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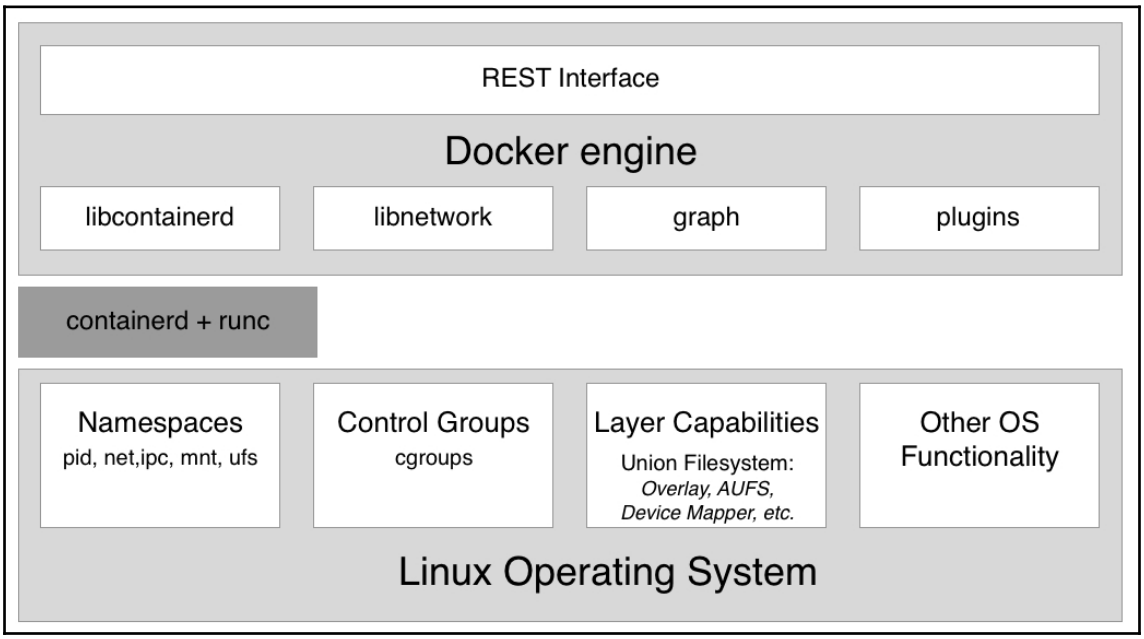
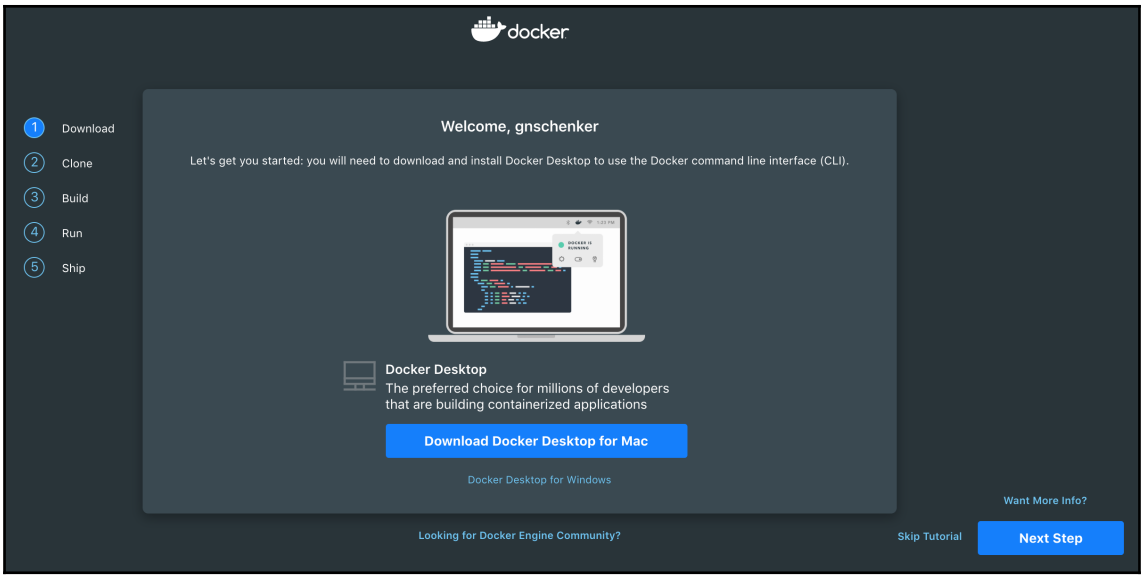
Chapter 1: What Are Containers and Why Should I Use Them?



Chapter 2: Setting Up a Working Environment




```
$ docker version
Client: Docker Engine - Community
 Version:           19.03.5
 API version:       1.40
 Go version:        go1.12.12
 Git commit:        633a0ea
 Built:             Wed Nov 13 07:22:37 2019
 OS/Arch:           windows/amd64
 Experimental:      false

Server: Docker Engine - Community
 Engine:
  Version:          19.03.5
  API version:      1.40 (minimum version 1.12)
  Go version:       go1.12.12
  Git commit:       633a0ea
  Built:            Wed Nov 13 07:29:19 2019
  OS/Arch:          linux/amd64
  Experimental:     false
 containerd:
  Version:          v1.2.10
  GitCommit:        b34a5c8af56e510852c35414db4c1f4fa6172339
 runc:
  Version:          1.0.0-rc8+dev
  GitCommit:        3e425f80a8c931f88e6d94a8c831b9d5aa481657
 docker-init:
  Version:          0.18.0
  GitCommit:        fec3683
```

```
$ docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1b930d010525: Pull complete
Digest: sha256:0e11c388b664df8a27a901dce21eb89f11d8292f7fca1b3e3c4321bf7897bffe
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
 1. The Docker client contacted the Docker daemon.
 2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
    (amd64)
 3. The Docker daemon created a new container from that image which runs the
    executable that produces the output you are currently reading.
 4. The Docker daemon streamed that output to the Docker client, which sent it
    to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
 $ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
 https://hub.docker.com/

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

```
Updating Homebrew...
==> Auto-updated Homebrew!
Updated 1 tap (homebrew/core).
==> Updated Formulae
anyenv                  cointop                 hlint                   phpmyadmin
buildifier              dependency-check        jenkins

==> Satisfying dependencies
All Cask dependencies satisfied.
==> Downloading https://github.com/docker/toolbox/releases/download/v18.06.1-ce/DockerToolb
==> Downloading from https://github-production-release-asset-2e65be.s3.amazonaws.com/382749
######################################################################## 100.0%
==> Verifying SHA-256 checksum for Cask 'docker-toolbox'.
==> Installing Cask docker-toolbox
==> Running installer for docker-toolbox; your password may be necessary.
==> Package installers may write to any location; options such as --appdir are ignored.
Password:
installer: Package name is Docker Toolbox
installer: choices changes file '/var/folders/gr/mtd645cs3nxbtvszn7zfrvd40000gp/T/choices20
wtvmzm.xml' applied
installer: Installing at base path /
installer: The install was successful.
==> Changing ownership of paths required by docker-toolbox; your password may be necessary
🍺  docker-toolbox was successfully installed!
```

```
C:\> choco install docker-toolbox -y
Chocolatey v0.10.15
Installing the following packages:
docker-toolbox
By installing you accept licenses for the packages.
Progress: Downloading docker-toolbox 19.03.1... 100%

docker-toolbox v19.03.1 [Approved]
docker-toolbox package files install completed. Performing other installation steps.
Downloading docker-toolbox
  from 'https://github.com/docker/toolbox/releases/download/v19.03.1/DockerToolbox-19.03.1.exe'
Progress: 100% - Completed download of C:\Users\gnsch\AppData\Local\Temp\chocolatey\docker-toolbox\19.03.1\DockerToolbox-19.03.1.exe (231.29 MB).
Download of DockerToolbox-19.03.1.exe (231.29 MB) completed.
Hashes match.
Installing docker-toolbox...
docker-toolbox has been installed.
  docker-toolbox can be automatically uninstalled.
Environment Vars (like PATH) have changed. Close/reopen your shell to
 see the changes (or in powershell/cmd.exe just type `refreshenv`).
 The install of docker-toolbox was successful.
  Software installed to 'C:\Program Files\Docker Toolbox\'

Chocolatey installed 1/1 packages.
 See the log for details (C:\ProgramData\chocolatey\logs\chocolatey.log).

Enjoy using Chocolatey? Explore more amazing features to take your
experience to the next level at
 https://chocolatey.org/compare
```

```
1. bash
$ docker-machine ls
NAME      ACTIVE   DRIVER       STATE     URL   SWARM   DOCKER     ERRORS
default   -        virtualbox   Stopped                 Unknown
$
```

```
$ docker-machine start default
Starting "default"...
(default) Check network to re-create if needed...
(default) Waiting for an IP...
Machine "default" was started.
Waiting for SSH to be available...
Detecting the provisioner...
Started machines may have new IP addresses. You may need to re-run the `docker-machine env` command.
$
```

```
$ docker-machine ls
NAME      ACTIVE   DRIVER       STATE     URL                         SWARM   DOCKER        ERRORS
default   -        virtualbox   Running   tcp://192.168.99.100:2376           v18.06.1-ce
$
```

```
$ docker-machine create --driver virtualbox default
Running pre-create checks...
(default) Default Boot2Docker ISO is out-of-date, downloading the latest release...
(default) Latest release for github.com/boot2docker/boot2docker is v18.09.6
(default) Downloading /Users/gabriel/.docker/machine/cache/boot2docker.iso from https://github.com/boot2d
ocker/boot2docker/releases/download/v18.09.6/boot2docker.iso...
(default) 0%....10%....20%....30%....40%....50%....60%....70%....80%....90%....100%
Creating machine...
(default) Copying /Users/gabriel/.docker/machine/cache/boot2docker.iso to /Users/gabriel/.docker/machine/
machines/default/boot2docker.iso...
(default) Creating VirtualBox VM...
(default) Creating SSH key...
(default) Starting the VM...
(default) Check network to re-create if needed...
(default) Waiting for an IP...
Waiting for machine to be running, this may take a few minutes...
Detecting operating system of created instance...
Waiting for SSH to be available...
Detecting the provisioner...
Provisioning with boot2docker...
Copying certs to the local machine directory...
Copying certs to the remote machine...
Setting Docker configuration on the remote daemon...
Checking connection to Docker...
Docker is up and running!
To see how to connect your Docker Client to the Docker Engine running on this virtual machine, run: docke
r-machine env default
$
```

```
$ docker version
Client:
 Version:           18.06.1-ce
 API version:       1.38
 Go version:        go1.10.3
 Git commit:        e68fc7a
 Built:             Tue Aug 21 17:21:31 2018
 OS/Arch:           darwin/amd64
 Experimental:      false

Server: Docker Engine - Community
 Engine:
  Version:          18.09.6
  API version:      1.39 (minimum version 1.12)
  Go version:       go1.10.8
  Git commit:       481bc77
  Built:            Sat May  4 02:41:08 2019
  OS/Arch:          linux/amd64
  Experimental:     false
$
```

```
$ docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1b930d010525: Pull complete
Digest: sha256:0e11c388b664df8a27a901dce21eb89f11d8292f7fca1b3e3c4321bf7897bffe
Status: Downloaded newer image for hello-world:latest

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 https://hub.docker.com/

For more examples and ideas, visit:
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```
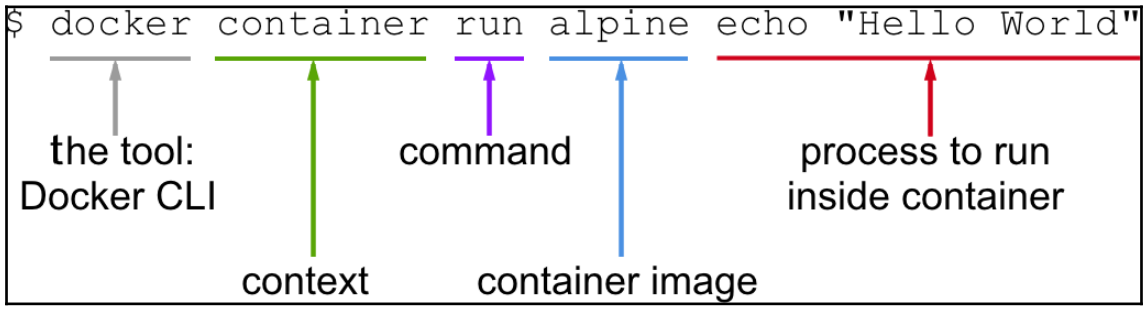

```
  minikube start
* minikube v1.8.1 on Microsoft Windows 10 Pro 10.0.19041 Build 19041
* Using the hyperv driver based on existing profile
* Downloading VM boot image ...
* Reconfiguring existing host ...
* Starting existing hyperv VM for "minikube" ...
E0311 10:10:48.463030   13336 config.go:71] Failed to preload container runtime Docker: copying file: sudo test -d \ &&
sudo scp -t \ && sudo touch -d "2020-03-11 08:27:52.0791109 +0100" \/preloaded.tar.lz4: Process exited with status 1
output: , falling back to caching images
* Preparing Kubernetes v1.17.3 on Docker 19.03.6 ...
* Launching Kubernetes ...
* Enabling addons: default-storageclass, storage-provisioner
* Done! kubectl is now configured to use "minikube"
```

```
$ kubectl version
Client Version: version.Info{Major:"1", Minor:"17", GitVersion:"v1.17.1", GitCommit:"d224476cd0730baca2b6e357d144171ed74
192d6", GitTreeState:"clean", BuildDate:"2020-01-14T21:04:32Z", GoVersion:"go1.13.5", Compiler:"gc", Platform:"windows/a
md64"}
Server Version: version.Info{Major:"1", Minor:"17", GitVersion:"v1.17.3", GitCommit:"06ad960bfd03b39c8310aaf92d1e7c12ce6
18213", GitTreeState:"clean", BuildDate:"2020-02-11T18:07:13Z", GoVersion:"go1.13.6", Compiler:"gc", Platform:"linux/amd
64"}
```

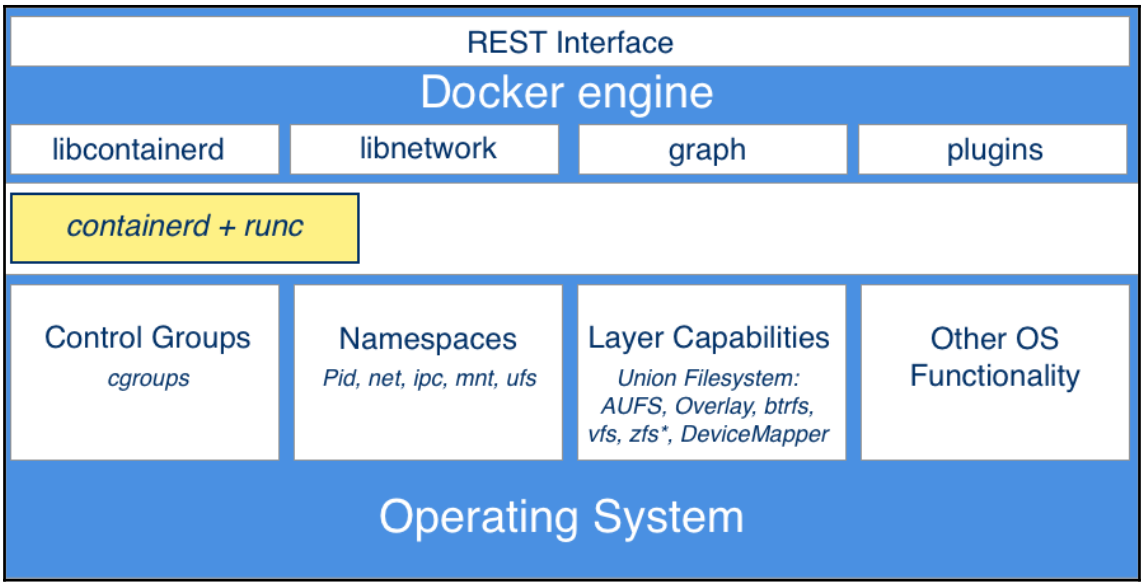
Chapter 3: Mastering Containers

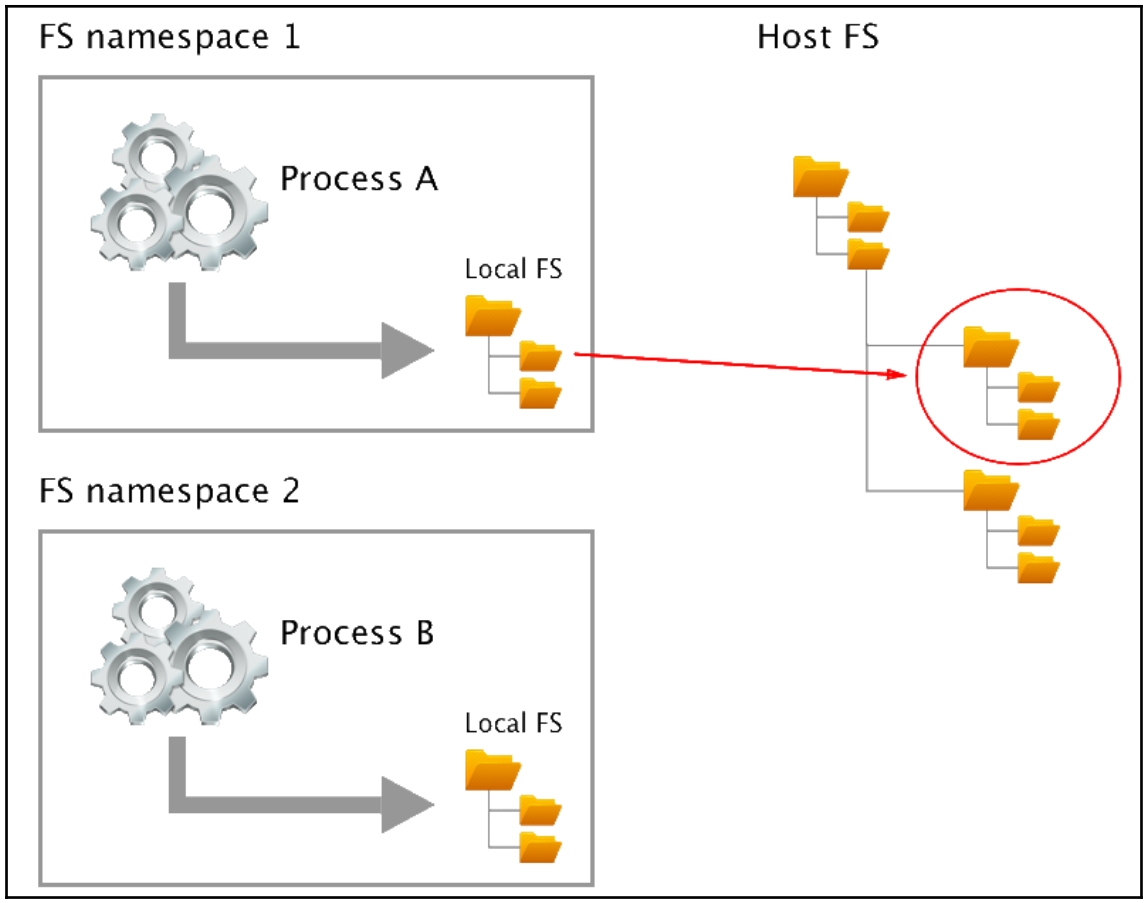


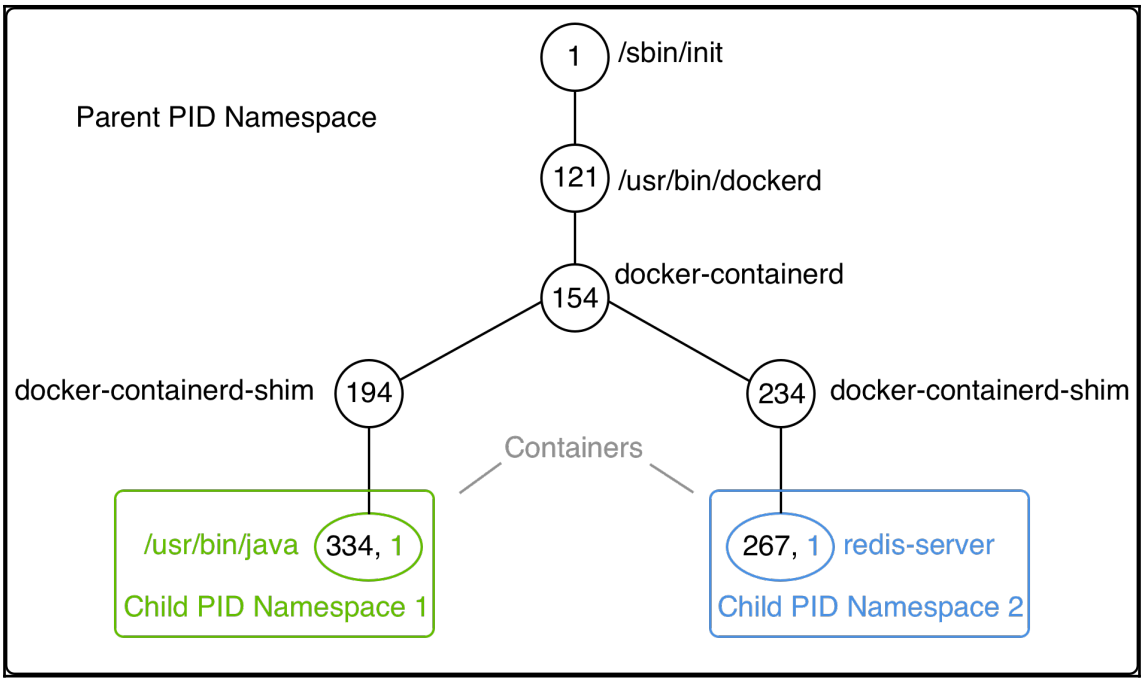

```
$ docker container ls
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS               NAMES
31d719b2f439        nginx:alpine        "nginx -g 'daemon of…"   35 seconds ago      Up 30 seconds       80/tcp              cranky_curie
27b96de70b58        alpine:latest       "ping 127.0.0.1"         23 hours ago        Up 23 hours                             c2
35b8dd512acb        alpine:latest       "/bin/sh"                23 hours ago        Up 23 hours                             c1
$
```

```
/app # ps
PID   USER     TIME  COMMAND
    1 root      0:00 /bin/sh -c source script.sh
  618 root      0:00 /bin/sh
  654 root      0:00 sleep 5
  655 root      0:00 ps
```

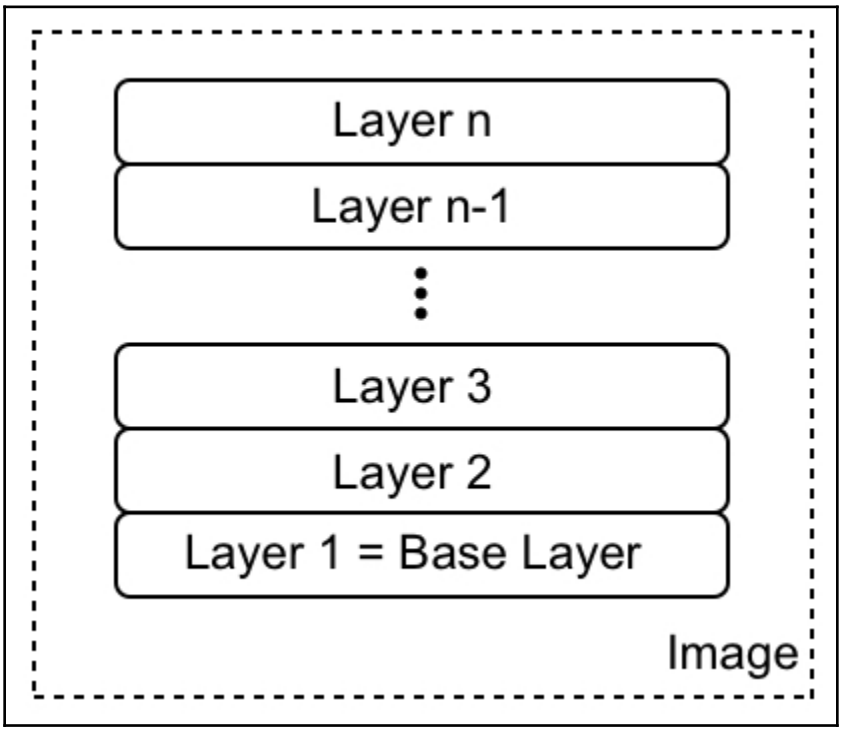
```
$ docker container exec trivia ps
PID   USER     TIME  COMMAND
    1 root      0:00 /bin/sh -c source script.sh
  760 root      0:00 sleep 5
  761 root      0:00 ps
$
```

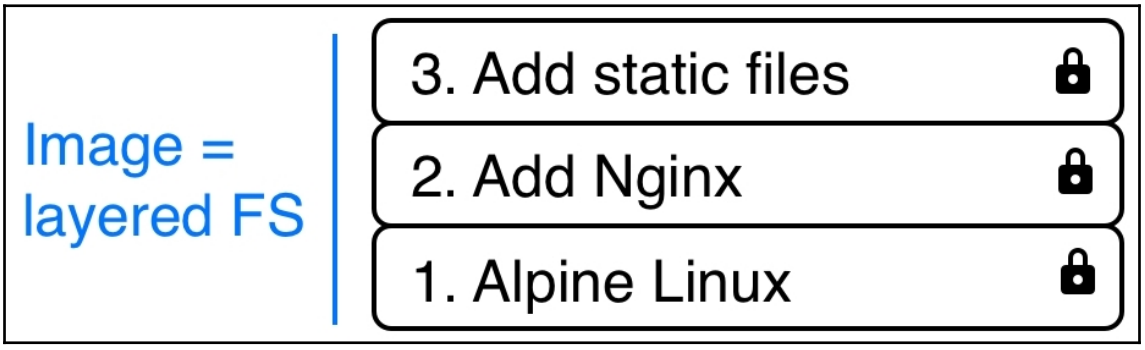

REST Interface
Docker engine
libcontainerd
libnetwork
graph
plugins
containerd + runc
Control Groups
cgroups
Namespaces
Pid, net, ipc, mnt, ufs
Layer Capabilities
Union Filesystem:
AUFS, Overlay, btrfs,
vfs, zfs*, DeviceMapper
Other OS
Functionality
Operating System

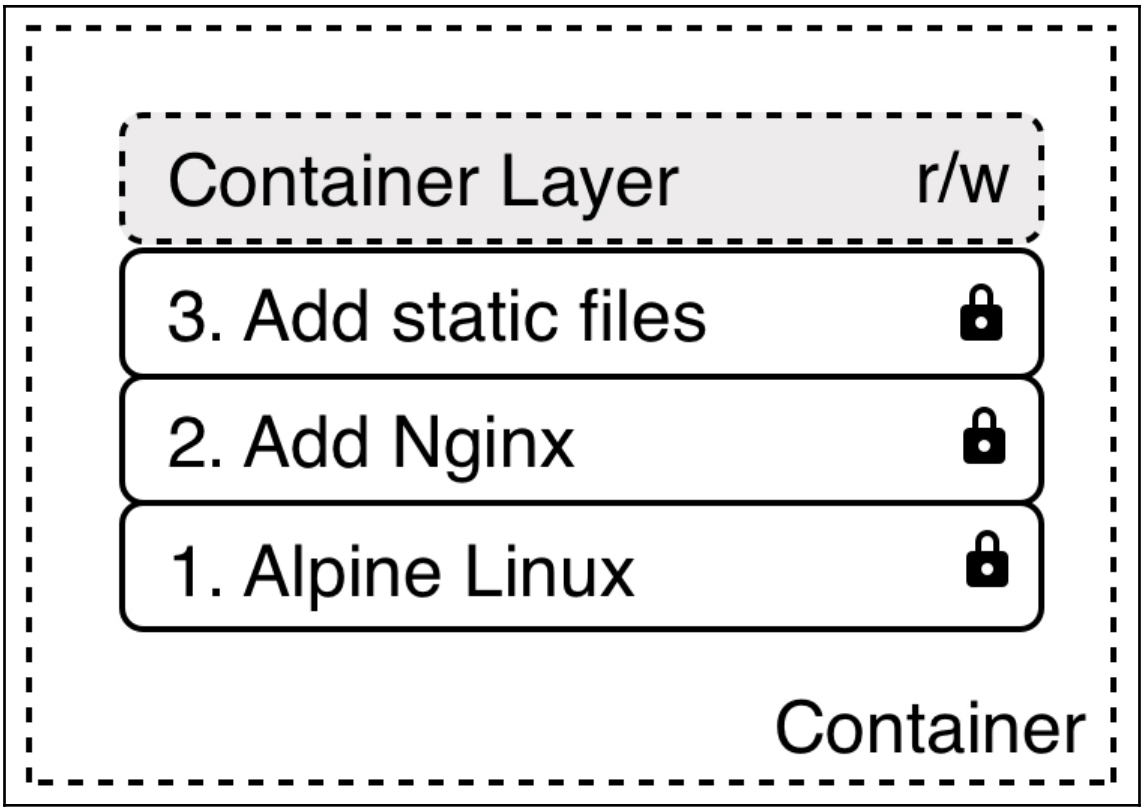

FS namespace 1
Host FS
Process A
Local FS
FS namespace 2
Process B
Local FS

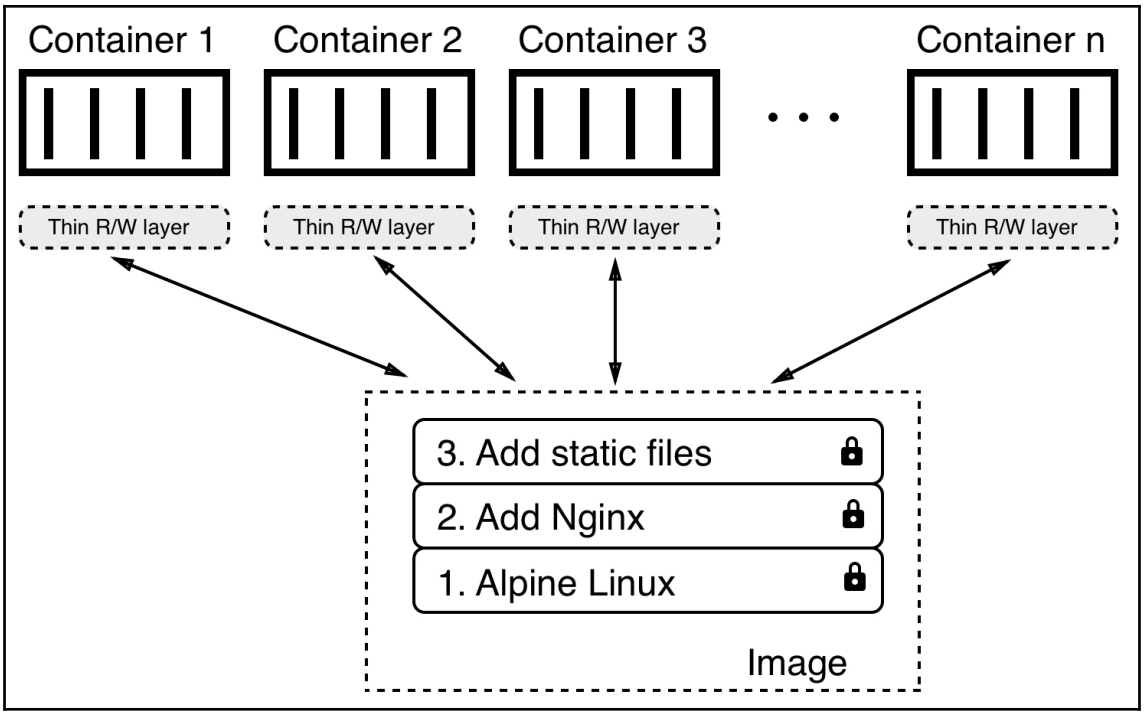

Parent PID Namespace
1
/sbin/init
121
/usr/bin/dockerd
154
docker-containerd
docker-containerd-shim
194
234
docker-containerd-shim
Containers
/usr/bin/java
334, 1
Child PID Namespace 1
267, 1
redis-server
Child PID Namespace 2

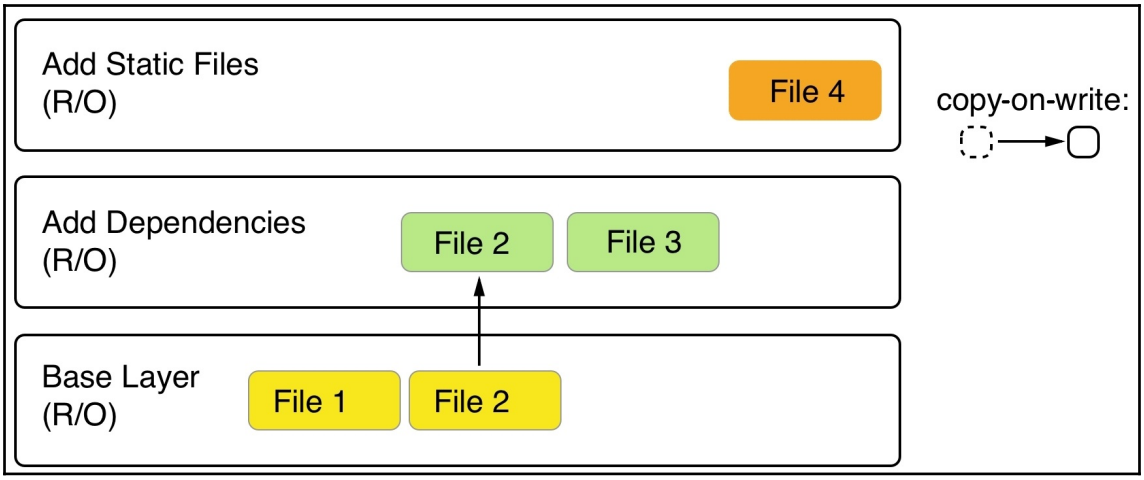
Chapter 4: Creating and Managing Container Images






Container Layer
r/w
3. Add static files
2. Add Nginx
1. Alpine Linux
Container

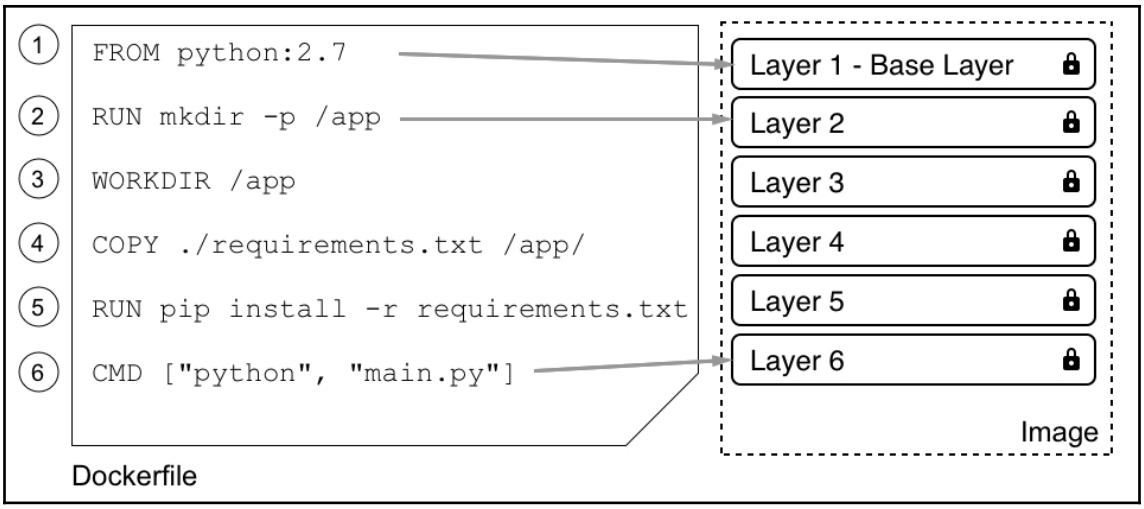

Container 1
Container 2
Container 3
Container n
Thin R/W layer
Thin R/W layer
Thin R/W layer
Thin R/W layer
3. Add static files
2. Add Nginx
1. Alpine Linux
Image

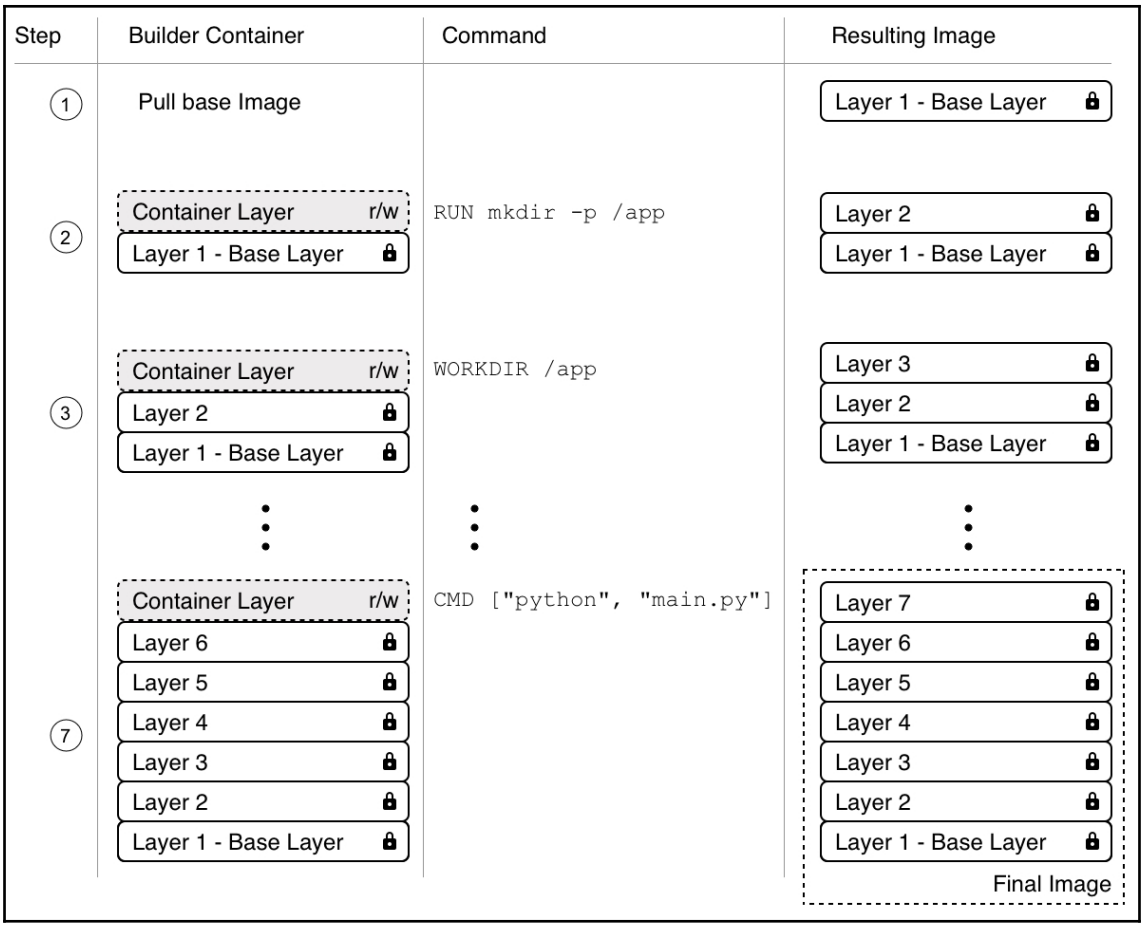

Add Static Files
(R/O)
File 4
copy-on-write:
Add Dependencies
(R/O)
File 2
File 3
Base Layer
(R/O)
File 1
File 2

```
/ # apk update && apk add iputils
fetch http://dl-cdn.alpinelinux.org/alpine/v3.10/main/x86_64/APKINDEX.tar.gz
fetch http://dl-cdn.alpinelinux.org/alpine/v3.10/community/x86_64/APKINDEX.tar.gz
v3.10.0-9-gf0bd10f20b [http://dl-cdn.alpinelinux.org/alpine/v3.10/main]
v3.10.0-8-gf1f49be1c7 [http://dl-cdn.alpinelinux.org/alpine/v3.10/community]
OK: 10327 distinct packages available
(1/2) Installing libcap (2.27-r0)
(2/2) Installing iputils (20180629-r1)
Executing busybox-1.30.1-r2.trigger
OK: 6 MiB in 16 packages
/ #
```

```
/ # ping -c 3 127.0.0.1
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
64 bytes from 127.0.0.1: icmp_seq=1 ttl=64 time=0.057 ms
64 bytes from 127.0.0.1: icmp_seq=2 ttl=64 time=0.064 ms
64 bytes from 127.0.0.1: icmp_seq=3 ttl=64 time=0.063 ms

--- 127.0.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 98ms
rtt min/avg/max/mdev = 0.057/0.061/0.064/0.007 ms
/ #
```

```
$ docker image history my-alpine
IMAGE               CREATED             CREATED BY                                      SIZE
ea57e53a92e5        5 minutes ago       /bin/sh                                         1.76MB
4d90542f0623        10 days ago         /bin/sh -c #(nop)  CMD ["/bin/sh"]              0B
<missing>           10 days ago         /bin/sh -c #(nop) ADD file:fef3b00b3ae63967d…   5.58MB
$
```

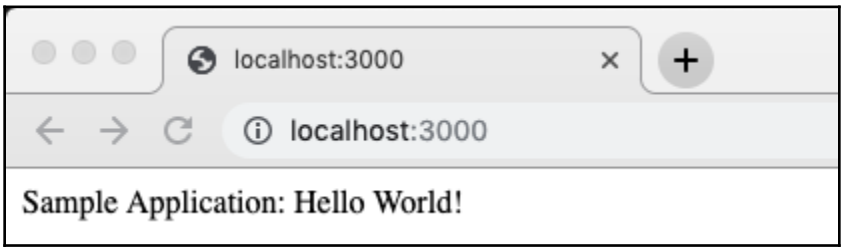

1
FROM python:2.7
2
RUN mkdir -p /app
3
WORKDIR /app
4
COPY ./requirements.txt /app/
5
RUN pip install -r requirements.txt
6
CMD ["python", "main.py"]
Dockerfile
Layer 1 - Base Layer
Layer 2
Layer 3
Layer 4
Layer 5
Layer 6
Image


Step
Builder Container
Command
Resulting Image
1
Pull base Image
Layer 1 - Base Layer
2
Container Layer r/w
Layer 1 - Base Layer
RUN mkdir -p /app
Layer 2
Layer 1 - Base Layer
3
Container Layer r/w
Layer 2
Layer 1 - Base Layer
WORKDIR /app
Layer 3
Layer 2
Layer 1 - Base Layer
7
Container Layer r/w
Layer 6
Layer 5
Layer 4
Layer 3
Layer 2
Layer 1 - Base Layer
CMD ["python", "main.py"]
Layer 7
Layer 6
Layer 5
Layer 4
Layer 3
Layer 2
Layer 1 - Base Layer
Final Image

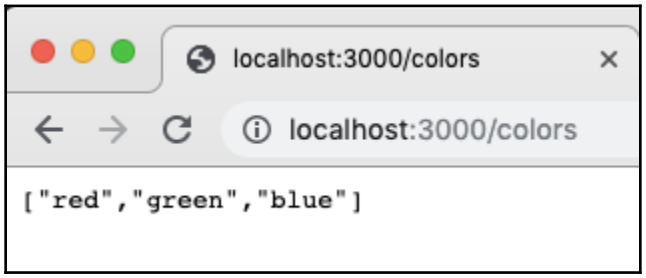
Chapter 5: Data Volumes and Configuration

```
$ docker-machine ssh node-1
   ( '>')
  /) TC (\   Core is distributed with ABSOLUTELY NO WARRANTY.
 (/-_--_-\)           www.tinycorelinux.net

docker@node-1:~$
```

Chapter 6: Debugging Code Running in Containers

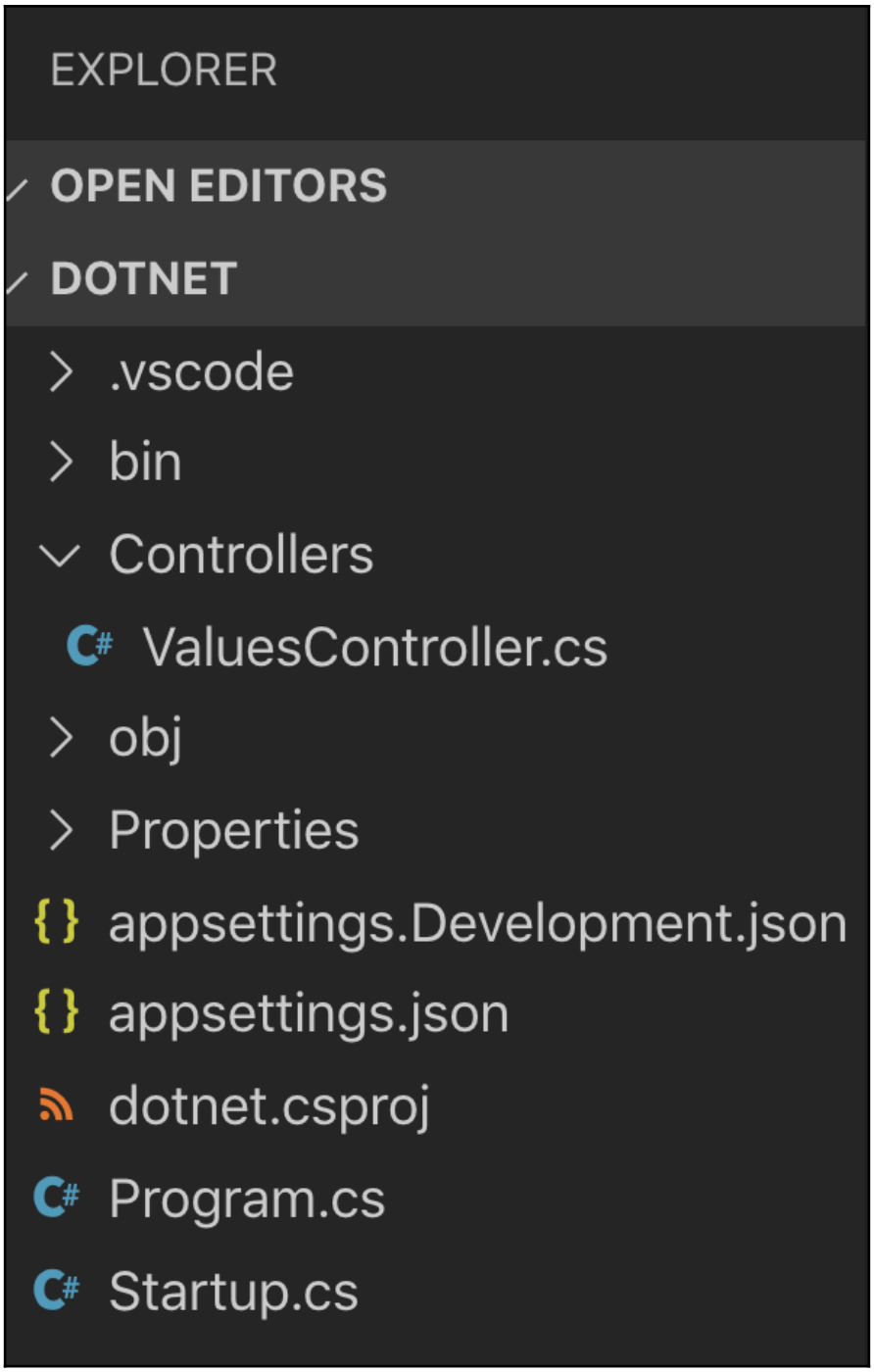



```
$ nodemon
[nodemon] 1.17.2
[nodemon] to restart at any time, enter `rs`
[nodemon] watching: *.*
[nodemon] starting `node index.js`
Application listening at 0.0.0.0:3000
```



```
$ nodemon main.py
[nodemon] 1.17.2
[nodemon] to restart at any time, enter `rs`
[nodemon] watching: *.*
[nodemon] starting `python main.py`
 * Serving Flask app "main" (lazy loading)
 * Environment: production
   WARNING: Do not use the development server in a production environment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

