Containers Introduction

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Objectives

Understand what Containers are

Learn Docker Fundamentals (Docker Engine and Client)

Understand Container Images and Docker Registry

Learn How to Build Container Image using Dockerfile

Learn how to Start, Stop, and Remove Docker Containers

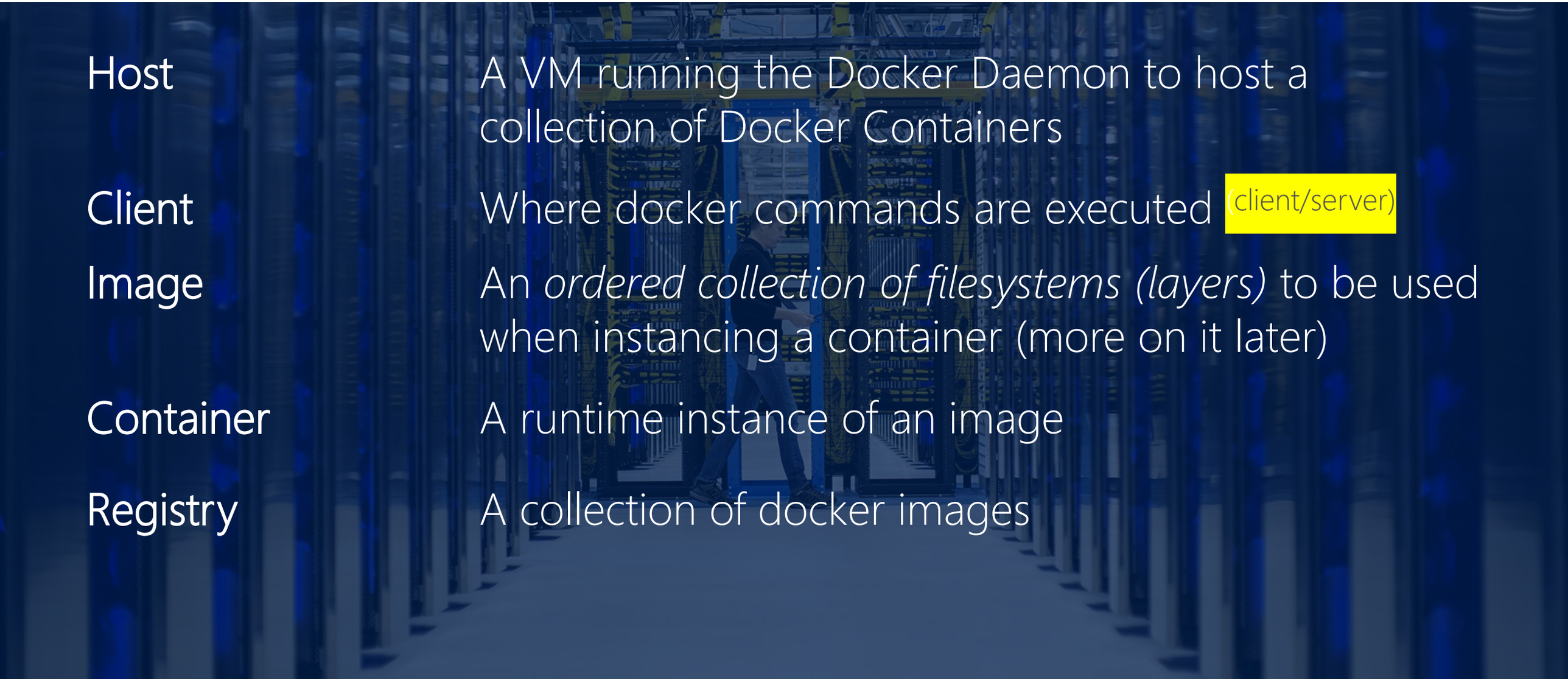
Understand use of Tags for Versioning Images

Microsoft Partnership with Docker Inc.

Why Docker?

