TECH SWITCH

A Shift from Monolithic to Microservice Architecture

TECH SWITCH

Applications have changed dramatically

~2000 — Today

Monolithic

Slow Changing

Big Server

A Decade Ago (and still valid)

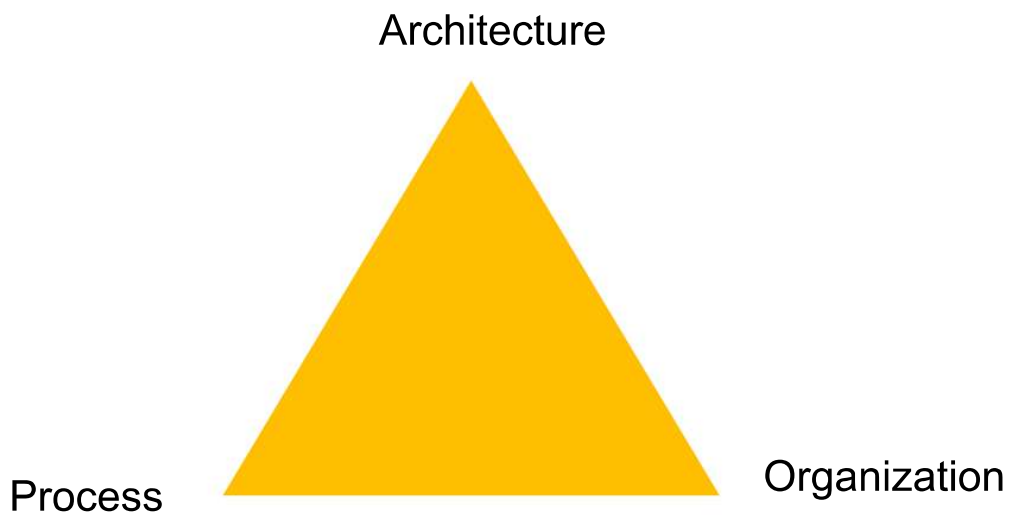
- Apps were monolithic
- Built on a single stack such as .NET or Java
- Long Lived
- Deployed to a single server

