Microsoft

Docker Commands

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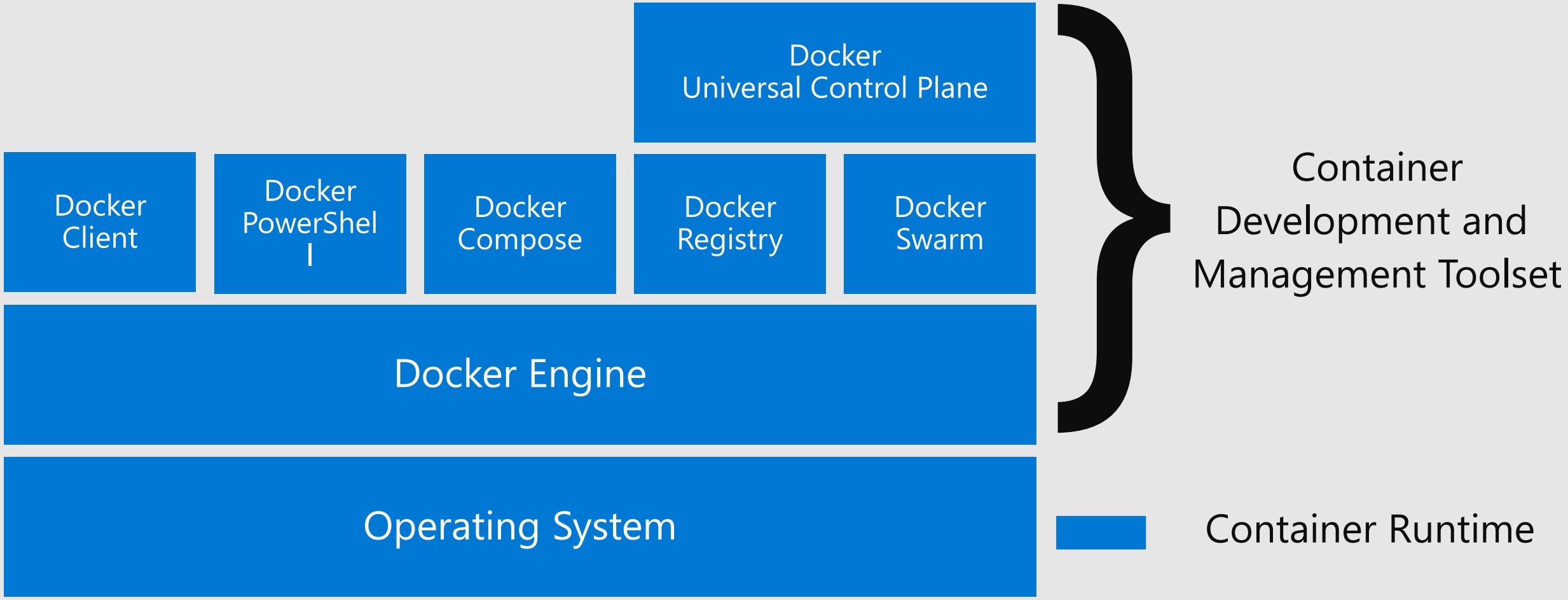
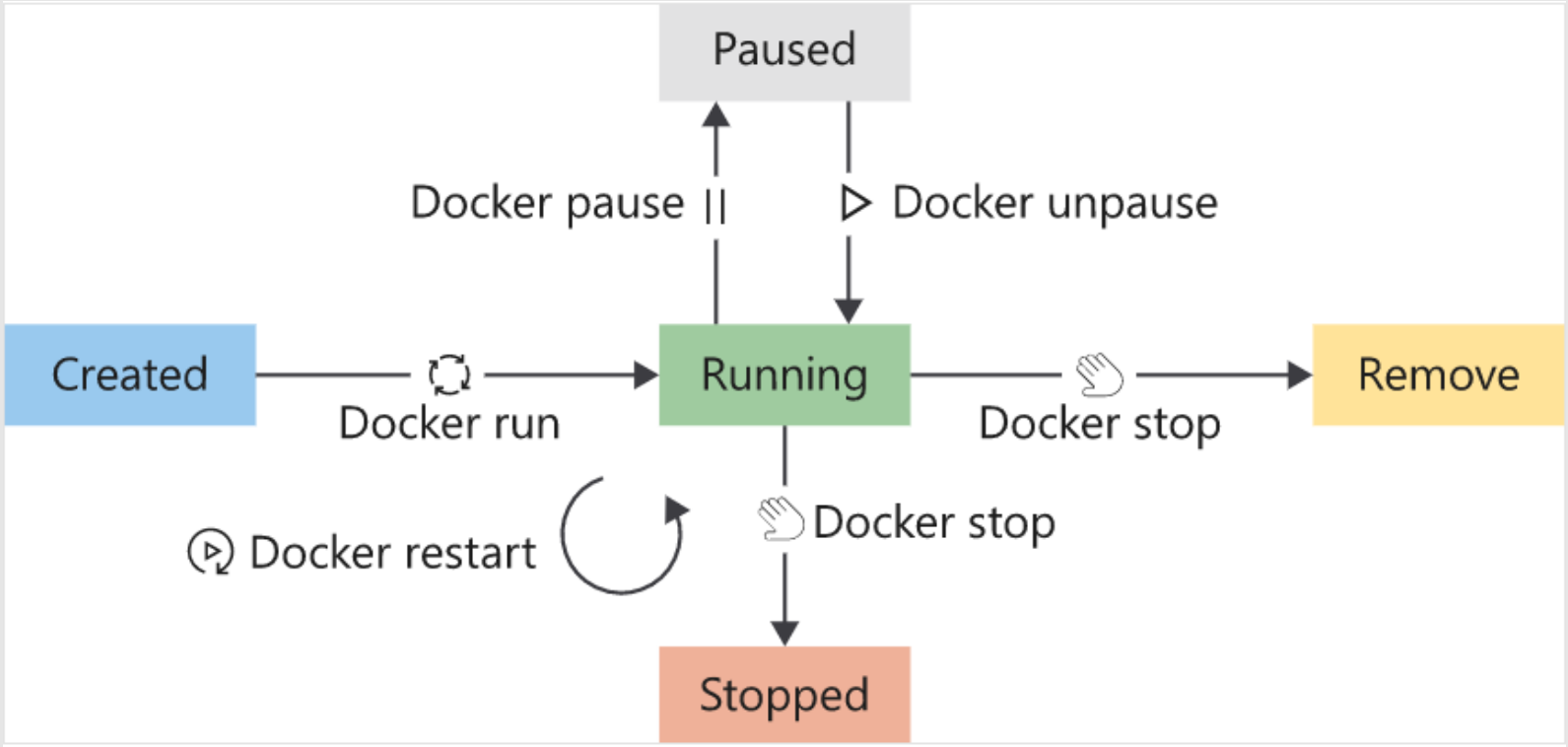
Apps

