Docker Deep Dive

Daniel Klopp

The Talk

- I’m not telling you what fishing rod to use

The Talk

- I’m not telling you what fishing rod to use
- I’m helping you understand the fishing rod

The Talk

- I’m not telling you what fishing rod to use
- I’m helping you understand the fishing rod
- You can decide if you should fish with it

The Talk

- This is an intermediate deep dive.

The Talk

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  - Don’t panic

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- This is not a demo

The Talk

- This is an intermediate deep dive.
  - Don’t panic
- Each category starts easy, and assumes progressively more knowledge
  - Don’t panic!
- This is not a demo
- If you have questions, ask.

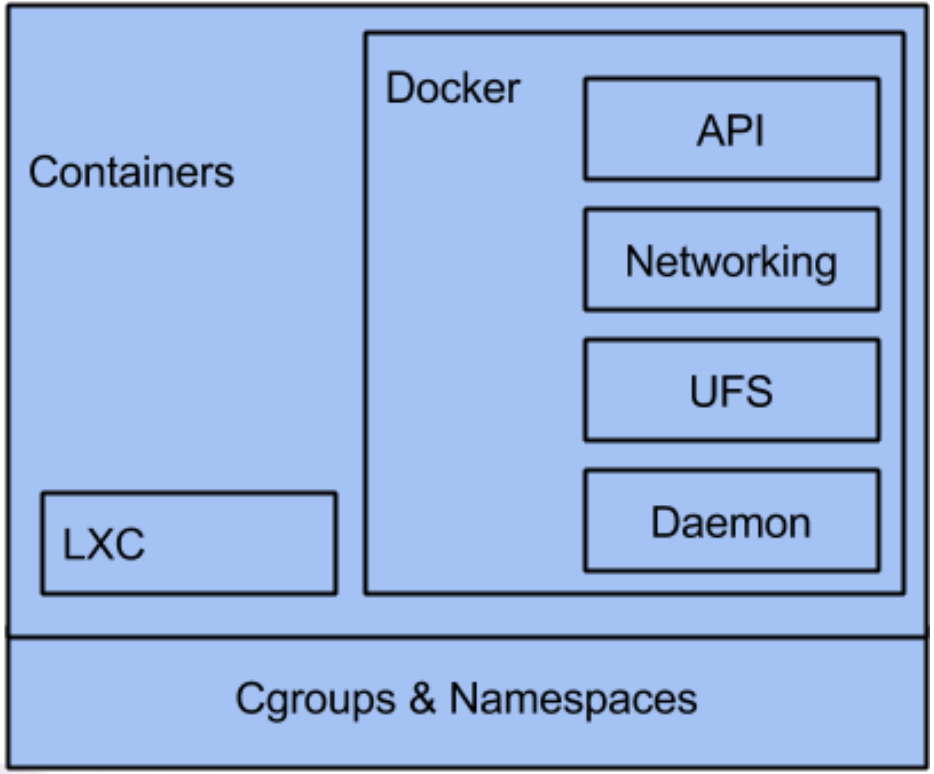
Assumptions

- I assume basic Linux knowledge
- I assume basic TCP/IP knowledge
- I assume basic Filesystem layout knowledge
- No knowledge of containers necessary

Who Am I?

- EE by training, DevOps by practice
- Worked in HPC at National Radio Astronomy Observatory
  - Including kernel development
- Taos, Unix / Scripting / DevOps handiman
- Unix Practice Leader at Taos Consulting

The Talk



TAOS

Outline

- What are containers
- Containers, hypervisors, jails, chroot
- Docker & Containers Intro
- Linux Container Implementation
  - LXC

Outline

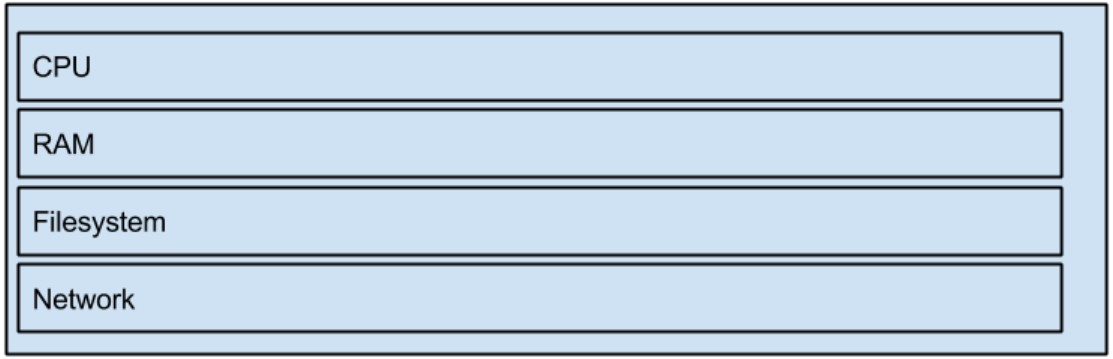
- Docker
- Docker Filesystem
- Docker Networking
- Docker API
- Docker Management Tools

Section
What Are Containers?

