How to create your first custom Helm Chart

Agenda:

1. Why Helm ?
2. What is Helm ?
3. Helm basic commands
4. How Helm communicates with your Kubernetes Cluster
5. How to find chart's details
6. Create a custom helm chart

How Kubernetes deployment works ?

In Kubernetes, if you have to deploy any application then at a minimum you need to create a these below components

- **secrets** for database and admin console authentication
- A **ConfigMap** for externalized database configuration
- **services** for networking
- A **PersistentVolumeClaim** for database storage
- A **StatefulSet** for deploying the database in a stateful fashion
- A **Deployment** for deploying the frontend

To create all these components you need to create a yaml file and provide all the configuration inside that. Maintaining this can be a tedious work and to solve this we use the concept of Helm.

What is Helm ?

Helm is an open source tool used for packaging and deploying applications on Kubernetes.

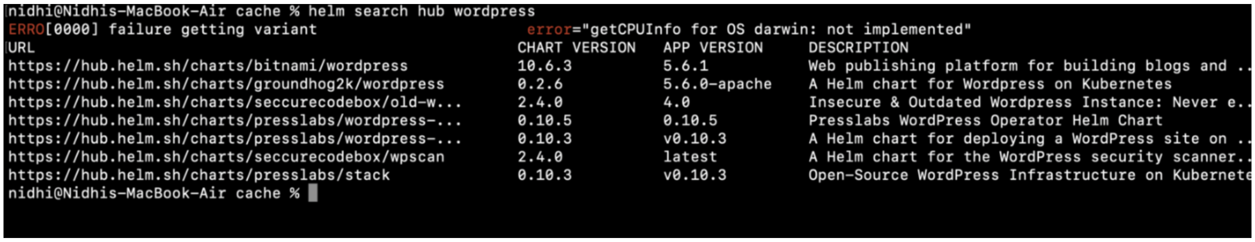
It is often referred to as the **Kubernetes Package Manager**

Helm Hub is a place where you can find all the known public chart repositories and it provide a search functionality.

How to search for a particular chart in Helm Hub

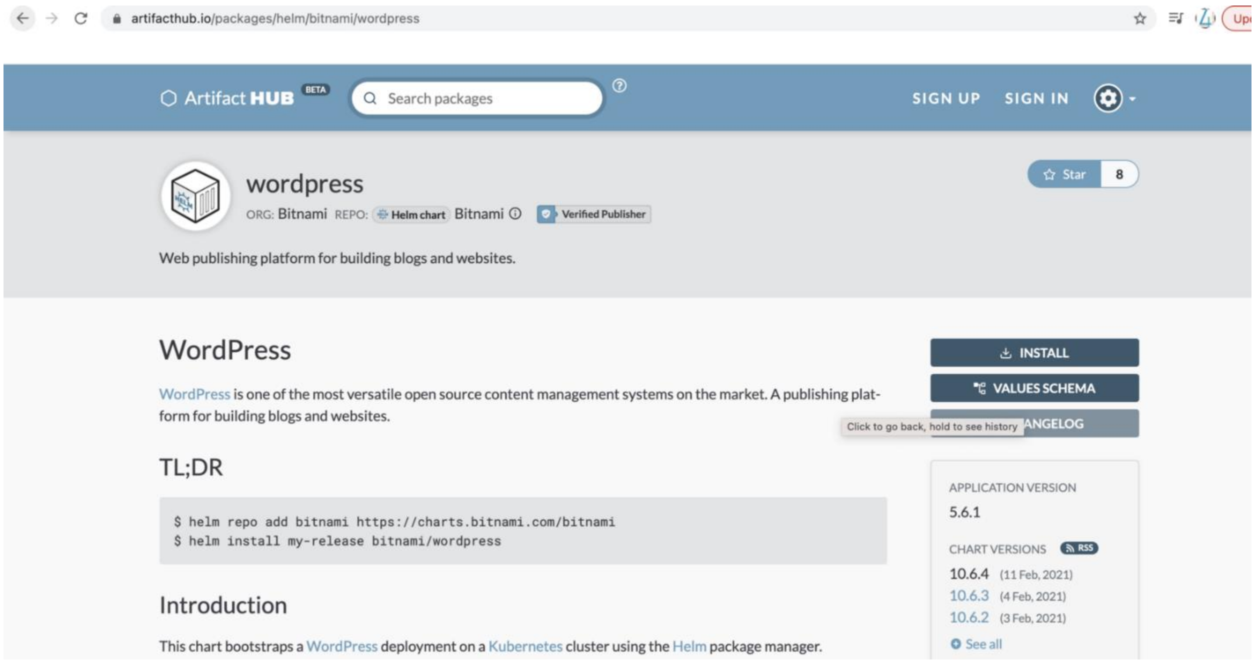
Below command will provide you information about all the charts which are available to use

```
helm search hub wordpress
```



```
nidhi@Nidhis-MacBook-Air cache % helm search hub wordpress
ERRO[0000] failure getting variant                        error="getCPUInfo for OS darwin: not implemented"
URL                                                     CHART VERSION   APP VERSION     DESCRIPTION
https://hub.helm.sh/charts/bitnami/wordpress            10.6.3          5.6.1           Web publishing platform for building blogs and ..
https://hub.helm.sh/charts/groundhog2k/wordpress        0.2.6           5.6.0-apache    A Helm chart for Wordpress on Kubernetes
https://hub.helm.sh/charts/seccurecodebox/old-w...      2.4.0           4.0             Insecure & Outdated Wordpress Instance: Never e..
https://hub.helm.sh/charts/presslabs/wordpress-...      0.10.5          0.10.5          Presslabs WordPress Operator Helm Chart
https://hub.helm.sh/charts/presslabs/wordpress-...      0.10.3          v0.10.3         A Helm chart for deploying a WordPress site on ..
https://hub.helm.sh/charts/seccurecodebox/wpscan        2.4.0           latest          A Helm chart for the WordPress security scanner..
https://hub.helm.sh/charts/presslabs/stack              0.10.3          v0.10.3         Open-Source WordPress Infrastructure on Kubernete
nidhi@Nidhis-MacBook-Air cache %
```

