Version 4.3
6/22/20

Prerequisites

- Modern system with 16G of memory and 35G free storage
- VirtualBox installed and running
- Virtual machine (.ova file) installed in VirtualBox
  - https://www.dropbox.com/s/0tmsfgxgwhafymp/jx-intro.ova?dl=0
- Setup doc is at
  - https://github.com/brentlaster/safaridocs/blob/master/jxi-setup.pdf
- Free GitHub account (signup at github.com)
- Labs doc for class
  - https://github.com/brentlaster/safaridocs/blob/master/jxi-labs.pdf
  - Should say Revision 1.5 at top
- Previous Jenkins 2 class or experience recommended

Introduction to Jenkins X

Brent Laster

About me

- Director, R&D
- Global trainer – training (Git, Jenkins, Gradle, Continuous Pipelines, CI/CD, DevOps, containers, Kubernetes, Istio, Helm, Kustomize, GitOps)
- Author -
  - OpenSource.com
  - Professional Git book
  - Jenkins 2 – Up and Running book
  - Jenkins X – in-progress (expected late 2020)
- https://www.linkedin.com/in/brentlaster
- @BrentCLaster

Book – Professional Git

- Extensive Git reference, explanations, and examples
- First part for non-technical
- Beginner and advanced reference
- Hands-on labs

Amazon Customer

I can't recommend this book more highly

February 12, 2017

Format: Kindle Edition

Brent Laster's book is in a different league from the many print and video sources that I've looked at in my attempt to learn Git. The book is extremely well organised and very clearly written. His decision to focus on Git as a local application for the first several chapters, and to defer discussion about it as a remote application until later in the book, works extremely well.

Laster has also succeeded in writing a book that should work for both beginners and people with a fair bit of experience with Git. He accomplishes this by offering, in each chapter, a core discussion followed by more advanced material and practical exercises.

I can't recommend this book more highly.

Ideal for hands-on reading and experimentation

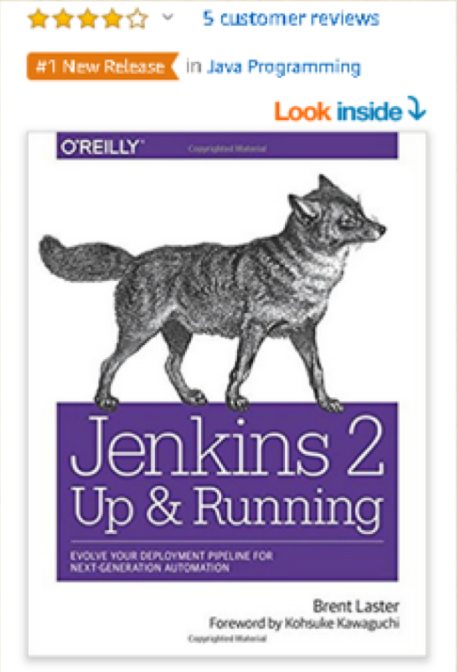
February 23, 2017

Format: Paperback | Verified Purchase

I just finished reading Professional Git, which is well organized and clearly presented. It works as both a tutorial for newcomers and a reference book for those more experienced. I found it ideal for hands-on reading and experimentation with things you may not understand at first glance. I was already familiar with Git for everyday use, but I've always stuck with a convenient subset. It was great to be able to finally get a much deeper understanding. I highly recommend the book.

Jenkins 2 Book

- Jenkins 2 – Up and Running
- Additional reference for this material
- "It's an ideal book for those who are new to CI/CD, as well as those who have been using Jenkins for many years. This book will help you discover and rediscover Jenkins."
  By Kohsuke Kawaguchi, Creator of Jenkins



This is highly recommended reading for anyone looking to use Jenkins 2 to ...
By Leila on June 2, 2018
Format: Paperback

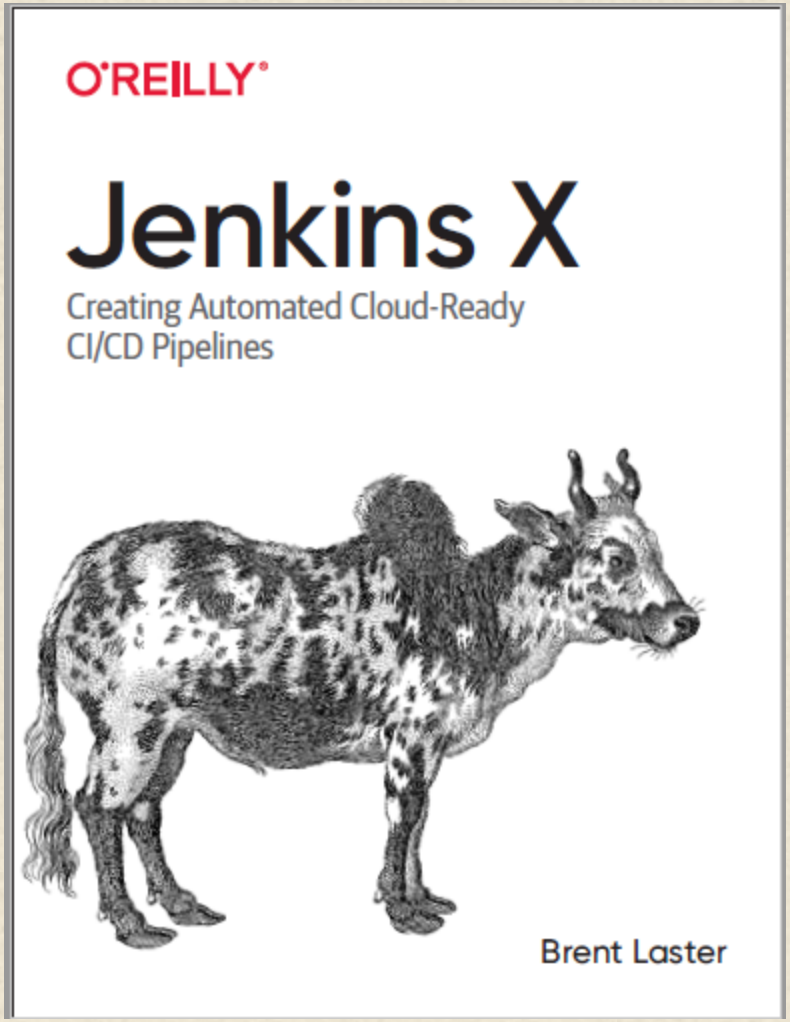
Brent really knows his stuff. I'm already a few chapters in, and I'm finding the content incredibly engaging. This is highly recommended reading for anyone looking to use Jenkins 2 to implement CD pipelines in their code.

A great resource
By Brian on June 2, 2018
Format: Paperback

I have to admit that most of the information I get usually comes through the usual outlets: stack overflow, Reddit, and others. But I've realized that having a comprehensive resource is far better than hunting and pecking for scattered answers across the web. I'm so glad I got this book!

Jenkins X Book

- In progress
- Early release chapters on O'Reilly



Agenda

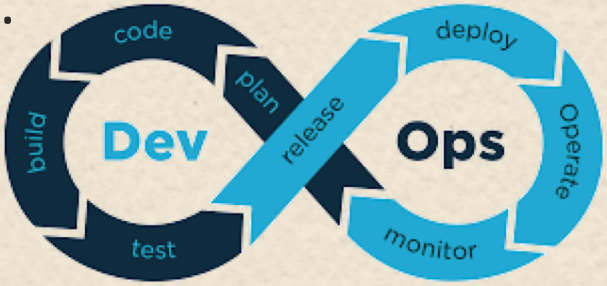
- Introduction to Jenkins X - what it is, benefits, motivation, practices, technologies it uses
- Crash course in Containers and Kubernetes
- Creating a cluster
- Install jx on the cluster
- Exploring environments
- Quickstarts - how to quickly and easily spin up new projects using Jenkins X
- Preview environments
- Promoting to production in Jenkins X

A bit of terminology…

- Pipeline – an automated, repeatable set of processes chained together to transform source code into a deployable product
- Continuous Integration (CI) - the process of automatically detecting, getting, and building updates as source code or configuration is changed for a product. CI is the activity that starts the pipeline
- Continuous Delivery (CD) – the ability to produce deployable products quickly, reliably, and consistently through automated processes responding to code or configuration changes
- DevOps – a set of practices (including CI/CD) that automate and simplify the processes and promote collaboration between dev teams and ops teams
- Cloud-ready / native / friendly – working well in a cloud environment where applications may need to be scaled, restarted, etc. and you pay for resources and time used
- Jenkins – a build and workflow orchestration tool
- Jenkins 2 – an evolution of Jenkins that focused on pipelines-as-code
- Jenkins X …?

What is Jenkins X?

- A way to automatically create and run CI/CD pipelines in a cloud (or cloud-like) environment.
- A framework with a set of tools and processes for doing the above.
- Think of it as a way to get “on-demand” pipelines via simple commands and develop applications with industry best practices and workflows already built-in.



What benefits does Jenkins X provide?

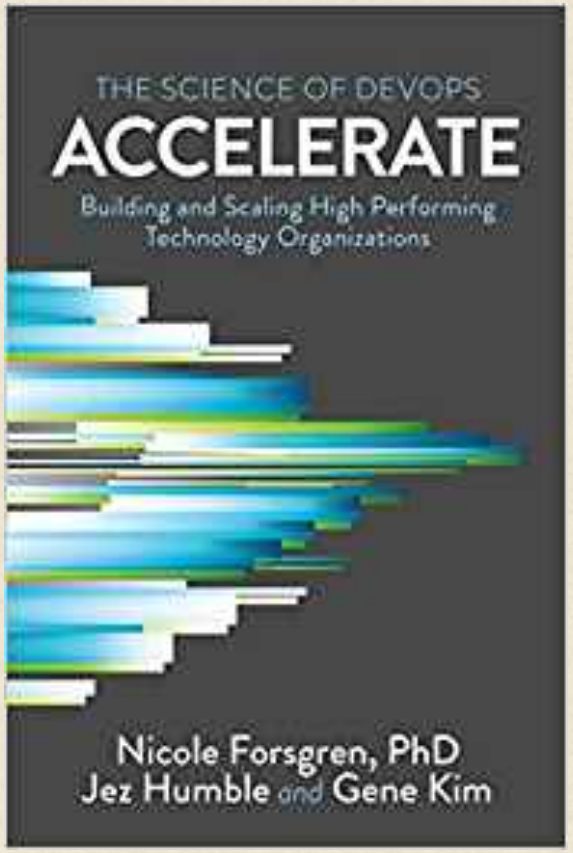
- **Cloud-ready development environment**
  - Ability to let you develop in any cloud
  - Spin up or tear down environments as needed
  - Easy pipeline for software development
  - Automatically implement CI/CD and DevOps best practices
  - Leverages best-of-breed applications, such as Jenkins and Kubernetes
- **Automates the hard stuff for setup and workflow**
  - Running one or two commands in Jenkins X can create an end-to-end CI/CD pipeline in a Kubernetes cluster, including:
    - » Git Repositories
    - » Promotion environments
    - » Webhooks to trigger actions
  - Includes the ability to create projects tailored for any number of common programming environments
    - » "Quickstart" project templates for Go, Python; build-in templates for Spring, etc.
  - Simple commands to move things through the pipeline
- **Managed promotion model with automatic environments**
- **Automatic feedback**
  - Updates pull requests and GitHub issue based on what is occurring and success/failure

What are the motivations for Jenkins X?

- Allow developers and others to focus on the code going through the pipeline rather than having to worry about the pipeline itself.
- Automate all the stuff that usually bogs down people trying to work with the technologies that it uses (namely Kubernetes).
- Be simple to use.
- Be cloud-friendly. Work well in any cloud or on-premise cloud-like environment.
- Leverage the industry-standard technologies
- Make it easy to do the "right thing" – use industry best practices.
  - As defined by research including the "Accelerate" book and "State of Devops" reports.

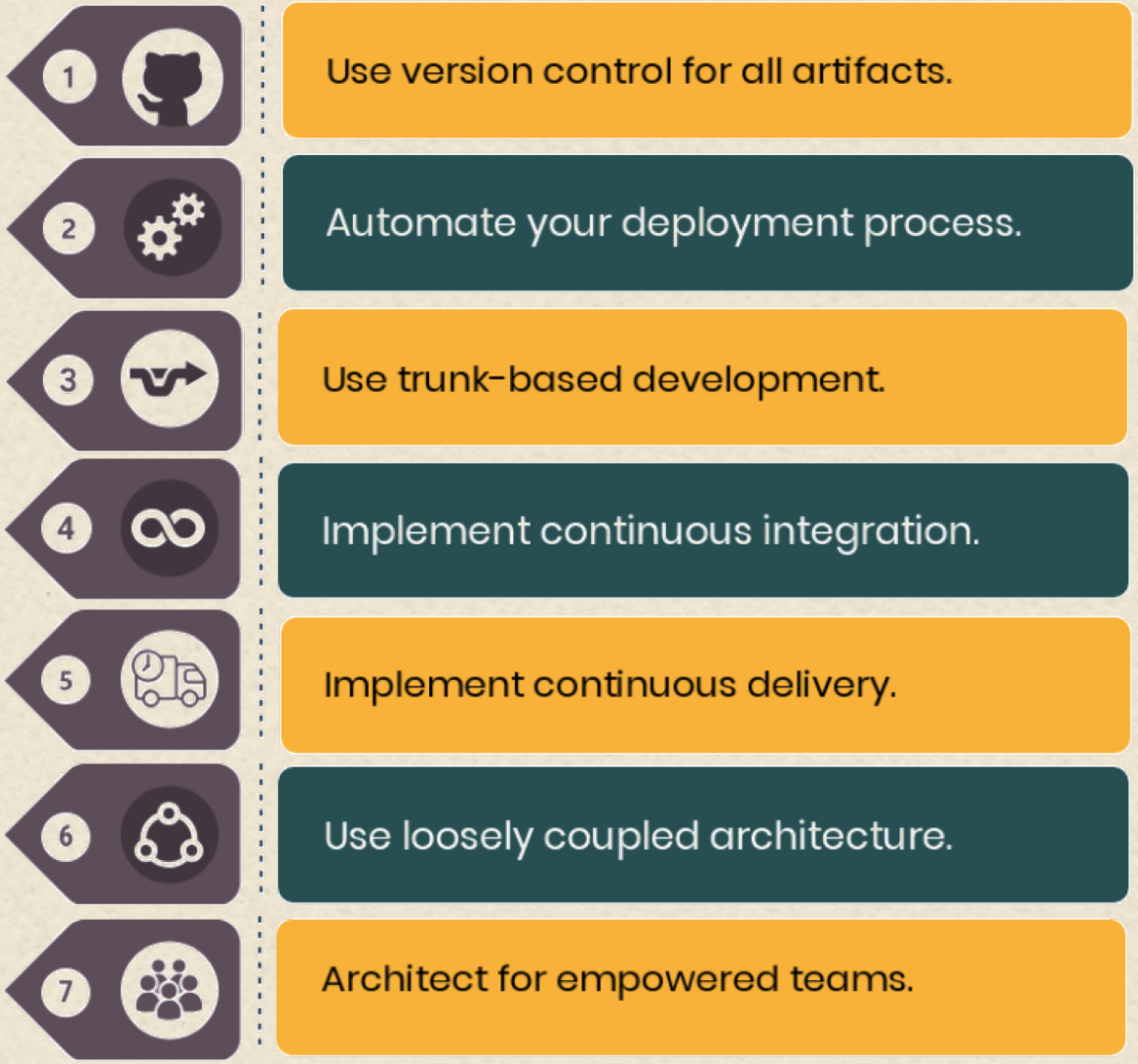
Accelerate!

