

Docker Image Development

Best practices for creating Docker images

[DVLP DNVR](#) | Denver, CO | 2018-10-18

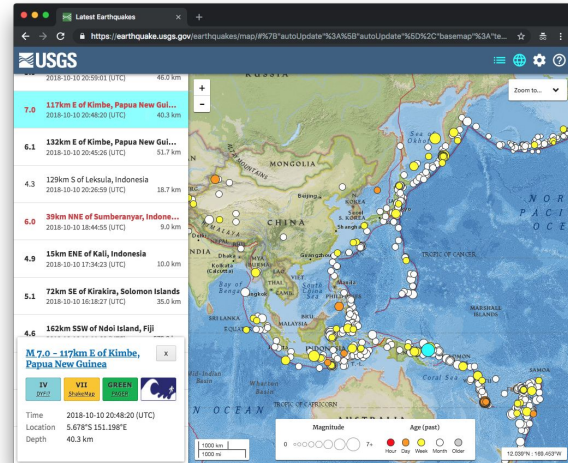
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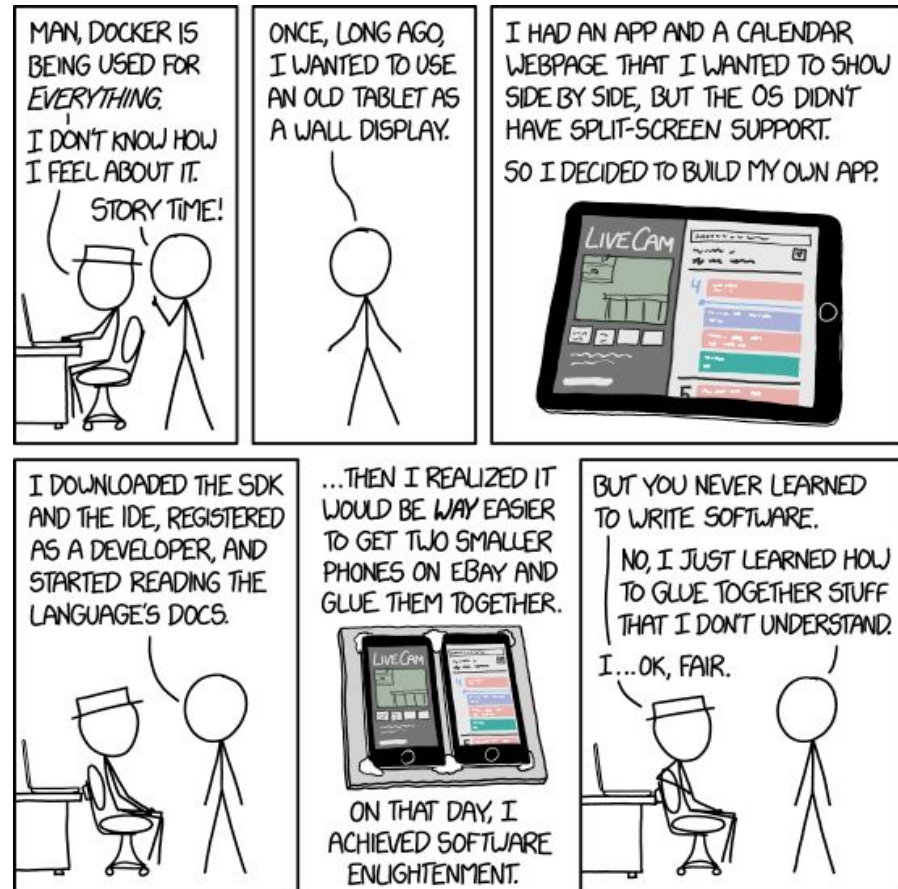
United States Geological Survey
National Earthquake Information Center

<https://earthquake.usgs.gov/>



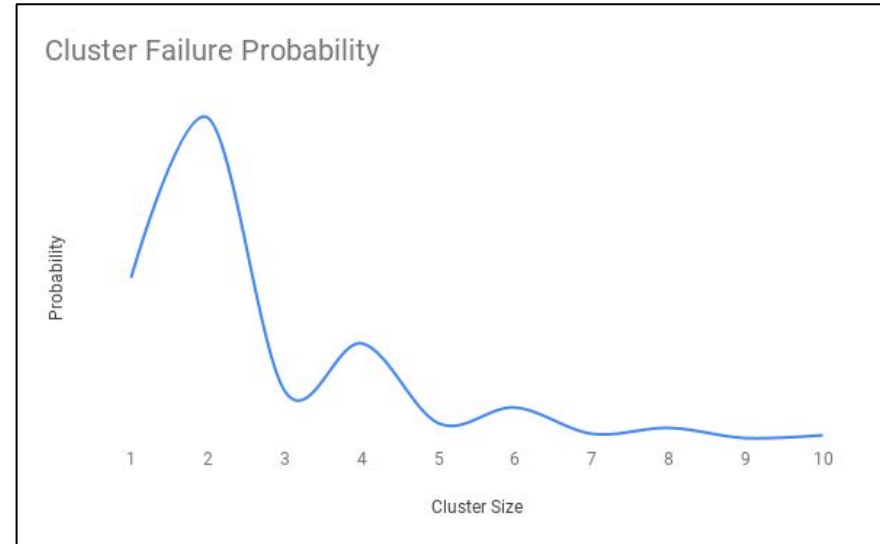
Scope / Outline

- Infrastructure
- Image Development
- Deployment Considerations



Infrastructure

- Servers
 - Managers/workers
 - Labels
- Image Registry
 - Trusted/public
 - Signing/scanning
- Automation
 - Build, test, deploy



$$\text{Cluster Failure* Probability} = \binom{N}{K+1} \cdot P^{(K+1)}$$

N : Number of nodes in the cluster

K : Cluster tolerance

P : Probability of any single node failing

*[Raft consensus](#) can not be reached. Existing replicas continue to function, but no action can be taken to change/correct current state.