So if you need to use a bitnami charts then you can use that url from the output above and that will provide you all the information about the charts as shown below:



artifacthub.io/packages/helm/bitnami/wordpress

wordpress

ORG: Bitnami REPO: Helm chart Bitnami Verified Publisher

Web publishing platform for building blogs and websites.

WordPress

WordPress is one of the most versatile open source content management systems on the market. A publishing platform for building blogs and websites.

TL;DR

```
$ helm repo add bitnami https://charts.bitnami.com/bitnami
$ helm install my-release bitnami/wordpress
```

Introduction

This chart bootstraps a WordPress deployment on a Kubernetes cluster using the Helm package manager.

APPLICATION VERSION
5.6.1

CHART VERSIONS RSS
10.6.4 (11 Feb, 2021)
10.6.3 (4 Feb, 2021)
10.6.2 (3 Feb, 2021)

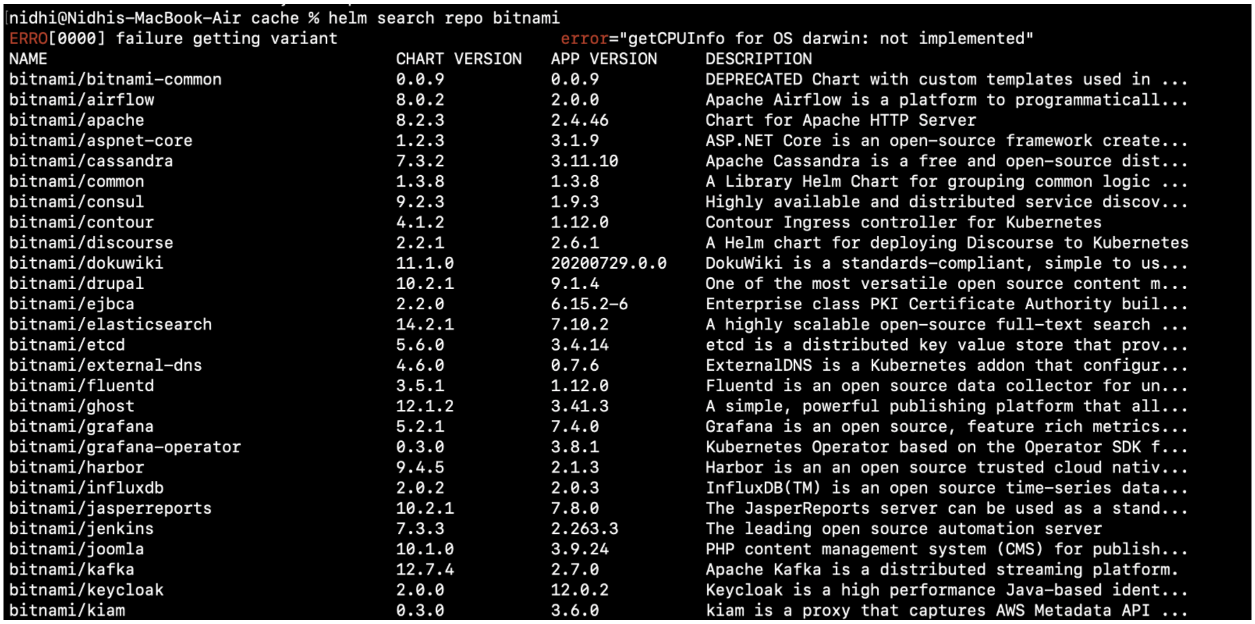
Add repository

Now you can add this repository on your local workstation using below command

```
helm repo add bitnami https://charts.bitnami.com/bitnami
```

