Kubernetes - Part 6

Solar Team

Version: 1.1

Kubernetes Deployment Strategies

- RollingUpdate Deployment
- Recreate Deployment
- Advance Strategies
  - Blue/green deployment
  - Canary deployment
    - By Label Selectors
    - By Header (using Nginx Controller)
    - By Weight (using Nginx Controller)

RollingUpdate Deployment

- The Deployment updates Pods in a rolling update fashion.
- RollingUpdate Deployments support running multiple versions of an application at the same time.
- Specify maxUnavailable and maxSurge value to control the rolling update process.
- The value can be an absolute number (for example, 5) or a percentage of desired Pods.
- MaxSurge indicates how many extra pods(over the desired number) we are willing to run during a rolling update.
- MaxUnavailable indicates how many pods we can lose during the rolling update.
- Both parameters can be zero (but not at the same time), the default value is 25%.
- progressDeadlineSeconds - the maximum time in seconds(defaults to 600) for a deployment to make progress before it is considered to be failed.
- revisionHistoryLimit specifies the number(default to 10) of old ReplicaSets to retain to allow rollback.

Updating a Deployment

- A Deployment's rollout is triggered if and only if the Deployment's Pod template (that is, .spec.template) is changed, for example if the labels or container images of the template are updated.
- Other updates, such as scaling the Deployment, do not trigger a rollout.
- Update your Deployment by:
  - kuberctl apply
  - kubectl set
  - kubectl edit
  - kubectl patch
- Checking the rollout status
  - kubectl rollout status
  - kubectl get deployments
  - kubectl get rs
  - kubectl get pods
- Rollover (aka multiple updates in-flight)
- Pod-template-hash label (Caution: Do not change this label.)

