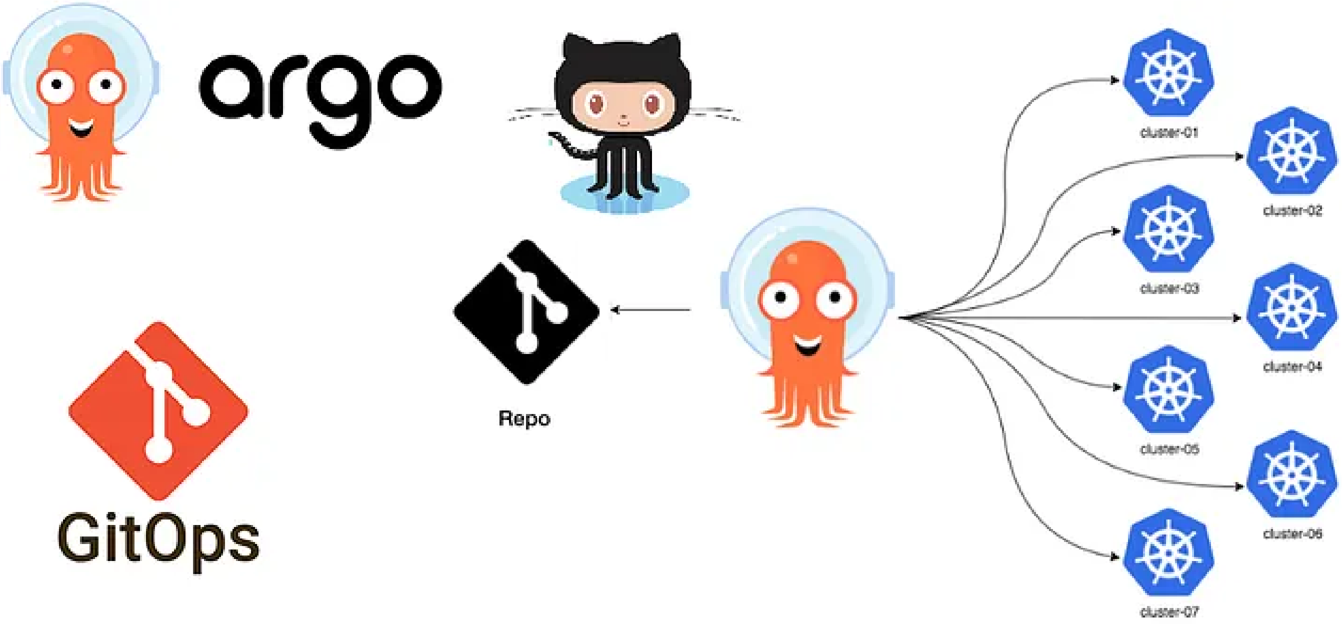
A Complete Overview of ArgoCD with a Practical Example

8 min read · Apr 5, 2024

V Veerababu Narni Follow

What is ArgoCD

Argo CD is a Kubernetes-native continuous deployment (CD) tool. Unlike external CD tools that only enable push-based deployments, Argo CD can pull updated code from Git repositories and deploy it directly to Kubernetes resources.



argoCD

What is GitOps?

GitOps is a way of implementing Continuous Deployment for cloud-native applications. It focuses on a developer-centric experience when operating infrastructure, by using tools developers are already familiar with, including Git and Continuous Deployment tools.

The core idea of GitOps is to have a Git repository that always contains declarative descriptions of the infrastructure currently desired in the production environment and an automated process to make the production environment match the described state in the repository. If you want to deploy a new application or update an existing one, you only need to update the repository — the automated process handles everything else. It's like having cruise control for managing your applications in production.

gitOps

How to achieve GitOps using Argo CD?

Every enterprise uses Git as its source code management software to store code. Developers can commit their infrastructure configurations, such as Kubernetes resources definition, in Git to create environments needed for application deployment.

Once a developer implements a feature (with a new application and K8S configurations) and merges with the main branch, the CI process is initiated for generating and testing an image.

After the review and approval of the application, the pull request in Git is merged with the main branch. With the help of the GitOps agent, Argo CD will immediately identify the new versions of a configuration that was recently merged and compare it with the running application in the destination environment (it can be pre-prod or prod).

In case of a mismatch, it highlights out-of-sync status, and in the backend, Argo CD uses the Kubernetes controller to reconcile the new changes to cluster resources. Once the Kubernetes resources are ready, it informs the user the application is in sync.

Argo CD also uses an agent to constantly monitor the end environment and check its status with Git. Argo CD synchronizes the current state with the declared state of configurations and ensures that new configurations are correctly deployed to a Kubernetes cluster.

As all the records of all changes, including all details of the environment, at every stage of the process are stored in Git, Argo CD helps roll back applications to previous states in a single click.

Benefits of Argo CD:

1. **Improve developer productivity**

Argo CD provides developers with a self-service environment for application deployment. Software development teams can focus on creativity and writing business logic instead of time and energy on manual and remedial deployments.

2. Improved software delivery compliance

Allow your developers, Ops, and DevOps teams to use a single platform for infrastructure change management. Apply organizational policies to restrict access to Kubernetes resources and minimize your application downtime and outages.

3. Increased collaboration in SDLC

While working on Argo CD, every team member can work from the same system to achieve GitOps and understand the status of individual processes. The single Git repository fosters collaboration amongst team members by assigning tasks to individuals and deploying code from each person as necessary.

4. Faster deployments

Argo CD allows teams to perform more rapid deployments into Kubernetes clusters across multi-cloud. Quicker releases of application changes mean shorter time to market and more flexibility in responding to customer demand.

Prerequisites:

- A running Kubernetes cluster

How to install ArgoCD?

- For this tutorial, you must have a running kubernetes cluster like I have minikube running on my server.
- **Create the namespace for argoCD**

```
kubectl create namespace argocd
```

- **Install ArgoCD using the below command**

```
kubectl apply -n argocd -f https://raw.githubusercontent.com/argoproj/argo-cd/stable/manifests/install.yaml
```

- **After installing the ArgoCD, you can run the below command to check what resources it has created.**

```
ubuntu@ip-172-31-7-106:~$ kubectl get all -n argocd
NAME                                                 READY   STATUS    RESTARTS   AGE
pod/argocd-application-controller-0                  1/1     Running   0          106m
pod/argocd-applicationset-controller-787bfd9669-4mxq6   1/1     Running   0          106m
pod/argocd-dex-server-bb76f899c-slg7k                1/1     Running   0          106m
pod/argocd-notifications-controller-5557f7bb5b-84cjr   1/1     Running   0          106m
pod/argocd-redis-b5d6bf5f5-482qq                     1/1     Running   0          106m
pod/argocd-repo-server-56998dcf9c-c75wk              1/1     Running   0          106m
pod/argocd-server-5985b6cf6f-zzgx8                   1/1     Running   0          106m
```

```
NAME                                                TYPE        CLUSTER-IP       EXTERNAL-IP
PORT(S)                     AGE
service/argocd-applicationset-controller            ClusterIP   10.102.163.101   <none>
7000/TCP,8080/TCP           106m
service/argocd-dex-server                           ClusterIP   10.101.227.215   <none>
5556/TCP,5557/TCP,5558/TCP  106m
service/argocd-metrics                              ClusterIP   10.111.59.189    <none>
8082/TCP                    106m
service/argocd-notifications-controller-metrics     ClusterIP   10.96.102.185    <none>
9001/TCP                    106m
service/argocd-redis                                ClusterIP   10.97.229.117    <none>
6379/TCP                    106m
service/argocd-repo-server                          ClusterIP   10.102.16.58     <none>
8081/TCP,8084/TCP           106m
service/argocd-server                               ClusterIP   10.98.71.135     <none>
```

```
80/TCP,443/TCP               106m
service/argocd-server-metrics                     ClusterIP   10.109.248.207   <none>
8083/TCP                     106m

NAME                                               READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/argocd-applicationset-controller   1/1     1            1           106m
deployment.apps/argocd-dex-server                  1/1     1            1           106m
deployment.apps/argocd-notifications-controller    1/1     1            1           106m
deployment.apps/argocd-redis                       1/1     1            1           106m
deployment.apps/argocd-repo-server                 1/1     1            1           106m
deployment.apps/argocd-server                      1/1     1            1           106m

NAME                                                          DESIRED   CURRENT   READY   AGE
replicaset.apps/argocd-applicationset-controller-787bfd9669   1         1         1       106m
replicaset.apps/argocd-dex-server-bb76f899c                   1         1         1       106m
replicaset.apps/argocd-notifications-controller-5557f7bb5b    1         1         1       106m
replicaset.apps/argocd-redis-b5d6bf5f5                        1         1         1       106m
replicaset.apps/argocd-repo-server-56998dcf9c                 1         1         1       106m
replicaset.apps/argocd-server-5985b6cf6f                      1         1         1       106m

NAME                                             READY   AGE
statefulset.apps/argocd-application-controller   1/1     106m
ubuntu@ip-172-31-7-106:~$
```

