DEPLOY LIKE A BOSS: USING **APACHE® IGNITE™** AND **KUBERNETES®**

DANI TRAPHAGEN
SOLUTION ARCHITECT
GRIDGAIN SYSTEMS
@DTRAPEZOID

AGENDA

- Setting up a Apache Ignite cluster
- Using the Kubernetes IP Finder and the Kubernetes Ignite Lookup Service
- Sharing the Ignite Cluster Configuration
- Deploying your Ignite Pods
- Adjusting the Ignite Cluster Size when you need to Scale
  - How to try it out with Azure!

BY THE END – THIS WILL BE YOU WILL BECOME THE…

FIRST - APACHE IGNITE'S PLATFORM

What it isn't:

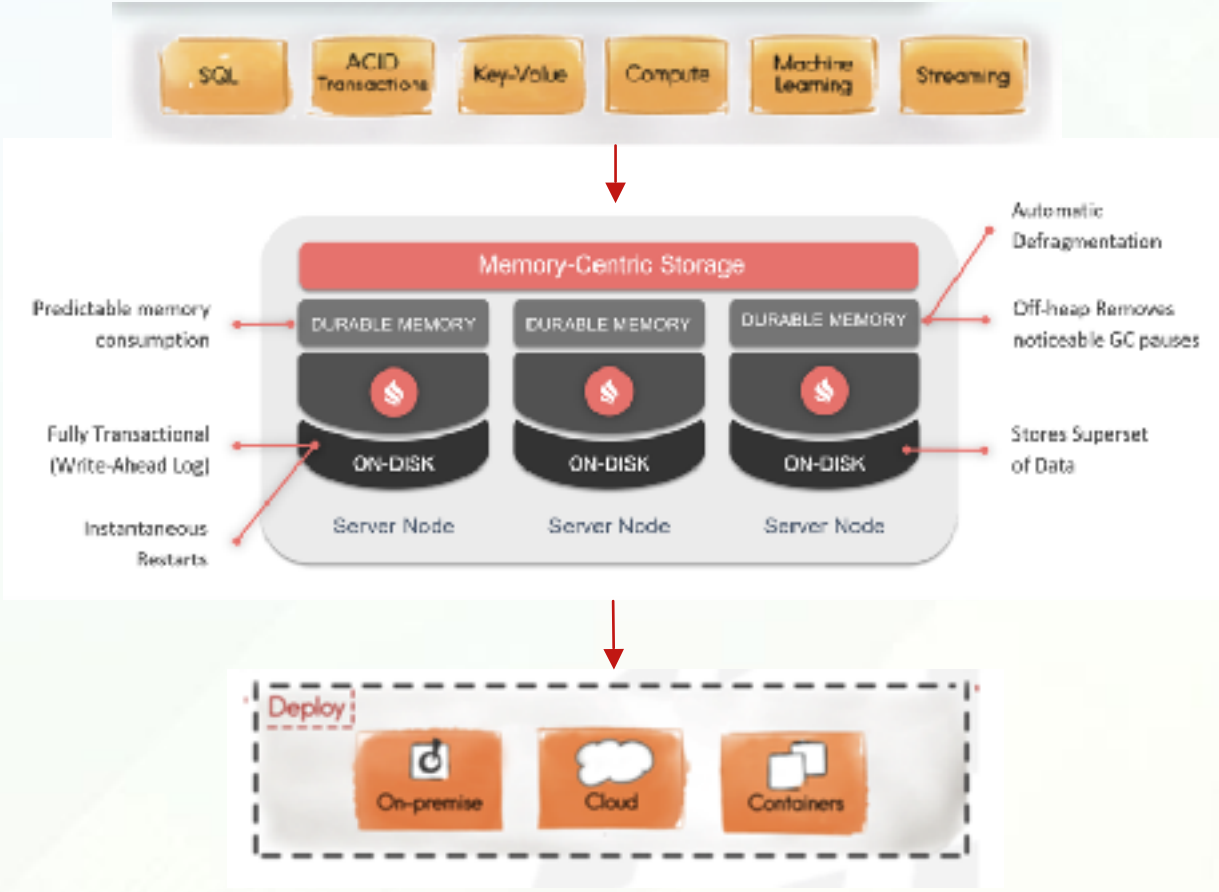
APACHE IGNITE PLATFORM (VERSION 2.1+ DEPICTED)
KUBERNETES WORKS WITH VERSIONS 1.9 AND ABOVE

What it is:

APIs to interact with your data

Apache Ignite Cluster

Deployment options



APACHE IGNITE FEATURES

- Ignite Persistence
- ACID Compliance
- Complete SQL Support
- Key-Value Store/APIs
- Collocated Processing
- Scalability and Durability

SECOND – DEPLOYMENT WITH KUBERNETES (K8)

What it isn't:

