

Docker

Master the execution environment of your applications

Aurélien Dumez

Inria Bordeaux - Sud-Ouest

Tuesday, March 24th 2015

Content

1 The bad parts

2 Overview

3 Internals

4 Docker@Inria-BSO

5 Let's play

6 Conclusion

The bad parts



- 09/09/14 [Is Docker ready for production? Feedbacks of a 2 weeks hands on]
- 02/07/15 [Lets review.. Docker (again)]
- 03/06/15 [Docker, la plateforme à la mode (linuxfr)]

Overview

- Automates the deployment of applications into containers
- Starts as an internal project within dotCloud (now Docker, Inc.)
- Is not a virtualization tool (not a new Vsomething)
- Does not turn a bad programmer (or sysadmin) into a good one

Remember the keyword : **container**

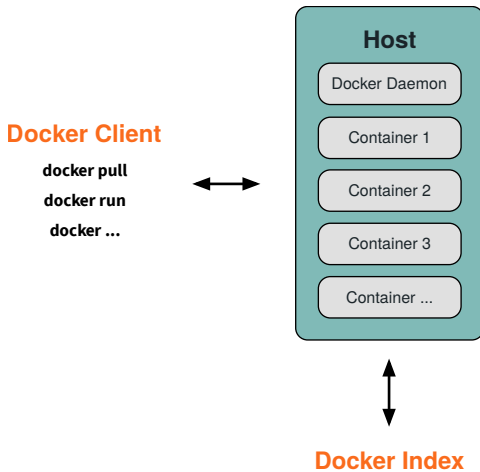
- Open-source (Apache 2.0 license)
- Written in Go (mainly because C/Java/Python/Other sucks)
- Heavily relies on Linux kernel's isolation features :
cgroups, namespaces, capabilities...
- First public release : March 2013
- Good release rate :
 - ▶ 2014 : 1.1 (Jul), 1.2 (Aug), 1.3 (Oct), 1.4 (Dec)
 - ▶ 2015 : 1.5 (Feb), 1.6 (due : Mar)

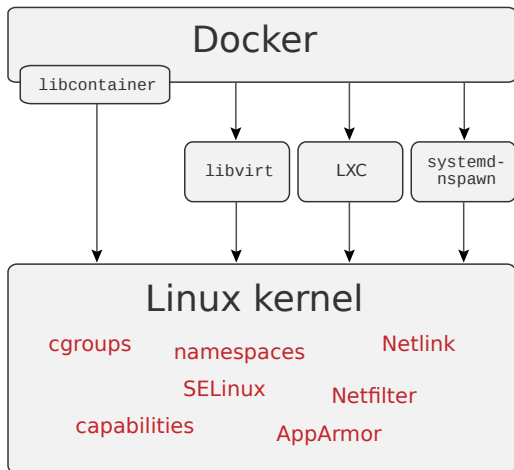
- Portable deployment across machines : simpler dependencies
- Application-centric : one container per task (not a full VM)
- Automatic build : Dockerfile
- Versioning : git-like versions tracking
- Component re-use : share images between containers
- Sharing : registry / Docker Hub

- 64-bit GNU/Linux distribution
- Kernel : 3.10+ / older with some patches (CentOS 6.5+)
- Storage backend : Device Mapper, AUFS, VFS, BTRFS
[See RedHat developer blog for more details]
- Preferably one or more security layer : SELinux, AppArmor...
[J. Petazzoni: Containers & Docker: How Secure Are They?]
- Successfully tested on :
 - ▶ Debian GNU/Linux 8
 - ▶ CentOS 6.6 (+EPEL Testing repository)
 - ▶ ArchLinux (btrfs)

