Deploying containers and managing them on multiple Docker hosts

docker

Outline

- why?
- mix
- mux
- allocating ressources
- general scheduling
- networking
- discussion

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Why?

- Docker is awesome on a single host
- how do you deploy on multiple hosts?
- how do you satisfy constraints?
  (ressources like CPU, RAM, disk; latency...)
- how do you link containers?

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Dockermix

- YAML description of your deployment
- script in Flang to synchronize file and cluster

- https://github.com/toscanini/maestro
  (original version)

- http://github.com/signalfuse/maestro-ng
  (new version, actively developed)

```
# multi-node ZooKeeper + multi-node Kafka for Maestro.
ships:
  # docker_port remains at default 4243 on all our hosts
  vm1:
    ip: 192.168.10.2
  vm2:
    ip: 192.168.11.2
services:
  # 2-node ZooKeeper cluster.|
  zookeeper:
    image: mpetazzoni/zookeeper:3.4.5
    instances:
      zk-node-1:
        ship: vm1
        ports:
          client: 2181
          peer: 2888
          leader_election: 3888
        volumes:
          /var/lib/zookeeper: /home/vagrant/data/zookeeper
      zk-node-2:
        ship: vm2
        ports:
          client: 2181
          peer: 2888
          leader_election: 3888
        volumes:
          /var/lib/zookeeper: /home/vagrant/data/zookeeper
  # 2-node Kafka cluster, requires ZooKeeper.
  kafka:
    image: mpetazzoni/kafka:latest
    requires: [zookeeper]
    ...
```

