Containers

all the way down

Containerisation

is not

virtualisation

Containers are NOT Hypervisors

Why virtualise?

60s-70s
Big mainframes, time-sharing
CP-65 for CP/CMS OS by IBM

Why virtualise?

cheap x86

low infrastructure utilisation

Why virtualise?

cheap x86

low infrastructure utilisation

define low?

Why virtualise?

VERY LOW
infrastructure utilisation

- 5% - McKinsey's Data Center study, 2008
- 8% - Accenture paper, 2011
- 12% - Gartner, 2012

How to virtualise?

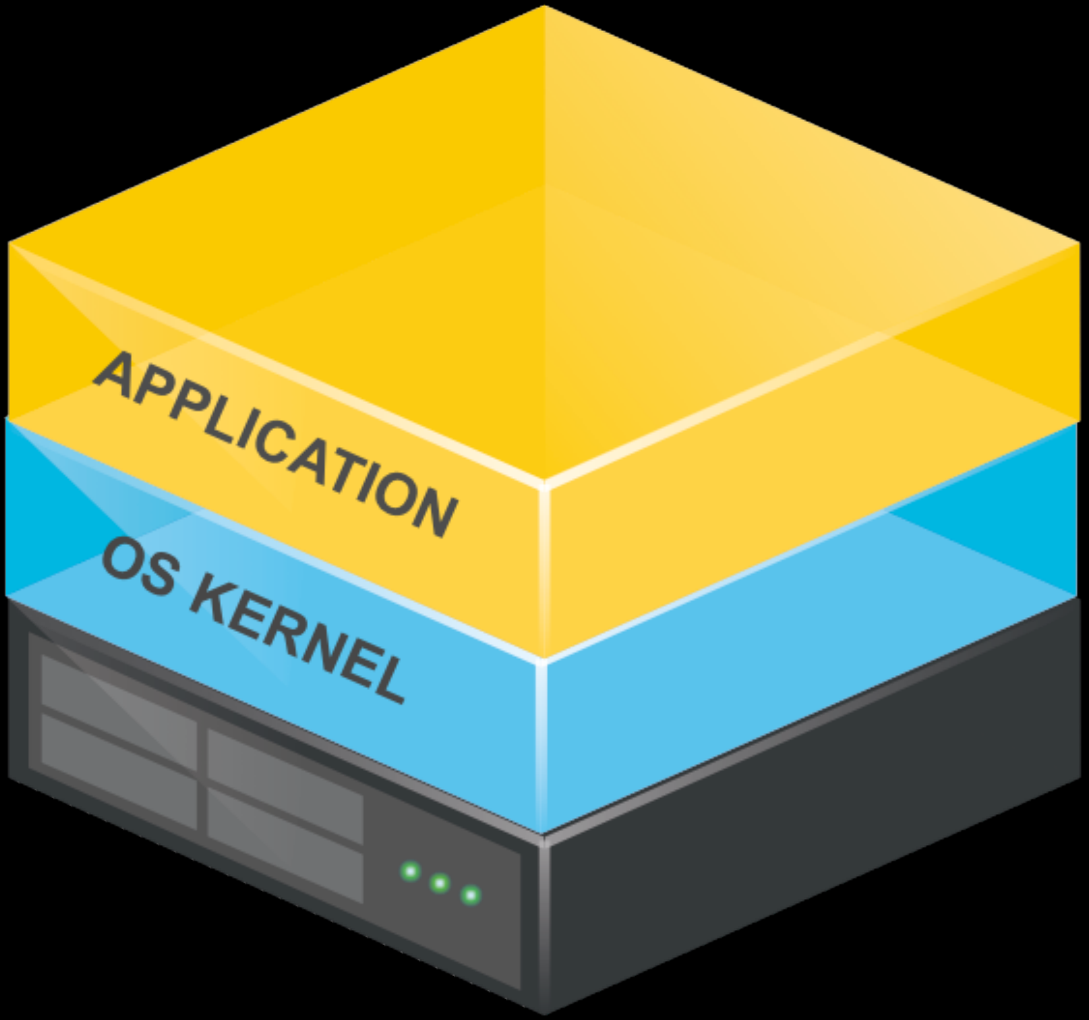
- Hypervisors
- Containers

Hypervisors

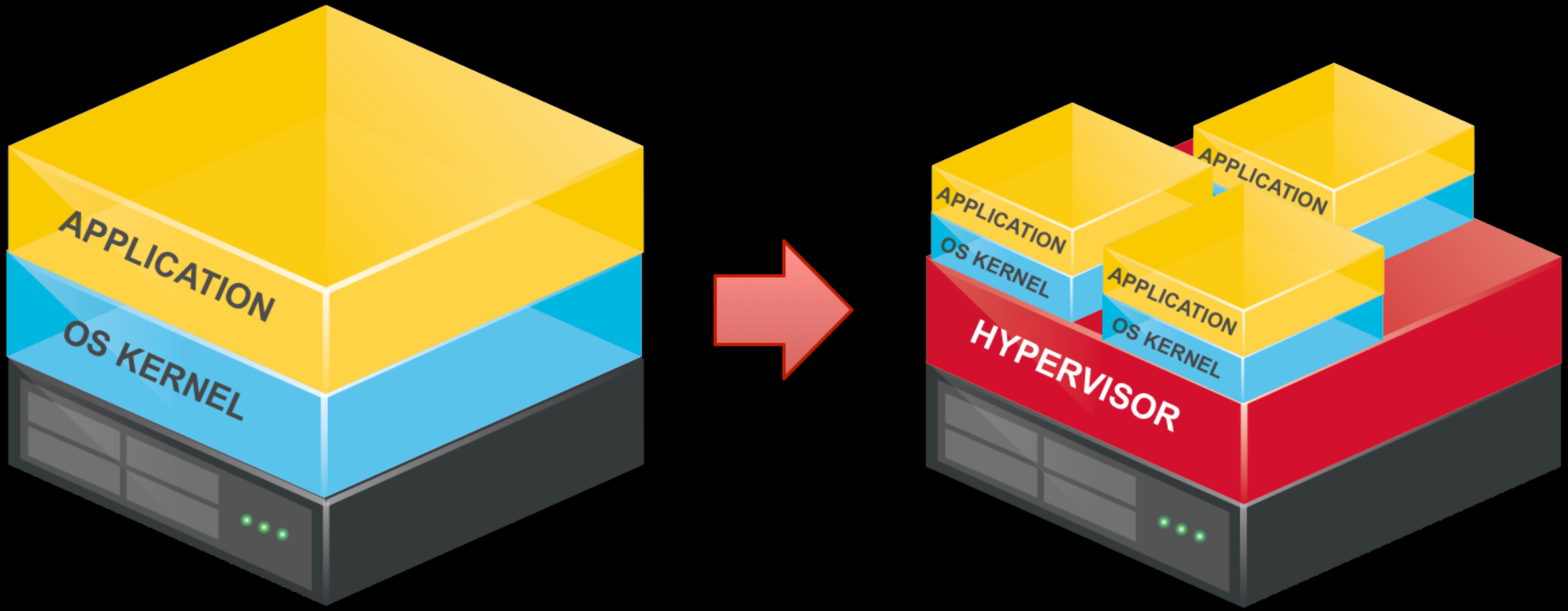
first mentioned in 1965, for IBM's system.

- 1988 - first SoftPC for Macintosh; can only run DOS, later - Win 3.x, 9x
- 1997 - Connectix VirtualPC for Macintosh, later sold to Microsoft