KUBERNETES IN A SIMPLE DEFINITION

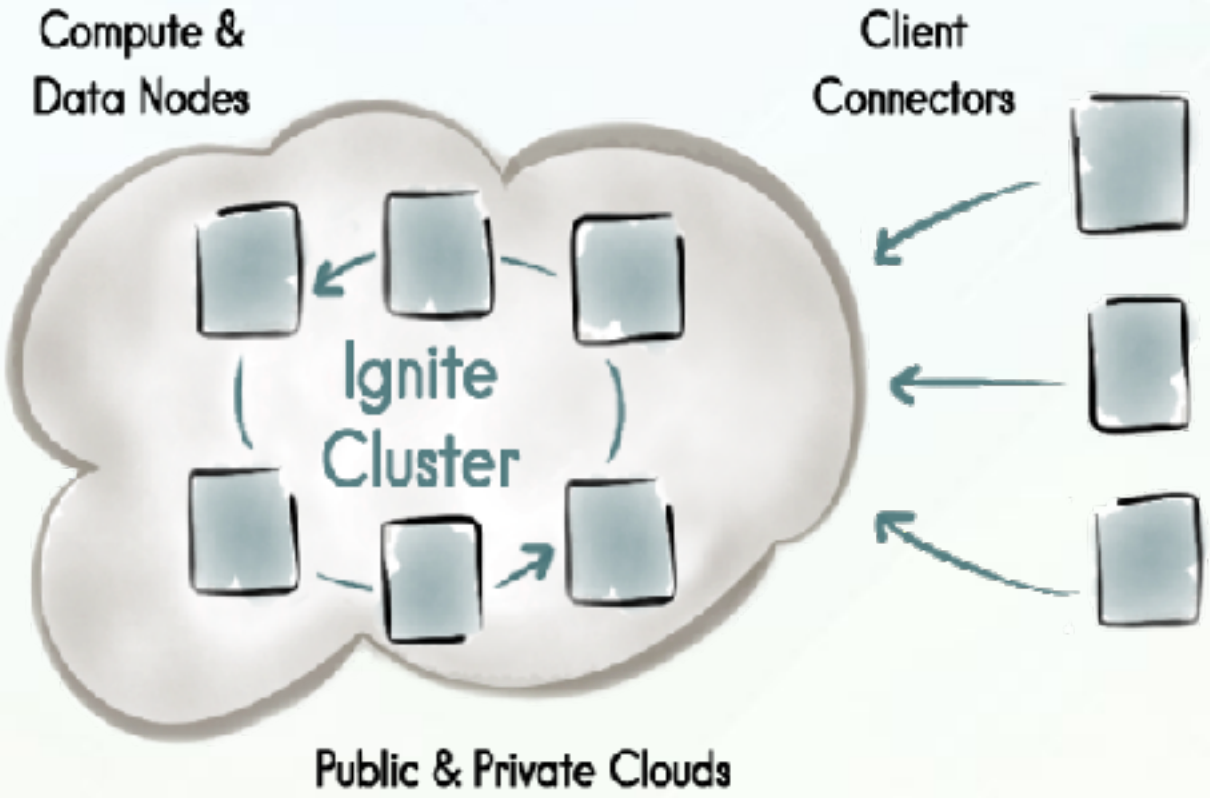
What it is:

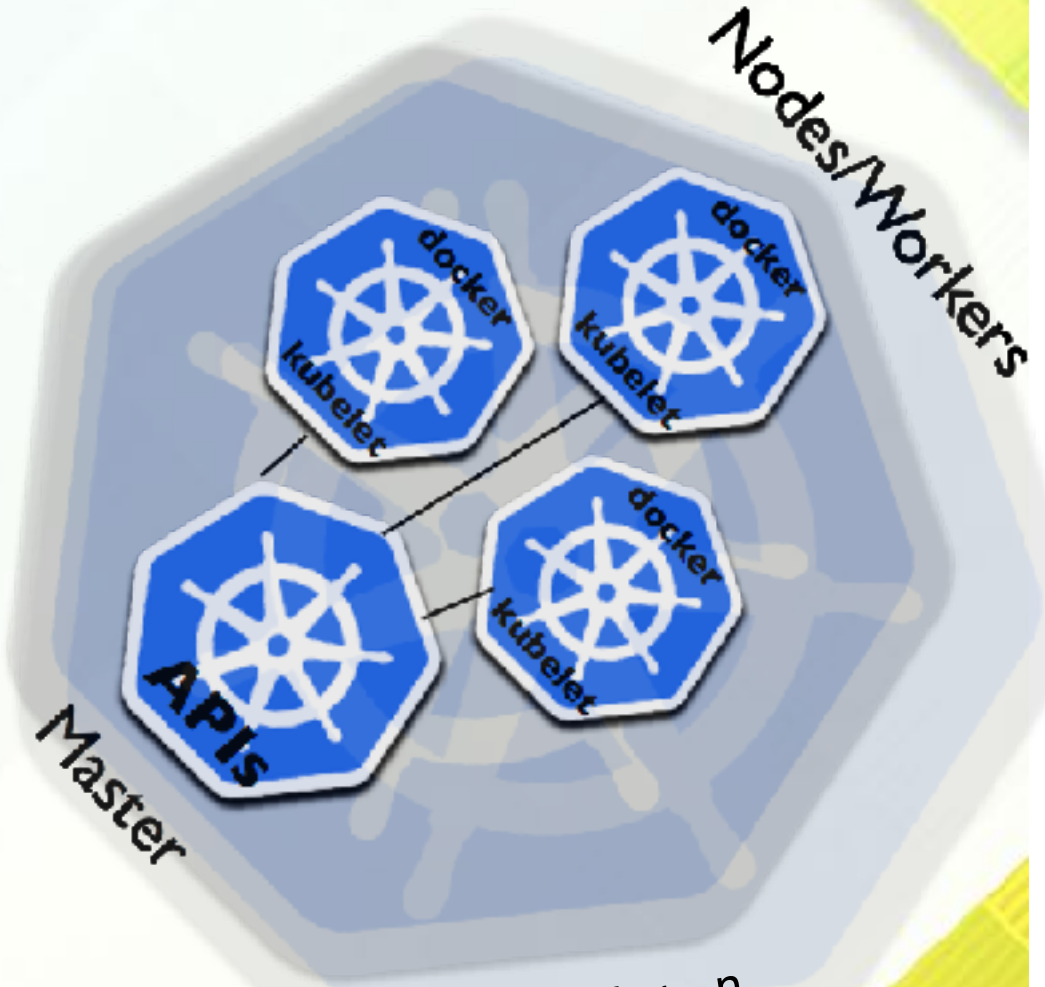
- “Kubernetes intends to radically simplify the task of building, deploying and maintaining distributed systems.”
  - Kubernetes: Up and Running: Dive into the Future of Infrastructure
    - By: Kelsey Hightower