High Level Architecture



Docker Container Lifecycle



Showing your Docker Engine Information

`Docker info`

```
C:\Windows\system32>docker info
Containers: 2
 Running: 0
 Paused: 0
 Stopped: 2
Images: 9
Server Version: 1.12.2-cs2-ws-beta
Storage Driver: windowsfilter
 Windows:
Logging Driver: json-file
Plugins:
 Volume: local
 Network: nat null overlay
Swarm: inactive
Default Isolation: process
Kernel Version: 10.0 14393 (14393.576.amd64fre.rs1_release_inmarket.161208-2252)
Operating System: Windows Server 2016 Datacenter
OSType: windows
Architecture: x86_64
CPUs: 1
Total Memory: 7.999 GiB
Name: WS2K16VM01
ID: V5BM:TVHT:3RM5:DW37:WBIX:UC4L:E2ZP:OFFE:P5KV:ZBY5:ABKN:4EYI
Docker Root Dir: D:\Docker
Debug Mode (client): false
Debug Mode (server): false
Registry: https://index.docker.io/v1/
Insecure Registries:
 127.0.0.0/8
Live Restore Enabled: false

C:\Windows\system32>_
```

Showing Docker Engine and Client version

docker version

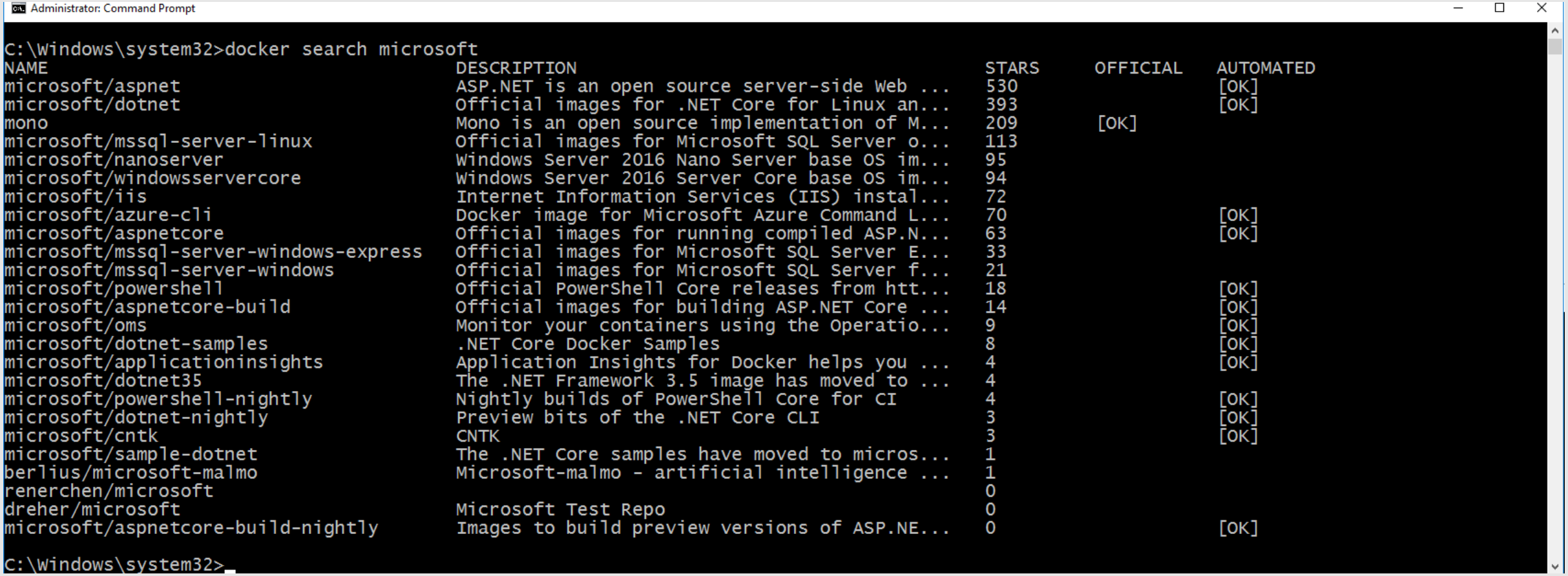
```
C:\ProgramData\chocolatey\bin>docker version
Client:
 Version:      1.13.0-rc4
 API version:  1.24 (downgraded from 1.25)
 Go version:   go1.7.3
 Git commit:   88862e7
 Built:        Sat Dec 17 01:34:17 2016
 OS/Arch:      windows/amd64

Server:
 Version:      1.12.2-cs2-ws-beta
 API version:  1.25 (minimum version )
 Go version:   go1.7.1
 Git commit:   050b611
 Built:        Tue Oct 11 02:35:40 2016
 OS/Arch:      windows/amd64
 Experimental: false

C:\ProgramData\chocolatey\bin>
```

Searching Container Images

- Docker search <string>



Pulling Container Image

Docker pull <image name>

The image with tag “latest” will be pulled

```
c:\test\nanoserver-iis>docker pull microsoft/aspnet
Using default tag: latest
latest: Pulling from microsoft/aspnet

3889bb8d808b: Already exists
04ee5d718c7a: Already exists
c0931dd15237: Pull complete
61784b745c20: Pull complete
d05122f129ca: Pull complete
c31417523ee9: Pull complete
Digest: sha256:48e6b45a43bc58e71da3d20d73839c29cc1c7ce87ed06ad257c4150e5286ade3
Status: Downloaded newer image for microsoft/aspnet:latest

c:\test\nanoserver-iis>_
```

List images in your Container Host

Docker images -a

```
c:\test\nanoserver-iis>docker images -a
REPOSITORY                                      TAG                 IMAGE ID            CREATED             SIZE
joedocker758/windowscontainertest/nanoserver-iis   latest              4fa20a6e0afd        21 minutes ago      934 MB
<none>                                          <none>              d308cdf768cd        21 minutes ago      933 MB
<none>                                          <none>              73590f6a6138        21 minutes ago      877 MB
<none>                                          <none>              5f2a7697111f        21 minutes ago      875 MB
iis                                             latest              83580a781895        3 days ago          9.7 GB
<none>                                          <none>              0b31e4f06d87        3 days ago          9.7 GB
<none>                                          <none>              2ced6c76b6e5        3 days ago          9.42 GB
microsoft/aspnet                                latest              08897a3b116a        2 weeks ago         9.97 GB
microsoft/windowsservercore                     latest              7baaa272ad7d        2 weeks ago         9.42 GB
microsoft/nanoserver                            latest              654716d8aec0        2 weeks ago         875 MB

c:\test\nanoserver-iis>_
```

Build your Image Manually (Demo)