```
[nodemon] restarting due to changes...
[nodemon] starting `python main.py`
 * Serving Flask app "main" (lazy loading)
 * Environment: production
   WARNING: Do not use the development server in a production environment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```


EXPLORER
OPEN EDITORS
DOTNET
.vscode
bin
Controllers
ValuesController.cs
obj
Properties
appsettings.Development.json
appsettings.json
dotnet.csproj
Program.cs
Startup.cs

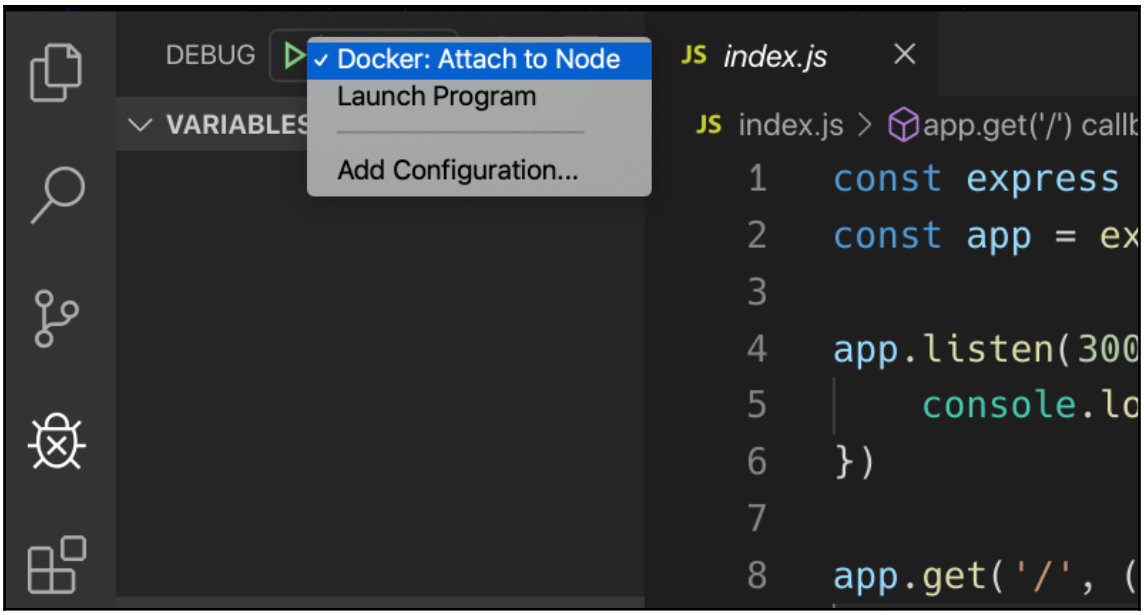
```
$ dotnet run
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/Users/gabriel/.aspnet/DataProtection-Keys' as key
repository; keys will not be encrypted at rest.
Hosting environment: Development
Content root path: /Users/gabriel/fod/ch06/dotnet
Now listening on: https://localhost:5001
Now listening on: http://localhost:5000
Application started. Press Ctrl+C to shut down.
```

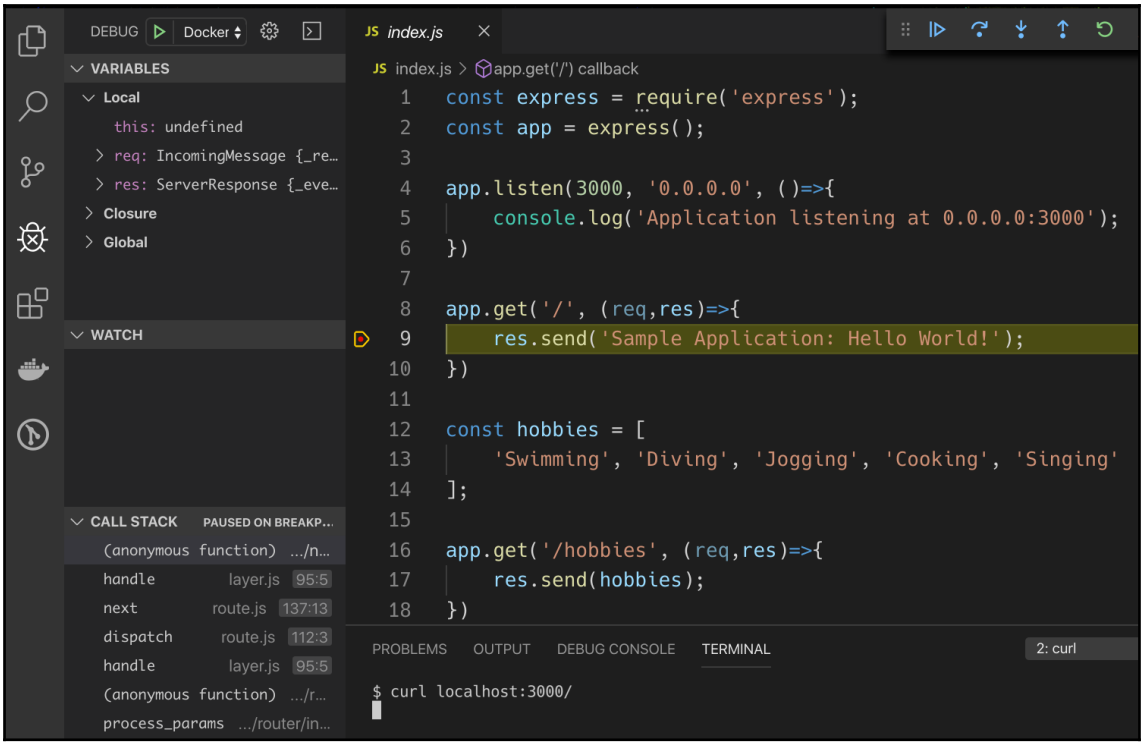
```
$ dotnet watch run
watch : Started
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/Users/gabriel/.aspnet/DataProtection-Keys' as key
repository; keys will not be encrypted at rest.
Hosting environment: Development
Content root path: /Users/gabriel/fod/ch06/dotnet
Now listening on: https://localhost:5001
Now listening on: http://localhost:5000
Application started. Press Ctrl+C to shut down.
```

```
Application is shutting down...
watch : Exited
watch : File changed: /Users/gabriel/fod/ch06/dotnet/Controllers/ValuesController.cs
watch : Started
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/Users/gabriel/.aspnet/DataProtection-Keys' as key
repository; keys will not be encrypted at rest.
Hosting environment: Development
Content root path: /Users/gabriel/fod/ch06/dotnet
Now listening on: https://localhost:5001
Now listening on: http://localhost:5000
Application started. Press Ctrl+C to shut down.
```

```
$ docker container run --rm -it \
>     -p 3000:3000 \
>     -v $(pwd):/app \
>     sample-app-dotnet
        Polling file watcher is enabled
        Started
: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/root/.aspnet/DataProtection-Keys' as key repositor
y; keys will not be encrypted at rest.
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[58]
      Creating key {313859e0-5e04-4ffc-84c6-35695a63df3d} with creation date 2019-08-26 07:
46:02Z, activation date 2019-08-26 07:46:02Z, and expiration date 2019-11-24 07:46:02Z.
warn: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[35]
      No XML encryptor configured. Key {313859e0-5e04-4ffc-84c6-35695a63df3d} may be persis
ted to storage in unencrypted form.
info: Microsoft.AspNetCore.DataProtection.Repositories.FileSystemXmlRepository[39]
      Writing data to file '/root/.aspnet/DataProtection-Keys/key-313859e0-5e04-4ffc-84c6-3
5695a63df3d.xml'.
Hosting environment: Development
Content root path: /app
Now listening on: http://0.0.0.0:3000
Application started. Press Ctrl+C to shut down.
```

```
Application is shutting down...
        Exited
        File changed: /app/Controllers/ValuesController.cs
        Started
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/root/.aspnet/DataProtection-Keys' as key repositor
y; keys will not be encrypted at rest.
Hosting environment: Development
Content root path: /app
Now listening on: http://0.0.0.0:3000
Application started. Press Ctrl+C to shut down.
```

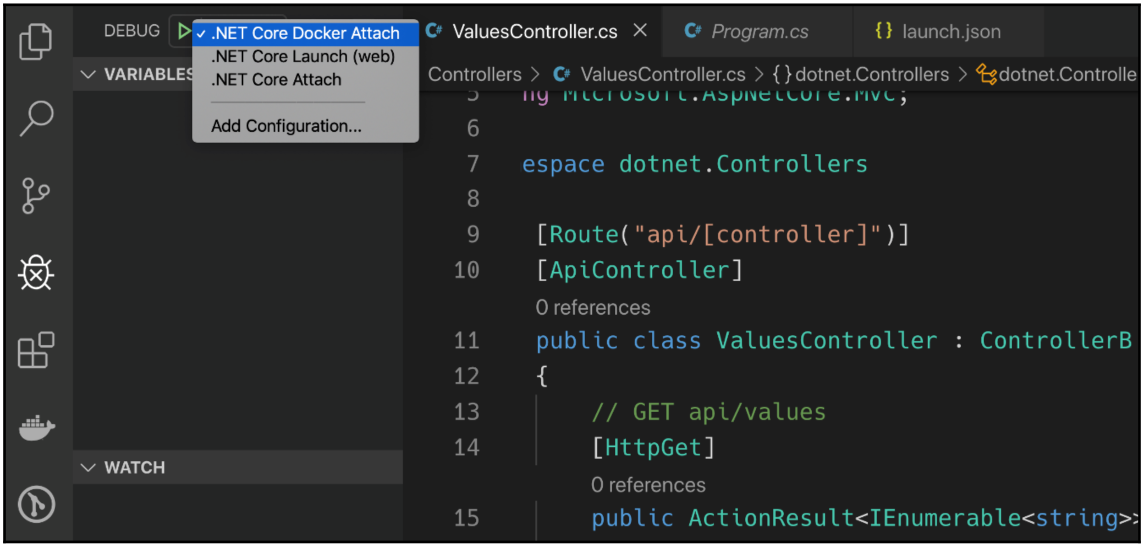

DEBUG
Docker: Attach to Node
Launch Program
Add Configuration...
VARIABLES
index.js
app.get('/') callb
const express
const app = ex
app.listen(300
console.lo
})
app.get('/', (

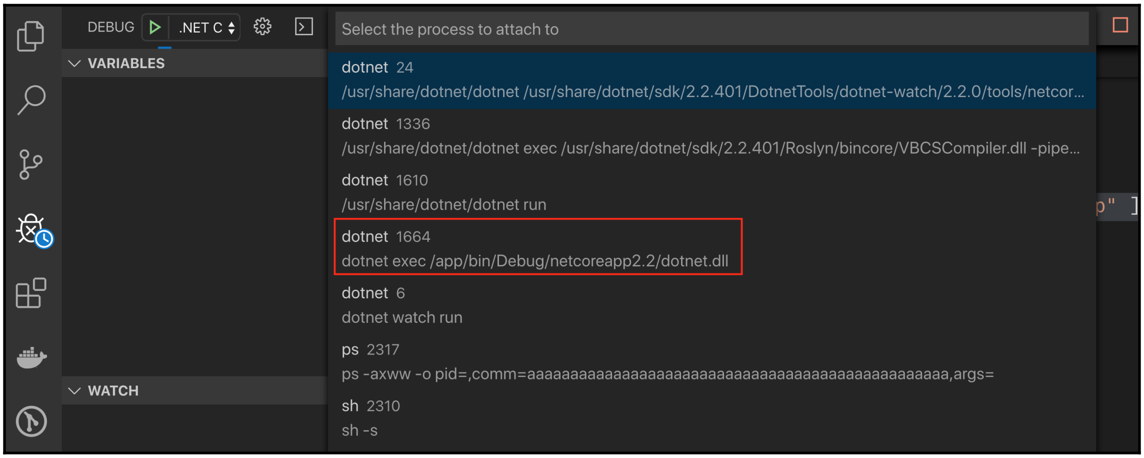

DEBUG
Docker
index.js
index.js > app.get('/') callback
VARIABLES
Local
this: undefined
req: IncomingMessage {_re…
res: ServerResponse {_eve…
Closure
Global
WATCH
CALL STACK
PAUSED ON BREAKP…
(anonymous function) …/n…
handle layer.js 95:5
next route.js 137:13
dispatch route.js 112:3
handle layer.js 95:5
(anonymous function) …/r…
process_params …/router/in…
const express = require('express');
const app = express();
app.listen(3000, '0.0.0.0', ()=>{
console.log('Application listening at 0.0.0.0:3000');
})
app.get('/', (req,res)=>{
res.send('Sample Application: Hello World!');
})
const hobbies = [
'Swimming', 'Diving', 'Jogging', 'Cooking', 'Singing'
];
app.get('/hobbies', (req,res)=>{
res.send(hobbies);
})
PROBLEMS
OUTPUT
DEBUG CONSOLE
TERMINAL
2: curl
$ curl localhost:3000/

```
$ docker container run --rm -it \
>     --name my-sample-app \
>     -p 3000:3000 \
>     -p 9229:9229 \
>     -v $(pwd):/app \
>     sample-app-dev nodemon --inspect=0.0.0.0 index.js
[nodemon] 1.19.1
[nodemon] to restart at any time, enter `rs`
[nodemon] watching: *.*
[nodemon] starting `node --inspect=0.0.0.0 index.js`
Debugger listening on ws://0.0.0.0:9229/6605853f-d28f-4d95-85b0-3aa17af83481
For help, see: https://nodejs.org/en/docs/inspector
Application listening at 0.0.0.0:3000
```

```
[nodemon] restarting due to changes...
[nodemon] starting `node --inspect=0.0.0.0 index.js`
Debugger listening on ws://0.0.0.0:9229/39da95bc-ca6e-4132-b6ea-e7f8c4aa5673
For help, see: https://nodejs.org/en/docs/inspector
Debugger attached.
Application listening at 0.0.0.0:3000
```

```
root@sdk:/app# dotnet run
: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/root/.aspnet/DataProtection-Keys' as key repository; keys will not
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[58]
      Creating key {4e83d14c-8e31-4c73-a6b5-189cc6c6505e} with creation date 2019-08-29 13:51:36Z, activatio
tion date 2019-11-27 13:51:36Z.
warn: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[35]
      No XML encryptor configured. Key {4e83d14c-8e31-4c73-a6b5-189cc6c6505e} may be persisted to storage in
info: Microsoft.AspNetCore.DataProtection.Repositories.FileSystemXmlRepository[39]
      Writing data to file '/root/.aspnet/DataProtection-Keys/key-4e83d14c-8e31-4c73-a6b5-189cc6c6505e.xml'.
Hosting environment: Development
Content root path: /app
Now listening on: http://0.0.0.0:3000
Application started. Press Ctrl+C to shut down.
```


DEBUG
✓ .NET Core Docker Attach
.NET Core Launch (web)
.NET Core Attach
Add Configuration...
VARIABLES
WATCH
ValuesController.cs
Program.cs
launch.json
Controllers > ValuesController.cs > {} dotnet.Controllers > dotnet.Controlle
6
7 espace dotnet.Controllers
8
9 [Route("api/[controller]")]
10 [ApiController]
0 references
11 public class ValuesController : ControllerB
12 {
13 // GET api/values
14 [HttpGet]
0 references
15 public ActionResult<IEnumerable<string>>


DEBUG
.NET C
VARIABLES
WATCH
Select the process to attach to
dotnet 24
/usr/share/dotnet/dotnet /usr/share/dotnet/sdk/2.2.401/DotnetTools/dotnet-watch/2.2.0/tools/netcor...
dotnet 1336
/usr/share/dotnet/dotnet exec /usr/share/dotnet/sdk/2.2.401/Roslyn/bincore/VBCSCompiler.dll -pipe...
dotnet 1610
/usr/share/dotnet/dotnet run
dotnet 1664
dotnet exec /app/bin/Debug/netcoreapp2.2/dotnet.dll
dotnet 6
dotnet watch run
ps 2317
ps -axww -o pid=,comm=aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaa,args=
sh 2310
sh -s

```
namespace dotnet.Controllers
{
    [Route("api/[controller]")]
    [ApiController]
    public class ValuesController : ControllerBase
    {
        // GET api/values
        [HttpGet]
        public ActionResult<IEnumerable<string>> Get()
        {
            return new string[] { "value1", "value2", "value3", "value4" };
        }
```

```
import logging

logger = logging.getLogger("Sample App")
logger.setLevel(logging.WARN)
# create a console handler
ch = logging.StreamHandler()
# create a formatter and add it to the handlers
formatter = logging.Formatter('%(asctime)s - %(name)s - %(levelname)s - %(message)s')
ch.setFormatter(formatter)
logger.addHandler(ch)
```

```
@app.route("/")
def hello():
    logger.info("Accessing endpoint '/'")
    return "Hello World!"
```

```
@app.route("/colors")
def colors():
    logger.warning("Warning, you are accessing /colors")
    return jsonify(["red", "green", "blue"])
```

```
$ python main.py
 * Serving Flask app "main" (lazy loading)
 * Environment: production
   WARNING: Do not use the development server in a production environment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
127.0.0.1 - - [06/Sep/2019 11:06:57] "GET / HTTP/1.1" 200 -
2019-09-06 11:07:04,466 - Sample App - WARNING - Warning, you are accessing /colors
127.0.0.1 - - [06/Sep/2019 11:07:04] "GET /colors HTTP/1.1" 200 -
```

```
                1 reference
20          public static IWebHostBuilder CreateWebHostBuilder(string[] args) =>
21              WebHost.CreateDefaultBuilder(args)
22                  .UseUrls("http://0.0.0.0:3000")
23                  .UseStartup<Startup>();
```

```
10      [Route("api/[controller]")]
11      [ApiController]
            1 reference
12      public class ValuesController : ControllerBase
13      {
                1 reference
14          private readonly ILogger _logger;
            0 references
15          public ValuesController(ILogger<ValuesController> logger){
16              _logger = logger;
17          }
18
```

```
19          // GET api/values
20          [HttpGet]
            0 references
21          public ActionResult<IEnumerable<string>> Get()
22          {
23              _logger.LogInformation("Getting a list of values");
24              return new string[] { "value1", "value2", "value3", "value4" };
25          }
```

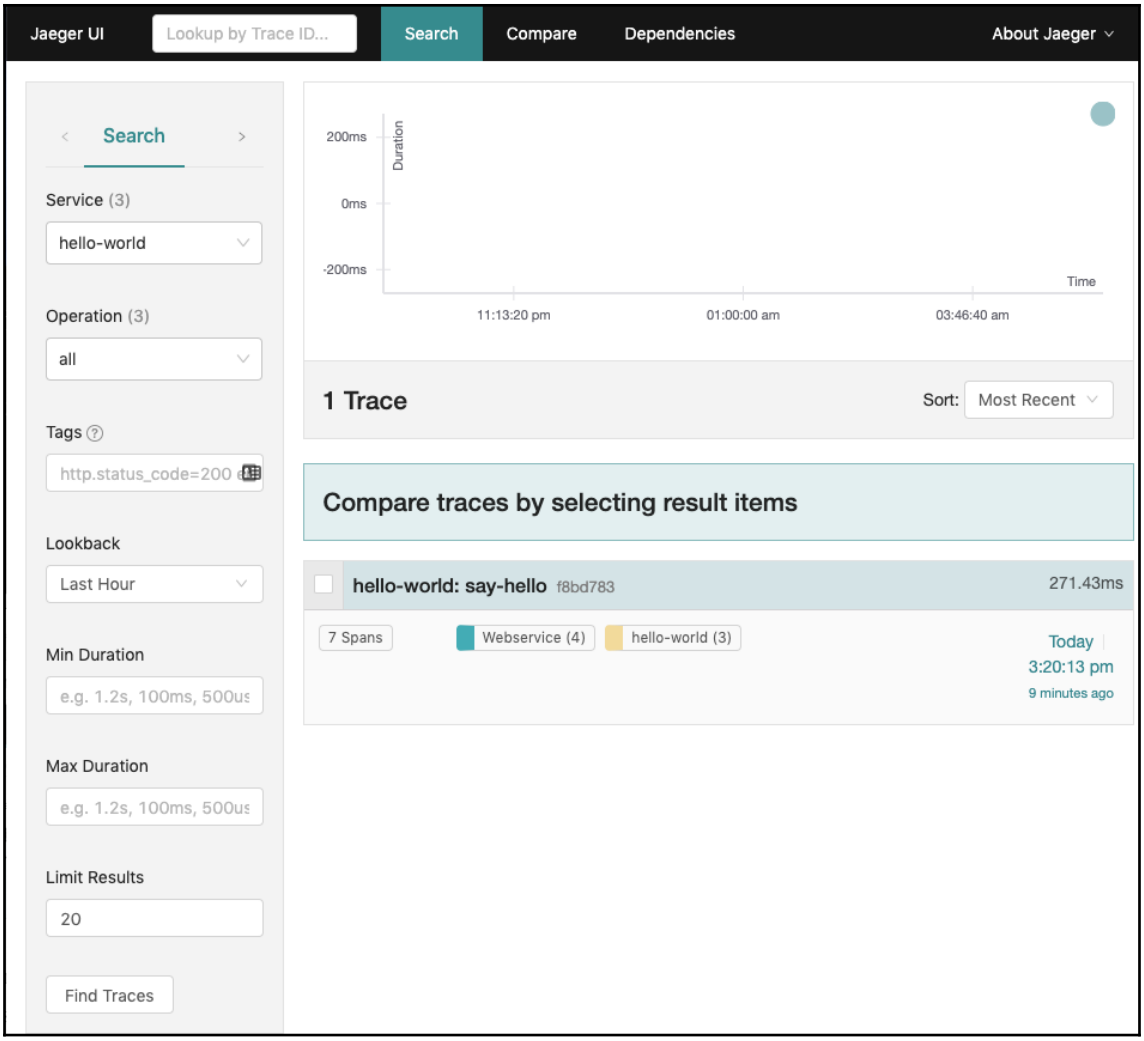
```
29          public ActionResult<string> Get(int id)
30          {
31              _logger.LogDebug($"Entering endpoint api/values/{id}");
32              if(id > 4 || id < 1){
33                  _logger.LogError($"You entered an invalid id ({id})");
34                  return NotFound("Value not found!");
35              }
36              return "value" + id;
37          }
```

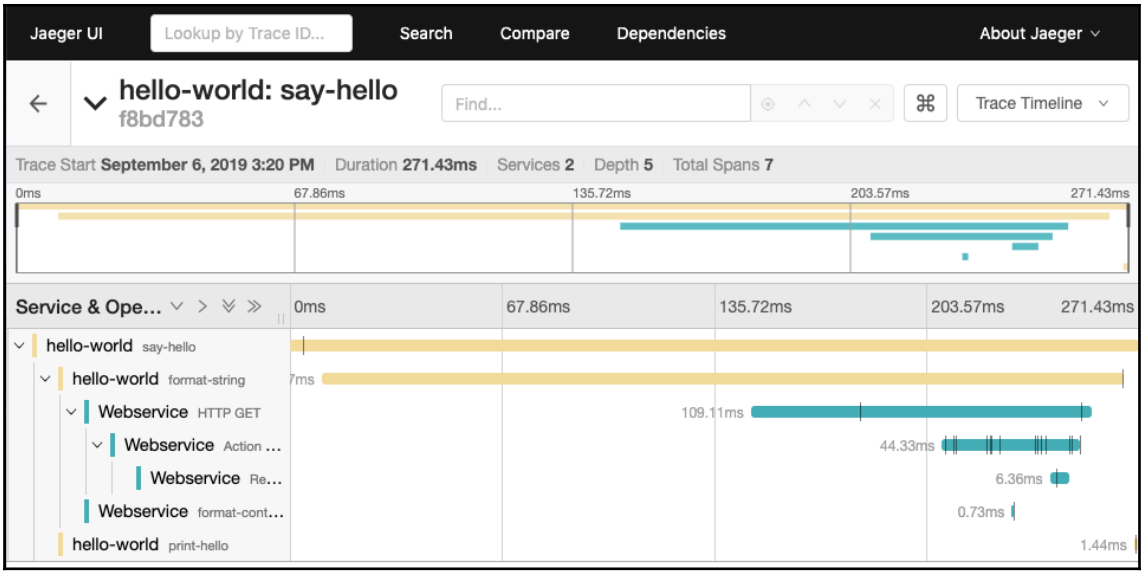
```
Application started. Press Ctrl+C to shut down.
info: Microsoft.AspNetCore.Hosting.Internal.WebHost[1]
      Request starting HTTP/1.1 GET http://localhost:3000/api/values
warn: Microsoft.AspNetCore.HttpsPolicy.HttpsRedirectionMiddleware[3]
      Failed to determine the https port for redirect.
info: Microsoft.AspNetCore.Routing.EndpointMiddleware[0]
      Executing endpoint 'dotnet.Controllers.ValuesController.Get (dotnet)'
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[3]
      Route matched with {action = "Get", controller = "Values"}. Executing controller action with signature M
lections.Generic.IEnumerable`1[System.String]] Get() on controller dotnet.Controllers.ValuesController (dotnet
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[1]
      Executing action method dotnet.Controllers.ValuesController.Get (dotnet) - Validation state: Valid
info: dotnet.Controllers.ValuesController[0]
      Getting a list of values
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[2]
      Executed action method dotnet.Controllers.ValuesController.Get (dotnet), returned result Microsoft.AspNe
info: Microsoft.AspNetCore.Mvc.Infrastructure.ObjectResultExecutor[1]
      Executing ObjectResult, writing value of type 'System.String[]'.
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[2]
      Executed action dotnet.Controllers.ValuesController.Get (dotnet) in 58.769ms
info: Microsoft.AspNetCore.Routing.EndpointMiddleware[1]
      Executed endpoint 'dotnet.Controllers.ValuesController.Get (dotnet)'
info: Microsoft.AspNetCore.Hosting.Internal.WebHost[2]
      Request finished in 115.4346ms 200 application/json; charset=utf-8
_
```

```
      Route matched with {action = "Get", controller = "Values"}. Executing controller action with signature M
ing] Get(Int32) on controller dotnet.Controllers.ValuesController (dotnet).
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[1]
      Executing action method dotnet.Controllers.ValuesController.Get (dotnet) - Validation state: Valid
dbug: dotnet.Controllers.ValuesController[0]
      Entering endpoint api/values/10
fail: dotnet.Controllers.ValuesController[0]
      You entered an invalid id (10)
info: Microsoft.AspNetCore.Mvc.Internal.ControllerActionInvoker[2]
      Executed action method dotnet.Controllers.ValuesController.Get (dotnet), returned result Microsoft.AspNe
info: Microsoft.AspNetCore.Mvc.Infrastructure.ObjectResultExecutor[1]
      Executing ObjectResult, writing value of type 'System.String'.
```

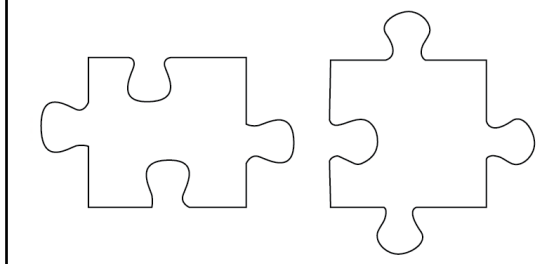
```
$ cd ~/fod/ch06/jaeger-sample/api/
$ dotnet run
info: Jaeger.Configuration[0]
      Initialized Tracer(ServiceName=Webservice, Version=CSharp-0.3.4.0, Reporter=CompositeReporter(Reporters
ftUdpClientTransport(Client=127.0.0.1:6831))), LoggingReporter(Logger=Microsoft.Extensions.Logging.Logger`1[J
ampler(True), IPv4=-1062731412, Tags=[jaeger.version, CSharp-0.3.4.0], [hostname, gabriel.home], [ip, 192.168
nLogs=False, UseTraceId128Bit=False)
info: Microsoft.AspNetCore.DataProtection.KeyManagement.XmlKeyManager[0]
      User profile is available. Using '/Users/gabriel/.aspnet/DataProtection-Keys' as key repository; keys
Hosting environment: Development
Content root path: /Users/gabriel/fod/ch06/jaeger-sample/api
Now listening on: http://0.0.0.0:5000
Application started. Press Ctrl+C to shut down.
```

```
$ cd ~/fod/ch06/jaeger-sample/client
$ dotnet run Gabriel Bonjour
info: Jaeger.Configuration[0]
      Initialized Tracer(ServiceName=hello-world, Version=CSharp-0.3.4.0, Reporter=CompositeReporter(Reporters=F
iftUdpClientTransport(Client=127.0.0.1:6831))), LoggingReporter(Logger=Microsoft.Extensions.Logging.Logger`1[Jae
Sampler(True), IPv4=-1062731412, Tags=[jaeger.version, CSharp-0.3.4.0], [hostname, gabriel.home], [ip, 192.168.1
onLogs=False, UseTraceId128Bit=False)
info: Jaeger.Reporters.LoggingReporter[0]
      Span reported: f8bd7830651cd37a:973bfb0ef5f20988:f8bd7830651cd37a:1 - format-string
info: FundamentalsOfDocker.ch06.Hello[0]
      Bonjour, Gabriel!
info: Jaeger.Reporters.LoggingReporter[0]
      Span reported: f8bd7830651cd37a:c9af56356275a115:f8bd7830651cd37a:1 - print-hello
info: Jaeger.Reporters.LoggingReporter[0]
      Span reported: f8bd7830651cd37a:f8bd7830651cd37a:0:1 - say-hello
$
```

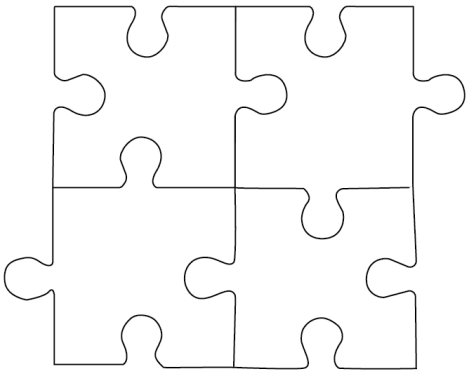

Jaeger UI
Lookup by Trace ID...
Search
Compare
Dependencies
About Jaeger
Search
Service (3)
hello-world
Operation (3)
all
Tags
http.status_code=200 e
Lookback
Last Hour
Min Duration
e.g. 1.2s, 100ms, 500us
Max Duration
e.g. 1.2s, 100ms, 500us
Limit Results
20
Find Traces
200ms
0ms
-200ms
Duration
Time
11:13:20 pm
01:00:00 am
03:46:40 am
1 Trace
Sort:
Most Recent
Compare traces by selecting result items
hello-world: say-hello
f8bd783
271.43ms
7 Spans
Webservice (4)
hello-world (3)
Today
3:20:13 pm
9 minutes ago


Jaeger UI
Lookup by Trace ID...
Search
Compare
Dependencies
About Jaeger
hello-world: say-hello
f8bd783
Find...
Trace Timeline
Trace Start September 6, 2019 3:20 PM
Duration 271.43ms
Services 2
Depth 5
Total Spans 7
0ms
67.86ms
135.72ms
203.57ms
271.43ms
Service & Ope...
hello-world say-hello
hello-world format-string
Webservice HTTP GET
Webservice Action ...
Webservice Re...
Webservice format-cont...
hello-world print-hello
109.11ms
44.33ms
6.36ms
0.73ms
1.44ms

Chapter 7: Using Docker to Supercharge Automation

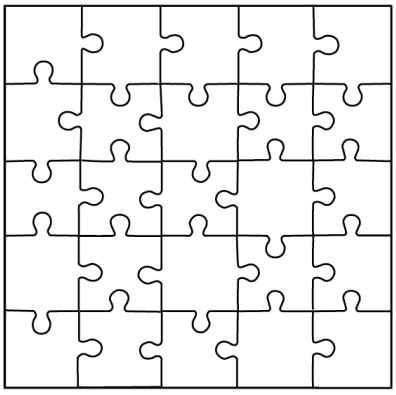


Unit Testing

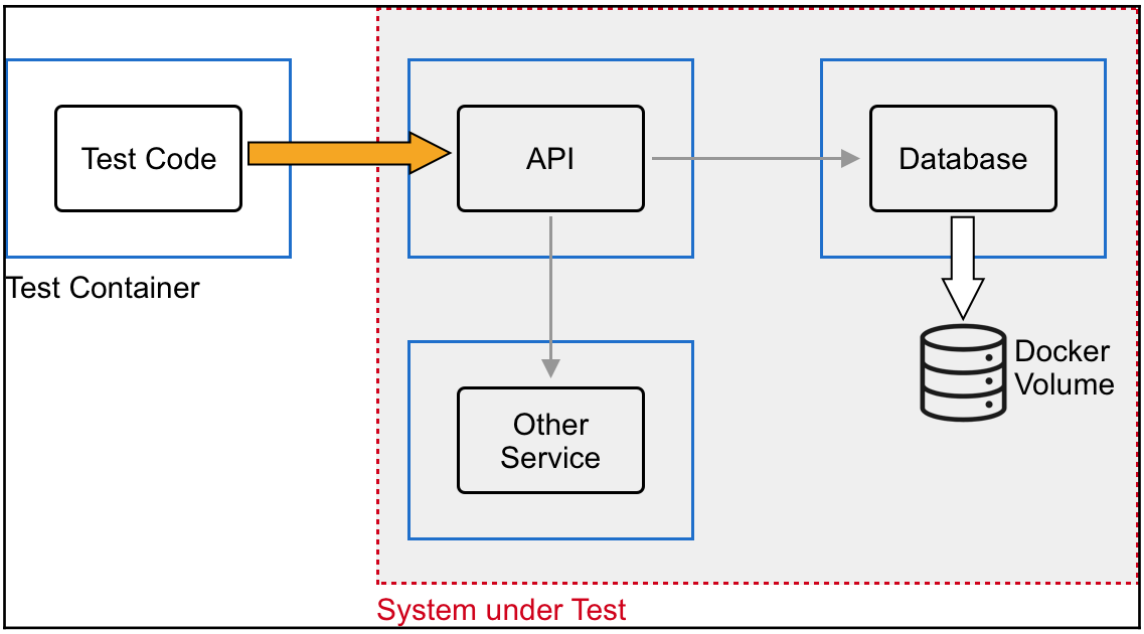


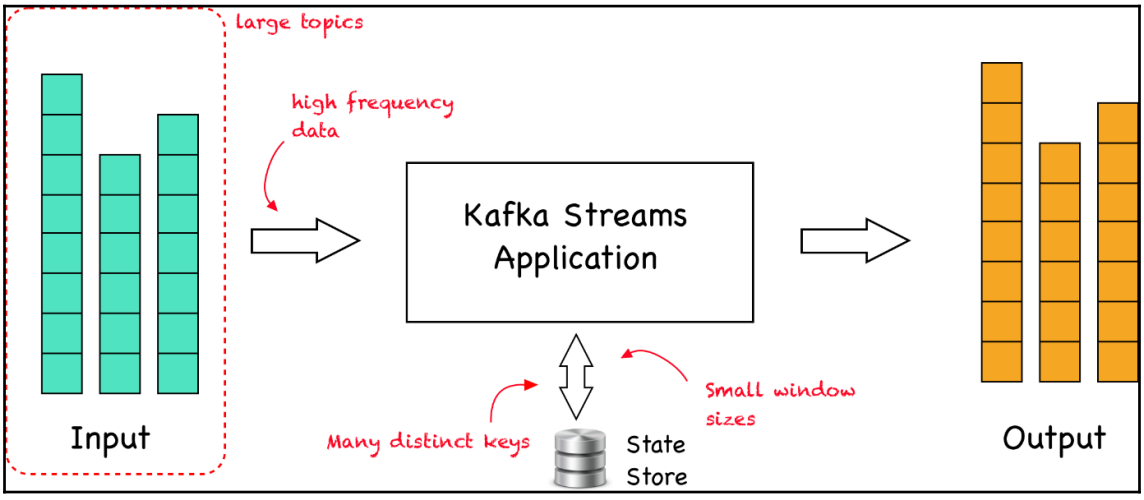
Integration Testing

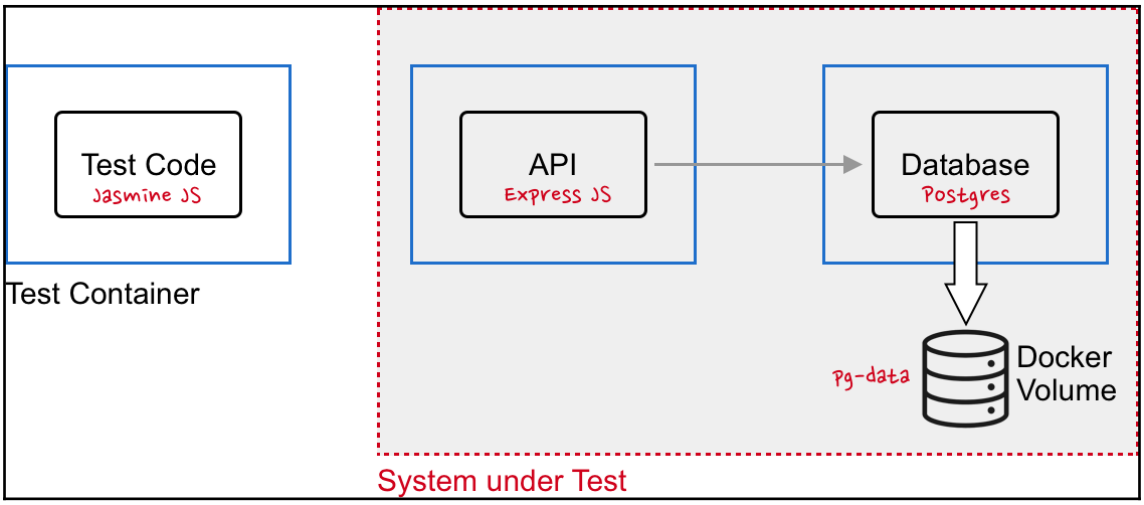
Stress & Load Testing



End-2-end Testing


Test Code
API
Database
Test Container
Docker
Volume
Other
Service
System under Test


large topics
high frequency
data
Kafka Streams
Application
Small window
sizes
Many distinct keys
State
Store
Input
Output




```
6   "scripts": {
7     "start": "node index.js",
8     "test": "echo \"Error: no test specified\" && exit 1"
9   },
```

```
12  "dependencies": {
13    "express": "^4.17.1"
14  }
```

```
1   const express = require('express');
2   const app = express();
3
4   app.listen(3000, '0.0.0.0', () => {
5       console.log('Application listening at 0.0.0.0:3000');
6   })
7
8   app.get('/', (req, res) => {
9       res.send('Sample API');
10  })
```

```
6     "scripts": {
7       "test": "jasmine"
8     },
```

```
$ npm test

> tests@1.0.0 test /Users/gabriel/fod/ch07/integration-test-node/tests
> jasmine

Randomized with seed 07145
Started


No specs found
Finished in 0.002 seconds
Incomplete: No specs found
Randomized with seed 07145 (jasmine --random=true --seed=07145)
npm ERR! Test failed.  See above for more details.
```

```
var request = require("request");

const base_url = process.env.BASE_URL || 'http://localhost:3000'

describe("API test suite", () => {
    desc any "GET /", () => {
        it("returns status code 200", function(done) {
            request.get(base_url, (error, response, body) => {
                expect(response.statusCode).toBe(200);
                done();
            });
        });
        it("returns description", () => {
            request.get(base_url, (error, response, body) => {
                expect(body).toBe("Sample API");
                done();
            });
        });
    });
});
```

```
$ npm test

> tests@1.0.0 test /Users/gabriel/fod/ch07/integration-test-node/tests
> jasmine

Started
..


2 specs, 0 failures
Finished in 0.023 seconds
```

```
{
  "name": "testcontainers-node",
  "version": "1.0.0",
  "main": "server.js",
  "scripts": {
    "start": "node server.js"
  },
  "license": "ISC",
  "dependencies": {
    "express": "^4.17.1",
    "pg": "^7.12.1"
  }
}
```

```
const express = require('express');
const app = express();

const host = process.env.DB_HOST || 'localhost'
const port = process.env.DB_PORT || '5432'
console.log("Database is at: %s:%s", host,  port)

const { Pool } = require('pg')
const pool = new Pool({
    user: 'dbuser',
    host: host,
    database: 'sample-db',
    password: 'secretpassword',
    port: parseInt(port),
})

app.listen(3000, '0.0.0.0', () => {
    console.log('Application listening at 0.0.0.0:3000');
})

app.get('/hobbies', async (req, res) => {
    const result = await pool.query('SELECT hobby FROM hobbies')
    res.send(result.rows );
})
```

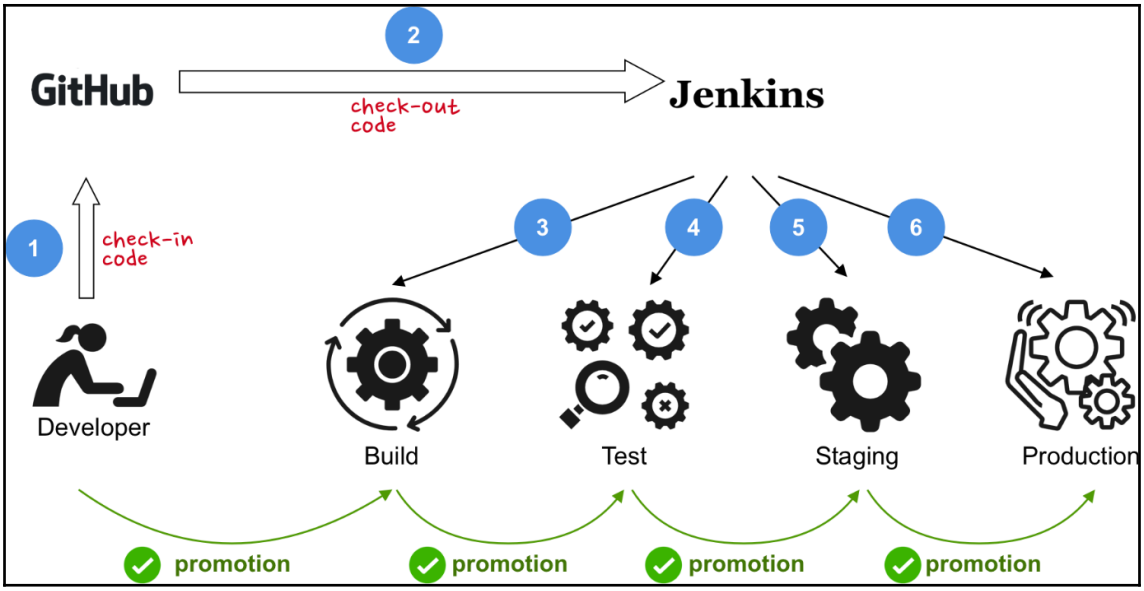
```
FROM node:alpine
WORKDIR /usr/src/app
COPY package.json ./
RUN npm install
COPY . .
EXPOSE 3000
CMD npm start
```

