Continuous Delivery Essentials – Deploying on K8s

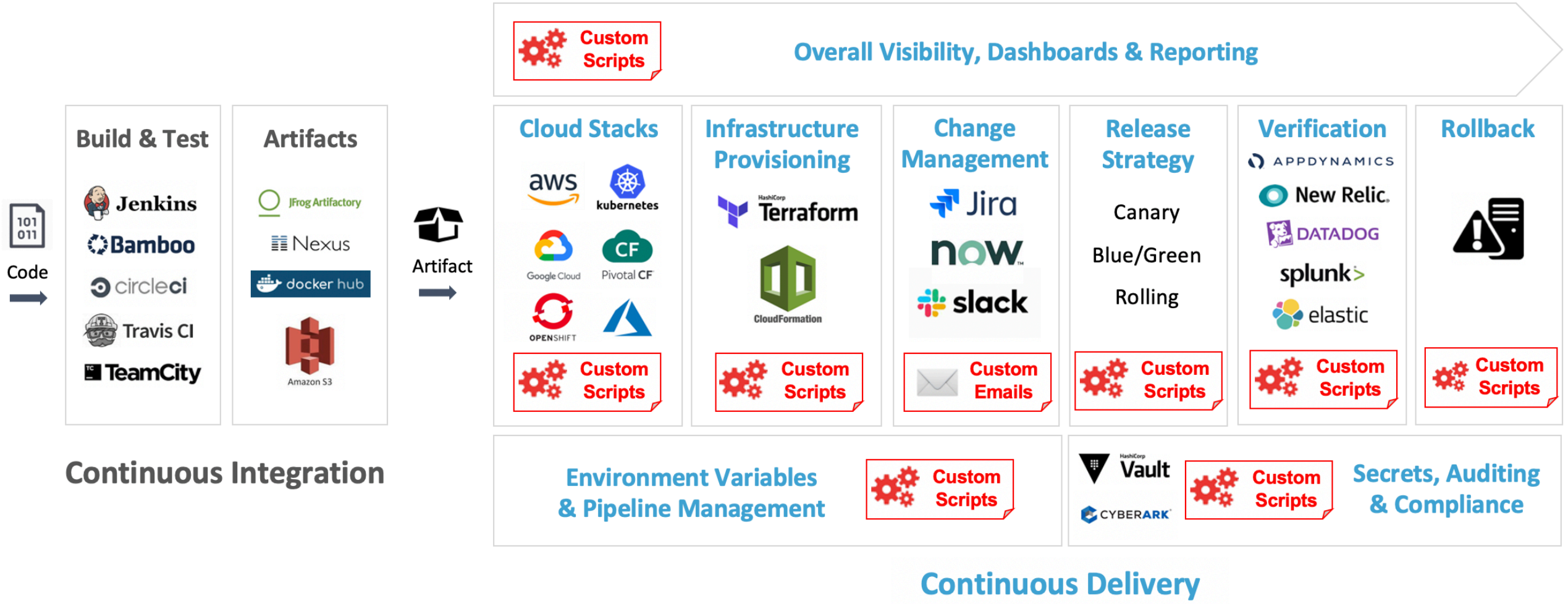
Course Outline

- How to differentiate CI from CD
- Understand the steps involved in typical deployments
- Learn industry best practices for deployments
- Explore Harness's capabilities for automated CD
- Setup a basic Harness delegate install
- Configure a basic Kubernetes deployment using Harness

Part 1:

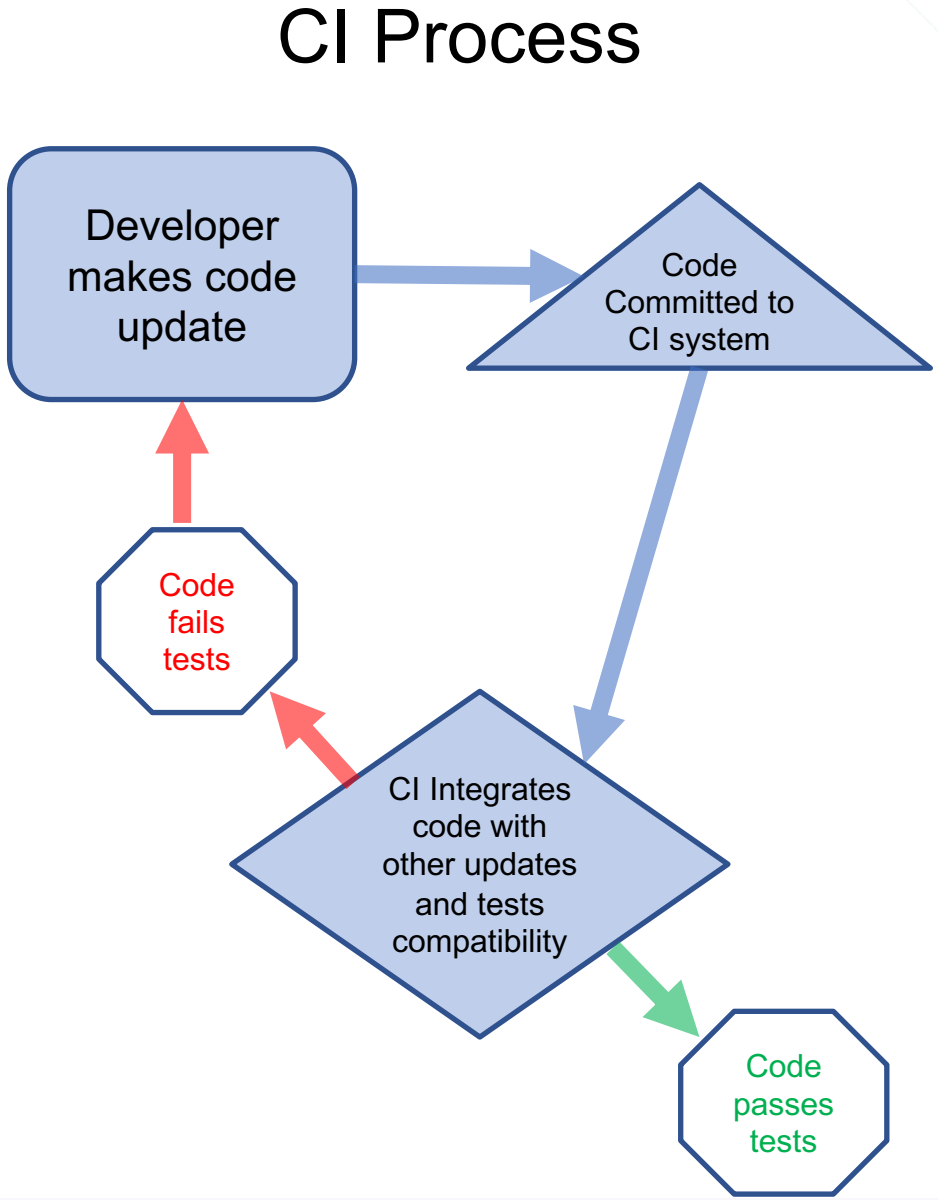
CI versus CD

Continuous Integration != Continuous Delivery



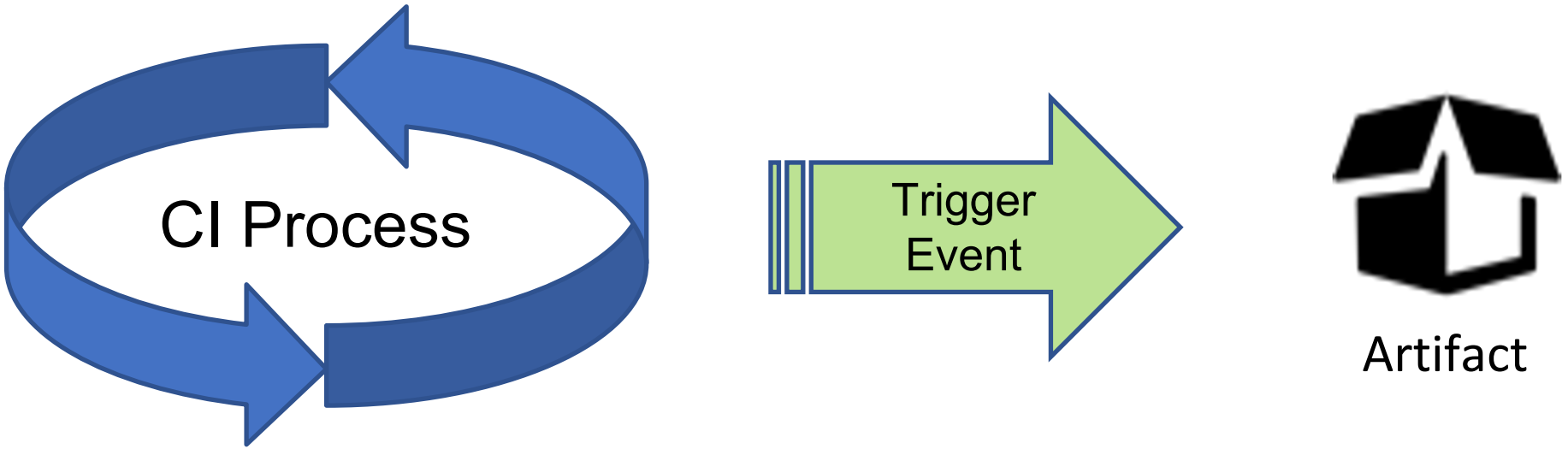
The CI Cycle and Purpose

- CI integrates and tests small changes to the codebase from multiple developers – usually many times daily
- One goal is to keep the various parts of the project as up to date as possible. That way different developers are using the most up-to-date copies of their peer's code to make their own updates
- Another goal is to keep the main branch of the project integrated, bug free, and up to date – as "deployable" as possible



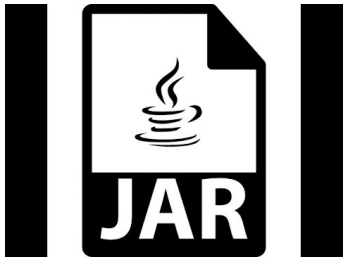
When Does the CI Cycle End?

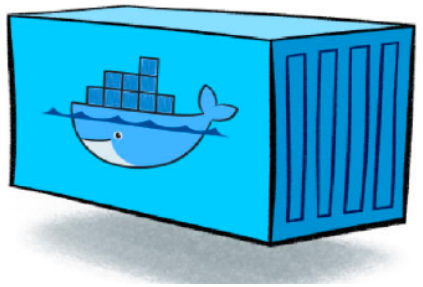
- Continuous Integration ends when you have a “releasable artifact”
- A releasable artifact could be many things: Docker image, VM image, AMI, .jar file, other packaged software bundle
- Not every successful pass through the CI cycle yields a releasable artifact though
- A ”trigger” event ends the CI cycle and generates an artifact



What's an Artifact?

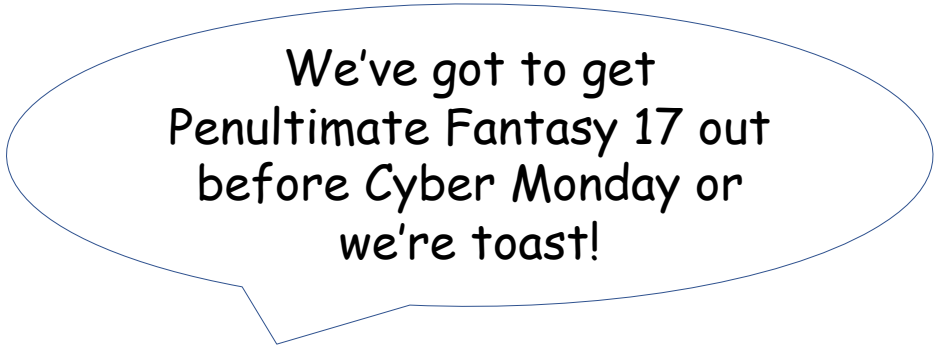
- Artifacts are units of deployable code – they range from large to small.
- Some examples: VM Images, AMIs, .jar files, Docker containers, serverless code, etc.



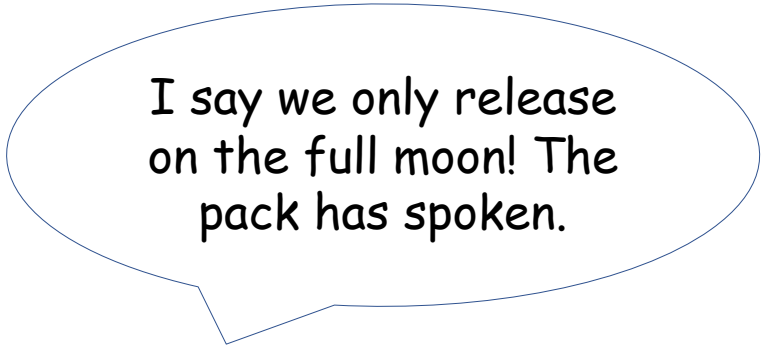


What Triggers That Trigger?

- Sometimes it's based on business needs, sometimes it's arbitrary:



Janette McGamexec
CTO, Second To Last Games, Inc.



Michael J. Teenwolf
Head Developer, Werewolves of London, Ltd.

- Sometimes it's just because deploying is hard, and you can't ask your team to give up **all** their Saturday nights. So you settle on once a month/quarter/year.
- In a perfect world you'd release as often as you could . . .

What is Continuous Delivery?

"Continuous Delivery is the ability to get changes of all types—including new features, configuration changes, bug fixes and experiments—into production, or into the hands of users, *safely* and *quickly* in a *sustainable* way."

Jez Humble, Founder continuousdelivery.com

How Often *Is* Continuous Deployment?

- Lots of factors determine this of course, but if your CI process is dialed in and your main branch is kept as bug free and ”deployable” as possible you can really up the frequency of your deployments
- The target is to achieve an interval that meets the business AND engineering needs
- The process is to increase your deployment frequency over time. Allow “virtuous cycles” in your CI and CD systems to constantly shrink your deployment interval

Harness.io SaaS Is a Product of Continuous Deployment

- Harness deploys new features and feature updates every day at 5 PM
- Bug fixes and security updates are deployed immediately once they are fully vetted – sometimes multiple times per day

Part 2:

Typical Steps to Deployment

CD Pipelines

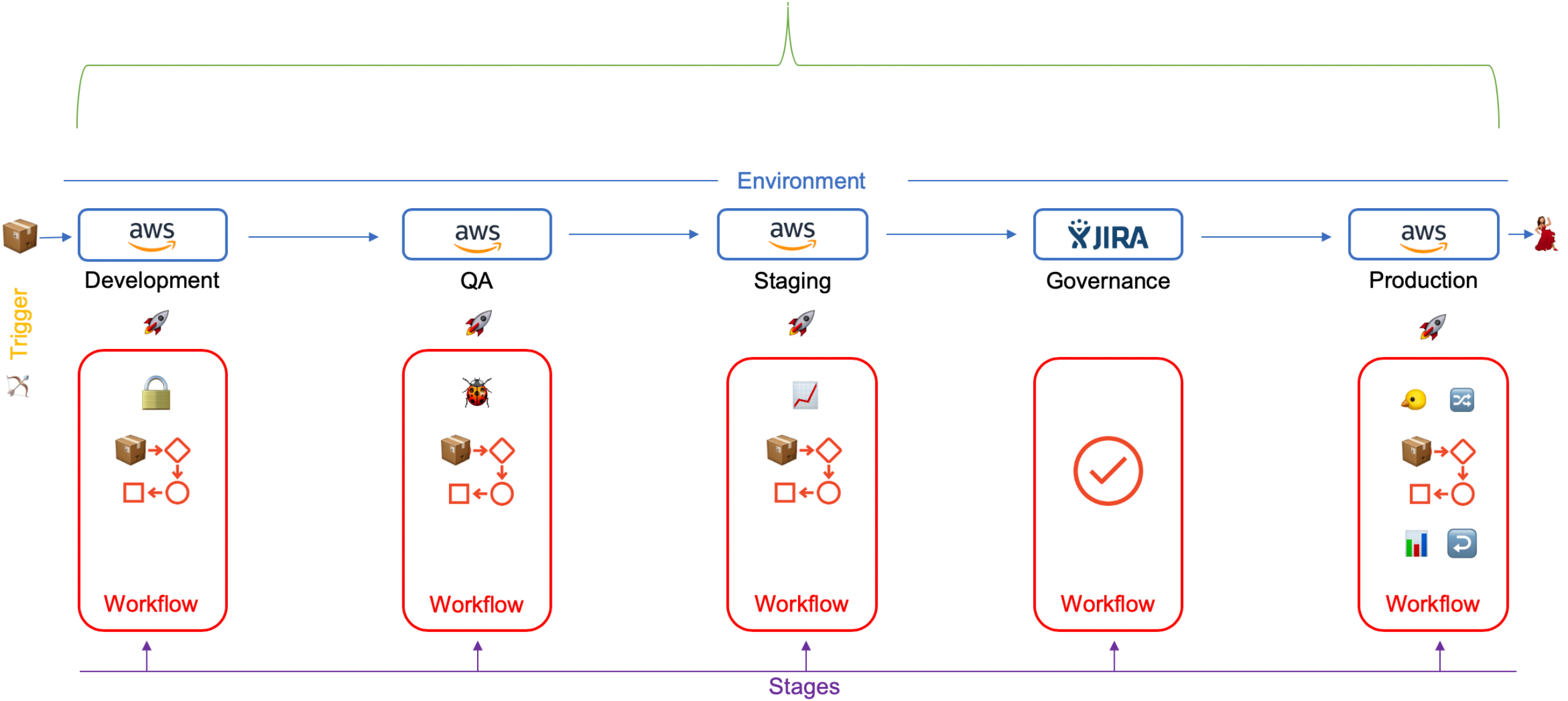
- Pipelines are the set of steps required to move an artifact from its repository to its final destination.
- Inside a single pipeline there can be multiple deployments, e.g. deploy to QA, deploy to Staging, deploy to prod.