Updating a Deployment - Example

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app
 namespace: default
spec:
 replicas: 3
 selector:
   matchLabels:
     app: hello-app
 template:
   metadata:
     labels:
       app: hello-app
   spec:
     containers:
     - image:
gcr.io/google-samples/hello-app:1.0
       imagePullPolicy: IfNotPresent
       name: hello-app
       resources: {}
     restartPolicy: Always
```

hello-app-deploy.yml

- kubectl apply -f hello-app-deploy.yml
- kubectl rollout status deploy hello-app
- kubectl rollout history deploy hello-app
- kubectl get deploy hello-app -oyaml > apply-v1.yml
- kubectl apply -f hello-app-deploy-chg-image.yml --record
- kubectl get deploy hello-app -oyaml > apply-v2.yml
- OR kubectl set image deploy hello-app hello-app=gcr.io/google-samples/hello-app:2.0 --record
- kubectl rollout history deploy hello-app

Rolling Update - History, Undo, Pause and Resume

- Check the revisions of this Deployment
  - kubectl rollout history <deployment>
- To see the details of each revision
  - kubectl rollout history <deployment> --revision=<revision number>
- Rolling Back to a Previous Revision
  - kubectl rollout undo <deployment>
- Rollback to a specific revision
  - kubectl rollout undo <deployment> --to-revision=<revision number>
- Pause a Deployment before triggering one or more updates
  - kubectl rollout pause <deployment>
- Resume the Deployment
  - kubectl rollout resume <deployment>

Rolling Update

- kubectl rollout history deploy hello-app
- kubectl rollout history deploy hello-app --revision 2
- kubectl rollout undo deploy hello-app
- OR kubectl rollout undo deploy hello-app [--to-revision ?]
- kubectl edit deploy hello-app # don't keep a record
- kubectl rollout history deploy hello-app
- Wrong image version!
  - kubectl set image deploy hello-app hello-app=gcr.io/google-samples/hello-app:3.0 --record
- Pause/Resume example
  - kubectl rollout pause deployment hello-app
  - kubectl set image deploy hello-app hello-app=gcr.io/google-samples/hello-app:1.0 --record # what happen!
  - kubectl rollout resume deployment hello-app

Recreate Deployment

- All existing Pods are killed before new ones are created.
- .spec.strategy.type==Recreate
- Expect downtime.

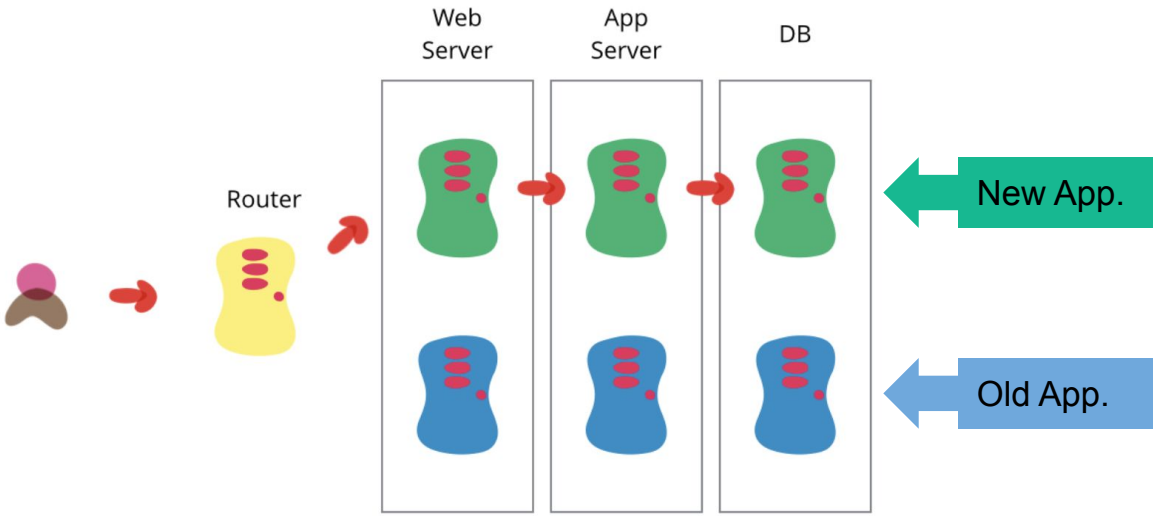
```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app-recreate
 namespace: default
spec:
 strategy:
   type: Recreate
 replicas: 3
 selector:
   matchLabels:
     app: hello-app-recreate
 template:
   metadata:
     labels:
       app: hello-app-recreate
   spec:
     containers:
     - image: gcr.io/google-samples/hello-app:1.0
       imagePullPolicy: IfNotPresent
       name: hello-app
       resources: {}
     restartPolicy: Always
```

hello-app-recreate.yml

- kubectl apply -f hello-app-recreate.yml
- kubectl set image deploy hello-app-recreate hello-app=gcr.io/google-samples/hello-app:2.0 --record

Blue/green Deployment

- Instantly switch over all the traffic from the old version to the new, instead of doing it progressively.
- Have enough hardware resources(on production) for deploying a new version of application.
- Blue-green deployment gives you a rapid way to rollback.
- Long-running transaction issues in the blue environment.



Credit: https://martinfowler.com/

Blue/green Deployment Example - Deploy Blue

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app-v1
 namespace: default
spec:
 replicas: 3
 selector:
   matchLabels:
     app: hello-app
     version: v1.0
 template:
   metadata:
     labels:
       app: hello-app
       version: v1.0
   spec:
     containers:
     - image:
gcr.io/google-samples/hello-app:1.0
       imagePullPolicy: IfNotPresent
       name: hello-app
       resources: {}
     restartPolicy: Always
```

hello-v1-deploy.yml

```yaml
apiVersion: v1
kind: Service
metadata:
 name: hello-bluegreen
spec:
 selector:
   app: hello-app
   version: v1.0
 ports:
   - protocol: TCP
     port: 8062
     targetPort: 8080
```

hello-bluegreen.yml

- kubectl apply -f hello-v1-deploy.yml
- kubectl apply -f hello-bluegreen.yml
- curl hello-bluegreen:8062