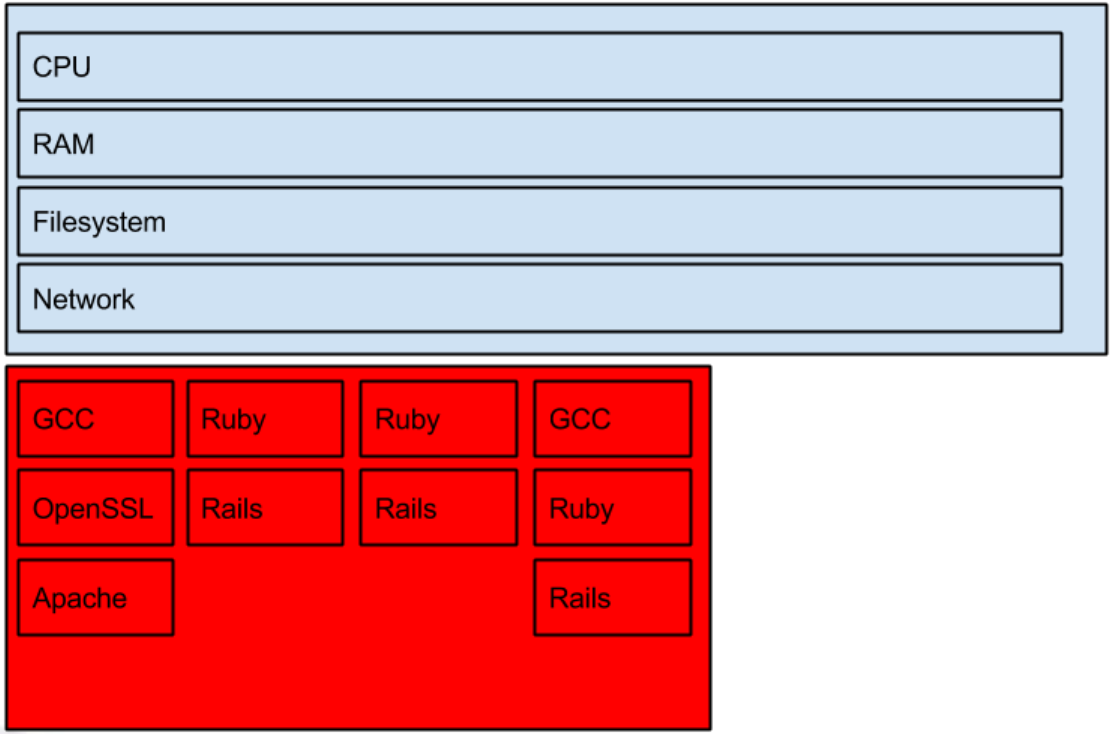
- A brief story
- Containers

A Story

- The good ol' days

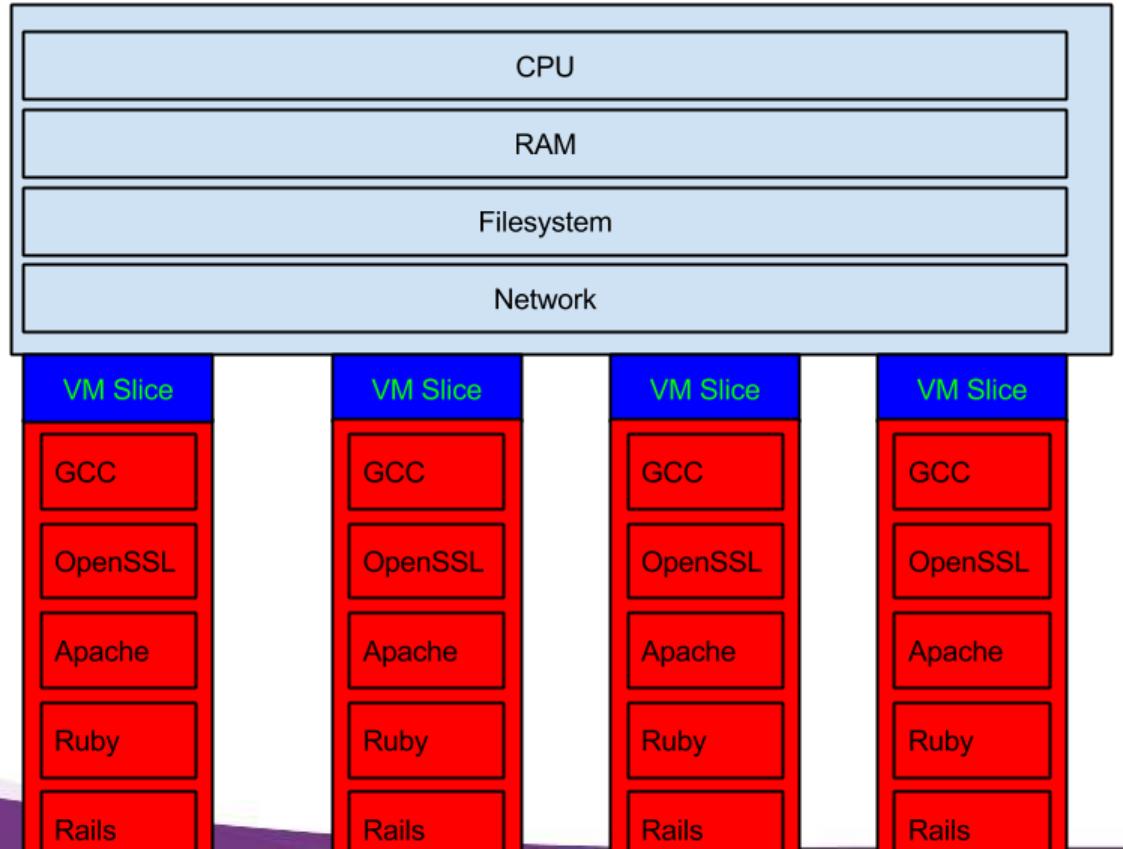


A Story


CPU
RAM
Filesystem
Network
GCC
Ruby
Ruby
GCC
OpenSSL
Rails
Rails
Ruby
Apache
Rails

TAOS

A Story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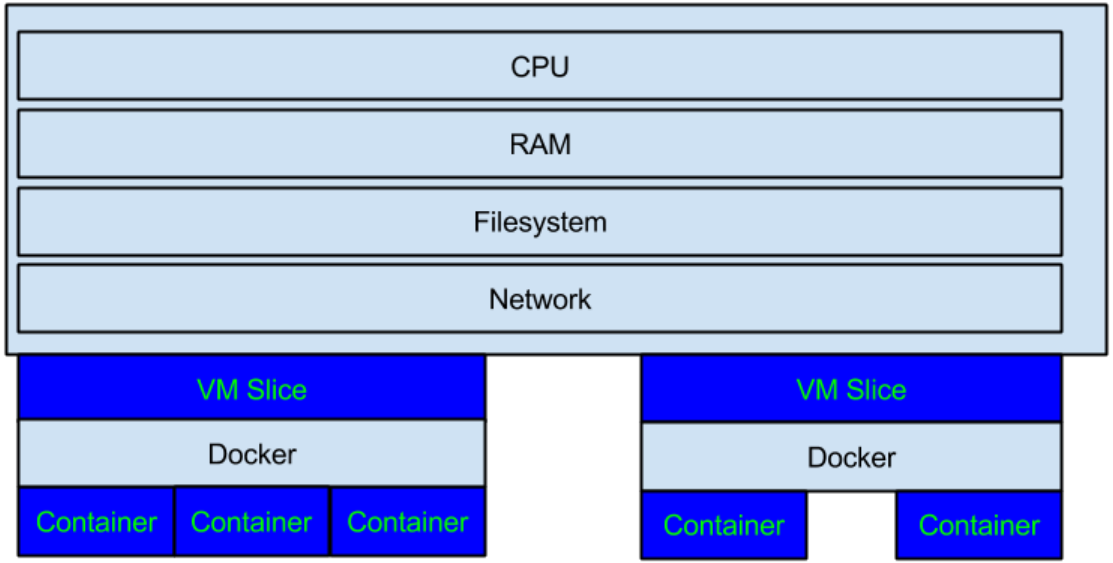
TAOS

A Story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TAOS

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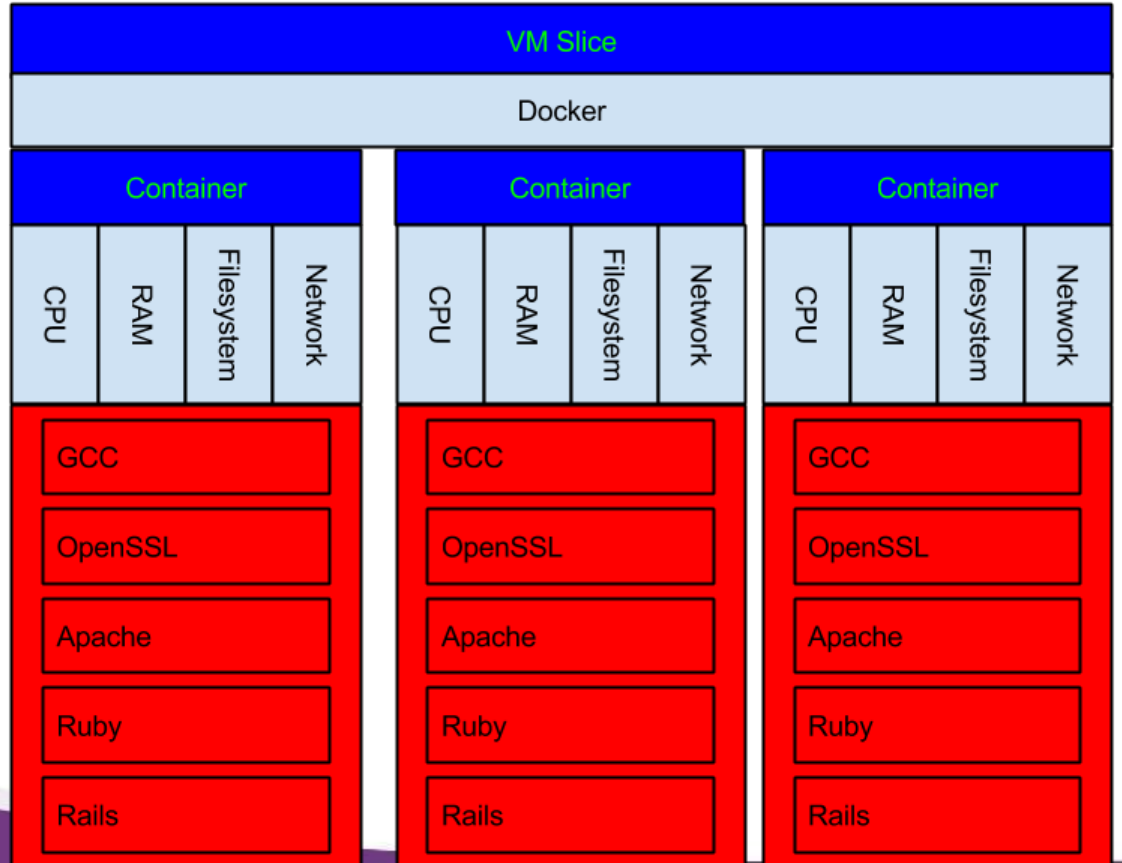
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TAOS

How Is This Achieved?

