Introduction to **Helm**

A Package Manager for Kubernetes

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Agenda

- Docker vs Kubernetes
- Helm Introduction
- Helm 2 Vs Helm 3
- Installing Helm
- Helm Charts
- Helm Dependencies
- Helm Templates
- Helm Commands
- Helm Extras

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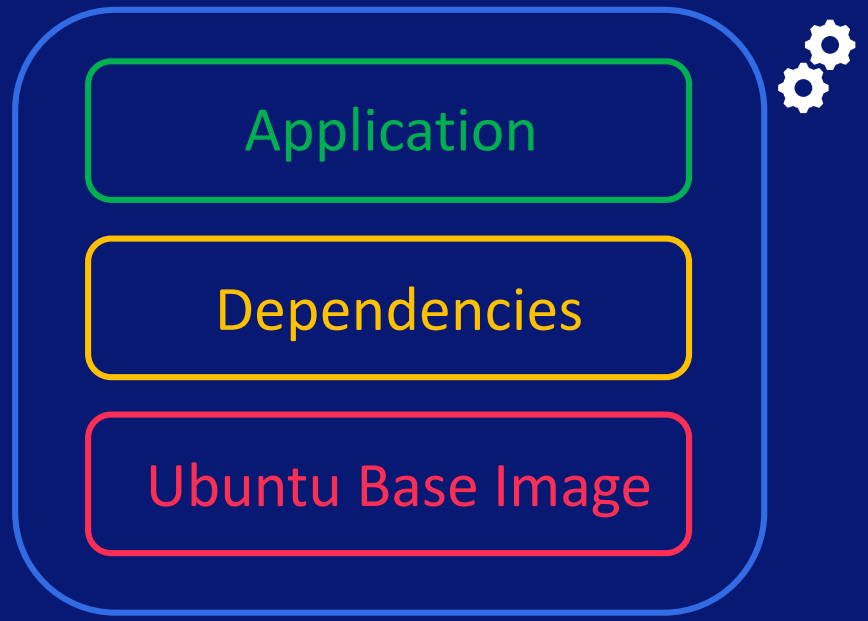
Docker

- Docker is a containerization engine, which provides blazing fast creation and management of containers. It makes it easy to develop, deploy, and manage applications by using containers
- Container refers to a lightweight, stand-alone, executable package of a piece of software that contains all the libraries, configuration files, dependencies, and other necessary parts to operate the application. They are the running instances of docker images
- Custom docker images can be built from Dockerfile

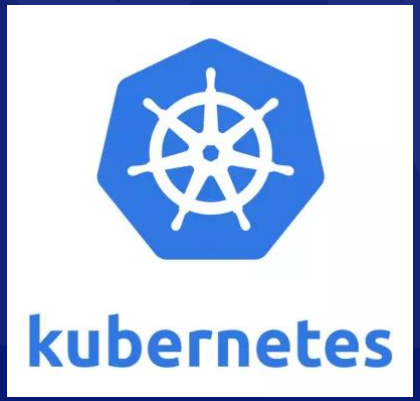
Ex: Ubuntu + Python + Dependencies



Kubernetes

Kubernetes

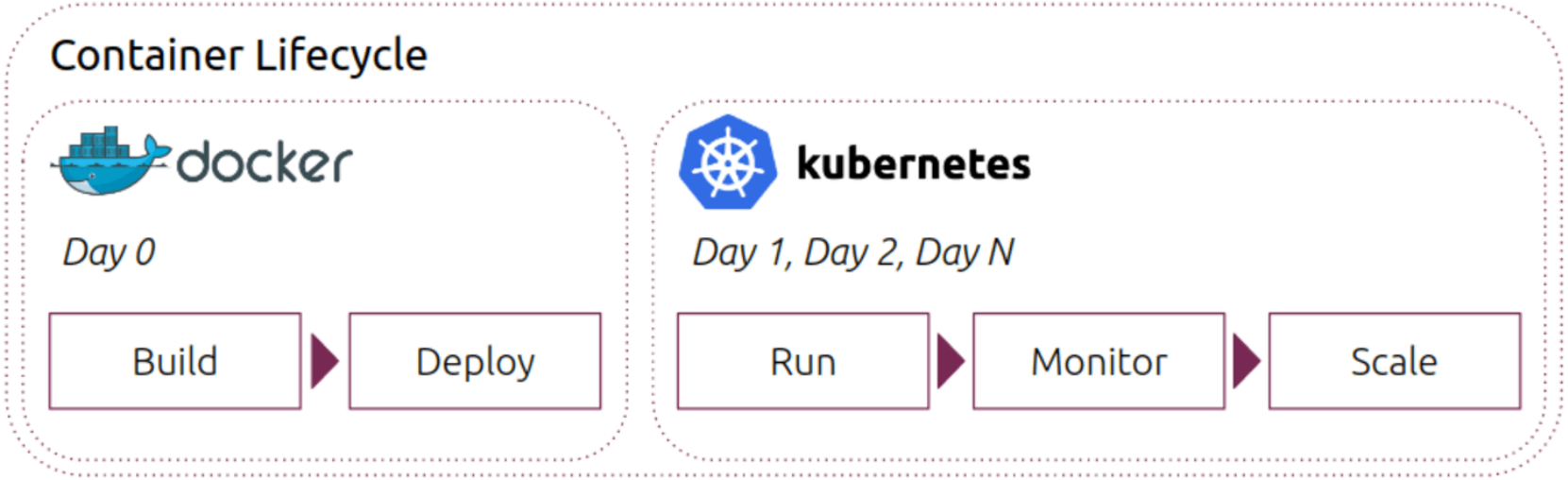
- Kubernetes also known as K8s, is an open-source Container Management tool
- It provides a container runtime, container orchestration, container-centric infrastructure orchestration, self-healing mechanisms, service discovery, load balancing and container (de)scaling
- Initially developed by Google, for managing containerized applications in a clustered environment but later donated to CNCF
- Written in Golang
- It is a platform designed to completely manage the life cycle of containerized applications and services using methods that provide predictability, scalability, and high availability.



Docker vs Kubernetes

Docker is a computer software that is able to perform operating-system-level-virtualization, popularly known as containerization. It runs containerized applications.

Kubernetes is a container orchestration engine that makes it easy to automate container provisioning, networking, load-balancing, security and scaling applications across all the nodes in a multi host cluster. Kubernetes needs a Container Runtime Interface (CRI) to run containers. Although Docker is by far the most widely used container platform, other CRIs like rkt, containerd, LXC etc., can be used.



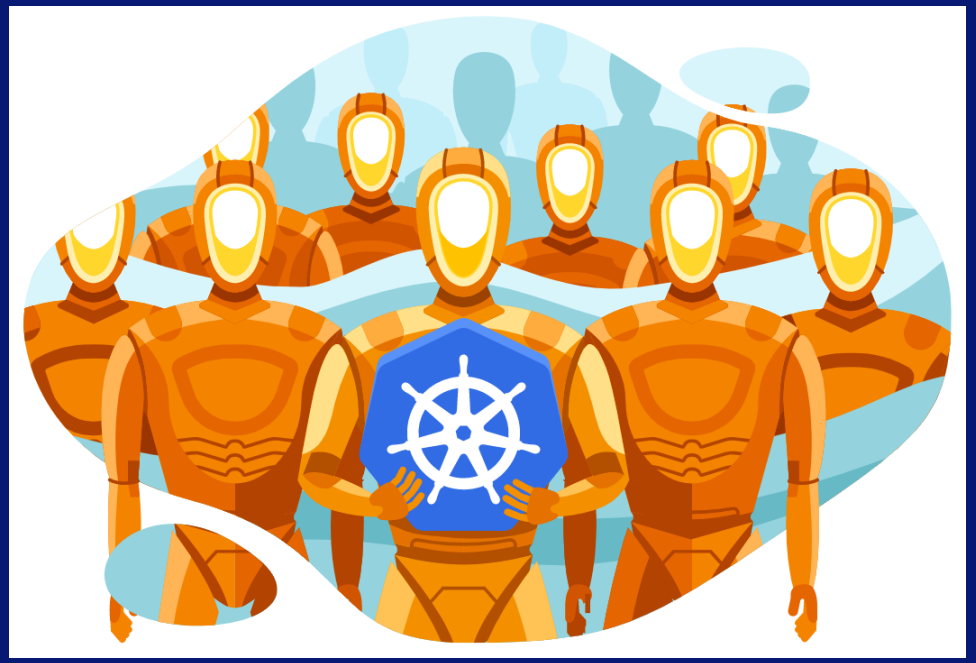
Kubernetes - Overview

A Kubernetes cluster is a set of physical or virtual machines and other infrastructure resources that are needed to run your containerized applications. Each machine in a Kubernetes cluster is called a **node**.

There are two types of node in each Kubernetes cluster:

Master node(s): hosts the Kubernetes control plane components and manages the cluster

Worker node(s): runs your containerized applications



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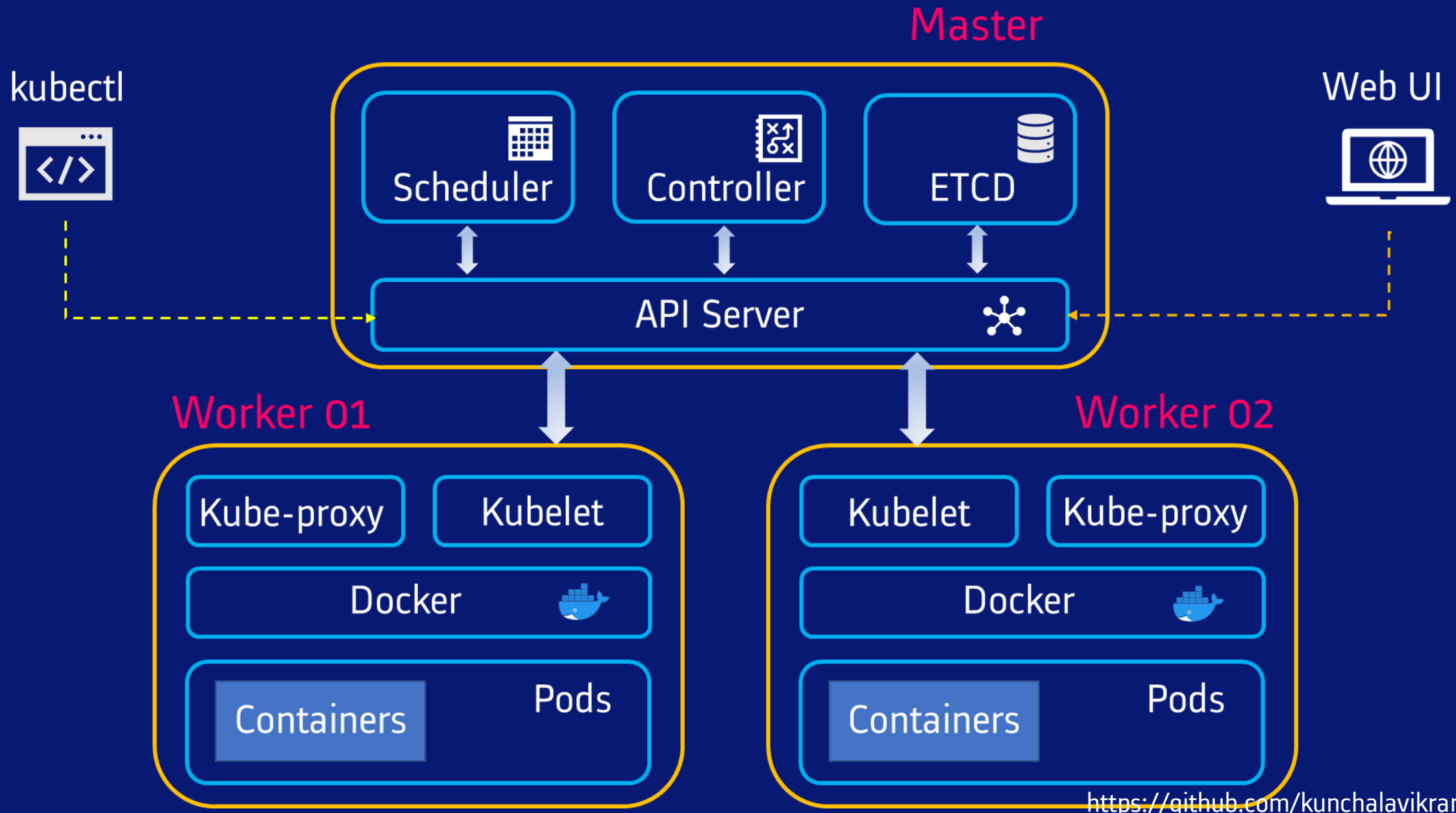
Kubernetes - Architecture



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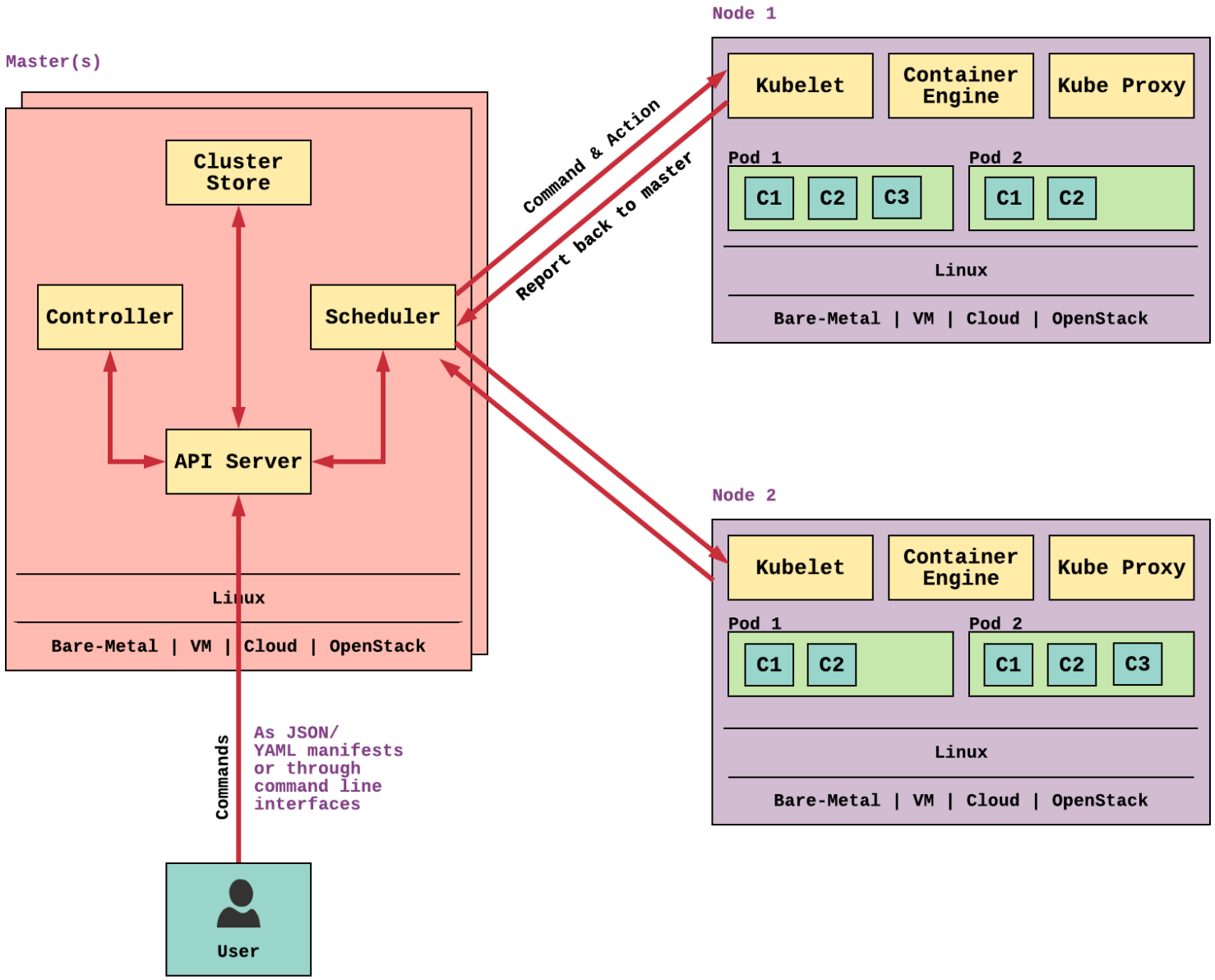
Kubernetes - Architecture



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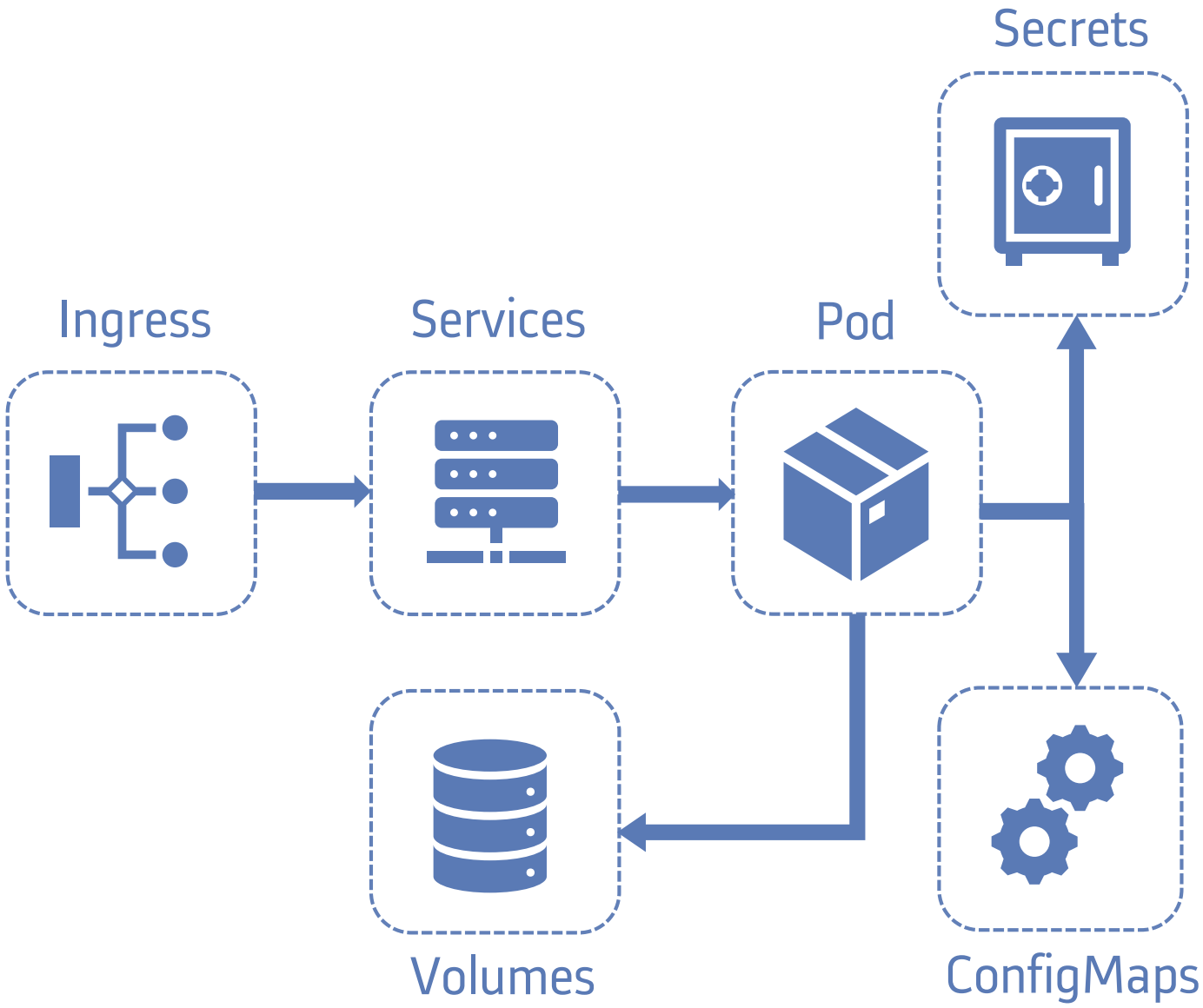
Kubernetes Resources

- Deployments
- Pods
- Services
- Ingress
- ConfigMaps
- Secrets
- Volumes: PV, PVC, storage
- DaemonSets
- RBAC

Etc.,



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Kubernetes – Manifest files

- We use yaml files to describe various objects in Kubernetes and to deployment applications in the cluster.

Deployment and Service yaml files

kubectl apply –f <object>.yml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: connectedcity-service
spec:
  ports:
  - port: 80
    targetPort: 5000
  selector:
    app: connectedcity
```

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: connectedcity-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: connectedcity
  template:
    metadata:
      labels:
        app: connectedcity
    spec:
      containers:
      - name: connectedcity
        image: kunchalavikram/connectedcity:v1
        ports:
        - containerPort: 5000
```

Application-1
Deployment + ClusterIP service

```yaml
apiVersion: v1
kind: Service
metadata:
  name: connectedfactory-service
spec:
  ports:
  - port: 80
    targetPort: 5000
  selector:
    app: connectedfactory
```

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: connectedfactory-deployment
spec:
  replicas: 3
  selector:
    matchLabels:
      app: connectedfactory
  template:
    metadata:
      labels:
        app: connectedfactory
    spec:
      containers:
      - name: connectedfactory
        image: kunchalavikram/connectedfactory:v1
        ports:
        - containerPort: 5000
```

Application-2
Deployment + ClusterIP service

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Kubernetes – Manifest files

- We use yaml files to describe various objects in Kubernetes and to deployment applications in the cluster.

Ingress Rules yaml file