Once its added, you can search all the repository which are available in this `bitnami` chart

```
helm search repo bitnami
```



```
[nidhi@Nidhis-MacBook-Air cache % helm search repo bitnami
ERRO[0000] failure getting variant                        error="getCPUInfo for OS darwin: not implemented"
NAME                                    CHART VERSION   APP VERSION     DESCRIPTION
bitnami/bitnami-common                  0.0.9           0.0.9           DEPRECATED Chart with custom templates used in ...
bitnami/airflow                         8.0.2           2.0.0           Apache Airflow is a platform to programmaticall...
bitnami/apache                          8.2.3           2.4.46          Chart for Apache HTTP Server
bitnami/aspnet-core                     1.2.3           3.1.9           ASP.NET Core is an open-source framework create...
bitnami/cassandra                       7.3.2           3.11.10         Apache Cassandra is a free and open-source dist...
bitnami/common                          1.3.8           1.3.8           A Library Helm Chart for grouping common logic ...
bitnami/consul                          9.2.3           1.9.3           Highly available and distributed service discov...
bitnami/contour                         4.1.2           1.12.0          Contour Ingress controller for Kubernetes
bitnami/discourse                       2.2.1           2.6.1           A Helm chart for deploying Discourse to Kubernetes
bitnami/dokuwiki                        11.1.0          20200729.0.0    DokuWiki is a standards-compliant, simple to us...
bitnami/drupal                          10.2.1          9.1.4           One of the most versatile open source content m...
bitnami/ejbca                           2.2.0           6.15.2-6        Enterprise class PKI Certificate Authority buil...
bitnami/elasticsearch                   14.2.1          7.10.2          A highly scalable open-source full-text search ...
bitnami/etcd                            5.6.0           3.4.14          etcd is a distributed key value store that prov...
bitnami/external-dns                    4.6.0           0.7.6           ExternalDNS is a Kubernetes addon that configur...
bitnami/fluentd                         3.5.1           1.12.0          Fluentd is an open source data collector for un...
bitnami/ghost                           12.1.2          3.41.3          A simple, powerful publishing platform that all...
bitnami/grafana                         5.2.1           7.4.0           Grafana is an open source, feature rich metrics...
bitnami/grafana-operator                0.3.0           3.8.1           Kubernetes Operator based on the Operator SDK f...
bitnami/harbor                          9.4.5           2.1.3           Harbor is an an open source trusted cloud nativ...
bitnami/influxdb                        2.0.2           2.0.3           InfluxDB(TM) is an open source time-series data...
bitnami/jasperreports                   10.2.1          7.8.0           The JasperReports server can be used as a stand...
bitnami/jenkins                         7.3.3           2.263.3         The leading open source automation server
bitnami/joomla                          10.1.0          3.9.24          PHP content management system (CMS) for publish...
bitnami/kafka                           12.7.4          2.7.0           Apache Kafka is a distributed streaming platform.
bitnami/keycloak                        2.0.0           12.0.2          Keycloak is a high performance Java-based ident...
bitnami/kiam                            0.3.0           3.6.0           kiam is a proxy that captures AWS Metadata API ...
```

Helm provides the **repo** subcommand to allow users to manage configured chart repositories.

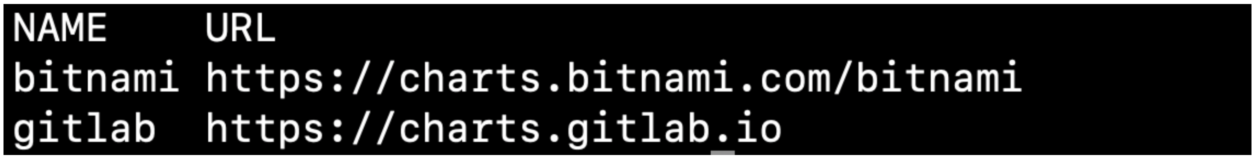
Here are the five **repo** subcommands:

- **add**: To add a chart repository
- **list**: To list chart repositories
- **remove**: To remove a chart repository
- **update**: To update information on available charts locally from chart repositories
- **index**: To generate an index file given a directory containing packaged charts

List repository

This will show all the repository which is added on your local workstation

```
helm repo list
```



```
NAME    URL
bitnami https://charts.bitnami.com/bitnami
gitlab  https://charts.gitlab.io
```

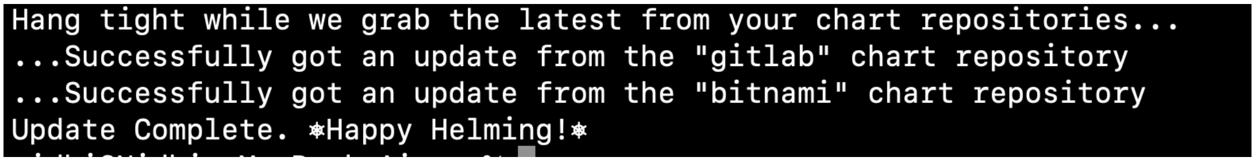
Update a chart

Over time, updates to charts will be published and released to these repositories.

Repository metadata is cached locally. As a result, Helm is not automatically aware when a chart is updated. You can run the below command

This command will update all the local repository which are present in your local workstation

```
helm repo update
```

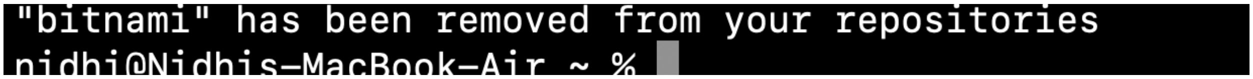


```
Hang tight while we grab the latest from your chart repositories...
...Successfully got an update from the "gitlab" chart repository
...Successfully got an update from the "bitnami" chart repository
Update Complete. ⎈Happy Helming!⎈
```

Remove a repository

This command will remove the repository from your local workstation

```
helm repo remove bitnami
```



```
"bitnami" has been removed from your repositories
nidhi@Nidhis-MacBook-Air ~ %
```

How Helm communicates with your Kubernetes Cluster

Helm needs to be able to authenticate with a Kubernetes cluster in order to deploy and manage applications.

It authenticates by referencing a **kubeconfig** file, which specifies different Kubernetes clusters and how to authenticate against them.

A **kubeconfig** file can be created by leveraging three different **kubectl** commands:

1. **kubectl config set-cluster**

The **set-cluster** command will define a **cluster** entry in the **kubeconfig** file. It determines the Kubernetes cluster's hostname or IP address, along with its certificate authority.