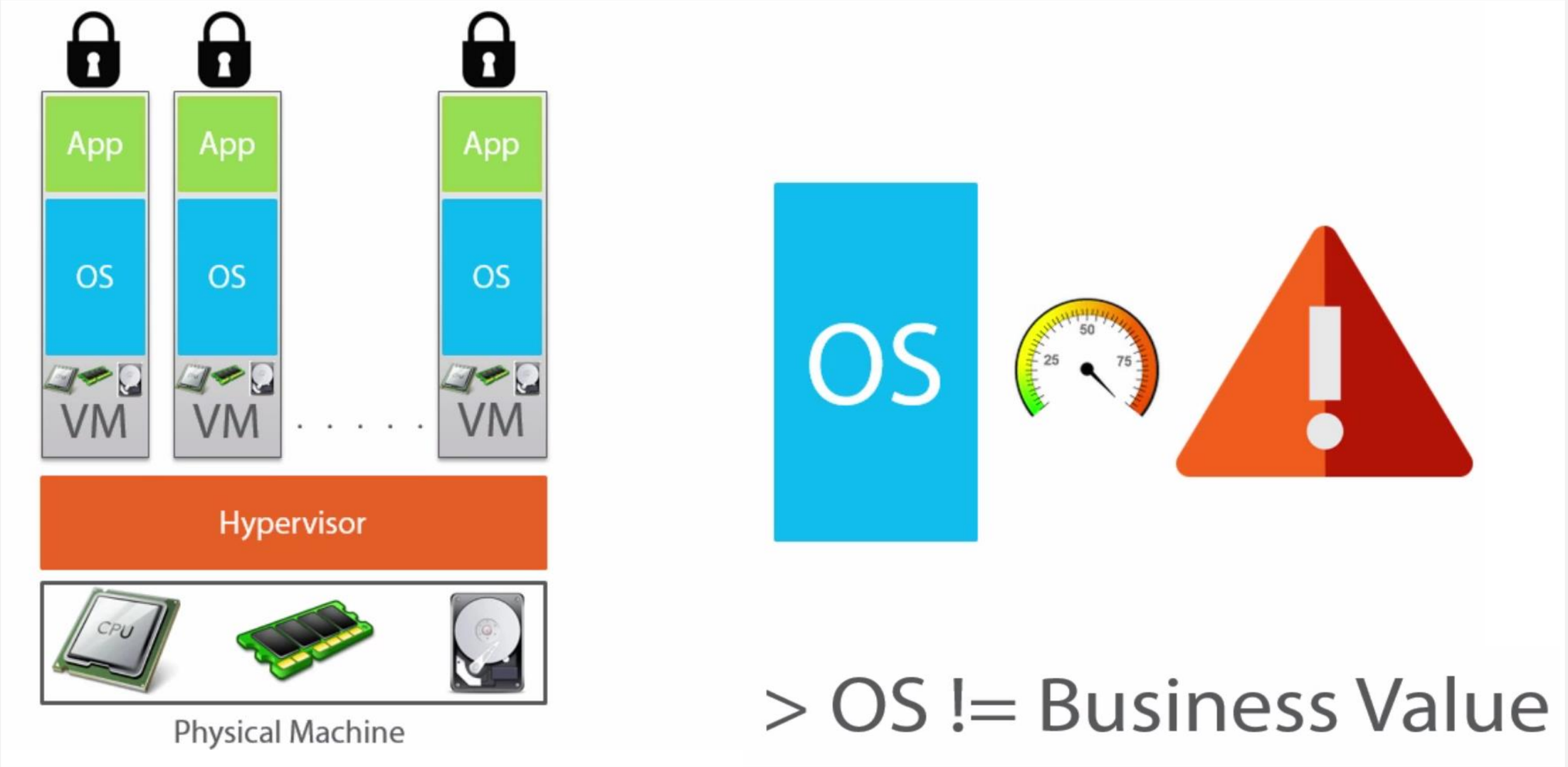
- Build any app in any language using any stack (OS)
- Dockerized apps can run anywhere on anything
- No more “It works on my machine”
- No more dependency daemons so Developers and System admins unite

Docker Vocabulary



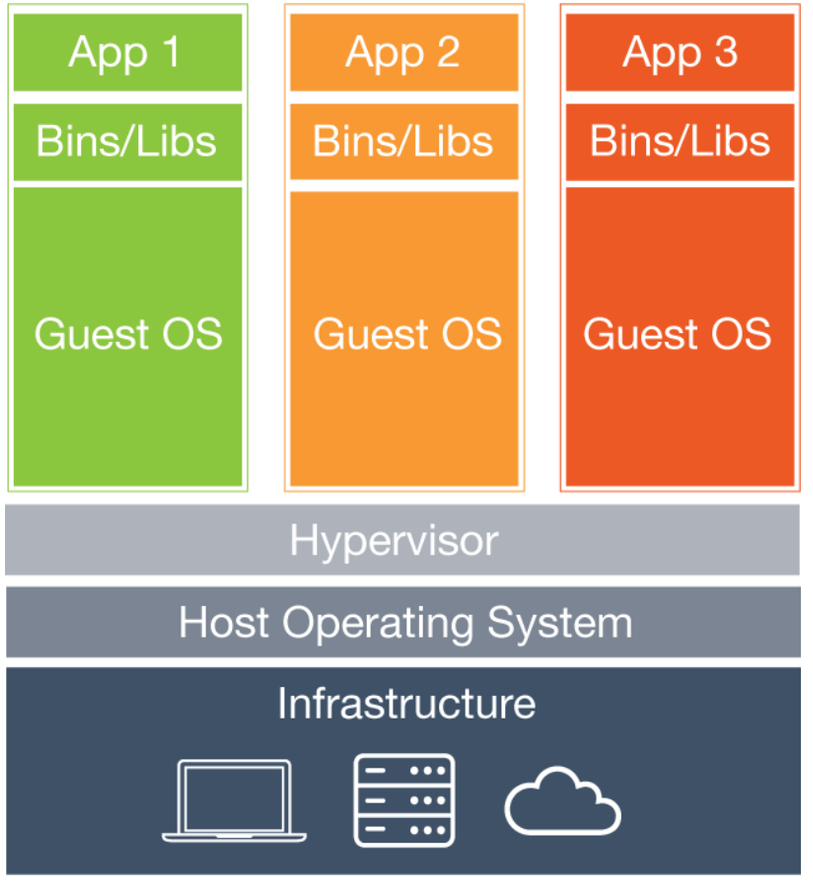
Host	A VM running the Docker Daemon to host a collection of Docker Containers
Client	Where docker commands are executed (client/server)
Image	An *ordered collection of filesystems (layers)* to be used when instancing a container (more on it later)
Container	A runtime instance of an image
Registry	A collection of docker images