K8 FEATURES

- Automatic Binpacking
- Horizontal Scaling
- Automated Rollouts and Rollbacks
- Storage Orchestration
- Self-Healing
- Service Discovery and Load Balancing
- Secret and Configuration Management
- Batch Execution

APACHE IGNITE + K8 CLUSTER ARCHITECTURE





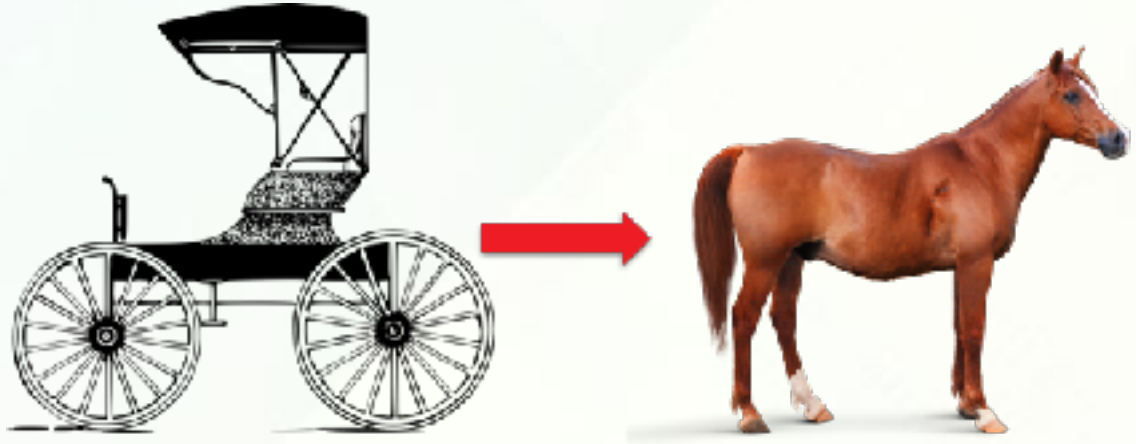
https://kubernetes.io/docs/admin/high-

BENEFITS OF K8 (VERSION 1.7)

- Cost Efficiency
  - Use of containers by multiple developers ensures shared resourcing rather than redundancy
- High Availability and Performance
  - *Self-healing:* Deploying with K8 and setting rules for a set number of nodes, will ensure your cluster can always handle the transactions hitting it
  - No more pager duty
    - Get home to your pet chinchilla sooner

SETTING UP AN APACHE IGNITE CLUSTER

- **Step 1:**
- What is your use case?
- Seriously, what is your use case?
- I'm not kidding. Use case, then set up…
  - Cart before horse please.



SETTING UP AN APACHE IGNITE CLUSTER

- 1. Download Apache Ignite
- 2. Make sure to add the ignite-kubernetes Maven Dependency to your pom.xml
- 3. Try using examples from our docs.

SETTING UP K8 ON A LOCAL MACHINE

- Install K8 where you intend
  - AWS
  - Google Cloud
  - Dev Machine
- Set your $PATH w/K8
  - Install Kubectl
    - Follow K8 Docs

KUBERNETES DISCOVERY

- Multicast = ☹
  - Use Static IP Finder & list Ignite IPs, K8 will dynamically assign them
- You can use other cloud Ignite IP finders but you need K8 to running in the cloud env.
- What's the point of the TcpDiscoveryKubernetesIpFinder?

USING THE KUBERNETES IP FINDER AND THE KUBERNETES IGNITE LOOKUP SERVICE

```
<property name="discoverySpi">
    <bean class="org.apache.ignite.spi.discovery.tcp.TcpDiscoverySpi">
        <property name="ipFinder">
            <bean class="org.apache.ignite.spi.discovery.tcp.ipfinder.kubernetes.TcpDiscoveryKubernetesIpFinder">
            </bean>
        </property>
    </bean>
```

- Apps & nodes running outside of K8 & Ignite will not be able to reach the cluster
- K8 service should be deployed before Ignite cluster boot
- The Ignite Pods internal IPs will be maintained by the K8 service.
  - Service name must be equal to setServiceName(String)
  - This will be `ignite` as a default

https://ignite.apache.org/releases/latest/javadoc/org/apache/ignite/spi/discovery/tcp/ipfinder/kubernetes/TcpDiscoveryKubernetesIpFinder.html