```yaml
apiVersion: networking.k8s.io/v1beta1
kind: Ingress
metadata:
  name: ingress-rules
  annotations:
    nginx.ingress.kubernetes.io/rewrite-target: /
spec:
  rules:
  - host: connected-city.com
    http:
      paths:
      - backend:
          serviceName: connectedcity-service
          servicePort: 80
  - host: connected-factory.com
    http:
      paths:
      - backend:
          serviceName: connectedfactory-service
          servicePort: 80
```

kubectl apply –f <object>.yml

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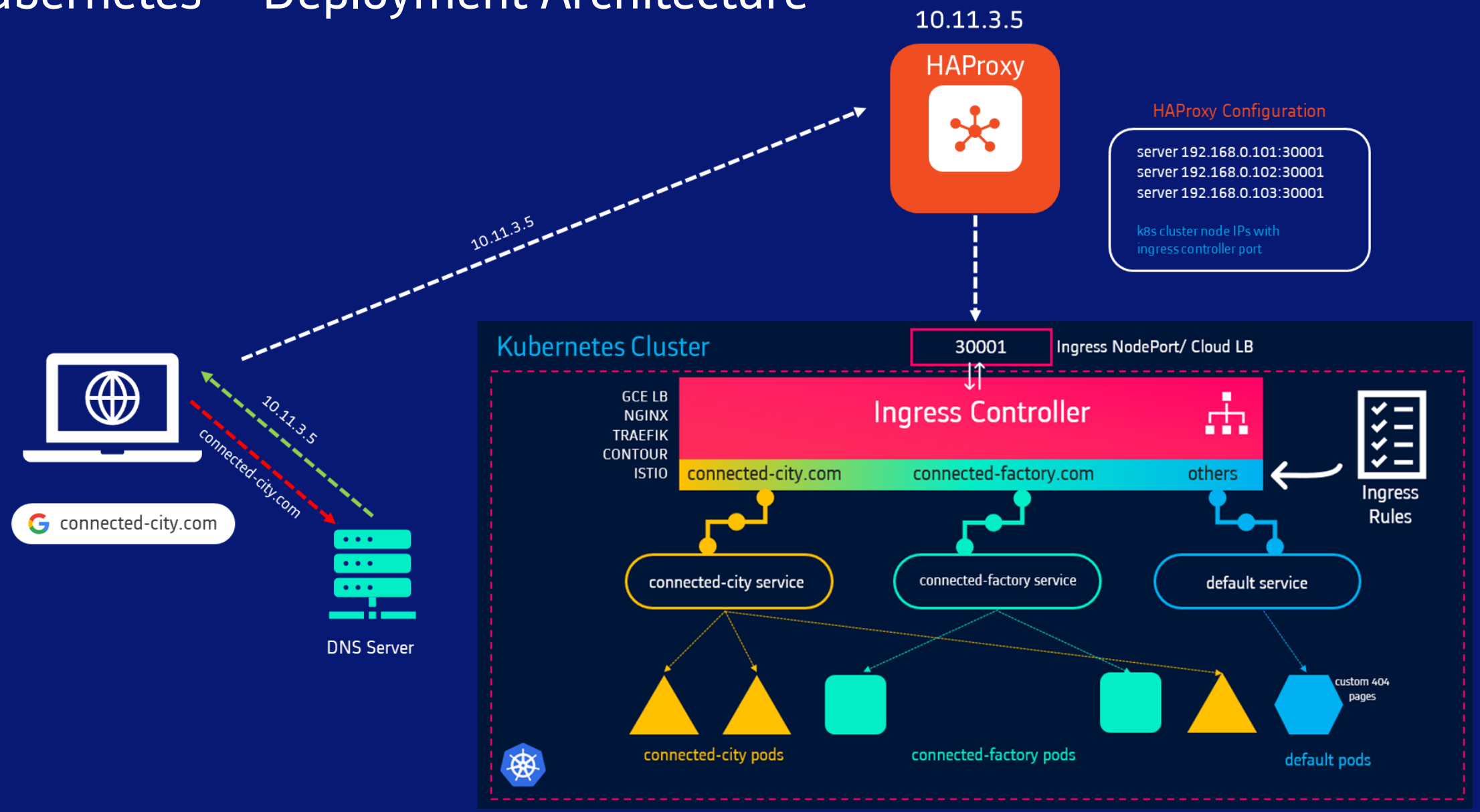
Kubernetes – Deployment Architecture



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Deployment Limitations

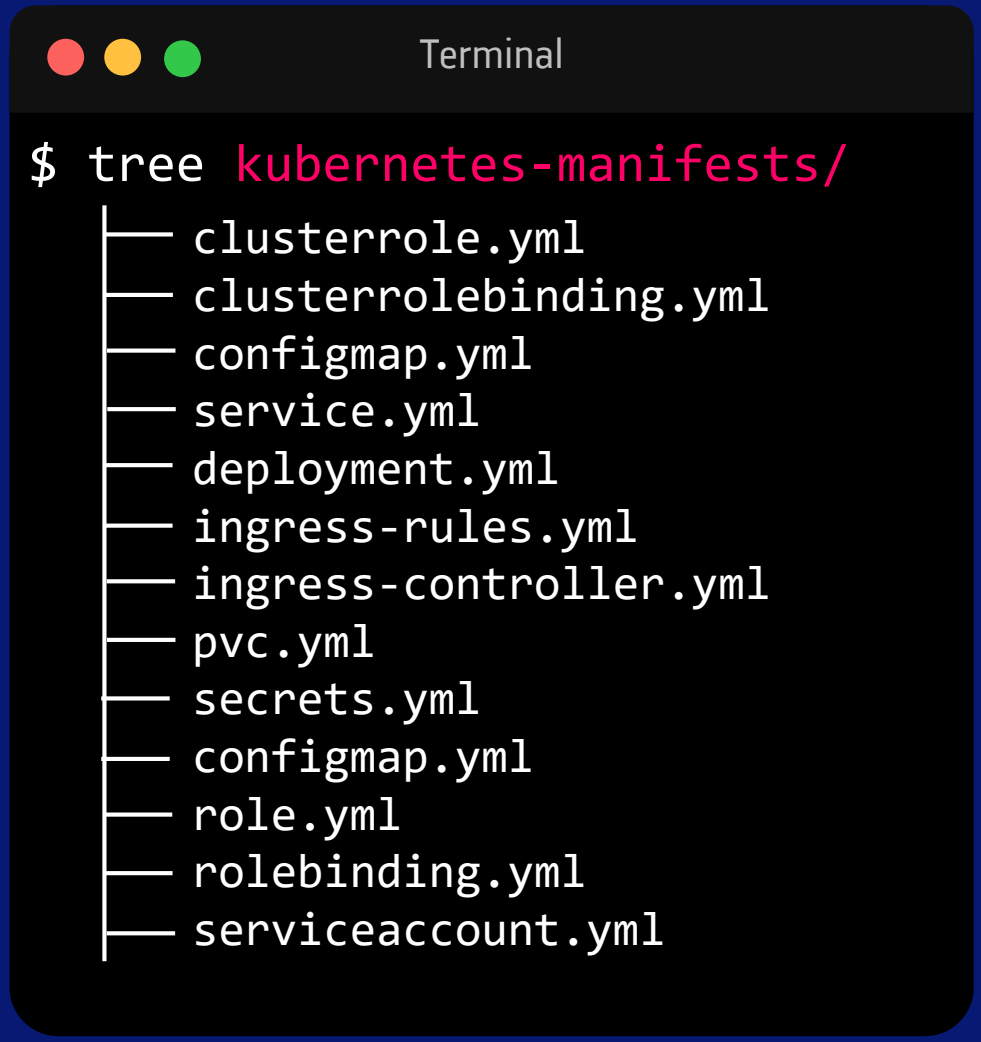
Kubernetes is a powerful tool, however, several challenges can hamper its adoption.

Deployment Complexity

- Deployment and management of applications on Kubernetes can become very complex with all the objects(YAML files) to be managed such as ConfigMaps, Services, Pods, Persistent Volumes. It can be tedious and error prone.

Impaired Developer Productivity

- Developers can spend a lot of time deploying test environments to test code and replicate customer issues.
- With Helm, developers can focus on developing applications instead of deploying dev-test environments.
- Helm Charts – such as MySQL, MongoDB and Postgresql – allow developers to get a working database quickly for their application.



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Helm

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What is Helm?

- Helm is a tool which allows to manage Kubernetes based applications by providing a standard approach for defining how we install, upgrade and uninstall applications
- It is a package manager for Kubernetes and the best way to find, share, and use software built for Kubernetes
- Allows developers to easily package, configure, and deploy applications and services onto Kubernetes clusters through Helm Charts
- Charts are files that are written in YAML and packaged in a particular directory structure which can be versioned within any source control systems. These charts describe a set of Kubernetes resources which makes up the entire application
- Helm is an official Kubernetes project and is part of the Cloud Native Computing Foundation(CNCF)
- Helm can:
  - ✓ Install software
  - ✓ Automatically install software dependencies
  - ✓ Upgrade software
  - ✓ Configure software deployments
  - ✓ Fetch software packages from repositories called Charts repository

Helm

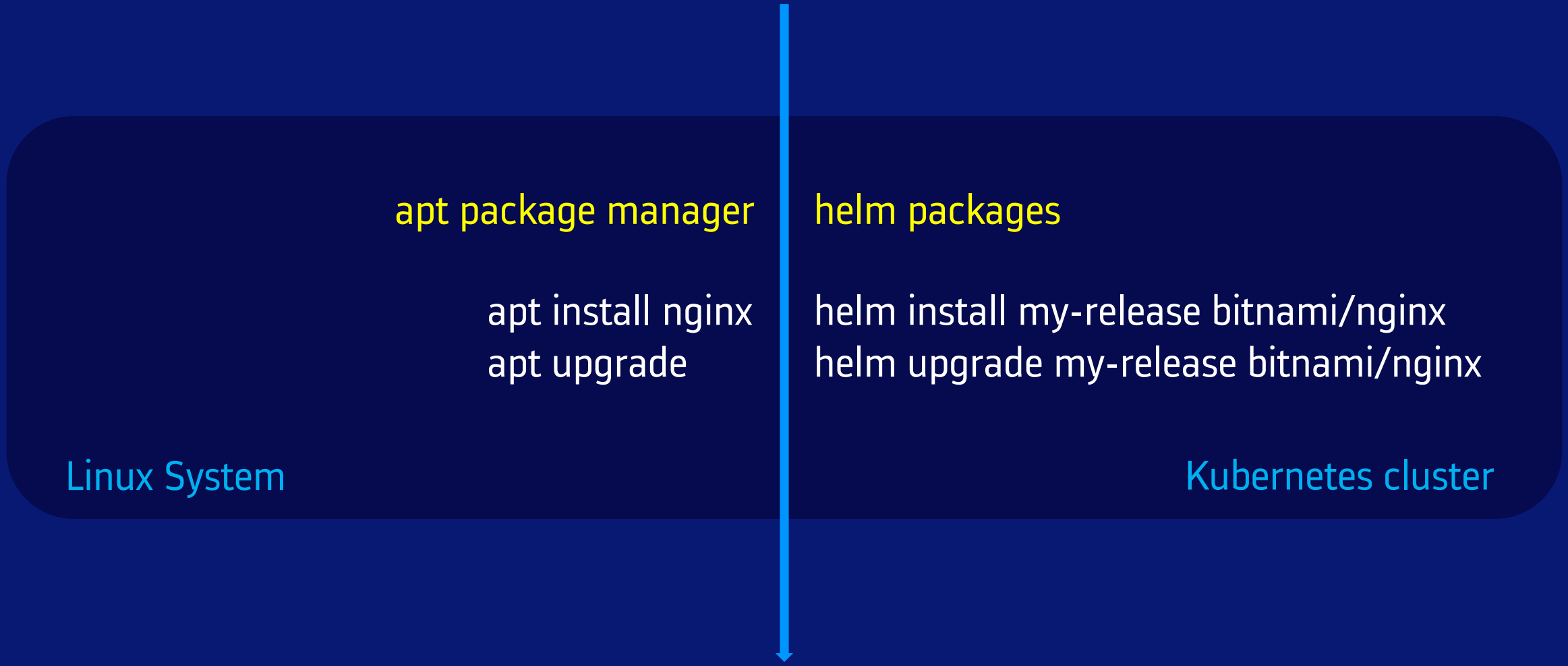
Package Managers

	Package manager	Packages
SYSTEM	apt	deb
	yum	rpm
DEVELOPMENT	maven	jar / java artifacts
	npm	node modules
	pip	python packages
KUBERNETES	helm	charts

A package manager is a collection of software tools that automates the process of installing, upgrading, configuring, and removing computer programs for a computer's operating system in a consistent manner.

Helm

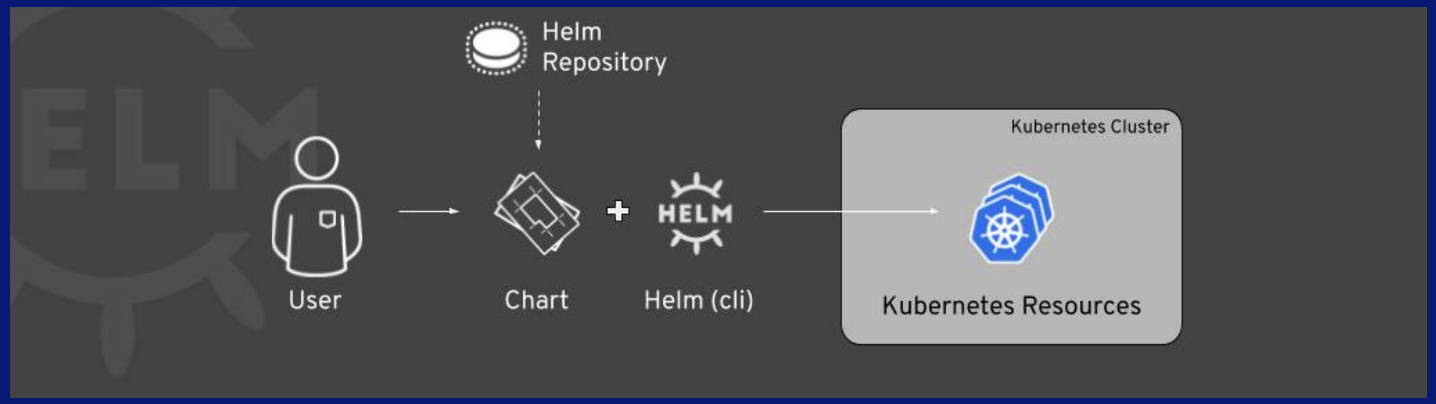
Package Managers



https://artifacthub.io/

What makes Helm so popular?

- Offers a simple way to package all application resources into one single chart and advertises what you can configure
- Hiding the complexity of running multiple YAML files to deploy the application. Instead we run a single command that install all YAML files at once
- One click install/upgrade/rollback applications
- Easy management of application releases
- Same chart can be used for different environment like dev, staging and prod
- Reusable charts from helm repositories
- Latest version is v3.4.2



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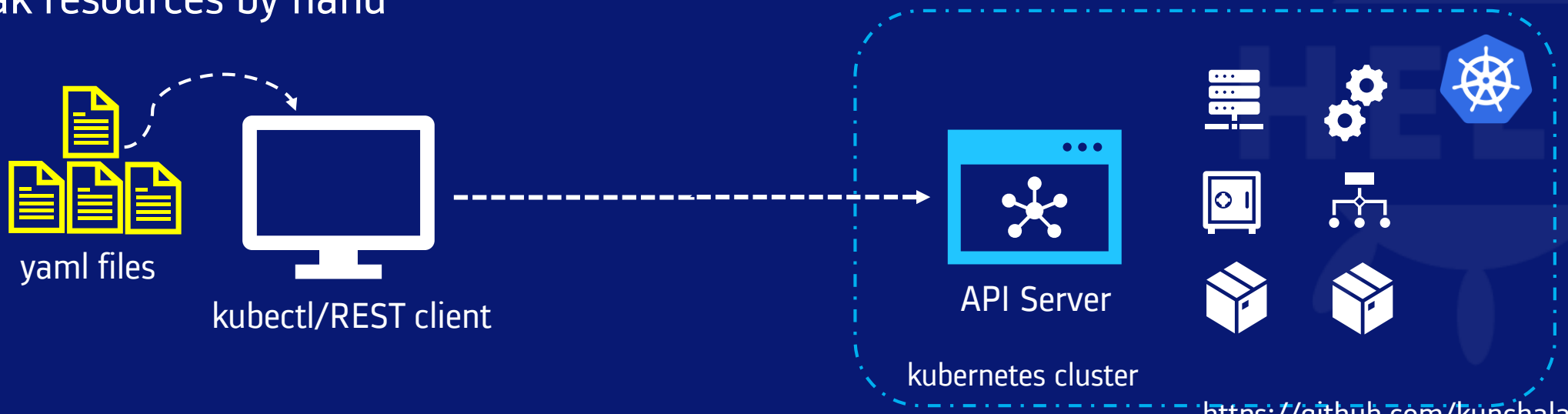
Without Helm

- Write and modify large set of Kubernetes manifests
- Do this every time a release is needed
- No packaging of files
- Rollbacks are possible at the YAML level. If an application has to be rolled back, all its dependent YAML files/resources are to be rolled back. Since no version is maintained for all resources, rollbacks are not easy
- No concept of application rollback since no application versioning is done in the cluster
- Figure out your own sharing: Git, offline etc
- Tweak resources by hand



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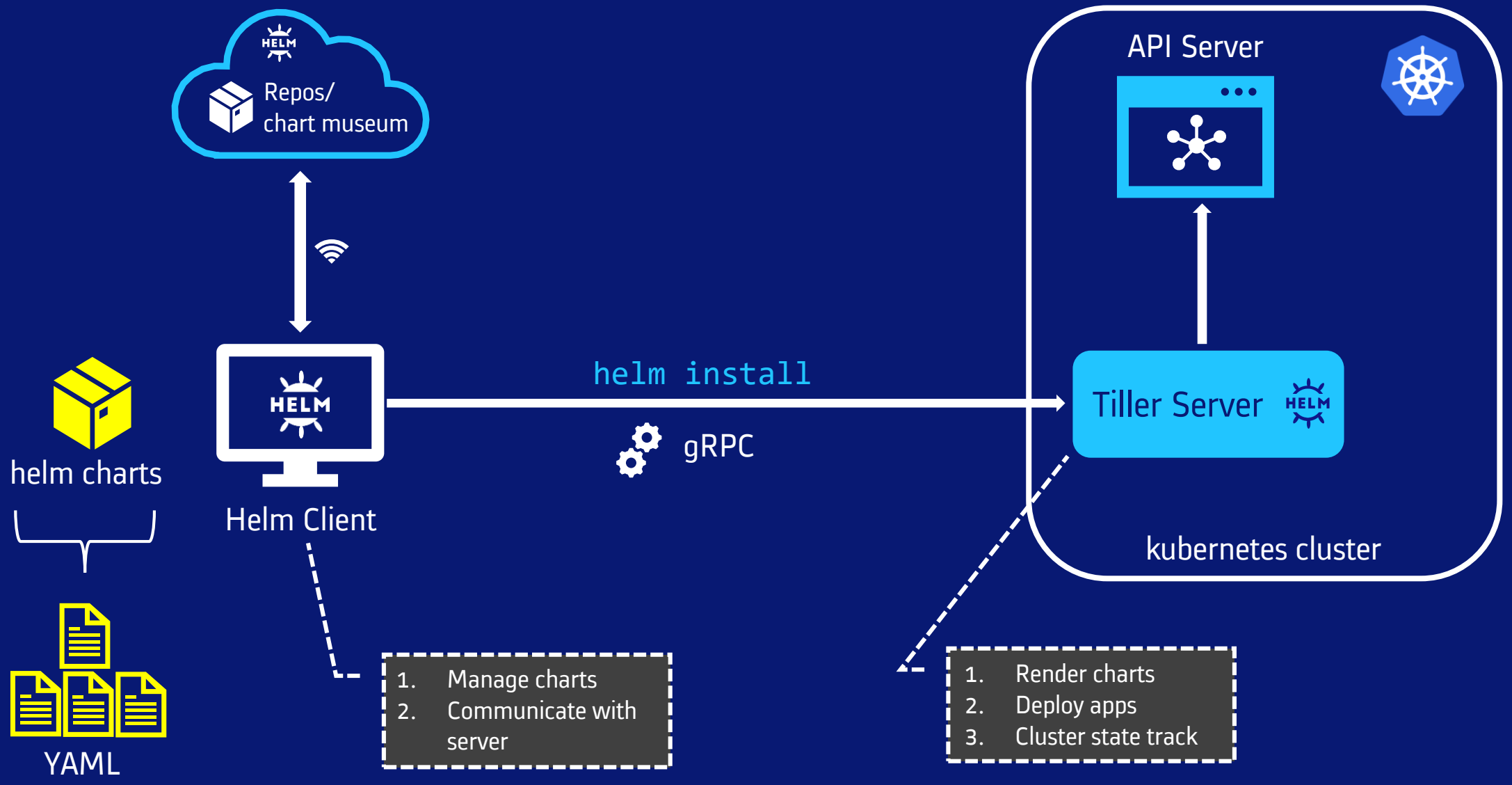
What Helm is NOT

- Full fledged system package manager
- Configuration management tool like Ansible, Chef, Puppet etc.
- Kubernetes resource lifecycle controller
- Version control system

Helm2 Architecture



Helm2 client uses gRPC protocol to communicate with Tiller server

Helm3 Architecture & Working

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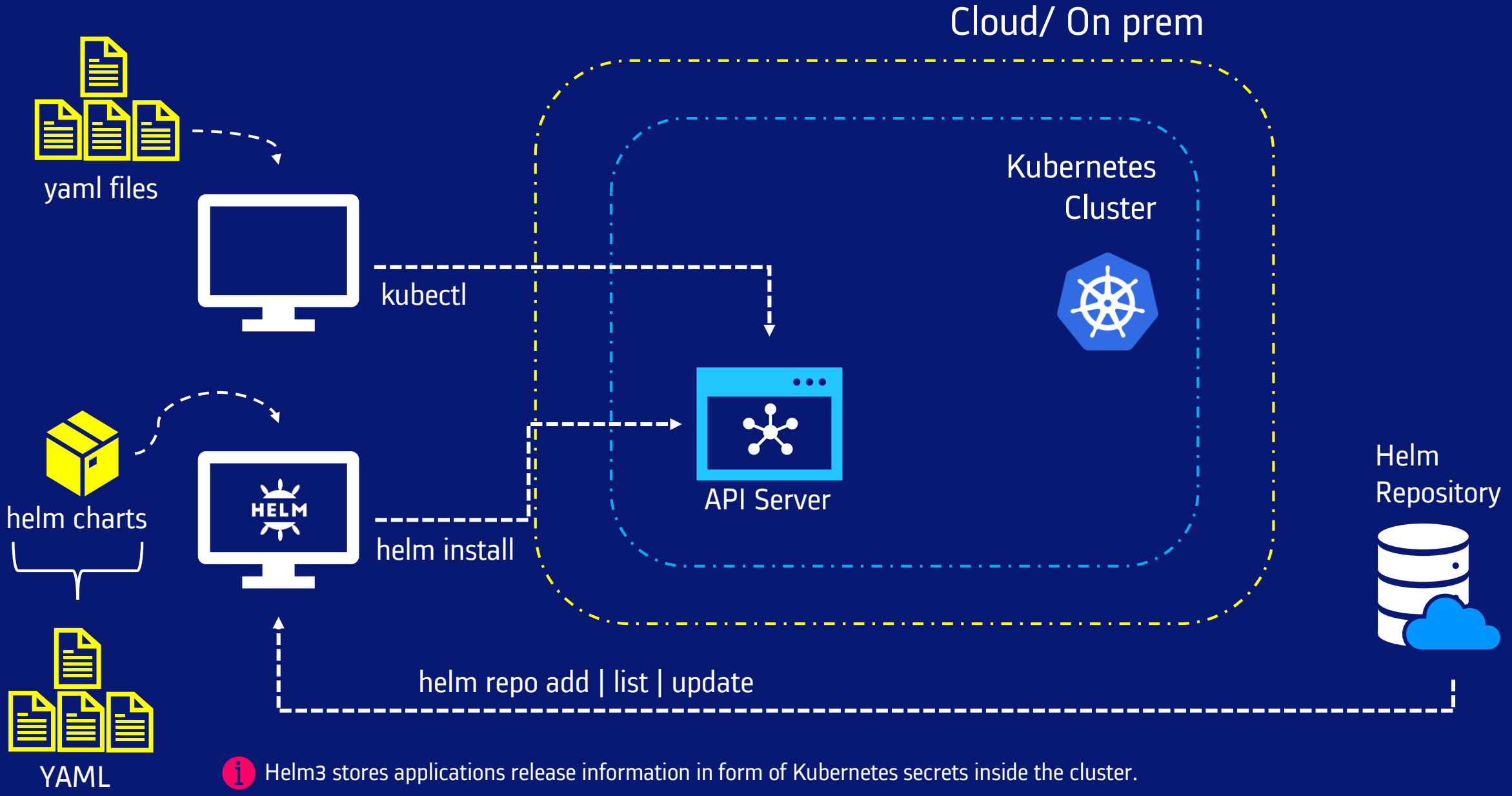


Helm3 stores applications release information in form of Kubernetes secrets inside the cluster.

Helm Common terminologies

Helm client/helm

- Helm Client is a command line tool for developing Charts, managing repositories and releases, and interfacing with the Helm Library.

Tiller

- Tiller is the Helm server.
- It interacts directly with the Kubernetes API server to install, upgrade, query, and remove Kubernetes resources. It is installed in the Kubernetes cluster and runs as a pod. Tiller is removed in Helm3

Chart

- It contains all of the resource definitions necessary to run an application, tool, or service inside of a Kubernetes cluster. A chart is basically a package of pre-configured Kubernetes resources.

Release

- An instance of a chart running in a Kubernetes cluster
- Same chart can be deployed multiple times in multiple environments

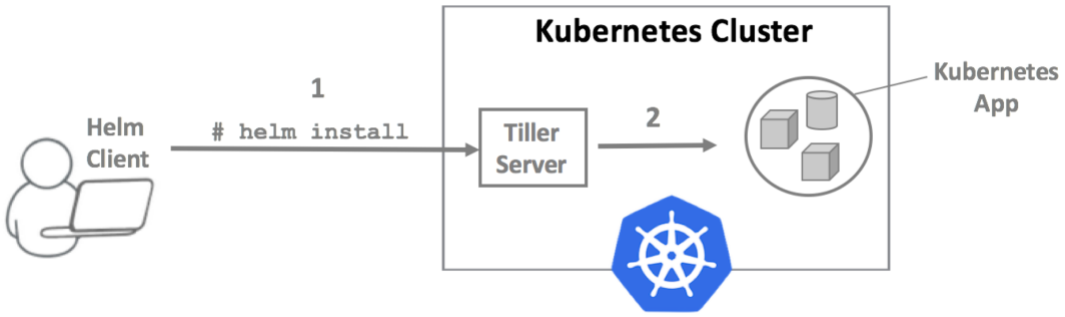
Repository

- Place where charts reside and can be shared with others

Helm2 Architecture

Helm Client

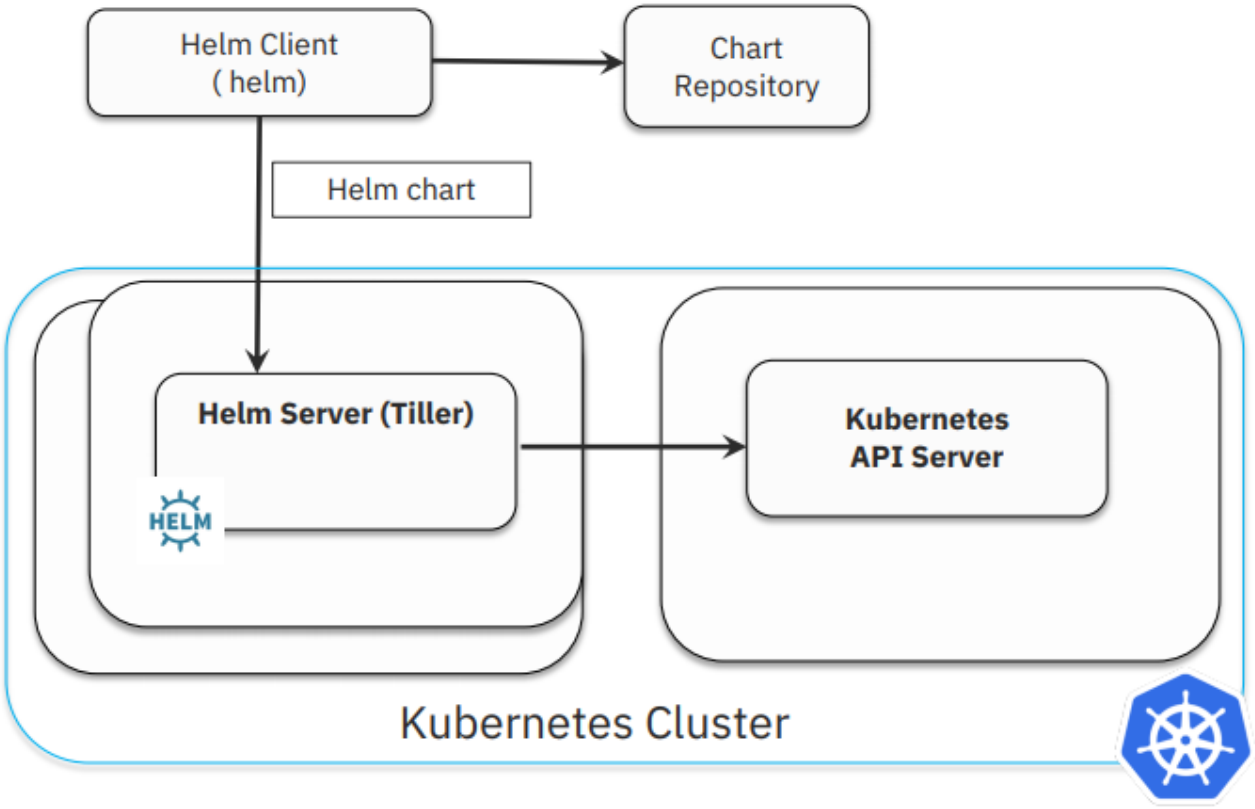
- Command-line client for end users
- Local chart development
- Managing repositories
- Interacts with the Tiller server by sending charts to be installed/upgrade/uninstall



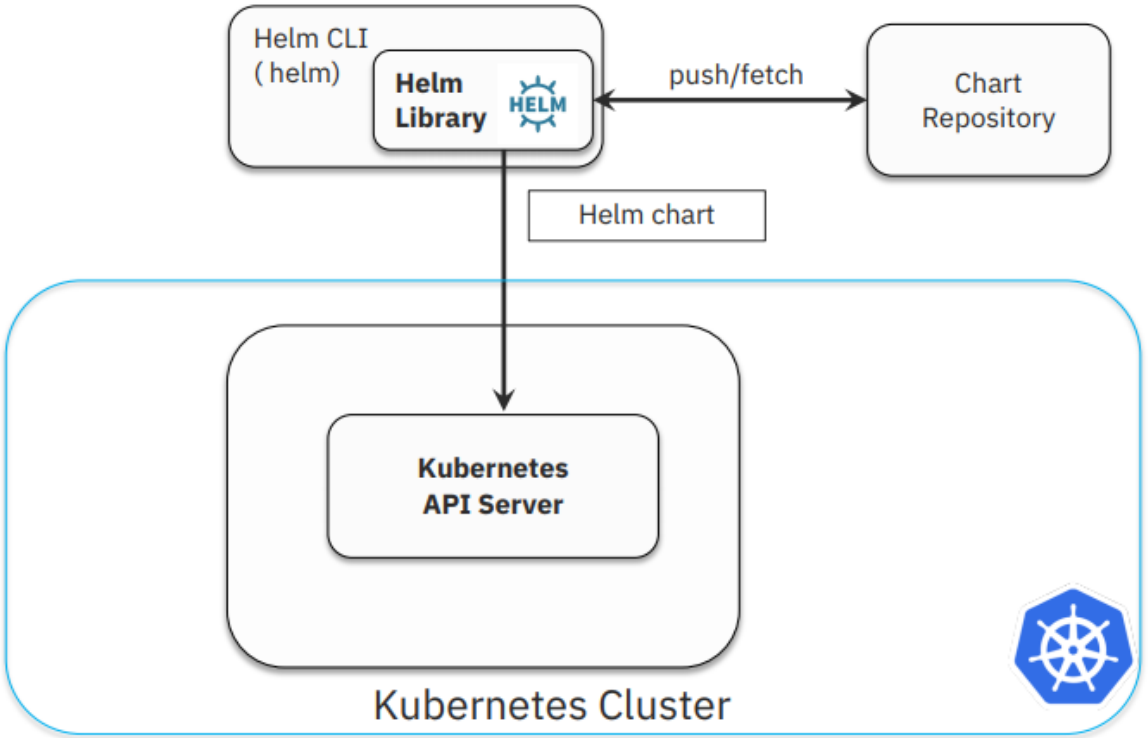
Tiller Server

- Listening for incoming requests from the Helm client
- Combining a chart and configuration to build a release: Rendering templates
- Installing charts into Kubernetes, and then tracking the subsequent release
- Upgrading and uninstalling charts by interacting with Kubernetes

Helm2 vs Helm3



v2



v3

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Helm3 – What changed from Helm2

Tiller removed in Helm3

- When Helm 2 was developed, Kubernetes did not had role-based access control (RBAC)
- So, Helm had to take care of authorizing who and what actions a user can perform in the cluster
- With Kubernetes 1.6 RBAC is enabled by default, so there is no need for Helm to do the same job which can be done natively by Kubernetes and that's why in Helm 3 tiller is removed completely

Three-way strategic merge patch

- In Helm 2 a patch would be generate by comparing the old manifest against the new manifest
- If someone manually changed the deployment, the helm has no info regarding that and rollbacks would give erroneous results
- In Helm 3, the patch is generated using the old manifest, the live state of the cluster, and the new manifest

Helm3 – What changed from Helm2

Secrets as the default storage driver

- Helm 2 used ConfigMaps to store release information. In Helm 3, Secrets are used instead as the default storage driver

JSON Schema Chart Validation

- A JSON Schema validation can now be forced upon chart values
- With this functionality, we can ensure that values provided by the user follow the schema created by the chart maintainer

  Ex: Port number can be made mandatory and without which the chart cannot be installed

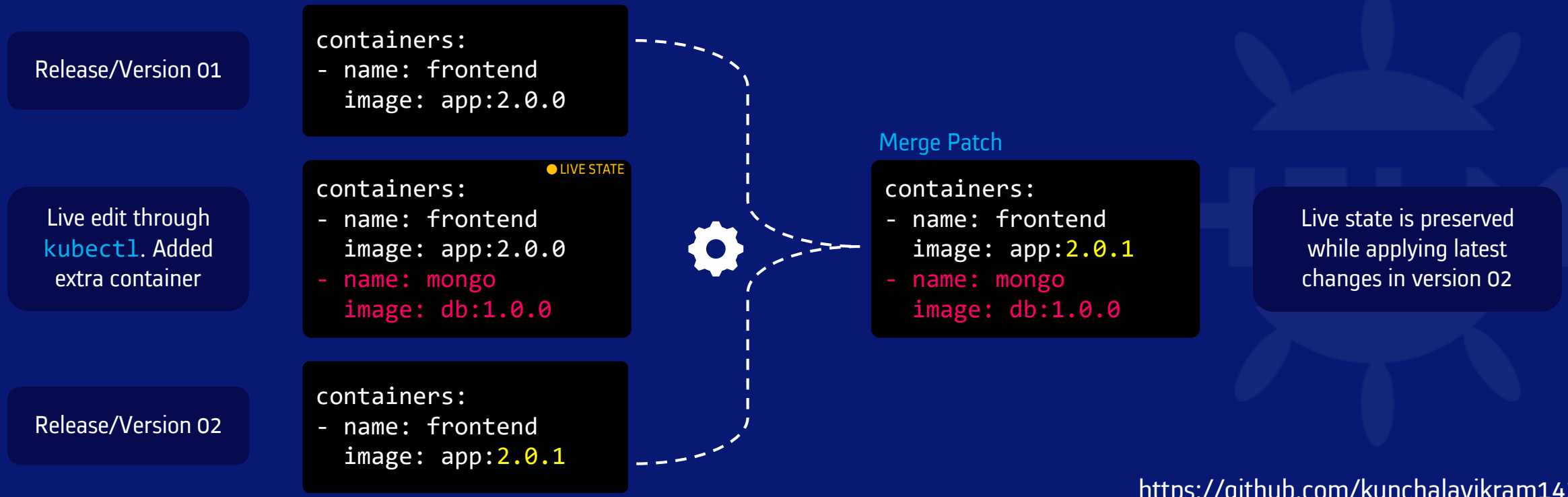
Release name is now required

- In Helm 2, if no name was provided, a random release name would be generated.
- Helm 3 will throw an error if no name is provided with helm install

Helm 2 charts are compatible with Helm 3, although the chart structure might differ

Helm: Three-way strategic merge patch

- Helm 3 uses three way strategic merge patch
- It means if any helm operation is to be performed like version upgrade, it compares the most recent manifest chart(v1) against the proposed chart manifest(v2) and also the live state of the cluster
- So, any manual changes made to the cluster using `kubectl` (for example kubectl edit), will also be considered and changes are retained in the final release



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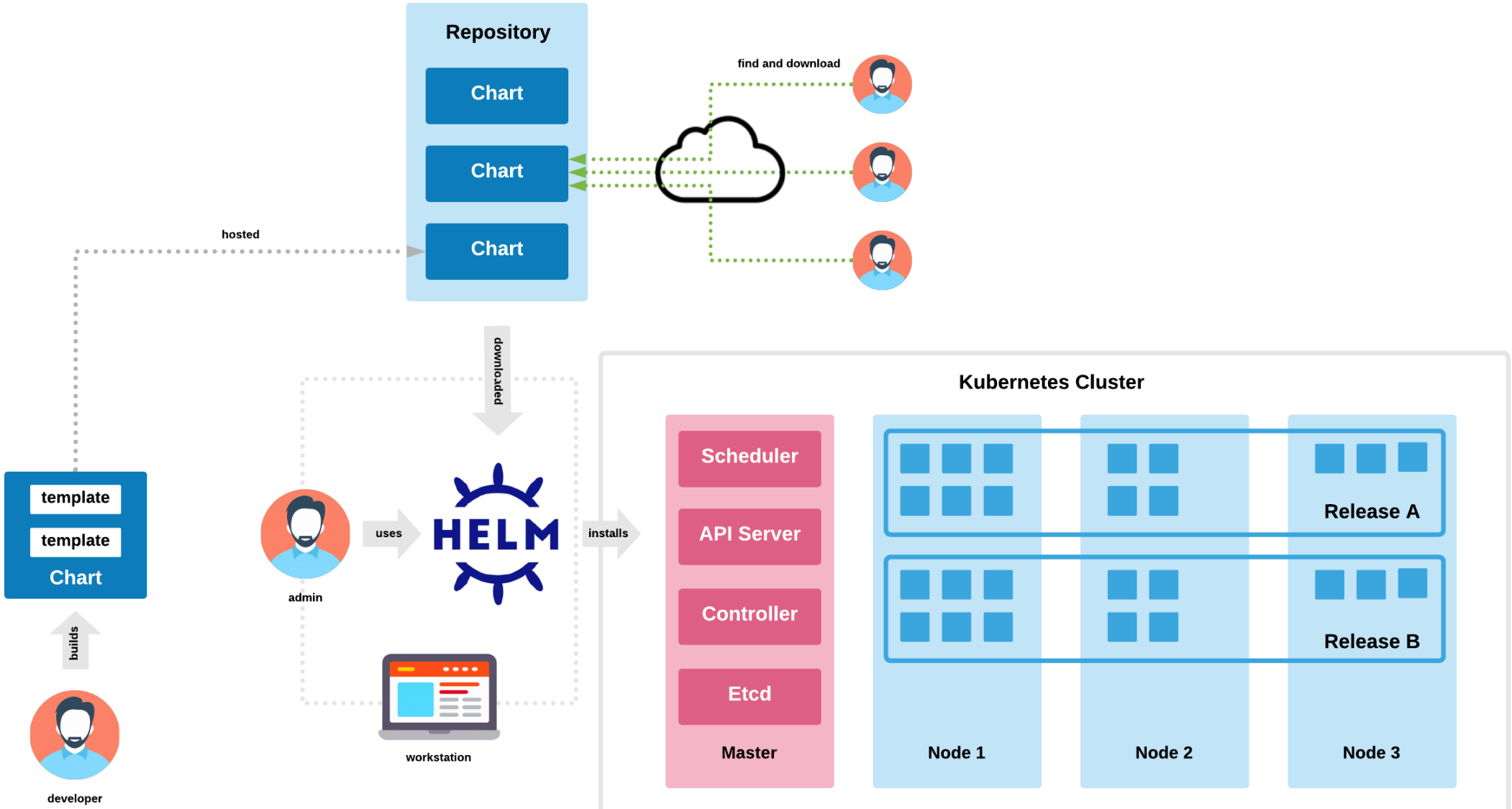
Helm Architecture



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Installing Helm

Installing Helm

From Source

- Download the desired version from https://github.com/helm/helm/releases
- Unpack the downloaded file. Ex:

```
tar -zxvf helm-v3.0.0-linux-amd64.tar.gz
```

- Find the helm binary in the unpacked directory, and move it to its desired destination

```
mv linux-amd64/helm /usr/local/bin/helm
```

Using Package Managers(apt)

```
curl https://baltocdn.com/helm/signing.asc | sudo apt-key add -
sudo apt-get install apt-transport-https --yes
echo "deb https://baltocdn.com/helm/stable/debian/ all main" | sudo tee /etc/apt/sources.list.d/helm-stable-debian.list
sudo apt-get update
sudo apt-get install helm
```

https://helm.sh/docs/intro/install/

Check Helm Installation

Check version

- `helm version`
- `helm version --short`

```
root@k8s-master:/home/osboxes# helm version
version.BuildInfo{Version:"v3.3.0", GitCommit:"8a4aeec08d67a7b84472007529e8097ec3742105", GitTreeState:"dirty", GoVersion:"go1.14.7"}
root@k8s-master:/home/osboxes# helm version --short
v3.3.0+g8a4aeec
root@k8s-master:/home/osboxes#
```

Man pages/help

- `helm help`

```
root@k8s-master:/home/osboxes# helm help | more
The Kubernetes package manager

Common actions for Helm:

- helm search:    search for charts
- helm pull:      download a chart to your local directory to view
- helm install:   upload the chart to Kubernetes
- helm list:      list releases of charts
```

Helm defaults directories & options

Default environment variables

`$KUBECONFIG` - set an alternative Kubernetes configuration file (default "~/.kube/config")
`$HELM_KUBEAPISERVER` - set the Kubernetes API Server Endpoint for authentication

Default default directories

Operating System	Cache Path	Configuration Path	Data Path
Linux	$HOME/.cache/helm	$HOME/.config/helm	$HOME/.local/share/helm
macOS	$HOME/Library/Caches/helm	$HOME/Library/Preferences/helm	$HOME/Library/helm
Windows	%TEMP%\helm	%APPDATA%\helm	%APPDATA%\helm

To view kubectl config file, run: `kubectl config view`

https://helm.sh/docs/helm/helm/

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Helm defaults directories & options

Environment information in use by Helm

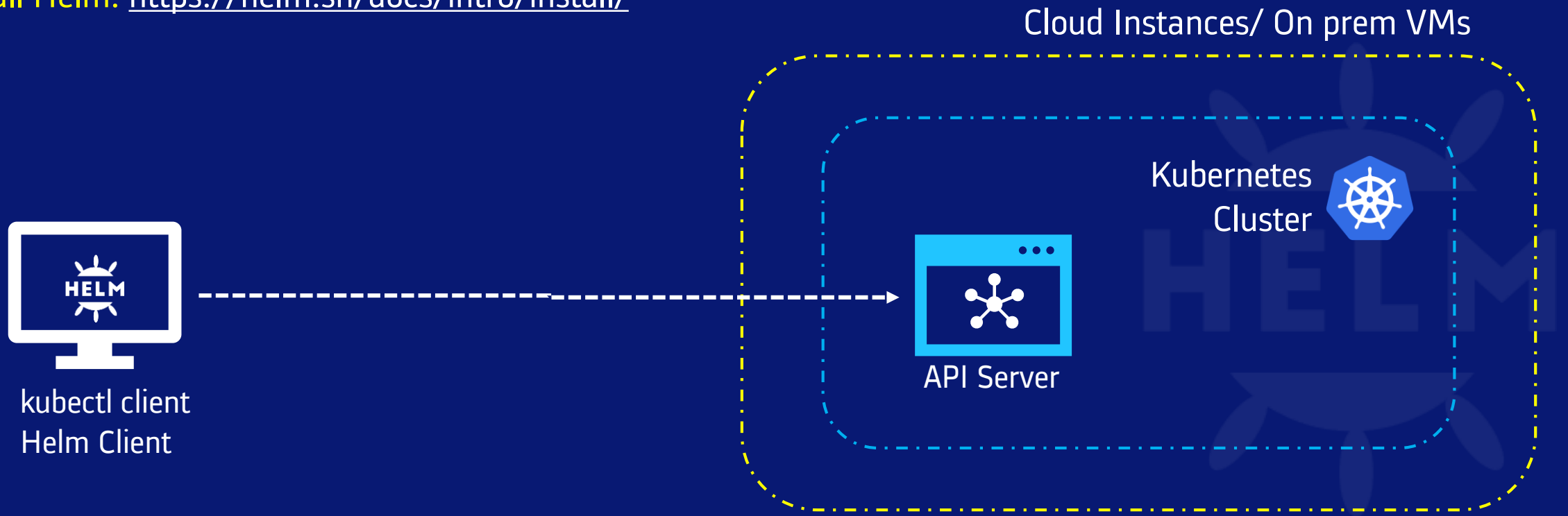
`helm env`

```
root@k8s-master:/home/osboxes# helm env
HELM_BIN="helm"
HELM_CACHE_HOME="/root/.cache/helm"
HELM_CONFIG_HOME="/root/.config/helm"
HELM_DATA_HOME="/root/.local/share/helm"
HELM_DEBUG="false"
HELM_KUBEAPISERVER=""
HELM_KUBECONTEXT=""
HELM_KUBETOKEN=""
HELM_NAMESPACE="default"
HELM_PLUGINS="/root/.local/share/helm/plugins"
HELM_REGISTRY_CONFIG="/root/.config/helm/registry.json"
HELM_REPOSITORY_CACHE="/root/.cache/helm/repository"
HELM_REPOSITORY_CONFIG="/root/.config/helm/repositories.yaml"
root@k8s-master:/home/osboxes#
```

To uninstall Helm completely, remove all the cache files stored in the above shown directories as well, along with removing the helm binary

Kubernetes cluster setup

- Cluster setup:
  - minikube https://minikube.sigs.k8s.io/docs/start/ (or)
  - kubectl https://github.com/kunchalavikram1427/Kubernetes_public/blob/master/Bootstrap_K8s_Cluster_Kubeadm.pdf
- Install kubectl utility: https://kubernetes.io/docs/tasks/tools/install-kubectl/
- Install Helm: https://helm.sh/docs/intro/install/

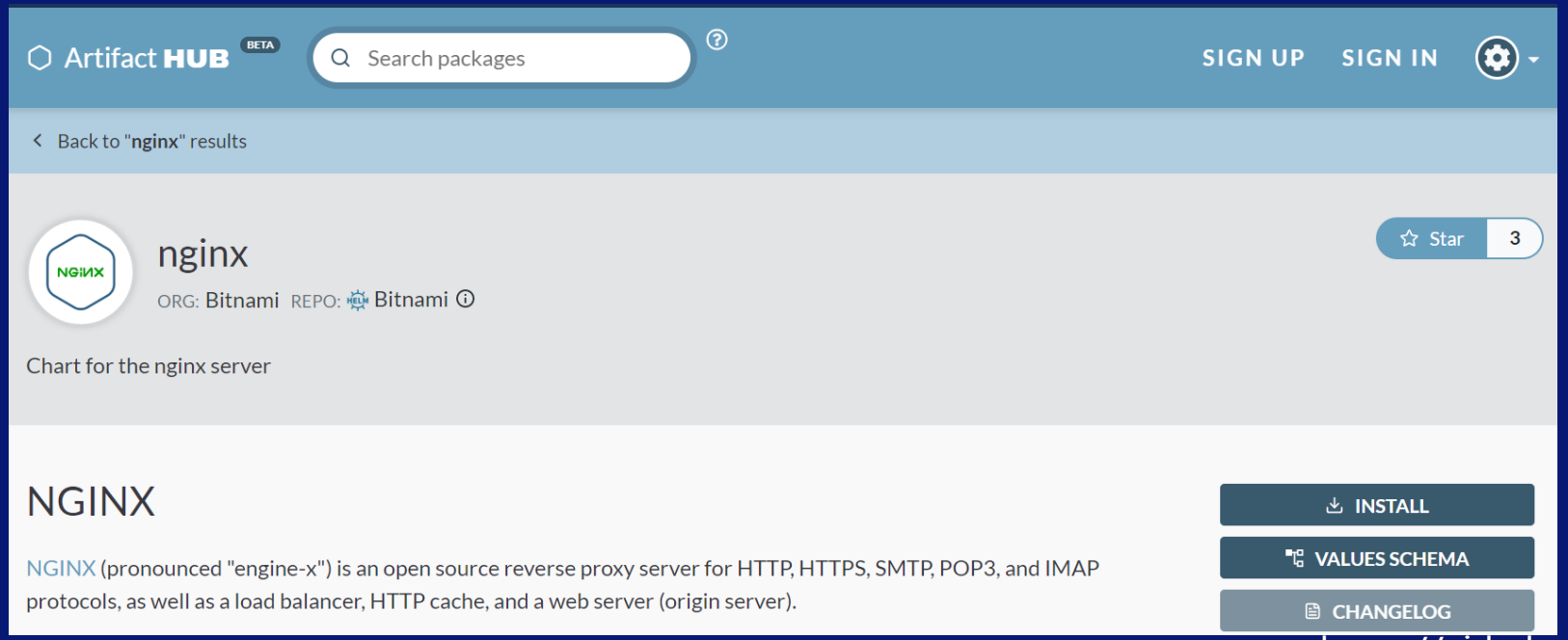


Helm Repositories

Helm Chart Repos

- Chart repository is a location where packaged charts can be stored and shared
- The official chart repository is maintained by the Kubernetes Charts, but Helm also makes it easy to create and run your own chart repository

```
helm repo add bitnami https://charts.bitnami.com/bitnami
helm repo update
helm install my-nginx bitnami/nginx --version 8.2.1
```

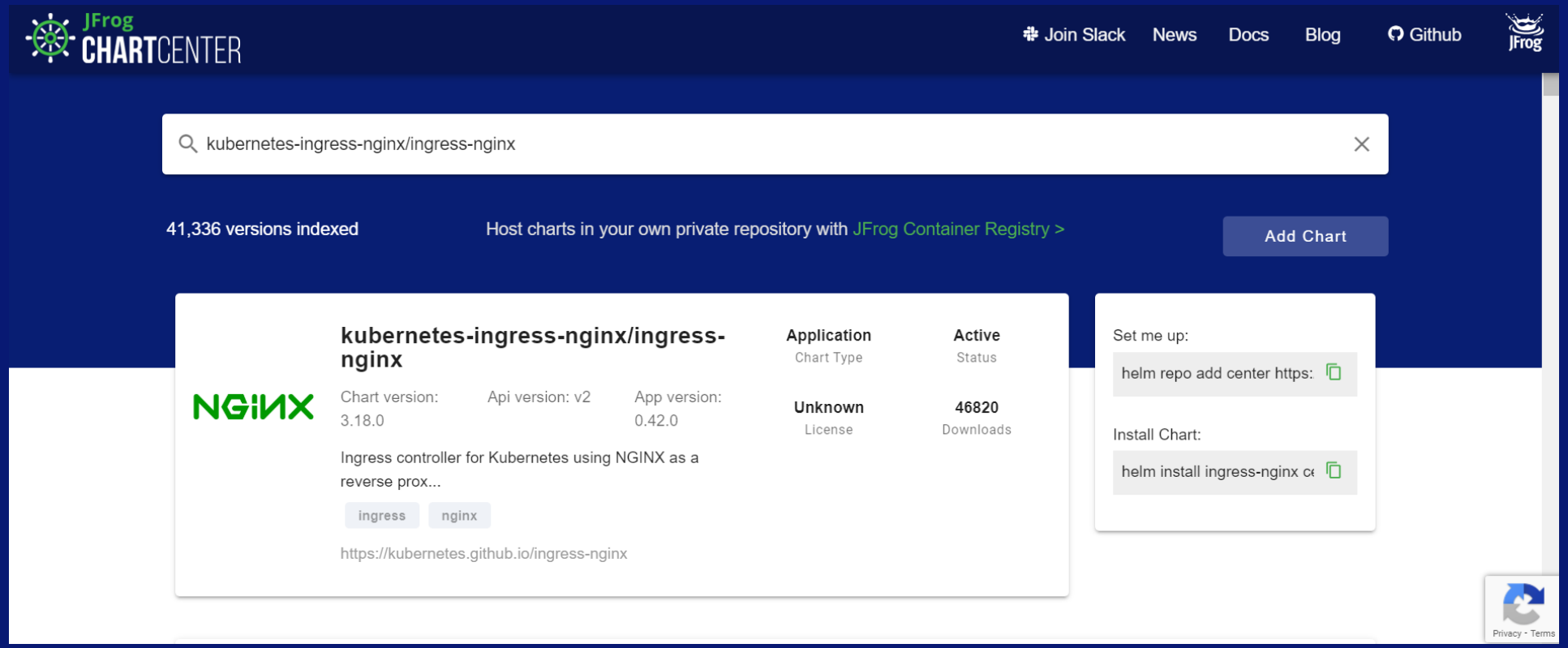


https://artifacthub.io/packages/search

https://github.com/kunchalavikram1427

Helm Chart Repos

```
helm repo add center https://repo.chartcenter.io
helm repo update
helm install ingress-nginx center/kubernetes-ingress-nginx/ingress-nginx
```



https://chartcenter.io/

https://github.com/kunchalavikram1427

Helm

Adding helm repos

- `helm repo add stable https://charts.helm.sh/stable`
- `helm repo add bitnami https://charts.bitnami.com/bitnami`
- `helm repo list`
- `helm repo remove <repo-name>`

```
root@k8s-master:/home/osboxes# helm repo add stable https://charts.helm.sh/stable
"stable" has been added to your repositories
root@k8s-master:/home/osboxes# helm repo add bitnami https://charts.bitnami.com/bitnami
"bitnami" has been added to your repositories
root@k8s-master:/home/osboxes# helm repo update
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "bitnami" chart repository
...Successfully got an update from the "stable" chart repository
Update Complete. ⎈ Happy Helming!⎈
root@k8s-master:/home/osboxes# helm repo list
NAME    URL
stable  https://charts.helm.sh/stable
bitnami https://charts.bitnami.com/bitnami
root@k8s-master:/home/osboxes#
```

Search for charts

- `helm repo update`
- `helm search repo mysql`

```
root@k8s-master:/home/osboxes# helm search repo mysql
NAME                                    CHART VERSION   APP VERSION     DESCRIPTION
bitnami/mysql                           8.2.3           8.0.22          Chart to create a Highly available MySQL cluster
stable/mysql                            1.6.9           5.7.30          DEPRECATED - Fast, reliable, scalable, and easy...
stable/mysqldump                        2.6.2           2.4.1           DEPRECATED! - A Helm chart to help backup MySQL...
stable/prometheus-mysql-exporter        0.7.1           v0.11.0         DEPRECATED A Helm chart for prometheus mysql ex...
bitnami/phpmyadmin                      8.0.2           5.0.4           phpMyAdmin is an mysql administration frontend
stable/percona                          1.2.3           5.7.26          DEPRECATED - free, fully compatible, enhanced, ...
stable/percona-xtradb-cluster           1.0.8           5.7.19          DEPRECATED - free, fully compatible, enhanced, ...
stable/phpmyadmin                       4.3.5           5.0.1           DEPRECATED phpMyAdmin is an mysql administratio...
bitnami/mariadb                         9.2.0           10.5.8          Fast, reliable, scalable, and easy to use open-...
bitnami/mariadb-cluster                 1.0.2           10.2.14         DEPRECATED Chart to create a Highly available M...
bitnami/mariadb-galera                  5.3.4           10.5.8          MariaDB Galera is a multi-master database clust...
stable/gcloud-sqlproxy                  0.6.1           1.11            DEPRECATED Google Cloud SQL Proxy
stable/mariadb                          7.3.14          10.3.22         DEPRECATED Fast, reliable, scalable, and easy t...
```

https://artifacthub.io/

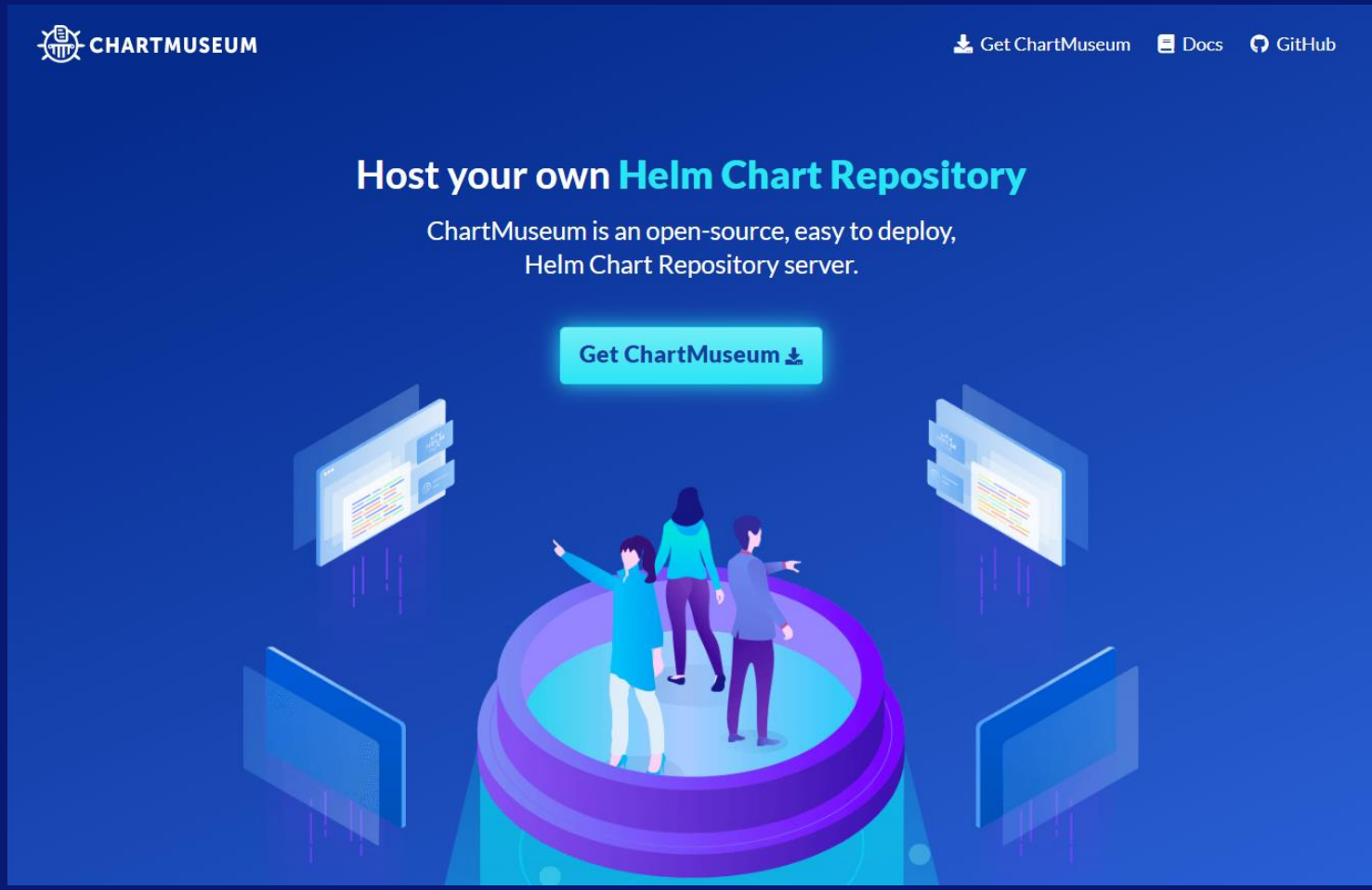
https://github.com/kunchalavikram1427

Hosting own Helm Chart Repository

ChartMuseum

ChartMuseum is an open-source Helm Chart Repository written in Go (Golang), with support for cloud storage backends, including Google Cloud Storage, Amazon S3, Microsoft Azure Blob Storage etc.

```
docker run --rm -it \
  -p 8080:8080 \
  -v $(pwd)/charts:/charts \
  -e DEBUG=true \
  -e STORAGE=local \
  -e STORAGE_LOCAL_ROOTDIR=/charts \
  chartmuseum/chartmuseum:latest
```



https://chartmuseum.com/

https://hub.docker.com/r/chartmuseum/chartmuseum

https://github.com/kunchalavikram1427

Helm Charts

Helm Charts

- Helm Charts are simply Kubernetes YAML manifests combined into a single package(archive) that can be installed in the Kubernetes cluster
- Also contains templates that are rendered into Kubernetes manifest files
- Once packaged, installing a Helm Chart into your cluster is as easy as running a single `helm install`, which really simplifies the deployment of containerized applications
- Can be packaged into versioned objects for sharing (repos). Ex: mychart-0.1.0.tgz, mychart-0.1.1.tgz
- Version numbers follows Semantic Versioning 2.0.0 specification: major.minor.patch
- Charts can have dependencies on other charts
- By default, directory name is considered as chart name

Generate chart template

```
helm create example-chart
```

https://helm.sh/docs/topics/charts/

https://github.com/kunchalavikram1427

Helm Charts

Generate chart template

```
helm create test-chart
```

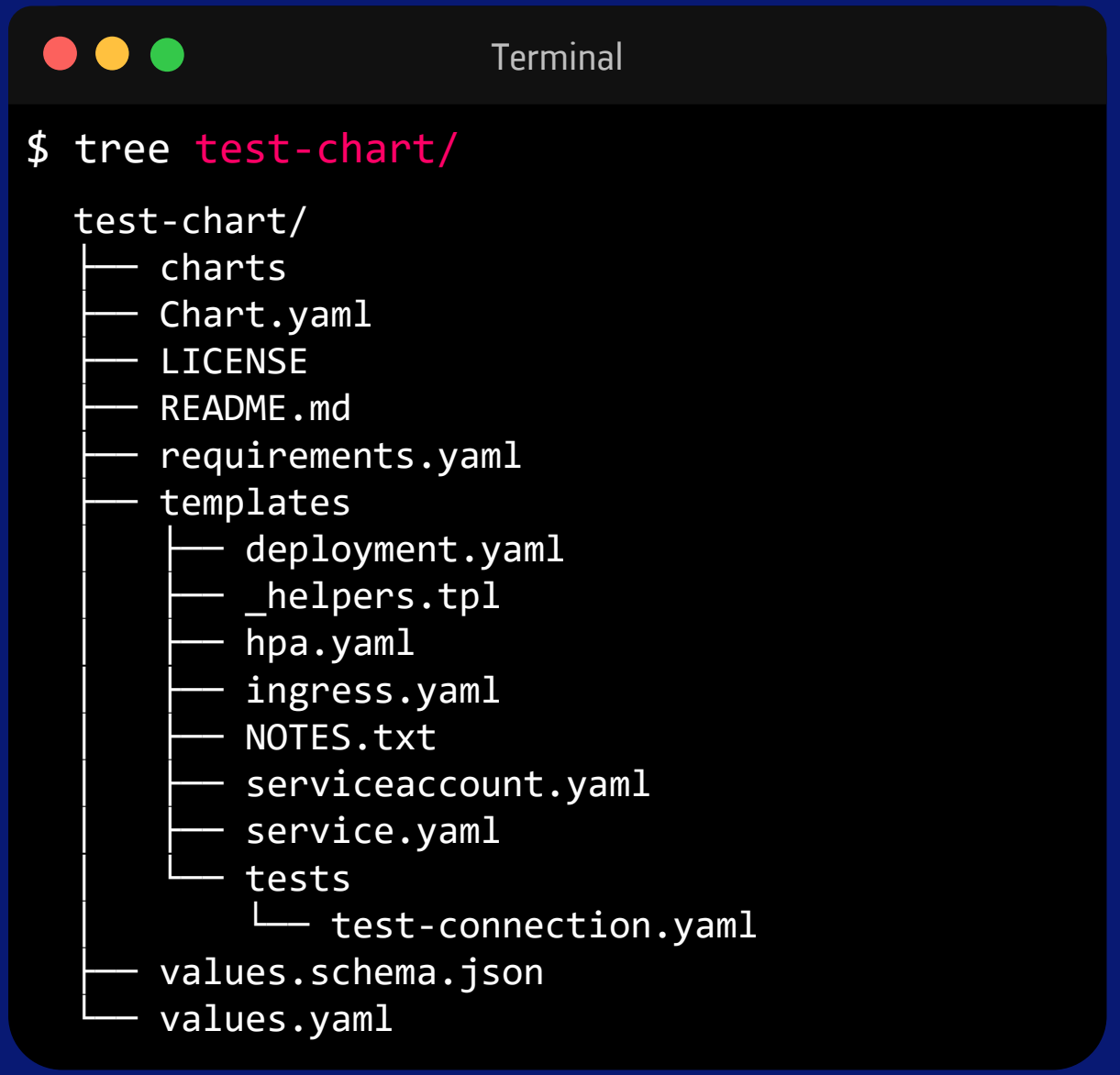
Terminal