TECH SWITCH

Let’s imagine you are building a large, complex application, e.g., Online Store

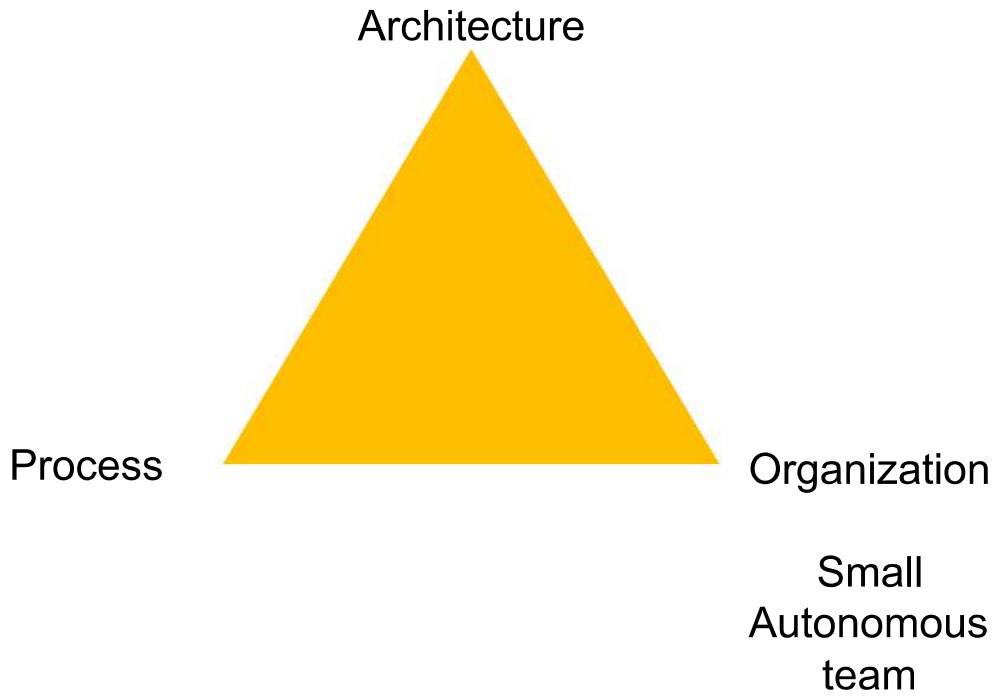
TECH SWITCH

Successful Software Development



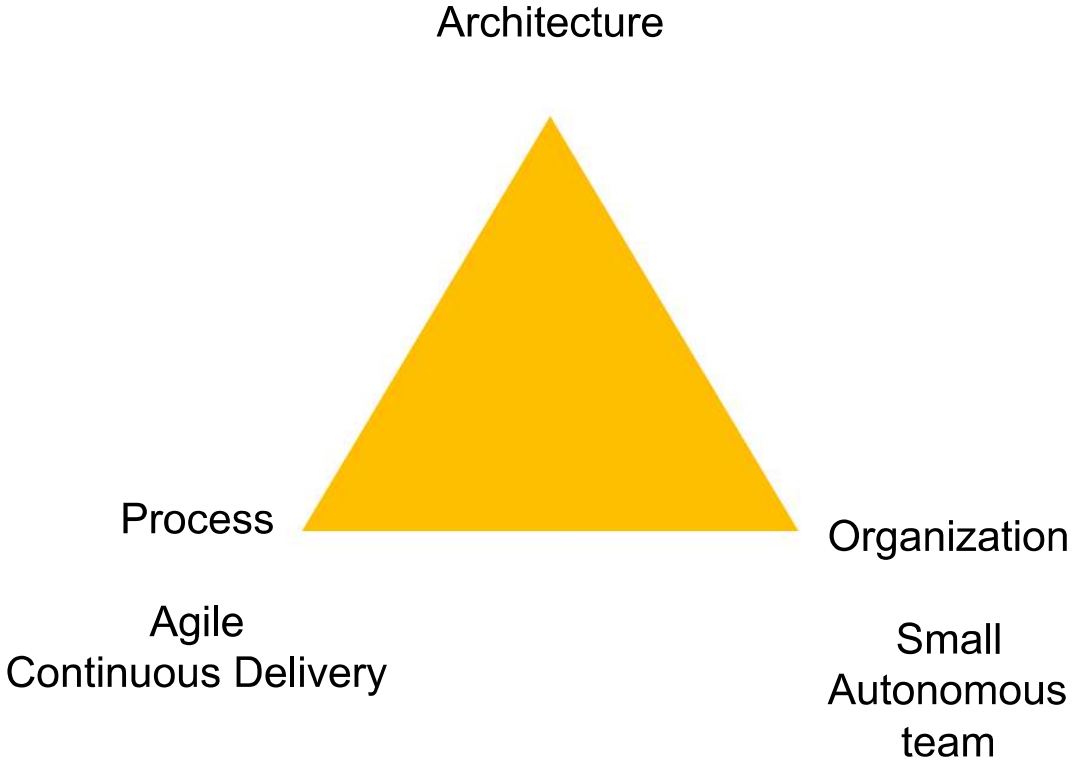
TECH SWITCH

Successful Software Development



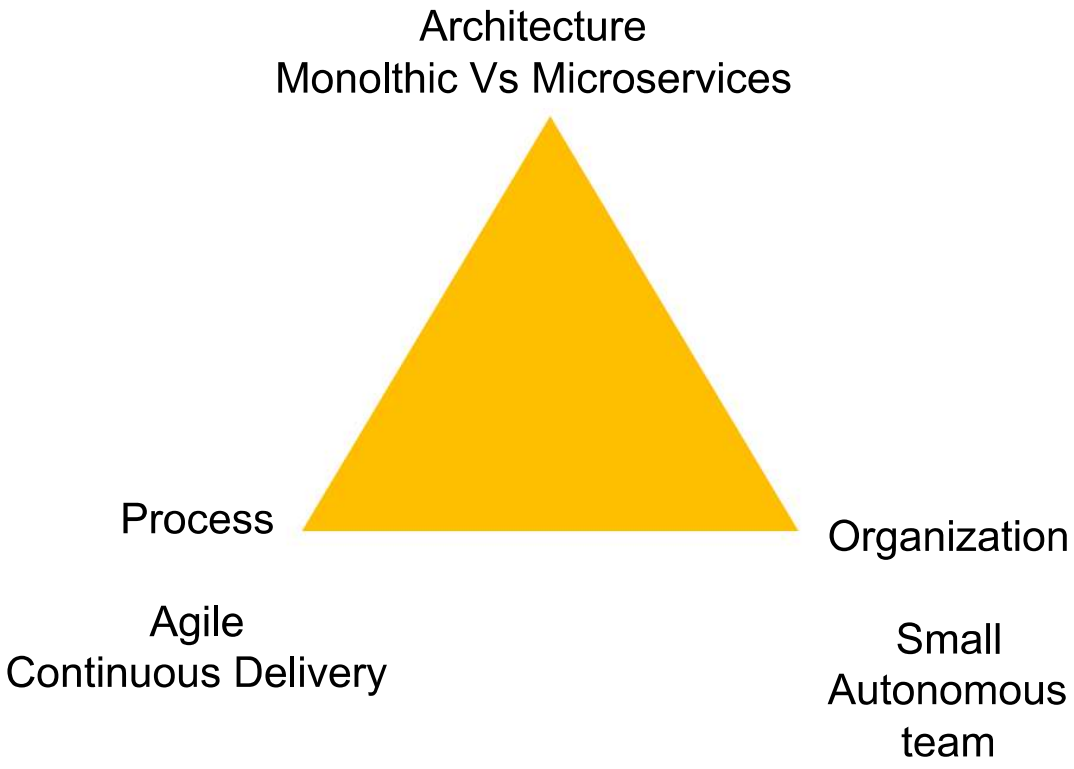
TECH SWITCH

Successful Software Development



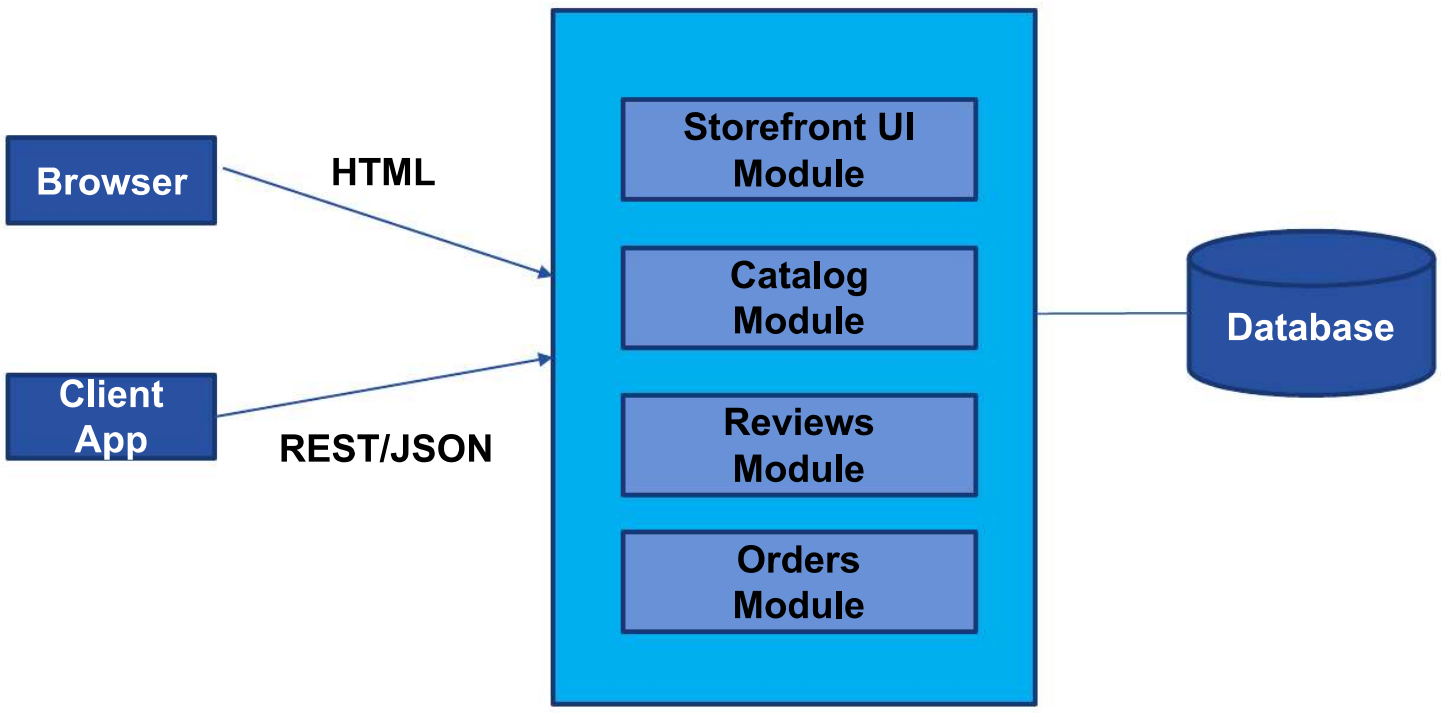
TECH SWITCH

Successful Software Development



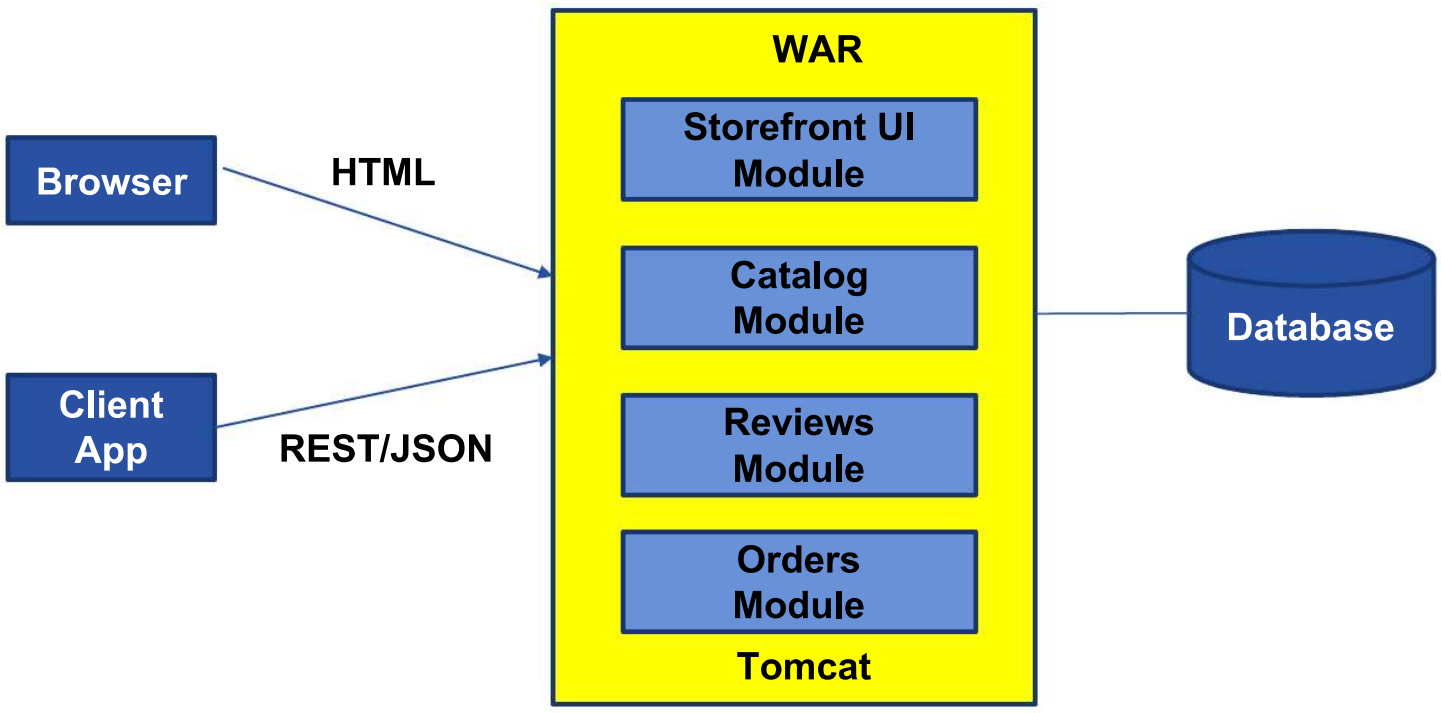
TECH SWITCH

A Close Look at Monolithic



TECH SWITCH

A Close Look at Monolithic



TECH SWITCH

Benefits of Monolith

Simple to Develop, Test, Deploy & Scale

- Simple to develop because of all the tools and IDEs support to that kind of application by default.
- Easy to deploy because all components are packed into one bundle.
- Easy to scale the whole application.

But successful applications keep growing ....

@crichardsor

TECH SWITCH

TECH SWITCH

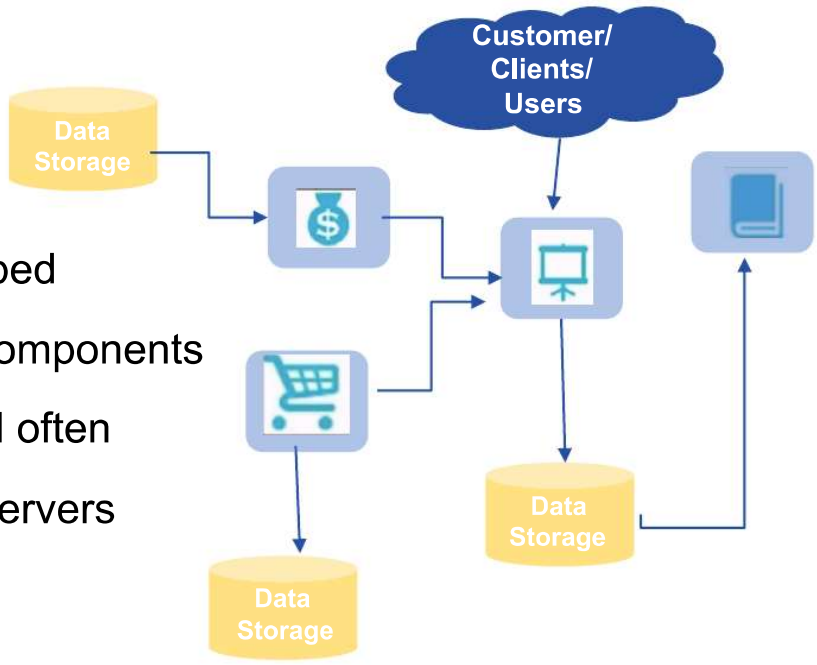
Disadvantages of Monolith

- Very difficult to maintain
- One component failure will cause the whole system to fail.
- Very difficult to understand and create the patches for monolithic applications.
- Adapting to new technology is very challengeable.
- Take a long time to startup because all the components need to get started.

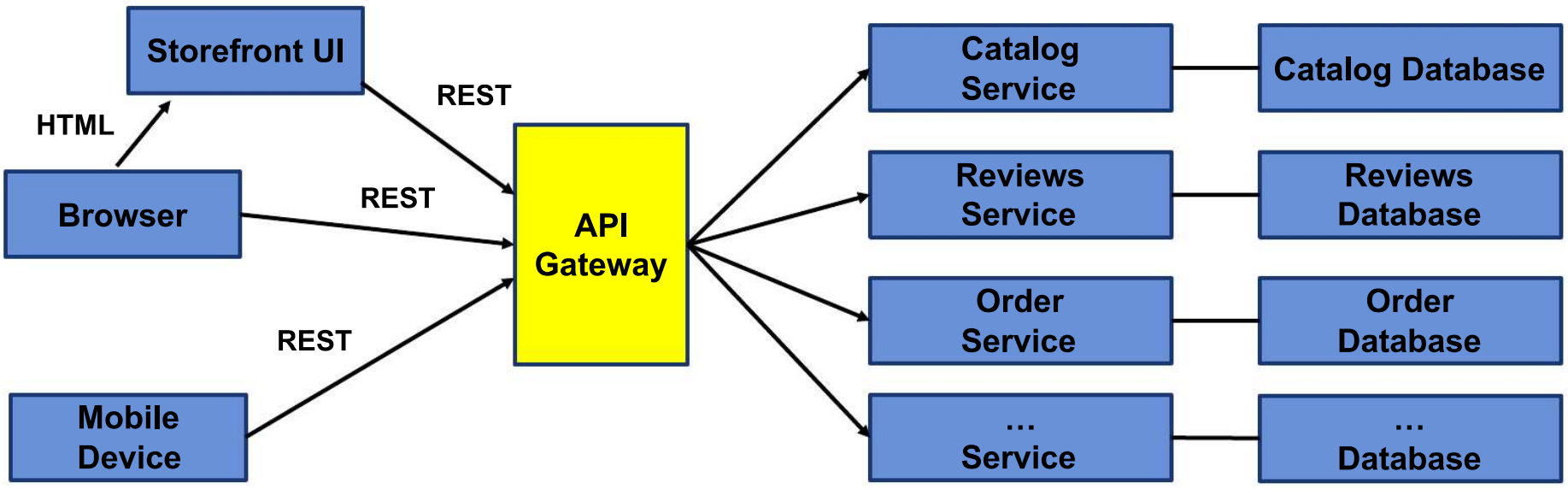
Applications have changed dramatically

Today

- Apps are constantly developed
- Built from loosely coupled components
- Newer version are deployed often
- Deployed to a multitude of servers



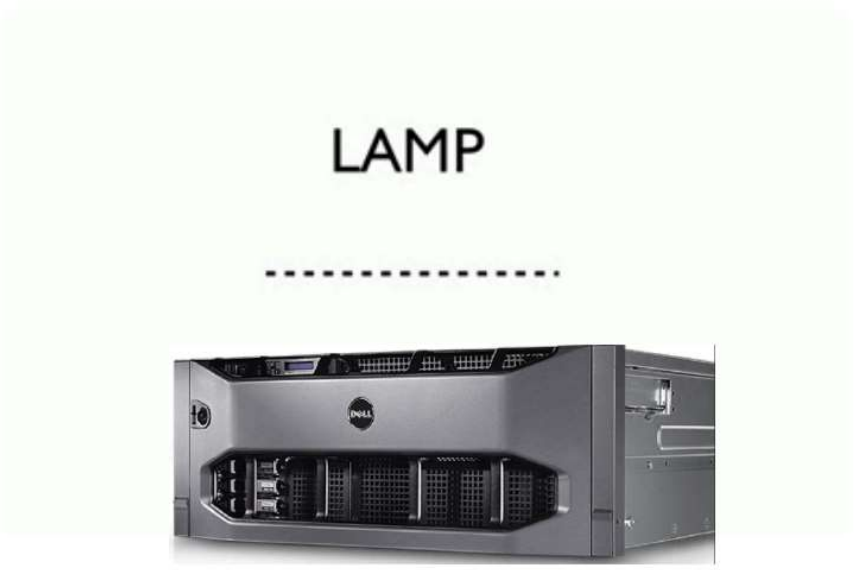
Microservice Architecture



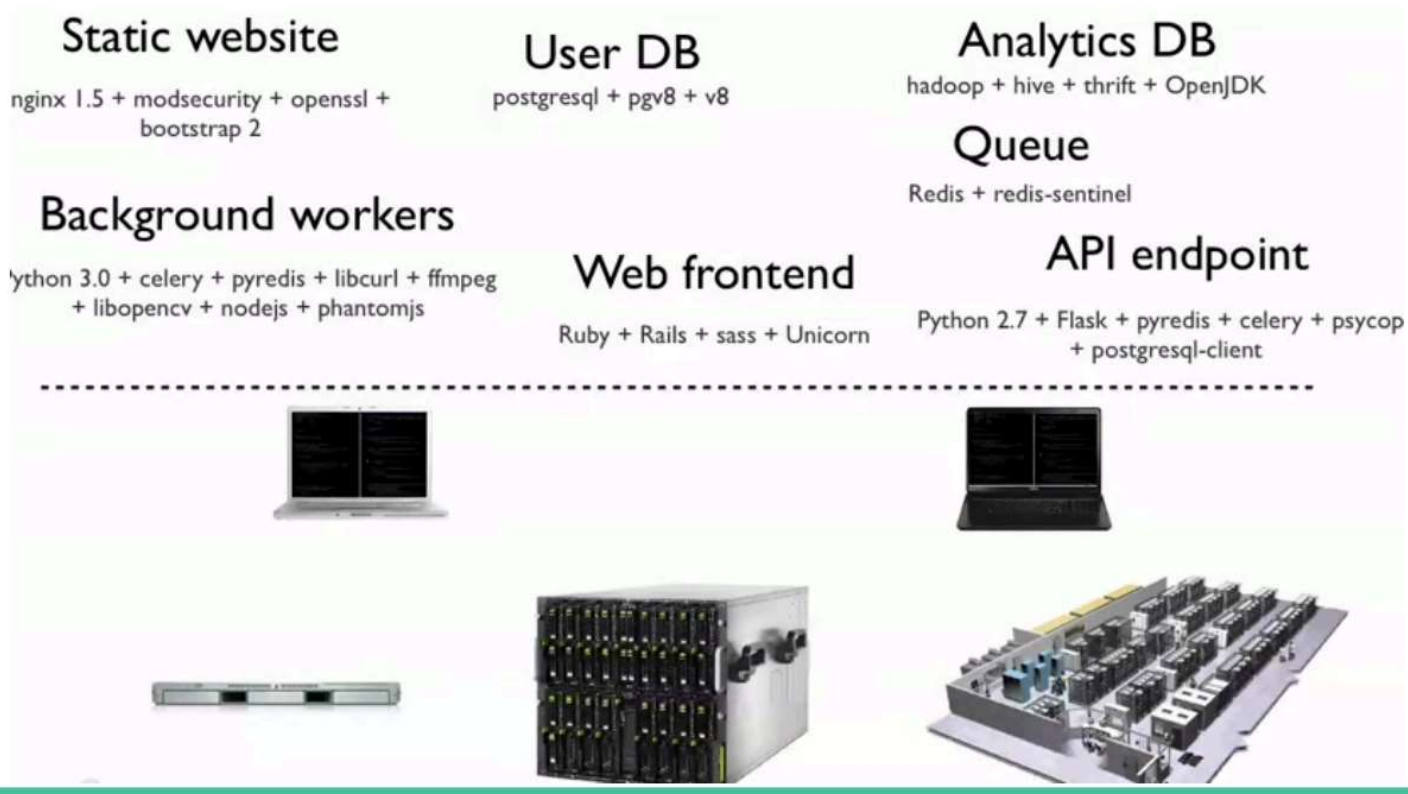
Benefits of Microservices

- Can scale independent microservices separately. No need to scale the whole the system
- Can use the latest technologies to develop the microservices.
- One component failure will not cause entire system downtimes.
- When developing an overall solution we can parallel the microservices development task with the small teams. So it helps to decrease the development time.