Building Blocks of a CD Pipeline

Typical deployments follow these steps:

1. Infrastructure and Platform deployment
2. Change management
3. Push Deployment
4. Verification
5. Roll Back (if necessary)

Pipeline



It All Starts With an Artifact

- Deployable artifacts live in repositories
- Besides storing and controlling access to artifacts, repositories sometimes perform other functions such as vulnerability scanning and secrets management

JFrog Artifactory

dockerhub

Amazon ECR

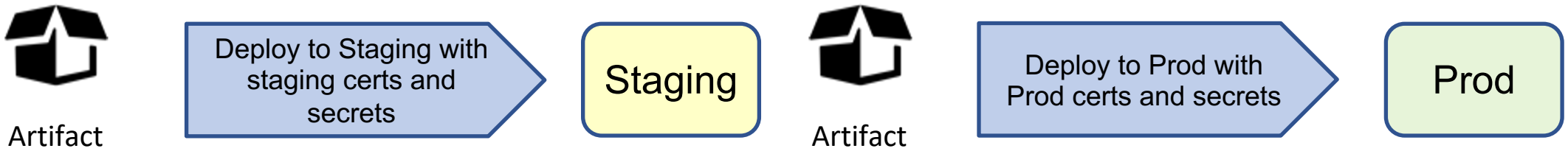
Bitbucket

GitLab

Azure Registry

Red Hat Quay

GitHub



Where Do Artifacts Go?

- Artifacts get deployed to places like:
  - Staging/QA
  - Production
  - Multiple Prod locations for DR and HA

Moving Artifacts With Environment and Cert Variables

- As artifacts get deployed to different environments consideration must be made to ensure the right environment and cert variables get set

Set Staging Variables

$db = testdb.mycompany.com
$logger = elk.mycompany.com
$product = testcat.mycompany.com
$cert = vault.staging.mycompany.com/ . . .

Set Prod Variables

$db = proddb.mycompany.com
$logger = splunk.mycompany.com
$product = prodcat.mycompany.com
$cert = vault.prod.mycompany.com/ . . .

Artifact

Deploy to Staging with staging certs and secrets

Staging

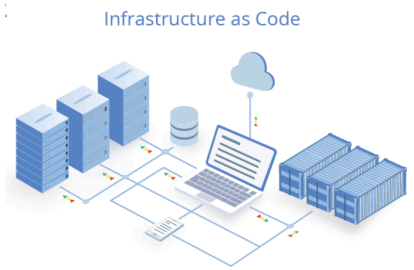
Artifact

Deploy to Prod with Prod certs and secrets

Prod

Infrastructure and Platform Deployment

- Before you can deploy your new artifact - it needs somewhere to deploy to: servers, network, load balancers, firewalls, etc.
- Before you can run those containers / serverless workloads they need a platform setup



Terraform

CloudFormation

PaaS
Platform as a Service

Pivotal CF

CLOUD COMPUTING

aws

Google Cloud

Release Strategy

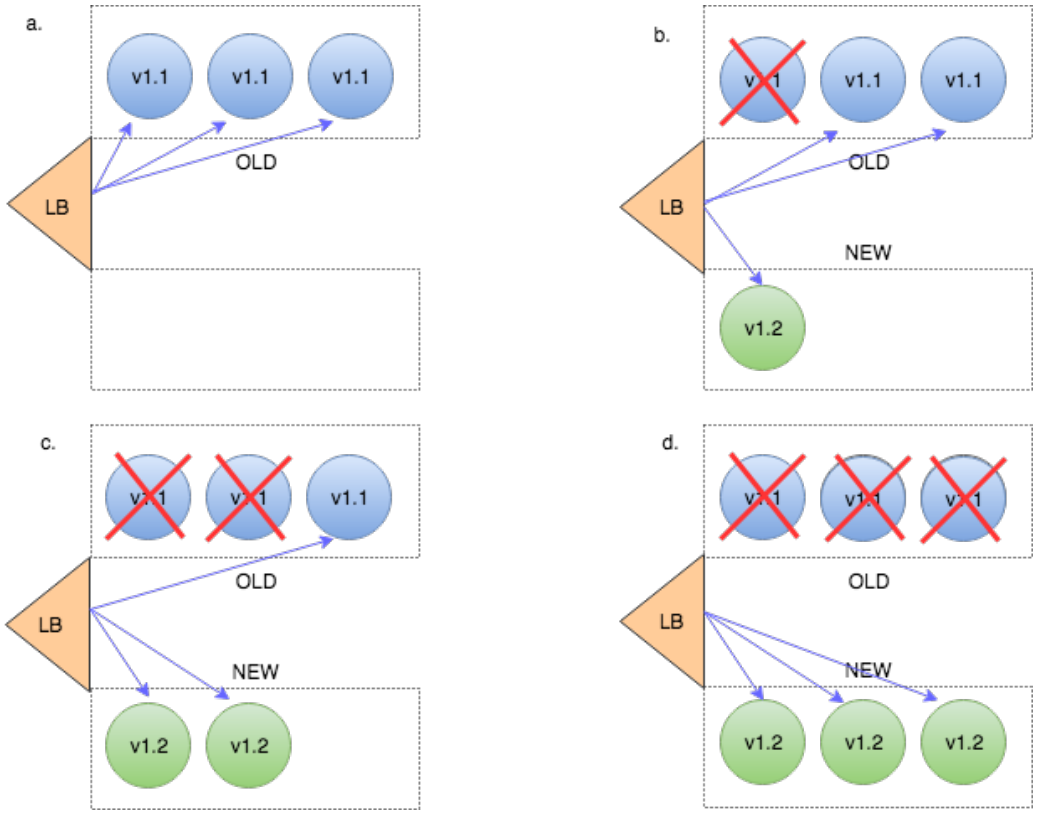
- Who approves your deployment? Sec-Ops? Product Management? Execs? All of the above?
- What tools do they use for this approval?

Pushing the Deployment

- There are multiple ways to deploy your artifact:
  - **Rolling Upgrade** – for many PaaS's this is the default deployment. Slowly scale up the new version while simultaneously slowly scaling down the old version.
  - **Blue/Green Deployment** – stand up a complete deployment of the new version (blue) while leaving a complete copy of the old version (green) up and running.
  - **Canary Deployment** – A variation of Blue/Green. Stand up a small deployment of the new version (the canary) and direct a small portion of incoming traffic to the canary

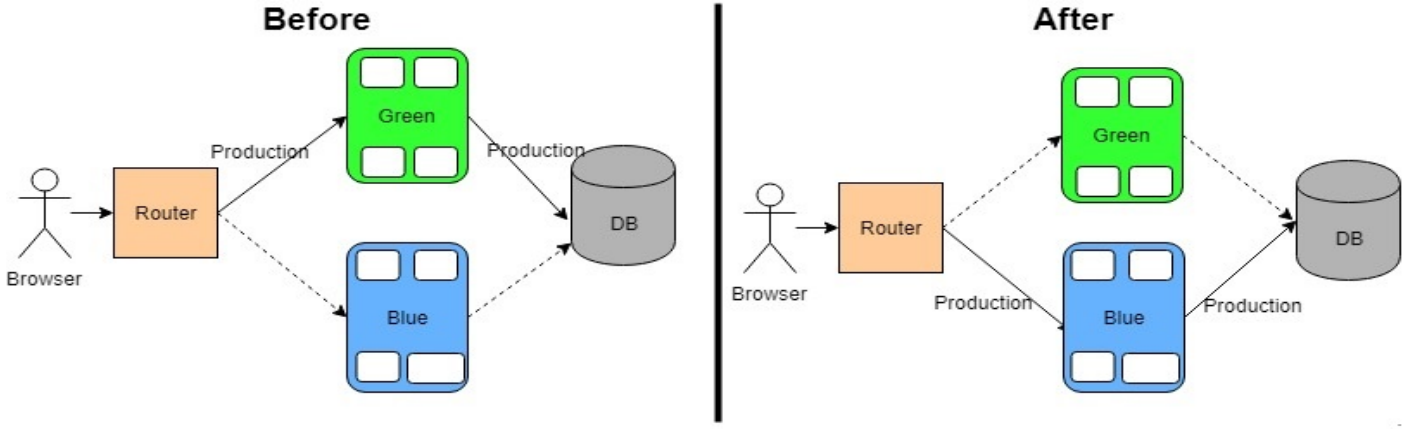
Types of Deployments – Rolling Upgrade

- **Pros:**
  - Easy to do – the default upgrade for many PaaS's
  - Respects hardware limitations / footprints
  - Minimally disruptive *if* everything goes well
- **Cons**
  - Slow – can take a long time depending on what you're deploying
  - Rollback is quite difficult / time consuming / maybe impossible – roll forward more likely



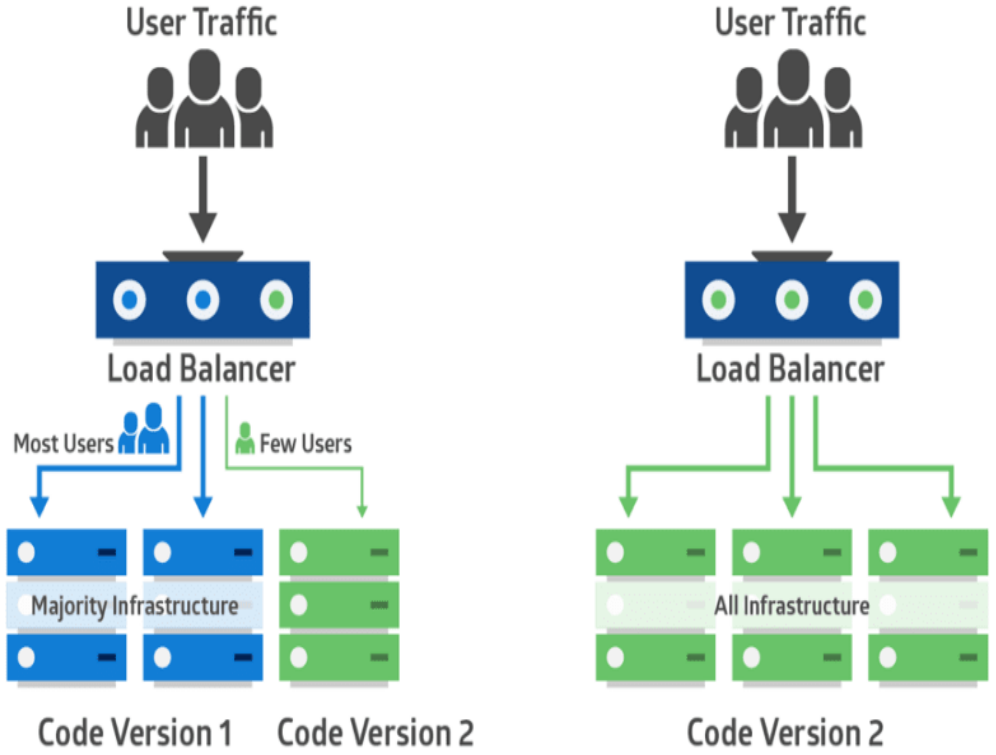
Types of Deployments – Blue / Green

- **Pros:**
  - Very easy rollback – just flip back to the green version
  - Easy networking – flip a switch on the LB
- **Cons**
  - Slow – can take a long time to get the entire Blue version up and running
  - Hardware / cloud footprint intensive – requires twice the infrastructure while both versions are up and running



Types of Deployment - Canary

- **Pros:**
  - Minimal extra hardware/cloud footprint
  - Rapid deployment and feedback – canaries come up quickly and give feedback on quality of deployment quickly
  - Easy-ish rollback – just kill the canary and reshape the network traffic back to the original
- **Cons**
  - Very difficult to setup – requires complex networking and orchestration deployment



Deployment Verification

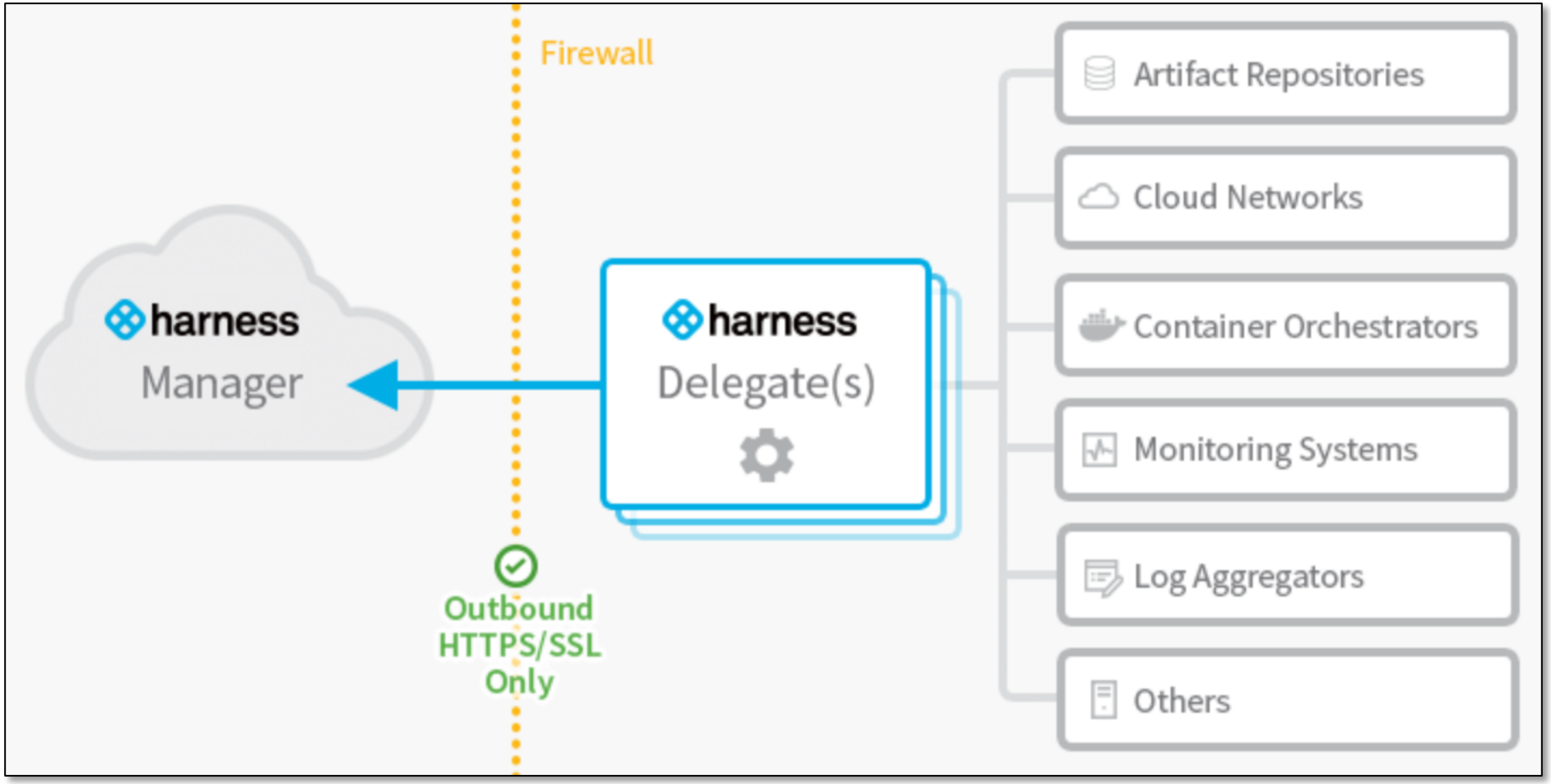
- When is a deployment *actually* finished? It didn't crash? It's running as well as the previous version? It's running better than the previous version? How do you know?
- APM software and log aggregation software can tell us how it went / is going

Deployment Rollbacks

- Depending on the deployment type this might be impossible
  - Many instead do a roll-forward: Deploy the last previous known good deployment as if it were a new deployment
- Blue/Green or Canary types – just flip the networking switch back to the Green/non-canary deployment

Harness Delegates

The Harness.io Platform




harness
Dashboards
Continuous Deployment
Continuous Verification
Continuous Security
Setup
2
Main Dashboard
See any problems detected with the Harness Delegate or other platform components.
ATTENTION NEEDED:
2 Setup Problems Detected
No Pending Approvals
No Pending Manual Intervention
Deployments
See the total number of deployments, the most failed deployments, and the Service instances deployed each day.
221
Deployments
156
Failed Deployments
743
Instances Deployed
See success and failure rates for the most active Services. Click a Service name to get a detailed view of its artifacts, Environments, and deployment infrastructures.
Most Active Services
deployments in the last 30 days
Order (Retail Application) 148
Catalog (sahithi-app) 21
DockerImage (Ankita App 2) 19
MyService (CretzmanApp) 9
career-contractorbenchmarking-main-be (Mercer HR) 5
Catalog (Retail Application) 5
Todolist-Datadog (Retail Application) 3
Service Instances
See instances by Service, by Cloud Provider, and by Production versus Non-Production Environments.
29
Total
By Service
By Cloud Provider
By Production/Non-Production

Harness Manager – SaaS or On-Prem

- The ”brains” of a Harness implementation
- Usually runs as SaaS managed by Harness, but can be run on-prem for high security and air-gap implementations
- All configurations and deployments are stored here
- Deployments get “kicked off” from here

