Descartes Labs

A Journey to Safe, Mission Critical Continuous Delivery at Descartes Labs

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Spinnaker Summit

What is this talk about?

- The value of high velocity deployments & short lead time to deploy
- How to approach Spinnaker with a small engineering team
  - Aka the value of self service pipeline templating
- A pattern for deployments to Kubernetes using the V2 provider
- How application developers become great operators
- Kubernetes, Istio & Spinnaker make for powerful canary deployments

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Descartes Labs is building a data refinery to collect, process, and analyze sensor data to quantify changes in the Earth

Our platform drives global-scale machine learning across more than 10 petabytes of geospatial data

Decades of experience in machine learning, remote sensing, large-scale computing, astrophysics, cosmology

Descartes Labs

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Spinnaker Summit

Headquartered in Santa Fe, NM

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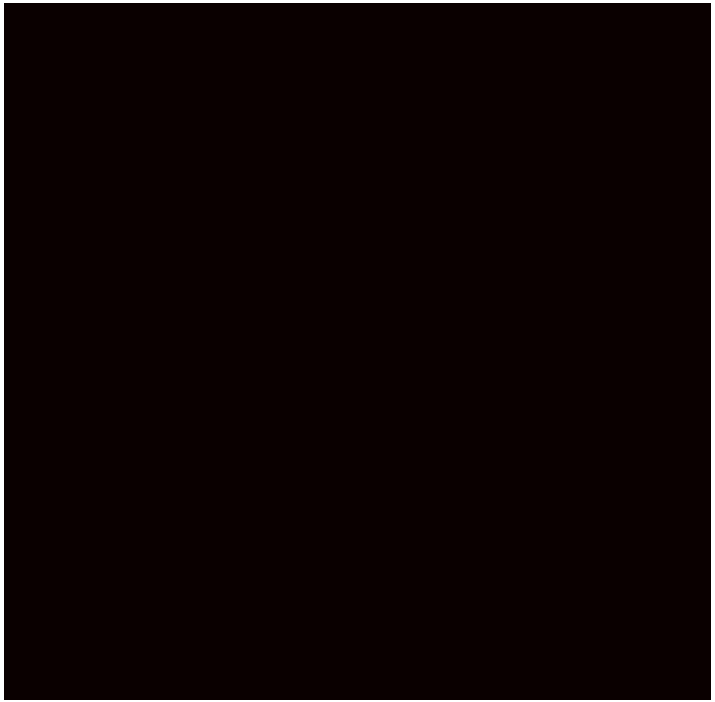
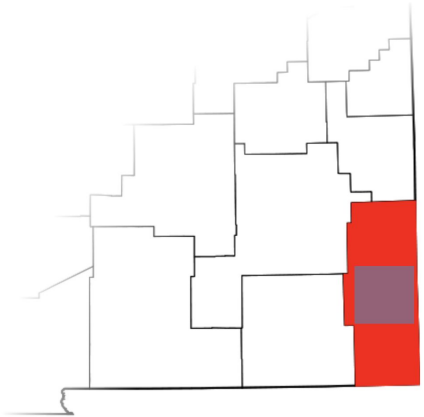
Wildfire Detection

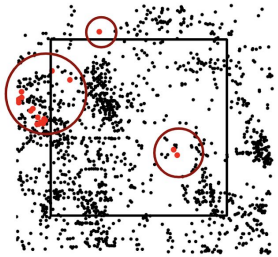


Methane Emissions

Lea County, NM:



- 18 high-probability leaks.



Methane Concentration (ppm)

1830 1890

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Spinnaker Summit

Mission Critical Delivery?

At any given time we have thousands of ML jobs hitting our APIs:

- Extracting insights from complex geospatial datasets
  - Historical and real time
- Models running on our platform can generate actionable insights within minutes of satellites passing overhead.

Our APIs are rapidly evolving:

- New features, bug fixes, new and revised models
- Up to 5 deploys per day for core services.

This combination of time sensitive intelligence generation and a rapidly evolving platform means we have developed some insights into safe, mission-critical continuous delivery.

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The value of high-velocity continuous delivery

*The **Accelerate: State of DevOps** Report demonstrates that increasing deployment frequency and reducing lead time for changes correlates with a lower change failure rate and a shorter time to recover from service incidents and defects.*

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Some early experiences

With a small site reliability engineering (SRE) team working to build a robust continuous delivery ecosystem, a few things became clear early on:

1. Manually creating deployment pipelines for each application was error-prone and did not scale.

2. Having SREs in the critical path for adding and configuring specific application pipelines was slow and inefficient.

3. Having SREs responsible for day-to-day operations of deployment pipelines was ineffective and does not scale

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Our Infrastructure

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Istio and Kubernetes

Istio is an extremely powerful service mesh:

- Advanced traffic routing strategies
- Rich telemetry (L7 metrics)
- Authentication/Authorization
- URI/Request/Response rewrites

For this talk we only care about Istio as a reverse proxy:

- Routes incoming traffic to the desired pods
  - Configured via Kubernetes CRDs (Istio virtualservices)
- Provides telemetry about traffic

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Staging, you keep using that word

All our pipelines deploy to production:

- *Prerelease*
- *Release*
- Dev
- *Baseline*
- *Canary*

https://medium.com/@copyconstruct/testing-in-production-the-safe-way-18ca102d0ef1
https://medium.com/@copyconstruct/testing-in-production-the-hard-parts-3f06cefaf592

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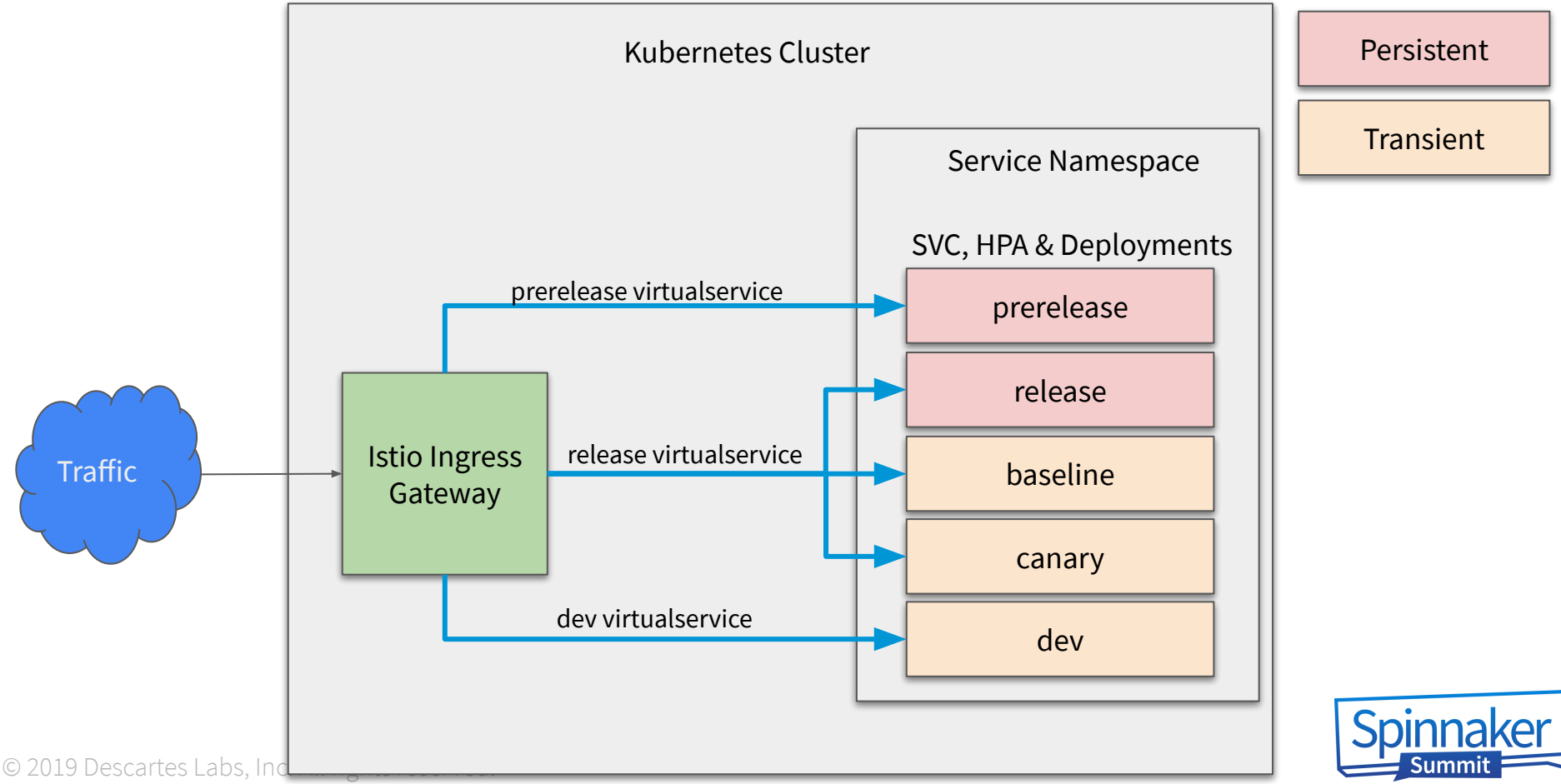

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From Development to Production:

Development (Github): Hours to Days
- Monorepo (Python, Rust & Go)
- Trunk based development
- Pull Requests from short-lived branches

Build & Push (Bazel and drone.io): Less than 20 minutes
- Triggered by webhook
- Push to container registry

Deploy (Spinnaker): Less than 40 minutes
- Triggered by pubsub message (or webhook)
- Deploy to Kubernetes
  - Continuous_Deployment Pipeline

Bazel

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Templated Pipelines

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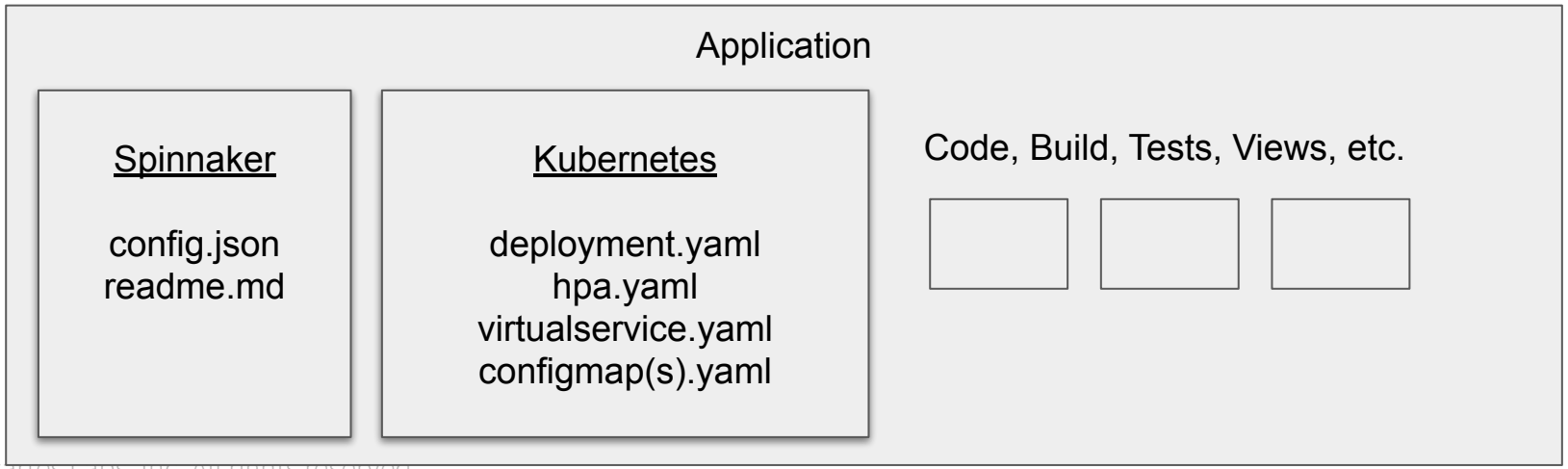
Spinnaker Pipelines

Configuration lives alongside application code:

- spin/config.json statically parameterizes Pipeline
- Pipeline dynamically parameterizes Kubernetes manifests



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A developer wants to start deploying a new application

1. Copy example Spinnaker config.json and Kubernetes YAMLs to their application folder.
2. Set the deployment name in the config.json
3. That's it!

- Automation picks up the new files and starts templating the deployment pipelines
  - Templated using Jinja pipeline templates
- While on a branch the pipelines are available as build artifacts
- After merging the pipelines are automatically applied to Spinnaker via spin-cli

This sets up:

- Kubernetes deployments, horizontal pod autoscalers and services along with VirtualServices.

* Namespaced based on application folder name.

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Jinja Pipeline Templates

Templates are about as readable as raw pipeline json.

- Variable substitution
  - {{ service.name }}
- Conditional stages
  - `{% if pipelines.Continuous_Deployment.use_configmap|default('false') == "true" %}`
- Looped stage insertion
  - `{% for predeploy_job in pipelines.Continuous_Deployment.predeploy_jobs %}`

Most complicated pipeline template is ~500 lines.

Generating the pipeline is not much more complicated than:

```
pipeline_template = j2_env.get_template(template_base + ".jinja2")
rendered_pipeline = pipeline_template.render(data)
```

There is a fair amount of Spinnaker expression language (SpEL)

- Debugging can be painful because somethings evaluated at template time, somethings evaluated at execution time.

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Spin/config.json


```
"service": {
  "name": "myservice",
  "image": "us.gcr.io/myproject/myservice/prod",
  "cluster_name": "mycluster",
  "prerelease":  {
    "envConfig": "Staging",
    "minReplicas": 2
  },
  "release":  {
    "envConfig": "Production",
    "minReplicas": 12
  }
},
```

Deployment configuration

```
"pipelines": {
  "continuous_deployment": {
    "id": "myservice_continuous_deployment",
    "predeploy_jobs" : [ {
       "name" : "migrate_schema",
       "type" : "migrations"
     } ],
    “canary”: “disabled”
  },
  "rollback": {"id": "myservice_rollback_release"},
  "k8s_deployment": {"id": "myservice_k8s_deployment" },
  "development_deployment": {"id": "myservice_development_deployment" },
  "k8s_hpa": { "id": "myservice_hpa" },
  "virtual_service": { "id": "myservice_virtualservice" },
  "k8s_service_default_config": {"id": "myservice_service_auto_config"},
}
```

Pipeline configuration

k8s/deployment.yaml

```
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
 annotations:
 labels:
   app: myservice
   stage: ${#root["stage"]}
 name: myservice-${#root["stage"]}
 namespace: myservice
 [...]
       - name: FLASK_CONFIG
         value: 'myservice.config.${#root["envConfig"]}Config'
 [...]
       image: us.gcr.io/myproject/myservice/prod
```

stage variable defined in our Jinja template.

#root function
- substitute the variable *stage* from the currently executing Spinnaker stage.

Stages:
- dev, prerelease, release, canary, baseline

This is how we reuse the same manifest for many different deployments.

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k8s/hpa.yaml

```
apiVersion: autoscaling/v1
kind: HorizontalPodAutoscaler
metadata:
 name: myservice-${#root["stage"]}
 namespace: myservice
spec:
 maxReplicas: 20
 minReplicas: ${#toInt(#root["minReplicas"])}
 scaleTargetRef:
   apiVersion: extensions/v1beta1
   kind: Deployment
   name: myservice-${#root["stage"]}
 targetConnectionsPerPod: 🙃
```

https://medium.com/descarteslabs-team/custom-kubernetes-scaling-via-envoy-metrics-110d0bac720

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Let’s look at a pipeline

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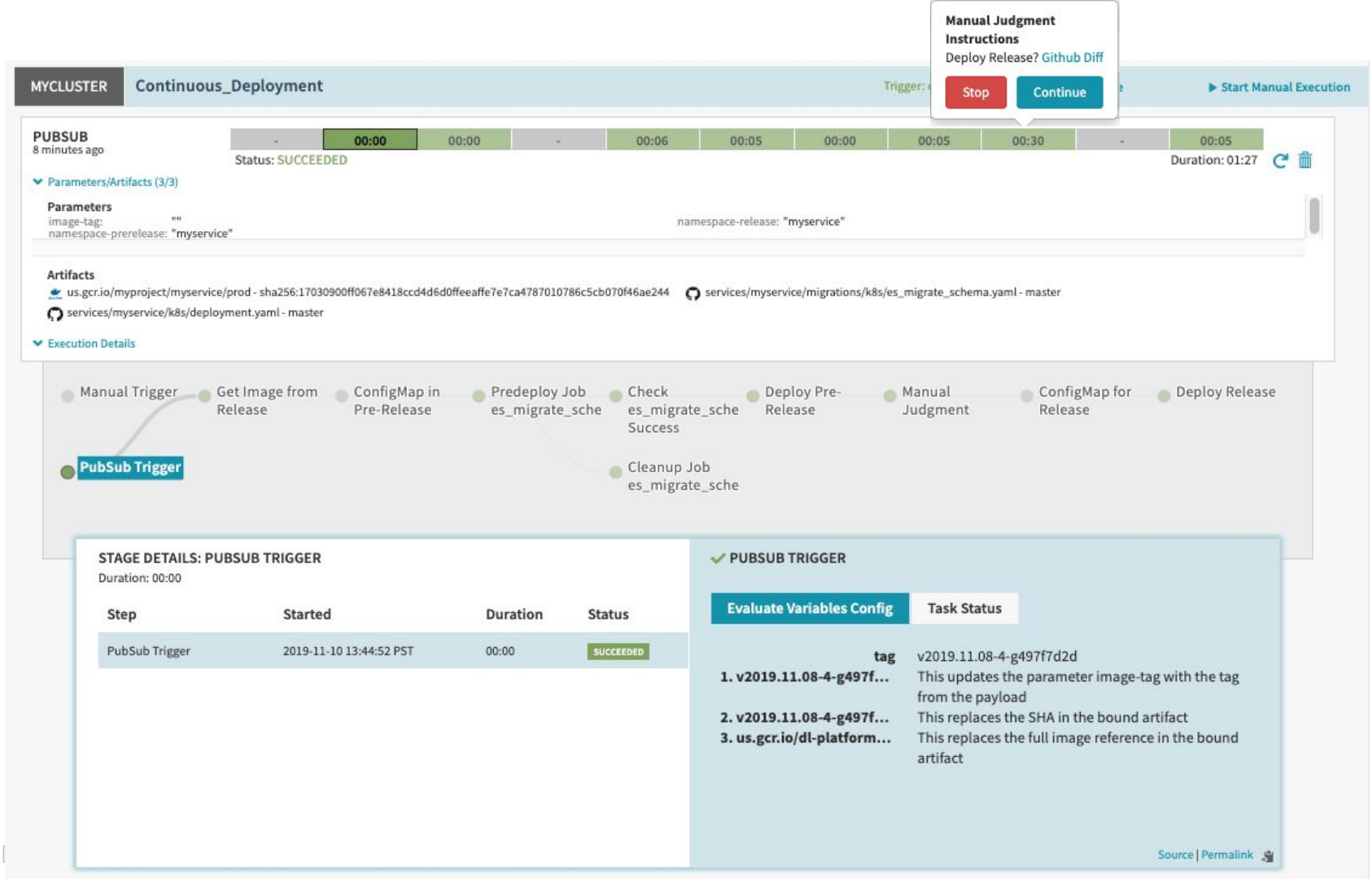
Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
services/myservice/k8s/deployment.yaml - master
Execution Details
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

