DOCKER Q & A

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Docker Q & A

1. **Difference between Docker Image and container.**

   If a Docker application works on our local computer, it'll work anywhere that supports Docker. It greatly simplifies development process and can be a powerful tool for continuous delivery.

   To understand Docker, we need to know two key facets of how Docker works. Docker image vs container!

   Docker image is a kind of snapshot. We can think of it as a picture of a Docker virtual machine and the container is the virtual machine.

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Docker & K8s

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Docker image and container via docker commands (search, pull, run, ps, restart, attach, and rm)
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More on docker run command (docker run -it, docker run --rm, etc.)
(/DevOps/Docker/Docker_Run_Com

Docker Networks - Bridge Driver Network
(/DevOps/Docker/Docker-Bridge-Driver-Networks.php)

A container is an instance of a docker image. In other words, a running instance of an image is a container. We can see all our images with `docker images`:

```
$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
mysql               latest              8457e9155715        9 days ago          546MB
busybox             latest              491198851f0c        2 weeks ago         1.23MB
ubuntu              18.04               c090eaba6b94        6 weeks ago         63.3MB
```

To see our running containers with `docker ps`:

```
$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
2666137d9726        busybox             "sh"                2 hours ago         Up 2 hours
55ae35026d6c        ubuntu:18.04        "/bin/bash"         6 days ago          Up 6 days
```

To see all containers including the ones stopped, we can use `docker ps -a`:

```
$ docker ps -a
CONTAINER ID        IMAGE               COMMAND                  CREATED              STATUS
5f6afe49bbd0        mysql               "docker-entrypoint.s…"   About a minute ago   Exited
2666137d9726        busybox             "sh"                     2 hours ago          Up 2 h
55ae35026d6c        ubuntu:18.04        "/bin/bash"              6 days ago           Up 6 d
```

2. **What is a Dockerfile?**

In order to build the application, we need to use a Dockerfile.

In cooking, we need a recipe to make cookies. In Docker, we need a Dockerfile to build an image.

A Dockerfile is simply a text-based script of instructions that is used to create a container image. Basically, it contains all the possible commands that a user may call on the command line to create an image.

To see how it works, we'll use https://github.com/docker/getting-started (https://github.com/docker/getting-started).

Docker Persistent Storage (/DevOps/Docker/Docker_Containe

File sharing between host and container (docker run -d -p -v) (/DevOps/Docker/Docker_File_Sha

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Docker Compose - NodeJS with MongoDB (/DevOps/Docker/Docker-Compose-Node-MongoDB.php)

Docker - Prometheus and Grafana with Docker-compose (/DevOps/Docker/Docker_Prometh

Docker - StatsD/Graphite/Grafana (/DevOps/Docker/Docker_StatsD_G

Docker - Deploying a Java EE JBoss/WildFly Application on AWS Elastic Beanstalk Using Docker Containers

```
$ git clone https://github.com/docker/getting-started/tree/master/app

$ tree ../getting-started -L 2
../getting-started
├── Jenkinsfile
├── LICENSE
├── README.md
├── app
│   ├── package.json
│   ├── spec
│   ├── src
│   └── yarn.lock
├── build.sh
├── docker-compose.yml
├── docs
│   ├── css
│   ├── fonts
│   ├── images
│   ├── index.md
│   └── tutorial
├── mkdocs.yml
├── requirements.txt
└── yarn.lock
```

1. Create a file named **Dockerfile** in the same folder as the file package.json with the following contents:

   ```
   FROM node:12-alpine
   WORKDIR /app
   COPY . .
   RUN yarn install --production
   CMD ["node", "src/index.js"]
   ```

2. Go to the app directory with the **Dockerfile** and build the container image using the `docker build` command:

   ```
   ~/getting-started/app $ ls
   Dockerfile      package.json    spec            src             yarn.lock

   ~/getting-started/app $ docker build -t getting-started .

   $ docker images
   REPOSITORY          TAG                 IMAGE ID            CREATED             SIZE
   getting-started     latest              295a1b181e50        22 minutes ago      179MB
   ```

   Here, we instructed the builder that we wanted to start from the **node:12-alpine** image. The **WORKDIR** command is used to define the working directory of a Docker container at any given time. Any RUN, CMD, ADD, COPY, or ENTRYPOINT command will be executed in the specified working directory.

   After the image was downloaded, we copied in our application and used `yarn` to install our application's dependencies. The `CMD` specifies the default command to run when starting a container from this image.

   The **-t** flag tags our image to give it a human-readable name. Since we named the image getting-started, we can refer to that image when we run a container.

   The **.** at the end of the `docker build` command tells that Docker should look for the Dockerfile in the current directory.