Hypervisors



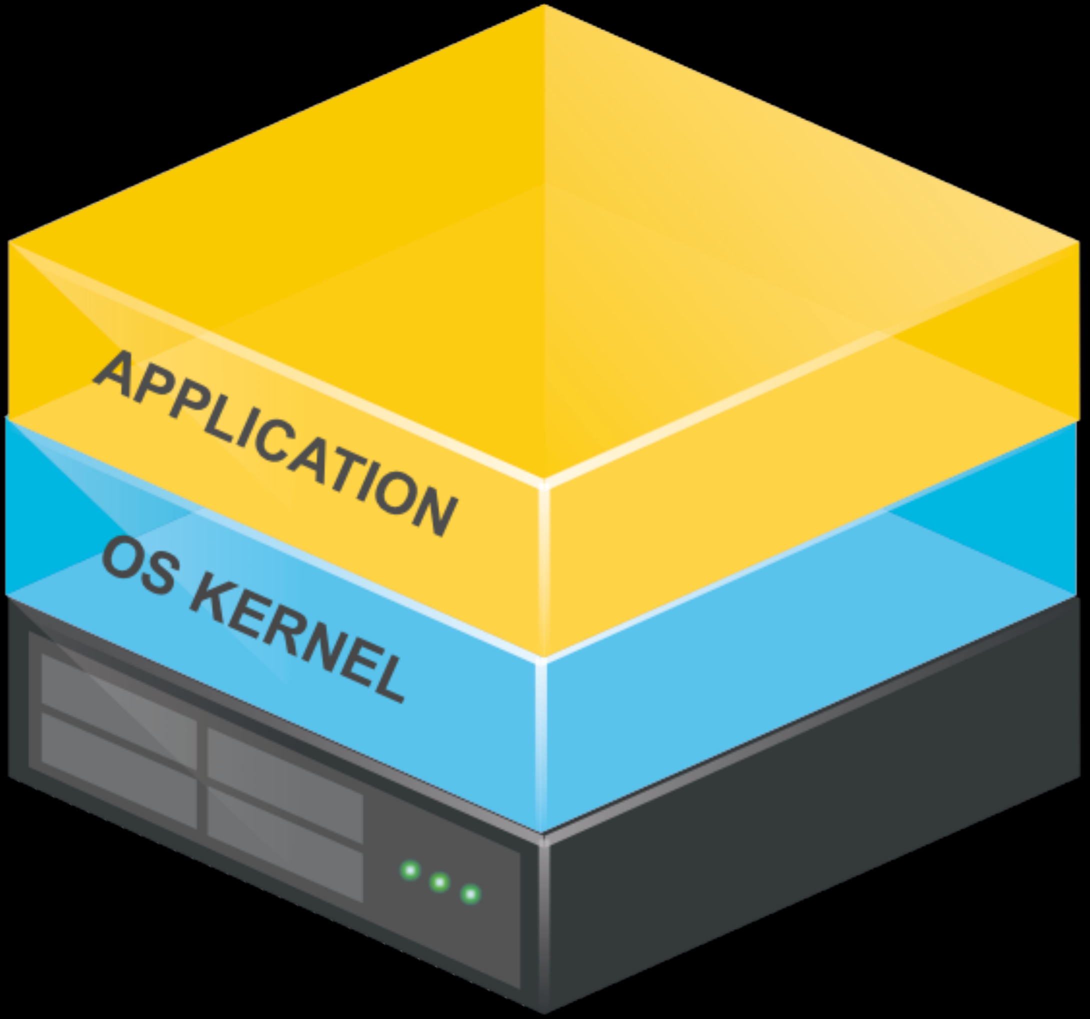
Hypervisors



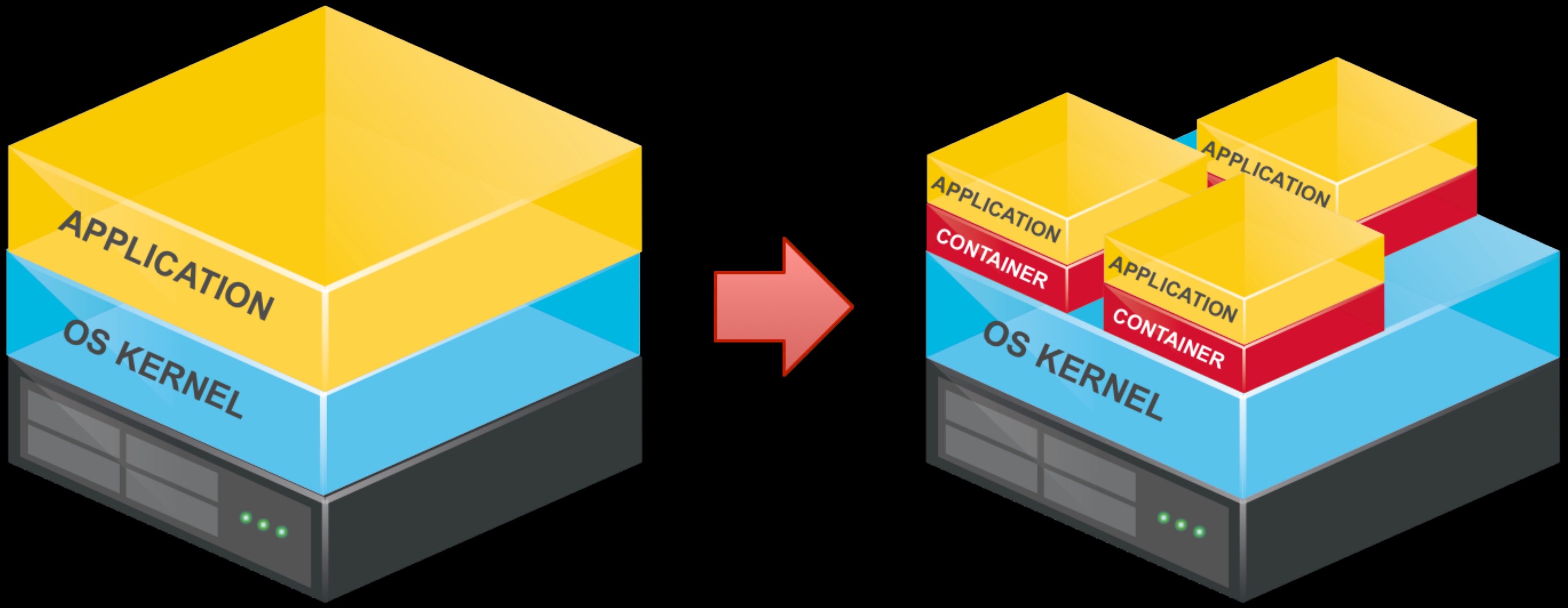
Hypervisors

- 2001 - VMWare GSX Server, x86 Windows; Connectix VirtualPC for Windows
- 2003 - Xen, open-source hypervisor
- 2005 - free VMWare Player
- 2006 - VMWare Server, free Microsoft VirtualPC
- 2007 - VirtualBox Open Source Edition

Containers



Containers



guest OS can only be of the same kind (e.g. Windows or Linux) as the host OS.

Containers

1982 - chroot (4.2BSD)

filesystem only

CHROOT

4.4BSD-Lite - sys/kern/vfs_syscalls.c

```
chroot(p, uap, retval)
// ...
{
    register struct filedesc *fdp = p->p_fd;
    int error;
    struct nameidata nd;

    if (error = suser(p->p_ucred, &p->p_acflag))
        return (error);
    NDINIT(&nd, LOOKUP, FOLLOW | LOCKLEAF, UIO_USERSPACE, uap->path, p);
    if (error = change_dir(&nd, p))
        return (error);
    if (fdp->fd_rdir != NULL)
        vrele(fdp->fd_rdir);
    fdp->fd_rdir = nd.ni_vp;
    return (0);
}
```

CHROOT

let's chroot something

```
sudo chroot -u `whoami` newroot
```

- 1982 - chroot (4.2BSD) (filesystem view only)
- 2000 - FreeBSD jail (fs + users, socket and process interaction restrictions)
- 2001 - Linux-VServer (with a kernel patch)
- 2005 - Solaris Zones (allow dedicated CPU, RAM, net-if controls, plus ZFS-powered features - snapshots and cloning)
- 2005 - OpenVZ - by SWSoft, aka Parallels (with a kernel patch)