USING DOCKER ON LOCAL MACHINE WITH MINIKUBE

```
daritraphagen@Dani-NBP ~$ docker ps

CONTAINER ID        IMAGE                                                COMMAND                  CREATED             STATUS
 PORTS               NAMES
97cc92b952b8        gcr.io/google_containers/kubernetes-dashboard-amd64    "/dashboard --inse..."   3 minutes ago       Up 3 minutes
                     k8s_kubernetes-dashboard_kubernetes-dashboard-xc9h2_kube-system_3e340ea3-87b9-11e7-9121-080027e5d2cc_0
abeb3cac70c2        gcr.io/google_containers/pause-amd64:3.0             "/pause"                 4 minutes ago       Up 4 minutes
                     k8s_POD_kubernetes-dashboard-xc9h2_kube-system_3e340ea3-87b9-11e7-9121-080027e5d2cc_0
6a0a5bd1fe67        gcr.io/google_containers/k8s-dns-dnsmasq-nanny-amd64   "/dnsmasq-nanny -v..."   35 minutes ago      Up 35 minutes
                     k8s_dnsmasq_kube-dns-910330662-98hwb_kube-system_cc653490-87b4-11e7-9121-080027e5d2cc_0
61c0b0ec07d4        gcr.io/google_containers/k8s-dns-kube-dns-amd64        "/kube-dns --domai..."   35 minutes ago      Up 35 minutes
                     k8s_kubedns_kube-dns-910330662-98hwb_kube-system_cc653490-87b4-11e7-9121-080027e5d2cc_0
02282e7c7c22        gcr.io/google_containers/k8s-dns-sidecar-amd64         "/sidecar --v=2 --..."   35 minutes ago      Up 35 minutes
                     k8s_sidecar_kube-dns-910330662-98hwb_kube-system_cc653490-87b4-11e7-9121-080027e5d2cc_0
c4c5a18dcd4d        gcr.io/google_containers/pause-amd64:3.0             "/pause"                 35 minutes ago      Up 35 minutes
                     k8s_POD_kube-dns-910330662-98hwb_kube-system_cc653490-87b4-11e7-9121-080027e5d2cc_0
b6743ee53b24        gcr.io/google_containers/echoserver                  "nginx -g 'daemon ..."   About an hour ago   Up 47 minutes
                     k8s_hello-minikube_hello-minikube-180744149-9n0g5_default_36b044eb-87b3-11e7-9121-080027e5d2cc_0
d8c59a7c5325        gcr.io/google_containers/pause-amd64:3.0             "/pause"                 About an hour ago   Up 47 minutes
                     k8s_POD_hello-minikube-180744149-9n0g5_default_36b044eb-87b3-11e7-9121-080027e5d2cc_0
fa27860f8345        gcr.io/google-containers/kube-addon-manager          "/opt/kube-addons.sh"    About an hour ago   Up 55 minutes
                     k8s_kube-addon-manager_kube-addon-manager-minikube_kube-system_c654b2f084cf26941c334a2c3d6db53d_0
157a056988b7        gcr.io/google_containers/pause-amd64:3.0             "/pause"                 About an hour ago   Up 55 minutes
                     k8s_POD_kube-addon-manager-minikube_kube-system_c654b2f084cf26941c334a2c3d6db53d_0
daritraphagen@Dani-NBP ~$
```

SHARING THE IGNITE CLUSTER CONFIGURATION

SERVICE STARTUP & SHARING CONFIGS

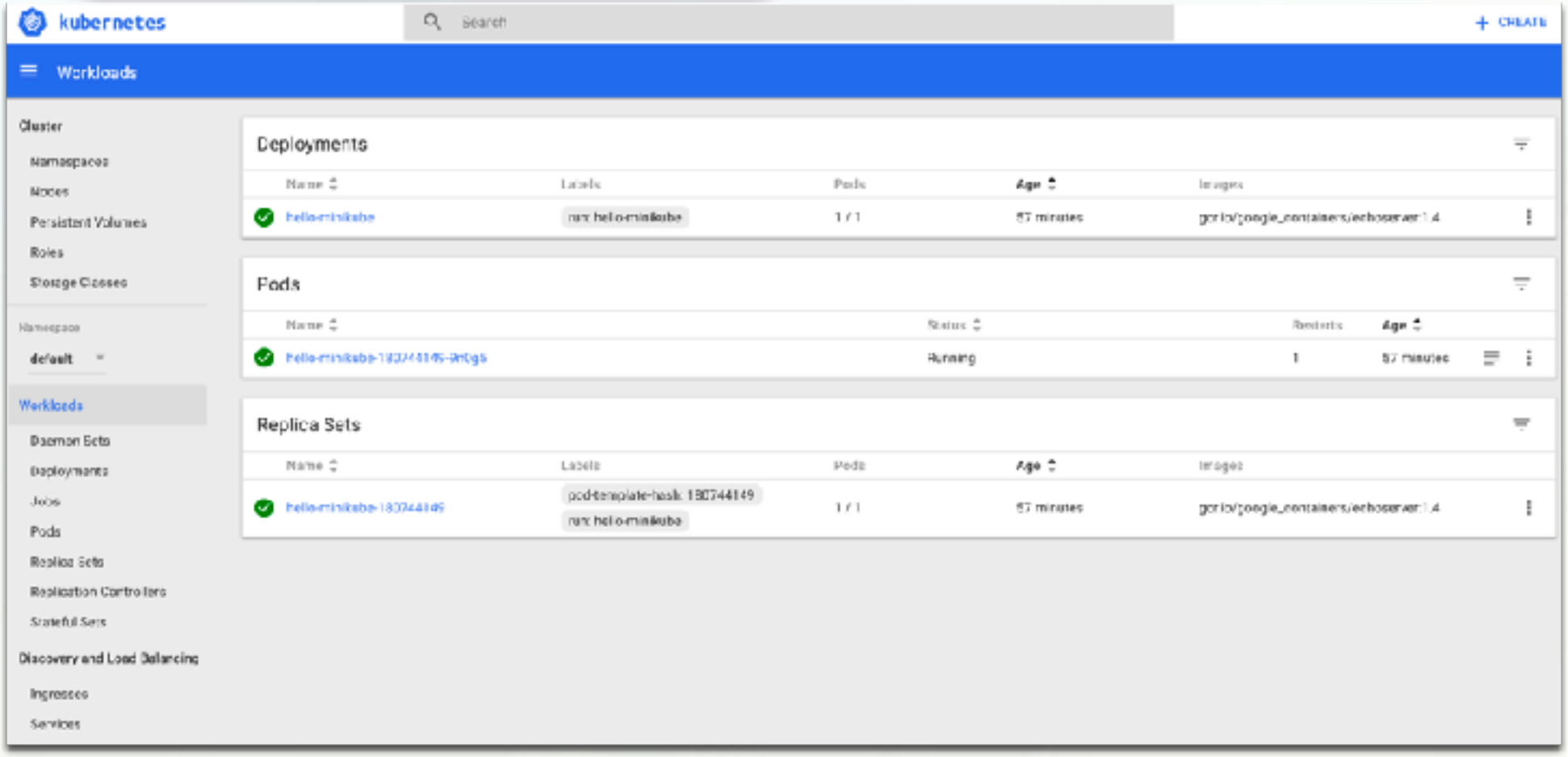
- Minikube - Two basic commands
  - minikube start
  - minikube dashboard
- Kubectl
  - kubectl create -f ~/<path-to-project>/<project-name>/config/ignite-service.yaml

```
service "ignite" created
danitraphagen@Dani-MBP ~$
```

```
danitraphagen@Dani-MBP ~$ minikube start
Starting local Kubernetes v1.7.0 cluster...
Starting VM...
Getting VM IP address...
Moving files into cluster...
Setting up certs...
Starting cluster components...
Connecting to cluster...
Setting up kubeconfig...
Kubectl is now configured to use the cluster.
danitraphagen@Dani-MBP ~$ minikube dashboard
Opening kubernetes dashboard in default browser...
danitraphagen@Dani-MBP ~$
```