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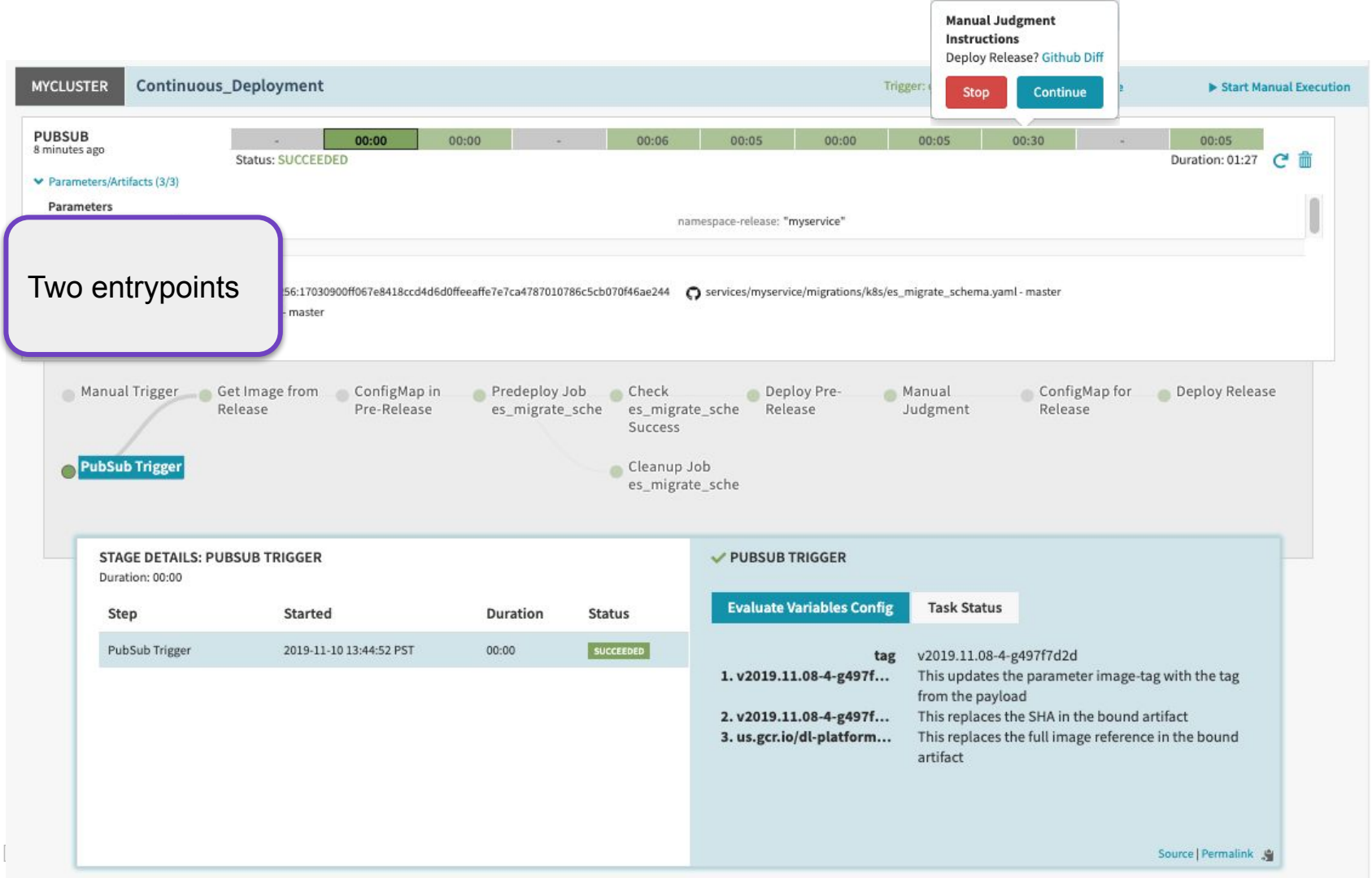
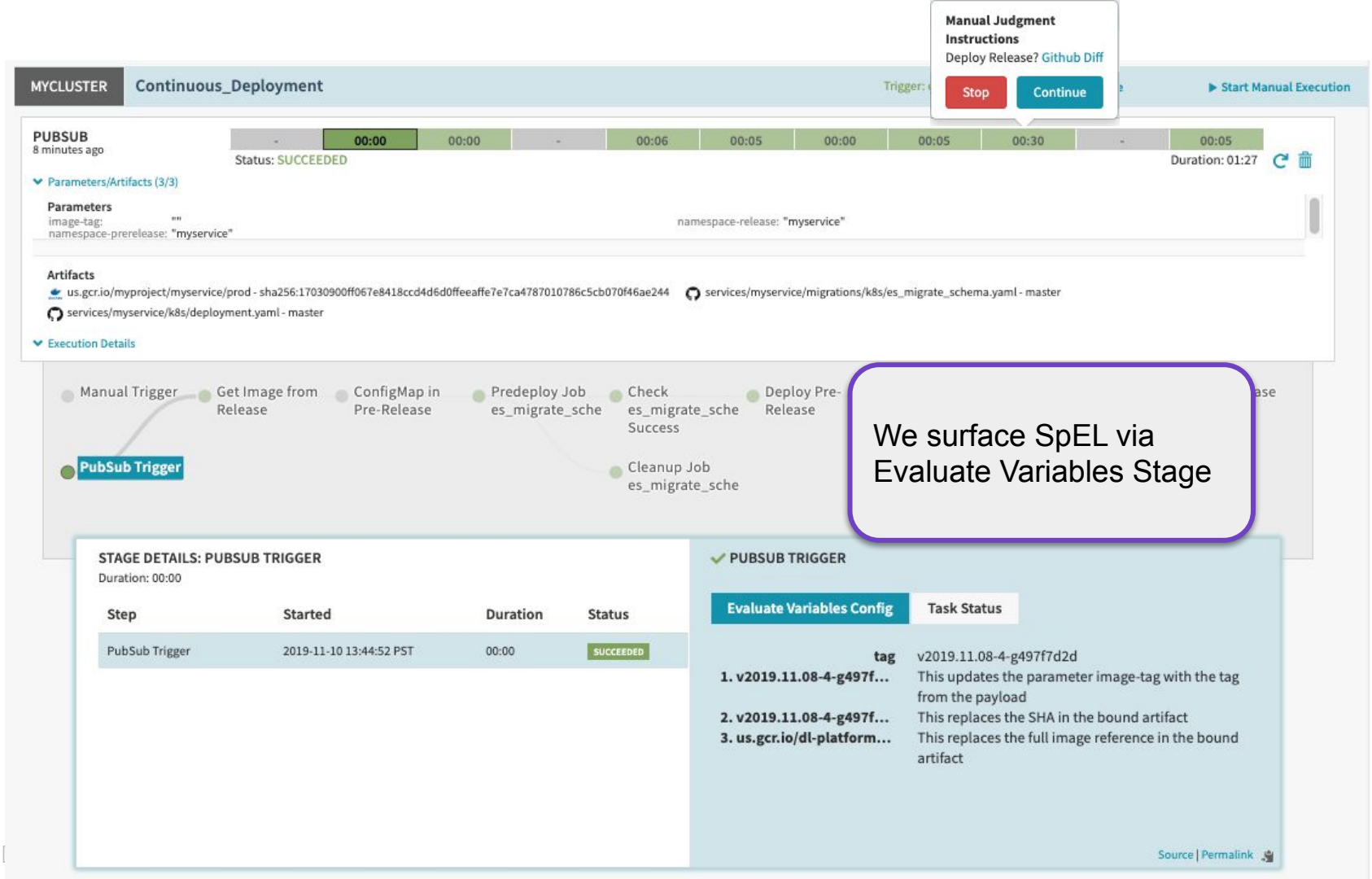

Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
namespace-release: "myservice"
Two entrypoints
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
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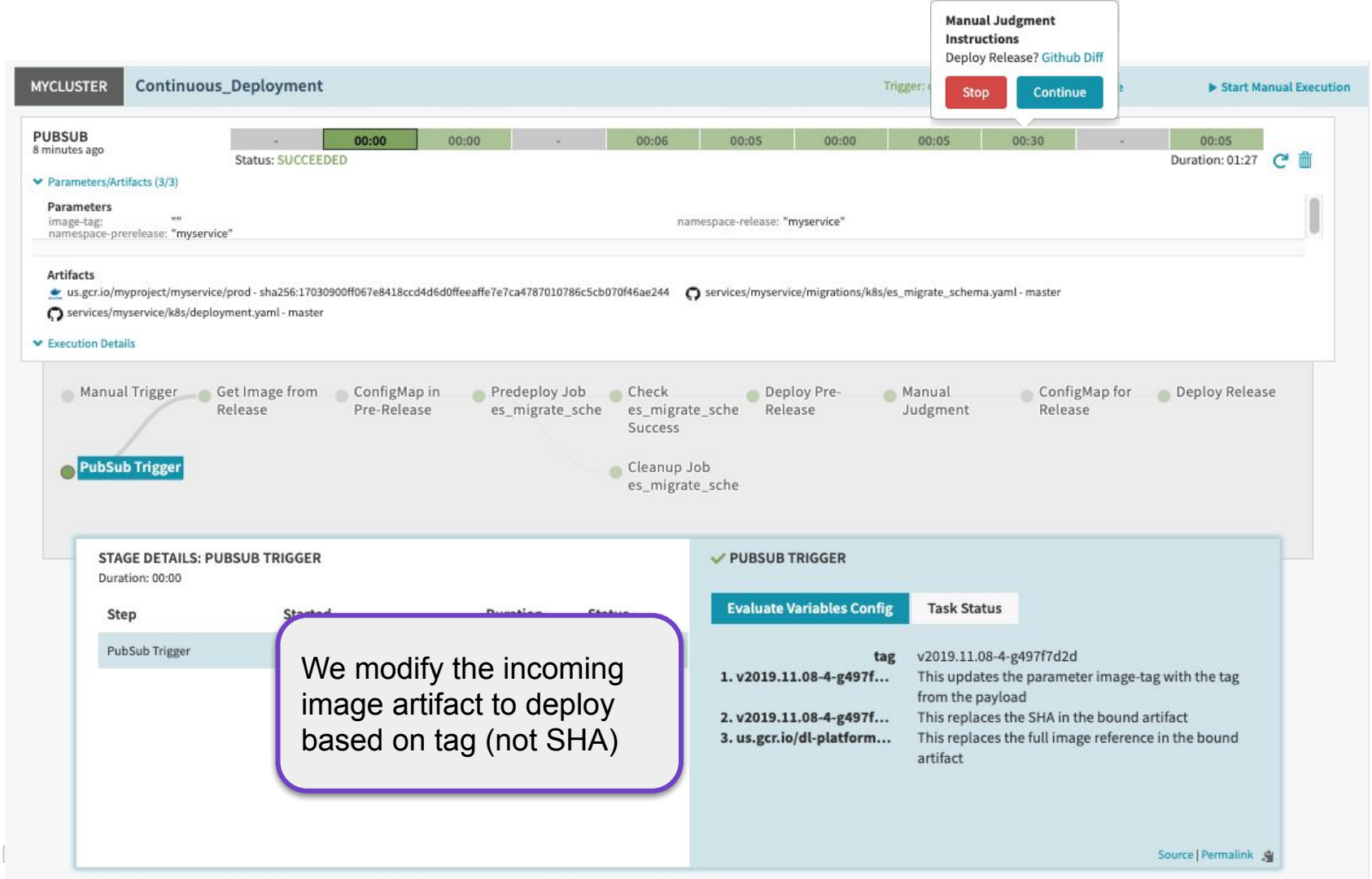
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
services/myservice/k8s/deployment.yaml - master
Execution Details
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche
Success
Deploy Pre-Release
PubSub Trigger
Cleanup Job es_migrate_sche
We surface SpEL via Evaluate Variables Stage
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

© 2019 I



We modify the incoming image artifact to deploy based on tag (not SHA)

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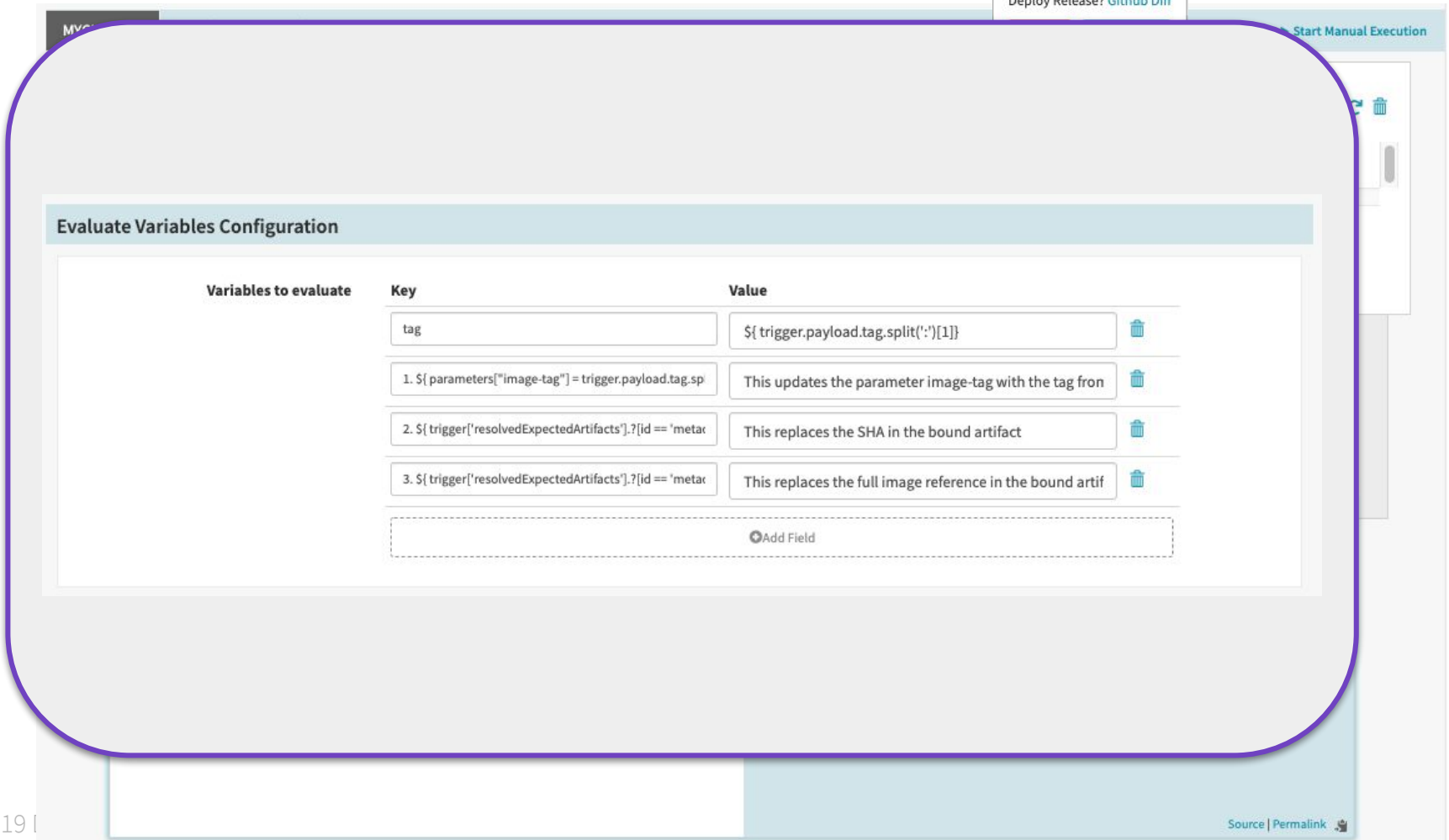
Manual Judgment
Instructions
Deploy Release? Github Diff
Start Manual Execution
Evaluate Variables Configuration
Variables to evaluate
Key
Value
tag
${ trigger.payload.tag.split(':')[1]}
1. ${ parameters["image-tag"] = trigger.payload.tag.sp
This updates the parameter image-tag with the tag fron
2. ${ trigger['resolvedExpectedArtifacts'].?[id == 'metac
This replaces the SHA in the bound artifact
3. ${ trigger['resolvedExpectedArtifacts'].?[id == 'metac
This replaces the full image reference in the bound artif
Add Field
Source | Permalink