p:work/maestro h:max>

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Dockermux

- my other VM is a container
- and this is how I ship

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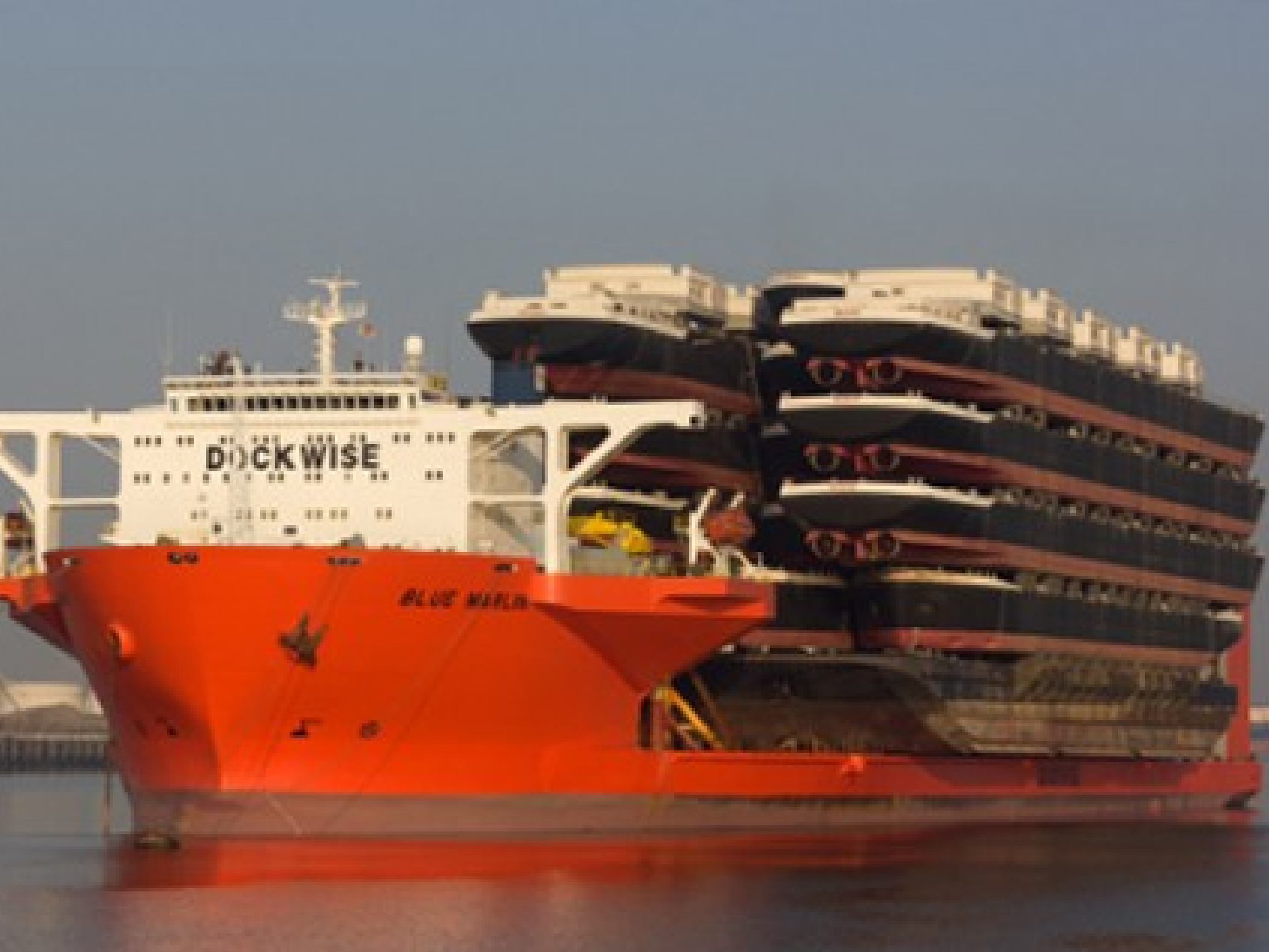
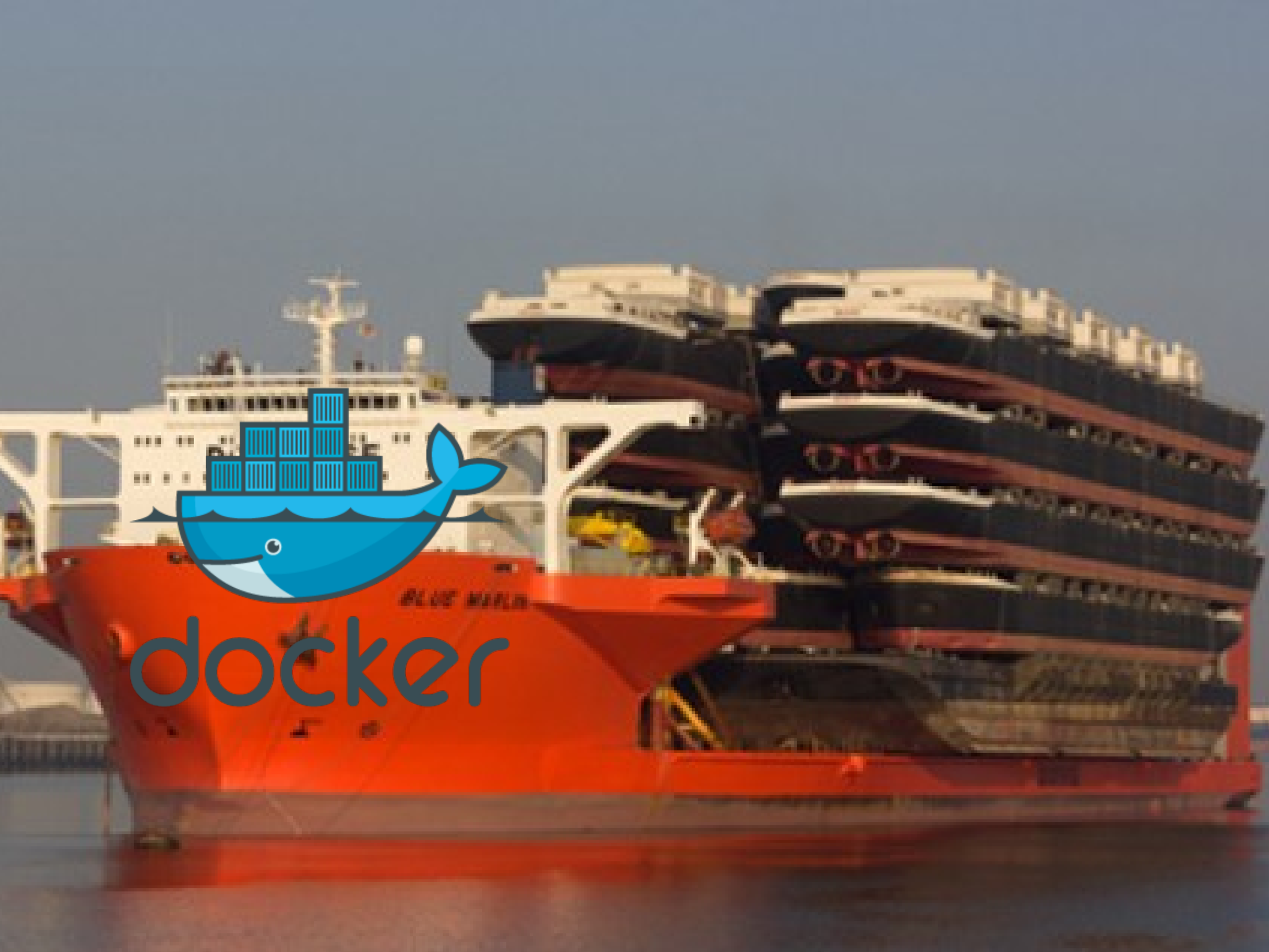
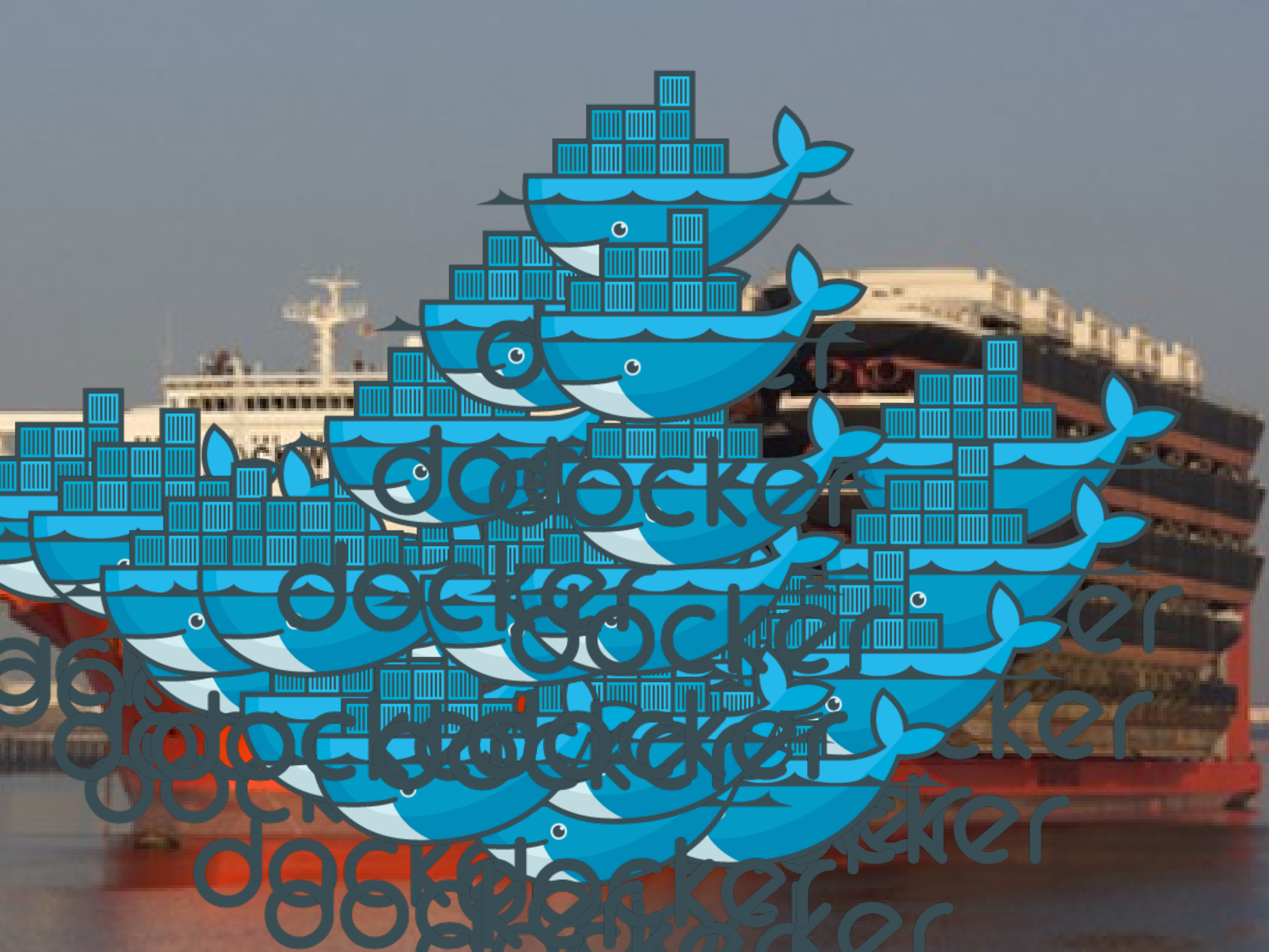