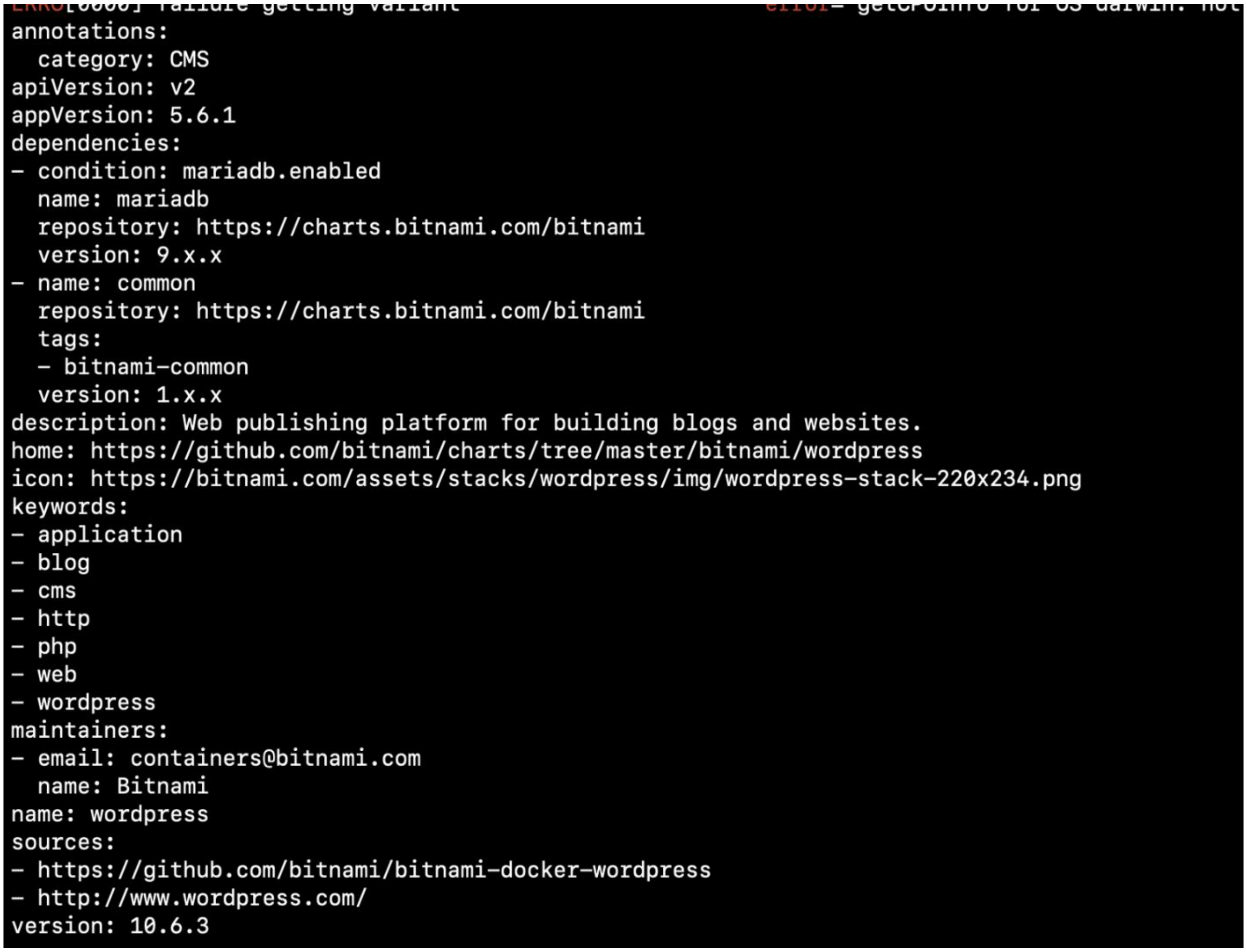
2. kubectl config set-credentials

3. kubectl config set-context

How to find chart’s details

If you need to find any information of charts you can run the below command which will shows the chart’s metadata (or chart definition)/values/readme

```
helm show chart bitnami/wordpress
helm show readme bitnami/wordpress
helm show values bitnami/wordpress
```



