Getting to DevOps with Docker

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- Software Engineer @ Red Hat
- Various Roles in IT since 1995
  - Programmer
  - Analyst
  - Manager (Ops, Dev, Special Projects)
  - Sales Engineering
  - etc.
- Work on Project Atomic: Tools that make containers easier

$ whoami
@bexelbie

Slides URL: www.winglemeyer.org

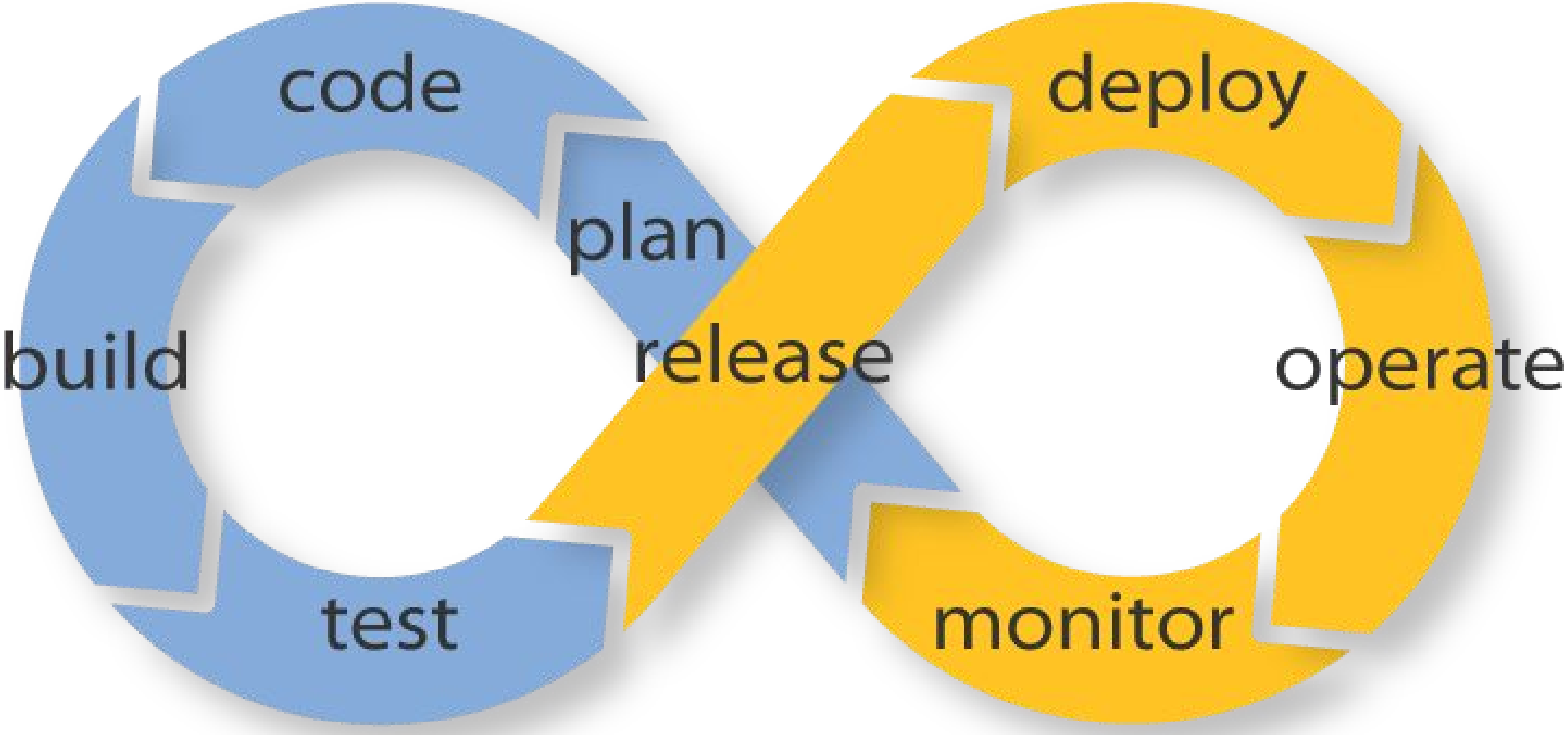
Question Time

DevOps

What is DevOps?

