



Running Applications on Kubernetes

Google Cloud

Nathen Harvey

Developer Advocate

@nathenharvey
(he/him)



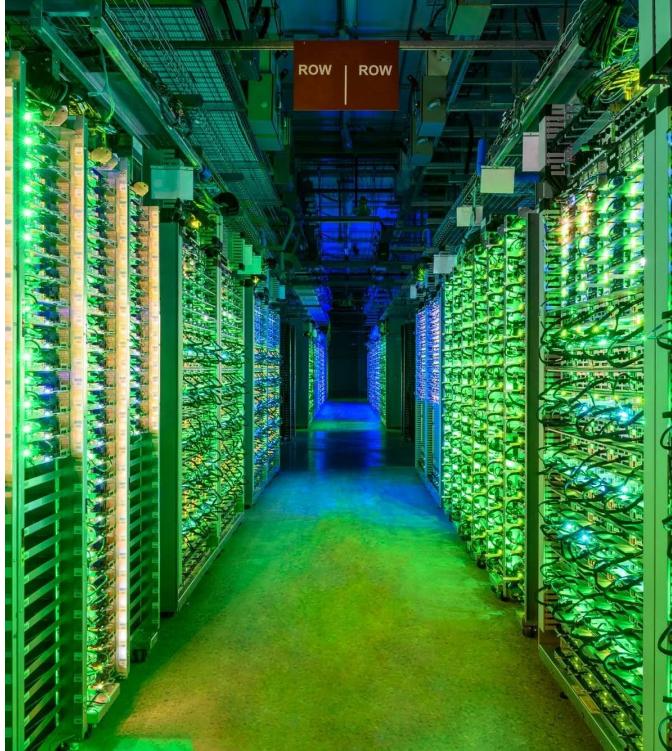
Say Hello

- Name
- Organization
- Role
- Experience with Kubernetes



Objectives

- Describe various features and benefits of Kubernetes
- Deploy and manage applications on Kubernetes



Break around 10:30



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console.cloud.google.com



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devstar9002@gcplab.me

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Welcome

 devstar9002@gcplab.me ▾

Enter your password

..... 

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English (United States) ▾

Help

Privacy

Terms



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Welcome to your new account

Welcome to your new account: devstar9002@gcplab.me. Your account is compatible with many [Google services](#), but your gcplab.me administrator decides which services you may access using your account. For tips about using your new account, visit the Google [Help Center](#).

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Welcome Star!

Create and manage your Google Cloud Platform instances, disks, networks, and other resources in one place.

Terms of Service

I agree to the [Google Cloud Platform Terms of Service](#), and the terms of service of [any applicable services and APIs](#).

Country of residence

United States ▾

AGREE AND CONTINUE



Welcome Star!

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Country of residence

Canada ▾

Email updates

I would like to receive periodic emails on news, product updates and special offers from Google Cloud and Google Cloud Partners.

AGREE AND CONTINUE



← → C https://console.cloud.google.com/getting-started

Incognito

Google Cloud Platform Select a project

Click on the menu anytime to find solutions for your business

GOT IT

Welcome!

Get started with Google Cloud Platform

TOUR CONSOLE

Top Products

-  Getting started
-  Security >

COMPUTE

-  App Engine >
-  Compute Engine >
-  Kubernetes Engine >
-  Cloud Functions
-  Cloud Run

Compute Engine
Scalable, high-performance virtual machines

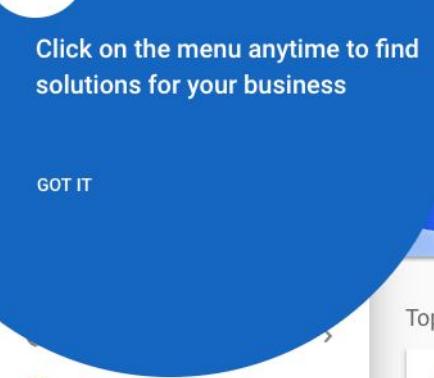
Cloud Storage
A powerful, simple and cost effective object storage service

Cloud SQL
A fully-managed MySQL/PostgreSQL service >

Explore

 API Google APIs

 Documentation



Project

Settings, permissions, and other metadata that describe your applications.

Every GCP resource belongs to a single project.

Google Cloud Platform

Select a project ▾

Select a project

 NEW PROJECT

 Search projects and folders

RECENT

ALL

Name	ID
▼  No organization	0
 ISCE tutorial Montreal 9002	k8s-isce19-yul-9002

CANCEL

OPEN



console.cloud.google.com

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Applications

Hello Node!



Google Cloud Shell



Google Cloud Shell

- Full Power Access From Anywhere



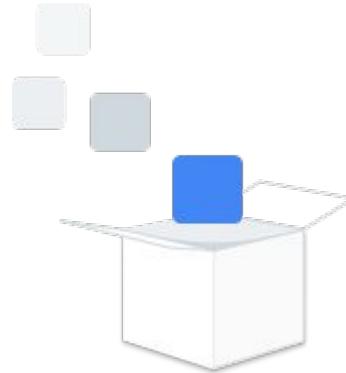
Google Cloud Shell

- Full Power Access From Anywhere
- Secure and Fully Authenticated by default



Google Cloud Shell

- Full Power Access From Anywhere
- Secure and Fully Authenticated by default
- Your Favorite Tools Pre-installed and Up-to-Date



Google Cloud Shell

- Full Power Access From Anywhere
- Secure and Fully Authenticated by default
- Your Favorite Tools Pre-installed and Up-to-Date
- Developer Ready



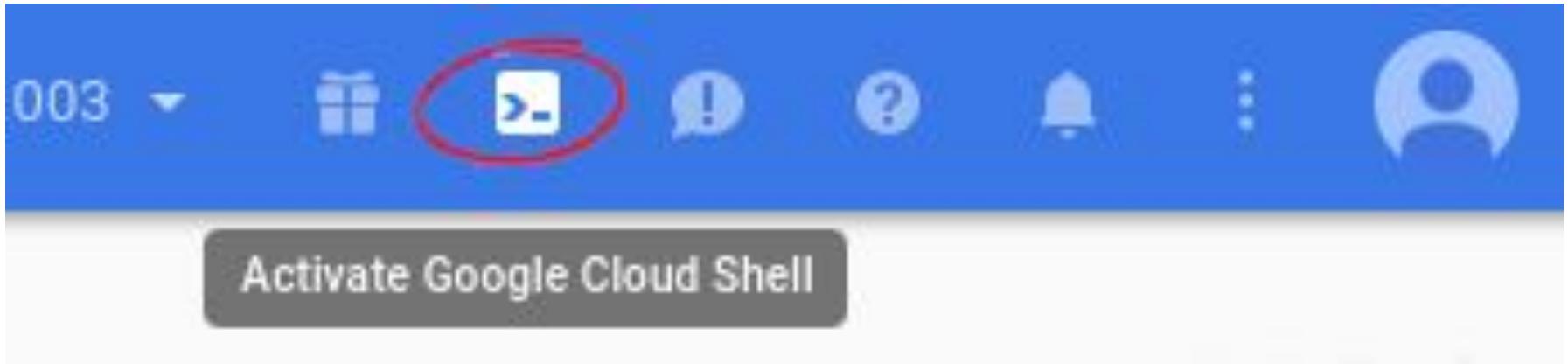
Google Cloud Shell

- Full Power Access From Anywhere
- Secure and Fully Authenticated by default
- Your Favorite Tools Pre-installed and Up-to-Date
- Developer Ready
- 5GB of Persistent Disk Storage



Lab: Google Cloud Shell





console.cloud.google.com

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Google Cloud Shell

Free, pre-installed with the tools you need for the Google Cloud Platform. [Learn More](#)

```
devstar9002@cloudshell:~$  
devstar9002@cloudshell:~$ gcloud compute instances list  
NAME          ZONE      MACHINE_TYPE PREEMPTIBLE INTERNAL_IP     EXTERNAL_IP    STATUS  
example-vm-1   asia-east1-a  f1-micro           10.240.160.142  104.155.216.228  RUNNING  
example-vm-2   europe-west1-b f1-micro           10.240.119.112  104.155.36.122   RUNNING  
example-vm-3   us-central1-f f1-micro           10.240.57.1     104.154.76.241   RUNNING  
devstar9002@cloudshell:~$  
devstar9002@cloudshell:~$ git clone https://github.com/GoogleCloud/appengine-example.git  
Cloning into 'appengine-example'...■
```

Real Linux environment

- Linux Debian-based OS
- 5GB persisted home directory
- Add, edit and save files

Configured for Google Cloud

- Google Cloud SDK
- Google App Engine SDK
- Docker
- Git
- Text editors
- Build tools
- View more ↗

Popular language support

- Python
- Java
- Go
- Node.js

CANCEL

START CLOUD SHELL



console.cloud.google.com

machines

effective object storage service

MySQL/PostgreSQL database

apps that scale autom...



(k8s-isce19-yul-9001) x



Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to **k8s-isce19-yul-9001**.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
devstar9001@cloudshell:~ (k8s-isce19-yul-9001)\$

gcloud

Command-line interface (CLI) for
Google Cloud Platform (GCP)

Part of the Google Cloud Software
Development Kit (SDK)

Pre-configured and authenticated



```
$ gcloud auth list
```

```
Credentialed Accounts
```

```
ACTIVE ACCOUNT
```

```
* devstar9002@gcplab.me
```

To set the active account, run:

```
$ gcloud config set account `ACCOUNT`
```

```
$ gcloud config list project
```

```
[core]
project = k8s-isce19-yul-9002
Your active configuration is: [cloudshell-21370]
```

```
$ echo $GOOGLE_CLOUD_PROJECT
```

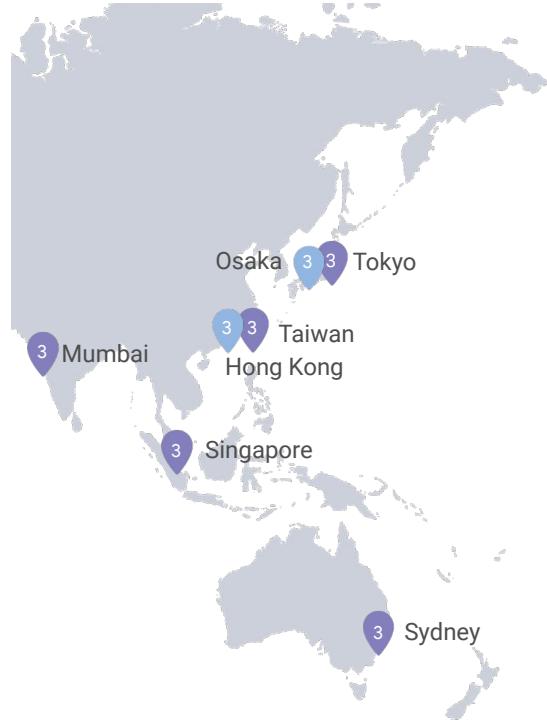
```
k8s-isce19-yul-9002
```

Regions and Zone

Resources exist in regions and zones.