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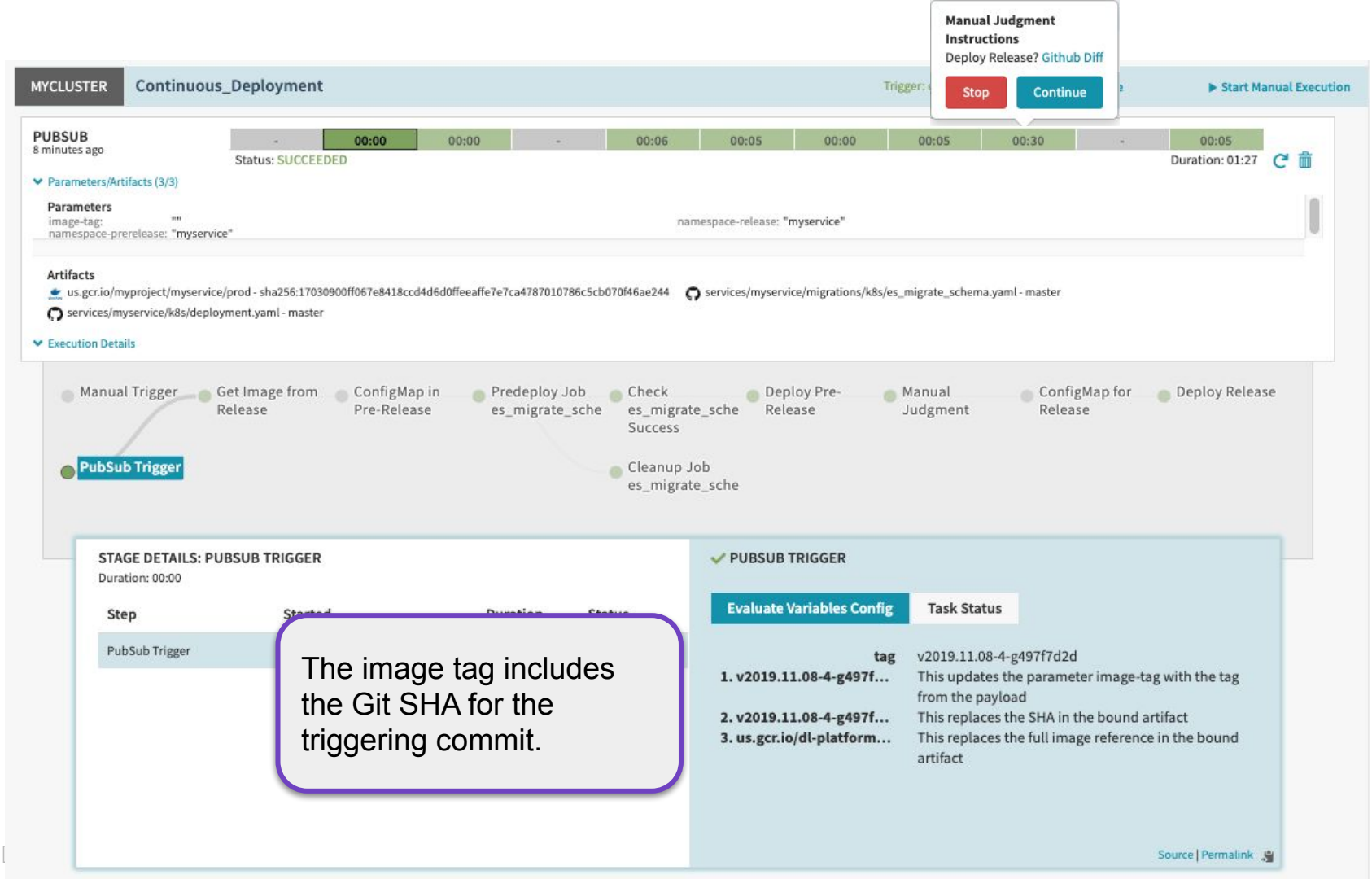
Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
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00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
services/myservice/k8s/deployment.yaml - master
Execution Details
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche
Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
PubSub Trigger
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink
The image tag includes the Git SHA for the triggering commit.

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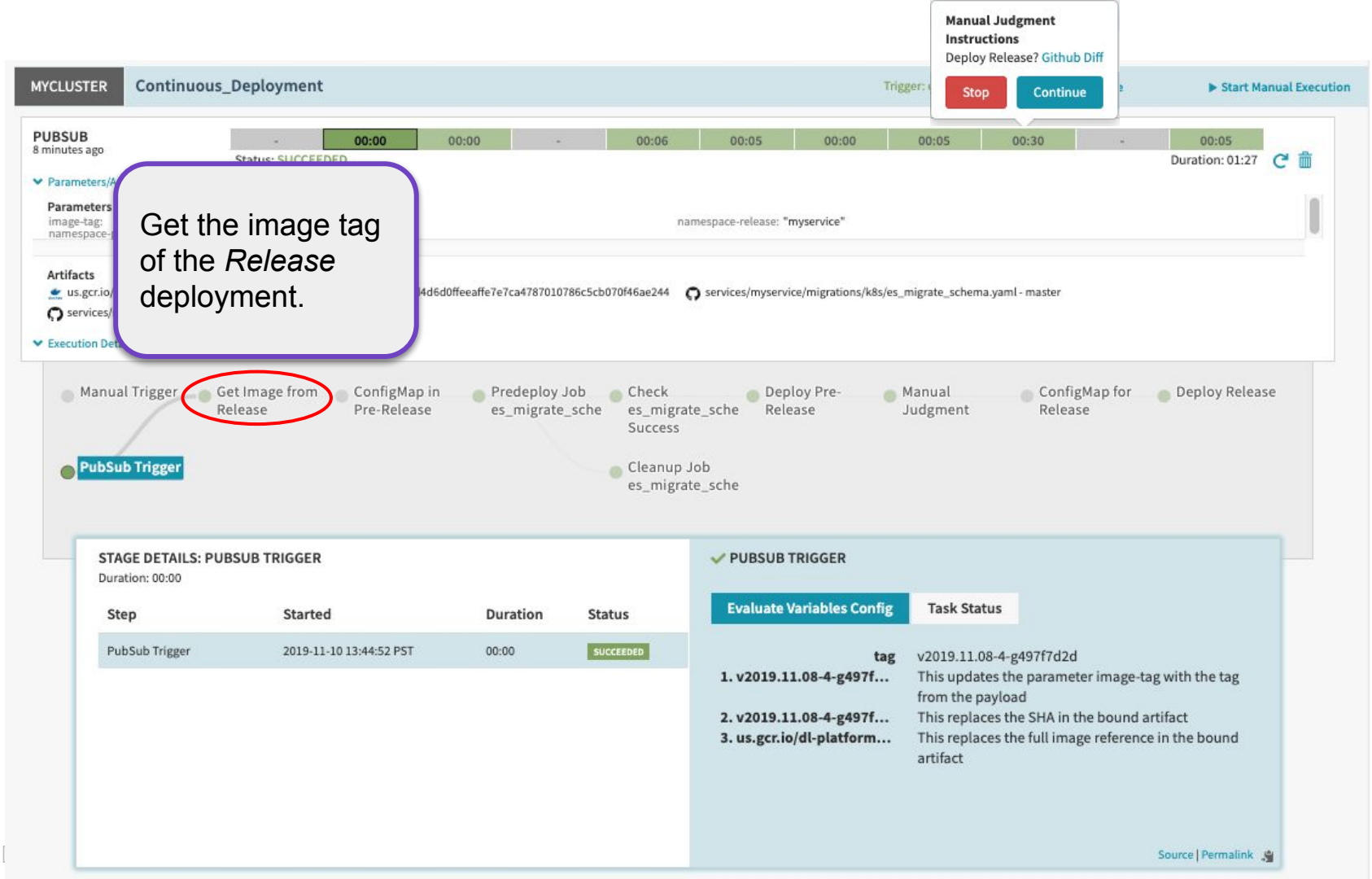
Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
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Duration: 01:27
Parameters
image-tag:
namespace-release: "myservice"
Artifacts
us.gcr.io/
services/
4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
Execution Det
Get the image tag of the *Release* deployment.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche
Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

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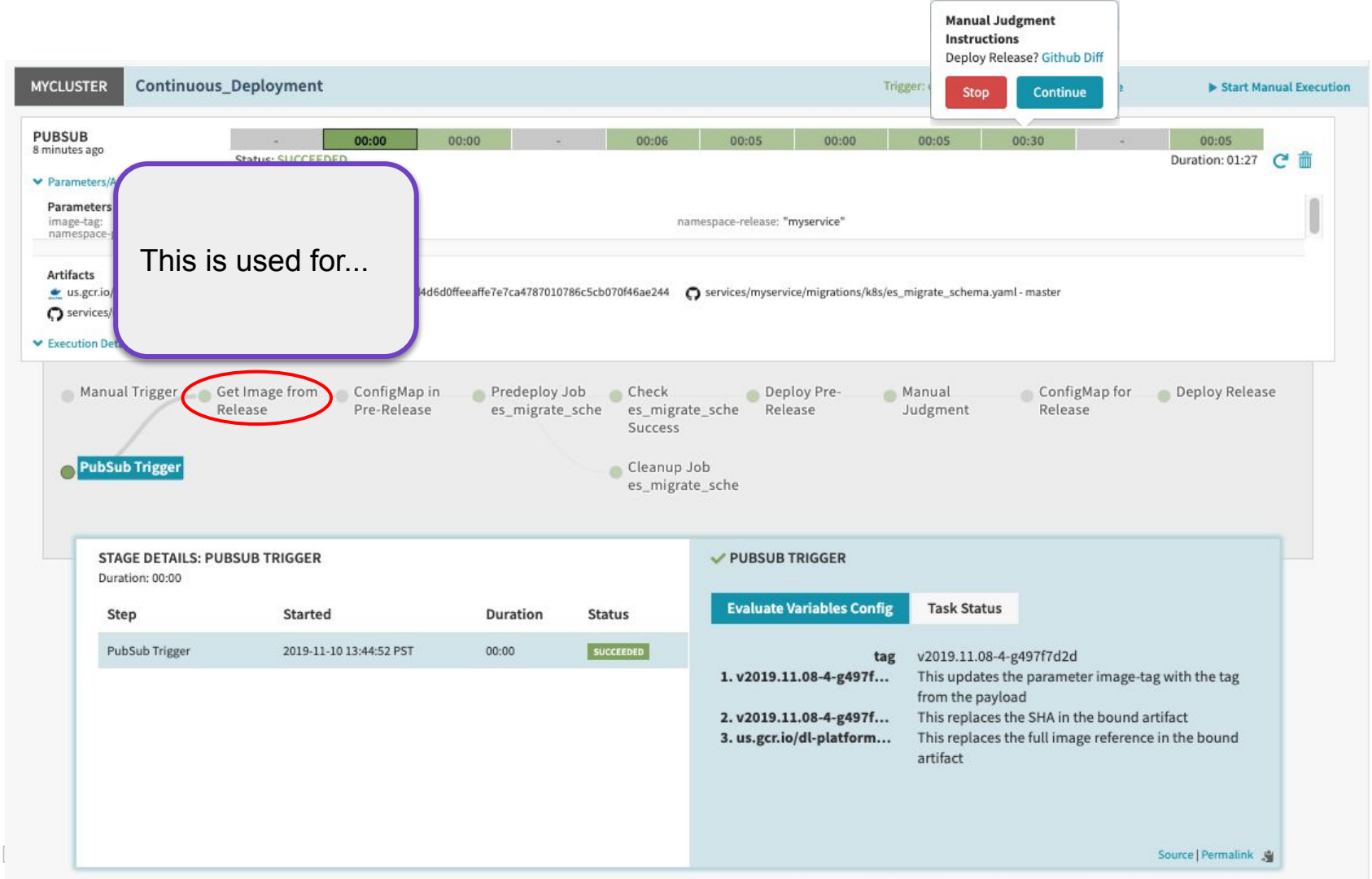
Manual Judgment
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MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
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00:00
00:06
00:05
00:00
00:05
00:30
00:05
Duration: 01:27
Parameters
image-tag:
namespace-release: "myservice"
Artifacts
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
This is used for...
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

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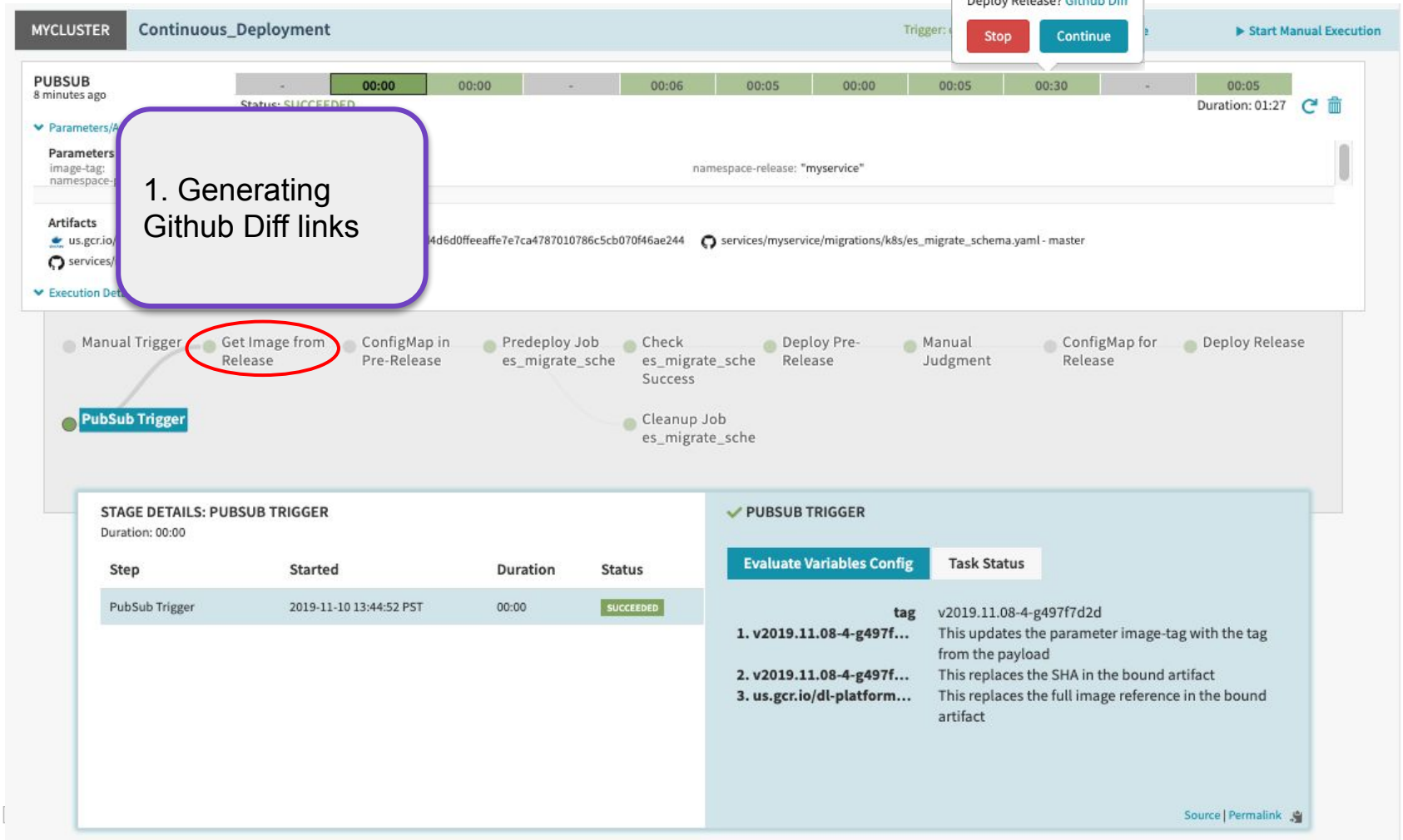
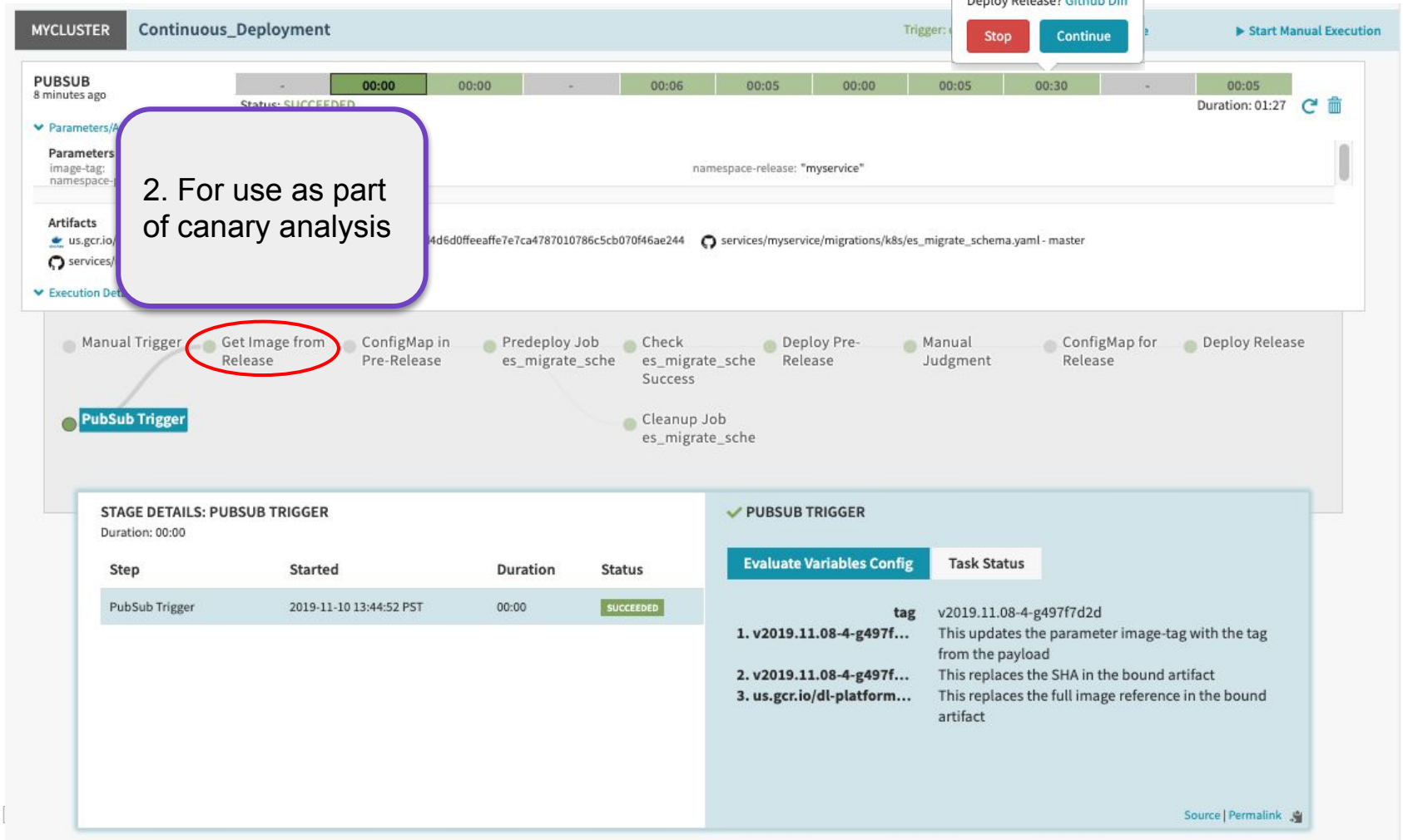

Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Duration: 01:27
Parameters
namespace-release: "myservice"
Artifacts
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
1. Generating Github Diff links
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Duration: 01:27
Parameters
namespace-release: "myservice"
Artifacts
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
2. For use as part of canary analysis
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

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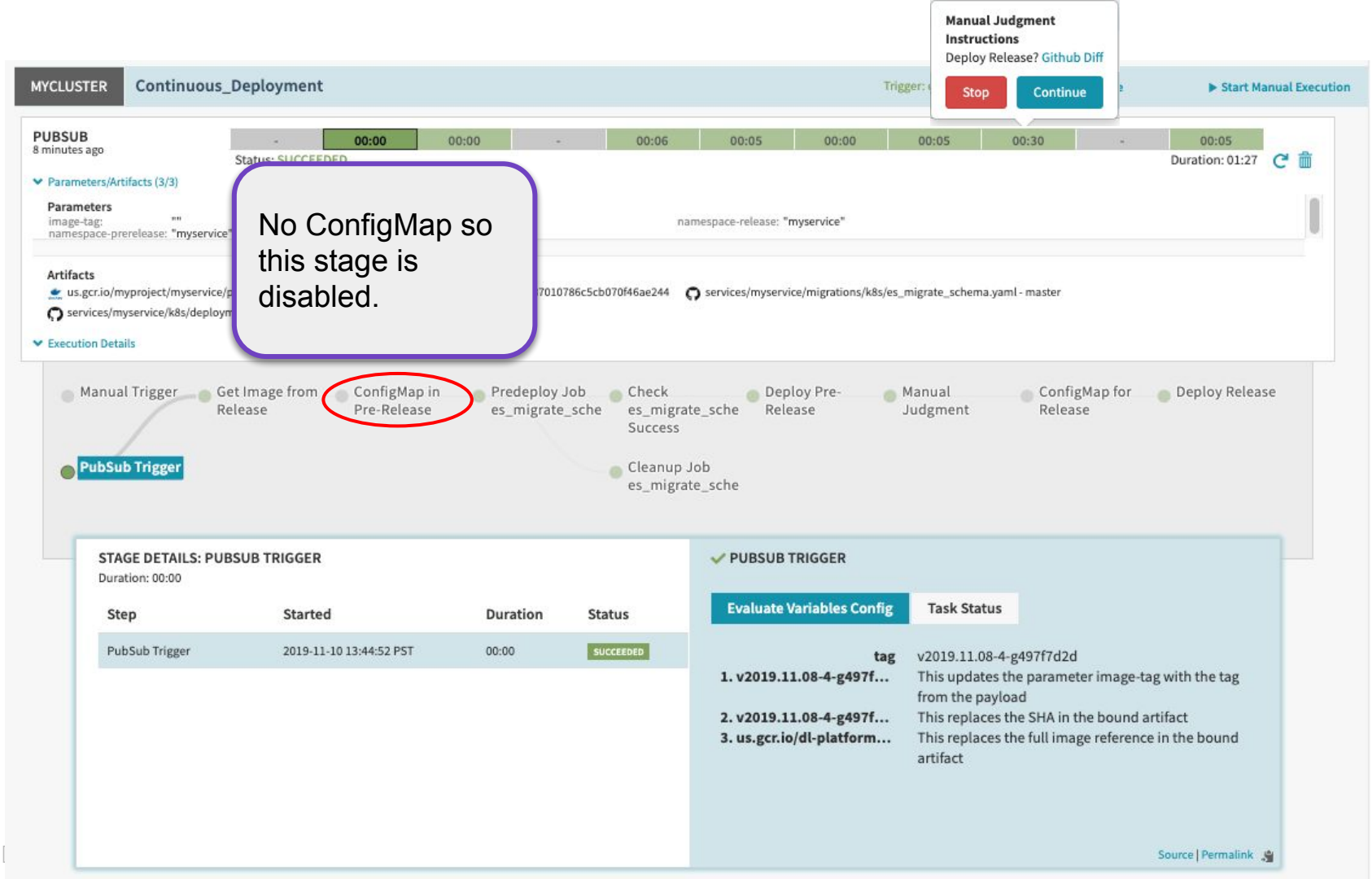
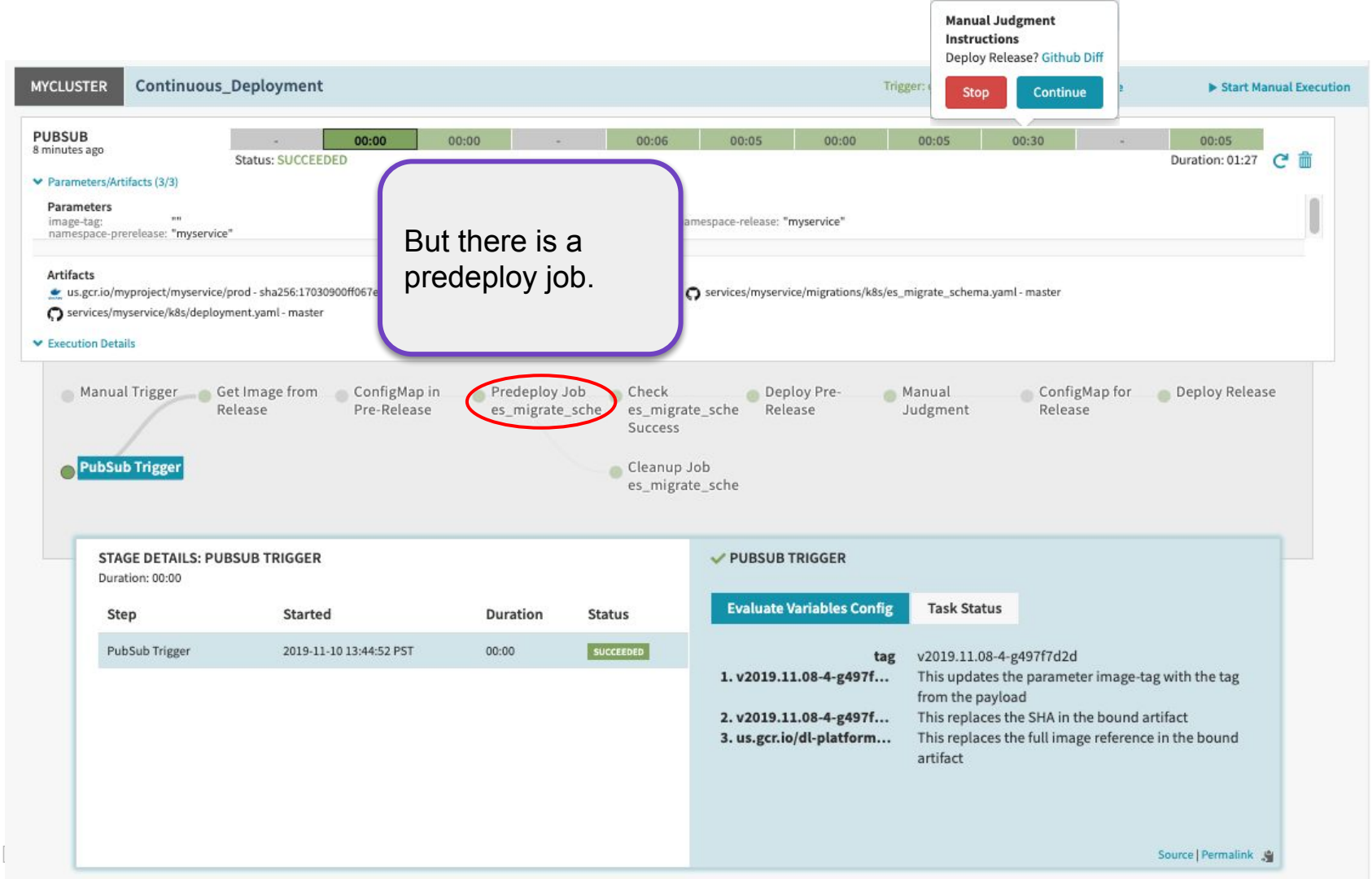
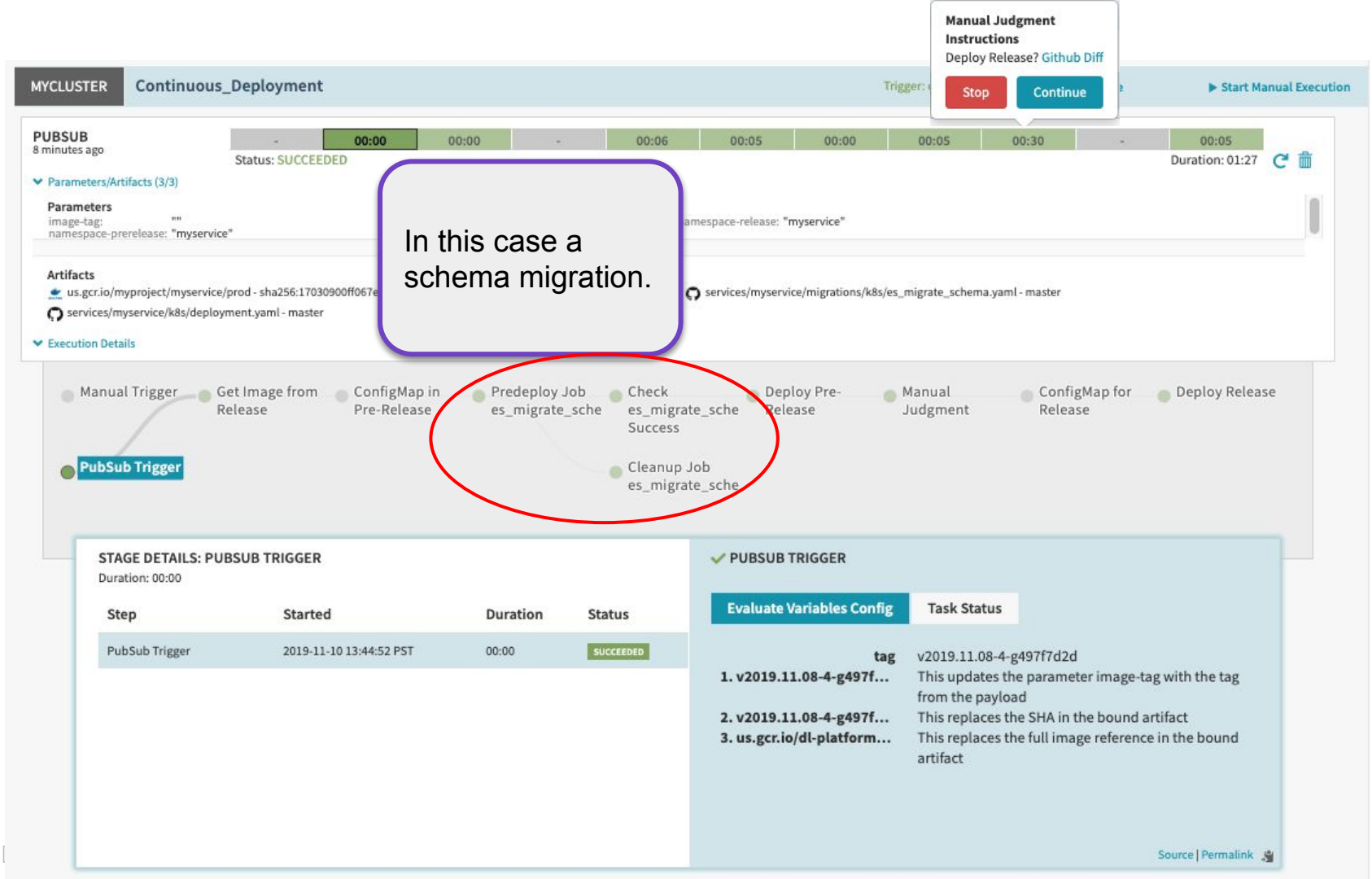

Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/p
services/myservice/k8s/deploym
7010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
Execution Details
No ConfigMap so this stage is disabled.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

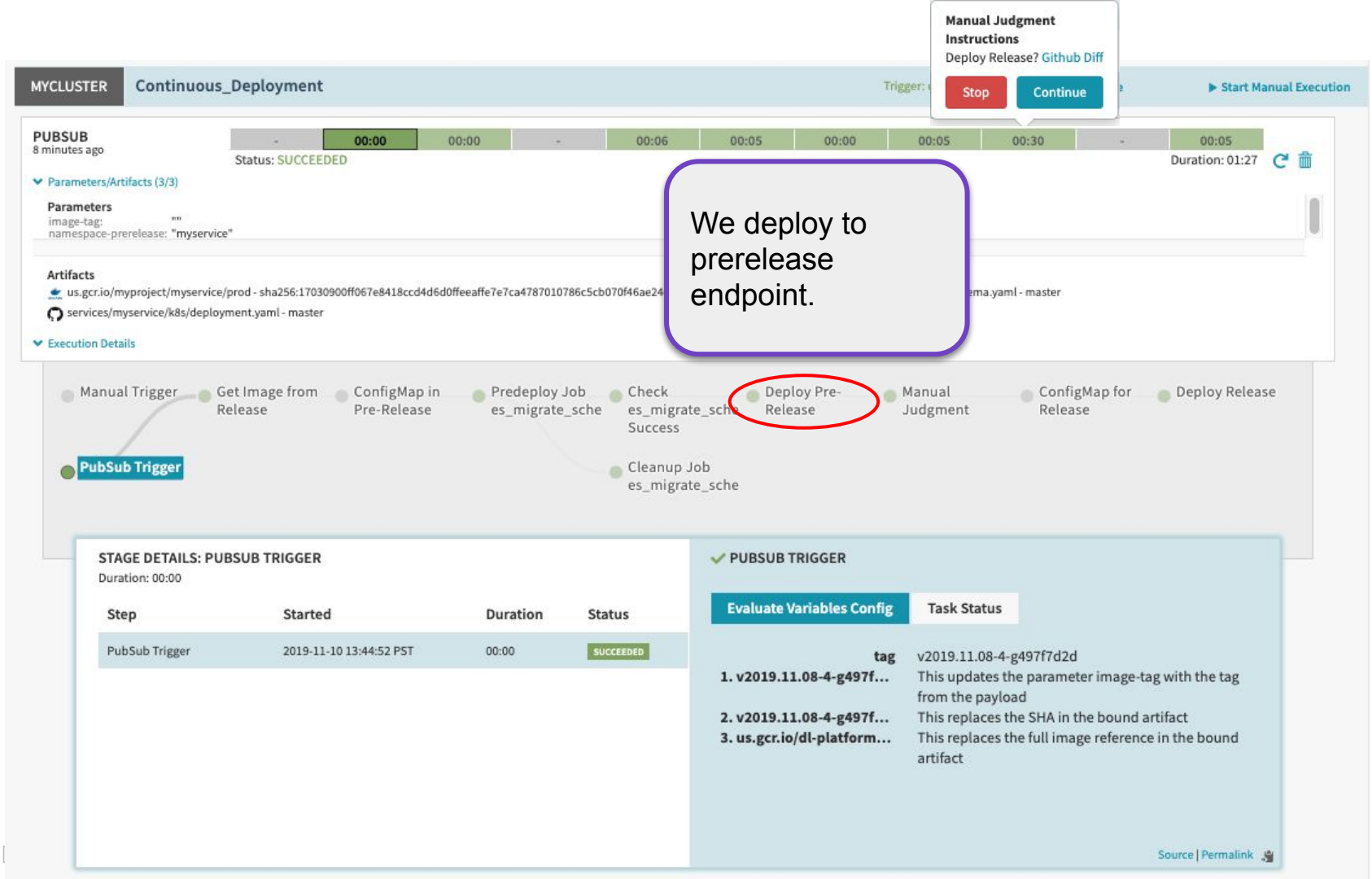
© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e
services/myservice/k8s/deployment.yaml - master
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
Execution Details
But there is a predeploy job.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