(/DevOps/Docker/Docker_Containe

Docker : NodeJS with GCP Kubernetes Engine (/DevOps/Docker/Docker-NodeJS-GCP-Kubernetes-Engine.php)

Docker : Jenkins Multibranch Pipeline with Jenkinsfile and Github (/DevOps/Docker/Docker-Jenkins-Multibranch-Pipeline-with-Jenkinsfile-and-Github.php)

Docker : Jenkins Master and Slave (/DevOps/Docker/Docker-Jenkins-Master-Slave-Agent-ssh.php)

Docker - ELK : ElasticSearch, Logstash, and Kibana (/DevOps/Docker/Docker_ELK_Elas

Docker - ELK 7.6 : Elasticsearch on Centos 7 (/DevOps/Docker/Docker_ELK_7_6_
Docker - ELK 7.6 : Filebeat on Centos 7 (/DevOps/Docker/Docker_ELK_7_6_

Docker - ELK 7.6 : Logstash on Centos 7 (/DevOps/Docker/Docker_ELK_7_6_

Docker - ELK 7.6 : Kibana on Centos 7 Part 1 (/DevOps/Docker/Docker_ELK_7_6_

Docker - ELK 7.6 : Kibana on Centos 7 Part 2 (/DevOps/Docker/Docker_ELK_7_6_

Docker - ELK 7.6 : Elastic Stack with Docker Compose (/DevOps/Docker/Docker_ELK_7_6_

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Docker - Deploy Elastic Stack via Helm on minikube (/DevOps/Docker/Docker_Kuberne

Docker Compose - A gentle introduction with WordPress (/DevOps/Docker/Docker-Compose.php)

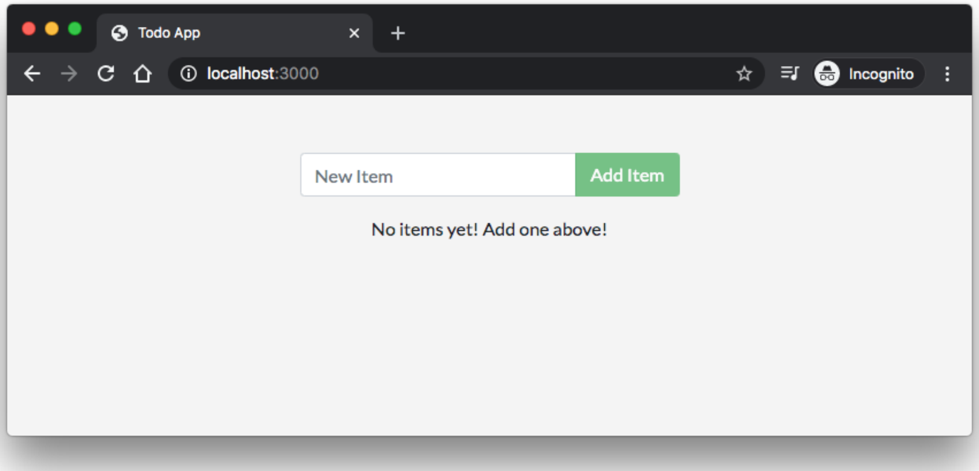
Docker Compose - MySQL (/DevOps/Docker/Docker-

Now that we have an image, it's time to run the application using `docker run` command:

```
$ docker run -d -p 3000:3000 getting-started
57198610f11c45a9eb4b7fd64fd93eabc2e0cbae17f980a8492618cb9822ba3f
```

Note that we're running the new container in "detached" mode (in the background) and creating a mapping between the host's port 3000 to the container's port 3000. Without the port mapping, we wouldn't be able to access the application.

3. Open a web browser to http://localhost:3000. We should see our app:



No items yet! Add one above!

4. One more thing about the `CMD` instruction: the difference between the `CMD` and `ENTRYPOINT` with related to the supplied to the docker run command. While the CMD will be completely over-written by the supplied command (or args), for the `ENTRYPOINT`, the supplied command will be appended to it (Dockerfile - Build Docker images automatically V - WORKDIR, ENV, ADD, and ENTRYPOINT (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically_5_WORKDIR_ENV_ADD_ENTRYPOINT.php)).

The **Dockfile** can be re-written as the following:

```
FROM node:12-alpine
WORKDIR /app
COPY . .
RUN yarn install --production
ENTRYPOINT ["node"]
CMD ["src/index.js"]
```

With the new **Dockerfile**, we can pass an arg to our `docker run` command, for example:

```
$ docker run -d -p 3000:3000 getting-started src/index.js
c85168de055f81f4390693c8029699266e69d304cdaf10e3c1c5a60d37040739
```

Here, though we used the same arg, as in `CMD ["src/index.js"]`, we could overwrite the arg provided by the `CMD` instruction.

Compose-MySQL.php)

MEAN Stack app on Docker containers : micro services (/MEAN-Stack/MEAN-Stack-NodeJS-Angular-Docker.php)

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Docker Compose - Hashicorp's Vault and Consul Part B (EaaS, dynamic secrets, leases, and revocation) (/DevOps/Docker/Docker-Vault-Consul-B.php)

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Docker compose : Nginx reverse proxy with multiple containers (/DevOps/Docker/Docker-Compose-Nginx-Reverse-Proxy-Multiple-Containers.php)

Docker compose : Nginx reverse proxy with multiple containers (/DevOps/Docker/Docker-Compose-Nginx-Reverse-Proxy-Multiple-Containers.php)

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Docker & Kubernetes : Ambassador - Envoy API Gateway on Kubernetes (/DevOps/Docker/Docker-Envoy-Ambassador-API-Gateway-for-Kubernetes.php)

For more about Dockerfile instructions, checkout the following list:

1. Dockerfile - Build Docker images automatically I - FROM, MAINTAINER, and build context (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically.php)
2. Dockerfile - Build Docker images automatically II - revisiting FROM, MAINTAINER, build context, and caching (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically_2.php)
3. Dockerfile - Build Docker images automatically III - RUN (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically_3.php)
4. Dockerfile - Build Docker images automatically IV - CMD (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically_4_CMD.php)
5. Dockerfile - Build Docker images automatically V - WORKDIR, ENV, ADD, and ENTRYPOINT (/DevOps/Docker/Docker_Dockerfile_to_build_images_automatically_5_WORKDIR_ENV_ADD_ENTRYPOINT.php)