- Jenkins X incorporates the best practices from the book “Accelerate” and the DevOps Institute’s State of DevOps reports.
- Those document what works and doesn’t work for high-performing DevOps organizations
- Implemented as seven core capabilities (implementation built-in) for Jenkins X.



7 Capabilities of Jenkins X

(https://jenkins-x.io/about/accelerate)



What technologies does Jenkins X use?

- Containers
- Docker
- Kubernetes
- Helm
- Git
- Static version
  - Jenkins
- Serverless version
  - Lighthouse (was prow - deprecated)
  - Tekton pipelines


```
apiVersion: tekton.dev/v1alpha1
kind: Task
metadata:
  name: build-docker-image
spec:
  inputs:
    resources:
      - name: git-repo
        type: git
    params:
      - name: pathToDockerFile
        description: Path to Dockerfile
        default: /workspace/git-repo/Dockerfile
      - name: pathToContext
        description: The build context used by Kaniko
        default: /workspace/git-repo
  outputs:
    resources:
      - name: image-registry
        type: image
  steps:
    - name: build-and-push
      image: gcr.io/kaniko-project/executor:v0.10.0
      env:
        - name: "DOCKER_CONFIG"
          value: "/builder/home/.docker/"
      command:
        - /kaniko/executor
      args:
        - --dockerfile=${inputs.params.pathToDockerFile}
        - --destination=${outputs.resources.image-registry.url}
        - --context=${inputs.params.pathToContext}
```

- We leverage the static version for an easier transition/ understanding (and because it works better on minikube)

Crash Course on Containers and Kubernetes

What are Containers?

- A container is a standard unit of software that functions like a fully provisioned machine installed with all the software needed to run an application.
- It's a way of packaging software so that applications and their dependencies have a self-contained environment to run in, are insulated from the host OS and other applications - and are easily ported to other environments.
- A container is NOT a VM. A container leverages several features of the Linux OS to "carve out" a self-contained space to run in.

Containers are running instances of images.
Images define what goes into a container.
Containers are built from images.

What is Docker?

- (Marketing) From docker.com

  An open platform for distributed applications for developers and sysadmins.

  Open source project to ship any app as a lightweight container

- (Technical)

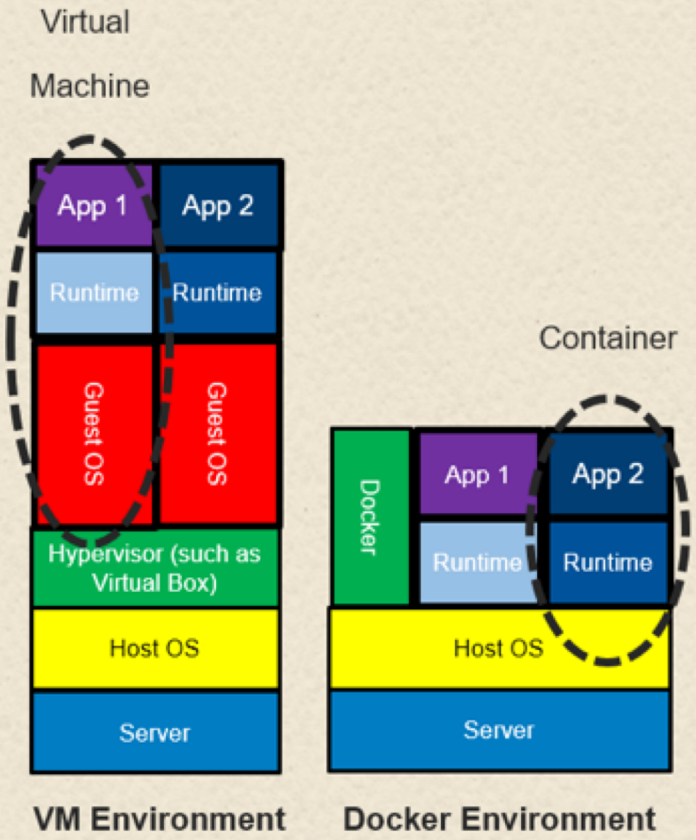
  Thin wrapper around Linux Container technology

  Leverages 3 functionalities from Linux to provide isolated environment in the OS

  - » union filesystem - data
  - » namespaces - visibility (pid)
  - » cgroups - control groups (resources)

- Provides restful interface for service
- Provides description format for containers
- Provides API for orchestration

How Containers from Docker differ from VM



- A VM requires a Hypervisor and a Guest OS to create isolation; Docker uses Linux container technologies to run processes in separate spaces on the same OS
- Because it doesn't require the Hypervisor and a Guest OS, Docker is:
  - Faster to startup
  - More portable (can run an image unchanged in multiple environments)

Dockerfile to Image to Container


```
FROM node:argon

# Create app directory
RUN mkdir -p /usr/src/app
WORKDIR /usr/src/app

# Install app dependencies
COPY package.json /usr/src/
RUN npm install

# Bundle app source
COPY . /usr/src/app

EXPOSE 8080
CMD [ "npm", "start" ]
```

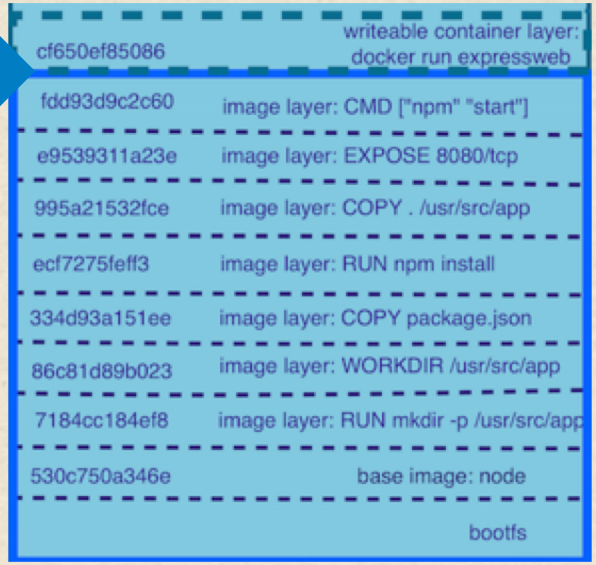
Build

```
$ docker build -t expressweb .
Step 1 : FROM node:argon
argon: Pulling from library/node...
...
Status: Downloaded newer image for node:argon
 ---> 530c750a346e
Step 2 : RUN mkdir -p /usr/src/app
 ---> Running in 5090fde23e44
 ---> 7184cc184ef8
Removing intermediate container 5090fde23e44
Step 3 : WORKDIR /usr/src/app
 ---> Running in 2987746b5fba
 ---> 86c81d89b023
Removing intermediate container 2987746b5fba
Step 4 : COPY package.json /usr/src/app/
 ---> 334d93a151ee
Removing intermediate container a678c817e467
Step 5 : RUN npm install
 ---> Running in 31ee9721cccb
 ---> ecf7275feff3
Removing intermediate container 31ee9721cccb
Step 6 : COPY . /usr/src/app
 ---> 995a21532fce
Removing intermediate container a3b7591bf46d
Step 7 : EXPOSE 8080
 ---> Running in fddb8afb98d7
 ---> e9539311a23e
Removing intermediate container fddb8afb98d7
Step 8 : CMD npm start
 ---> Running in a262fd016da6
 ---> fdd93d9c2c60
Removing intermediate container a262fd016da6
Successfully built fdd93d9c2c60
```

Run

```
docker history <image>


$ docker history expressweb
IMAGE          CREATED     CREATED BY                          SIZE
fdd93d9c2c60   2 days ago  /bin/sh -c CMD ["npm" "start"]      0 B
e9539311a23e   2 days ago  /bin/sh -c EXPOSE 8080/tcp          0 B
995a21532fce   2 days ago  /bin/sh -c COPY dir:50ab47bff7      760 B
ecf7275feff3   2 days ago  /bin/sh -c npm install              3.439 MB
334d93a151ee   2 days ago  /bin/sh -c COPY file:551095e67      265 B
86c81d89b023   2 days ago  /bin/sh -c WORKDIR /usr/src/app     0 B
7184cc184ef8   2 days ago  /bin/sh -c mkdir -p /usr/src/app    0 B
530c750a346e   2 days ago  /bin/sh -c CMD ["node"]             0 B
```



How do we think about this?

- Consider analogy of installing software on a machine…
- And then provisioning systems for users

What is Kubernetes?

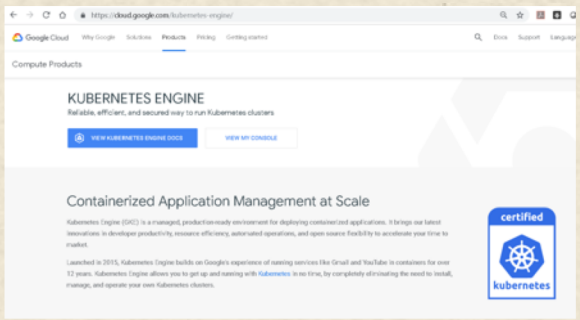
- A portable, extensible platform for managing containerized workloads and services (cluster orchestration system)
- Name derived from Greek for helmsman, thus the icon
- Frequently abbreviated as “k8s”
- Formerly known as “borg” – an internal Google project
- Open-sourced by Google in 2014
- Groups containers together for an application as a logical unit called a “pod”.
- Goal is to provide a robust platform for running many containers.
- Allows automation of deployment, scaling, and managing containerized workloads.
- Kubernetes provides you with a framework to run distributed systems (of containers) resiliently.
- Takes care of
  - scaling requirements
  - failover
  - deployment patterns

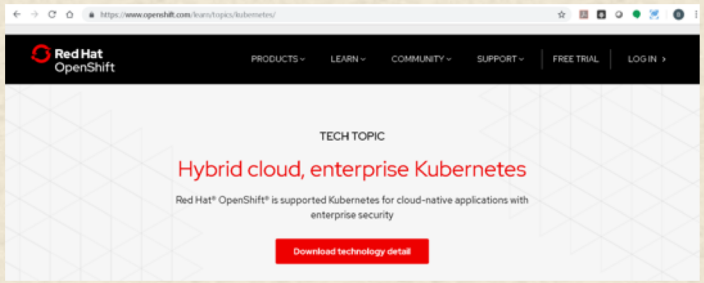
So how do we think about this?

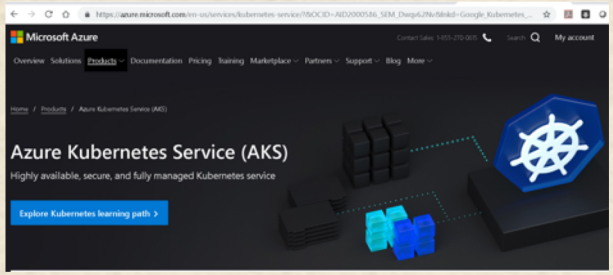
- Analogy: Datacenter for containers
  - If we think of images/containers as being like computers we stage and use
  - We can think of Kubernetes as being like a datacenter for those containers
  - Main jobs of datacenter
    - » Provide systems to service needs (regardless of the applications)
    - » Keep systems up and running
    - » Add more systems / remove systems depending on load
    - » Deal with systems that are having problems
    - » Deploy new systems when needed
    - Provide simple access to pools of systems
    - Etc..

Kubernetes is everywhere

- Has effectively "won the war" over other competitors
  - Docker swarm
  - Mesos
- Cloud providers all endorse it and provide ways to get a Kubernetes cluster
- Implementations on other enterprise platforms

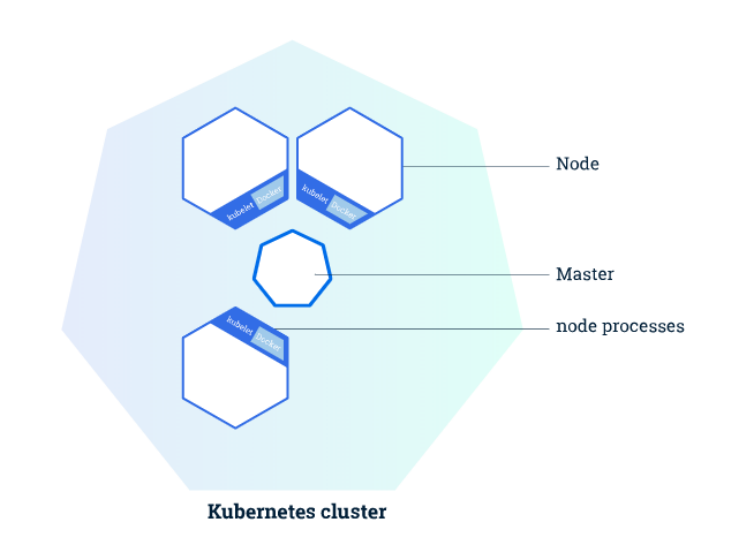






What is a K8s Cluster?