Blue/green Deployment Example - Deploy Green

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app-v2
 namespace: default
spec:
 replicas: 3
 selector:
   matchLabels:
     app: hello-app
     version: v2.0
 template:
   metadata:
     labels:
       app: hello-app
       version: v2.0
   spec:
     containers:
     - image: gcr.io/google-samples/hello-app:2.0
       imagePullPolicy: IfNotPresent
       name: hello-app
       resources: {}
     restartPolicy: Always
```

hello-v2-deploy.yml

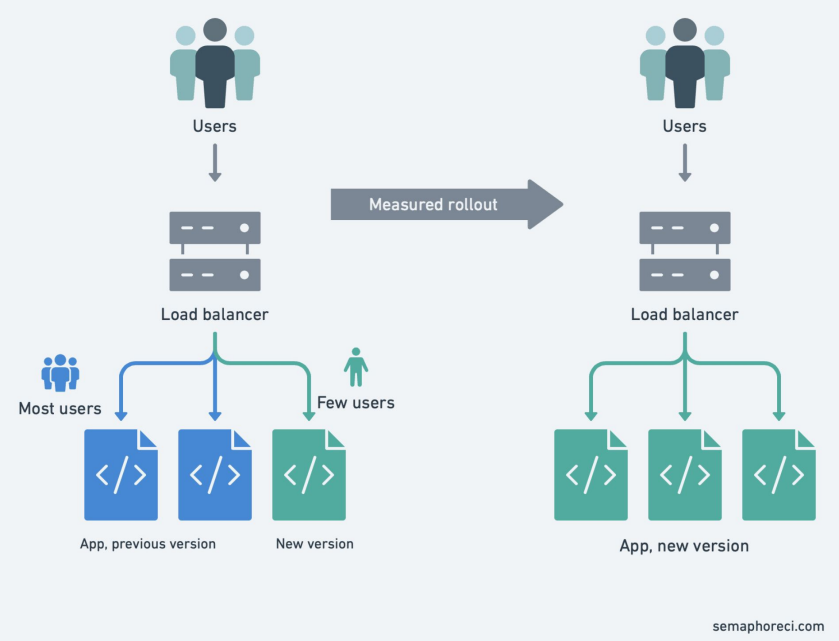
```yaml
apiVersion: v1
kind: Service
metadata:
 name: hello-bluegreen
spec:
 selector:
   app: hello-app
   version: v1.0
 ports:
   - protocol: TCP
     port: 8062
     targetPort: 8080
```

hello-bluegreen.yml

- kubectl apply -f hello-v2-deploy.yml
- switch to v2.0 pods
  - kubectl patch service hello-bluegreen -p '{"spec": {"selector": {"app": "hello-app" , "version": "v2.0"}}}'
- curl hello-bluegreen:8062 # should be return v2.0

Canary Deployment

- Canary deployment is a technique to reduce the risk of introducing a new software version in production.
- Allows you to test your new service version on a real small user group without a full rollout.
- Compare metrics between the current version and the canary that we just deployed.



Canary Deployment - By Label Selectors

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app-v1
 namespace: default
spec:
 replicas: 3
 selector:
   matchLabels:
     app: hello-app
     version: v1.0
     enabled: "true"
 template:
   metadata:
     labels:
       app: hello-app
       version: v1.0
       enabled: "true"
   spec:
```