A region is a geographical location with one or more zones.

Google Cloud Platform Regions



```
$ gcloud config set compute/zone northamerica-northeast1-c
```

```
Updated property [compute/zone].
```

```
$ gcloud config list compute/zone
```

```
[compute]  
zone = northamerica-northeast1-c
```

Google Cloud Shell



Questions

- What is the primary organizing entity in GCP?
- What are regions and zones?
How are they related to one another?
- What is the Google Cloud Shell?



Questions

- What is the primary CLI for interacting with GCP?
- How long does it take a new developer on your team to get a fully configured development environment?



What questions do you have?

Lab: Write a node application





Launch the editor



Cloud Shell

File Edit Selection View Go Help



New File



New Folder



Open...

⌘ O



Open Workspace...

⌘ W



Open Recent Workspace...

⌘ R



Save Workspace As...



Save

⌘ S



Save All

⌘ ⌘ S



Save As...

⌃ ⌄ S



Create a new file

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EXPLORER



DEVSTAR9002

New File



server.js

OK

server.js

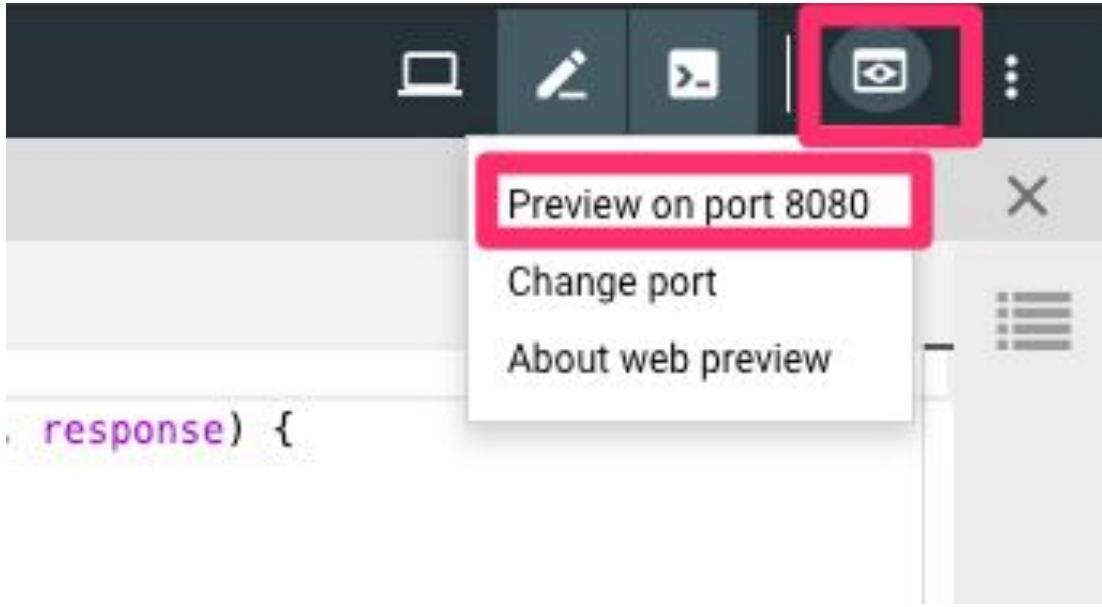
```
var http = require('http');

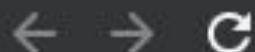
var handleRequest = function(request, response) {
    response.writeHead(200);
    response.end("Hello World!");
}

var www = http.createServer(handleRequest);

www.listen(8080);
```

```
$ node server.js
```





https://8080-dot-7446408-dot-devshell.appspot.com/?auth

Hello World!



Preview in web browser

```
$ Ctrl+c
```

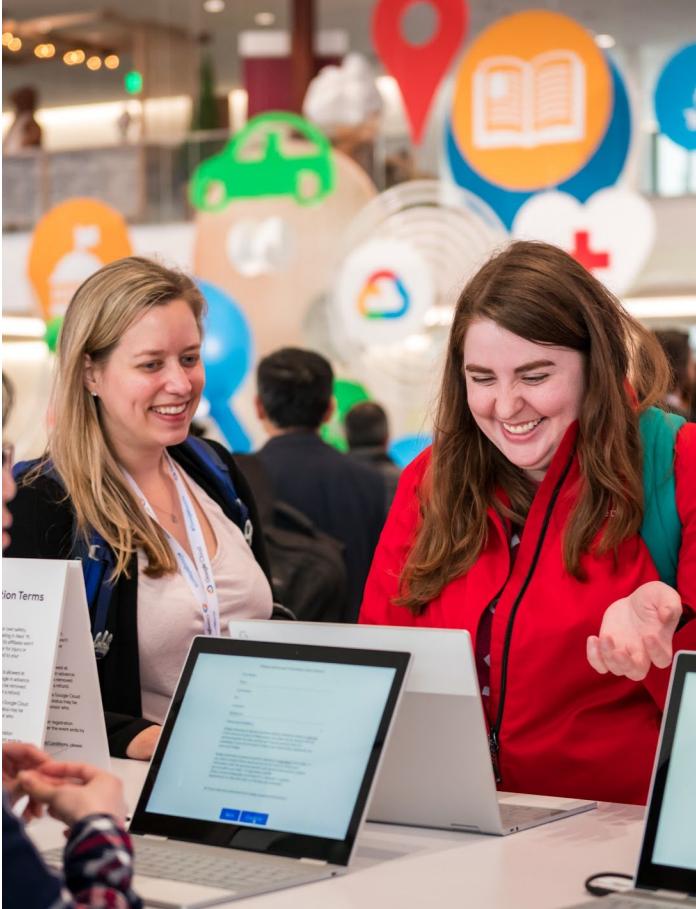
```
^C
```

Write a node application



Questions

- We just wrote a node.js application, what critical steps did we skip?
- How would you change the listening port for the application?
- What is your favorite text editor?



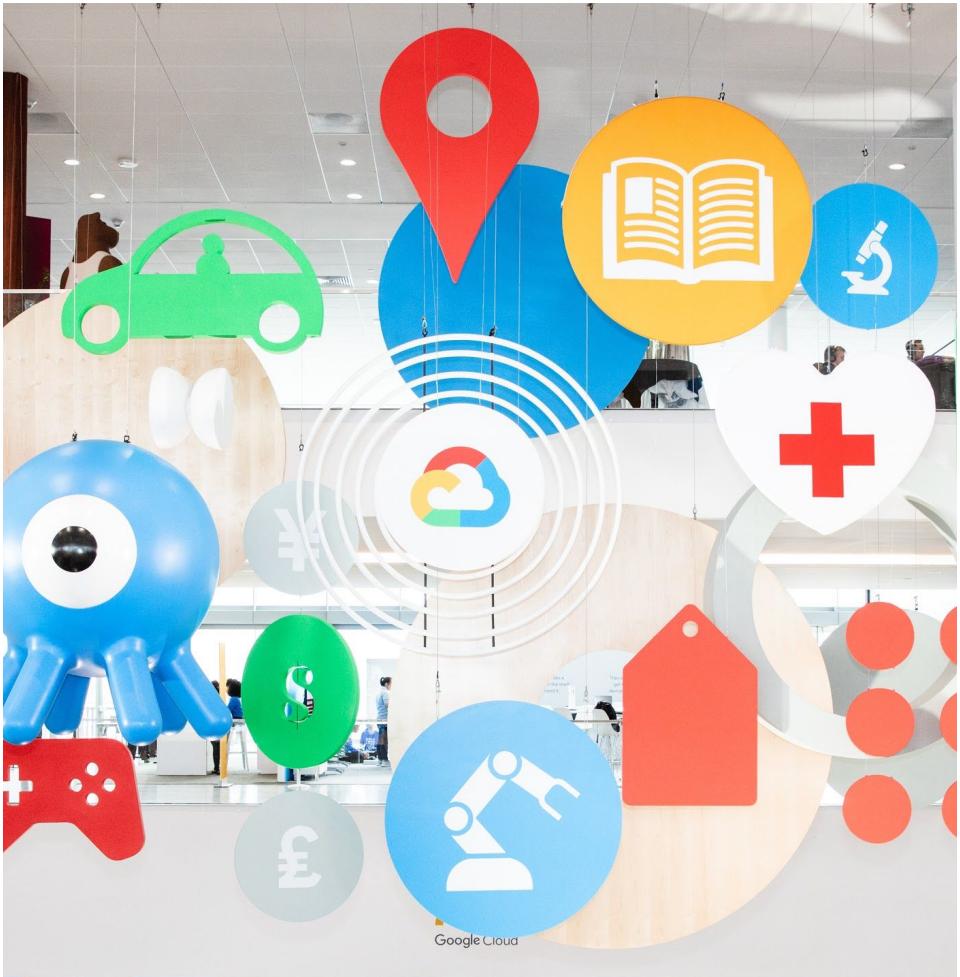
What questions do you have?