- Kubernetes is about clusters
  - A k8s cluster is an HA set of computers coordinated by k8s to work as a unit.
  - Abstractions we have in k8s allow you to deploy containers in the cluster w/o tying them to a specific host.
  - K8s automates distribution and scheduling of containers across cluster in an efficient manner.
  - Nodes in a cluster are either
    - master – coordinates the work
    - nodes – run the applications
  - Simplest example is a one node cluster, such as minikube



What is minikube?

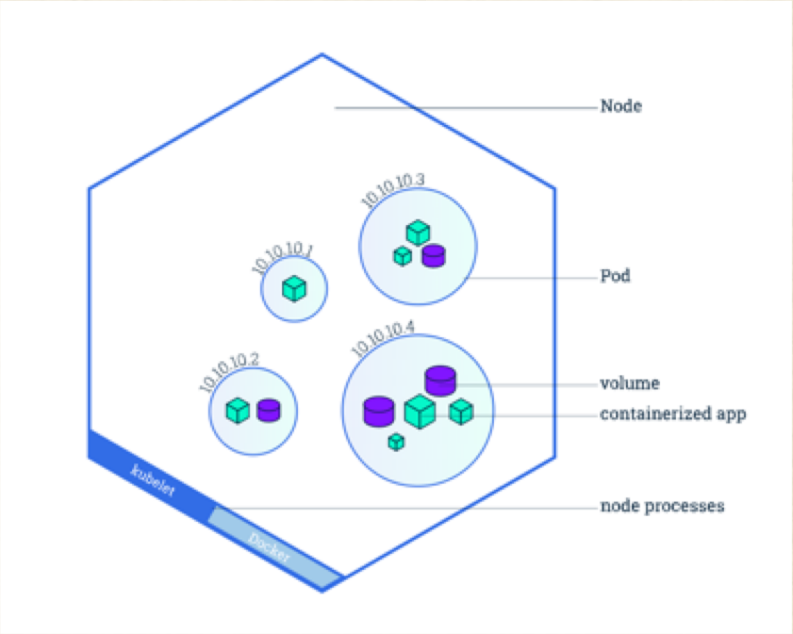
- Minikube is a simple program to learn about or work with small k8s deployments
- Creates a VM on your local machine
- Deploys a cluster containing only one node
- Has a CLI that starts and stops it, etc.
- Otherwise behaves like standard k8s

K8s Quick Terminology

- Pods – object that contains and manages one or more containers and any attached volumes
- Service – abstraction that groups together pods based on identifiers called labels (or other characteristic)
- Deployment – defines a stateless app with a set number of pod replicas (scaled instances)
- Ingress – resource that lets cluster applications be exposed to external traffic
- Namespace - a logical area that groups k8s items like pods

How are containers organized on K8S?

- K8s clusters have nodes
- Nodes run pods
- Pods are wrapped around one or more containers
- Pods are front-ended by services
- Pods are scaled (replicated) by deployments
- Namespaces group objects like pods, services, deployments together



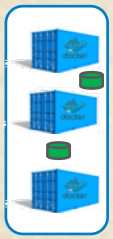
Data Center Analogy

29

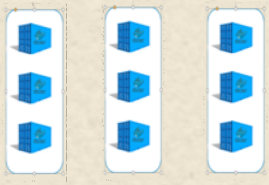
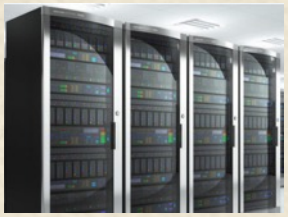
- Functions: Uptime, scaling, redundancy…

  - Container in a pod ~ server in a rack

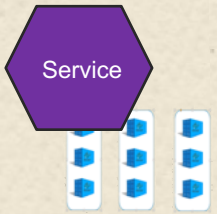

  - Pod ~ rack of servers




  - Deployment ~ multiple racks (replicas)

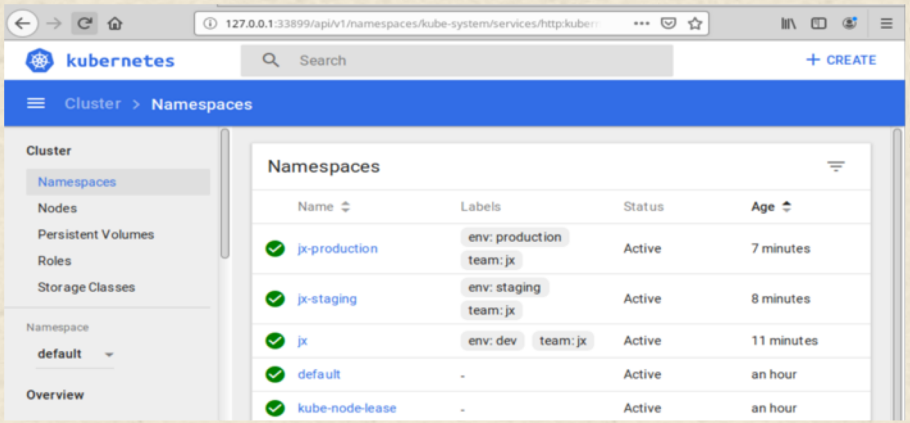
  - Service ~ central control / login server

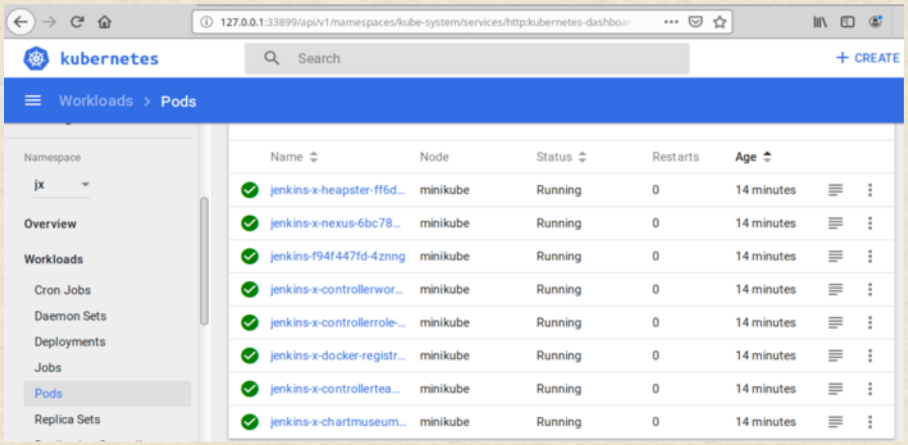


  - Namespace ~ server room

Looking at Kubernetes objects

- Command line utility – kubectl
- Dashboard
  - Browse around objects
  - Select by namespace
  - Drill in to see details





Jenkins X Initial Setup

- Prereq: Infrastructure that can run Kubernetes with Kubernetes installed on it
- Can be either on-prem or in external cloud
- Install jx
  - » Instructions https://jenkins-x.io/getting-started/install/
- Afterwards, ready to create new cluster or attempt to use existing one

jx – Command Line tool for Jenkins X

- Syntax: jx [options] command [command arguments]
- Options: -b, --batch-mode, --verbose, --help

- jx add - Adds a new resource
- jx boot - Boots up Jenkins X in a Kubernetes cluster using GitOps and a Jenkins X Pipeline
- jx cloudbees - Opens the CloudBees app for Kubernetes for visualising CI/CD and your environments
- jx completion - Output shell completion code for the given shell (bash or zsh)
- jx compliance - Run compliance tests against Kubernetes cluster
- jx console - Opens the Jenkins console
- jx context - View or change the current Kubernetes context (Kubernetes cluster)
- jx controller - Runs a controller
- jx create - Create a new resource
- jx delete - Deletes one or more resources
- jx diagnose - Print diagnostic information about the Jenkins X installation
- jx docs - Open the documentation in a browser
- jx edit - Edit a resource
- jx environment - View or change the current environment in the current Kubernetes cluster
- jx gc - Garbage collects Jenkins X resources
- jx get - Display one or more resources
- jx import - Imports a local project or Git repository into Jenkins
- jx init - Init Jenkins X
- jx install - Install Jenkins X in the current Kubernetes cluster
- jx login - Onboard an user into the CloudBees application
- jx logs - Tails the log of the latest pod for a deployment
- jx namespace - View or change the current namespace context in the current Kubernetes cluster
- jx open - Open a service in a browser
- jx options -
- jx preview - Creates or updates a Preview Environment for the current version of an application
- jx profile - Set your jx profile
- jx promote - Promotes a version of an application to an Environment
- jx prompt - Generate the command line prompt for the current team and environment
- jx repository - Opens the web page for the current Git repository in a browser
- jx rsh - Opens a terminal in a pod or runs a command in the pod
- jx scan - Perform a scan action
- jx shell - Create a sub shell so that changes to the Kubernetes context, namespace or environment remain local to the shell
- jx start - Starts a process such as a pipeline
- jx status - status of the Kubernetes cluster or named node
- jx step - pipeline steps
- jx stop - Stops a process such as a pipeline
- jx sync - Synchronises your local files to a DevPod
- jx team - View or change the current team in the current Kubernetes cluster
- jx uninstall - Uninstall the Jenkins X platform
- jx update - Updates an existing resource
- jx upgrade - Upgrades a resource
- jx version - Print the version information

Deprecated Commands

- install – boot
- init – boot
- create post
- create spring – create project
- upgrade platform – upgrade boot
- upgrade ingress – boot
- get post
- delete extension – apps
- edit extensions repository – apps
- step post
- step nexus drop
- step nexus release
- create vault
- delete vault

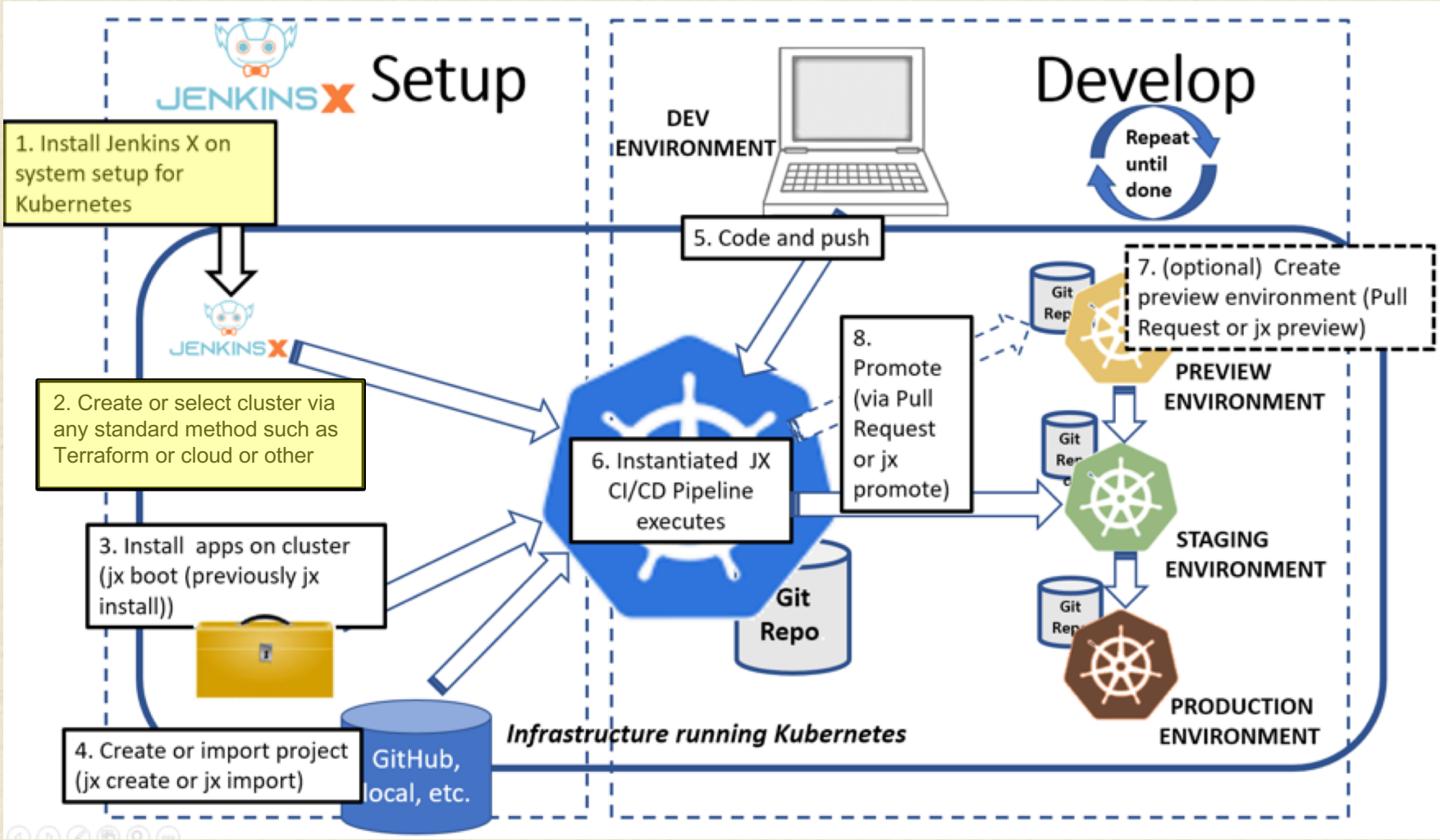
Cluster Setup

- Terraform will be recommended going forward
- Can use cloud tools
- Can have jx set one up for you (being deprecated)
  - "jx create cluster"
  - Requires parameters
    - » Amount of memory
    - » CPU cores
    - » Disk space
    - » Driver
- Can use existing cluster
  - Must be suitable and meet requirements for running jx
  - To check that, run

    "jx compliance"

Lab 1: Creating a Cluster with Jenkins X

Jenkins X Overall Workflow



Installing Jenkins X on the Cluster

- Installs set of client binaries
- Configures associated Git repositories
- Installs the Jenkins X platform
- Formerly used “jx install” – now deprecated
- For existing cluster with latest Jenkins X - “jx boot”
  - Specs defined in jx-requirements.yml
- Prerequisites:
  - Kubernetes > 1.8
  - RBAC (Role-based Access Controls) enabled
  - Default cluster dynamic storage class for provisioning persistent volumes
- Example – installing to an on premise Kubernetes cluster

```
jx install --provider=kubernetes --on-premise
```

Jenkins X tooling

- Formerly jx came in two versions – static and serverless
- Overall interface and user experience was same for both versions
- Difference is how core CI/CD functionality is implemented
- Static Jenkins X (deprecated)
  - Jenkins leveraged standard Jenkins 2 instance as core piece for CI/CD part of pipeline – runs in Kubernetes
  - Used Jenkinsfiles
- Serverless Jenkins X (only option going forward)
  - Instead of Jenkins 2, Jenkins X leverages tools called Lighthouse and Tekton to produce pipeline code to run the CI/CD process
  - These tools allow for creating pipelines-as-code that run natively in a Kubernetes cluster instead of needing separate tool (like Jenkins)
  - Uses jenkins-x.yml file – similar syntax to declarative pipeline
  - Default

What happens when we install Jenkins X into a cluster?