- **Now in order to access the UI of ArgoCD, you need to run the below command**

```
kubectl edit svc argocd-server -n argocd  #enable Node Port
```

- Now, in order to log into the UI you need the credentials. So, for a username, you can write `admin` and the password is stored in the secret called `argocd-initial-admin-secret` in the cluster.
- You need to run the below command to get the value of the secret.

```
kubectl get secret argocd-initial-admin-secret -n argocd -o yaml
```

- The secret base64 encoded so, you have to decode the secret by running the below command.

```
echo "secret value" | base64 --decode
```

- After running the above command you can have the decoded value of the secret and using that as a password you can log in to the UI.
- Now, the installation has been completed.

Now, the installation is completed.

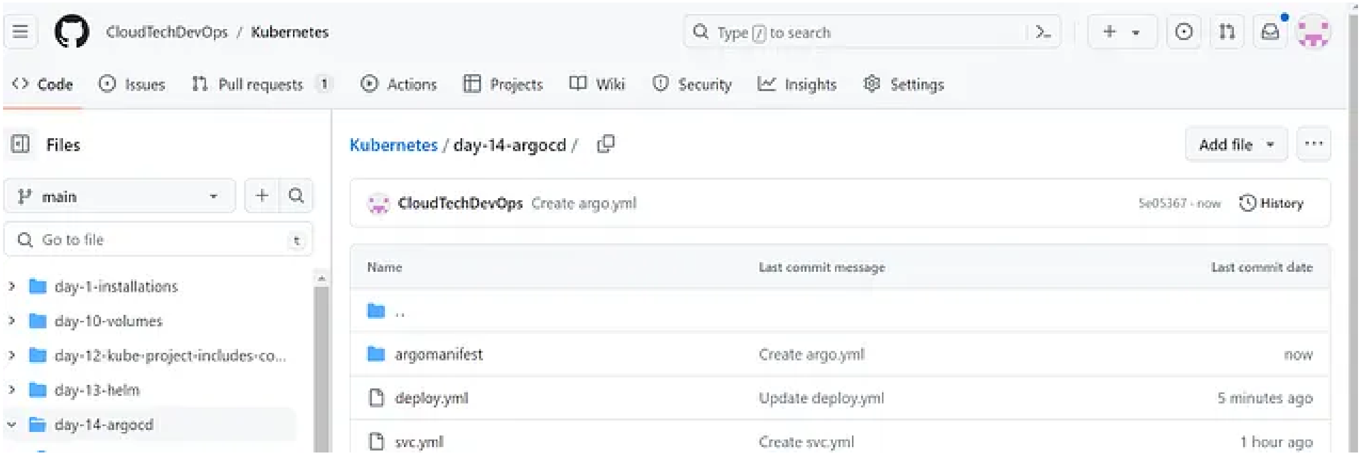
So, now I have an application running on my kubernetes cluster. Below are the manifest files for that.

1. **Deployment file**

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: swiggy-app
  labels:
    app: swiggy-app
spec:
  replicas: 3
  selector:
    matchLabels:
      app: swiggy-app
  template:
    metadata:
      labels:
        app: swiggy-app
    spec:
      terminationGracePeriodSeconds: 30
      containers:
      - name: swiggy-app
        image: veeranarni/hotstar:latest
        imagePullPolicy: "Always"
        ports:
        - containerPort: 3000
```

2. Service file

```
apiVersion: v1
kind: Service
metadata:
  name: swiggy-app
  labels:
    app: swiggy-app
spec:
  type: LoadBalancer
  ports:
  - port: 80
    targetPort: 3000
  selector:
    app: swiggy-app
```



Kubernetes / day-14-argocd /

CloudTechDevOps Create argo.yml 5e05367 · now

Name	Last commit message	Last commit date
..		
argomanifest	Create argo.yml	now
deploy.yml	Update deploy.yml	5 minutes ago
svc.yml	Create svc.yml	1 hour ago

Repository

So, now in order for argoCD to sync with this repository we need to write some manifest file for that. Here is the manifest file for that.

```
apiVersion: argoproj.io/v1alpha1
kind: Application
metadata:
  name: myapp-argo-application
  namespace: argocd
spec:
  project: default

  source:
    repoURL: https://github.com/CloudTechDevOps/Kubernetes.git
    targetRevision: HEAD
    path: day-14-argocd
  destination:
    server: https://kubernetes.default.svc
    namespace: myapp

  syncPolicy:
    syncOptions:
    - CreateNamespace=true

    automated:
      selfHeal: true
      prune: true
```

- `argoproj.io/v1alpha1` is an API version of argoCD. The API Version might get changed once argoCD has some new release. Always refer to the documentation for the latest information.
- I am defining my repository URL in `repoURL` section.
- `targetRevision` is set to HEAD so that it will always fetch the latest commit.
- `path` is set to 'day-14-argocd' because I have my application's manifest files in 'day-14-argocd' folder.
- In the `destination` section we have `server` section and it is set to `https://kubernetes.default.svc` which is the internal service of the kubernetes API Server.

```
ubuntu@ip-172-31-7-106:~$ kubectl get svc
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   137m
ubuntu@ip-172-31-7-106:~$
```

- `namespace` is set to `myapp` , because we want to create our application in that namespace. Now, we actually don't have the namespace already created because we want argoCD to create that automatically.
- In order for argoCD to create the namespace automatically we need to define the below attributes.

