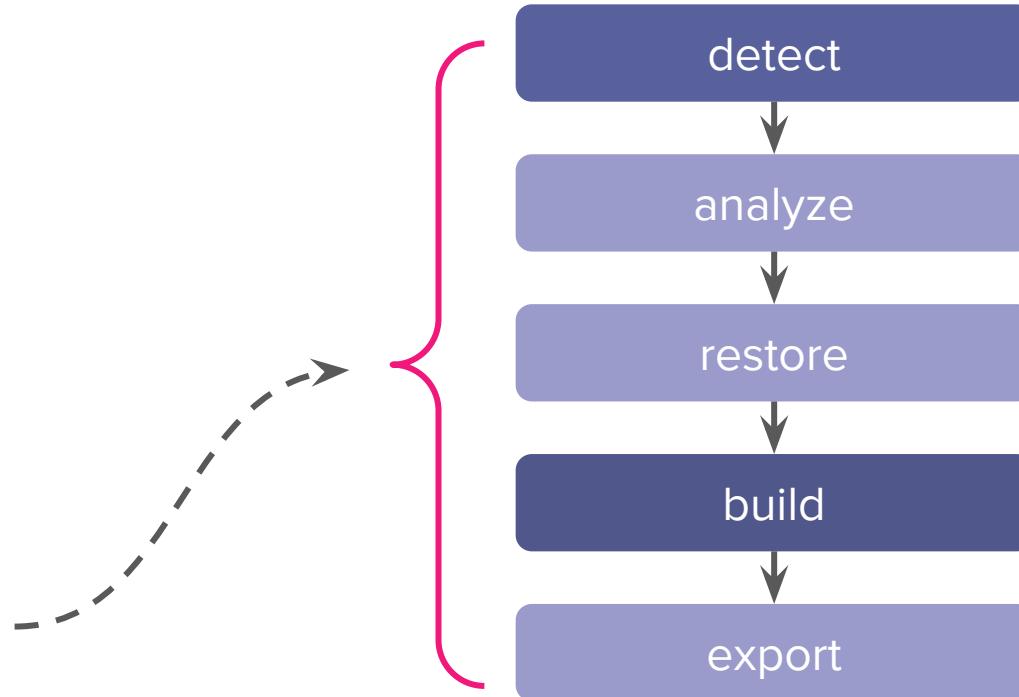
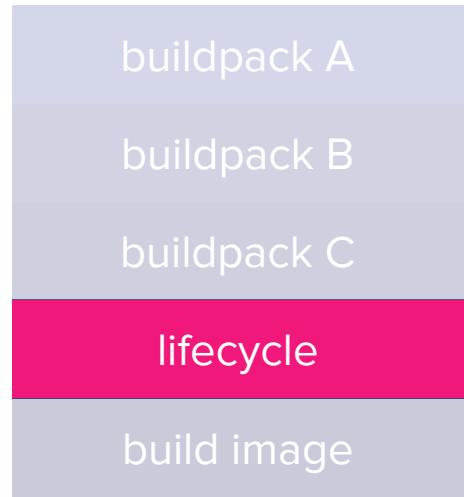
```
version: 2.1
orbs:
  pack: buildpacks/pack@0.2.0
workflows:
  main:
    jobs:
      - pack/build:
          image-name: buildpacksiodev/hello-circleci
          builder: 'paketobuildpacks/builder:tiny'
      - test:
          requires:
            - pack/build
jobs:
  test:
    machine: true
    steps:
      - attach_workspace:
          at: /tmp/workspace
      - run:
          command: |
            docker load -i /tmp/workspace/images/image.tgz
            docker run -d -p 8080:8080 buildpacksiodev/hello-circleci
            curl localhost:8080/
```