hello-v1-deploy.yml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
 name: hello-app-v2
 namespace: default
spec:
 replicas: 1
 selector:
   matchLabels:
     app: hello-app
     version: v2.0
     enabled: "true"
 template:
   metadata:
     labels:
       app: hello-app
       version: v2.0
       enabled: "true"
   spec:
```

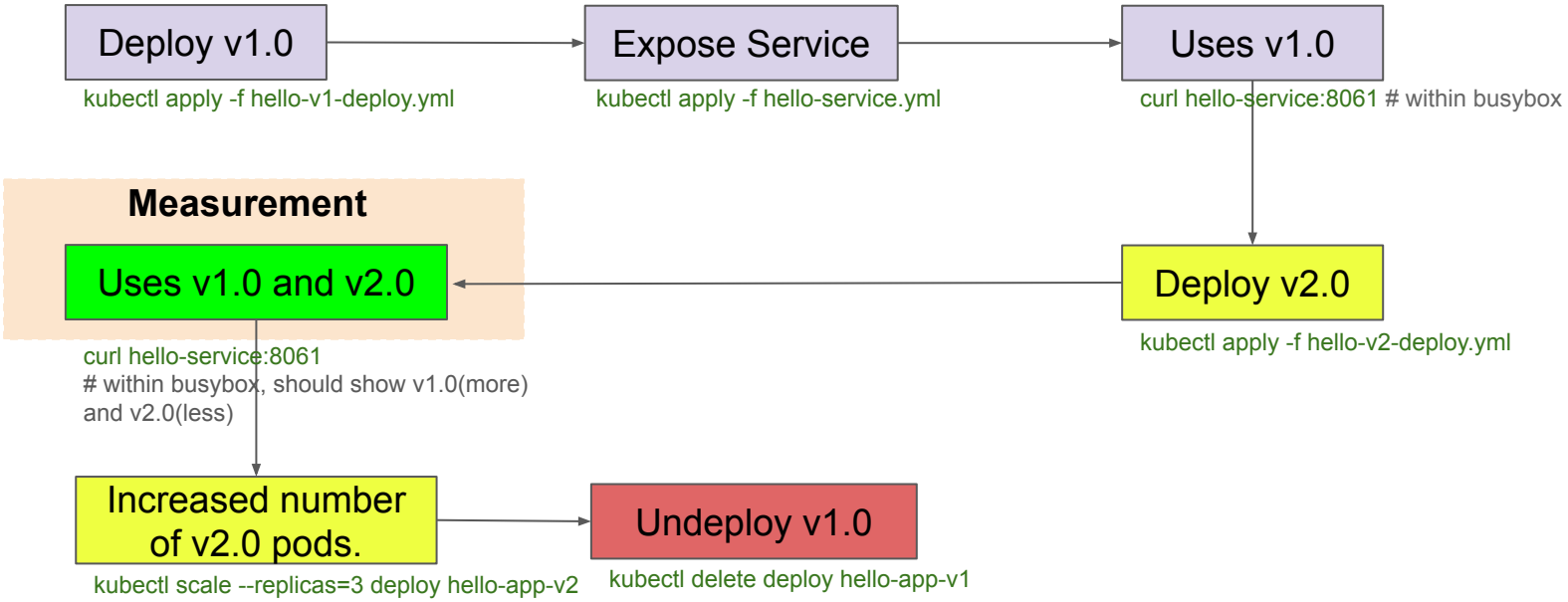
hello-v2-deploy.yml

```yaml
apiVersion: v1
kind: Service
metadata:
 name: hello-service
spec:
 selector:
   app: hello-app
   enabled: "true"
 ports:
   - protocol: TCP
     port: 8061
     targetPort: 8080
```

hello-service..yml

- **kubectl apply -f hello-v1-deploy.yml**
- kubectl apply -f hello-service.yml
- curl hello-service:8061 # within busybox
- **kubectl apply -f hello-v2-deploy.yml**
- curl hello-service:8061 # within busybox, should show v1.0(more) and v2.0(less)
- kubectl scale --replicas=3 deploy hello-app-v2
- curl hello-service:8061 # within busybox, v1.0 and v2.0 should be called at similar rates.
- **kubectl delete deploy hello-app-v1**

Canary Deployment - By Label Selectors - Flows



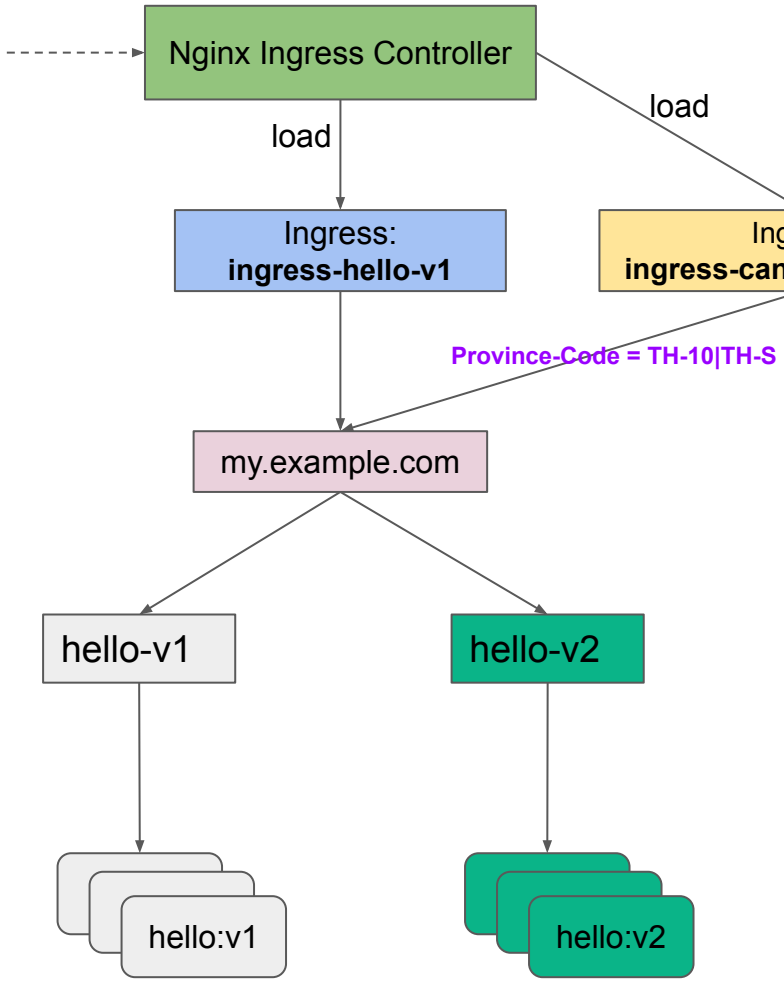
- If version 2 failed.
  - kubectl delete deploy hello-app-v2

Canary Deployment Example - By Header

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
 name: ingress-canary-by-header
 annotations:
   kubernetes.io/ingress.class: nginx
   nginx.ingress.kubernetes.io/rewrite-target: /
   nginx.ingress.kubernetes.io/canary: "true"
   nginx.ingress.kubernetes.io/canary-by-header: "Province-Code"
   nginx.ingress.kubernetes.io/canary-by-header-pattern: "TH-10|TH-S"
spec:
 rules:
 - host: my.example.com
   http:
     paths:
     - path: /hello-test
       pathType: Prefix
       backend:
         service:
           name: hello-v2
           port:
             number: 8060
```