3. **Preferred way of removing containers?**

Let's stop the "busybox" container. First we need to do `docker stop`:

```
$ docker stop 2666137d9726
2666137d9726
```

and then followed by a `docker rm`:

```
$ docker rm 2666137d9726
2666137d9726
```

4. **Difference between Docker pause and stop.**

```
$ docker run -it -d --name=busybox1 busybox /bin/sh
007d5db147718b9fe6e2d2d4054fc6e1683836a74c4df11d08458e7d2a7e7018

$ docker run -it -d --name=busybox2 busybox /bin/sh
d00834397e505f86979ede9c9bd97bc2d4945d3f0c8f8486721a04165661ec68

$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
d00834397e50        busybox             "/bin/sh"           4 seconds ago       Up 4 seconds
007d5db14771        busybox             "/bin/sh"           13 seconds ago      Up 13 second
```

Docker Packer (/DevOps/Docker/Docker-Packer.php)

Docker Cheat Sheet (/DevOps/Docker/Docker-Cheat-Sheet.php)

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Docker - Run a React app in a docker (/DevOps/Docker/Docker-React-App.php)

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Docker - NodeJS and MySQL app with React in a docker (/DevOps/Docker/Docker-React-Node-MySQL-App.php)

Docker - Step by Step NodeJS and MySQL app with React - I (/DevOps/Docker/Step-by-Step-React-Node-MySQL-App.php)

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Nginx Docker install via Ansible (/DevOps/Ansible/Ansible-Deploy-Nginx-to-Docker.php)

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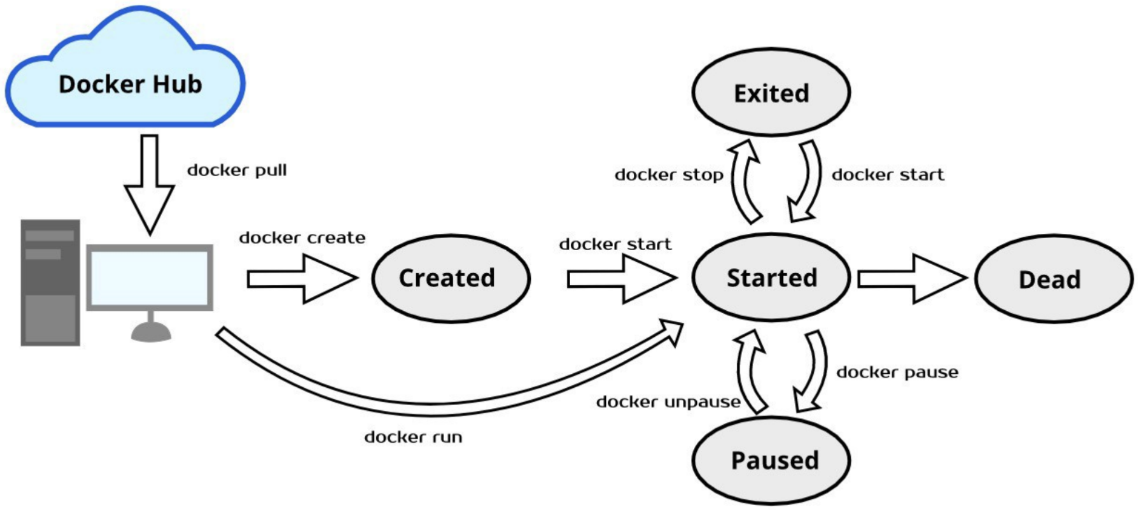
Docker - Deploying Flask app to ECS (/DevOps/Docker/Docker-Flask-ALB-ECS.php)

Docker Compose - Deploying WordPress to AWS (/DevOps/Docker/Docker-Compose-WordPress-AWS.php)



Picture credit: Get Started with Docker Lifecycle (https://medium.com/future-vision/docker-lifecycle-tutorial-and-quickstart-guide-c5fd5b987e0d)

We can stop the "busybox1" and pause the "busybox2":

```
$ docker stop busybox1
busybox1

$ docker pause busybox2
busybox2

$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
21f6d14521b8        busybox             "/bin/sh"           22 minutes ago      Up 45 second
```

The `docker pause` command suspends (via SIGSTOP signal) all processes in the specified containers.

The `docker stop` command. The main process inside the container will receive SIGTERM, and after a grace period, SIGKILL.