- Namely
  - Linux Namespaces
  - Kernel cgroups
  - Union Filesystems

How Is This Achieved?

- Namely
  - Linux Namespaces
  - Kernel cgroups
  - Union Filesystems
- We'll review this foundation soon

Kernel Cgroups

- Started by Google
  - Paul Menage and Rohit Seth
- Merged in kernel 2.6.24 (2008)
- Provides
  - Resource Limitation
  - Prioritization
  - Accounting
  - Control

Linux Namespaces

- Isolation
  - Deployment
  - Security

Linux Namespaces

- Isolation
  - Deployment
  - Security
- We will hardly cover this.

Section
Containers, Hypervisors, Jails

- Operating Systems
- Hypervisors
- Jails
- Chroots
- Containers

Operating Systems

- Manage hardware resources
- Provide shared interfaces for programs
- Police programs
- Operating Systems
  - Android
  - Linux
  - Windows
  - BSD
  - Mac

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Hypervisors

- Hypervisors virtualize and manage hardware resources
- Popular Type I Hypervisors:
  - KVM
  - Xen
  - VMWare ESX(i)
- Popular Type II Hypervisors:
  - Virtualbox

Chroot

- In practice used to narrow filesystem view
- Cannot isolate process tree
- Cannot enforce resource limits
  - Filesystem only exception
- 20 customers, 20 chroots?
  - 1 misbehaving customer, all customers suffer
- Suffers from escalation insecurities

Jails

- BSD and Solaris
- Operating System level container

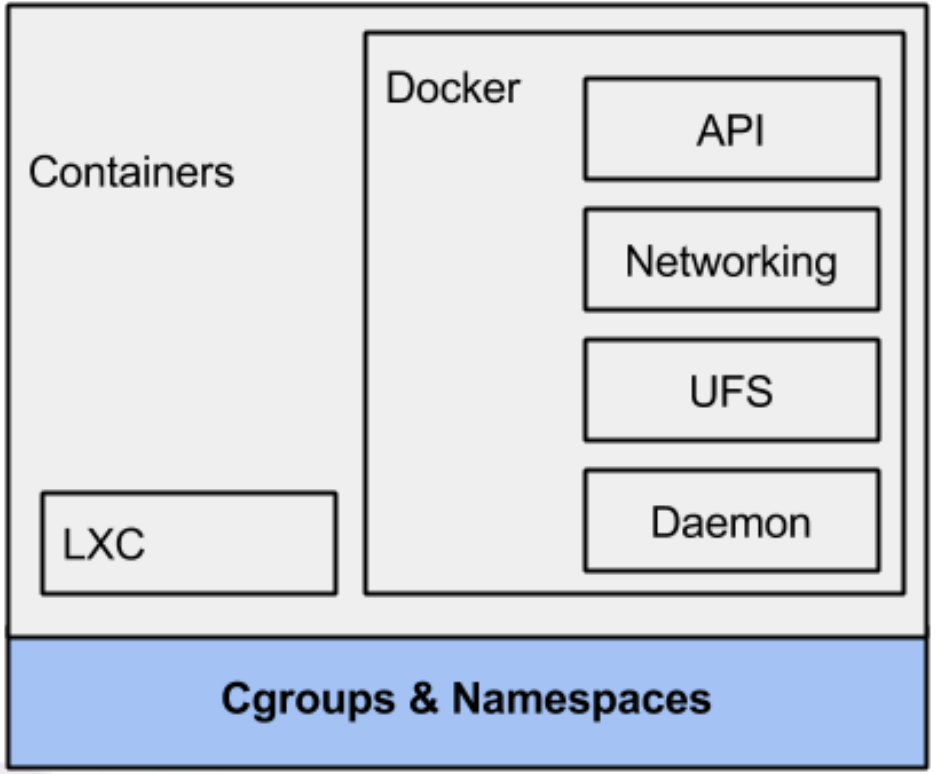
Containers

- Operating System level container
- Almost, but not quite, a Linux “jail”
  - (Don’t kill the messenger!)
- Provides meaningful resource controls
  - CPU
  - RAM
- Provides isolation

Section
Linux Container Implementation

- Cgroups
- Namespaces

Where We Are



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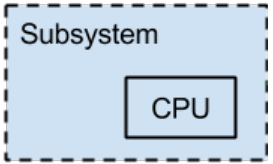
Kernel Cgroups

- Hierarchical

Kernel Cgroups

- Hierarchical
  - Top-level are “subsystems” or “controllers”



Kernel Cgroups

- Hierarchical
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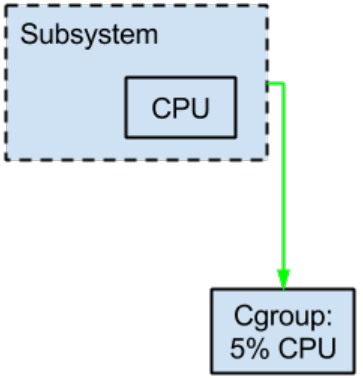
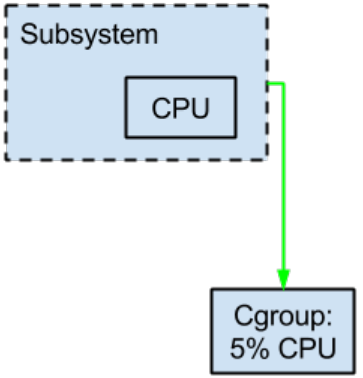
  - Lower-level are “cgroups”



Kernel Cgroups

- Hierarchical
  - Top-level are “subsystems” or “controllers”
  - Lower-level are “cgroups”
    - “cgroups” can be nested



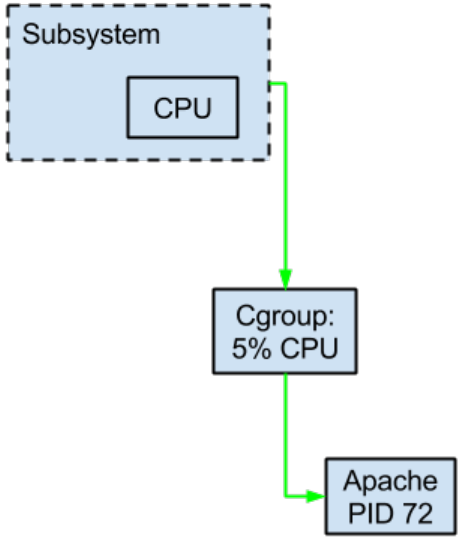
Subsystems

- Also known as “Controllers”
- They are the root of a hierarchy
- They control resources, such as
  - CPU
  - Memory
  - Network
- A “cgroup” is attached to a subsystem, forming a hierarchy