```
syncPolicy:
    syncOptions:
```

```
    - CreateNamespace=true
```

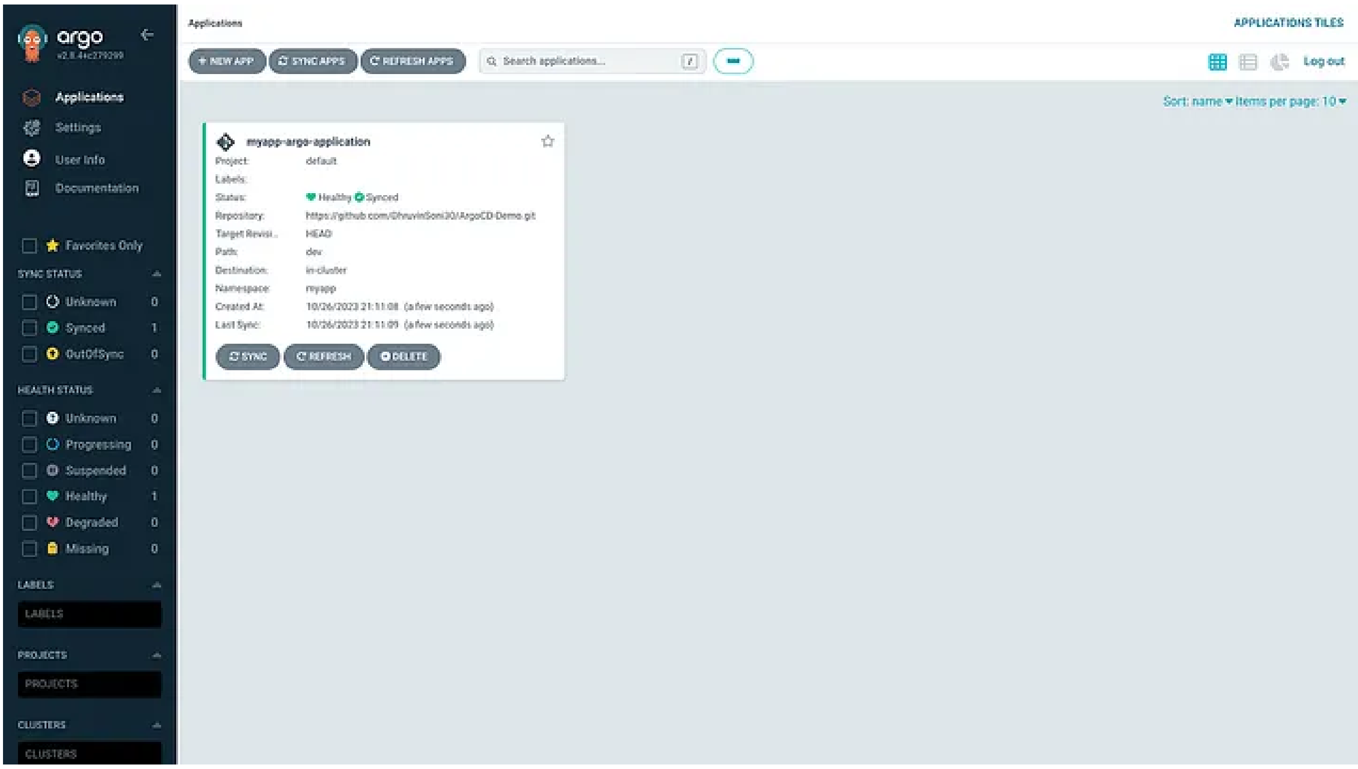
- We want argoCD to automatically sync any changes in the git repository but by default, it is turned off. So in order to enable that we need to define the below attributes.

```
automated:
  selfHeal: true
  prune: true
```

- If you apply any changes from the backend using `kubectl` utility then we want to override that with whatever we have in our git repository in order to do that we have `selfHeal: true` for that.
- If we rename any component or delete the entire component then we want argoCD to delete that component in the cluster as well and in order to do that we have `prune: true` for that.
- argoCD will check the changes in the git repository every 3 minutes. If you want argoCD to check the changes as soon as it has done then you can implement the webhook for that.
- Now, that we have our file ready we need to run the below command to apply that.