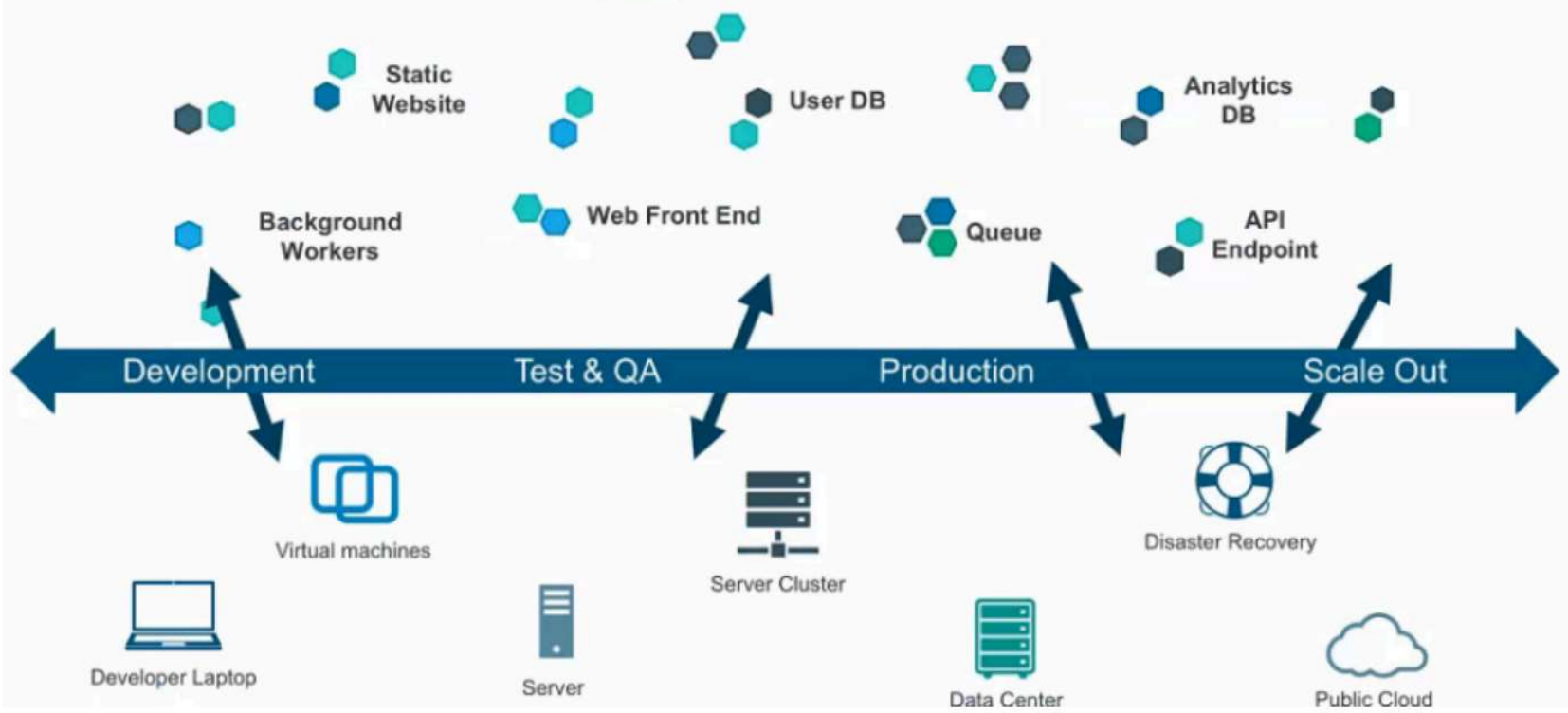
Once upon a time...a Software Stack

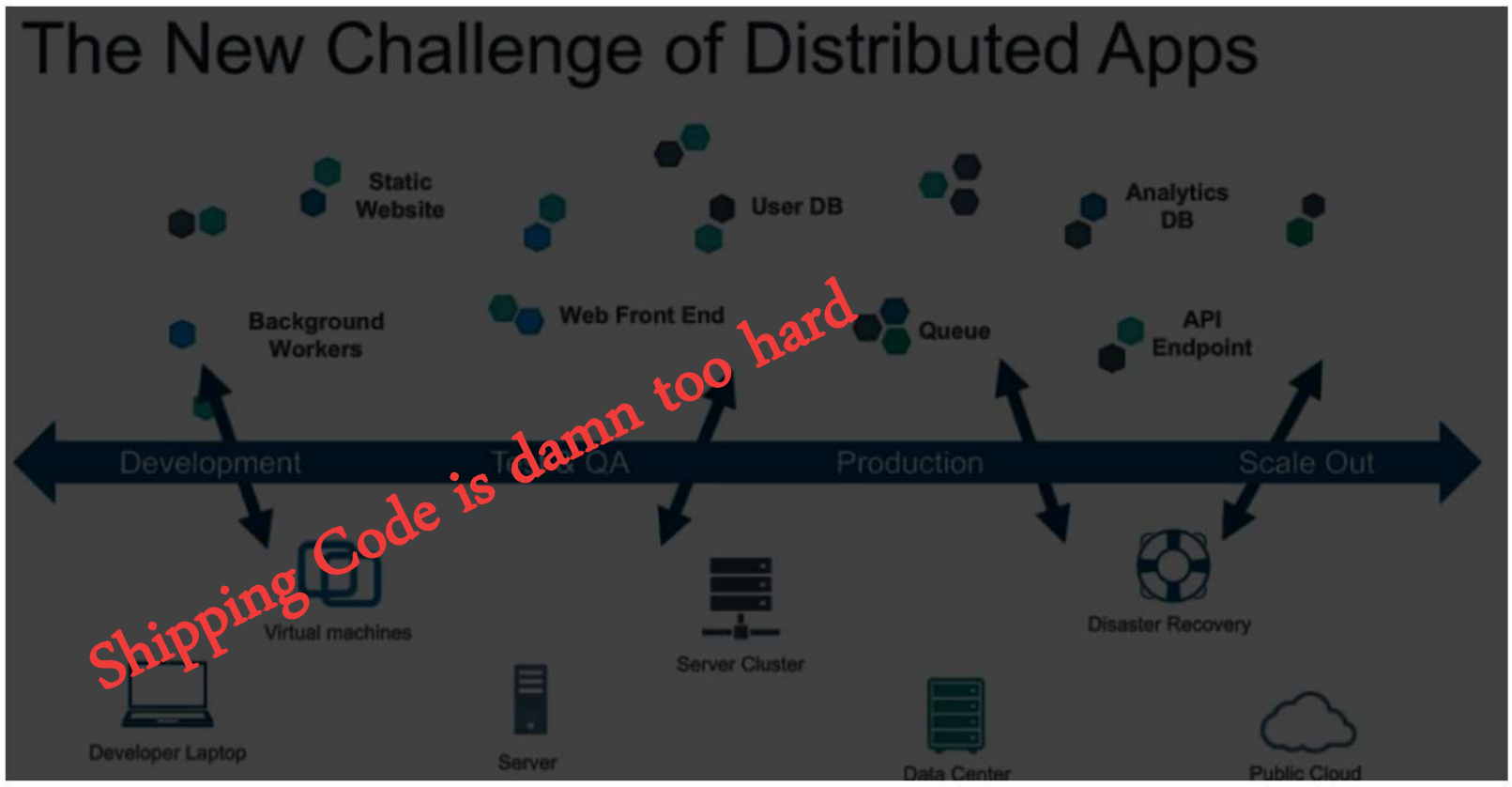


Now much more distributed & complex...

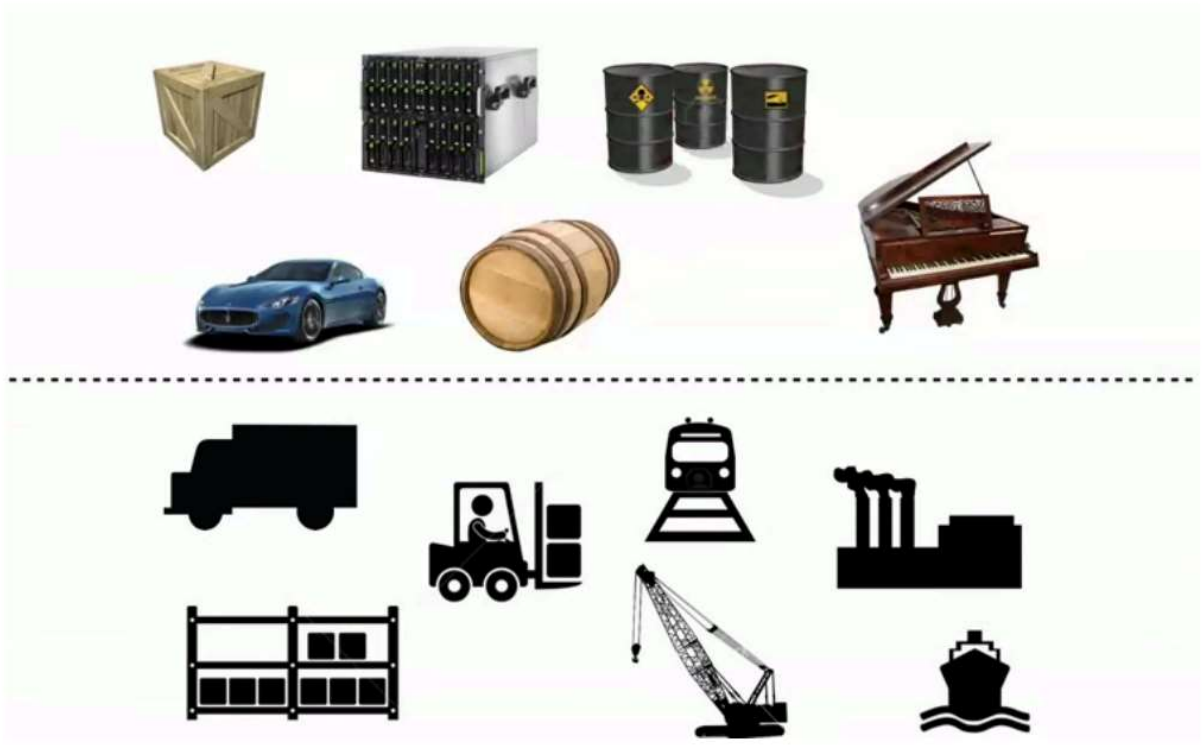


The New Challenge of Distributed Apps




The New Challenge of Distributed Apps
Static Website
User DB
Analytics DB
Background Workers
Web Front End
Queue
API Endpoint
Development
Test & QA
Production
Scale Out
Shipping Code is damn too hard
Virtual machines
Server Cluster
Disaster Recovery
Developer Laptop
Server
Data Center
Public Cloud