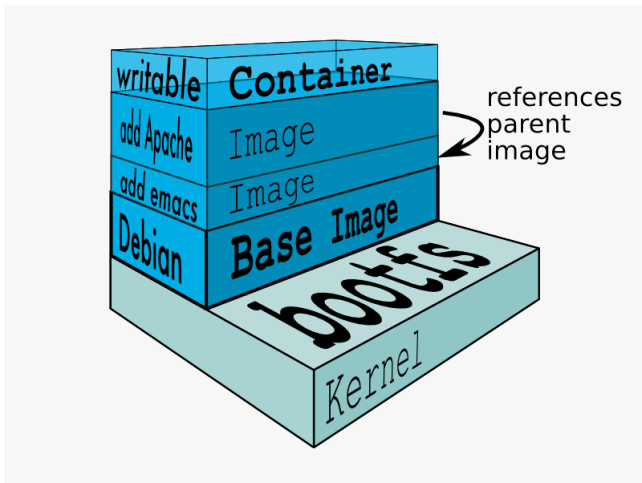
Internals

- Client-Server application
- RESTful API





- Base Image : image without parent
- Image : read-only layer on top of another image
- Container : read-write layer on top of another image



Docker@Inria-BSO

- First contact : June 2014
- Into production : November 2014
- OS : CentOS 6.6 (with EPEL Testing repository)
- Web sites powered by Docker :
 - ▶ Forum « Poppy Project »
 - ▶ Forum « Dessine-moi un Robot »
 - ▶ Forum « OpenLab Flowers »
- Other uses : web apps testing (Joomla !, WordPress...)

Let's play

Who are you ?

```
1 ~$ docker version
2 Client version: 1.3.3
3 Client API version: 1.15
4 Go version (client ): go1.3.3
5 Git commit (client ): d344625
6 OS/Arch (client): linux/amd64
7 Server version: 1.3.3
8 Server API version: 1.15
9 Go version (server): go1.3.3
10 Git commit (server): d344625
```

- Registry : public or private place to store docker's images
- Docker Hub : public registry + web interface + REST API
- User account needed to publish images
- Pricing : free for unlimited public repos + 1 private repo

```
1 ~$ docker login
2 Username: dumez
3 Password:
4 Email: aurelien.dumez@...
5 Account created. Please use the confirmation link we sent to your e-mail to activate it .
```

Security concerns ? You may run your own registry ! Really...

Search for and download an image

```

1 ~$ docker images
2 REPOSITORY      TAG          IMAGE ID      CREATED      VIRTUAL SIZE
3
4 ~$ docker search centos
5 NAME            DESCRIPTION          STARS  OFFICIAL  AUTOMATED
6 centos          The official build of CentOS.      877    [OK]
7 ansible/centos7--ansible  Ansible on CentOS7      35
8 tutum/centos    Centos image with SSH access. For the root... 13    [OK]
9 blalor/centos   Bare--bones base CentOS 6.5 image    9     [OK]
10
11 ~$ docker pull centos:7
12 Pulling repository centos
13 88f9454e60dd: Download complete
14 511136ea3c5a: Download complete
15 5b12ef8fd570: Download complete
16 Status: Downloaded newer image for centos:7
17
18 ~$ docker images
19 REPOSITORY      TAG          IMAGE ID      CREATED      VIRTUAL SIZE
20 centos          7            88f9454e60dd  13 days ago  210 MB
21 centos          centos7      88f9454e60dd  13 days ago  210 MB
22 centos          latest       88f9454e60dd  13 days ago  210 MB