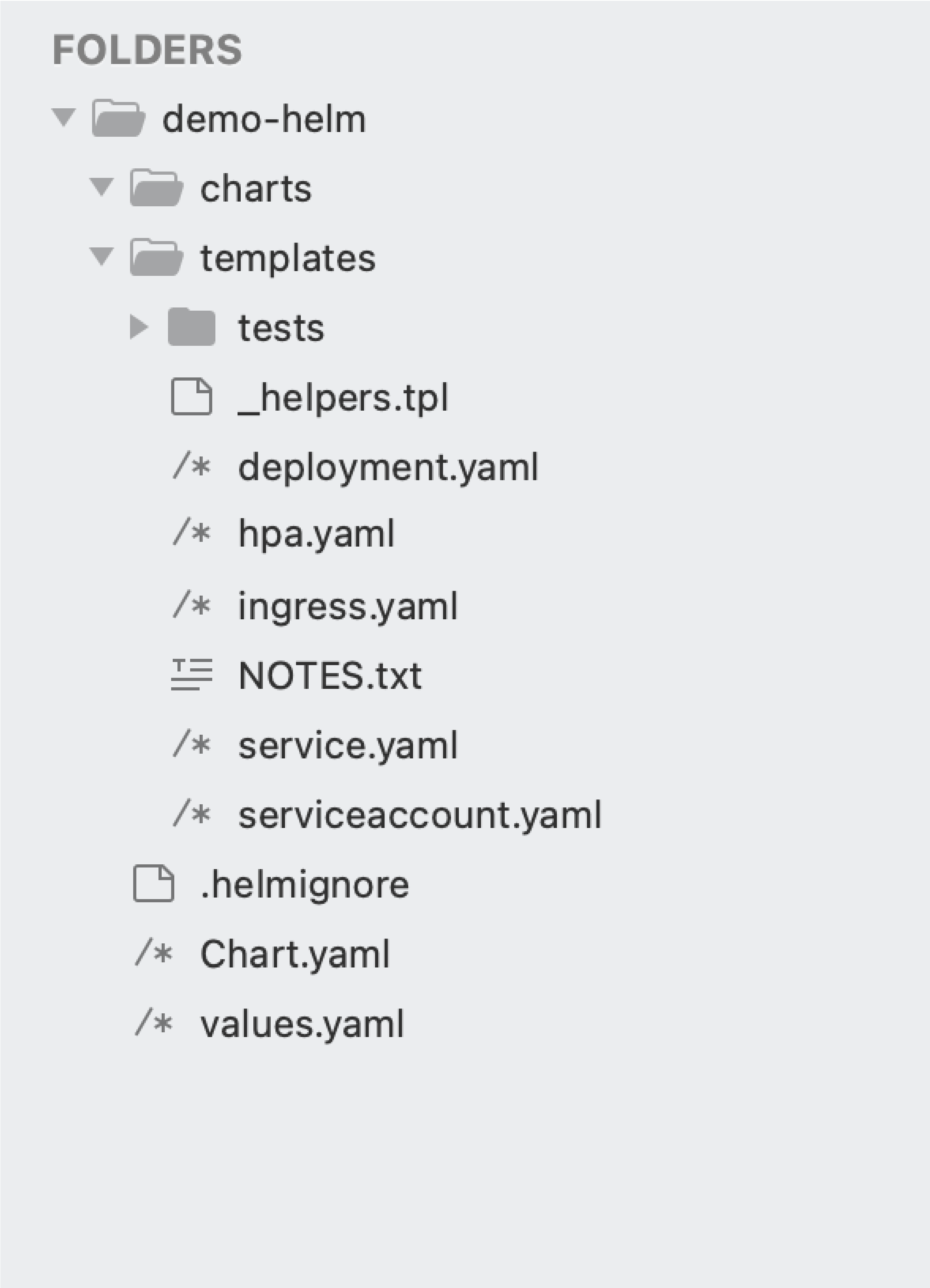
```
ERRO[0000] failure getting variant                      error= getCPUInfo for OS darwin: not
annotations:
  category: CMS
apiVersion: v2
appVersion: 5.6.1
dependencies:
- condition: mariadb.enabled
  name: mariadb
  repository: https://charts.bitnami.com/bitnami
  version: 9.x.x
- name: common
  repository: https://charts.bitnami.com/bitnami
  tags:
  - bitnami-common
  version: 1.x.x
description: Web publishing platform for building blogs and websites.
home: https://github.com/bitnami/charts/tree/master/bitnami/wordpress
icon: https://bitnami.com/assets/stacks/wordpress/img/wordpress-stack-220x234.png
keywords:
- application
- blog
- cms
- http
- php
- web
- wordpress
maintainers:
- email: containers@bitnami.com
  name: Bitnami
name: wordpress
sources:
- https://github.com/bitnami/bitnami-docker-wordpress
- http://www.wordpress.com/
version: 10.6.3
```

Let’s create a custom chart and then deploy it on GKE

```
helm create demo-helm
```

Inside the directory, you will see the following four files and folders:

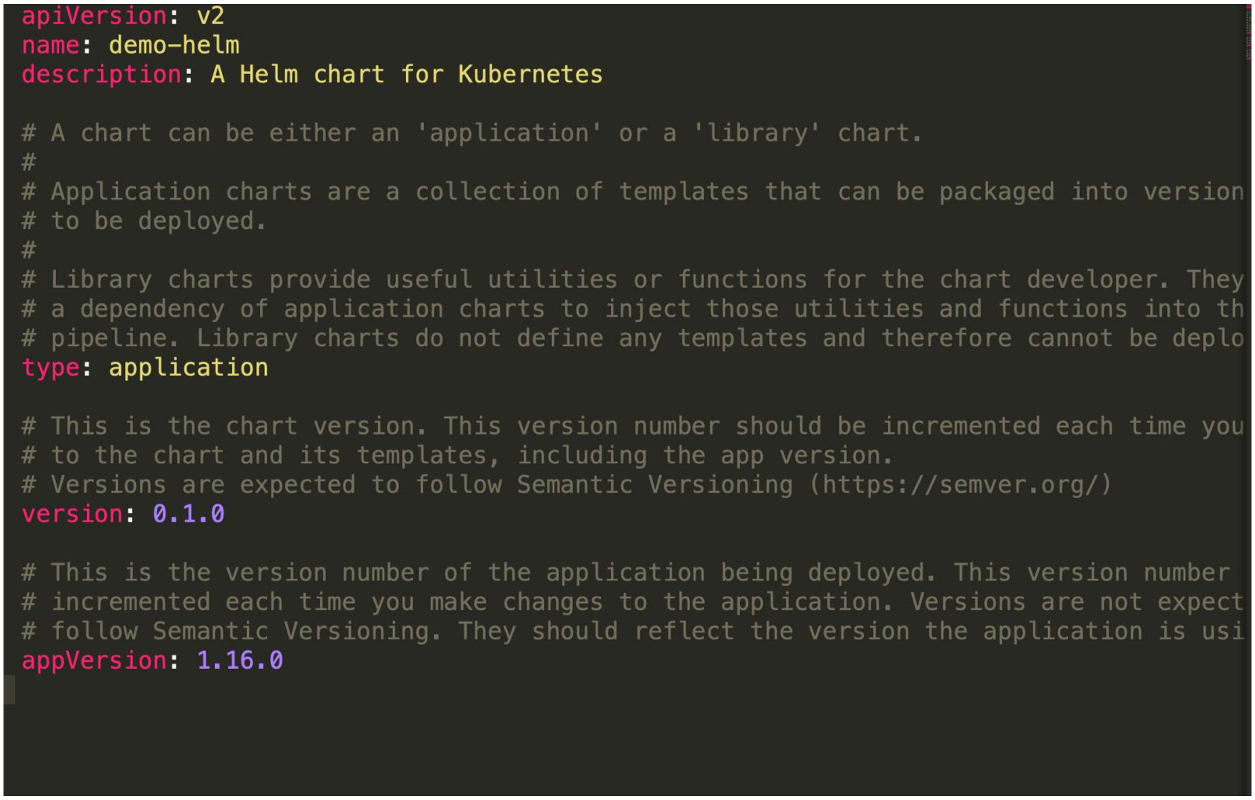
- **charts/**
- **Chart.yaml**
- **templates/**
- **values.yaml**



```
FOLDERS
▼ demo-helm
    ▼ charts
    ▼ templates
        ▶ tests
          _helpers.tpl
          deployment.yaml
          hpa.yaml
          ingress.yaml
          NOTES.txt
          service.yaml
          serviceaccount.yaml
      .helmignore
      Chart.yaml
      values.yaml
```