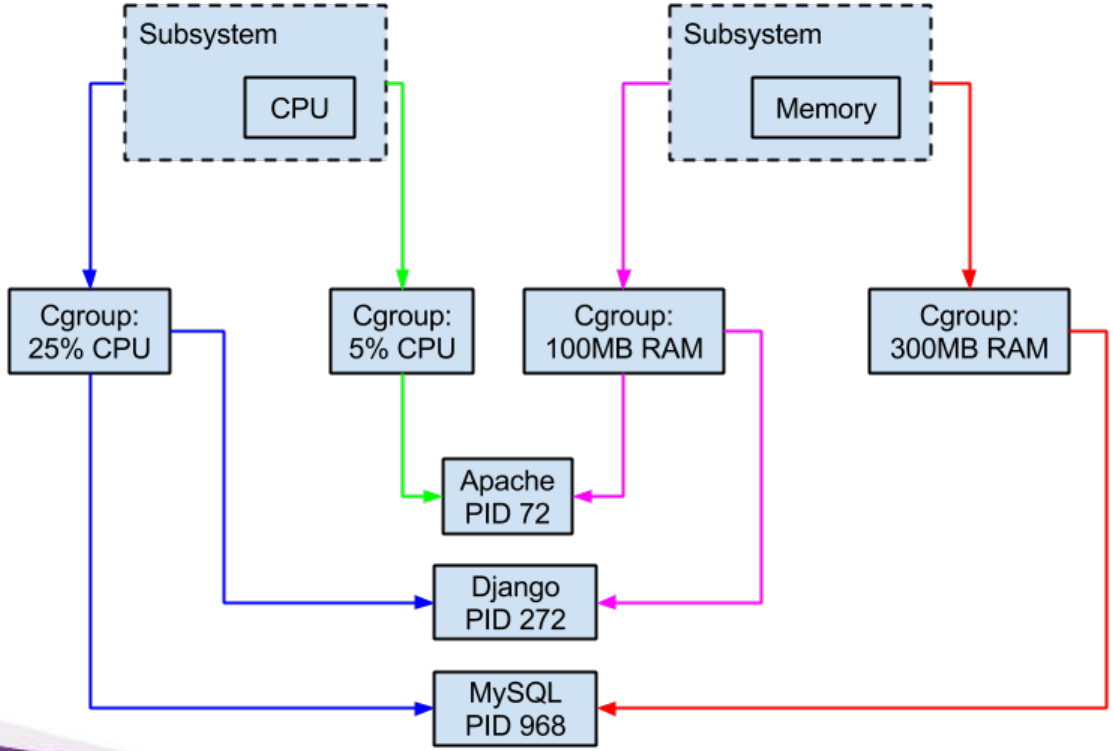
Cgroups

- Encapsulate a set of tasks
- Encapsulate a set of parameters
- The parameters confine the tasks
  - Limiting memory, cpu shares, etc
- Tasks are processes in Linux parlance

Simple Cgroup Hierarchy



Complicated Cgroup Hierarchy



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Interacting with Cgroups

- View subsystems in /sys/fs/cgroup
  - They are mounted cgroup filesystems

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- Memory root cgroup: /sys/fs/cgroup/memory
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Interacting with Cgroups

- View subsystems in /sys/fs/cgroup
  - They are mounted cgroup filesystems
- Memory root cgroup: /sys/fs/cgroup/memory
- CPU root cgroup in: /sys/fs/cgroup/cpu
- They are filesystems, view subsystems with ‘mount’ command

Some Cgroups on Fedora 21

- Sample mounted cgroups (output formatted)

```
cgroup on /sys/fs/cgroup/cpuset type cgroup (rw,n
osuid,nodev,noexec,relatime,cpuset)

cgroup on /sys/fs/cgroup/cpu,cpuacct type cgroup
(rw,nosuid,nodev,noexec,relatime,cpu,cpuacct)

cgroup on /sys/fs/cgroup/memory type cgroup (rw,n
osuid,nodev,noexec,relatime,memory)
```

TAOS

Interacting with Cgroups

- Let's write a horrible python program

```
def eat_all_ram():
  x=[]
  for i in itertools.count(start=0, step=1):
    x.append(operation(i))
  return len(x)
eat_all_ram()
```

Interacting with Cgroups

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eat_all_ram()
```

- Oh no! A misbehaving program is eating all our memory!

TAOS

Interacting with Cgroups

- Create a cgroup under the memory subsystem and limit the PID to 10MB

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```
[root@fedora ~]# mkdir /sys/fs/cgroup/memory/dangroup
[root@fedora ~]# cd /sys/fs/cgroup/memory/dangroup
[root@fedora dangroup]# echo 10485760 > memory.limit_in_bytes
[root@fedora dangroup]# echo 2345 > tasks
```

Interacting with Cgroups

- Create a cgroup under the memory subsystem and limit the PID to 10MB

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[root@fedora ~]# mkdir /sys/fs/cgroup/memory/dangroup
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- All fixed!