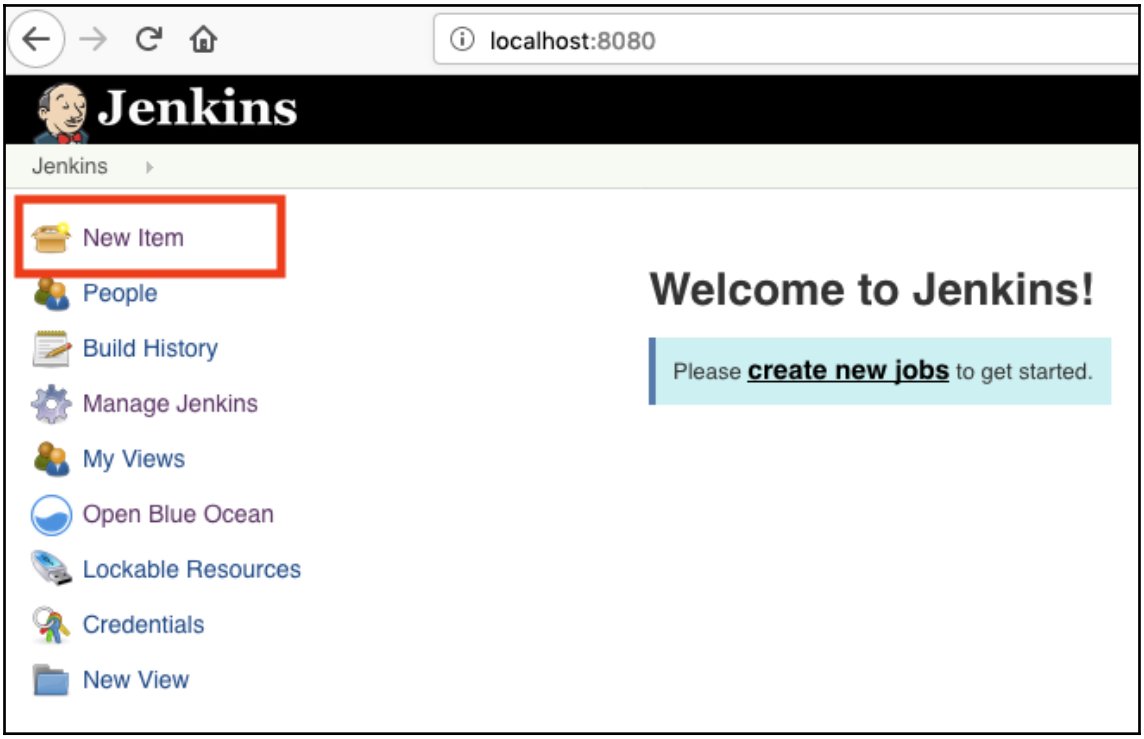
{} package.json ×

ch07 > testcontainers-node > tests > {} package.json > {} scripts

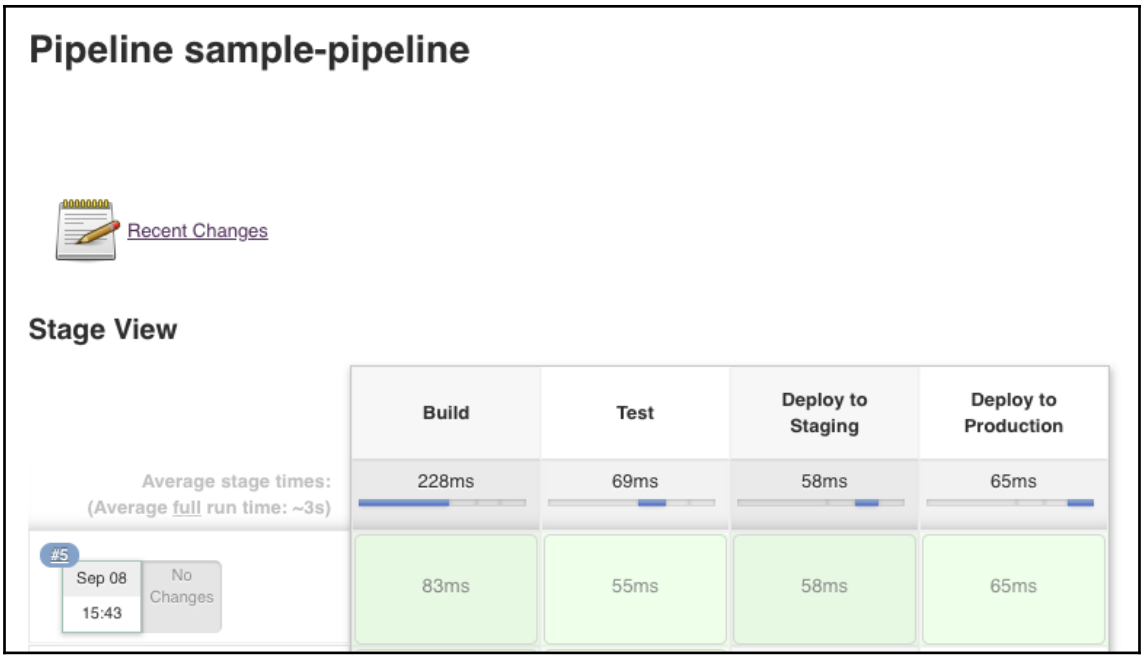
```
{
  "name": "tests",
  "version": "1.0.0",
  "description": "",
  "main": "tests.js",
  "scripts": {
    "test": "echo \"Error: no test specified\" && exit 1"
  },
  "author": "Gabriel N. Schenker",
  "license": "ISC",
  "devDependencies": {
    "testcontainers": "^2.0.0",
    "request": "^2.88.0"
  }
}
```

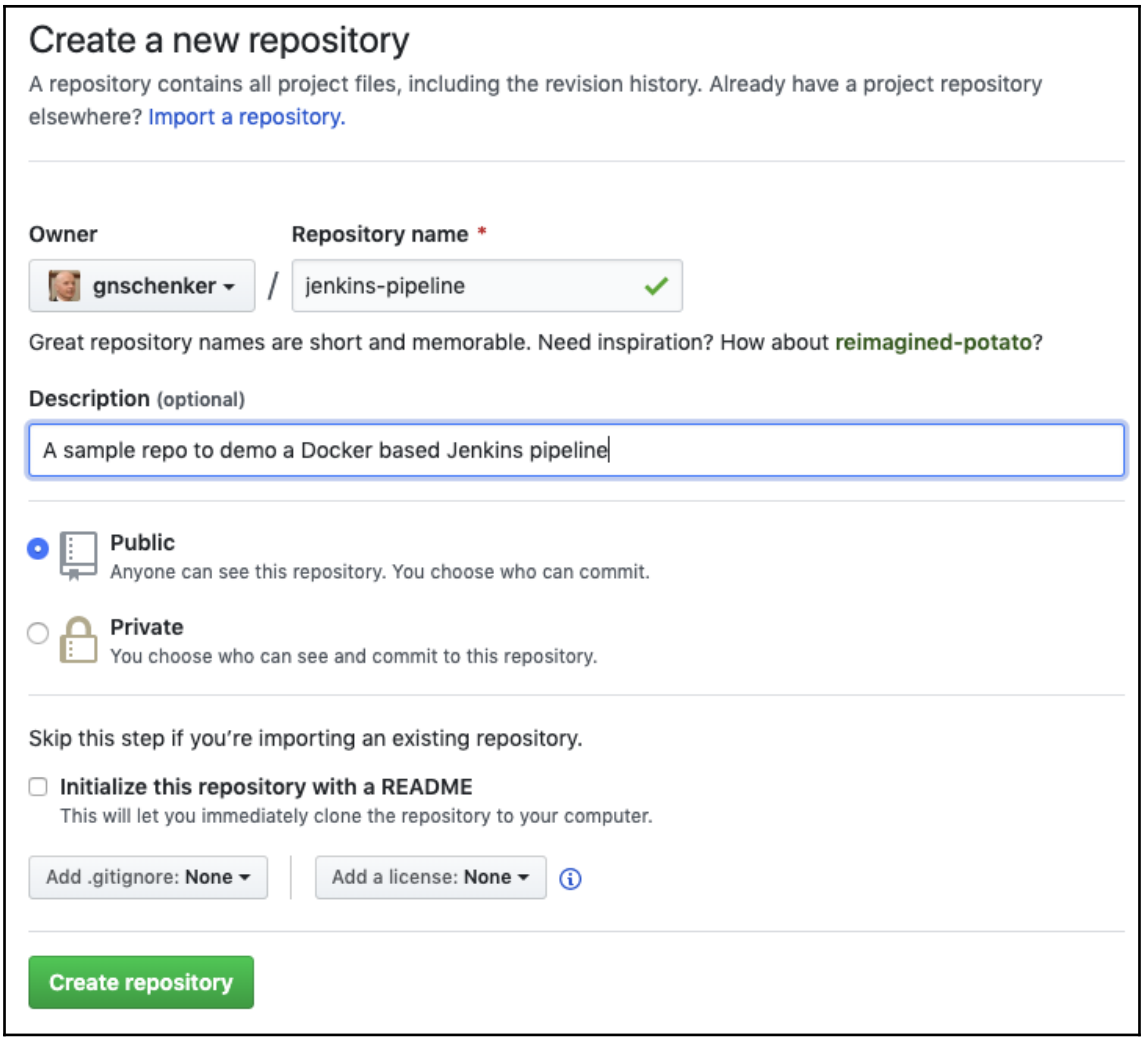
```
$ node tests.js
Starting Postgres...
Postgres listening at host port: 51726
My IP4 is: 192.168.1.108
Building API container image...
Image name is: 4ea3ddfbd4f2e9ce6957cf4b4d96f929:fd16b1ece26e863be4884c13a09a1d17
Starting API container...
API listening at host port 51728
API base URL: http://localhost:51728
> expecting status code 200
> expecting length of hobbies == 5
> expecting first hobby == swimming
Cleaning up...
```

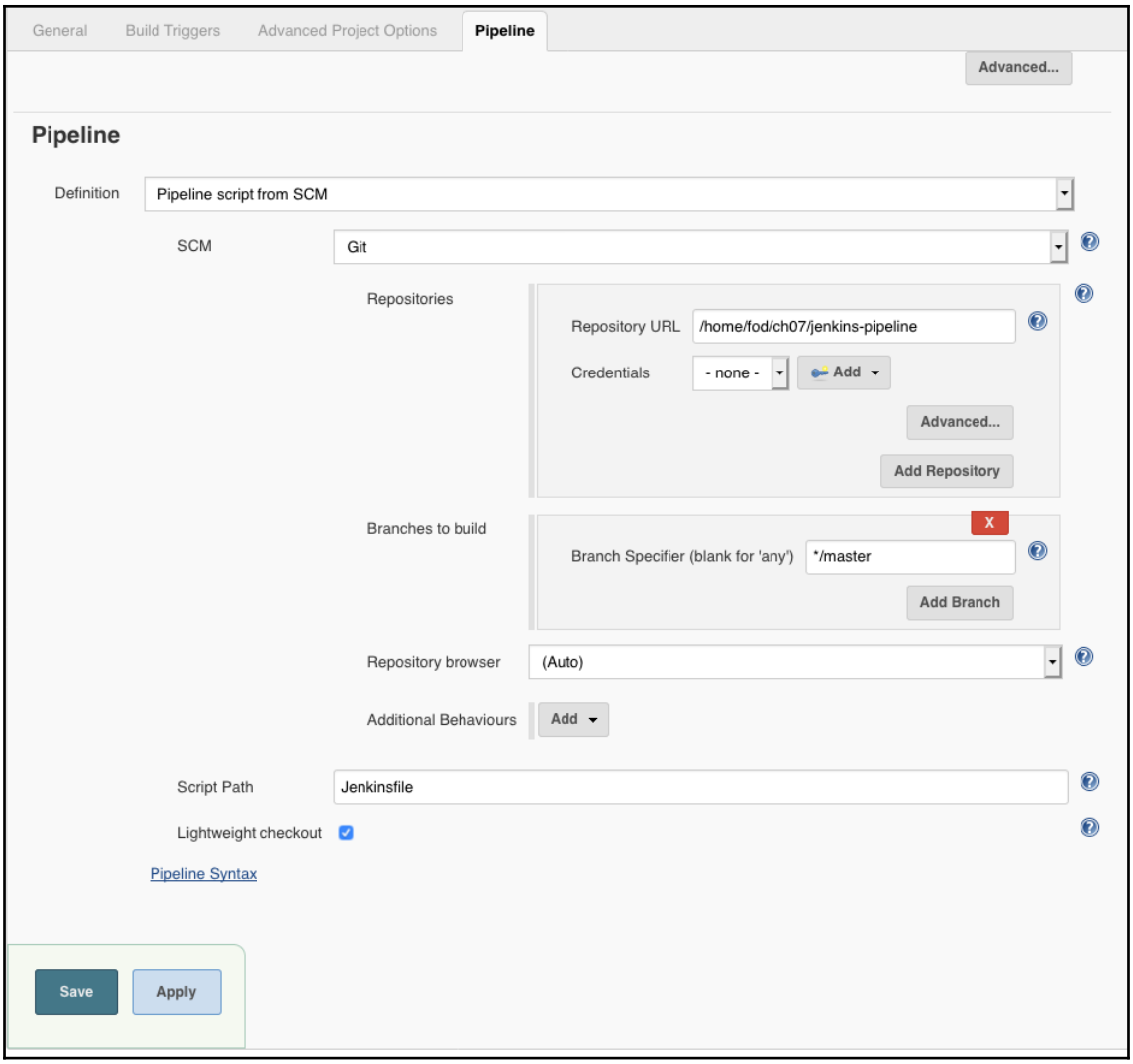

GitHub
2
check-out code
Jenkins
1
check-in code
3
4
5
6
Developer
Build
Test
Staging
Production
promotion
promotion
promotion
promotion

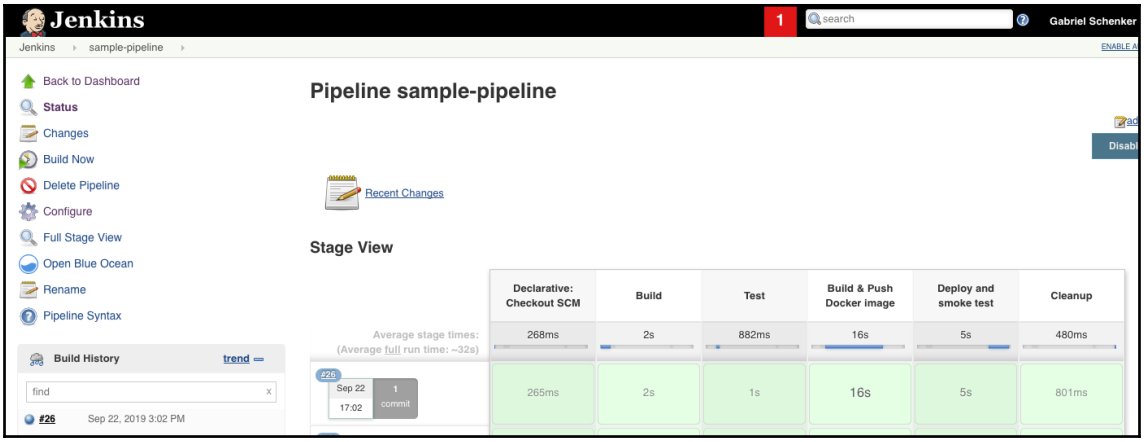

localhost:8080
Jenkins
Jenkins
New Item
People
Build History
Manage Jenkins
My Views
Open Blue Ocean
Lockable Resources
Credentials
New View
Welcome to Jenkins!
Please create new jobs to get started.


Pipeline
Definition
Pipeline script
Script
1 pipeline {
2 agent any
3 options {
4 skipStagesAfterUnstable()
5 }
6 stages {
7 stage('Build') {
8 steps {
9 echo 'Building'
10 }
11 }
12 stage('Test') {
13 steps {
14 echo 'Testing'
15 }
Use Groovy Sandbox
Pipeline Syntax


Pipeline sample-pipeline
Recent Changes
Stage View
Build
Test
Deploy to Staging
Deploy to Production
Average stage times:
(Average full run time: ~3s)
228ms
69ms
58ms
65ms
#5
Sep 08
15:43
No Changes
83ms
55ms
58ms
65ms

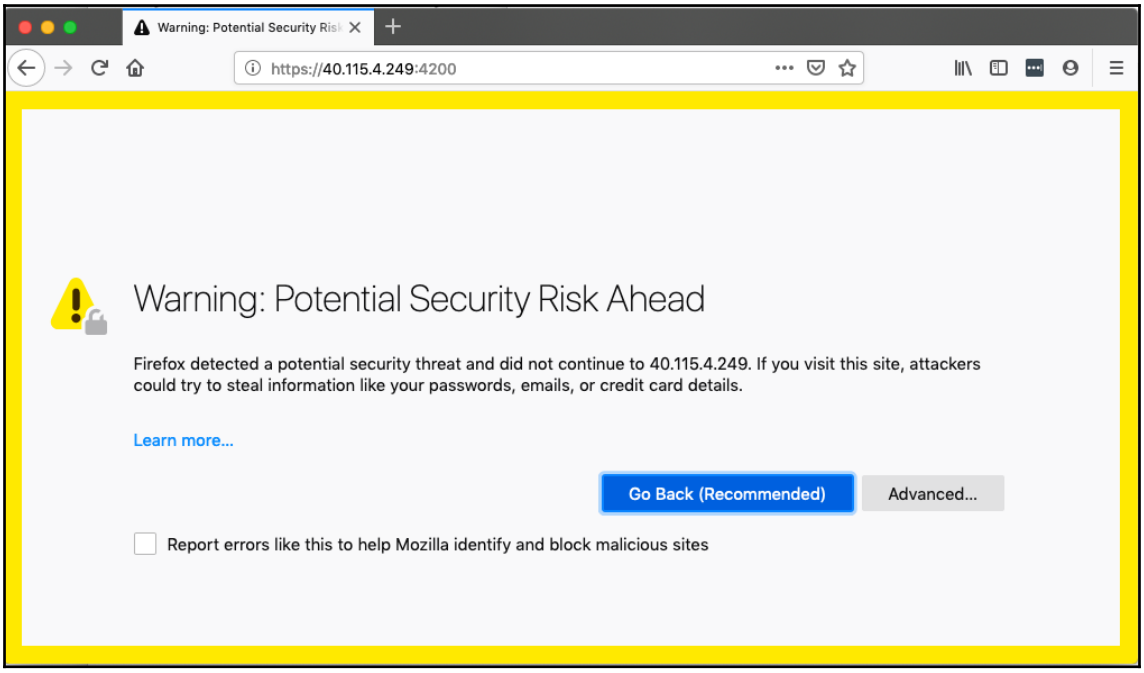

Create a new repository
A repository contains all project files, including the revision history. Already have a project repository elsewhere? Import a repository.
Owner
Repository name *
gnschenker
/
jenkins-pipeline
Great repository names are short and memorable. Need inspiration? How about reimagined-potato?
Description (optional)
A sample repo to demo a Docker based Jenkins pipeline
Public
Anyone can see this repository. You choose who can commit.
Private
You choose who can see and commit to this repository.
Skip this step if you're importing an existing repository.
Initialize this repository with a README
This will let you immediately clone the repository to your computer.
Add .gitignore: None
Add a license: None
Create repository

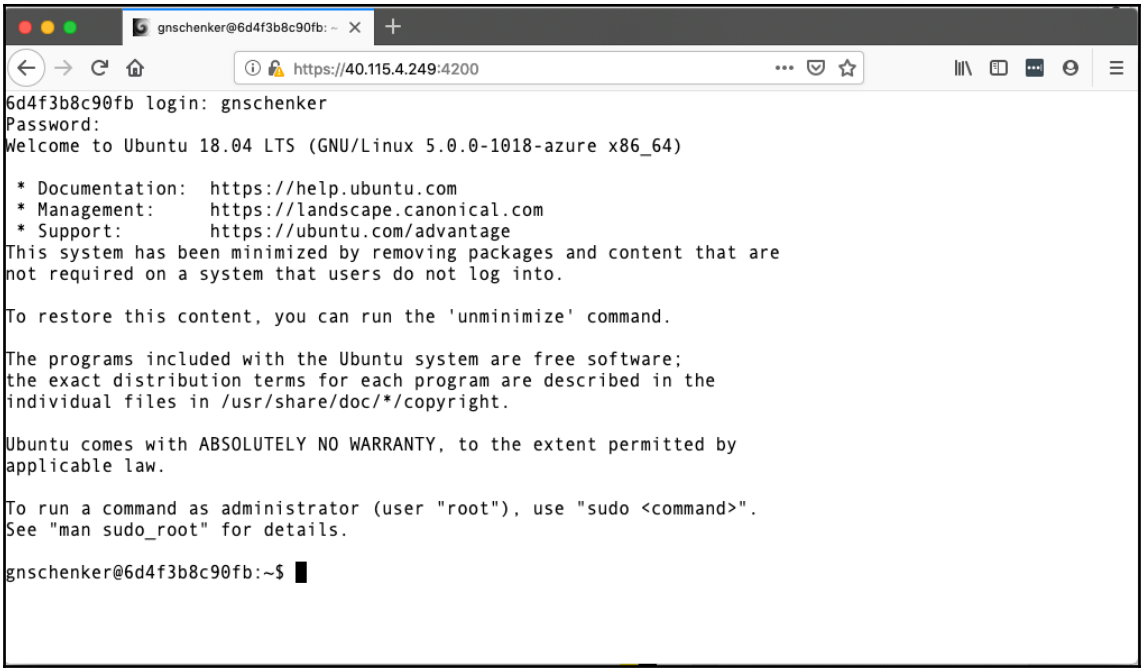

General
Build Triggers
Advanced Project Options
Pipeline
Advanced...
Pipeline
Definition
Pipeline script from SCM
SCM
Git
Repositories
Repository URL
/home/fod/ch07/jenkins-pipeline
Credentials
- none -
Add
Advanced...
Add Repository
Branches to build
X
Branch Specifier (blank for 'any')
*/master
Add Branch
Repository browser
(Auto)
Additional Behaviours
Add
Script Path
Jenkinsfile
Lightweight checkout
Pipeline Syntax
Save
Apply

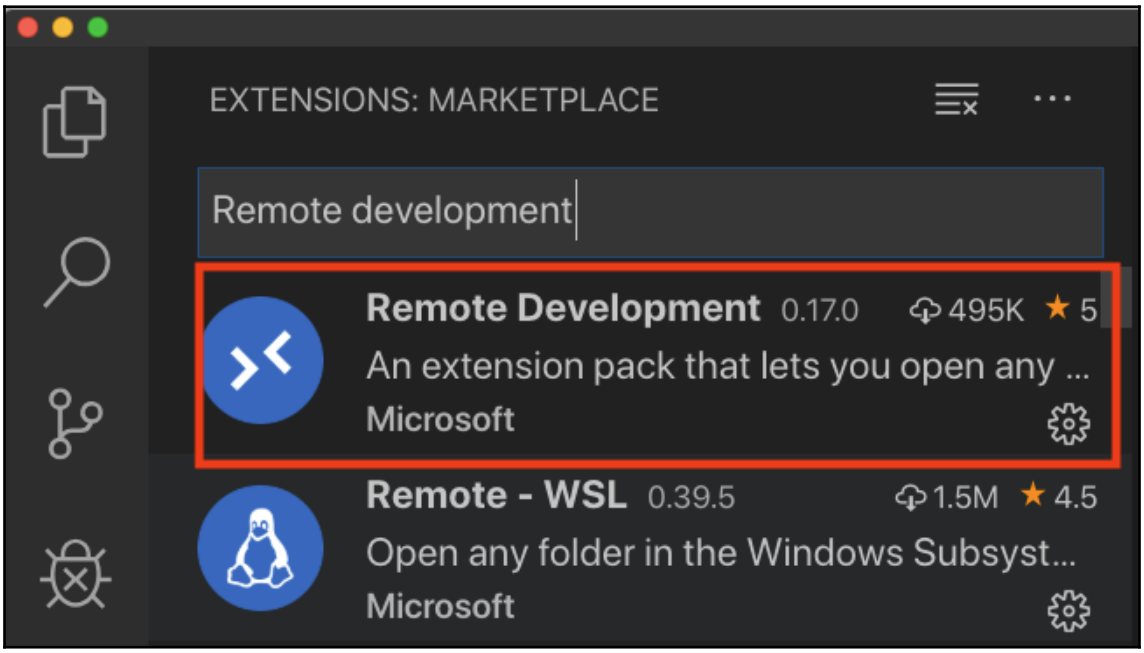

Jenkins
1
search
Gabriel Schenker
Jenkins
sample-pipeline
Back to Dashboard
Status
Changes
Build Now
Delete Pipeline
Configure
Full Stage View
Open Blue Ocean
Rename
Pipeline Syntax
Build History
trend
find
#26
Sep 22, 2019 3:02 PM
Pipeline sample-pipeline
Recent Changes
Stage View
Declarative: Checkout SCM
Build
Test
Build & Push Docker image
Deploy and smoke test
Cleanup
Average stage times:
(Average full run time: ~32s)
268ms
2s
882ms
16s
5s
480ms
#26
Sep 22
17:02
1
commit
265ms
2s
1s
16s
5s
801ms

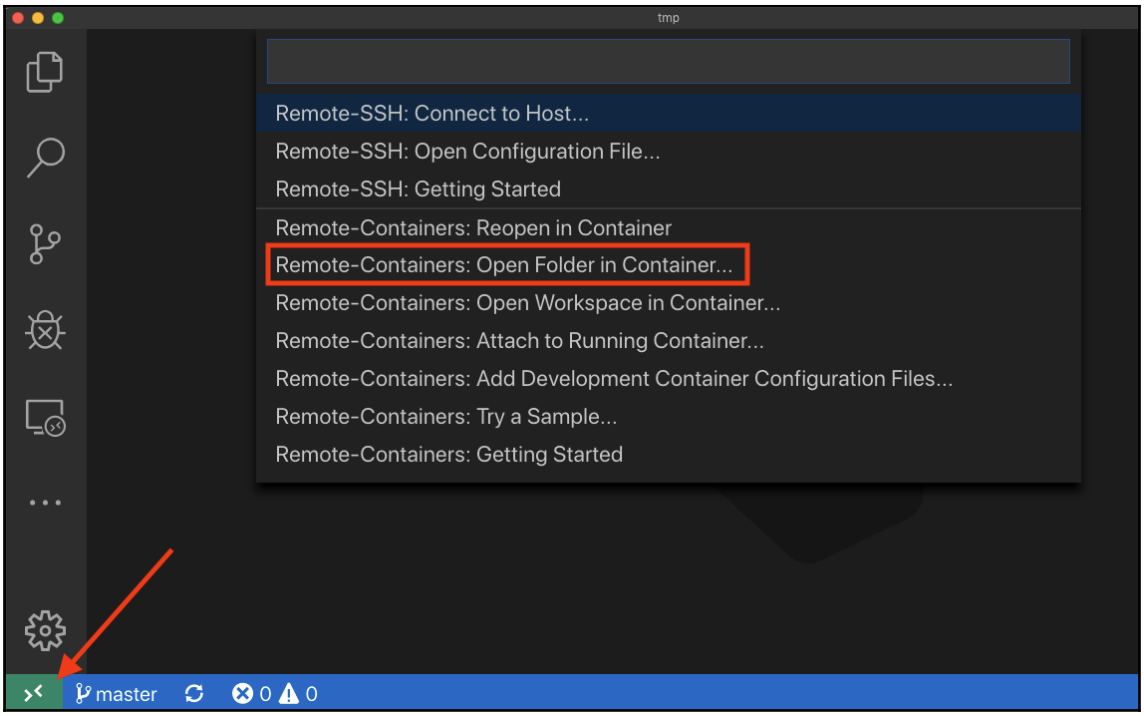
Chapter 8: Advanced Docker Usage Scenarios

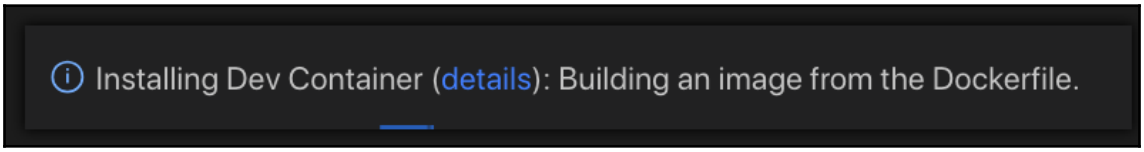
```
CONTAINER ID        NAME                CPU %               MEM USAGE / LIMIT   MEM %               NET I/O             BLOCK I/O
8e00c974ae6e        stress-test         0.00%               1.871MiB / 512MiB   0.37%               16MB / 271kB        0B / 111MB
```

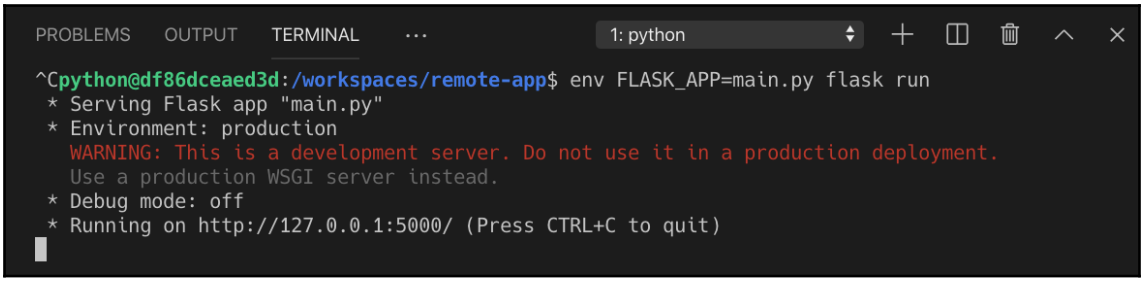


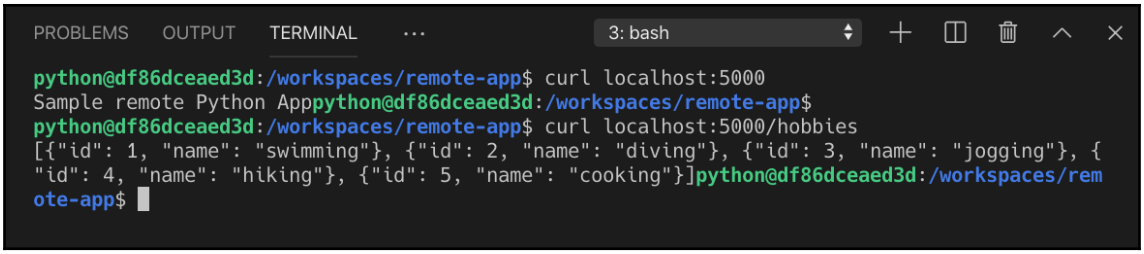

gnschenker@6d4f3b8c90fb: ~
https://40.115.4.249:4200
6d4f3b8c90fb login: gnschenker
Password:
Welcome to Ubuntu 18.04 LTS (GNU/Linux 5.0.0-1018-azure x86_64)
* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/advantage
This system has been minimized by removing packages and content that are
not required on a system that users do not log into.
To restore this content, you can run the 'unminimize' command.
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.
Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.
gnschenker@6d4f3b8c90fb:~$


EXTENSIONS: MARKETPLACE
Remote development
Remote Development 0.17.0 495K 5
An extension pack that lets you open any ...
Microsoft
Remote - WSL 0.39.5 1.5M 4.5
Open any folder in the Windows Subsyst...
Microsoft

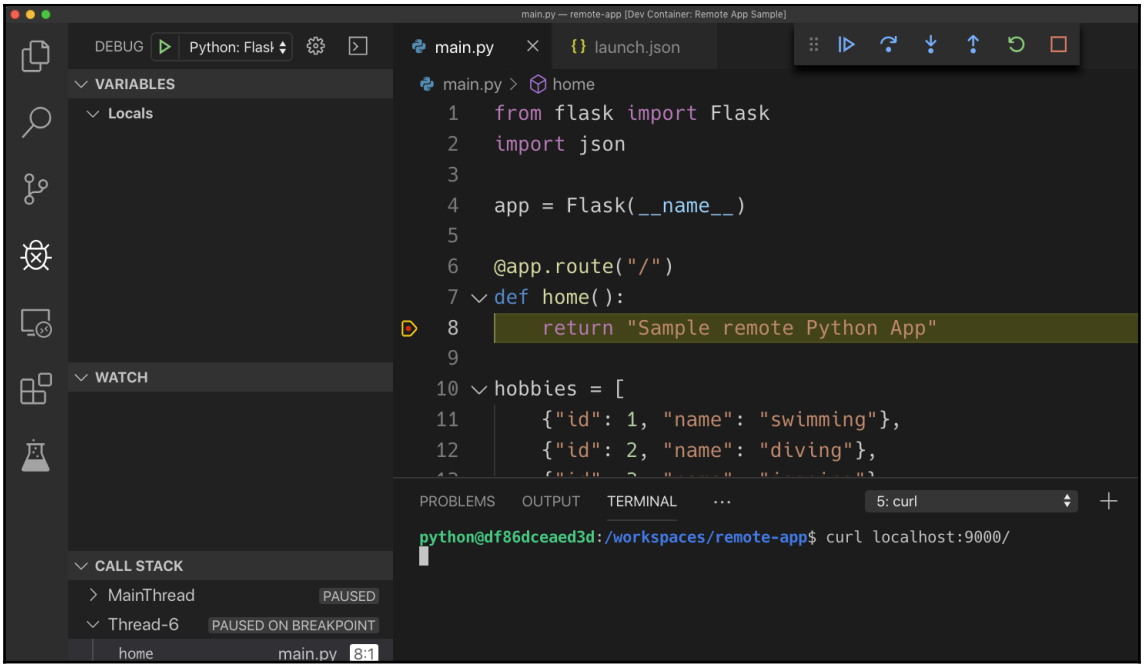

tmp
Remote-SSH: Connect to Host...
Remote-SSH: Open Configuration File...
Remote-SSH: Getting Started
Remote-Containers: Reopen in Container
Remote-Containers: Open Folder in Container...
Remote-Containers: Open Workspace in Container...
Remote-Containers: Attach to Running Container...
Remote-Containers: Add Development Container Configuration Files...
Remote-Containers: Try a Sample...
Remote-Containers: Getting Started
master
0 0

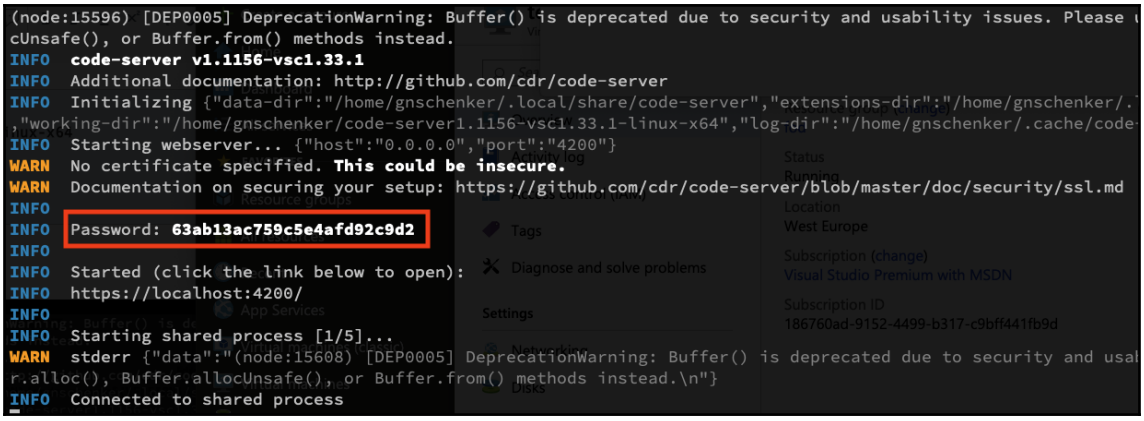

Installing Dev Container (details): Building an image from the Dockerfile.

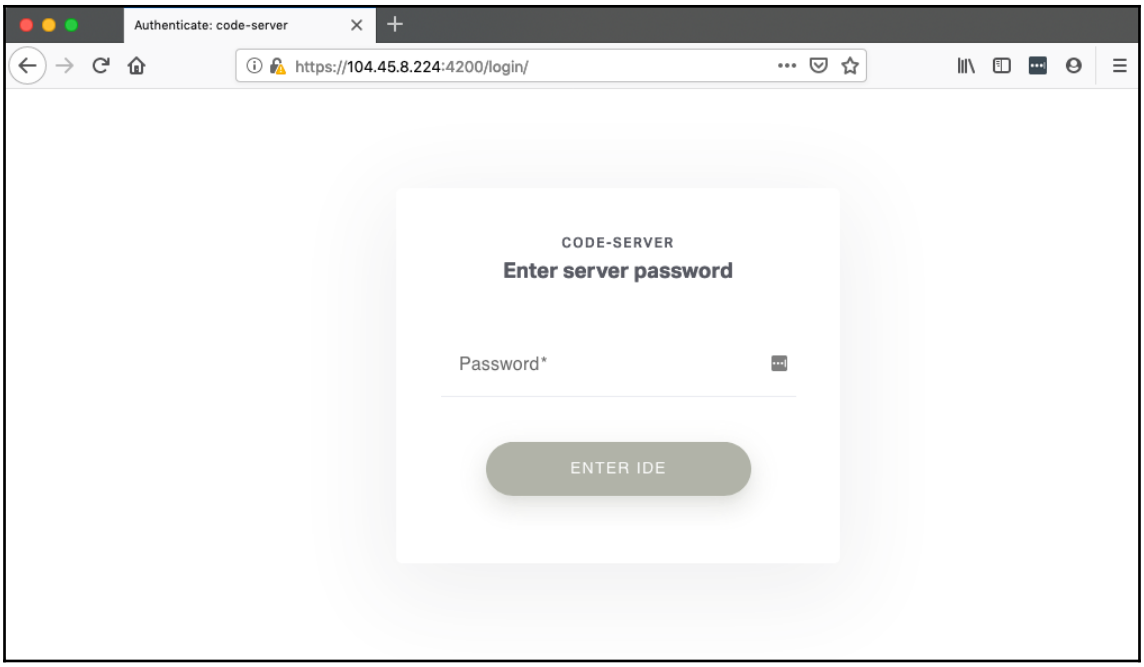

PROBLEMS
OUTPUT
TERMINAL
1: python
^Cpython@df86dceaed3d:/workspaces/remote-app$ env FLASK_APP=main.py flask run
* Serving Flask app "main.py"
* Environment: production
WARNING: This is a development server. Do not use it in a production deployment.
Use a production WSGI server instead.
* Debug mode: off
* Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)

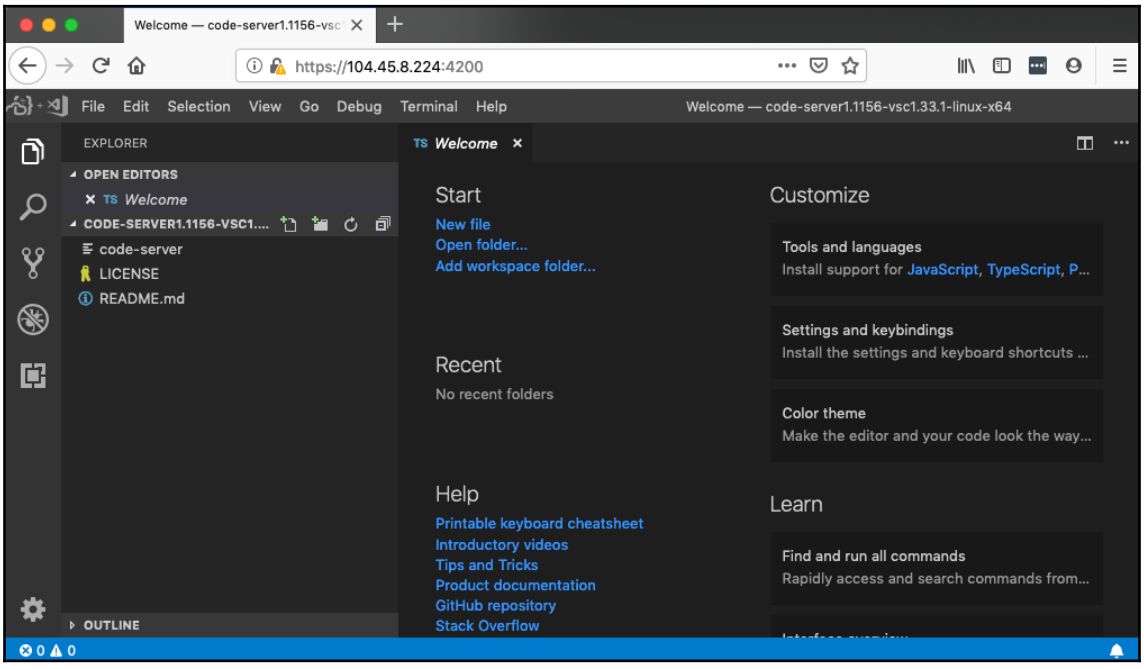

PROBLEMS
OUTPUT
TERMINAL
3: bash
python@df86dceaed3d:/workspaces/remote-app$ curl localhost:5000
Sample remote Python Apppython@df86dceaed3d:/workspaces/remote-app$
python@df86dceaed3d:/workspaces/remote-app$ curl localhost:5000/hobbies
[{"id": 1, "name": "swimming"}, {"id": 2, "name": "diving"}, {"id": 3, "name": "jogging"}, {
"id": 4, "name": "hiking"}, {"id": 5, "name": "cooking"}]python@df86dceaed3d:/workspaces/rem
ote-app$

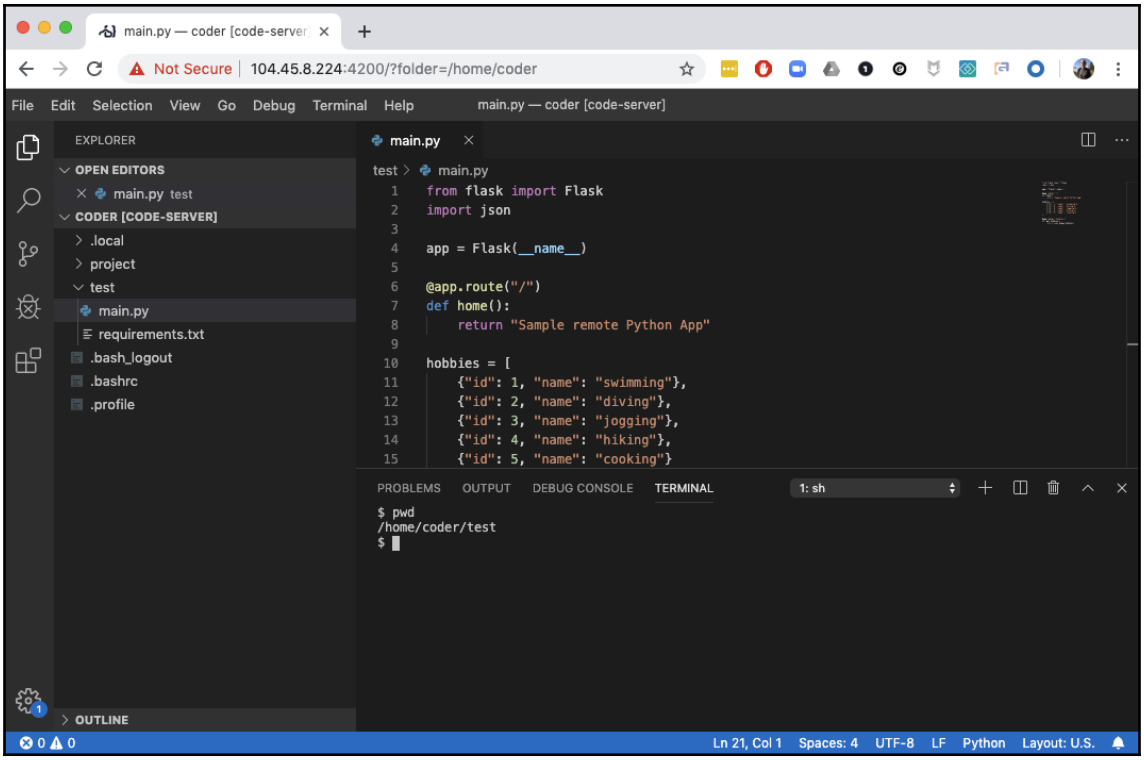

PROBLEMS
OUTPUT
TERMINAL
4: Python Debug Console
python/.vscode-server/bin/b37e54c98e1a74ba89e03073e5a3761284e3ffb0 VSCODE_INJECT_NODE_MODULE
_LOOKUP_PATH=/home/python/.vscode-server/bin/b37e54c98e1a74ba89e03073e5a3761284e3ffb0/remote
/node_modules VSCODE_LOGS=/home/python/.vscode-server/data/logs/20190927T164543 AMD_ENTRYPOI
NT=vs/server/remoteExtensionHostProcess PIPE_LOGGING=true VERBOSE_LOGGING=true VSCODE_EXTHOS
T_WILL_SEND_SOCKET=true VSCODE_HANDLES_UNCAUGHT_ERRORS=true VSCODE_LOG_STACK=false 'VSCODE_N
LS_CONFIG={"locale":"en","availableLanguages":{}}' VSCODE_IPC_HOOK_CLI=/tmp/vscode-ipc-133a2
3cc-fa96-4e6f-a18a-95377c73f2fa.sock APPLICATION_INSIGHTS_NO_DIAGNOSTIC_CHANNEL=true PATH=/h
ome/python/.vscode-server/bin/b37e54c98e1a74ba89e03073e5a3761284e3ffb0/bin:/usr/local/bin:/u
sr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin PYTHONIOENCODING=UTF-8 PYTHONUNBU
FFERED=1 /usr/local/bin/python /home/python/.vscode-server/extensions/ms-python.python-2019.
9.34911/pythonFiles/ptvsd_launcher.py --default --client --host localhost --port 44555 -m fl
ask run --host 0.0.0.0 --port 9000 --no-debugger --no-reload
* Serving Flask app "main.py"
* Environment: development
* Debug mode: off
* Running on http://0.0.0.0:9000/ (Press CTRL+C to quit)


main.py — remote-app [Dev Container: Remote App Sample]
DEBUG
Python: Flask
main.py
launch.json
VARIABLES
Locals
WATCH
CALL STACK
MainThread
PAUSED
Thread-6
PAUSED ON BREAKPOINT
home
main.py 8:1
main.py > home
1 from flask import Flask
2 import json
3
4 app = Flask(__name__)
5
6 @app.route("/")
7 def home():
8 return "Sample remote Python App"
9
10 hobbies = [
11 {"id": 1, "name": "swimming"},
12 {"id": 2, "name": "diving"},
PROBLEMS
OUTPUT
TERMINAL
5: curl
python@df86dceaed3d:/workspaces/remote-app$ curl localhost:9000/