Containers

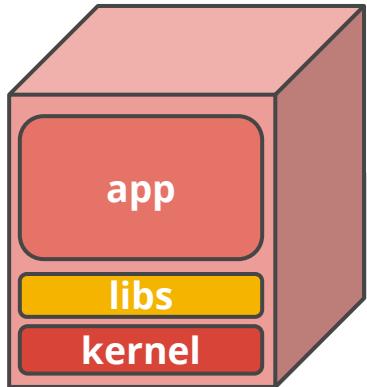


Applications

- Dependencies
- Configuration
- Deployment
- Infrastructure

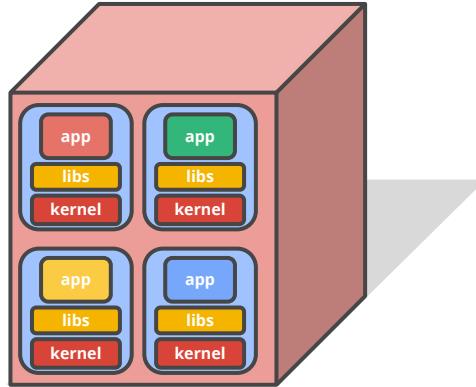


Deploying Applications



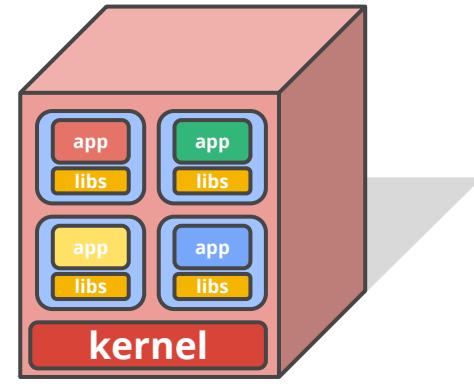
Physical Machine

- ✗ No isolation
- ✗ Common libs
- ✗ Highly coupled Apps & OS



Virtual Machines

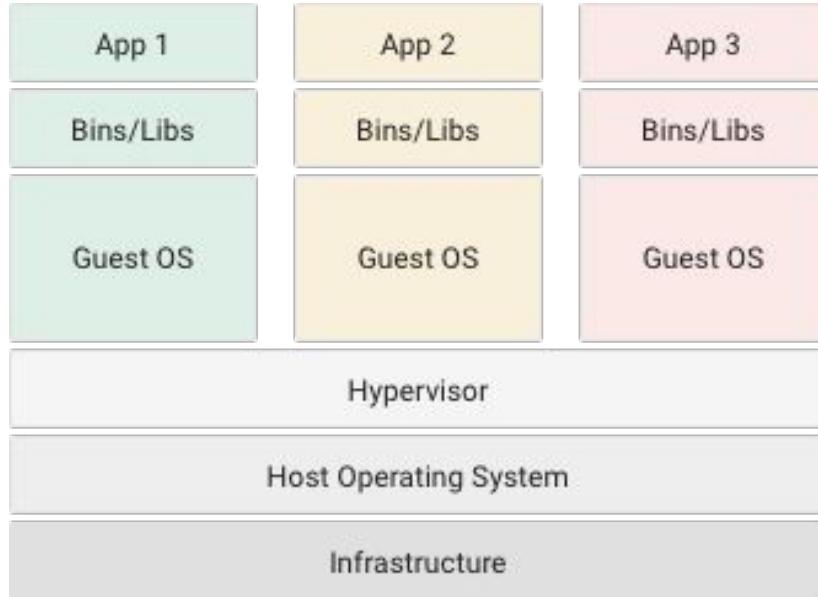
- ✓ Isolation
- ✓ No Common Libs
- ✗ Expensive and Inefficient
- ✗ Hard to manage



Containers

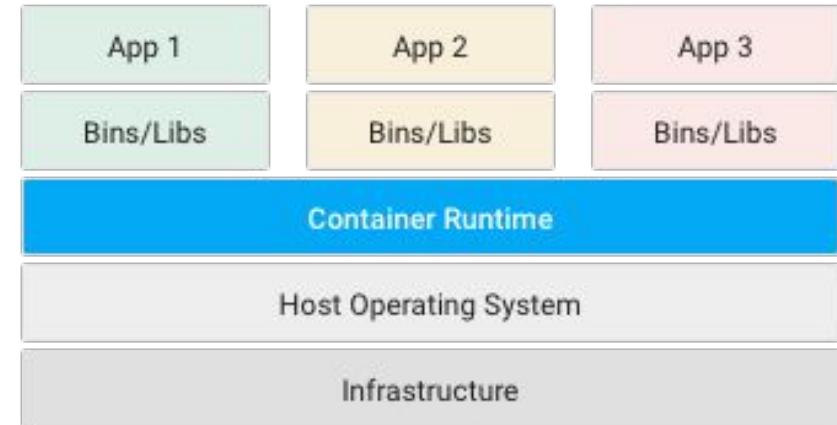
- ✓ Isolation
- ✓ No Common Libs
- ✓ Less overhead
- ✗ Less Dependency on Host OS

Containers



Virtual Machines

Google Cloud



Containers

Why Containers?

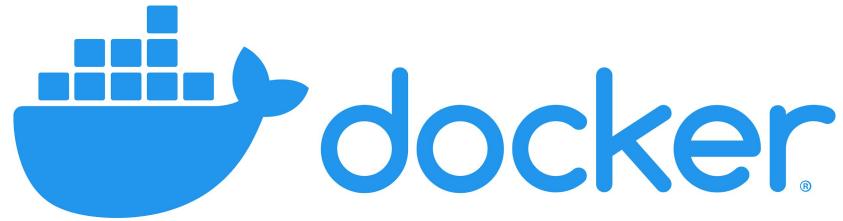
Consistent Environment

Run Anywhere

Isolation



Lab: Hello, Docker



Docker Vocabulary

Image - an executable package that includes everything needed to run an application

Container - a runtime instance of an image

```
$ docker --version
```

```
Docker version 18.03.1-ce, build 9ee9f40
```

```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
------------	-----	----------	---------	------

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
--------------	-------	---------	---------	--------	-------	-------

```
$ docker run hello-world
```

```
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1b930d010525: Pull complete
Digest: sha256:92c7f9c92844bbbb5d0a101b22f7c2a7949e40f8ea90c8b3bc396879d95e899a
Status: Downloaded newer image for hello-world:latest
```

Hello from Docker!

This message shows that your installation appears to be working correctly.

...

For more examples and ideas, visit:
<https://docs.docker.com/get-started/>

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
--------------	-------	---------	---------	--------	-------	-------

```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
hello-world	latest	fce289e99eb9	4 months ago	1.84kB

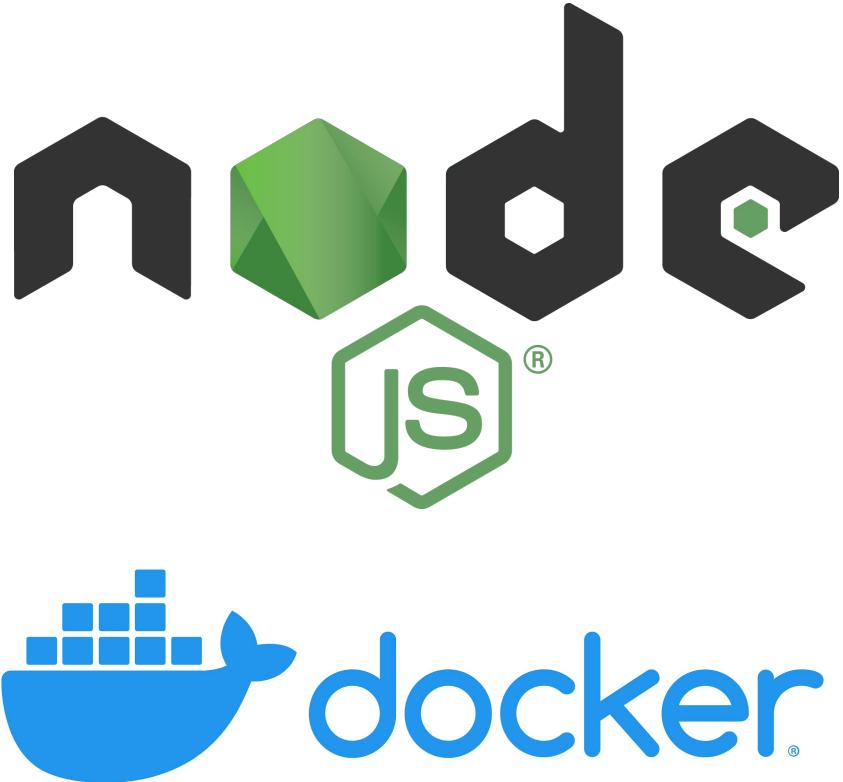
Questions

- What is the name of the Docker command-line interface (CLI)?
- What is an image?
- What is a container?
- Where did the hello-docker image come from?



What questions do you have?

Lab: Containerize the node.js app



Docker Vocabulary

Dockerfile - defines what goes on
in the environment inside of a
container.



Launch the editor



Cloud Shell

File Edit Selection View Go Help



New File



New Folder



Open...

⌃ ⌘ O



Open Workspace...

⌃ ⌘ W



Open Recent Workspace...

⌃ ⌘ R



Save Workspace As...



Save

⌘ S



Save All

⌃ ⌘ S



Save As...

^ ⌘ S

New File



Dockerfile

OK



Create a new file

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Dockerfile

```
FROM node:12.3.1  
  
EXPOSE 8080  
  
COPY server.js .  
  
CMD node server.js
```

```
$ docker build -t \
$ gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v1 .
```

```
Sending build context to Docker daemon 1.905MB
```

```
Step 1/4 : FROM node:12.3.1
```

```
...
```

```
Successfully built 285446326a52
```

```
Successfully tagged
```

```
gcr.io/k8s-isce19-yul-9002/hello-node:v1
```

```
$ docker images
```

How many should we see?

```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
gcr.io/k8s-isce19-yul-9002/hello-node	v1	285446326a52	About a minute ago	908MB
node	12.3.1	6be2fabd4196	3 days ago	908MB
hello-world	latest	fce289e99eb9	4 months ago	1.84kB

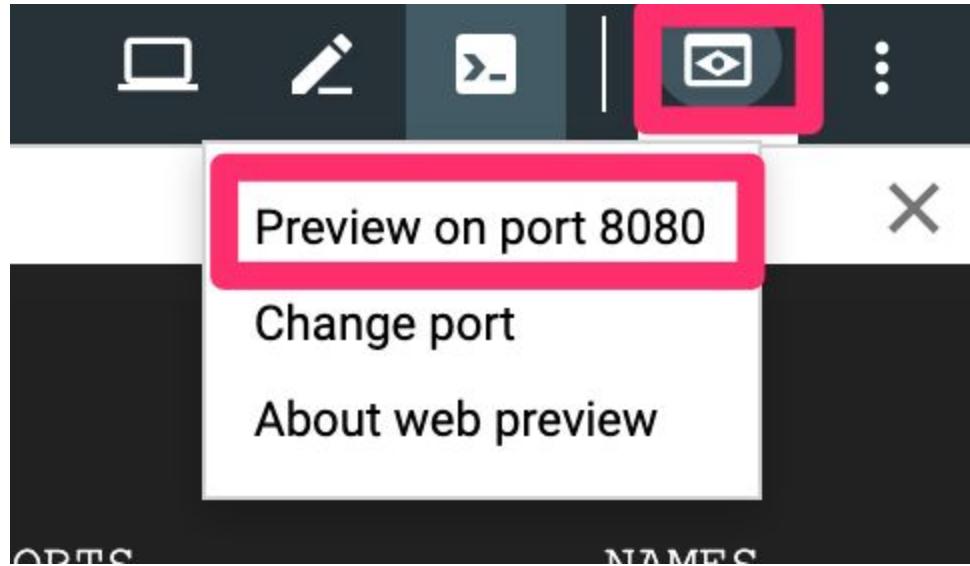
```
$ docker images
```

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
gcr.io/k8s-isce19-yul-9002/hello-node	v1	285446326a52	About a minute ago	908MB
node	12.3.1	6be2fabd4196	3 days ago	908MB
hello-world			ago	1.84kB

Three!