- Culture, not tools
- You can’t buy DevOps
- If you’re using Docker, you’re not necessarily DevOps
- No one’s title is now DevOps

```
$sudo dnf install DevOps
No package DevOps available.
Error: Unable to find a match.
```



Endless Possibilities: DevOps can create an infinite loop of release and feedback for all your code and deployment targets.

https://blog.appdynamics.com/devops/devops-scares-me-part-2/

So, what is DevOps?

- Collaboration of People
- Convergence of Process
- Creation & Exploitation of Tools

Ben Rockwood
Director of IT & Operations at Chef

- http://cuddletech.com/slides/DevOps-Demystified.pdf
- https://www.youtube.com/watch?v=h5E--QSBVBY

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Dev

Ops

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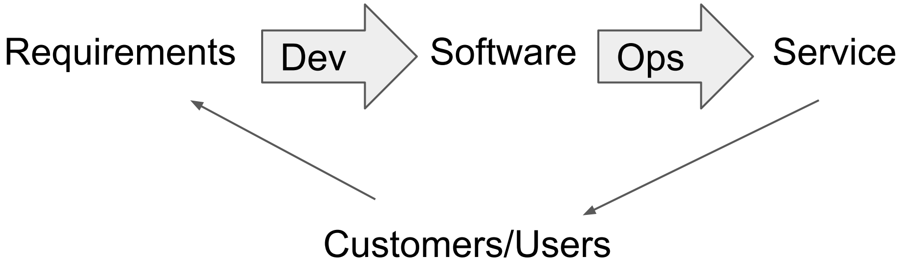

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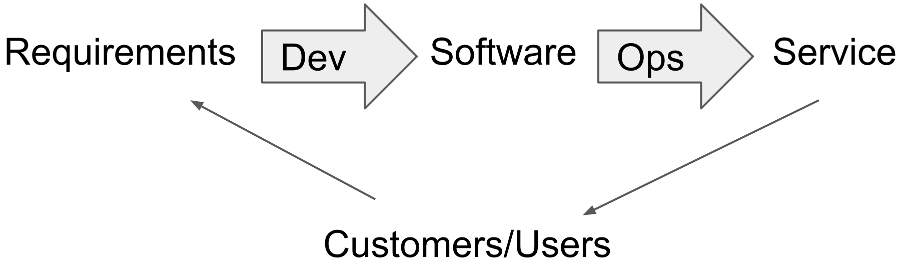
So, what is DevOps?

It’s about flow

- Collaboration of People
- Convergence of Process
- Creation & Exploitation of Tools



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Why DevOps? What Problem(s) does it Solve?

- Developers
  - Differences in Test/Production lead to Dependency Errors [Portability]
    - “It works on my laptop!”
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  - New Code never seems to fit into production exactly [Controlled Infrastructure]
    - a/k/a “You can’t just rev the httpd version you need and not tell anyone”
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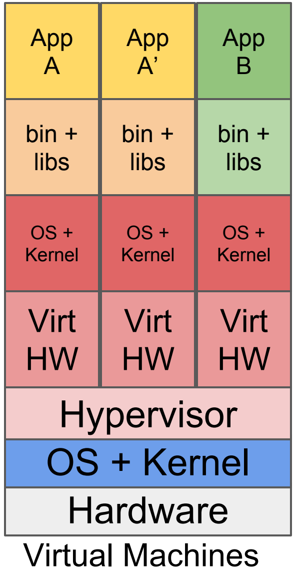
Project/Business Win: Faster Time to Market

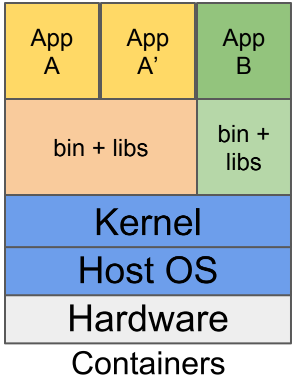
Resource: Rack Space Video: https://www.youtube.com/watch?time_continue=41&v=_I94-tJIovg

Docker

What is Docker?