We cannot remove a paused container.

```
$ docker rm busybox2
Error response from daemon: You cannot remove a paused container 21f6d14521b8c16455166536000
Unpause and then stop the container before attempting removal or force remove
```

SIGSTOP is the pause signal that cannot be caught or ignored. The shell uses pausing (and its counterpart, resuming via SIGCONT) to implement job control.

```
$ docker restart busybox2
busybox2

$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
21f6d14521b8        busybox             "/bin/sh"           About an hour ago   Up 5 seconds
55ae35026d6c        ubuntu:18.04        "/bin/bash"         6 days ago          Up 6 days
```

Docker - WordPress Deploy to ECS with Docker-Compose (ECS-CLI EC2 type) (/DevOps/Docker/Docker-ECS-CLI-Docker-Compose-Wordpress-EC2-Type.php)

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Docker - ECS Fargate (/DevOps/Docker/Docker-ECS-Service-Dicsovery-Redis-Flask.php)

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Docker & Kubernetes 2 : minikube Django with Postgres - persistent volume (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes 3 : minikube Django with Redis and Celery (/DevOps/Docker/Docker_Kuberne

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Docker & Kubernetes : Kops on AWS (/DevOps/DevOps-Kubernetes-II-kops-on-AWS.php)

Docker & Kubernetes : Ingress controller on AWS with Kops (/DevOps/Docker/Docker-Kubernetes-kops-on-AWS-Ingress.php)

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Docker & Kubernetes : Persistent Volumes & Persistent Volumes Claims - hostPath and annotations (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Persistent

5. **How can we create a Docker container in the Stopped state?**

```
$ docker create --name MyContainer ubuntu
692b7ce25a7743907be877e7a758fd6a16b390a09275d73ade607dd25c4b0ee9
```

We can see that it has created a new container. But we won't see MyContainer because though it was created, it was never started.

```
$ docker ps -a
CONTAINER ID        IMAGE               COMMAND                   CREATED             STATUS
692b7ce25a77        ubuntu              "/bin/bash"               2 minutes ago       Created
```

We can start this container with `docker start` command:

```
$ docker start MyContainer
MyContainer
```

6. `docker stats`:
The docker stats command returns a live data stream for running containers.

```
$ docker ps
CONTAINER ID        IMAGE               COMMAND               CREATED             STATUS
c85168de055f        getting-started     "node src/index.js"   2 hours ago         Up 2 hours
55ae35026d6c        ubuntu:18.04        "/bin/bash"           8 days ago          Up 8 days

$ docker stats
CONTAINER ID        NAME                  CPU %               MEM USAGE / LIMIT     MEM %
c85168de055f        modest_easley         0.00%               16.38MiB / 2.434GiB   0.66%
55ae35026d6c        laughing_mcclintock   0.00%               1.125MiB / 2.434GiB   0.05%


$ docker stats c85168de055f
CONTAINER ID        NAME                CPU %               MEM USAGE / LIMIT     MEM %
c85168de055f        modest_easley       0.00%               16.38MiB / 2.434GiB   0.66%
```

7. `docker system prune`:
It's a command used to remove all stopped containers, unused networks, build caches, and dangling images. The `prune` is one of the most useful commands in Docker:

Volumes - Dynamic volume provisioning (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : DaemonSet (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Secrets (/DevOps/Docker/Docker_Kuberne

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Docker & Kubernetes : Run a React app in a minikube (/DevOps/Docker/Docker-Kubernetes-React-App.php)

Docker & Kubernetes : Minikube install on AWS EC2 (/DevOps/Docker/Docker-Kubernetes-Minikube-install-on-AWS-EC2.php)

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Docker & Kubernetes : Terraform and AWS EKS (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Pods and Service definitions (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Headless service and discovering pods (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Service IP and the Service Type (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Kubernetes DNS with Pods and

```
$ docker system prune
WARNING! This will remove:
  - all stopped containers
  - all networks not used by at least one container
  - all dangling images
  - all dangling build cache

Are you sure you want to continue? [y/N] y
Deleted Containers:
1470e09b748c5a89a41a415d4bdfbeec61e4091d38eaceef94c96ac9edb90469
692b7ce25a7743907be877e7a758fd6a16b390a09275d73ade607dd25c4b0ee9
...

Deleted Images:
deleted: sha256:295a1b181e50c37a3a9595bd498b5c980a9f90823473abdb8704ce3308628eef
deleted: sha256:77234e845dbed0075aecab391e14bb9f1a34ec7bd34b88284d2f74b31b9837b0
...

Total reclaimed space: 89.85MB
```

8. **docker-compose**:

   Most of the time, we will most likely want to bring up all of the services listed in our **docker-compose.yml** and have the containers run their default command, so we would want to use `docker-compose up`.

   The `docker-compose run` command will spin up a new container for us to use while the `docker-compose exec` command will allow us to use a container that is already running.

9. **Multistage Image Builds**:

   While using containers to build applications can be useful, it is important to distinguish between the **build image** and the **runtime image**.

   The build image contains all the tooling and libraries that are necessary to compile the application, while the runtime image contains the application to be deployed. A Java application has a build image that contains the JDK, Gradle/Maven, and compilation and testing tooling. Then our runtime image can contain only the Java runtime and our application.

   Compiling code as part of the image build is the most common ways of accidentally building large images.

   To resolve this issue, Docker introduced **multistage builds**. Rather than producing a single image, with the multistage builds, a Docker file can actually produce multiple images where each image is considered a stage. Artifacts can be copied from preceding stages to the current stage.