Chart.yaml

- contain the metadata of a Helm chart



```yaml
apiVersion: v2
name: demo-helm
description: A Helm chart for Kubernetes

# A chart can be either an 'application' or a 'library' chart.
#
# Application charts are a collection of templates that can be packaged into version
# to be deployed.
#
# Library charts provide useful utilities or functions for the chart developer. They
# a dependency of application charts to inject those utilities and functions into th
# pipeline. Library charts do not define any templates and therefore cannot be deplo
type: application

# This is the chart version. This version number should be incremented each time you
# to the chart and its templates, including the app version.
# Versions are expected to follow Semantic Versioning (https://semver.org/)
version: 0.1.0

# This is the version number of the application being deployed. This version number
# incremented each time you make changes to the application. Versions are not expect
# follow Semantic Versioning. They should reflect the version the application is usi
appVersion: 1.16.0
```

Application charts are used to deploy a specific application.

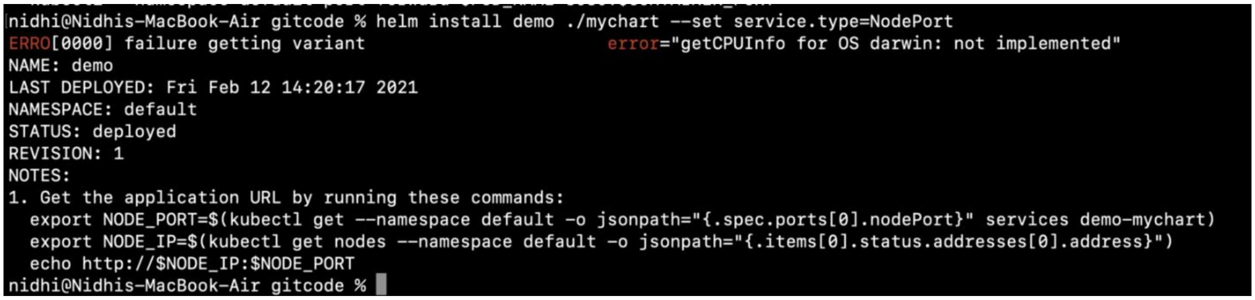
Library charts contain a set of helper functions (also called ‘named templates’) that can be used across other charts to reduce boilerplate.

values.yaml: Used to define default chart values

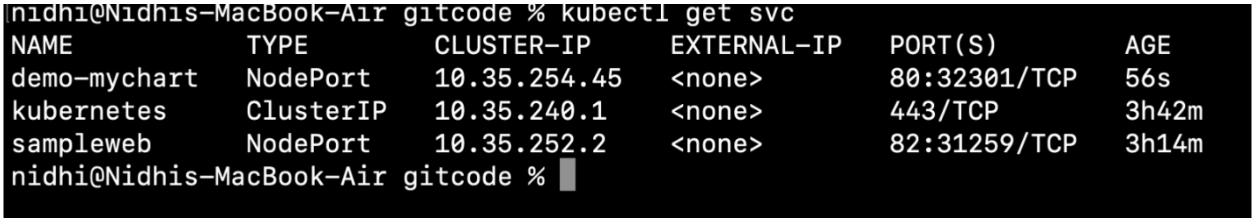
templates/: Used to define chart templates and Kubernetes resources to be created