An Effort to solve the problem Complexity



Every possible good to ship X Every Possible way to Ship

		?	?	?	?	?	?
		?	?	?	?	?	?
		?	?	?	?	?	?
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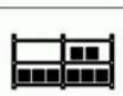
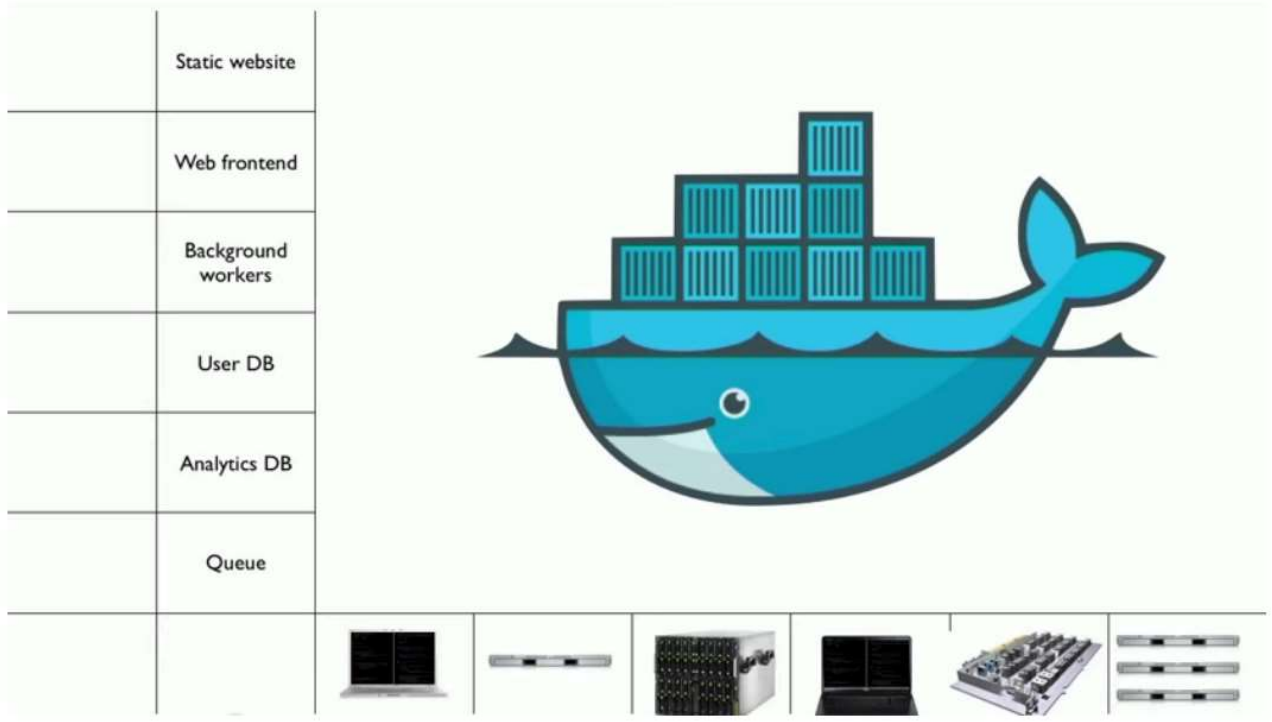
							

Enter….Internodal Container

That’s what Docker is all about..



What is Docker and what problem does it solve?

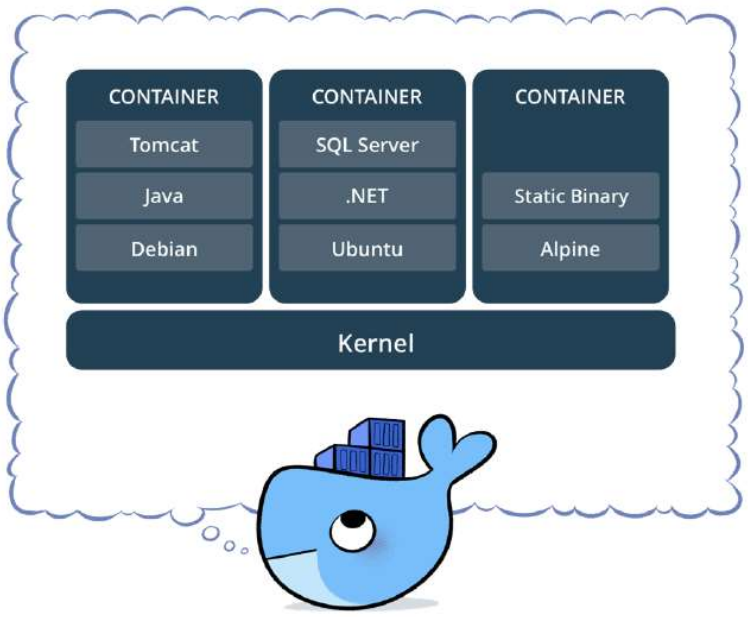
What is Docker?

Refers to several things in 2019

- Docker as a “Company”
- Docker as a “Product”
- Docker as a “Platform”
- Docker as a “CLI Tool”
- Docker as a “Computer Program”


```
PS C:\Users\Ajeet_Raina> docker version
Client: Docker Engine - Community
 Version:           18.09.1
 API version:       1.39
 Go version:        go1.10.6
 Git commit:        4c52b90
 Built:             Wed Jan  9 19:34:26 2019
 OS/Arch:           windows/amd64
 Experimental:      false

Server: Docker Engine - Community
 Engine:
  Version:          18.09.1
  API version:      1.39 (minimum version 1.12)
  Go version:       go1.10.6
  Git commit:       4c52b90
  Built:            Wed Jan  9 19:41:49 2019
  OS/Arch:          linux/amd64
  Experimental:     true
```

What is Docker?



- Standardized packaging for software and dependencies
- Isolate apps from each other
- Share the same OS kernel
- Works for all major Linux distributions
- Containers native to Windows Server 2016 & 1809

Docker Product Offerings

SaaS	On the Desktop	On Servers and In the Cloud		From the Ecosystem
	Docker for Mac	Docker Community Edition	Docker Enterprise Edition (EE) Docker Universal Control Plane Docker Trusted Registry Docker Engine (aka EE Basic)	Docker Certified Certified Containers Certified Plugins Certified Infrastructure
Docker Hub	Docker for Windows			

Docker Hub Docker Cloud Docker Store	→	Docker Hub
Docker for Mac Docker for Windows	→	Docker Desktop
Docker Community Edition	→	Docker Engine
Docker Enterprise Edition - Basic	→	Docker Engine - Enterprise
Docker Enterprise Edition	→	Docker Enterprise

Today Docker runs on

Windows 10

debian

ubuntu

amazon web services

Orange pi

Orange Pi PC

Microsoft Windows Server 2019

Google Cloud Platform

Microsoft Azure

vmware

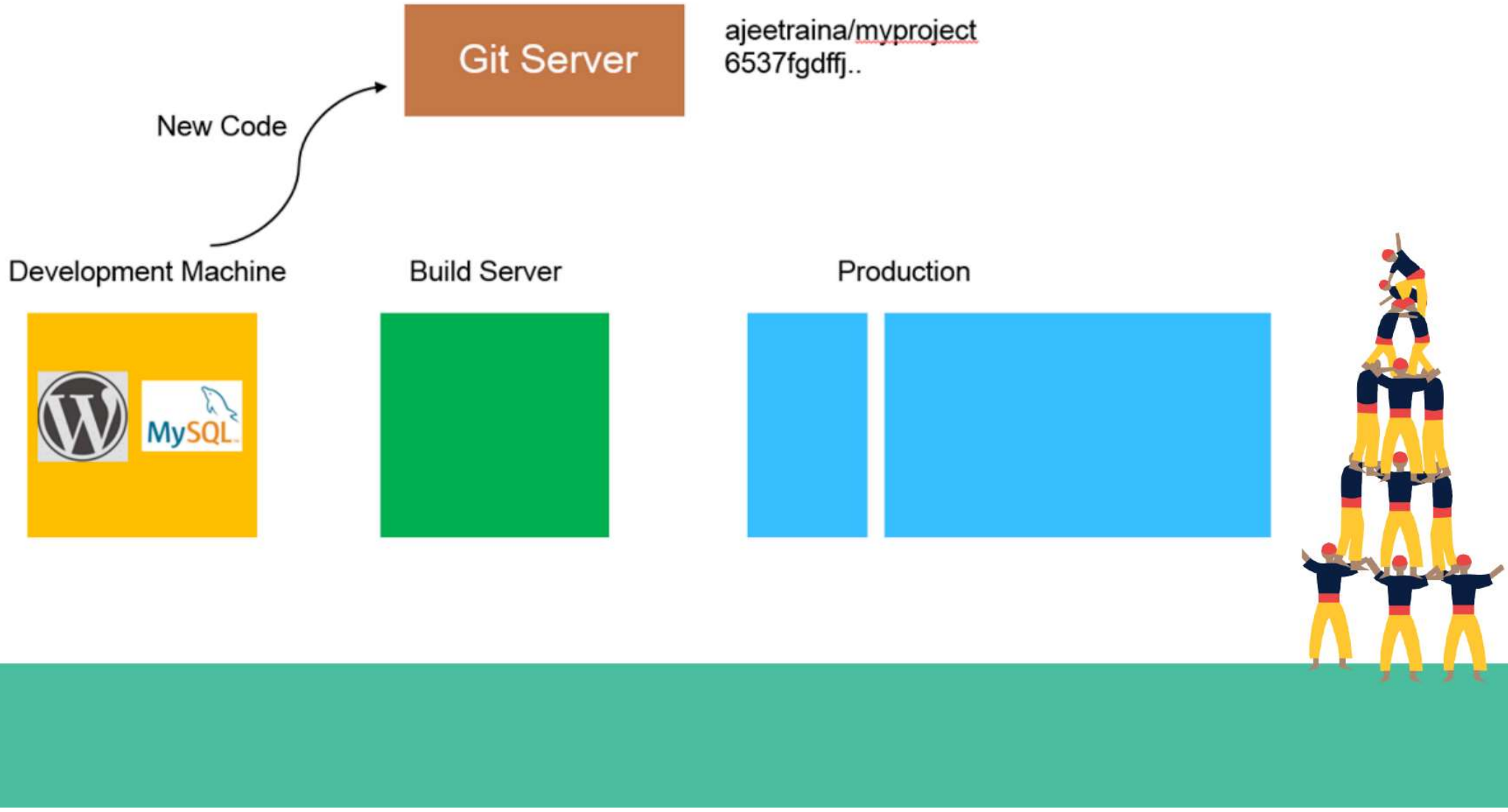
Traditional Software Development WorkFlow (without Docker)