Yes, someone I follow on Twitter did this.

NOW KUBERNETES IS RUNNING!



CONFIGURING YOUR IGNITE PODS

- **2 Things Needed!**
  - 1. Apache Ignite Configuration File with the Kubernetes IP Finder
  - 2. YAML Configurations for the Apache Ignite pods/ nodes
- **Steps:**
- **Create your ignite-service.yaml**
  - kubectl create -f ignite-service.yaml
  - kubectl get svc ignite

```
NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)    AGE
ignite    None         <none>        9042/TCP   29s
```

SHARING IGNITE CLUSTER CONFIGS

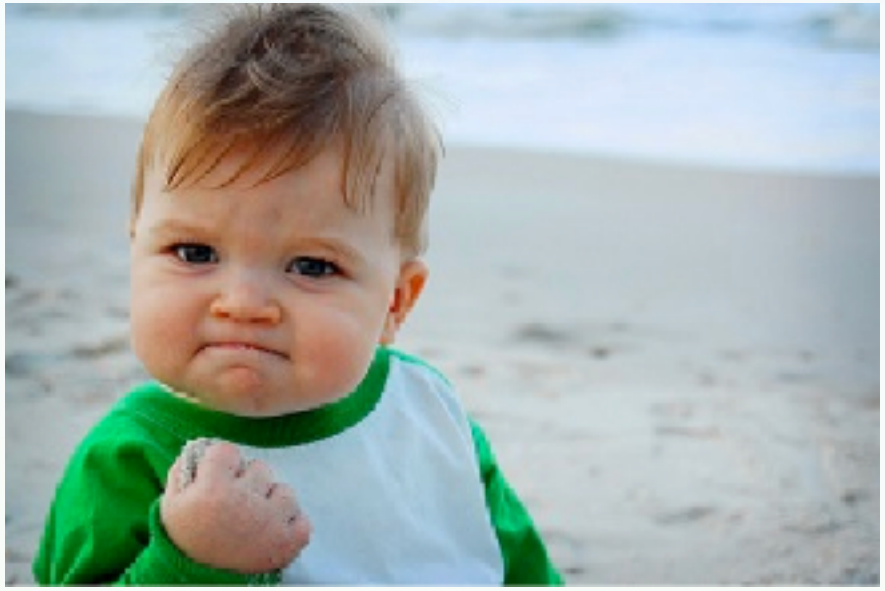
- Confirm the ignite service was created
- Make a path to the persistence volume docker will use to pass the kubernetes config ‘example-kube.xml’

```
danitraphagen@Dani-MBP ~$  kubectl get svc ignite

NAME      CLUSTER-IP   EXTERNAL-IP   PORT(S)     AGE
ignite    None         <none>        9042/TCP    13m
```

```
danitraphagen@Dani-MBP ~/data/ignite$ kubectl create -f ignite-volume.yaml

persistentvolume "ignite-volume" created
```

SUCCESS

Now, do this for the ignite-volume-claim.yaml



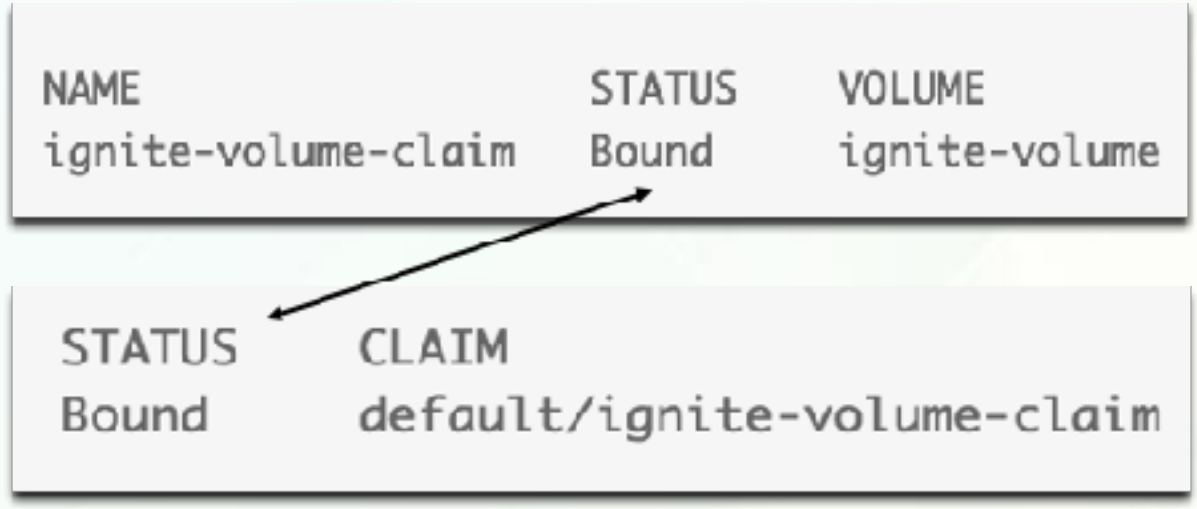
```
danitraphagen@Dani-MBP ~/data/ignite$ kubectl get pv ignite-volume

NAME            CAPACITY   ACCESSMODES   RECLAIMPOLICY   STATUS
ignite-volume   1Gi        RWO           Retain          Available
danitraphagen@Dani-MBP ~/data/ignite$
```