- Creates “jx” namespace and sets it as default
- Prompts for basic Git user info (name and email)
- Installs Helm orchestration/templating tool for Kubernetes
  - Helm chart is set of template files that get values filled in to specify applications and configuration to be deployed in that environment
- Sets up ingress if needed
- Gets GitHub username
- Gets token for human user
- Gets token for bot user
- “Installs” tools
- Sets up API token to access static Jenkins instance
- Creates staging and production environments
  - Git repositories
  - Jenkins projects
  - Webhooks

Managed promotion model

- Jenkins X provides a built-in model for code promotion
  - Creates several default environments for you
    - » Staging
    - » Production
  - Environments are effectively a pipeline in themselves
    - » Git repository
    - » Kubernetes namespace
  - Predefined promotion policies
    - » Always
    - » Never
  - Promotions done via Pull Requests (PRs)
  - Items (Git repo, K8s namespace are in addition to the ones for managing your projects' code)

What gets "installed" with (static) Jenkins X?

- Jenkins X comes with and installs a minimum number of "best of breed" core applications to do CI/CD on K8s
- Helm – templating language for K8s manifests
- Applications get installed as Kubernetes objects in "jx"namespace

Standard Deployment Name	Purpose
jenkins	Standard Jenkins to provide CI/CD automation
jenkins-x-chartmuseum	Registry for publishing Helm charts
jenkins-x-nexus	Dependency cache for Nodejs and Java apps to improve build time
jenkins-x-monocular-api	UI used for discovering and running Helm charts
jenkins-x-docker-registry	Local docker registry
jenkins-x-controller*	Controllers in K8S take care of routine tasks to ensure desired state of cluster matches the observed state – processing for custom objects
jenkins-x-mongodb	Nosql database

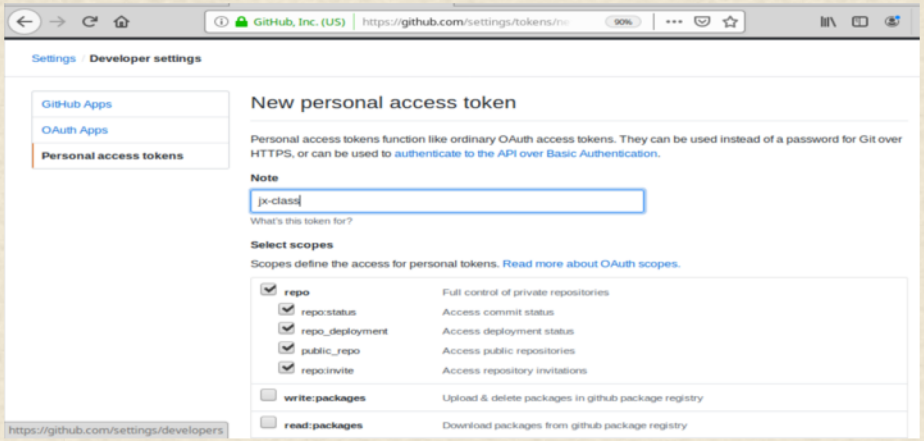
- May also have K8s jobs (one-shot pods) named "gc*"
  - Garbage collection that runs periodically

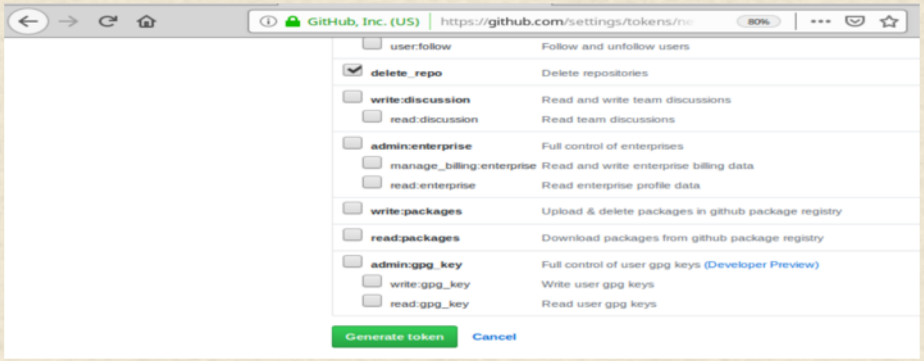
Git and Jenkins X

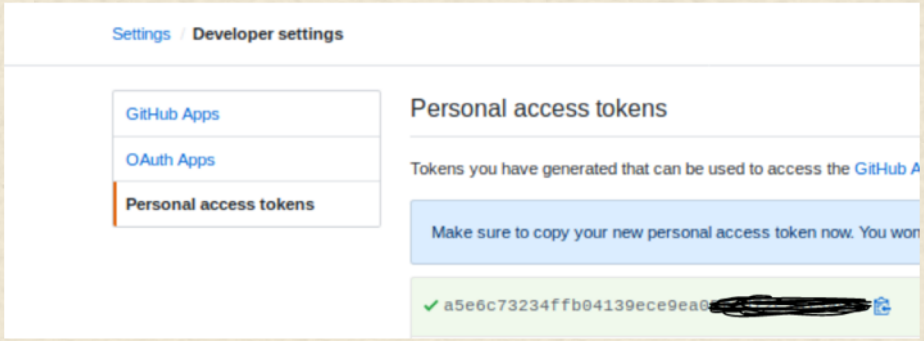
- Jenkins X uses Git for
  - Repositories for managed environments
  - Quickstart repositories
  - Pull-requests and automation
- Defaults to GitHub
  - Can also use GitLab
  - Can also use Gitea (limited)
- Two users
  - Developer (jx human user)
    - » Need userid, name, and email
  - jx-bot (system automation process)
- jx needs Git API tokens to work with both

GitHub Personal Access Tokens

- Can create a personal access token and use in place of password when
  - Doing operations over HTTPS
  - Using command line or API
- Need existing account
- Fill in info for token and copy it – won't be displayed again
- Jenkins X supplies URL to generate token