1. Ensure the official image microsoft/iis exists in the local registry
   Docker images –a

2. Start a Windows Container using the image microsoft/iis
   docker run -d --name myIIS -p 80:80 microsoft/iis

3. Start an interactive cmd in the container
   Docker ps
   Docker exec –i myIIS cmd

4. Changing the default page in IIS
   del C:\inetpub\wwwroot\iisstart.htm
   echo "Hello World From a WinServer Container" > C:\inetpub\wwwroot\index.html
   Exit

5. Check the container is stopped
   docker ps –a

6. Build the image using Docker commit
   docker commit myIIS modified-iis

Dockerfile's (Docker Build)

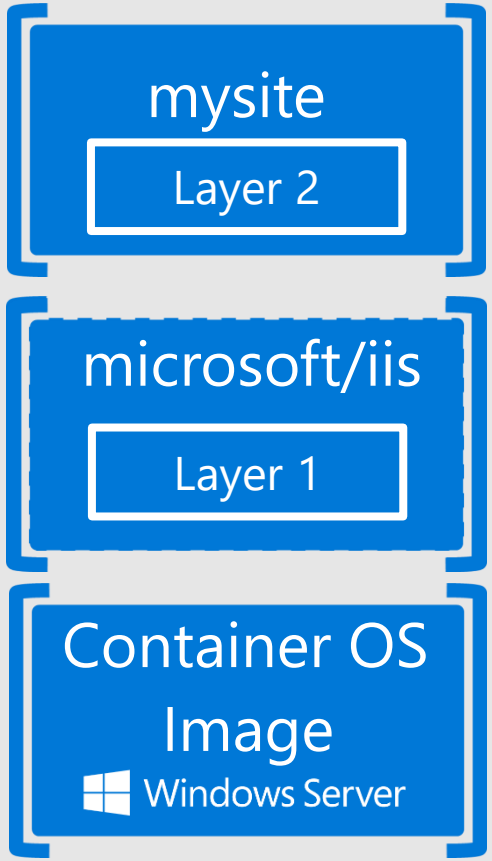
- Method for automated container image build
- Consumed when running "docker build"
- Enables automated builds via docker hub
- Caches unchanged commands

- IIS Image

  FROM windowsservercore
  RUN powershell –command Add-WindowsFeature Web-Server

- WebApp Image

  FROM iis
  ADD mysite.htm inetpub\mysite.htm



Dockerfile Common commands

Full explanation here

FROM	It defines the base image to use to start the build process
LABEL	This non-executing command declares the author, hence setting the author field of the images
ADD	The 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	Similar to ADD, but it lacks support for URLs and auto unpack of recognized compression format
RUN	It takes a command as its argument and runs it to form the image. Unlike CMD, it actually is used to build the image (forming another layer on top of the previous one which is committed).
CMD	An initial, default command that gets executed (i.e. run) with the initiation of containers based on the image. It can be overridden by runtime parameter in "docker run"
EXPOSE	The EXPOSE command is used to associate a specified port to enable networking between the running process inside the container and the outside world (i.e. the host). EXPOSE port(s) will be mapped to Container Host random port(s) when –P option is used in Docker Run
ENTRYPOINT	ENTRYPOINT argument sets the concrete default application that is used every time a container is created using the image. It cannot be overridden by runtime parameter in "docker run"

Viewing Image History

Docker history –no-trunc <image name>

```
C:\demo\iis>docker history --no-trunc joedocker758/nanoserver-iis
IMAGE                                                                     CREATED             CREATED BY
                                    SIZE                COMMENT
sha256:7faab9de9b4f443b8742f61e014380a4f25c20d17bcf5d360ca6b529f414763d   40 minutes ago      cmd /S /C #(nop)  EXPOSE 80/tcp
                                    56.8 MB
sha256:a4645e12efdae3d6710c09fc446e171ca31e52fc7baeffaa3d161b4ffe84ab2c   40 minutes ago      cmd /S /C #(nop)  CMD ["ping" "localhost" "-t"]
                                    2.14 MB
sha256:85f120ee5e8ed631104c47d98d4529fd76f729f0b66f32bde8ee3e9c112b48e5   40 minutes ago      cmd /S /C dism /online /apply-unattend:c:\build\unattend.xml & rd
c:\build /s /q & net start w3svc    41 kB
sha256:23526eceb9b5ed6510604428c3a97c9ddef5f9f9b6403e871da8d5ae7e17a266   41 minutes ago      cmd /S /C #(nop) ADD dir:b0e859dfaedb6fb5a99b4d6946d6607e00554240b
ec70f0cc34b67654cca7d28 in \build\   41 kB
sha256:b01d09bccd6d3bed79b9542dbe2ef6c99e4aedbcf3a953a27506797c96efcf04   41 minutes ago      cmd /S /C #(nop)  MAINTAINER Joe Wong
                                    174 MB
sha256:6bd5609f34ea4e8f0c53935092dfa9577ca72d198a6c87a667e0708ecfbc4d8b   41 minutes ago      cmd /S /C #(nop)  LABEL Description=IIS Vendor=Microsoft Version=1
0 OS=Nanoserver2016                 701 MB

C:\demo\iis>
```