   The following two Dockerfiles demonstrate the multistage image builds from Use multi-stage builds (https://docs.docker.com/develop/develop-images/multistage-build/):

   Dockerfile with number:

Services
(/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes - Scaling and Updating application
(/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Horizontal pod autoscaler on minikubes
(/DevOps/Docker/Docker-Kubernetes-Horizontal-Pod-Autoscaler.php)

Docker & Kubernetes : NodePort vs LoadBalancer vs Ingress
(/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Load Testing with Locust on GCP Kubernetes
(/DevOps/Docker/Docker-Load-Testing-with-Locust-on-GCP-Kubernetes.php)

Docker & Kubernetes : From a monolithic app to micro services on GCP Kubernetes
(/DevOps/Docker/Docker-from-Monolithic-to-Micro-services-GCP-Kubernetes.php)

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(/DevOps/Docker/Docker-Rolling-Update-Canary-Blue-Green-Deployments-to-GKE-Kubernetes.php)

Docker & Kubernetes : Slack Chat Bot with NodeJS on GCP Kubernetes
(/DevOps/Docker/Docker-Slack-NodeJS-ChatBot-GCP-Kubernetes.php)

Docker & Kubernetes : Continuous Delivery with Jenkins Multibranch Pipeline for Dev, Canary, and Production Environments on GCP Kubernetes
(/DevOps/Docker/Docker-Continuous-Delivery-with-Jenkins-Multibranch-Pipeline-for-Dev-Canary-Production-

```
FROM golang:1.7.3
WORKDIR /go/src/github.com/alexellis/href-counter/
RUN go get -d -v golang.org/x/net/html
COPY app.go .
RUN CGO_ENABLED=0 GOOS=linux go build -a -installsuffix cgo -o app .

FROM alpine:latest
RUN apk --no-cache add ca-certificates
WORKDIR /root/
COPY --from=0 /go/src/github.com/alexellis/href-counter/app .
CMD ["./app"]
```

The second FROM instruction starts a new build stage with the alpine:latest image as its base. The `COPY --from=0` line copies just the built artifact from the previous stage into this new stage. The Go SDK and any intermediate artifacts are left behind, and not saved in the final image.

Dockerfile with name:

```
FROM golang:1.7.3 AS builder
WORKDIR /go/src/github.com/alexellis/href-counter/
RUN go get -d -v golang.org/x/net/html
COPY app.go    .
RUN CGO_ENABLED=0 GOOS=linux go build -a -installsuffix cgo -o app .

FROM alpine:latest
RUN apk --no-cache add ca-certificates
WORKDIR /root/
COPY --from=builder /go/src/github.com/alexellis/href-counter/app .
CMD ["./app"]
```

By default, the stages are not named, and we refer to them by their integer number, starting with 0 for the first `FROM` instruction as shown in the first Dockerfile. However, we can name our stages, by adding an `AS <NAME>` to the `FROM` instruction. The 2nd example improves the 1st one by naming the stages and using the name in the `COPY` instruction.

Here is another sample that builds a "Go" application and runs the app.

hello.go:

Environments-GCP-Kubernetes-Engine-Namespace.php)

Docker & Kubernetes - MongoDB with StatefulSets on GCP Kubernetes Engine (/DevOps/Docker/Docker_MongoD

Docker & Kubernetes : Nginx Ingress Controller on minikube (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Nginx Ingress Controller for Dashboard service on Minikube (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Nginx Ingress Controller on GCP Kubernetes (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Kubernetes Ingress with AWS ALB Ingress Controller in EKS (/DevOps/Docker/Docker-Kubernetes-ALB-Ingress-Controller-with-EKS.php)

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Docker & Kubernetes : StatefulSets on minikube (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : RBAC (/DevOps/Docker/Docker-Kubernetes-RBAC.php)

Docker & Kubernetes Service Account, RBAC, and IAM (/DevOps/Docker/Docker-

```
package main

import (
        "fmt"
        "log"
        "net/http"
)

//Hello Server responds to requests with the given URL path.
func HelloServer(w http.ResponseWriter, r *http.Request) {
        fmt.Fprintf(w, "Hello, you requested: %s", r.URL.Path)
        log.Printf("Received request for path: %s", r.URL.Path)
}
func main() {
        var addr string = ":8181"
        handler := http.HandlerFunc(HelloServer)
        if err := http.ListenAndServe(addr, handler); err != nil {
                log.Fatalf("Could not listen on port %s %v", addr, err)
        }
}
```

Dockerfile that builds the app then copy the binary into a container:

```
FROM golang:1-alpine as build
WORKDIR /app
COPY hello.go /app
RUN go build hello.go

FROM alpine:latest
WORKDIR /app
COPY --from=build /app /app
EXPOSE 8180
ENTRYPOINT ["./hello"]
```

Now, we have the following files in our working directory:

```
$ ls
Dockerfile      hello.go
```

We are now ready to build the image from the Dockerfile:

Kubernetes-Service-Account.php)

Docker & Kubernetes - Kubernetes Service Account, RBAC, IAM with EKS ALB, Part 1 (/DevOps/Docker/Docker-Kubernetes-ALB-on-EKS-1.php)

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Docker & Kubernetes : Istio (service mesh) sidecar proxy on GCP Kubernetes (/DevOps/Docker/Docker_Kuberne

```
$ docker build -t hello-go .
Sending build context to Docker daemon  3.072kB
Step 1/9 : FROM golang:1-alpine as build
 ---> 14ee78639386
Step 2/9 : WORKDIR /app
 ---> Using cache
 ---> 295af3c2ffa0
Step 3/9 : COPY hello.go /app
 ---> Using cache
 ---> debfbdb3c01d
Step 4/9 : RUN go build hello.go
 ---> Using cache
 ---> e29f2ba09000
Step 5/9 : FROM alpine:latest
 ---> 49f356fa4513
Step 6/9 : WORKDIR /app
 ---> Running in 034e0cf20138
Removing intermediate container 034e0cf20138
 ---> 03048fdf20d8
Step 7/9 : COPY --from=build /app /app
 ---> f496e0e4bbcb
Step 8/9 : EXPOSE 8180
 ---> Running in 7f2b631302e1
Removing intermediate container 7f2b631302e1
 ---> c1545d176662
Step 9/9 : ENTRYPOINT ["./hello"]
 ---> Running in dfeb253925e1
Removing intermediate container dfeb253925e1
 ---> 10456b843247
Successfully built 10456b843247
Successfully tagged hello-go:latest

$ docker images
REPOSITORY                    TAG                 IMAGE ID            CREATED             S
hello-go                      latest              10456b843247        About a minute ago  1
```