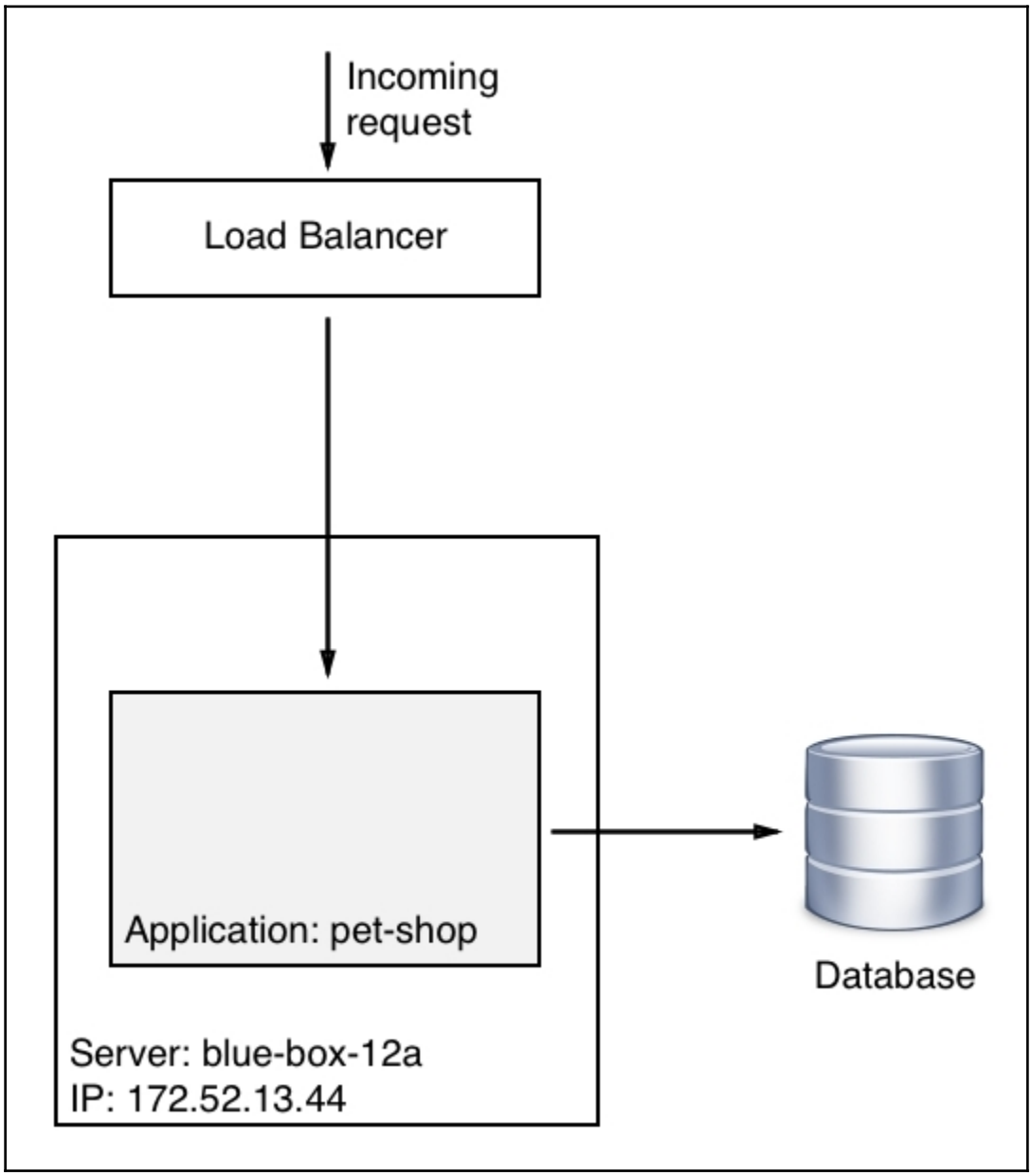

(node:15596) [DEP0005] DeprecationWarning: Buffer() is deprecated due to security and usability issues. Please
cUnsafe(), or Buffer.from() methods instead.
INFO code-server v1.1156-vsc1.33.1
INFO Additional documentation: http://github.com/cdr/code-server
INFO Initializing {"data-dir":"/home/gnschenker/.local/share/code-server","extensions-dir":"/home/gnschenker/.
,"working-dir":"/home/gnschenker/code-server1.1156-vsc1.33.1-linux-x64","log-dir":"/home/gnschenker/.cache/code-
INFO Starting webserver... {"host":"0.0.0.0","port":"4200"}
WARN No certificate specified. This could be insecure.
WARN Documentation on securing your setup: https://github.com/cdr/code-server/blob/master/doc/security/ssl.md
INFO
INFO Password: 63ab13ac759c5e4afd92c9d2
INFO
INFO Started (click the link below to open):
INFO https://localhost:4200/
INFO
INFO Starting shared process [1/5]...
WARN stderr {"data":"(node:15608) [DEP0005] DeprecationWarning: Buffer() is deprecated due to security and usal
r.alloc(), Buffer.allocUnsafe(), or Buffer.from() methods instead.\n"}
INFO Connected to shared process

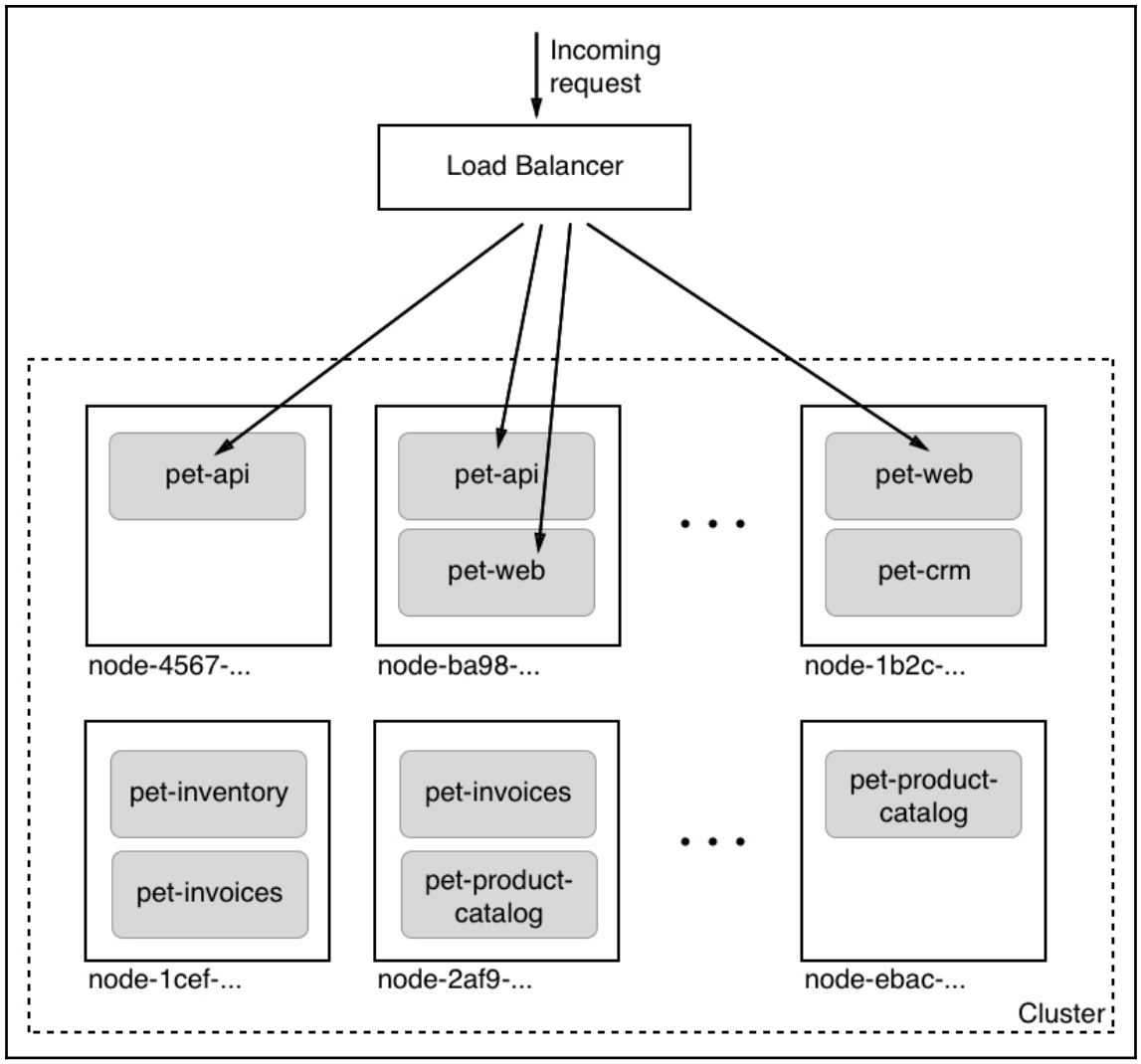

Authenticate: code-server
https://104.45.8.224:4200/login/
CODE-SERVER
Enter server password
Password*
ENTER IDE

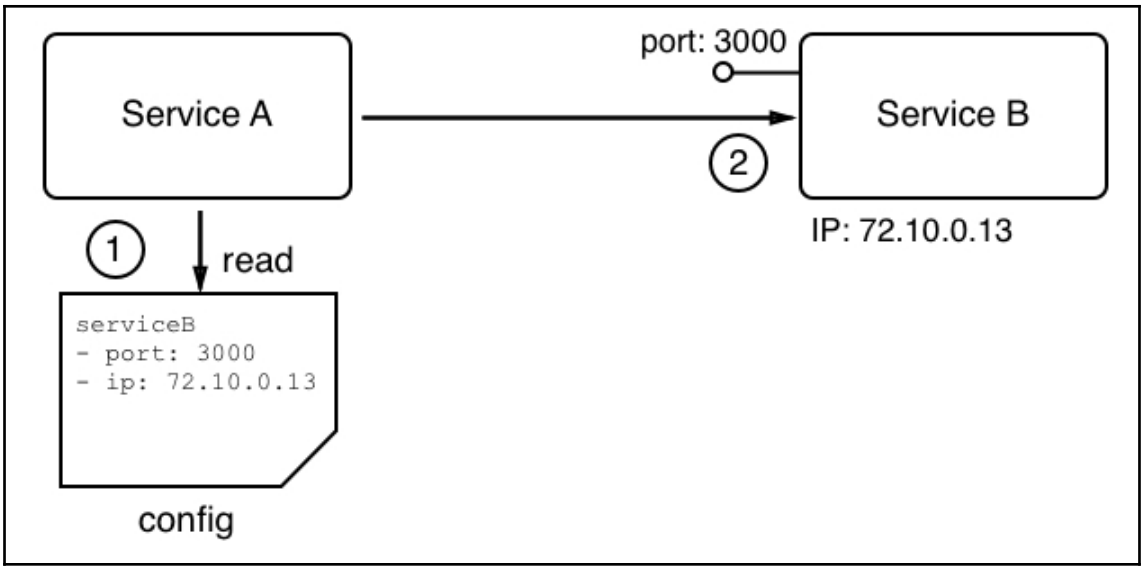

Welcome — code-server1.1156-vsc
https://104.45.8.224:4200
File Edit Selection View Go Debug Terminal Help
Welcome — code-server1.1156-vsc1.33.1-linux-x64
EXPLORER
OPEN EDITORS
Welcome
CODE-SERVER1.1156-VSC1....
code-server
LICENSE
README.md
OUTLINE
Start
New file
Open folder...
Add workspace folder...
Recent
No recent folders
Help
Printable keyboard cheatsheet
Introductory videos
Tips and Tricks
Product documentation
GitHub repository
Stack Overflow
Customize
Tools and languages
Install support for JavaScript, TypeScript, P...
Settings and keybindings
Install the settings and keyboard shortcuts ...
Color theme
Make the editor and your code look the way...
Learn
Find and run all commands
Rapidly access and search commands from...

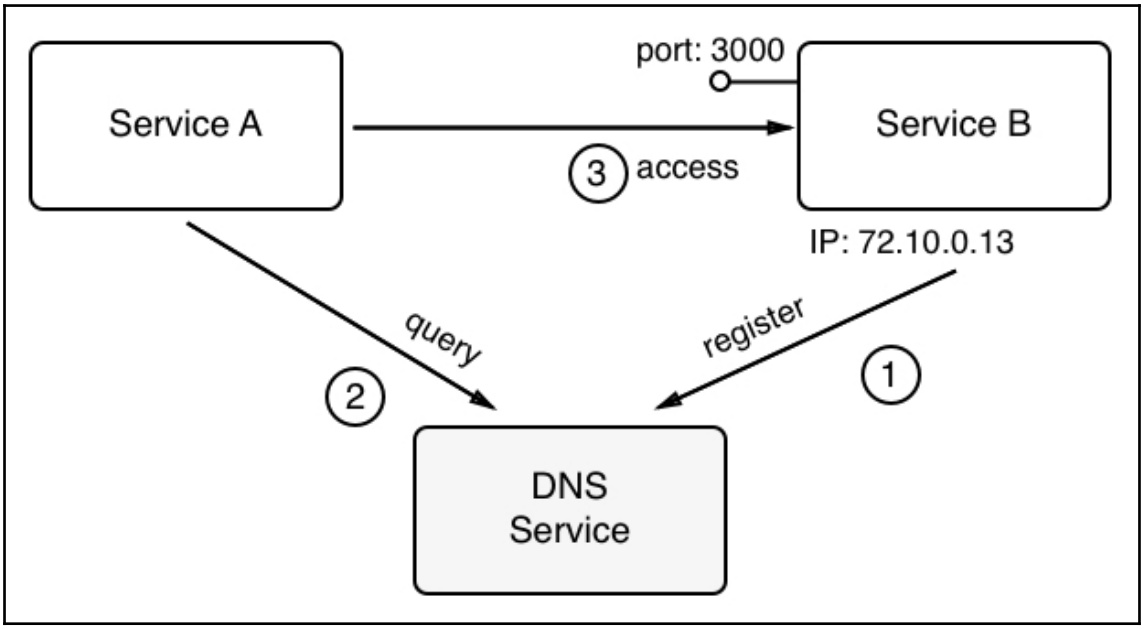

main.py — coder [code-server]
Not Secure | 104.45.8.224:4200/?folder=/home/coder
File Edit Selection View Go Debug Terminal Help
main.py — coder [code-server]
EXPLORER
OPEN EDITORS
main.py test
CODER [CODE-SERVER]
.local
project
test
main.py
requirements.txt
.bash_logout
.bashrc
.profile
OUTLINE
main.py
test > main.py
1 from flask import Flask
2 import json
3
4 app = Flask(__name__)
5
6 @app.route("/")
7 def home():
8 return "Sample remote Python App"
9
10 hobbies = [
11 {"id": 1, "name": "swimming"},
12 {"id": 2, "name": "diving"},
13 {"id": 3, "name": "jogging"},
14 {"id": 4, "name": "hiking"},
15 {"id": 5, "name": "cooking"}
PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL
1: sh
$ pwd
/home/coder/test
$
0 0
Ln 21, Col 1 Spaces: 4 UTF-8 LF Python Layout: U.S.

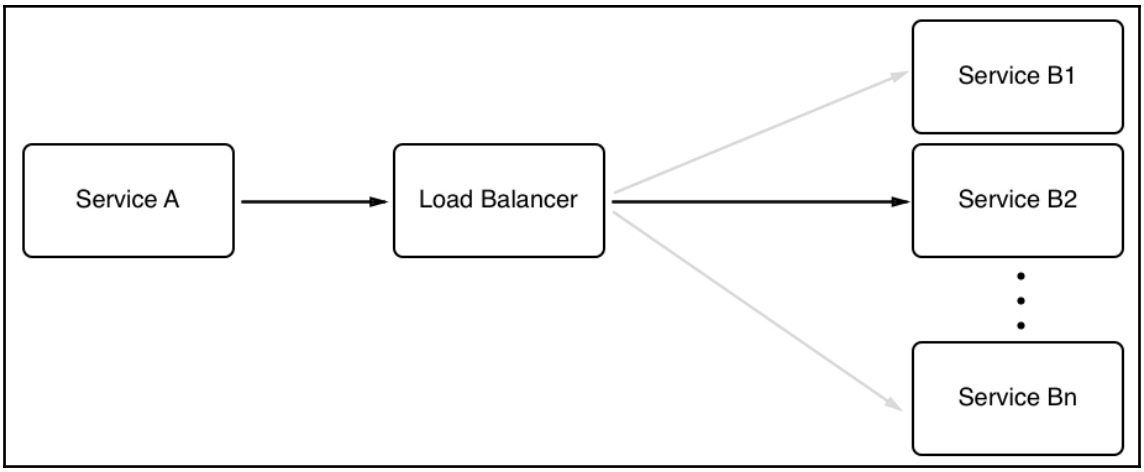
Chapter 9: Distributed Application Architecture

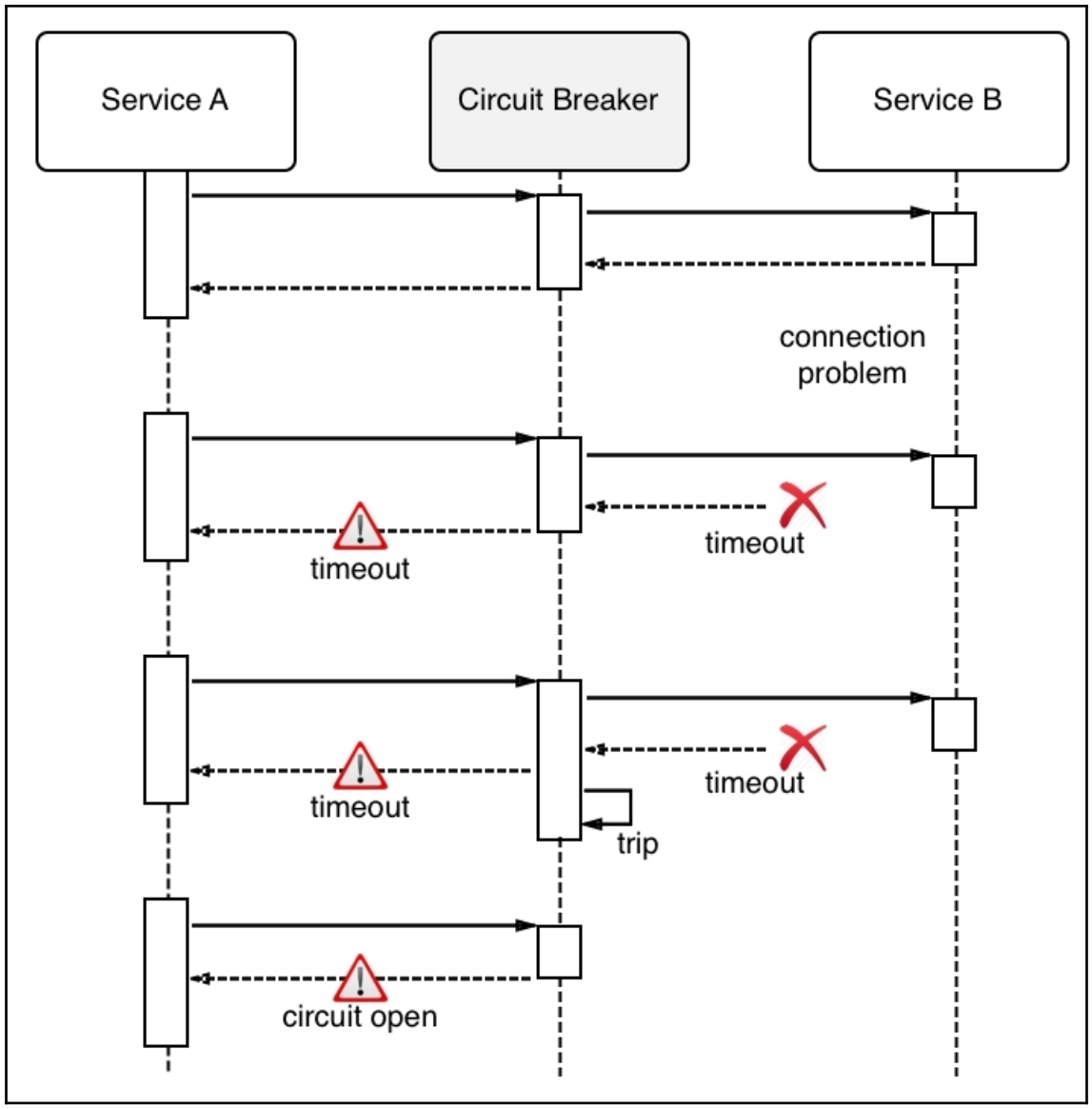


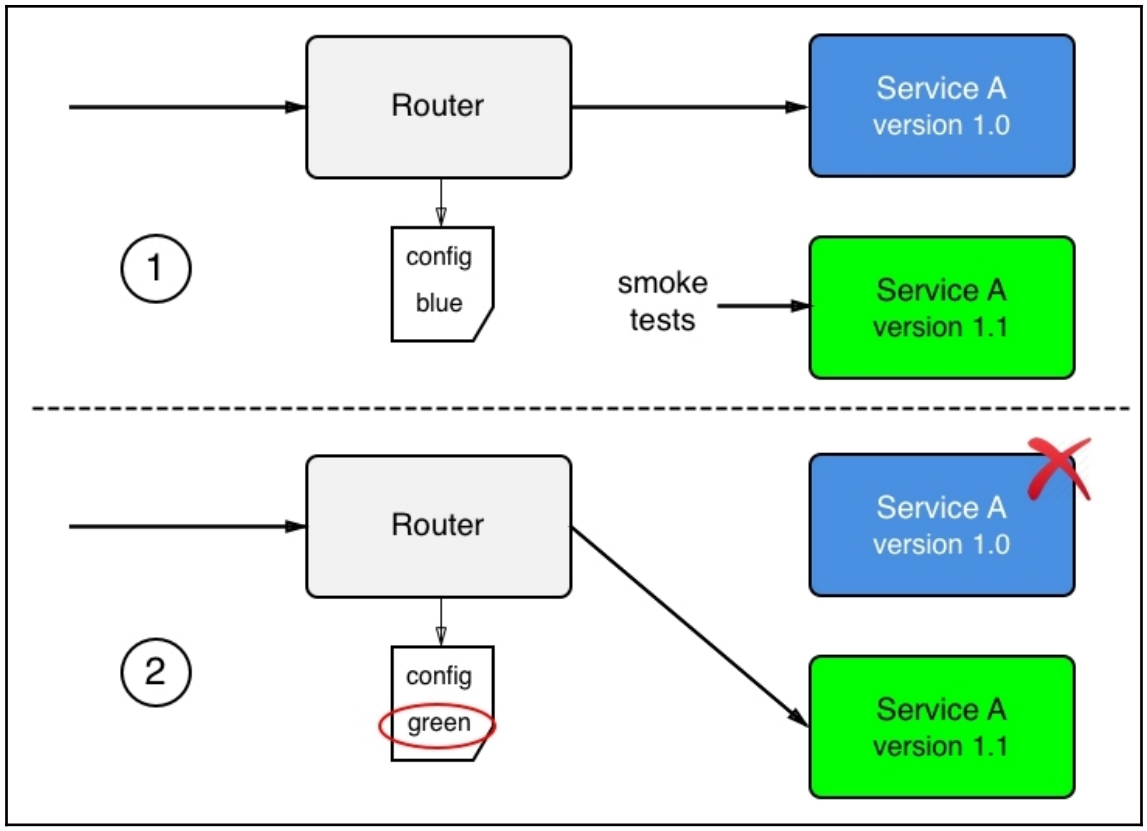

Incoming request
Load Balancer
pet-api
pet-api
pet-web
pet-web
pet-crm
node-4567-...
node-ba98-...
node-1b2c-...
pet-inventory
pet-invoices
pet-invoices
pet-product-catalog
pet-product-catalog
node-1cef-...
node-2af9-...
node-ebac-...
Cluster

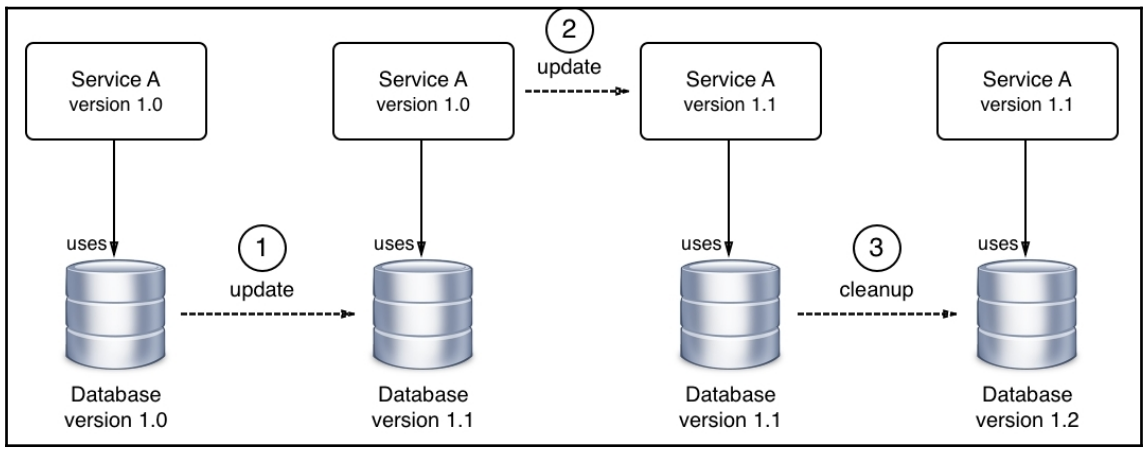

Service A
port: 3000
Service B
2
IP: 72.10.0.13
1
read
serviceB
- port: 3000
- ip: 72.10.0.13
config


Service A
port: 3000
Service B
3
access
IP: 72.10.0.13
query
2
register
1
DNS
Service

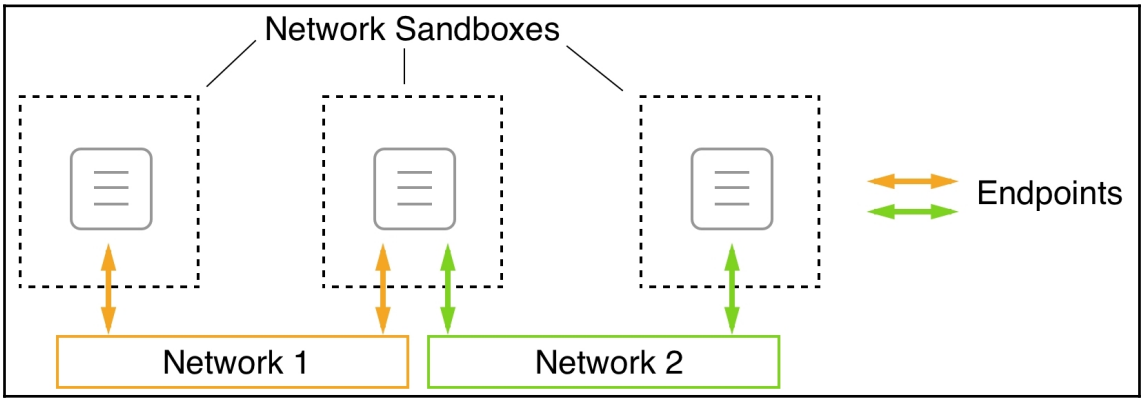

Service A
Load Balancer
Service B1
Service B2
Service Bn

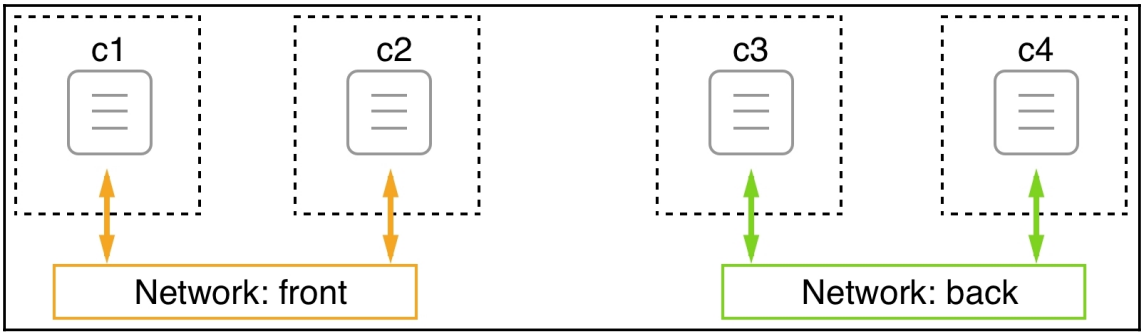

Service A
Circuit Breaker
Service B
connection
problem
timeout
timeout
timeout
timeout
trip
circuit open

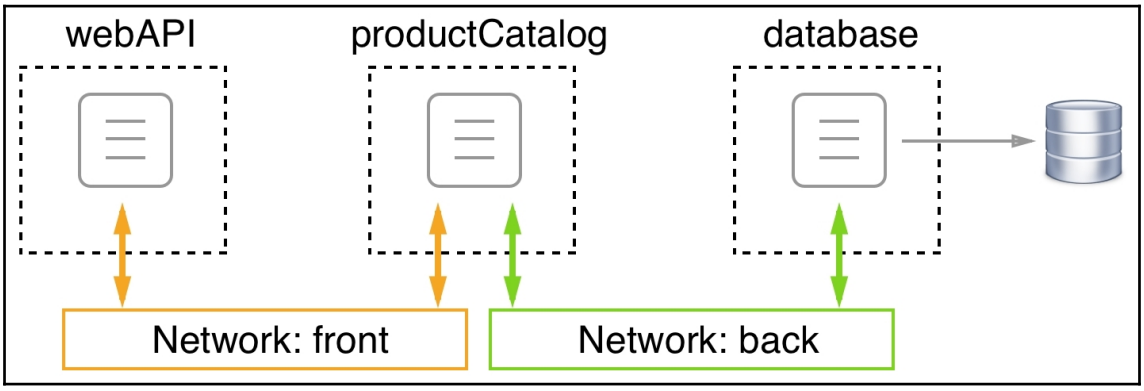

Router
Service A
version 1.0
1
config
blue
smoke
tests
Service A
version 1.1
Router
Service A
version 1.0
2
config
green
Service A
version 1.1


Service A
version 1.0
Service A
version 1.0
2
update
Service A
version 1.1
Service A
version 1.1
uses
1
update
uses
uses
3
cleanup
uses
Database
version 1.0
Database
version 1.1
Database
version 1.1
Database
version 1.2

Chapter 10: Single-Host Networking

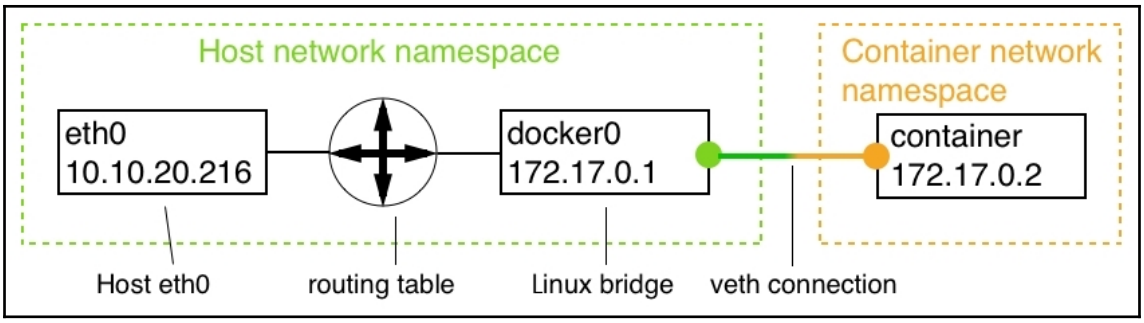


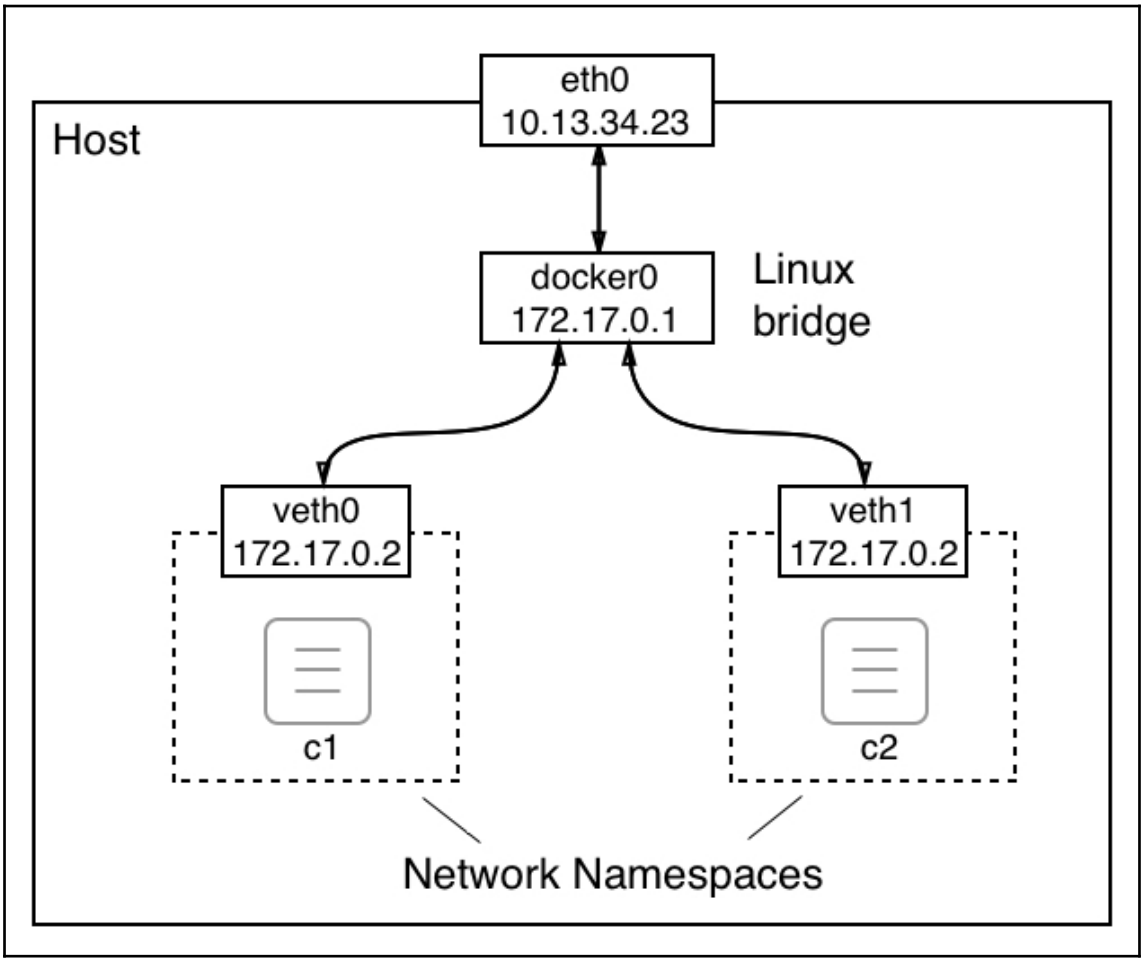




```
$ docker network ls
NETWORK ID          NAME                DRIVER              SCOPE
928c8ce47bf2        bridge              bridge              local
bdb36adcf70c        host                host                local
af82006f2f2d        none                null                local
$
```

```
C:\Users\admin>docker network inspect bridge
[
    {
        "Name": "bridge",
        "Id": "3b08c1c711ada84ae859c4bed48b5af1f45b68db89356ca5045dc7ee8672e946",
        "Created": "2018-04-09T09:47:29.9424652Z",
        "Scope": "local",
        "Driver": "bridge",
        "EnableIPv6": false,
        "IPAM": {
            "Driver": "default",
            "Options": null,
            "Config": [
                {
                    "Subnet": "172.17.0.0/16",
                    "Gateway": "172.17.0.1"
                }
            ]
        },
        "Internal": false,
        "Attachable": false,
        "Ingress": false,
        "ConfigFrom": {
            "Network": ""
        },
        "ConfigOnly": false,
        "Containers": {},
        "Options": {
            "com.docker.network.bridge.default_bridge": "true",
            "com.docker.network.bridge.enable_icc": "true",
            "com.docker.network.bridge.enable_ip_masquerade": "true",
            "com.docker.network.bridge.host_binding_ipv4": "0.0.0.0",
            "com.docker.network.bridge.name": "docker0",
            "com.docker.network.driver.mtu": "1500"
        },
        "Labels": {}
    }
]
```


Host network namespace
Container network namespace
eth0
10.10.20.216
docker0
172.17.0.1
container
172.17.0.2
Host eth0
routing table
Linux bridge
veth connection

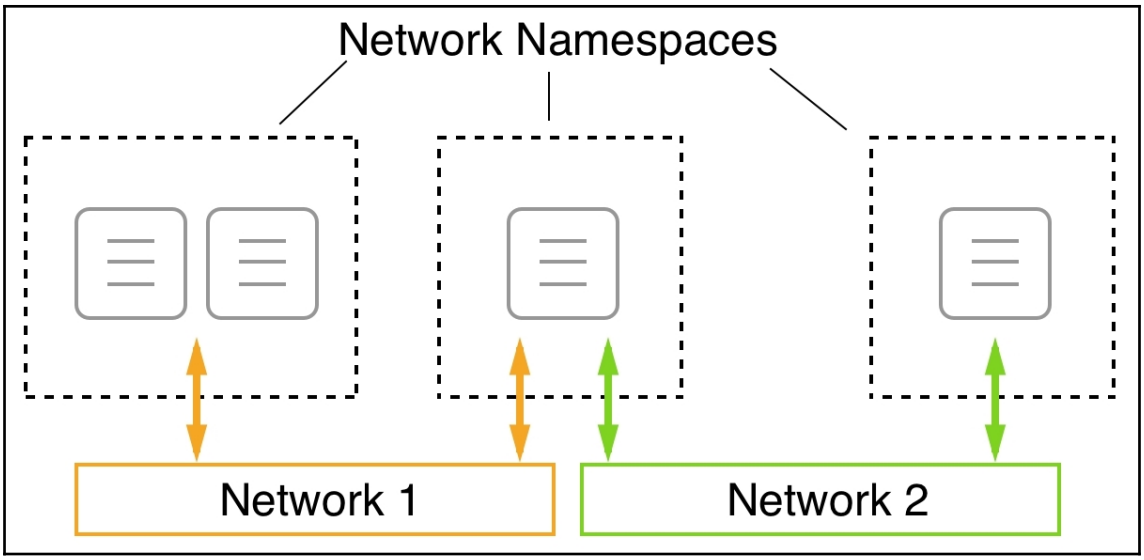

eth0
10.13.34.23
Host
docker0
172.17.0.1
Linux
bridge
veth0
172.17.0.2
veth1
172.17.0.2
c1
c2
Network Namespaces

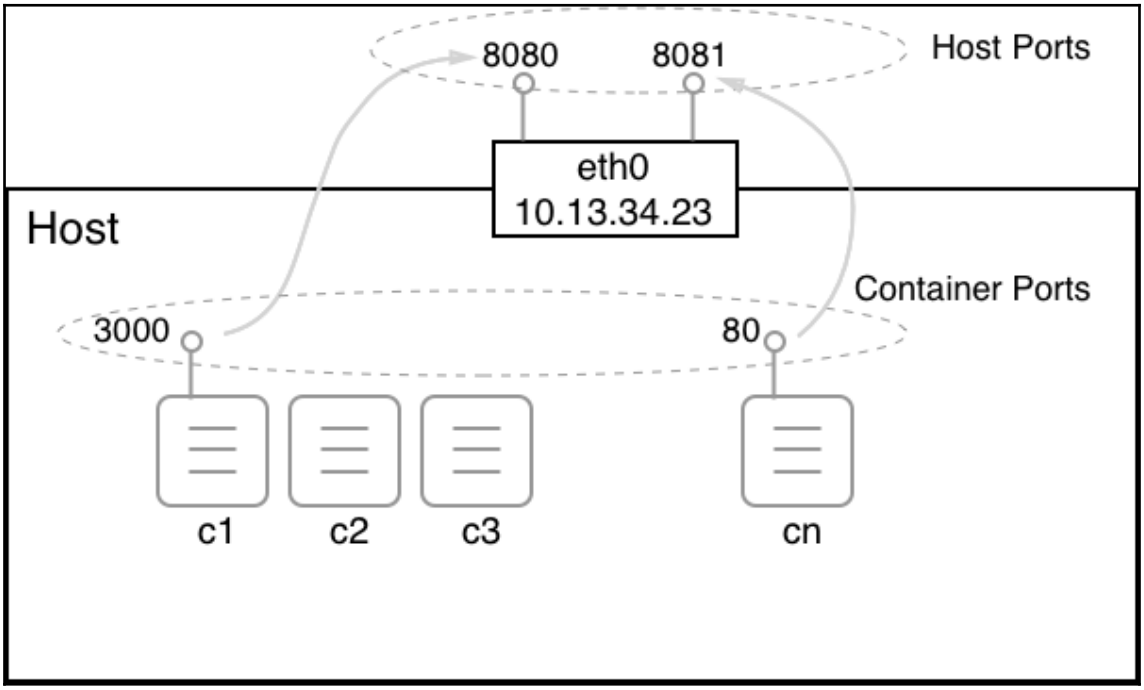
```
    },
    "NetworkSettings": {
        "Bridge": "",
        "SandboxID": "ae53496fba49de3d0a4727105cc0799b7fbd30746d76700238cb47c611f3eb68",
        "HairpinMode": false,
        "LinkLocalIPv6Address": "",
        "LinkLocalIPv6PrefixLen": 0,
        "Ports": {},
        "SandboxKey": "/var/run/docker/netns/ae53496fba49",
        "SecondaryIPAddresses": null,
        "SecondaryIPv6Addresses": null,
        "EndpointID": "c063a725d1f66e867b5769a80d1477cc88d07618860655fa3033a97478e55713",
        "Gateway": "172.17.0.1",
        "GlobalIPv6Address": "",
        "GlobalIPv6PrefixLen": 0,
        "IPAddress": "172.17.0.4",
        "IPPrefixLen": 16,
        "IPv6Gateway": "",
        "MacAddress": "02:42:ac:11:00:04",
        "Networks": {
            "bridge": {
                "IPAMConfig": null,
                "Links": null,
                "Aliases": null,
                "NetworkID": "026e653c2504e464748b4ce9b25cce69d29bc82a52105a25920f2b796663e635",
                "EndpointID": "c063a725d1f66e867b5769a80d1477cc88d07618860655fa3033a97478e55713",
                "Gateway": "172.17.0.1",
                "IPAddress": "172.17.0.4",
                "IPPrefixLen": 16,
                "IPv6Gateway": "",
                "GlobalIPv6Address": "",
                "GlobalIPv6PrefixLen": 0,
                "MacAddress": "02:42:ac:11:00:04",
                "DriverOpts": null
            }
        }
    }
```

```
/ # ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN qlen 1
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
2: tunl0@NONE: <NOARP> mtu 1480 qdisc noop state DOWN qlen 1
    link/ipip 0.0.0.0 brd 0.0.0.0
3: ip6tnl0@NONE: <NOARP> mtu 1452 qdisc noop state DOWN qlen 1
    link/tunnel6 00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00 brd 00:00:00:00:00:00:00:00:00:00:00:00:00:00:00:00
19: eth0@if20: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:11:00:04 brd ff:ff:ff:ff:ff:ff
    inet 172.17.0.4/16 brd 172.17.255.255 scope global eth0
       valid_lft forever preferred_lft forever
/ #
```

```
    "ConfigOnly": false,
    "Containers": {
        "27b96de70b58cd918d35c235a7c180f56f71df58cf4cec50b8f0103dd529b95f": {
            "Name": "c2",
            "EndpointID": "8883649774c5c4c53063da02598c8d09fe7ee427145b348b1d1703f31213e9ca",
            "MacAddress": "02:42:ac:11:00:03",
            "IPv4Address": "172.17.0.3/16",
            "IPv6Address": ""
        },
        "35b8dd512acb985647833e1cc52625e129c15e903fd8a0c0ab247932bc910166": {
            "Name": "c1",
            "EndpointID": "28269a9cc630135ab287052fa69c72f28c57a10bd5e7523c451bf2d0976fd1b5",
            "MacAddress": "02:42:ac:11:00:02",
            "IPv4Address": "172.17.0.2/16",
            "IPv6Address": ""
        }
    },
    "Options": {
```

```
"Containers": {
    "134295caa6012df5dc7d541436954af1a5264c6f69d5b8012e88f9c12faf40f1": {
        "Name": "c3",
        "EndpointID": "5693cd9329437a9ecec1d27f439887bb0258837b9342a1c32204fa4571298457",
        "MacAddress": "02:42:0a:01:00:02",
        "IPv4Address": "10.1.0.2/16",
        "IPv6Address": ""
    },
    "4a277d33ebfb74f00d31be272d2d74cbfec4b17666e44d88e26cfe83b0a790cc": {
        "Name": "c4",
        "EndpointID": "a1e9ecafebdcf816261883c171434273d9973832d43255b5aa224b081853ed0f",
        "MacAddress": "02:42:0a:01:00:03",
        "IPv4Address": "10.1.0.3/16",
        "IPv6Address": ""
    }
```


Network Namespaces
Network 1
Network 2


8080
8081
Host Ports
eth0
10.13.34.23
Host
Container Ports
3000
80
c1
c2
c3
cn


```
$ flask run
 * Serving Flask app "main.py"
 * Environment: production
   WARNING: This is a development server. Do not use it in a production deployment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://127.0.0.1:5000/ (Press CTRL+C to quit)
```

```
$ ping acme.com

Ping wird ausgeführt für acme.com [127.0.0.1] mit 32 Bytes Daten:
Antwort von 127.0.0.1: Bytes=32 Zeit<1ms TTL=128
Antwort von 127.0.0.1: Bytes=32 Zeit<1ms TTL=128
Antwort von 127.0.0.1: Bytes=32 Zeit<1ms TTL=128
```

```
$ curl http://acme.com:5000/catalog?type=bicycles
[{"id": 1, "name": "Mountanbike Driftwood 24\"", "unitPrice": 199}, {"id": 2, "name": "Tribal 100 Flat Bar Cycle Touring Road Bike", "u
nitPrice": 300}, {"id": 3, "name": "Siech Cycles Bike (58 cm)", "unitPrice": 459}]$
$
$ curl http://acme.com:5000/checkout
Starting checkout of your shopping cart...$
$
```