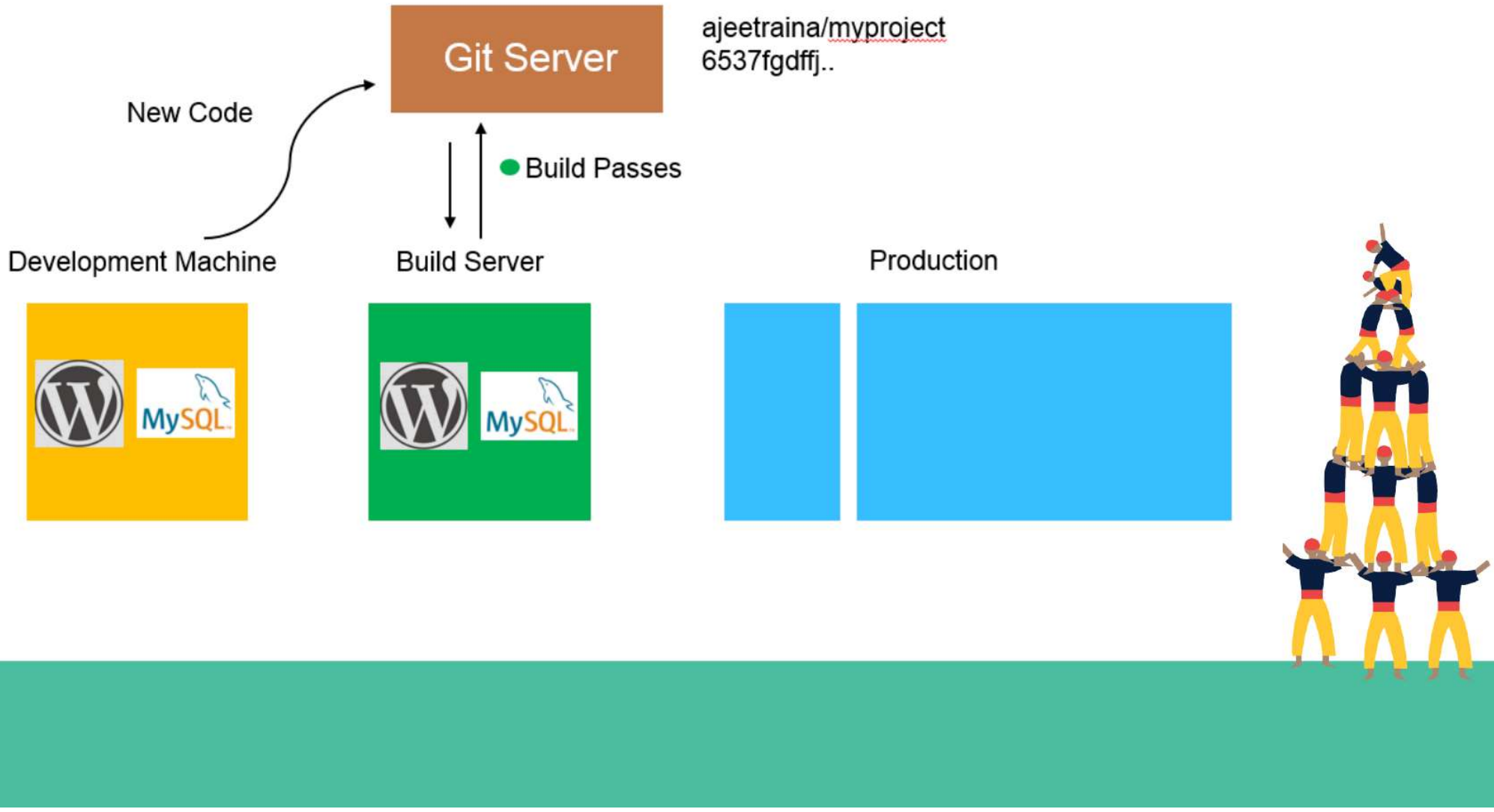
Git Server

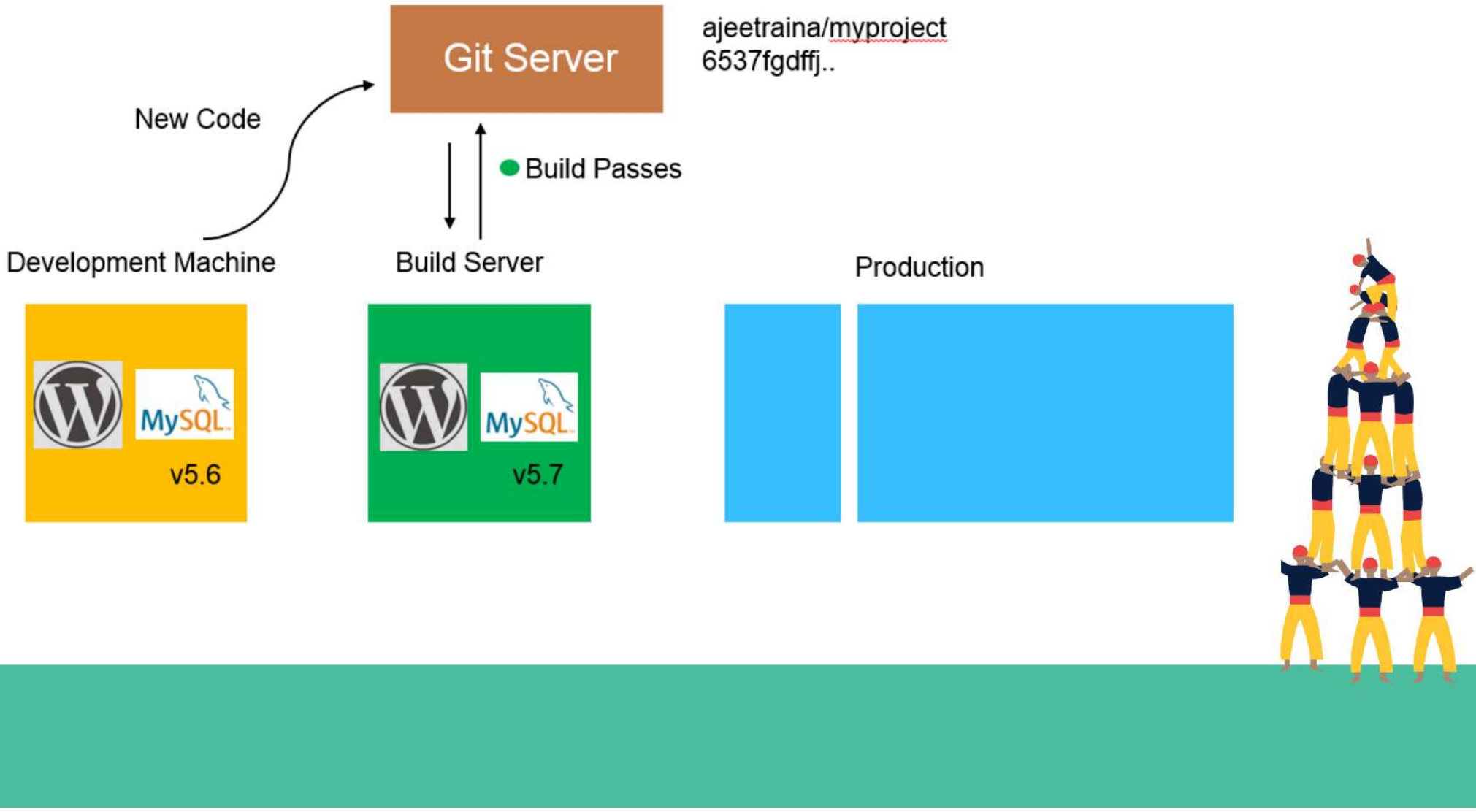
Development Machine

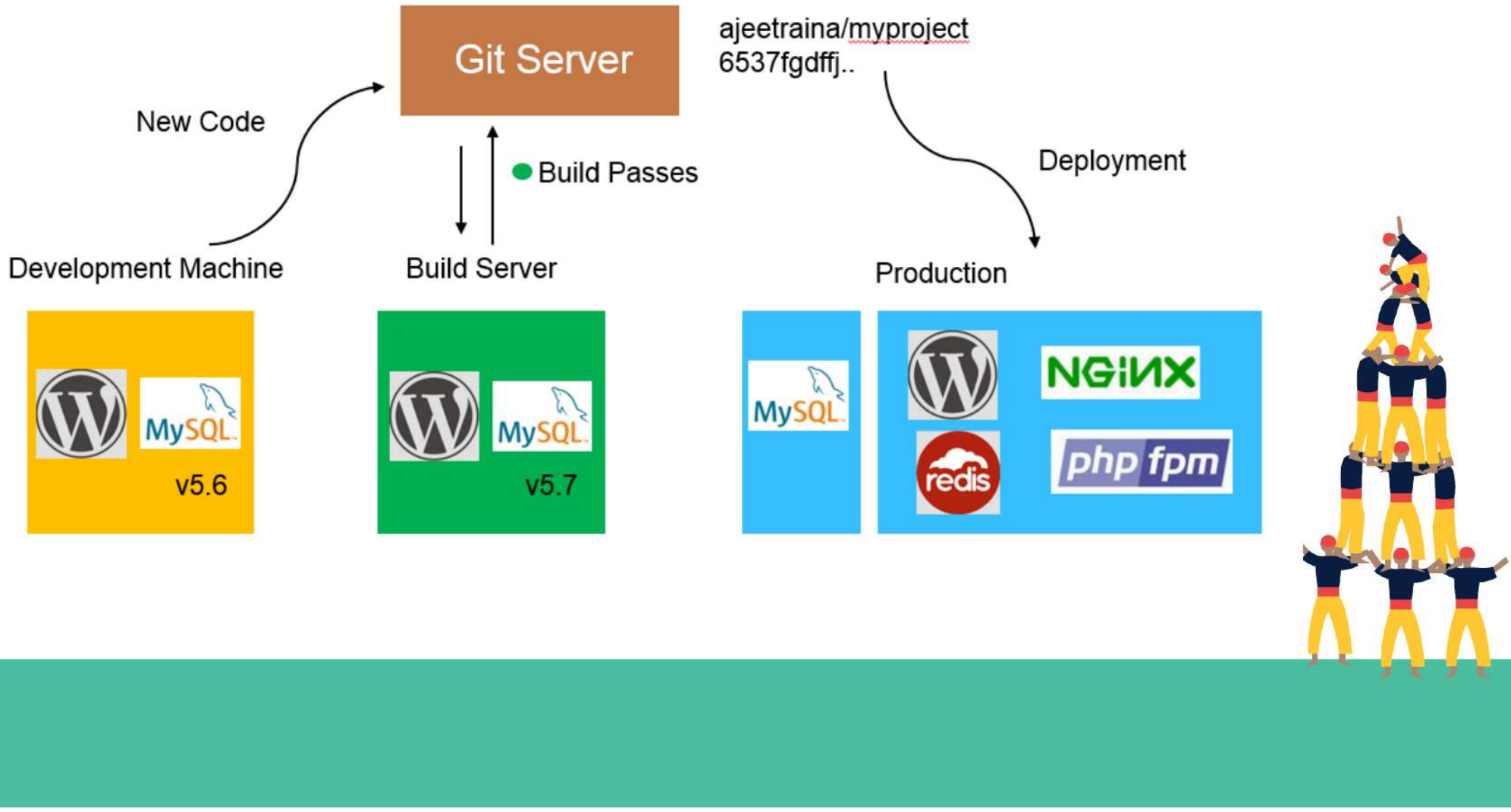
Build Server

Production


Git Server
ajeetraina/myproject
6537fgdffj..
New Code
Development Machine
Build Server
Production
MySQL


Git Server
ajeetraina/myproject
6537fgdffj..
New Code
Build Passes
Development Machine
Build Server
Production
MySQL
MySQL


Git Server
ajeetraina/myproject
6537fgdffj..
New Code
Build Passes
Development Machine
Build Server
Production
MySQL
v5.6
MySQL
v5.7


Git Server
ajeetraina/myproject
6537fgdffj..
New Code
Build Passes
Deployment
Development Machine
Build Server
Production
MySQL
v5.6
MySQL
v5.7
MySQL
NGINX
redis
php fpm

Traditional Software Development WorkFlow (with Docker)