See it in action: CircleCI



Virtual

Recap: Lifecycle



See it in action: Tekton

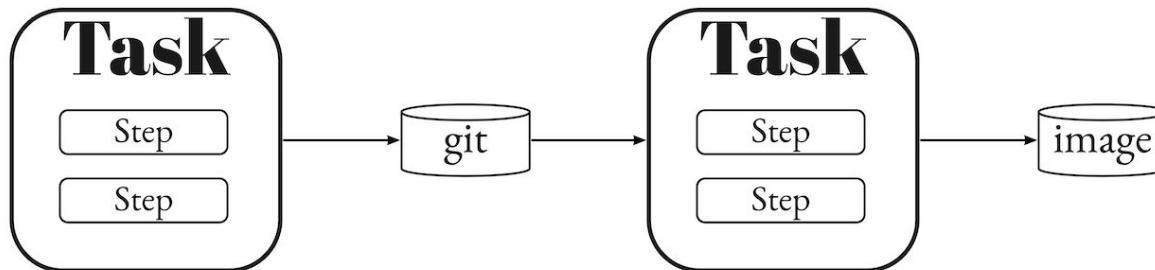


Virtual

- Task maintained by: CNB Project
- Highlights:
 - Uses lifecycle
 - k8s native
- Target persona: platform operator

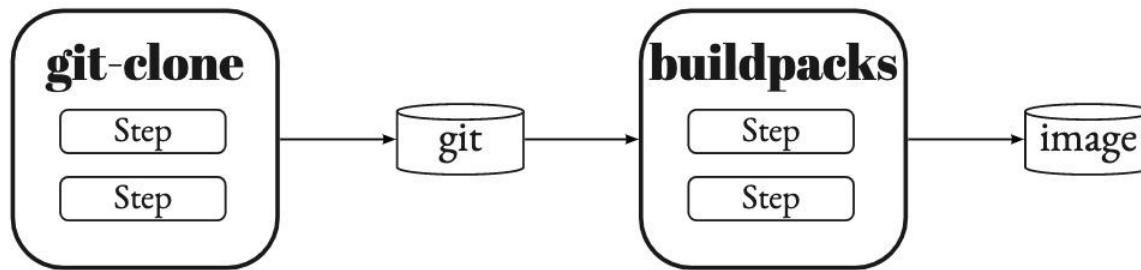
See it in action: Tekton

Pipeline



See it in action: Tekton

Pipeline



See it in action: Tekton



Virtual

PipelineRuns

Input a label filter of the format labelKey:labelValue

Status

Name

Pipeline



[buildpacks-test-pipeline-run3](#)

[buildpacks-test-pipeline](#)



[buildpacks-test-pipeline-run2](#)

[buildpacks-test-pipeline](#)

See it in action: Tekton



Virtual

```
kind: Task
metadata:
  name: buildpacks
...
spec:
...
steps:
- name: prepare
...
- name: create
  image: $(params.BUILDER_IMAGE)
  imagePullPolicy: Always
  command: ["/cnb/lifecycle/creator"]
  args:
    - "-app=$(workspaces.source.path)/$(params.SOURCE_SUBPATH)"
...
...
```

See it in action: Tekton

```
kind: Task
metadata:
  name: buildpacks-phases
...
spec:
...
steps:
  - name: prepare
...
  - name: detect
    image: ${params.BUILDER_IMAGE}
    imagePullPolicy: Always
    command: ["/cnb/lifecycle/detector"]
    args:
      - "-app=$(workspaces.source.path)/$(params.SOURCE_SUBPATH)"
...
  - name: analyze
    image: buildpacksio/lifecycle:0.8.1
    imagePullPolicy: Always
    command: ["/cnb/lifecycle/analyzer"]
...
  - name: restore
    image: buildpacksio/lifecycle:0.8.1
    imagePullPolicy: Always
    command: ["/cnb/lifecycle/restorer"]
...
  - name: build
    image: ${params.BUILDER_IMAGE}
    imagePullPolicy: Always
    command: ["/cnb/lifecycle/builder"]
...
  - name: export
    image: buildpacksio/lifecycle:0.8.1
    imagePullPolicy: Always
    command: ["/cnb/lifecycle/exporter"]
    args:
...