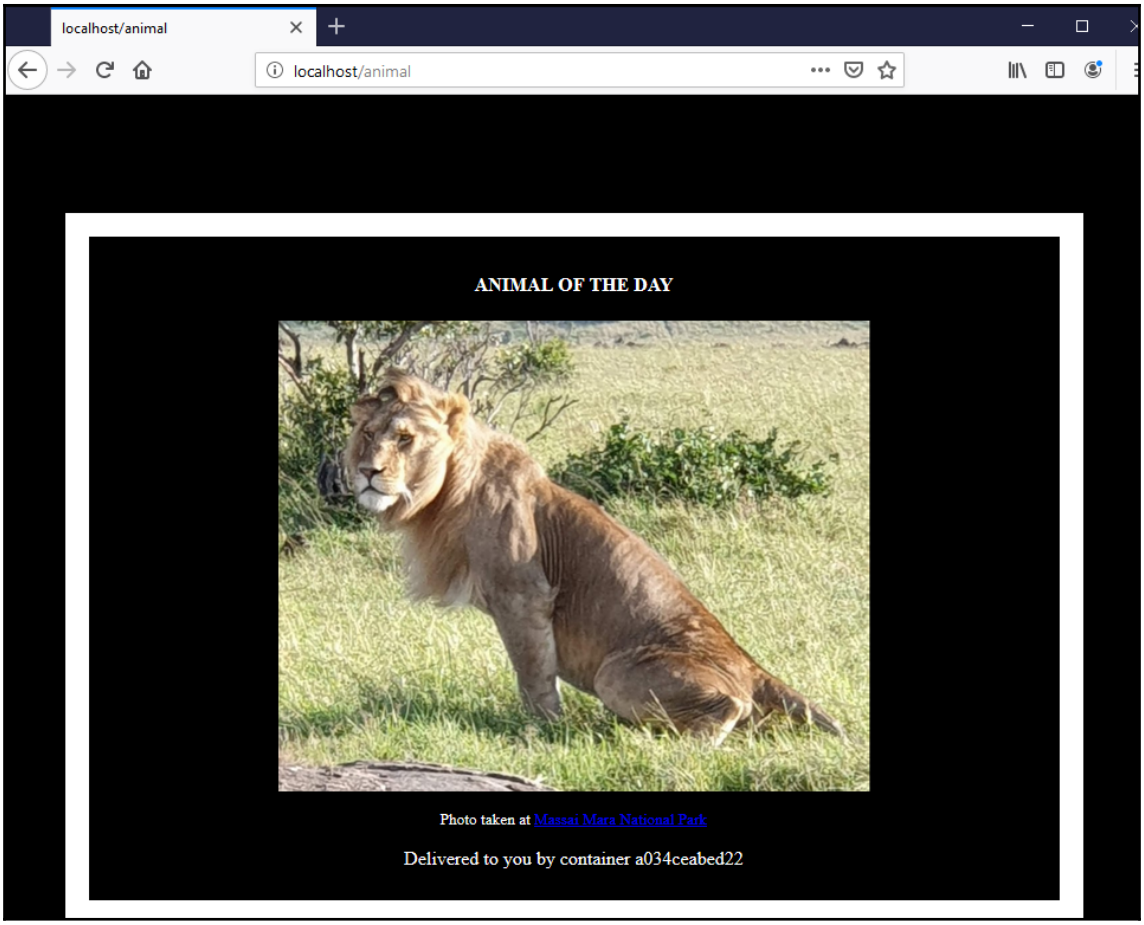
Chapter 11: Docker Compose

```
$ docker-compose build
Building web
Step 1/7 : FROM node:12.12-alpine
12.12-alpine: Pulling from library/node
e7c96db7181b: Pull complete
96ed4fdcea75: Pull complete
c1504b6f0fcb: Pull complete
16d47b051efb: Pull complete
Digest: sha256:3d8c2e124f20861de12d72ce29685ca73e0ebe57f232800ae1c4cadbb5e63c36
Status: Downloaded newer image for node:12.12-alpine
 ---> 0fcfd7e52b09
Step 2/7 : WORKDIR /app
 ---> Running in fb6284297648
Removing intermediate container fb6284297648
 ---> cda3a345e8c4
Step 3/7 : COPY package.json /app/
 ---> 4384dbe02fcd
Step 4/7 : RUN npm install
 ---> Running in beef36cc6c97
npm notice created a lockfile as package-lock.json. You should commit this file.
npm WARN pets@2.0.0 No repository field.

added 71 packages from 55 contributors and audited 147 packages in 3.343s
found 0 vulnerabilities

Removing intermediate container beef36cc6c97
 ---> d2c2e538a621
Step 5/7 : COPY ./src /app/src
 ---> f11a333bbe0c
Step 6/7 : EXPOSE 3000
 ---> Running in b309697fb93b
Removing intermediate container b309697fb93b
 ---> 5df5cec904e9
Step 7/7 : CMD npm start
 ---> Running in 885a71e9b006
Removing intermediate container 885a71e9b006
 ---> 639bfb80b96a

Successfully built 639bfb80b96a
Successfully tagged fundamentalsofdocker/ch11-web:2.0
```

```
Building db
Step 1/5 : FROM postgres:12.0-alpine
12.0-alpine: Pulling from library/postgres
9d48c3bd43c5: Pull complete
f112202a5fec: Pull complete
e2827e7bbe4a: Pull complete
5ce43a1630c4: Pull complete
13772e4e58b6: Pull complete
a9c3c1abc664: Pull complete
b8495f782617: Pull complete
8ba4145edc35: Pull complete
Digest: sha256:fe9a6bf89c50fb3c6755c0c2d67cb09dc8e90ac468b3212167700b155c902a5d
Status: Downloaded newer image for postgres:12.0-alpine
 ---> cef3c8b4bfa5
Step 2/5 : COPY init-db.sql /docker-entrypoint-initdb.d/
 ---> 1332ed0660c4
Step 3/5 : ENV POSTGRES_USER dockeruser
 ---> Running in daf9af0488f5
Removing intermediate container daf9af0488f5
 ---> 600702032c3c
Step 4/5 : ENV POSTGRES_PASSWORD dockerpass
 ---> Running in 445f8befc1d3
Removing intermediate container 445f8befc1d3
 ---> d78418ece041
Step 5/5 : ENV POSTGRES_DB pets
 ---> Running in abac2c36a4db
Removing intermediate container abac2c36a4db
 ---> 1c7fc1935863

Successfully built 1c7fc1935863
Successfully tagged fundamentalsofdocker/ch11-db:2.0
```

```
$ docker-compose up
Creating network "ch11_default" with the default driver
Creating volume "ch11_pets-data" with default driver
Creating ch11_web_1 ... done
Creating ch11_db_1  ... done
Attaching to ch11_db_1, ch11_web_1
db_1    | The files belonging to this database system will be owned by user "postgres".
db_1    | This user must also own the server process.
db_1    |
db_1    | The database cluster will be initialized with locale "en_US.utf8".
db_1    | The default database encoding has accordingly been set to "UTF8".
db_1    | The default text search configuration will be set to "english".
db_1    |
db_1    | Data page checksums are disabled.
db_1    |
db_1    | fixing permissions on existing directory /var/lib/postgresql/data ... ok
db_1    | creating subdirectories ... ok
db_1    | selecting dynamic shared memory implementation ... posix
db_1    | selecting default max_connections ... 100
db_1    | selecting default shared_buffers ... 128MB
db_1    | selecting default time zone ... UTC
db_1    | creating configuration files ... ok
db_1    | running bootstrap script ... ok
db_1    | performing post-bootstrap initialization ... sh: locale: not found
db_1    | 2019-10-19 09:41:15.324 UTC [26] WARNING:  no usable system locales were found
web_1   |
web_1   | > pets@2.0.0 start /app
web_1   | > node src/server.js
web_1   |
web_1   | Listening at 0.0.0.0:3000
db_1    | ok
db_1    | syncing data to disk ... ok
db_1    |
```

```
db_1   |  done
db_1   | server started
db_1   | CREATE DATABASE
db_1   |
db_1   |
db_1   | /usr/local/bin/docker-entrypoint.sh: running /docker-entrypoint-initdb.d/init-db.sql
db_1   | CREATE TABLE
db_1   | ALTER TABLE
db_1   | ALTER ROLE
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   | INSERT 0 1
db_1   |
db_1   |
db_1   | 2019-10-19 09:41:16.026 UTC [30] LOG:  received fast shutdown request
db_1   | waiting for server to shut down....2019-10-19 09:41:16.028 UTC [30] LOG:  aborting any active transac
db_1   | 2019-10-19 09:41:16.029 UTC [30] LOG:  background worker "logical replication launcher" (PID 37) exit
db_1   | 2019-10-19 09:41:16.029 UTC [32] LOG:  shutting down
db_1   | 2019-10-19 09:41:16.050 UTC [30] LOG:  database system is shut down
db_1   |  done
db_1   | server stopped
db_1   |
db_1   | PostgreSQL init process complete; ready for start up.
db_1   |
db_1   | 2019-10-19 09:41:16.132 UTC [1] LOG:  starting PostgreSQL 12.0 on x86_64-pc-linux-musl, compiled by g
db_1   | 2019-10-19 09:41:16.133 UTC [1] LOG:  listening on IPv4 address "0.0.0.0", port 5432
db_1   | 2019-10-19 09:41:16.133 UTC [1] LOG:  listening on IPv6 address "::", port 5432
db_1   | 2019-10-19 09:41:16.136 UTC [1] LOG:  listening on Unix socket "/var/run/postgresql/.s.PGSQL.5432"
db_1   | 2019-10-19 09:41:16.147 UTC [43] LOG:  database system was shut down at 2019-10-19 09:41:16 UTC
db_1   | 2019-10-19 09:41:16.151 UTC [1] LOG:  database system is ready to accept connections
```




```
Starting ch11_db_1  ... done
Starting ch11_web_1 ... done
Attaching to ch11_db_1, ch11_web_1
db_1    | 2019-10-19 10:40:06.611 UTC [1] LOG:  starting PostgreSQL 12.0 on x86_64-pc-linux-musl, compiled by gcc
db_1    | 2019-10-19 10:40:06.611 UTC [1] LOG:  listening on IPv4 address "0.0.0.0", port 5432
db_1    | 2019-10-19 10:40:06.611 UTC [1] LOG:  listening on IPv6 address "::", port 5432
db_1    | 2019-10-19 10:40:06.616 UTC [1] LOG:  listening on Unix socket "/var/run/postgresql/.s.PGSQL.5432"
db_1    | 2019-10-19 10:40:06.628 UTC [18] LOG:  database system was shut down at 2019-10-19 10:39:32 UTC
db_1    | 2019-10-19 10:40:06.631 UTC [1] LOG:  database system is ready to accept connections
web_1   |
web_1   | > pets@2.0.0 start /app
web_1   | > node src/server.js
web_1   |
web_1   | Listening at 0.0.0.0:3000
```

```
$ docker-compose ps
   Name                 Command               State          Ports
-------------------------------------------------------------------------
ch11_db_1    docker-entrypoint.sh postgres    Up      5432/tcp
ch11_web_1   docker-entrypoint.sh /bin/ ...   Up      0.0.0.0:80->3000/tcp
```

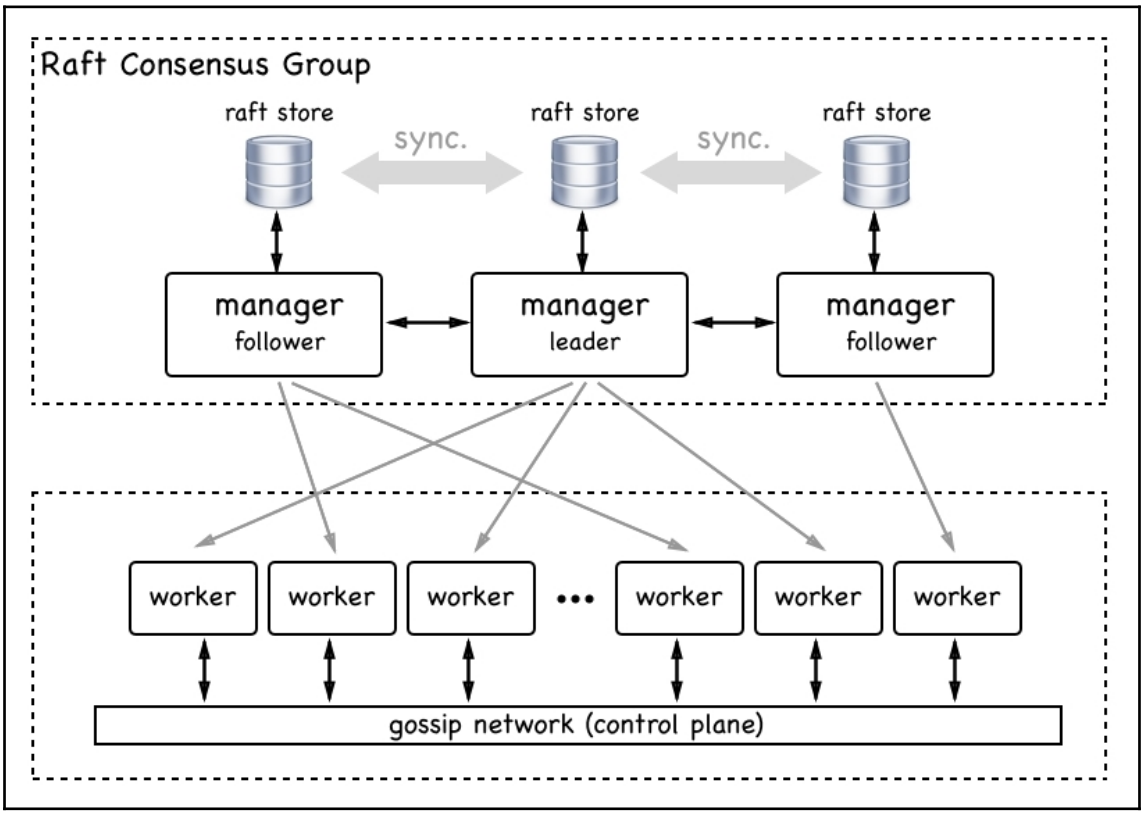
```
$ docker-compose up --scale web=3
ch11_db_1 is up-to-date
WARNING: The "web" service specifies a port on the host. If multiple containers for this service are created on a single host, the port will c
lash.
Starting ch11_web_1 ... done
Creating ch11_web_2 ... error
Creating ch11_web_3 ... error

ERROR: for ch11_web_3  Cannot start service web: driver failed programming external connectivity on endpoint ch11_web_3 (b71b482cd511c1d610204
8a91188faf8102a2a6766016f2be0fb7a7fd081aa7c): Bind for 0.0.0.0:80 failed: port is already allocated

ERROR: for ch11_web_2  Cannot start service web: driver failed programming external connectivity on endpoint ch11_web_2 (a96198908fe8eeeb16f2a
e7f69266da08c755fa42244c064cc6d93f4ca960ea9): Bind for 0.0.0.0:80 failed: port is already allocated

ERROR: for web  Cannot start service web: driver failed programming external connectivity on endpoint ch11_web_3 (b71b482cd511c1d6102048a91188
faf8102a2a6766016f2be0fb7a7fd081aa7c): Bind for 0.0.0.0:80 failed: port is already allocated
ERROR: Encountered errors while bringing up the project.
```

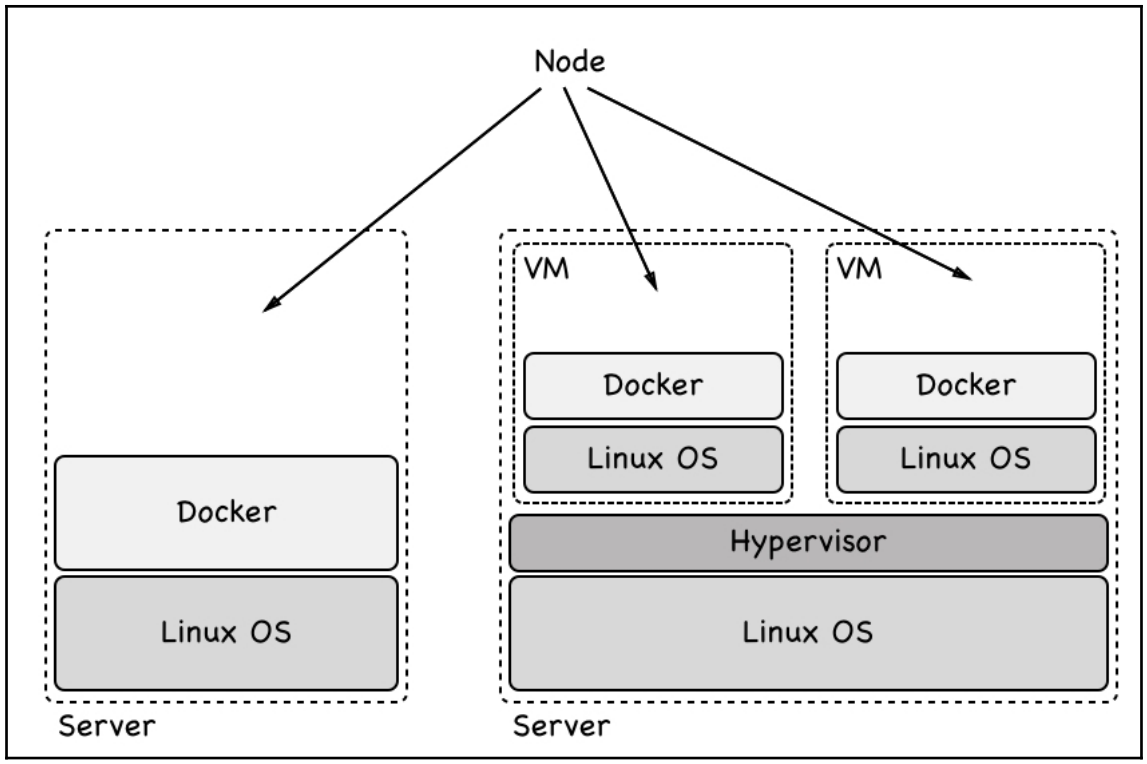
```
$ docker-compose ps
   Name                 Command               State          Ports
-------------------------------------------------------------------------
ch11_db_1    docker-entrypoint.sh postgres    Up      5432/tcp
ch11_web_1   docker-entrypoint.sh /bin/ ...   Up      0.0.0.0:32771->3000/tcp
ch11_web_2   docker-entrypoint.sh /bin/ ...   Up      0.0.0.0:32773->3000/tcp
ch11_web_3   docker-entrypoint.sh /bin/ ...   Up      0.0.0.0:32772->3000/tcp
```

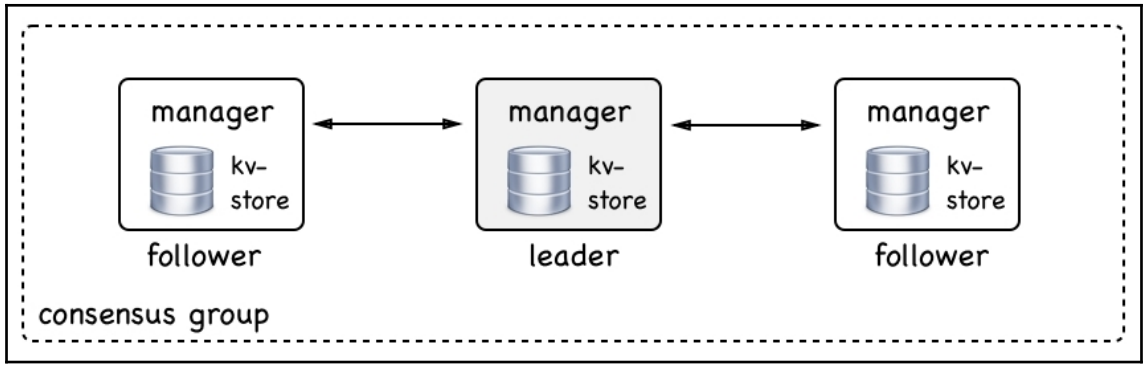
```
Pushing web (fundamentalsofdocker/ch11-web:2.0)...
The push refers to repository [docker.io/fundamentalsofdocker/ch11-web]
734009e0d2c2: Pushing [======>                                            ]  1.183MB/9.213MB
449090f6e2d8: Pushing [==================================================>]   5.12kB
a485feff37c0: Pushing [=================================================>    ]  4.832MB/5.158MB
eb0392faf413: Pushing [==================================================>]   2.56kB
c59a51ff3038: Pushing  1.536kB
f79218cf4e46: Waiting
9bbfc6927ce9: Waiting
233b3b1fa72b: Waiting
f1b5933fe4b5: Waiting
```

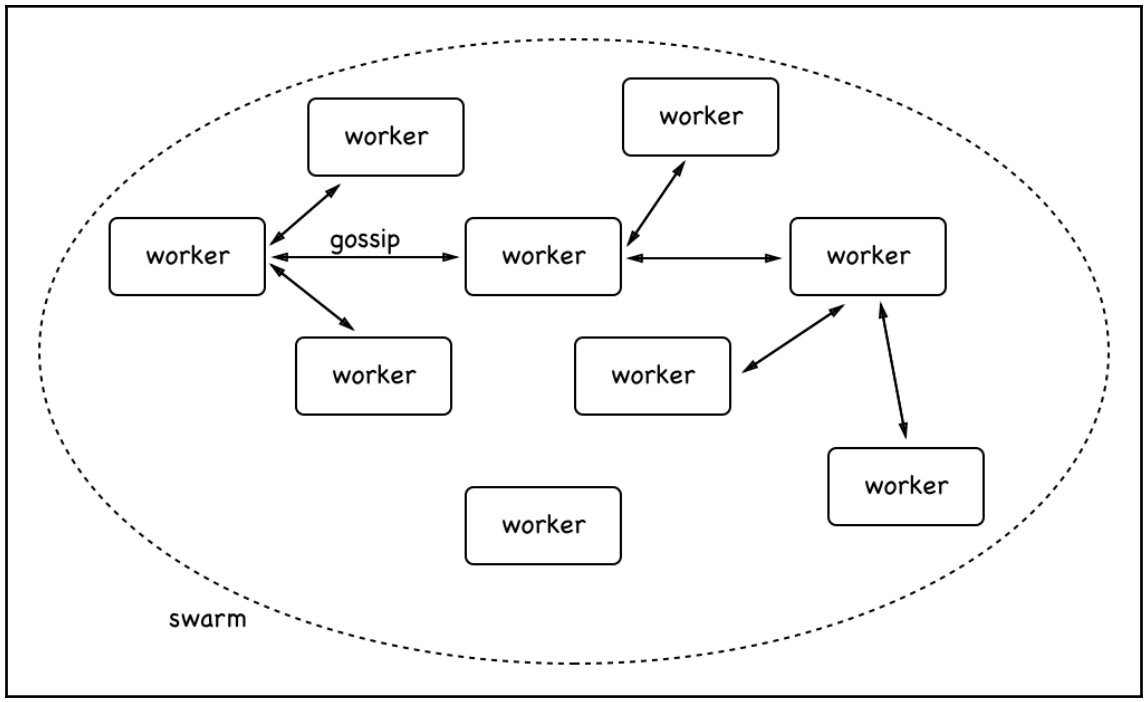
Chapter 12: Orchestrators

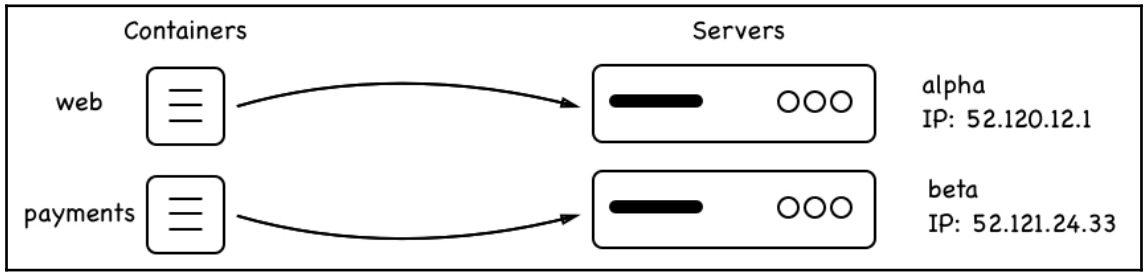
Chapter 13: Introduction to Docker Swarm

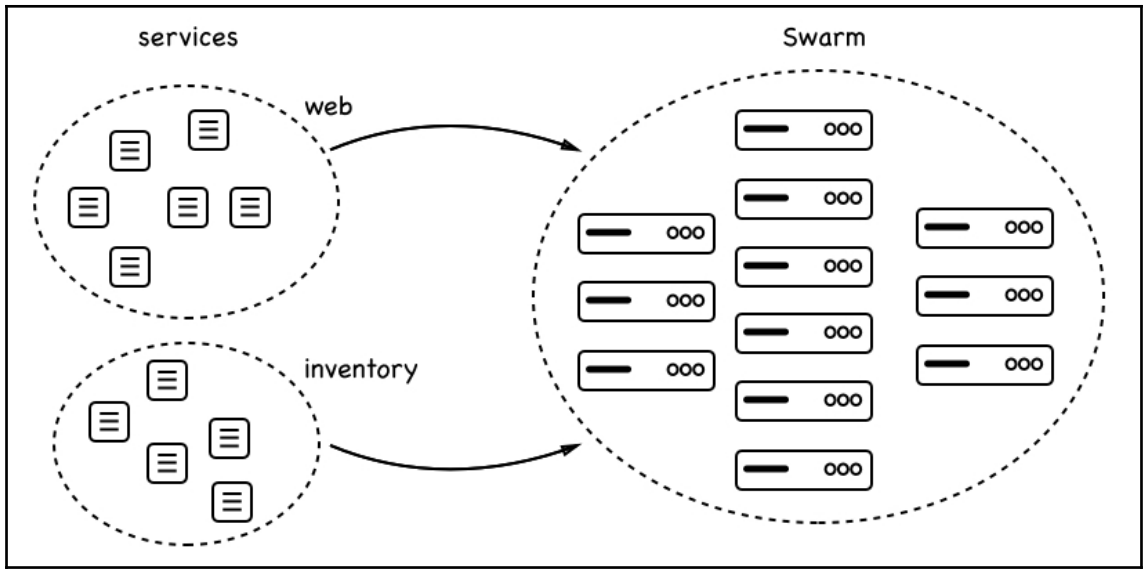


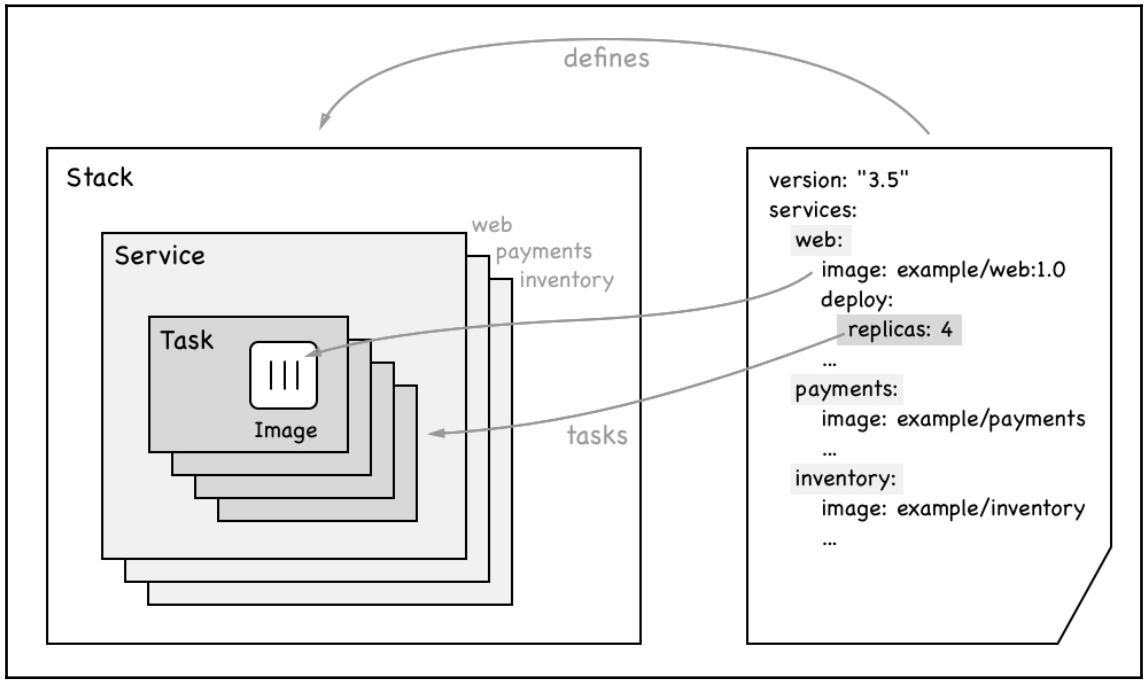

Node
VM
VM
Docker
Docker
Linux OS
Linux OS
Docker
Linux OS
Hypervisor
Linux OS
Server
Server

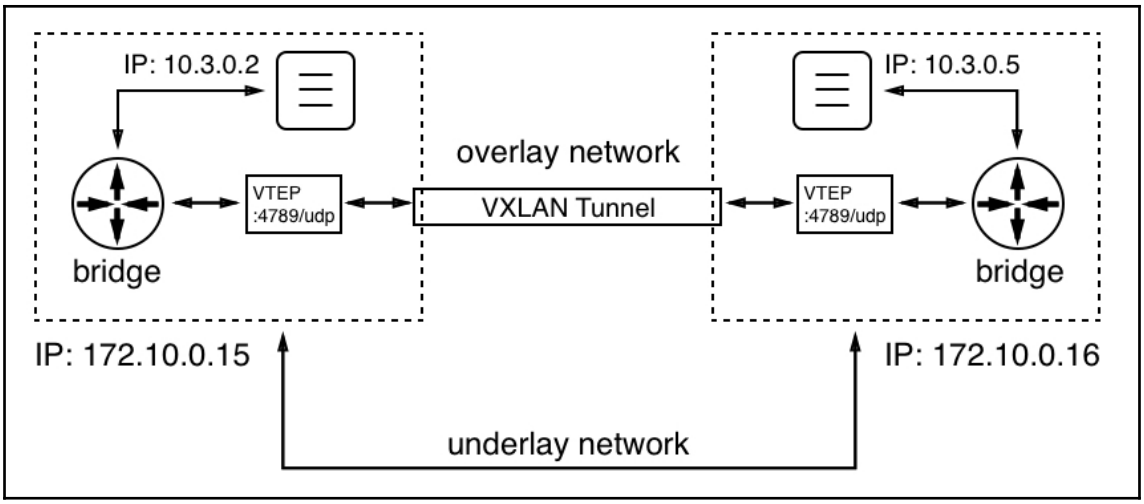

manager
kv-store
manager
kv-store
manager
kv-store
follower
leader
follower
consensus group


worker
worker
worker
gossip
worker
worker
worker
worker
worker
worker
swarm


Containers
Servers
web
payments
alpha
IP: 52.120.12.1
beta
IP: 52.121.24.33


services
Swarm
web
inventory


defines
Stack
Service
Task
Image
web
payments
inventory
tasks
version: "3.5"
services:
web:
image: example/web:1.0
deploy:
replicas: 4
...
payments:
image: example/payments
...
inventory:
image: example/inventory
...




```
$ docker swarm init
Swarm initialized: current node (mc07c43kp8v8d4ofnl5i9skb2) is now a manager.

To add a worker to this swarm, run the following command:

    docker swarm join --token SWMTKN-1-1ynzcy7z2tze0zhrbw7h855biywspmg9mjewknn5hwg6g10b5m-7h98rot6dfi5723ftkitsb1vt 192.168.65.3:2377

To add a manager to this swarm, run 'docker swarm join-token manager' and follow the instructions.
```

```
$ docker node ls
ID                            HOSTNAME            STATUS              AVAILABILITY        MANAGER STATUS      ENGINE VERSION
s5hjreg5z3cqk4jmsslqx6auc *   docker-desktop      Ready               Active              Leader              19.03.4
```

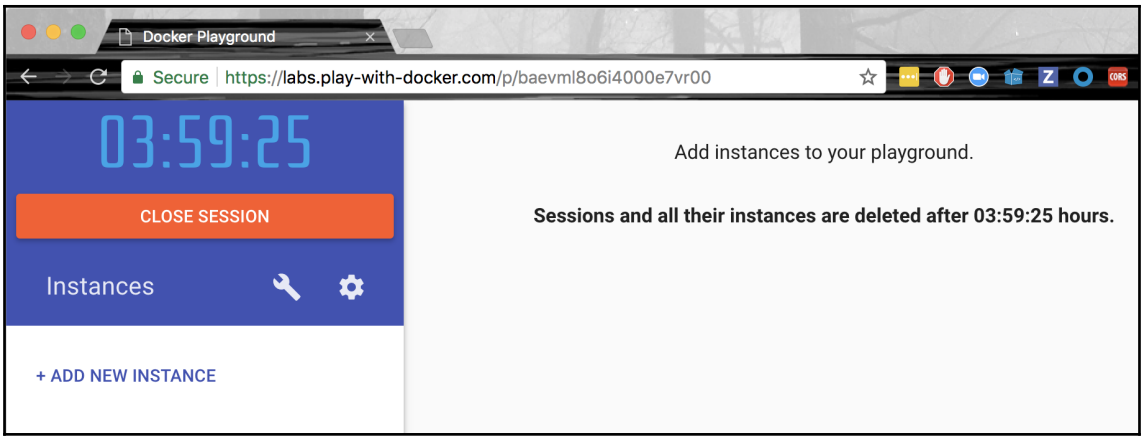
```
$ docker node inspect s5hjreg5z3cqk4jmsslqx6auc
[
    {
        "ID": "s5hjreg5z3cqk4jmsslqx6auc",
        "Version": {
            "Index": 9
        },
        "CreatedAt": "2019-11-03T18:18:54.4662205Z",
        "UpdatedAt": "2019-11-03T18:18:54.9865568Z",
        "Spec": {
            "Labels": {},
            "Role": "manager",
            "Availability": "active"
        },
        "Description": {
            "Hostname": "docker-desktop",
            "Platform": {
                "Architecture": "x86_64",
                "OS": "linux"
            },
            "Resources": {
                "NanoCPUs": 2000000000,
                "MemoryBytes": 2076631040
            },
            "Engine": {
                "EngineVersion": "19.03.4",
                "Plugins": [
                    {
                        "Type": "Log",
                        "Name": "awslogs"
                    },
```

```
$ docker-machine ls
NAME      ACTIVE   DRIVER    STATE     URL                       SWARM   DOCKER      ERRORS
default   -        hyperv    Running   tcp://192.168.8.104:2376          v19.03.4
```

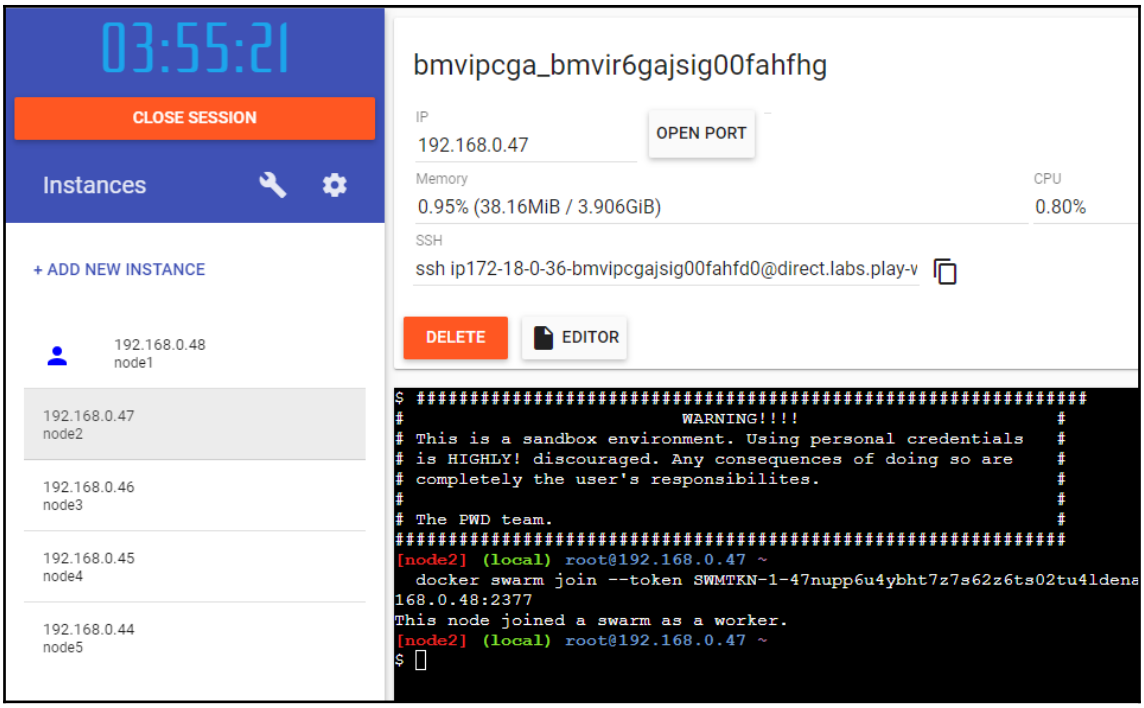
```
$ docker-machine create --driver virtualbox default
Running pre-create checks...
Creating machine...
(default) Copying /Users/gabriel/.docker/machine/cache/boot2docker.iso to /Users/gabriel/.docker/m
(default) Creating VirtualBox VM...
(default) Creating SSH key...
(default) Starting the VM...
(default) Check network to re-create if needed...
(default) Waiting for an IP...
Waiting for machine to be running, this may take a few minutes...
Detecting operating system of created instance...
Waiting for SSH to be available...
Detecting the provisioner...
Provisioning with boot2docker...
Copying certs to the local machine directory...
Copying certs to the remote machine...
Setting Docker configuration on the remote daemon...
Checking connection to Docker...
Docker is up and running!
To see how to connect your Docker Client to the Docker Engine running on this virtual machine, rur
$
```

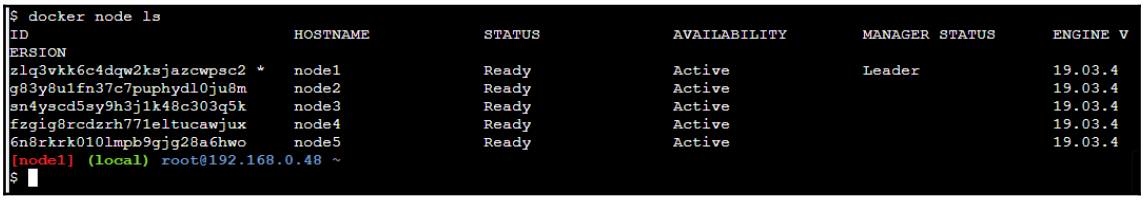
```
$ docker-machine ls
NAME      ACTIVE   DRIVER       STATE     URL                         SWARM   DOCKER        ERRORS
default   -        virtualbox   Running   tcp://192.168.99.100:2376           v17.12.1-ce
node-1    -        virtualbox   Running   tcp://192.168.99.101:2376           v17.12.1-ce
node-2    -        virtualbox   Running   tcp://192.168.99.102:2376           v17.12.1-ce
node-3    -        virtualbox   Running   tcp://192.168.99.103:2376           v17.12.1-ce
node-4    -        virtualbox   Running   tcp://192.168.99.104:2376           v17.12.1-ce
node-5    -        virtualbox   Running   tcp://192.168.99.105:2376           v17.12.1-ce
$
```

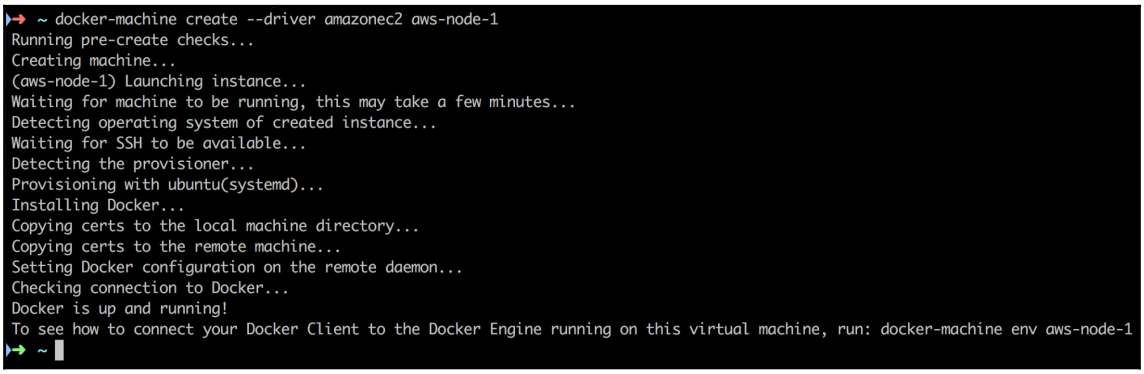
```
$ docker-machine ssh node-1 docker node ls
ID                            HOSTNAME            STATUS              AVAILABILITY        MANAGER STATUS
kgvj80vupkw9ucdkxw853dejt *   node-1              Ready               Active              Leader
m2bel1iye6szjqs5nghfpcmzv     node-2              Ready               Active              Reachable
ij0yjtlrd7mzr4jq5mn9fwyky     node-3              Ready               Active              Reachable
ys3cg84plfu6krz4pskebhcg7     node-4              Ready               Active
esm46efplk769rel3q2tebz8b     node-5              Ready               Active
$
```


Docker Playground
Secure
https://labs.play-with-docker.com/p/baevml8o6i4000e7vr00
03:59:25
CLOSE SESSION
Instances
+ ADD NEW INSTANCE
Add instances to your playground.
Sessions and all their instances are deleted after 03:59:25 hours.


03:59:07
CLOSE SESSION
Instances
+ ADD NEW INSTANCE
192.168.0.48
node1
bmvipcga_bmvipk0ajsig00fahfdg
IP
192.168.0.48
OPEN PORT
Memory
0.78% (31.33MiB / 3.906GiB)
CPU
1.07%
SSH
ssh ip172-18-0-27-bmvipcgajsig00fahfd0@direct.labs.play-v
DELETE
EDITOR
$ ##
# WARNING!!!! #
# This is a sandbox environment. Using personal credentials #
# is HIGHLY! discouraged. Any consequences of doing so are #
# completely the user's responsibilites. #
# #
# The PWD team. #
##
[node1] (local) root@192.168.0.48 ~

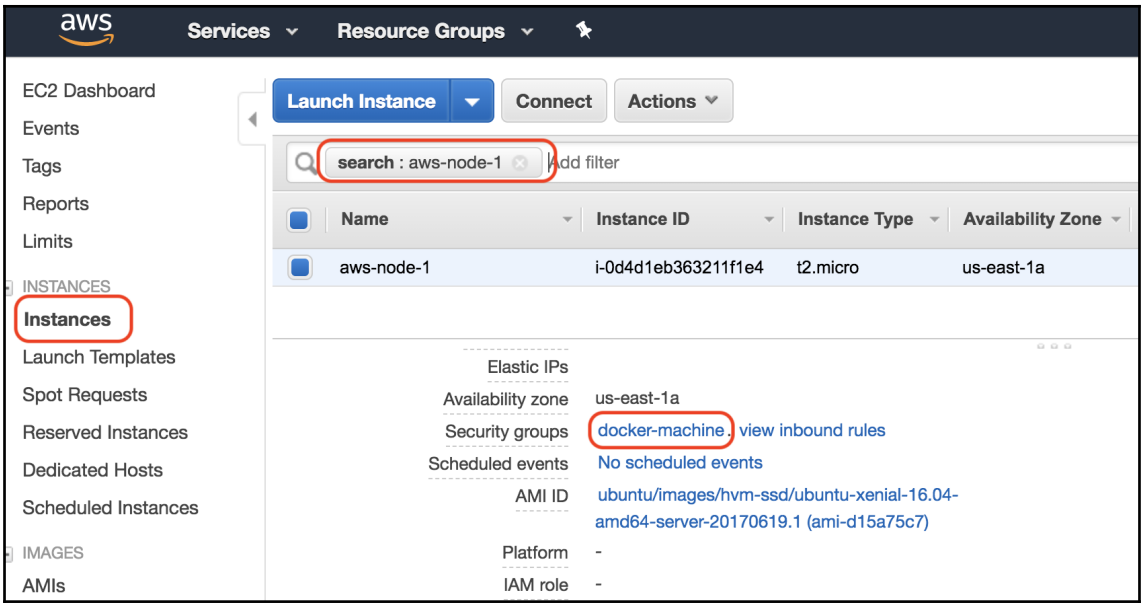

03:55:21
CLOSE SESSION
Instances
+ ADD NEW INSTANCE
192.168.0.48
node1
192.168.0.47
node2
192.168.0.46
node3
192.168.0.45
node4
192.168.0.44
node5
bmvipcga_bmvir6gajsig00fahfhg
IP
192.168.0.47
OPEN PORT
Memory
0.95% (38.16MiB / 3.906GiB)
CPU
0.80%
SSH
ssh ip172-18-0-36-bmvipcgajsig00fahfd0@direct.labs.play-v
DELETE
EDITOR
$ ##
# WARNING!!!! #
# This is a sandbox environment. Using personal credentials #
# is HIGHLY! discouraged. Any consequences of doing so are #
# completely the user's responsibilites. #
# #
# The PWD team. #
##
[node2] (local) root@192.168.0.47 ~
docker swarm join --token SWMTKN-1-47nupp6u4ybht7z7s62z6ts02tu4ldena
168.0.48:2377
This node joined a swarm as a worker.
[node2] (local) root@192.168.0.47 ~
$

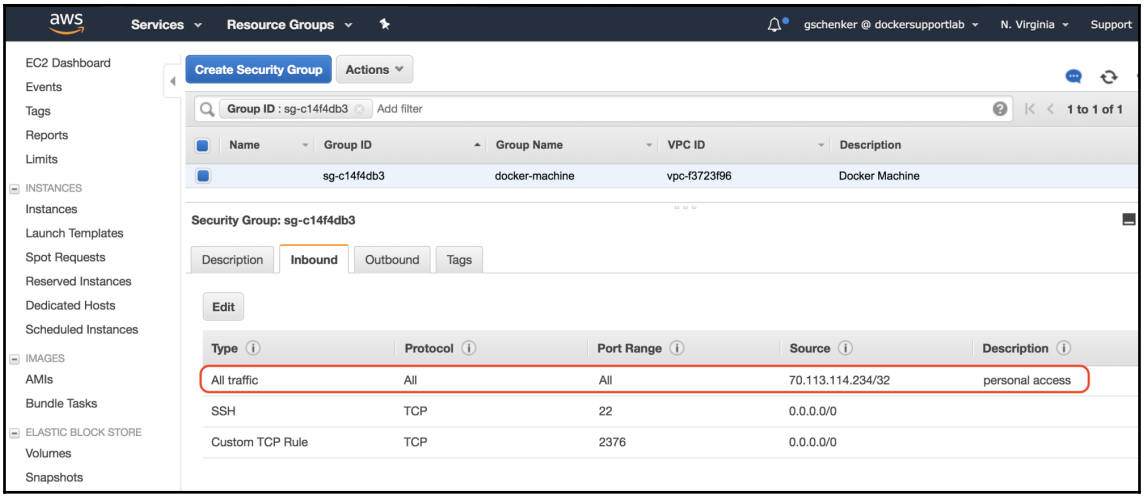

$ docker node ls
ID HOSTNAME STATUS AVAILABILITY MANAGER STATUS ENGINE V
ERSION
zlq3vkk6c4dqw2ksjazcwpsc2 * node1 Ready Active Leader 19.03.4
g83y8u1fn37c7puphydl0ju8m node2 Ready Active 19.03.4
sn4yscd5sy9h3j1k48c303q5k node3 Ready Active 19.03.4
fzgig8rcdzrh771eltucawjux node4 Ready Active 19.03.4
6n8rkrk0101mpb9gjg28a6hwo node5 Ready Active 19.03.4
[node1] (local) root@192.168.0.48 ~
$


~ docker-machine create --driver amazonec2 aws-node-1
Running pre-create checks...
Creating machine...
(aws-node-1) Launching instance...
Waiting for machine to be running, this may take a few minutes...
Detecting operating system of created instance...
Waiting for SSH to be available...
Detecting the provisioner...
Provisioning with ubuntu(systemd)...
Installing Docker...
Copying certs to the local machine directory...
Copying certs to the remote machine...
Setting Docker configuration on the remote daemon...
Checking connection to Docker...
Docker is up and running!
To see how to connect your Docker Client to the Docker Engine running on this virtual machine, run: docker-machine env aws-node-1
~

```
➜  ~ export | grep DOCKER
DOCKER_CERT_PATH=/Users/gabriel/.docker/machine/machines/aws-node-1
DOCKER_HOST=tcp://35.172.240.127:2376
DOCKER_MACHINE_NAME=aws-node-1
DOCKER_TLS_VERIFY=1
➜  ~
```

```
➜  ~ curl -4 35.172.240.127:8000
curl: (7) Failed to connect to 35.172.240.127 port 8000: Operation timed out
➜  ~
```





Type	Protocol	Port Range	Source	Description
All traffic	All	All	70.113.114.234/32	personal access
All traffic	All	All	sg-c14f4db3 (docker-machine)	intra swarm commun...
SSH	TCP	22	0.0.0.0/0	
Custom TCP Rule	TCP	2376	0.0.0.0/0	