Challenges with Virtualization

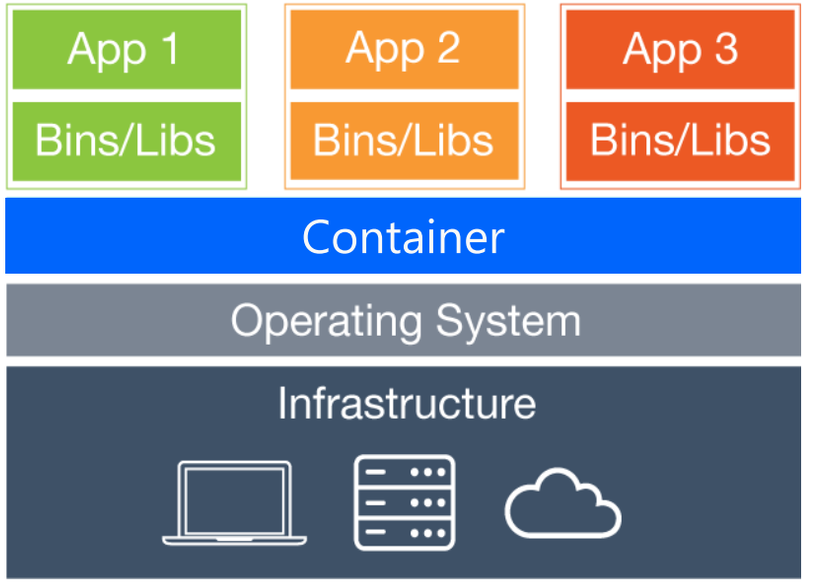


Virtual Machine versus Containers

Virtual Machine



Container



Containers

Physical

- Applications traditionally built and deployed onto physical systems with 1:1 relationship
- New applications often required new physical systems for isolation of resources

Virtual

- Higher consolidation ratios and better utilization
- Faster app deployment than in a traditional, physical environment
- Apps deployed into VMs with high compatibility success
- Apps benefited from key VM features i.e. Live migration, HA

Physical/Virtual

Package and run apps within

Containers

Key Benefits

Further accelerate of app deployment

Reduce effort to deploy apps

Streamline development and testing

Lower costs associated with app deployment

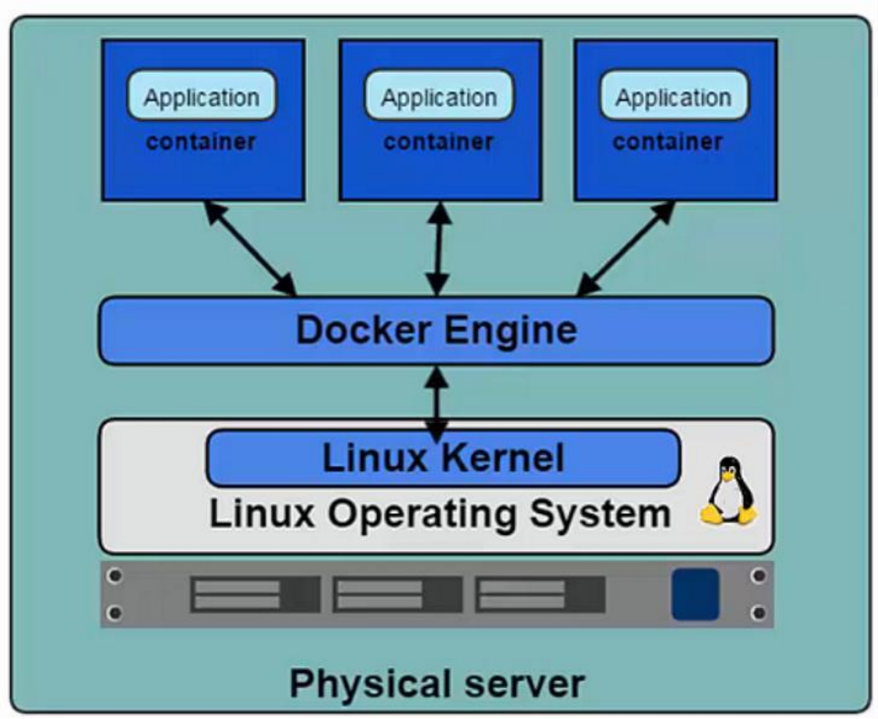
Increase server consolidation

Docker Platform

- Docker Engine (a.k.a. Docker Daemon)
  - The program that enables containers to be built, shipped, and run.
  - Uses Linux Kernel namespaces and control groups to give an isolated runtime environment for each application