```

See it in action: Tekton

```
apiVersion: tekton.dev/v1alpha1
kind: PipelineResource
metadata:
  name: buildpacks-app-image
spec:
  type: image
  params:
    - name: url
      value: buildpacksio/dev/hello-tekton
```

```
apiVersion: tekton.dev/v1beta1
kind: PipelineRun
metadata:
  name: buildpacks-test-pipeline-run
spec:
  serviceAccountName: buildpacks-service-account
  pipelineRef:
    name: buildpacks-test-pipeline
  workspaces:
    - name: shared-workspace
    persistentvolumeclaim:
      claimName: buildpacks-source-pvc
  resources:
    - name: build-image
    resourceRef:
      name: buildpacks-app-image
  podTemplate:
    volumes:
      - name: buildpacks-cache
        persistentVolumeClaim:
          claimName: buildpacks-cache-pvc
```

```
apiVersion: tekton.dev/v1beta1
kind: Pipeline
metadata:
  name: buildpacks-test-pipeline
spec:
  workspaces:
    - name: shared-workspace
  resources:
    - name: build-image
      type: image
  tasks:
    - name: fetch-repository
      taskRef:
        name: git-clone
      workspace:
        name: shared-workspace
    - name: output
      workspace: shared-workspace
      params:
        - name: url
          value: https://github.com/dfreilich/kubecon-na-20-demo
        - name: subdirectory
          value: ""
        - name: deleteExisting
          value: "true"
    - name: buildpacks
      taskRef:
        name: buildpacks
      runAfter:
        - fetch-repository
      workspace:
        name: source
        workspace: shared-workspace
      params:
        - name: SOURCE_SUBPATH
          value: app/
        - name: BUILDER_IMAGE
          value: paketobuildpacks/builder:base
        - name: CACHE
          value: buildpacks-cache
      resources:
        outputs:
          - name: image
            resource: build-image
```

See it in action: Tekton



Virtual

```
kubectl apply -f resources.yaml
```

```
kubectl apply -f run.yml
```

See it in action: Tekton



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What we've seen so far



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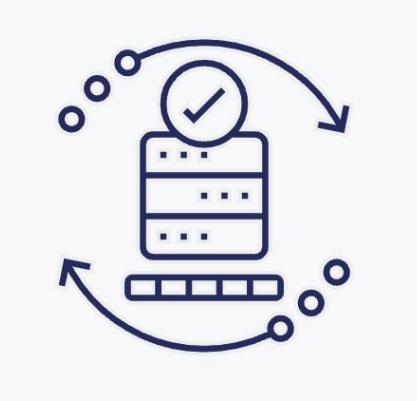
Virtual



Let application
developers
focus on
development



Give operators
control over
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Enable fast
patching of OS
vulnerabilities