Harness Delegates

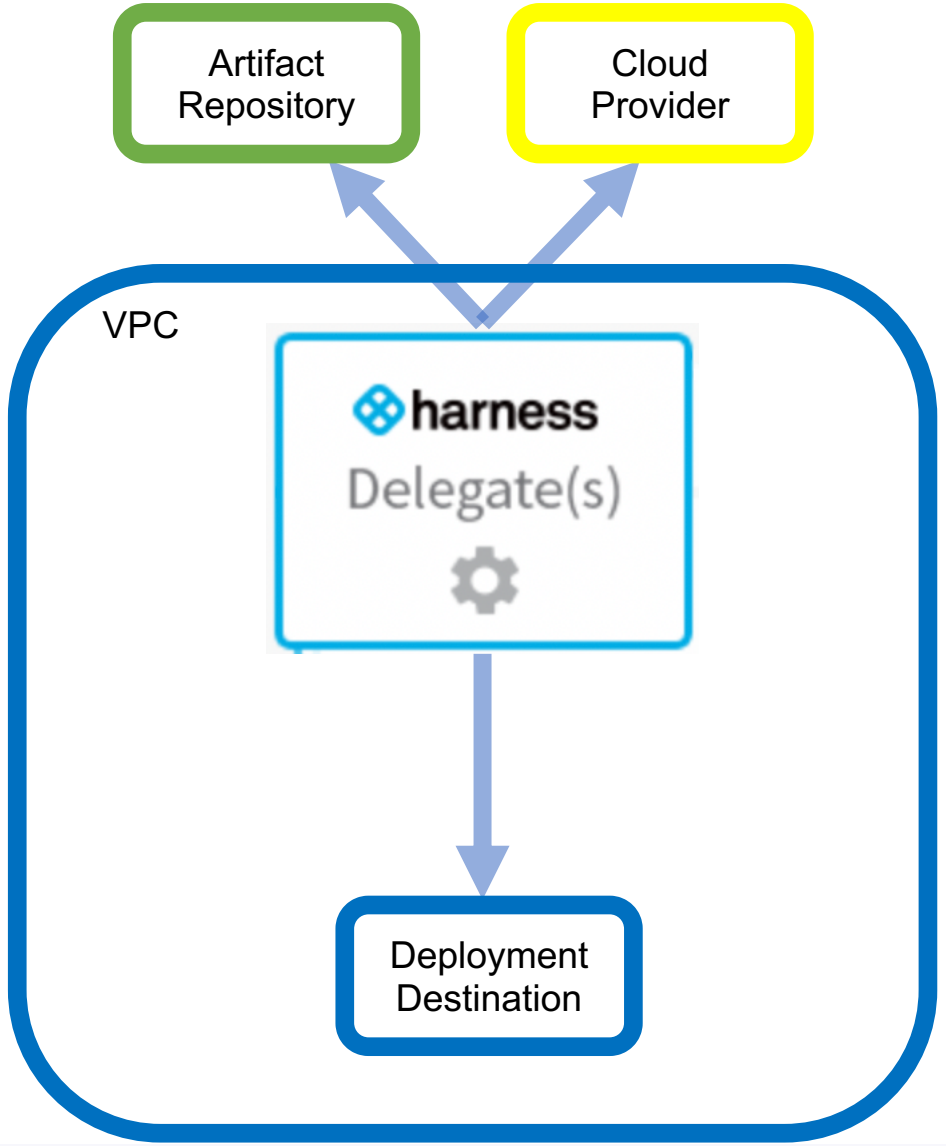
- The “worker” or “proxy” of a Harness implementation
- Installed and runs inside your infrastructure, on-prem or cloud
- Multiple delegates can be run for high availability
- Multiple delegates may also be needed to due to internal network policies
- Connects to the various internal systems to facilitate deployments

Delegate Connectivity

- Only outgoing connection from Delegate to Manager is HTTPS on port 443
- Delegates must also connect to other systems to deploy. For example: API/CLI calls to cloud providers, authenticating and downloading from artifact repositories, obtaining data from verification providers such as AppDynamics or Splunk, and many more depending on the deployment and environment
- Connectivity considerations play a large role in Delegate deployment – *See Enterprise Harness Deployments* for details

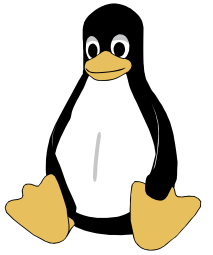
Where to Install Delegates

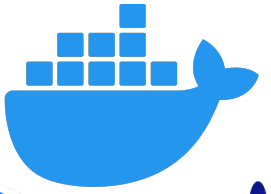
- Where and how to run Delegates can be a complex subject that's covered in detail in the Enterprise Harness Implementations course
- For now just know that Delegates need connectivity to the artifact repository, the cloud provider, and the destination systems the artifact will deploy to
- Generally you'll want to run at least one Delegate per VPC / security zone in your systems



Delegate Run Time Specs

- Linux/UNIX server or container
- Minimum 1 CPU
- Minimum 8GB RAM. Ensure that you provide the minimum memory for the Delegate and enough memory for the host/node system. Minimum 6GB Disk space
- ulimit set to at least 10000
- Access to artifact servers, deployment environments, and cloud providers.

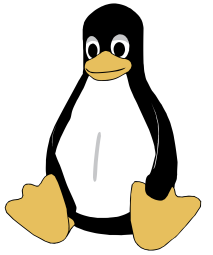


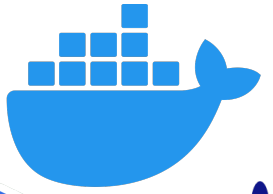


Amazon
ECS

Delegate Run Time Specs - Cont

- Delegates do NOT need to run as root
- Delegates that run in a container do run as root by default – that includes Docker, K8s, and ECS.
- It's possible to run containerized Delegates as non-root, but you lose the ability to use Delegate Profiles
  - We will cover Delegate profiles later in the course. You can read about them here: https://docs.harness.io/article/h9tkwmkrm7-delegate-installation#delegate_profiles





Amazon
ECS

Giving Delegates a Happy Home

- Delegates can be run as either a normal Linux process or in an Ubuntu container with an orchestrator
- The server or container running the Delegate may also need other packages installed such as kubectl, Terraform, or cloud provider CLIs
- This can be accomplished by using Delegate Profiles in Harness or configuring the underlying VM image or container the Delegate will run on

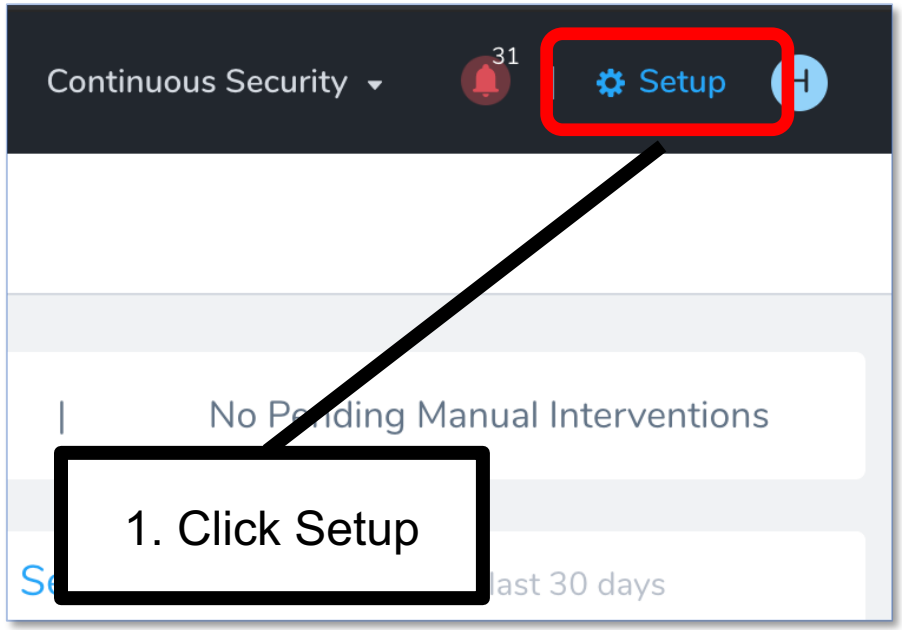
Delegate Profiles

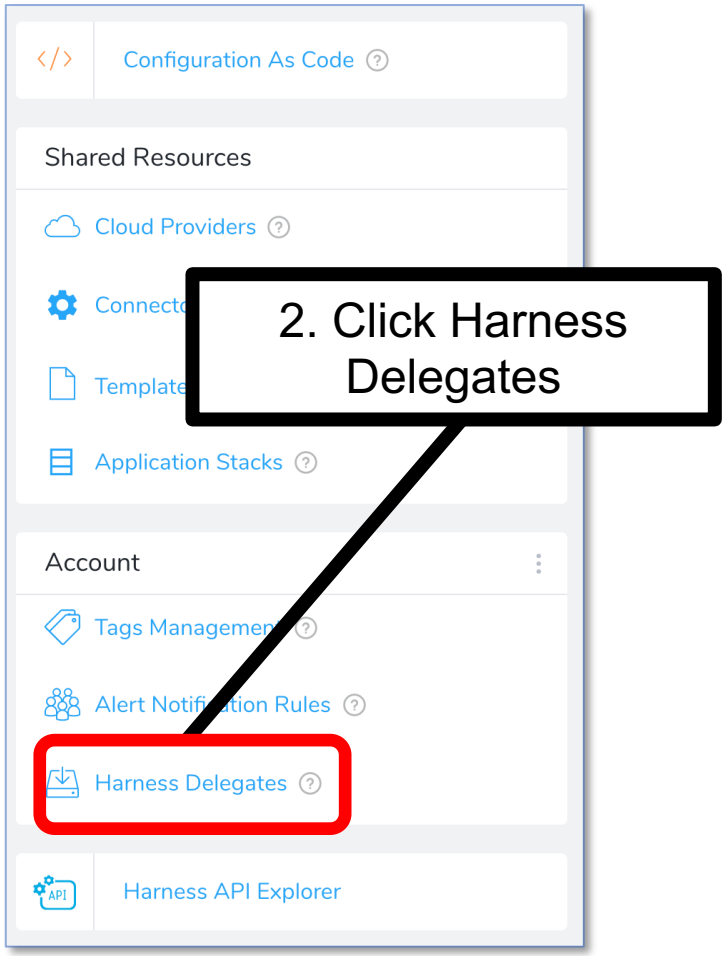
- Delegate Profiles are scripts that run when a new Delegate in that Profile gets installed, or you add a Delegate to that profile
  - Updates to an existing Delegate Profile will cause all members to rerun their scripts
- For the container-based Delegates with root access, you can use normal Ubuntu `apt-get` commands to install packages
- For any other system follow the package install instructions for that version of Linux
- See https://docs.harness.io/article/nxhlbmbgkj-common-delegate-profile-scripts

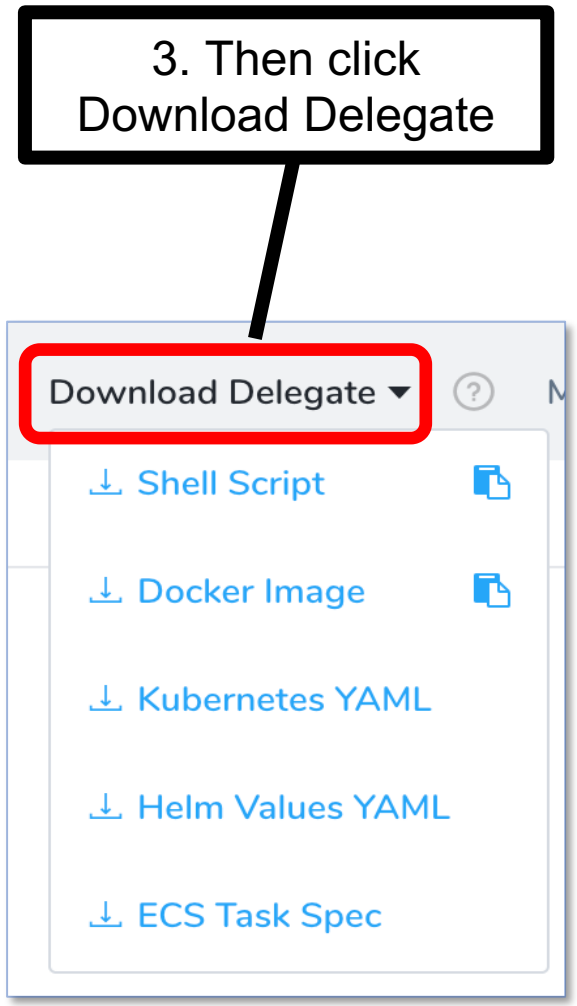
Container Based Delegates

- Docker, K8s, and ECS Delegates are all based on the containerized version of the Delegate
- The Delegate runs in an Ubuntu 18.04 image
- The image can be downloaded and added to a private repository
- It can also be customized using this docker file as an example: https://github.com/bfeuling01/harness-io/blob/master/delegate/Dockerfile

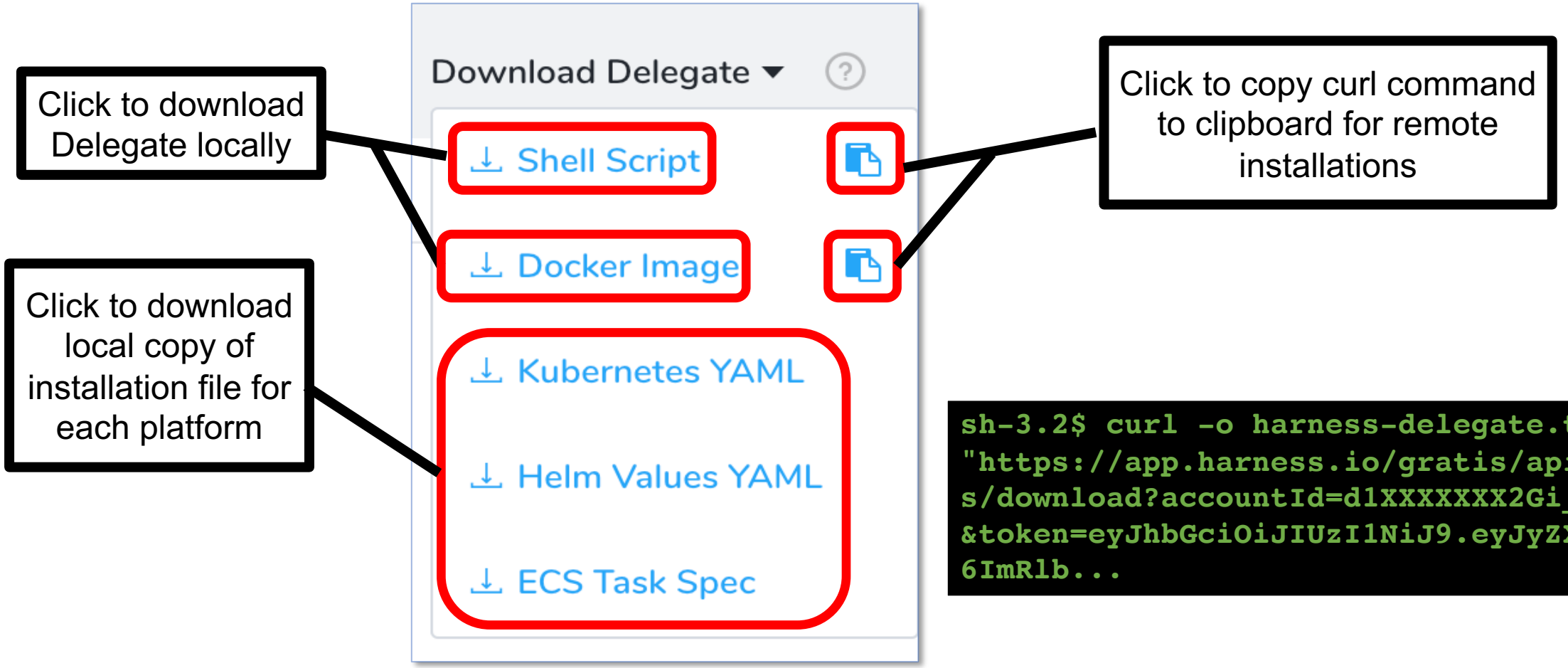
Installing a Delegate – Getting There







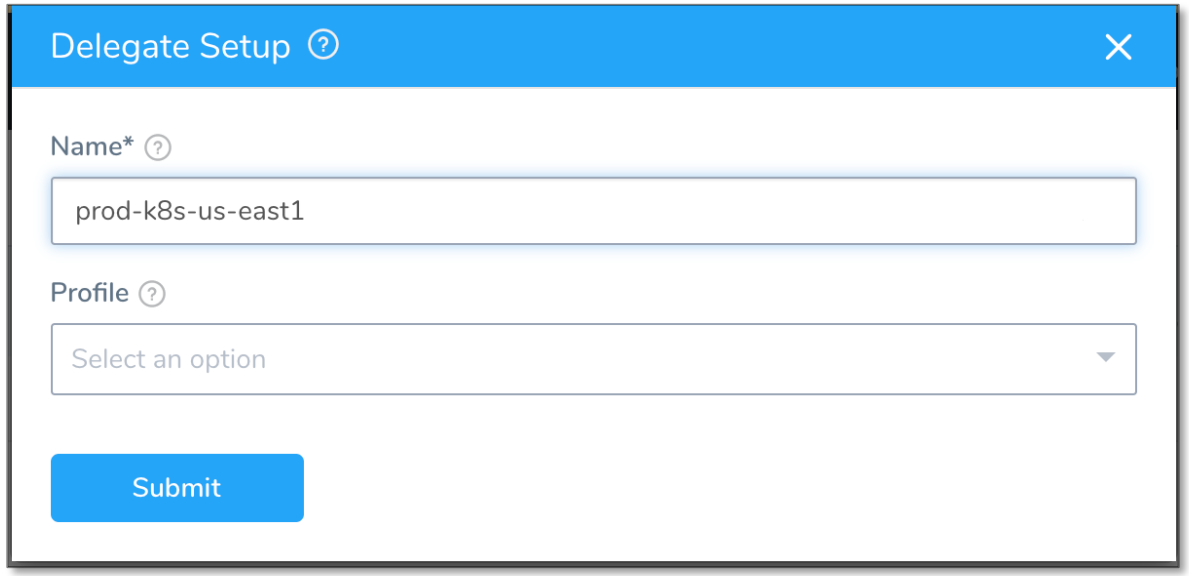
Download Delegate File or `curl` Command




```
sh-3.2$ curl -o harness-delegate.tar.gz
"https://app.harness.io/gratis/api/delegate
s/download?accountId=d1XXXXXXX2Gi_UFimZzDaA
&token=eyJhbGciOiJIUzI1NiJ9.eyJyZXNvdXJjZSI
6ImRlb...
```

K8s Delegate Install

- To generate the correct yaml for Kubernetes Harness needs to know about the name of the delegate any profile settings