ingress-canary-by-header.yml

Canary Deployment Example - By Header



- **Deploy hello application version 1**
  - kubectl create deployment hello-app-v1 --image=gcr.io/google-samples/hello-app:1.0
- Expose Service version 1
  - kubectl expose deployment hello-app-v1 --port=8060 --target-port=8080 --name=hello-v1
- Deploy Ingress resource
  - kubectl apply -f ingress-hello-v1.yml
- Testing
  - curl http://my.example.com/hello-test

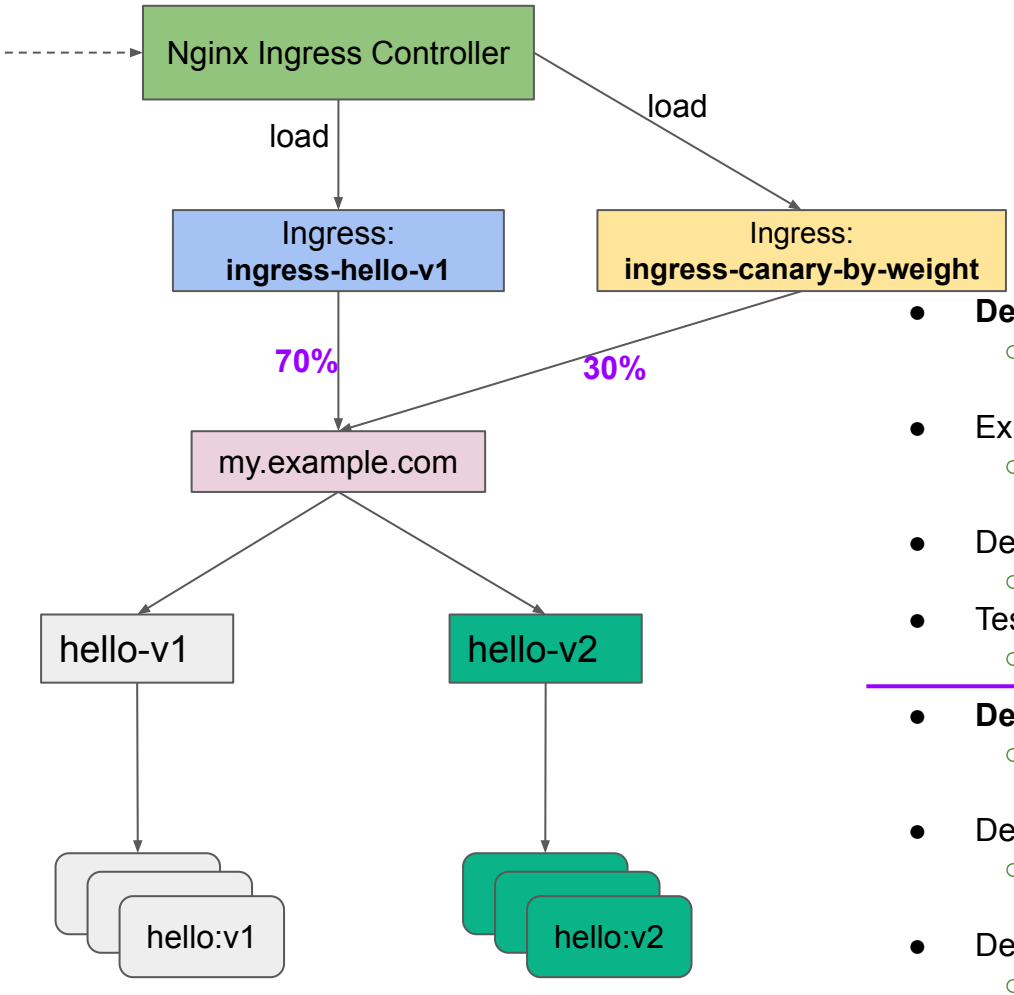
- **Deploy hello application Version 2**
  - kubectl create deployment hello-app-v2 --image=gcr.io/google-samples/hello-app:2.0
- Deploy Service version 2
  - kubectl expose deployment hello-app-v2 --port=8060 --target-port=8080 --name=hello-v2
- Deploy Canary Ingress resource
  - kubectl apply -f **ingress-canary-by-header.yml**
- Testing
  - curl -H "Province-Code: TH-11" http://my.example.com/hello-test