```
$ helm create test-chart
Creating test-chart
$ tree test-chart/
test-chart/
├── charts
├── Chart.yaml
├── LICENSE
├── README.md
├── requirements.yaml
├── templates
│   ├── deployment.yaml
│   ├── _helpers.tpl
│   ├── hpa.yaml
│   ├── ingress.yaml
│   ├── NOTES.txt
│   ├── serviceaccount.yaml
│   ├── service.yaml
│   └── tests
│       └── test-connection.yaml
├── values.schema.json
└── values.yaml
```

https://github.com/kunchalavikram1427

Helm Charts

- helmignore: holds all the files to ignore when packaging the chart. Similar to .gitignore for git
- Chart.yaml: holds the metadata about the chart, such as chart name and version, maintainer information, a relevant website, and search keywords
- Charts: stores other charts that main chart depends on.
- Values.yaml: holds all the values to be injected into the templates. Templates are rendered into kubernetes manifest files
- Values.schema.json: validates values.yml file. Removing any required fields will result in an error as JSON schema validation fails.This check happens everytime we run helm install/upgrade/template

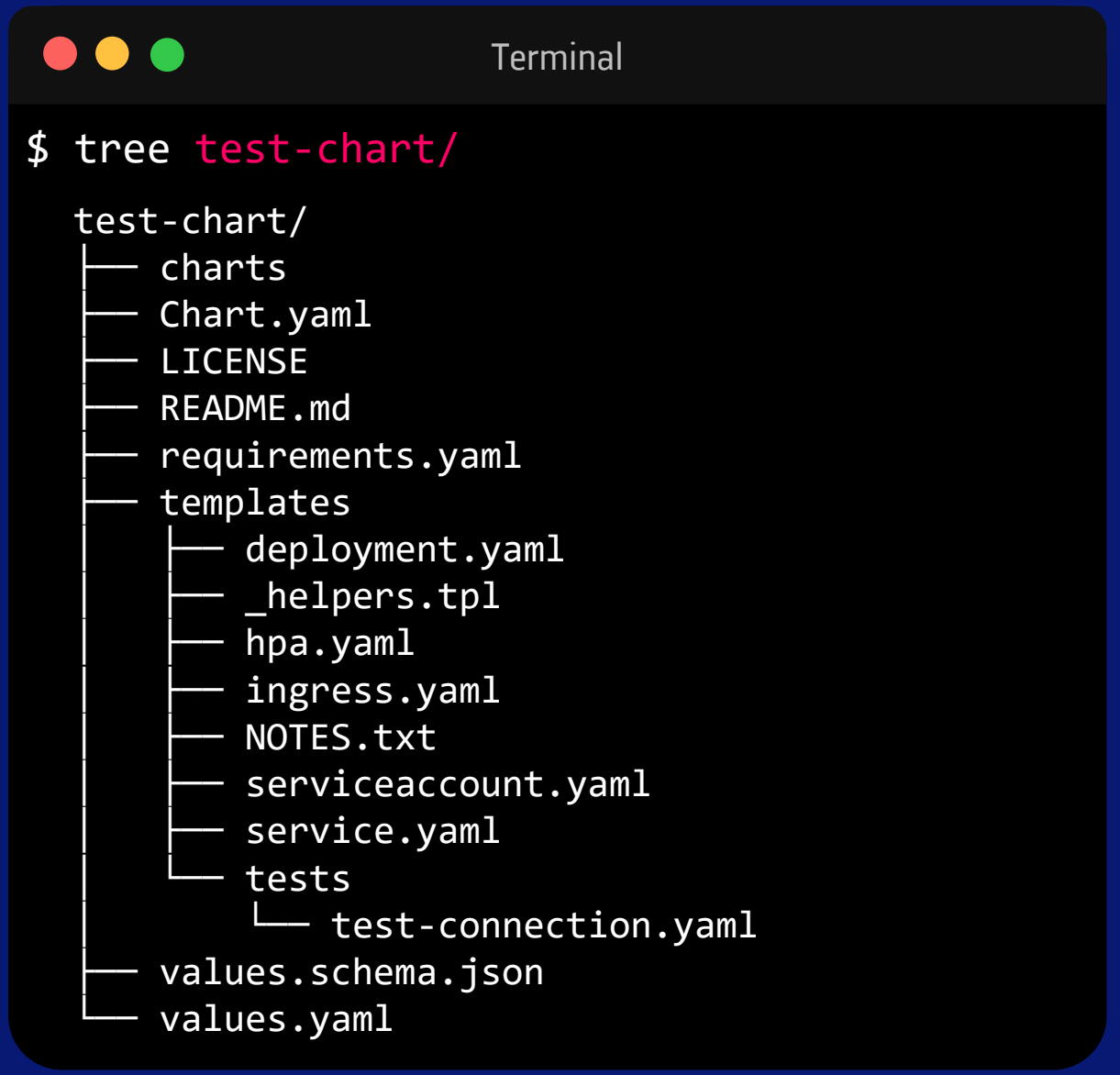


https://github.com/kunchalavikram1427

Helm Charts

- Templates: holds the actual manifests to be deployed with the chart. For example deployment.yaml, service.yaml, config.yaml and secrets.yaml all in the templated format. They will all get their values from values.yaml from above.
- LICENSE: A plaintext license for the chart
- NOTES.txt file: prints on the command line when the chart is installed
- _helpers.tpl: handles templates
- README.md: A readme file with information for users of the chart.
- requirements.yaml: A YAML file that lists the chart's dependencies.

The files whose names begin with an underscore ('_') are assumed to not have a manifest inside, so they are not turned into Kubernetes API resource definitions. However, they are available everywhere within other chart templates for use. These files are conventionally used to store sub-templates and helpers. _helpers.tpl is the default location for small sub-templates.



https://github.com/kunchalavikram1427

Helm Charts

Umbrella Charts

- Umbrella charts are the charts with nested stack of dependencies
- Dependencies are to be mentioned in requirements.yaml file at the same level as the values.yaml file
- Dependencies can be from a public repository(`helm repo add`)or from a local chart from a file path
- From Helm3 dependencies are moved to Chart.yaml file, thus eliminating the need for requirements.yaml file

requirements.yaml

```
dependencies:
  - name: jenkins
    repository: https://kubernetes-charts.storage.googleapis.com/
    version: 1.3.6
  - name: my-local-chart
    repository: file://path/to/charts/
    version: 1.0
```

requirements.yaml

To download all the dependencies into charts directory, run `helm dependency update`

Helm Charts

Chart.yaml

- chart.yaml contains the information of name of chart, version of chart, version of application, dependencies, sources, maintainers, icon etc.,
- version indicates chart version and appVersion indicates actual application version
- The apiVersion field should be v2 for Helm 3 and v1 for Helm 2. However, v1 charts are still installable by Helm 3

Chart.yaml

```yaml
apiVersion: v1/v2
appVersion: "1.0.0"
description: A Helm chart for demo application
name: demo-application
type: application
version: 0.1.0
sources:
  - https://github.com/user/demo-application-nodejs
maintainers:
  - name: myaccount
    email: myacount@mycompany.com
icon: https://github.com/user/blob/master/images/logo.jpg
dependencies:
  - name: mongodb
    version: 7.8.1
    repository: https://kubernetes-charts.storage.googleapis.com
```

Refer '**Tags and Condition fields in dependencies**' at https://helm.sh/docs/topics/charts/ to see how to manage multiple dependencies.

https://semver.org/spec/v2.0.0.html

Helm Charts

values.yaml

- values.yaml holds all the values to be injected into the templates
- Templates are rendered into kubernetes manifest files using values from values.yaml file

values.yaml

```yaml
# Default values for chart.
# This is a YAML-formatted file.
# Declare variables to be passed into your templates.

replicaCount: 1

image:
  repository: nginx
  pullPolicy: IfNotPresent
  # Overrides the image tag whose default is the chart appVersion.
  tag: ""

imagePullSecrets: []
nameOverride: ""
fullnameOverride: ""

serviceAccount:
  # Specifies whether a service account should be created
  create: true
  # Annotations to add to the service account
  annotations: {}
  # The name of the service account to use.
  # If not set and create is true, a name is generated using the
    fullname template
  name: ""
```

values.yaml

```yaml
service:
  type: ClusterIP
  port: 80

ingress:
  enabled: false
hosts:
    - host: chart-example.local
      paths: []
  tls: []
  #  - secretName: chart-example-tls

resources: {}
# limits:
  #   cpu: 100m
  #   memory: 128Mi
  # requests:
  #   cpu: 100m
  #   memory: 128Mi

autoscaling:
  enabled: false
  minReplicas: 1
  maxReplicas: 100
  targetCPUUtilizationPercentage: 80
  # targetMemoryUtilizationPercentage: 80
```

https://github.com/kunchalavikram1427

Helm Charts

Pull a chart without installing

`helm pull bitnami/mysql`

```
root@k8s-master:/home/osboxes# helm pull bitnami/mysql
root@k8s-master:/home/osboxes# ls -l mysql-8.2.5.tgz
-rw-r--r-- 1 root root 36831 Jan 18 09:52 mysql-8.2.5.tgz
root@k8s-master:/home/osboxes#
```

tar -xzf mysql-8.2.5.tgz

```
root@k8s-master:/home/osboxes# tar -xzf mysql-8.2.5.tgz
root@k8s-master:/home/osboxes# ls -l mysql/
total 136
-rw-r--r-- 1 root root   219 Jan 15 10:08 Chart.lock
drwxr-xr-x 3 root root  4096 Jan 18 09:56 charts
-rw-r--r-- 1 root root   624 Jan 15 10:08 Chart.yaml
drwxr-xr-x 2 root root  4096 Jan 18 09:56 ci
drwxr-xr-x 3 root root  4096 Jan 18 09:56 files
-rw-r--r-- 1 root root 54456 Jan 15 10:08 README.md
drwxr-xr-x 4 root root  4096 Jan 18 09:56 templates
-rw-r--r-- 1 root root 26440 Jan 15 10:08 values-production.yaml
-rw-r--r-- 1 root root 26416 Jan 15 10:08 values.yaml
root@k8s-master:/home/osboxes#
```

Helm Charts

Start-up order of deployment files

- Helm collects all of the resources in a given Chart and it's dependencies, groups them by resource type, and then installs them in the order(shown to the right)
- So secrets/volumes/ConfigMaps are always created prior to the pods mounting them
- While uninstalling the resources, Helm follows the reverse order

```
CHART - A
A-Namespace
A-StatefulSet
A-Service
```

```
CHART - B
B-Namespace
B-StatefulSet
B-Service
```

```
FINAL RELEASE ORDER
A-Namespace
B-Namespace
A-StatefulSet
B-StatefulSet
A-Service
B-Service
```

- You can use initContainers to add waits to check the dependent microservices are functional before starting other services. Example: MQTT service is up before the dependent java service starts.
- You can also use chart hooks to execute a Job before/after installing a new chart https://helm.sh/docs/topics/charts_hooks/

```
Namespace
ResourceQuota
LimitRange
PodSecurityPolicy
Secret
ConfigMap
StorageClass
PersistentVolume
PersistentVolumeClaim
ServiceAccount
CustomResourceDefinition
ClusterRole
ClusterRoleBinding
Role
RoleBinding
Service
DaemonSet
Pod
ReplicationController
ReplicaSet
Deployment
StatefulSet
Job
CronJob
Ingress
APIService
```

https://github.com/helm/helm/blob/release-2.10/pkg/tiller/kind_sorter.go#L29

Helm Charts

Best practices when creating Helm Charts

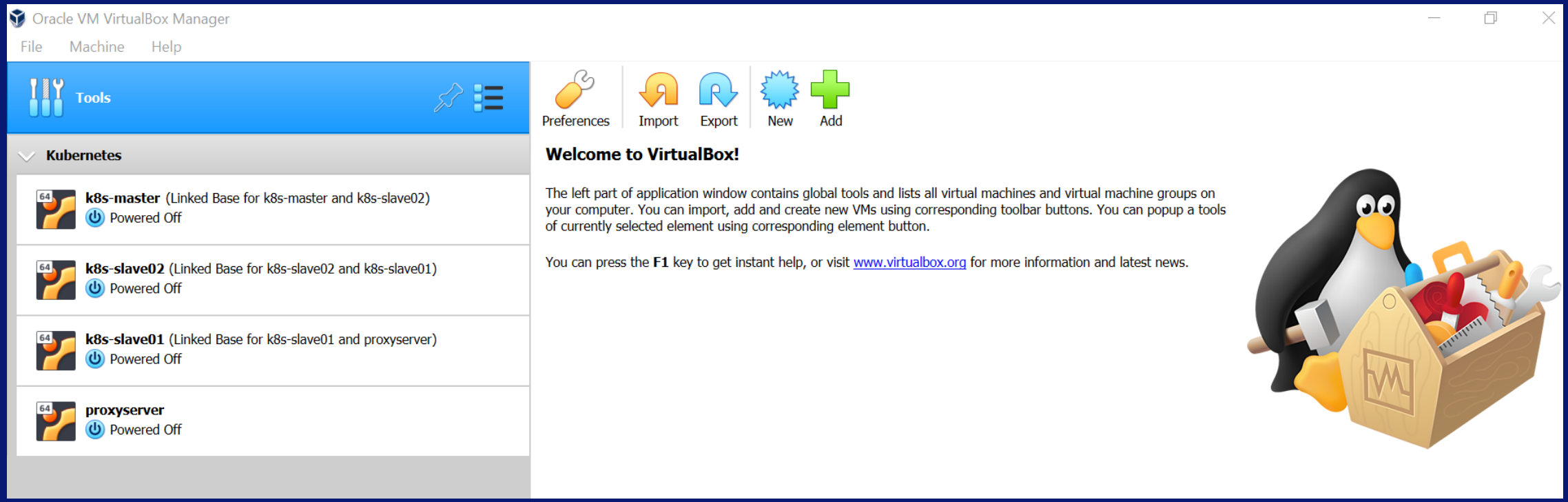
- Chart name should be lower case letters and numbers. The words can be separated with dashes (-)
- When the directory contains a chart, the directory name must be the same as the chart name.
- When versioning is applied, the version numbers follow the SemVer format.
- YAML files should be indented using two spaces
- The name of a variable should begin with a lowercase letter, and words should be separated using camel case
- You should quote all strings for type conversion. To ensure that integers and floats used as image tags in the values.yaml are evaluated as a string, the quote function can be used in the file consuming the value to wrap the value in double quotes.
  Ex: `{{ .Values.my.value | quote }}`
- Template files should have the extension .yaml if they produce YAML output. The extension .tpl can be used for template files that produce no formatted content.
- Template file names should use dash notation, not camel case
- For a chart, you should use version ranges instead of referring to an exact version:
  Ex: `Version: ~ 1.2.3`

Cluster Setup

Helm

Cluster Requirements

- 3 Kubernetes nodes: 1 Master and 2 Slaves. Refer pre-requisites section for setup.
- 1 VM to act as Reverse Proxy (Needed for on-prem. For cloud instances, a service type of LoadBalancer for Ingress controller should do)



This tutorial assumes you are running all the helm charts on on-prem Kubernetes cluster setup using any of the tools like Kubeadm. For running on cloud managed clusters like EKS/AKS/GKE, service types are to be changed accordingly.

Helm

Check the cluster once it is setup...

kubectl version --short

```
root@k8s-master:/home/osboxes/Monitoring_tools# kubectl version --short
Client Version: v1.18.3
Server Version: v1.18.3
root@k8s-master:/home/osboxes/Monitoring_tools#
```

kubectl get nodes -o wide

```
NAME              STATUS   ROLES    AGE   VERSION   INTERNAL-IP      EXTERNAL-IP   OS-IMAGE             KERNEL-VERSION      CONTAINER-RUNTIME
node/k8s-master   Ready    master   52d   v1.18.3   192.168.0.102    <none>        Ubuntu 18.04.3 LTS   5.0.0-23-generic    docker://19.3.11
node/k8s-slave01  Ready    <none>   52d   v1.18.3   192.168.0.103    <none>        Ubuntu 18.04.3 LTS   5.0.0-23-generic    docker://19.3.10
node/k8s-slave02  Ready    <none>   52d   v1.18.3   192.168.0.113    <none>        Ubuntu 18.04.3 LTS   5.0.0-23-generic    docker://19.3.10
```

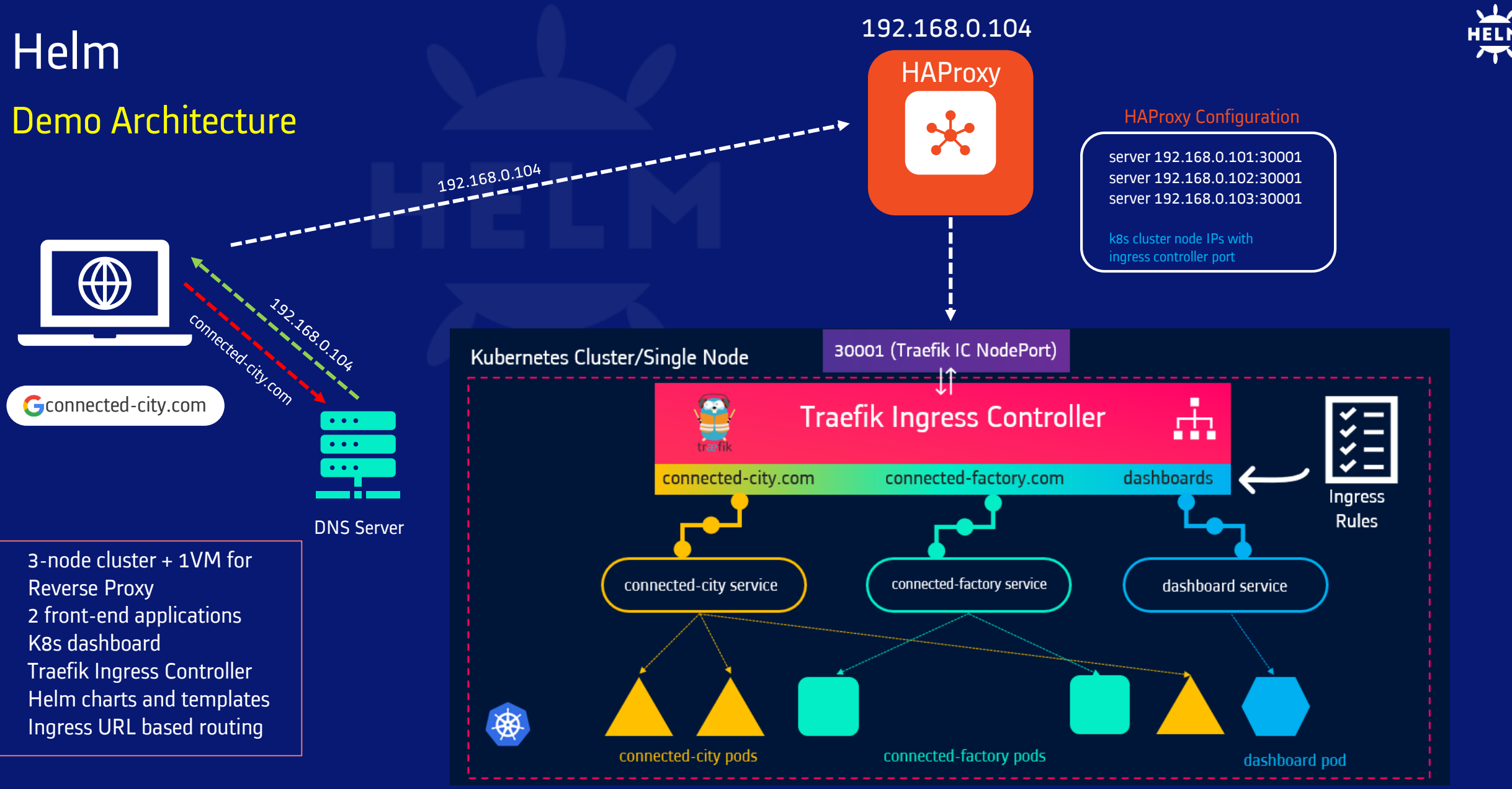
We need the IPs of all the nodes in the cluster to configure HA Proxy VM later

kubectl cluster-info

```
root@k8s-master:/home/osboxes# kubectl cluster-info
Kubernetes master is running at https://192.168.50.2:6443
KubeDNS is running at https://192.168.50.2:6443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy
Metrics-server is running at https://192.168.50.2:6443/api/v1/namespaces/kube-system/services/https:metrics-server:/proxy
```

Helm

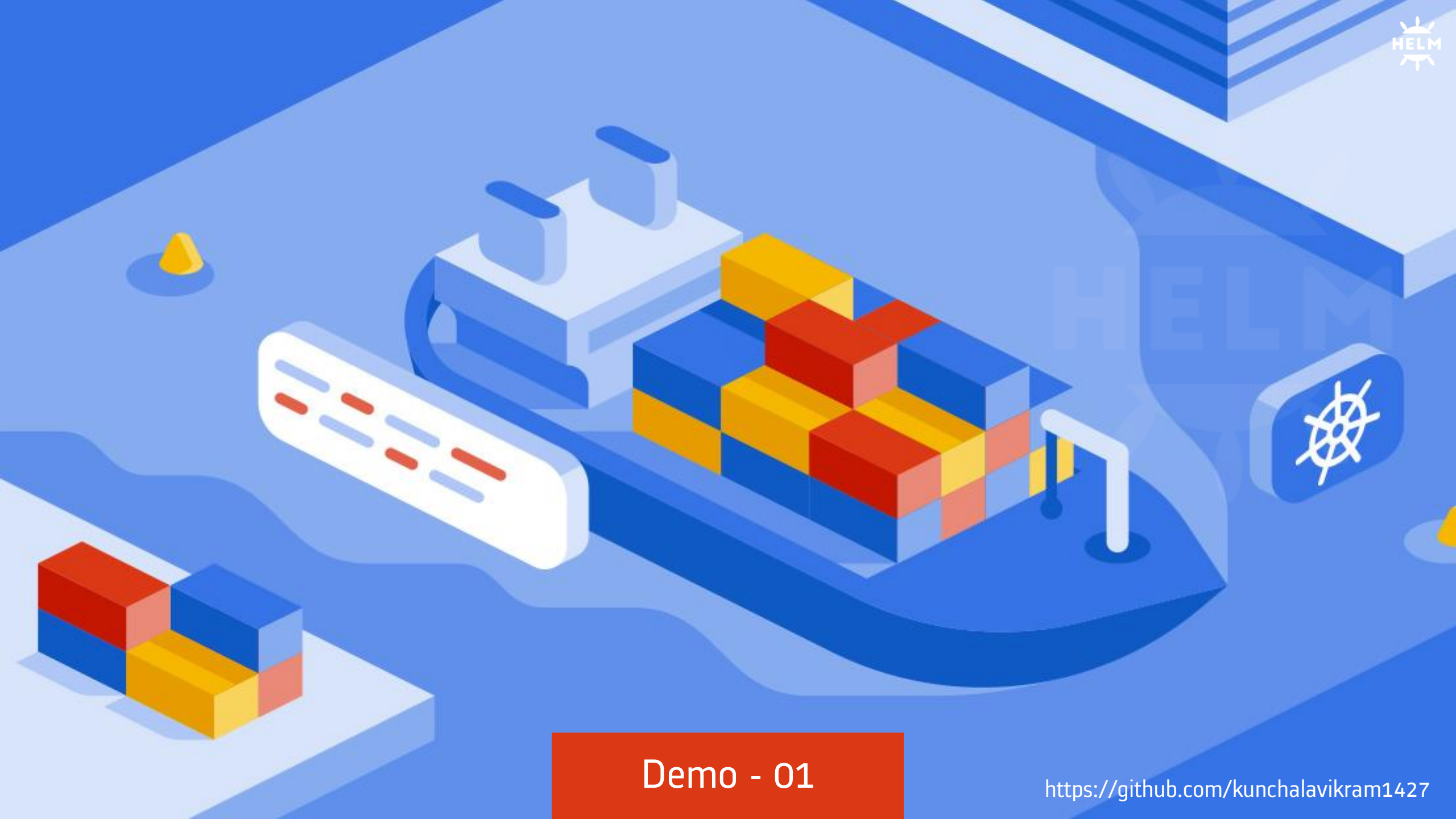
Demo Architecture



- 3-node cluster + 1VM for Reverse Proxy
- 2 front-end applications
- K8s dashboard
- Traefik Ingress Controller
- Helm charts and templates
- Ingress URL based routing

Refer https://github.com/kunchalavikram1427/Kubernetes_public/blob/master/end_to_end_demo/Kubernetes_End_to_End_Demo.pdf for setup instructions

https://github.com/kunchalavikram1427



https://github.com/kunchalavikram1427

Helm

Demo – 01: Installing applications using Kubectl

We will install all the applications manually using kubectl command line utility from the master node

`kubectl create -f kubectl-app-deployment/`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl create -f kubectl-app-deployment/
deployment.apps/connectedcity-deployment created
service/connectedcity-service created
deployment.apps/connectedfactory-deployment created
service/connectedfactory-service created
ingress.networking.k8s.io/application-ingress-rules created
ingress.networking.k8s.io/kubernetes-web-ui created
deployment.apps/k8dash created
service/k8dash created
serviceaccount/k8dash-sa created
clusterrolebinding.rbac.authorization.k8s.io/k8dash-sa created
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Helm

Demo – 01: Installing applications using Kubectl

Check all installed resources like pods, replicasets, deployments, services and ingress rules

```
kubectl get pods,svc,deployments,ingress
kubectl get all -n kube-system | grep k8dash   - Dashboard is installed in kube-system namespace
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl create -f kubectl-app-deployment/
deployment.apps/connectedcity-deployment created
service/connectedcity-service created
deployment.apps/connectedfactory-deployment created
service/connectedfactory-service created
ingress.networking.k8s.io/application-ingress-rules created
ingress.networking.k8s.io/kubernetes-web-ui created
deployment.apps/k8dash created
service/k8dash created
serviceaccount/k8dash-sa created
clusterrolebinding.rbac.authorization.k8s.io/k8dash-sa created
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get all -n kube-system | grep k8dash
pod/k8dash-84978cd779-j9xd6                        1/1     Running   0          5m42s
service/k8dash                   ClusterIP   10.103.69.97    <none>        80/TCP
deployment.apps/k8dash                       1/1     1            1           5m42s
replicaset.apps/k8dash-84978cd779                    1         1         1       5m42s
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Traefik ingress controller is already installed in the cluster. If you are using minikube enable the ingress add on by running

```
minikube addons enable ingress
```

https://github.com/kunchalavikram1427

Helm

Demo – 01: Installing applications using Kubectl

Check all endpoints & Ingress

`kubectl get ep -A`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get ep -A
NAMESPACE     NAME                        ENDPOINTS
default       connectedcity-service       10.244.0.177:5000,10.244.1.91:5000,10.244.2.85:5000
default       connectedfactory-service    10.244.0.176:5000,10.244.1.92:5000,10.244.2.86:5000
default       kubernetes                  192.168.50.2:6443
kube-system   k8dash                      10.244.1.93:4654
kube-system   kube-controller-manager     <none>
kube-system   kube-dns                    10.244.0.170:53,10.244.0.171:53,10.244.0.170:9153 + 3 more...
kube-system   kube-scheduler              <none>
kube-system   metrics-server              192.168.0.105:4443
kube-system   traefik-ingress-service     10.244.2.81:8080,10.244.2.81:80
kube-system   traefik-web-ui              10.244.2.81:8080
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