To run the container and expose the internal port 8181 to our host port 8182:

```
$ docker run -d --name hello-go-container --rm -p 8182:8181 hello-go
907ad5290aa7a2db70496082906d25a291a5077933d343f6a8a7d50efa0760c7

$ docker ps
CONTAINER ID        IMAGE       COMMAND    CREATED             STATUS              PORTS
907ad5290aa7        hello-go    "./hello"  16 seconds ago      Up 15 seconds       8180/tcp,
```

Test the application:

```
$ curl localhost:8182
Hello, you requested: /
```

It appears to be working fine!

One more step. Let's go into the container and check the **/app** folder:

Docker & Kubernetes : Istio on EKS (/DevOps/Docker/Docker-Kubernetes-EKS-with-ISTIO.php)

Docker & Kubernetes : Deploying .NET Core app to Kubernetes Engine and configuring its traffic managed by Istio (Part I) (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Deploying .NET Core app to Kubernetes Engine and configuring its traffic managed by Istio (Part II - Prometheus, Grafana, pin a service, split traffic, and inject faults) (/DevOps/Docker/Docker_Kuberne

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Docker & Kubernetes : Deploying Memcached on Kubernetes Engine (/DevOps/Docker/Docker_Helm_Pa

Docker & Kubernetes : EKS Control Plane (API server) Metrics with Prometheus (/DevOps/Docker/Docker-Kubernetes-EKS-Control-Plane-API-Server-Metrics-with-Prometheus.php)

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Docker & Kubernetes : Continuous Delivery Pipelines with Spinnaker and Kubernetes Engine (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes: Multi-node Local Kubernetes cluster - Kubeadm-dind(docker-in-docker) (/DevOps/Docker/Docker-Kubernetes-Multi-Node-Local-Clusters-dind.php)

Docker & Kubernetes: Multi-node Local Kubernetes cluster - Kubeadm-kind(k8s-in-docker) (/DevOps/Docker/Docker-Kubernetes-Multi-Node-Local-Clusters-kind.php)

Docker & Kubernetes :

```
$ docker exec -it hello-go-container /bin/sh
/app # ls -la
total 6044
drwxr-xr-x    1 root     root          4096 Apr  6 23:47 .
drwxr-xr-x    1 root     root          4096 Apr  6 23:53 ..
-rwxr-xr-x    1 root     root       6176661 Apr  6 21:23 hello
-rw-r--r--    1 root     root           493 Apr  6 20:22 hello.go
```

As we can see the binary (**hello**) has been copied successfully from **build** stage to the last stage.

10. **Sometimes when we run a docker container it exits immediately. Why?**

The short answer is that the container exits because it has no process to run.

In this section, we'll also learn the difference between `CMD` and `ENTRYPOINT`

When we run an Ubuntu image, it exits immediately as we can see below:

```
$ docker run ubuntu:18.04
Unable to find image 'ubuntu:18.04' locally
18.04: Pulling from library/ubuntu
6cf436f81810: Pull complete
987088a85b96: Pull complete
b4624b3efe06: Pull complete
d42beb8ded59: Pull complete
Digest: sha256:7a47ccc3bbe8a451b500d2b53104868b46d60ee8f5b35a24b41a86077c650210
Status: Downloaded newer image for ubuntu:18.04

$ docker ps -a
CONTAINER ID IMAGE        COMMAND     CREATED        STATUS                         PORTS
9ba1aa158caf ubuntu:18.04 "/bin/bash" 11 seconds ago Exited (0) 10 seconds ago
```

Why is that? Why it exited?

Unlike VMs which are meant to host OS, containers are meant to run a task or a process such as a web server/application or a db. So, once a task is complete, a container exits. A container lives as long as a process within it is running. If an application in a container crashes, container exits.

So, who defines which process should be running inside a container?

Let's look into the following Dockerfile for nginx (), specially the **CMD[]** instruction:

nodeSelector, nodeAffinity, taints/tolerations, pod affinity and anti-affinity - Assigning Pods to Nodes (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : Jenkins-X on EKS (/DevOps/Docker/Docker_Kuberne X-EKS.php)

Docker & Kubernetes : ArgoCD App of Apps with Heml on Kubernetes (/DevOps/Docker/Docker_Kuberne

Docker & Kubernetes : ArgoCD on Kubernetes cluster (/DevOps/Docker/Docker_Kuberne

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```
#
# Nginx Dockerfile
#
# https://github.com/dockerfile/nginx
#

# Pull base image.
FROM dockerfile/ubuntu

# Install Nginx.
RUN \
  add-apt-repository -y ppa:nginx/stable && \
  apt-get update && \
  apt-get install -y nginx && \
  rm -rf /var/lib/apt/lists/* && \
  echo "\ndaemon off;" >> /etc/nginx/nginx.conf && \
  chown -R www-data:www-data /var/lib/nginx