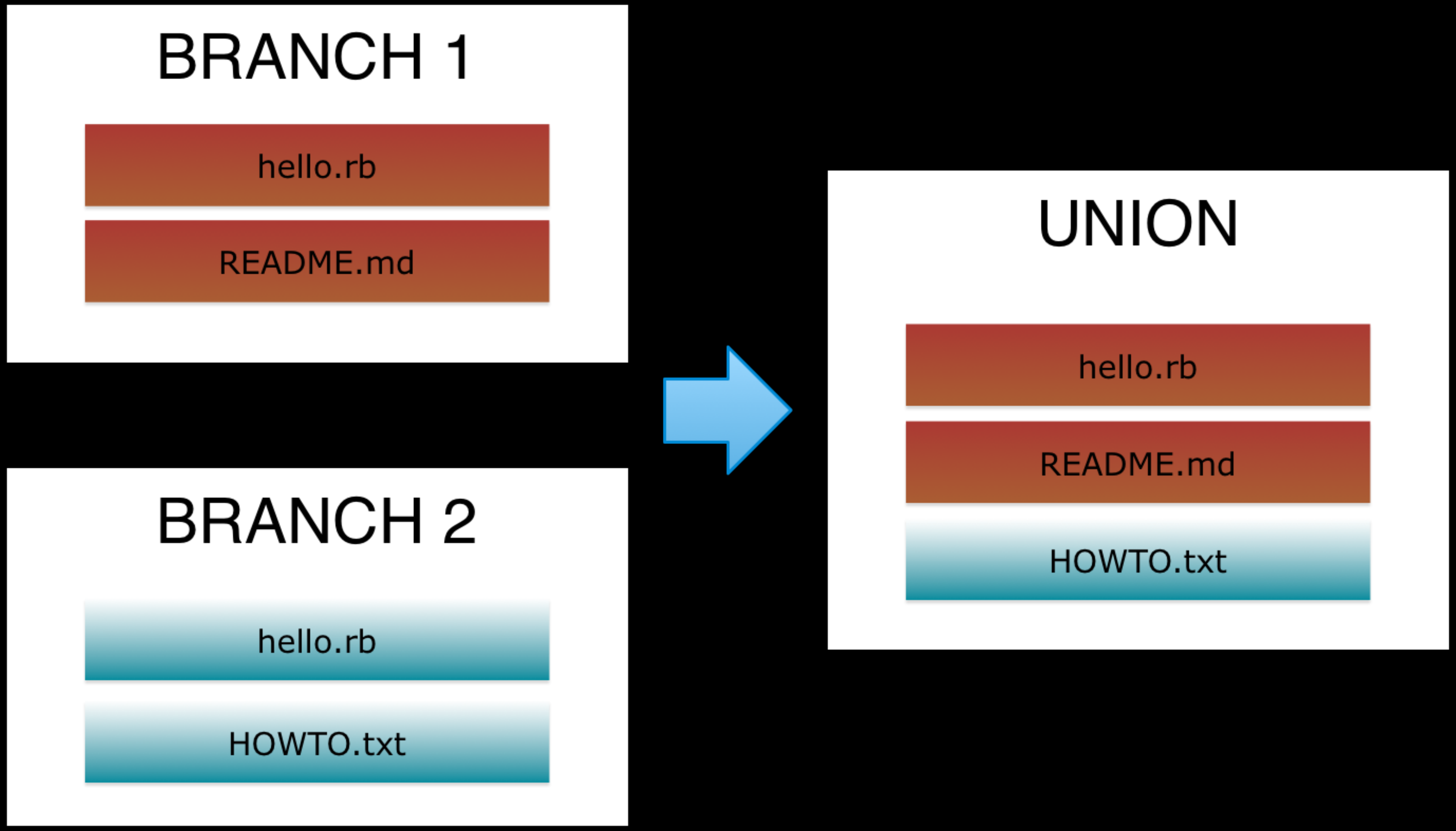
- 2008 - LXC
- 2013 - lmctfy (Google's set of tools controlling cgroups)
- 2013 - Docker (leverages Linux cgroups and namespaces - first via LXC, then libcontainer)

AuFS

Advanced Multi Layered Unification Filesystem

unite several directories (branches) into a single virtual filesystem

AUFS


BRANCH 1
hello.rb
README.md
BRANCH 2
hello.rb
HOWTO.txt
UNION
hello.rb
README.md
HOWTO.txt

AUFS

```
sudo mount -t aufs -o br=~/work/dir01:~/work/dir02 none ~/view

mount -o remount ~/view
```

Docker

- LXC
- AuFS
- Application-centric
- Toolset and ecosystem

Docker

LXC

namespaces and cgroups
process isolation

Docker

AUFS

layered filesystem (versioning)

Docker

Application-centric

**deploying applications,
not servers**

Docker

Toolset and ecosystem

- base images
- public registry
- standard containers
- third-party tools and workflows

ClickME Application

Two containers:

- Ruby (trivial Sinatra app)
- Redis

Docker on OSX

boot2docker

runs a vm on VirtualBOX,
automatically installs/configures it

Docker on OSX

boot2docker

much better than it used to be,
but sometimes still buggy

Docker on OSX

boot2docker

```
> brew install boot2docker
> boot2docker help
> boot2docker init
> boot2docker start
```

Dockerfile

container definition

Reference

just read it, it's a dozen of commands :)

LET'S BUILD A CONTAINER!

WHY? (AGAIN)

Why? (Again)

Repeatable infrastructure

Containers + Registry

Why? (Again)

Immutable infrastructure

CoreOS

Why? (Again)

Immutable infrastructure

Also a challenge - no local state/storage!