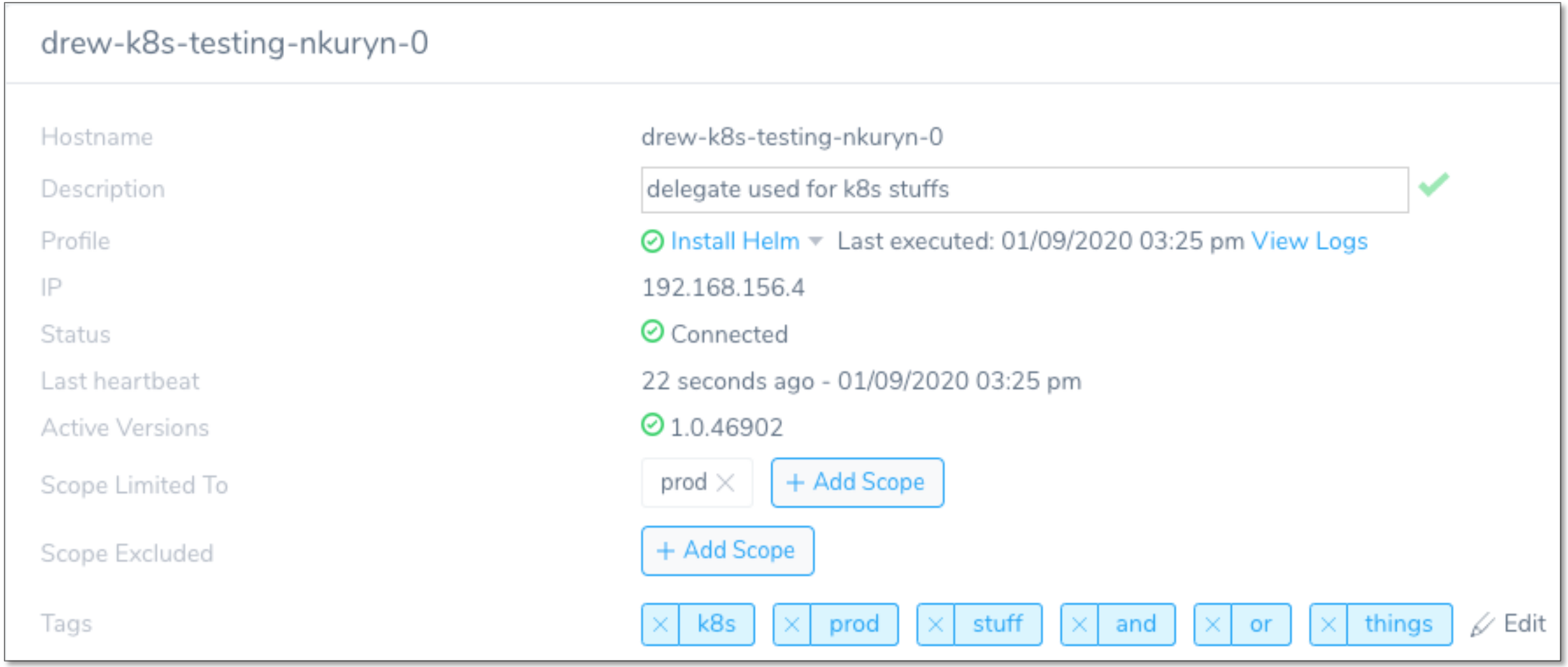


- Download and unzip the tar.gz file like the other delegates
- The zip contains a yaml file to run your Delegate in Kubernetes

The K8s Yaml File Unpacked

- The Delegate yaml file creates the following Kubernetes structures:
  - A namespace named “harness-delegate”
  - A cluster-admin ClusterRoleBinding – this is the default, but can be changed to something more limited within the cluster if needed
  - The actual delegate process itself is a single replica set with a 1 CPU and 8 GB memory limit
  - Proxy settings can also be added to the yaml for connectivity to Harness.io Manager service

K8s Delegates



Running a Delegate With Local / Laptop K8s

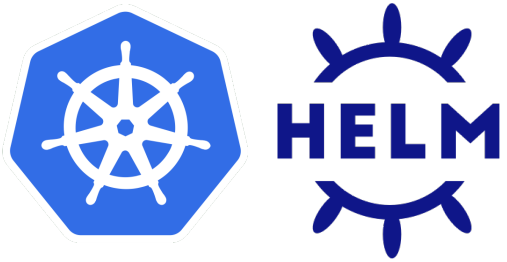
- By default Harness delegates are sized for high volume / production workloads
- It's possible to run a delegate locally on your laptop if you resize the delegate footprint AND have enough resources on your laptop to give Minikube or Docker Desktop at least 8 gigs of RAM and 2 CPUs
- Change the harness-delegate.yaml memory spec from "8Gi" to "4Gi"
- See the self-guided labs that accompany this class for more details

```
minikube start --memory 8192 --cpus 2
```

Delegate Helm Install

- Similar to the K8s install
- Requires Tiller to be installed
- See the docs for further details:

  https://docs.harness.io/article/6n7fon8rit-using-the-helm-delegate



Lab 1
Demo

Building Deployments with Harness

Hooking Harness Up to Your Environment

- For Harness to work its magic on your deployments it must make connections to various systems that will run or manage your deployments
- In Harness these take two forms: Cloud Providers and Connectors

Setting Up Cloud Providers

1

Setup

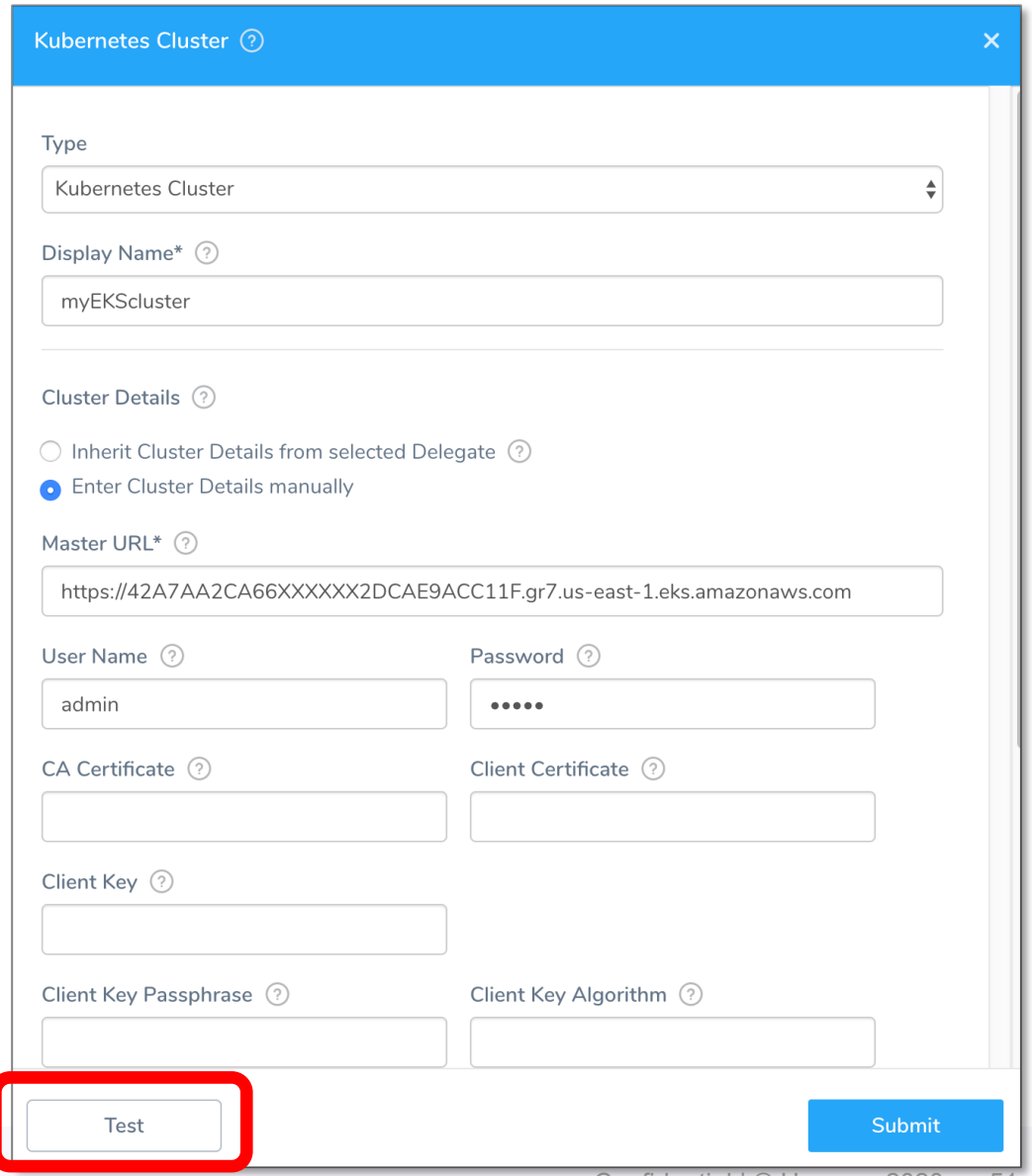
2

Cloud Providers

3

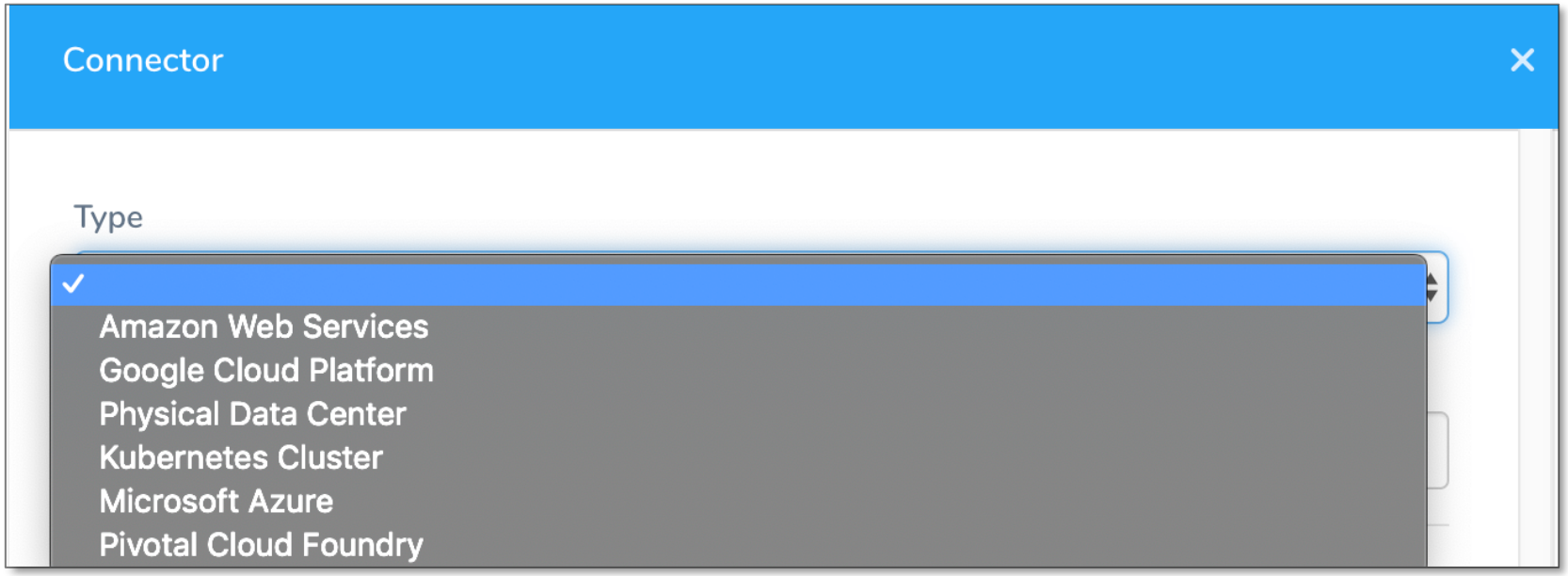
+ Add Cloud Provider

4



Use the Test button to test the auth credentials for the cloud provider

Types of Cloud Providers



- See the docs for specific settings for each provider:

  https://docs.harness.io/article/whwnovprrb-cloud-providers

- Except Kubernetes, covered next

Kubernetes Cloud Provider - Authentication

- 4 ways to authenticate to K8s – choose only one
  - Use the authentication settings from a Harness Kubernetes Delegate already running in the cluster
  - Use simple username and password
  - Use certificates
  - Use K8s service account
- Credentials get validated when you save the K8s Cloud Provider by doing a list of services in the default Namespace – select skip verification if you have deleted the default Namespace or the credentials used don't have access to the default NS