```

Create and list containers

```

1  ~$ docker ps -a
2  CONTAINER ID  IMAGE  COMMAND  CREATED  STATUS  PORTS  NAMES
3
4  ~$ docker run -ti centos:7 /bin/bash
5  [root@dce6ed9c055c /]# cat /etc/os-release
6  NAME="CentOS Linux"
7  VERSION="7 (Core)"
8  ID="centos"
9  ID_LIKE="rhel fedora"
10 VERSION_ID="7"
11 PRETTY_NAME="CentOS Linux 7 (Core)"
12 ANSI_COLOR="0;31"
13 CPE_NAME="cpe:/o:centos:centos:7"
14 HOME_URL="https://www.centos.org/"
15 BUG_REPORT_URL="https://bugs.centos.org/"
16 [root@dce6ed9c055c /]# ps aux
17 USER PID %CPU %MEM VSZ  RSS TTY STAT START  TIME COMMAND
18 root  1  0.0  0.0  11752 2924 ?  Ss  13:04  0:00 /bin/bash
19 root  19  0.0  0.0  19756 2260 ?  R+  13:05  0:00 ps aux
20 [root@dce6ed9c055c /]# exit
21 exit
22
23 ~$ docker ps -a
24 CONTAINER ID  IMAGE  COMMAND  CREATED  STATUS  PORTS  NAMES
25 dce6ed9c055c  centos:7  "/bin/bash"  2 minutes ago  Exited (130) 3 seconds ago  kickass_poincare

```

Restart a container

```
1 ~$ docker start -ai dce6
2 [root@dce6ed9c055c /]# ping -c 2 linuxfr.org
3 PING linuxfr.org (88.191.250.176) 56(84) bytes of data.
4 64 bytes from prod. linuxfr .org (88.191.250.176): icmp_seq=1 ttl=49 time=16.5 ms
5 64 bytes from prod. linuxfr .org (88.191.250.176): icmp_seq=2 ttl=49 time=16.5 ms
6
7 --- linuxfr.org ping statistics ---
8 2 packets transmitted, 2 received, 0% packet loss, time 1001ms
9 rtt min/avg/max/mdev = 16.567/16.572/16.578/0.128 ms
10 [root@dce6ed9c055c /]# exit
11 ~$
```

...and yes, networking just works out of the box !

What happened in my container ?

```
1 ~$ docker logs dce6
2 [root@dce6ed9c055c /]# cat /etc/os-release
3 NAME="CentOS Linux"
4 VERSION="7 (Core)"
5 ID="centos"
6 ID_LIKE="rhel fedora"
7 VERSION_ID="7"
8 PRETTY_NAME="CentOS Linux 7 (Core)"
9 ANSI_COLOR="0;31"
10 CPE_NAME="cpe:/o:centos:centos:7"
11 HOME_URL="https://www.centos.org/"
12 BUG_REPORT_URL="https://bugs.centos.org/"
13
14 [root@dce6ed9c055c /]# ps aux
15 USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
16 root         1  0.0  0.0  11752 2924 ?        Ss   13:04   0:00 /bin/bash
17 root        19  0.0  0.0  19756 2260 ?        R+   13:05   0:00 ps aux
18 [root@dce6ed9c055c /]# exit
19 exit
20 [root@dce6ed9c055c /]# ping -c 2 linuxfr.org
21 PING linuxfr.org (88.191.250.176) 56(84) bytes of data:
22 64 bytes from prod. linuxfr .org (88.191.250.176): icmp_seq=1 ttl=49 time=16.5 ms
23 64 bytes from prod. linuxfr .org (88.191.250.176): icmp_seq=2 ttl=49 time=16.5 ms
24
25 --- linuxfr.org ping statistics ---
26 2 packets transmitted, 2 received, 0% packet loss, time 1001ms
27 rtt  min/avg/max/mdev = 16.567/16.572/16.578/0.128 ms
28 [root@dce6ed9c055c /]# exit
```

Launch multiple containers in daemon mode

```
1 ~$ docker run -d centos:7 /bin/cat /etc/hostname
2 b9d0952884d1dcb8e3a4a666088e8c34fbe3f3e8c3e3ea73dc0eb4695e0bf6e5
3
4 ~$ docker run -d centos:7 /bin/cat /etc/hostname
5 7393f6df79b73bd9a2a780d0f7bd49b711cf1f7b687eb44985d56ff81ed45f05
6
7 ~$ docker run -d centos:7 /bin/cat /etc/hostname
8 7c9011c9867a52810322c364831baa706572b15e5f2ff04af1eb1d17b876b07f
9
10 ~$ docker ps -a
11 CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORTS          NAMES
12 7c9011c9867a   centos:7  "/bin/cat /etc/hostn    2 seconds ago   Exited (0)     2 seconds ago  jolly_goodall
13 7393f6df79b7   centos:7  "/bin/cat /etc/hostn    3 seconds ago   Exited (0)     3 seconds ago  insane_carson
14 b9d0952884d1   centos:7  "/bin/cat /etc/hostn    5 seconds ago   Exited (0)     4 seconds ago  happy_feynman
15 dce6ed9c055c   centos:7  "/bin/bash"             58 minutes ago  Exited (0)     10 minutes ago  kickass_poincare
```