ignite-volume-claim.yaml

```yaml
kind: PersistentVolumeClaim
apiVersion: v1
metadata:
  name: ignite-volume-claim
spec:
  accessModes:
    - ReadWriteOnce
  resources:
    requests:
      storage: 1Gi
```

PERSISTENT VOLUME BOUND?

- Make sure your persistent volume is bound to the claim
  - kubectl get pvc ignite-volume-claim
  - kubectl get pv ignite volume



use xhyve driver so you can access persistent volumes

minikube start --vm-driver=xhyve

& modify the hostPath: **"/data/ignite"** that is used in the examples to **"/Users/<username>/data/ignite"**

DEPLOYING YOUR IGNITE PODS

- Now it’s time to launch
  - kubectl create -f ignite-deployment.yaml
  - kubectl get pods
- Get the logs and examine for each cluster… ex)
  - kubectl logs ignite-cluster-3454482164-d4m6g
- Scale out:
  - kubectl scale --replicas=5 -f ignite-deployment.ya

```
NAME                                READY     STATUS    RESTARTS   AGE
ignite-cluster-3454482164-d4m6g     1/1       Running   0          25m
ignite-cluster-3454482164-w0xtx     1/1       Running   0          25m
```

```
NAME                                READY     STATUS    RESTARTS   AGE
ignite-cluster-3454482164-d4m6g     1/1       Running   0          34m
ignite-cluster-3454482164-ktkrr     1/1       Running   0          58s
ignite-cluster-3454482164-r20f8     1/1       Running   0          58s
ignite-cluster-3454482164-vf8kh     1/1       Running   0          58s
ignite-cluster-3454482164-w0xtx     1/1       Running   0          34m
```

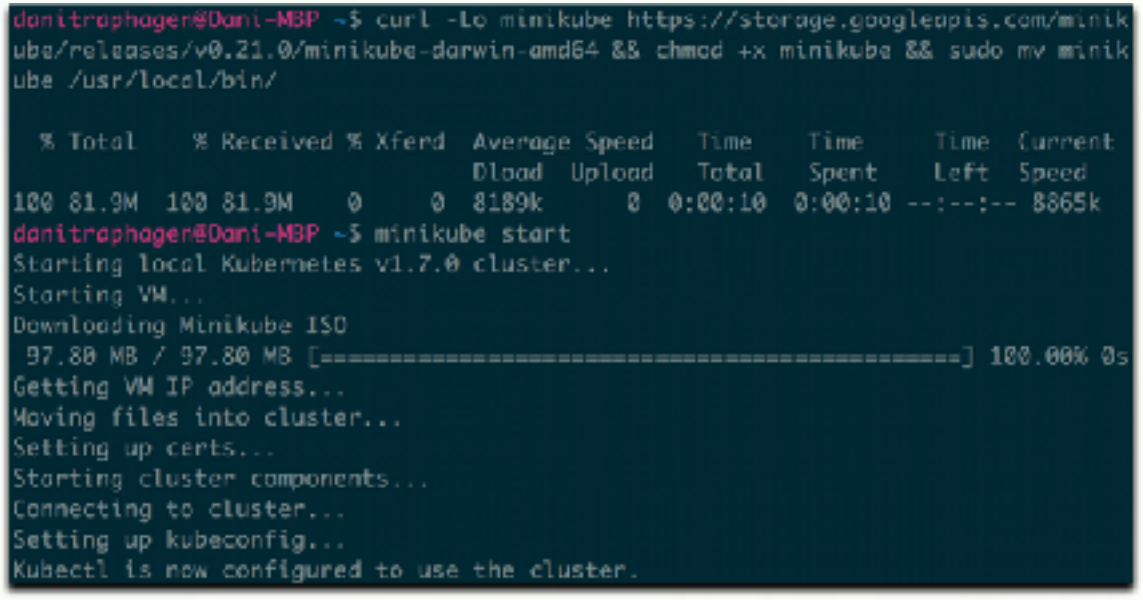
MANY DEPLOYMENT OPTIONS

- On Premise
- Cloud
  - Azure
  - EC2
  - Google Cloud

```
Last login: Wed Aug 23 01:30:22 2017 from cpe-172-114-236-18.socal.res.rr.com

       __|  __|_  )
       _|  (     /   Amazon Linux AMI
      ___|\___|___|

https://aws.amazon.com/amazon-linux-ami/2017.03-release-notes/
[ec2-user@ip-172-31-12-255 ~]$ curl -LO https://storage.googleapis.com/kubernete
s-release/release/$(curl -s https://storage.googleapis.com/kubernetes-release/re
lease/stable.txt)/bin/linux/amd64/kubectl
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100 68.9M  100 68.9M    0     0  36.0M      0  0:00:01  0:00:01 --:--:-- 36.0M
[ec2-user@ip-172-31-12-255 ~]$ chmod +x ./kubectl
[ec2-user@ip-172-31-12-255 ~]$ sudo mv ./kubectl /usr/local/bin/kubectl
[ec2-user@ip-172-31-12-255 ~]$ kubectl cluster-info
Kubernetes master is running at http://localhost:8080

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
[ec2-user@ip-172-31-12-255 ~]$
```