# Define mountable directories.
VOLUME ["/etc/nginx/sites-enabled", "/etc/nginx/certs", "/etc/nginx/conf.d", "/var/log/nginx

# Define working directory.
WORKDIR /etc/nginx

# Define default command.
CMD ["nginx"]

# Expose ports.
EXPOSE 80
EXPOSE 443
```

Yes, the **CMD[]** tells the Docker which program should be run when the container starts. In our case, it is the "nginx" command.

For **mysql** Dockerfile it is **mysqld** command:

```
COPY docker-entrypoint.sh /entrypoint.sh
COPY healthcheck.sh /healthcheck.sh
ENTRYPOINT ["/entrypoint.sh"]
HEALTHCHECK CMD /healthcheck.sh
EXPOSE 3306 33060
CMD ["mysqld"]
```

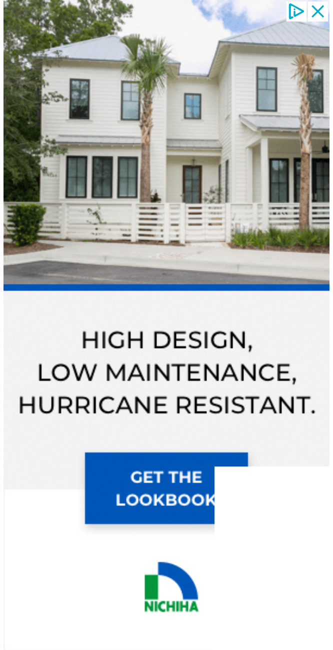
How about our Ubuntu image Dockerfile?

```
...
CMD ["/bin/bash"]
```

It uses **bash** for its default command.

Unlike the web server or a db, the **bash** is not a process, it's just a shell listening and waiting for an input. If it does not get any from a terminal, it exits.

Earlier, when we run a container from the Ubuntu image, it launches a "bash" program but the Docker, by default, not attaching any terminal to a container when it runs. So, the container could not find a terminal, and just exited.



Ansible 2.0

What is Ansible? (/DevOps/Ansible/Ansible_What_is

Quick Preview - Setting up web servers with Nginx, configure environments, and deploy an App (/DevOps/Ansible/Ansible_SettingU

SSH connection & running commands (/DevOps/Ansible/Ansible-SSH-Connection-Setup-Run-Command.php)

Ansible: Playbook for Tomcat 9 on Ubuntu 18.04 systemd with AWS (/DevOps/Ansible/Ansible-Tomcat9-Ubuntu18-Playbook.php)

Modules (/DevOps/Ansible/Ansible-Modules.php)

Playbooks (/DevOps/Ansible/Ansible-Playbooks.php)

We can make container alive for a while by overwriting the CMD ["/bin/bash"], for example, sleep 30s when we run docker:

```
$ docker run ubuntu:18.04 sleep 30s

$ docker ps
CONTAINER ID  IMAGE          COMMAND       CREATED         STATUS         PORTS  NAMES
55ab52fa884d  ubuntu:18.04   "sleep 30s"   7 seconds ago   Up 6 seconds          relaxed_eule
```

But how we can make the container always run the `sleep` command when it starts? Note that we added it to the `docker run` command.

One way to avoid adding the "sleep 30s" after the command is to use the `CMD` instruction in our Dockerfile:

```
FROM ubuntu:18.04
CMD sleep 30
```

Or we can use array:

```
FROM ubuntu:18.04
CMD ["sleep", "30"]
```

Note that we should NOT use the following because the command and args should be separated:

```
CMD ["sleep 30"] X
```

Now we can build our image with a name of "ubuntu-sleep":

```
$ docker build -t ubuntu-sleep .
Sending build context to Docker daemon  2.048kB
Step 1/2 : FROM ubuntu:18.04
 ---> 47b19964fb50
Step 2/2 : CMD ["sleep", "30"]
 ---> Running in c84ecc7a5b3d
Removing intermediate container c84ecc7a5b3d
 ---> 3f21ee94c150
Successfully built 3f21ee94c150
Successfully tagged ubuntu-sleep:latest
```

Then, run a container from the newly created image:

```
$ docker run ubuntu-sleep
```

The container always sleeps 30s after it started!

But we have a problem. What if we want to change the sleep time?

Currently, it's been hard-coded.

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Terraform

Introduction to Terraform with AWS elb & nginx

Of course, we can overwrite the command like this:

```
$ docker run ubuntu-sleep sleep 5
```

However, because the image name itself is already indicating it would sleep, we need to find a way of just feeding the seconds as an argument not with the `sleep` command, and the image automatically invoke the "sleep" command needing only the parameter. Something like this:

```
$ docker run ubuntu-sleep 5
```

That's why we need the `ENTRYPOINT` instruction.

It simply specifies a program to run when a container starts.

So, our Dockerfile should be changed from:

```
FROM ubuntu:18.04
CMD ["sleep", "30"]
```

to:

```
FROM ubuntu:18.04
ENTRYPOINT ["sleep"]
```

Build a new image and run the container:

```
$ docker build -t ubuntu-sleep .
Sending build context to Docker daemon  2.048kB
Step 1/2 : FROM ubuntu:18.04
 ---> 47b19964fb50
Step 2/2 : ENTRYPOINT ["sleep"]
 ---> Running in e5e6e83e9e01
Removing intermediate container e5e6e83e9e01
 ---> affbc2e6ed86
Successfully built affbc2e6ed86
Successfully tagged ubuntu-sleep:latest