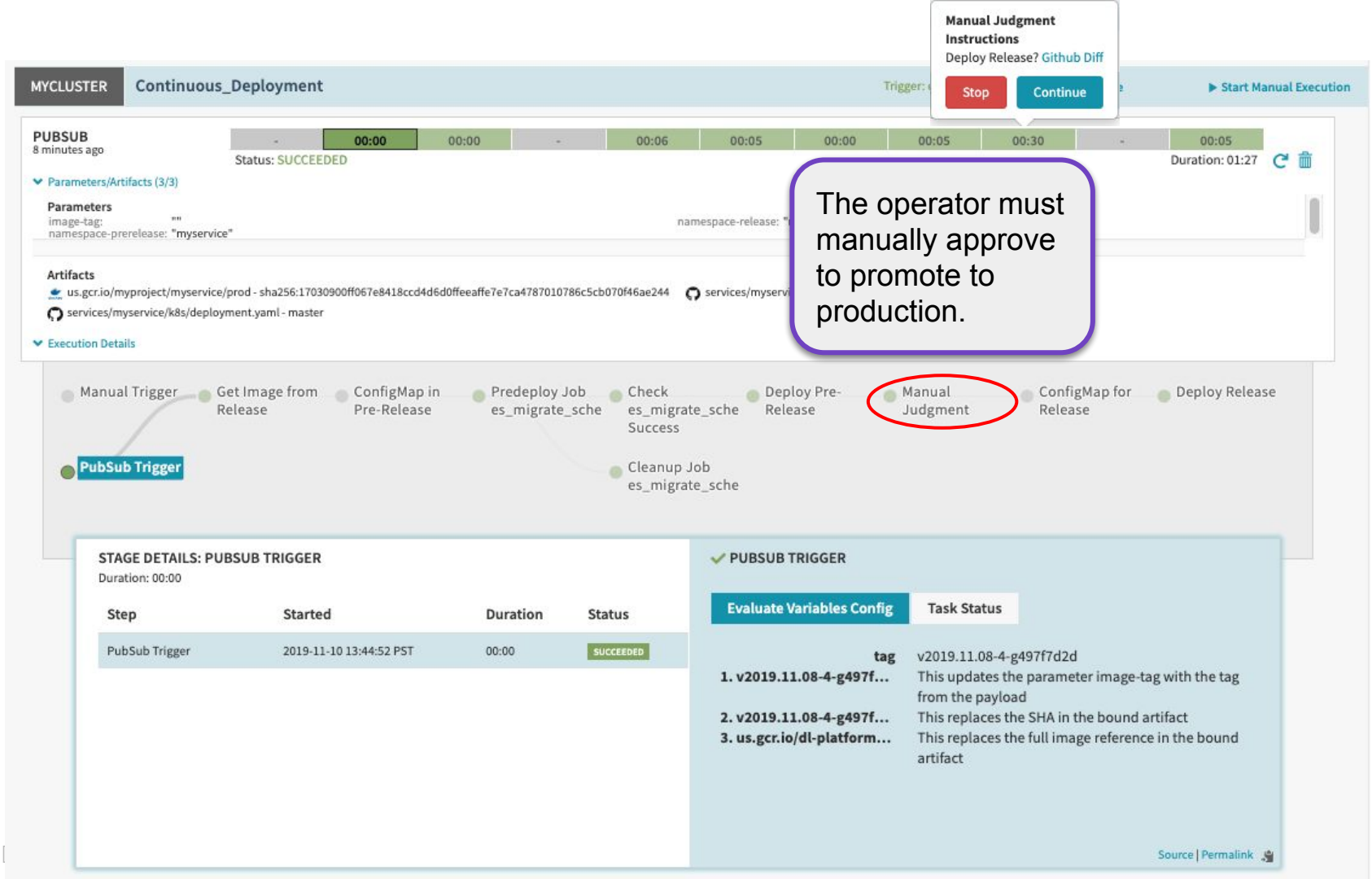
© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e
services/myservice/k8s/deployment.yaml - master
services/myservice/migrations/k8s/es_migrate_schema.yaml - master
Execution Details
In this case a schema migration.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche
Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

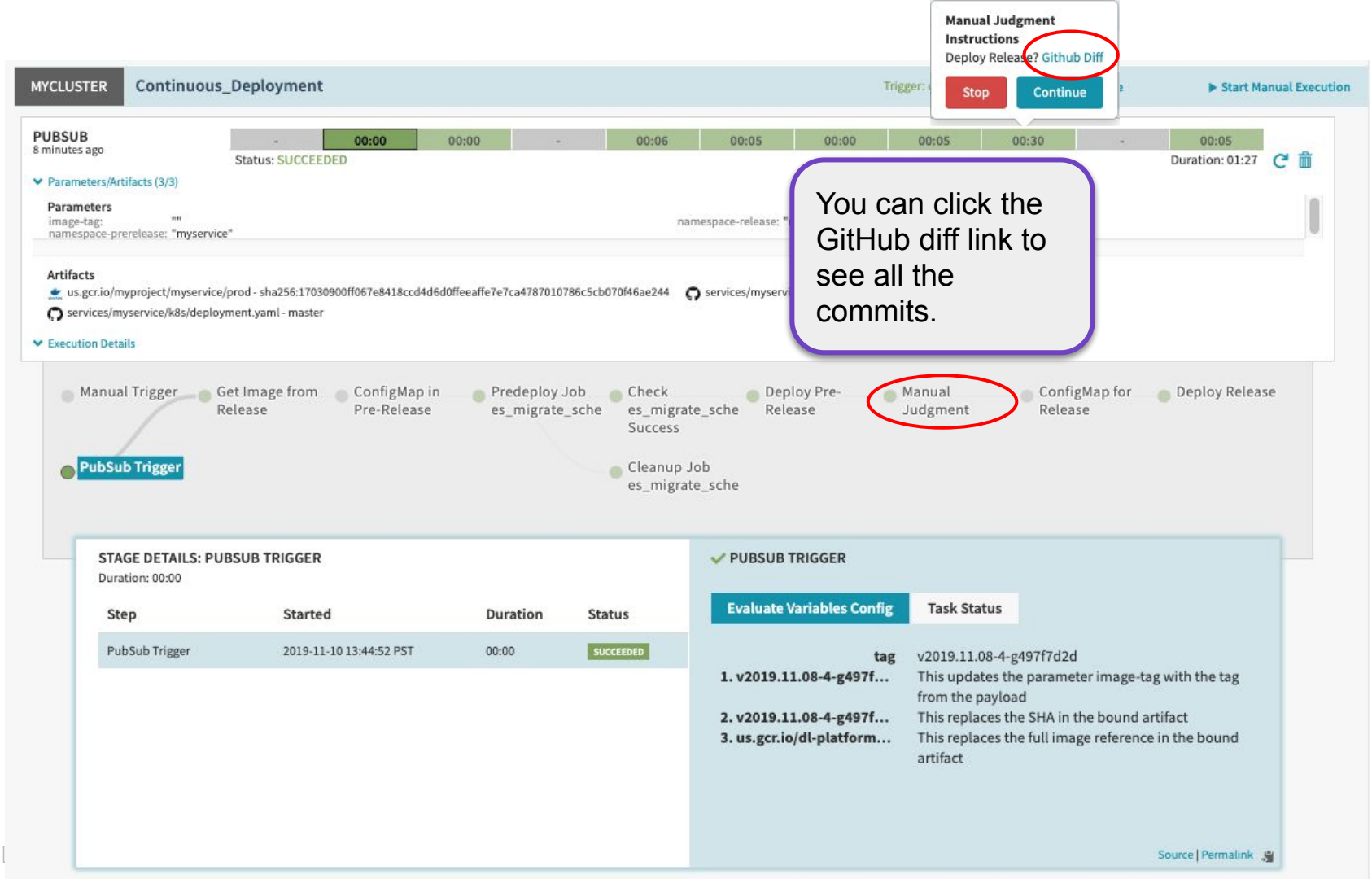
© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae24
services/myservice/k8s/deployment.yaml - master
Execution Details
We deploy to prerelease endpoint.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sch Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

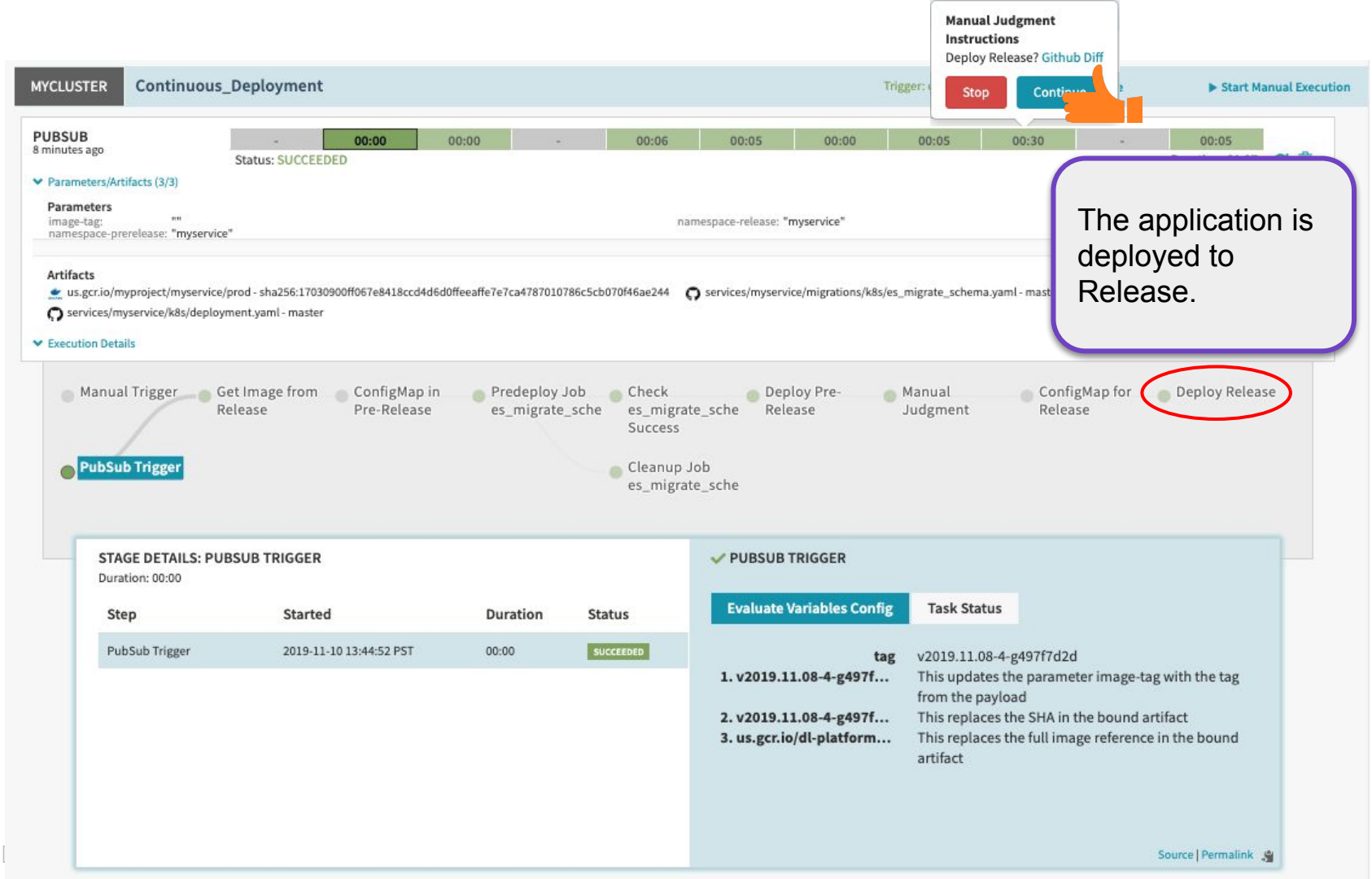
© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/k8s/deployment.yaml - master
Execution Details
The operator must manually approve to promote to production.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

© 2019 I

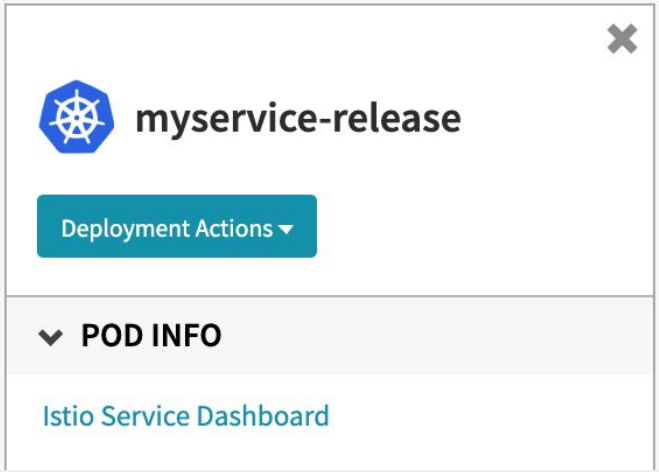

Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Duration: 01:27
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/k8s/deployment.yaml - master
Execution Details
You can click the GitHub diff link to see all the commits.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

© 2019 I


Manual Judgment
Instructions
Deploy Release? Github Diff
Stop
Continue
MYCLUSTER
Continuous_Deployment
Start Manual Execution
PUBSUB
8 minutes ago
00:00
00:00
00:06
00:05
00:00
00:05
00:30
00:05
Status: SUCCEEDED
Parameters/Artifacts (3/3)
Parameters
image-tag: ""
namespace-prerelease: "myservice"
namespace-release: "myservice"
Artifacts
us.gcr.io/myproject/myservice/prod - sha256:17030900ff067e8418ccd4d6d0ffeeaffe7e7ca4787010786c5cb070f46ae244
services/myservice/migrations/k8s/es_migrate_schema.yaml - mast
services/myservice/k8s/deployment.yaml - master
Execution Details
The application is deployed to Release.
Manual Trigger
Get Image from Release
ConfigMap in Pre-Release
Predeploy Job es_migrate_sche
Check es_migrate_sche Success
Deploy Pre-Release
Manual Judgment
ConfigMap for Release
Deploy Release
PubSub Trigger
Cleanup Job es_migrate_sche
STAGE DETAILS: PUBSUB TRIGGER
Duration: 00:00
Step
Started
Duration
Status
PubSub Trigger
2019-11-10 13:44:52 PST
00:00
SUCCEEDED
PUBSUB TRIGGER
Evaluate Variables Config
Task Status
tag
v2019.11.08-4-g497f7d2d
1. v2019.11.08-4-g497f...
This updates the parameter image-tag with the tag from the payload
2. v2019.11.08-4-g497f...
This replaces the SHA in the bound artifact
3. us.gcr.io/dl-platform...
This replaces the full image reference in the bound artifact
Source | Permalink

© 2019 I

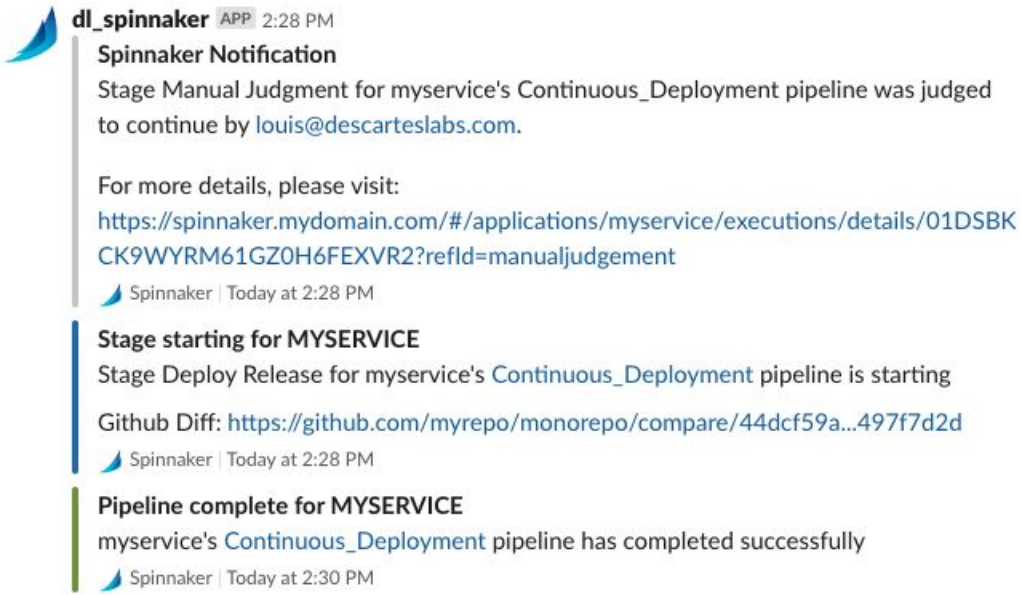
Deployment annotations let us surface monitoring links in the Clusters pane.



© 2019 I

Notifications

Dedicated Spinnaker Slack channel.



Any failed stage results in Slack notification + link to the git diff.

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Operating Pipelines

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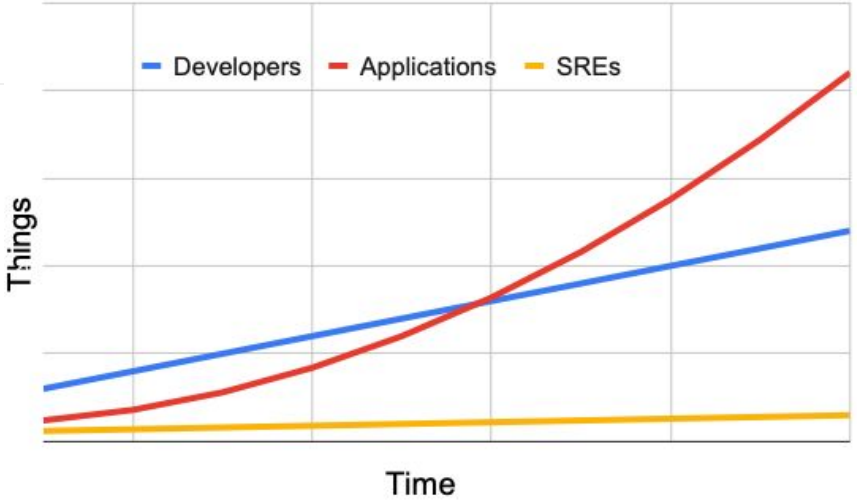
Scaling Pipeline Operations



Spinnaker provides several features that facilitate pushing pipeline operation to application developers:

- Authorization: Pipeline execution can be restricted to individual teams.
- Audit trail: Clear tracking of who executed manual triggers or approvals.
- Rich diagnostics: View deployment/pod health and logs from within the Spinnaker UI.