USING MINIKUBE FOR LOCAL DEV

- A good place to start for exploration
- When you want to get in the cloud - pick your poison
  - Post on setup w/Azure by Ignite PMC Denis Magda:
    - https://dzone.com/articles/deploying-apache-ignite-in-kubernetes-on-microsoft
    - https://kubernetes.io/docs/setup/pick-right-solution/#turnkey-cloud-solutions



DARE TO TRY?

1. DEPLOY CLOUD ENVIRONMENT

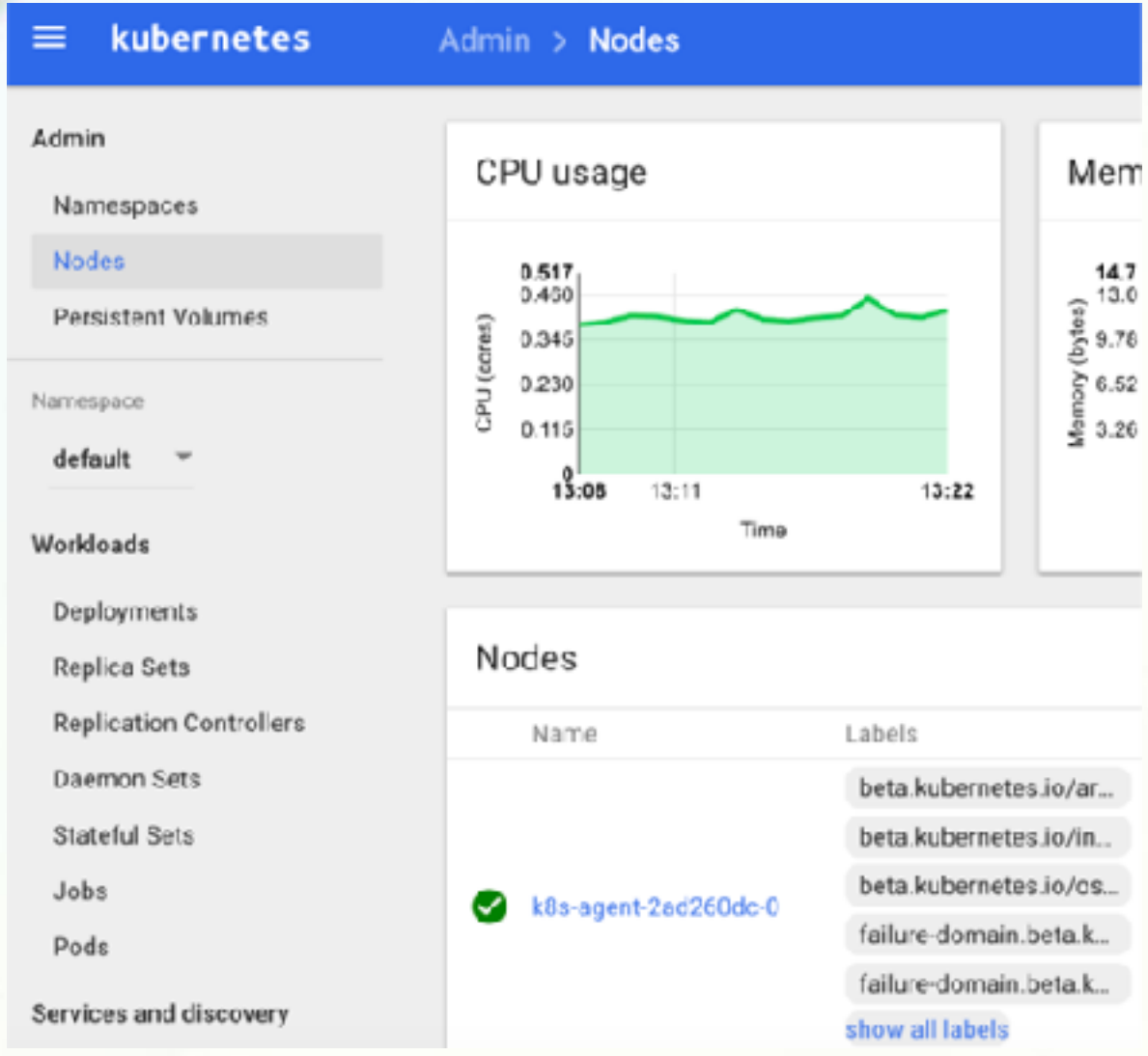
```
dani@Azure:~$ kubectl get nodes
NAME                    STATUS                        AGE       VERSION
k8s-agent-747b6f74-0    NotReady                      15s       v1.6.6
k8s-agent-747b6f74-1    NotReady                      15s       v1.6.6
k8s-agent-747b6f74-2    NotReady                      19s       v1.6.6
k8s-master-747b6f74-0   NotReady,SchedulingDisabled   17s       v1.6.6
dani@Azure:~$ kubectl get nodes
NAME                    STATUS                        AGE       VERSION
k8s-agent-747b6f74-0    Ready                         1m        v1.6.6
k8s-agent-747b6f74-1    Ready                         1m        v1.6.6
k8s-agent-747b6f74-2    Ready                         1m        v1.6.6
k8s-master-747b6f74-0   Ready,SchedulingDisabled      1m        v1.6.6
dani@Azure:~$
```