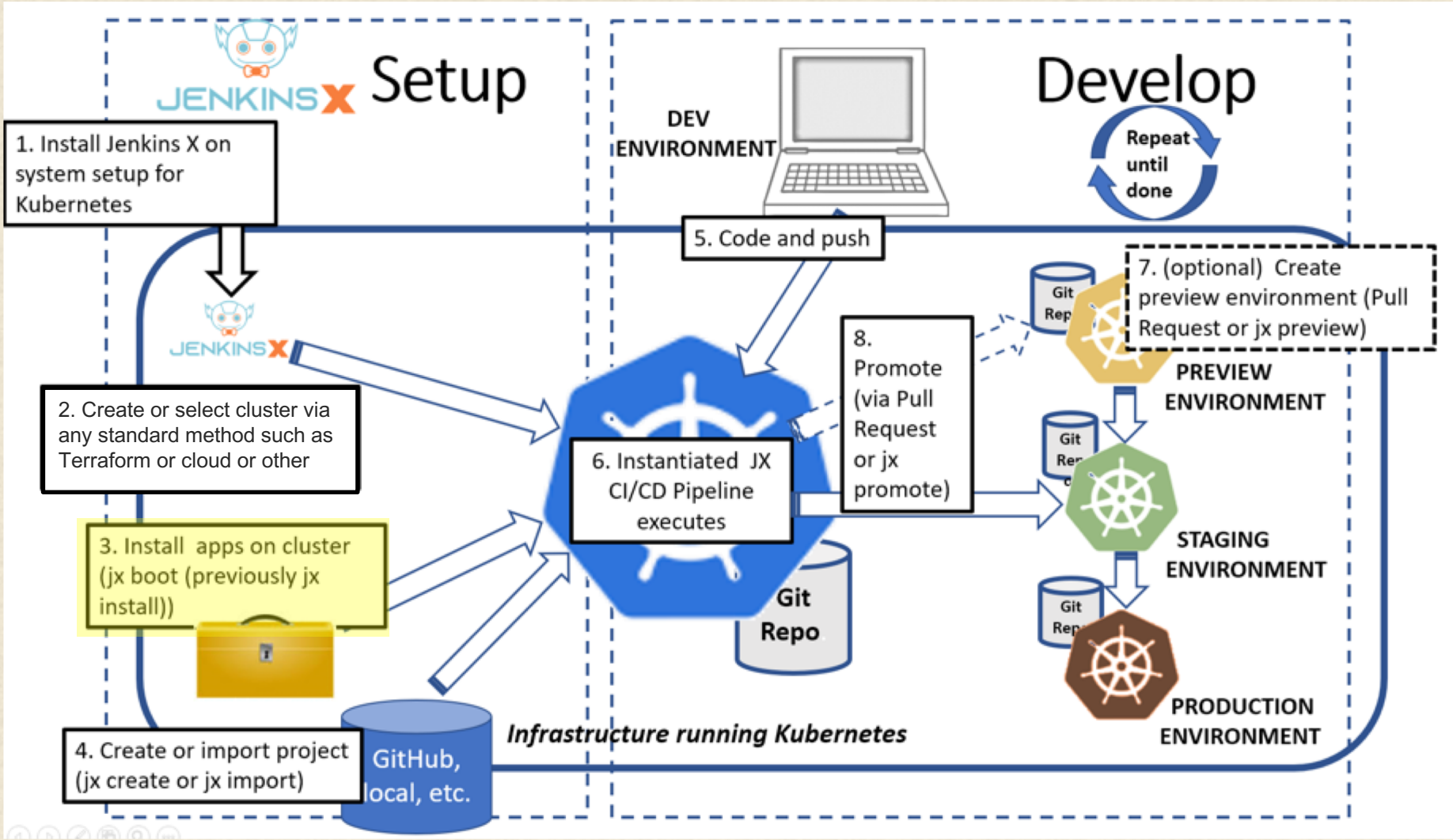




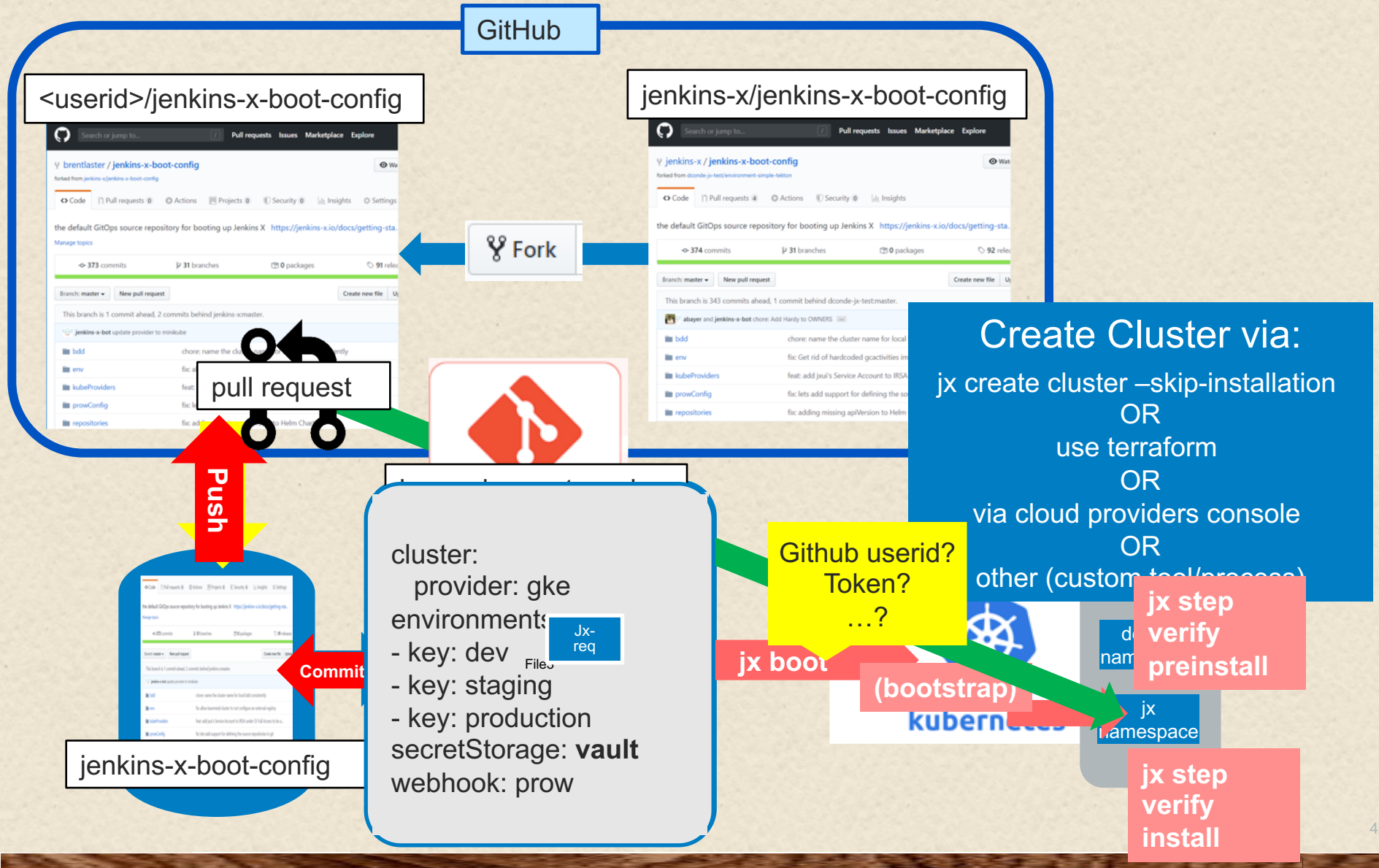


Lab 2: Creating a default CI/CD pipeline in the cluster using Jenkins X

Jenkins X Overall Workflow



How the jx boot process works



About Jenkins X Environments

- Jenkins X installation will have
  - Development Environment (dev)
    - » K8S namespace where tools are put (Jenkins, Nexus, etc.)
    - » Not linked to Git repository – will never promote changes
    - » Just K8S namespace for running applications while developing them
    - » Applications here are minimum to run CI/CD on K8s
    - » Scope: each team in an organization can have its own independent dev environment
  - Permanent Environments (staging and production to start)
    - » Environments where applications will run
    - » Can have more permanent ones if desired
    - » Linked to Git repositories
      - » Contains Helm chart defining
        - – Which application charts to be installed
        - – Which versions
        - – Environment configuration
        - – Additional resources needed
    - » To deploy to these, use Pull Request
    - » When PRs merged into environment's Git repo,
      - » Pipeline runs
      - » Applies helm chart in repo to K8s namespace
  - (Optional) Preview Environment – more later

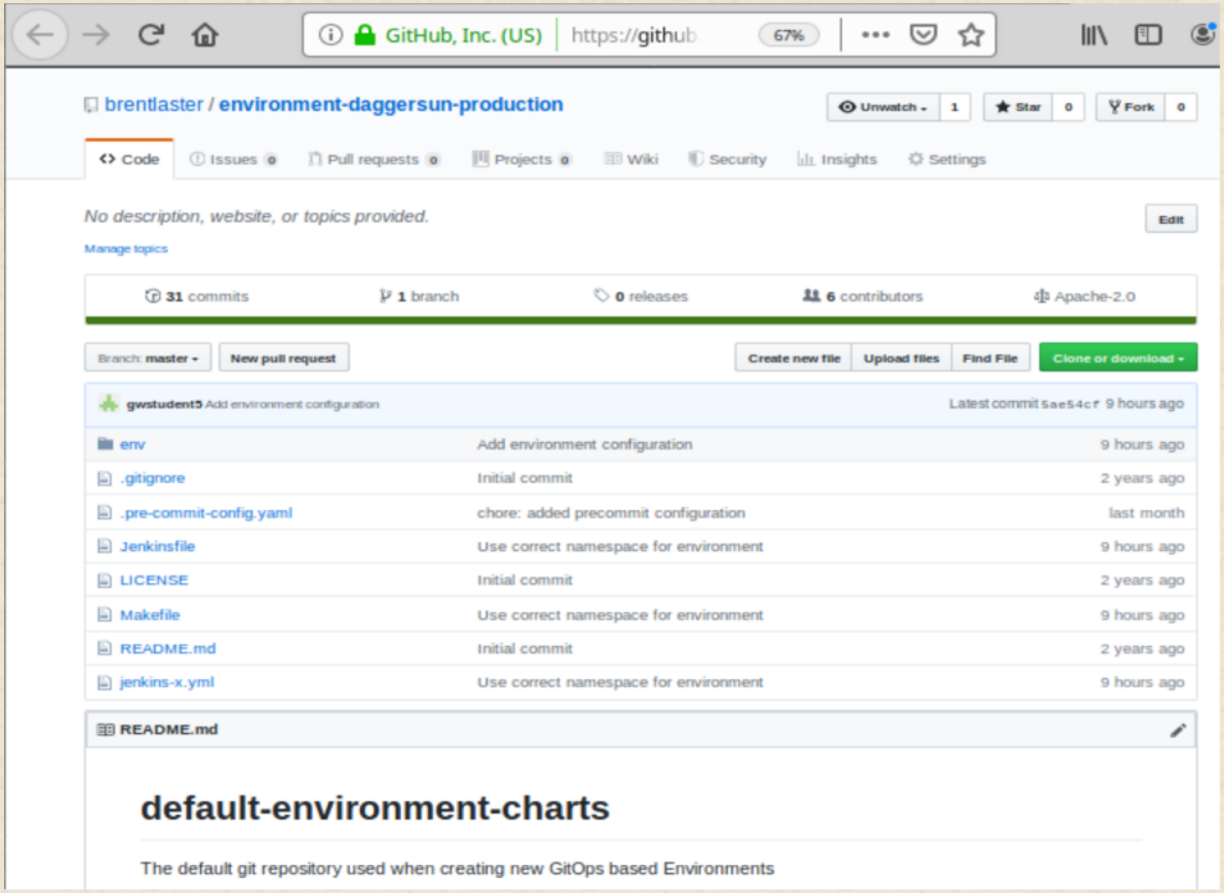
Staging and Production environments

Available after “jx install” completes

```
diyuser3@training1:~$ jx get env
NAME       LABEL       KIND        PROMOTE NAMESPACE     ORDER CLUSTER SOURCE                                                    REF PR
dev        Development Development Never   jx            0
staging    Staging     Permanent   Auto    jx-staging    100           https://github.com/brentlaster/environment-daggersun-staging.git
production Production  Permanent   Manual  jx-production 200           https://github.com/brentlaster/environment-daggersun-production.git
```

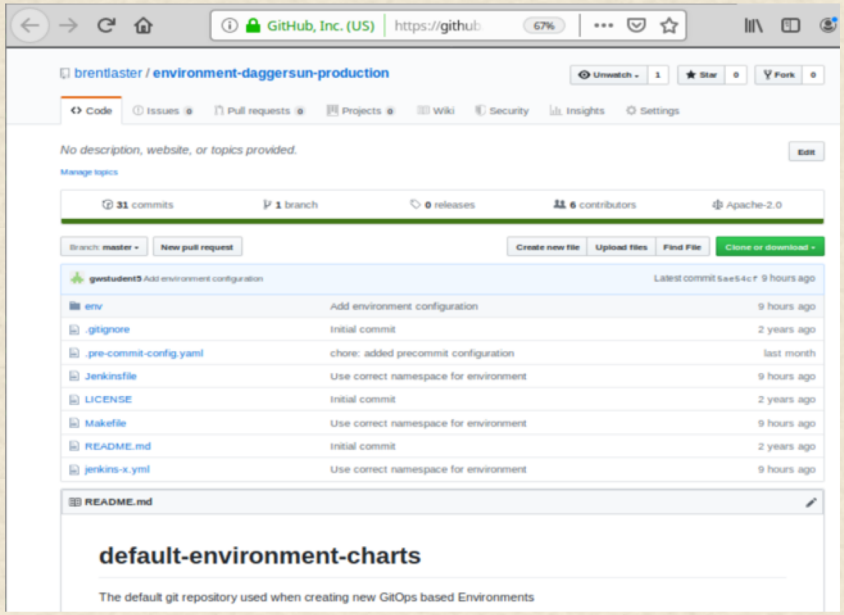
```
brentlaster
├── environment-daggersun-production
│   ├── env
│   │   ├── Chart.yaml
│   │   ├── requirements.yaml
│   │   ├── templates
│   │   └── values.yaml
│   ├── Jenkinsfile
│   ├── jenkins-x.yml
│   ├── LICENSE
│   ├── Makefile
│   └── README.md
└── environment-daggersun-staging
    ├── env
    │   ├── Chart.yaml
    │   ├── requirements.yaml
    │   ├── templates
    │   └── values.yaml
    ├── Jenkinsfile
    ├── jenkins-x.yml
    ├── LICENSE
    ├── Makefile
    └── README.md
```

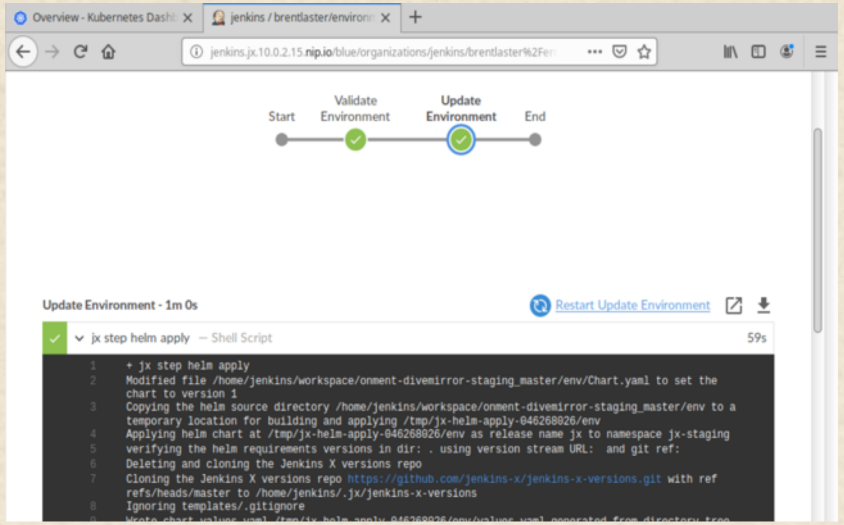
```
diyuser3@training1:~$ k get ns
NAME              STATUS   AGE
default           Active   9h
jx                Active   9h
jx-production     Active   9h
jx-staging        Active   9h
kube-node-lease   Active   9h
kube-public       Active   9h
kube-system       Active   9h
```



Environments have a pipeline

- Git repositories for environments are separate from one you use for your project code
- Environments are used for promotion: dev->staging, staging->production
- Jenkins uses Git repositories to manage what is deployed to each environment
- Repositories contain Helm charts to specify applications to be deployed
- Promotions done via Git pull requests (PR)
- Above is known as GitOps
- Environments have pipeline to handle promotions



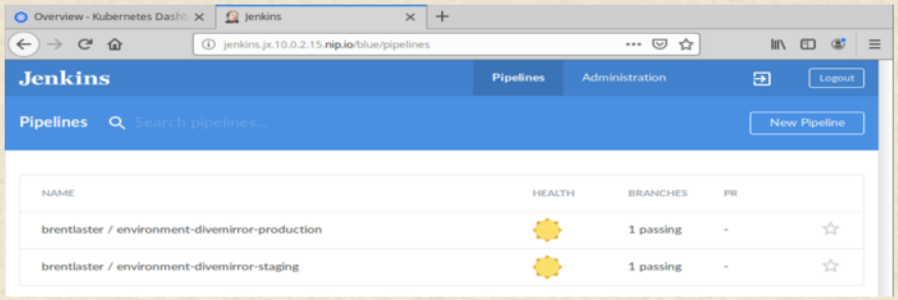


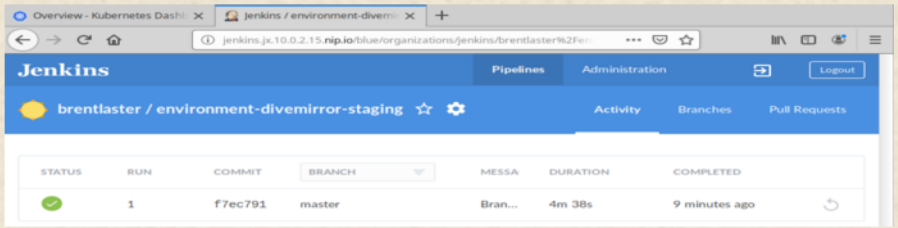
Serverless Pipelines

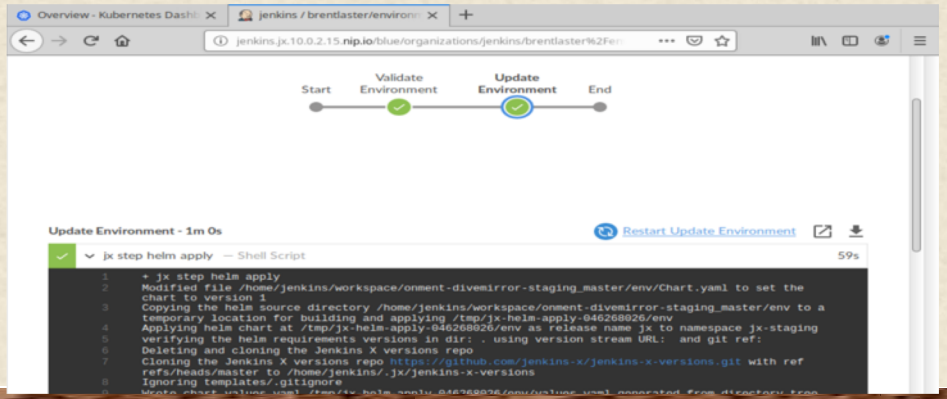
- Pipelines today become more of a codified expression of a process
  - leverages commands, plugins, external processes to take code from source to product
- Serverless Jenkins X uses jenkins-x.yml file instead of Jenkinsfile
  - Lives in project's repository
  - Can draw on existing functionality in buildpacks (also form of jenkins-x.yml)
- Each yml file has multiple pipeline "flavors"
  - release
    - » for processing merges to the main branch
    - » would usually create a new version and trigger promotion
  - pullRequest - for processing Pull Requests
  - feature - for processing merges to feature branch
- Jenkins X pipeline also defines "lifecycle phases"
  - setup – steps to create needed environment (scm checkout, credentials, etc.)
  - prebuild, build, postbuild
  - promote – moving to another level

Viewing a Static Pipeline

- Can use links in output
- Can use “jx console”
  - Brings up Jenkins instance running in jx namespace
  - Sign in
- Shows Blue Ocean interface with pipelines
  - Multi-branch pipelines (based off of Jenkinsfiles in Git branches)
- Select pipeline
- Select branch
- Explore details

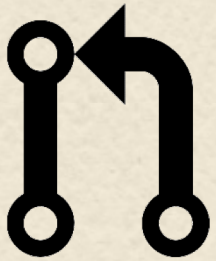






What is a Pull Request?