$ docker run ubuntu-sleep 5
```

Note the difference between the `CMD` and `ENTRYPOINT` with related to the supplied to the `docker run` command. While the `CMD` will be completely over-written by the supplied command (or args), for the `ENTRYPOINT`, the supplied command will be appended to it.

Another problem in our Dockerfile: let's see:

```
$ docker run ubuntu-sleep
sleep: missing operand
Try 'sleep --help' for more information.
```

(/DevOps/Terraform/Terraform-Introduction-AWS-elb-nginx.php)

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Terraform Tutorial - VPC,

In the command above, we did not supply an arg for the `sleep` command, and got an error when the container started.

We need a default value for the command so that container runs event though an arg is missing.

Here is where the `CMD` comes into play: the `CMD` instruction will be appended to the `ENTRYPOINT` instruction.

Here is our new Dockerfile:

```
FROM ubuntu:18.04
ENTRYPOINT ["sleep"]
CMD ["5"]
```

Build the image and run a container from the image, and we should not get any error when we do not specify sleep time:

```
$ docker build -t ubuntu-sleep .
$ docker run ubuntu-sleep
```

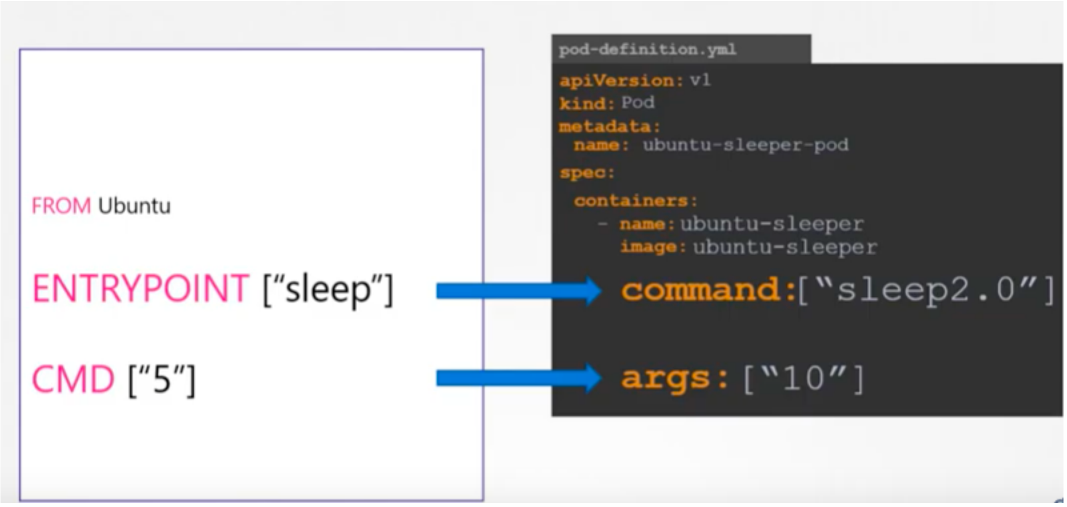
If we add a parameter to the command, it will overwrites the default value specified in `CMD`.

One more thing regarding the `ENTRYPOINT`. What if we want to override the command specified in the `ENTRYPOINT`?

In that case, we can give a new command in `docker run` command, for example:

```
$ docker run --entrypoint new-sleep-command ubuntu-sleep 60
```

Let's go further and look into how the `ENTRYPOINT` and `CMD` in Dockerfile are translated in a Pod definition yaml file:



```
FROM Ubuntu

ENTRYPOINT ["sleep"]

CMD ["5"]
```

```
pod-definition.yml
apiVersion: v1
kind: Pod
metadata:
  name: ubuntu-sleeper-pod
spec:
  containers:
    - name: ubuntu-sleeper
      image: ubuntu-sleeper
      command:["sleep2.0"]

      args: ["10"]
```

Picture source Docker for Beginners - Commands vs Entrypoint - Kubernetes (https://www.youtube.com/watch?v=OYbEWUbmk90&index=7&list=PL2We04F3Y_43dAehLMT5GxJhtk3mJtkl5)

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Delegate Access Across AWS Accounts Using IAM Roles (/DevOps/Terraform/Terraform_AV

AWS KMS (/DevOps/Terraform/Terraform-AWS-KMS.php)

As we can see the parameters in `ENTRYPOINT` and `CMD` can be overwritten with the ones provided via "command" are "args" in "spec.containers" of the yaml.

11. **How we can run a container with "root" privilege?**

```
$ docker exec -u 0 -it my-container sh
```

12. **How to push an image to AWS ECR?**

Docker login first assuming the AWS credentials are in place either from ENV or from ~/.aws/credentials:

```
$ aws --region us-west-2 ecr get-login-password \
    | docker login \
        --password-stdin \
        --username AWS \
        437028470429.dkr.ecr.us-west-2.amazonaws.com

Login Succeeded
```

Then, push it to ECR:

```
$ docker push 437028470429.dkr.ecr.us-west-2.amazonaws.com/test-khong:0.2.1
The push refers to repository [437028470429.dkr.ecr.us-west-2.amazonaws.com/test-khong]
...
0.2.1: digest: sha256:ca2fc17f610...2ceaddf5e0cbda5e74 size: 4484
```

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