This means we can limit Kubernetes access from developers.

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Spinnaker Summit

Let’s recap our early experiences

Problem: Manually creating deployment pipelines for each application was error-prone and did not scale.

✔️ Pipeline templates and automated deployments

Problem: Having SREs in the critical path for adding and configuring specific application pipelines was slow and inefficient.

✔️ Self-service pipeline configuration and deployment architecture

Problem: Having SREs responsible for day-to-day operations of deployment pipelines was ineffective and does not scale.

✔️ Developers as pipeline operators

12% of SRE tickets this year mention Spinnaker

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Safer Deployments

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Safer deployments using canaries

Don’t Kubernetes Deployment rollouts use Canaries?
Yes, but:

- Simplistic canary criteria based on liveness/readiness checks.
- Slow roll-backs (if we need to revert a deployment)
- Traffic routing is related to pod counts

Great if application is broken, not so useful if your application has a higher error rate

Istio provides a mechanism for fine grained canary rollouts, along with high level metrics regarding service behavior.

Can’t Spinnaker manage traffic routing?

- Yes! But this relies on ReplicaSets and has the same traffic limitations as above.

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What is a baseline?

Our original canary pipeline compared the Canary to the Release deployment.

This has several issues:

- The Release deployment is stable or scaling down, while the Canary is scaling up.
  - The Canary sees more traffic volume per pod.
- The Release deployment is warmed up.
  - Cache, open upstream connections, etc.
- The Release deployment may have slow burning problems.
  - Slow memory leak also present in Canary masks newly introduced problem.

Using a Baseline deployment under the same conditions is the best way to make a meaningful comparison between application versions.

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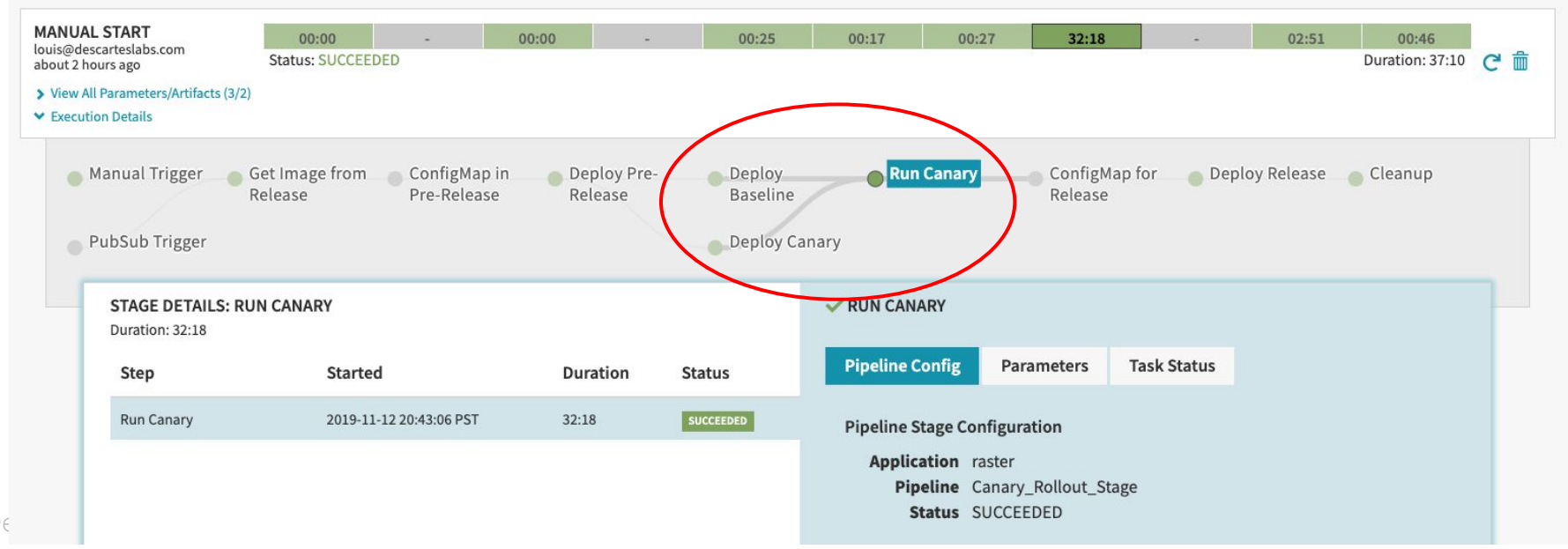
How does this change our Continuous_Deployment pipeline?

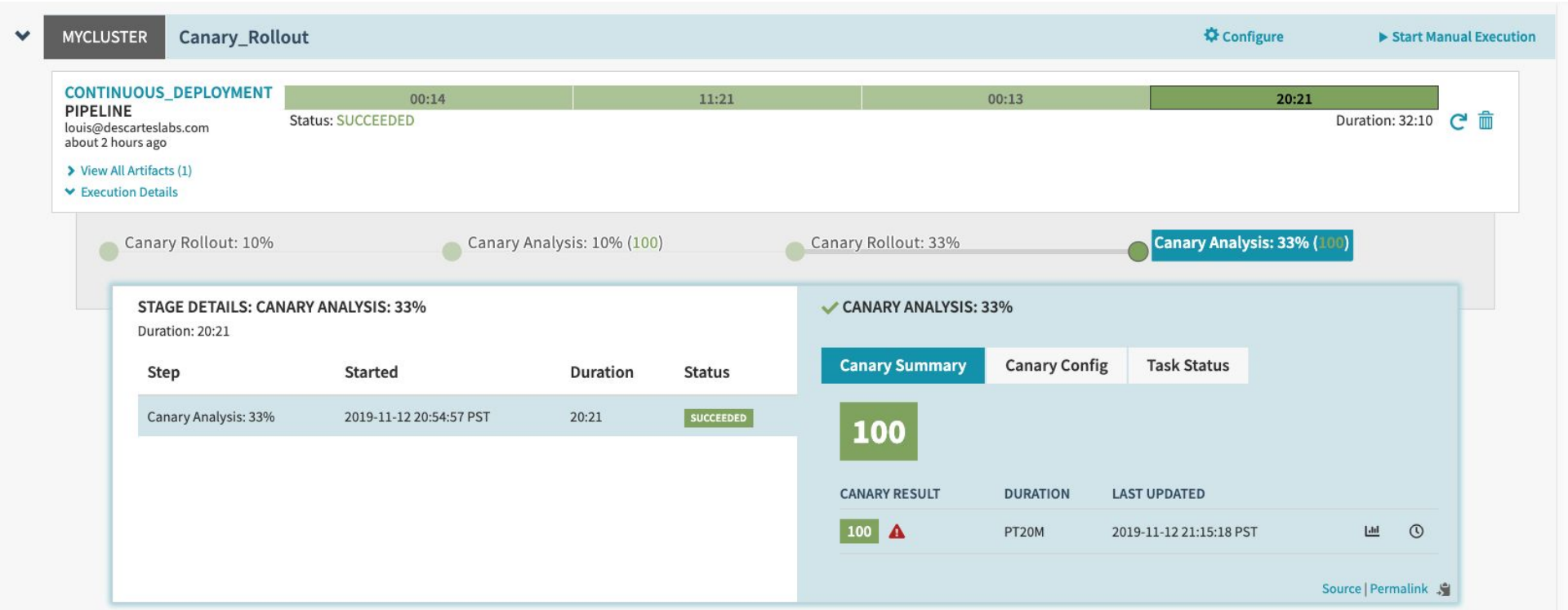
Almost exactly the same before except the **Manual Approval** stage replaced with:

- Deploy Baseline (copy of Release) and Canary (new image deployment)
- Run the Canary Rollout (this is an external pipeline)