Canary Deployment - By Weight

```yaml
apiVersion: networking.k8s.io/v1
kind: Ingress
metadata:
 name: ingress-canary-by-header
 annotations:
   kubernetes.io/ingress.class: nginx
   nginx.ingress.kubernetes.io/rewrite-target: /
   nginx.ingress.kubernetes.io/canary: "true"
   nginx.ingress.kubernetes.io/canary-weight: "30"
spec:
 rules:
 - host: my.example.com
   http:
     paths:
     - path: /hello-test
       pathType: Prefix
       backend:
         service:
           name: hello-v2
           port:
             number: 8060
```

ingress-canary-by-header.yml

Canary Deployment Example - by Weight



- **Deploy version 1**
  - kubectl create deployment hello-app-v1 --image=gcr.io/google-samples/hello-app:1.0
- Expose Service
  - kubectl expose deployment hello-app-v1 --port=8060 --target-port=8080 --name=hello-v1
- Deploy Ingress resource
  - kubectl apply -f ingress-hello-v1.yml
- Testing
  - curl http://my.example.com/hello-test

- **Deploy Version 2**
  - kubectl create deployment hello-app-v2 --image=gcr.io/google-samples/hello-app:2.0
- Deploy Service for app version 2
  - kubectl expose deployment hello-app-v2 --port=8060 --target-port=8080 --name=hello-v2
- Deploy Canary Ingress resource
  - kubectl apply -f **ingress-canary-by-weight.yml**
- Testing
  - curl http://my.example.com/hello-test

DEPLOYMENT STRATEGIES

When it comes to production, a ramped or blue/green deployment is usually a good fit, but proper testing of the new platform is necessary.