See it in action: kpack



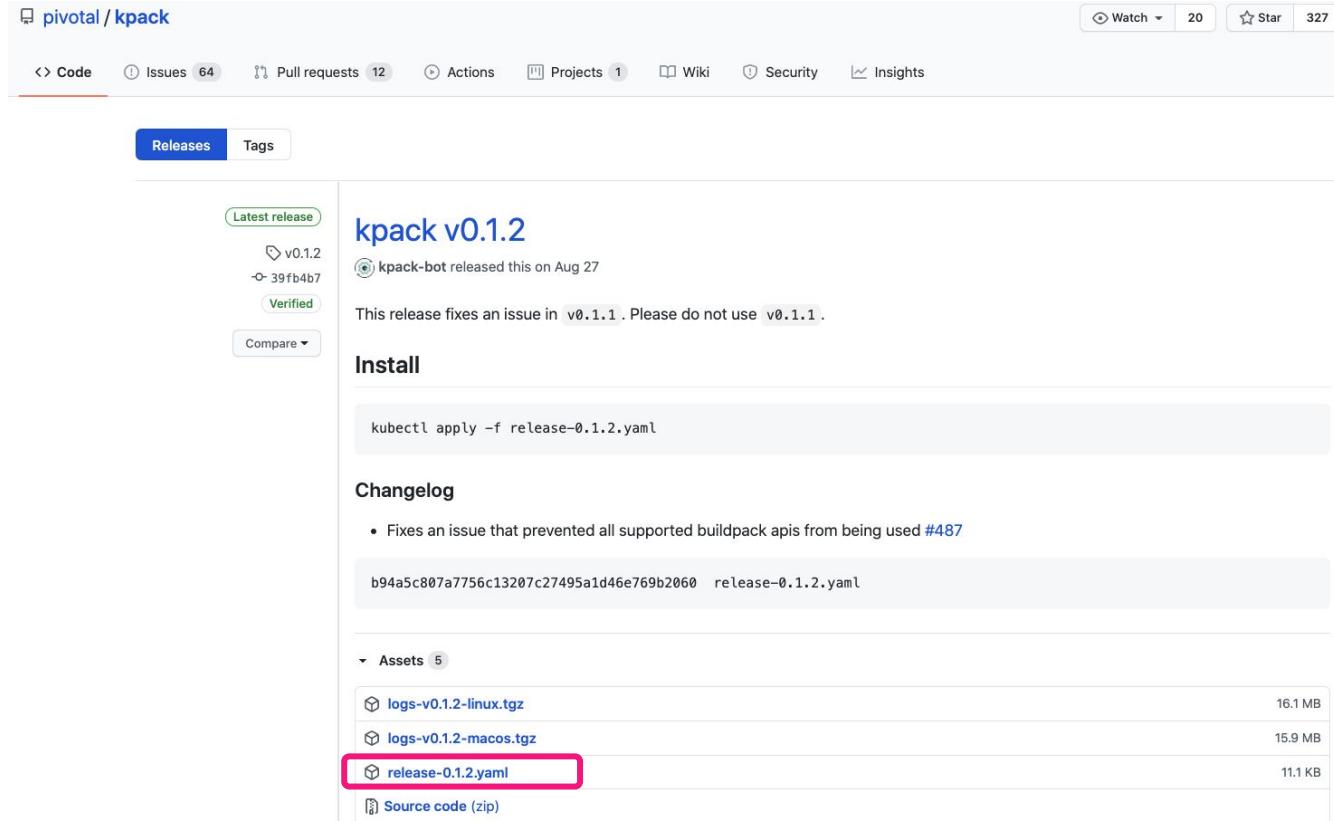
Virtual

- Maintained by: VMware
- Highlights:
 - Uses lifecycle
 - Supports building and rebasing
 - k8s native
- Target persona: platform operator

See it in action: kpack



Virtual



A screenshot of a GitHub repository page for "pivotal / kpack". The "Releases" tab is selected. A prominent release is shown for "kpack v0.1.2", which was released by "kpack-bot" on Aug 27. The release notes state: "This release fixes an issue in v0.1.1. Please do not use v0.1.1." Below the release notes is an "Install" section containing the command "kubectl apply -f release-0.1.2.yaml". The "Changelog" section lists a single fix: "Fixes an issue that prevented all supported buildpack apis from being used #487". In the "Assets" section, there are five files listed: "logs-v0.1.2-linux.tgz" (16.1 MB), "logs-v0.1.2-macos.tgz" (15.9 MB), "release-0.1.2.yaml" (11.1 KB, highlighted with a red box), and "Source code (zip)".

pivotal / kpack

< Code Issues 64 Pull requests 12 Actions Projects 1 Wiki Security Insights

Releases Tags

Latest release

v0.1.2
- 39fb4b7
Verified

Compare ▾

kpack v0.1.2

kpack-bot released this on Aug 27

This release fixes an issue in v0.1.1. Please do not use v0.1.1.

Install

```
kubectl apply -f release-0.1.2.yaml
```

Changelog

- Fixes an issue that prevented all supported buildpack apis from being used #487

```
b94a5c807a7756c13207c27495a1d46e769b2060 release-0.1.2.yaml
```

Assets 5

logs-v0.1.2-linux.tgz	16.1 MB
logs-v0.1.2-macos.tgz	15.9 MB
release-0.1.2.yaml	11.1 KB
Source code (zip)	