Docker containers wrap up a piece of software in a complete filesystem that contains everything it needs to run. (docker.com)





Remember These?

- S/370 LPARs
- AIX WPARs
- BSD Jails
- Solaris Zones
- chroot ...

Docker is a way of packaging software and accessing Linux kernel features like cgroups, namespaces, capabilities, etc.

Thinking in Docker

- Virtual Machine Lite
    - Initially people thought it was a faster VM technology
    - Containers with
        - ssh
        - init
        - daemons, etc.
- Application in a box
    - Delete ssh, daemons
    - Lots of processes with init
    - Databases + servers + ...
- Microservices
    - Like Service-Oriented Architecture (SOA)
    - Minimal unit of an application
    - Helps with scale out

What about my data? What about Configs

Pets vs. Cattle

What about my data? What about Configs

~~Pets vs. Cattle~~

Scotch vs. Beer

What about my data? What about Configs

~~Pets vs. Cattle~~

Slivovice vs. Slivovice

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Images: Brian Exelbierd; itesco.cz

Docker Vocabulary

Image: An immutable read-only template of a container. This is the distributable object.

What does an image consist of?

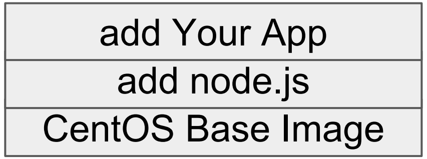
A tar file of the filesystem for the layer(s)
Metadata (image name, version, etc.)

Layer: Images are made with copy on write union file systems that create layers when you make modifications. This means you can start with a base image and layer your software over the top. This also means only your changes have to be distributed.

Base Image: An image containing enough of the libraries and binaries of an OS to support running software.

Registry: A public or private store for images used for network distribution.

Container: An image that has been instantiated. The isolated run-time unit.



add Your App
add node.js
CentOS Base Image

Getting and Managing Images

Docker Hub (hub.docker.com) - public registry of over 100,000 different images

- 2708 apache images, non-official
- Not signed yet

Remember: Images are templates

```
# Search for images
$ docker search apache


# Download images
$ docker pull centos


# List all images on your machine
$ docker images

# Remove images from your machine
$ docker rmi <ID|Name>
```

Running and Managing Containers

Run Options of Note:

```
-i Keep STDIN open even when not
    attached
-t Allocate a pseudo-tty
--rm Automatically remove a
    container when it stops
--name=<name> Use <name>
-e VAR=VALUE Set environment
    variables
-d Detach container and run in
    background
-p <hport>:<cport> map a host
port
    to a container port
--help Help :)
```

```
# Instantiate an Image as a Container
$ docker run <dockerargs> <image> [cmd]

# List Running Containers
$ docker ps

# List all containers on your machine
$ docker ps -a

# Stop a container
$ docker stop <ID|Name>
$ docker kill <ID|Name>

# Remove containers from your machine
$ docker rm <ID|Name>
```

Building Images

Dockerfile specifies build directives

FROM - A starting image (can be a base image or any other image)

RUN - execute this command in the image

EXPOSE - make a port available

ADD - Move files from the build host into the image

CMD - default command to be run when the image is started (There was no command in our example …)