- GitHub model for contributing and gating changes into a repository.
- Proposed change is made in one place (source) and targeted for another place (destination)
- Source and destination can be:
  - Branch-to-branch in the same project
  - Project-to-project



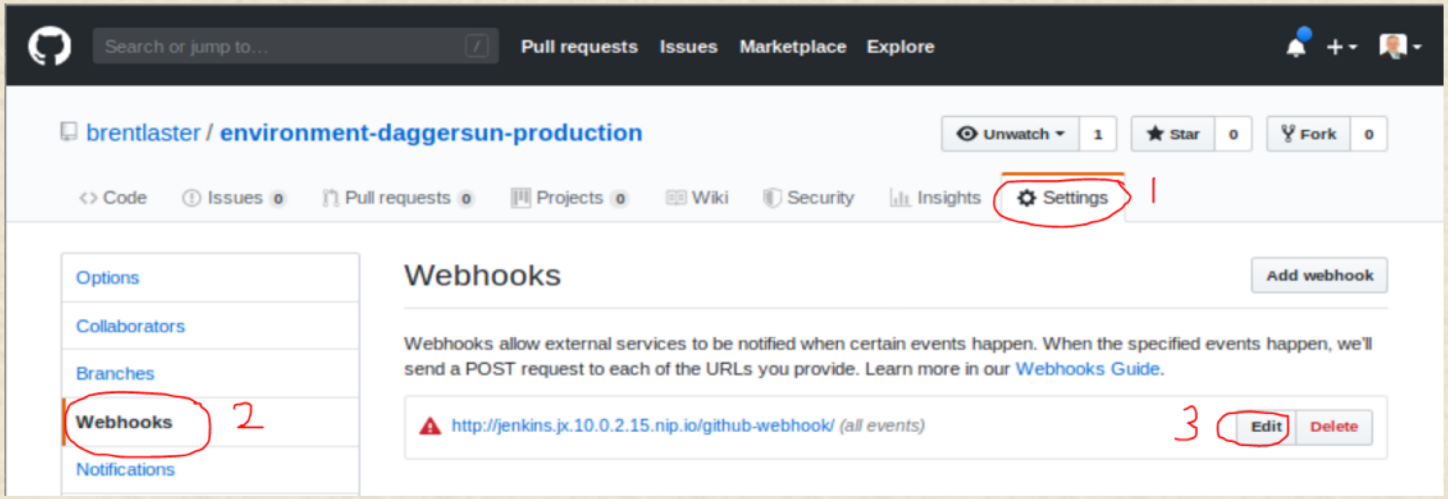
- Source and destination are specified when you open (create) a new PR
- PR's can be automatically built for verification
- PR's can be automatically approved
- Notifications about changes from GitHub side are via Webhooks

Webhooks

- Webhook is a way for an app/site (provider) to send a signal across the web when an event occurs
- Sends information (payload) to a URL that is “listening” (listener)
- Listener receives the webhook and performs a predefined action based on the information in the payload
- Webhooks are event-based while APIs are request based
- Jenkins X uses webhooks setup in Git repository to notify Jenkins X when event happens in Git that Jenkins X should react to (examples: push, PR merged, etc.)

Webhooks in GitHub for Jenkins X

- Automatically created by Jenkins X
- Accessible via project->Settings->Webhooks
- Defaults to sending notifications to Jenkins URL



nip.io

- General DNS mapping so you don't have to have a custom domain
- Used by Jenkins X if you don't have a custom domain
- Maps <anything>[.-]<IP Address>.nip.io to corresponding <IP Address>
  - Dot notation: foo.127.0.0.1.nip.io maps to 127.0.0.1
  - Dash notation: foo-127-0-0-1.nip.io maps to 127.0.0.1
- For our case, <IP Address> corresponds to ip address of node
  - http://jenkins.jx.10.0.2.15.nip.io maps to 10.0.2.15
  - Minikube ip = 10.0.2.15
- However, our urls still aren't visible outside of virtual machine
- For that, we leverage a tool called "ultrahook"

Ultrahook

- Simple command line tool that connects public webhook endpoints to private endpoints accessible from your system
- Solves problem of how to get webhook payloads locally to system that isn't exposed to outside web
- Allows for webhook requests to be bounced off of a name-spaced server and sent to your machine
- Installs ruby gem on system and run local command to have it detect requests to endpoint and send them on locally
- Can use different "subdomains" to direct different requests to
  - Example: http://foo.jx1.ultrahook.com, http://bar.jx1.ultrahook.com
- For our purposes, subdomain = your GitHub userid

Lab 3: Creating a Quickstart Project

Quickstarts

- Basic applications you can use to start a project, instead of starting from nothing
- Command to create one
  - jx create quickstart
  - provides list of types to choose from
  - Can also filter with –l option (i.e. jx create quickstart –l go)
  - Can also filter with –f http on names
- Maintained at https://github.com/jenkins-x-quickstarts

```
android-quickstart
angular-io-quickstart
aspnet-app
dlang-http
golang-http
golang-http-from-jenkins-x-yml
jenkins-cwp-quickstart
jenkins-quickstart
node-http
node-http-watch-pipeline-activity
open-liberty
php-helloworld
python-http
rails-shopping-cart
react-quickstart
rollout-app
rust-http
scala-akka-http-quickstart
spring-boot-http-gradle
spring-boot-rest-prometheus
spring-boot-rest-prometheus-java11
spring-boot-watch-pipeline-activity
vertx-rest-prometheus
```

What happens when a quickstart is created?

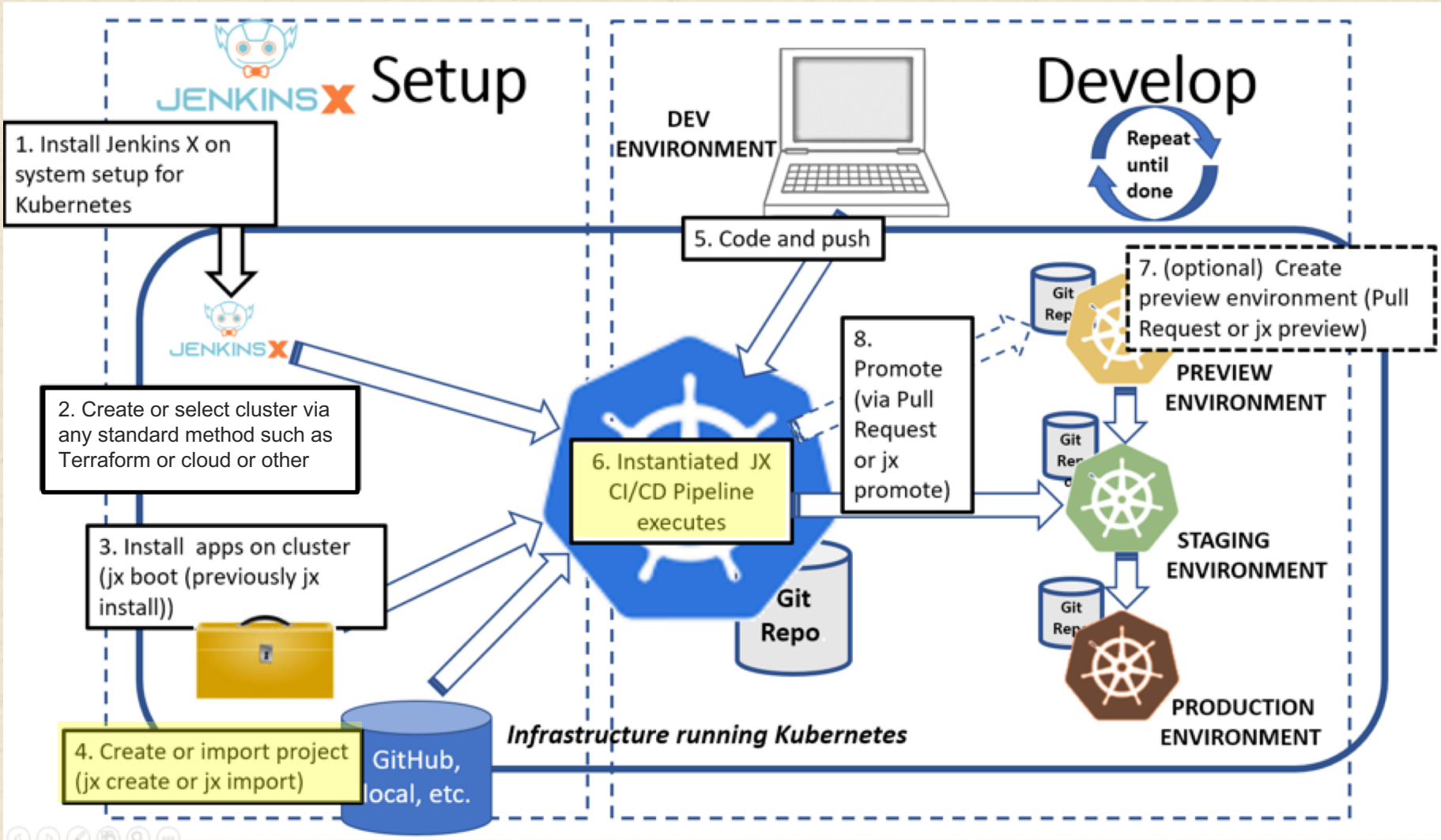
- User
  - Chooses the type of project to create
  - Provides a name
- Jenkins X automatically
  - Creates a new application from the quickstart project in a directory
  - Adds the source code into the local Git repository
  - Creates a remote Git repository (such as on GitHub)
  - Pushes the code to the remote Git repository
  - Adds necessary default versions of “infrastructure” files
    - » Dockerfile – to be able to build the application as a docker image
    - » Jenkinsfile – to implement the CI/CD pipeline
    - » Helm chart – to run the application in Kubernetes
  - Registers a webhook on the remote Git repository directed to your local Jenkins running in Kubernetes
  - Configures Jenkins to know about the Git repository
  - Triggers an initial pipeline run

Quickstart and Environments

- By default, project from Quickstart doesn't belong to any permanent environments (is in dev context)
- Dev environment only contains services created by Jenkins X
- If successfully built through pipeline, and promotion policy is auto, will be moved to staging.
- To make project visible where promotion policy is manual (such as production), must promote it

Lab 4: Creating a Quickstart project

Overall Jenkins X Workflow



Preview Environments

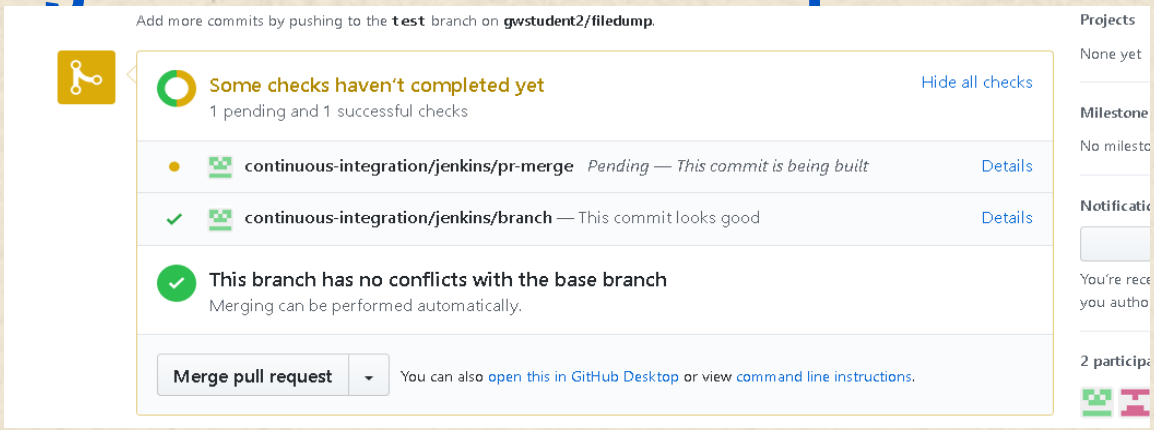
- "Extra" environment that Jenkins X can provide to allow users to get early/fast feedback on changes before they are merged into master branch
- Allows you to try changed versions of your work in your cluster first
  - Make sure they work as expected before promoting them
  - Deployed into cluster namespace/environment
- Jenkins X can create Preview environments for you
  - Automatically created for any Pull Requests
  - Additional ones can be created as needed using "jx preview" command
- When Preview environment is created
  - New environment of kind Preview is created
    - » New Kubernetes namespace is created
  - Visible via "jx get environments" and "jx namespace"
  - Pull Request is built as preview docker image
  - Image is deployed into preview environment via Helm chart
  - Comment is added to Pull Request to indicate preview application is ready for testing with link to the application