See it in action: kpack



Virtual

```
kubectl apply -f release-0.1.2.yaml
```

```
namespace/kpack created
customresourcedefinition.apiextensions.k8s.io/builds.kpack.io created
customresourcedefinition.apiextensions.k8s.io/builders.kpack.io created
customresourcedefinition.apiextensions.k8s.io/clusterbuilders.kpack.io created
customresourcedefinition.apiextensions.k8s.io/clusterstores.kpack.io created
configmap/build-init-image created
configmap/rebase-image created
configmap/lifecycle-image created
configmap/completion-image created
deployment.apps/kpack-controller created
serviceaccount/controller created
clusterrole.rbac.authorization.k8s.io/kpack-controller-admin created
clusterrolebinding.rbac.authorization.k8s.io/kpack-controller-admin-binding created
role.rbac.authorization.k8s.io/kpack-controller-local-config created
rolebinding.rbac.authorization.k8s.io/kpack-controller-local-config-binding created
customresourcedefinition.apiextensions.k8s.io/images.kpack.io created
service/kpack-webhook created
customresourcedefinition.apiextensions.k8s.io/sourceresolvers.kpack.io created
customresourcedefinition.apiextensions.k8s.io/clusterstacks.kpack.io created
mutatingwebhookconfiguration.admissionregistration.k8s.io/defaults.webhook.kpack.io created
validatingwebhookconfiguration.admissionregistration.k8s.io/validation.webhook.kpack.io created
secret/webhook-certs created
deployment.apps/kpack-webhook created
serviceaccount/webhook created
role.rbac.authorization.k8s.io/kpack-webhook-certs-admin created
rolebinding.rbac.authorization.k8s.io/kpack-webhook-certs-admin-binding created
clusterrole.rbac.authorization.k8s.io/kpack-webhook-mutatingwebhookconfiguration-admin created
clusterrolebinding.rbac.authorization.k8s.io/kpack-webhook-certs-mutatingwebhookconfiguration-admin-binding created
```

See it in action: kpack



Virtual

```
kubectl get pods --namespace kpack --watch
```

NAME	READY	STATUS	RESTARTS	AGE
kpack-controller-6f57d5f7d-jqdgr	1/1	Running	0	71s
kpack-webhook-5cf99c5cd7-gwnbg	1/1	Running	0	59s

See it in action: kpack



Virtual

```
apiVersion: kpack.io/v1alpha1
kind: ClusterStack
metadata:
  name: base
spec:
  id: "io.buildpacks.stacks.bionic"
  buildImage:
    image: "paketobuildpacks/build:base-cnb"
  runImage:
    image: "paketobuildpacks/run:base-cnb"
```

```
apiVersion: kpack.io/v1alpha1
kind: ClusterStore
metadata:
  name: default
spec:
  sources:
    - image: gcr.io/paketo-buildpacks/java
    - image: gcr.io/paketo-buildpacks/nodejs
```

```
apiVersion: kpack.io/v1alpha1
kind: Builder
metadata:
  name: my-builder
  namespace: default
spec:
  serviceAccount: tutorial-service-account
  cacheSize: "1.5Gi"
  tag: buildpacksiodev/hello-kpack-builder
  stack:
    name: base
    kind: ClusterStack
  store:
    name: default
    kind: ClusterStore
  order:
    - group:
        - id: paketo-buildpacks/java
    - group:
        - id: paketo-buildpacks/nodejs
```

See it in action: kpack



Virtual

```
apiVersion: kpack.io/v1alpha1
kind: Image
metadata:
  name: hello-kpack
  namespace: default
spec:
  tag: buildpacksio/dev/hello-kpack
  serviceAccount: tutorial-service-account
  builder:
    name: my-builder
    kind: Builder
  source:
    git:
      url: https://github.com/natalieparellano/kubecon-na-20-demo
      revision: b50649790825aeebd263158ba0c1d271e4fc379
  subPath: app
```

See it in action: kpack



Virtual

```
kubectl apply -f store.yml
```

```
kubectl apply -f stack.yml
```

```
kubectl apply -f builder.yml
```