Git Server

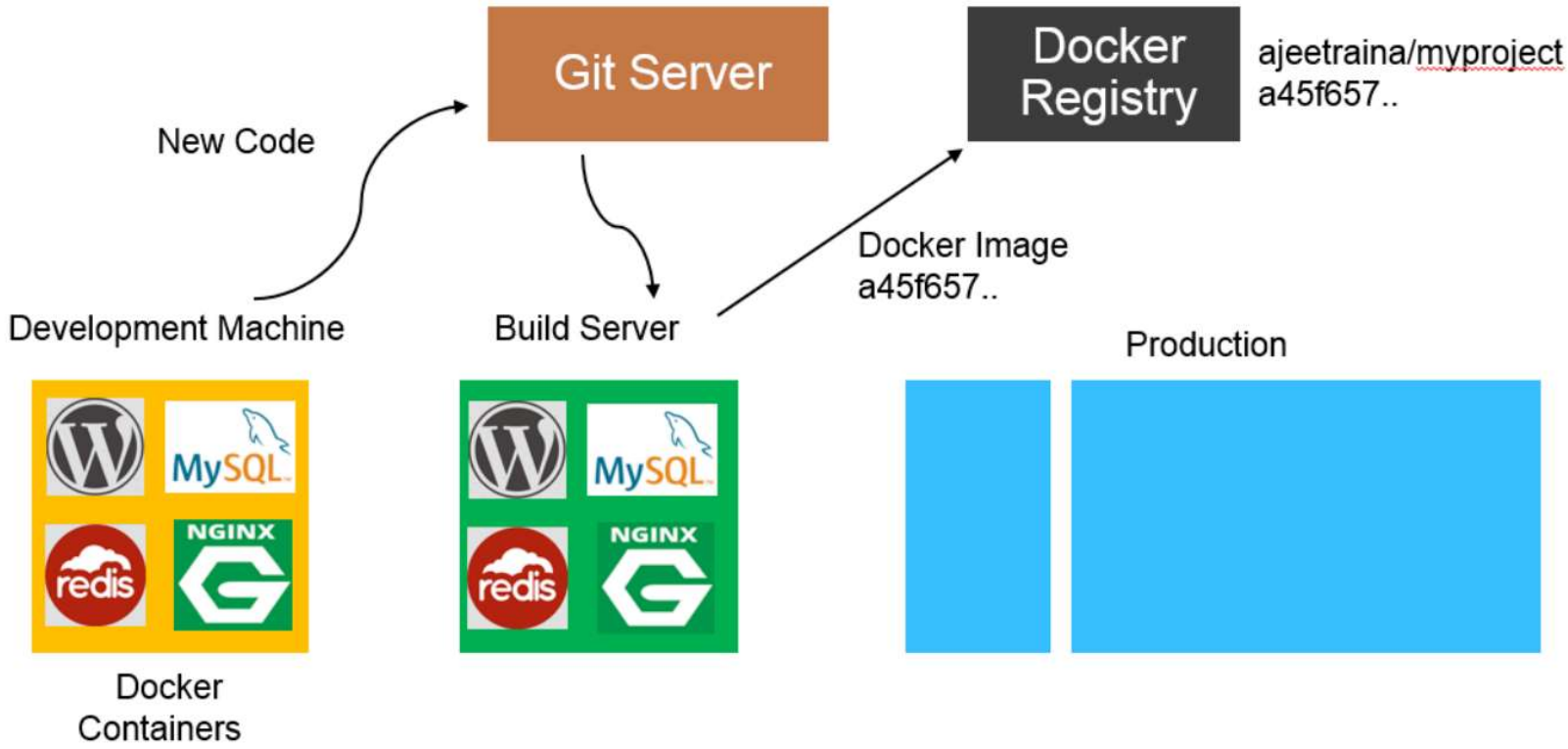
Docker Registry

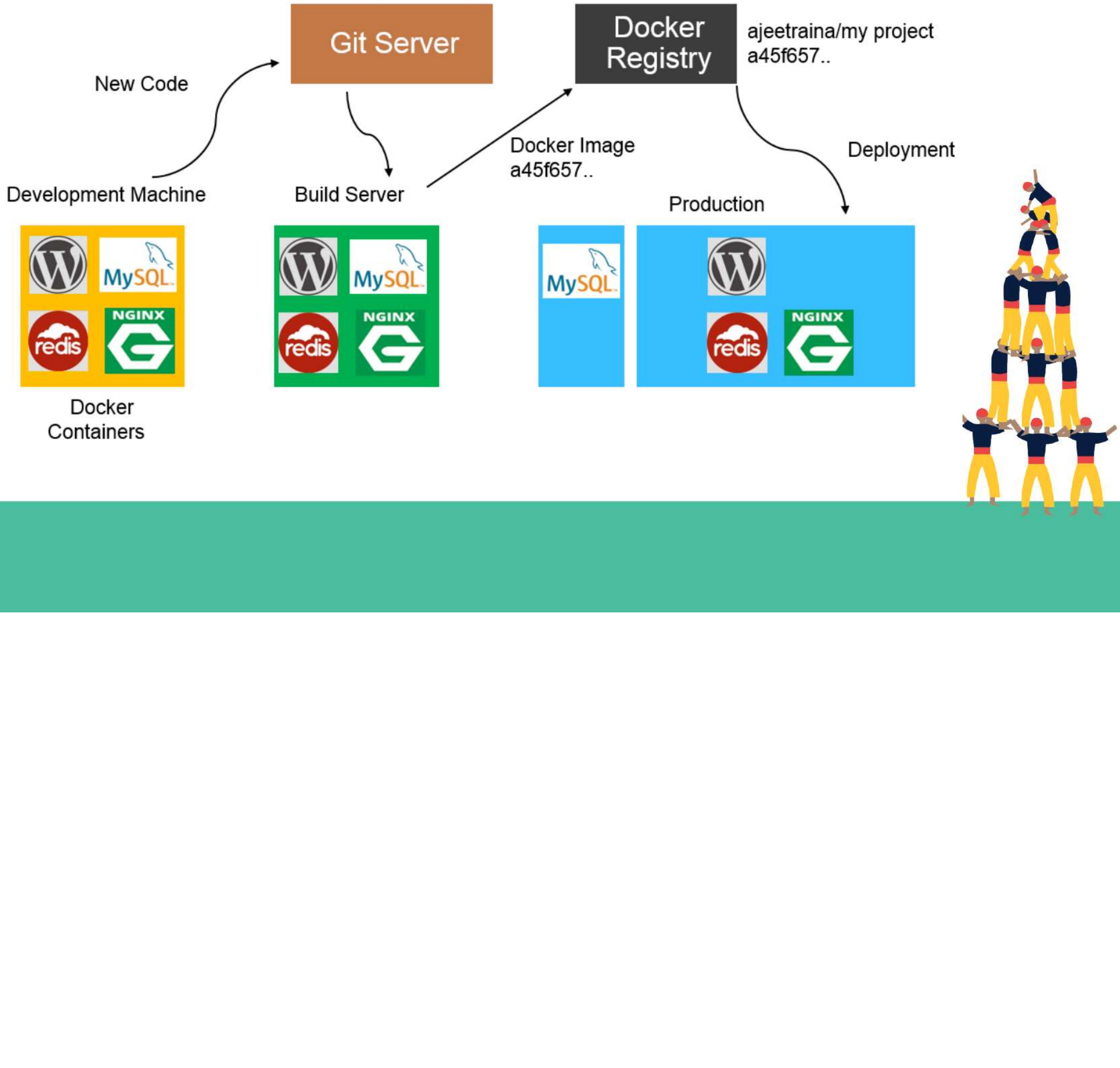
Development Machine

Docker Containers

Build Server

Production


Git Server
Docker Registry
ajeetraina/myproject
a45f657..
New Code
Docker Image
a45f657..
Development Machine
Build Server
Production
MySQL
NGINX
redis
Docker Containers


Git Server
Docker Registry
ajeetraina/my project
a45f657..
New Code
Docker Image
a45f657..
Deployment
Development Machine
Build Server
Production
MySQL
NGINX
redis
Docker
Containers

TECH SWITCH

Docker Vs VM

Docker Containers are NOT VMs

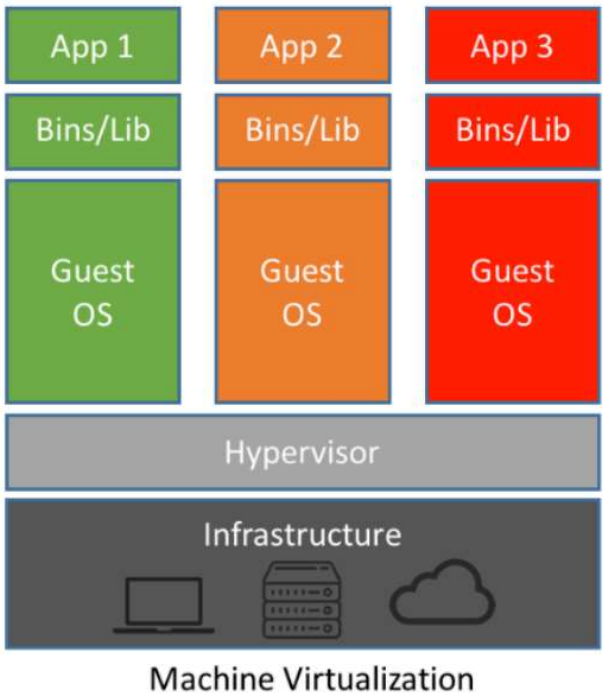
TECH SWITCH

Virtual Machine

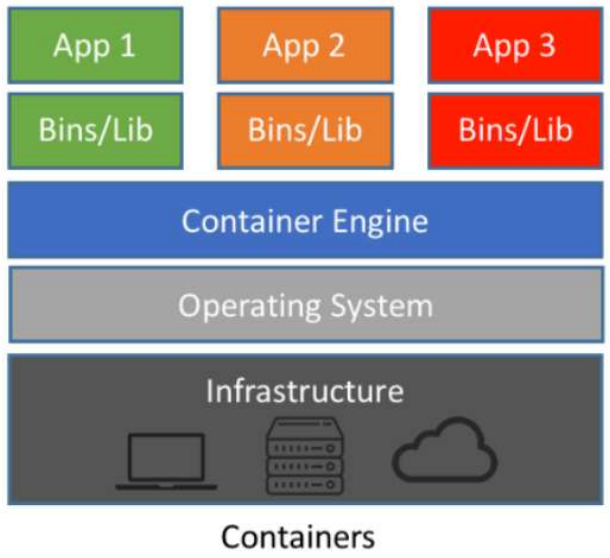
TECH SWITCH

Containers

Docker Container Vs VM



Machine Virtualization



Containers

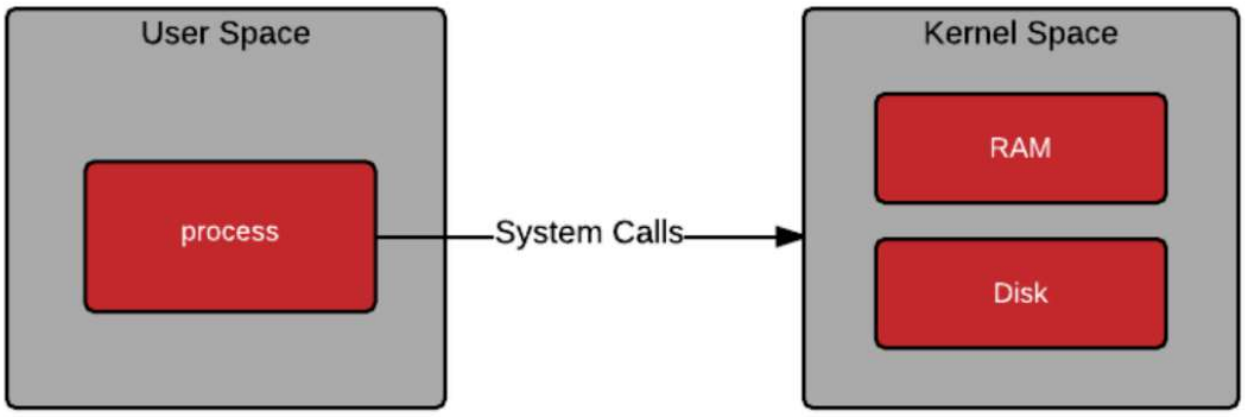
Comparing Docker & VM

Virtual Machines	Docker
Each VM runs its own OS	Container is just a user space of OS
Boot up time is in minutes	Containers instantiate in seconds
VMs snapshots are used sparingly	Images are built incrementally on top of another like layers. Lots of images/snapshots
Not effective diffs. Not version controlled	Images can be diffed and can be version controlled. Docker hub is like GITHUB
Cannot run more than couple of VMs on an average laptop	Can run many Docker containers in a laptop.
Only one VM can be started from one set of VMX and VMDK files	Multiple Docker containers can be started from one Docker image

What makes Containers so small?

Container = User Space of OS

User space refers to all of the code in an operating system that lives outside of the kernel.