- Docker Hub
  - A online registry of Docker images

- Docker Trusted Registry
  - Private on-site Registry for Docker images

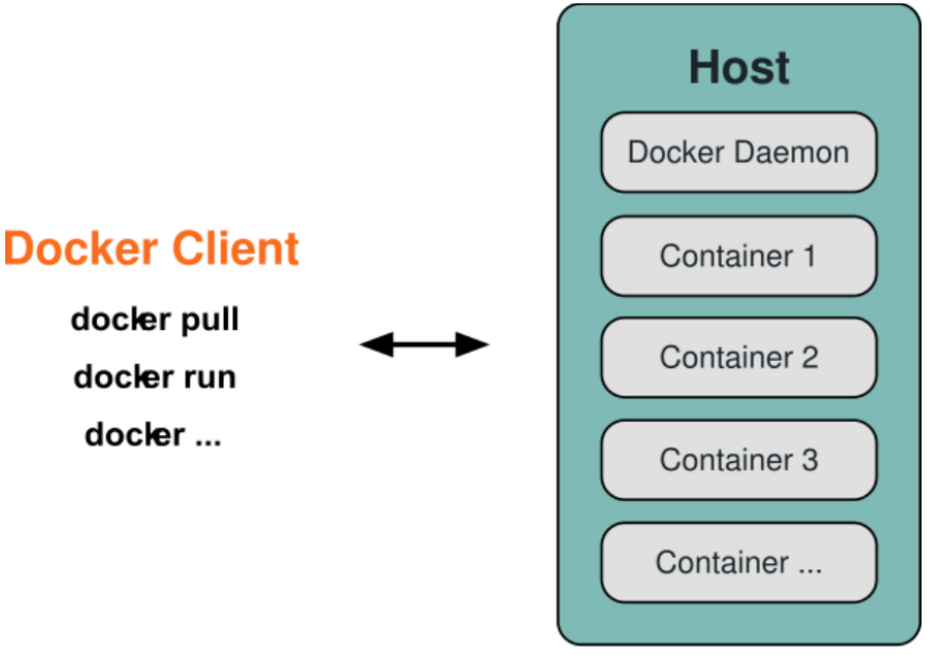


Docker Platform (Cont.)

- Docker Client
  - Takes user inputs and sends them to the Daemon.
  - Client and Daemon can run on the same host or on different hosts.

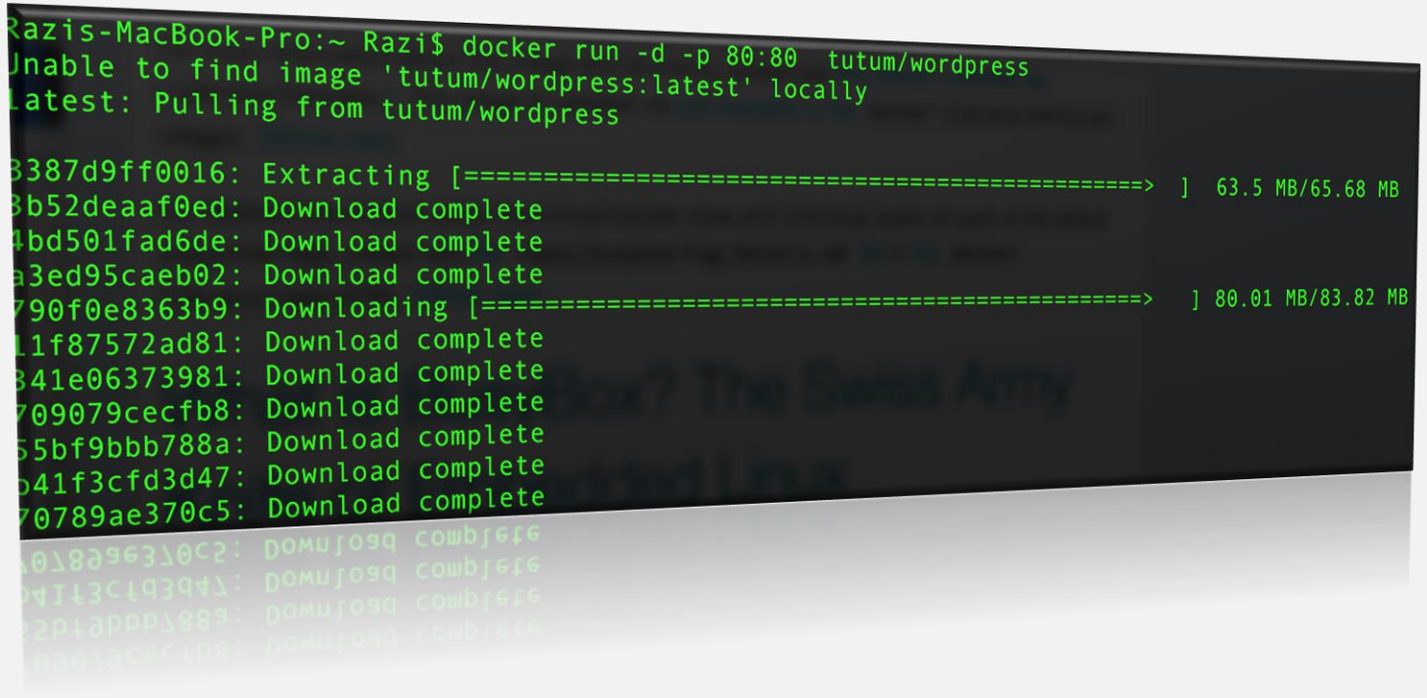
- Docker Images
  - Read-only template used to create containers.
  - Contains a set of instructions for creating the containers.

- Docker Containers
  - Isolated application platform based on one or more images.
  - Contains everything needed to run your application.



Quick Question?

- How fast you can launch a fully functional WordPress blog engine?
- How about multiple WordPress blog engines running side by side on same host?