Interacting with Cgroups

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[root@fedora dangroup]# echo 10485760 > memory.limit_in_bytes
[root@fedora dangroup]# echo 2345 > tasks
```

- All fixed!
- Except...process will swap near 10 MB.

Linux Namespaces

- PID
- NET
- MNT
- IPC
- UTS

Linux Namespaces

- PID
- NET
- MNT
- IPC
- UTS
- I'll only summarize PID and NET

PID Namespace

- Isolated process tree
  - eg, each tree may run its own init as pid 1
- PID Namespace is hierarchical, but one way
  - A parent namespace process is aware of child namespace processes
  - The converse is not true.
- With one parent and one child namespace, a child PID has two PID's.

NET Namespace

- Isolated network
- Separate route tables
- Seperate IP space
- Separate ARP tables
- Very powerful
- Also used by OpenStack

NET Namespace

- Isolated network
- Separate route tables
- Seperate IP space
- Separate ARP tables
- Very powerful
- Also used by OpenStack
- Check out ‘ip netns’

Section
LXC

- LXC

LXC

- Released 2008
- First native Linux container technology
  - Prior work required kernel patches
- Powerful but limited
- Docker is to Ubuntu what LXC is to Gentoo

LXC

- LXC is lightweight, but at a cost
- Not portable between distributions
  - Docker is
- Manual configuration of networking
  - iptables, brctl, ip netns, etc
- Manual configuration of union filesystem

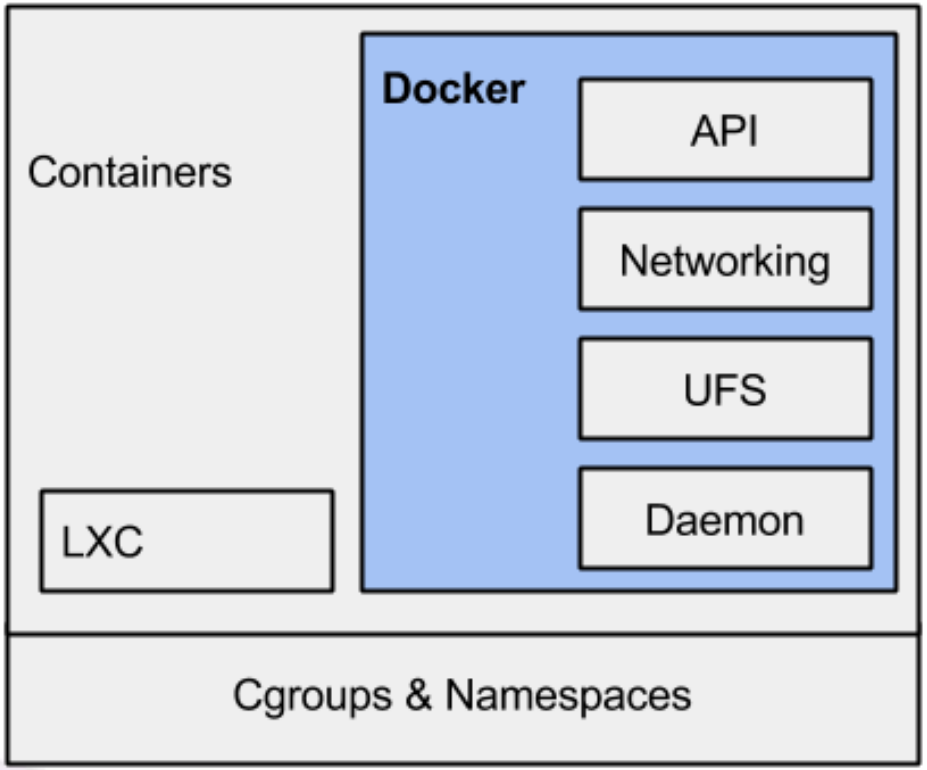
LXC versus Docker

- Both use the same cgroups, namespaces, and low level tools
- Fundamental distinction
  - Docker packages portable application centric containers
  - LXC is only a container technology

Section
Docker

- Docker

Where We Are



TAOS

What is Docker?

- A container implementation for Linux
- Released in 2013
- Current release 1.5
- Open Source, Apache License
  - github.com/docker/docker
- Owned by the Docker Corporation

Docker Implementation

- A monolithic daemon enabling operating system level virtualization for Linux.
- Relatively modern kernel needed
  - 2.6.32+
  - Centos/RHEL 6.5+
  - Ubuntu 12.04+
- Cgroups were merged in 2.6.24 (2008)

Platforms other than Linux?

- BSD
  - Not really
  - Jails are preferred
- Windows
  - With a Linux virtual machine
- Mac
  - With a Linux virtual machine

Platforms other than Linux?

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  - Not really
  - Jails are preferred
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  - With a Linux virtual machine
- Mac
  - With a Linux virtual machine
- Docker is a Linux container implementation

Terminology

- Image
- Container
- Layer
- Dockerfile

Image

- A set of UFS layers and metadata
- The “Ubuntu” image
- Images can be downloaded from Dockerhub
- Images are never “run”
  - Containers are
- Images are never “modified”
  - Modifications create new images

Container

- An instance of an image
- Containers are a running image with a topmost read-write UFS layer
- A container should serve one function
  - Pending business logic it can be complicated
  - Don’t replicate a monolithic stack for “everything”
  - One function scales better
  - One function is easier to isolate and debug

Layer

- Docker containers are built upon UFS
- UFS is the Union File System
  - Not “strictly” a union, as upper layer can overwrite lower layer.
  - Once committed, nothing in a layer is ever deleted
- Docker images limited to 127 Layers

Dockerfile

- An image build recipe
  - Procedural
  - Basic operations for executing programs and copying files.
  - Not configuration management
- Each Dockerfile directive creates a layer
  - Maximum number of layers: 127
- Examples will follow later

Networking

- Virtual bridges
- Container Linking
  - Environment variables
  - /etc/hosts
  - Retained within Linux network namespace
- Host to container port forwarding
- iptables is used for masquerading

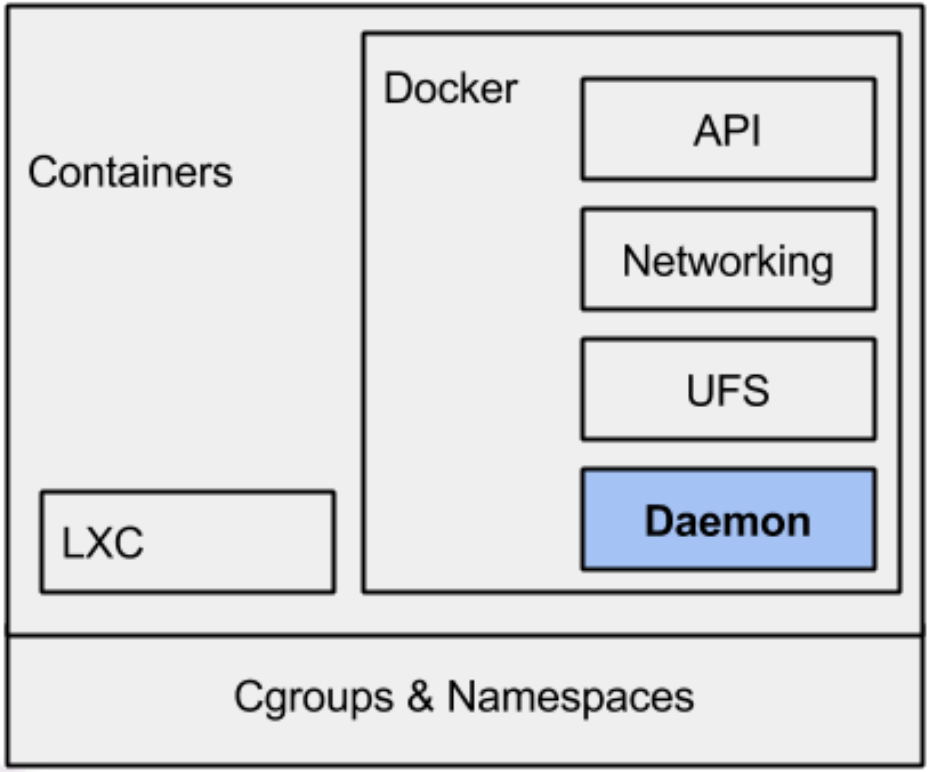
Filesystem

- Union File System
  - Base image + layers defines final image
  - Limit of 127 “layers”
  - Each docker “RUN” adds to a layer
- “Flattening” image is not natively supported
  - Achievable by exporting a container as an image
  - docker-squash utility available to help

Docker Resource Controls

- No Disk I/O Throttling
- No Disk quota
- Filesystem isolation
- CPU quotas
- RAM limits
- Network isolation but no limits

Where We Are


Containers
Docker
API
Networking
UFS
Daemon
LXC
Cgroups & Namespaces

Docker Daemon

- Client-server Architecture
  - Monolithic design
- Daemon manages containers
- Has a REST API via HTTP and Socket
  - /var/run/docker.sock
  - HTTP will be covered later by example
- Note: API uses an Open Schema.
  - Incorrect entries are ignored.

Basic Operation

- Use the ‘docker’ command.
- This is not a guide about Docker CLI
  - Examples are for illustration only
- Download an image

```
docker pull fedora
```

- Run an image as a container

Basic Operation

- List all images

```
[root@fedora ~]# docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             VIRTUAL SIZE
dsklopp/multilayer  latest              fa1864ec747a        About an hour ago   229.2 MB
ubuntu              14.04               d0955f21bf24        9 days ago          188.3 MB
ubuntu              14.04.2             d0955f21bf24        9 days ago          188.3 MB
ubuntu              latest              d0955f21bf24        9 days ago          188.3 MB
ubuntu              trusty              d0955f21bf24        9 days ago          188.3 MB
ubuntu              trusty-20150320     d0955f21bf24        9 days ago          188.3 MB
<none>              <none>              00a0c78eeb6d        4 months ago        0 B
[root@fedora ~]#
```

TAOS

Basic Operation

- Run an image interactively

```
docker run -t -i ubuntu:14.04 /bin/bash
```

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docker run -t -i ubuntu:14.04 /bin/bash
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docker start c6fda327bc33
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Basic Operation

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```

- Stop a container

```
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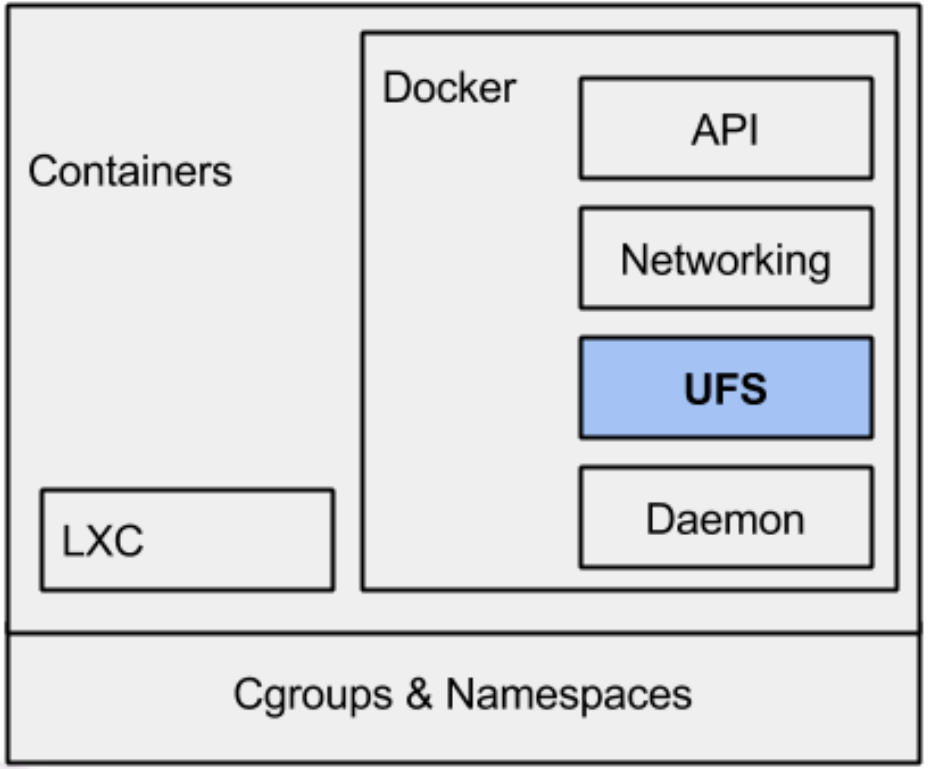
```

Section
Docker Filesystem

- Docker Filesystem
- Dockerfiles
- Squashing Docker Containers

Where We Are



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Union File System

- Docker utilizes Union File Systems
  - AUFS
  - BTRFS
  - VFS
  - DeviceMapper

Union File System

- Docker utilizes Union File Systems
  - AUFS
  - BTRFS
  - VFS
  - DeviceMapper
- Implementation depends on the platform
  - Fedora 21 uses DeviceMapper
  - Ubuntu 14.04 uses AUFS

Dockerfiles

- Docker UFS is best explained by Dockerfiles
- Dockerfile runs commands on an image
- Each directive creates a new layer
- The end result is an image
  - Send it to Dockerhub!
  - Share to the world!
  - Deploy it in your infrastructure

Dockerfile Structure

- Structured text file called ‘Dockerfile’

Dockerfile Structure

- Structured text file called ‘Dockerfile’
- Sample