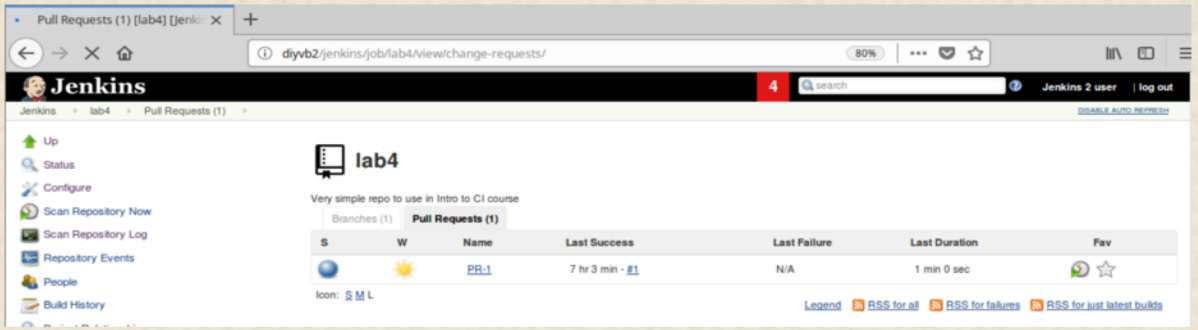
Typical Change Process for App Update

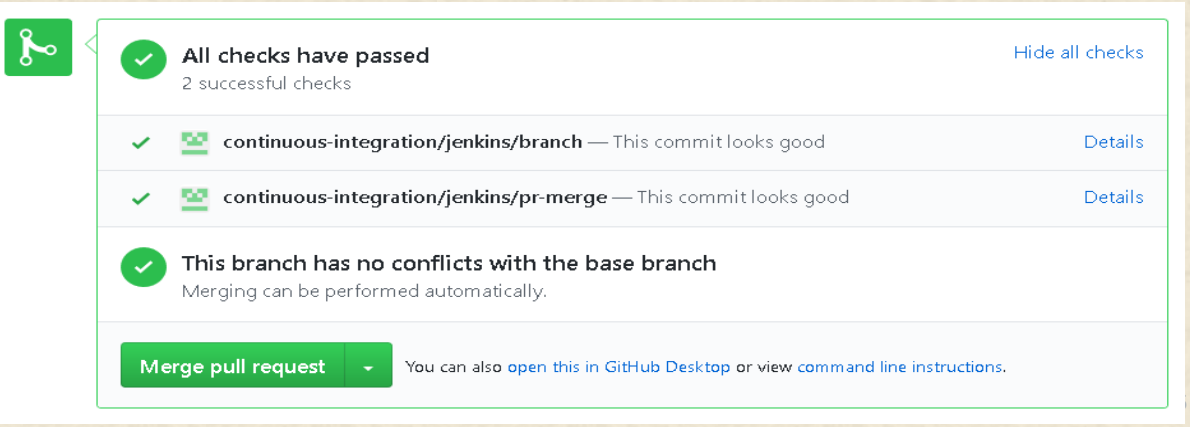
- Happens after app has been created
- In local app directory, create new local branch
- In new branch, make code changes
- Commit changes locally and push to remote repository
- Create Pull Request from new branch to master
- Preview environment gets created for you with running new version of your app to “preview” functionality
- Merge pull request

Continuous Integration with Pull Requests

- If can be merged automatically, Jenkins build will be kicked off
- Jenkins multibranch pipeline will show PR like branch
- If Jenkins build successful (and all checks successful), “Merge” button enabled

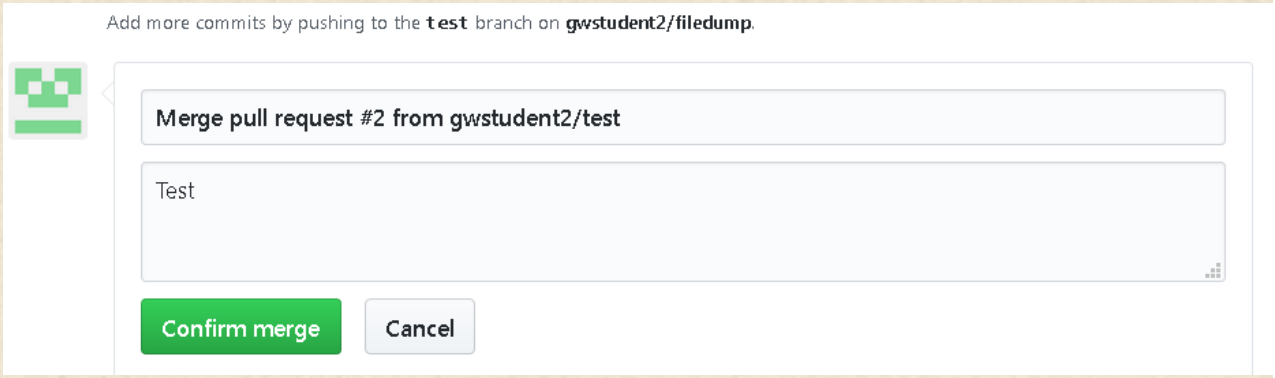


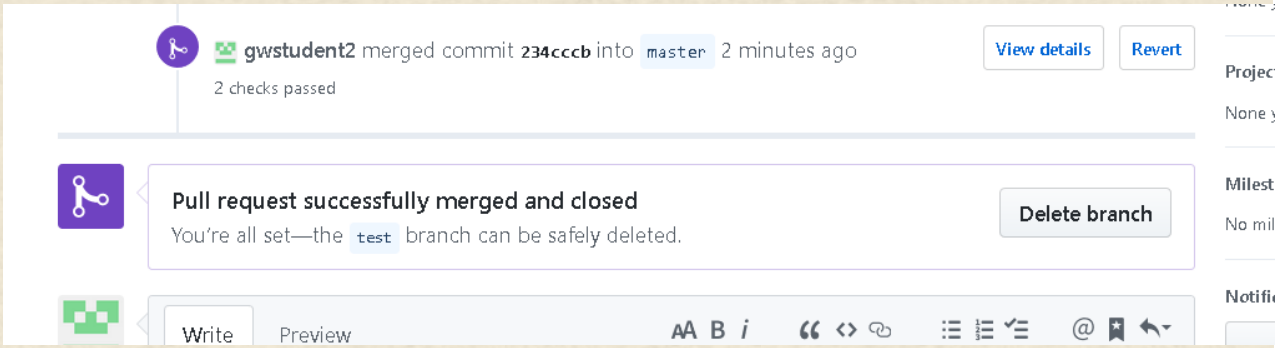


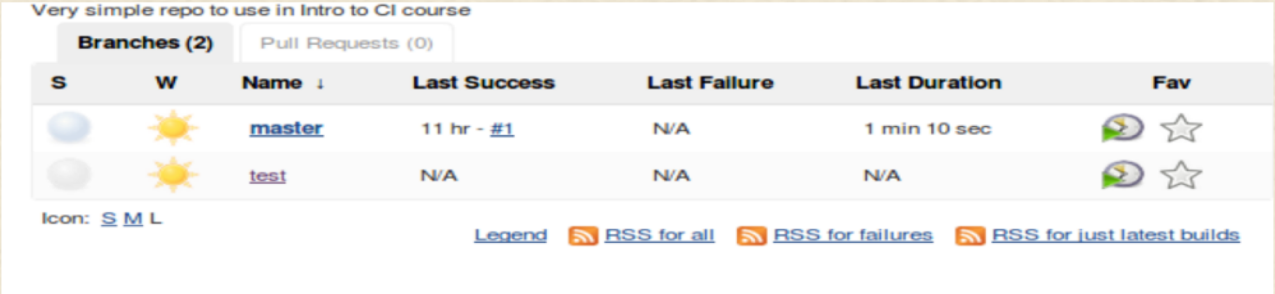


Completing the PR

- After checks have passed, you can click on “Merge” button and confirm (automated in Jenkins X)
- After a moment, results will show in GitHub (and be available to Jenkins X)
- In Jenkins, PR will no longer show

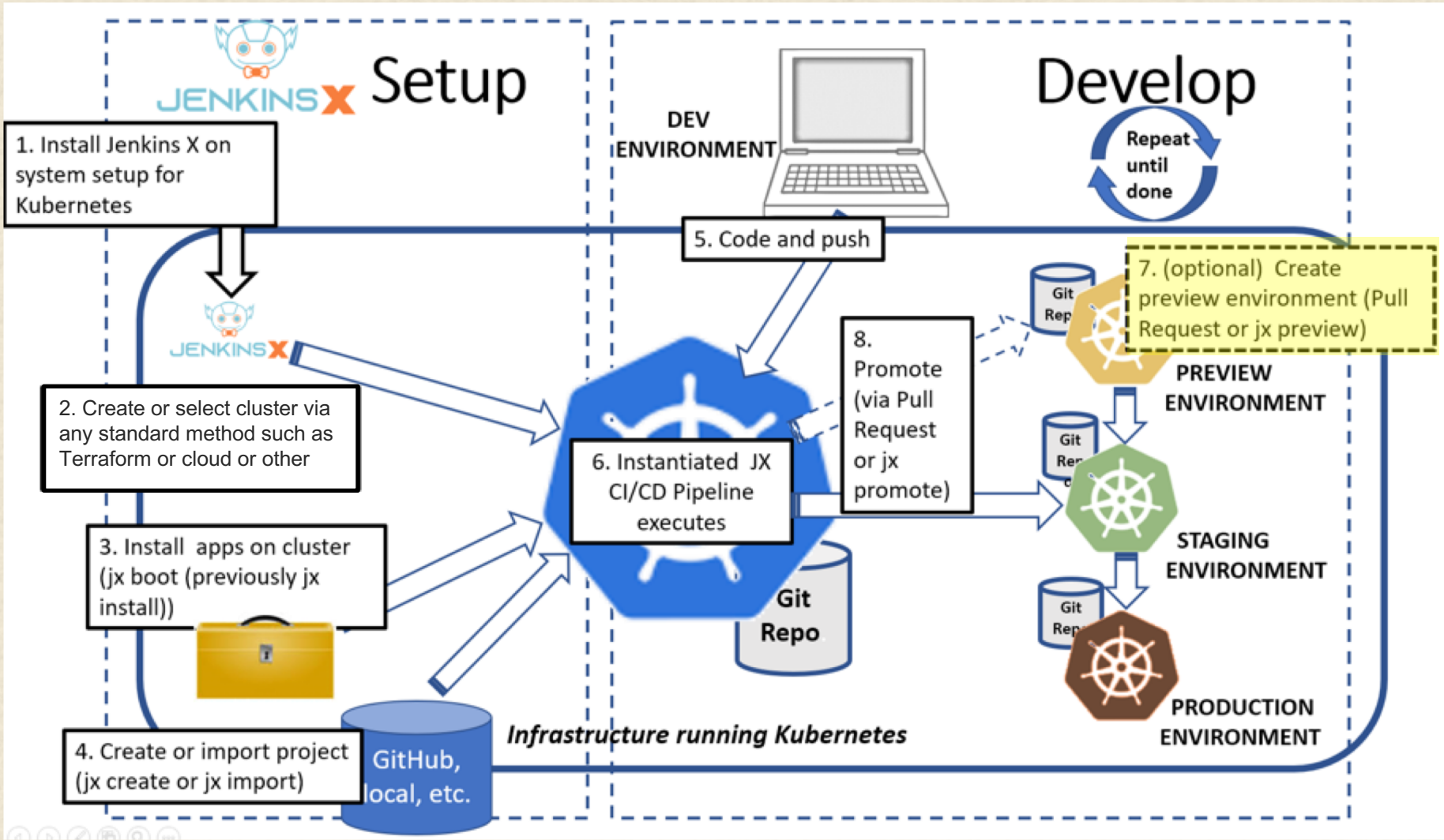






Lab 5: Creating a Preview environment

Jenkins X Overall Workflow



Typical Project Promotion Workflow (Auto)

Create a branch off of master

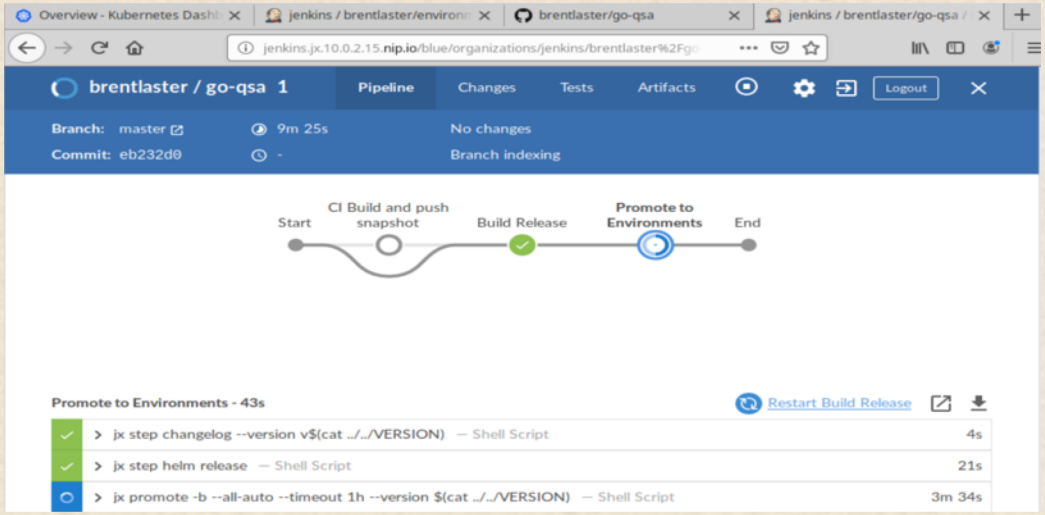
Make a change and push it to remote Git repository

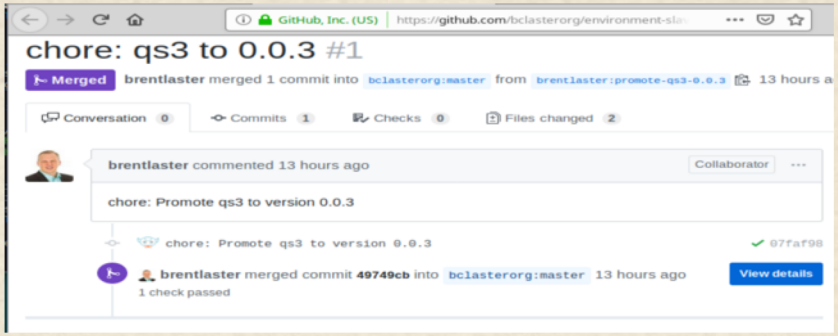
Since remote Git repository has webhook to local Jenkins, kicks off, multibranch pipeline is kicked off