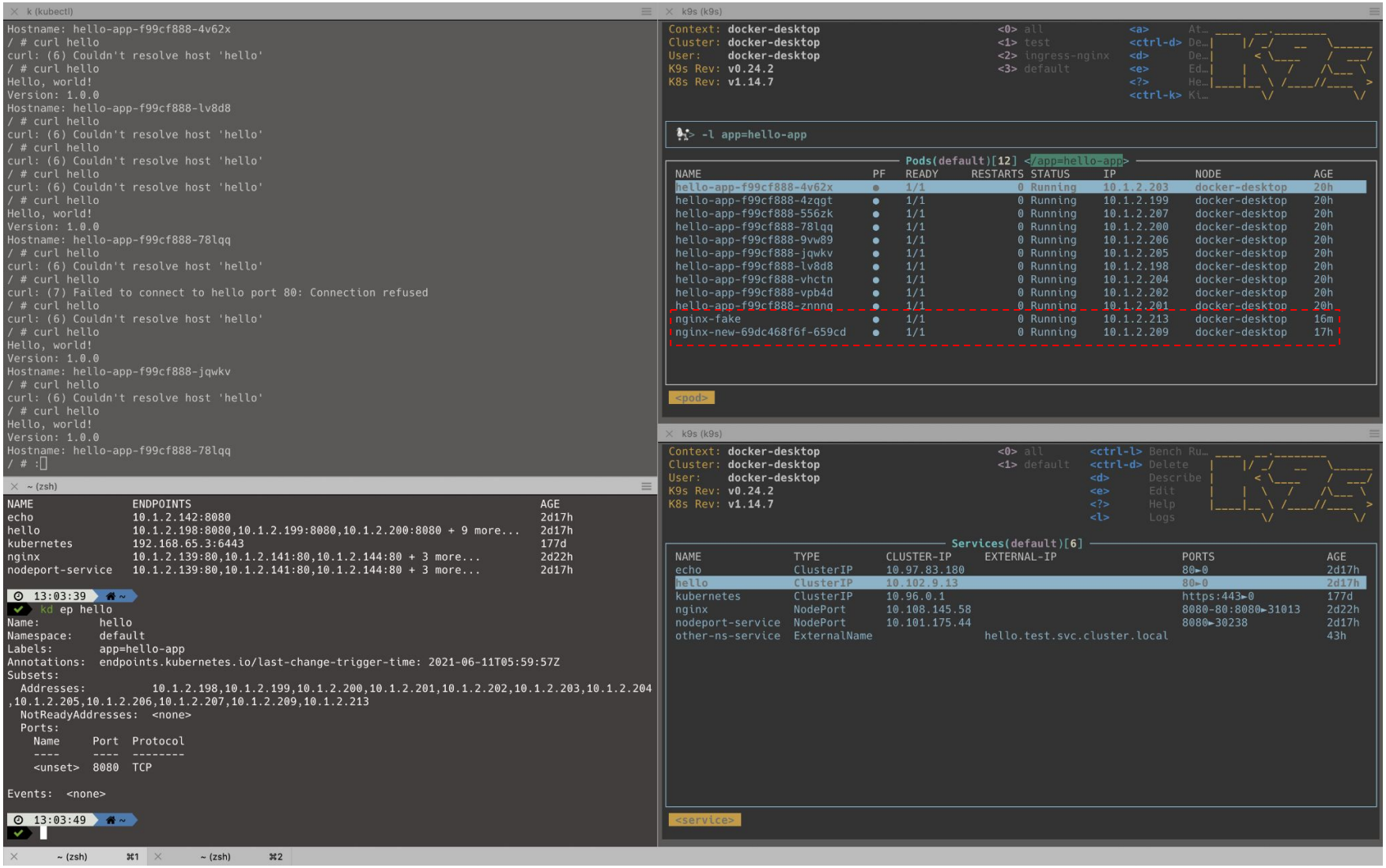
Blue/green and shadow strategies have more impact on the budget as it requires double resource capacity. If the application lacks in tests or if there is little confidence about the impact/stability of the software, then a canary, a/b testing or shadow release can be used.

If your business requires testing of a new feature amongst a specific pool of users that can be filtered depending on some parameters like geolocation, language, operating system or browser features, then you may want to use the a/b testing technique.

Container Solutions

Strategy	ZERO DOWNTIME	REAL TRAFFIC TESTING	TARGETED USERS	CLOUD COST	ROLLBACK DURATION	NEGATIVE IMPACT ON USER	COMPLEXITY OF SETUP
RECREATE version A is terminated then version B is rolled out	✗	✗	✗	■□□	■■■	■■■	□□□
RAMPED version B is slowly rolled out and replacing version A	✓	✗	✗	■□□	■■■	■□□	■□□
BLUE/GREEN version B is released alongside version A, then the traffic is switched to version B	✓	✗	✗	■■■	□□□	■■□	■■□
CANARY version B is released to a subset of users, then proceed to a full rollout	✓	✓	✗	■□□	■□□	■□□	■■□
A/B TESTING version B is released to a subset of users under specific condition	✓	✓	✓	■□□	■□□	■□□	■■■
SHADOW version B receives real world traffic alongside version A and doesn't impact the response	✓	✓	✗	■■■	□□□	□□□	■■■

Be careful when using label and selector



End.