```
FROM ubuntu:14.04
MAINTAINER Daniel Klopp

RUN touch $HOME/shell_run_variant
RUN [ "/bin/bash", "-c", "touch $HOME/exec_run_variant" ]
RUN [ "/bin/mkdir", "-p", "$HOME/exec_run_variant_mkdir" ]
RUN [ "/usr/bin/touch", "$HOME/exec_run_variant_noshell" ]
```

Dockerfile RUN

- Creates file /root/shell_run_variant

```
RUN touch $HOME/shell_run_variant
```

Dockerfile RUN

- Creates file /root/shell_run_variant

```
RUN touch $HOME/shell_run_variant
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- Creates /root/exec_run_variant

```
RUN [ "/bin/bash", "-c", "touch $HOME/exec_run_variant" ]
```

Dockerfile RUN

- Creates file /root/shell_run_variant

```
RUN touch $HOME/shell_run_variant
```

- Creates /root/exec_run_variant

```
RUN [ "/bin/bash", "-c", "touch $HOME/exec_run_variant" ]
```

- ‘$HOME/exec_run_variant_mkdir’, literally.

```
RUN [ "/bin/mkdir", "-p", "$HOME/exec_run_variant_mkdir" ]
```

Dockerfile build

- Build and cropped output

```
docker build --no-cache -t dsklopp/run_variants .
```

Dockerfile build

- Build and cropped output

```
docker build --no-cache -t dsklopp/run_variants .
```

```
Step 0 : FROM ubuntu:14.04
 ---> d0955f21bf24
Step 1 : MAINTAINER Daniel Klopp
 ---> Running in 1f4b4a83bd1e
 ---> aa57bc7e6633
Removing intermediate container 1f4b4a83bd1e
Step 2 : RUN touch $HOME/shell_run_variant
 ---> Running in 24e2d896c2e5
 ---> 981adeaf7d60
```

The Layers of a Docker Build

- Five directives, five new layers

```
ubuntu:trusty-20150320
├─aa57bc7e6633 Virtual Size: 188.3 MB
│ └─981adeaf7d60 Virtual Size: 188.3 MB
│   └─48a88966b2b8 Virtual Size: 188.3 MB
│     └─dabec6013060 Virtual Size: 188.3 MB
│       └─8570adf87230 Virtual Size: 188.3 MB Tags: dsklopp/run_variants
```

- One layer for MAINTAINER
- Four layers for four RUN directives

Honorable Directive Mentions

- ENV, set environment variables for container
- These work in Dockerfiles, sample:

```
ENV myName="Dan Klopp" myDistro="Ubuntu"
RUN echo $myName > $HOME/name.txt
RUN echo $myDistro >> $HOME/name.txt
```

- The variables are accessible from Dockerfile and the container itself.

Honorable Directive Mentions

- Inside the container:

```
root@8ea2a330dcf1:/# env |grep -i my
myDistro=Ubuntu
myName=Dan Klopp
root@8ea2a330dcf1:/# cat $HOME/name.txt
Dan Klopp
Ubuntu
root@8ea2a330dcf1:/#
```

Honorable Directive Mentions

- Environment variables can be set on launch
- Pass to docker run command:

```
--env newKey="newValue"
```

Honorable Directive Mentions

- Environment variables can be set on launch
- Pass to docker run command:

```
--env newKey="newValue"
```

- A handy debug option!

More Directive Details

- See the official documentation

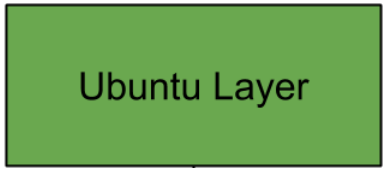
  < https://docs.docker.com/reference/builder/ >

Layers, Size and Building

- Each Layer adds to the size

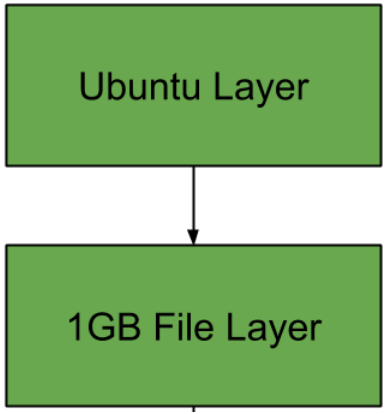
Layers, Size and Building

- Each Layer adds to the size
  - Layer 1 has Ubuntu, ~188 MB



Layers, Size and Building

- Each Layer adds to the size
  - Layer 1 has Ubuntu, ~188 MB
  - Layer 2 adds a 1 GB file



Layers, Size and Building

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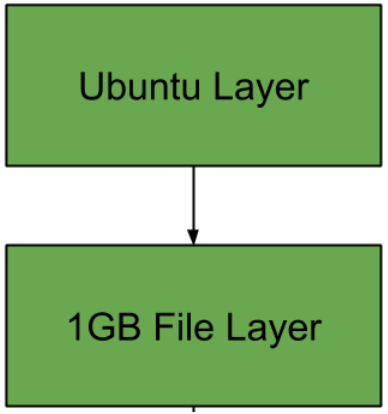
  - Layer 2 adds a 1 GB file
  - Total size ~1.2 GB



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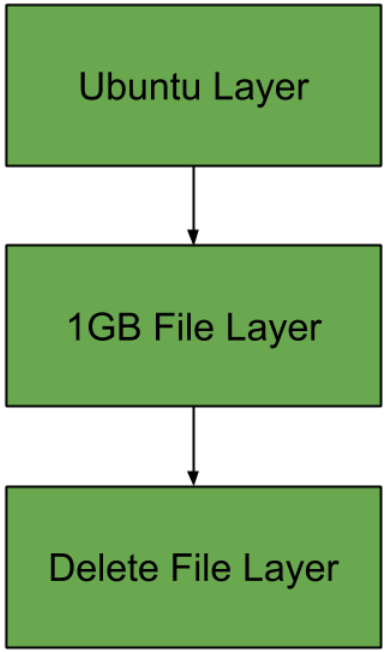
- Delete the 1 GB file in Layer 3