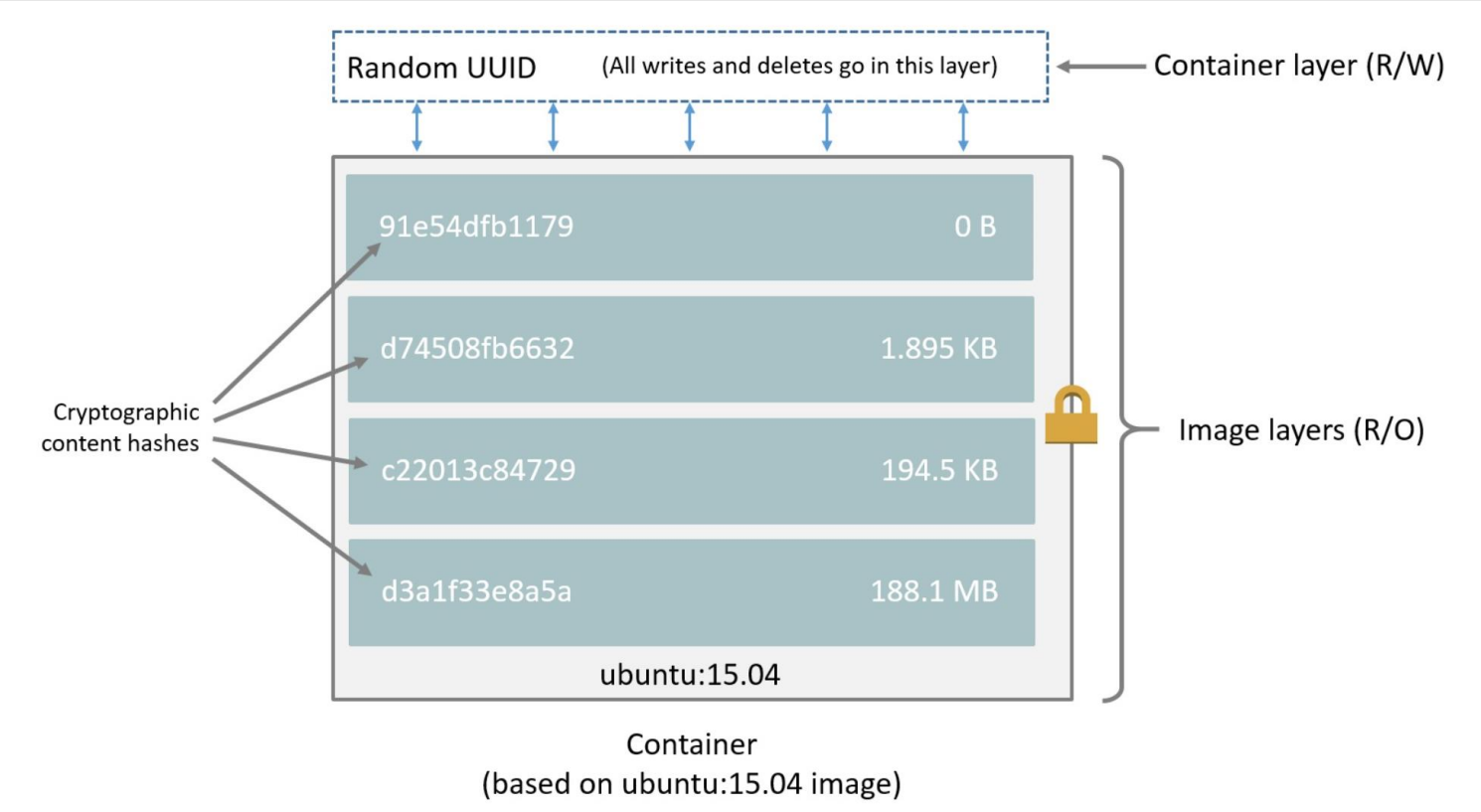
Inspecting Docker Image

- Run the command
  - Docker inspect <image name>

```
C:\demo\nanoserver-iis>docker inspect joedocker758/nanoserver-iis
[
    {
        "Id": "sha256:6ea9e7b6306243819d04abde530ba5e73bf59a6073f202f1acc39683c60bd32e",
        "RepoTags": [
            "joedocker758/nanoserver-iis:latest"
        ],
        "RepoDigests": [],
        "Parent": "sha256:6637299c0dd5cd7fed7cbd85aa2ed5d4dbb6638e7239cffc889e15078831c007",
        "Comment": "",
        "Created": "2017-01-03T08:41:50.0367661Z",
        "Container": "68d00c56dc92477979cbccc98d804a0b5249cf08f6db5e5186defc0b5d33d25f",
        "ContainerConfig": {
            "Hostname": "12e4f120816f",