Setting Up Connectors

Setup > Connectors

Artifact Servers

(1) Harness Docker Hub

Verification Providers

(0) None

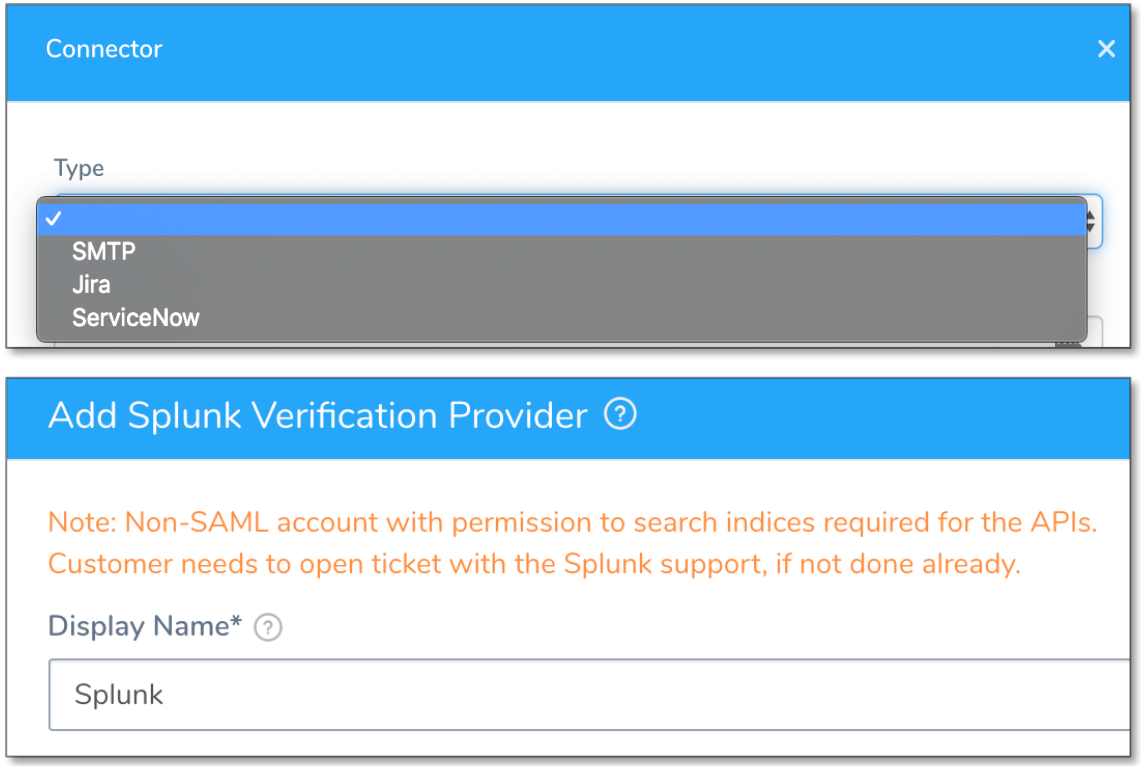
Source Repo Providers

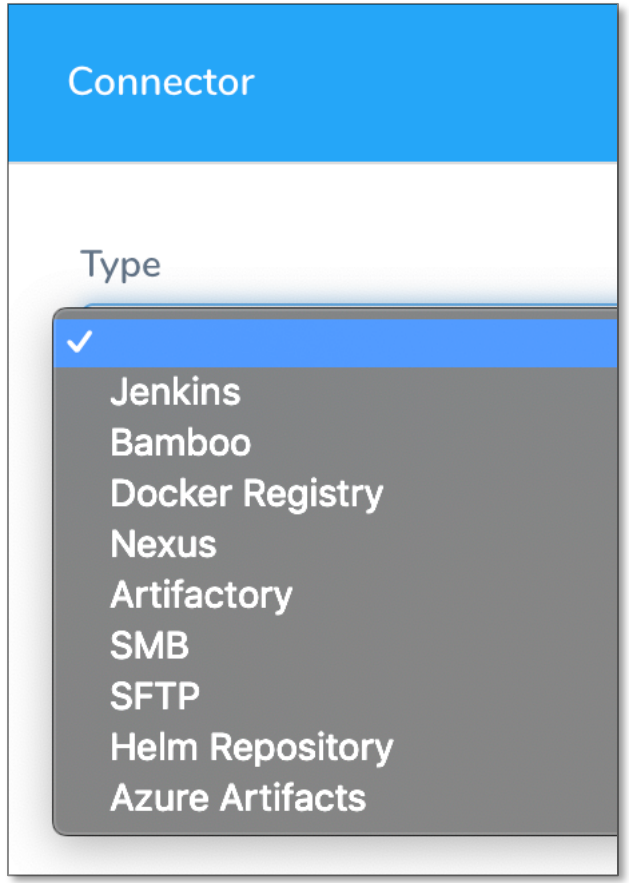
(0) None

Collaboration Providers

(0) None

Connector Specifics

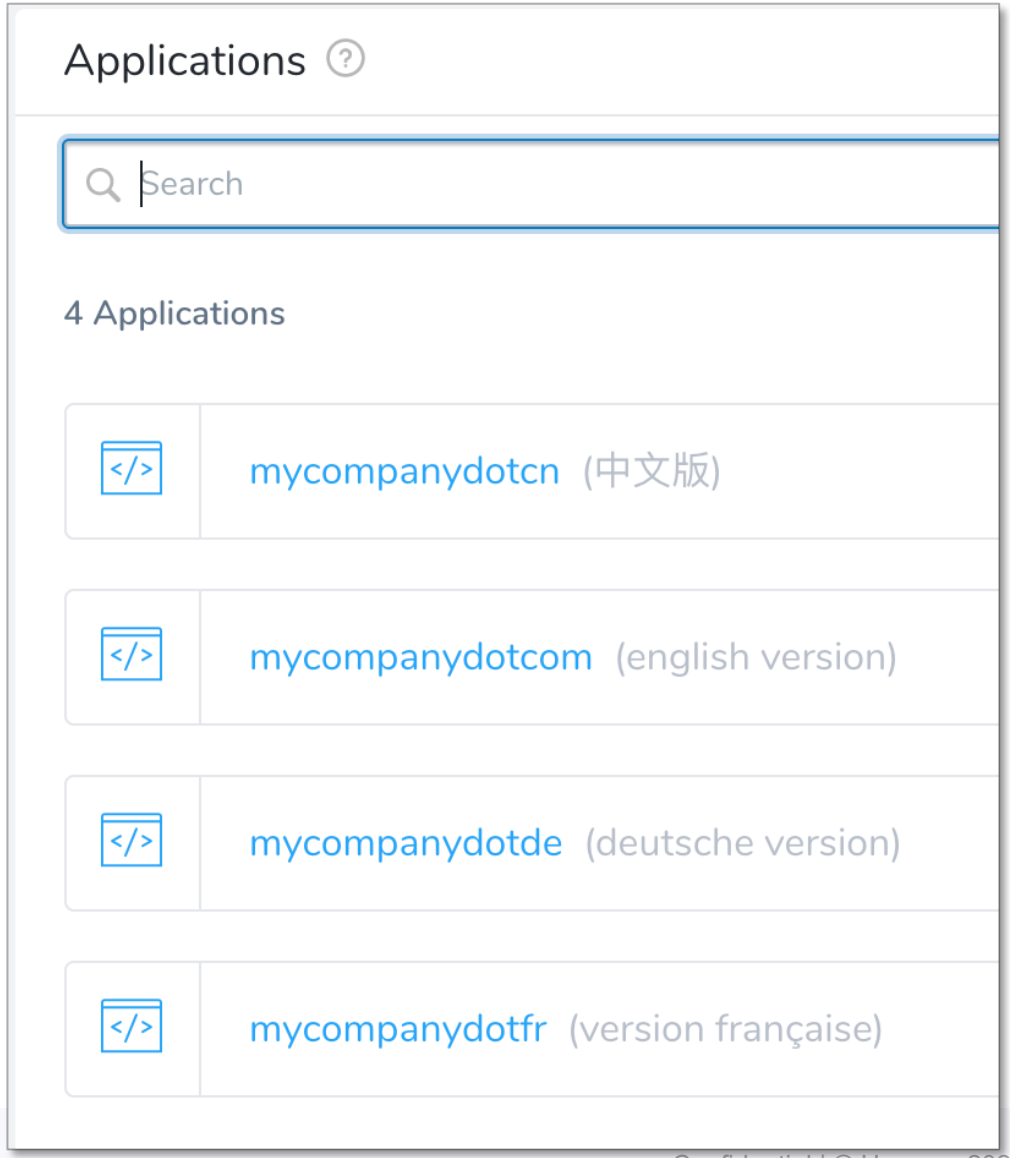




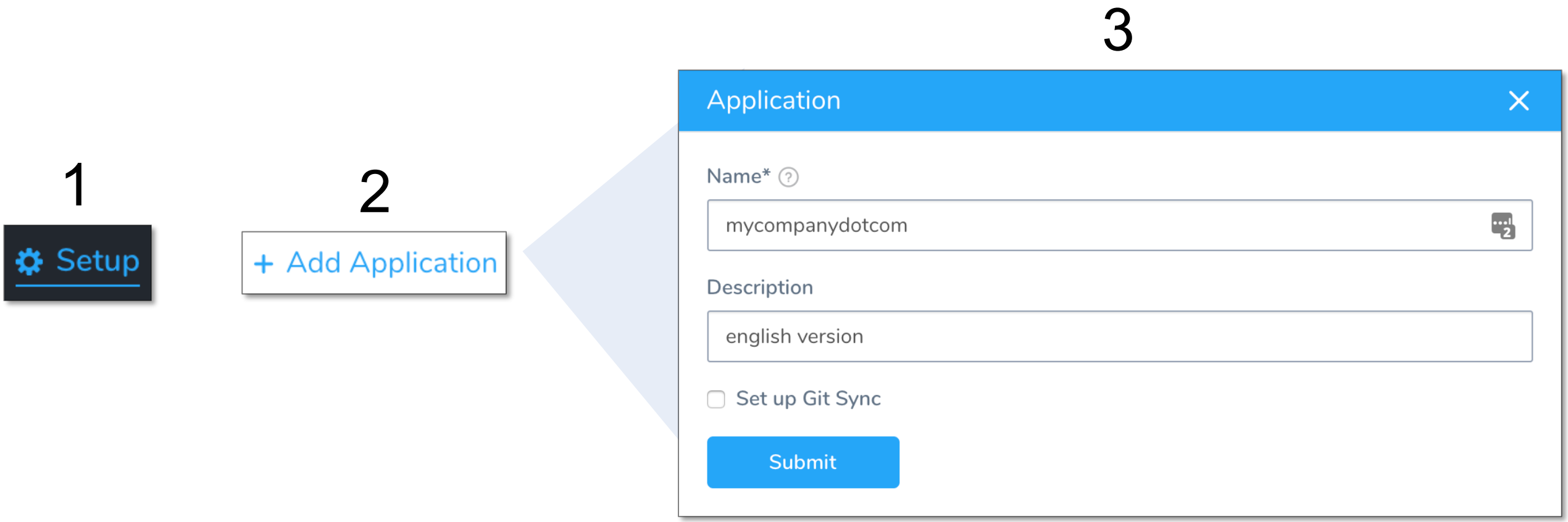
- See both inline help in the Harness UI as well as the Harness Docs for specifics on settings up each different system
  - https://docs.harness.io/article/ifx4yks50s-connectors-and-providers-setup#docker_registry_across_multiple_projects

Applications to Organize Your Deployments

- Applications are arbitrary groupings of deployments inside Harness
- Use them to:
  - Create RBAC divisions for compliance, security, etc.
  - Establish other enterprise-specific organizational divisions



Creating an Application



Inside an Application

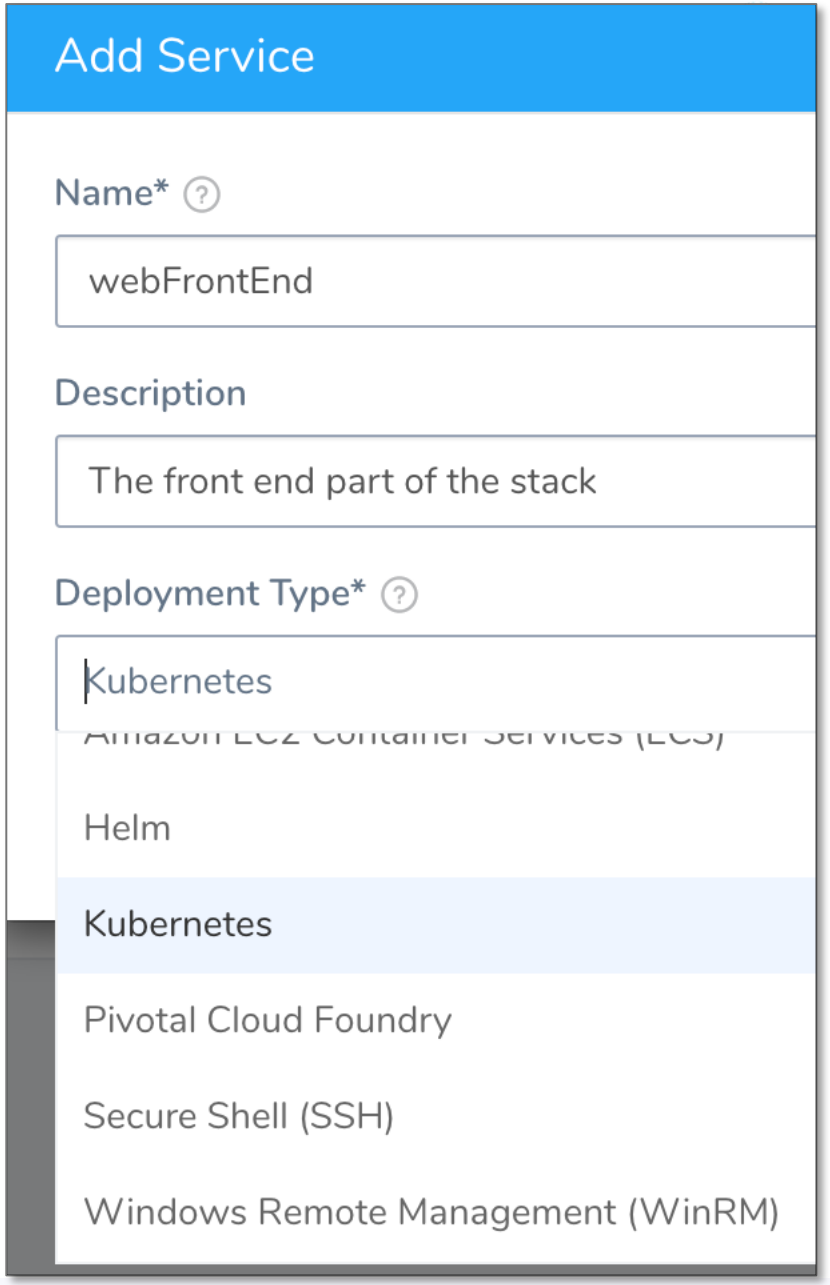
mycompanydotcom english version

Application Defaults

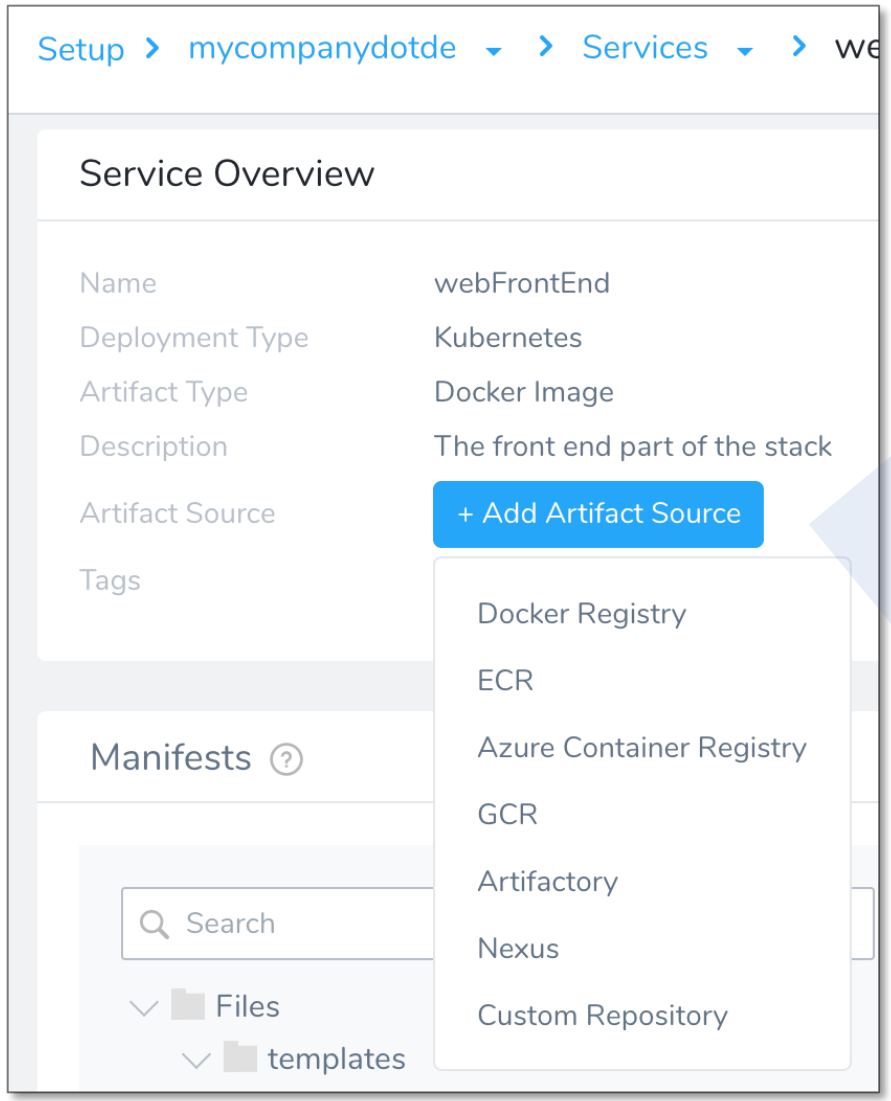
Services	Environments
(0)	(0)
Workflows	**Pipelines**
(0)	(0)
Triggers	**Infrastructure Provisioners**
(0)	(0)

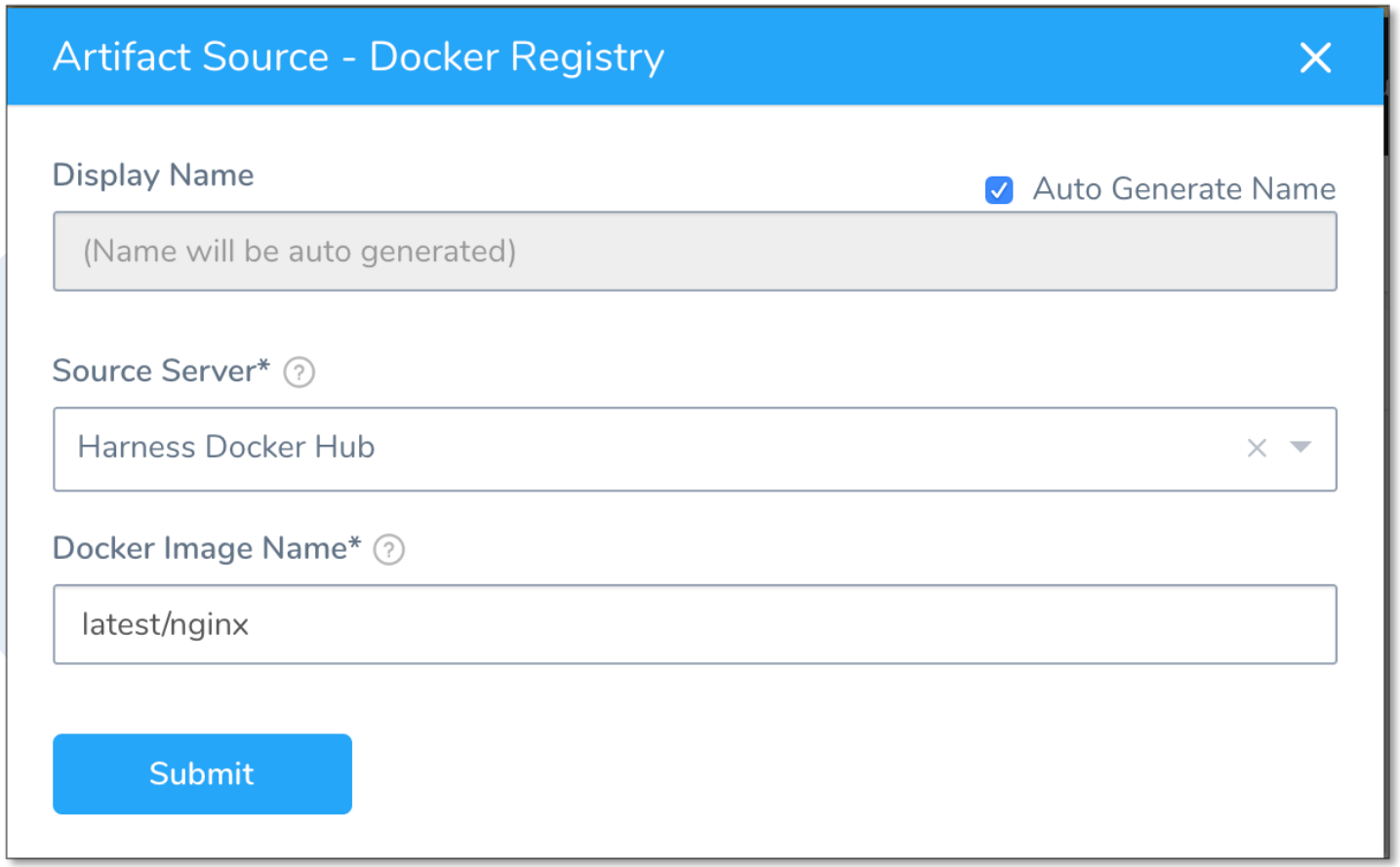
What Are Services

- Services are the individual components / microservices that make up your stack
- In Kubernetes usually represented by a group of yamls to define the particular service parameters
- In Helm represented by a chart
- See docs for more details https://docs.harness.io/article/i3n6qr8p5i-deployments-overview#deployment_guides



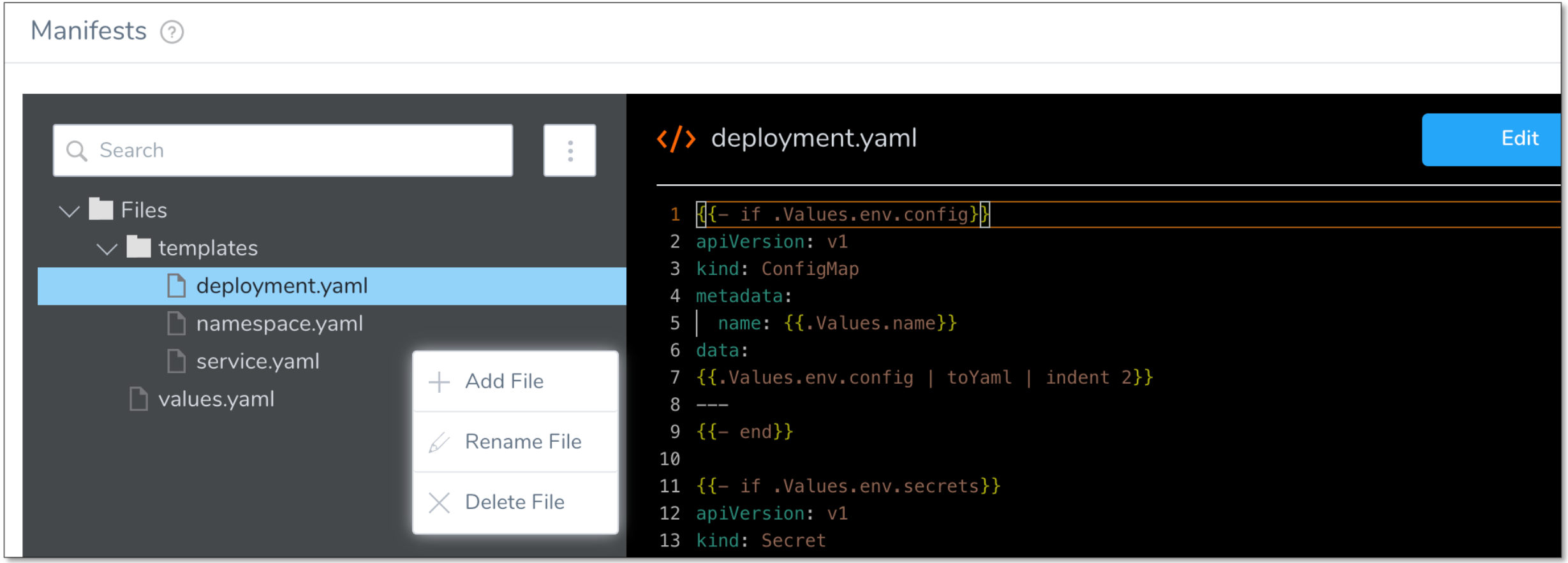
Setting Up Harness Kubernetes Service* - Artifact Source