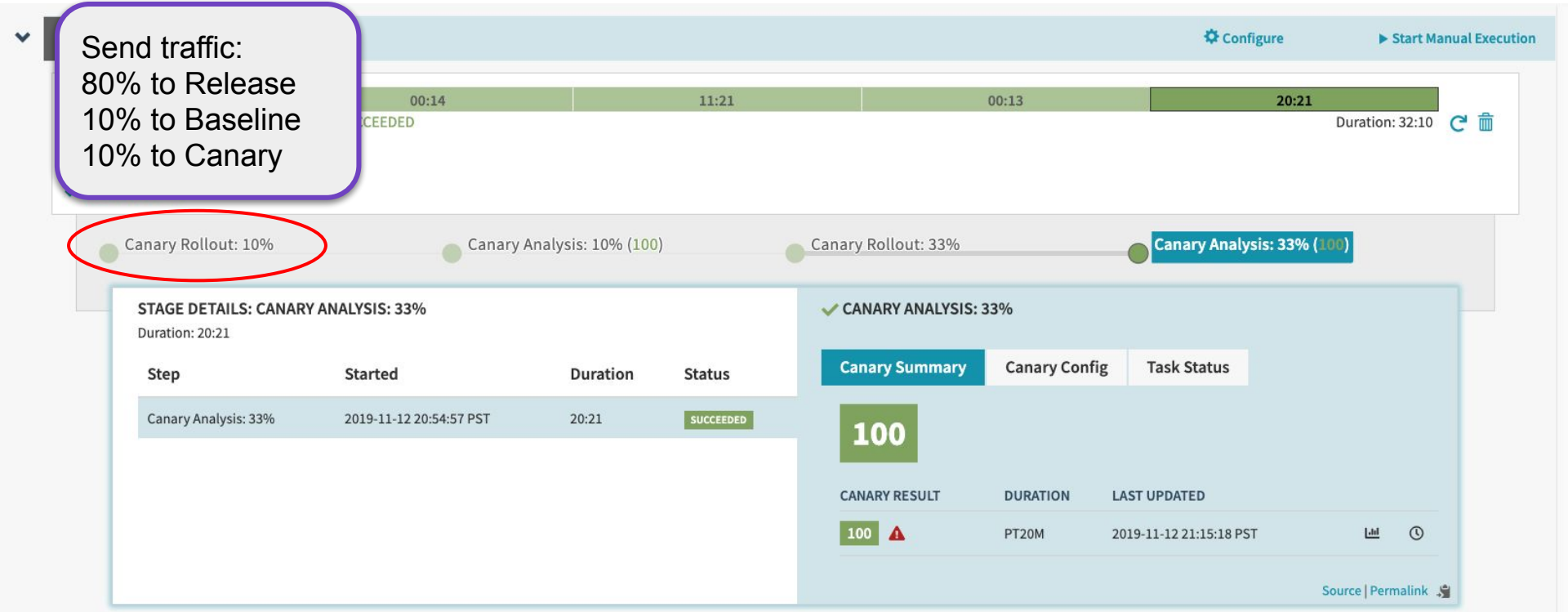
© 2019 De

The Canary_Rollout pipeline



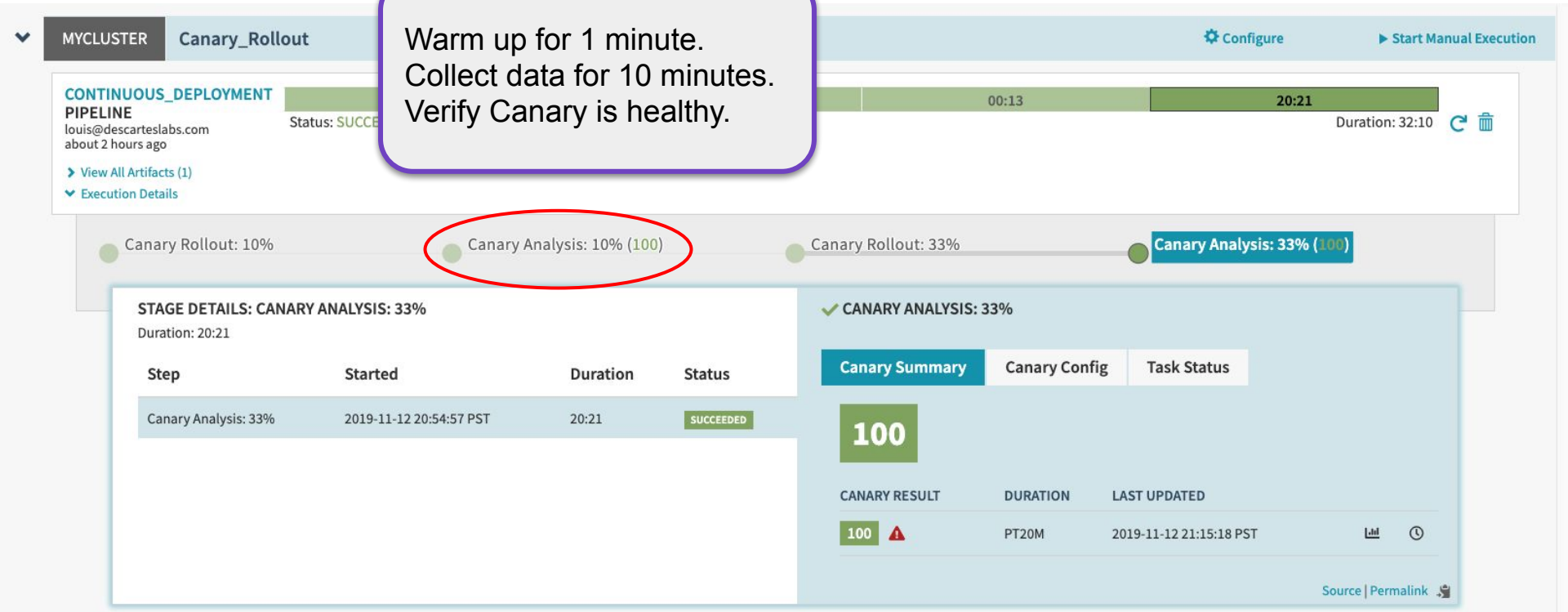
The Canary_Rollout pipeline

Send traffic:
80% to Release
10% to Baseline
10% to Canary

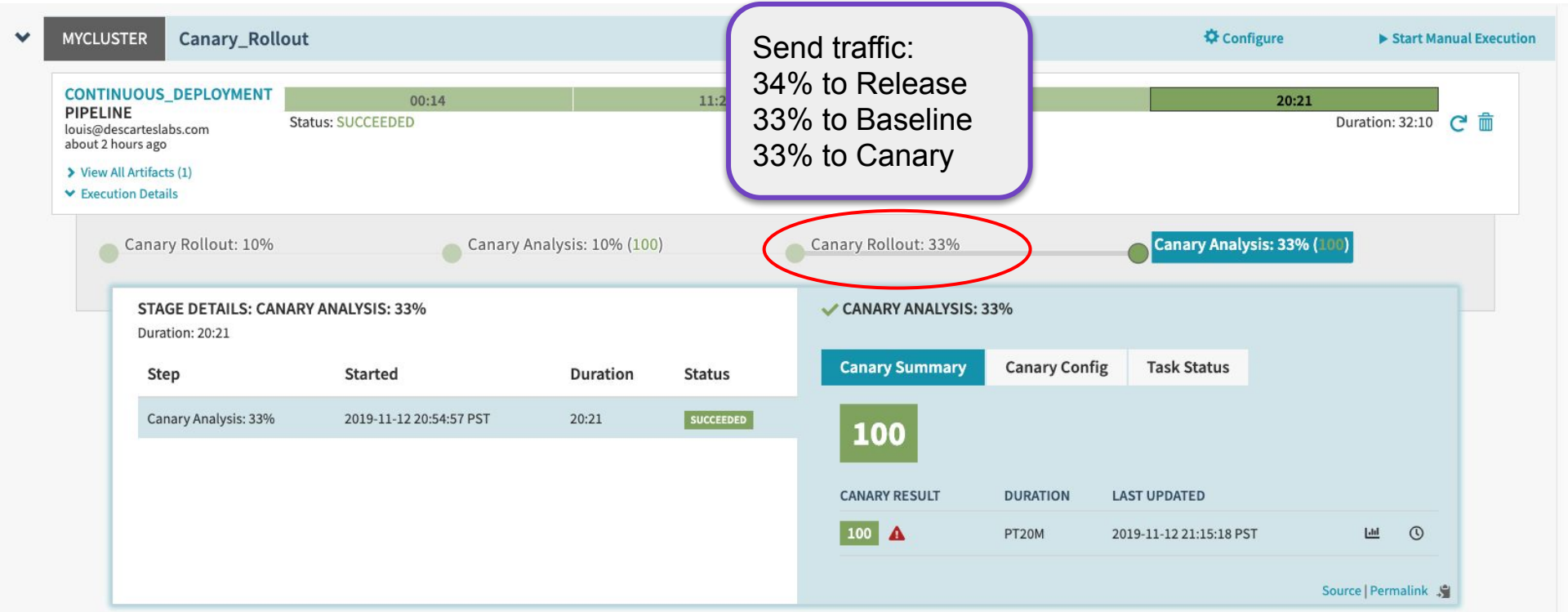


The Canary_Rollout pipeline

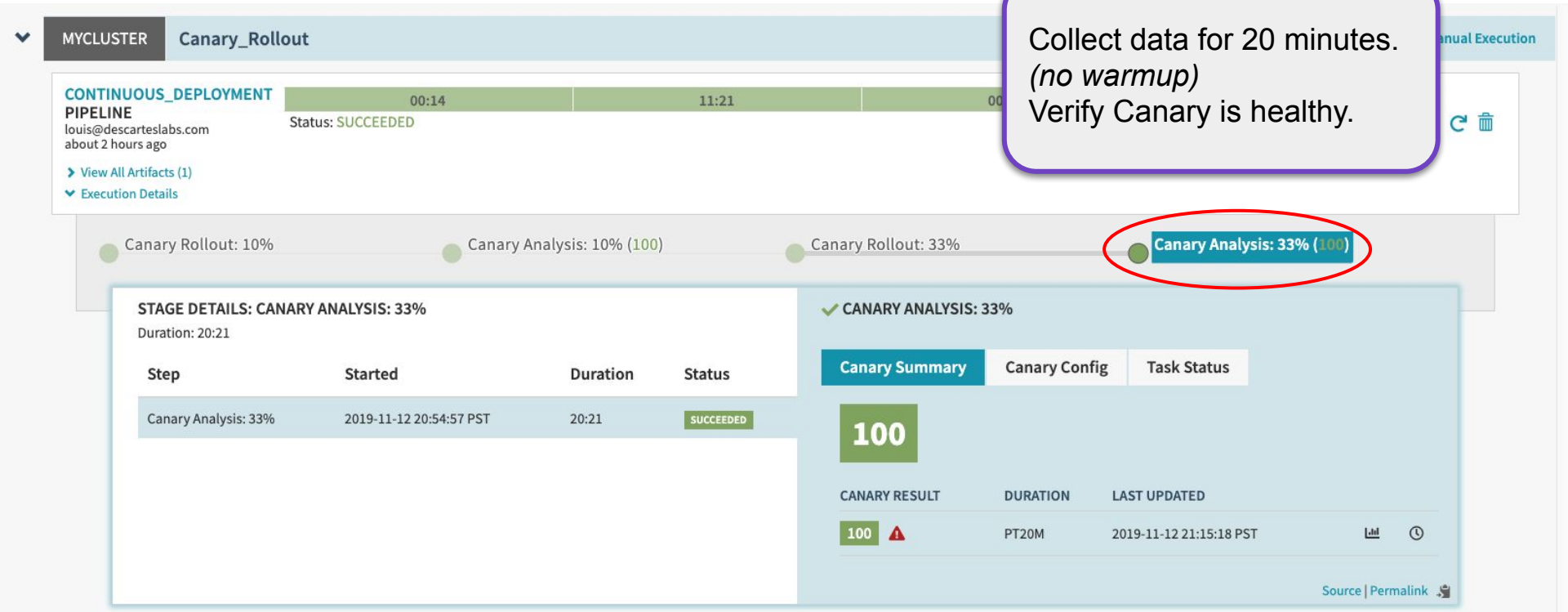
Warm up for 1 minute.
Collect data for 10 minutes.
Verify Canary is healthy.



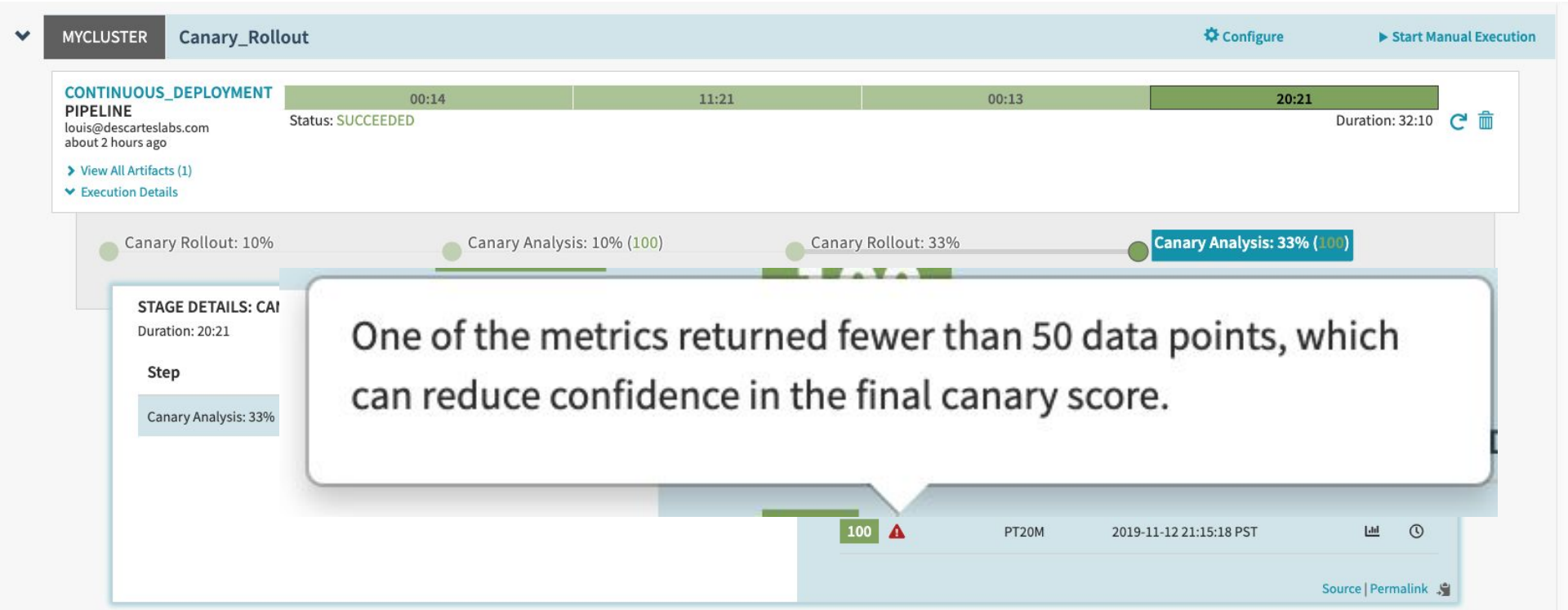
The Canary_Rollout pipeline



The Canary_Rollout pipeline



The Canary_Rollout pipeline



Defining Metrics

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METRICS

ALL | ISTIO METRICS | KUBERNETES METRICS

Add Group

METRIC NAME	GROUPS				
Healthy Responses	Istio Metrics	Edit	Move Group	Copy	Delete
95th Percentile Latency	Istio Metrics	Edit	Move Group	Copy	Delete
CPU Utilization	Kubernetes Metrics	Edit	Move Group	Copy	Delete
Memory Utilization	Kubernetes Metrics	Edit	Move Group	Copy	Delete

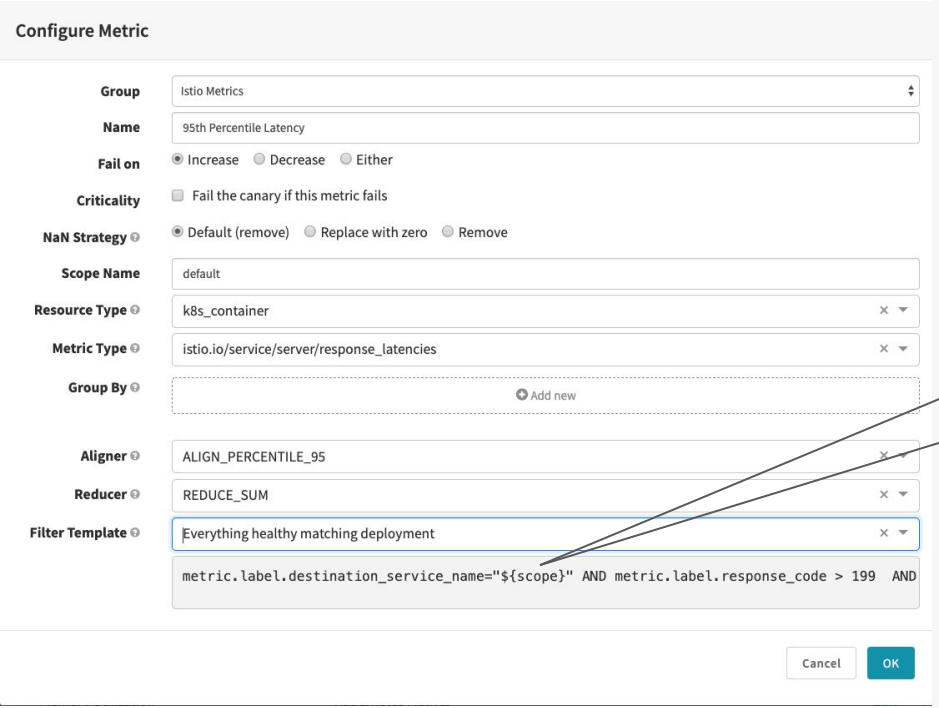
Add Metric

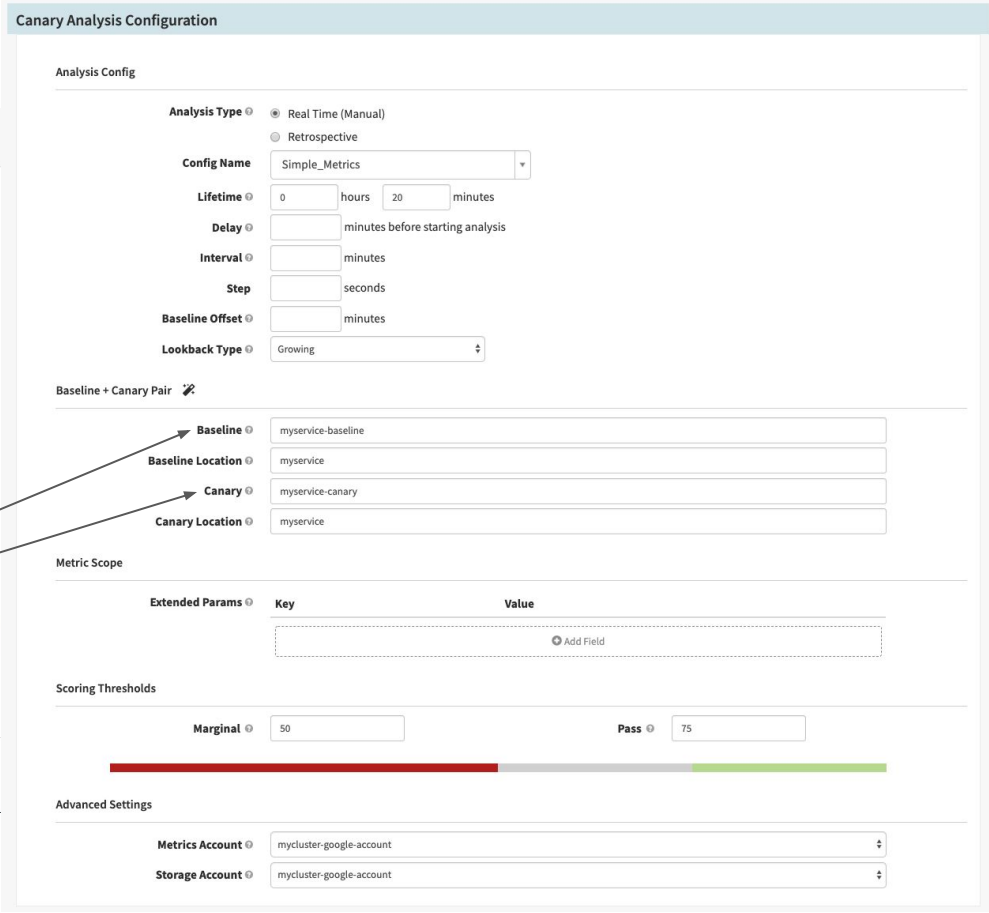
SCORING

Metric Group Weights

Istio Metrics	60
Kubernetes Metrics	40

Configuring Metrics & Analysis





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Steering Traffic

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Dynamically steering traffic with Spinnaker and Istio

Pipeline JSON

```
"stages": [
  {
    "name": "Canary Rollout: 10%",
    "release-weight": 80,
    "baseline-weight": 10,
    "canary-weight": 10,
    "cloudProvider": "kubernetes",
    "account": "mycluster",
    "manifestArtifactAccount": "github-artifact-account",
    "manifestArtifactId": "myservice-virtualservice-manifest",
    "moniker": {
      "app": "myservice"
    },
    "refId": "update-virtualservice10",
    "source": "artifact",
    "type": "deployManifest"
  },
```

Istio VirtualService Manifest

```
- match:
  - uri:
      prefix: /myservice/
  rewrite:
    uri: /
  route:
  - destination:
      host:  myservice-release.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["release-weight"]}
  - destination:
      host:  myservice-baseline.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["baseline-weight"]}
  - destination:
      host:  myservice-canary.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["canary-weight"]}
```

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Dynamically steering traffic with Spinnaker and Istio

Pipeline JSON

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  {
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  - destination:
      host:  myservice-baseline.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["baseline-weight"]}
  - destination:
      host:  myservice-canary.myservice.svc.cluster.local
      port:
        number: 8000
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```

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Dynamically steering traffic with Spinnaker and Istio

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      port:
        number: 8000
    weight: ${#root["release-weight"]}
  - destination:
      host:  myservice-baseline.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["baseline-weight"]}
  - destination:
      host:  myservice-canary.myservice.svc.cluster.local
      port:
        number: 8000
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```

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Dynamically steering traffic with Spinnaker and Istio