```
$ docker run -d -p 8080:8080 \
$ gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v1
```

```
73d9261af23147e23e128660a5dbe6fa95604cf2bc191b6e36fe87990cd8e966
```





Hello World!

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	
CREATED	STATUS	PORTS	NAMES
73d9261af231 seconds ago	gcr.io/k8s-isce19-yul-9002/hello-node:v1 Up 6 seconds	0.0.0.0:8080->8080/tcp	nostalgic_thompson

```
$ docker stop 73d9261af231
```

```
73d9261af231
```

Questions

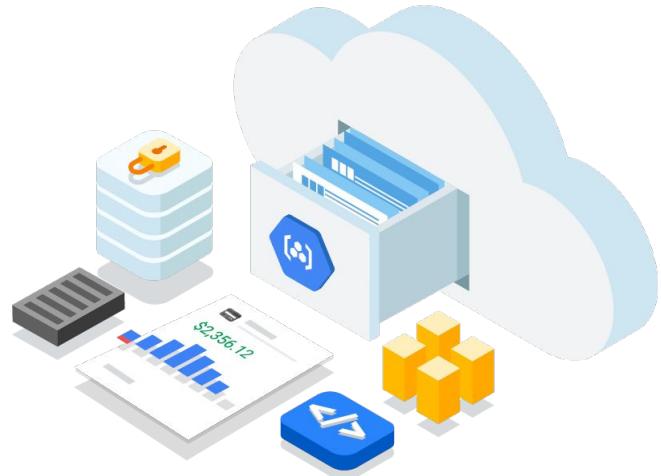
- What is a Dockerfile?
- How would you change the listening port for the application?
- How is a Docker image created?



What questions do you have?

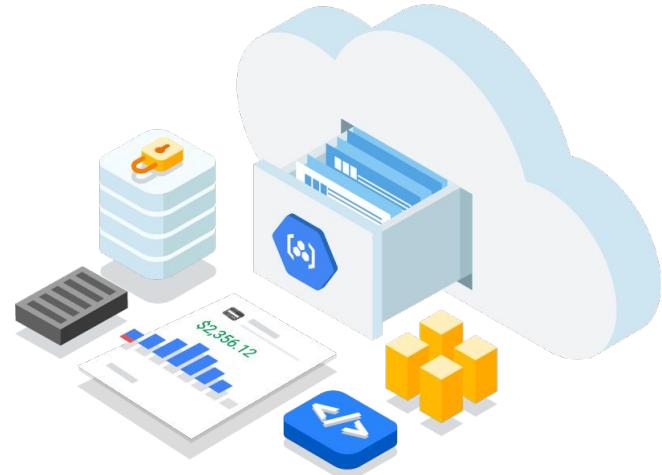
Lab:

Publish the container image



Container Registry

- Secure, private Docker registry
- Build & deploy automatically
- In-depth vulnerability scanning
- Lock down risky images
- Native Docker support
- Fast, high-availability access





Google Cloud Platform

ISCE tutorial Montreal 9002 ▾



Home



Profiler

TOOLS



Cloud Build



Cloud Scheduler



Cloud Tasks



Container Registry



Source Repositories



Deployment Manager



The background shows the Google Cloud Platform homepage with a blue header and a central 'Welcome' section.

Get started with Google Cloud

TOUR CONSOLE

Cloud Storage

A powerful, simple and cost effective way to store and serve your data.



Google Cloud

Enable Container Registry

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Container Registry

Google Container Registry provides secure, private Docker repository storage on Google Cloud Platform. You can use gcloud to [push images to your registry](#), then you can pull images using an HTTP endpoint from any machine, whether it's a Google Compute Engine instance or your own hardware. [Learn more](#)



Container Registry API not enabled

[Enable Container Registry API](#)

```
$ gcloud auth configure-docker
```

```
WARNING: Your config file at [/home/devstar9002/.docker/config.json] contains these  
credential helper entries:
```

```
...
```

```
The following settings will be added to your Docker config file  
located at [/home/devstar9002/.docker/config.json]:
```

```
{  
  "credHelpers": {  
    "gcr.io": "gcloud",  
    ...  
  }  
}
```

```
Do you want to continue (Y/n)?
```

```
$ y
```

```
Docker configuration file updated.
```

```
$ docker push gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v1
```

```
The push refers to repository  
[gcr.io/k8s-isce19-yul-9002/hello-node]  
01c6c7c4477b: Pushed  
...  
v1: digest:  
sha256:f4e4f672eaf0b25fc2e82864f358a6ff15989f33a84a993e5e52  
449515ddb0be size: 2215
```



Container Registry

Repositories

REFRESH

Images

ISCE tutorial Montreal 9002

Filter

Name ^

Hostname

hello-node

gcr.io

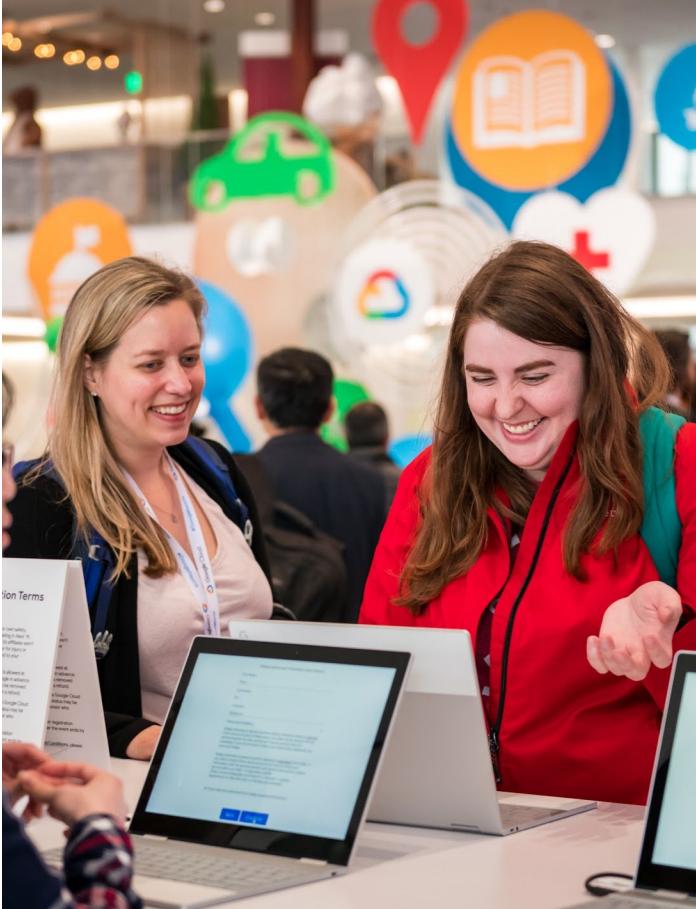
hello-node

gcr.io / k8s-isce19-yul-9002 / hello-node [\[\]](#) Filter by name or tag

<input type="checkbox"/>	Name	Tags	Uploaded
<input type="checkbox"/>	f4e4f672eaf0	v1	2 minutes

Questions

- Where are Docker images stored?
- What command is used to publish Docker images?



What questions do you have?

Kubernetes (K8s)



kubernetes

Kubernetes

Open-source system for automating deployment, scaling, and management of containerized applications

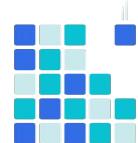


Kubernetes

Planet Scale



Never Outgrow



Run Anywhere



Kubernetes

- Service discovery and load balancing
- Automatic bin packing
- Storage orchestration
- Self-healing
- Automated rollouts and rollbacks
- Secret and configuration management
- Batch execution
- Horizontal scaling

K8s Vocabulary

Cluster - a collection of computers that run Kubernetes. Each cluster consists of at least one *cluster master* and multiple work machines, called *nodes*.

Google Kubernetes Engine (GKE)

Containerized
application
management at
scale



GKE

- Deploy a Wide Variety of Applications
- Operate Seamlessly with High Availability
- Scale Effortlessly to Meet Demand
- Run Securely on Google's Network
- Move Freely between On-premises and Clouds



Lab: Create a GKE Cluster





Home



Pins appear here ?



Getting started



Security >

COMPUTE

App Engine >

Compute Engine >

Kubernetes Engine >

Cloud Functions

Cloud Run

repositories

REFRESH

ISCE tutorial Montreal 9002

Filter

Name ^

Hostname

hello-node

gcr.io

hello-node

gcr.io

hello-node

gcr.io

hello-node

gcr.io

Clusters

Workloads

Services

Applications

Clusters

 Kubernetes Engine API is being enabled. This may take a minute or more. [Learn more](#) ↗

Kubernetes Engine Kubernetes clusters

Containers package an application so it can be easily deployed to run in its own isolated environment. Containers are managed in clusters that automate VM creation and maintenance. [Learn more](#)

[Create cluster](#)

[Deploy container](#)

[Take the quickstart](#)



Create a GKE Cluster

Kubernetes Engine

Kubernetes clusters

Containers package an application so it can be easily deployed to run in its own isolated environment. Containers are managed in clusters that automate VM creation and maintenance. [Learn more](#)

Create cluster

Deploy container

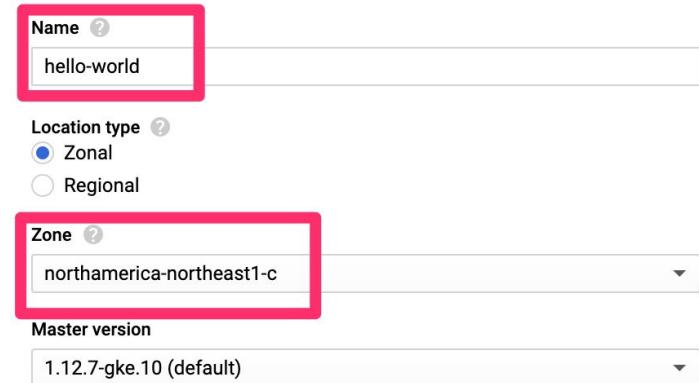
Take the quickstart

Do not click create!

Name: hello-world

Zone:
northamerica-northeast1-c

Number of Nodes: 2



Name ?
hello-world

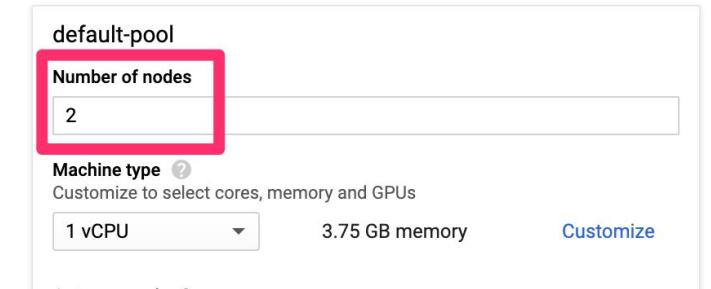
Location type ?
 Zonal
 Regional

Zone ?
northamerica-northeast1-c

Master version
1.12.7-gke.10 (default)

Node pools

Node pools are separate instance groups running Kubernetes in a cluster. You may add node pools in different zones for higher availability, or add node pools of different type machines. To add a node pool, click Edit. [Learn more](#)



default-pool

Number of nodes
2

Machine type ?
Customize to select cores, memory and GPUs

1 vCPU 3.75 GB memory Customize



Create Reset

Equivalent REST or command line



Node pools

Node pools are separate instance groups running Kubernetes in a cluster. You may add node pools in different zones for higher availability, or add node pools of different type machines. To add a node pool, click Edit. [Learn more](#)

default-pool

Number of nodes

2

Machine type 

Customize to select cores, memory and GPUs

1 vCPU



3.75 GB memory

Customize

Auto-upgrade: On

Create

Reset

Equivalent REST API command line

gcloud command line

This is the gcloud command line with the parameters you have selected.