            "Domainname": "",
            "User": "",
            "AttachStdin": false,
            "AttachStdout": false,
            "AttachStderr": false,
            "ExposedPorts": {
                "80/tcp": {}
            },
            "Tty": false,
            "OpenStdin": false,
            "StdinOnce": false,
            "Env": null,
            "Cmd": [
```

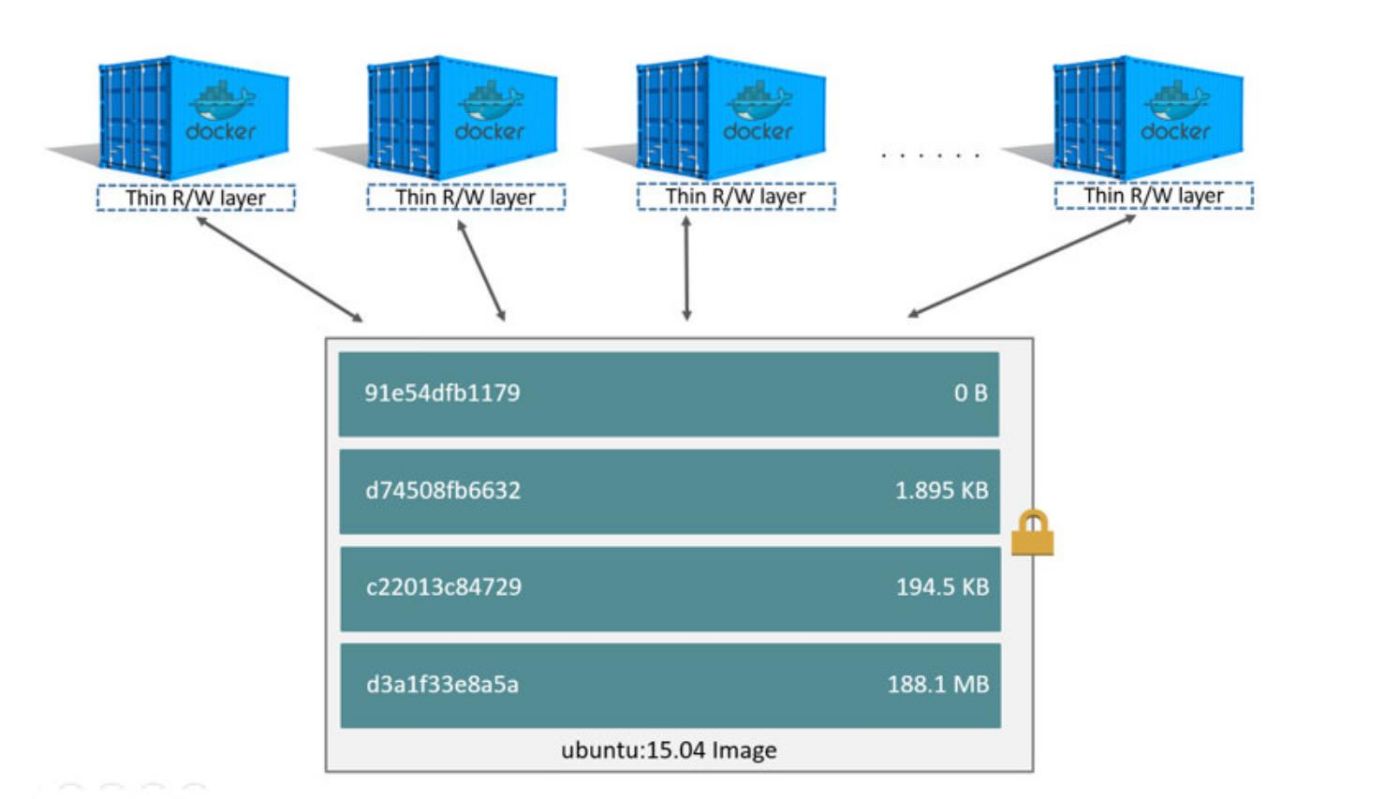
Images and Layers

When you create a new container, you add a new, thin, writable layer on top of the underlying stack. This layer is often called the "container layer



Containers, images and layers

- Running containers sharing same image but each with its own thin writable container layer,.