* Please note that a “Harness Kubernetes Service” is not the same thing as a “Kubernetes service”

Setting Up Harness Kubernetes Service – Manifests Editor



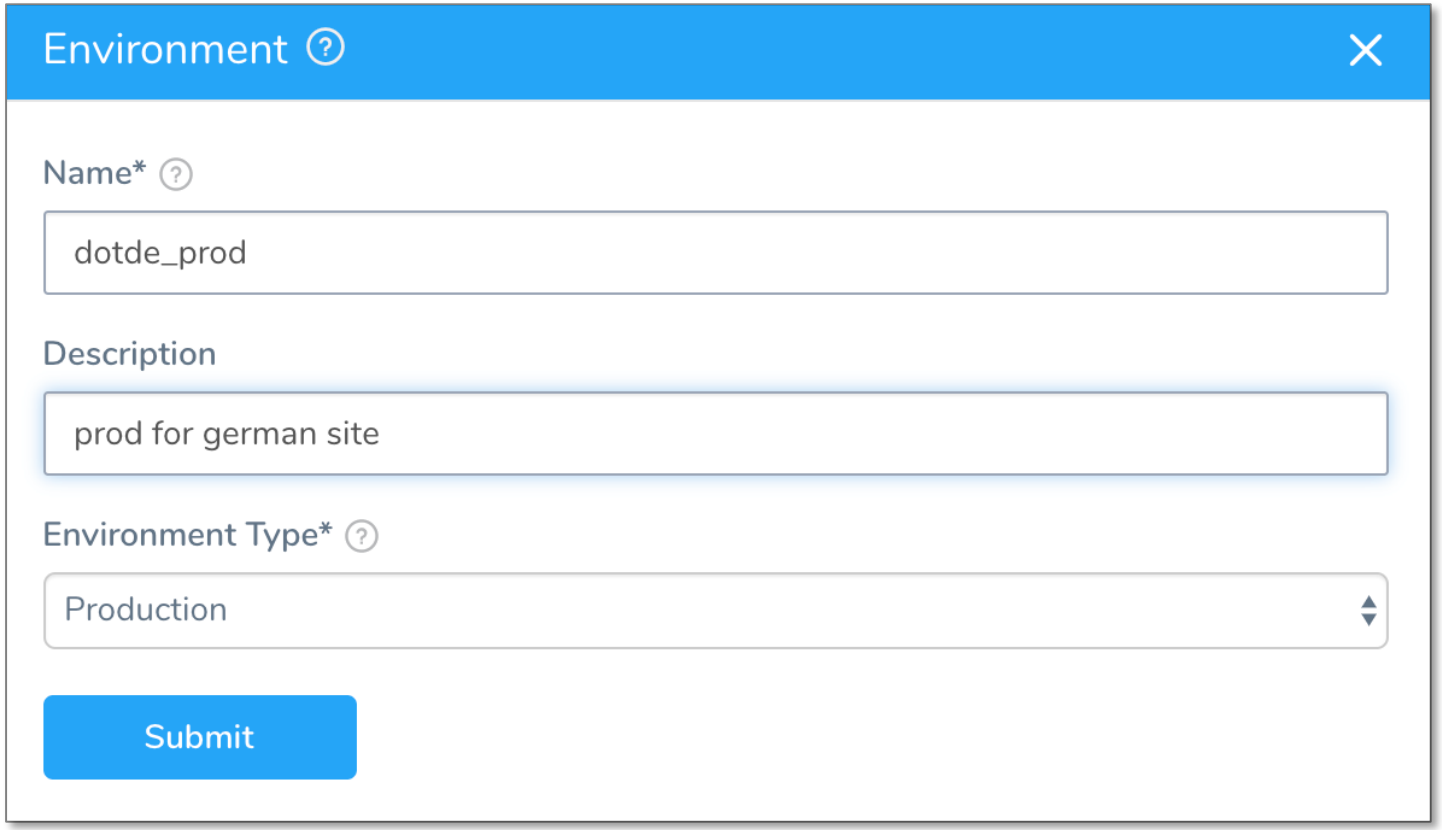
- Comes preconfigured to use the go text template package
- https://godoc.org/text/template

Service Specific Configurations

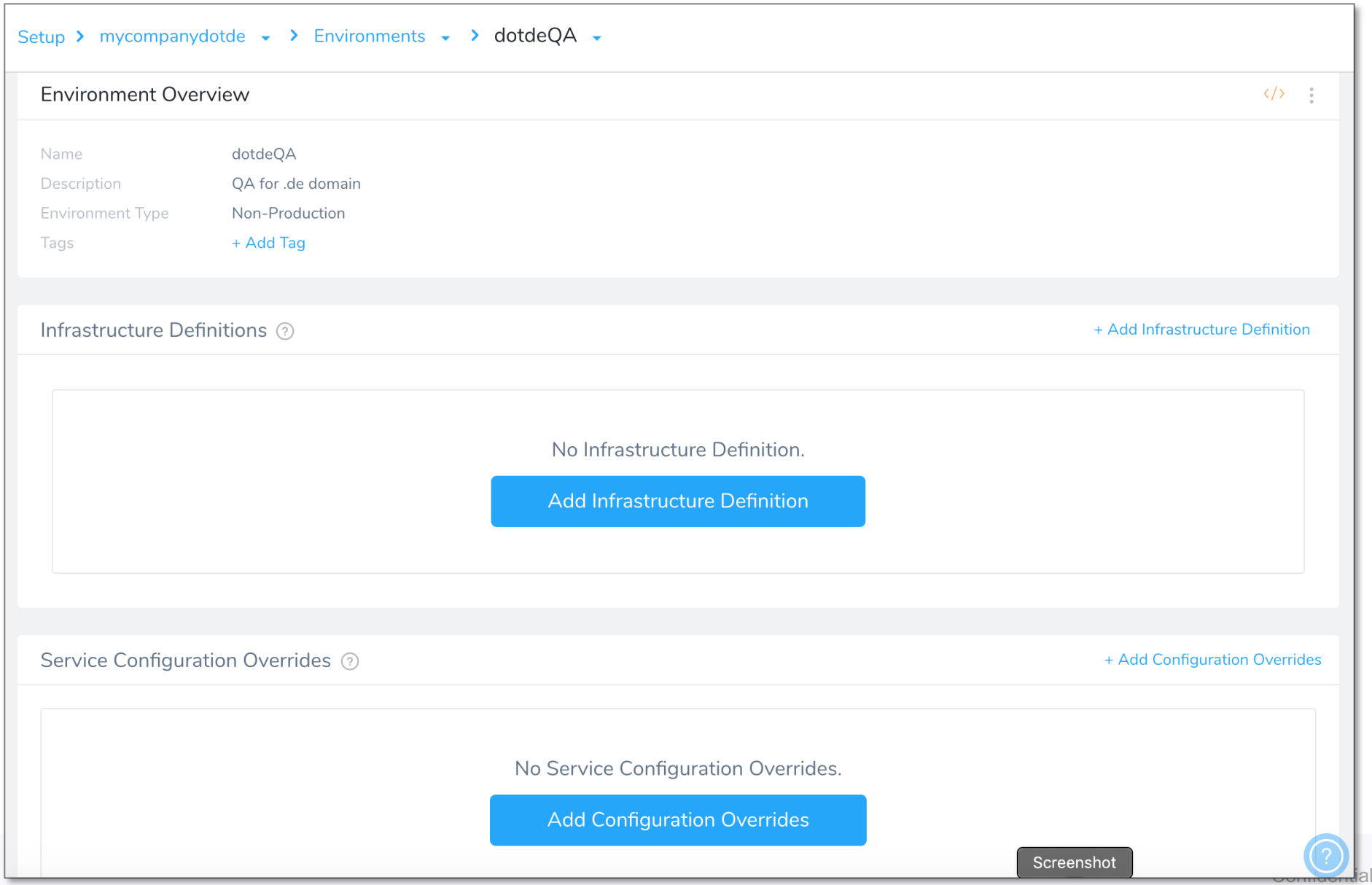
- It’s possible to specify service level variables – both plain text and encrypted
- It’s also possible to include service-specific config files and values yaml overrides

Environments

- If Harness Services are what you are deploying, Environments are where you are deploying them to
- For example: Prod, QA, Staging, multi-geo sites for HA and DR, etc.

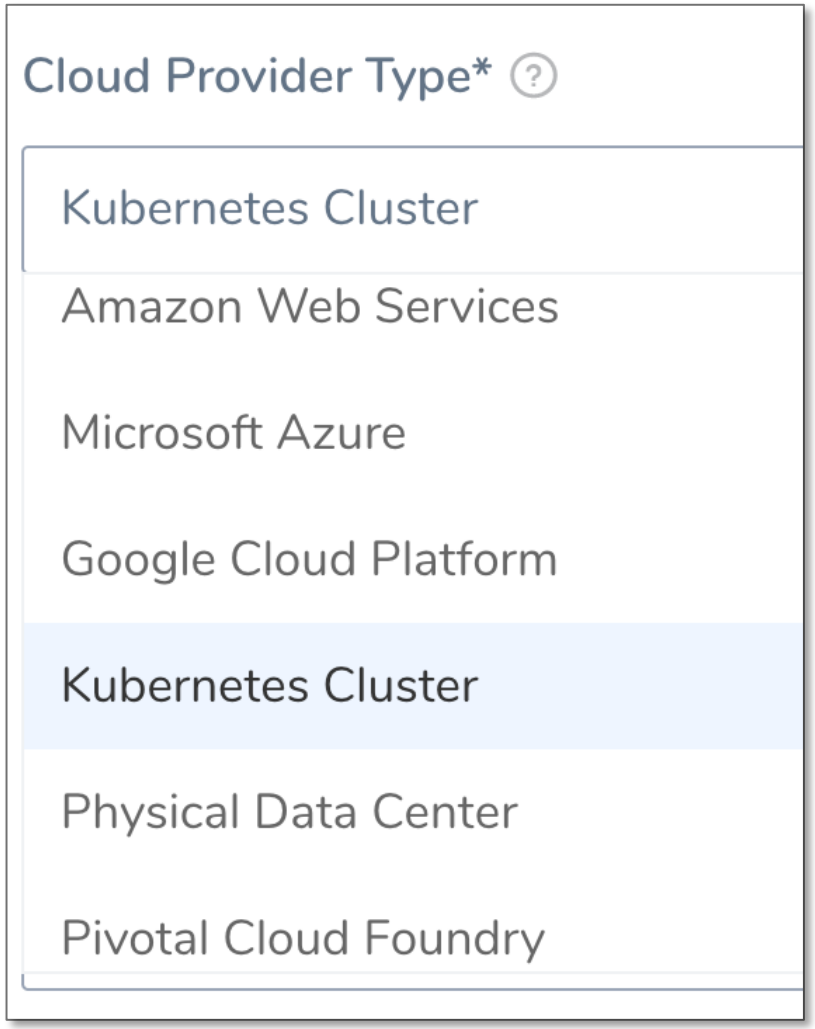


Setting Up Environments for Kubernetes

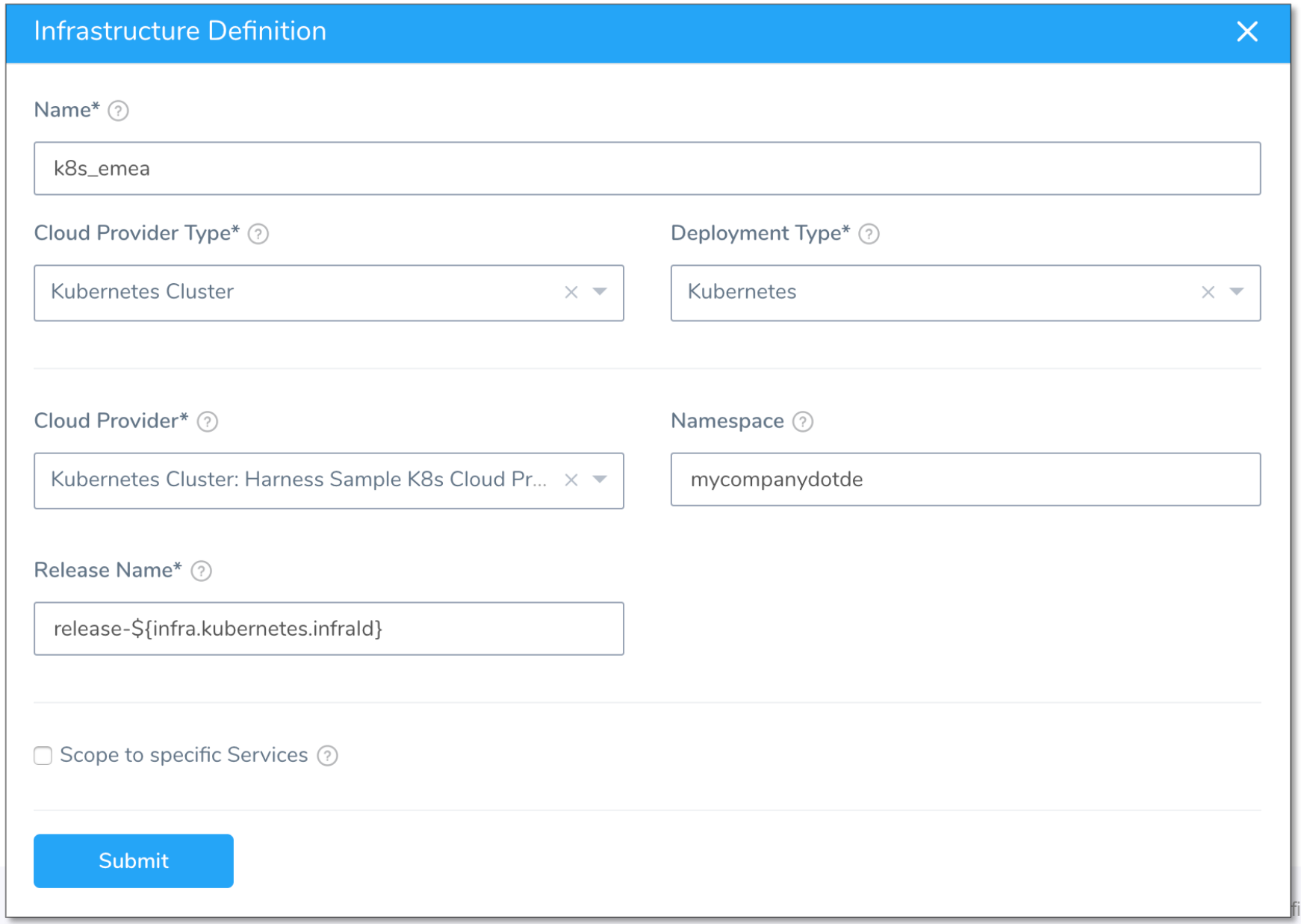


Environments – Infrastructure Definition

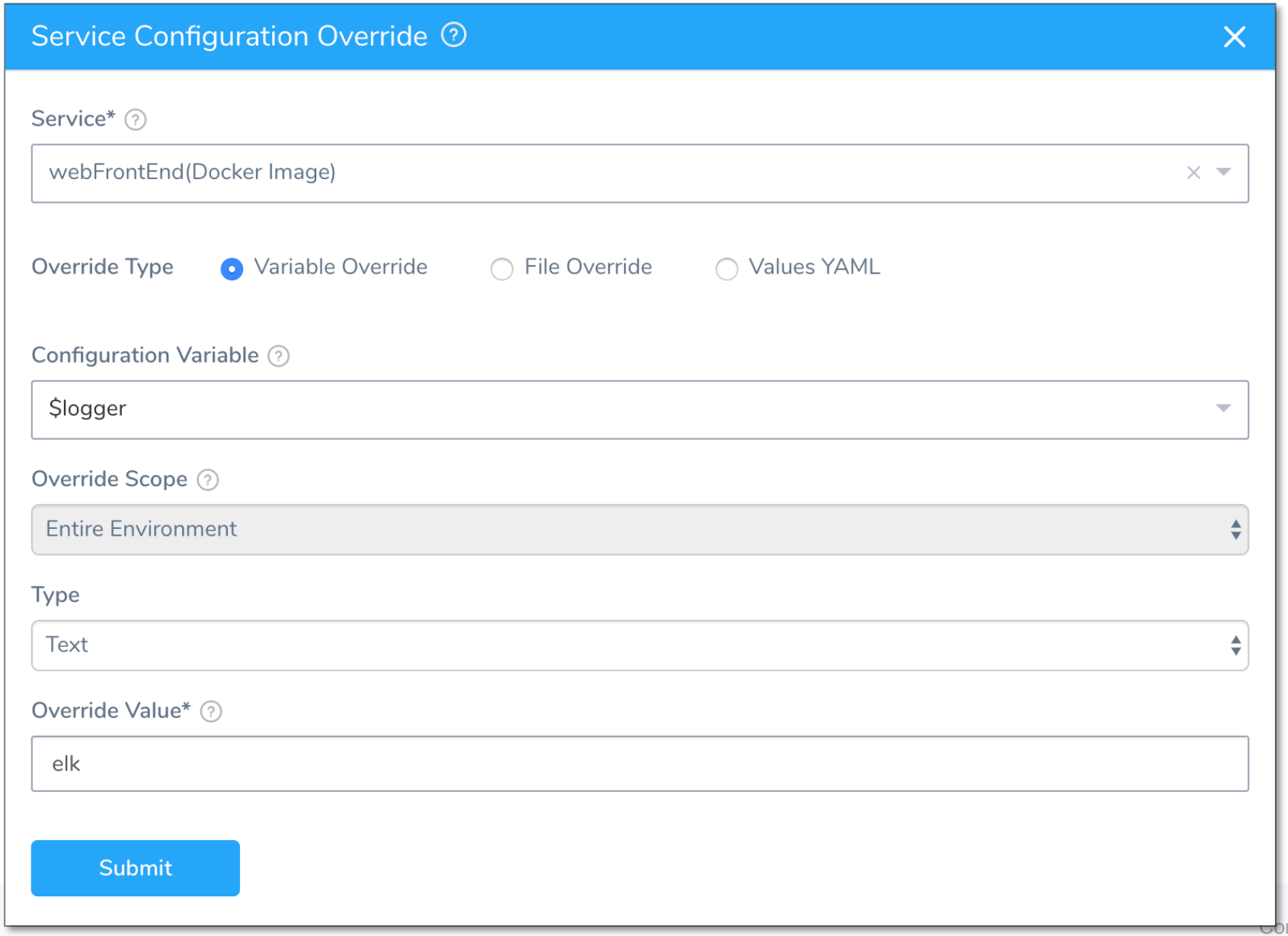
- Infrastructure Definitions are based on which Cloud Provider Type you use
- Kubernetes Cluster Cloud Provider Type covers Helm and all flavors of Kubernetes