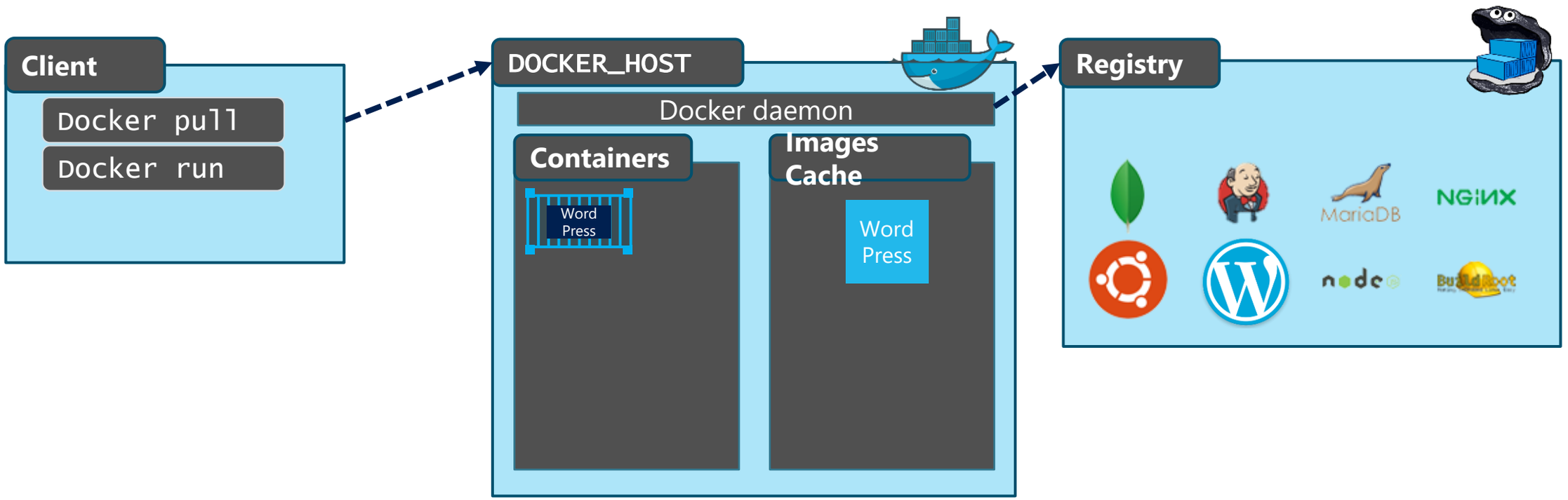


Demonstration: Running Docker Containers

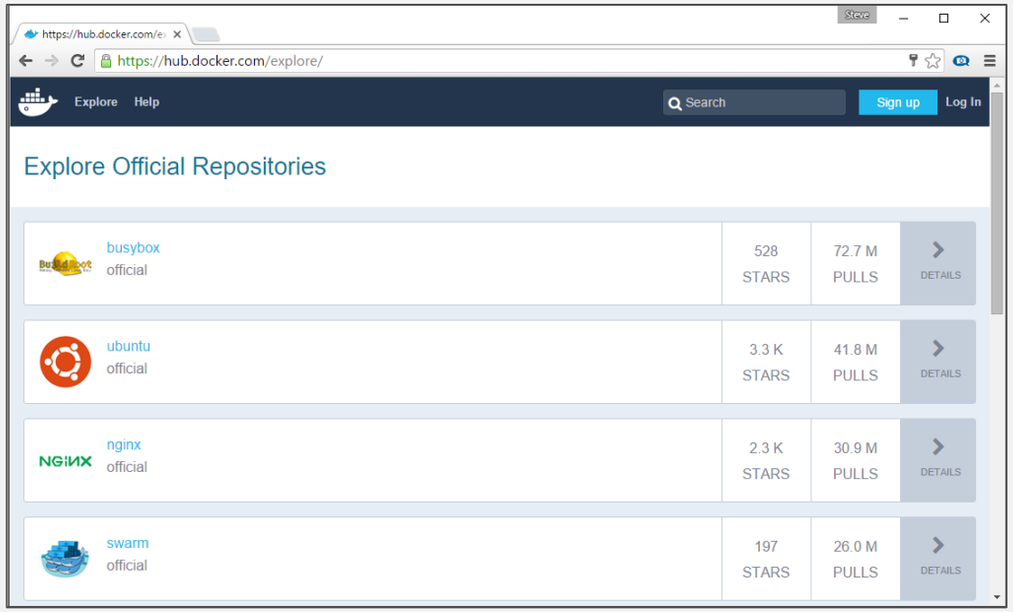
Launch a single WordPress Container

Running multiple WordPress Containers side by side

Docker In Action



Docker Registry



- Stores docker images
- Searchable
- Public Registry – hub.docker.com
- Private Registries – Instanced for you.

  E.g. Azure Container Registry
- The Registry is open-source under the permissive Apache License