Some housekeeping

```
1 ~$ docker ps -a
2 CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
3 7c9011c9867a centos:7 "/bin/cat /etc/hostn 2 seconds ago Exited (0) 2 seconds ago jolly_goodall
4 7393f6df79b7 centos:7 "/bin/cat /etc/hostn 3 seconds ago Exited (0) 3 seconds ago insane_carson
5 b9d0952884d1 centos:7 "/bin/cat /etc/hostn 5 seconds ago Exited (0) 4 seconds ago happy_feynman
6 dce6ed9c055c centos:7 "/bin/bash" 58 minutes ago Exited (0) 10 minutes ago kickass_poincare
7
8 ~$ docker rm 7c 73 b9
9 7c
10 73
11 b9
12 ~$ docker ps -a
13 CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
14 dce6ed9c055c centos:7 "/bin/bash" 58 minutes ago Exited (0) 10 minutes ago kickass_poincare
```

Did you say : "Lego[®] bricks" ?

- 1 `docker run --name some_mysql -e MYSQL_ROOT_PASSWORD=mysecretpassword -d -P mysql`
- 2 `docker run --name some_wordpress --link some_mysql:mysql -p 127.0.0.1:8080:80 -d wordpress`

The screenshot shows a web browser window with the address bar set to 'localhost:8080'. The page content is as follows:

- Dockerized WP**
Un site utilisant WordPress
- Recherche...
- ARTICLES RÉCENTS**
Bonjour tout le monde !
- Bonjour tout le monde !**
- Bienvenue dans WordPress. Ceci est votre premier article. Modifiez-le ou supprimez-le, puis lancez-vous !
- 19 mars 2015 1 Comment

No magic inside

```
1 ~$ docker exec -ti 58 /bin/bash
2 root@5887fa436734:/var/www/html# env
3 [.....]
4 HOSTNAME=5887fa436734
5 MYSQL_ENV_MYSQL_ROOT_PASSWORD=mysecretpassword
6 MYSQL_PORT_3306_TCP_PORT=3306
7 MYSQL_PORT_3306_TCP=tcp://172.17.0.2:3306
8 MYSQL_ENV_MYSQL_VERSION=5.6.23
9 MYSQL_NAME=/some_wordpress/mysql
10 MYSQL_PORT_3306_TCP_PROTO=tcp
11 MYSQL_PORT_3306_TCP_ADDR=172.17.0.2
12 MYSQL_ENV_MYSQL_MAJOR=5.6
13 MYSQL_PORT=tcp://172.17.0.2:3306
14
15 root@5887fa436734:/var/www/html# cat /etc/hosts
16 [.....]
17 172.17.0.3 5887fa436734
18 172.17.0.2 mysql
```

Dockerfile

```
1 FROM centos:6
2 MAINTAINER Aurelien Dumez <aurelien.dumez@inria.fr>
3 RUN yum -y update; yum clean all
4 RUN yum -y install httpd; yum clean all
5 RUN mkdir -p /var/www/html
6 ADD index.html /var/www/html/
7 ADD start.sh /
8 EXPOSE 80
9
10 #CMD ["/usr/sbin/httpd", "-DFOREGROUND"]
11 CMD ["/bin/bash", "/start.sh"]
```