Docker Tag

- You may change the image and tag using:
  - docker tag IMAGE[:tag] IMAGE[:tag]

```
C:\demo\nanoserver-iis-custom>docker images
REPOSITORY                          TAG                 IMAGE ID            CREATED             SIZE
joedocker758/nanoserver-iis-custom  latest              bf5e2bf204e2        16 minutes ago      937 MB
joedocker758/nanoserver-iis         latest              6ea9e7b63062        22 minutes ago      934 MB
<none>                              <none>              506717ecf300        29 minutes ago      934 MB
<none>                              <none>              2d089bfd0355        39 minutes ago      934 MB
joedocker758/nanoserver-iis-custom  1.0                 520040c9940d        About an hour ago   937 MB
joedocker758/nanoserver-iis-custom  1.1                 520040c9940d        About an hour ago   937 MB
<none>                              <none>              eafdfe1b4ae5        About an hour ago   937 MB
iis                                 latest              77fae265eeb5        2 hours ago         9.69 GB
joedocker758/nanoserver-iis         1.0                 7faab9de9b4f        2 hours ago         934 MB
joedocker758/nanoserver-iis         1.1                 7faab9de9b4f        2 hours ago         934 MB
microsoft/aspnet                    latest              08897a3b116a        2 weeks ago         9.97 GB
microsoft/iis                       latest              9172ea5044cb        2 weeks ago         9.71 GB
microsoft/windowsservercore         latest              7baaa272ad7d        2 weeks ago         9.42 GB
microsoft/nanoserver                latest              654716d8aec0        3 weeks ago         875 MB

C:\demo\nanoserver-iis-custom>docker tag joedocker758/nanoserver-iis-custom:latest joedocker758/nanoserver-iis-custom:1.2

C:\demo\nanoserver-iis-custom>docker images
REPOSITORY                          TAG                 IMAGE ID            CREATED             SIZE
joedocker758/nanoserver-iis-custom  1.2                 bf5e2bf204e2        17 minutes ago      937 MB
joedocker758/nanoserver-iis-custom  latest              bf5e2bf204e2        17 minutes ago      937 MB
joedocker758/nanoserver-iis         latest              6ea9e7b63062        23 minutes ago      934 MB
```

Running and Managing Containers

Starting Containers

- General Syntax:
  - docker run [OPTIONS] IMAGE[:TAG] [COMMAND] [ARG...]

- Start container interactively with pseudo-TTY
  - docker run –it <image>

- Start container in background
  - docker run –d <image>

- Start container interactively with pseudo-TTY and run cmd.exe when container is created
  - docker run –it <image> cmd

- Start Hyper-V container (only Windows containers)
  - docker run –d –isolation=hyperv <image>

Process to start when starting a container

- Each container is designed to start a process when it is initialized. Container will stop automatically when the starting process ends
- The default starting program is specified in the ENTRYPOINT or CMD command in the Dockerfile when the image is built by developer
- The default starting program can be overridden at runtime using the –entrypoint or command parameters
  - docker run [OPTIONS] IMAGE[:TAG] [COMMAND] [ARG...]
  - docker run –entrypoint [Entry point command] IMAGE[:TAG] [ARG…]
- Example:
  - Docker run –entrypoint ping joedocker758/nanoserver-iis:latest localhost -t

Identifying container

- Show the list of running containers

  docker ps
- Show the list of all containers (including stopped ones)