Why? (again)

Immutable infrastructure

Network everything

- logs - syslogd/fluentd/logstash,
- files - object storage (S3/Swift/Riak)

Why? (again)

Infrastructure as a code

Dockerfile

Why? (Again)

Easy preconfigured environments

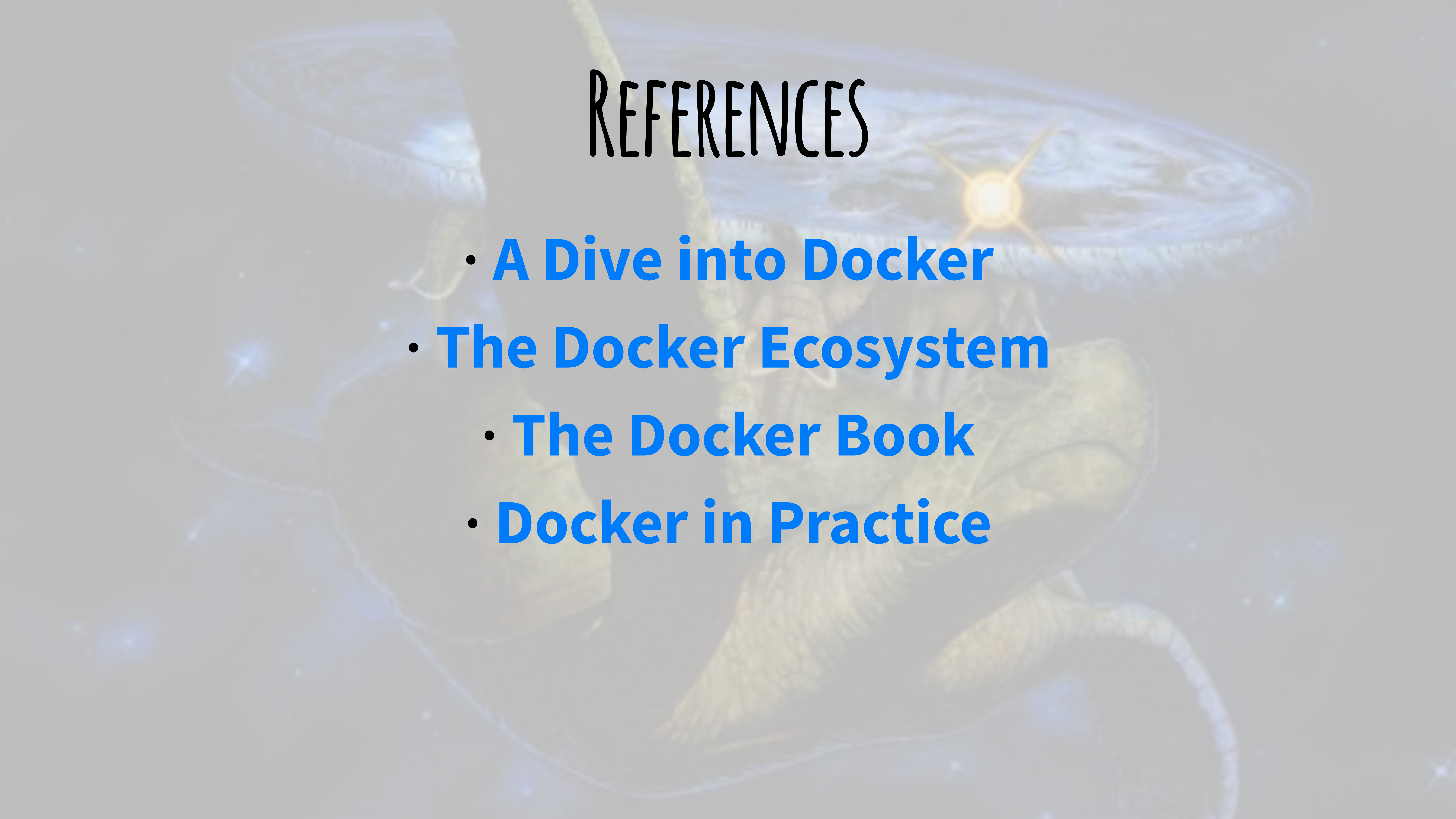
docker-compose

Why? (Again)

Composable services

docker-swarm, fleet

The cloud is coming!



References

- A Dive into Docker
- The Docker Ecosystem
- The Docker Book
- Docker in Practice