```
gcloud beta container --project "k8s-isce19-yul-9002" clusters create "hello-world" --zone "northamerica-northeast1-c" --no-enable-basic-auth --cluster-version "1.12.7-gke.10" --machine-type "n1-standard-1" --image-type "COS" --disk-type "pd-standard" --disk-size "100" --scopes "https://www.googleapis.com/auth/devstorage.read_only","https://www.googleapis.com/auth/logging.write","https://www.googleapis.com/auth/monitoring","https://www.googleapis.com/auth/servicecontrol","https://www.googleapis.com/auth/service.management.readonly","https://www.googleapis.com/auth/trace.append" --num-nodes "2" --enable-cloud-logging --enable-cloud-monitoring --no-enable-ip-alias --network "projects/k8s-isce19-yul-9002/global/networks/default" --subnetwork "projects/k8s-isce19-yul-9002/regions/northamerica-northeast1/subnetworks/default" --addons HorizontalPodAutoscaling,HttpLoadBalancing --enable-autoupgrade --enable-autorepair
```



Create a GKE Cluster

Paste and add...

--no-issue-client-certificate

--metadata disable-legacy-endpoints=true



(k8s-isce19-yul-9002) ×



```
devstar9002@cloudshell:~ (k8s-isce19-yul-9002)$ gcloud beta container --project "k8s-isce19-yul-9002" clusters create "hello-world" --zone "northamerica-northeast1-c" --no-enable-basic-auth --cluster-version "1.12.7-gke.10" --machine-type "n1-standard-1" --image-type "COS" --disk-type "pd-standard" --disk-size "100" --scopes "https://www.googleapis.com/auth/devstorage.read_only","https://www.googleapis.com/auth/logging.write","https://www.googleapis.com/auth/monitoring","https://www.googleapis.com/auth/servicecontrol","https://www.googleapis.com/auth/service.management.readonly","https://www.googleapis.com/auth/trace.append" --num-nodes "2" --enable-cloud-logging --enable-cloud-monitoring --no-enable-ip-alias --network "projects/k8s-isce19-yul-9002/global/networks/default" --subnet-network "projects/k8s-isce19-yul-9002/regions/northamerica-northeast1/subnetworks/default" --addons HorizontalPodAutoscaling,HttpLoadBalancing --enable-autoupgrade --enable-autorepair --no-issue-client-certificate --metadata disable-legacy-endpoints=true
WARNING: Your Pod address range (`--cluster-ipv4-cidr`) can accommodate at most 1008 node(s).
This will enable the autorepair feature for nodes. Please see https://cloud.google.com/kubernetes-engine/docs/node-auto-repair for more information on node autorepairs.
Creating cluster hello-world in northamerica-northeast1-c... Cluster is being deployed...:|
```



Create a GKE Cluster

ICSE 2019 - 2019-05-28

\$ [the pasted command]

To inspect the contents of your cluster, go to:

https://console.cloud.google.com/kubernetes/workload_/gcloud/northamerica-northeast1-c/hello-world?project=k8s-isce19-yul-9002
kubeconfig entry generated for hello-world.

NAME	LOCATION	MASTER_VERSION	MASTER_IP
MACHINE_TYPE	NODE_VERSION	NUM_NODES	STATUS
hello-world	northamerica-northeast1-c	1.12.7-gke.10	
35.203.33.24	n1-standard-1	1.12.7-gke.10	RUNNING

Kubernetes clusters

[+ CREATE CLUSTER](#)[+ DEPLOY](#)[⟳ REFRESH](#)[trash DELETE](#)[SHOW INF](#)

A Kubernetes cluster is a managed group of VM instances for running containerized applications. [Learn more](#)

 Filter by label or name

<input type="checkbox"/> Name ^	Location	Cluster size	Total cores	Total memory	Notifications	Labels	
<input checked="" type="checkbox"/> hello-world	northamerica-northeast1-c	2	2 vCPUs	7.50 GB			Connect

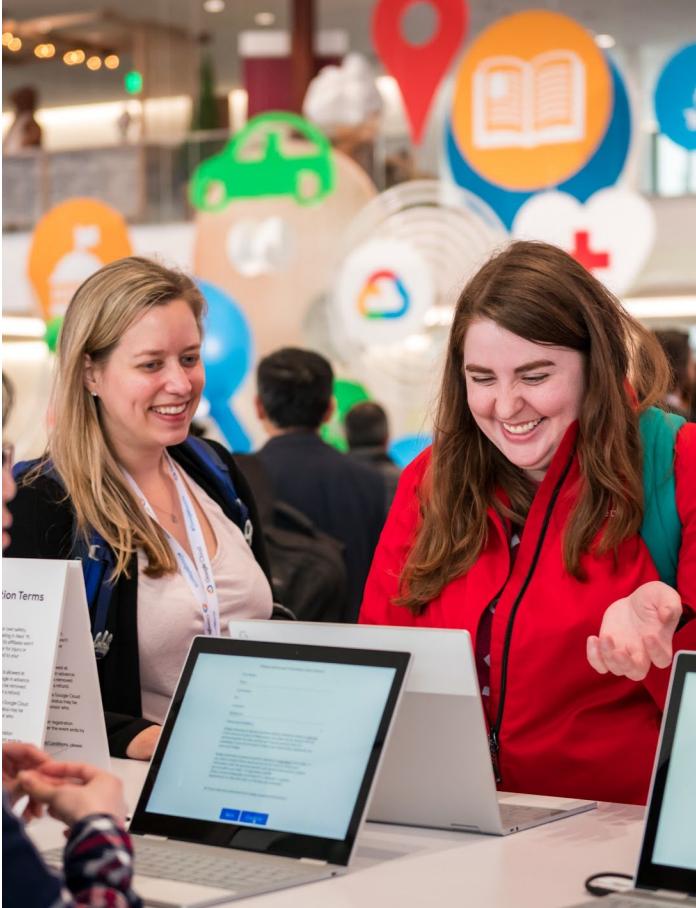


Create a GKE Cluster

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Questions

- Name one feature of Kubernetes.
- Is GKE the only way to run Kubernetes?
- Why might you use the CLI instead of the user interface to create a cluster?



Questions

- Why is Kubernetes often shortened to "K8s"?
- What is the significance of the number "8"?



What questions do you have?

Deploy the Application



kubernetes



K8s Vocabulary

- **kubectl** - a command-line interface for running commands against Kubernetes clusters

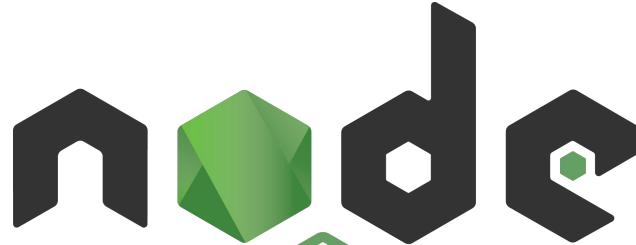
K8s Vocabulary - Pod

- the smallest and simplest unit in the Kubernetes object model that you create or deploy
- a single instance of an application in Kubernetes

K8s Vocabulary

- **deployment** - a controller that provides declarative updates for Pods. Describe a desired state and the controller changes the actual state to the desired state.

Lab: Create a Deployment



```
$ kubectl create deployment hello-node \  
--image=gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v1
```

```
deployment.apps/hello-node created
```

```
$ kubectl get deployments
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE
hello-node	1	1	1	1	51s

```
$ kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
hello-node-b54cd7964-bdl4q	1/1	Running	0	59s

```
$ kubectl cluster-info
```

```
Kubernetes master is running at https://35.20...
```

```
GLBCDefaultBackend is running at https://35.20...
```

```
Heapster is running at https://35.20...
```

```
KubeDNS is running at https://35.20...
```

```
Metrics-server is running at https://35.20...
```

```
$ kubectl config view
```

```
apiVersion: v1
clusters:
- cluster:
  certificate-authority-data: DATA+OMITTED
  server: https://35.203.33.24
  name:
...
...
```

```
$ kubectl get events
```

10m	Normal	Scheduled	Pod	Successfully ...
10m	Normal	Pulled	Pod	Container ima...
10m	Normal	Created	Pod	Created conta...
10m	Normal	Started	Pod	Started conta...
10m	Normal	SuccessfulCreate	ReplicaSet	Created pod: ...
13m	Normal	ScalingReplicaSet	Deployment	Scaled up rep...
10m	Normal	ScalingReplicaSet	Deployment	Scaled up rep...

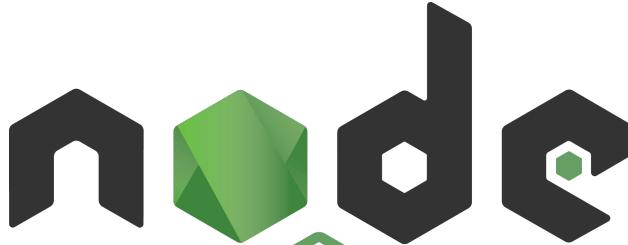
Questions

- What is the CLI used to interact with a Kubernetes cluster?
- What is a pod?
- What is a deployment?



What questions do you have?

Lab: Allow external traffic



kubernetes



```
$ kubectl expose deployment hello-node \
--type="LoadBalancer" --port 8080
```

```
service/hello-node exposed
```

K8s Vocabulary

- **service** - an abstraction which defines a logical set of Pods and a policy by which to access them.