```
kubectl apply -f application.yaml
```

- Once you apply the file you can check your application in the UI.

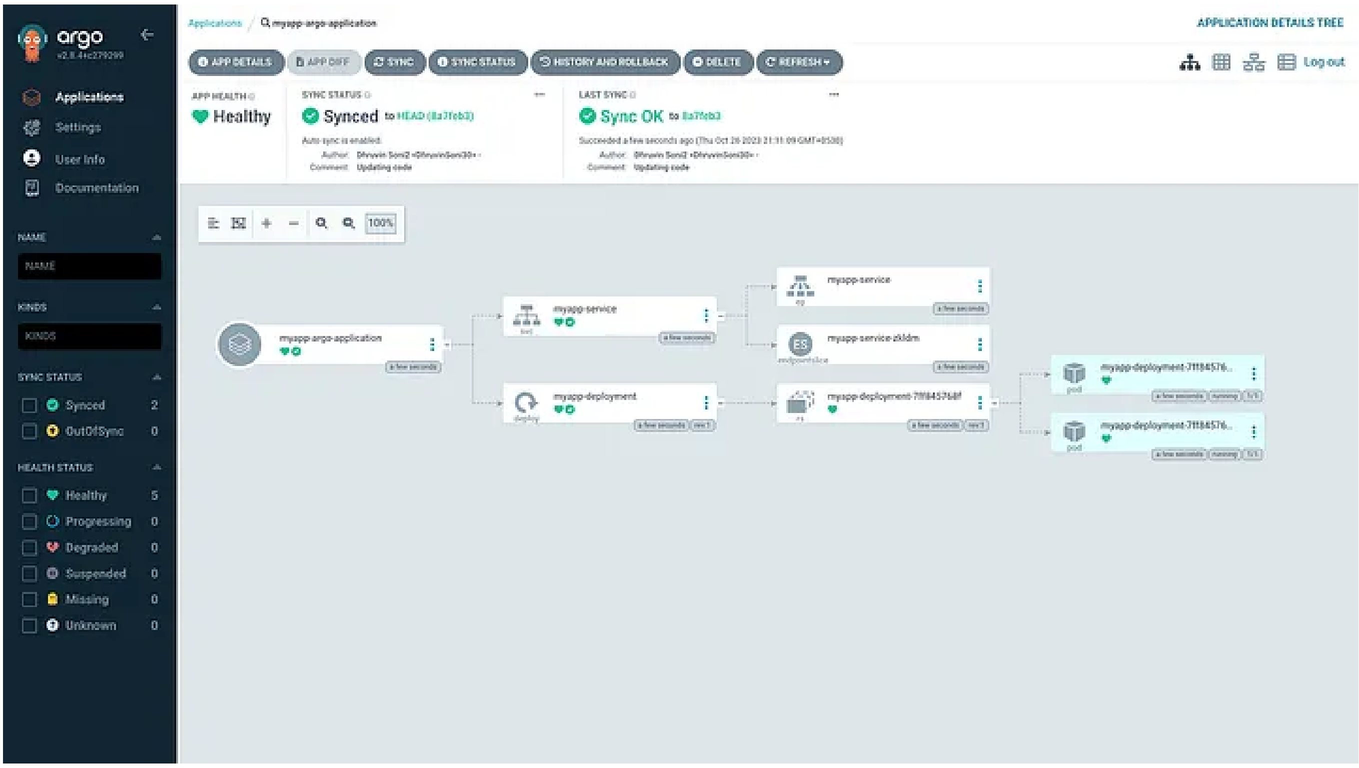


myapp-argo-application

Project: default
Labels:
Status: Healthy Synced
Repository: https://github.com/DhruvinSoni30/ArgoCD-Demo.git
Target Revisi... HEAD
Path: dev
Destination: in-cluster
Namespace: myapp
Created At: 10/26/2023 21:11:08 (a few seconds ago)
Last Sync: 10/26/2023 21:11:09 (a few seconds ago)

Application

- You can click on your application and check the various details.



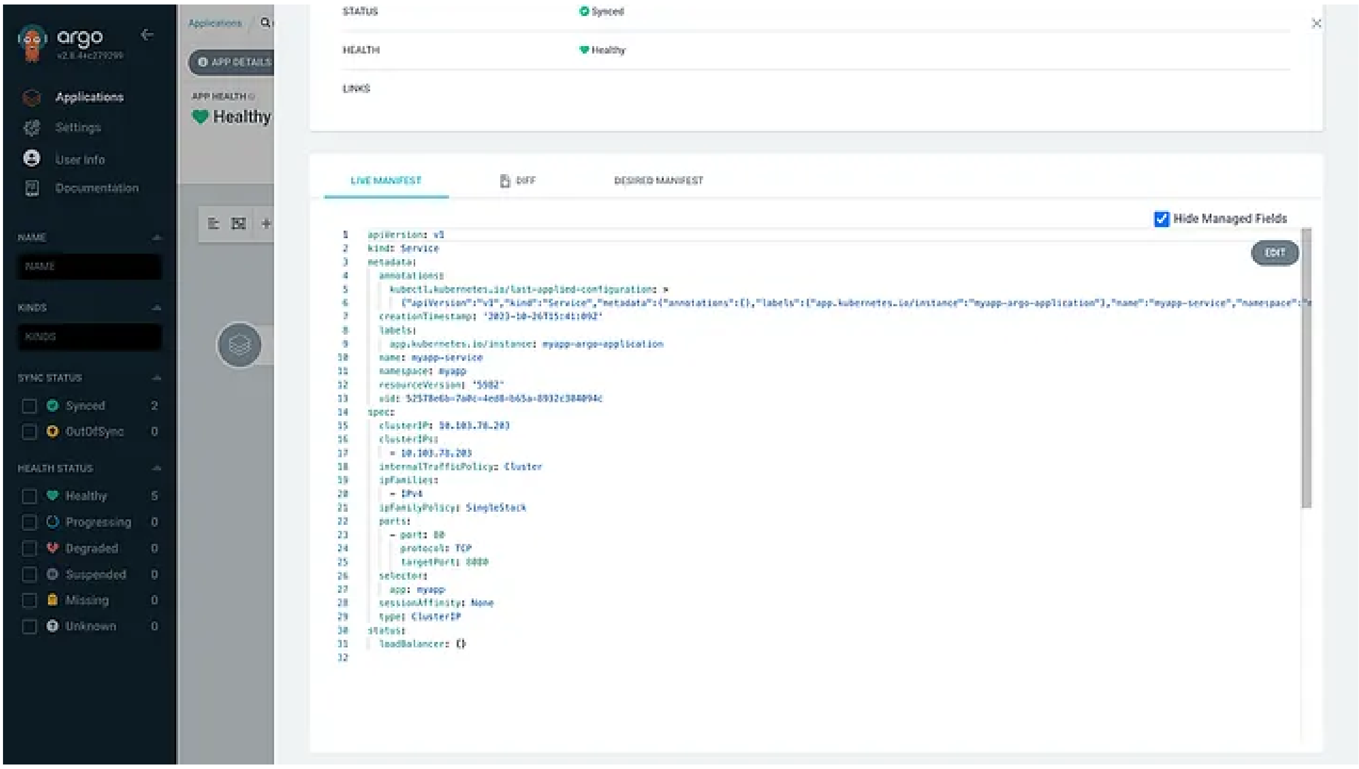
Applications / myapp-argo-application

APP HEALTH: Healthy

SYNC STATUS: Synced to HEAD (8a7feb3)
Auto-sync is enabled.
Author: Dhruvin Soni2 <DhruvinSoni30> -
Comment: Updating code

LAST SYNC: Sync OK to 8a7feb3
Succeeded a few seconds ago (Thu Oct 26 2023 21:31:09 GMT+0530)
Author: Dhruvin Soni2 <DhruvinSoni30> -
Comment: Updating code

Workflow

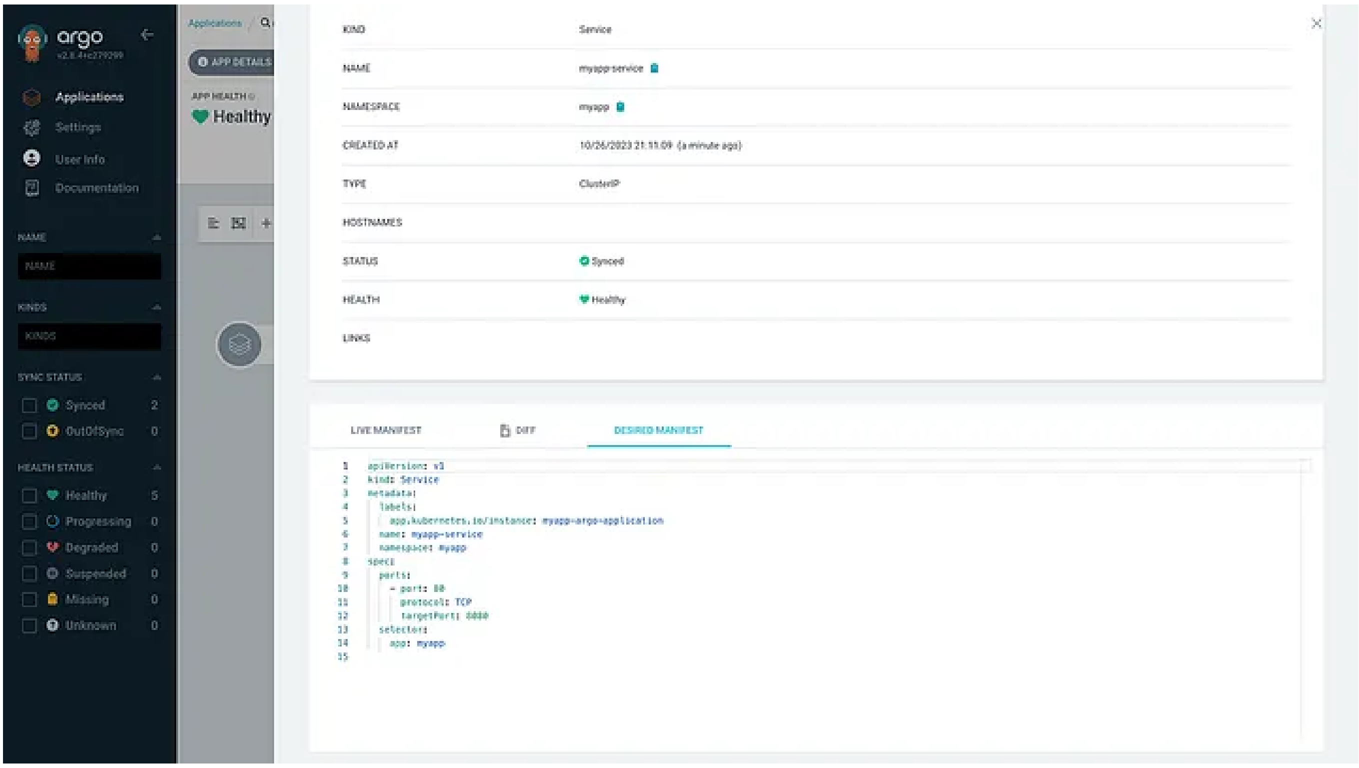


STATUS: Synced
HEALTH: Healthy
APP HEALTH: Healthy

☑ Hide Managed Fields