Build

```
1 ~$ docker build --rm -t dumez/centos_httpd .
2 Sending build context to Docker daemon 4.608 kB
3 Sending build context to Docker daemon
4 Step 0 : FROM centos:6
5 ----> f6808a3e4d9e
6 [.....]
7 Step 8 : CMD /bin/bash /start.sh
8 ----> Running in fd917c365721
9 ----> 80557bbfc1d0
10 Removing intermediate container fd917c365721
11 Successfully built 80557bbfc1d0
12 ~$
```

Step by step

```
1 ~$ docker history dumez/centos_httppd
2 IMAGE          CREATED          CREATED BY          SIZE
3 80557bbfc1d0   23 hours ago    /bin/sh -c #(nop) CMD [/bin/bash /start.sh] 0 B
4 d79a897fa0a6   23 hours ago    /bin/sh -c #(nop) EXPOSE map[80/tcp:{}] 0 B
5 e271b2439c32   23 hours ago    /bin/sh -c #(nop) ADD file:f70778d9d3db9a13c0 63 B
6 55049b1cdb19   23 hours ago    /bin/sh -c #(nop) ADD file:302d28059438a7495f 156 B
7 a28e0f8428fe   23 hours ago    /bin/sh -c mkdir -p /var/www/html 0 B
8 437ee40ad1d5   23 hours ago    /bin/sh -c yum -y install httpd; yum clean al 29.95 MB
9 fef0a9e288f0   23 hours ago    /bin/sh -c yum -y update; yum clean all 13.42 MB
10 3764a81cd6e5   23 hours ago    /bin/sh -c #(nop) MAINTAINER Aurelien Dumez < 0 B
11 f6808a3e4d9e   2 weeks ago     /bin/sh -c #(nop) ADD file:2b2b26209d285cd1a9 202.6 MB
12 5b12ef8fd570   5 months ago    /bin/sh -c #(nop) MAINTAINER The CentOS Proje 0 B
13 511136ea3c5a   21 months ago   0 B
```

Connect to a running container

```
1 ~$ docker run -d -P dumez/centos_http
2 b71600b5b407286248e0cc0d0af2685b9770fc3a822885beab901e368dbe4068
3
4 ~$ docker exec -ti b71 /bin/bash
5 [root@b71600b5b407 /]# ps aux
6 USER      PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
7 root         1   0.0  0.0   11360 2344 ?        Ss   15:26   0:00 /bin/bash /start .sh
8 root         9   0.0  0.0   175336 6344 ?        Ss   15:26   0:00 /usr/sbin/httpd
9 root        10   0.0  0.0    4164  456 ?        S    15:26   0:00 tail -f /var/log/httpd/access_log
10 apache     11   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
11 apache     12   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
12 apache     13   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
13 apache     14   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
14 apache     15   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
15 apache     16   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
16 apache     17   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
17 apache     18   0.0  0.0   175336 3860 ?        S    15:26   0:00 /usr/sbin/httpd
18 root        19   2.0  0.0   14784 3004 ?        S    15:26   0:00 /bin/bash
19 root        32   0.0  0.0   16668 2140 ?        R+   15:26   0:00 ps aux
```



Hello Docker !

```
1 $ docker logs -f b7
2 172.17.42.1 -- [19/Mar/2015:15:31:19 +0000] "GET / HTTP/1.1" 200 156 "-" "Mozilla/5.0
3 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2272.76 Safari/537.36"
4 172.17.42.1 -- [19/Mar/2015:15:31:19 +0000] "GET /favicon.ico HTTP/1.1" 404 287 "-" "Mozilla/5.0
5 (X11; Linux x86_64) AppleWebKit/537.36 (KHTML, like Gecko) Chrome/41.0.2272.76 Safari/537.36"
```

Conclusion

- Form your own opinion : use Docker
- Don't stay alone : use the Hub
- Docker can really save your time (Discourse@Inria-BSO)
- Docker evolves quickly : stay tuned

Thanks ! Questions ?