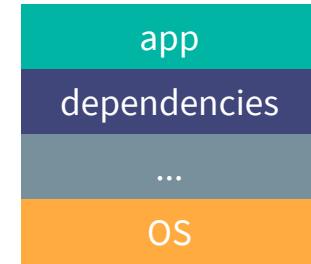
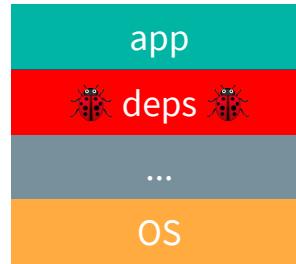
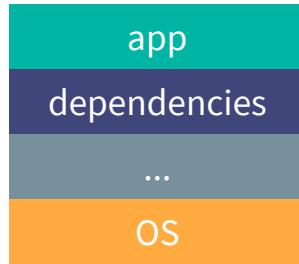
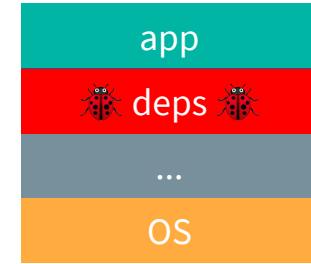
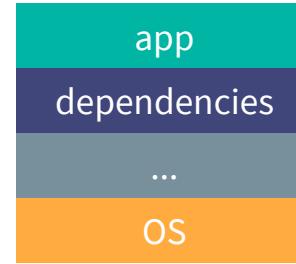
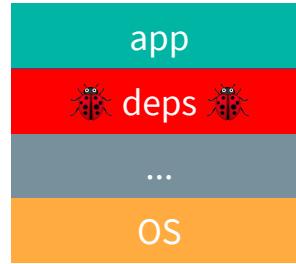
```
kubectl apply -f image.yml
```

See it in action: kpack

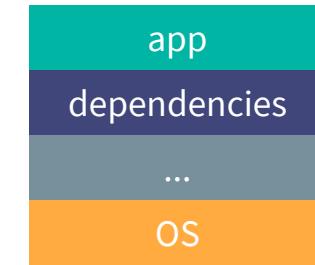
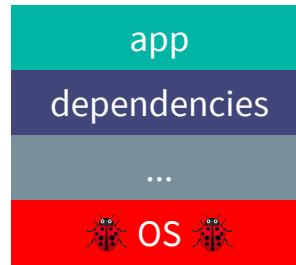
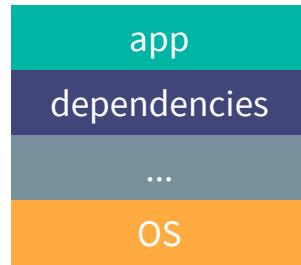
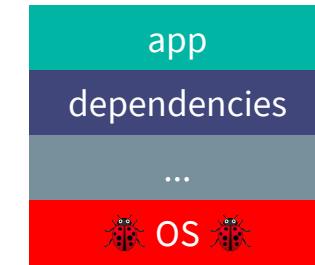
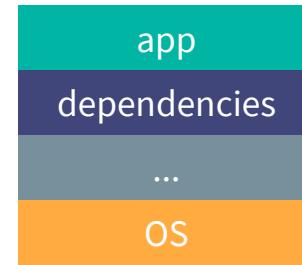