```
apiVersion: v1
kind: Service
metadata:
  annotations:
    kubectl.kubernetes.io/last-applied-configuration: >
      {"apiVersion":"v1","kind":"Service","metadata":{"annotations":{},"labels":{"app.kubernetes.io/instance":"myapp-argo-application"},"name":"myapp-service","namespace":"
  creationTimestamp: '2023-10-26T15:41:09Z'
  labels:
    app.kubernetes.io/instance: myapp-argo-application
  name: myapp-service
  namespace: myapp
  resourceVersion: '5982'
  uid: 52578e6b-7a0c-4ed8-b65a-8932c384094c
spec:
  clusterIP: 10.103.78.203
  clusterIPs:
    - 10.103.78.203
  internalTrafficPolicy: Cluster
  ipFamilies:
    - IPv4
  ipFamilyPolicy: SingleStack
  ports:
    - port: 80
      protocol: TCP
      targetPort: 8080
  selector:
    app: myapp
  sessionAffinity: None
  type: ClusterIP
status:
  loadBalancer: {}
```

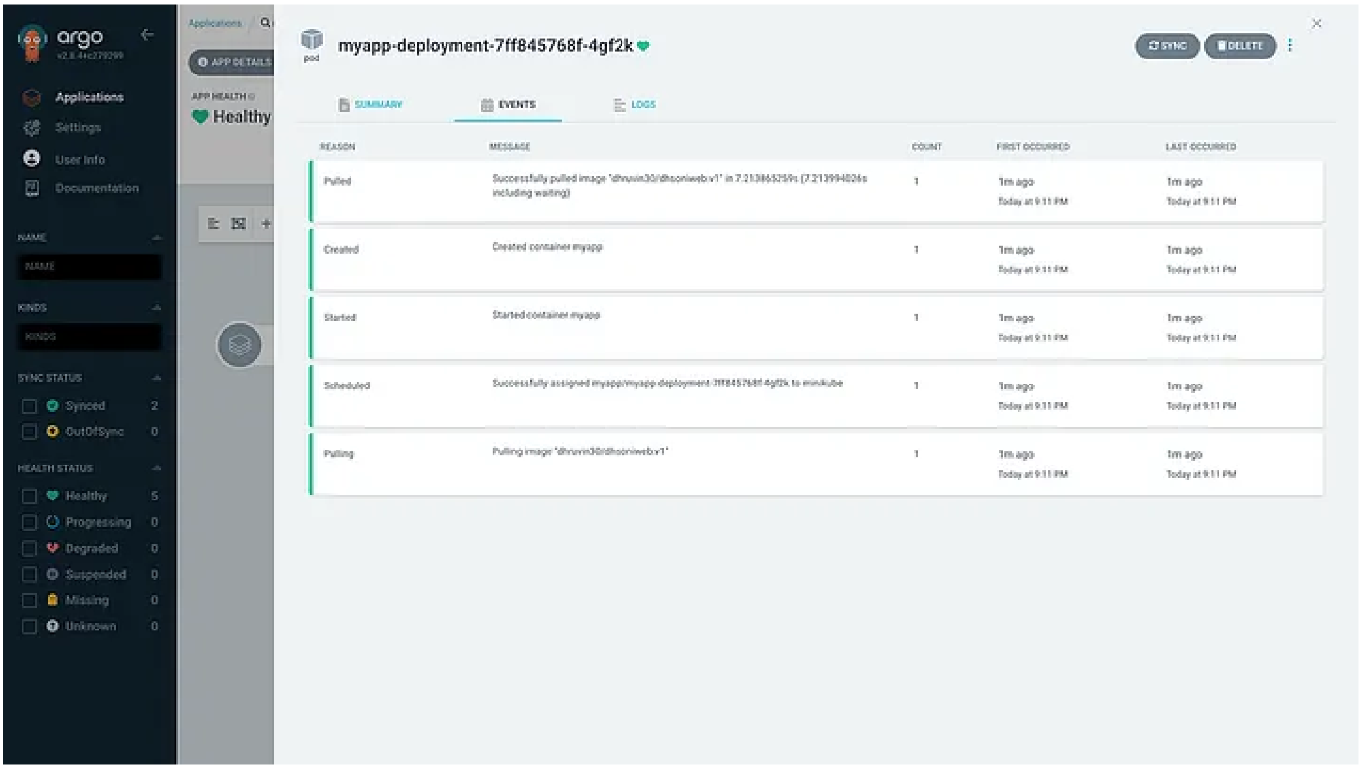
Manifest file



KIND	Service
NAME	myapp-service
NAMESPACE	myapp
CREATED AT	10/26/2023 21:11:09 (a minute ago)
TYPE	ClusterIP
HOSTNAMES	
STATUS	Synced
HEALTH	Healthy
LINKS	

```
apiVersion: v1
kind: Service
metadata:
  labels:
    app.kubernetes.io/instance: myapp-argo-application
  name: myapp-service
  namespace: myapp
spec:
  ports:
    - port: 80
      protocol: TCP
      targetPort: 8080
  selector:
    app: myapp
```

Manifest file



myapp-deployment-7ff845768f-4gf2k

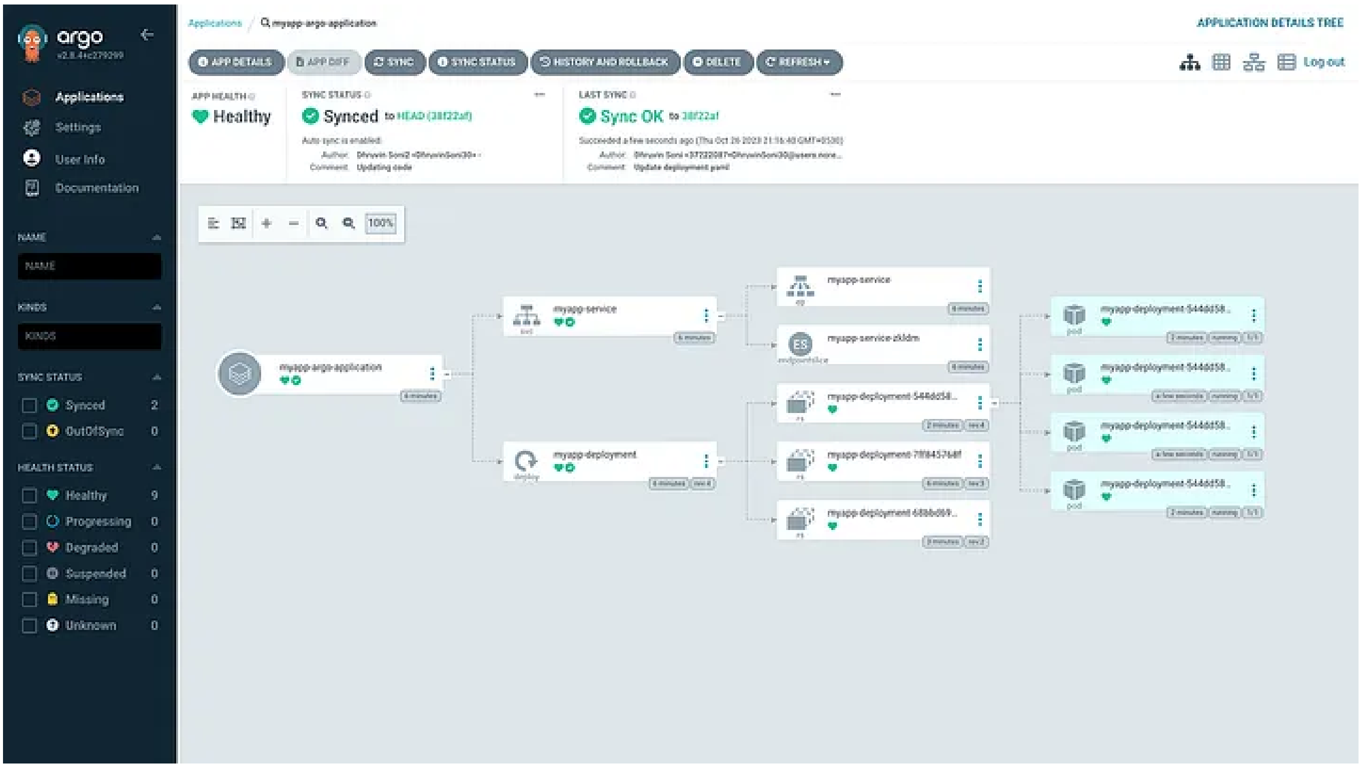
REASON	MESSAGE	COUNT	FIRST OCCURRED	LAST OCCURRED
Pulled	Successfully pulled image "dhruvin30/dhsoniweb:v1" in 7.213865259s (7.213994026s including waiting)	1	1m ago Today at 9:11 PM	1m ago Today at 9:11 PM
Created	Created container myapp	1	1m ago Today at 9:11 PM	1m ago Today at 9:11 PM
Started	Started container myapp	1	1m ago Today at 9:11 PM	1m ago Today at 9:11 PM
Scheduled	Successfully assigned myapp/myapp-deployment-7ff845768f-4gf2k to minikube	1	1m ago Today at 9:11 PM	1m ago Today at 9:11 PM
Pulling	Pulling image "dhruvin30/dhsoniweb:v1"	1	1m ago Today at 9:11 PM	1m ago Today at 9:11 PM

Events of pod creation

- Now let’s say you want to increase the replica for your application. You just need to commit your changes in the git repository deployment.yml

Changes

- As soon as you commit the changes in the repository, argoCD will look for the changes and apply the changes in the cluster.



Changes in cluster

- As you can see, now we have a total of 4 pods in the cluster.