`kubectl get ing -A`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get ing -A
NAMESPACE     NAME                        CLASS    HOSTS                                        ADDRESS   PORTS   AGE
default       application-ingress-rules   <none>   connected-city.com,connected-factory.com               80      54m
kube-system   kubernetes-web-ui           <none>   k8s-dashboard.com                                      80      54m
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

https://github.com/kunchalavikram1427

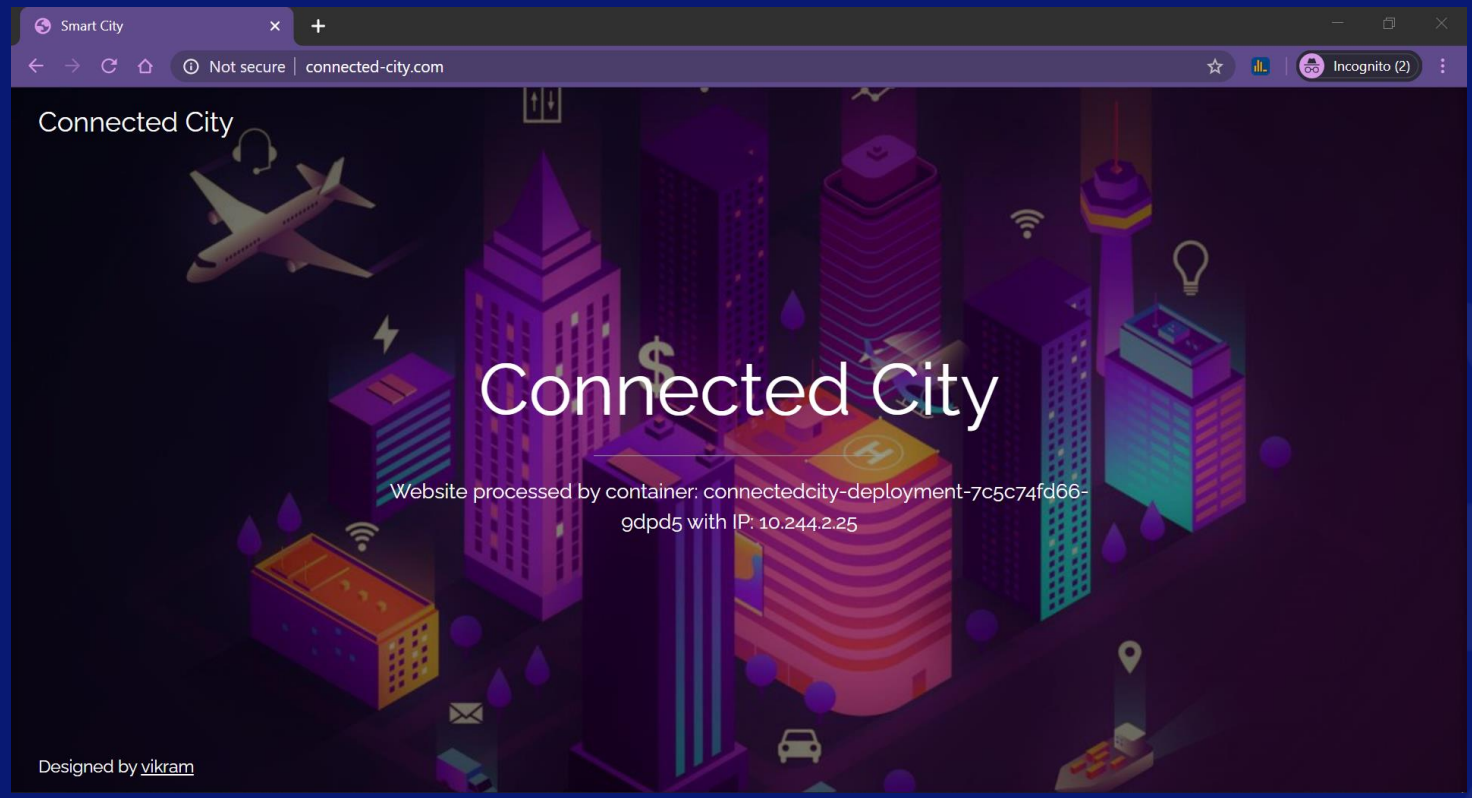
Helm

https://github.com/kunchalavikram1427

Demo – 01: Installing applications using Kubectl

Accessing Dashboards

connected-city.com

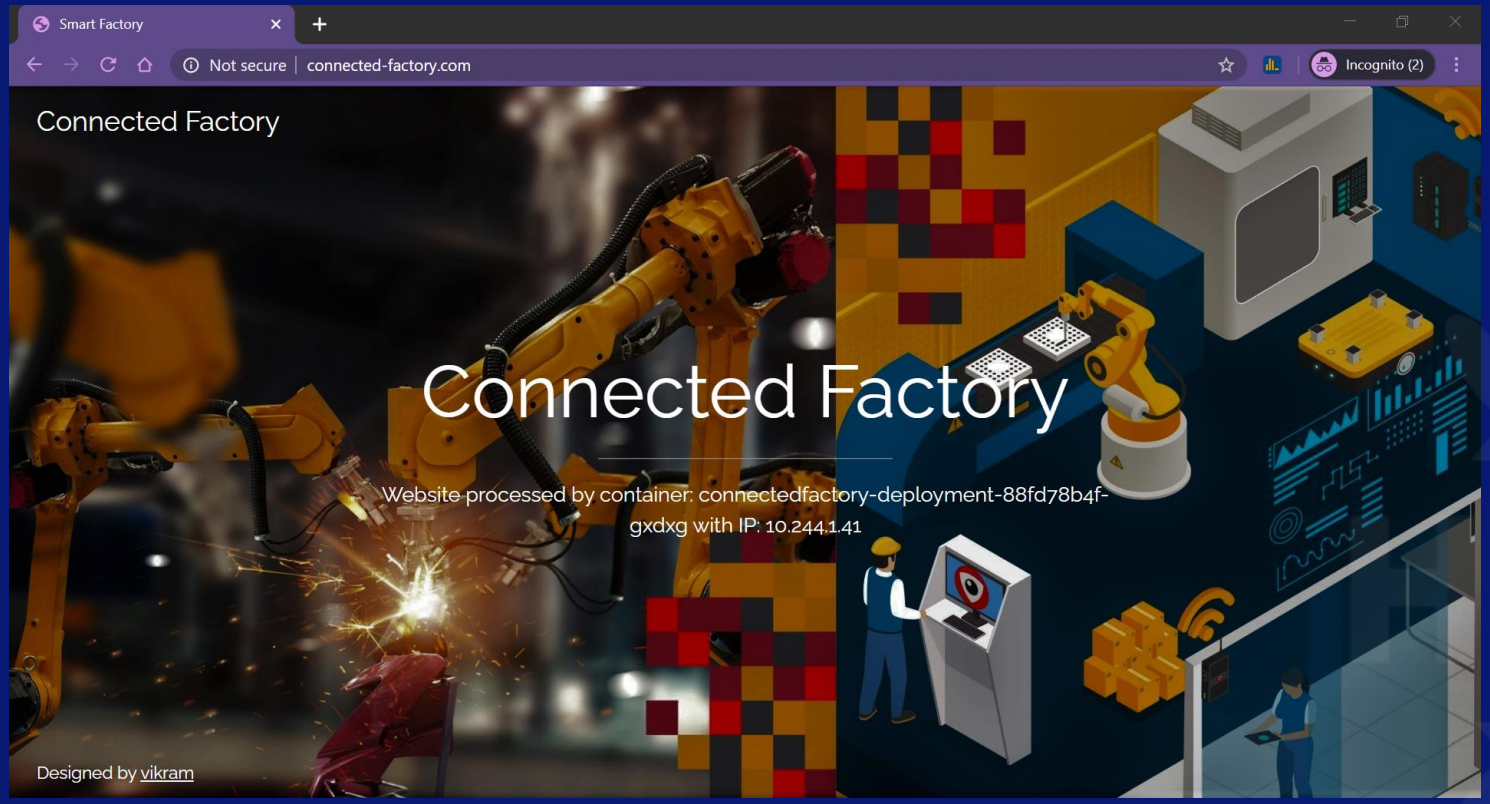


Since there are 3 instances of frontend applications running, the service load balances the requests.
You can view this effect by refreshing the page and see the actual content changing like POD serving the request and its IP.

Demo – 01: Installing applications using Kubectl

Accessing Dashboards

connected-factory.com



Since there are 3 instances of frontend applications running, the service load balances the requests.
You can view this effect by refreshing the page and see the actual content changing like POD serving the request and its IP.

Helm

Demo – 01: Installing applications using Kubectl

- For accessing k8s dashboard, we need a token that is generated during the deployment

```
kubectl get secret
kubectl describe secret <k8s-dash-secret-name>
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get secret
NAME                  TYPE                                  DATA   AGE
default-token-l6wnb   kubernetes.io/service-account-token   3      205d
k8dash-sa-token-jk42m   kubernetes.io/service-account-token   3      67m
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl describe secret k8dash-sa-token-jk42m
Name:         k8dash-sa-token-jk42m
Namespace:    default
Labels:       <none>
Annotations:  kubernetes.io/service-account.name: k8dash-sa
              kubernetes.io/service-account.uid: cc870392-0c1e-4267-8746-db01a26c934d

Type:  kubernetes.io/service-account-token

Data
====
token:      eyJhbGciOiJSUzI1NiIsImtpZCI6Ijd0MFMwcEdFMjJqbHM5VDlCY2VQanZNNFlWT3VjM1VMVVZUQW9EUVFTVXMifQ.eyJpc3MiOiJrdWJlcm5ldGVzL3NlcnZpY2VhY2NvdW50Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9uYW1lc3BhY2UiOiJkZWZhdWx0Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9zZWNyZXQubmFtZSI6Ims4ZGFzaC1zYS10b2tlbi1qazQybSIsImt1YmVybmV0ZXMuaW8vc2VydmljZWFjY291bnQvc2VydmljZS1hY2NvdW50Lm5hbWUiOiJrOGRhc2gtc2EiLCJrdWJlcm5ldGVzLmlvL3NlcnZpY2VhY2NvdW50L3NlcnZpY2UtYWNjb3VudC51aWQiOiJjYzg3MDM5Mi0wYzFlLTQyNjctODc0Ni1kYjAxYTI2YzkzNGQiLCJzdWIiOiJzeXN0ZW06c2VydmljZWFjY291bnQ6ZGVmYXVsdDprOGRhc2gtc2EifQ.ygedpZL8OQu2MDKlCwDFVsToXcg7VHJnpgbhE33EIvzlqd0fQb1hSyprfsI5oZc0SznGd8d5sZTOr1mXjnsIfW1j5WHIifqI6xFcXtmemuNMQbuTRdZ1cZcZb64Ld0T687HPcR6SIZ8sc4MfPDRdX1TbpdtmlJRsSg-ni7vZRBKxMICT6p4CAOj6k_TF9hYMJOqUl1VnatPj13K3WEgFhirOr9kaRVK5jBf1FsJuAdeAIhTtPM0rckq0KChXYxUcgMq6BLZQnuSrp1O_dM2ccEomdp40sEIffzKODft0_cMsOF-HfRtneYUasgF-UE5YfhEMNnrIXQzMwQp7CBljmA
ca.crt:     1025 bytes
namespace:  7 bytes
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Copy the token to use it at the login page

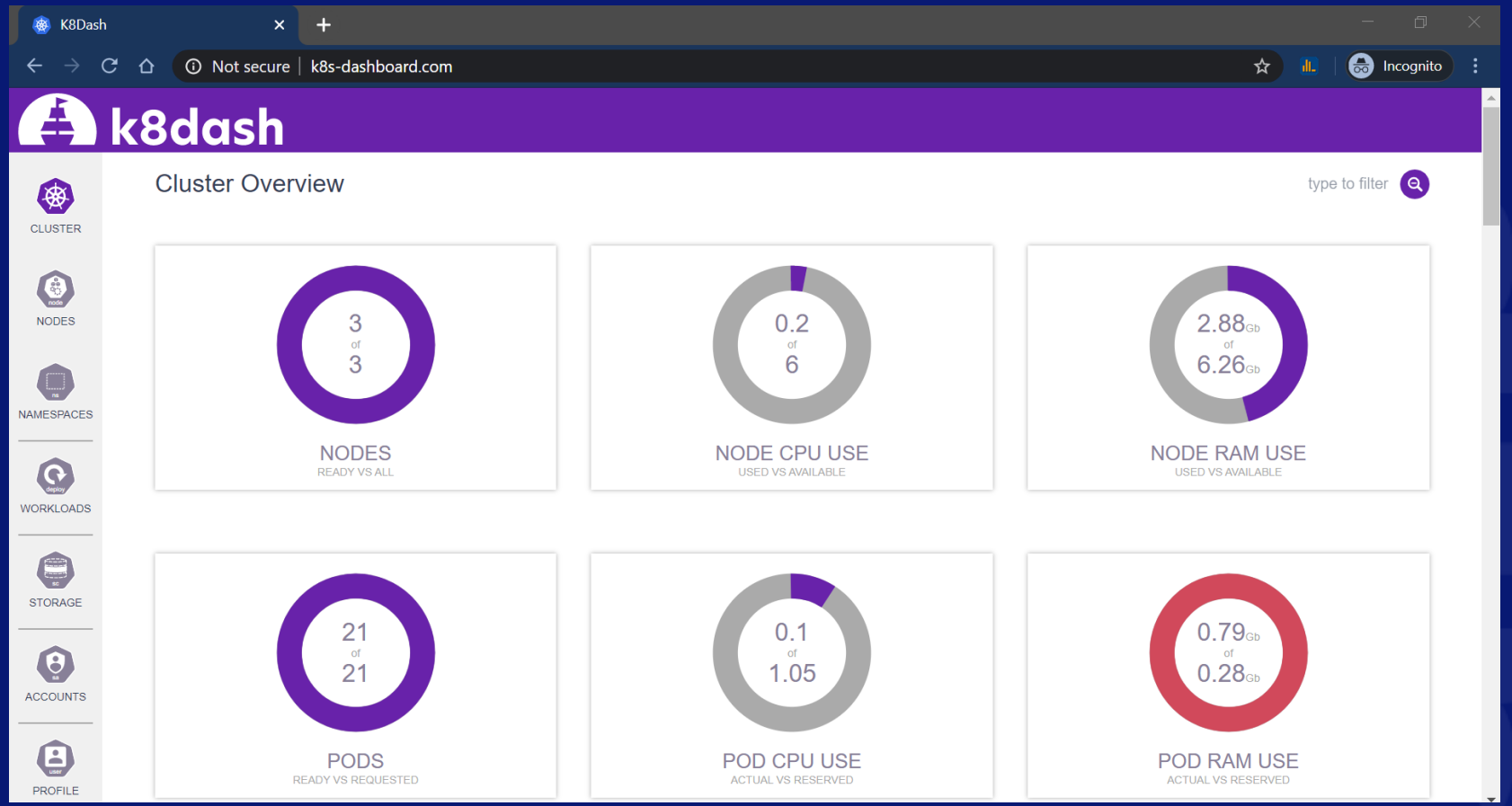
https://github.com/kunchalavikram1427

Helm

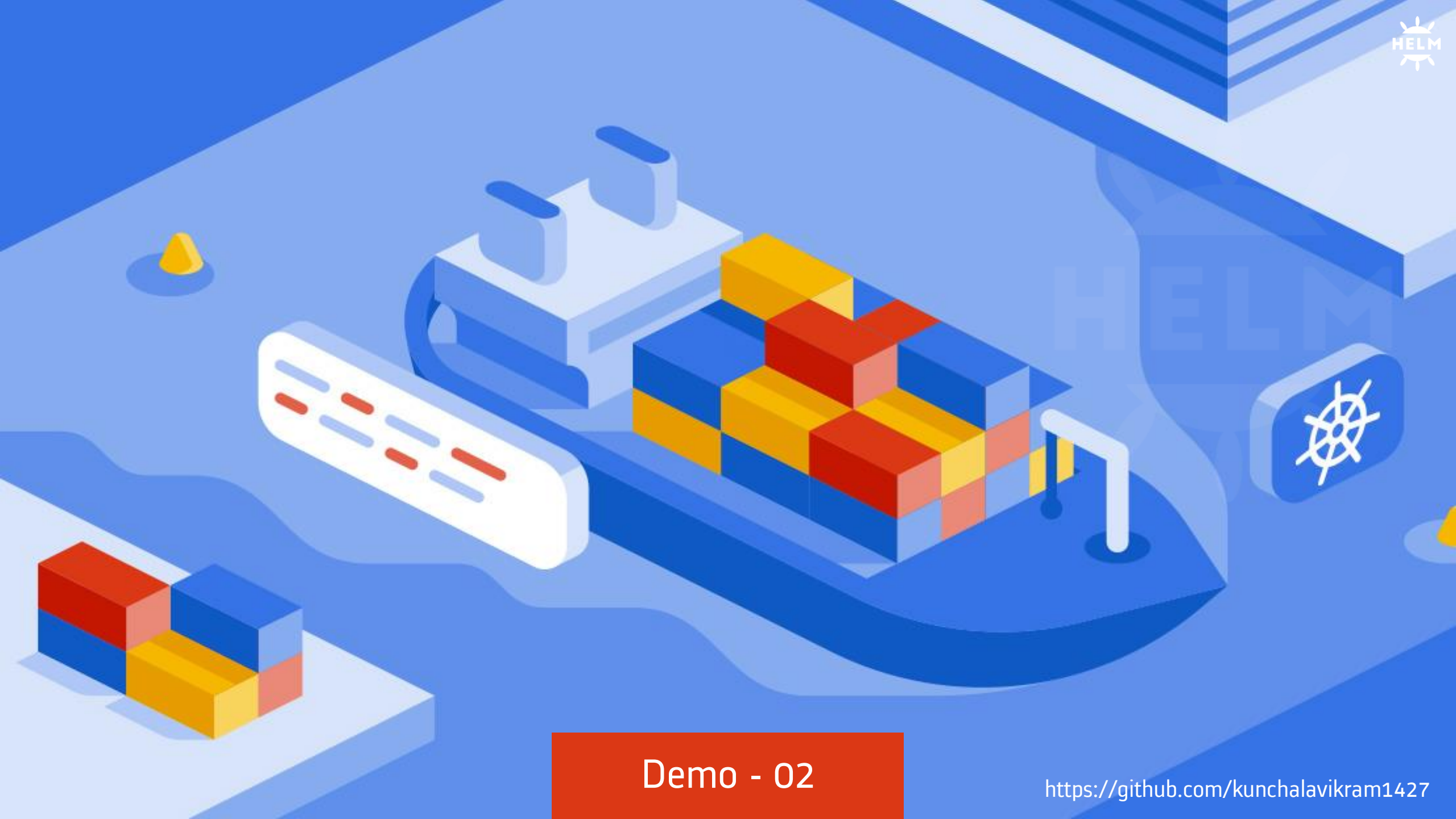
Demo – 01: Installing applications using Kubectl

Accessing Dashboards

k8s-dashboard.com



https://github.com/kunchalavikram1427



Demo - 02

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Helm Charts

Demo – 02: Installing basic chart

Consider below helm charts

Terminal

```
$ tree helm-chart-01-simple
helm-chart-01-simple
├── Chart.yaml
└── templates
    ├── applications-deployments.yml
    ├── applications-ingress-rules.yml
    ├── applications-services.yml
    ├── k8s-dashboard-deployment.yml
    ├── k8s-dashboard-ingress-rules.yml
    └── k8s-dashboard-service.yml
```

Both chart are same except for applications shown as sub charts in umbrella chart. In this case, each application will have its own Chart.yaml, values.yaml and can be installed individually.
In a 3-tier architecture, we have frontend, backend and database charts under charts directory.

Terminal

```
$ tree helm-chart-02-umbrella
helm-chart-02-umbrella
├── charts
│   ├── connectedcity-app
│   │   ├── Chart.yaml
│   │   └── templates
│   │       ├── deployment.yml
│   │       ├── ingress.yml
│   │       └── service.yml
│   ├── connectedfactory-app
│   │   ├── Chart.yaml
│   │   └── templates
│   │       ├── deployment.yml
│   │       ├── ingress.yml
│   │       └── service.yml
│   └── kubernetes-dashboard
│       ├── Chart.yaml
│       └── templates
│           ├── clusterrolebinding.yml
│           ├── deployment.yml
│           ├── ingress.yml
│           ├── serviceaccount.yml
│           └── service.yml
└── Chart.yaml
```

Umbrella charts

https://github.com/kunchalavikram1427

Helm Charts

Install the chart

helm install <release-name> <chart-name>

```
helm install demo-release helm-chart-01-simple (or)
helm install demo-release helm-chart-02-umbrella
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm install demo-release helm-chart-01-simple
NAME: demo-release
LAST DEPLOYED: Sun Jan  3 12:01:20 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Get status of release

helm status <release-name>

```
helm status demo-release
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm status demo-release
NAME: demo-release
LAST DEPLOYED: Sun Jan  3 12:01:20 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Helm Charts

Checking the deployed resources

`kubectl get all`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get all
NAME                                              READY   STATUS    RESTARTS   AGE
pod/connectedcity-deployment-7c5c74fd66-dpdqf     1/1     Running   0          14s
pod/connectedcity-deployment-7c5c74fd66-f25sr     1/1     Running   0          14s
pod/connectedcity-deployment-7c5c74fd66-zdcm2     1/1     Running   0          14s
pod/connectedfactory-deployment-88fd78b4f-bbn9s   1/1     Running   0          14s
pod/connectedfactory-deployment-88fd78b4f-jd5b6   1/1     Running   0          14s
pod/connectedfactory-deployment-88fd78b4f-rchnr   1/1     Running   0          14s

NAME                                 TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)    AGE
service/connectedcity-service        ClusterIP   10.110.34.172   <none>        80/TCP     15s
service/connectedfactory-service     ClusterIP   10.110.24.165   <none>        80/TCP     14s
service/kubernetes                   ClusterIP   10.96.0.1       <none>        443/TCP    3d23h

NAME                                         READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/connectedcity-deployment     3/3     3            3           14s
deployment.apps/connectedfactory-deployment  3/3     3            3           14s

NAME                                                    DESIRED   CURRENT   READY   AGE
replicaset.apps/connectedcity-deployment-7c5c74fd66     3         3         3       14s
replicaset.apps/connectedfactory-deployment-88fd78b4f   3         3         3       14s
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Helm Charts

Upgrade the chart

Update the manifest file with any changes like image tags, replicas and upgrade the chart/release

helm upgrade <release-name> <chart>

```
helm upgrade demo-release helm-chart-01-simple (or)
helm upgrade demo-release helm-chart-02-umbrella
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm upgrade demo-release helm-chart-01-simple
Release "demo-release" has been upgraded. Happy Helming!
NAME: demo-release
LAST DEPLOYED: Sun Jan  3 12:08:42 2021
NAMESPACE: default
STATUS: deployed
REVISION: 2
TEST SUITE: None
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Note the REVISION number from the output

Helm Charts

Check revision history

helm history <release-name>

```
helm history demo-release
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm history demo-release
REVISION        UPDATED                         STATUS          CHART                   APP VERSION     DESCRIPTION
1               Sun Jan  3 12:01:20 2021        superseded      demo-chart-01-1.0.0     1.0             Install complete
2               Sun Jan  3 12:08:42 2021        deployed        demo-chart-01-1.0.0     1.0             Upgrade complete
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Rollback to previous release

helm rollback <release-name> <revision-number>

```
helm rollback demo-release 1
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm rollback demo-release 1
Rollback was a success! Happy Helming!
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm history demo-release
REVISION        UPDATED                         STATUS          CHART                   APP VERSION     DESCRIPTION
1               Sun Jan  3 12:01:20 2021        superseded      demo-chart-01-1.0.0     1.0             Install complete
2               Sun Jan  3 12:08:42 2021        superseded      demo-chart-01-1.0.0     1.0             Upgrade complete
3               Sun Jan  3 12:12:54 2021        deployed        demo-chart-01-1.0.0     1.0             Rollback to 1
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

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Helm Charts

Show details of a release(manifests, notes, values for a release

helm get all <release-name>

```
helm get all demo-release
helm get manifest demo-release
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm get all demo-release
NAME: demo-release
LAST DEPLOYED: Sun Jan  3 12:12:54 2021
NAMESPACE: default
STATUS: deployed
REVISION: 3
TEST SUITE: None
USER-SUPPLIED VALUES:
null

COMPUTED VALUES:
{}

HOOKS:
MANIFEST:
---
# Source: demo-chart-01/templates/k8s-dashboard-deployment.yml
apiVersion: v1
kind: ServiceAccount
metadata:
  name: k8dash-sa
---
# Source: demo-chart-01/templates/k8s-dashboard-deployment.yml
apiVersion: rbac.authorization.k8s.io/v1
kind: ClusterRoleBinding
metadata:
  name: k8dash-sa
roleRef:
  apiGroup: rbac.authorization.k8s.io
  kind: ClusterRole
  name: cluster-admin
subjects:
- kind: ServiceAccount
  name: k8dash-sa
  namespace: default
---
# Source: demo-chart-01/templates/applications-services.yml
apiVersion: v1
kind: Service
metadata:
  name: connectedcity-service
spec:
```

Since we don't have any values.yaml file in the chart, the output will be shown as null/none

Helm Charts

List all releases

`helm list`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm list
NAME            NAMESPACE       REVISION        UPDATED                                 STATUS          CHART                   APP VERSION
demo-release    default         3               2021-01-03 12:12:54.863672293 -0500 EST deployed        demo-chart-01-1.0.0     1.0
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Uninstall a release

helm uninstall <release-name>

`helm uninstall demo-release`

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm uninstall demo-release
release "demo-release" uninstalled
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

use `helm delete <release-name>` for helm2

Helm Charts

Install the chart in different namespace

helm install -n <namespace> <release-name> <chart-name>

```
kubectl create ns dev
helm install -n dev demo-release helm-chart-02-umbrella
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# helm install -n dev demo-release helm-chart-02-umbrella
NAME: demo-release
LAST DEPLOYED: Sun Jan  3 12:48:50 2021
NAMESPACE: dev
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

Uninstall a release from a namespace

helm uninstall -n <namespace> <release-name>

```
helm uninstall -n dev demo-release
```

Helm Charts

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- Helm stores the release information in form of kubernetes secrets

```
kubectl get secrets | grep -i helm
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# kubectl get secrets | grep -i helm
sh.helm.release.v1.demo-release.v1   helm.sh/release.v1                    1      13m
sh.helm.release.v1.demo-release.v2   helm.sh/release.v1                    1      5m58s
sh.helm.release.v1.demo-release.v3   helm.sh/release.v1                    1      107s
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

```
kubectl describe secret sh.helm.release.v1.demo-release.v2
```

```
root@k8s-master:/home/osboxes/end_to_end_demo_helm# k describe secret sh.helm.release.v1.demo-release.v2
Name:         sh.helm.release.v1.demo-release.v2
Namespace:    default
Labels:       modifiedAt=1609693975
              name=demo-release
              owner=helm
              status=superseded
              version=2
Annotations:  <none>

Type:  helm.sh/release.v1

Data
====
release:  3484 bytes
root@k8s-master:/home/osboxes/end_to_end_demo_helm#
```

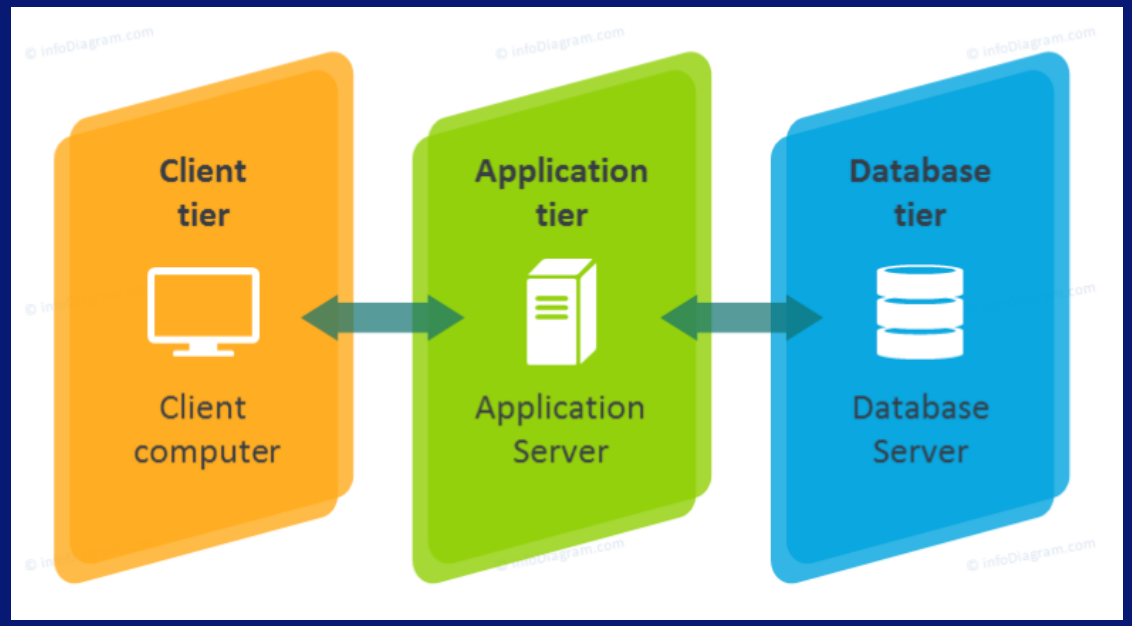
- Decode the secret

```
kubectl get secrets <secret-name> -o jsonpath="{ .data.release }" | base64 -d | base64 -d | gunzip | json_pp
```

Helm Charts

Three-Tier Architecture Charts

Three-tier architecture is a well-established software application architecture that organizes applications into three logical and physical computing tiers: the presentation tier, or user interface; the application tier, where data is processed; and the data tier, where the data associated with the application is stored and managed.



https://github.com/kunchalavikram1427

Terminal

```
$ tree web-application
web-application/
├── charts
│   ├── backend
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── backend-service.yaml
│   │   │   ├── backend.yaml
│   │   │   ├── _helpers.tpl
│   │   │   └── ingress.yaml
│   │   └── values.yaml
│   ├── database
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── _helpers.tpl
│   │   │   ├── mongodb-secret.yaml
│   │   │   ├── mongodb-service.yaml
│   │   │   └── mongodb.yaml
│   │   └── values.yaml
│   └── frontend
│       ├── Chart.yaml
│       ├── templates
│       │   ├── frontend-configmap.yaml
│       │   ├── frontend-service.yaml
│       │   ├── frontend.yaml
│       │   ├── _helpers.tpl
│       │   └── ingress.yaml
│       └── values.yaml
├── Chart.yaml
├── templates
│   ├── ingress.yaml
│   └── NOTES.txt
└── values.yaml
```

https://github.com/kunchalavikram1427

Helm Dependencies

Helm Charts

Chart Dependencies

- In Helm, one chart may depend on any number of other charts
- These dependencies can be dynamically linked using the dependencies field in Chart.yaml
- Dependencies can be pulled from a URL or repo name if already added through `helm repo add`

Chart.yaml

```yaml
apiVersion: v2
name: dependency-example
appVersion: "1.0"
description: A Demo Helm chart for dependencies test
version: 1.0.0
dependencies:
  - name: nginx
    version: 8.3.0
    repository: https://charts.bitnami.com/bitnami
  - name: wordpress
    version: 10.4.4
    repository: https://charts.bitnami.com/bitnami
```