MAINTAINER - metadata

```
FROM fedora:20

MAINTAINER http://fedoraproject.org/wiki/Cloud

RUN yum -y update && yum clean all

RUN yum -y install httpd && yum clean all

RUN echo "Apache" >> /var/www/html/index.html

EXPOSE 80

# Simple startup script to avoid some issues
observed with container restart

ADD run-apache.sh /run-apache.sh

RUN chmod -v +x /run-apache.sh

CMD ["/run-apache.sh"]
```

Building Images

Best Practices are being developed

- https://github.com/projectatomic/container-best-practices
- https://docs.docker.com/articles/dockerfile_best-practices/

1. Old Fedora Version
2. update in container considered sub-optimal
3. Combine yum commands to reduce layers
4. Label it with meta-data https://github.com/projectatomic/ContainerApplicationGenericLabels

```
FROM fedora:20
MAINTAINER http://fedoraproject.org/wiki/Cloud
RUN yum -y update && yum clean all
RUN yum -y install httpd && yum clean all
RUN echo "Apache" >> /var/www/html/index.html
EXPOSE 80
# Simple startup script to avoid some issues
observed with container restart
ADD run-apache.sh /run-apache.sh
RUN chmod -v +x /run-apache.sh
CMD ["/run-apache.sh"]

LABEL VERSION="1.0"
LABEL RUN="docker run -d -p 8080:80 \${IMAGE}"
```

How do I link Microservices? What about my Data?

Option 1: Docker Linking

```
$ docker run --link DBC webserver
```

Creates a private networking link between the DBC (database container) and the webserver. Helpful Environment variables for ports, etc.

Option 2: Orchestration

- Kubernetes
- Mesos (Marathon)
- Docker Swarm
- ...

Option 1: Docker Volumes

```
$ docker run -v /webdata:/var/www apache
```

Make the data from the host's /webdata available via a mount to the container.

Option 2: Volume containers

Data is mounted (`--volumes-from`) from another container.

Option 3: Orchestration Provider/Persistent Storage

Look at your provider, check out things like Ceph/Gluster with containers

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Project/Business Win: Faster Time to Market

Resource: Rack Space Video: https://www.youtube.com/watch?time_continue=41&v=_I94-tJlovg

Portability

```
bexelbie@bexelbie:~$ cat /etc/fedora-release
Fedora release 22 (Twenty Two)
bexelbie@bexelbie:~$ uname -a
Linux bexelbie 4.1.6-201.fc22.x86_64 #1 SMP Fri Sep 4 17:49:
24 UTC 2015 x86_64 x86_64 x86_64 GNU/Linux
bexelbie@bexelbie:~$ docker run -i -t --rm centos bash
[root@bcd983bbeb57 /]# cat /etc/centos-release
CentOS Linux release 7.1.1503 (Core)
[root@bcd983bbeb57 /]# uname -a
Linux bcd983bbeb57 4.1.6-201.fc22.x86_64 #1 SMP Fri Sep 4
17:49:24 UTC 2015 x86_64 x86_64 x86_64 GNU/Linux
```

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Deployment

- Designed for automated build
- Pushes you to a model for easy use from a git repo (Dockerfile + source)
- Jenkins/etc. already working with it
- Project Atomic’s Nulecule is formalizing multi-container application definition

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Controlled Infrastructure

```
$ cat Dockerfile
FROM mycorp/node:1.0
RUN dnf install custom-node-library
ADD node-app
```

```
$ cat Dockerfile
FROM mycorp/node:1.0
RUN npm install scary_lib
ADD node-app
```

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Scale Out

- Fast to start and stop
- *Slivovice vs. Slivovice* means design supports scale from the start
- Orchestration providers

Thank you

Brian (bex) Exelbierd

@bexelbie

Slides: www.winglemeyer.org

Fake Demo: Command #1

```
$ docker search apache
INDEX     NAME                     DESCRIPTION                 STARS  OFFICIAL   AUTOMATED
docker.io docker.io/tomcat         Apache Tomcat is an op...   299    [OK]
docker.io docker.io/fedora/apache                              33                    [OK]
docker.io docker.io/eboraas/apache Apache (with SSL on Debian  22                    [OK]
docker.io docker.io/bitnami/apache      Bitnami Apache Docker Image 9
[OK]
...
```