2. CONNECT TO YOUR CLOUD ENVIRONMENT FROM YOUR LOCAL MACHINE, EX) AZURE

```
#connect to cluster, make sure your sshkeys are setup

az acs kubernetes get-credentials --resource-group=myResourceGroup --name=myK8sCluster

#make sure you see the k8s-agents & master

kubectl get nodes
```

USING THE DASHBOARD

1.kubectl proxy
2.http://localhost:8001/ui

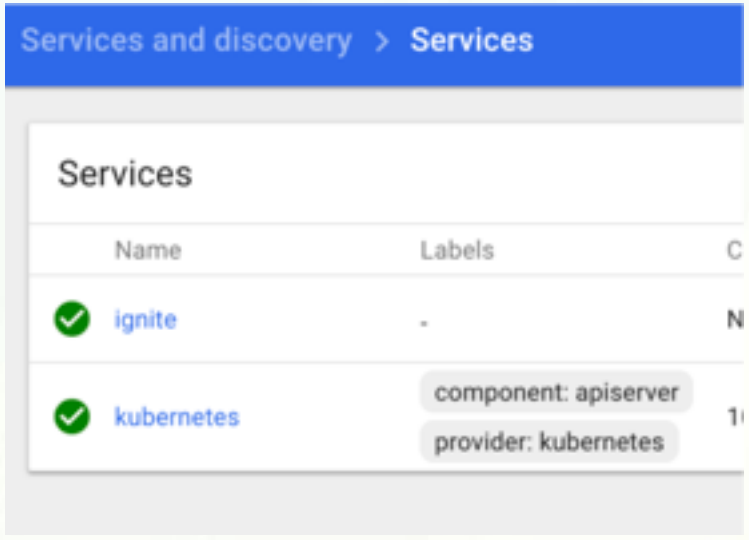


4. CREATE THE K8 LOOKUP SERVICE

#using above link, next to the number 4, create the file then initiate the service

kubectl create -f ignite-service.yaml

#you will see that the ignite service is under the services tab

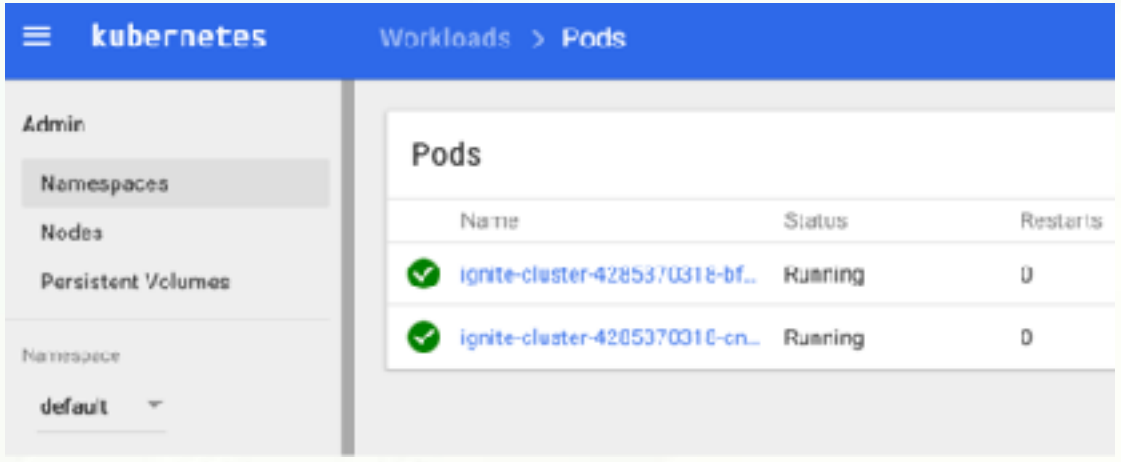


5. DEPLOY YOUR APACHE IGNITE CLUSTER

#create the ignite-deployment.yaml file following instructions here

kubectl create -f ignite-deployment.yaml

#you will see that the ignite cluster is running in kubernetes



ADJUSTING THE IGNITE CLUSTER SIZE WHEN YOU NEED TO SCALE

- When you want to elasticly scale out your cluster with K8:
  - kubectl scale –replicas=<n> -f ignite-deployment.yaml
- Run:
  - kubectl get pods
- Let's say you want 5 nodes?
  - kubectl scale --replicas=5 -f ~/kubernetes_dev/azure/ignite-deployment.yaml
- You will see your cluster scale out – in this case from 2 to 5 nodes!

OVERALL STEPS

Ignite Download:

https://ignite.apache.org/download.cgi

Run Kubernetes Locally:

https://kubernetes.io/docs/getting-started-guides/minikube/

Deploy Kubernetes & Ignite

https://apacheignite.readme.io/docs/kubernetes-deployment

RESOURCES

- Denis Magda's & Akmal Chaudhri's blog's on deploying Ignite w/K8 and Azure or AWS:
  - https://dzone.com/articles/deploying-apache-ignite-in-kubernetes-on-microsoft
  - https://www.gridgain.com/resources/blog/kubernetes-and-apacher-ignitetm-deployment-aws
- Tutorials
  - https://kubernetes.io/docs/tutorials/
- K8 Book by Kelsey Hightower:
  - http://shop.oreilly.com/product/0636920043874.do
- Ignite Book by Shahim & others:
  - https://leanpub.com/ignite

ANY QUESTIONS?

- Reach me on Twitter @dtrapezoid
- Use #apacheignite
- Checkout http://ignite.apache.org