If promotion attribute for environment is set to “auto”, project is automatically built, PR created and merged and product promoted

App runs in container in our staging namespace in cluster

```
diyuser3@training1:~$ jx get env
NAME       LABEL       KIND        PROMOTE NAMESPACE    ORDER CLUSTER SOURCE
  REF PR
dev        Development Development Never   jx           0
staging    Staging     Permanent   Auto    jx-staging   100         https://github.com/brentlaster/environment-divemirror-staging.git
production Production  Permanent   Manual  jx-production 200        https://github.com/brentlaster/environment-divemirror-production.g
it
```



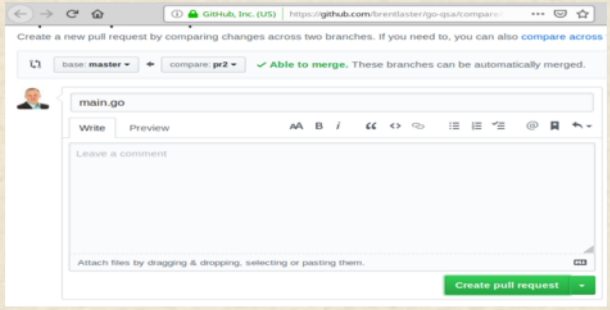


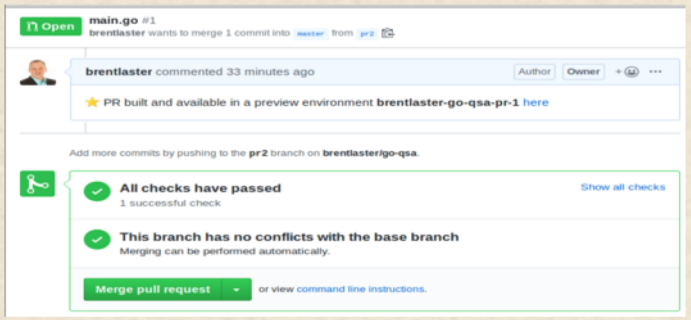

```
Promote to Environments          16m58s   16m55s Succeeded
Promote: staging                 16m13s   15m58s Succeeded
  PullRequest                    16m13s    3m7s Succeeded  PullRequest: https:
//github.com/bclasterorg/environment-slaveroan-staging/pull/1 Merge SHA: 49749cb
78011baa2268ae0c16ce4494bc7798204
  Update                         13m6s    12m51s Succeeded  Status: Success at:
 http://jenkins.jx.10.0.2.15.nip.io/job/bclasterorg/job/environment-slaveroan-st
aging/job/master/2/display/redirect
  Promoted                       13m6s    12m51s Succeeded  Application is at:
http://qs3.jx-staging.10.0.2.15.nip.io
```

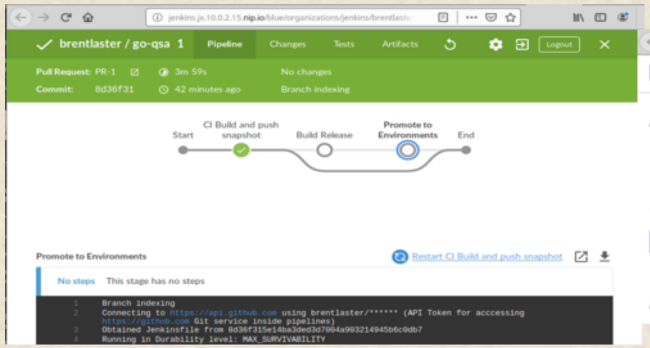
Typical Project Promotion Workflow (Manual)

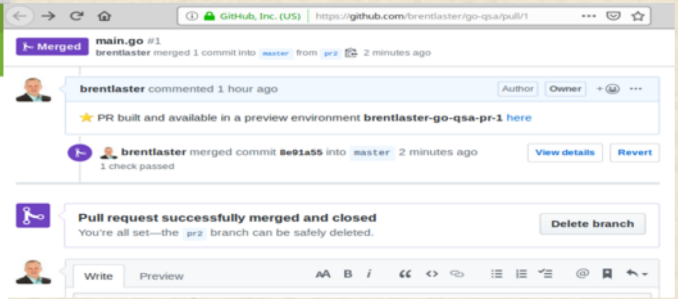
- Create a branch off of master
- Make a change and push it to remote Git repository. You are presented with a link to open a PR.
- Go to Git and create PR.
- Jenkins X runs a build to make sure it is ok to merge, creates a Preview Environment and informs you in PR about it.
- Jenkins will show build for Preview Environment.
- Can see Preview Environment via jx preview.
- Promote via “jx promote” command

```
diyuser3@training1:~$ jx get env
NAME       LABEL       KIND        PROMOTE NAMESPACE     ORDER CLUSTER SOURCE
   REF PR
dev        Development Development Never   jx            0
staging    Staging     Permanent   Auto    jx-staging    100         https://github.com/brentlaster/environment-divemirror-staging.git
production Production  Permanent   Manual  jx-production 200         https://github.com/brentlaster/environment-divemirror-production.g
it
```





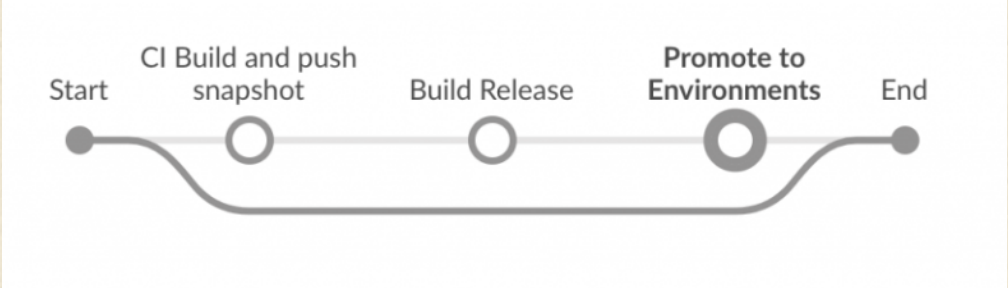


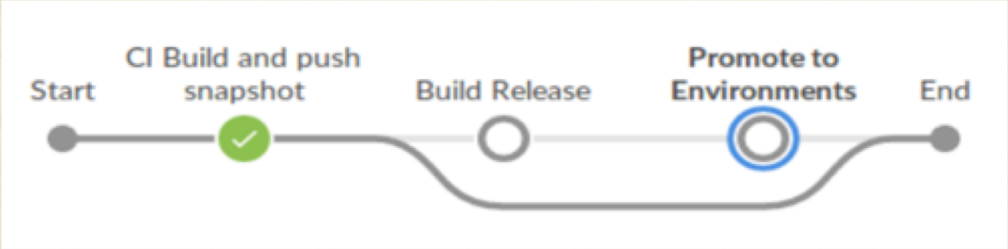



```
diyuser3@training1:~$ jx get preview
PULL REQUEST                                  NAMESPACE                APPLICATION
https://github.com/brentlaster/go-qsa/pull/1 jx-brentlaster-go-qsa-pr-1 http://go-qsa.jx-brentlaster-go-qsa-pr-1.10.0.2.15.nip.io
```

Stages in PR Pipeline

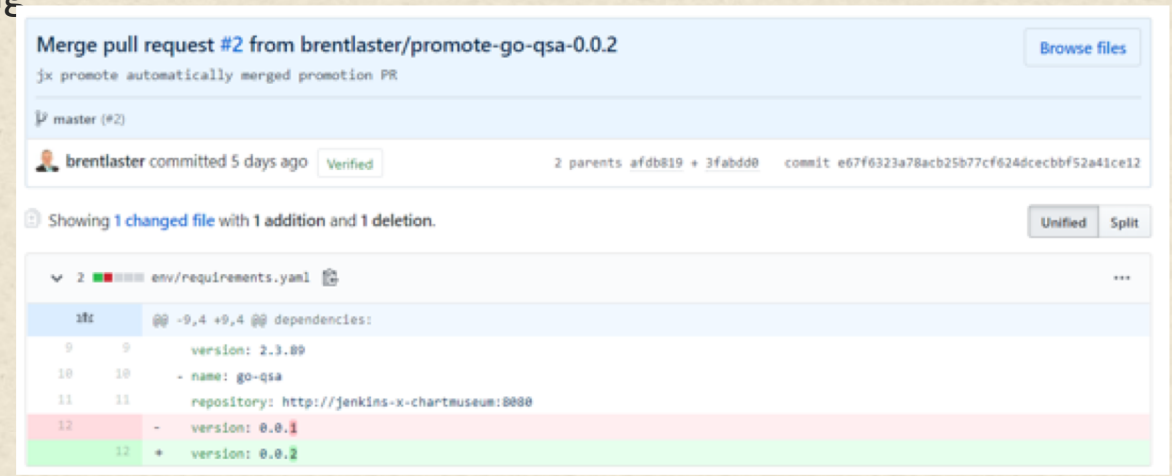
- CI Build and push snapshot
- Build Release
  - Runs tests
  - Creates Docker image
  - Pushes it to Docker registry
- Promote to Environments
  - Creates release information in repository
    - » Archived source code
    - » Pull request history
  - Creates Helm chart and pushes it to Chartmuseum
  - Accessible to Monocular for pulling from Helm





Jenkins X versioning of apps

- Jenkins X uses semantic versioning
  - Format - **Major.Minor.Patch-<label>**
  - Increment Major version for incompatible API changes.
  - Increment Minor version for adding functionality in a backwards-compatible manner.
  - Increment Patch version for backwards-compatible bug fixes.
  - Labels for pre-release or build metadata can be added as an extension to the version number (in “<label>”).
- Stored in env/requirements.yaml
- Accessible via “jx get version”



- Jenkins X uses git tags to calculate the next release version
- Will automatically create a released version on every merge to master

Other jx commands

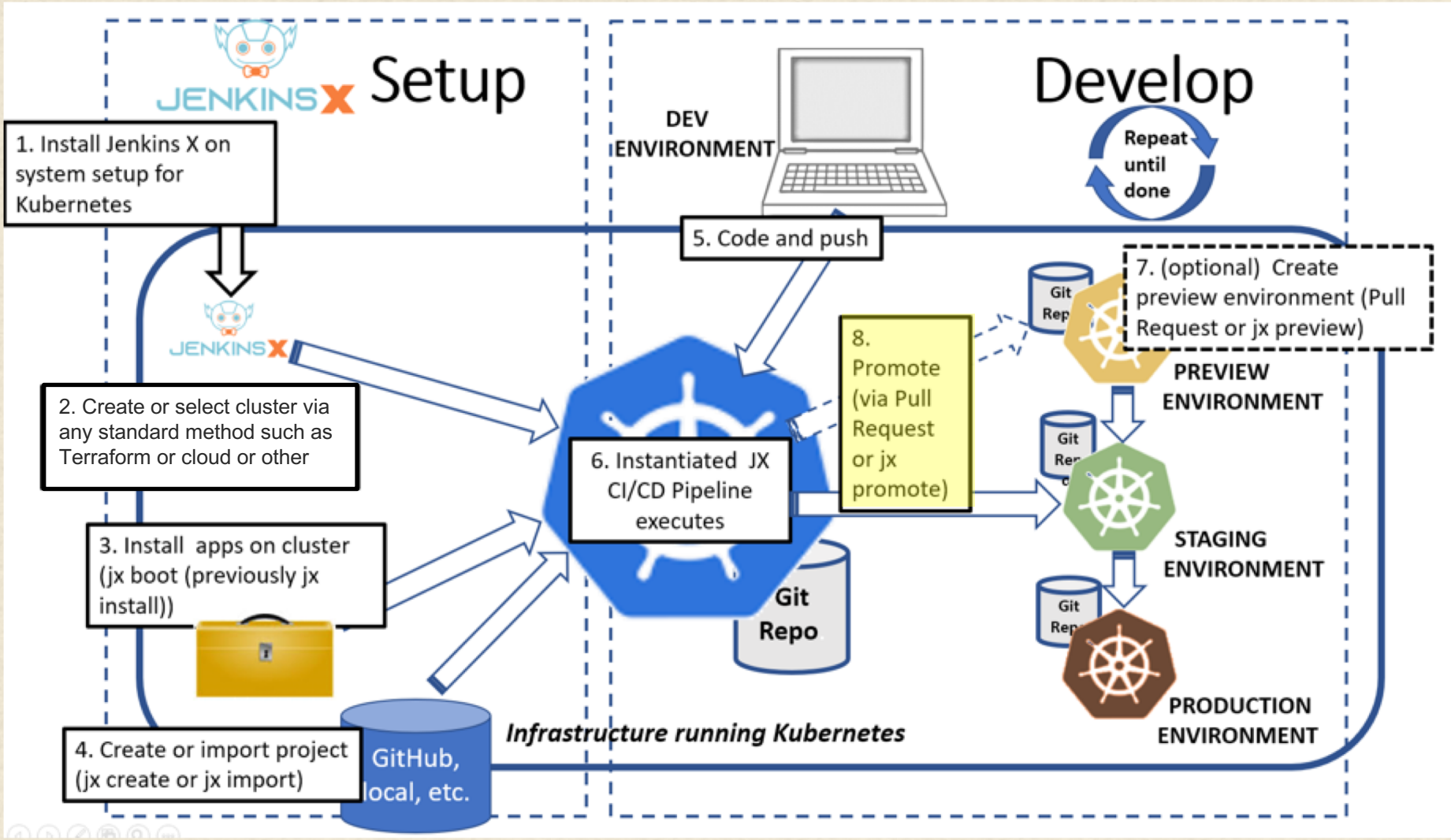
- jx open <app name> -e <level>
- jx promote <app name> -e <level>

  Or

  jx promote –version < version number > -e <level>

Lab 6: Promoting to Prod

Jenkins X Overall Workflow



That's all - thanks!

Professional Git 1st Edition

by Brent Laster (Author)

3 customer reviews

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