```
$ kubectl get services
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
hello-node	LoadBalancer	10.19.240.39	35.203.89.122	8080:30806/TCP	5m13s
kubernetes	ClusterIP	10.19.240.1	<none>	443/TCP	48m

Hello World!

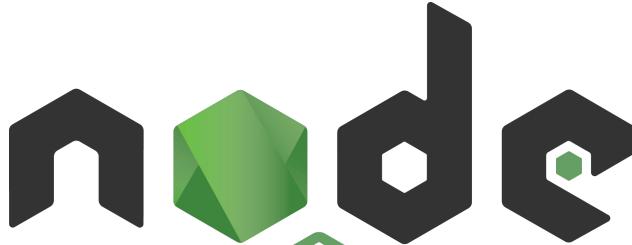
Questions

- What is a service?
- We only have one pod, why did we create a load balancer?



What questions do you have?

Lab: Scale the service



kubernetes



```
$ kubectl scale deployment \
hello-node --replicas=4
```

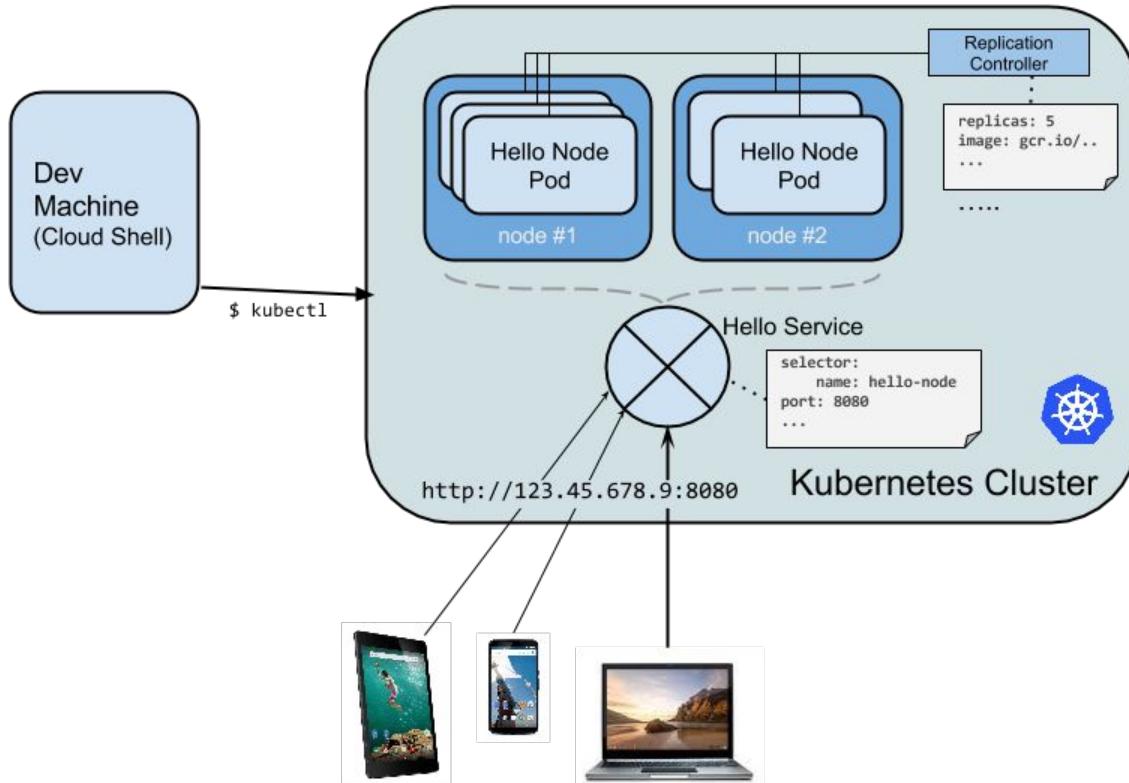
```
deployment.extensions/hello-node scale
```

```
$ kubectl get deployments
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE
hello-node	4	4	4	3	25m

```
$ kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
hello-....bd14q	1/1	Running	0	26m
hello-....lb6tl	1/1	Running	0	93s
hello-....rsvtm	1/1	Running	0	93s
hello-....ssgmn	1/1	Running	0	93s



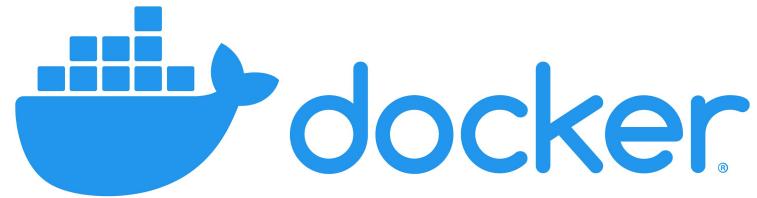
Questions

- How many nodes did we need to deploy in order to scale our service?
- How might you scale the service down?



What questions do you have?

Lab: Upgrade the application



kubernetes



server.js

```
var http = require('http');

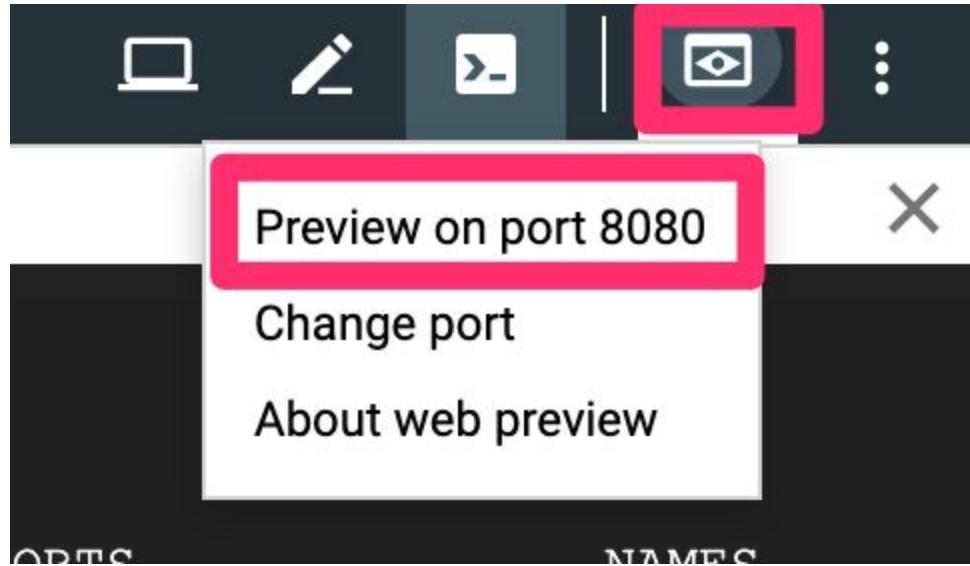
var handleRequest = function(request, response) {
    response.writeHead(200);
    response.end("Hello Kubernetes World!");
}

var www = http.createServer(handleRequest);
www.listen(8080);
```

```
$ docker build -t \
$ gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v2 .
```

```
Sending build context to Docker daemon 2.05MB
Step 1/4 : FROM node:12.3.1
...
Removing intermediate container e4deda512d8a
--> 2c44110f0037
Successfully built 2c44110f0037
Successfully tagged gcr.io/k8s-isce19-yul-9002/hello-node:v2
```

```
$ node server.js
```



← → ⌂



<https://8080-dot-7446408-dot-devshell.appspot.com/?authuser=1>

Hello Kubernetes World!



Web preview

ICSE 2019 - 2019-05-28

```
$ Ctrl+c
```

```
^C
```

```
$ docker push \
gcr.io/$GOOGLE_CLOUD_PROJECT/hello-node:v2
```

The push refers to repository [gcr...
b05e6dfa9fef: Pushed
13bee598853b: Layer already exists
30305939d920: Layer already exists
...
v2: digest: sha256:afc321da162d1bd...

```
$ kubectl edit deployment hello-node
```

...

containers:

- image: gcr.io/.../hello-node:v1

- image: gcr.io/.../hello-node:v2

imagePullPolicy: IfNotPresent

...

```
$ kubectl edit deployment hello-node
```

```
deployment.extensions/hello-node edited
```

```
$ kubectl get deployments
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE
hello-node	4	4	4	4	51m

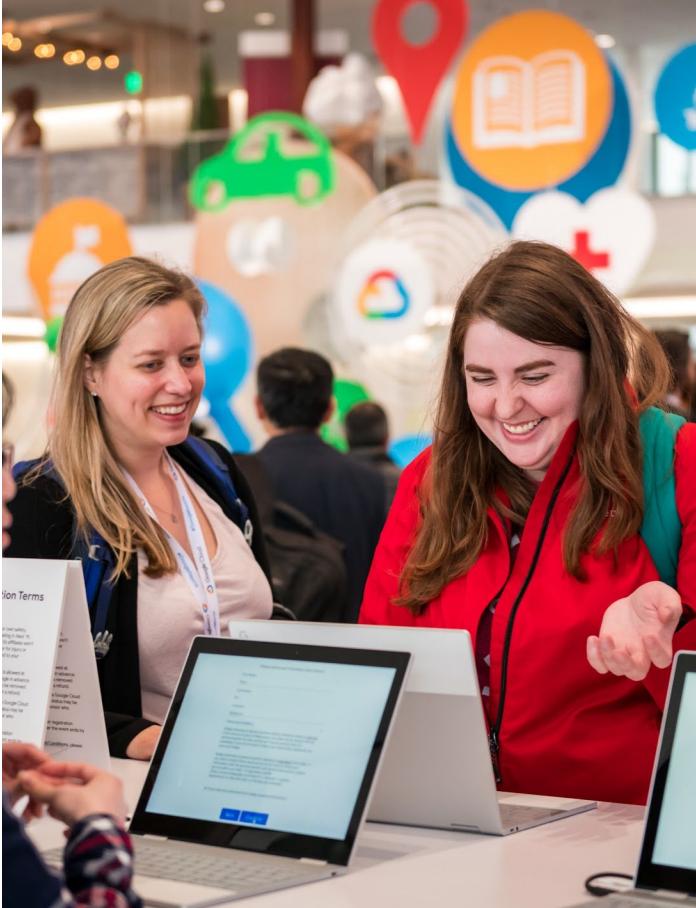
← → ⌂

ⓘ Not Secure | 35.203.89.122:8080

Hello Kubernetes World!

Questions

- What are the primary steps for upgrading the application?
- How would using `FROM` node in the Dockerfile change impact our deployment?
- What are we missing for proper upgrades?



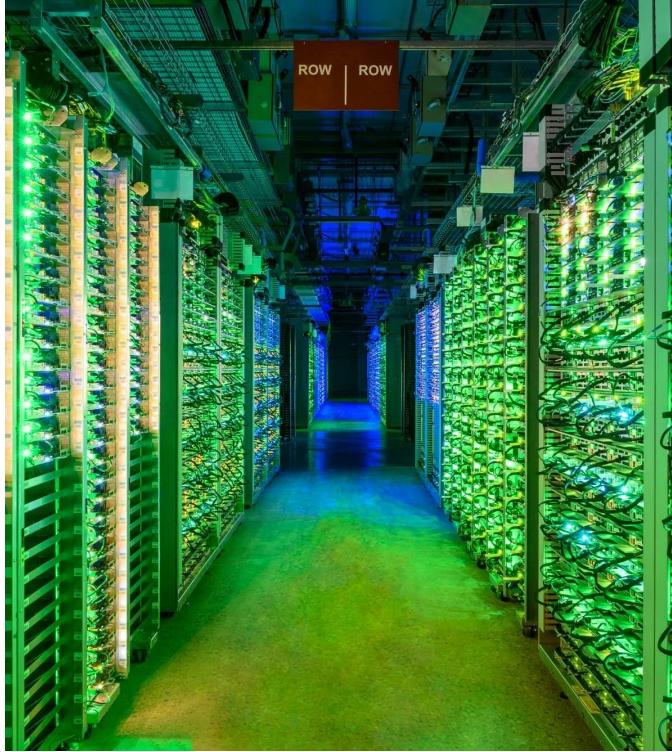
What questions do you have?

Recap

- Google Cloud Platform
- Project
- Google Cloud Shell
- node.js Application
- Containerization with Docker
- Run Applications with K8s

Objectives

- Describe various features and benefits of Kubernetes
- Deploy and manage applications on Kubernetes



What's Next?

- Clean-up
- [Spring Boot Application](#)
- [Wrap-up](#)

How much time do we have?

Lab: Spring Boot Hello World Application

```
$ git clone \
$ https://github.com/spring-guides/gs-spring-boot.git
```

```
Cloning into 'gs-spring-boot'...
remote: Enumerating objects: 1204, done.
remote: Total 1204 (delta 0), reused 0 (delta 0), pack-reused
1204
Receiving objects: 100% (1204/1204), 488.86 KiB | 0 bytes/s,
done.
Resolving deltas: 100% (813/813), done.
```

```
$ cd gs-spring-boot/complete
```

```
$ ./mvnw -DskipTests spring-boot:run
```

```
Downloading https://repo1.maven.org/maven...
```

```
Unzipping /home/devstar9002/.m2/wrapper/d...
```

```
Set executable permissions for: /home/dev...
```

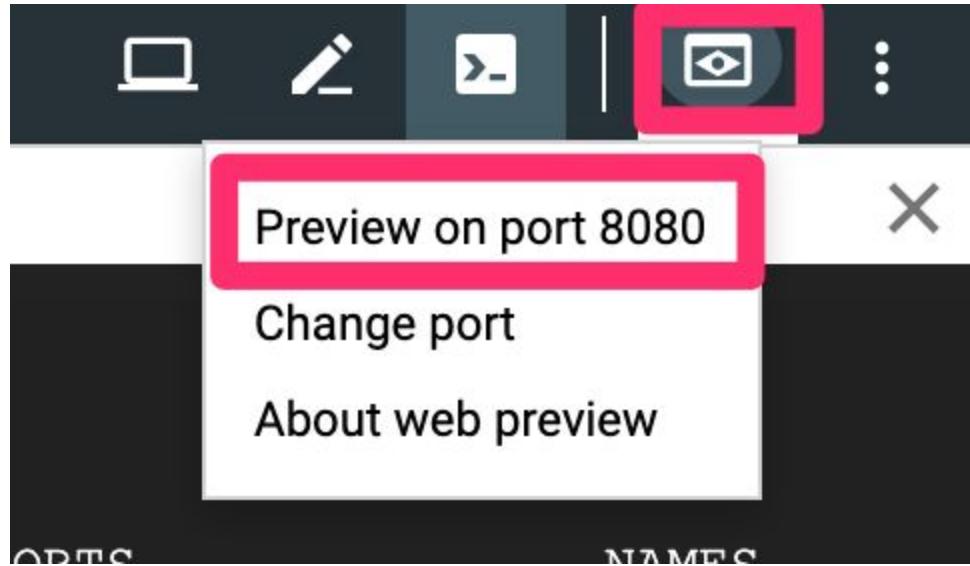
```
[INFO] Scanning for projects...
```

```
Downloading: https://repo.maven.apache.or...
```

```
...
```

```
websocketServletWebServerCustomizer
```

```
welcomePageHandlerMapping
```



← → C

🔒 https://8080-dot-7446408-dot-devshell.appspot.com/?authuser=0

Greetings from Spring Boot!



Web preview

ICSE 2019 - 2019-05-28

```
$ Ctrl+c
```

```
^C
```

```
$ ./mvnw -DskipTests package
```

```
[INFO] Scanning for projects...
[INFO]
[INFO] -----
[INFO] Building gs-spring-boot 0.1.0
[INFO] -----
...
[INFO] -----
[INFO] BUILD SUCCESS
[INFO] -----
[INFO] Total time: 5.718 s
[INFO] Finished at: 2019-05...
[INFO] Final Memory: 27M/105M
[INFO] -----
```

```
./mvnw -DskipTests  
$ com.google.cloud.tools:jib-maven-plugin:build \  
-Dimage=gcr.io/$GOOGLE_CLOUD_PROJECT/hello-java:v1
```

```
[INFO] Scanning for projects...  
Downloading: https://repo.maven.apache.org/maven2/com/google/cloud/...  
...  
[INFO] Built and pushed image as gcr.io/k8s-isce19-yul-9002/hello-java:v1  
[INFO] Executing tasks:  
...  
[INFO] BUILD SUCCESS  
...  
[INFO] Final Memory: 26M/62M
```



Container Registry

Repositories

REFRESH



Images

ISCE tutorial Montreal 9002

Filter

Name ^

Hostname

hello-java

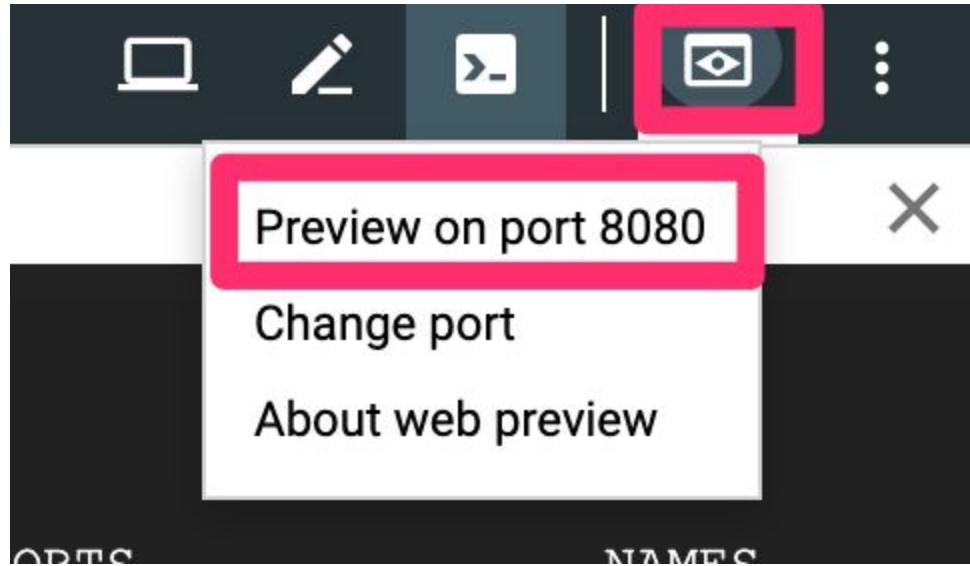
gcr.io

hello-node

gcr.io

```
$ docker run -it -p 8080:8080 \
$ gcr.io/$GOOGLE_CLOUD_PROJECT/hello-java:v1
```

```
Unable to find image 'gcr.io/k8s-isce19-yul-9002/hello-...
v1: Pulling from k8s-isce19-yul-9002/hello-java
155814304360: Pull complete
...
Digest: sha256:da7a12f5f9c194279c2e5cc8dedba05615df9d70b846...
...
welcomePageHandlerMapping
```



← → C

🔒 https://8080-dot-7446408-dot-devshell.appspot.com/?authuser=0

Greetings from Spring Boot!



Web preview

ICSE 2019 - 2019-05-28