Virtual

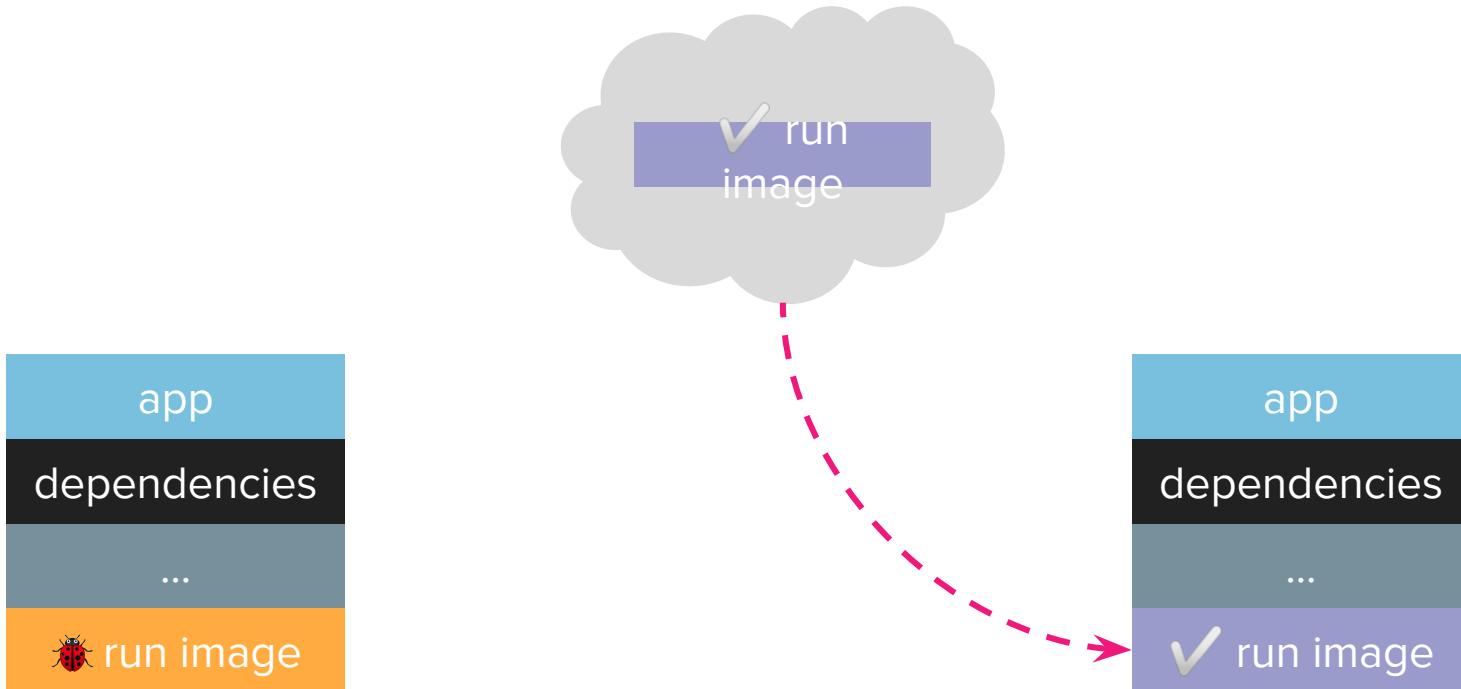
Dependency Updates



OS Updates



Rebasing



But how?



See it in action: kpack



Virtual

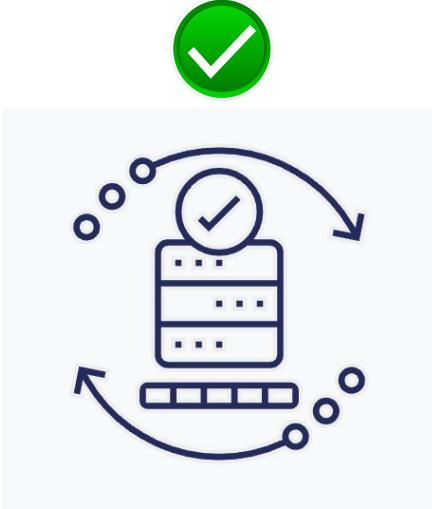
Summary



Let application
developers
focus on
development



Give operators
control over
build inputs



Enable fast
patching of OS
vulnerabilities

Platforms



Virtual



S K A F F O L D



Google Cloud Build



Spring
Boot



heroku



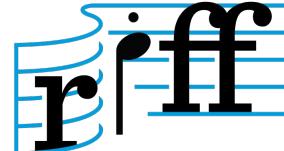
circleci



GitLab



vmware
kpack



CLOUD FOUNDRY



VMware Tanzu



Dokku





Resources

Demo Links



Virtual



pack:

<https://buildpacks.io/docs/tools/pack/>



GitLab Demo:

<https://gitlab.com/cnb1/hello-buildpacks>



CircleCI Orb:

<https://circleci.com/developer/orbs/orb/buildpacks/pack>



Tekton/CircleCI Demo:

<https://github.com/dfreilich/kubecon-na-20-demo>

kpack:

<https://github.com/pivotal/kpack/blob/master/docs/tutorial.md>

Get in touch!

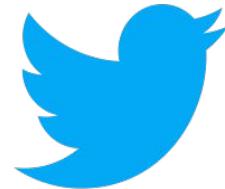


Virtual



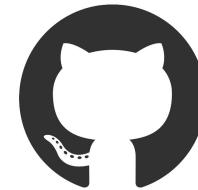
Slack

slack.buildpacks.io



Twitter

[@buildpacks_io](https://twitter.com/buildpacks_io)



GitHub

github.com/buildpacks