Fake Demo: Command #2 1/2

```
$ docker pull centos
Using default tag: latest
Trying to pull repository docker.io/library/centos ... latest: Pulling from library/centos
47d44cb6f252: Pull complete
168a69b62202: Pull complete
812e9d9d677f: Pull complete
4234bfdd88f8: Pull complete
ce20c473cd8a: Pull complete
library/centos:latest: The image you are pulling has been verified. Important: image
verification is a tech preview feature and should not be relied on to provide security.
Digest: sha256:3aaab9f1297db9b013063c781cfe901e2aa6e7e334c1d1f4df12f25ce356f2e5
Status: Downloaded newer image for docker.io/centos:latest
```

Fake Demo: Command #2 2/2

```
$ docker pull centos:6.7
Trying to pull repository docker.io/library/centos ... 6.7: Pulling from library/centos
5fc6f5013018: Pull complete
8e6730e0eaef: Pull complete
b89573a5b116: Pull complete
3fba1048142f: Pull complete
47d44cb6f252: Already exists
library/centos:6.7: The image you are pulling has been verified. Important: image
verification is a tech preview feature and should not be relied on to provide security.
Digest: sha256:89d9204927e3ebbe7d93fb7b07b86d2ab5502c31e9c964cb995d6d4fd1ea3039
Status: Downloaded newer image for docker.io/centos:6.7
```

Fake Demo: Command #3

```
$ docker images
REPOSITORY              TAG        IMAGE ID            CREATED             VIRTUAL SIZE
docker.io/centos        latest     ce20c473cd8a        5 days ago          172.3 MB
docker.io/centos        centos6.7  3fba1048142f        5 days ago          190.6 MB
docker.io/jekyll/jekyll latest     44d4bdcdf669        5 weeks ago         145 MB
docker.io/redis         latest     2f2578ff984f        5 weeks ago         109.2 MB
docker.io/nginx         latest     0b354d33906d        5 weeks ago         132.8 MB
docker.io/mysql         latest     6762f304c834        5 weeks ago         283.5 MB
docker.io/fedora        latest     ded7cd95e059        4 months ago        186.5 MB
```

Fake Demo: Command #4

```
$ docker rmi centos:6.7
Untagged: centos:6.7
Deleted: 3fba1048142f7f89f67f2b6b11256053a3beaa280b97538dd85d51d4f0a65961
Deleted: b89573a5b116e61624906884fc48ba0cd7037a72cf1d2757c77fbd73f03c150a
Deleted: 8e6730e0eaef34246dd562b1ecc41ab72012a1bab74996edd4b5783bbfe71b82
Deleted: 5fc6f5013018fd5f1e84a3b5d304f03cfb81b6131ca20c968262bc60c2edb107
```

Fake Demo: Command #5

```
$ docker run -d -p 8080:80 fedora/apache
c20ee8740ab0342fcb5e9ff9c948a07b57734c692bbc57c0d7ac7b6461ec4dee

$ docker ps
CONTAINER ID IMAGE         COMMAND          CREATED        STATUS
PORTS              NAMES
c20ee8740ab0 fedora/apache "/run-apache.sh" 32 seconds ago Up 31 seconds 0.0.0.0:8080-
>80/tcp   naughty_carson

$ curl localhost:8080
Apache
```