```
ubuntu@ip-172-31-7-106:~$ kubectl get pods -n myapp
NAME                               READY   STATUS    RESTARTS   AGE
myapp-deployment-544dd58bc4-4sntz   1/1     Running   0          13h
myapp-deployment-544dd58bc4-wkf5j   1/1     Running   0          13h
myapp-deployment-544dd58bc4-xt7hb   1/1     Running   0          13h
myapp-deployment-544dd58bc4-zjmn8   1/1     Running   0          13h
ubuntu@ip-172-31-7-106:~$
```

- Now you can perform different changes as per your need and argoCD will take care of the further action.

Written by Veerababu Narni

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Responses (4)

Write a response

What are your thoughts?

William Hatch
Mar 4

More needless complexity for a technology rooted in needless complexity... yay! I can't even with k8s anymore.

3 Reply

Ajay Kumar he
May 18 (edited)

This is not a very good explanation

1 Reply

Nsvr Bandi
6 days ago

Nice Explanation

Reply

See all responses

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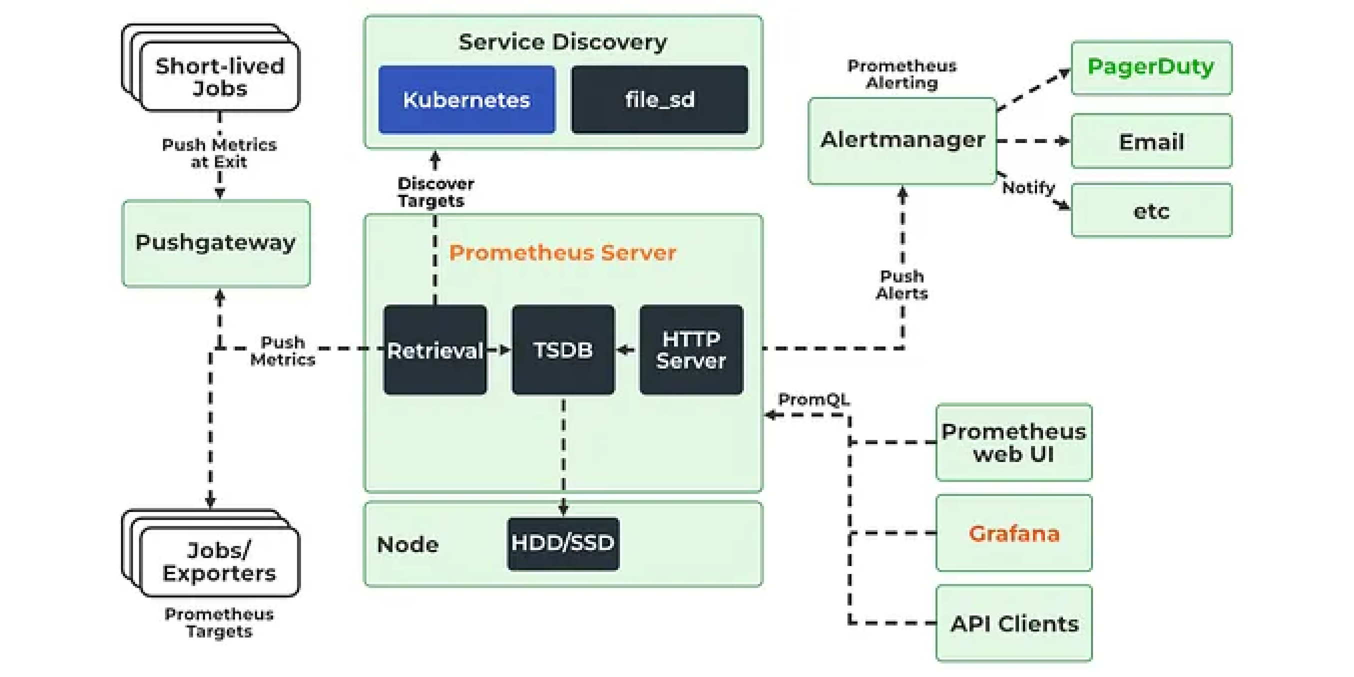

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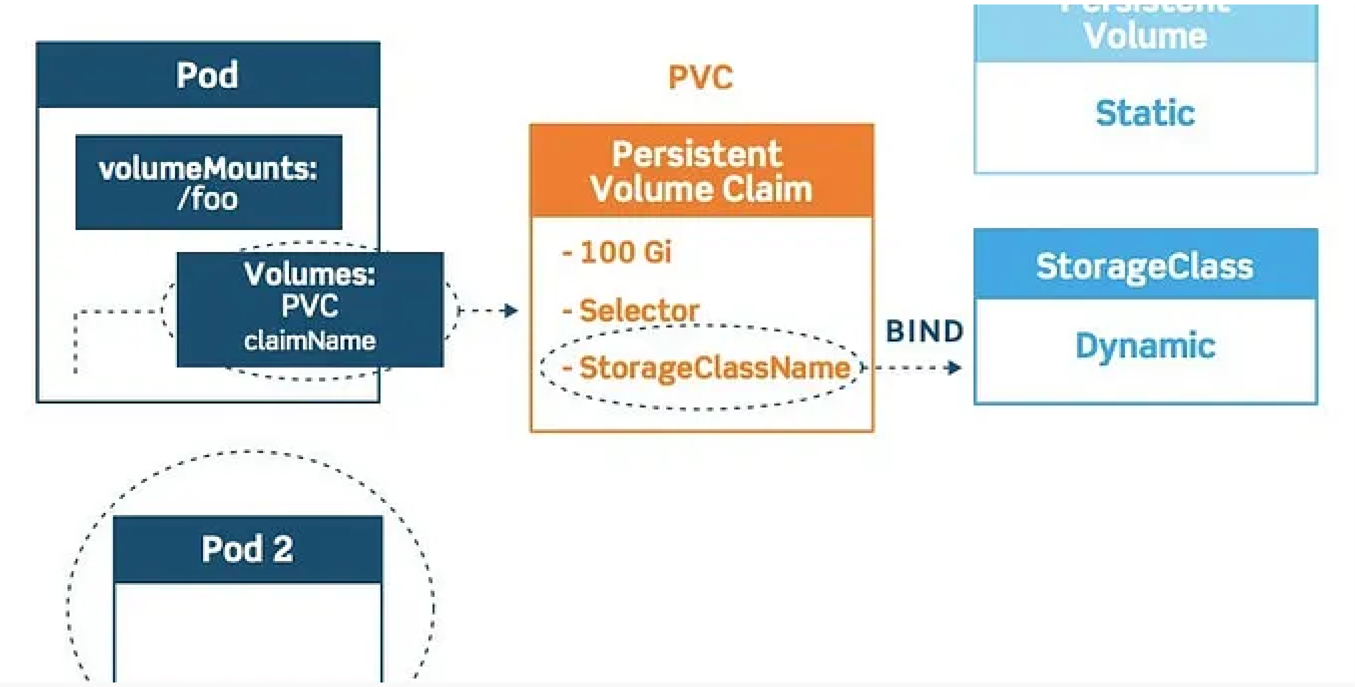