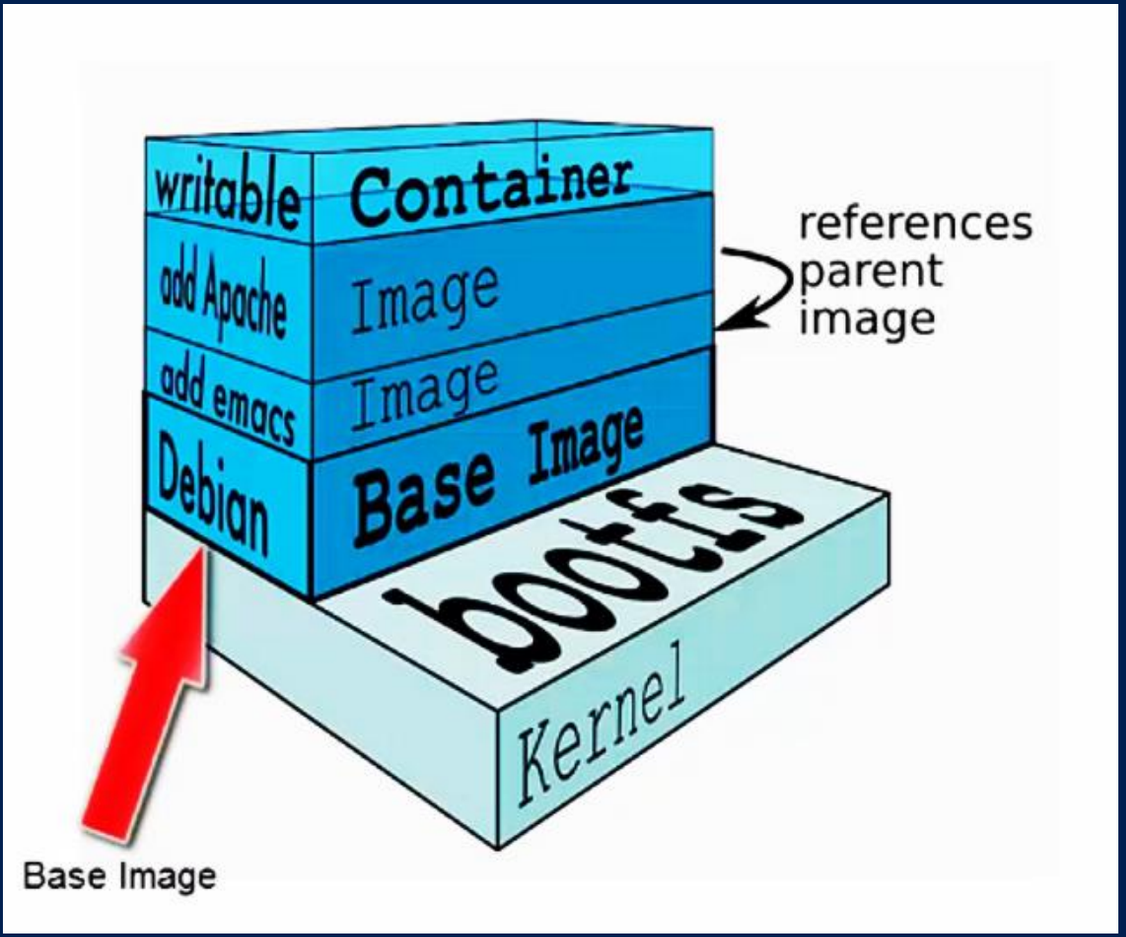
Demonstration: Docker Registry

Search Docker Registry using Docker CLI

Search Images on DockerHub

Docker Images

- A Docker image is built up from a series of layers.
- Base platform OS image is provided by vendors like Microsoft for Windows OS image, Canonical for Ubuntu image etc. These images get published to DockerHub.
- Each layer represents an instruction in the image's Dockerfile.
- Each layer except the last one is read-only.



Demonstration: Docker Image Layers

List All Layers for Docker Image

Look at locally cached images

Dockerfile

- Text file with Docker commands in it to create a new image. You can think of it as a configuration file with set of instructions needed to assemble a new image.

- Docker has a docker build command that parses Dockerfile to build a new container image.

```
# Simple Dockerfile for NGINX

FROM nginx:stable-alpine

MAINTAINER Razi Rais

COPY index.html /usr/share/nginx/html/index.html

CMD ["nginx", "-g", "daemon off;"]
```

```
FROM microsoft/dotnet:1.1.0-sdk-projectjson

COPY . /app

WORKDIR /app

RUN ["dotnet", "restore"]

RUN ["dotnet", "build"]

EXPOSE 5000/tcp

CMD ["dotnet", "run", "--server.urls", "http://*:5000"]
```

```
# Simple Dockerfile for NodeJS

FROM node:boron

MAINTAINER Razi Rais

# Create app directory
RUN mkdir -p /usr/src/app
WORKDIR /usr/src/app

# Install app dependencies
COPY package.json /usr/src/app/
RUN npm install

# Bundle app source
COPY . /usr/src/app

EXPOSE 8080

CMD [ "npm", "start" ]
```

Common Dockerfile Instructions

FROM instruction initializes a new build stage and sets the Base Image for subsequent instructions.

LABEL is a key-value pair, stored as a string. You can specify multiple labels for an object, but each key-value pair must be unique within an object.

RUN will execute any commands in a new layer on top of the current image and commit the results.

WORKDIR instruction sets the working directory for any RUN, CMD, ENTRYPOINT, COPY and ADD instructi ons that follow it.

ADD instruction copies new files, directories or remote file URLs from <src> and adds them to the filesystem of the image at the path <dest>.

COPY instruction copies new files or directories from <src> and adds them to the filesystem of the container at the path <dest>.

CMD provide defaults for an executing container. These defaults can include an executable.

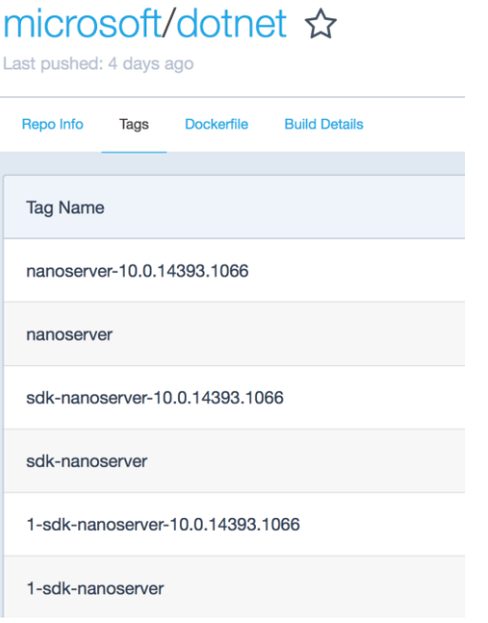
ENTRYPOINT allows you to configure a container that will run as an executable.