```
$ Ctrl+c
```

```
^C
```



Kubernetes Engine

Kubernetes clusters

[+ CREATE CLUSTER](#)[+ DE](#)

Clusters

A Kubernetes cluster is a managed group of VM instances for running containerized workloads.



Workloads

 Filter by label or name

Services



Applications



Configuration



Storage

<input type="checkbox"/> Name ^	Location	Cluster size	Total c
<input checked="" type="checkbox"/> hello-world	northamerica-northeast1-c	2	2 vCPUs

Do not click create!

Name: hello-java-cluster

Zone:

northamerica-northeast1-c

Number of Nodes: 2



'Standard cluster' template (edited)

Continuous integration, web serving, backends. Best choice for further customization or if you are not sure what to choose.

Some fields can't be changed after the cluster is created.
Hover over the help icons to learn more.

Name ?
hello-java-cluster

Location type ?
 Zonal
 Regional

Zone ?
northamerica-northeast1-c

Master version
1.12.7-gke.10 (default)

Node pools

Node pools are separate instance groups running Kubernetes in a cluster. You may add node pools in different zones for higher availability, or add node pools of different type machines. To add a node pool, click Edit. [Learn more](#)

default-pool
Number of nodes **2**

Machine type ?
Customize to select cores, memory and GPUs

1 vCPU 3.75 GB memory

[Customize](#)

Auto-upgrade: On

[More options](#)

[+ Add node pool](#)

Availability, networking, security, and additional features

Delete **Reset**

Equivalent REST API command line

Additional features

- Enable Stackdriver Kubernetes Engine Monitoring
- Enable node auto-provisioning (beta)
 - Set limits for maximum CPU and Memory
- Enable Vertical Pod Autoscaling (beta)

Node pools

Node pools are separate instance groups running Kubernetes in a cluster. You may add node pools in different zones for higher availability, or add node pools of different type machines. To add a node pool, click Edit. [Learn more](#)

default-pool

Number of nodes

2

Machine type 

Customize to select cores, memory and GPUs

1 vCPU



3.75 GB memory

[Customize](#)

Auto-upgrade: On

[Create](#)

[Reset](#)

[Equivalent REST API](#) [command line](#)

gcloud command line

This is the gcloud command line with the parameters you have selected.

```
gcloud beta container --project "k8s-isce19-yul-9002" clusters create "hello-java-cluster" --zone "northamerica-northeast1-c" --no-enable-basic-auth --cluster-version "1.12.7-gke.10" --machine-type "n1-standard-1" --image-type "COS" --disk-type "pd-standard" --disk-size "100" --scopes "https://www.googleapis.com/auth/devstorage.read_only","https://www.googleapis.com/auth/logging.write","https://www.googleapis.com/auth/monitoring","https://www.googleapis.com/auth/servicecontrol","https://www.googleapis.com/auth/service.management.readonly","https://www.googleapis.com/auth/trace.append" --num-nodes "2" --enable-stackdriver-kubernetes --no-enable-ipAlias --network "projects/k8s-isce19-yul-9002/global/networks/default" --subnetwork "projects/k8s-isce19-yul-9002/regions/northamerica-northeast1/subnetworks/default" --addons HorizontalPodAutoscaling,HttpLoadBalancing --enable-autoupgrade --enable-autorepair --enable-autoprovisioning --min-cpu 1 --max-cpu 10 --min-memory 1 --max-memory 100 --enable-vertical-pod-autoscaling
```



Create a GKE Cluster

Paste and add...

--no-issue-client-certificate

--metadata disable-legacy-endpoints=true

\$ [the pasted command]

```
WARNING: Your Pod address range (`--cluster-ipv4-cidr`) can ...
This will enable the autorepair feature for nodes. Please se...
Creating cluster hello-java-cluster in northamerica-northeas...
Created [https://container.googleapis.com/v1beta1/projects/k...
To inspect the contents of your cluster, go to: https://cons...
kubeconfig entry generated for hello-java-cluster.
```

NAME	LOCATION	MASTER_VERSIO...
hello-java-cluster	northamerica-northeast1-c	1.12.7-gke.10...

Kubernetes clusters

[!\[\]\(f330bf75dea44dc43177009ece6f8692_img.jpg\) CREATE CLUSTER](#)[!\[\]\(89da1837a3aac0dff039e1dacdfe6def_img.jpg\) DEPLOY](#)[!\[\]\(f2b8d6e48f84a57eaf4030fd2522da8f_img.jpg\) REFRESH](#)[!\[\]\(44a779c1edc1048376239fc76ac01410_img.jpg\) DELETE](#)

A Kubernetes cluster is a managed group of VM instances for running containerized applications. [Learn more](#)

 Filter by label or name

<input type="checkbox"/> Name ^	Location	Cluster size	Total cores	Total memory	Notifications
<input checked="" type="checkbox"/> hello-java-cluster	northamerica-northeast1-c	2	2 vCPUs	7.50 GB	
<input checked="" type="checkbox"/> hello-world	northamerica-northeast1-c	2	2 vCPUs	7.50 GB	

```
$ kubectl create deployment hello-java \  
--image=gcr.io/$GOOGLE_CLOUD_PROJECT/hello-java:v1
```

```
deployment.apps/hello-java created
```

```
$ kubectl get deployments
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE
hello-java	1	1	1	1	41s

```
$ kubectl get pods
```

NAME	READY	STATUS	RESTARTS	AGE
hello-java-6bd5947964-ggqn1	1/1	Running	0	59s

```
$ kubectl expose deployment hello-java \
--type="LoadBalancer" --port 8080
```

```
service/hello-java exposed
```

```
$ kubectl get services
```

NAME	TYPE	CLUSTER-IP	EXTERNAL-IP	PORT(S)	AGE
hello-java	LoadBalancer	10.59.248.73	35.203.57.149	8080:32736/TCP	50s
kubernetes	ClusterIP	10.59.240.1	<none>	443/TCP	14m

← → ⏪

ⓘ Not Secure | 35.203.57.149:8080

Greetings from Spring Boot!



Greetings!

ICSE 2019 - 2019-05-28

```
$ kubectl scale deployment hello-java --replicas=3
```

```
deployment.extensions/hello-java scaled
```

```
$ kubectl get deployment
```

NAME	DESIRED	CURRENT	UP-TO-DATE	AVAILABLE	AGE
hello-java	3	3	3	3	6m51s

```
$ edit src/main/java/hello/HelloController.java
```

HelloController.java

```
package hello;  
  
...  
  
public String index() {  
    return "Greetings from Spring Boot!";  
    return "Greetings from Google Kubernetes Engine!";  
...  
}
```

```
$ ./mvnw -DskipTests package
```

```
[INFO] Scanning for projects...
```

```
...
```

```
[INFO] BUILD SUCCESS
```

```
...
```

```
[INFO] Total time: 4.939 s
```

```
[INFO] Finished at: 2019-05-27T21:02:13-04:00
```

```
[INFO] Final Memory: 25M/59M
```

```
...
```

```
./mvnw -DskipTests \
$ com.google.cloud.tools:jib-maven-plugin:build \
-Dimage=gcr.io/$GOOGLE_CLOUD_PROJECT/hello-java:v2
```

```
[INFO] Scanning for projects...
...
[INFO] BUILD SUCCESS
[INFO] -----
...
[INFO] Final Memory: 24M/57M
...
```

```
$ kubectl set image deployment/hello-java \
hello-java=gcr.io/$GOOGLE_CLOUD_PROJECT/hello-java:v2
```

```
deployment.extensions/hello-java image updated
```

Greetings from Google Kubernetes Engine!

```
$ kubectl rollout undo deployment/hello-java
```

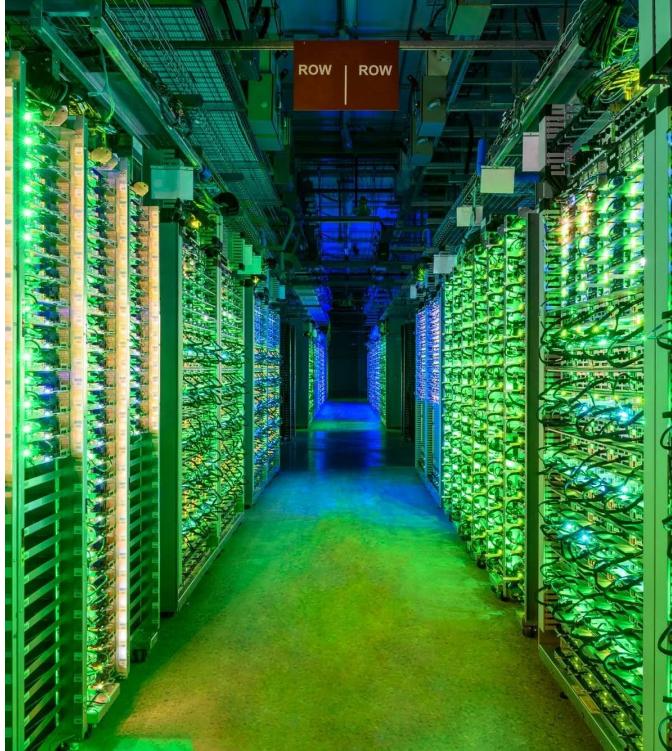
```
deployment.extensions/hello-java
```

Wrap-up



Objectives

- Describe various features and benefits of Kubernetes
- Deploy and manage applications on Kubernetes





Awwvision: Cloud Vision API from a Kubernetes Cluster

Updated Nov 29, 2018



Start

Build a Slack Bot with Node.js on Kubernetes

43 min

Updated Mar 17, 2017



Start

Continuous Delivery to Kubernetes Using Spinnaker

61 min

Updated Apr 3, 2019



Start

Deploy ASP.NET Core app to Google Kubernetes Engine with Istio (Part 1)

43 min

Updated May 3, 2019



Start

Deploy ASP.NET Core app to Google Kubernetes Engine with Istio (Part 2)

40 min

Updated May 3, 2019



Start

Deploy ASP.NET Core app to Kubernetes on Google Kubernetes Engine

79 min

Updated May 20, 2019



Start

Deploy a Java application to Kubernetes on Google Kubernetes Engine

36 min

Updated Nov 14, 2018



Start

Deploy a Micronaut application containerized with Jib to Google Kubernetes Engine

38 min

Updated Nov 13, 2018



Start

Hello Istio Codelab (with Google Kubernetes Engine)

23 min

Updated Jan 25, 2019



Start

Hello Node Kubernetes Codelab

High Availability PostgreSQL and

High Availability PostgreSQL and

Thank You!

Nathen Harvey

Developer Advocate

@nathenharvey
(he/him)





Running Applications on Kubernetes

Google Cloud