Fake Demo: Command #6

```
$ docker ps -a
CONTAINER ID        IMAGE
COMMAND                  CREATED             STATUS                         PORTS
     NAMES
c20ee8740ab0        fedora/apache                                                    "/run-
apache.sh"          57 seconds ago      Up 56 seconds                  0.0.0.0:8080->80/tcp
naughty_carson
179273eba685        mysql
"/entrypoint.sh mysql"   29 minutes ago      Exited (137) 35 seconds ago
     some-mysql
b8110e2d14f9        53e2c71cae40dc932e4927cc5f0c938aef8e0c8d0fd1f18e568b98f7c6cde318
"/bin/true"              3 days ago          Created
     cranky_goodall
b721362b0cba        fedora
"/bin/bash"              3 days ago          Exited (0) 3 days ago
     mnt_test
```

Fake Demo: Command #7

```
$ docker stop naughty_carson
naughty_carson

$ docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
     PORTS               NAMES

$ $ docker ps -a | grep -e 'carson\|CONTAINER'
CONTAINER ID        IMAGE
COMMAND                  CREATED             STATUS                          PORTS
     NAMES
c20ee8740ab0        fedora/apache                                                        "/run-
apache.sh"          8 minutes ago       Exited (0) About a minute ago
naughty_carson


...
```

Fake Demo: Command #8

```
$ docker rm naughty_carson
naughty_carson

$ docker ps -a | grep -e 'carson\|CONTAINER'
CONTAINER ID        IMAGE
COMMAND                  CREATED             STATUS                         PORTS
     NAMES

$ docker images | grep apache
docker.io/fedora/apache            latest              1eff270e703a        3 months ago
     649.7 MB
```

Fake Demo: Command #9 1/3

```
$ docker build -t fed_apache_test .
Sending build context to Docker daemon 23.55 kB
Step 0 : FROM fedora:20
 ---> 0d071bb732e1
Step 1 : MAINTAINER http://fedoraproject.org/wiki/Cloud
 ---> Running in 4f52dc14f7cf
 ---> 68c6cfc842c3
Removing intermediate container 4f52dc14f7cf
Step 2 : RUN yum -y update && yum clean all
 ---> Running in 1f4dce793c25
No packages marked for update
Cleaning repos: fedora updates
Cleaning up everything
 ---> dc61cc0c770b
Removing intermediate container 1f4dce793c25
```

Fake Demo: Command #9 2/3

```
Step 3 : RUN yum -y install httpd && yum clean all
 ---> Running in 5836318d3d9c
Resolving Dependencies
--> Running transaction check
---> Package httpd.x86_64 0:2.4.10-2.fc20 will be installed
--> Processing Dependency: httpd-tools = 2.4.10-2.fc20 for package: httpd-2.4.10-2.fc20.
x86_64
...

Complete!
Cleaning repos: fedora updates
Cleaning up everything
 ---> fd611aaea307
Removing intermediate container 5836318d3d9c
Step 4 : RUN echo "Apache" >> /var/www/html/index.html
 ---> Running in 3bd0cef73706
 ---> 106033d132d7
Removing intermediate container 3bd0cef73706
```

Fake Demo: Command #9 3/3

```
Step 5 : EXPOSE 80
 ---> Running in a74a8b9c8ef3
 ---> d6d79e693080
Removing intermediate container a74a8b9c8ef3
Step 6 : ADD run-apache.sh /run-apache.sh
 ---> ed5f0bd13f85
Removing intermediate container 7eb0357f7d54
Step 7 : RUN chmod -v +x /run-apache.sh
 ---> Running in be6bc6501f5d
mode of '/run-apache.sh' changed from 0664 (rw-rw-r--) to 0775 (rwxrwxr-x)
 ---> 2e2cf3065cbb
Removing intermediate container be6bc6501f5d
Step 8 : CMD /run-apache.sh
 ---> Running in 8a5259ac3e61
 ---> cd0882400d7c
Removing intermediate container 8a5259ac3e61
Successfully built cd0882400d7c
```

Is it Really Fast?

```
$ time sudo docker run -it --rm fedora sleep 5

real    0m6.200s
user    0m0.023s
sys    0m0.022s

$ time sleep 5

real    0m5.004s
user    0m0.000s
sys    0m0.001s
```

Thank you

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