DOCKWISE


docker


docker

Dockermux

- Docker multiplexer: single API endpoint
- talk to it with the regular Docker API
- it talks to many Docker hosts

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Dockermux: load balancing

- docker run -name webfront_red
- docker run -name webfront_green
- docker run -name webfront_blue
- docker run -name <group>_<member>

→ never deploy two members of the same group on the same hosts

Dockermux: affinity

- docker run -name cms_www
- docker run -name cms_db
- docker run -name cms_cache
- docker run -name <group>_<member>

→ always deploy members of the same group on the same hosts

docker

Dockermux: provisioning

- docker run -name <group>_<member>

→ spin up new VMs for each <group>,
for security reasons

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Dockermux: linking

- docker run -name webdb
- docker run -name webfront -link webdb:db

→ if they end up on different hosts,
setup an ambassador/proxy container

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Allocating CPU and RAM

- docker run -c $CPU_SHARES -m $RAM_MB

Docker API will soon expose:

- total CPU/RAM
- allocated CPU/RAM
- used CPU/RAM

WARNING: memory metrics are tricky!

docker

Memory metrics

- free

```
jpetazzo@tarrasque:~$ free
             total       used       free     shared    buffers     cached
Mem:       8076564    7019656    1056908          0          8    2634528
-/+ buffers/cache:    4385120    3691444
Swap:            0          0          0
```

- this is useless

docker

Memory metrics

- cat /proc/meminfo

```
MemTotal:        8076564 kB
MemFree:         1055260 kB
Buffers:               8 kB
Cached:          2634528 kB
SwapCached:            0 kB
Active:          3198088 kB
Inactive:        1407516 kB
Active(anon):    1986692 kB
Inactive(anon):   185252 kB
Active(file):    1211396 kB
Inactive(file):  1222264 kB
Unevictable:           0 kB
Mlocked:               0 kB
SwapTotal:             0 kB
SwapFree:              0 kB
Dirty:               144 kB
Writeback:             0 kB
AnonPages:       1971208 kB
Mapped:          2402276 kB
Shmem:            200876 kB
Slab:             148020 kB
SReclaimable:      90680 kB
SUnreclaim:        57340 kB
KernelStack:        4936 kB
PageTables:        43928 kB
NFS_Unstable:          0 kB
Bounce:                0 kB
WritebackTmp:          0 kB
CommitLimit:     4038280 kB
Committed_AS:    8365088 kB
VmallocTotal:   34359738367 kB
VmallocUsed:       357696 kB
VmallocChunk:   34359349628 kB
HardwareCorrupted:     0 kB
AnonHugePages:         0 kB
HugePages_Total:       0
HugePages_Free:        0
HugePages_Rsvd:        0
HugePages_Surp:        0
Hugepagesize:       2048 kB
DirectMap4k:      210384 kB
DirectMap2M:     8056832 kB
```