Pipeline JSON

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  {
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  - destination:
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      port:
        number: 8000
    weight: ${#root["release-weight"]}
  - destination:
      host:  myservice-baseline.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["baseline-weight"]}
  - destination:
      host:  myservice-canary.myservice.svc.cluster.local
      port:
        number: 8000
    weight: ${#root["canary-weight"]}
```

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Canary Rollout Questions

Q: Why 10% and 33%?

10% provides enough metric volume for many services

- While keeping user impact fairly small

33% of traffic is statistically representative

- We can't go above 50% (*Canary* vs *Baseline*)

Q: Are two canary stages enough?

More stages = more complexity and slower deployment rollout

Q: Are there scaling problems?

- Scaling up: Benefit of comparing against baseline (both under same conditions)
- Reversion shock: Our custom HPA for *Release* can scale based on *total* traffic.

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Analysis Results

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Delivery

PIPELINES | CANARY CONFIGS | CANARY REPORTS

HIDE DETAILS

100
PASS

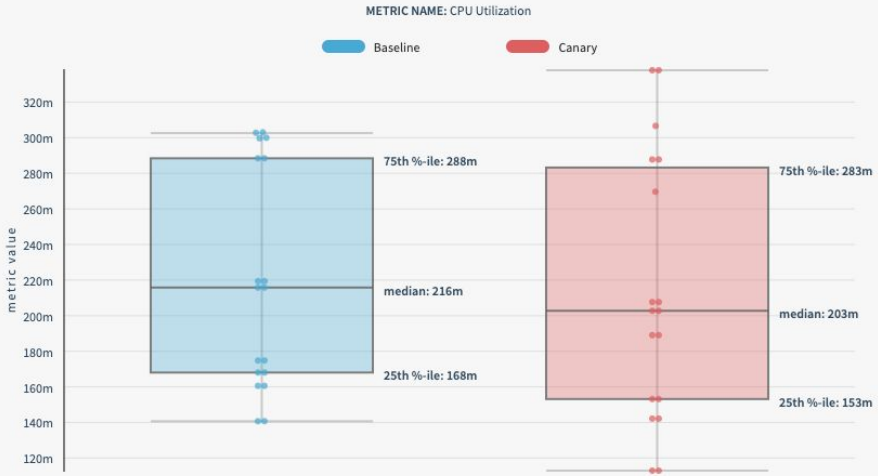
Simple_Metrics

BASELINE	CANARY	TIME	THRESHOLD	SOURCE
SCOPE: raster-baseline	SCOPE: raster-canary	START: 2019-11-12 20:54:57 PST	MARGINAL: 50	Report
LOCATION: raster	LOCATION: raster	END: 2019-11-12 21:14:57 PST	PASS: 75	Metrics
		STEP: 1 min		

ALL | ISTIO METRICS | KUBERNETES METRICS

METRIC NAME	DEVIATION	RESULT
95th Percentile Latency	+6.7%	Pass
CPU Utilization	-2.5%	Pass
Healthy Responses	+7.5%	Pass
Memory Utilization	-0.7%	Pass

GRAPH: Time Series | Histogram | Beeswarm Box Plot



Copy this Metric URL | Explore More Data in Atlas

	START	COUNT	AVG	MAX	MIN
Baseline	2019-11-12 20:55:57 PST	18	0.219	0.303	0.141
Canary	2019-11-12 20:55:57 PST	18	0.214	0.338	0.113

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Delivery

PIPELINES | CANARY CONFIGS | CANARY REPORTS

HIDE DETAILS

60
MARGINAL
Simple_Metrics

BASELINE
SCOPE: raster-baseline
LOCATION: raster

CANARY
SCOPE: raster-canary
LOCATION: raster

TIME
START: 2019-11-11 20:21:10 PST
END: 2019-11-11 20:31:10 PST
STEP: 1 min

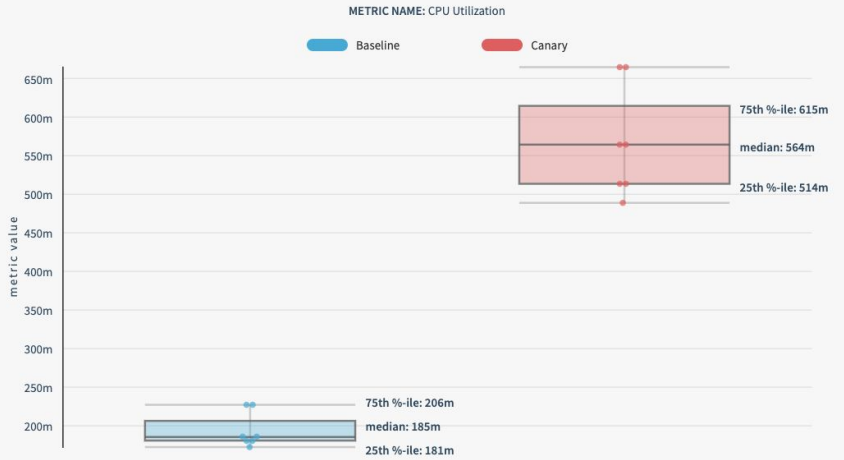
THRESHOLD
MARGINAL: 50
PASS: 75

SOURCE
Report
Metrics

ALL | ISTIO METRICS | KUBERNETES METRICS

METRIC NAME	DEVIATION	RESULT
95th Percentile Latency	-4.9%	Pass
CPU Utilization	+192.3%	High
Healthy Responses	+23.1%	Pass
Memory Utilization	+34.1%	High

GRAPH: Time Series | Histogram | Beeswarm Box Plot



Copy this Metric URL | Explore More Data in Atlas

CLASSIFICATION REASON
CPU Utilization was classified as High

	START	COUNT	AVG	MAX	MIN
Baseline	2019-11-11 20:22:10 PST	7	0.194	0.227	0.172
Canary	2019-11-11 20:22:10 PST	7	0.568	0.665	0.489

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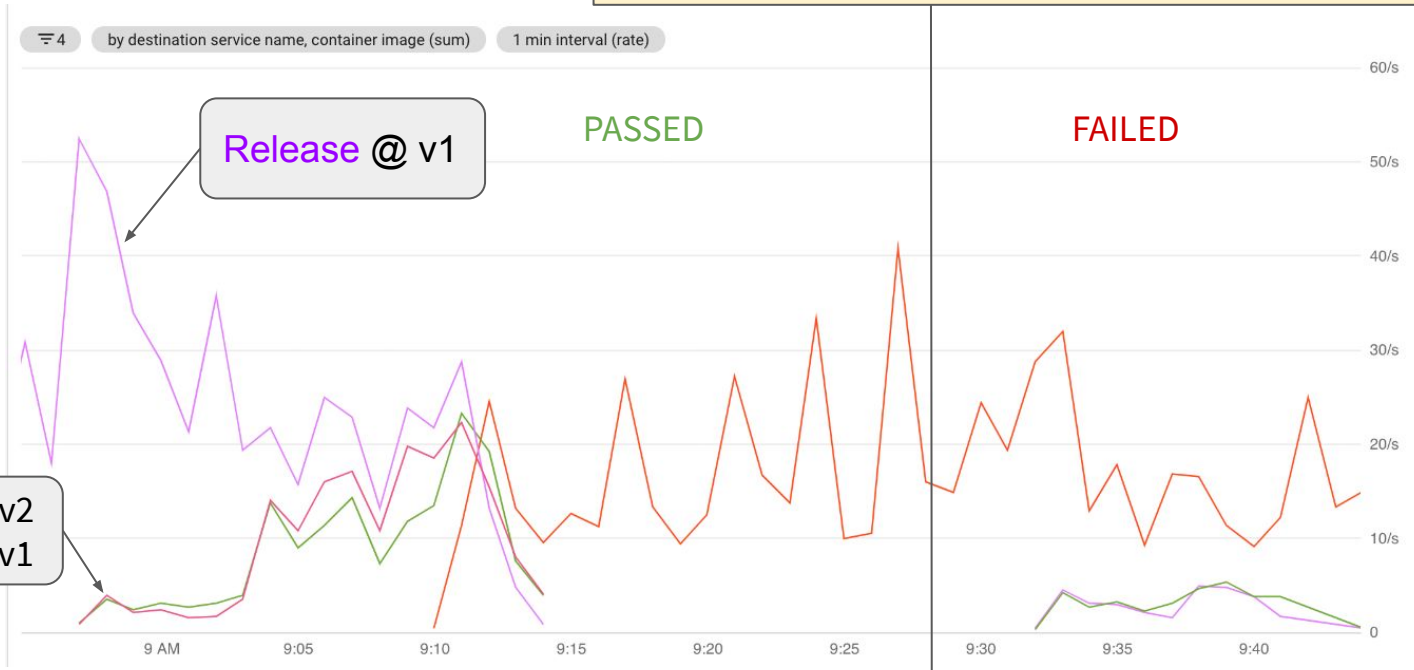
A tale of two canaries

A canary rollout is started for image: version2



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A tale of two canaries

10% of traffic is going to Canary and 10% to Baseline

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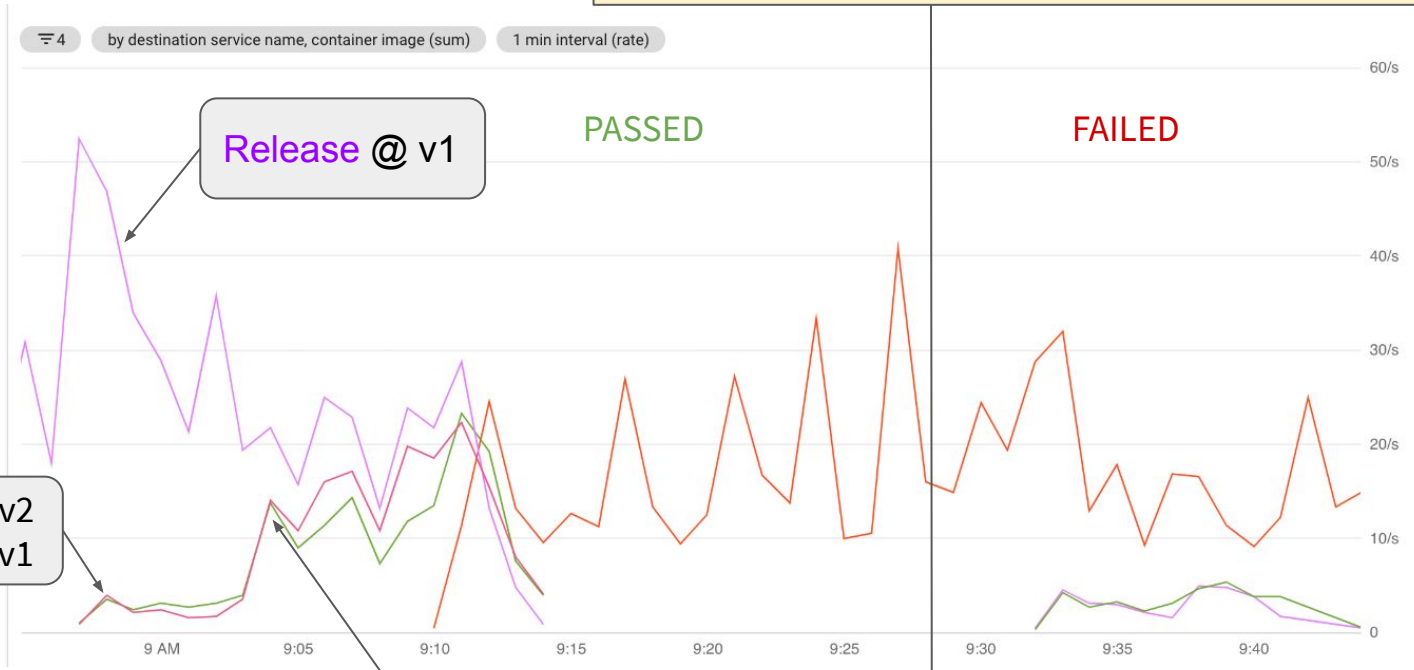
Spinnaker Summit

A tale of two canaries

The first canary stage passes, so we send 33% of traffic to Canary (and Baseline).



Canary @ v2
Baseline @ v1

Canary 33%
Baseline 33%
Release 34%

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A tale of two canaries

The second canary succeeds. We start a rolling deployment of Release using the version2 image.

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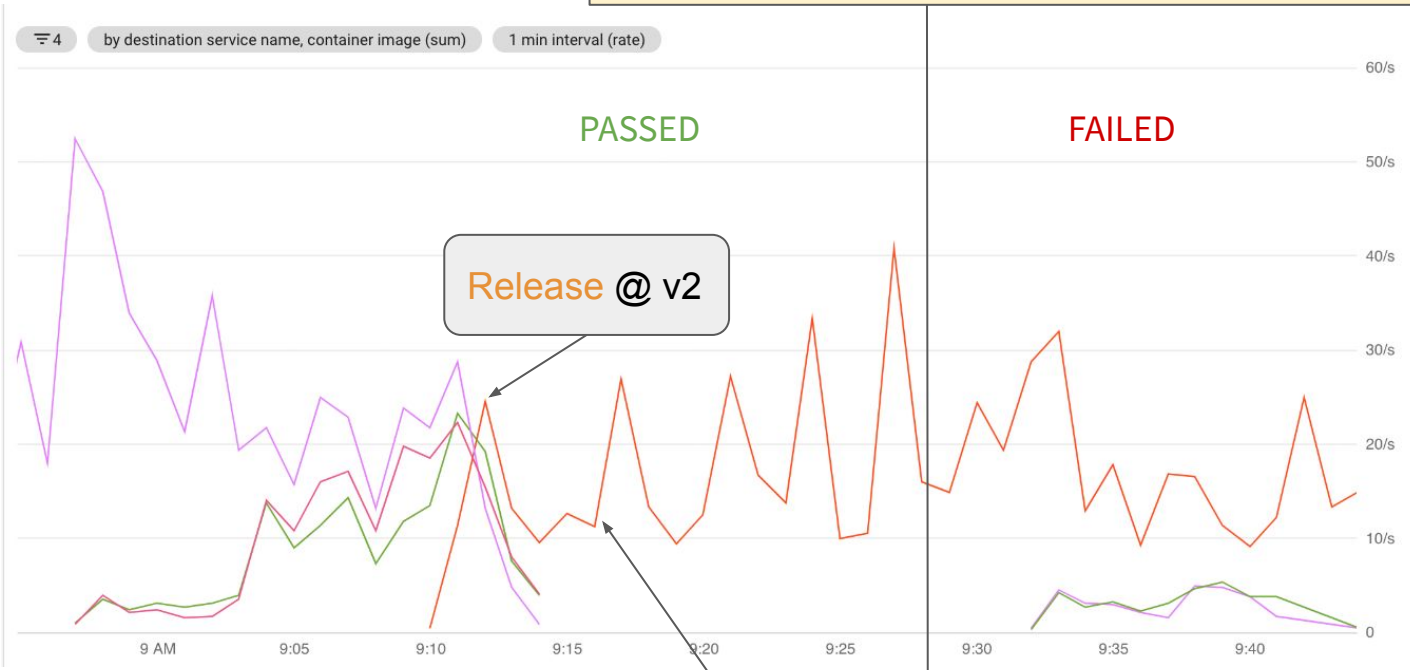
A tale of two canaries

The pipeline succeeds, we start sending 100% of traffic to Release and delete Canary and Baseline.



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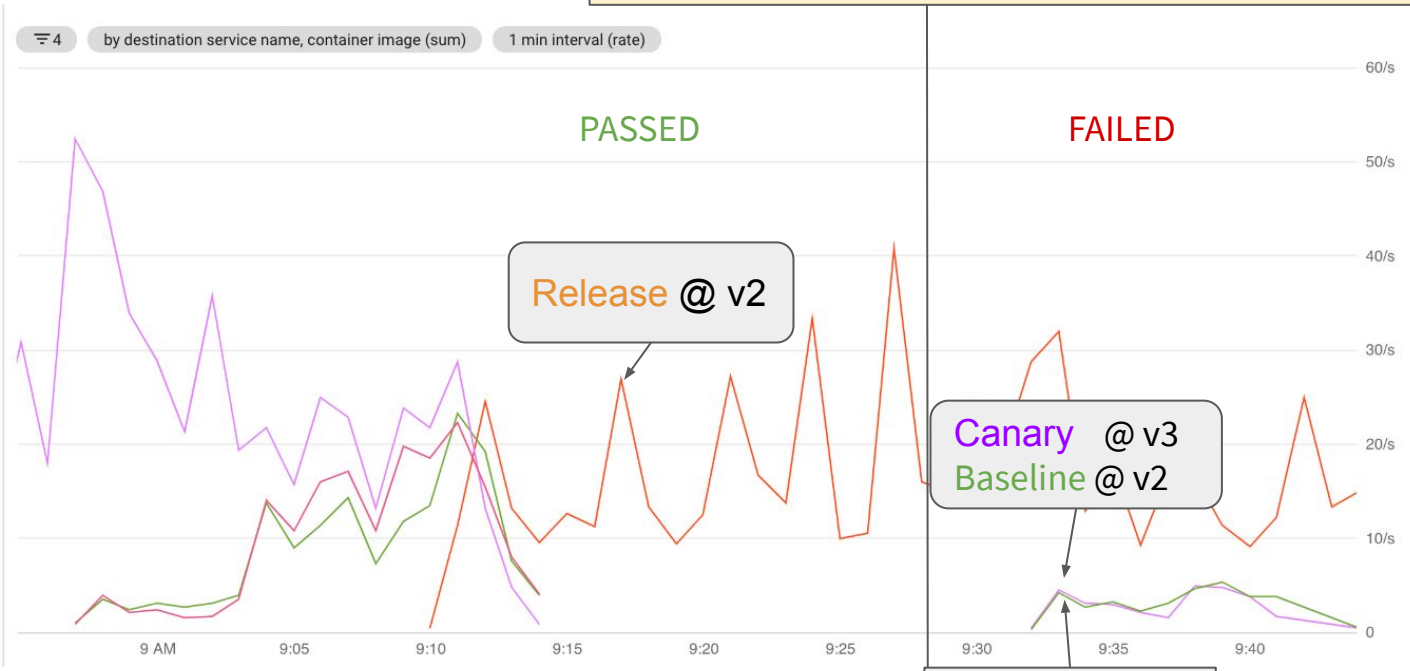
A tale of two canaries

We start a canary rollout for image: version3



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A tale of two canaries

The first (10%) canary fails

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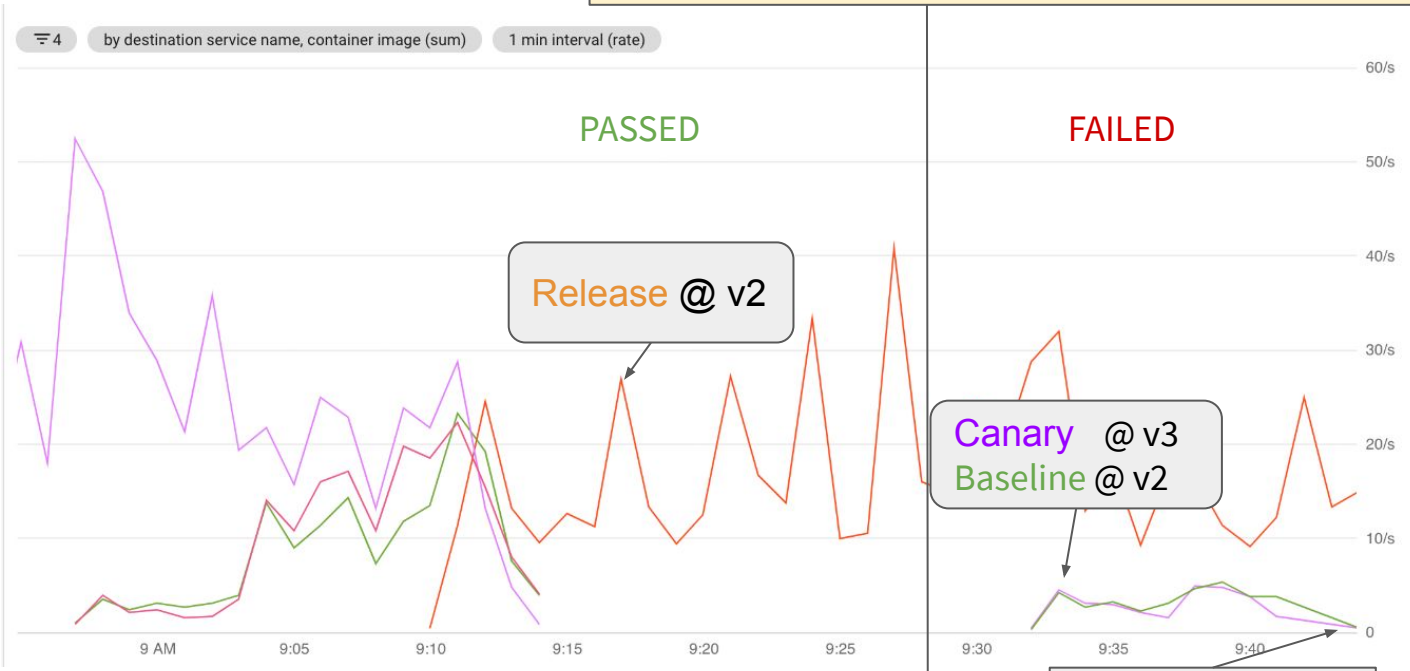
A tale of two canaries

The pipeline fails, we start sending 100% of traffic to Release and delete Canary and Baseline.



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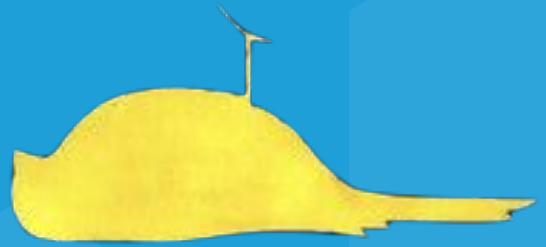

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How does this all work out? The numbers

16 services actively deployed by our *Continuous_Delivery* pipeline

Averaging **Three** deploys per day for each service
- Fewer make it to the Release endpoint

Zero rollbacks in the past three months

Four engineer months spent on Spinnaker tickets in the past twelve months
- Includes lots of operational time (fixing, debugging, upgrading, etc).

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Conclusions

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What’s next for us?

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Spinnaker Summit

Thank you! Questions?

https://github.com/louisvernon/SpinnakerSummit2019

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