Chart.yaml

```yaml
apiVersion: v2
name: dependency-example
appVersion: "1.0"
description: A Demo Helm chart for dependencies test
version: 1.0.0
dependencies:
  - name: nginx
    version: 8.3.0
    repository: “@bitnami”
  - name: wordpress
    version: 10.4.4
    repository: “@bitnami”
```

```
root@k8s-master:/home/osboxes/helm# helm repo list
NAME            URL
stable          https://charts.helm.sh/stable
bitnami         https://charts.bitnami.com/bitnami
mirantis        https://charts.mirantis.com
root@k8s-master:/home/osboxes/helm#
```

https://helm.sh/docs/topics/charts/

https://github.com/kunchalavikram1427

Helm Charts

List all dependencies of a chart

helm dependency list <chart-name>

```
helm dependency list helm-dependency-example/
```

```
root@k8s-master:/home/osboxes/helm# helm dependency list helm-dependency-example/
NAME    VERSION REPOSITORY                              STATUS
nginx   8.3.0   https://charts.bitnami.com/bitnami      missing
mysql   8.2.5   https://charts.bitnami.com/bitnami      missing
```

If required dependencies are not available in the chart.

```
root@k8s-master:/home/osboxes/helm# helm dependency list helm-dependency-example/
NAME    VERSION REPOSITORY                              STATUS
nginx   8.3.0   https://charts.bitnami.com/bitnami      ok
mysql   8.2.5   https://charts.bitnami.com/bitnami      ok
```

If required dependencies are available in the chart. Downloaded through `helm dependency update`

Helm Charts

Pull chart dependencies

helm dependency update <chart-name>

`helm dependency update helm-dependency-example/`

```
root@k8s-master:/home/osboxes/helm# helm dependency update helm-dependency-example/
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "mirantis" chart repository
...Successfully got an update from the "stable" chart repository
...Successfully got an update from the "bitnami" chart repository
Update Complete. ⎈Happy Helming!⎈
Saving 2 charts
Downloading nginx from repo https://charts.bitnami.com/bitnami
Downloading wordpress from repo https://charts.bitnami.com/bitnami
Deleting outdated charts
```

tree helm-dependency-example/

```
root@k8s-master:/home/osboxes/helm# tree helm-dependency-example/
helm-dependency-example/
├── Chart.lock
├── charts
│   ├── nginx-8.3.0.tgz
│   └── wordpress-10.4.4.tgz
└── Chart.yaml

1 directory, 4 files
root@k8s-master:/home/osboxes/helm#
```

https://github.com/kunchalavikram1427

Helm Charts

Chart Dependencies: Tags and Conditions

- By default, all dependencies are installed
- Tags and conditions control loading of the dependencies and to be set in parent values.yaml file
- Both take Boolean values
- Conditions always override tags
- Multiple conditions can be separated by commas and the first condition path that exists wins, ignoring the subsequent ones
- Absence of condition has no effect - it is equivalent to evaluating to *true*
- Multiple tags can be injected as a list. If at least one tag is true, the dependency is installed (logical OR)

Chart.yaml

```yaml
dependencies:
  - name: subchart1
    version: 8.3.0
    repository: https://charts.bitnami.com/bitnami
    condition: subchart1.enabled
    tags:
      - front-end
      - subchart1
  - name: subchart2
    version: 10.4.4
    repository: https://charts.bitnami.com/bitnami
    condition: subchart2.enabled
    tags:
      - back-end
      - subchart2
```

values.yaml

```yaml
subchart1:
  enabled: true
tags:
  front-end: false
  back-end: true
```

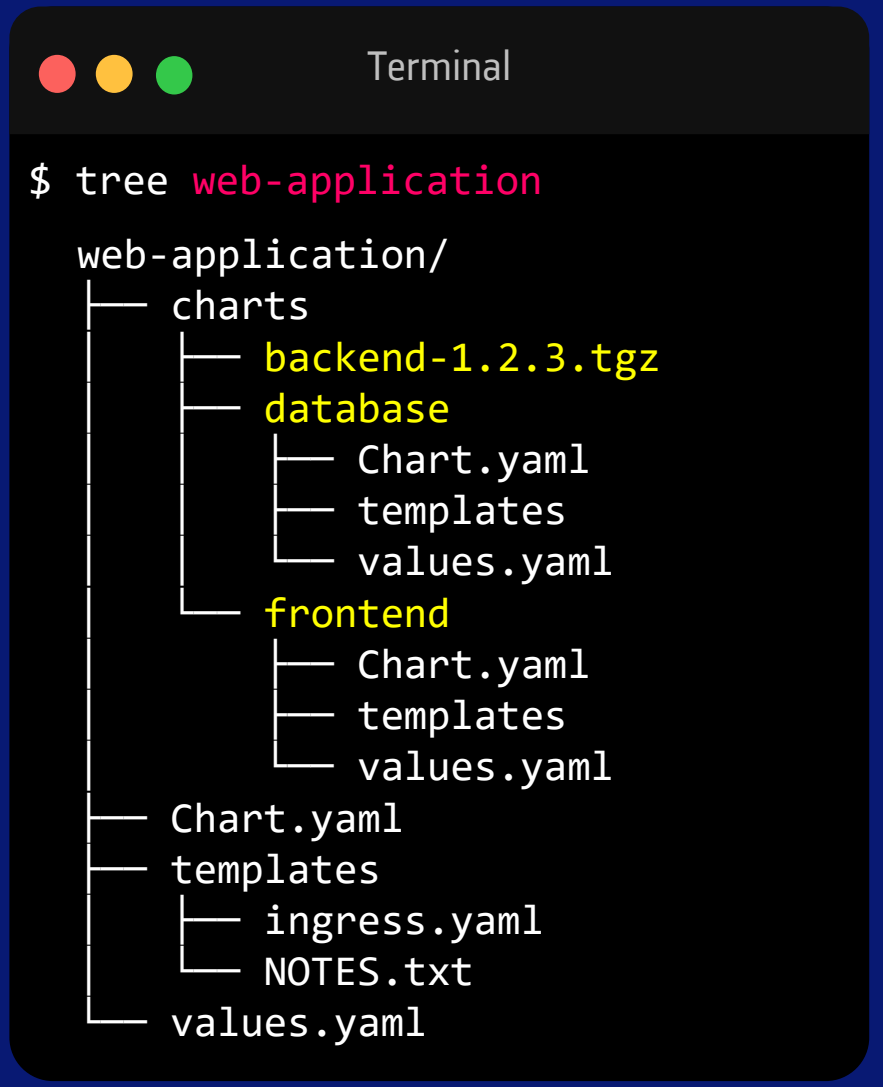
- In this example, subchart1 dependency will be installed as it is enabled in values.yaml file, even though the front-end tag is set to false(conditions override tags)
- subchart2 dependency will also be installed even though no condition is set for subchart2.enabled in values.yaml(absence of condition evaluates to true). Also notice that back-end tag is set to true

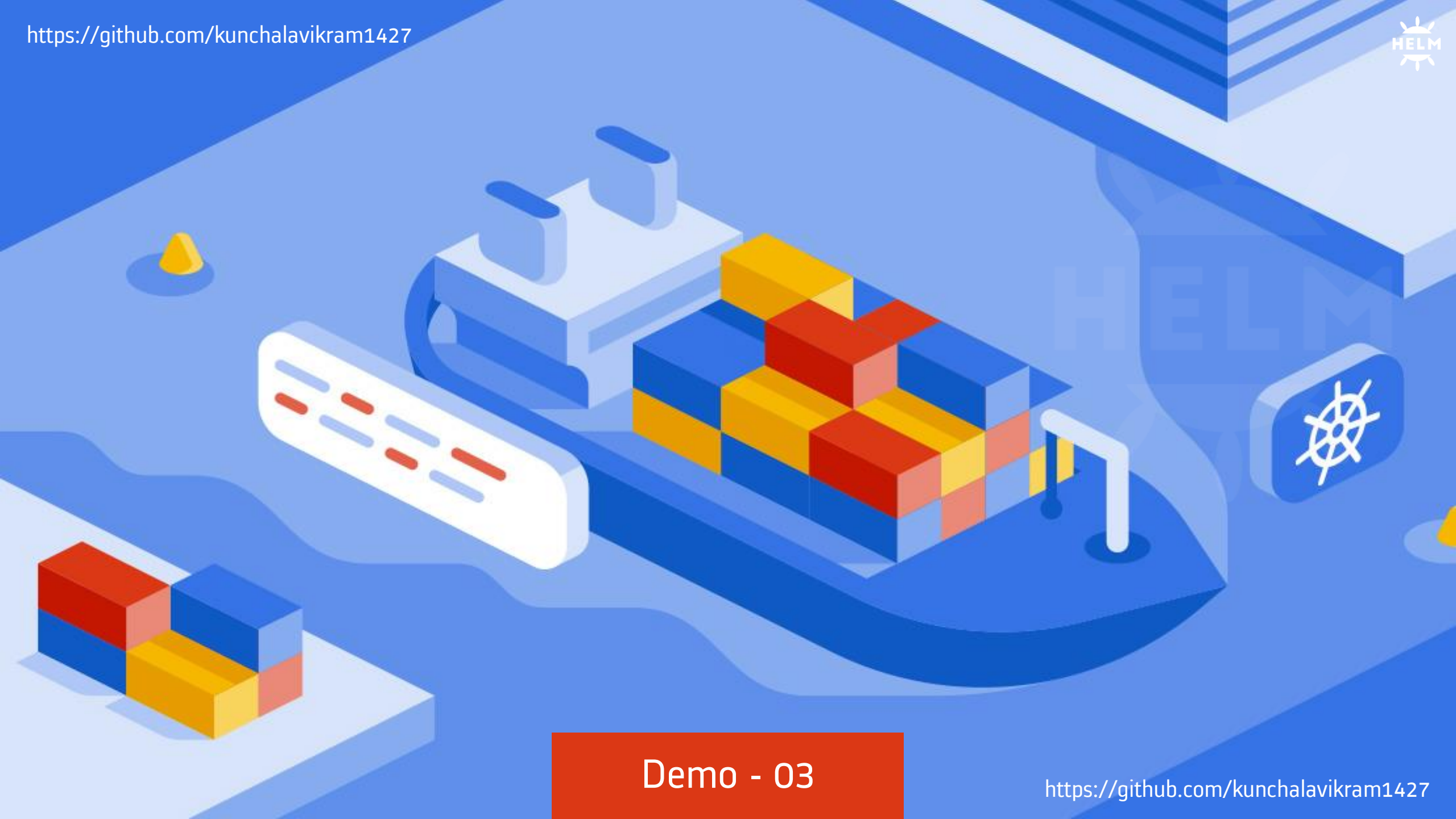
https://helm.sh/docs/topics/charts/#tags-and-condition-fields-in-dependencies

Helm Charts

Managing Dependencies manually via the charts/ directory

- If more control over dependencies is desired, these dependencies can be expressed explicitly by copying the dependency charts into the charts/ directory
- A dependency can be either a chart archive (backend-1.2.3.tgz) or an unpacked chart directory
- Dependency name cannot start with _ or .. Such files are ignored by the chart loader
  Ex: _helpers.tpl and .helmignore





Demo - 03

Helm Charts

Demo – 03: Chart Dependencies basic chart

Chart.yaml

```yaml
apiVersion: v2
name: dependency-example
appVersion: "1.0"
description: A Demo Helm chart for dependencies test
version: 1.0.0
dependencies:
  - name: nginx
    version: 8.3.0
    repository: https://charts.bitnami.com/bitnami
    condition: nginx.enabled
    tags:
      - nginx
      - front-end
  - name: mysql
    version: 8.2.5
    repository: https://charts.bitnami.com/bitnami
    condition: mysql.enabled
    tags:
      - mysql
      - back-end
```

values.yaml

```yaml
nginx:
  enabled: true
tags:
  front-end: false
  back-end: true
```

Chart for demonstration only. Not a working configuration

https://github.com/kunchalavikram1427

Helm Charts

Install the chart

```
helm install demo-rel helm-dependency-example/
helm list
```

```
root@k8s-master:/home/osboxes/helm# helm install demo-rel helm-dependency-example/
NAME: demo-rel
LAST DEPLOYED: Mon Jan 18 13:11:27 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/helm# helm list
NAME            NAMESPACE       REVISION        UPDATED                                 STATUS          CHART                           APP VERSION
demo-rel        default         1               2021-01-18 13:11:27.150474131 -0500 EST deployed        dependency-example-1.0.0        1.0
root@k8s-master:/home/osboxes/helm#
```

kubectl get pods

```
root@k8s-master:/home/osboxes/helm# kubectl get pods
NAME                              READY   STATUS    RESTARTS   AGE
demo-rel-mysql-0                  0/1     Pending   0          100s
demo-rel-nginx-5f5bcc5b75-b7vc4   1/1     Running   0          100s
root@k8s-master:/home/osboxes/helm#
```

✓ Both dependencies are installed as discussed earlier

```
helm uninstall demo-rel
```

https://github.com/kunchalavikram1427

Helm Charts

Overriding the default values using --set

values.yaml

```
nginx:
  enabled: true
tags:
  front-end: false
  back-end: true
```

values.yaml doesn't have any condition to enable/disable mysql dependency.
We can override this while installing the chart

helm install <release-name> <chart-name> --set <name1>=<value1>,<name2>=<value2>

```
helm install demo-rel helm-dependency-example/ --set mysql.enabled=false
```

```
root@k8s-master:/home/osboxes/helm# helm install demo-rel helm-dependency-example/ --set mysql.enabled=false
NAME: demo-rel
LAST DEPLOYED: Mon Jan 18 13:19:53 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/helm# kubectl get pods
NAME                              READY   STATUS    RESTARTS   AGE
demo-rel-nginx-5f5bcc5b75-wzttf   0/1     Running   0          6s
root@k8s-master:/home/osboxes/helm#
```

mysql dependency is not installed as it is disabled dynamically

https://github.com/kunchalavikram1427

Helm Charts

Overriding the default values using --set

values.yaml

```yaml
ingress:
  enabled: true
image:
  name: nginx
  tag: 1.0
  labels:
  - app: nginx
  - type: application
service:
  type: ClusterIP
  port: 80
  protocol: TCP
```

```
--set .ingress.enabled=false
--set .image.tag=1.1
--set .service.type=NodePort
--set .service.port=30001
```

```
helm install --set .Values.ingress.enabled=false, --set .Values.service.type=NodePort <chart-name>
```

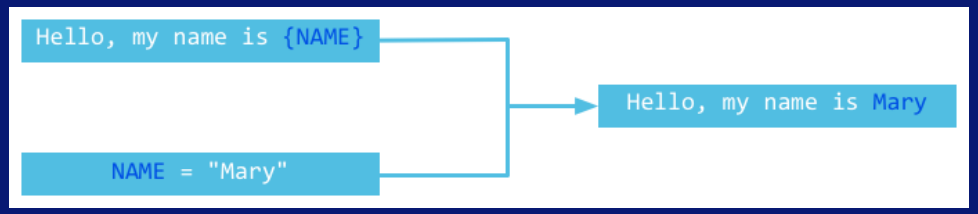
Helm Templates

Helm Templates

https://github.com/kunchalavikram1427

- Templates are Kubernetes manifest files that describe the Kubernetes resources
- Helm uses the Go templating engine by default + functions from “Sprig” lib like default, quote etc.,
- Avoids hardcoded values
- Templates are rendered by Helm template engine into Kubernetes manifest files at the client side before sending it to kubernetes API
- All template files are stored in a chart’s templates/ folder. When Helm renders the charts, it will pass every file in that directory through the template engine
- The values for the templates can be supplied in one of three ways:
  1. values.yaml file inside of a chart. This file may contain default values
  2. Custom values YAML file to be provided at the command line with the `helm install -f` command
  3. Using `--set` flag. This set value will replace the value in the values.yaml file

```
$ helm install my-wordpress-prod bitnami/wordpress --version 10.1.4 -f values-production.yaml
$ helm install --values myvalues.yaml stable/mysql
$ helm install demo-sql stable/mysql --set db.name=‘test'
```



Terminal

```
$ tree helm-template-01/
helm-template-01/
├── Chart.yaml
├── templates
│   ├── pod.yaml
└── values.yaml
```

https://helm.sh/docs/howto/charts_tips_and_tricks/

https://masterminds.github.io/sprig/

Helm Templates

- In order to release the same application in the same cluster, all the resources should have unique name across the cluster
- It becomes tedious to manually write unique names for each resource. Helm templates solves this issues by generating unique names for each object using templates
- Here Release name is used to generate unique name for each resource like Pods

pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: dev-wordpress-pod
  labels:
    app: wordpress
spec:
  containers:
  - name: wordpress
    image: wordpress:latest
    imagePullPolicy: IfNotPresent
```

pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: prod-wordpress-pod
  labels:
    app: wordpress
spec:
  containers:
  - name: wordpress
    image: wordpress:latest
    imagePullPolicy: IfNotPresent
```

A template directive is enclosed in `{{` and `}}` blocks.

Go template directive/tag used: `{{ .Release.Name }}`
We can release the same application in 2 different namespaces without any name conflicts

https://github.com/kunchalavikram1427

Helm Templates

Template Directives

- A template directive/tag, is enclosed in {{ and }} blocks, and it is recommended to pad the directive with space at its left and right
- The simplest directive renders a value. A value is a namespaced object, where each dot (.) separates each namespaced element
- A leading dot indicates that we start with the top-most namespace/root for the scope

pod.yaml

```
apiVersion: v1
kind: Pod
metadata:
  name: {{ .Release.Name }}-wordpress-pod
  labels:
    app: wordpress
spec:
  containers:
  - name: wordpress
    image: wordpress:latest
    imagePullPolicy: IfNotPresent
```

Helm Templates

Whitespace Handling

- The spaces inside a directive/tag is irrelevant
- The '{{' and '}}' directive delimiters, without any other modifications, leave the template whitespace surrounding them
- A hyphen '-' placed after the '{{' delimiter or before the '}}' delimiter instructs the rendering engine to trim/drop the whitespace, includes spaces, tabs, newline ('\n') and carriage return ('\r'), around the directive

pod.yaml

```
spec:
  containers:
  - name: nginx-pod
    image: nginx:latest
    ports:
    - containerPort: {{ .Values.port }}
```

without -

pod.yaml

```
spec:
  containers:
  - name: nginx-pod
    image: nginx:latest
    ports:
    - containerPort: 80
```

pod.yaml

```
spec:
  containers:
  - name: nginx-pod
    image: nginx:latest
    ports:
    - containerPort: {{- .Values.port }}
```

with -

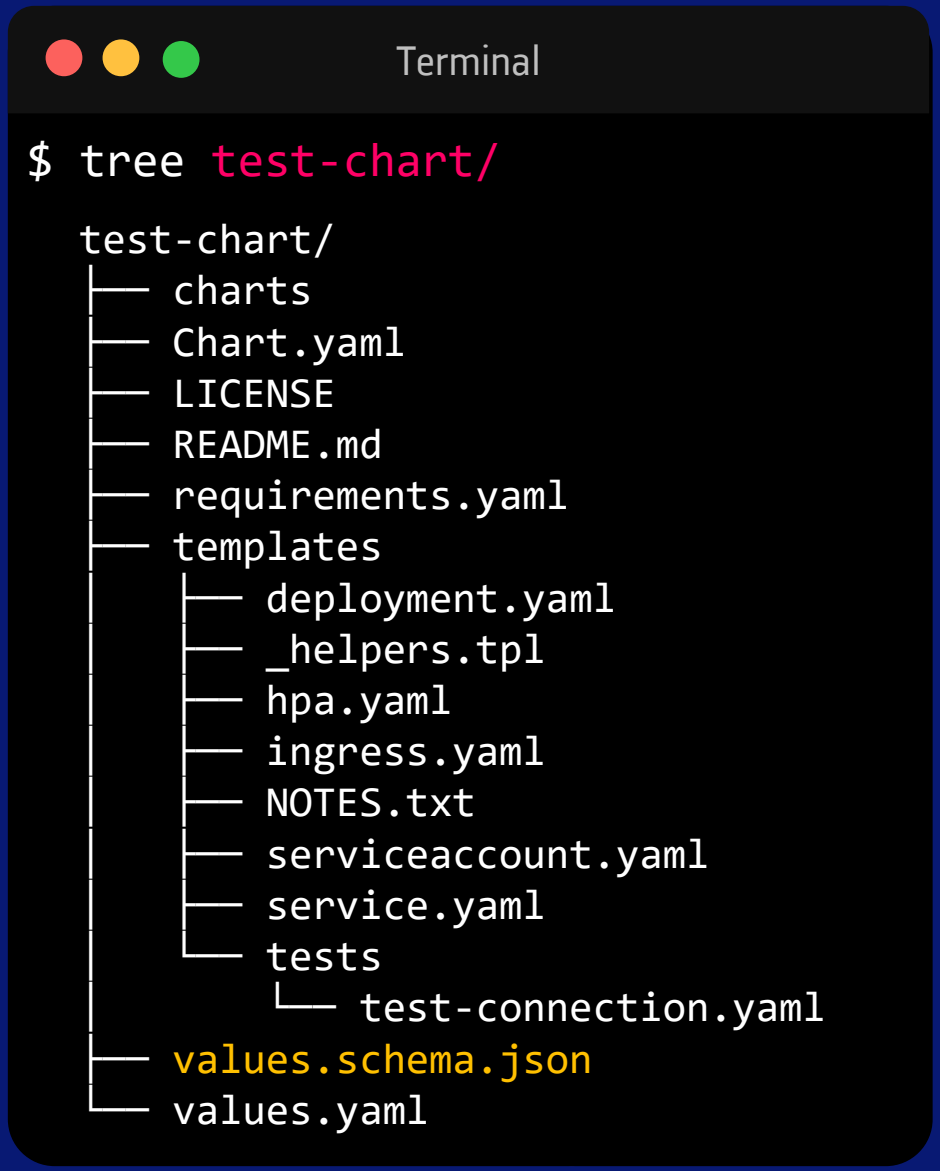
pod.yaml

```
spec:
  containers:
  - name: nginx-pod
    image: nginx:latest
    ports:
    - containerPort:80
```

Helm Templates

JSON Schema Files

- Used to validate the values in values.yaml file
- Sometimes the chart developer might put restrictions on type of values to be used, mandatory values to be used etc.,
- Failing to adhering to these restrictions/rules will result in chart installation errors
  Ex: Container Port can be made as a mandatory value
- Validation occurs every time the user runs `helm install/upgrade/template/lint`
- values.schema.json file to be located at the root of the chart folder



https://json-schema.org/draft/2019-09/json-schema-validation.html

https://helm.sh/docs/topics/charts/#schema-files

Helm Templates

Rendering Templates

values.yaml

```yaml
image:
  name: nginx
  tag: latest
  pullPolicy: IfNotPresent
```

templates/pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
spec:
  containers:
  - name: {{ .Chart.Name }}
    image: "{{ .Values.image.name }}:{{ .Values.image.tag }}"
    imagePullPolicy: {{ .Values.image.pullPolicy }}
    ports:
    - containerPort: 80
```

helm template <chart-name>

```
helm template helm-template-01/
```

pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
spec:
  containers:
  - name: demo-template-01
    image: "nginx:latest"
    imagePullPolicy: IfNotPresent
    ports:
    - containerPort: 80
```

`helm template` renders the template by replacing values from values.yaml file without installing the chart. No k8s cluster needed for this and no release name will be generated

`helm template` cannot replace any values that depends on Release information. Ex: `{{ .Release.Name }}`

Helm Templates

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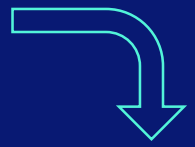
Rendering Templates with Release Information

values.yaml

```yaml
image:
  name: nginx
  tag: latest
  pullPolicy: IfNotPresent
```

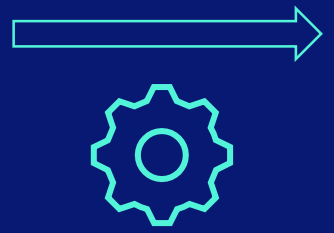


helm install <release-name> <chart-name> --dry-run –debug

```
helm install demo-01 helm-template-01/ --dry-run --debug
```

templates/pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    release: {{ .Release.Name }}
spec:
  containers:
  - name: {{ .Chart.Name }}
    image: "{{ .Values.image.name }}:{{ .Values.image.tag }}"
    imagePullPolicy: {{ .Values.image.pullPolicy }}
    ports:
    - containerPort: 80
```



pod.yaml

```yaml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    release: demo-01
spec:
  containers:
  - name: demo-template-01
    image: "nginx:latest"
    imagePullPolicy: IfNotPresent
    ports:
    - containerPort: 80
```

`helm install --dry-run` renders the template by replacing values from values.yaml file by sending the manifests to k8s API server. A release name will be generated in this case without actual chart installation

Helm Templates

Rendering Templates with Release Information

```
root@k8s-master:/home/osboxes/helm# helm install demo-01 helm-template-01/ --dry-run --debug
install.go:173: [debug] Original chart version: ""
install.go:190: [debug] CHART PATH: /home/osboxes/helm/helm-template-01

NAME: demo-01
LAST DEPLOYED: Tue Jan 19 07:43:33 2021
NAMESPACE: default
STATUS: pending-install
REVISION: 1
TEST SUITE: None
USER-SUPPLIED VALUES:
{}

COMPUTED VALUES:
image:
  name: nginx
  pullPolicy: IfNotPresent
  tag: latest

HOOKS:
MANIFEST:
---
# Source: demo-template-01/templates/pod.yml
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    release: demo-01
spec:
  containers:
  - name: demo-template-01
    image: "nginx:latest"
    imagePullPolicy: IfNotPresent
    ports:
    - containerPort: 80
```

https://github.com/kunchalavikram1427

Helm Templates

Mandatory/Required values

values.yaml

```
image:
  name: nginx
  pullPolicy: IfNotPresent
```

templates/pod.yaml

```
apiVersion: v1
kind: Pod
metadata:
  name: myapp-pod
  labels:
    app: myapp
    release: {{ .Release.Name }}
spec:
  containers:
  - name: {{ .Chart.Name }}
    image: "{{ .Values.image.name }}:{{ required "A valid .Values.image.tag entry required!" .Values.image.tag }}""
    imagePullPolicy: {{ .Values.image.pullPolicy }}
    ports:
    - containerPort: 80
```

`helm install demo-01 helm-template-01/ --dry-run --debug`

```
root@k8s-master:/home/osboxes/helm# helm install demo-01 helm-template-01/ --dry-run --debug
install.go:173: [debug] Original chart version: ""
install.go:190: [debug] CHART PATH: /home/osboxes/helm/helm-template-01

Error: execution error at (demo-template-01/templates/pod.yml:11:41): A valid .Values.image.tag entry required!
helm.go:81: [debug] execution error at (demo-template-01/templates/pod.yml:11:41): A valid .Values.image.tag entry required!
root@k8s-master:/home/osboxes/helm#
```

when required values are not set in values.yaml file, Helm throws an error. Alternatively, values can be passed through command line as shown below

`helm install demo-01 helm-template-01/ --set image.tag=latest --dry-run --debug`

Helm Templates

Default values

values.yaml

```yaml
image:
  name: nginx
  tag: latest
  pullPolicy: IfNotPresent
replicas: 2
```

templates/pod.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: myapp-deployment
  labels:
    app: web-development
spec:
  replicas: {{ default 1 .Values.replicas | int }}
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      name: myapp-pod
      labels:
        app: nginx
    spec:
      containers:
      - name: myapp-container
        image: "{{ .Values.image.name }}:{{ .Values.image.tag }}"
        imagePullPolicy: {{ .Values.image.pullPolicy }}
        ports:
        - containerPort: 80
```

Tip: variable quoting – To ensure that integers and floats used as image tags in the values.yaml are evaluated as a string, the quote function can be used in the file consuming the value to wrap the value in double quotes. {{ .Values.image.tag | quote }}

For integers: int function can be used

```
helm install demo-01 helm-template-01/ --dry-run --debug
```

when values are not set in values.yaml file, default values are used. The same syntax for default values can also be written as `{{ .Values.replicas | default 1 | int }}`

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Helm Templates

Predefined values

- `Release.Name:` The name of the release (not the chart)
- `Release.Namespace:` The namespace the chart was released to
- `Release.IsUpgrade:` This is set to true if the current operation is an upgrade or rollback
- `Release.IsInstall:` This is set to true if the current operation is an install
- `Release.Revision:` The revision number for this release. On install, this is 1, and it is incremented with each upgrade and rollback
- `Release.Service:` The service that is rendering the present template. On Helm, this is always Helm
- `Chart.Name:` The name of the chart
- `Chart.Version:` The version of chart

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  myvalue: "Hello World“
  env: {{ .Release.Namespace }}
```

https://helm.sh/docs/chart_template_guide/builtin_objects/

https://github.com/kunchalavikram1427

Helm Templates

Template Functions

- When injecting strings into the template, we ought to quote these strings
- Instead of quoting, we can call the quote function in the template directive

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  myvalue: "Hello World"
  url: {{ quote .Values.app.url }}
  type: {{ quote .Values.app.type }}
```

values.yaml

```
colors:
  - blue
  - red
  - green
image:
  labels:
    - app: web
    - env: prod
```