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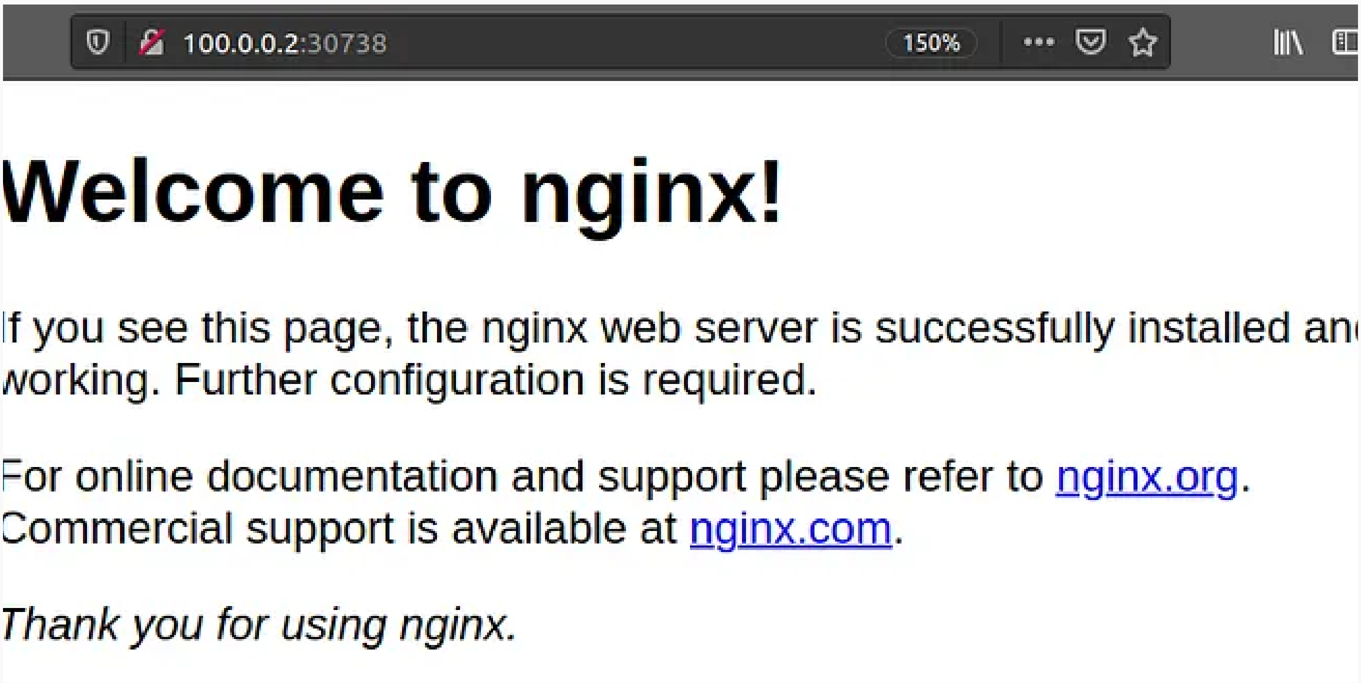

Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

Thank you for using nginx.

Veerababu Narni

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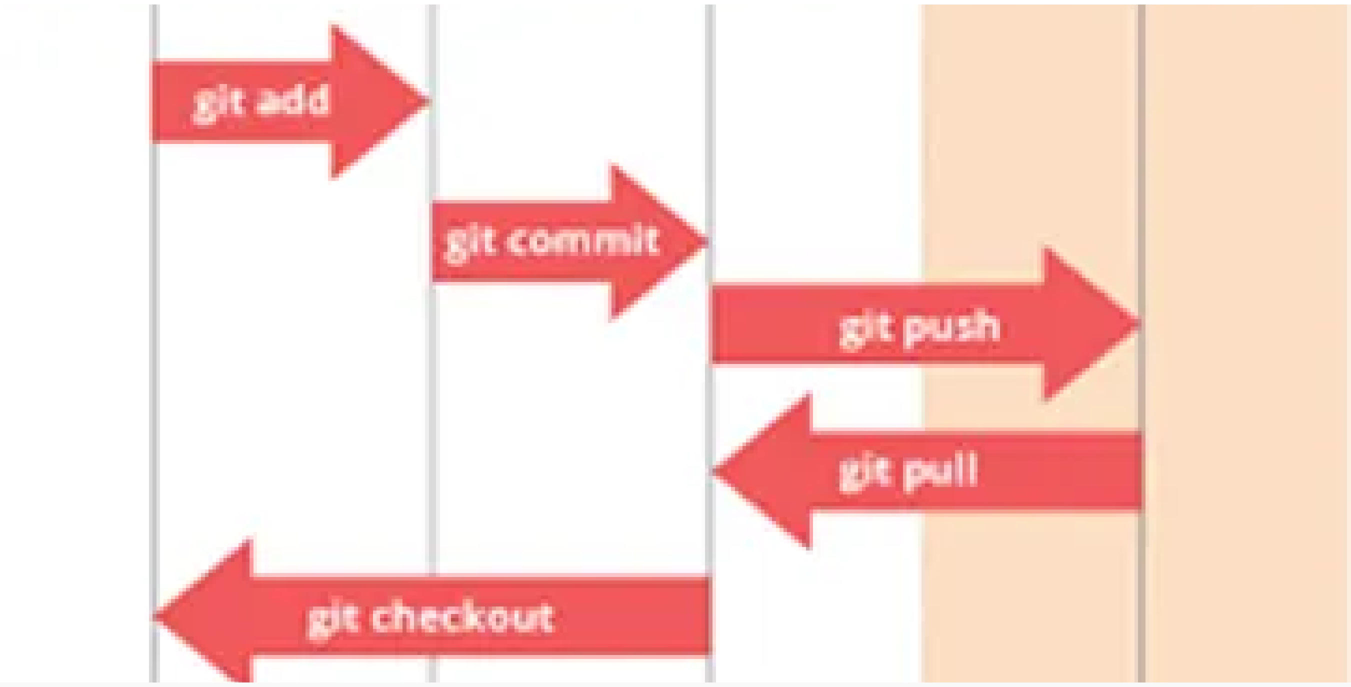

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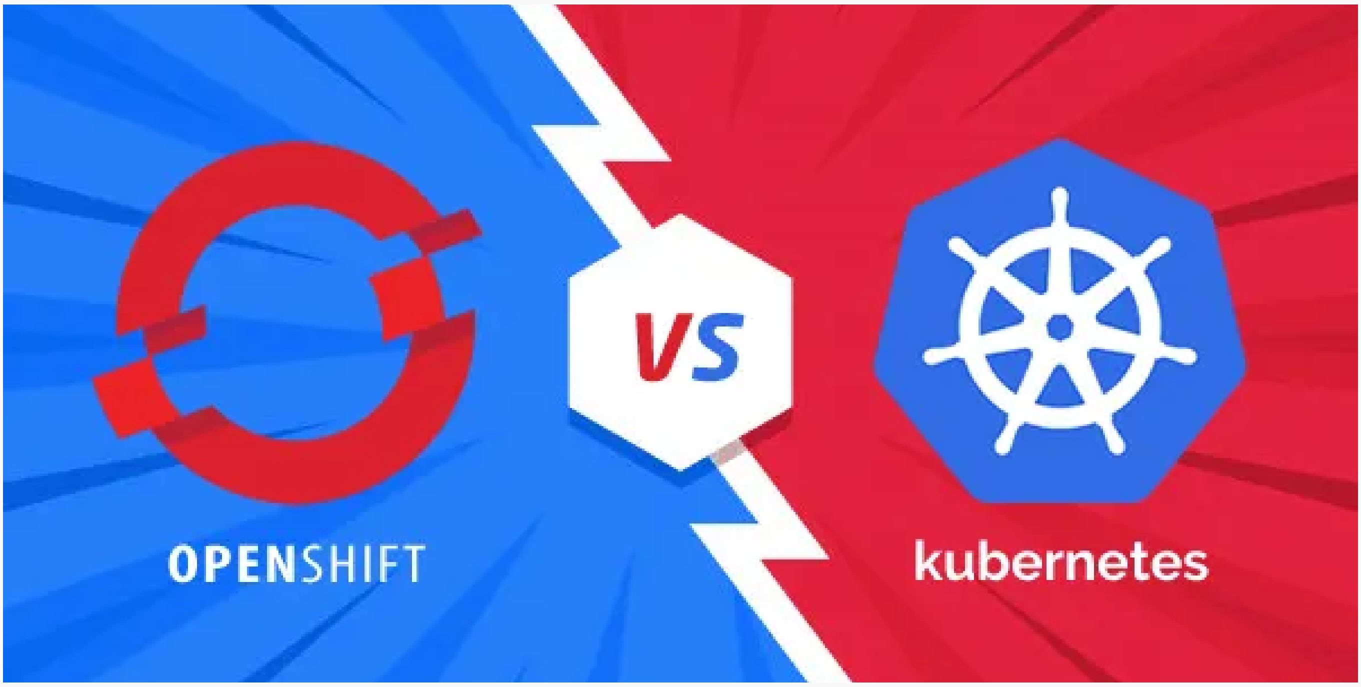

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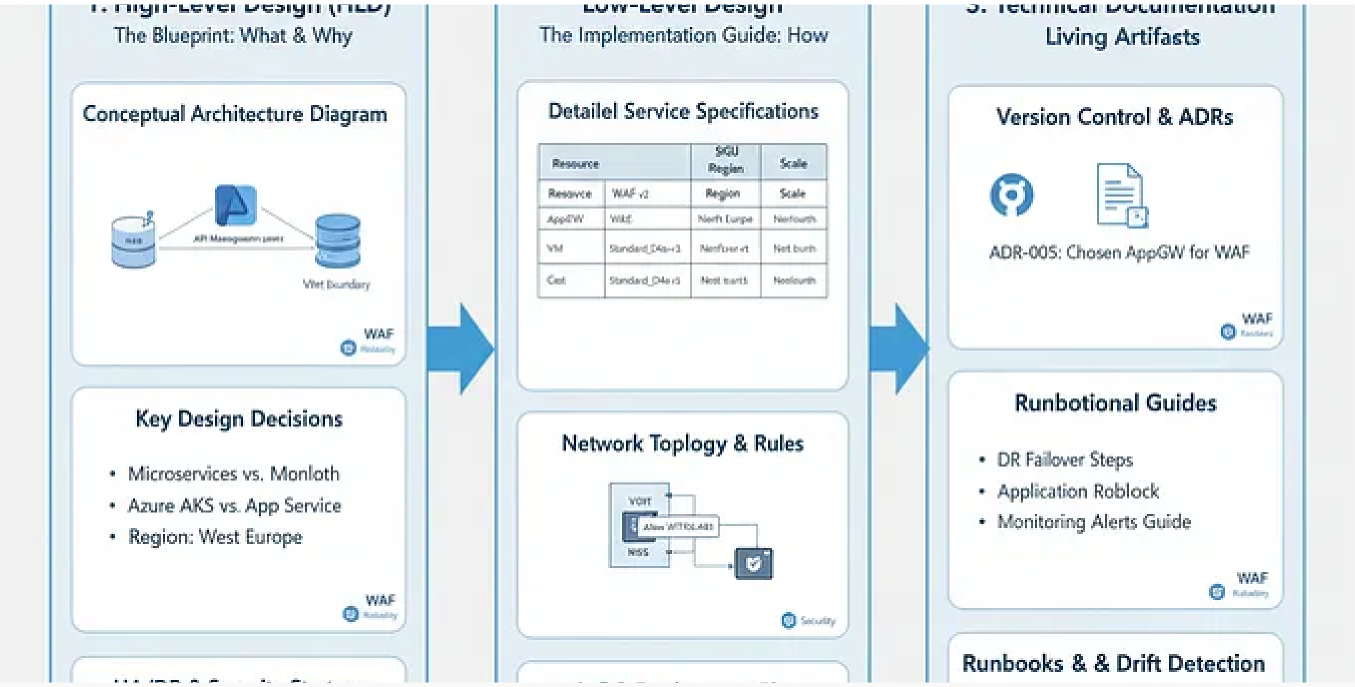

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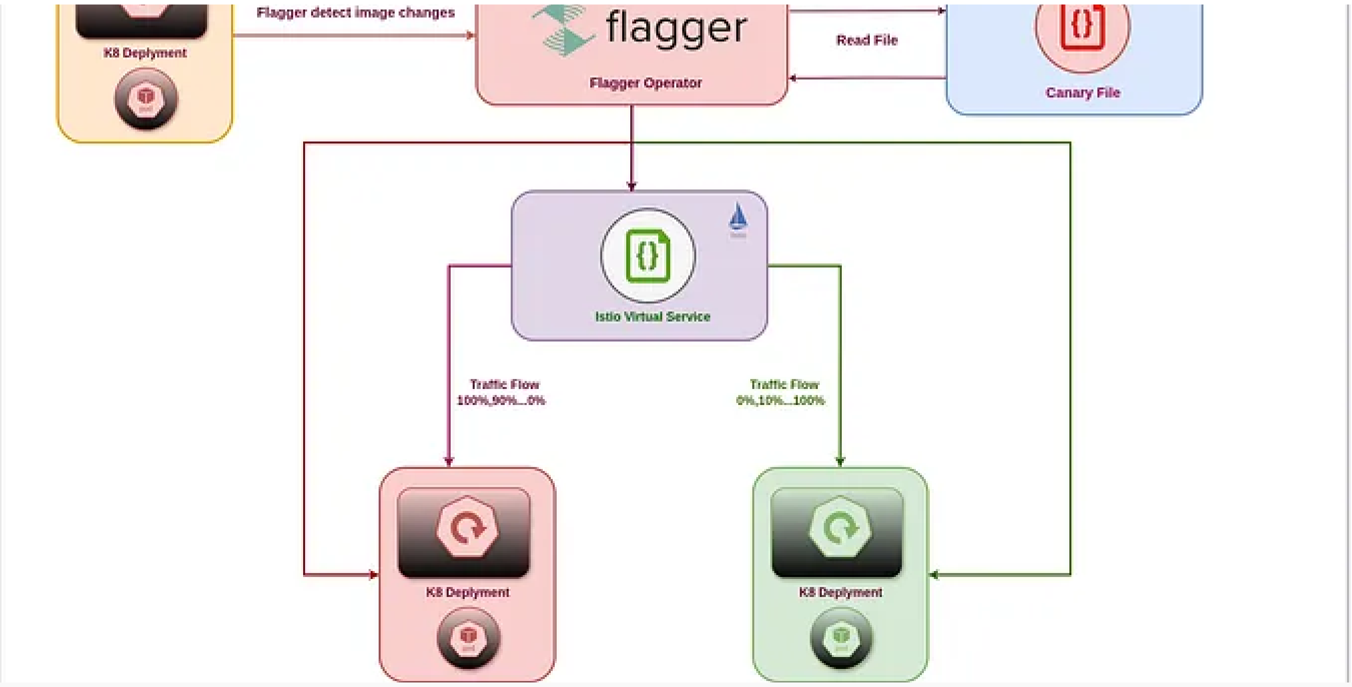

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