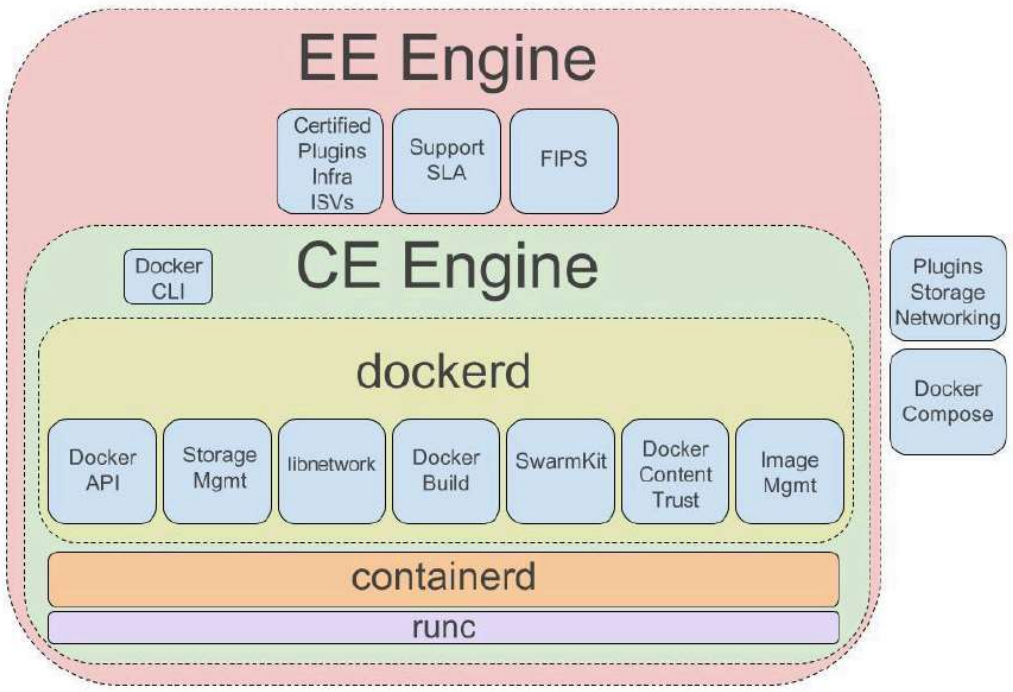
Process Virtualization

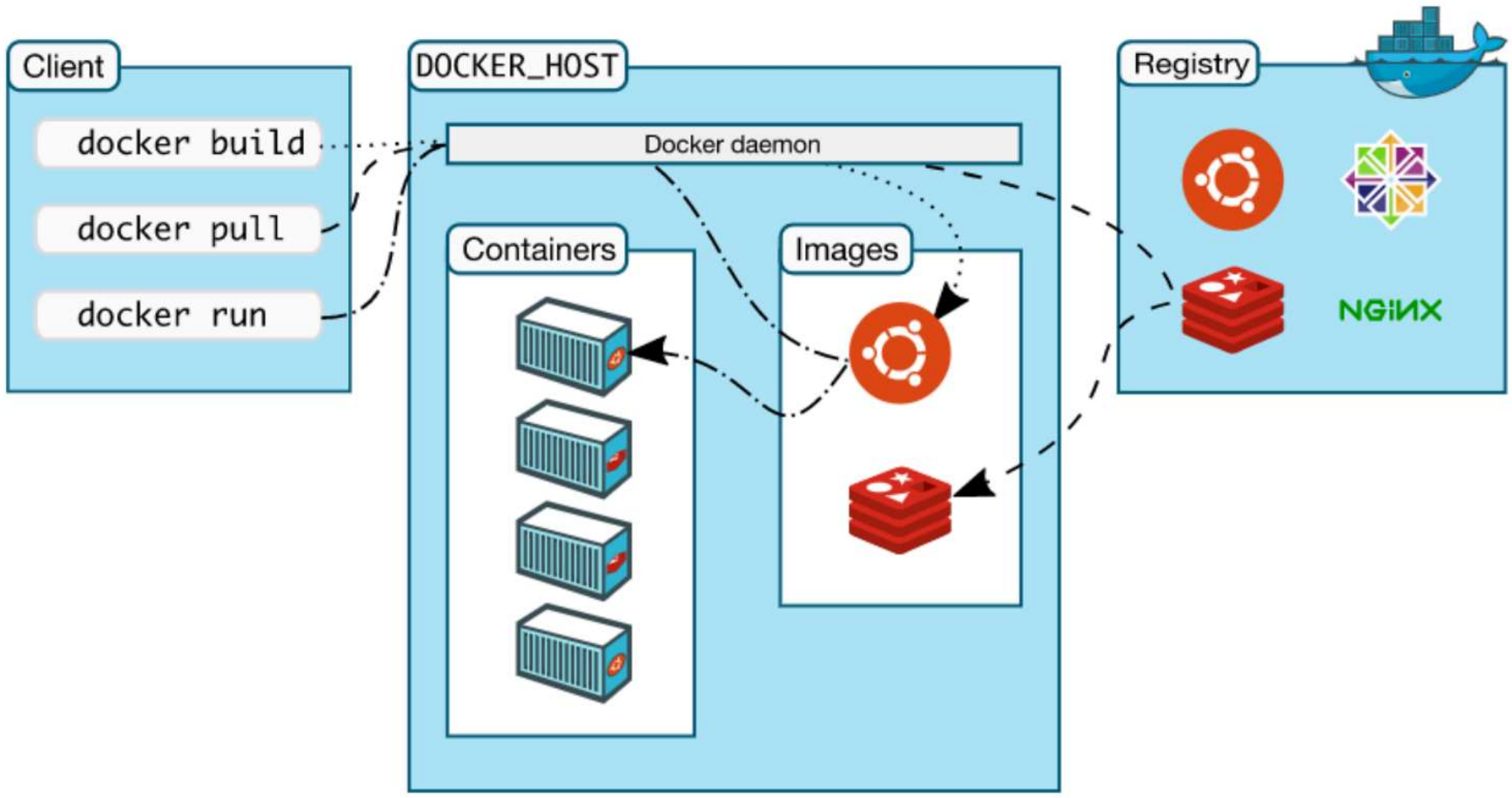
Demonstrating Process Virtualization

Demonstration Process Virtualization

Docker Engine Architecture

Docker Engine Architecture




Client
docker build
docker pull
docker run
DOCKER_HOST
Docker daemon
Containers
Images
Registry
NGINX

Docker Vocabulary

Some Docker vocabulary

Containers	Images
How you **run** your application	How you **store** your application

Docker Image

The basis of a Docker container. Represents a full application

Docker Container

The standard unit in which the application service resides and executes

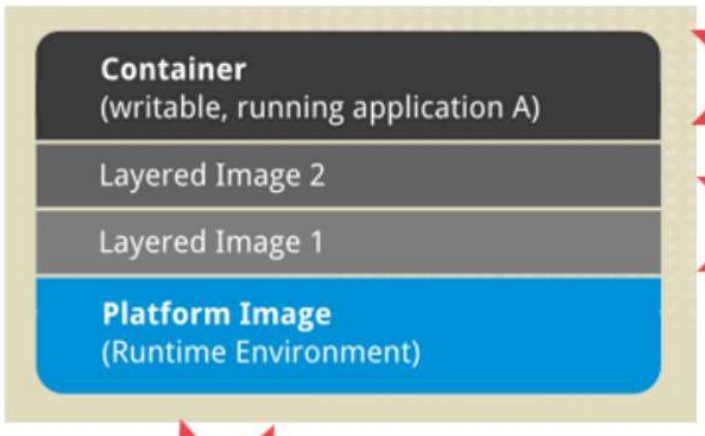
Docker Engine

Creates, ships and runs Docker containers deployable on a physical or virtual, host locally, in a datacenter or cloud service provider

Registry Service (Docker Hub or Docker Trusted Registry)

Cloud or server based storage and distribution service for your images

Image Layering



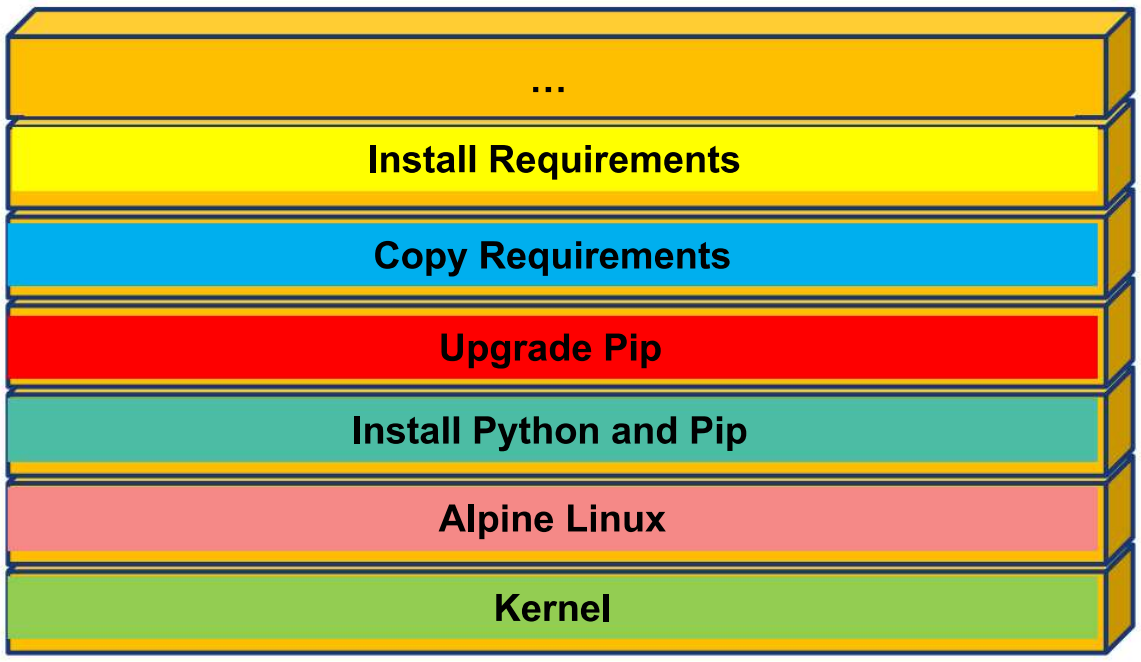
An application sandbox.

- Each container is based on an image that holds necessary config data.
- When you launch a container from an image, a writable layer is added on top of this image

- A static snapshot of the containers' configuration.
  - Image is a read-only layer that is never modified, all changes are made in top-most writable layer, and can be saved only by creating a new image.
  - Each image depends on one or more parent images

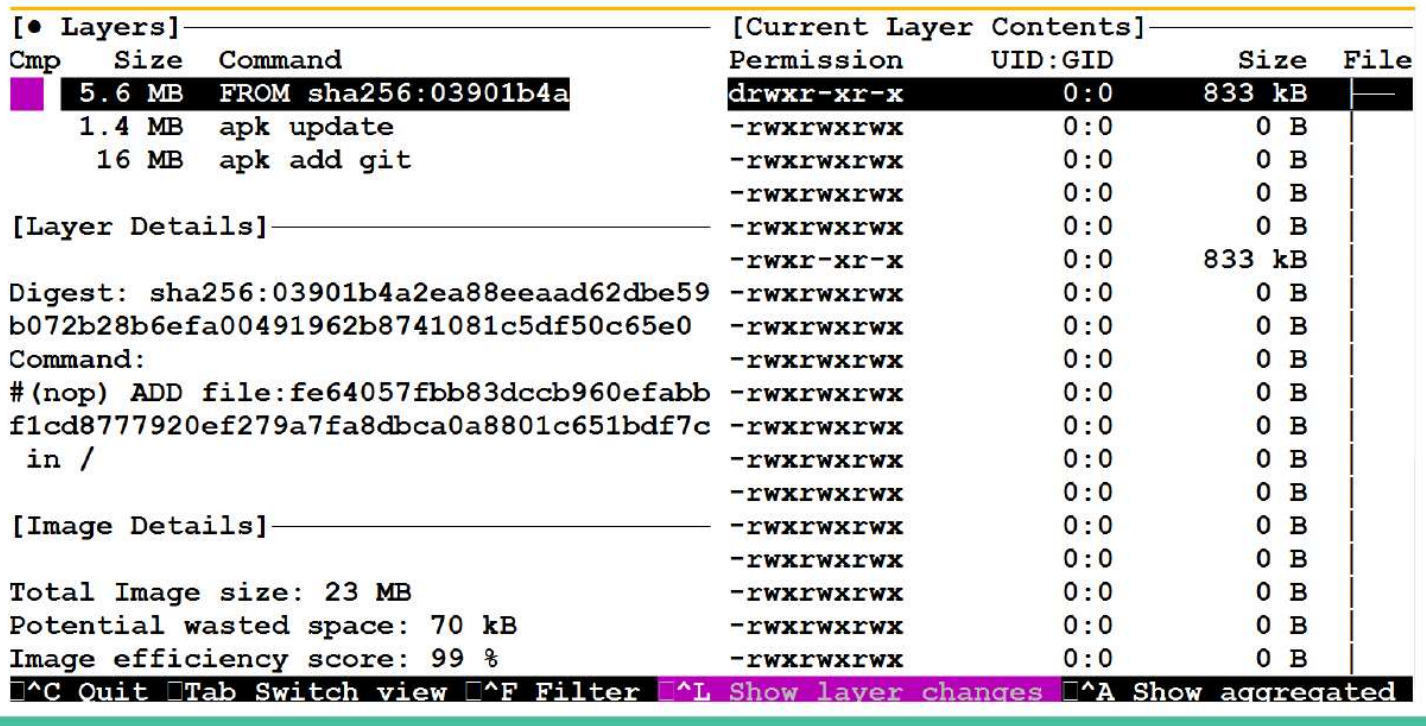
- An image that has no parent.
- Platform images define the runtime environment, packages and utilities necessary for containerized application to run.