Environment Infrastructure Definition K8s



Make Environment-Specific Exceptions

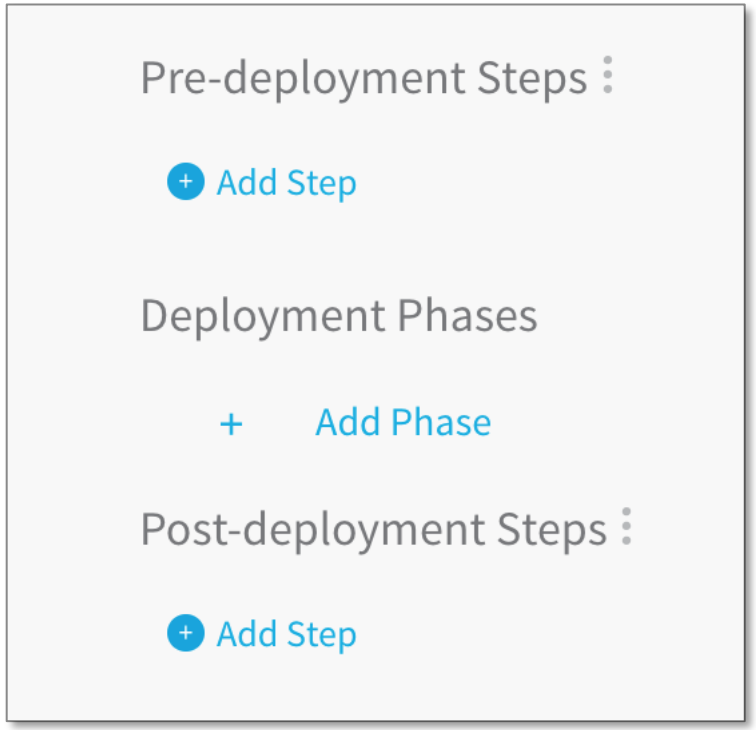


Setting Up Workflows – Deployment Types

Workflow Type	Description
Basic	A Basic deployment selects nodes and installs a service.
Multi-Service	A Multi-Service uses one or more phases composed of separate steps.
Canary	A Canary deployment rolls out a new app version to small sets of users in separate phases, tests and verifies it at each phase, gradually rolling it out to your entire infrastructure.
Build	A Build deployment simply collects artifacts.
Rolling	A Rolling deployment lets you gradually roll out your deployment, enabling and disabling services as necessary.
Blue/Green	In a Blue/Green deployment, network traffic to your service/artifact is routed between two identical environments called blue (staging) and green (production). Both environments run simultaneously, containing different versions or the service/artifact.

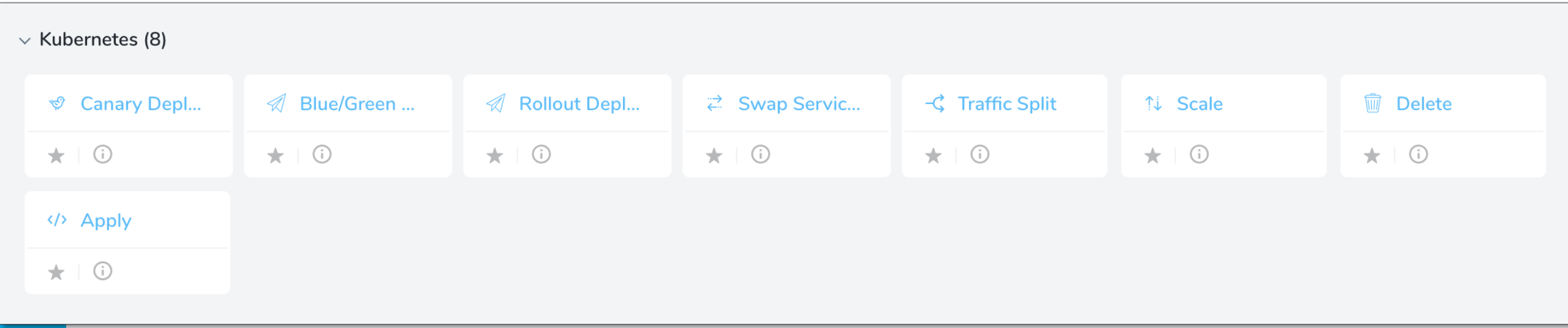
Workflow Components

- Workflows are made up of different steps
- Depending on the type of deployment and cloud provider you're using there will be different steps and options available in your workflows
- See the docs for details on non-Kubernetes Workflows



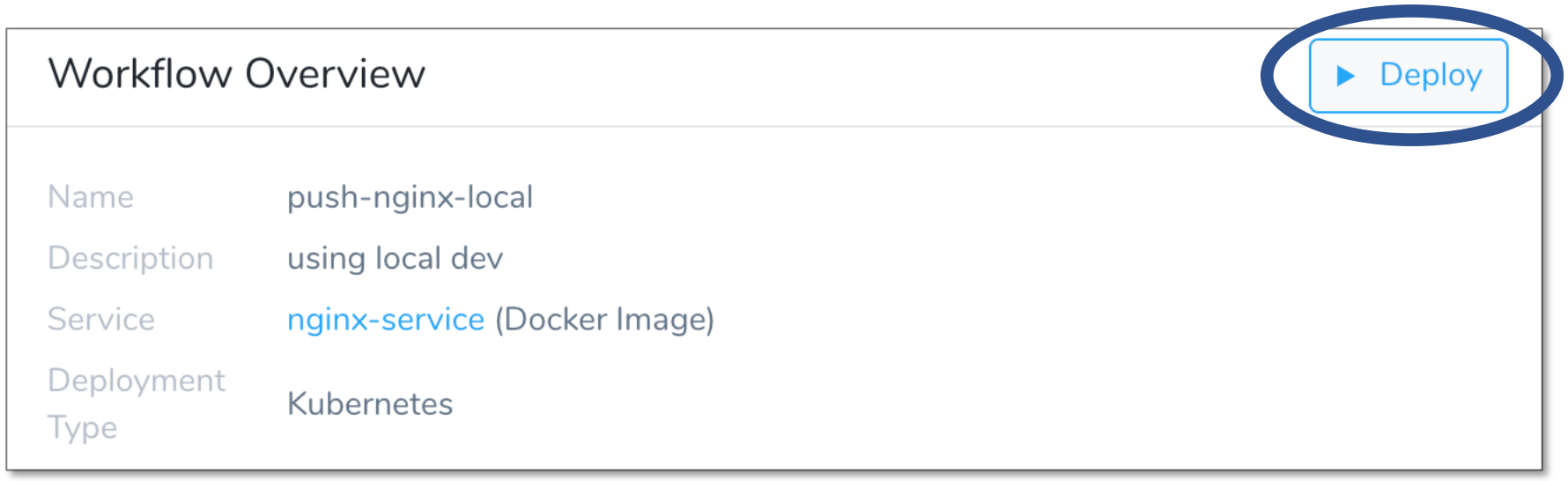
Building a Workflow

- Workflow steps and options will vary depending on your type of deployment as well where you're deploying to
- Add actions to your workflow using the Harness UI
- For Kubernetes based deployments you can run K8s specific commands and actions.

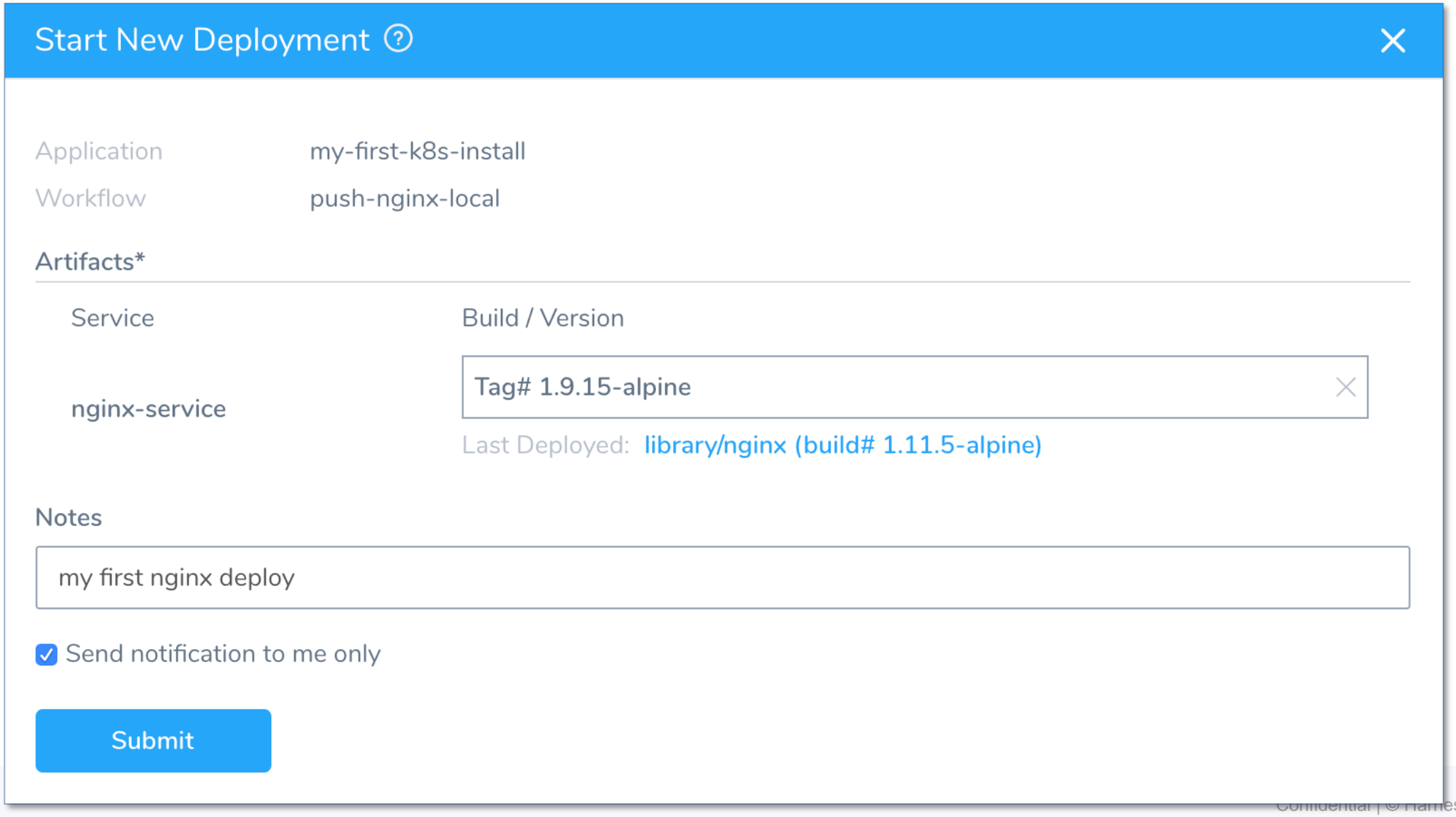


Running Your Workflow

- Once you've built a workflow you have all the building blocks for a basic deployment
- More complex deployments group together workflows into Pipelines, which are covered in a upcoming course
- To run a just a Workflow you can start it right from the Workflow page just by clicking deploy



Individual Deployment Specifics



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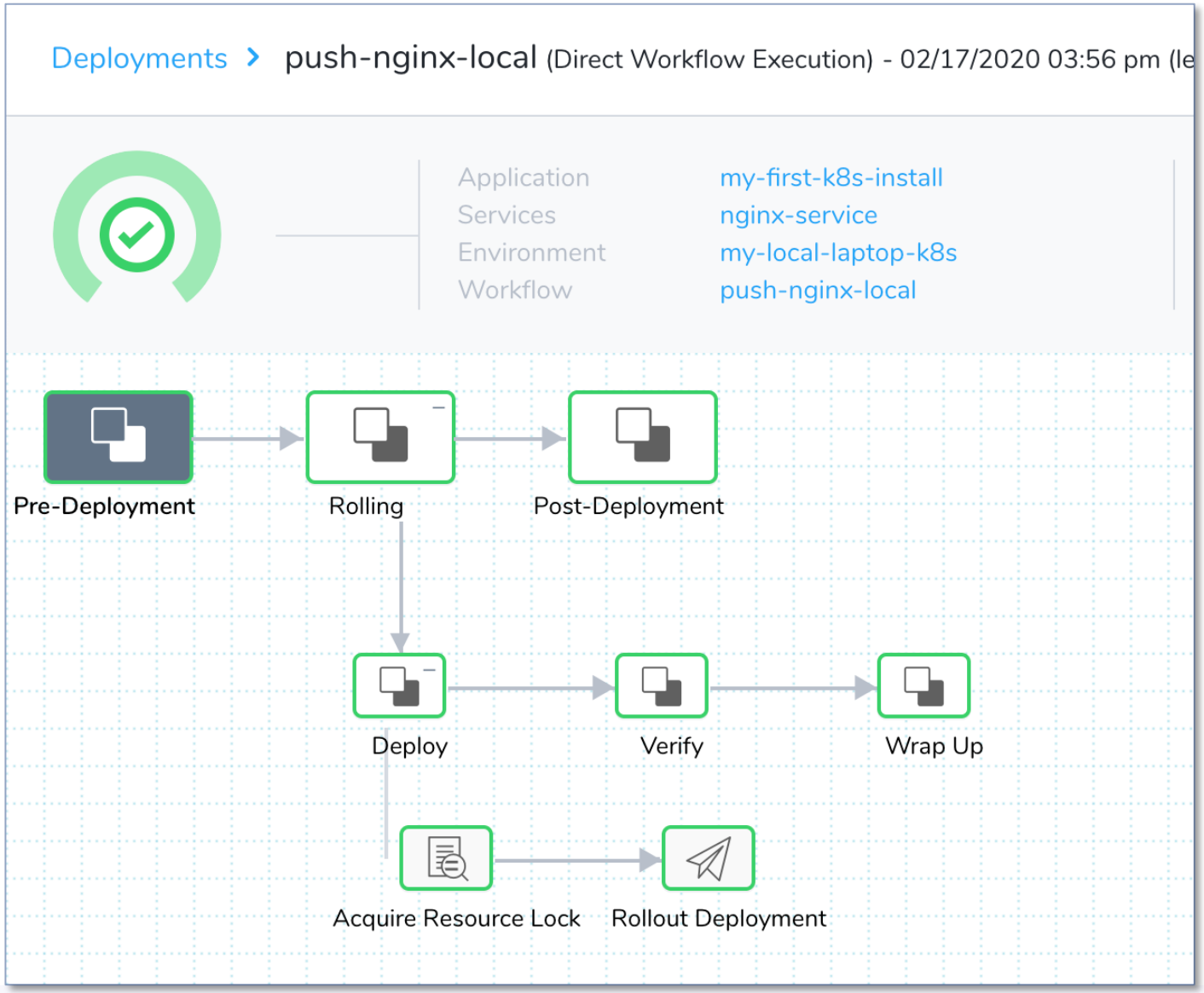
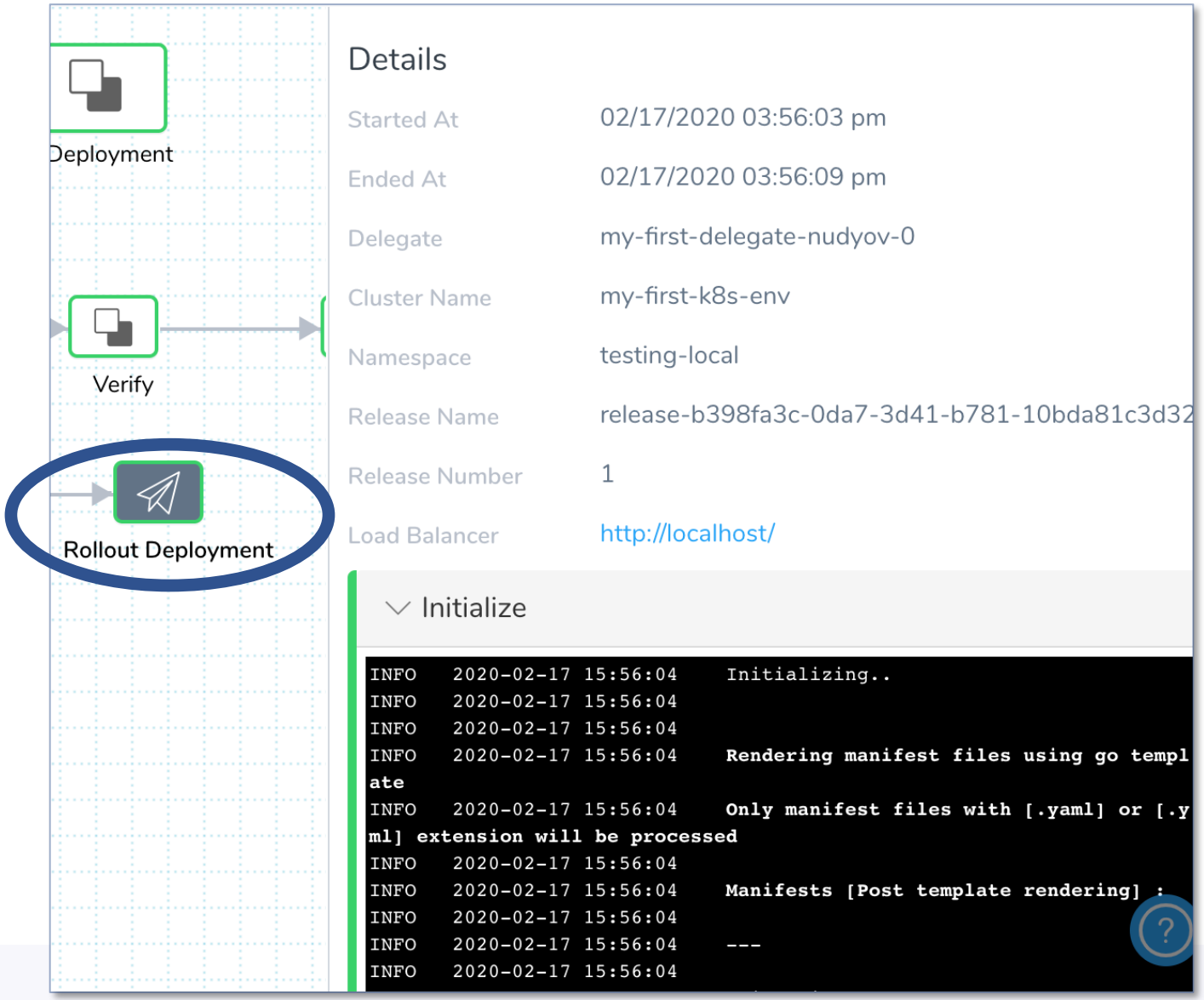