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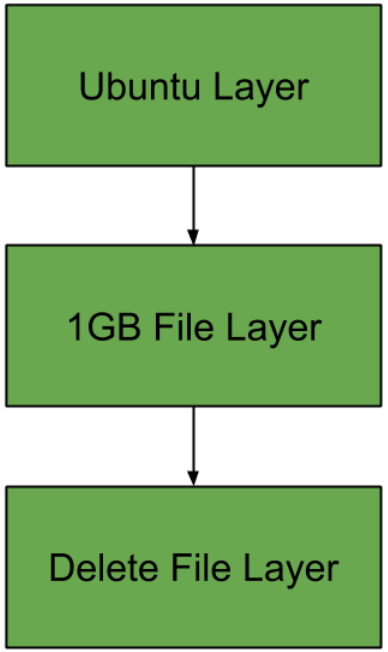

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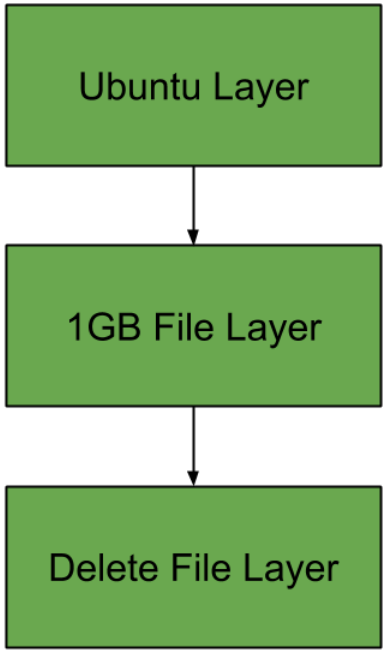

Layers, Size and Building

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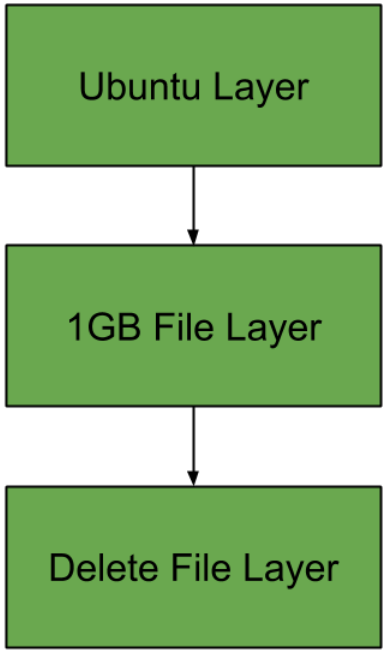
- Delete the 1 GB file in Layer 3
  - Layer 3 deletes the 1 GB file
  - Total size ~1.2 GB
- This can be a problem



Layers, Size and Building

- Each ‘directive’ adds a layer
- Run all commands in one directive, contrast:

```
RUN dd if=/dev/zero of=/bigfile.zeroes \
 bs=1k count=$((1024*1024))
RUN rm -f /bigfile.zeroes
```

- With

```
RUN dd if=/dev/zero of=/bigfile.zeroes \
 bs=1k count=$((1024*1024)) \
 && rm -f /bigfile.zeroes
```

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Layers, Size and Building

- This makes a significant difference in size

```
dsklopp/optimized     ...   188.3  MB
dsklopp/unoptimized   ...   1.262  GB
```

Dockerfiles

- Are not configuration management
- Package the results of a build process
- Each layer should be functional
  - OS layer
  - Patch to latest
  - Webserver
  - Webserver content
- A build process makes this less relevant

How To Compress Layers

- A container is a collection of layers
- In Ubuntu, this is implemented with aufs
- /var/lib/docker stores the FS and metadata.
- Edit the half dozen json files and aufs entries
- ...
- Maybe that isn't such a good idea
  - If only there was a program to do it for us
  - Jason Wilder's "docker-squash"

Docker-squash

- https://github.com/jwilder/docker-squash
- Trivial to use. Sample Dockerfile:

```
RUN dd if=/dev/zero of=/bigfile.zeroes \
 bs=1k count=$((1024*128))
RUN rm -f /bigfile.zeroes
RUN touch /testfile.txt
```

- Size

```
dsklopp/nonflat   ...   322.5  MB
```

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Docker-squash

- Present layer hierarchy

```
ubuntu:trusty, ubuntu:trusty-20150320
    ├─8406a4346504 Virtual Size: 188.3 MB
    │ ├─76bf86be913c Virtual Size: 322.5 MB
    │ │ └─1f79b453eaf8 Virtual Size: 322.5 MB
    │ │   └─d9b59ab2e0ad Virtual Size: 322.5 MB Tags: dsklopp/nonflat
```

- Compress it with docker-squash:

```
docker save d9b59ab2e0ad |\
./docker-squash --from 8406a4346504 -t dsklopp/flat |\
docker load
```

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Docker-squash

- The new hierarchy:

```
ubuntu:trusty, ubuntu:trusty-20150320
    ├─8406a4346504 Virtual Size: 188.3 MB
    │ ├─5aa152140bf7 Virtual Size: 188.3 MB Tags: dsklopp/flat:latest
    │ ├─76bf86be913c Virtual Size: 322.5 MB
    │ │ └─1f79b453eaf8 Virtual Size: 322.5 MB
    │ │   └─d9b59ab2e0ad Virtual Size: 322.5 MB Tags: dsklopp/nonflat
```

- Sizing:

```
dsklopp/flat      ...   188.3  MB
dsklopp/nonflat   ...   322.5  MB
```

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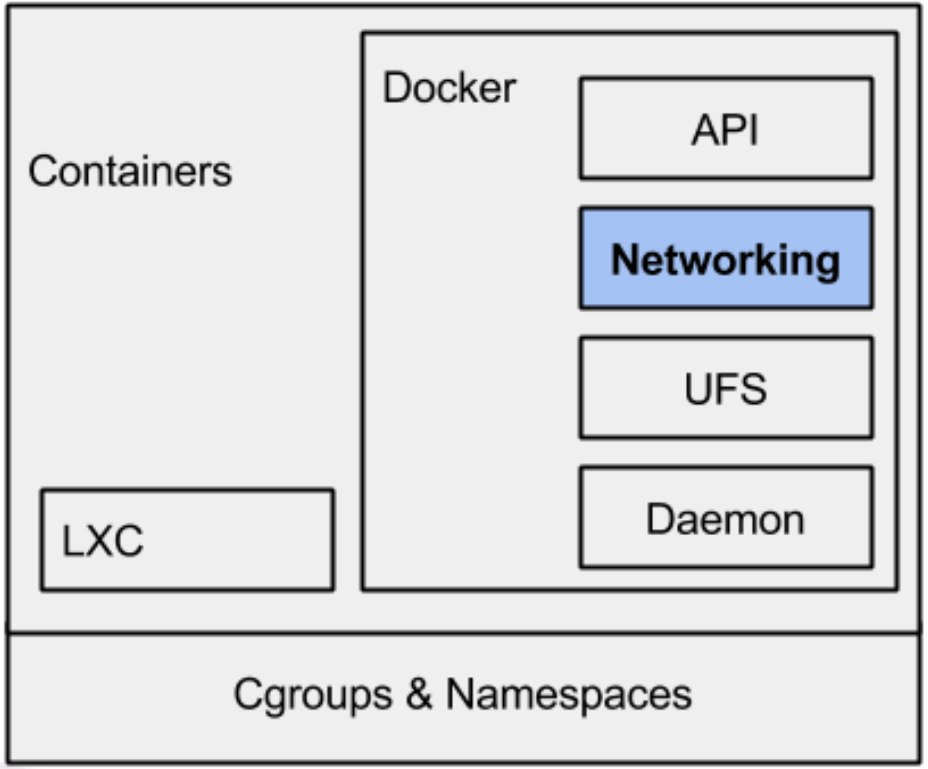
Docker-squash

- One downside is you lose layer history
- A problem if this is significant
- If the build process is automated, it rarely is.

Section
Docker Networking

- Docker Networking

Where We Are



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This Will Be Brief

- Networking deserves its own presentation to do it justice
- Docker networking is also non-trivial
- I will only go over the basics today

Default Networking

- Docker utilizes a virtual ethernet bridge
  - By default called ‘docker0’
- Containers connect via a veth interface
- Containers on docker0 can freely communicate with each other
  - Controlled by start flag ‘icc=true’, the default

Networking

- Four modes
  - None (self-explanatory)
  - Bridged (default)
  - Host
  - Shared

Bridged Networking

- Virtual Linux Ethernet bridge
- Docker default
- Dynamically or manually configured
- With icc=true (default), all containers can contact other containers.