- `{{ (index .Values.image.labels 0).app }}`
- `{{ (index .Values.image.labels 1).env }}`
- `{{ index .Values.colors 0 }}`

index function is used to access array elements

https://helm.sh/docs/chart_template_guide/functions_and_pipelines/
https://kb.novaordis.com/index.php/Helm_Templates

Helm Templates

Template Pipelines

- Pipelines chain together a series of template commands to express a series of transformations
- Pipelines are an efficient way of getting several things done in sequence

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  myvalue: "Hello World"
  url: {{ .Values.app.url | quote}}
  type: {{ .Values.app.type | quote}}
```

In this example, instead of calling quote ARGUMENT, we inverted the order. We sent the argument to the function using a pipeline (|)

Few Pipelines

- `{{ .Values.url | upper | quote }}`
- `{{ .Values.type | repeat 5 | quote }}`
- `{{ .Values.replicas | default 1 | quote }}`
- `{{ .Values.secret.db_password | b64enc | quote }}`
- `{{- default .Chart.Name .Values.nameOverride | trunc 63 | trimSuffix "-" -}}`

https://helm.sh/docs/chart_template_guide/functions_and_pipelines/
https://kb.novaordis.com/index.php/Helm_Templates

Helm Templates

https://github.com/kunchalavikram1427

Template Variables

- Variable is a named reference to another object. It follows the form `$name`. Variables are assigned with a special assignment operator: `:=`
- Used in conjunction with `with` and `range`
- Variables are normally not global. They are scoped to the block in which they are declared. However, there is one variable that is aways global: `$.` This variable will always point to the root context:

```
{{ $.Chart.AppVersion }}
```

templates/pod.yaml

```
{{- $podname := "nginx" -}}
apiVersion: v1
kind: Pod
metadata:
  name: {{ $podname }}-pod
spec:
  containers:
  - name: {{ $podname }}-container
    image: nginx:latest
    ports:
    - containerPort: 80
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  {{- $relenv := .Release.Namespace -}}
  {{- with .Values.configmap }}
  url: {{ .url | quote }}
  db_user: {{ .user | lower | quote }}
  release: {{ $relenv }}
  {{- end }}
```

```
Ex: {{ $fullName := printf "%s-%s" .Release.Name .Chart.Name | trunc 63 | trimSuffix "-" }}
```

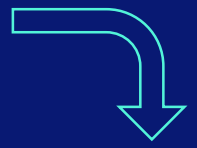
Helm Templates

Flow Control: Range function

- Range function will "range over" (iterate through) a list
- Range operator sets the scope to ".", so the simples way to access the current iteration element is with {{ . }}

values.yaml

```
data:
  color: 'red'
  shape: 'triangle'
```



templates/dep.yaml

```
metadata:
  {{- if .Values.data }}
  annotations:
    {{- range $key, $value := .Values.data }}
    {{ $key }}: {{ $value | quote -}}
    {{ end }}
  {{- end}}
```

Iterating over an In-Line List

templates/pod.yaml

```
env:
{{- range list "blue" "red" "green" }}
- name: {{ . | upper | printf "COLOR_%s" }}
  value: {{ . -}}
{{ end }}
```

o/p

```
env:
- name: COLOR_BLUE
  value: blue
- name: COLOR_RED
  value: red
- name: COLOR_GREEN
  value: green
```

https://github.com/kunchalavikram1427

Helm Templates

Range function

Iterating over a List

values.yaml

```
colors:
  - blue
  - red
  - green
  - yellow
```

templates/dep.yaml

```
env:
{{- range .Values.colors }}
- name: {{ . | upper | printf "COLOR_%s" }}
  value: {{ . -}}
{{ end }}
```

o/p

```
env:
- name: COLOR_BLUE
  value: blue
- name: COLOR_RED
  value: red
- name: COLOR_GREEN
  value: green
- name: COLOR_YELLOW
  value: yellow
```

Iterating over a Map

values.yaml

```
shapes:
  FIRST_SHAPE: square
  SECOND_SHAPE: circle
  THIRD_SHAPE: triangle
```

templates/dep.yaml

```
env:
{{- range $key, $value := .Values.shapes }}
- name: {{ $key }}
  value: {{ $value | upper -}}
{{ end }}
```

o/p

```
env:
- name: FIRST_SHAPE
  value: SQUARE
- name: SECOND_SHAPE
  value: CIRCLE
- name: THIRD_SHAPE
  value: TRIANGLE
```

Helm Templates

Range function

Iterating over a List

values.yaml

```yaml
favorite:
  drink: coffee
  food: pizza
pizzaToppings:
  - mushrooms
  - cheese
  - peppers
  - onions
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  myvalue: "Hello World"
  {{- with .Values.favorite }}
  drink: {{ .drink | default "tea" | quote }}
  food: {{ .food | upper | quote }}
  {{- end }}
  toppings: |-
    {{- range .Values.pizzaToppings }}
    - {{ . | title | quote }}
    {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: edgy-dragonfly-configmap
data:
  myvalue: "Hello World"
  drink: "coffee"
  food: "PIZZA"
  toppings: |-
    - "Mushrooms"
    - "Cheese"
    - "Peppers"
    - "Onions"
```

In the example above, we used | to indicate a multi-line string. But the content of the string will be followed with a trailing \n. If we want the YAML processor to strip off the trailing newline, we can add a - after the |

Helm Templates

if-else

- if/else can be used to create conditional blocks
- For templates, the operators (eq, ne, lt, gt, and, or, not….) are all implemented as functions

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  env: {{ .Values.db_data.env | default "dev" }}
  db_user: {{ .Values.db_data.db_user | lower }}
  {{- if eq .Values.db_data.db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: test-configmap
data:
  env: prod
  db_user: admin
  db: test-db
```

https://github.com/kunchalavikram1427

Helm Templates

if-else

- The operators (eq, ne, lt, gt, and, or, not….) are all implemented as functions

OR

```
{{- if or .Values.myApp.config.local .Values.myApp.config.nfs }}
   ...
{{- end }}
```

NOT

```
{{ if not .Values.myApp.something }}
...
{{ end }}
```

EQUAL

```
{{- if eq .Values.myApp.something .Values.myApp.somethingElse }}
...
{{- end }}
```

NOT EQUAL

```
{{- if ne .Values.myApp.color "blue" }}
...
{{- end }}
```

Helm Templates

Modifying Scope using 'with'

- `With` controls variable scoping & current scope can be changed using it
- `.` is a reference to the current scope as seen earlier
- In the below template, scope is now at `db_data`, so `.Values.db_data.env` can be directly referenced with `.env` .This is because the `with` statement sets `.` to point to `.Values.db_data`
- The `.` is reset to its previous scope after `{{ end }}`

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: test-configmap
data:
  env: prod
  db_user: admin
  db: test-db
```

https://github.com/kunchalavikram1427

Helm Templates

Named Templates

- Named template/sub-template/embedded template, is a fragment of text that is declared in one file and then rendered in-line into another template, usually defined in a different file, every time it is invoked with the `template` action or the `include` function
- Sub-template is declared with the `define` action
- Sub-template has a name, declared when the sub-template is defined
- Template engine renders the sub-template declaration, when it encounters a `template` action or a `include` function that specify the sub-template name
- Sub-template names, including those declared in subcharts, are global. This means that if two sub-templates have the same name, whichever is loaded last will be the one to be used
- For this reason, is a good practice to name the sub-templates with chart-specific names, and prefix the name of the sub-template with the name of the chart

```
{{ define "mychart.mysubtemplate" }}
```

- Sub-templates can be declared inside other template files, in helper files, for example `_helpers.tpl`, inside the chart's templates/ directory

Helm Templates

Create a sub-template using ‘define’

- `define` action is used to declare the name and the content of the sub-template
- define declaration does not produce output, until the sub-template is rendered with `template` or `include` action
- The indentation of the sub-template body is important
- The `template` action will render the body as is, honouring the existing white space and indentation. So no modifications can be done to a sub-template with `template`
- The `include` function, however, can be used to modify the sub-template like indent the body, by piping it through the indent function
- Both `template` and `include` are used to embed the template into manifests

```
{{ define "MY.NAME" }}
  # body of template here
{{ end }}
```

templates/_helpers.tpl

```
{{/*
Generate basic labels.
This is a multi-line comment.
*/}}
{{- define "mychart.mysubtemplate" }}
  labels:
    color: blue
    date: {{ now | htmlDate }}
{{- end }}
```

https://helm.sh/docs/chart_template_guide/named_templates/#declaring-and-using-templates-with-define-and-template

https://github.com/kunchalavikram1427

Helm Templates

Embed a sub-template using ‘template’

- The 'template' action renders the specified sub-template, with the given scope, in the enclosing template.

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{/*
This is a multi-line comment.
Define usage of subtemplate here.
*/}}
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
{{- end }}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- template "mychart.labels" }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    generator: helm
    date: 2021-01-21
data:
  env: prod
  db_user: admin
  db: test-db
```

https://github.com/kunchalavikram1427

Helm Templates

Embed template inside manifests

templates/cm.yaml

```
{{/*
This is a multi-line comment.
Define usage of subtemplate here.
*/}}
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
{{- end }}

apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- template "mychart.labels" }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

Helm Templates

Scope of sub-templates

- If a sub-template includes references to built-in objects(`.Chart.Name, .Chart.Version`), those objects need to be reachable from the scope the sub-template is invoked with
- The scope is specified as the second argument of `template` or `include` invocation, after the sub-template name

`Syntax:`

- `{{ include "<sub-template-name>" <scope> }}`
- `{{ template "<sub-template-name>" <scope> }}`

`{{ include "mychart.mysubtemplate" . }}` – Scope at root of chart
`{{ template "mychart.mysubtemplate" .Values }}` – Scope at values.yaml file

Helm Templates

Scope of sub-templates

- observe that `Chart.Name, .Chart.Version` are not replaced from the sub template because they are not in the scope where sub-chart is defined

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
    chart: {{ .Chart.Name }}
    version: {{ .Chart.Version }}
{{- end }}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- template "mychart.labels" }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    generator: helm
    date: 2021-01-21
    chart:
    version:
data:
  env: prod
  db_user: admin
  db: test-db
```

Helm Templates

https://github.com/kunchalavikram1427

Scope of sub-templates

- Scope is now at `.` (dot indicates chart root). Now both `Chart.Name,.Chart.Version` are replaced from the sub template
- Observe the dot at the template action below

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- template "mychart.labels" . }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

templates/_helpers.tpl

```
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
    chart: {{ .Chart.Name }}
    version: {{ .Chart.Version }}
{{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    generator: helm
    date: 2021-01-21
    chart: demo-chart
    version: 1.0.0
data:
  env: prod
  db_user: admin
  db: test-db
```

Helm Templates

Scope of sub-templates

- Scope is now at `.Values`
- Works similar to `with` function

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
    env: {{ .db_data.env }}
{{- end }}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- template "mychart.labels" .Values }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    generator: helm
    date: 2021-01-21
    env: prod
data:
  env: prod
  db_user: admin
  db: test-db
```

Helm Templates

Embed a sub-template using 'include'

- The `include` function is the preferred alternative to embed a template
- The output of the function can be processed by a pipeline before embedding, hence the indentation can be controlled, unlike in template case

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{- define "mychart.labels" }}
  labels:
    generator: helm
    date: {{ now | htmlDate }}
    chart: {{ .Chart.Name }}
    version: {{ .Chart.Version }}
{{- end }}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  {{- include "mychart.labels" . }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- if eq .db_table "test-db" }}
  db: test-db
  {{ else }}
  db: app-db
  {{- end }}
  {{- end }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    generator: helm
    date: 2021-01-21
    chart: demo-chart
    version: 1.0.0
data:
  env: prod
  db_user: admin
  db: test-db
```

Helm Templates

Embed a sub-template using ‘include’

- Notice the indentation issues in the final rendered manifest
- The output of the `include` function can be processed by a pipeline before embedding, hence the indentation can be controlled, unlike in template case

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{- define "mychart.app" -}}
app_name: {{ .Chart.Name }}
app_version: "{{ .Chart.Version }}"
{{- end -}}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  labels:
    {{ template "mychart.app" . }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
{{ template "mychart.app" . }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    app_name: demo-chart
app_version: "1.0.0"
data:
  env: prod
  db_user: admin
  db: test-db
  app_name: demo-chart
app_version: "1.0.0"
```

Helm Templates

Embed a sub-template using 'include'

- The output of the `include` function is processed by a pipeline before embedding, hence the indentation is corrected

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{- define "mychart.app" -}}
app_name: {{ .Chart.Name }}
app_version: "{{ .Chart.Version }}"
{{- end -}}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  labels:
{{ include "mychart.app" . | indent 4 }}
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
{{ include "mychart.app" . | indent 2 }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
  labels:
    app_name: demo-chart
    app_version: "1.0.0"
data:
  env: prod
  db_user: admin
  db: test-db
  app_name: demo-chart
  app_version: "1.0.0"
```

Helm Templates

Comments

Single line:

```
{{/* Single line comment */}}
```

Multiline:

```
{{- /*
This is a
multi-line
comment
*/ -}}
```

Helm Templates

Sub-templates as Variables

- Sub-templates may be used instead of variables, by declaring a template that acts like a variable

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: test-db"
```

templates/_helpers.tpl

```
{{/*
Compute the service name that depends on the release name.
This partial should be inlined every time the service name is needed.
*/}}
{{- define "myChart.dbName" -}}
{{- printf "%s-%s" .db_data.env .db_data.db_table -}}
{{- end -}}
```

templates/cm.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Release.Name }}-configmap
  labels:
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  {{- end }}
  db: {{ template "myChart.dbName" .Values }}
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: RELEASE-NAME-configmap
data:
  env: prod
  db_user: admin
  db: prod-test-db
```

Helm Templates

Sprig

- Sprig provides out-of-box many useful functions to be used with Helm charts
- Many template functions for Go templates like String, Math, Encoding, OS, Cryptographic and Security
- Functions like trim, quote, upper, lower, regex, sha, genCA, genCAWithKey, indent etc. are available

String Functions

trim function removes space from either side of a string

```
trim "   hello    "
hello
```

trimSuffix trim just the suffix from a string

```
trimSuffix "-" "hello-"
hello
```

Replace perform simple string replacement.

```
"Hi Helm" |replace " " "-"
Hi-Helm
```

More functions at http://masterminds.github.io/sprig/

Helm Templates

Use of nindent

- While `indent` function indents every line in a given string to the specified indent width, `nindent` also prepends a new line to the beginning of that string

values.yaml

```
image:
  name: nginx
  tag: latest
  pullPolicy: IfNotPresent
replicas: 1
```

templates/_helpers.tpl

```
{{- define "chart.labels" -}}
app: {{- printf " %s-%s" .Release.Name .Chart.Name |
trunc 63 | trimSuffix "-" -}}
{{- end -}}
```

templates/deployment.yaml

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: {{ .Release.Name }}-{{ .Chart.Name }}
  labels: {{ include "chart.labels" . | nindent 4 }}
spec:
  replicas: {{ default 1 .Values.replicas | int }}
  selector:
    matchLabels:
      app: {{ .Release.Name }}-{{ .Chart.Name }}
  template:
  [ . . . ]
```

o/p

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: RELEASE-NAME-nginx-demo-chart
  labels:
    app: RELEASE-NAME-nginx-demo-chart
spec:
  replicas: 1
  selector:
    matchLabels:
    [...]
```

Helm

Helm Plugins

- Helm community maintains lots of custom plugin to ease out day to day operations with Helm

List all installed plugins

```
helm plugin list
```

Install a plugin

```
helm plugin install https://github.com/databus23/helm-diff
```

```
root@k8s-master:/home/osboxes# helm plugin list
NAME    VERSION DESCRIPTION
diff    3.1.3   Preview helm upgrade changes as a diff
```

Helm diff shows the difference in manifests for 2 different revisions of a release

https://helm.sh/docs/community/related/

https://github.com/kunchalavikram1427

Helm

Helm Plugins

Show difference between 2 revisions/upgrade of a release

```
helm diff revision <release-name> 1 2
```

Uninstall the plugin

```
helm plugin uninstall diff
```

Terminal

```
root@k8s-master:/home/osboxes/helm# helm install demo-release helm-chart-plugin-demo/
NAME: demo-release
LAST DEPLOYED: Sat Jan 23 01:20:22 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
root@k8s-master:/home/osboxes/helm# helm upgrade demo-release helm-chart-plugin-demo/
Release "demo-release" has been upgraded. Happy Helming!
NAME: demo-release
LAST DEPLOYED: Sat Jan 23 01:20:33 2021
NAMESPACE: default
STATUS: deployed
REVISION: 2
TEST SUITE: None
root@k8s-master:/home/osboxes/helm# helm diff revision demo-release 1 2
apiVersion: apps/v1
  kind: Deployment
  metadata:
    name: myapp-deployment
    labels:
      app: web-development
  spec:
-   replicas: 1
+   replicas: 2
    selector:
      matchLabels:
        app: nginx
    template:
      metadata:
        name: myapp-pod
        labels:
          app: nginx
        [. . .]
```

https://helm.sh/docs/community/related/

https://github.com/kunchalavikram1427

Helm Templates

NOTES.txt

- The "help text" for your chart and provides instructions to your chart users
- At the end of a `helm install` or `helm upgrade`, Helm can print out a block of helpful information for users
- This information is highly customizable using templates
- Generally, the endpoints, URLs, Ports information are templated in the NOTES.txt file to show users on what URL and Port the application is running/accessible

templates/NOTES.txt

```
Thank you for installing {{ .Chart.Name }}.

Your release is named {{ .Release.Name }}.

To learn more about the release, try:

  $ helm status {{ .Release.Name }}
  $ helm get all {{ .Release.Name }}
```

```
helm install test-chart helm-template-01/
```

o/p

```
Thank you for installing demo-chart.

Your release is named test-chart.

To learn more about the release, try:

  $ helm status test-chart
  $ helm get all test-chart
```

```
POD_NAME=$(kubectl get pods --namespace {{ .Release.Namespace }} -l "app={{ template "prometheus.name" . }},component={{
.Values.pushgateway.name }}" -o jsonpath="{.items[0].metadata.name}")

kubectl --namespace {{ .Release.Namespace }} port-forward $POD_NAME 9091
```

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Helm Templates

.helmignore file

- The .helmignore file is used to specify files you don't want to include in your helm chart
- If this file exists, the `helm package` command will ignore all the files that match the pattern specified in the .helmignore file while packaging your application
- This can help in avoiding unnecessary or sensitive files or directories from being added in your helm chart
- The .helmignore file supports Unix shell glob matching, relative path matching, and negation (prefixed with !). Only one pattern per line is considered.

.helmignore

```
# comment

# Match any file or path named .git
.git

# Match any text file
*.txt

# Match only directories named mydir
mydir/

# Match only text files in the top-level
directory
/*.txt

# Match only the file foo.txt in the top-
level directory
/foo.txt

# Match any file named ab.txt, ac.txt, or
ad.txt
a[b-d].txt

# Match any file under subdir matching
temp*
*/temp*

*/*/temp*
temp?
```

https://github.com/kunchalavikram1427

Helm Templates

Templating Best Practices

```
my-app:
  config:
    rbac:
      enabled: true
```

```
tls_secret: xyz
```

```
secret_name: abc
Config_Name: xyz
```

```
rbac:
  enabled: true
```

```
tls:
  secret: xyz
```

```
secretName: abc
configName: xyz
```

https://github.com/kunchalavikram1427

Helm Charts Revisited

Subcharts and Global Values

Helm Charts

Subcharts and Global Values

- A chart can have dependencies, called subcharts, which have their own values and templates
- All subcharts are placed under charts/ at the root of the chart
- A subchart is considered "stand-alone", which means it can neither depend on its parent chart nor access the values of it
- A parent chart can override values for subcharts by mentioning the subchart name in root/main values.yaml file
- Helm has a concept of global values that can be accessed by all charts. Use `global` keyword to mark a value as global in root values.yaml file

https://helm.sh/docs/chart_template_guide/subcharts_and_globals/

Terminal

```
$ tree web-application
web-application/
├── charts
│   ├── backend
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── backend-service.yaml
│   │   │   ├── backend.yaml
│   │   │   ├── _helpers.tpl
│   │   │   └── ingress.yaml
│   │   └── values.yaml
│   ├── database
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── _helpers.tpl
│   │   │   ├── mongodb-secret.yaml
│   │   │   ├── mongodb-service.yaml
│   │   │   └── mongodb.yaml
│   │   └── values.yaml
│   └── frontend
│       ├── Chart.yaml
│       ├── templates
│       │   ├── frontend-configmap.yaml
│       │   ├── frontend-service.yaml
│       │   ├── frontend.yaml
│       │   ├── _helpers.tpl
│       │   └── ingress.yaml
│       └── values.yaml
├── Chart.yaml
├── templates
│   ├── ingress.yaml
│   └── NOTES.txt
└── values.yaml
```

https://github.com/kunchalavikram1427

Helm Charts

Subcharts and Global Values

- without values override and globals

values.yaml

```
db_data:
  env: prod
  db_user: admin
  db_table: admin-db
```

charts/backend/values.yaml

```
db_data:
  env: dev
  db_user: dev
  db_table: dev-db
```

configMap.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Chart.Name }}-configmap
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
```

charts/backend/templates/configMap.yaml

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Chart.Name }}-configmap
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
```

```
helm template helm-chart-subcharts-globals/
```

Terminal

```
$ tree helm-chart-subcharts-globals
helm-chart-subcharts-globals/
├── charts
│   └── backend
│       ├── Chart.yaml
│       ├── templates
│       │   └── configMap.yml
│       └── values.yaml
├── Chart.yaml
├── templates
│   └── configMap.yml
└── values.yaml
```

o/p

```
apiVersion: v1
kind: ConfigMap
metadata:
  name: backend-configmap
data:
  env: dev
  db_user: dev
  db: dev-db
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: demo-chart-main-configmap
data:
  env: prod
  db_user: admin
  db: admin-db
```

https://github.com/kunchalavikram1427

Helm Charts

Subcharts and Global Values

- Overriding subchart values by main chart values and using global values

values.yaml

```yaml
db_data:
  env: prod
  db_user: admin
  db_table: admin-db
backend:
  db_data:
    env: test
    db_user: test
    db_table: test-db
global:
  debug: true
```

charts/backend/values.yaml

```yaml
db_data:
  env: dev
  db_user: dev
  db_table: dev-db
```

configMap.yaml

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Chart.Name }}-configmap
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
  debug: {{ .Values.global.debug }}
```

charts/backend/templates/configMap.yaml

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: {{ .Chart.Name }}-configmap
data:
  {{- with .Values.db_data }}
  env: {{ .env | default "dev" }}
  db_user: {{ .db_user | lower }}
  db: {{ .db_table | lower }}
  {{- end }}
  debug: {{ .Values.global.debug }}
```

```
helm template helm-chart-subcharts-globals/
```

For subchart to access newly override values from main values.yaml file, no changes are needed in yaml files as helm automatically manages the scope to point to the correct values.
Ex: `.Values.db_data` need not be changed to `.Values.backend.db_data` in subchart configMap.yaml file

Terminal

```
$ tree helm-chart-subcharts-globals
helm-chart-subcharts-globals/
├── charts
│   └── backend
│       ├── Chart.yaml
│       ├── templates
│       │   └── configMap.yml
│       └── values.yaml
├── Chart.yaml
├── templates
│   └── configMap.yml
└── values.yaml
```

o/p

```yaml
apiVersion: v1
kind: ConfigMap
metadata:
  name: backend-configmap
data:
  env: test
  db_user: test
  db: test-db
  debug: true
---
apiVersion: v1
kind: ConfigMap
metadata:
  name: demo-chart-main-configmap
data:
  env: prod
  db_user: admin
  db: admin-db
  debug: true
```

https://github.com/kunchalavikram1427

Helm

Check the charts for errors

- Use `helm lint` to check the chart for syntax errors
- It's much faster then searching for errors after deployment

```
root@k8s-master:/home/osboxes/helm# helm lint helm-chart-plugin-demo/
==> Linting helm-chart-plugin-demo/
[INFO] Chart.yaml: icon is recommended

1 chart(s) linted, 0 chart(s) failed
```

Debugging the chart

- For debugging, use `helm template` or `helm install --debug --dry-run`

Helm

Package and share helm chart

- Use `helm package` to package the chart into .tgz file
- Once packed, create a new directory and move the .tgz file into it
- Run `helm repo index` command to generate the index.yaml
- index.yaml contains metadata about the package, including the contents of a chart's Chart.yaml file. A valid chart repository must have an index file
- Now you can upload the chart and the index file to your chart repository using a sync tool or manually

```
helm package helm-chart-plugin-demo
mkdir test-chart
mv nginx-demo-chart-1.0.0.tgz  test-chart/
helm repo index test-chart –url <url-name>
```

```
root@k8s-master:/home/osboxes/helm# tree test-chart/
test-chart/
├── index.yaml
└── nginx-demo-chart-1.0.0.tgz
```

index.yaml

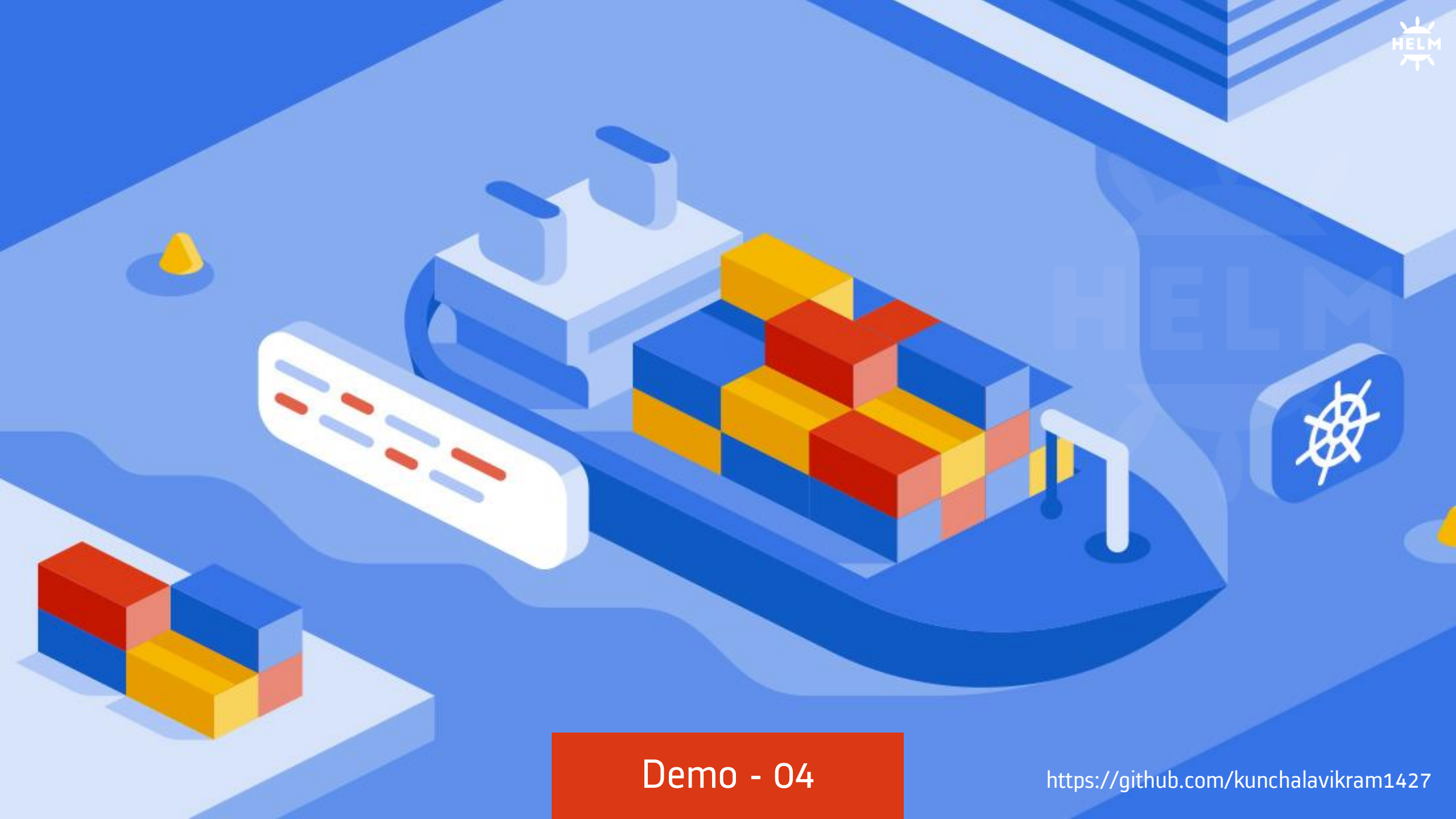
```
apiVersion: v1
entries:
  nginx-demo-chart:
  - apiVersion: v2
    appVersion: "1.0"
    created: "2021-01-2T02:59:01.8152-05:00"
    description: A Demo Helm nginx template
digest: 9bc0320c1d84da96ef33e5e45
name: nginx-demo-chart
    type: application
    urls:
    - nginx-demo-chart-1.0.0.tgz
    version: 1.0.0
generated: "2021-01-23T02:59:01.813831407-
05:00"
```

```
$ helm push-artifactory nginx-demo-chart-1.0.0.tgz http://localhost:8081/artifactory/helm-chart-artifactory-repo --username myadminusername --password myadminpass
```

https://helm.sh/docs/topics/chart_repository/

https://chartmuseum.com/docs/#uploading-a-chart-package

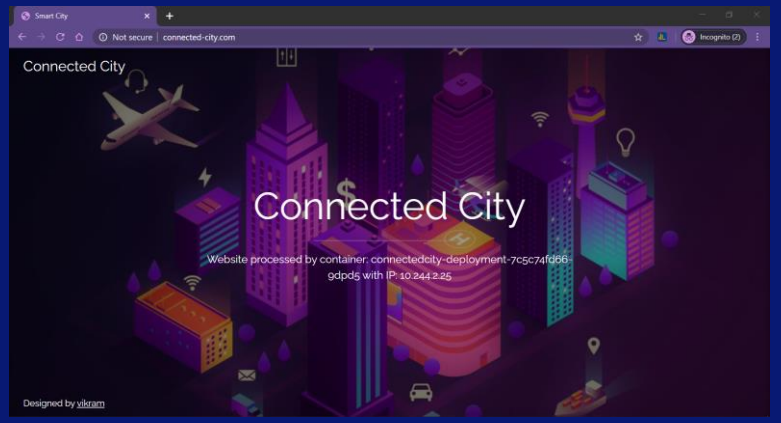
https://github.com/kunchalavikram1427

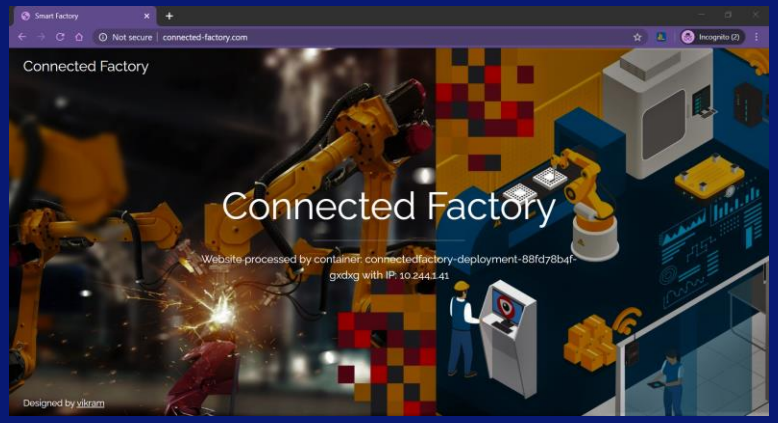

HELM
Demo - 04
https://github.com/kunchalavikram1427

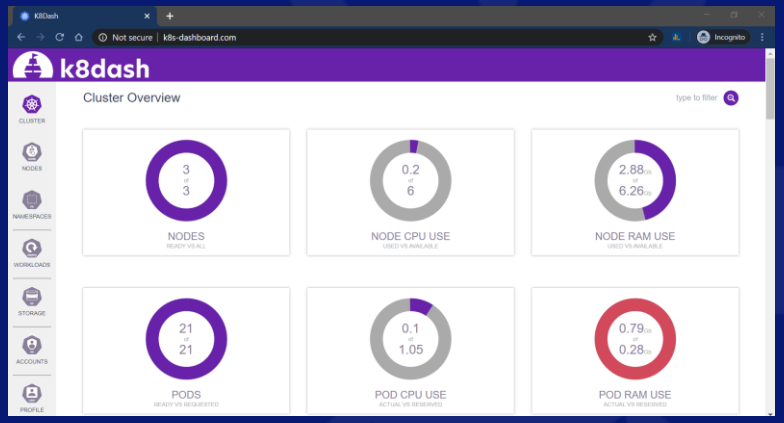
Helm

Demo -04

- 3 front-end templatized applications
- Metrics-server and Traefik Ingress Controller installation within the same chart
- Helper functions & values files for each subchart and main chart
- NOTES.txt file to show URL info to the users
- Override values of subcharts







https://github.com/kunchalavikram1427

Helm

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Demo -04

Install the chart

```
helm install demo helm-template-final
```

```
NAME: demo
LAST DEPLOYED: Sat Jan 23 03:31:27 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
NOTES:
Thank you for installing connected-applications.

Your release is named demo.

To learn more about the release, try:

  $ helm status demo
  $ helm get all demo

You can access the applications at the following urls :
  http://connected-city.com
  http://connected-factory.com
  http://dashboard.com

  To access dashboard, a token is needed to be entered
  Get token by running the command:
  kubectl describe secret $(kubectl get secrets | grep k8s-dashboard-app | awk '{print
$1}' )
  Copy and paste the token in the browser

Have fun !!!
```