Deployment Details



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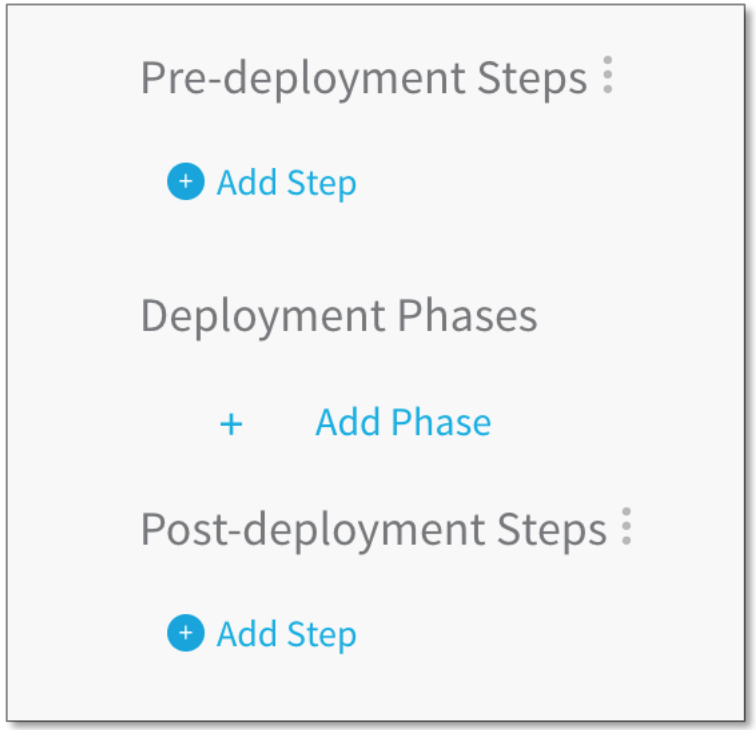

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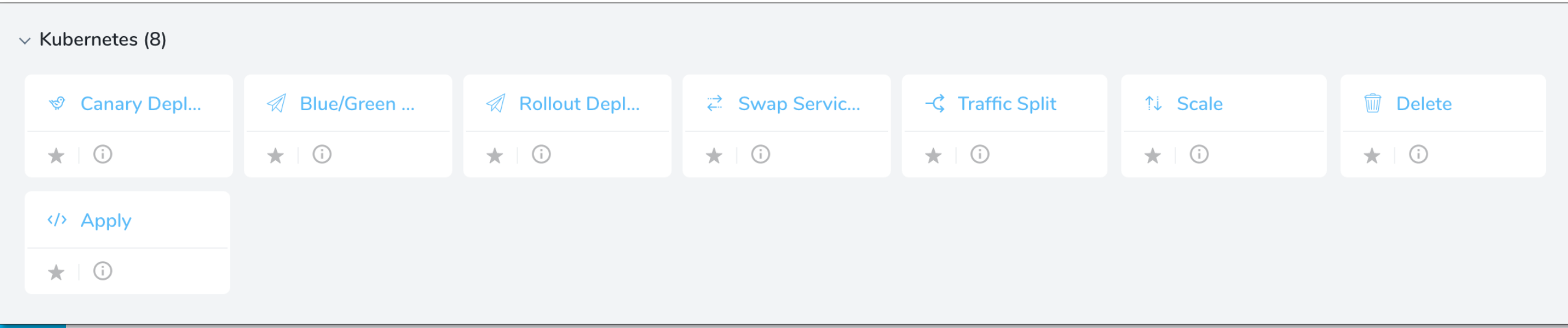

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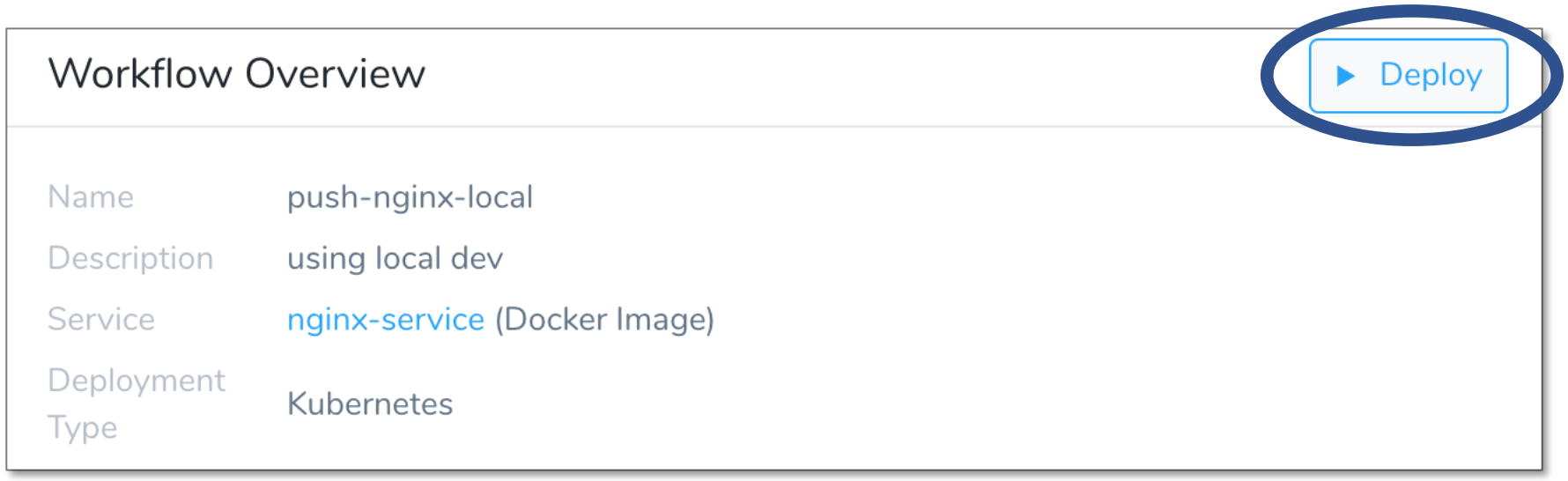

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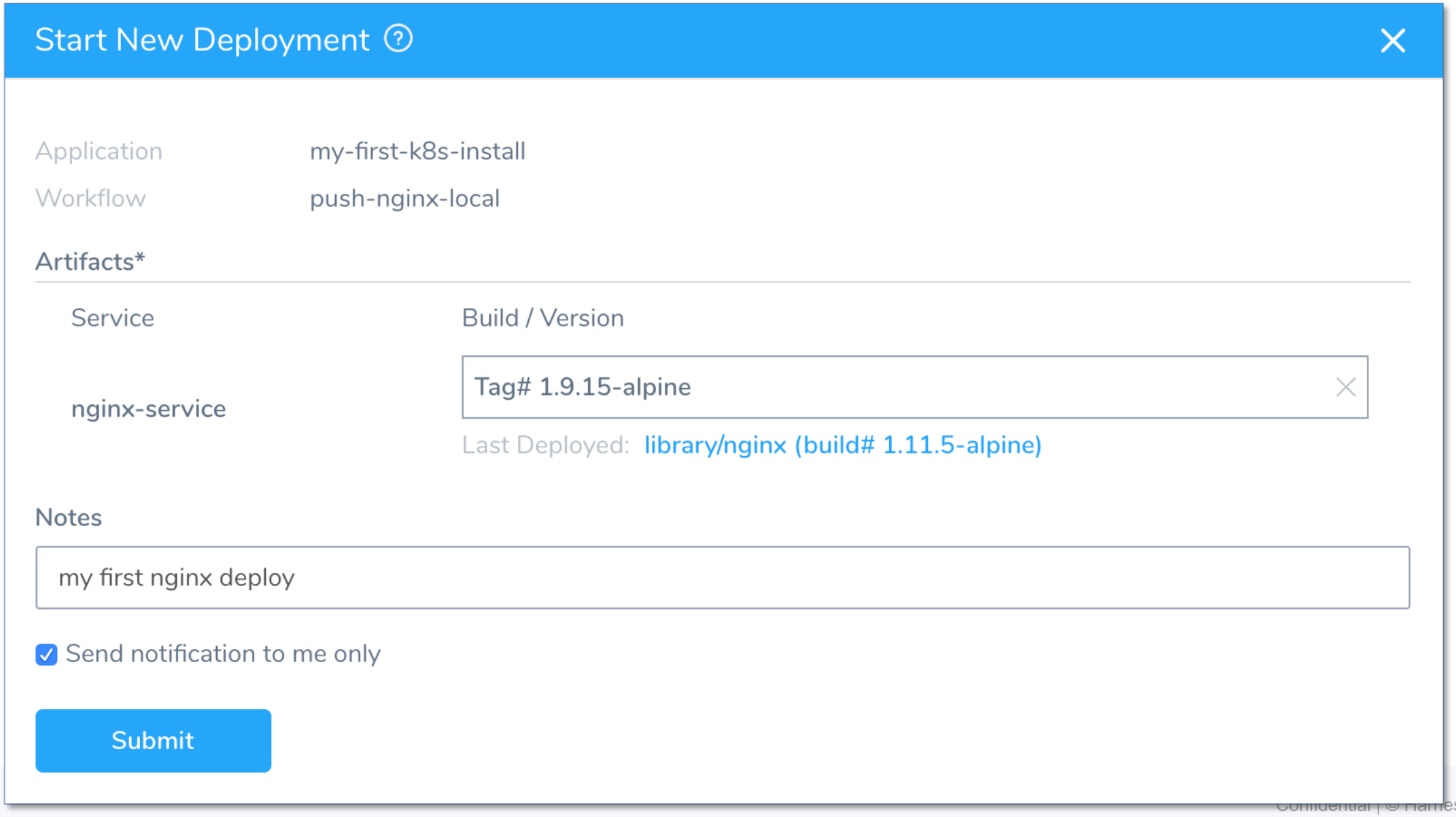

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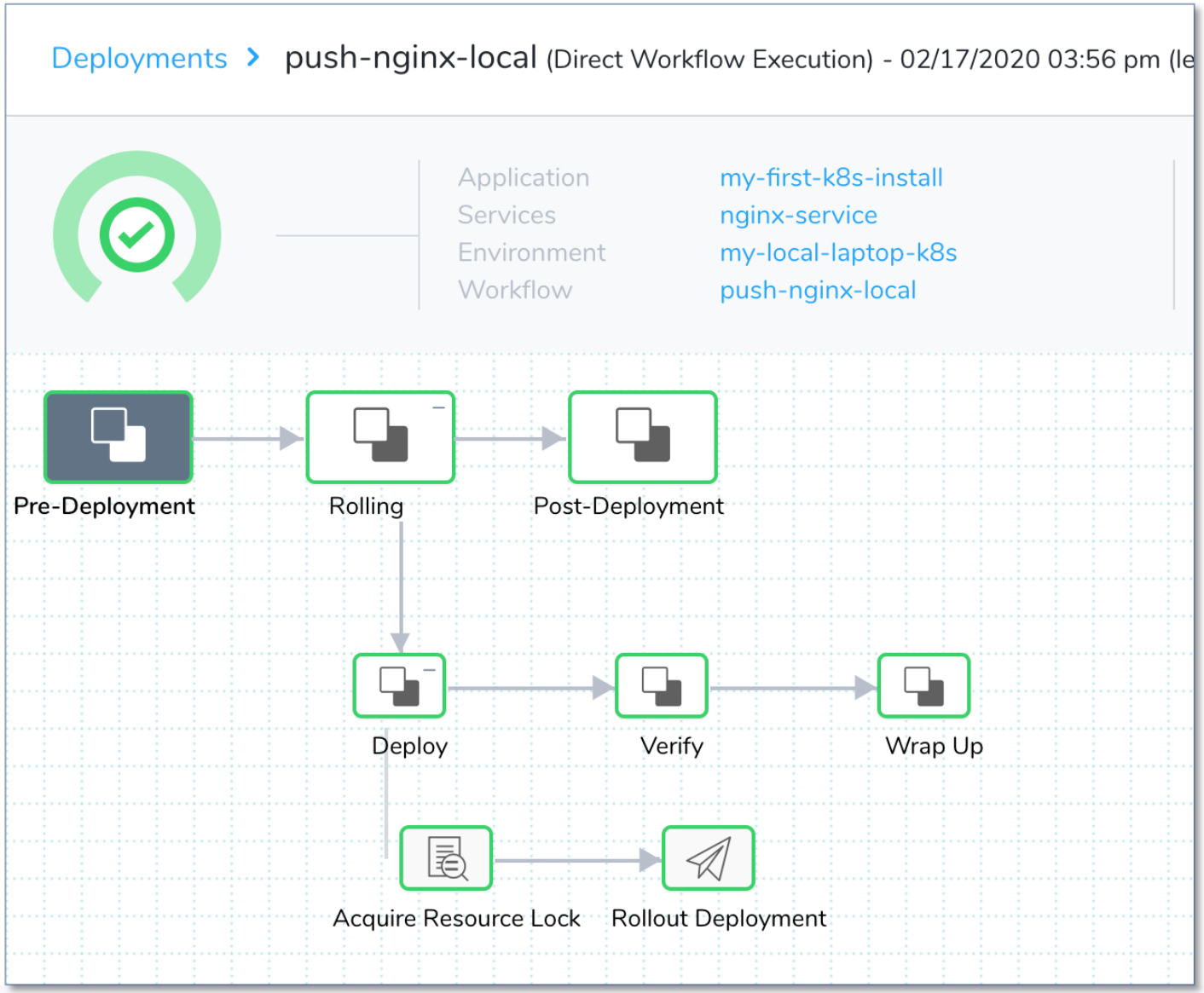

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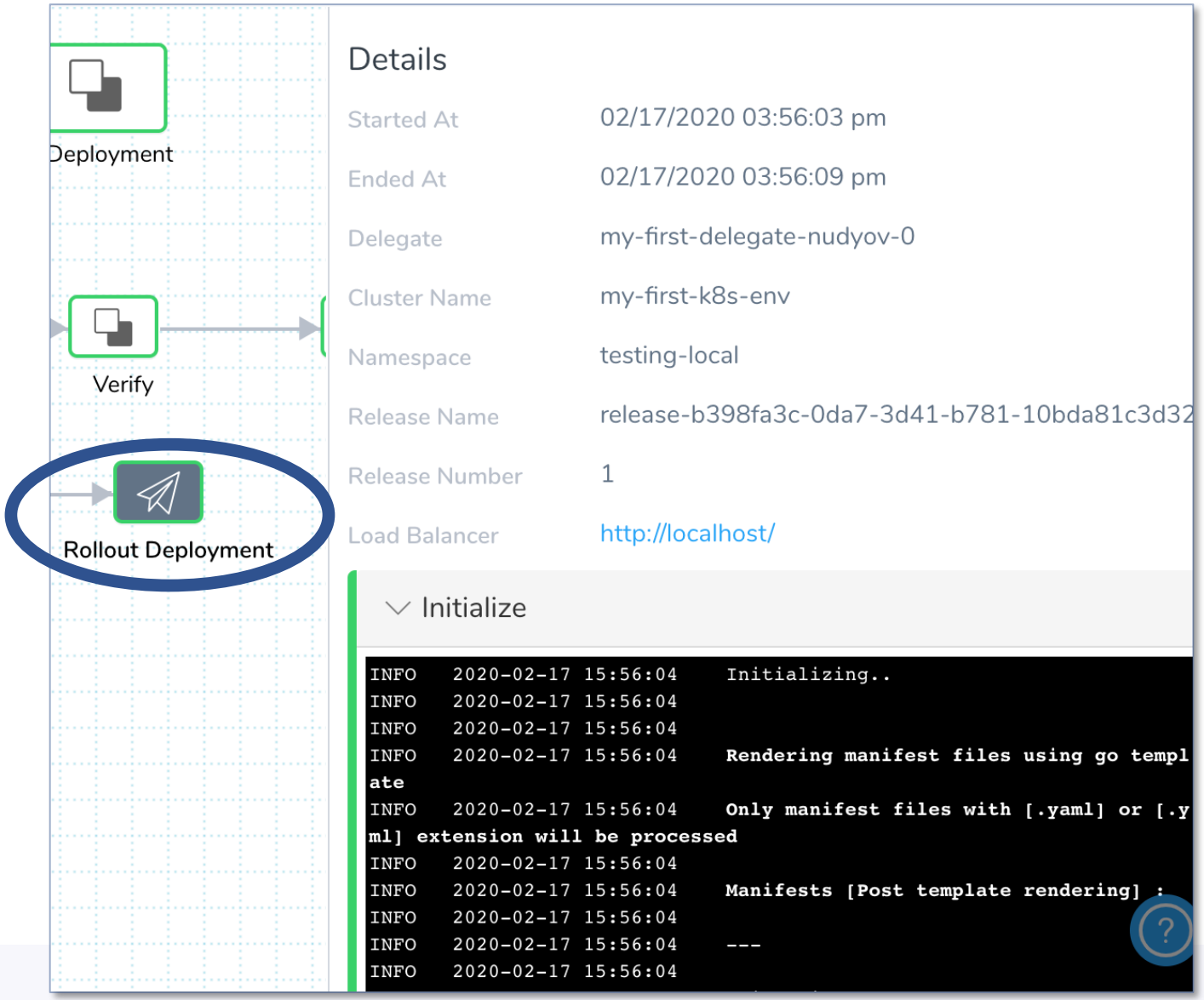

Lab 2
Demo