

CNT4931C-5475-O

Kubernetes Cluster with WordPress and Keycloak

A Capstone Project

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November 30, 2022

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What is Kubernetes?

Kubernetes is an open-source cluster management tool for containers. It allows you to configure container resources across multiple machines and ensure that they run properly, and have the resources they need to be accessible, composable and scalable.

Cluster A collection of connected computers that are assigned jobs from a controller

Container A package of all of the required configurations and programs required to run a particular program or application

Why Kubernetes?

- Easy to setup and scale
- Well documented
- Industry standard cluster management system
- First-party support for many cloud providers
- Expansive pre-written and tested application library
- Makes setting up complicated applications more accessible
- Containers allow for segmented permissions and boundaries without manual intervention
- I've never setup a cluster environment before

The Tools

In order for me to setup a proper environment, there are several key tools needed to get started:

- A cloud provider
- A version of kubernetes (K8s, K3s, etc)
- A management tool

There are many choices for each of these. Including a fully packaged system from Amazon that does it all for you... for a price.

The Cloud Provider

Hetzner Cloud

Unfortunately, I don't have enough hardware lying around that I could cobble together a cluster with enough *oomph* to run anything useful. Fortunately, we live in an era where virtualization allows us to access nearly unlimited resources on a pay-as-you-go basis. I chose Hetzner Cloud (henceforth “hcloud”), mainly because I've used them before, and because of their dirt-cheap VPS prices.

VPS Virtual Private Server, a slice of a large server that can be used for pretty much anything you want.

Cloud Someone else's computer

Infrastructure Setup

Terraform

In order to make setting up the infrastructure easier to do, and to make sure that it gets done consistently, each time. I opted to use Terraform to connect to HCloud and setup the machines and the networking. Terraform makes this easy, and because it can inspect the current state, it can easily continue where it left off if something breaks.

The Management Interface

Rancher

To better understand and control the status of my cluster, and to add containers to it, I decided to use the popular open-source package called Rancher. With it I get a nice management interface that I can use from the web to configure the cluster, install containers, see the status of the various nodes and configure ingress endpoints.

Node A computing resource, usually a virtual or physical machine dedicated to running the various workloads assigned to the cluster

Ingress How an external request gets to an application inside the cluster. Not all containers need this, but if you want to access your application from the web, you need this

Setup

Using Terraform to Bootstrap My HCloud

- Terraform definition
- Deploy/Apply
- Install Longhorn for local persistent storage

Installing WordPress

- Use Helm Charts
- Charts not only allow you to pre-configure certain aspects, it allows you to get all the needed parts provisioned
- Make sure you setup the persistent storage and ingress to the correct systems you have installed (longhorn, nginx)

Installing Keycloak

- Use official Helm Chart for installation
- Configure ingress with TLS (even if self-signed)
- You will want to configure persistent storage as well (longhorn)

Configuring WordPress & Keycloak

- Configure a new Keycloak Realm for WordPress
- Download a SAML or OpenID plugin for WordPress (I used miniOrange)
- Configure both the miniOrange plugin with the realm information from keycloak
- Configure a new client in Keycloak with the information from miniOrange
- Create a new user in Keycloak. Because I'm using the free vesion of miniOrange, I used my email as my username. This is a limiation of not being able to pass NameID as anything other than username
- Test configuration

...Profit?

I learned *a lot* of new things building this cluster. There are many different configuration options and needs for different applications. While I'm still a bit reluctant about my own usage for it, it did open my eyes to the recent wide-spread usage in enterprise IT.