All demo charts are in the github: https://github.com/kunchalavikram1427/helm

Terminal

```
$ tree helm-template-final
helm-template-final
├── charts
│   ├── connectedcity
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── connectedcity-app-deployment.yml
│   │   │   ├── connectedcity-app-ingress.yml
│   │   │   ├── connectedcity-app-service.yml
│   │   │   └── _helpers.tpl
│   │   └── values.yaml
│   ├── connectedfactory
│   │   ├── Chart.yaml
│   │   ├── templates
│   │   │   ├── connectedfactory-app-deployment.yml
│   │   │   ├── connectedfactory-app-ingress.yml
│   │   │   ├── connectedfactory-app-service.yml
│   │   │   └── _helpers.tpl
│   │   └── values.yaml
│   └── kubernetesdashboard
│       ├── Chart.yaml
│       ├── templates
│       │   ├── _helpers.tpl
│       │   ├── kubernetes-dashboard-clusterrolebinding.yml
│       │   ├── kubernetes-dashboard-deployment.yml
│       │   ├── kubernetes-dashboard-ingress.yml
│       │   ├── kubernetes-dashboard-serviceaccount.yml
│       │   └── kubernetes-dashboard-service.yml
│       └── values.yaml
├── Chart.yaml
├── templates
│   ├── _helpers.tpl
│   ├── metrics-server.yml
│   ├── NOTES.txt
│   └── traefik-ingress-controller.yml
└── values.yaml
```

Helm

Demo -04

Get the token for dashboard

```
kubectl describe secret $(kubectl get secrets | grep k8s-dashboard-app | awk '{print $1}' )
```

```
NAME: demo
LAST DEPLOYED: Sat Jan 23 03:31:27 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
TEST SUITE: None
NOTES:
Thank you for installing connected-applications.

Your release is named demo.

To learn more about the release, try:

  $ helm status demo
  $ helm get all demo

You can access the applications at the following urls :
  http://connected-city.com
  http://connected-factory.com
  http://dashboard.com

  To access dashboard, a token is needed to be entered
  Get token by running the command:
  kubectl describe secret $(kubectl get secrets | grep k8s-dashboard-app | awk '{print $1}' )
  Copy and paste the token in the browser

Have fun !!!
```

```
root@k8s-master:/home/osboxes/helm# kubectl describe secret $(kubectl get secrets | grep k8s-dashboard-app | awk '{print $1}' )
Name:         demo-k8s-dashboard-app-token-59mvj
Namespace:    default
Labels:       <none>
Annotations:  kubernetes.io/service-account.name: demo-k8s-dashboard-app
              kubernetes.io/service-account.uid: e71b4886-bfb0-47c3-ac7b-a1133f1ade49

Type:  kubernetes.io/service-account-token

Data
====
token:
eyJhbGciOiJSUzI1NiIsImtpZCI6IlE3a2Z4SDdNb2JhT1VIWnJRVWJQWVc2bER0OGlaS2J5dThIdFFKdFRZNFEifQ.eyJpc3MiOiJrdWJlcm5ldGVzL3NlcnZpY2VhY2NvdW50Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9uYW1lc3BhY2UiOiJkZWZhdWx0Iiwia3ViZXJuZXRlcy5pby9zZXJ2aWNlYWNjb3VudC9zZWNyZXQubmFtZSI6ImRlbW8tazhzLWRhc2hib2FyZC1hcHAtdG9rZW4tNTltdmoiLCJrdWJlcm5ldGVzLmlvL3NlcnZpY2VhY2NvdW50L3NlcnZpY2UtYWNjb3VudC5uYW1lIjoiZGVtby1rOHMtZGFzaGJvYXJkLWFwcCIsImt1YmVybmV0ZXMuaW8vc2VydmljZWFjY291bnQvc2VydmljZS1hY2NvdW50LnVpZCI6ImU3MWI0ODg2LWJmYjAtNDdjMy1hYzdiLWExMTMzZjFhZGU0OSIsInN1YiI6InN5c3RlbTpzZXJ2aWNlYWNjb3VudDpkZWZhdWx0OmRlbW8tazhzLWRhc2hib2FyZC1hcHAifQ.bgWS8vxd34nGVrpTrrCFwH5HHQ0d279Ps7zESwme5Le4lCREUCRRhDuvat-N4afC02WF-M8Y9SIn1t5szHJGjpKeEr0JdTAd8ujvhrdFx9fym5V7wYhQ8wtoyzLxeCUr57ECVoNGbkULOA20723gohQwFBgP7pHHI_daUbfvV7kTUcuJXtnqXq0ovQoHZ_GWXIcN-siOCMJWH4yn6P2qHYExVoI91Ac0ZoBMlpkHD64HZMHsFh5cgwDMkjjs6bSsO3y2wRDE7faxh0jlvP6kZ4O8GOBMJ82Mj_IkTTPuVl1iy_6kGbhjnctUBXeKXwuj7h6Mzv_XkQaQy0TBsU7WFQ
```

All demo charts are in the github: https://github.com/kunchalavikram1427/helm

https://github.com/kunchalavikram1427

Helm Commands

https://github.com/kunchalavikram1427

Helm Commands

```
# find helm version
$ helm version --short

# install tiller in helm 2
$ helm init

# list repos
$ helm repo list

# add repos:
$ helm repo add stable https://kubernetes-charts.storage.googleapis.com/
$ helm repo add stable https://charts.helm.sh/stable
$ helm repo add bitnami https://charts.bitnami.com/bitnami
$ helm repo add mirantis https://charts.mirantis.com
```

Helm Commands

```
# update repos index
$ helm repo update

# remove repos
$ helm repo remove <repo-name>

# search for charts
$ helm search repo mysql

# pull a chart without installing
$ helm pull chartrepo/chartname

# render the template:
$ helm template <release-name> <chart>
$ helm template --debug <chart>
$ helm template --debug <chart> -f override-values.yaml
```

Helm Commands

```
# deploy a chart/release:
$ helm install <release-name> <chart>  - helm install demo-sql stable/mysql
$ helm install <release-name> . - deployment from current directory
$ helm install <release-name> <chart> --dry-run --debug  - helm install without actual commit; can generate a release name
$ helm install chart-name --debug --dry-run
$ helm install mychart-0.1.0.tgz
$ helm install my-apache bitnami/apache --version 8.0.2

# to override values with a values file, use the --values or the --f flag:
$ helm install <release-name> <chart> --set <some_parameter>=<new_value>  - helm install my-nginx nginx --set replicaCount=2 --set
service.type=LoadBalancer
$ helm install --set user.name='student',user.password='password' stable/mysql
$ helm install banzaicloud-stable/logging-operator --set rbac.enabled=false
$ helm install <release-name> <chart> --values /path/to/values/file
$ helm install -f myvalues.yaml chart # to be verified
$ helm install --set-string long_int=1234567890 myredis ./redis
$ helm install my-wordpress-prod bitnami/wordpress --version 10.1.4 -f values-production.yaml
$ helm install --values myvalues.yaml stable/mysql
```

https://github.com/kunchalavikram1427

Helm Commands

```
# to deploy the release into a Kubernetes namespace, use the --namespace flag:
$ helm install --namespace db stable/mysql

# list all releases:
$ helm list --all

# upgrade a release
$ helm upgrade <release-name> <chart>
$ helm upgrade -f <values-file> <release-name> <chart-name>
$ helm upgrade my-apache bitnami/apache --version 8.0.3
$ helm upgrade --install <release-name> --values <values-file> <chart-name>

# rollback a release:
$ helm rollback <release-name> <revision-number>
```

Helm Commands

```
# print release history
$ helm history <release-name>

# get/display release status
$ helm status <release-name>

# delete a release
$ helm delete <release-name> - for helm2
$ helm uninstall <release-name> - for helm3
$ helm uninstall --keep-history <release-name>

# force delete a release
$ helm delete --purge <release> - for helm2

# get details of a release like manifests etc.,
$ helm get all <release-name>
$ helm get manifest <release-name>
$ helm get manifest demo-app
```

Helm Commands

```
# show all the environment information of helm
$ helm env

# shows all values in the values.yaml file
$ helm inspect values <chart-name>
$ helm inspect values stable/mysql

# show list of needed dependencies for a chart and their download status
$ helm dependency list <chart-name>

# download dependencies
$ helm dependency update

# create a helm chart template layout
$ helm create <chart-name>

# generate manifests after replacing values in templates. Can work without a cluster. No Release name generated
$ helm template <chart-name>
```

Helm Commands

```
# generate manifests after replacing values in templates. helm install without actual commit; can generate a release name
$ helm install <release-name> <chart> --dry-run --debug
$ helm install <release-name> <chart> --dry-run --debug 2>&1 | less

# package a chart into .tgz
$ helm package <chart-name>

# push chart to a repo
$ helm push-artifactory xyz-demofile-0.1.1.tgz http://localhost:8081/artifactory/helm-chart-artifactory-repo --username
myadminusername --password myadminpass

# examine a chart for possible issues like syntax errors and runs a series of tests to verify that the chart is well-formed.
$ helm lint <chart-name>

# helm plugins
$ helm plugin list
$ helm plugin install https://github.com/databus23/helm-diff
$ helm diff revision <release-name> 1 2
$ helm plugin uninstall diff
```

Helm Extras

5

`nameOverride` replaces the name of the chart in the `Chart.yaml` file, when this is used to construct Kubernetes object names. `fullnameOverride` completely replaces the generated name.

These come from [the template provided by Helm for new charts](). A typical object in the templates is named

```
name: {{ include "<CHARTNAME>.fullname" . }}
```

If you install a chart with a deployment with this name, and where the `Chart.yaml` file specifies `name: chart-name`...

- `helm install release-name .`, the Deployment will be named `release-name-chart-name`
- `helm install release-name . --set nameOverride=name-override`, the Deployment will be named `release-name-name-override`
- `helm install release-name . --set fullnameOverride=fullname-override`, the Deployment will be named `fullname-override`

The generated `...fullname` template is (one code branch omitted, still from the above link)

```
{{- define "<CHARTNAME>.fullname" -}}
{{- if .Values.fullnameOverride }}
{{- .Values.fullnameOverride | trunc 63 | trimSuffix "-" }}
{{- else }}
{{- $name := default .Chart.Name .Values.nameOverride }}
{{- printf "%s-%s" .Release.Name $name | trunc 63 | trimSuffix "-" }}
{{- end }}
{{- end }}
```

https://stackoverflow.com/questions/63838705/what-is-the-difference-between-fullnameoverride-and-nameoverride-in-helm

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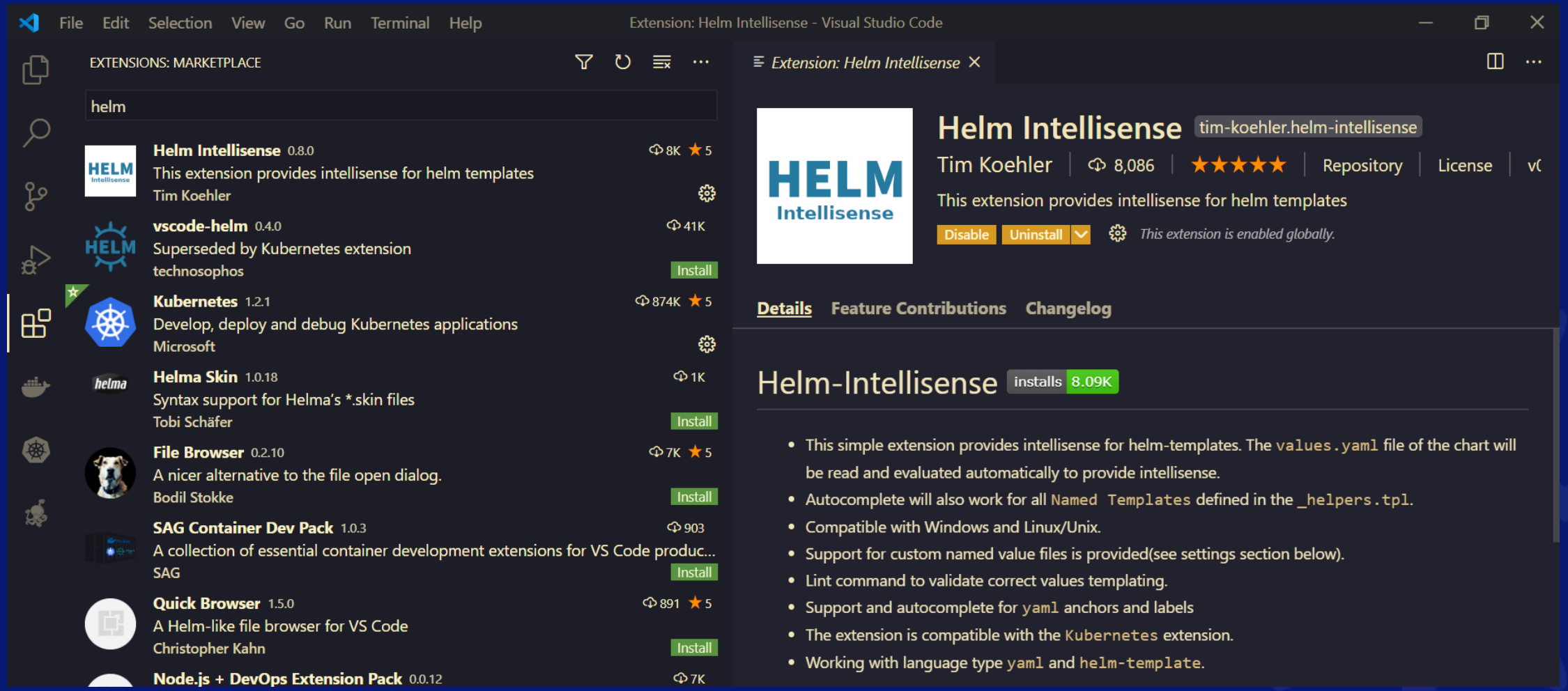
Helm Extras

VS Code Extension



https://github.com/kunchalavikram1427

References

- Helm official site
  https://helm.sh/
- Artifactory
  https://artifacthub.io/packages/search
- Helm Alternatives
  https://kustomize.io/
- Helm Online Practice
  https://www.katacoda.com/mjboxboat/courses/kubernetes-fundamentals-2/04-helm

- Helm tutorials
  https://opensource.com/article/20/5/helm-charts
  https://www.baeldung.com/kubernetes-helm
  https://kb.novaordis.com/index.php/Helm_Templates
  https://nirmata.com/2020/06/04/why-do-devops-engineers-love-helm/
  https://docs.bitnami.com/tutorials/create-your-first-helm-chart/
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  https://medium.com/stakater/using-chartmuseum-as-a-chart-repository-for-helm-b4d12205f4c9
  https://www.ibm.com/cloud/architecture/content/course/helm-fundamentals

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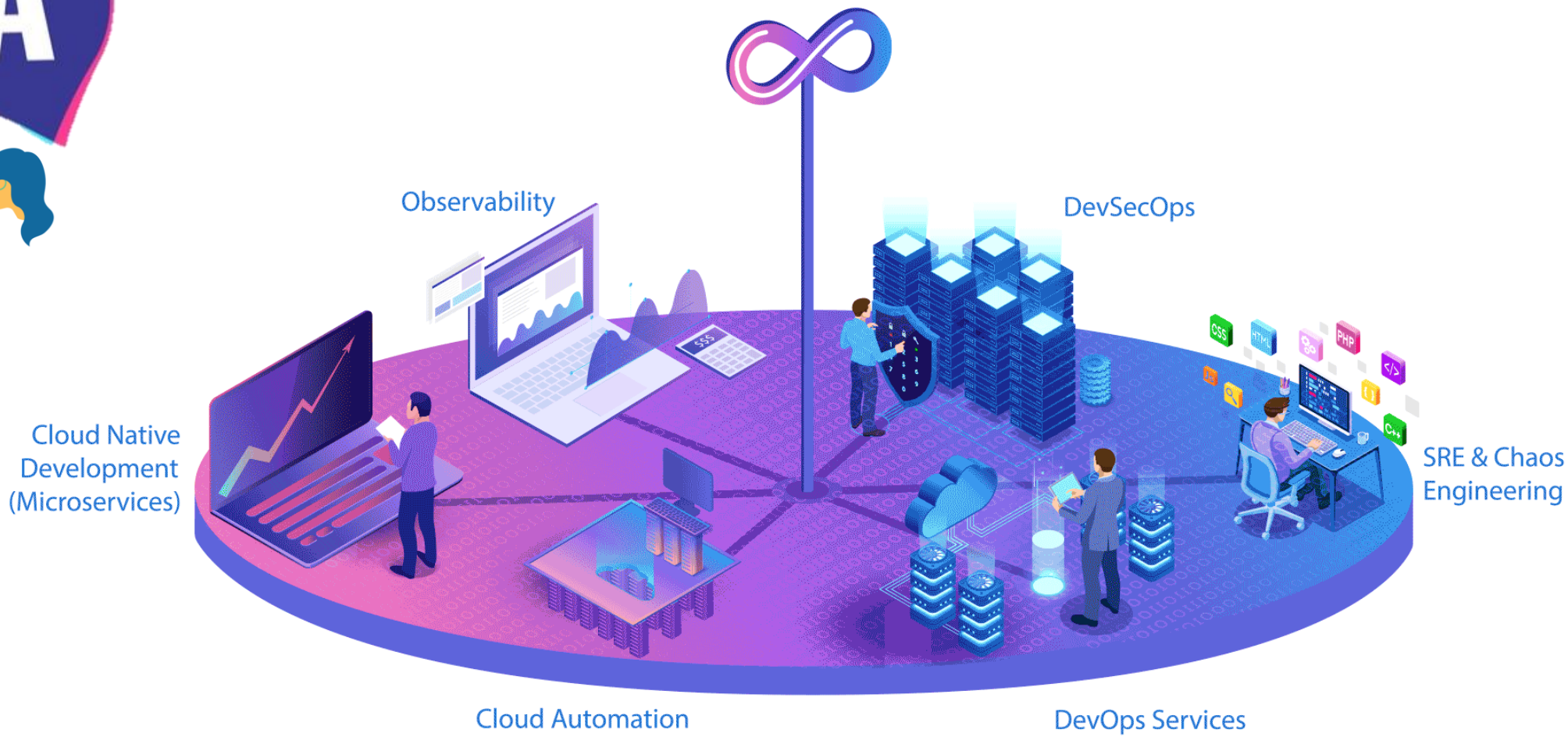

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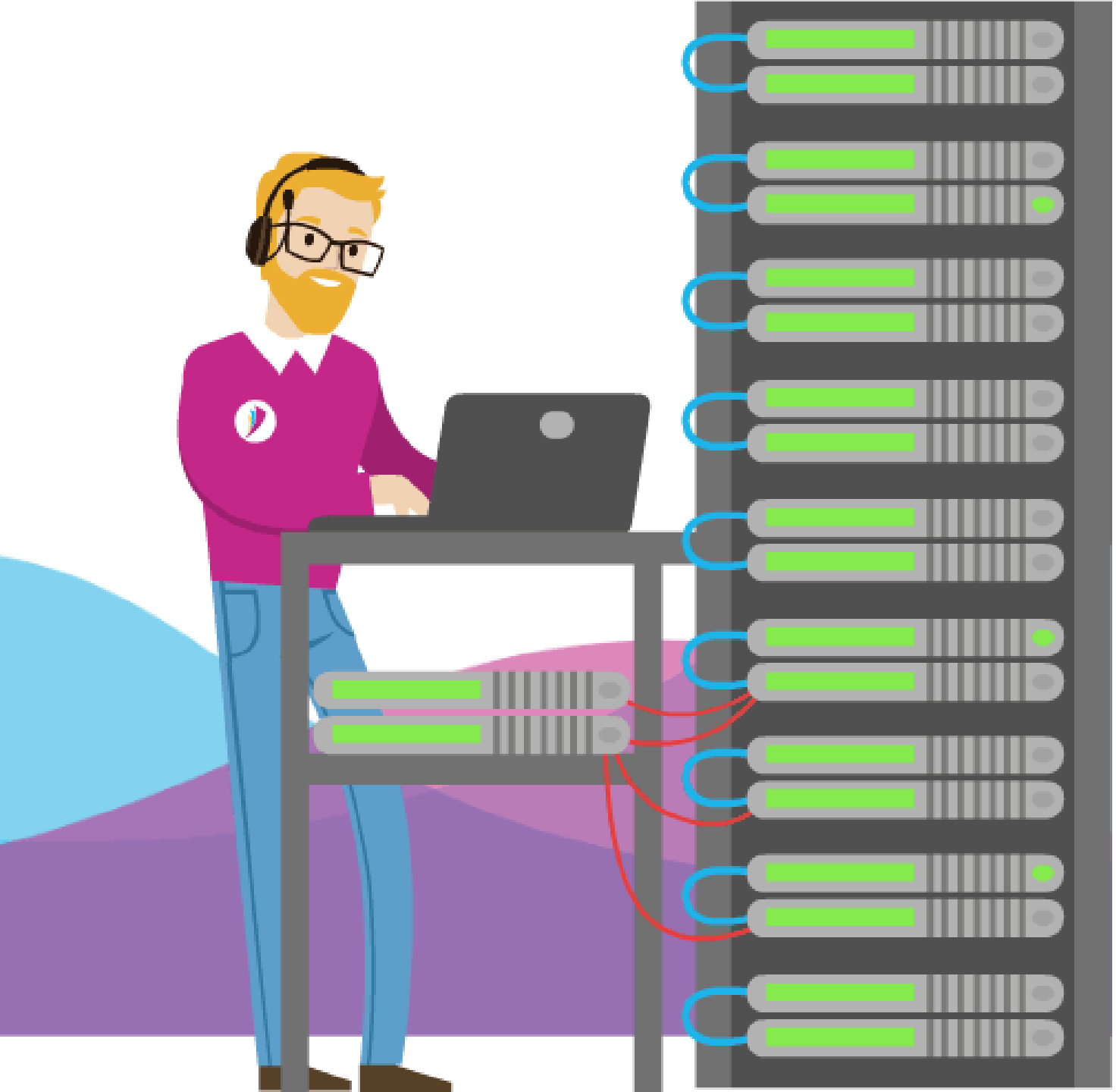

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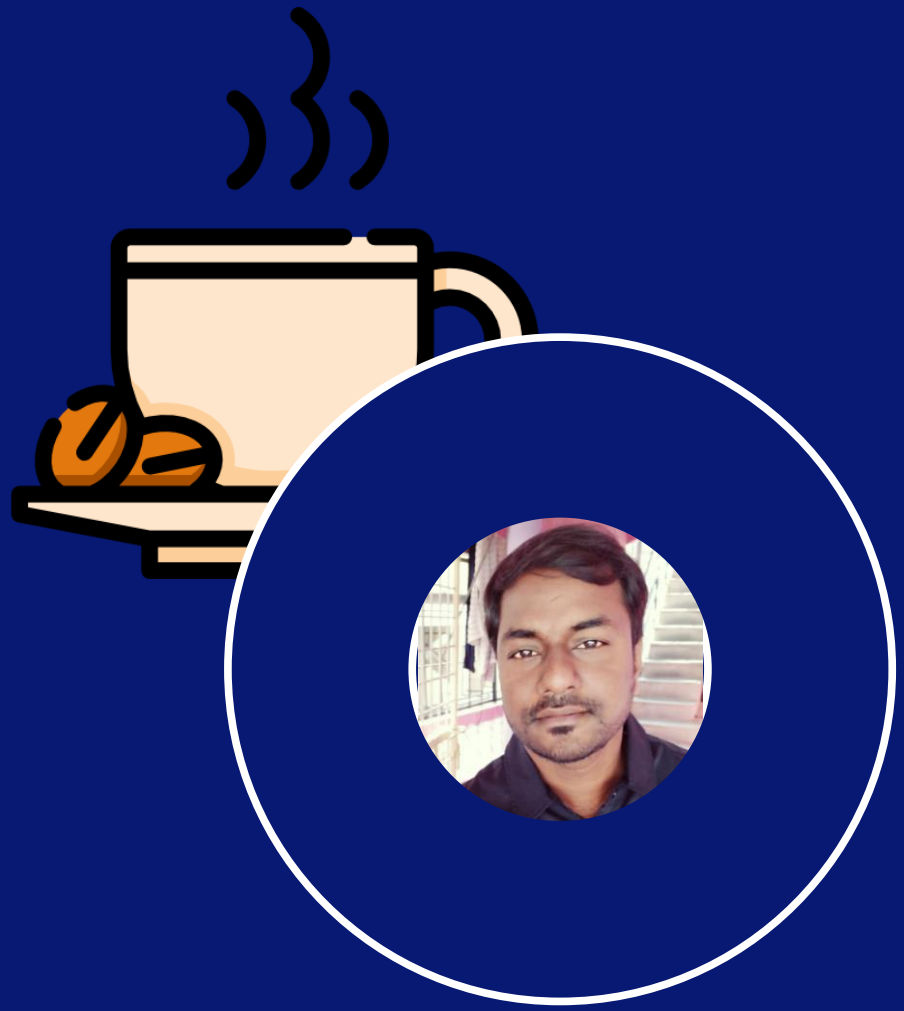

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