Host Networking

- Docker containers use host network stack
- Though conceptually easy, not good practice
- Allows access to D-Bus
- Unexpected behavior may result
- Generally a bad idea

Shared Networking

- Existing container network stack is shared
- Each container PID and FS are distinct
- Only network namespace is shared.

Default Docker Networking

- Containers can reach out
- Outside cannot reach in without explicit port mappings
- Containers can communicate with other containers

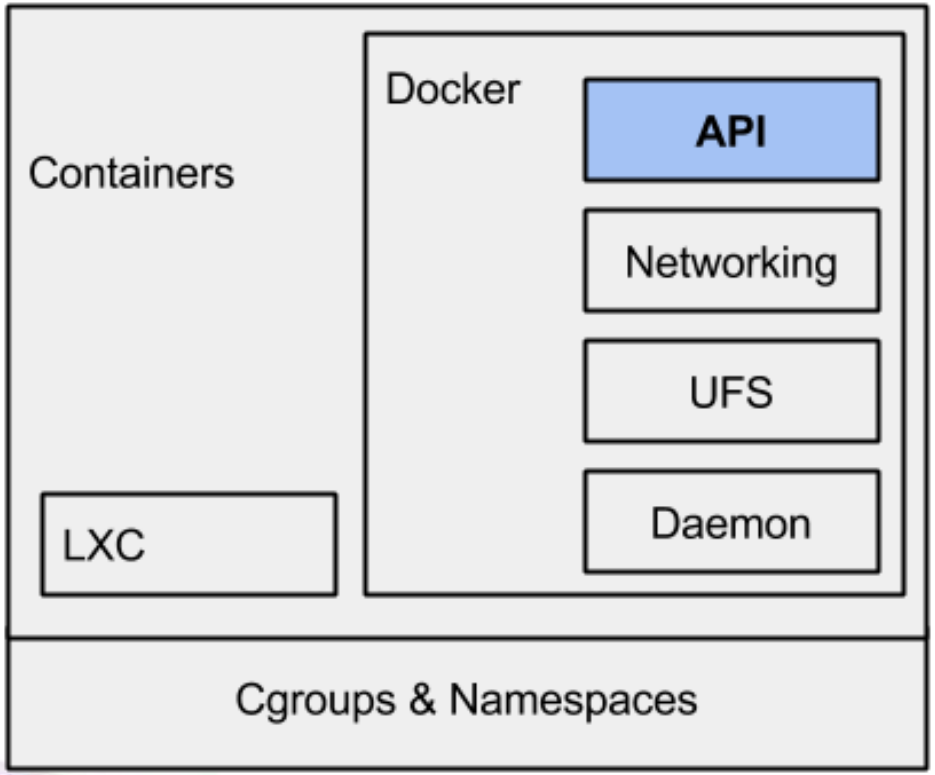
Default Docker Networking

- Ultimately, it is made up of Iptables, network namespaces, and Linux bridges (virtual switches).
  - Your limits are your imagination
- If there is interest, I can create an in depth networking presentation

Section
Docker API

- Docker API

Where We Are



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Docker API

- Has a (non) REST API via Unix Socket
  - /var/run/docker.sock
- Note: API uses an Open Schema.
  - Incorrect entries are ignored.
- There is an HTTP endpoint
  - disabled by default

Docker API via HTTP

- Disabled by default
- Pass “-H $host:$port” to daemon
  - Ubuntu: /etc/default/docker
  - Fedora: /etc/sysconfig/docker

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  - Certain operations are hijacked for STDOUT/ERR

Docker API via HTTP

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- Pass “-H $host:$port” to daemon
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- It is REST-like, but not REST
  - It does not allow querying for URI’s
  - Certain operations are hijacked for STDOUT/ERR
- https://docs.docker.com/reference/api/docker_remote_api

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Docker API Query

```
curl -sX GET 127.0.0.1:2375/info | python -m json.tool
```

Docker API Query

```
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```


```
{
    "Containers": 5,
    "Debug": 0,
    "DockerRootDir": "/var/lib/docker",
    "Driver": "devicemapper",
    "DriverStatus": [
        [
            "Pool Name",
            "docker-253:1-263795-pool"
        ],
```


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Docker API

- Queries are nice, but wouldn't it be awesome if we could create containers via the API?

Docker API

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Docker API

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  - We can
- POST /containers/create

Docker API

- POST /containers/create
- That’s easy!

Docker API

- POST /containers/create
- That’s easy!
- Pet peeve: online documentation for generating proper POST requests is scant

Docker API Launch Container

- The Docker POST requires a configuration.
- Get one from a running container
- Start an interactive container

```
docker run -t -i ubuntu:14.04 /bin/bash
```

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Docker API Launch Container

- Get the container's ID

```
curl -sX GET 127.0.0.1:2375/containers/json
```

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Docker API Launch Container

- Get the container's ID

```
curl -sX GET 127.0.0.1:2375/containers/json
```


```
[
    {
        "Command": "/bin/bash",
        "Created": 1427597350,
        "Id": "027912d4100bebc3a43bdd1c466df2142ac0cda2bddc876
        "Image": "ubuntu:14.04",
        "Names": [
            "/angry_pike"
        ],
        "Ports": [],
        "Status": "Up 32 seconds"
    }
]
```


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Docker API Launch Container

- Get the container's Configuration

```
curl -X GET 127.0.0.1:2375/containers/$ID/json
```

- Take the config output (cropped below)

```
"Config": {
    "AttachStderr": true,
    "AttachStdin": true,
    "AttachStdout": true,
    "Cmd": [
        "/bin/bash"
    ],
```

- Docker inspect will also display this information.

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Docker API Launch Container

- Modify the config to your liking, and send it as the POST body. For example

```
curl -sX POST -H "Content-Type: application/json" \
http://127.0.0.1:2375/containers/create -d '{ $CONTENT_HERE }'
```

- Where $CONTENT_HERE is the POST body you copied from before.
- Cropped output:

```
{"Id":"ae821e145e6f1e9beb4848722d2fde82d33535756c2a9625430bb1d88
```

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Docker API Launch Container

- The container isn't started yet.
- Start it with the ID returned from the POST

```
curl -sX POST -H 'Content-Type: application/json'
127.0.0.1:2375/containers/$IDNEW/start
```

- Check on your container

```
docker ps
```

```
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS
ae821e145e6f        ubuntu:14.04        "/bin/bash"         4 minutes ago       Up 2 sec
```

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Docker API

- Start / stop containers
- Import / export images
- Look at running processes
- Attach to a running container
- Extremely powerful
  - Be wary of access, it is inherently insecure

Section
Docker Management

- Docker Management

Docker Management

- In short, there aren’t.

Docker Management

- In short, there aren't.
- Ok, that was harsh.
  - This is a very new field.
  - There are a lot of newfound projects for this gap

Docker Management

- A major gap
- New field, largely untested, mostly custom
- Noteworthy Solutions
  - Swarm (official)
  - Machine
  - Compose
  - Mesos

Docker Management

- Config Management is entering the race too!
  - Chef
  - Puppet
  - Ansible

Summary

- Docker is built upon Linux Containers
  - Cgroups
  - Namespaces
  - Union File Systems
- Docker provides single-host management functionality of containers
- Containers on one system will work on another.

What We Covered

- Why containers are important
- Kernel features enabling containerization
  - cgroups
  - namespaces
- LXC and its complexities

What We Covered

- Docker Implementation
  - General operation
  - Filesystem
  - Networking
  - API
- Docker Management, or lack thereof

Summary

- We talked about the fishing rod
  - Now go fish!

Special Thanks

- Taos
- SVLUG
- GE
- Especially
  - Rachel Pecchenino
  - Kevin Dankwardt

Questions?