  docker ps –a

- Container can be identified by container name, container ID (UUID short identifier), or UUID long identifier

```
C:\Windows\system32>docker ps
CONTAINER ID        IMAGE                                COMMAND                  CREATED             STATUS              PORTS               NAMES
a1606b227761        microsoft/nanoserver                 "ping localhost -t"      17 minutes ago      Up 17 minutes                           romantic_panin
720ac817c313        joedocker758/nanoserver-iis-custom   "C:\\ServiceMonitor..."  29 minutes ago      Up 29 minutes       80/tcp              compassionate_
yne
34944a7d774b        joedocker758/nanoserver-iis-custom   "C:\\ServiceMonitor..."  50 minutes ago      Up 50 minutes       0.0.0.0:83->80/tcp  high_poitras
a8a5714c47e9        joedocker758/nanoserver-iis          "C:\\ServiceMonitor..."  58 minutes ago      Up 58 minutes       0.0.0.0:80->80/tcp  stoic_hopper

C:\Windows\system32>docker ps -a
CONTAINER ID        IMAGE                                COMMAND                  CREATED             STATUS                                  PORTS
  NAMES
d03325a3dd67        joedocker758/nanoserver-iis          "ping localhost -t"      2 minutes ago       Exited (3221225786) 12 seconds ago
  hopeful_lovelace
e255b5c3a92f        joedocker758/nanoserver-iis          "c://servicemonito..."   3 minutes ago       Exited (0) 3 minutes ago
  jovial_hodgkin
a1606b227761        microsoft/nanoserver                 "ping localhost -t"      17 minutes ago      Up 17 minutes
  romantic_panini
8519c1db8ff6        microsoft/nanoserver                 "cmd"                    23 minutes ago      Exited (9009) 18 minutes ago
  eager_ramanujan
022f4718f0ff        iis                                  "cmd"                    25 minutes ago      Exited (0) 23 minutes ago
```

Stopping and removing container

- Stop a container
  - docker stop [container id|container name]
- Remove a container
  - docker rm [container id|container name]

Docker Run (more options…)

- Start Container with a custom hostname and container name
  docker ps –d –hostname WS2K16VM22 –name WS2KVM22 microsoft/nanoserver cmd

- Start Container attached to default nat network, with port mapping from container port 80 to host port 81
  docker ps –it –p 81:80 microsoft/iis cmd

- **Execute a command in a running container**
  docker exec –it [container id] cmd

- **Attach to a running container**
  Docker run –name demo1 –d microsoft/nanoserver ping localhost –t
  Docker attach demo1

- **Show process within a container**
  Docker top <container name>

Limit a container's resources

- By default, a container has no resource constraints
- can use as much of a given resource as the host's kernel scheduler allows.
- Docker provides ways to control how much memory, or CPU a container can use

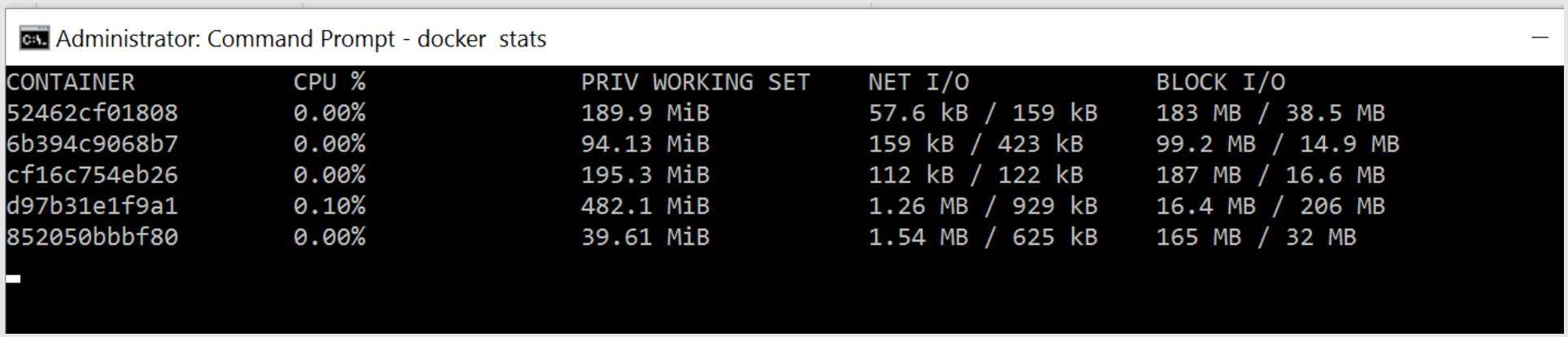
Resource	Option	Example
Memory	--memory	--memory=200m
	--memory-reservation	--memory-reservation=50m
CPU	--cpu-shares	--cpu-shares=2048 (default is 1024)
	--cpu-percent	--cpu-percent=10

Example:

```
docker run -d -p 8383:80 -m 200m --cpu-shares 2048 microsoft/nanoserver ping localhost -t
```

Monitoring Container Resource Usage

Use docker stats



Knowledge Check

1. What command gets an image from repository?
2. What does docker build command do?
3. Steps to publish image to repository
4. How to limit container resources?

Lab 4

Web apps and Docker

45 mins

Microsoft

Thank you! Questions?

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