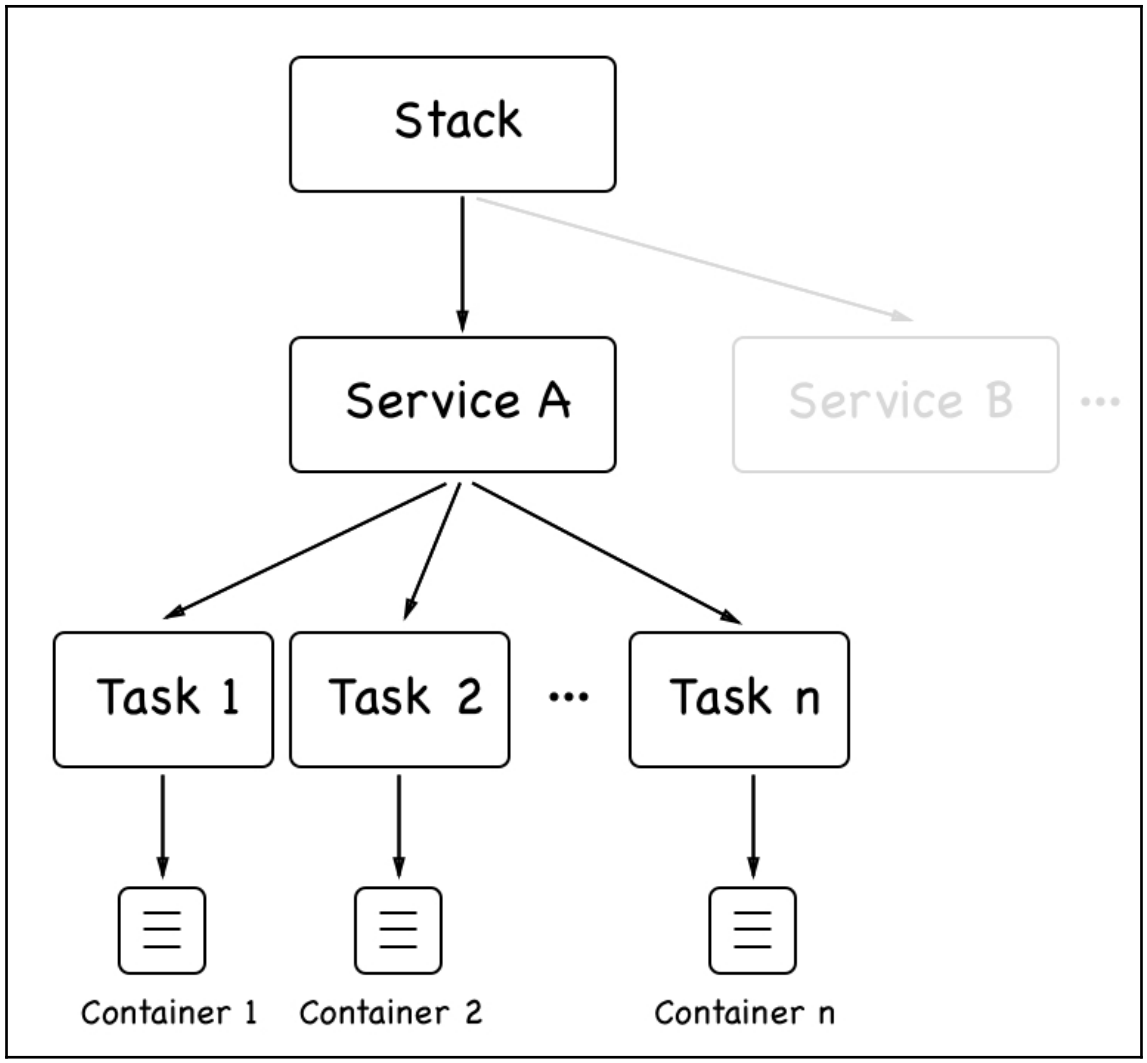
```
➜  ~ docker-machine ls
NAME          ACTIVE   DRIVER       STATE     URL                         SWARM   DOCKER        ERRORS
aws-node-1    *        amazonec2    Running   tcp://35.172.240.127:2376           v18.02.0-ce
aws-node-2    -        amazonec2    Running   tcp://54.236.40.1:2376              v18.02.0-ce
aws-node-3    -        amazonec2    Running   tcp://34.205.171.56:2376            v18.02.0-ce
aws-node-4    -        amazonec2    Running   tcp://34.239.93.22:2376             v18.02.0-ce
aws-node-5    -        amazonec2    Running   tcp://52.205.26.218:2376            v18.02.0-ce
node-1        -        virtualbox   Running   tcp://192.168.99.100:2376           v17.12.1-ce
node-2        -        virtualbox   Running   tcp://192.168.99.101:2376           v17.12.1-ce
node-3        -        virtualbox   Running   tcp://192.168.99.102:2376           v17.12.1-ce
node-4        -        virtualbox   Running   tcp://192.168.99.103:2376           v17.12.1-ce
node-5        -        virtualbox   Running   tcp://192.168.99.104:2376           v17.12.1-ce
➜  ~
```

```
$ docker node ls
ID                            HOSTNAME            STATUS              AVAILABILITY        MANAGER STATUS      ENGINE VERSION
xiwj6h20yjo5i93ba3pl5c862 *   node1               Ready               Active              Leader              19.03.4
n1bjs6qk9voat2jlxtggcglde     node2               Ready               Active                                  19.03.4
fp9xuzm4sse62j07vg4m5cd5w     node3               Ready               Active                                  19.03.4
5a2blzwulu7gvs91nfh7nf7ip     node4               Ready               Active                                  19.03.4
fsls4x95rjxvu675581svckml     node5               Ready               Active                                  19.03.4
```

```
$ docker service ls
ID                  NAME                MODE                REPLICAS            IMAGE                     PORTS
lqyymm2u2mry        sample-stack_whoami   replicated          6/6                 training/whoami:latest    *:81->8000/tcp
$
```

```
docker@node-1:~$ docker service ps sample-stack_whoami
ID                  NAME                    IMAGE                     NODE                DESIRED STATE       CURRENT STATE           ERROR               PORTS
mtvvunqieacg        sample-stack_whoami.1   training/whoami:latest    node-5              Running             Running 26 seconds ago
n21e7ktyvo4b        sample-stack_whoami.2   training/whoami:latest    node-1              Running             Running 26 seconds ago
lozzitfydlad        sample-stack_whoami.3   training/whoami:latest    node-2              Running             Running 27 seconds ago
xymlohw68639        sample-stack_whoami.4   training/whoami:latest    node-2              Running             Running 27 seconds ago
yn84l8fc83el        sample-stack_whoami.5   training/whoami:latest    node-3              Running             Running 28 seconds ago
3hvu4qul0dzs        sample-stack_whoami.6   training/whoami:latest    node-4              Running             Running 27 seconds ago
docker@node-1:~$
```

```
docker@node-1:~$ docker container ls
CONTAINER ID        IMAGE                     COMMAND             CREATED             STATUS              PORTS               NAMES
d11a82869bf0        training/whoami:latest    "/app/http"         7 minutes ago       Up 7 minutes        8000/tcp            sample-stack_whoami.2.n21e7ktyvo4b2sufalk0aibzy
docker@node-1:~$
```


Stack
Service A
Service B
Task 1
Task 2
Task n
Container 1
Container 2
Container n

```
docker@node-1:~$ docker service logs sample-stack_whoami
sample-stack_whoami.2.n21e7ktyvo4b@node-1     | Listening on :8000
sample-stack_whoami.1.mtvvunqieacg@node-5     | Listening on :8000
sample-stack_whoami.6.3hvu4qul0dzs@node-4     | Listening on :8000
sample-stack_whoami.4.xymlohw68639@node-2     | Listening on :8000
sample-stack_whoami.3.lozzitfydlad@node-2     | Listening on :8000
sample-stack_whoami.5.yn84l8fc83el@node-3     | Listening on :8000
docker@node-1:~$
```

```
docker@node-1:~$ docker service logs n21e7ktyvo4b
sample-stack_whoami.2.n21e7ktyvo4b@node-1     | Listening on :8000
docker@node-1:~$
```

```
docker@node-1:~$ docker service ps sample-stack_whoami
ID                  NAME                      IMAGE                   NODE                DESIRED STATE       CURRENT STATE            ERROR                         PORTS
mtvvunqieacg        sample-stack_whoami.1     training/whoami:latest  node-5              Running             Running 7 hours ago
i8reh311h03z        sample-stack_whoami.2     training/whoami:latest  node-1              Running             Running 12 seconds ago
n21e7ktyvo4b         \_ sample-stack_whoami.2 training/whoami:latest  node-1              Shutdown            Failed 17 seconds ago    "task: non-zero exit (137)"
lozzitfydlad        sample-stack_whoami.3     training/whoami:latest  node-2              Running             Running 7 hours ago
xymlohw68639        sample-stack_whoami.4     training/whoami:latest  node-2              Running             Running 7 hours ago
yn84l8fc83el        sample-stack_whoami.5     training/whoami:latest  node-3              Running             Running 7 hours ago
3hvu4qul0dzs        sample-stack_whoami.6     training/whoami:latest  node-4              Running             Running 7 hours ago
docker@node-1:~$
```

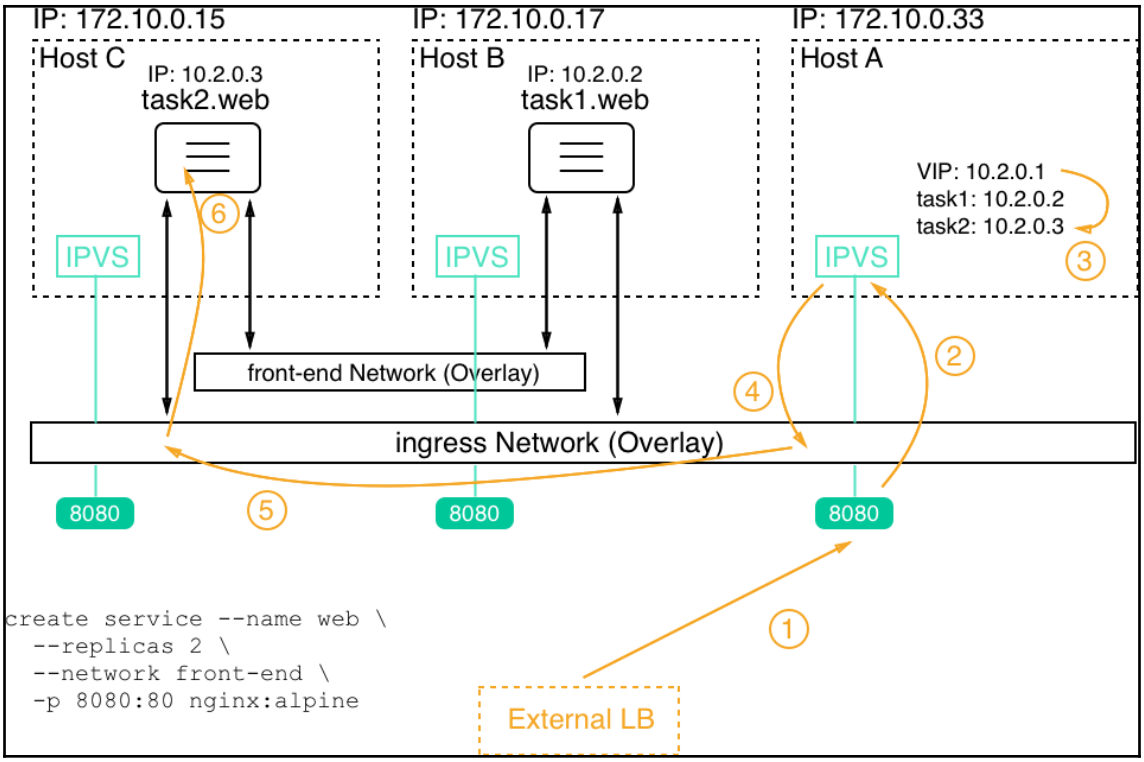
```
docker@node-1:~$ docker service ps sample-stack_whoami
ID                  NAME                      IMAGE                   NODE                DESIRED STATE       CURRENT STATE            ERROR                         PORTS
mtvvunqieacg        sample-stack_whoami.1     training/whoami:latest  node-5              Running             Running 7 hours ago
i8reh311h03z        sample-stack_whoami.2     training/whoami:latest  node-1              Running             Running 11 minutes ago
n21e7ktyvo4b         \_ sample-stack_whoami.2 training/whoami:latest  node-1              Shutdown            Failed 11 minutes ago    "task: non-zero exit (137)"
sa43kdd4o3h5        sample-stack_whoami.3     training/whoami:latest  node-1              Ready               Ready 1 second ago
lozzitfydlad         \_ sample-stack_whoami.3 training/whoami:latest  node-2              Shutdown            Running 9 seconds ago
jhlqlhnkzgt7        sample-stack_whoami.4     training/whoami:latest  node-3              Ready               Ready 1 second ago
xymlohw68639         \_ sample-stack_whoami.4 training/whoami:latest  node-2              Shutdown            Running 9 seconds ago
yn84l8fc83el        sample-stack_whoami.5     training/whoami:latest  node-3              Running             Running 7 hours ago
3hvu4qul0dzs        sample-stack_whoami.6     training/whoami:latest  node-4              Running             Running 7 hours ago
docker@node-1:~$
```

```
docker@node-1:~$ docker stack rm sample-stack
Removing service sample-stack_whoami
Removing network sample-stack_test-net
docker@node-1:~$
```

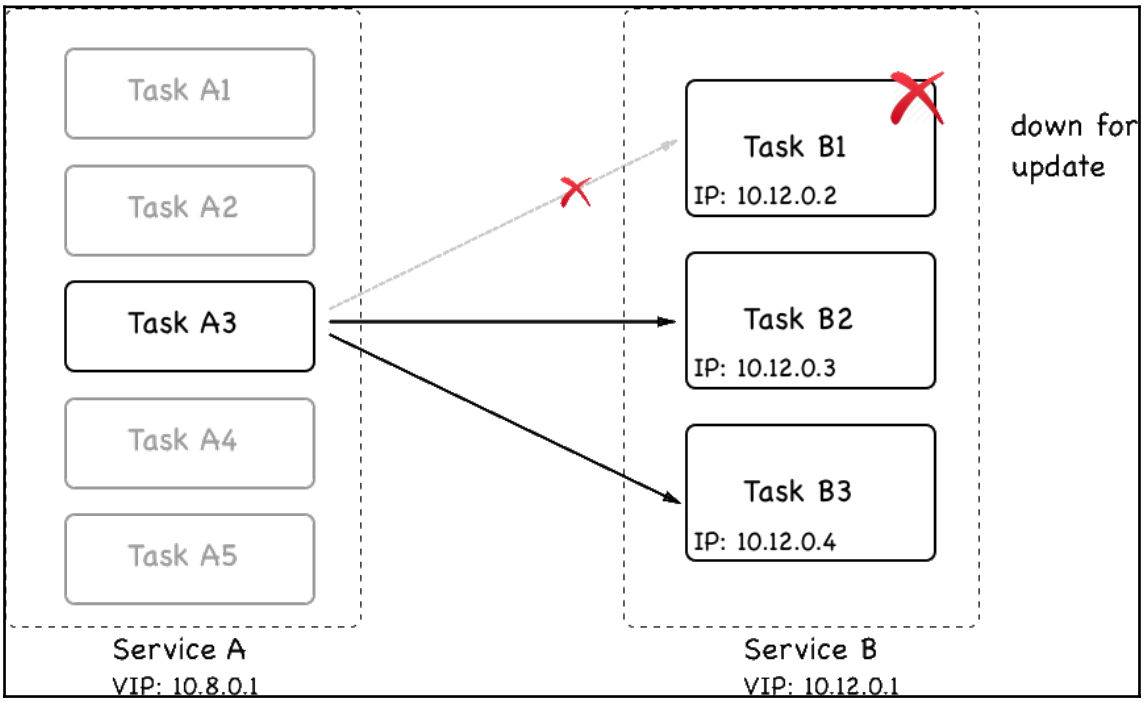
```
docker@node-1:~$ docker stack deploy -c pet-stack.yaml pets
Creating network pets_pets-net
Creating service pets_db
Creating service pets_web
docker@node-1:~$ 4
```

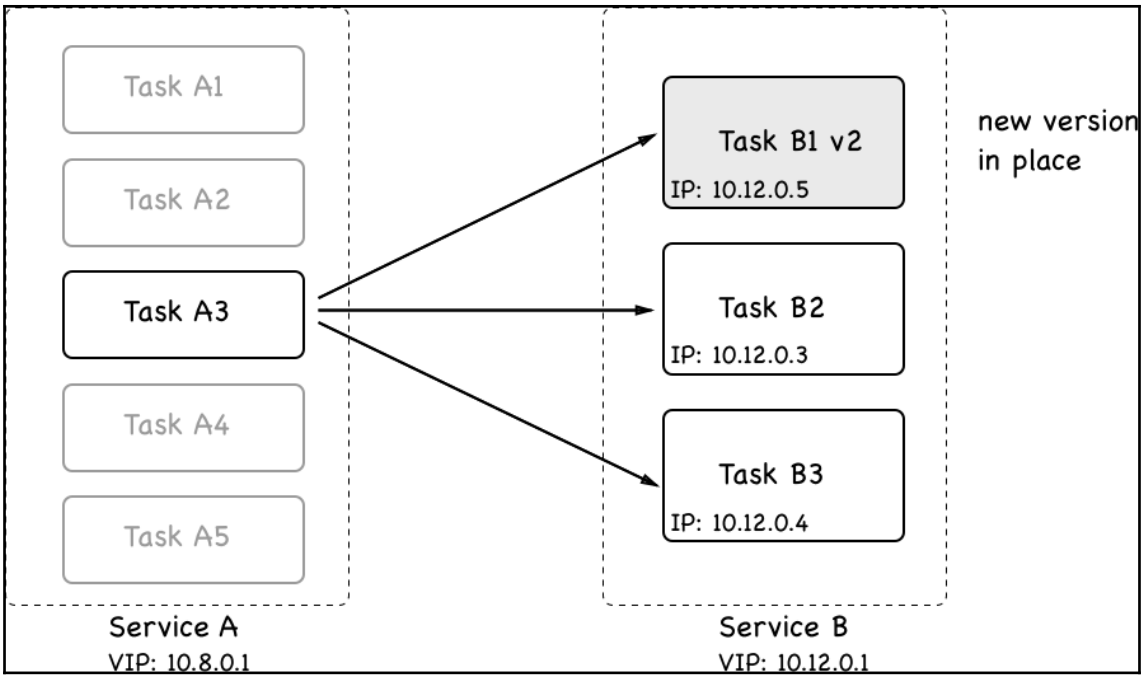
```
$ docker stack ps pets
ID                  NAME                IMAGE                                NODE                DESIRED STATE       CURRENT STATE           ERRO
h9z90us6gy6i        pets_db.1           fundamentalsofdocker/ch11-db:2.0     node4               Running             Running 5 seconds ago
u14wevitw9mg        pets_web.1          fundamentalsofdocker/ch11-web:2.0    node2               Running             Running 4 seconds ago
qsf7wbqwwr9g        pets_web.2          fundamentalsofdocker/ch11-web:2.0    node3               Running             Running 4 seconds ago
umza51f7beqs        pets_web.3          fundamentalsofdocker/ch11-web:2.0    node1               Running             Running 4 seconds ago
```

```
$ curl localhost:3000/pet
<html>
<head>
    <link rel="stylesheet" href="css/main.css">
</head>
<body>
    <div class="container">
        <h4>Animal of the day</h4>
        <img src="images&#x2F;male-lion.png"" />
        <p><small>Photo taken at <a href="https://www.maasaimara.com/">Massai Mara National Park</a></small></p>
        <p>Delivered to you by container 8b906b509a7e<p>
    </div>
</body>
</html>[node1] (local) root@192.168.0.33 ~
```


IP: 172.10.0.15
Host C
IP: 10.2.0.3
task2.web
IP: 172.10.0.17
Host B
IP: 10.2.0.2
task1.web
IP: 172.10.0.33
Host A
VIP: 10.2.0.1
task1: 10.2.0.2
task2: 10.2.0.3
IPVS
IPVS
IPVS
front-end Network (Overlay)
ingress Network (Overlay)
8080
8080
8080
1
2
3
4
5
6
create service --name web \
--replicas 2 \
--network front-end \
-p 8080:80 nginx:alpine
External LB

Chapter 14: Zero-Downtime Deployments and Secrets





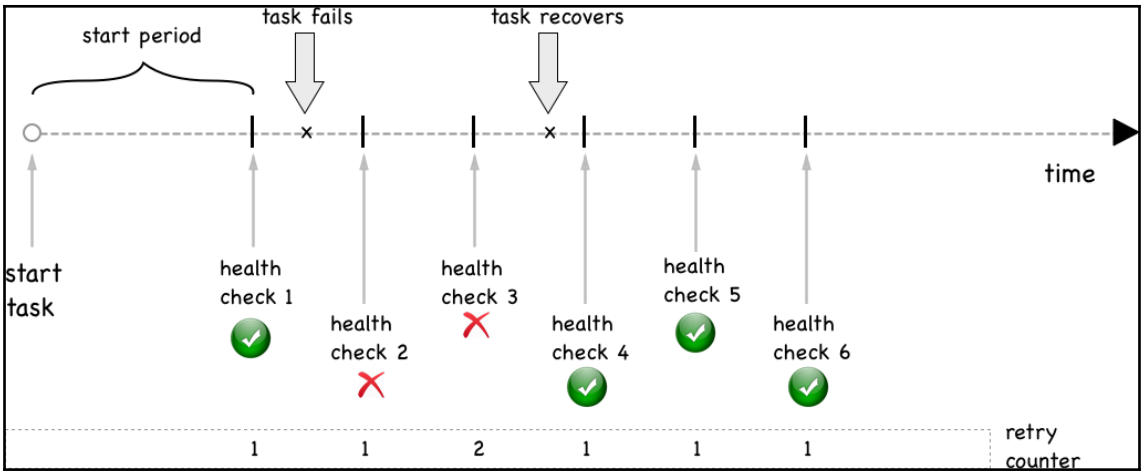

```
$ docker stack deploy -c stack.yaml web
Creating network web_default
Creating service web_web
$
```

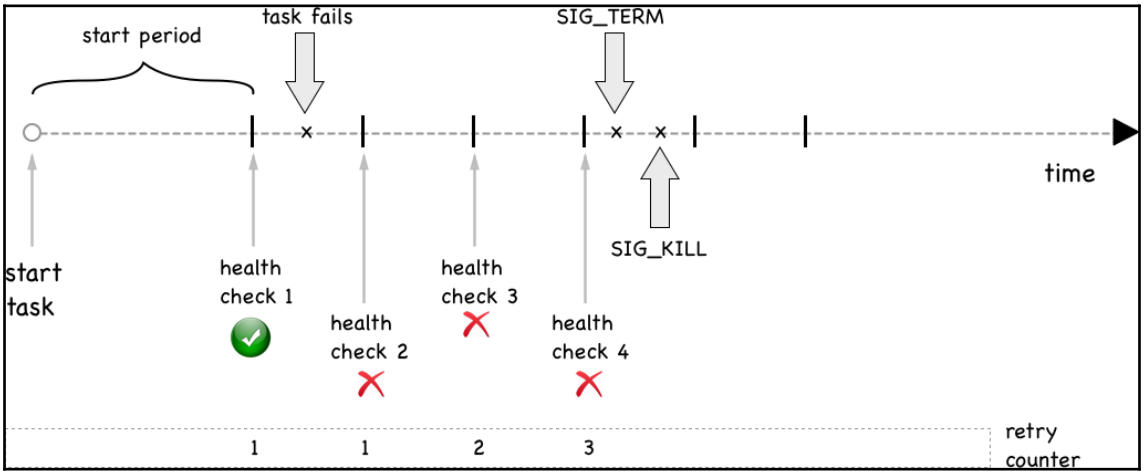
```
Every 2.0s: docker stack ps web

ID                  NAME                IMAGE               NODE                DESIRED STATE       CURRENT STATE           ERROR               PORTS
ze29yvu4jyyc        web_web.1           nginx:1.12-alpine   node-2              Running             Running 3 minutes ago
i1cy5v4o9ld3        web_web.2           nginx:1.12-alpine   node-2              Running             Running 3 minutes ago
kzqylcub4a49        web_web.3           nginx:1.12-alpine   node-1              Running             Running 3 minutes ago
ynt8n4ke8yld        web_web.4           nginx:1.12-alpine   node-3              Running             Running 3 minutes ago
qai8xv1u9v1d        web_web.5           nginx:1.12-alpine   node-5              Running             Running 3 minutes ago
5inv9mkxlpkv        web_web.6           nginx:1.12-alpine   node-4              Running             Running 3 minutes ago
iyjntpgy6cwe        web_web.7           nginx:1.12-alpine   node-1              Running             Running 3 minutes ago
q230vi6rlwrv        web_web.8           nginx:1.12-alpine   node-5              Running             Running 3 minutes ago
nh6jm2fyzwre        web_web.9           nginx:1.12-alpine   node-3              Running             Running 3 minutes ago
iuu56iot6dxm        web_web.10          nginx:1.12-alpine   node-4              Running             Running 3 minutes ago
```

```
overall progress: 4 out of 10 tasks
1/10: running   [==================================================>]
2/10: running   [==================================================>]
3/10: running   [==================================================>]
4/10: running   [==================================================>]
5/10: preparing [=====================================>             ]
6/10: preparing [=====================================>             ]
7/10:
8/10:
9/10:
10/10:
```

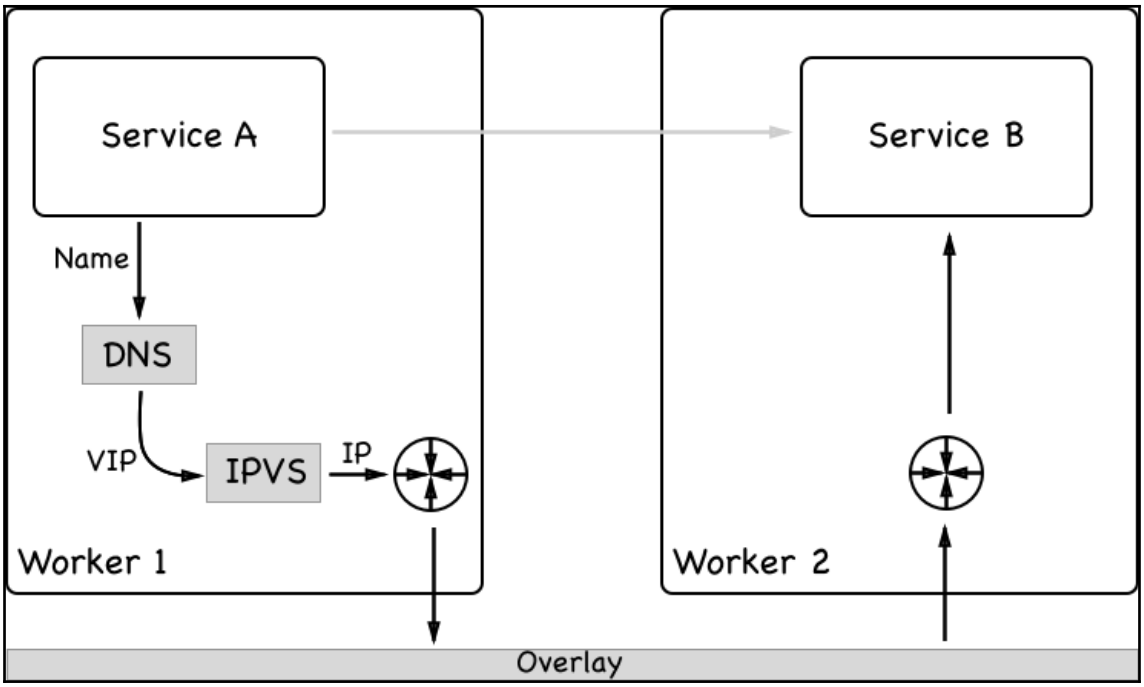
```
Every 2.0s: docker stack ps web

ID             NAME             IMAGE                NODE      DESIRED STATE   CURRENT STATE            ERROR     PORTS
ze29yvu4jyyc   web_web.1        nginx:1.12-alpine    node-2    Running         Running 7 minutes ago
i1cy5v4o9ld3   web_web.2        nginx:1.12-alpine    node-2    Running         Running 7 minutes ago
kzqylcub4a49   web_web.3        nginx:1.12-alpine    node-1    Running         Running 7 minutes ago
ynt8n4ke8yld   web_web.4        nginx:1.12-alpine    node-3    Running         Running 7 minutes ago
qai8xv1u9v1d   web_web.5        nginx:1.12-alpine    node-5    Running         Running 7 minutes ago
5inv9mkxlpkv   web_web.6        nginx:1.12-alpine    node-4    Running         Running 7 minutes ago
iyjntpgy6cwe   web_web.7        nginx:1.12-alpine    node-1    Running         Running 7 minutes ago
goxtziaseswi   web_web.8        nginx:1.13-alpine    node-5    Running         Running 7 seconds ago
q230vi6rlwrv    \_ web_web.8    nginx:1.12-alpine    node-5    Shutdown        Shutdown 8 seconds ago
y3q1e0mk20wn   web_web.9        nginx:1.13-alpine    node-3    Running         Running 9 seconds ago
nh6jm2fyzwre    \_ web_web.9    nginx:1.12-alpine    node-3    Shutdown        Shutdown 10 seconds ago
iuu56iot6dxm   web_web.10       nginx:1.12-alpine    node-4    Running         Running 7 minutes ago
```

```
Every 2.0s: docker stack ps web

ID             NAME             IMAGE                NODE      DESIRED STATE   CURRENT STATE                ERROR     PORTS
v99yet3urtyf   web_web.1        nginx:1.13-alpine    node-2    Running         Running 2 minutes ago
ze29yvu4jyyc    \_ web_web.1    nginx:1.12-alpine    node-2    Shutdown        Shutdown 2 minutes ago
s6was0b36hoa   web_web.2        nginx:1.13-alpine    node-2    Running         Running 2 minutes ago
i1cy5v4o9ld3    \_ web_web.2    nginx:1.12-alpine    node-2    Shutdown        Shutdown 2 minutes ago
m2fvxq7yxfqc   web_web.3        nginx:1.13-alpine    node-1    Running         Running 2 minutes ago
kzqylcub4a49    \_ web_web.3    nginx:1.12-alpine    node-1    Shutdown        Shutdown 2 minutes ago
xsjjudndb7jm   web_web.4        nginx:1.13-alpine    node-3    Running         Running 2 minutes ago
ynt8n4ke8yld    \_ web_web.4    nginx:1.12-alpine    node-3    Shutdown        Shutdown 2 minutes ago
fuk4xpb5g5un   web_web.5        nginx:1.13-alpine    node-5    Running         Running about a minute ago
qai8xv1u9v1d    \_ web_web.5    nginx:1.12-alpine    node-5    Shutdown        Shutdown about a minute ago
ipa1sc5hee7d   web_web.6        nginx:1.13-alpine    node-4    Running         Running about a minute ago
5inv9mkxlpkv    \_ web_web.6    nginx:1.12-alpine    node-4    Shutdown        Shutdown about a minute ago
feyu3l2ufjgr   web_web.7        nginx:1.13-alpine    node-1    Running         Running 2 minutes ago
iyjntpgy6cwe    \_ web_web.7    nginx:1.12-alpine    node-1    Shutdown        Shutdown 2 minutes ago
goxtziaseswi   web_web.8        nginx:1.13-alpine    node-5    Running         Running 2 minutes ago
q230vi6rlwrv    \_ web_web.8    nginx:1.12-alpine    node-5    Shutdown        Shutdown 2 minutes ago
y3q1e0mk20wn   web_web.9        nginx:1.13-alpine    node-3    Running         Running 2 minutes ago
nh6jm2fyzwre    \_ web_web.9    nginx:1.12-alpine    node-3    Shutdown        Shutdown 2 minutes ago
7r93m02hhizg   web_web.10       nginx:1.13-alpine    node-4    Running         Running 2 minutes ago
iuu56iot6dxm    \_ web_web.10   nginx:1.12-alpine    node-4    Shutdown        Shutdown 2 minutes ago
```






```
$ docker-machine ssh node-3 docker container ls
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS                    PORTS               NAMES
93c998264c10        nginx:alpine        "nginx -g 'daemon of…"   22 seconds ago      Up 21 seconds (healthy)   80/tcp              myapp_web.1.kkxlhze5xtqenk33ynvwyc83s
$
```



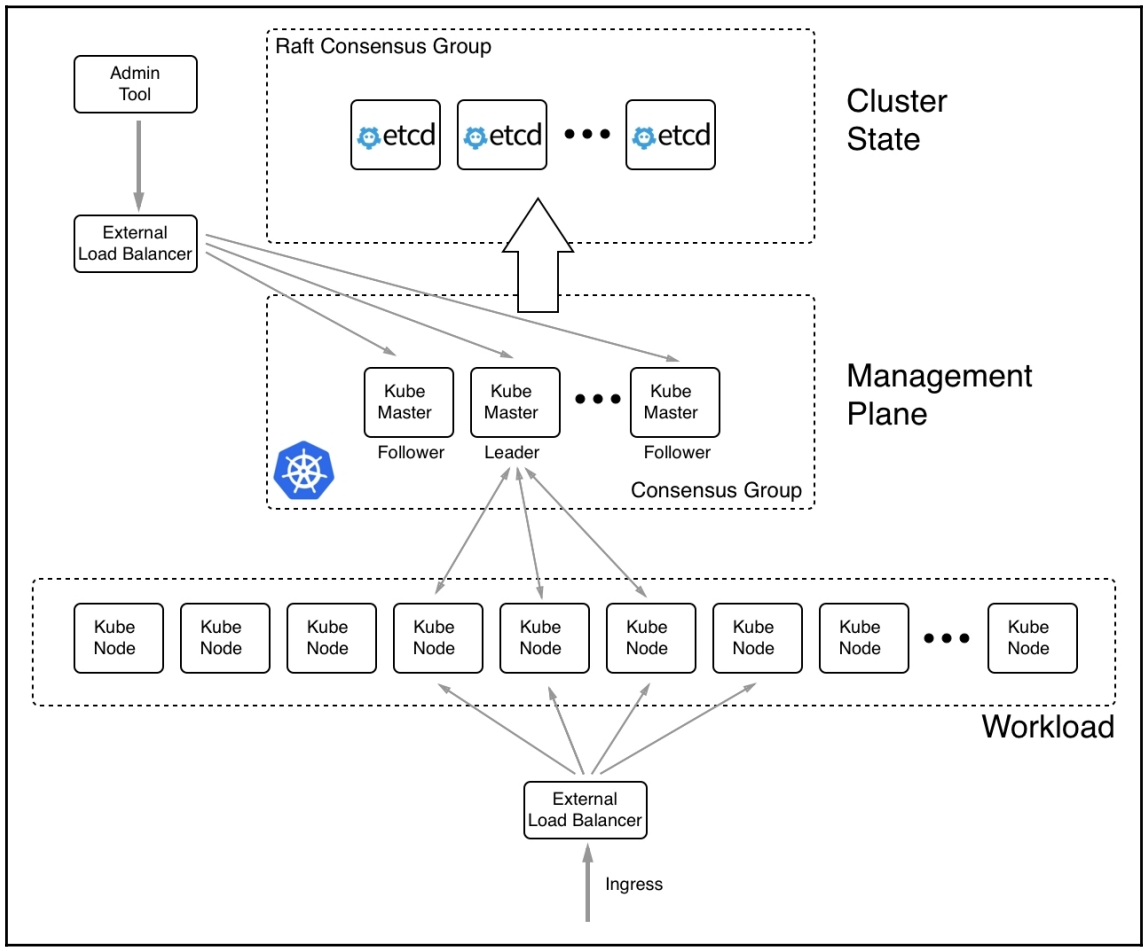

```
$ docker secret ls
ID                          NAME             DRIVER          CREATED              UPDATED
axykb7msipit1g5so63ef02it   other-secret                     28 seconds ago       28 seconds ago
puns1op5wr5hi21st5h3wjd64   sample-secret                    3 minutes ago        3 minutes ago
$
```

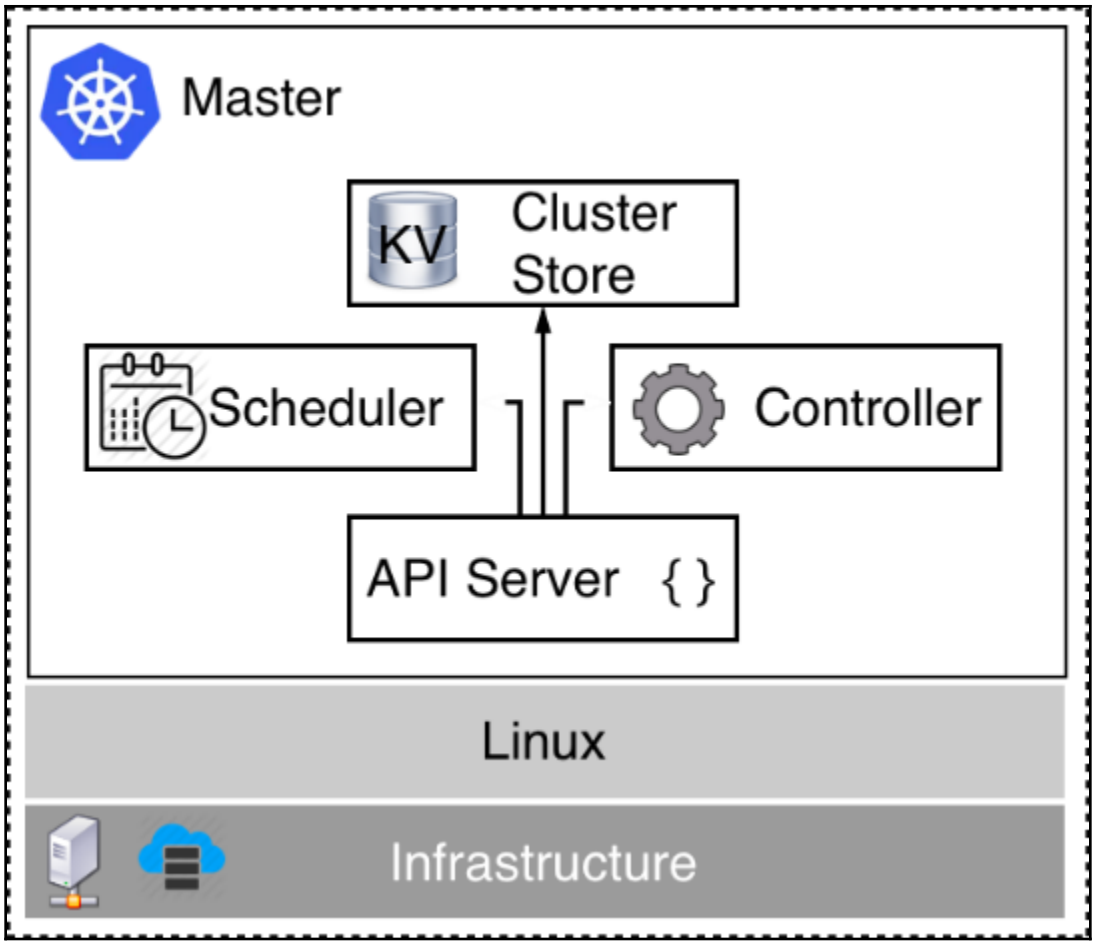
```
$ docker secret inspect other-secret
[
    {
        "ID": "axykb7msipit1g5so63ef02it",
        "Version": {
            "Index": 135
        },
        "CreatedAt": "2018-03-16T01:29:14.367872931Z",
        "UpdatedAt": "2018-03-16T01:29:14.367872931Z",
        "Spec": {
            "Name": "other-secret",
            "Labels": {}
        }
    }
]
$
```

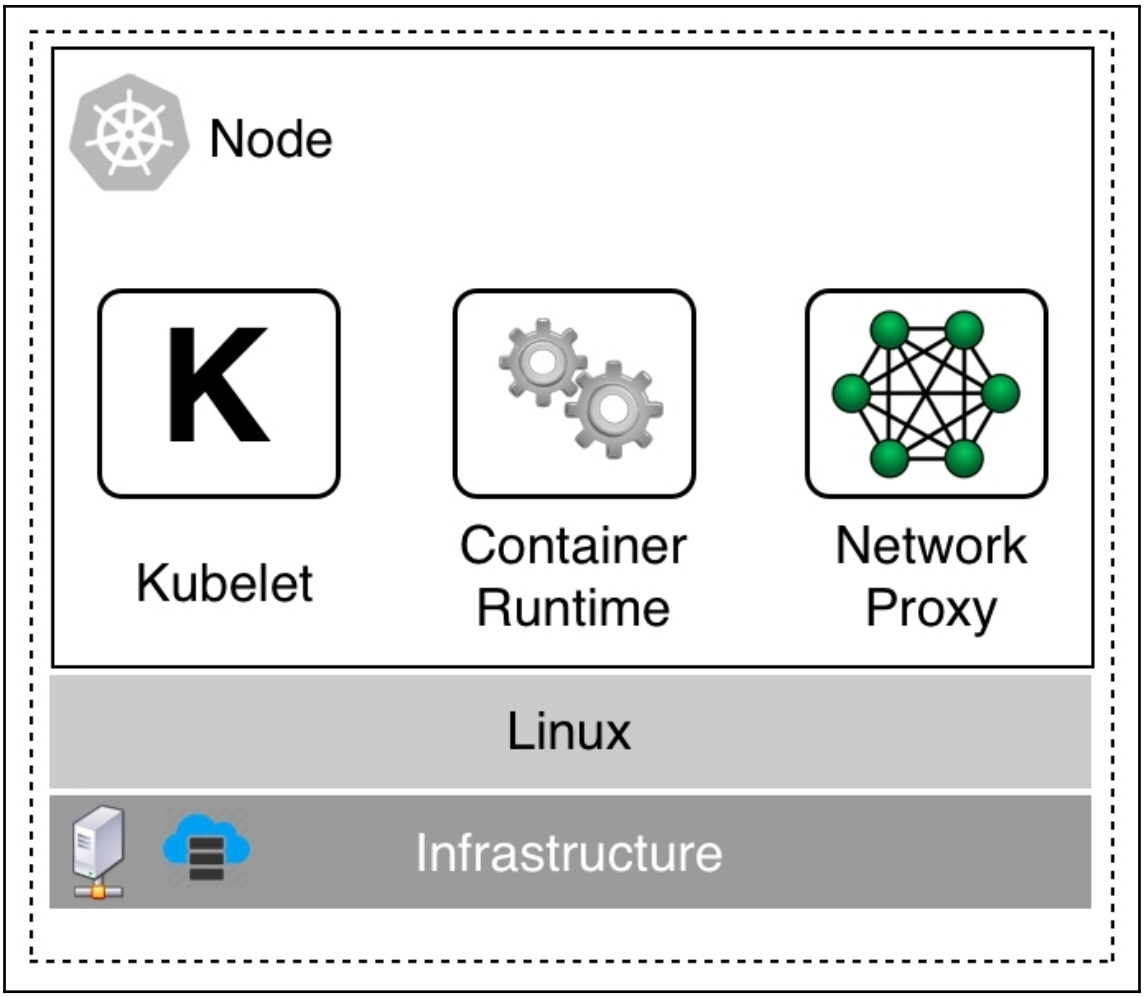
```
$ docker service create --name web \
>     --secret api-secret-key \
>     --publish 8000:8000 \
>     fundamentalsofdocker/whoami:latest
dzxxme8kmo0bglr2ufwrhcztm
overall progress: 1 out of 1 tasks
1/1: running   [==================================================>]
verify: Service converged
$
```

```
docker@node-1:~$ docker container exec -it d5133b0e3eb3 cat /run/secrets/api-secret-key
my secret key
docker@node-1:~$
```

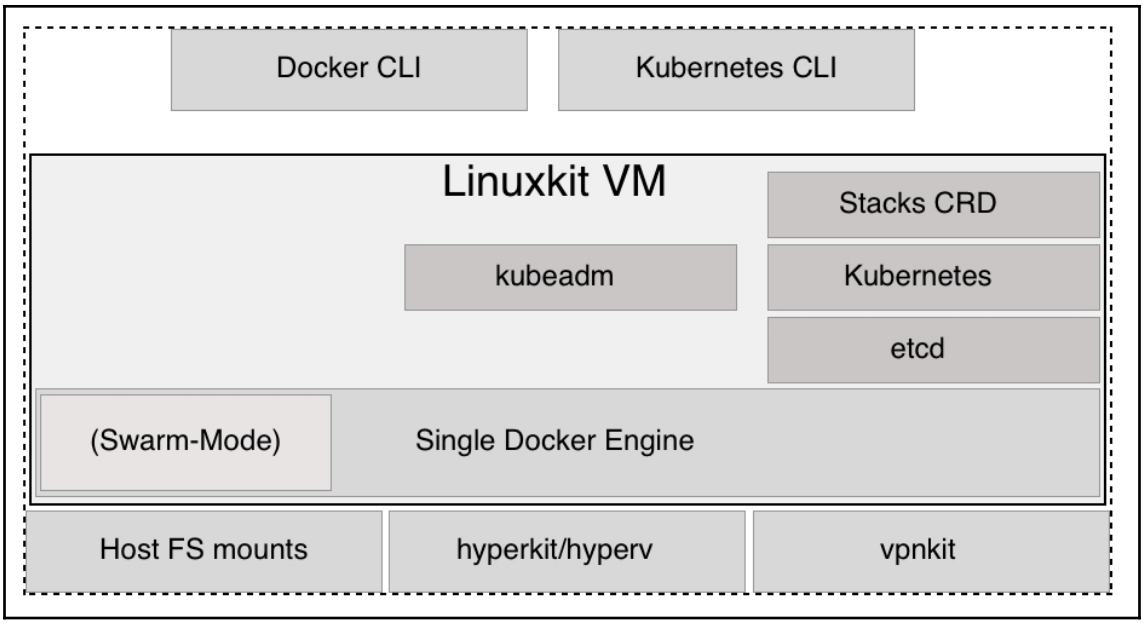
Chapter 15: Introduction to Kubernetes

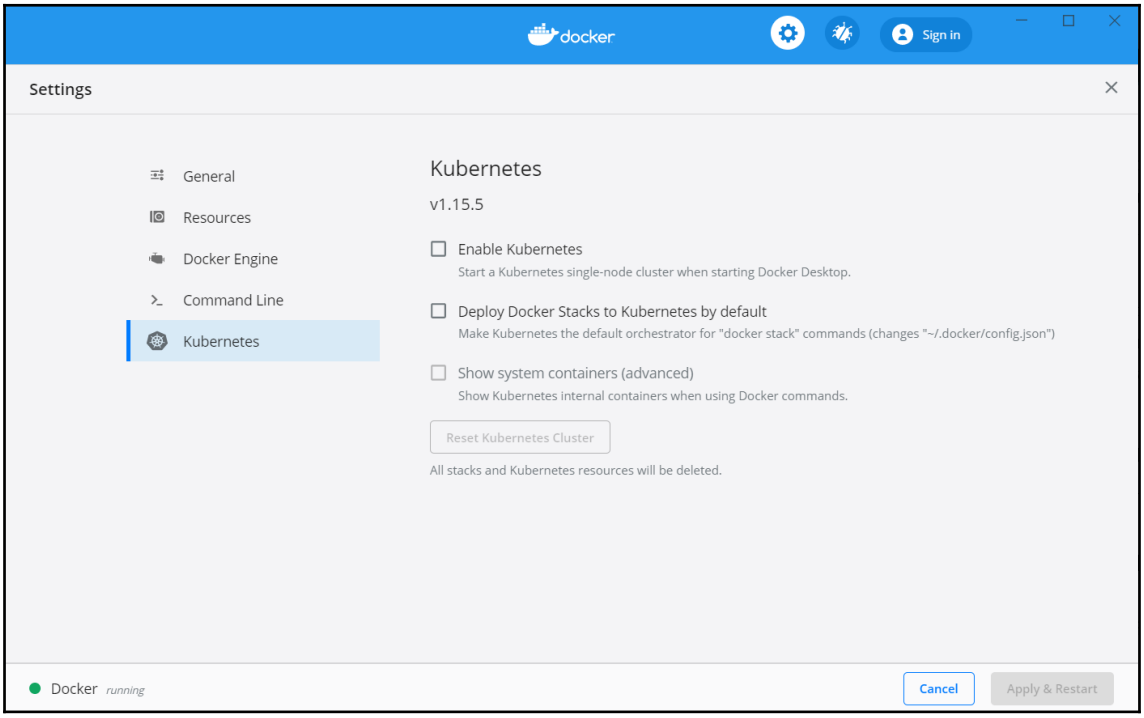



Master
KV
Cluster
Store
Scheduler
Controller
API Server { }
Linux
Infrastructure




```
$ kubectl get nodes
NAME       STATUS   ROLES    AGE    VERSION
minikube   Ready    master   2m2s   v1.16.2
```