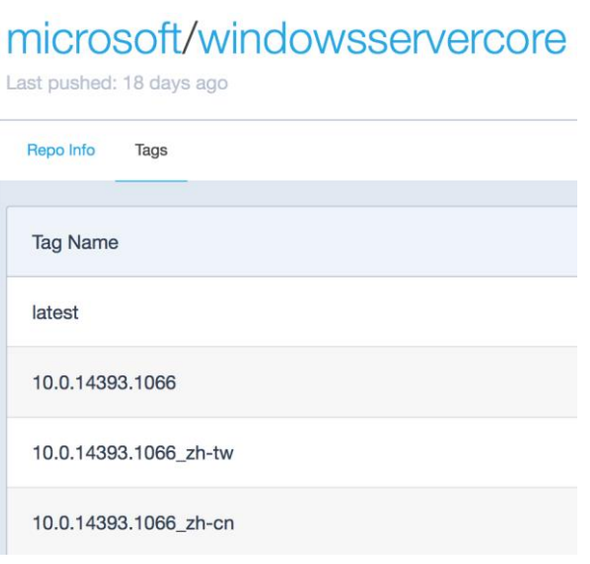
EXPOSE instruction informs Docker that the container listens on the specified network port(s).

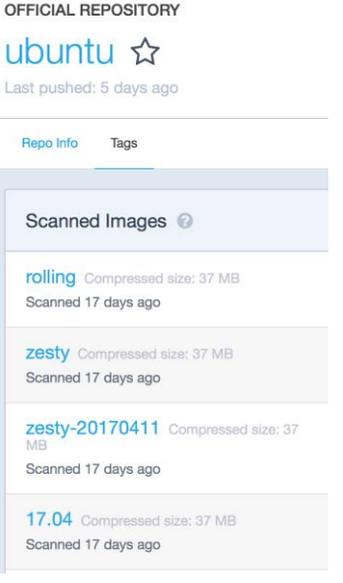
Image Tags

- A Tag name is a string value that you can use to distinguish versions of your Docker images so you can preserve older copies or variants of a primary build.

- You can group your images together using names and tags (if you don't provide any tag default value of latest is assumed)







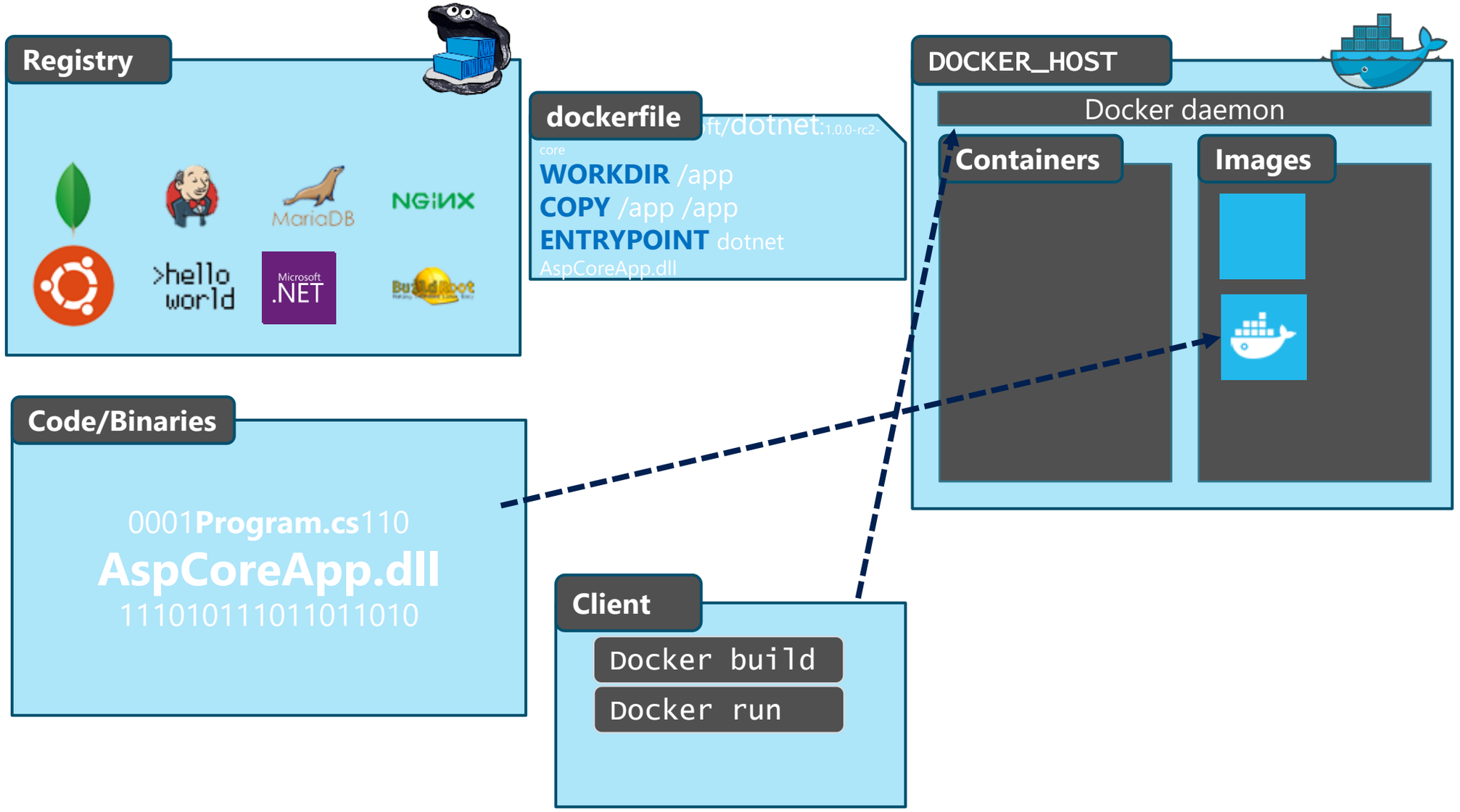
Demonstration: Dockerfile and Docker Build