Let’s run this helm chart

```
helm install demo --dry-run --debug ./demo-helm
helm install demo ./demo-helm --set service.type=NodePort
```

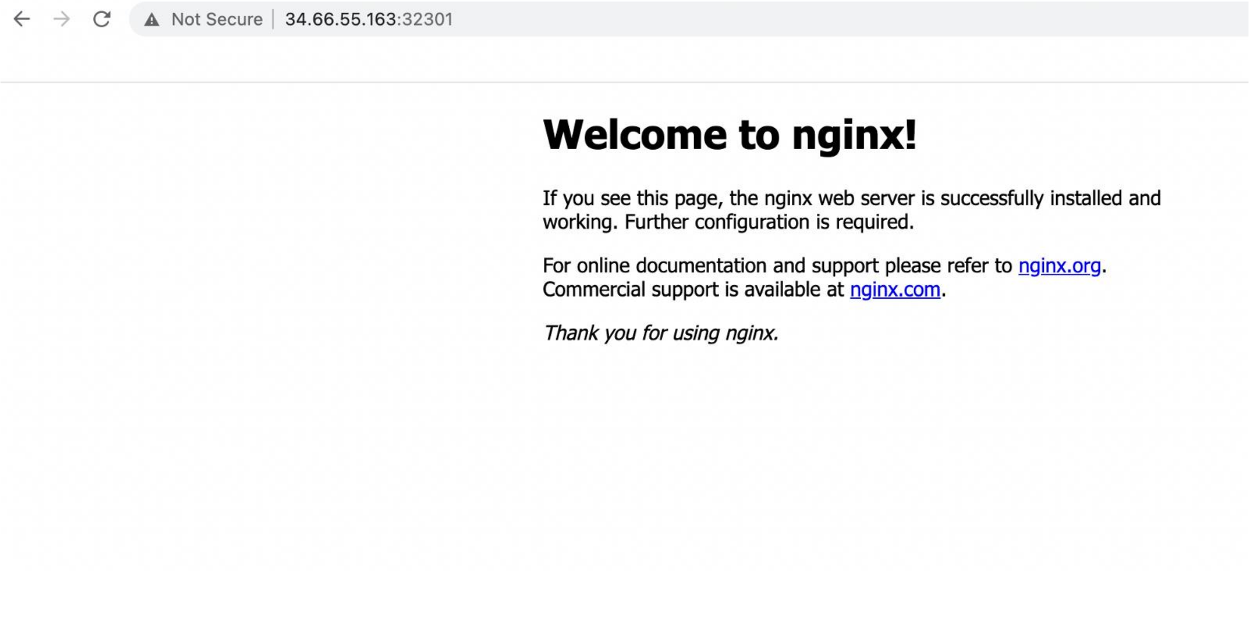


```
nidhi@Nidhis-MacBook-Air gitcode % helm install demo ./mychart --set service.type=NodePort
ERRO[0000] failure getting variant                         error="getCPUInfo for OS darwin: not implemented"
NAME: demo
LAST DEPLOYED: Fri Feb 12 14:20:17 2021
NAMESPACE: default
STATUS: deployed
REVISION: 1
NOTES:
1. Get the application URL by running these commands:
  export NODE_PORT=$(kubectl get --namespace default -o jsonpath="{.spec.ports[0].nodePort}" services demo-mychart)
  export NODE_IP=$(kubectl get nodes --namespace default -o jsonpath="{.items[0].status.addresses[0].address}")
  echo http://$NODE_IP:$NODE_PORT
nidhi@Nidhis-MacBook-Air gitcode %
```



```
nidhi@Nidhis-MacBook-Air gitcode % kubectl get svc
NAME           TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)        AGE
demo-mychart   NodePort    10.35.254.45   <none>        80:32301/TCP   56s
kubernetes     ClusterIP   10.35.240.1    <none>        443/TCP        3h42m
sampleweb      NodePort    10.35.252.2    <none>        82:31259/TCP   3h14m
nidhi@Nidhis-MacBook-Air gitcode %
```

I can access it using node external IP and node port



Welcome to nginx!

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

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

Thank you for using nginx.

This is the basic template that helm provides for nginx service.