Docker CLI
Kubernetes CLI
Linuxkit VM
Stacks CRD
kubeadm
Kubernetes
etcd
(Swarm-Mode)
Single Docker Engine
Host FS mounts
hyperkit/hyperv
vpnkit


docker
Sign in
Settings
General
Resources
Docker Engine
Command Line
Kubernetes
Kubernetes
v1.15.5
Enable Kubernetes
Start a Kubernetes single-node cluster when starting Docker Desktop.
Deploy Docker Stacks to Kubernetes by default
Make Kubernetes the default orchestrator for "docker stack" commands (changes "~/.docker/config.json")
Show system containers (advanced)
Show Kubernetes internal containers when using Docker commands.
Reset Kubernetes Cluster
All stacks and Kubernetes resources will be deleted.
Docker running
Cancel
Apply & Restart

```
$ kubectl config get-contexts
CURRENT   NAME                 CLUSTER                      AUTHINFO             NAMESPACE
          docker-for-desktop   docker-for-desktop-cluster   docker-for-desktop
*         minikube             minikube                     minikube
$
```

```
$ kubectl config use-context docker-for-desktop
Switched to context "docker-for-desktop".
$
```

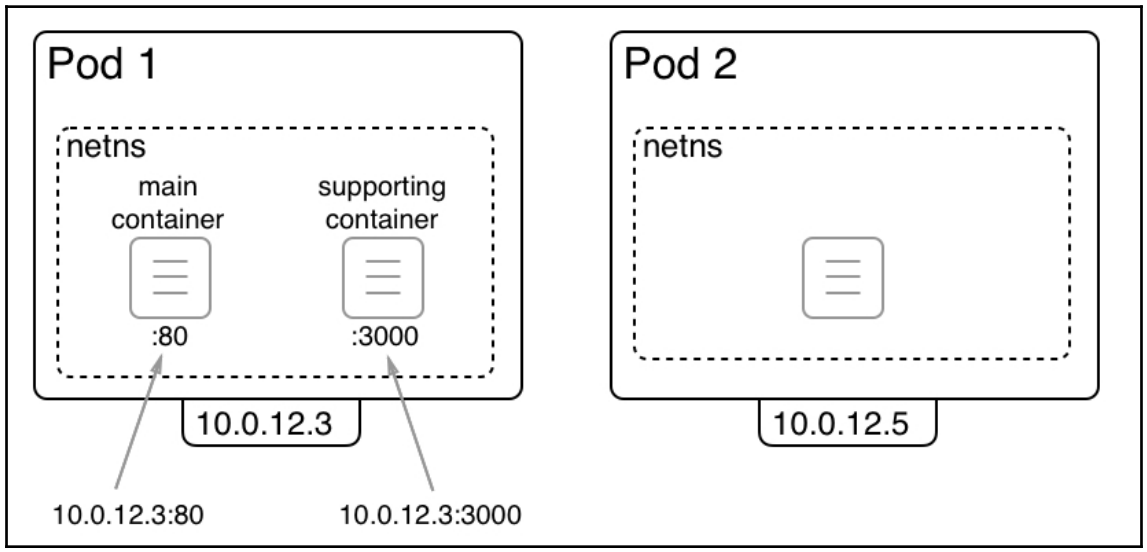
```
$ kubectl get nodes
NAME                 STATUS   ROLES    AGE     VERSION
docker-desktop       Ready    master   5m24s   v1.15.5
```

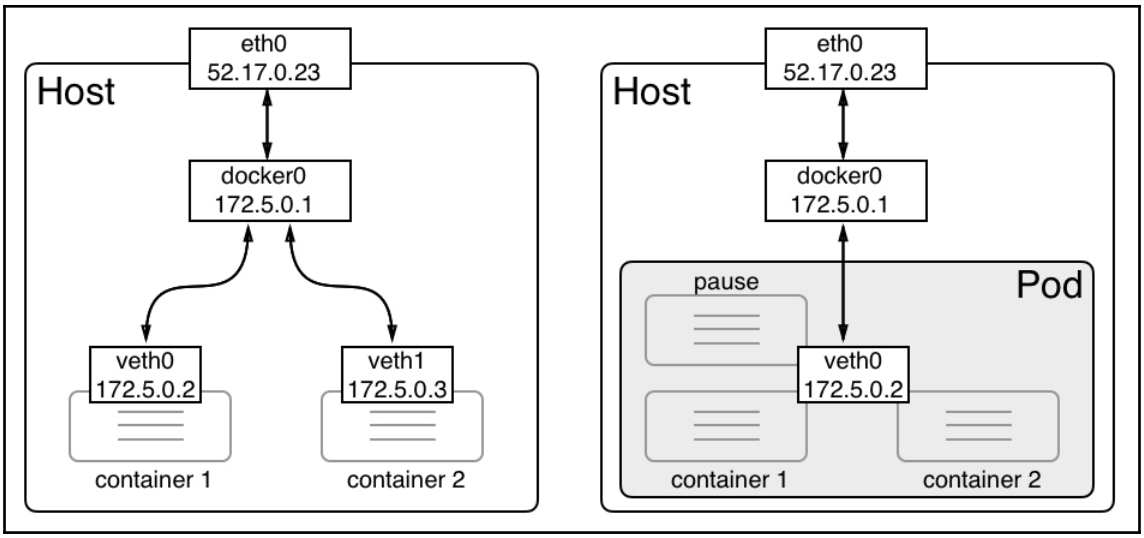
```
$ docker container ls --format "table {{.ID}}\t{{.Names}}"
CONTAINER ID        NAMES
29703c62234c        k8s_compose_compose-7b7c5cbbcc-blmq2_docker_15818891-db82-40cb-889c-e5b9fa1cb9a9_0
45e112a9e861        k8s_compose_compose-api-dbbf7c5db-d4vmt_docker_36a7d59e-d87f-4a3b-b4e4-a0a764d9b0d4_0
f155297794da        k8s_POD_compose-7b7c5cbbcc-blmq2_docker_15818891-db82-40cb-889c-e5b9fa1cb9a9_0
923022934d6f        k8s_POD_compose-api-dbbf7c5db-d4vmt_docker_36a7d59e-d87f-4a3b-b4e4-a0a764d9b0d4_0
481bb29b5e03        k8s_coredns_coredns-5c98db65d4-jh2nm_kube-system_69575ab5-0844-4e25-9eb3-659bee0f393f_0
225b9e9d6fe3        k8s_coredns_coredns-5c98db65d4-xnzgx_kube-system_77a9a4b1-4deb-4a70-b52b-294f2a81ac30_0
5347452ad6a1        k8s_POD_coredns-5c98db65d4-xnzgx_kube-system_77a9a4b1-4deb-4a70-b52b-294f2a81ac30_0
e0eb2c4a801e        k8s_POD_coredns-5c98db65d4-jh2nm_kube-system_69575ab5-0844-4e25-9eb3-659bee0f393f_0
67a719547cf8        k8s_kube-proxy_kube-proxy-29ddv_kube-system_bc4255b1-bc51-48f6-be64-4d10b86c3dd2_0
8767002b6df6        k8s_POD_kube-proxy-29ddv_kube-system_bc4255b1-bc51-48f6-be64-4d10b86c3dd2_0
0748011e43ac        k8s_kube-scheduler_kube-scheduler-docker-desktop_kube-system_131c3f63daec7c0750818f64a2f75d20_0
76c60b2d2319        k8s_kube-apiserver_kube-apiserver-docker-desktop_kube-system_556b996466155d7ad37d896897208f67_0
f445f90a286b        k8s_etcd_etcd-docker-desktop_kube-system_f132e1c85abd4953a304d1c65d9d74f9_0
93da22c08ab9        k8s_kube-controller-manager_kube-controller-manager-docker-desktop_kube-system_1197f92998203f9630beada45e56954f_0
bae7c1399278        k8s_POD_kube-scheduler-docker-desktop_kube-system_131c3f63daec7c0750818f64a2f75d20_0
4c69c69aa4e8        k8s_POD_kube-controller-manager-docker-desktop_kube-system_1197f92998203f9630beada45e56954f_0
081a8411ae7a        k8s_POD_kube-apiserver-docker-desktop_kube-system_556b996466155d7ad37d896897208f67_0
c6a8d74b2af3        k8s_POD_etcd-docker-desktop_kube-system_f132e1c85abd4953a304d1c65d9d74f9_0
```

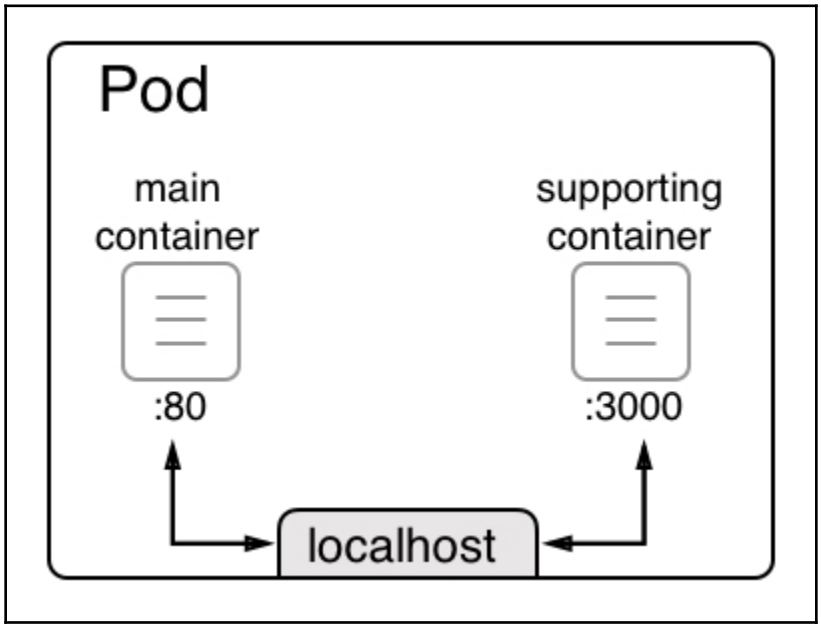
```
$ docker stack deploy -c docker-compose.yml app
Stack app was created
Waiting for the stack to be stable and running...
 - Service db has one container running
 - Service web has one container running
Stack app is stable and running
```

```
$ curl localhost:3000/pet
  % Total    % Received % Xferd  Average Speed   Time    Time     Time  Current
                                 Dload  Upload   Total   Spent    Left  Speed
100   395  100   395    0     0   7900      0 --:--:-- --:--:-- --:--:--  7900<html>
<head>
    <link rel="stylesheet" href="css/main.css">
</head>
<body>
    <div class="container">
        <h4>Animal of the day</h4>
        <img src="images&#x2F;buffalo.png"" />
        <p><small>Photo taken at <a href="https://www.maasaimara.com/">Massai Mara National Park</a></small></p>
        <p>Delivered to you by container e535c40a3e6b<p>
    </div>
</body>
</html>
```

```
$ kubectl get all
NAME         DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
deploy/web   1         1         1            1           9m

NAME                DESIRED   CURRENT   READY     AGE
rs/web-5c5964c9b8   1         1         1         9m

NAME         DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
deploy/web   1         1         1            1           9m

NAME                DESIRED   CURRENT   READY     AGE
rs/web-5c5964c9b8   1         1         1         9m

NAME              DESIRED   CURRENT   AGE
statefulsets/db   1         1         9m

NAME                     READY     STATUS    RESTARTS   AGE
po/db-0                  1/1       Running   0          9m
po/web-5c5964c9b8-b5jq9  1/1       Running   0          9m

NAME                TYPE           CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
svc/db              ClusterIP      None            <none>        55555/TCP        9m
svc/kubernetes      ClusterIP      10.96.0.1       <none>        443/TCP          45m
svc/web             ClusterIP      None            <none>        55555/TCP        9m
svc/web-published   LoadBalancer   10.111.43.147   localhost     3000:32590/TCP   9m
$
```



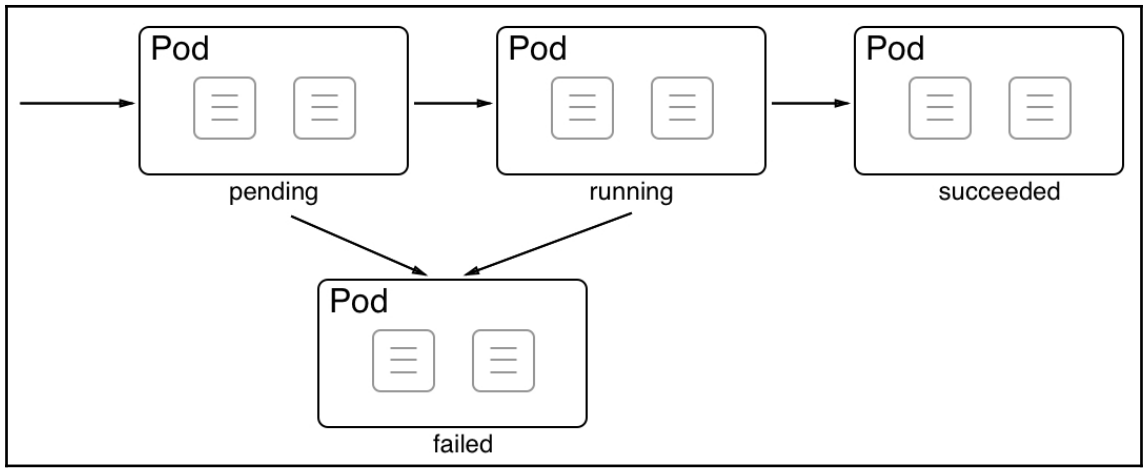

Host
eth0
52.17.0.23
docker0
172.5.0.1
veth0
172.5.0.2
veth1
172.5.0.3
container 1
container 2
Host
eth0
52.17.0.23
docker0
172.5.0.1
pause
Pod
veth0
172.5.0.2
container 1
container 2


Pod
main
container
:80
supporting
container
:3000
localhost

```
/ # wget -qO - localhost
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
    body {
        width: 35em;
        margin: 0 auto;
        font-family: Tahoma, Verdana, Arial, sans-serif;
    }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
/ #
```

```
/ # ip a show eth0
11: eth0@if12: <BROADCAST,MULTICAST,UP,LOWER_UP,M-DOWN> mtu 1500 qdisc noqueue state UP
    link/ether 02:42:ac:11:00:02 brd ff:ff:ff:ff:ff:ff
    inet 172.17.0.2/16 brd 172.17.255.255 scope global eth0
       valid_lft forever preferred_lft forever
/ #
```

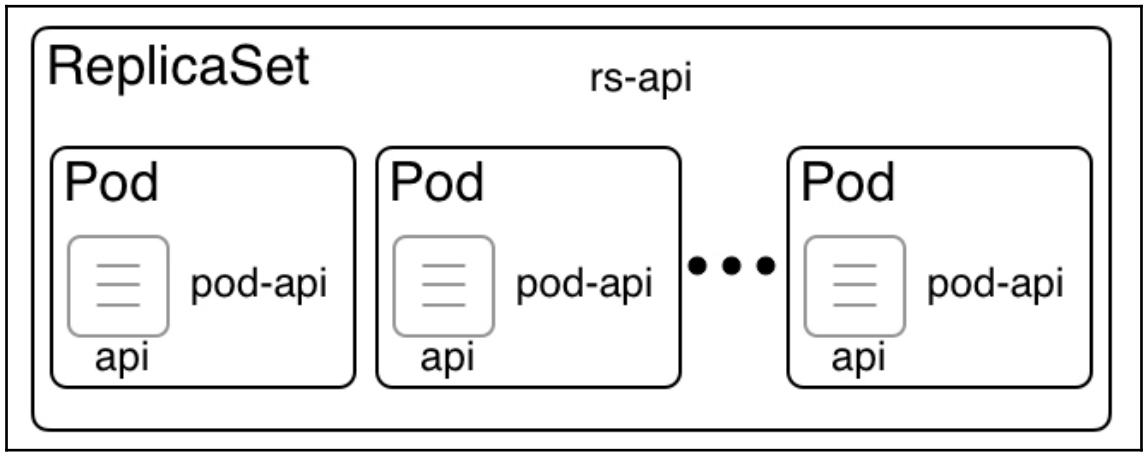
```
$ docker network inspect bridge
[
    {
        "Name": "bridge",
        "Id": "41909c08794041cabc3a9d2e034426f2344f5310bd1cbfcbae65c5f25a05f541",
        "Created": "2018-03-26T22:16:44.790966007Z",
        "Scope": "local",
        "Driver": "bridge",
        "EnableIPv6": false,
        "IPAM": {
            "Driver": "default",
            "Options": null,
            "Config": [
                {
                    "Subnet": "172.17.0.0/16",
                    "Gateway": "172.17.0.1"
                }
            ]
        },
        "Internal": false,
        "Attachable": false,
        "Ingress": false,
        "ConfigFrom": {
            "Network": ""
        },
        "ConfigOnly": false,
        "Containers": {
            "8965ec65ca4a1de1f1d9c987b68e888c1115cf64f44ba3842953d29a2b9a0ea8": {
                "Name": "pause",
                "EndpointID": "890fc0527f7cb6484d24b7886772db23bb5a0502fe34269fc306277ea7a6f95e",
                "MacAddress": "02:42:ac:11:00:02",
                "IPv4Address": "172.17.0.2/16",
                "IPv6Address": ""
            }
        },
        "Options": {
            "com.docker.network.bridge.default_bridge": "true",
            "com.docker.network.bridge.enable_icc": "true",
            "com.docker.network.bridge.enable_ip_masquerade": "true",
            "com.docker.network.bridge.host_binding_ipv4": "0.0.0.0",
            "com.docker.network.bridge.name": "docker0",
            "com.docker.network.driver.mtu": "1500"
        },
        "Labels": {}
    }
]
$
```


Pod
Pod
Pod
pending
running
succeeded
Pod
failed

```
$ kubectl describe pod/web-pod
Name:         web-pod
Namespace:    default
Node:         minikube/192.168.99.105
Start Time:   Sun, 25 Mar 2018 22:47:49 -0500
Labels:       <none>
Annotations:  <none>
Status:       Running
IP:           172.17.0.3
Containers:
  web:
    Container ID:   docker://e8784dfc2e3fcf1de4bfb9ab1508176799b6024b96d9447126e1db5dd5e2201f
    Image:          nginx:alpine
    Image ID:       docker-pullable://nginx@sha256:17c4704e19a11cd47545fa3c17e6903fc88672021f7f907f212d6663baf6ab57
    Port:           80/TCP
    State:          Running
      Started:      Sun, 25 Mar 2018 22:47:50 -0500
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from default-token-fhdsm (ro)
Conditions:
  Type           Status
  Initialized    True
  Ready          True
  PodScheduled   True
Volumes:
  default-token-fhdsm:
    Type:        Secret (a volume populated by a Secret)
    SecretName:  default-token-fhdsm
    Optional:    false
QoS Class:       BestEffort
Node-Selectors:  <none>
Tolerations:     <none>
Events:
  Type    Reason                 Age   From               Message
  ----    ------                 ----  ----               -------
  Normal  Scheduled              5m    default-scheduler  Successfully assigned web-pod to minikube
  Normal  SuccessfulMountVolume  5m    kubelet, minikube  MountVolume.SetUp succeeded for volume "default-token-fhdsm"
  Normal  Pulled                 5m    kubelet, minikube  Container image "nginx:alpine" already present on machine
  Normal  Created                5m    kubelet, minikube  Created container
  Normal  Started                5m    kubelet, minikube  Started container
$
```

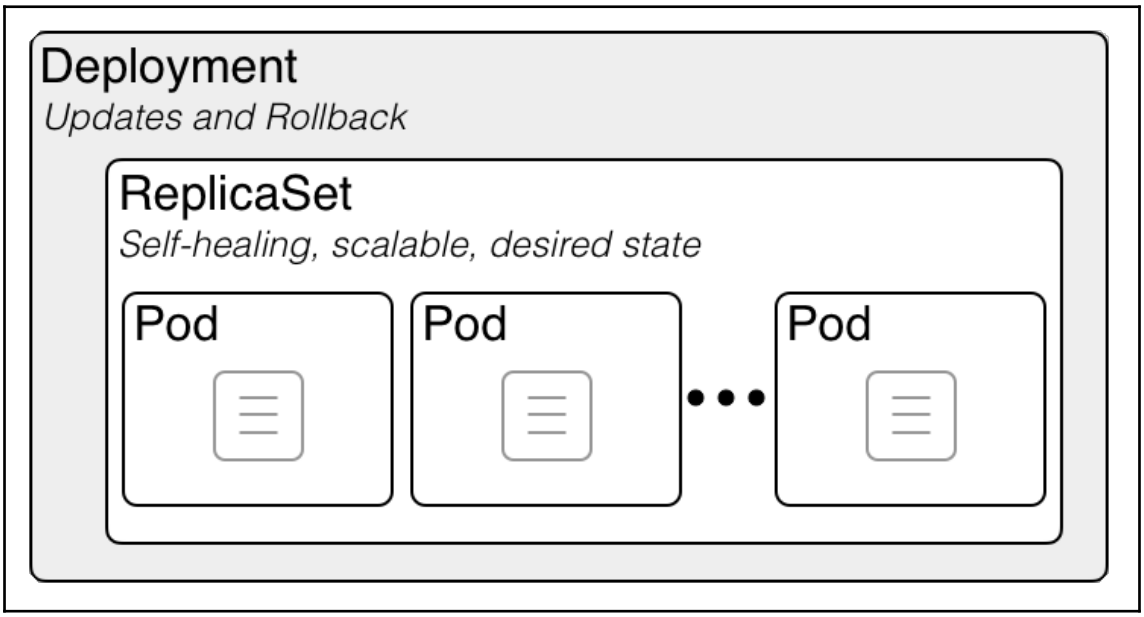
```
$ kubectl get pvc
NAME            STATUS    VOLUME                                     CAPACITY   ACCESS MODES   STORAGECLASS   AGE
my-data-claim   Bound     pvc-aac3bb2c-3224-11e8-a07f-080027c10823   2Gi        RWO            standard       14m
$
```

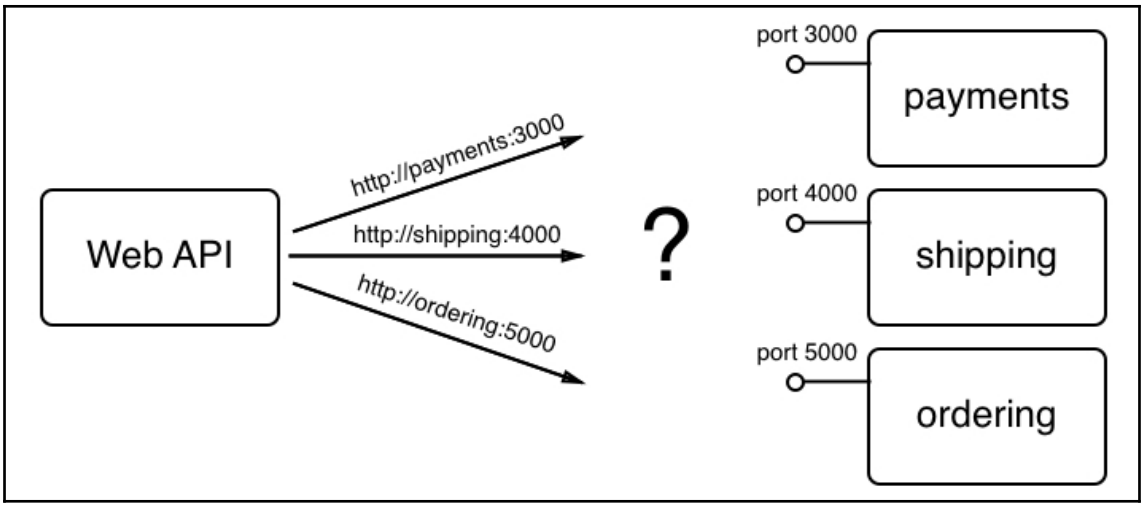
```
$ kubectl delete po/web-pod
pod "web-pod" deleted
$ kubectl create -f pod-with-vol.yaml
pod "web-pod" created
$ kubectl exec -it web-pod -- /bin/sh
/ # cat /data/sample.txt
Hello world!
/ #
```

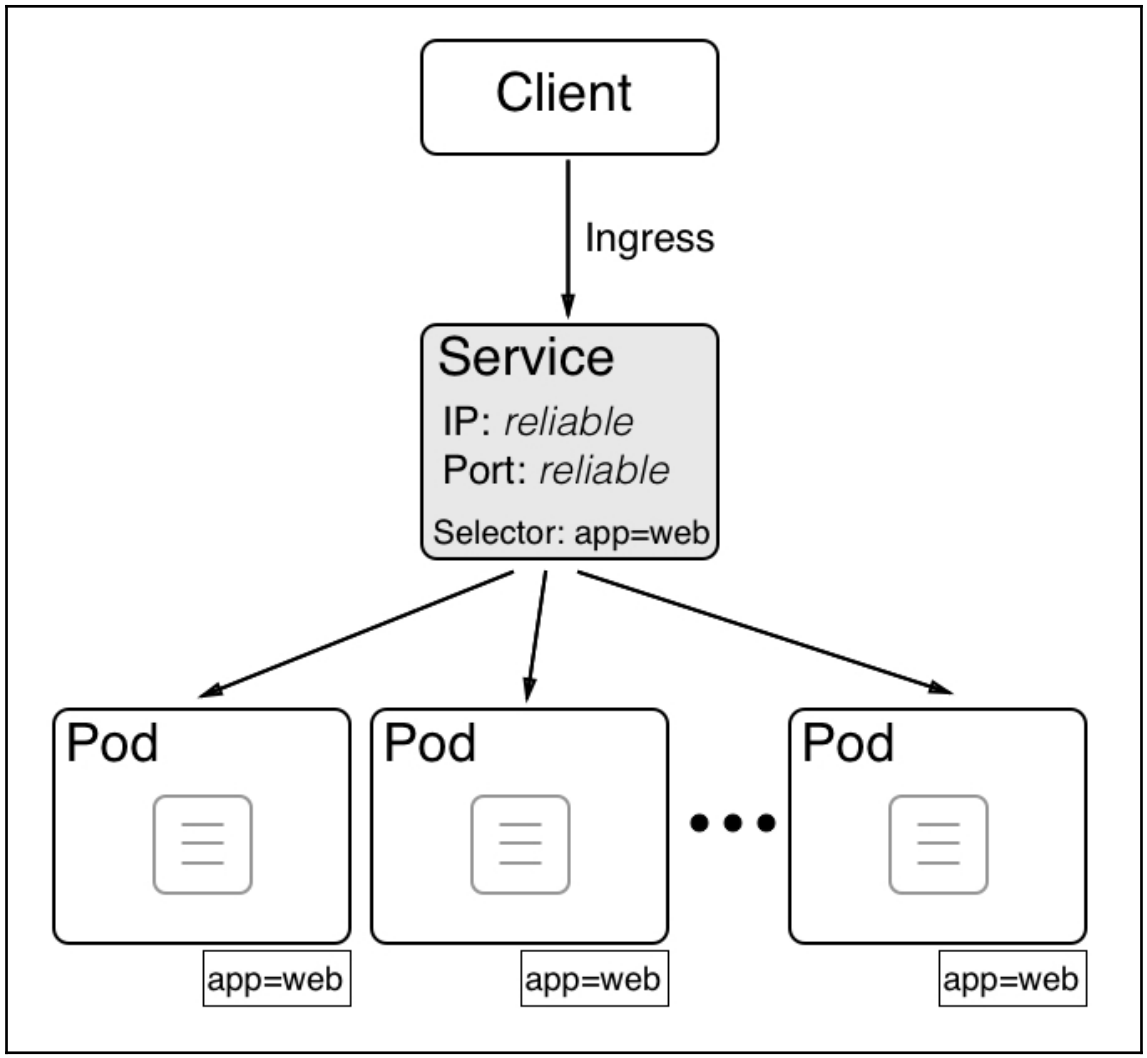


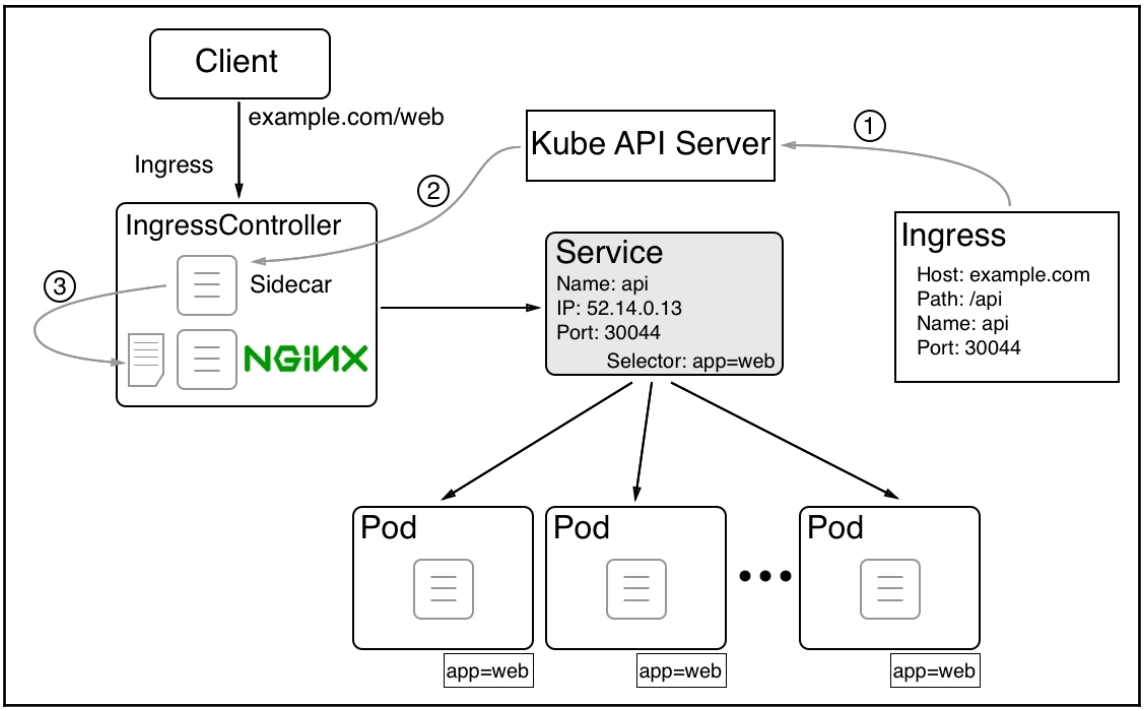

```
$ kubectl get pods
NAME          READY     STATUS    RESTARTS   AGE
rs-web-frj2m  1/1       Running   0          22h
rs-web-q6cr7  1/1       Running   0          41s
rs-web-zd2kt  1/1       Running   0          22h
$
```

```
$ kubectl describe rs/rs-web
Name:         rs-web
Namespace:    default
Selector:     app=web
Labels:       app=web
Annotations:  <none>
Replicas:     3 current / 3 desired
Pods Status:  3 Running / 0 Waiting / 0 Succeeded / 0 Failed
Pod Template:
  Labels:  app=web
  Containers:
   nginx:
    Image:        nginx:alpine
    Port:         80/TCP
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Events:
  Type    Reason            Age   From                   Message
  ----    ------            ----  ----                   -------
  Normal  SuccessfulCreate  4m    replicaset-controller  Created pod: rs-web-q6cr7
```




Web API
http://payments:3000
http://shipping:4000
http://ordering:5000
?
port 3000
payments
port 4000
shipping
port 5000
ordering


Client
Ingress
Service
IP: reliable
Port: reliable
Selector: app=web
Pod
Pod
Pod
app=web
app=web
app=web


Client
example.com/web
Ingress
Kube API Server
1
2
IngressController
Sidecar
3
NGINX
Service
Name: api
IP: 52.14.0.13
Port: 30044
Selector: app=web
Ingress
Host: example.com
Path: /api
Name: api
Port: 30044
Pod
Pod
Pod
app=web
app=web
app=web

Chapter 16: Deploying, Updating, and Securing an Application with Kubernetes

web-deployment.yaml

ch16 > web-deployment.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: web
spec:
  replicas: 1
  selector:
    matchLabels:
      app: pets
      service: web
  template:
    metadata:
      labels:
        app: pets
        service: web
    spec:
      containers:
      - image: fundamentalsofdocker/ch11-web:2.0
        name: web
        ports:
        - containerPort: 3000
          protocol: TCP
```

```
$ kubectl get all
NAME                         READY   STATUS    RESTARTS   AGE
pod/web-5989d6fc88-52mbf     1/1     Running   0          8s

NAME                 TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
service/kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   126m

NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/web   1/1     1            1           9s

NAME                                DESIRED   CURRENT   READY   AGE
replicaset.apps/web-5989d6fc88      1         1         1       9s
```

! web-service.yaml ×

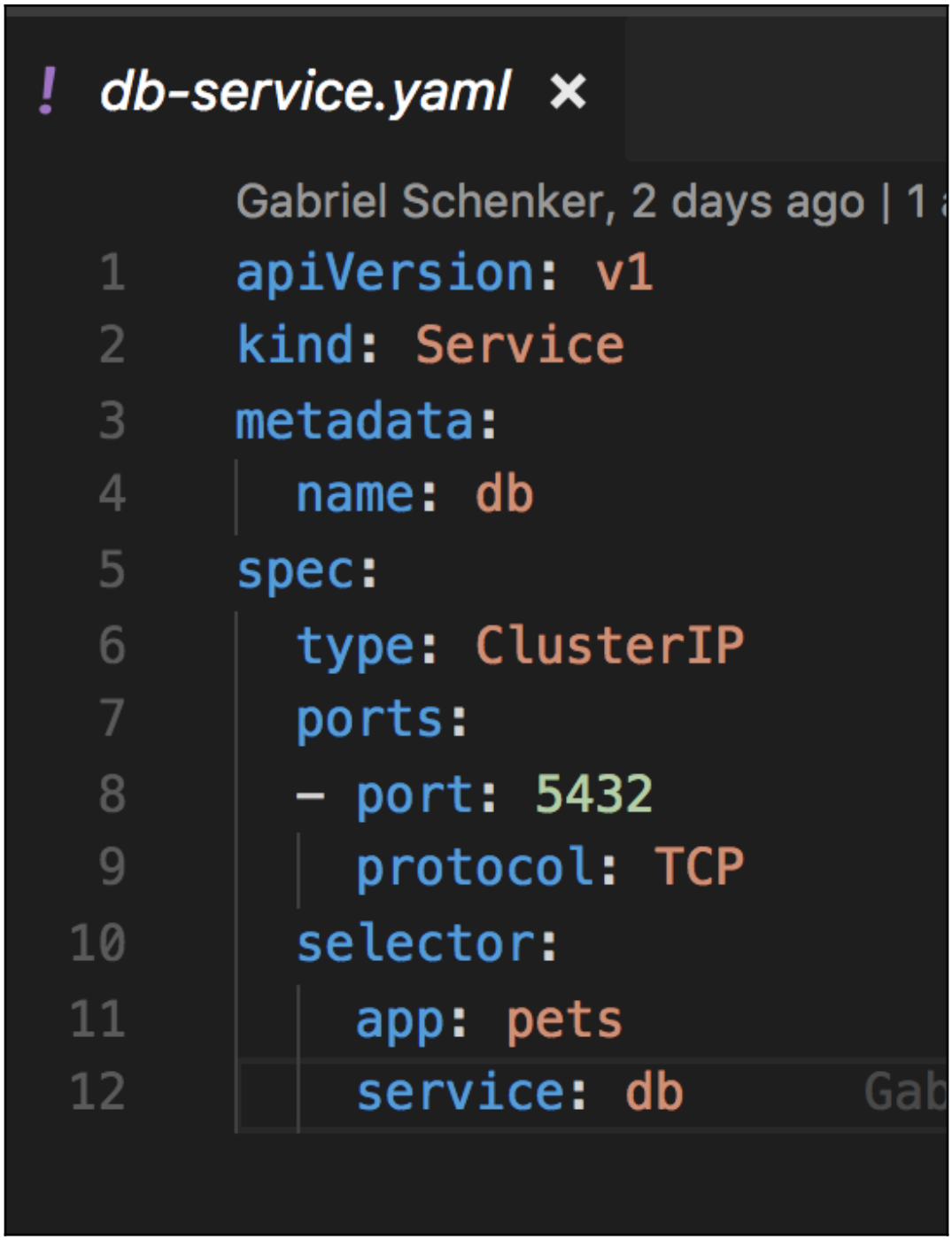
```yaml
apiVersion: v1
kind: Service
metadata:
  name: web
spec:
  type: NodePort
  ports:
  - port: 3000
    protocol: TCP
  selector:
    app: pets
    service: web
```

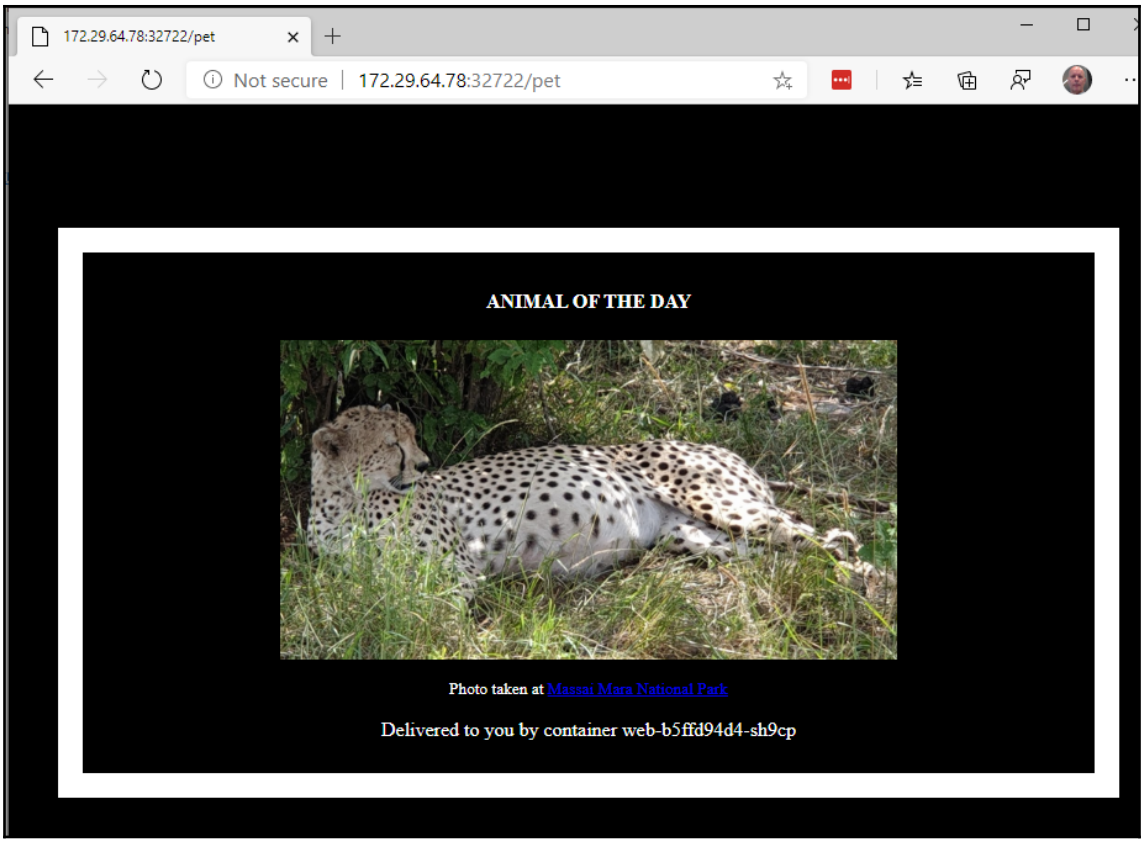
```
$ kubectl get services
NAME         TYPE        CLUSTER-IP     EXTERNAL-IP   PORT(S)          AGE
kubernetes   ClusterIP   10.96.0.1      <none>        443/TCP          131m
web          NodePort    10.99.99.133   <none>        3000:31331/TCP   12s
```

db-stateful-set.yaml

```yaml
apiVersion: apps/v1
kind: StatefulSet
metadata:
  name: db
spec:
  selector:
    matchLabels:
      app: pets
      service: db
  serviceName: db
  template:
    metadata:
      labels:
        app: pets
        service: db
    spec:
      containers:
      - image: fundamentalsofdocker/ch08-db:1.0
        name: db
        ports:
        - containerPort: 5432
        volumeMounts:
        - mountPath: /var/lib/postgresql/data
          name: pets-data
  volumeClaimTemplates:
  - metadata:
      name: pets-data
    spec:
      accessModes:
      - ReadWriteOnce
      resources:
        requests:
          storage: 100Mi
```

```
$ kubectl get all
NAME                         READY   STATUS    RESTARTS   AGE
pod/db-0                     1/1     Running   0          6s
pod/web-5989d6fc88-52mbf     1/1     Running   0          13m

NAME                 TYPE        CLUSTER-IP      EXTERNAL-IP   PORT(S)          AGE
service/kubernetes   ClusterIP   10.96.0.1       <none>        443/TCP          140m
service/web          NodePort    10.99.99.133    <none>        3000:31331/TCP   9m9s

NAME                  READY   UP-TO-DATE   AVAILABLE   AGE
deployment.apps/web   1/1     1            1           13m

NAME                                   DESIRED   CURRENT   READY   AGE
replicaset.apps/web-5989d6fc88         1         1         1       13m

NAME                  READY   AGE
statefulset.apps/db   1/1     6s
```


db-service.yaml
Gabriel Schenker, 2 days ago | 1
1 apiVersion: v1
2 kind: Service
3 metadata:
4 name: db
5 spec:
6 type: ClusterIP
7 ports:
8 - port: 5432
9 protocol: TCP
10 selector:
11 app: pets
12 service: db




```
$ kubectl create -f pets.yaml
deployment "web" created
service "web" created
statefulset "db" created
service "db" created
$
```

```
$ ./remove-pets.sh
deployment "web" deleted
service "web" deleted
statefulset "db" deleted
service "db" deleted
$
```

```
Events:
  Type    Reason     Age   From                Message
  ----    ------     ----  ----                -------
  Normal  Scheduled  26s   default-scheduler   Successfully assigned default/probes-demo to docker-desktop
  Normal  Pulled     25s   kubelet, docker-desktop  Container image "fundamentalsofdocker/probes-demo:2.0" already present on machine
  Normal  Created    25s   kubelet, docker-desktop  Created container probes-demo
  Normal  Started    25s   kubelet, docker-desktop  Started container probes-demo
```

```
Events:
  Type     Reason     Age                From                Message
  ----     ------     ----               ----                -------
  Normal   Scheduled  72s                default-scheduler   Successfully assigned default/probes-demo to docker-desktop
  Normal   Pulled     71s                kubelet, docker-desktop  Container image "fundamentalsofdocker/probes-demo:2.0" already present on machine
  Normal   Created    71s                kubelet, docker-desktop  Created container probes-demo
  Normal   Started    71s                kubelet, docker-desktop  Started container probes-demo
  Warning  Unhealthy  30s (x3 over 40s)  kubelet, docker-desktop  Liveness probe failed: cat: /app/healthy: No such file or directory
  Normal   Killing    30s                kubelet, docker-desktop  Container probes-demo failed liveness probe, will be restarted
```

```
 9   app.set('views', __dirname);
10
11   app.get('/',function(req,res){
12       res.status(200).send('Pets Demo Application v2\n');
13   });
14
```

```
Events:
  Type    Reason             Age              From                   Message
  ----    ------             ----             ----                   -------
  Normal  ScalingReplicaSet  12m              deployment-controller  Scaled up replica set web-769b88f67 to 5
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled up replica set web-55cdf67cd to 1
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled down replica set web-769b88f67 to 4
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled up replica set web-55cdf67cd to 2
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled down replica set web-769b88f67 to 3
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled up replica set web-55cdf67cd to 3
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled down replica set web-769b88f67 to 2
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled up replica set web-55cdf67cd to 4
  Normal  ScalingReplicaSet  3m               deployment-controller  Scaled down replica set web-769b88f67 to 1
  Normal  ScalingReplicaSet  3m (x2 over 3m)  deployment-controller  (combined from similar events): Scaled down replica
 set web-769b88f67 to 0
$
```

```
$ kubectl get rs
NAME              DESIRED   CURRENT   READY     AGE
web-55cdf67cd     5         5         5         27m
web-769b88f67     0         0         0         36m
$
```

```
$ kubectl get rs
NAME              DESIRED   CURRENT   READY     AGE
web-55cdf67cd     0         0         0         36m
web-769b88f67     5         5         5         45m
$
```

web-deploy-blue.yaml

ch16 > web-deploy-blue.yaml