Working with Dockerfile

Build container images using Docker build command:
- ASP.NET Core

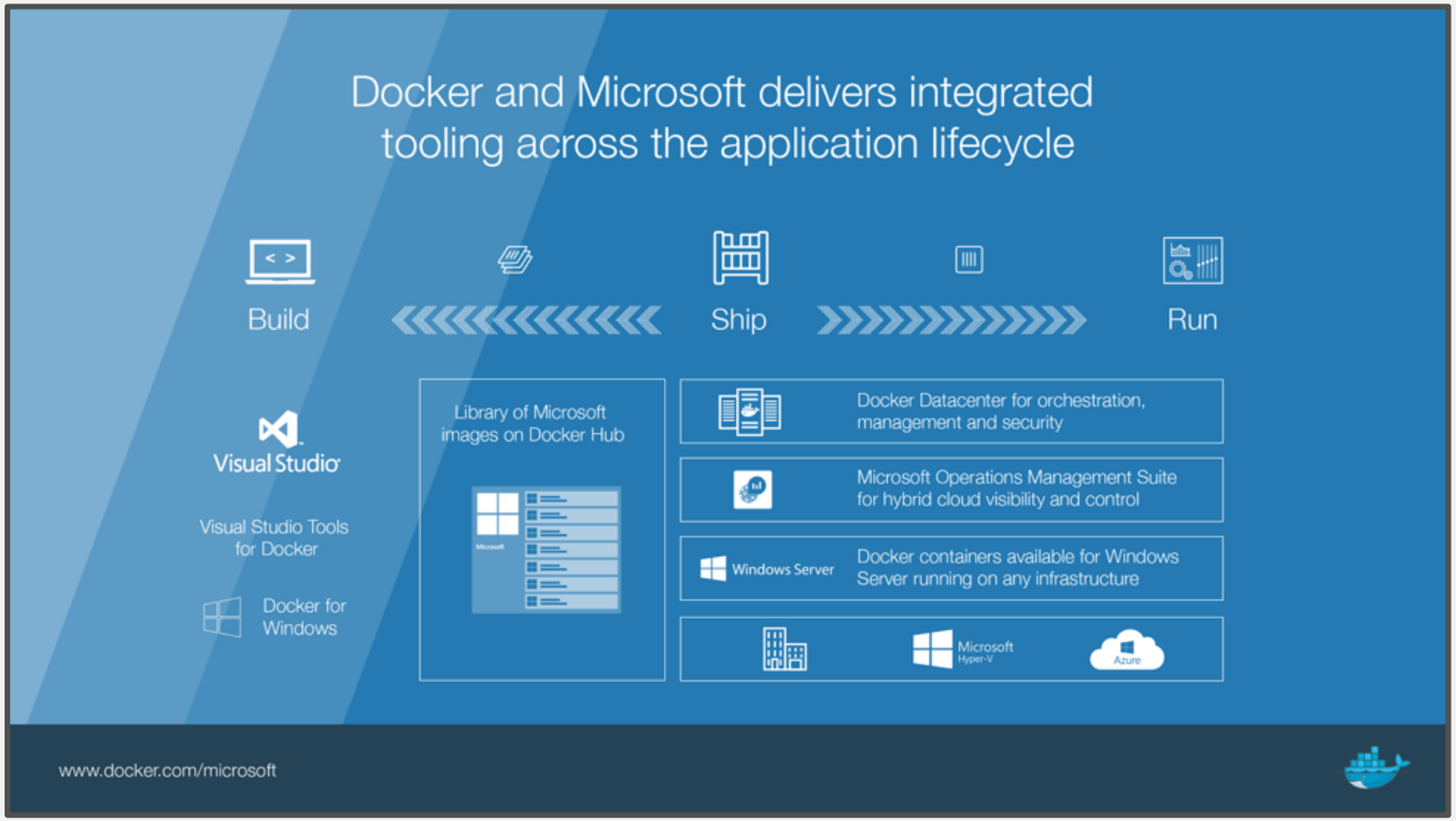
Using Image Tags

How does Docker build work?



Docker and Microsoft Partnership

- Docker Engine is tested, validated, and supported on Windows Server 2016/Windows 10 customers at no additional cost.
- Microsoft will provide Windows Server 2016 customers enterprise support for CS Docker Engine, backed by Docker, Inc.
- Docker is supported throughout Microsoft Cloud and on-premises ecosystem.



Docker and Microsoft Partnership (Cont.)

- For developers, the integration of **Visual Studio Tools for Docker** and **Docker for Windows** provides complete desktop development environments for building Dockerized Windows apps
- To jumpstart app development, Microsoft has contributed **Windows Server container base images and apps to Docker Hub**
- For IT pros, Docker Datacenter will be designed to manage Windows Server environments in addition to the Linux environments Datacenter already manages