- GRRRREAT

Memory metrics

- cat /sys/fs/cgroup/memory/memory.stat

```
cache 2700967936
rss 1977851904
rss_huge 0
mapped_file 275435520
swap 0
pgpgin 104106567
pgpgout 102964277
pgfault 140459553
pgmajfault 3858
inactive_anon 168316928
active_anon 1993658368
inactive_file 1258921984
active_file 1257791488
unevictable 0
hierarchical_memory_limit 9223372036854775807
hierarchical_memsw_limit 9223372036854775807
total_cache 2700967936
total_rss 1977851904
total_rss_huge 0
total_mapped_file 275435520
total_swap 0
total_pgpgin 104106567
total_pgpgout 102964277
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total_inactive_file 1258921984
total_active_file 1257791488
total_unevictable 0
```

- slightly better...

Memory metrics

- cat /sys/fs/cgroup/memory/memory.stat

- this looks better

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Memory metrics

- cat /sys/fs/cgroup /memory /memory.stat

- but you want *this*

```
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Scheduling?

- I have a cluster
  - RAM, CPU, disk
  - different locations
- I want to run stuff
  - using specific amount of ressources
  - without overcommitting nodes
  - with location constraints
    (same node for latency; different nodes for HA)

docker

Ideas for scheduling

- mesos
- omega
- scampi (Flynn)
- ...

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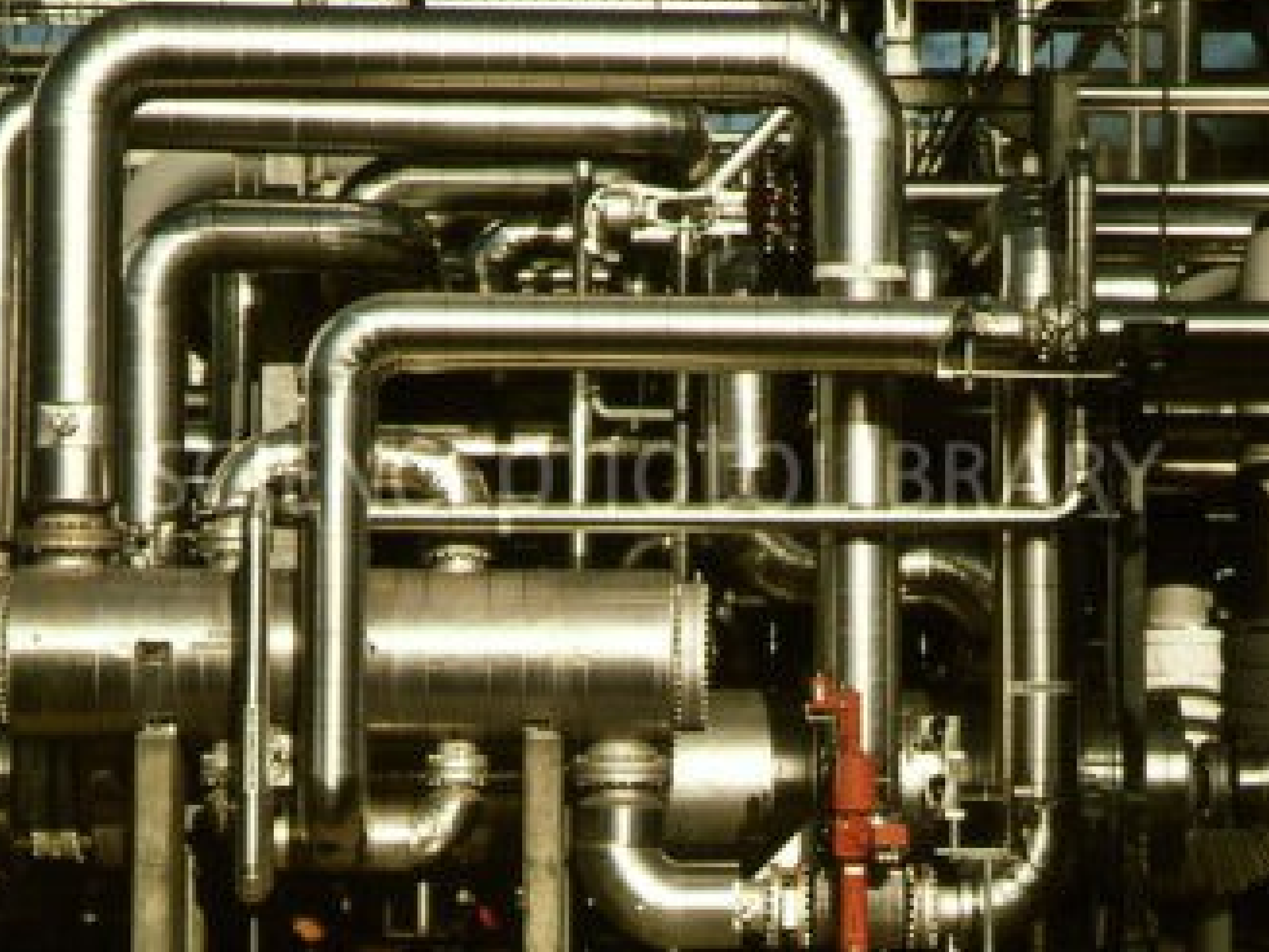
Networking

- sometimes, you need to expose *range of ports*
- or completely arbitary ports
- or non-IP protocols
- or you have special needs:
  - more than 1 Gb/s in containers
  - more than 1,000 connections/s
  - more than 100,000 concurrent connections

Get rid of the overhead

- use openvswitch
- bridge a container directly with a NIC
  (remove iptables out of the equation)
- move a (macvlan) NIC to a container
  (a bit of overhead; multi-tenant)
- move a (physical) NIC to a container
  (zero overhead; single-tenant)
- move a (virtual function) NIC to a container
  (if your hardware supports it)


LIBRARY

Pipework

- sidekick script for Docker
- I replaced the plumber with
  a very small small shell script

```
pipework br1 $APACHE 192.168.1.1/24
pipework br1 $MYSQL 192.168.1.2/24
pipework br1 $CONTAINERID 192.168.4.25/20@192.168.4.1
pipework eth2 $(docker run -d hipache) 50.19.169.157
pipework eth3 $(docker run -d hipache) 107.22.140.5
pipework br0 $(docker run -d zmqworker) dhcp fa:de:b0:99:52:1c
```

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USEFUL LINKS*

- Dockermix version recommended by Petazzoni Mafia:
  http://github.com/signalfuse/maestro-ng
- Extremely Awesome Blog Post About Containers Metrics!!!
  http://jpetazzo.github.io/2013/10/08/docker-containers-metrics/
- Shipping ship to ship shipping ships:
  http://en.wikipedia.org/wiki/MV_Blue_Marlin
- Another story involving stuff in containers:
  http://en.wikipedia.org/wiki/Dexter_Morgan
- Pull request to add CPU/RAM allocation to Docker API:
  https://github.com/dotcloud/docker/pull/2607
- Pipework
  https://github.com/jpetazzo/pipework

*Limitations apply.