Image Layers



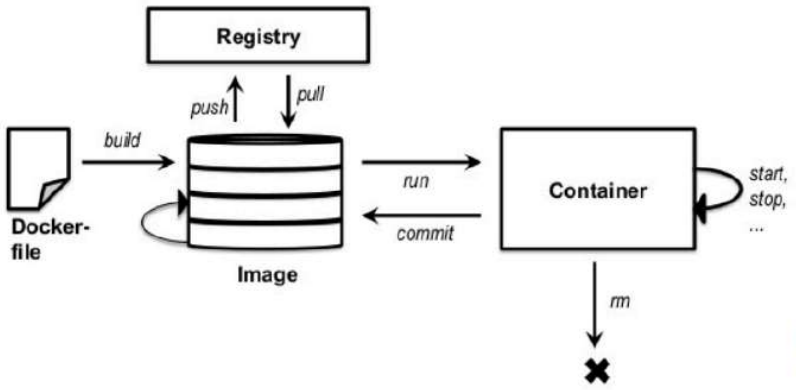
A Look at “Dive” Tool

A tool for exploring each layer in a Docker image



https://github.com/wagoodman/dive

Basic Docker CLIs



Pulling Docker Image

$ docker pull ajeetraina/hellowhale

Listing out Docker Images

$ docker image ls

Running Docker Containers

$ docker run –d –p 5000:5000 –-name hellowhale ajeetraina/hellowhale

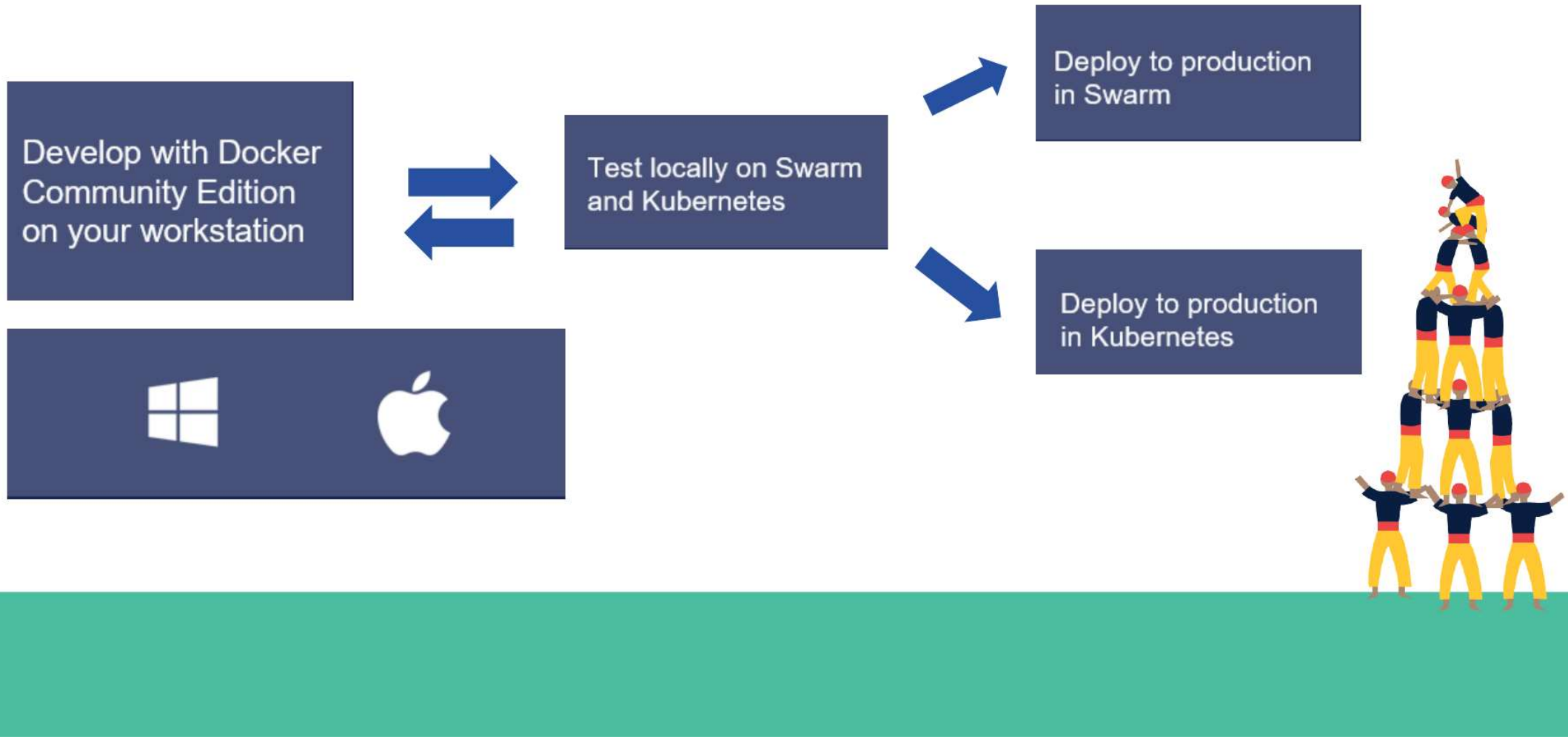
Stopping the container

$ docker stop hellowhale (or <container id>)

Docker Desktop Community Vs Docker Enterprise

Docker Community Edition

All in one development for Swarm and Kubernetes



Docker Desktop Community Vs Enterprise

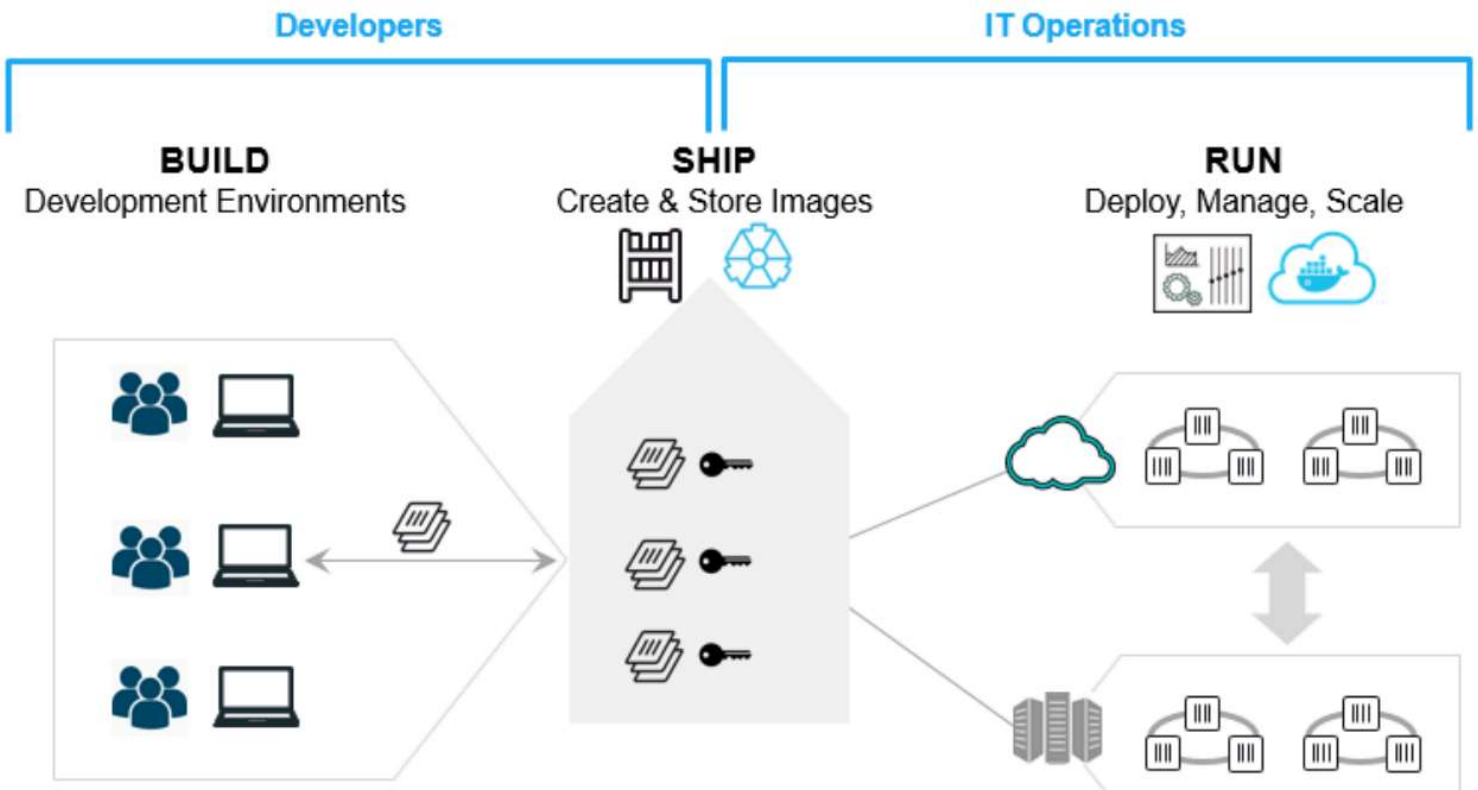
	Docker Desktop Community	Docker Desktop Enterprise
Simplest Path to Container-based Development		
Latest Docker Engine Based on Containerd	●	●
Certified Kubernetes	●	●
Available for Windows 10 & MacOS	●	●
Develop in any Language & Framework, even multiple versions simultaneously	●	●

Docker Desktop Community Vs Enterprise

	Docker Desktop Community	Docker Desktop Enterprise
Production-Ready Environment		
Same API & Commands shared by Developers in Production	●	●
Application Designer interface to simplify creating & developing Docker applications		●
Swappable Docker Engine and Kubernetes versions to match Docker Enterprise production environments		●

Using Docker – Build, Ship & Run WorkFlow

Build. Ship. Run.



Demo

- Create DockerHub Account(if not completed)

Docker New CLI Plugin

Docker New CLI Plugin

Plugins	Delivery Vehicle	Availability
app	19.03-ce, 19.03-ee, Desktop CE, Desktop EE	Available now via Engine Community and Desktop Community (Mac | Windows) Docker Enterprise 3.0
assemble	19.03-ee, Desktop Enterprise	Available with Docker Enterprise 3.0
template	19.03-ee, Desktop Enterprise	Available with Docker Enterprise 3.0
cluster	19.03-ee, Desktop Enterprise	Available with Docker Enterprise 3.0
gmsa	19.03-ee, Desktop Enterprise	Available with Docker Enterprise 3.0
registry	19.03-ee, Desktop Enterprise	Available with Docker Enterprise 3.0
buildx	desktop-edge	Available in Desktop CE Edge (Mac | Windows), download the plugin
jump	Sign up for more information	Sign up for more information
pipeline	Sign up for more information	Sign up for more information

Building Docker Containers & Microservices

Introducing Dockerfile

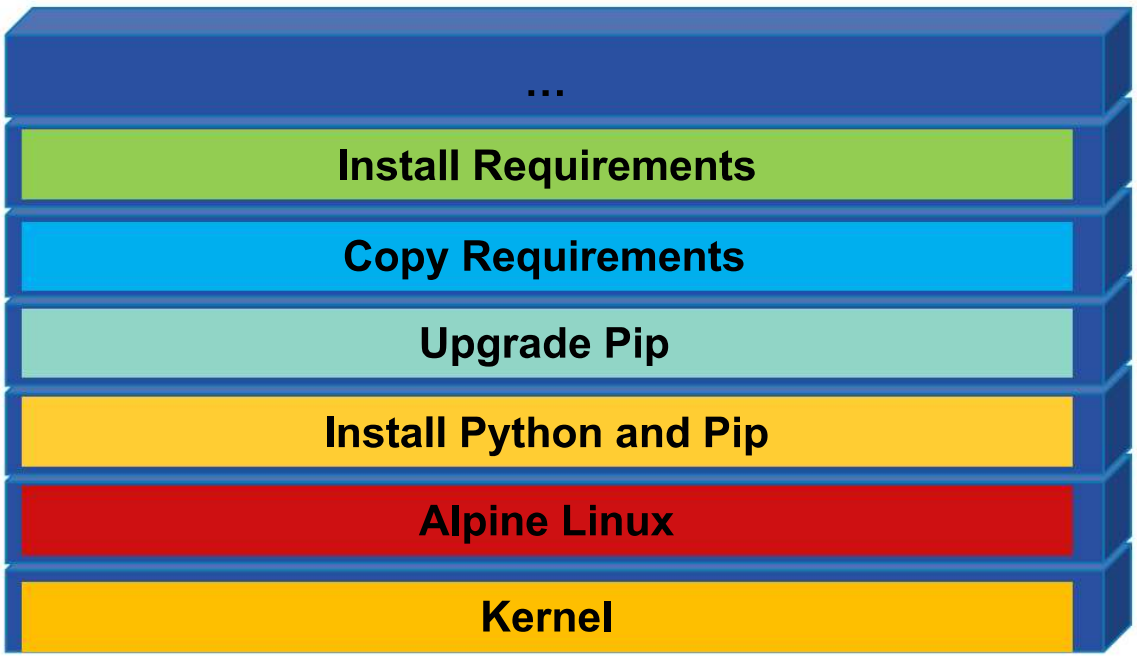
Series of instructions to build Docker Images

```
FROM alpine:3.6
LABEL maintainer ajeetraina@gmail.com
RUN apk update && \
    apk add git
```

Dockerfile – Example

```
# our base image
FROM alpine:latest

# Install python and pip
RUN apk add --update py-pip

# upgrade pip
RUN pip install --upgrade pip

# install Python modules needed by the Python app
COPY requirements.txt /usr/src/app/
RUN pip install --no-cache-dir -r /usr/src/app/requirements.txt

# copy files required for the app to run
COPY app.py /usr/src/app/
COPY templates/index.html /usr/src/app/templates/

# tell the port number the container should expose
EXPOSE 5000

# run the application
CMD ["python", "/usr/src/app/app.py"]
```

Each Dockerfile creates a Layer



Docker Compose

Compose is a tool for defining and running multi-container Docker applications

```yaml
version: '3'
services:
   db:
     image: mysql:5.7
     volumes:
       - db_data:/var/lib/mysql
     restart: always
     environment:
       MYSQL_ROOT_PASSWORD: somewordpress
       MYSQL_DATABASE: wordpress
       MYSQL_USER: wordpress
       MYSQL_PASSWORD: wordpress
   wordpress:
     depends_on:
       - db
     image: wordpress:latest
     ports:
       - "8000:80"
     restart: always
     environment:
       WORDPRESS_DB_HOST: db:3306
       WORDPRESS_DB_USER: wordpress
       WORDPRESS_DB_PASSWORD: wordpress
volumes:
    db_data:
```

Backend Service

Specify Volumes/Network

Environmental variables

Frontend Service

Specify Volumes/Network

Environmental variables

docker