```yaml
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: web-blue
spec:
  replicas: 1
  selector:
    matchLabels:
      app: pets
      service: web
      color: blue
  template:
    metadata:
      labels:
        app: pets
        service: web
        color: blue
    spec:
      containers:
      - image: fundamentalsofdocker/ch11-web:2.0
        name: web
        ports:
        - containerPort: 3000
          protocol: TCP

```

! web-svc-blue-green.yaml ×

```yaml
apiVersion: v1
kind: Service
metadata:
  name: web
spec:
  type: NodePort
  ports:
  - port: 3000
    protocol: TCP
  selector:
    app: pets
    service: web
    color: blue
```

! web-deploy-green.yaml ×

ch16 > ! web-deploy-green.yaml

```yaml
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: web-green
spec:
  replicas: 1
  selector:
    matchLabels:
      app: pets
      service: web
      color: green
  template:
    metadata:
      labels:
        app: pets
        service: web
        color: green
    spec:
      containers:
      - image: fundamentalsofdocker/ch16-web:2.1
        name: web
        ports:
        - containerPort: 3000
          protocol: TCP
```

```
$ kubectl get deploy
NAME        DESIRED   CURRENT   UP-TO-DATE   AVAILABLE   AGE
web-blue    1         1         1            1           23h
web-green   1         1         1            1           3s
$
```

```
$ echo "john.doe" | base64
am9obi5kb2UK
$ echo "sEcret-pasSw0rD" | base64
c0VjcmV0LXBhc1N3MHJECg==
$
```

```
$ kubectl create -f pets-secret.yaml
secret "pets-secret" created
$ kubectl describe secrets/pets-secret
Name:           pets-secret
Namespace:      default
Labels:         <none>
Annotations:    <none>

Type:  Opaque

Data
====
password:  16 bytes
username:  9 bytes
$
```

```
$ kubectl get secrets/pets-secret -o yaml
apiVersion: v1
data:
  password: c0VjcmV0LXBhc1N3MHJECg==
  username: am9obi5kb2UK
kind: Secret
metadata:
  creationTimestamp: 2018-03-31T20:36:05Z
  name: pets-secret
  namespace: default
  resourceVersion: "154786"
  selfLink: /api/v1/namespaces/default/secrets/pets-secret
  uid: 22d818bd-3523-11e8-a3cb-080027c10823
type: Opaque
$
```

web-deploy-secret.yaml

ch16 > web-deploy-secret.yaml

```yaml
apiVersion: apps/v1
kind: Deployment
metadata:
  name: web
spec:
  replicas: 1
  selector:
    matchLabels:
      app: pets
      service: web
  template:
    metadata:
      labels:
        app: pets
        service: web
    spec:
      containers:
      - image: fundamentalsofdocker/ch11-web:2.0
        name: web
        ports:
        - containerPort: 3000
          protocol: TCP
        volumeMounts:
        - name: secrets
          mountPath: "/etc/secrets"
          readOnly: true
      volumes:
      - name: secrets
        secret:
          secretName: pets-secret
```

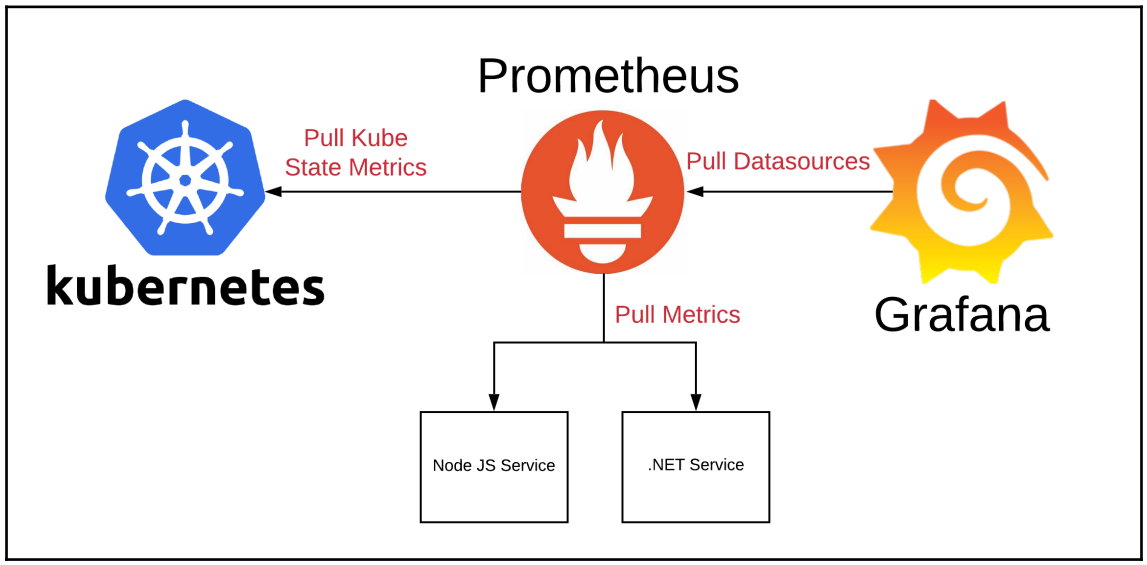
```
$ kubectl exec -it web-597b7f7749-87mq5 -- /bin/sh
/app # cd /etc/secrets/
/etc/secrets # ls -l
total 0
lrwxrwxrwx    1 root     root            15 Apr  2 01:26 password -> ..data/password
lrwxrwxrwx    1 root     root            15 Apr  2 01:26 username -> ..data/username
/etc/secrets # cat username && cat password
john.doe
sEcret-pasSw0rD
/etc/secrets #
```

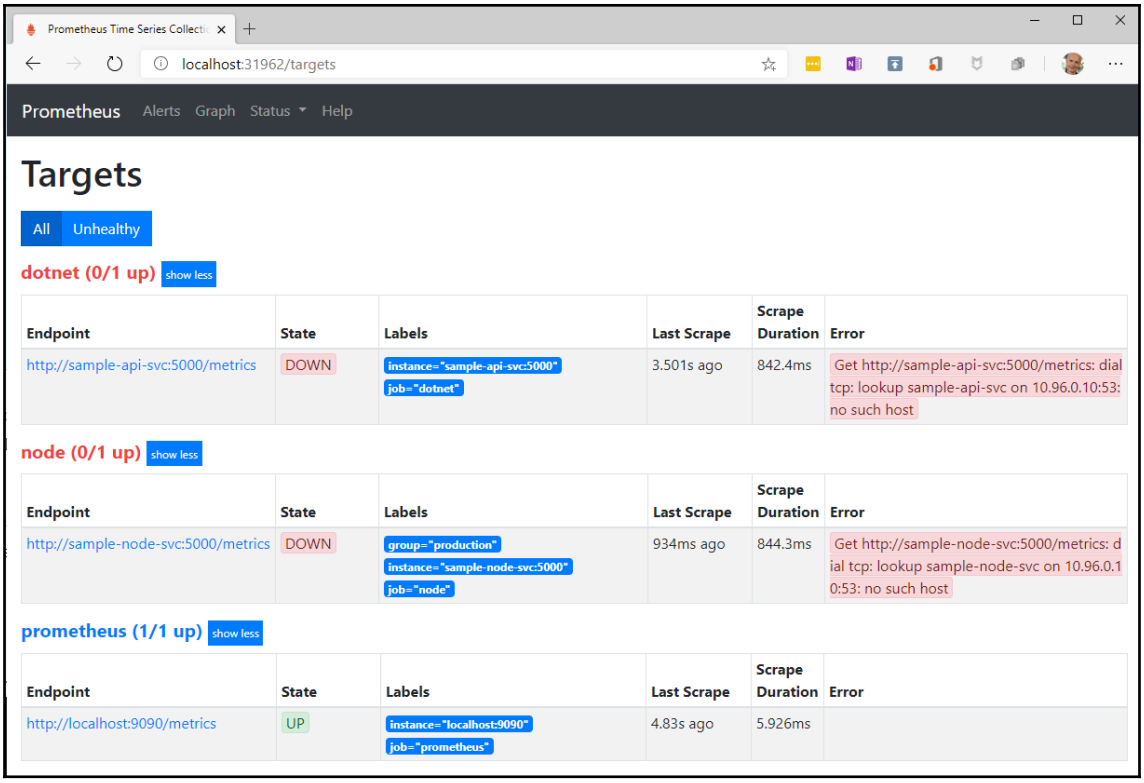
! web-deploy-secret-env.yaml ×

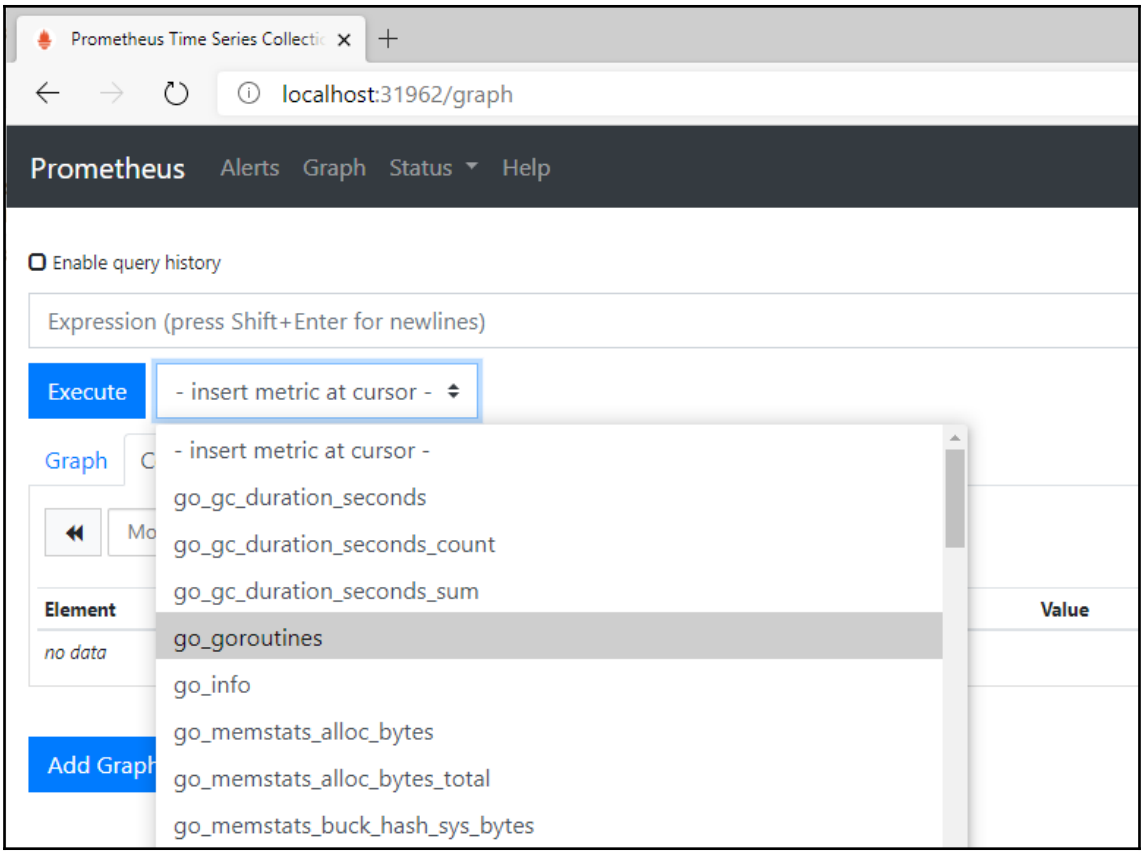
```yaml
apiVersion: extensions/v1beta1
kind: Deployment
metadata:
  name: web
spec:
  replicas: 1
  selector:
    matchLabels:
      app: pets
      service: web
  template:
    metadata:
      labels:
        app: pets
        service: web
    spec:
      containers:
      - image: fundamentalsofdocker/ch08-web:1.0
        name: web
        ports:
        - containerPort: 3000
          protocol: TCP
        env:
          - name: PETS_USERNAME
            valueFrom:
              secretKeyRef:
                name: pets-secret
                key: username
          - name: PETS_PASSWORD
            valueFrom:
              secretKeyRef:
                name: pets-secret
                key: password
```

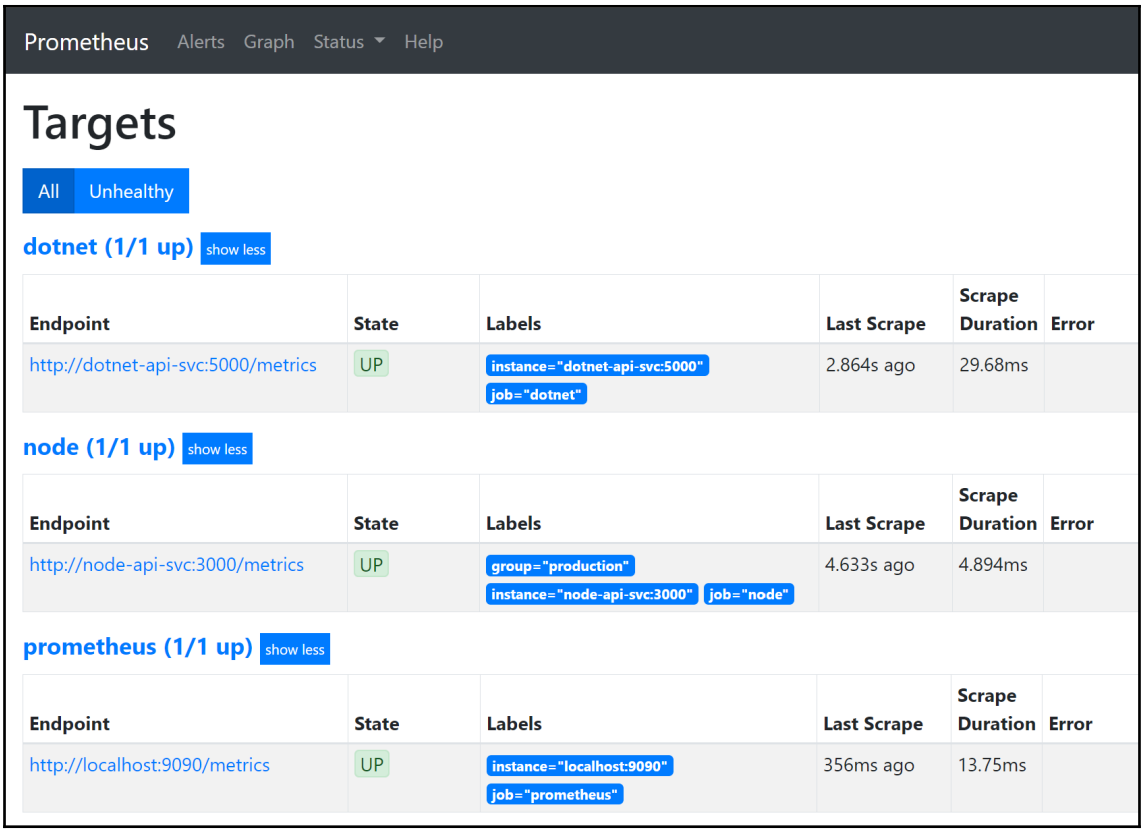
```
$ kubectl exec -it web-694f958cd4-6zq89 -- /bin/sh
/app # echo $PETS_USERNAME && echo $PETS_PASSWORD
john.doe
sEcret-pasSw0rD
/app #
```

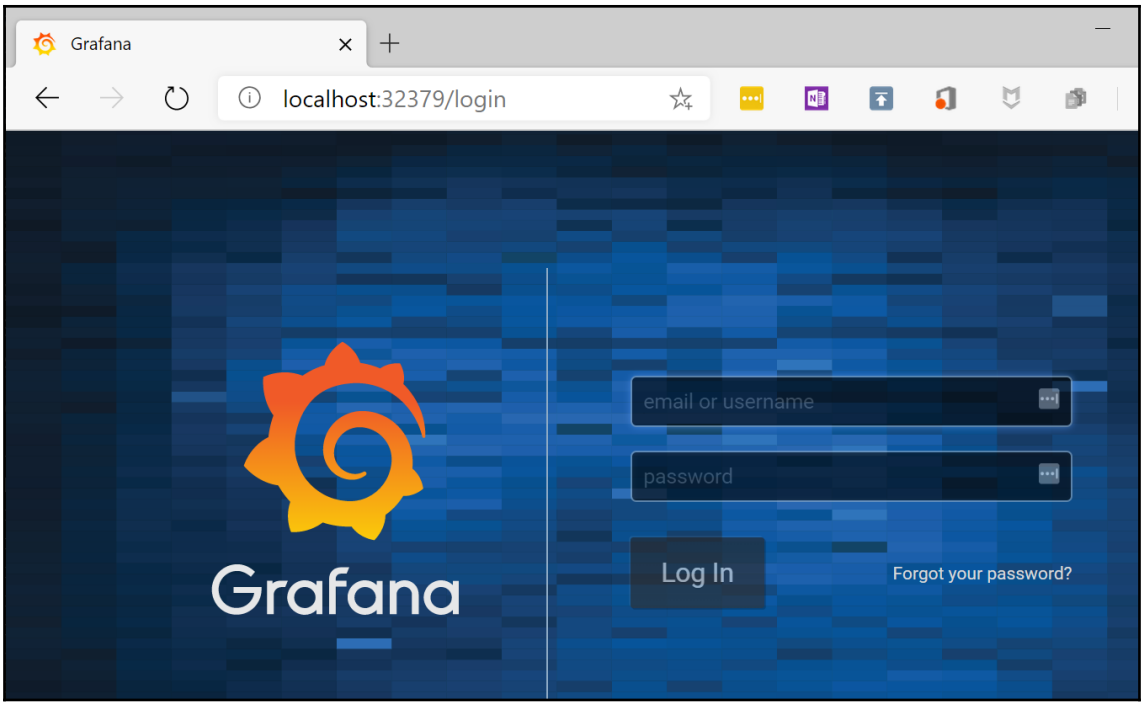
Chapter 17: Monitoring and Troubleshooting an App Running in Production

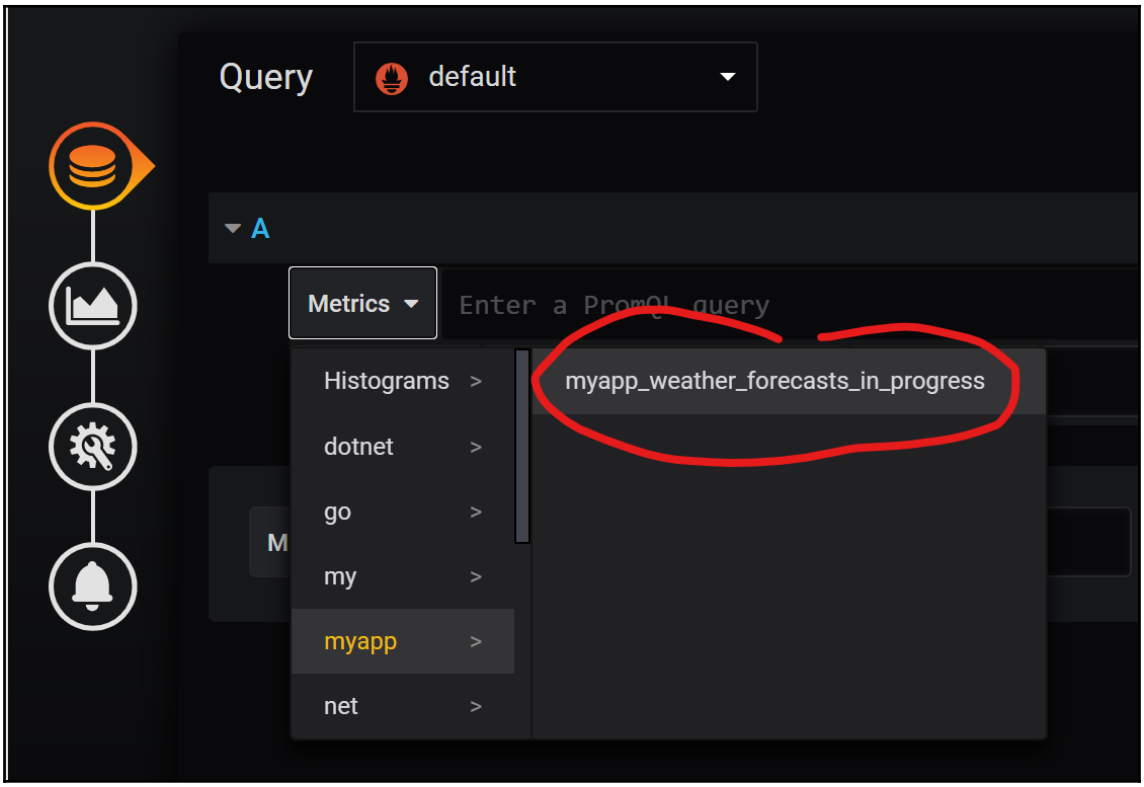


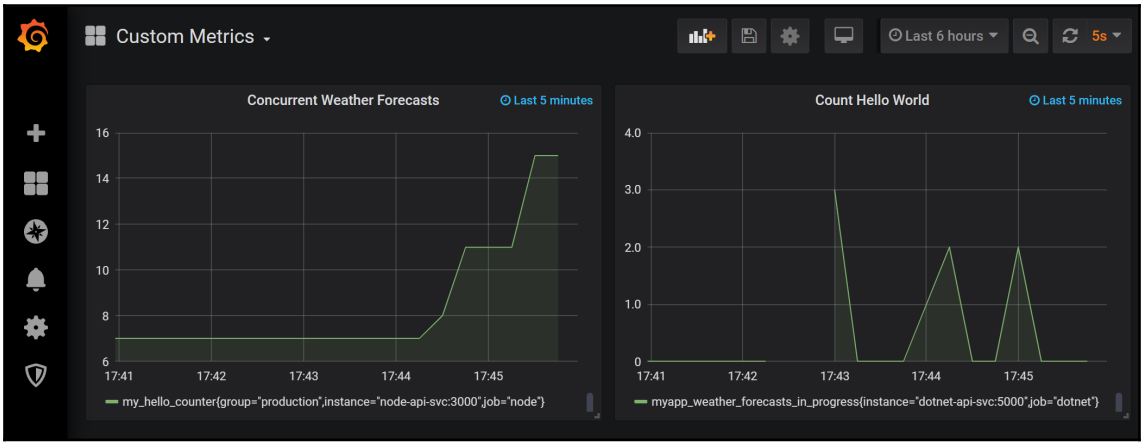

Prometheus Time Series Collecti
localhost:31962/targets
Prometheus
Alerts
Graph
Status
Help
Targets
All
Unhealthy
dotnet (0/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://sample-api-svc:5000/metrics
DOWN
instance="sample-api-svc:5000"
job="dotnet"
3.501s ago
842.4ms
Get http://sample-api-svc:5000/metrics: dial tcp: lookup sample-api-svc on 10.96.0.10:53: no such host
node (0/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://sample-node-svc:5000/metrics
DOWN
group="production"
instance="sample-node-svc:5000"
job="node"
934ms ago
844.3ms
Get http://sample-node-svc:5000/metrics: dial tcp: lookup sample-node-svc on 10.96.0.10:53: no such host
prometheus (1/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://localhost:9090/metrics
UP
instance="localhost:9090"
job="prometheus"
4.83s ago
5.926ms


Prometheus Time Series Collecti
localhost:31962/graph
Prometheus
Alerts
Graph
Status
Help
Enable query history
Expression (press Shift+Enter for newlines)
Execute
- insert metric at cursor -
Graph
Element
Value
no data
Add Graph
- insert metric at cursor -
go_gc_duration_seconds
go_gc_duration_seconds_count
go_gc_duration_seconds_sum
go_goroutines
go_info
go_memstats_alloc_bytes
go_memstats_alloc_bytes_total
go_memstats_buck_hash_sys_bytes

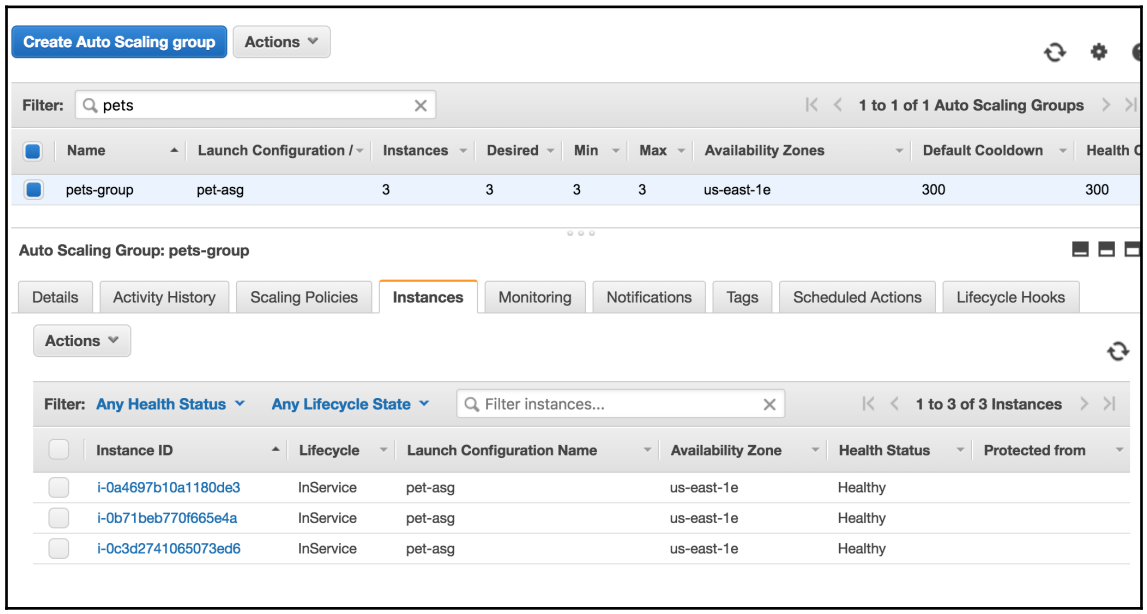

Prometheus
Alerts
Graph
Status
Help
Targets
All
Unhealthy
dotnet (1/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://dotnet-api-svc:5000/metrics
UP
instance="dotnet-api-svc:5000"
job="dotnet"
2.864s ago
29.68ms
node (1/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://node-api-svc:3000/metrics
UP
group="production"
instance="node-api-svc:3000"
job="node"
4.633s ago
4.894ms
prometheus (1/1 up)
show less
Endpoint
State
Labels
Last Scrape
Scrape Duration
Error
http://localhost:9090/metrics
UP
instance="localhost:9090"
job="prometheus"
356ms ago
13.75ms

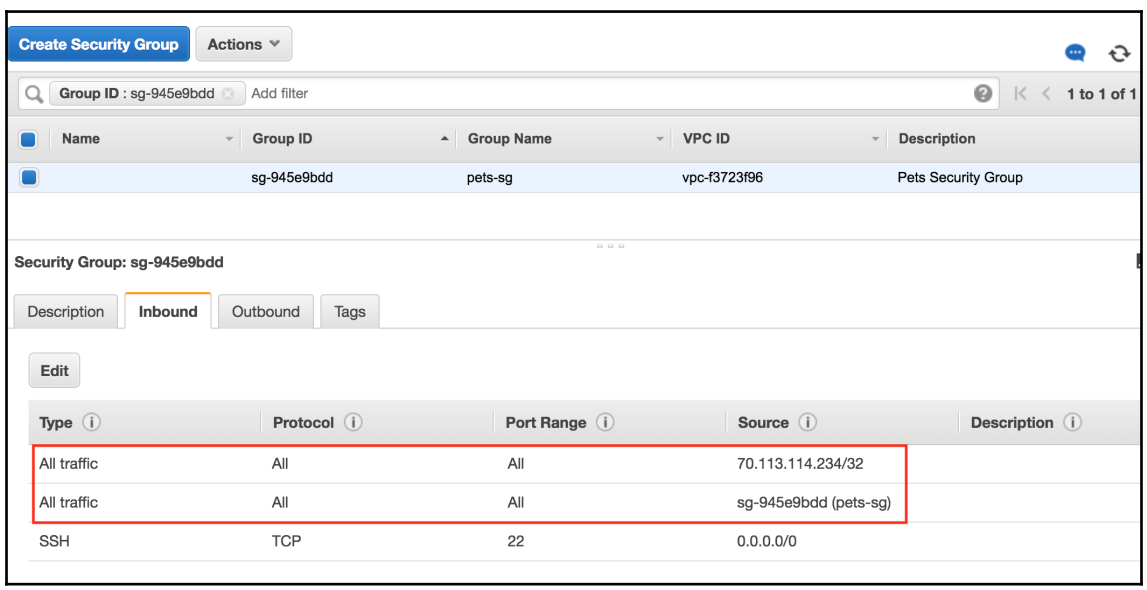

Grafana
localhost:32379/login
Grafana
email or username
password
Log In
Forgot your password?


Query
default
A
Metrics
Enter a PromQL query
Histograms
dotnet
go
my
myapp
net
myapp_weather_forecasts_in_progress

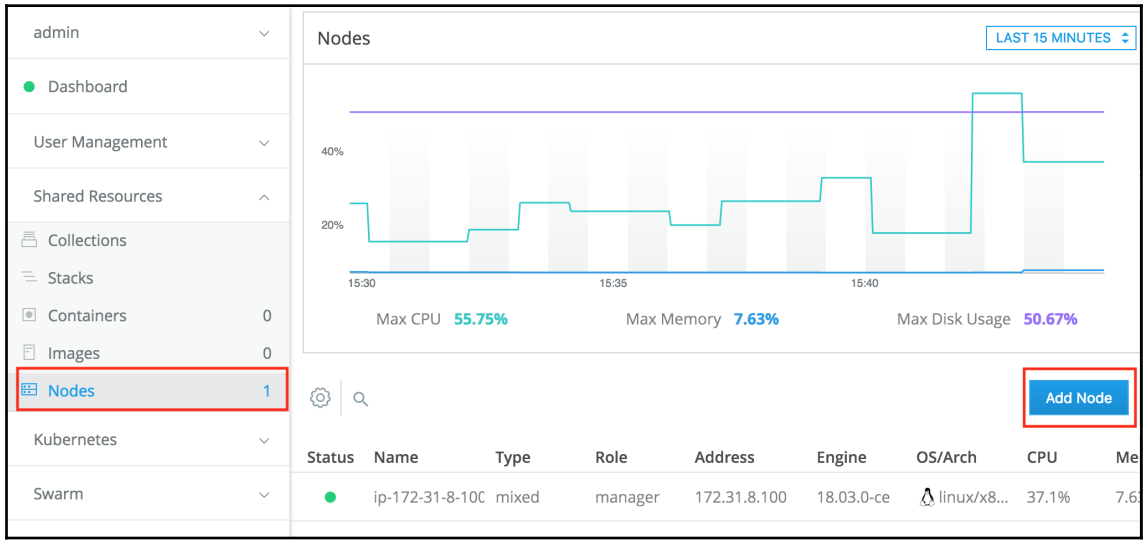

Custom Metrics
Last 6 hours
5s
Concurrent Weather Forecasts
Last 5 minutes
16
14
12
10
8
6
17:41
17:42
17:43
17:44
17:45
my_hello_counter{group="production",instance="node-api-svc:3000",job="node"}
Count Hello World
Last 5 minutes
4.0
3.0
2.0
1.0
0
17:41
17:42
17:43
17:44
17:45
myapp_weather_forecasts_in_progress{instance="dotnet-api-svc:5000",job="dotnet"}

Chapter 18: Running a Containerized App in the Cloud



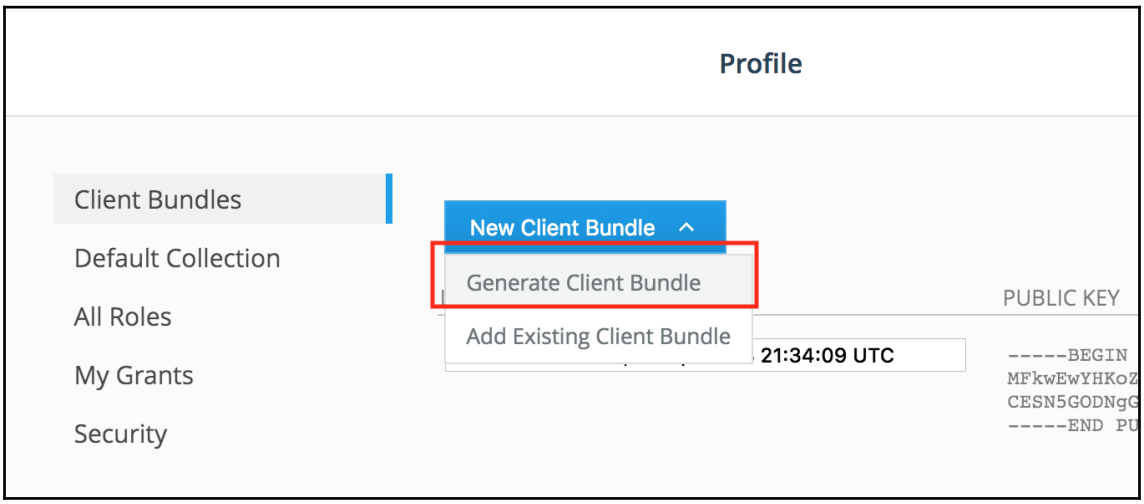


```
ubuntu@ip-172-31-8-100:~$ docker container run --rm -it --name ucp \
>     -v /var/run/docker.sock:/var/run/docker.sock \
>     docker/ucp:${UCP_VERSION} install \
>     --admin-username admin \
>     --admin-password adminadmin \
>     --san ${UCP_IP} \
>     --san ${UCP_FQDN}
INFO[0000] Verifying your system is compatible with UCP 3.0.0-beta2 (4f665c3)
INFO[0000] Your engine version 18.03.0-ce, build 0520e24 (4.4.0-1052-aws) is compatible
INFO[0000] All required images are present
INFO[0000] Initializing a new swarm at 172.31.8.100
INFO[0005] Establishing mutual Cluster Root CA with Swarm
INFO[0008] Installing UCP with host address 172.31.8.100 - If this is incorrect, please sp
INFO[0008] Generating UCP Client Root CA
INFO[0008] Deploying UCP Service
INFO[0049] Installation completed on ip-172-31-8-100 (node jatip5ocsvhighii1o55ho41v)
INFO[0049] UCP Instance ID: 803f54eedvsdlc2wvfju0iv47
INFO[0049] UCP Server SSL: SHA-256 Fingerprint=51:E8:13:FF:5F:2C:89:CC:E8:53:46:5C:D9:2F:3
INFO[0049] Login to UCP at https://172.31.8.100:443
INFO[0049] Username: admin
INFO[0049] Password: (your admin password)
ubuntu@ip-172-31-8-100:~$
```



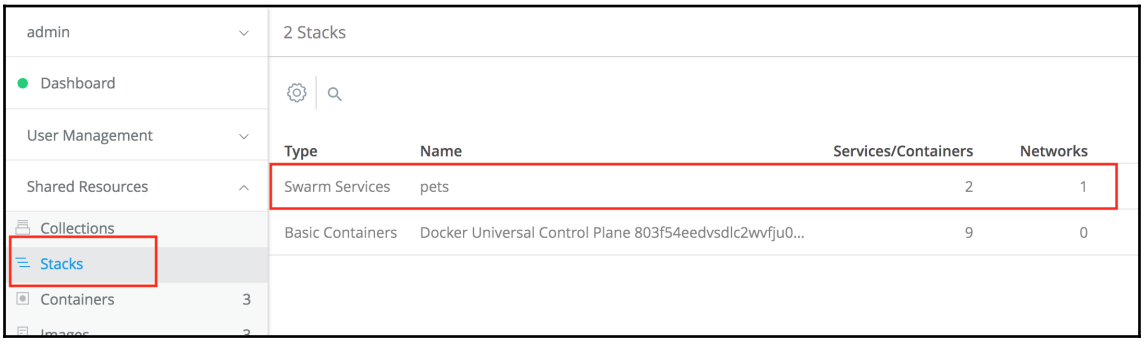
```
$ ssh -i pets.pem ubuntu@54.208.149.247
Welcome to Ubuntu 16.04.4 LTS (GNU/Linux 4.4.0-1052-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

  Get cloud support with Ubuntu Advantage Cloud Guest:
    http://www.ubuntu.com/business/services/cloud

30 packages can be updated.
0 updates are security updates.


*** System restart required ***
Last login: Sun Apr  8 20:58:32 2018 from 70.113.114.234
ubuntu@ip-172-31-6-57:~$ docker swarm join --token SWMTKN-1-4w858a6f37b8v4ozyxn0bxacjoxtcogizu04dmosga
c3j5ocna-983bleo9oaygu03wmyz1ekptb 172.31.8.100:2377
This node joined a swarm as a worker.
ubuntu@ip-172-31-6-57:~$
```

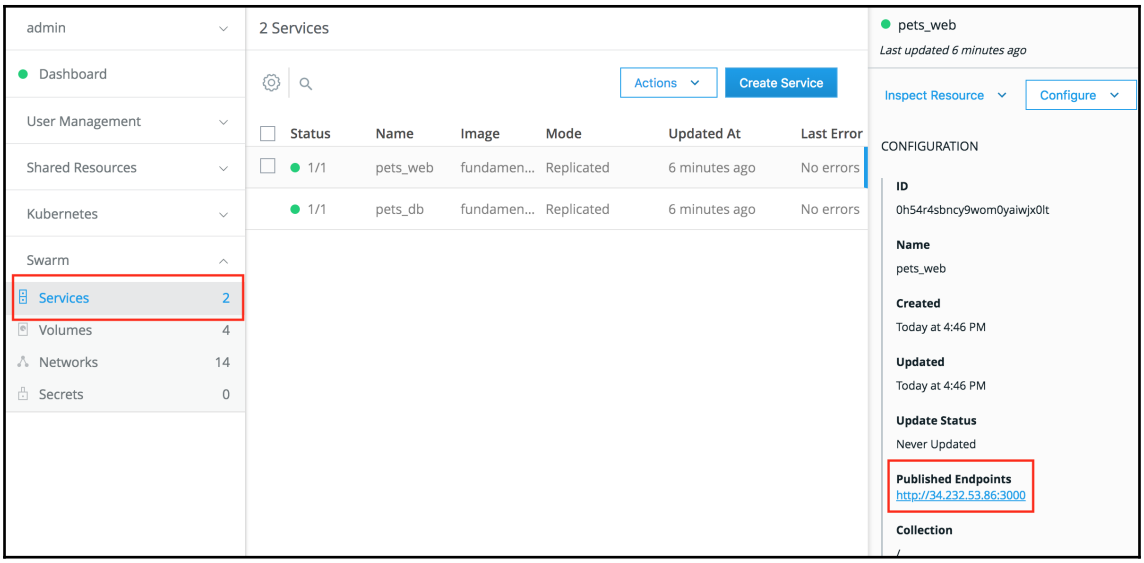
Status	Name	Type	Role	Address	Engine	OS/Arch	CPU	Memory	Disk	Details
●	ip-172-31-8-10(	mixed	manager	172.31.8.100	18.03.0-ce	linux/x8...	31.95%	7.71%	50.73%	Healthy UCP ...
●	ip-172-31-15-11	swarm	worker	172.31.15.110	18.03.0-ce	linux/x8...	3.5%	1.05%	31.36%	Healthy UCP ...
●	ip-172-31-6-57	swarm	worker	172.31.6.57	18.03.0-ce	linux/x8...	3.27%	1.07%	31.36%	Healthy UCP ...



```
$ docker node ls
ID                            HOSTNAME            STATUS              AVAILABILITY        MANAGER STATUS      ENGINE VERSION
wougljiphzk4vmmbm1tlqi2kg     ip-172-31-6-57      Ready               Active                                  18.03.0-ce
jatip5ocsvhighii1o55ho41v *   ip-172-31-8-100     Ready               Active              Leader              18.03.0-ce
tlkaeww3idlte90ko5zr8xkeu     ip-172-31-15-110    Ready               Active                                  18.03.0-ce
$
```

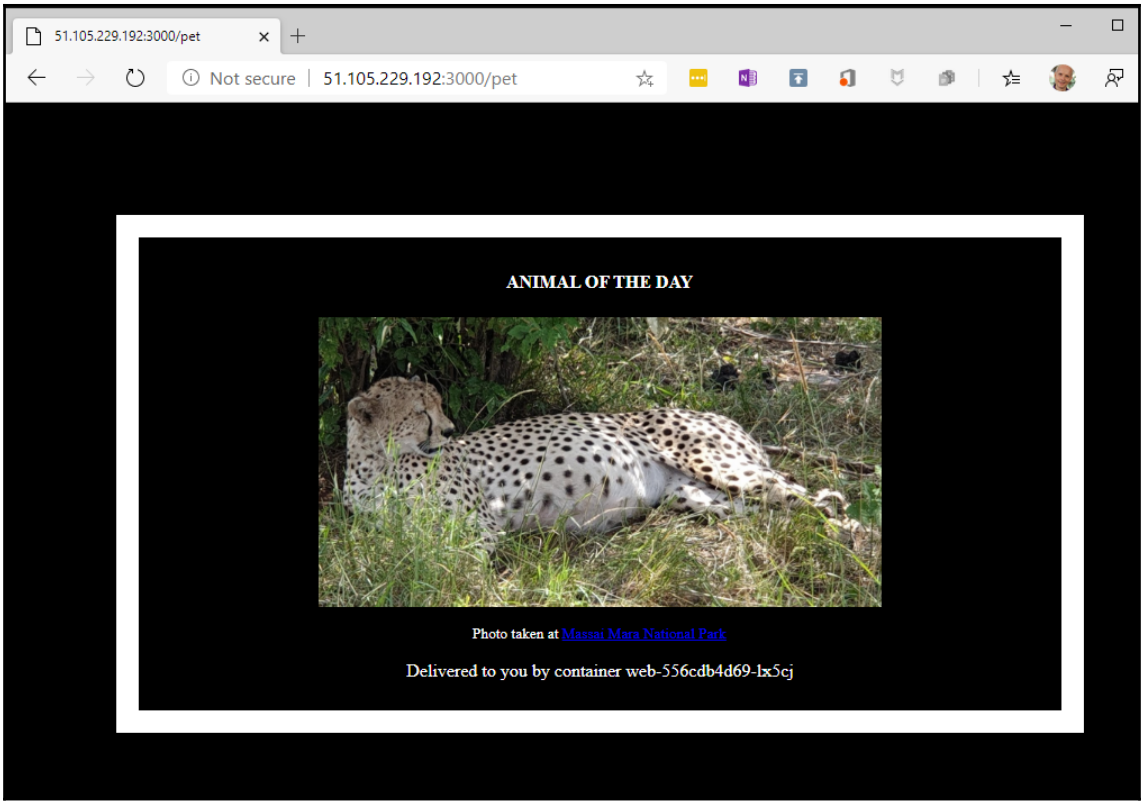
```
$ docker stack deploy -c stack.yml pets
Creating network pets_pets-net
Creating service pets_db
Creating service pets_web
$
```

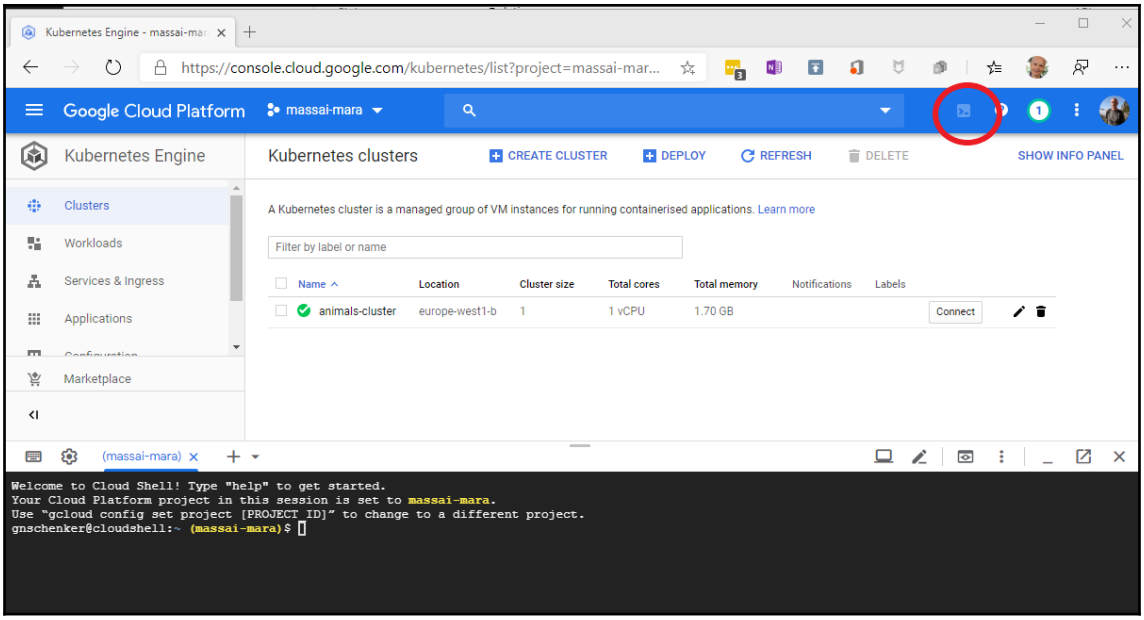





```
$ kubectl get nodes
NAME                STATUS    ROLES     AGE       VERSION
ip-172-31-15-110    Ready     <none>    1h        v1.8.2-docker.128+56ab40b2f3e9b9
ip-172-31-6-57      Ready     <none>    1h        v1.8.2-docker.128+56ab40b2f3e9b9
ip-172-31-8-100     Ready     master    22h       v1.8.2-docker.128+56ab40b2f3e9b9
$
```

```
$ kubectl create -f pets.yaml
deployment "web" created
service "web" created
deployment "db" created
service "db" created
$
```


51.105.229.192:3000/pet
Not secure | 51.105.229.192:3000/pet
ANIMAL OF THE DAY
Photo taken at Massai Mara National Park
Delivered to you by container web-556cdb4d69-lx5cj


Kubernetes Engine - massai-mar
https://console.cloud.google.com/kubernetes/list?project=massai-mar...
Google Cloud Platform
massai-mara
Kubernetes Engine
Kubernetes clusters
CREATE CLUSTER
DEPLOY
REFRESH
DELETE
SHOW INFO PANEL
Clusters
Workloads
Services & Ingress
Applications
Marketplace
A Kubernetes cluster is a managed group of VM instances for running containerised applications. Learn more
Filter by label or name
Name
Location
Cluster size
Total cores
Total memory
Notifications
Labels
animals-cluster
europe-west1-b
1
1 vCPU
1.70 GB
Connect
(massai-mara)
Welcome to Cloud Shell! Type "help" to get started.
Your Cloud Platform project in this session is set to massai-mara.
Use "gcloud config set project [PROJECT_ID]" to change to a different project.
gnschenker@cloudshell:~ (massai-mara)$