Automation

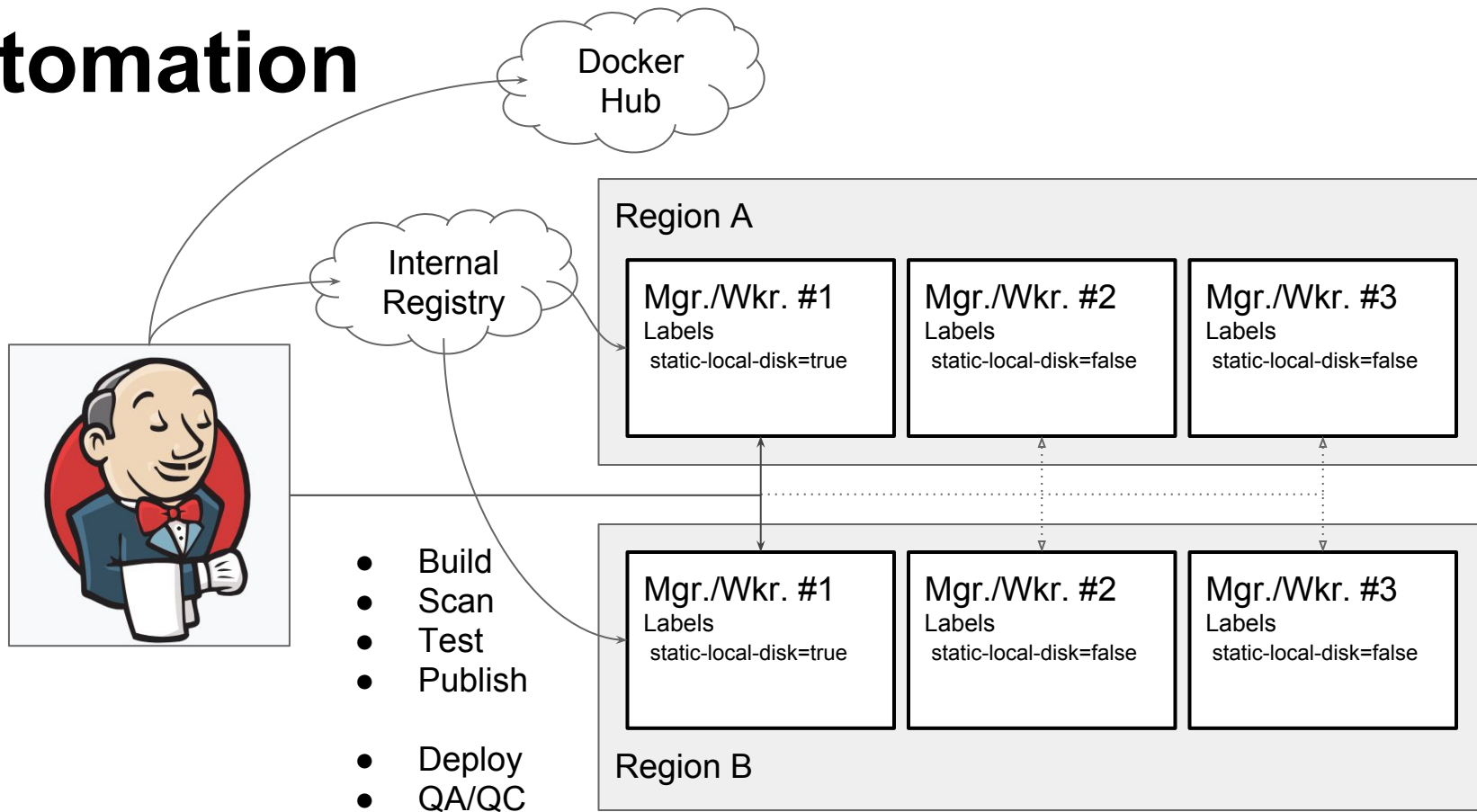


Image Development

Dockerfile

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

- **ARG**
- FROM
- ENV
- LABEL
- RUN
- USER
- WORKDIR
- **COPY**
- EXPOSE
- **HEALTHCHECK**
- STOPSIGNAL
- **ENTRYPOINT / CMD**

ARG

In Dockerfile (provides a default)

```
ARG name=value
```



On command line (provides preferred value)

```
$ docker build --build-arg name=value ..
```

Can be used before FROM to change base image.

Multi-Stage Builds

Example: [Dockerfile](#)

- Help keep distributed image size small
- Download install build tools in builder stage
- Copy artifacts out of builder stage into distributable image

COPY

In general, copies files/directories from build context to image file system.

- `--from=stage`
- `--chown=user:group`

```
COPY --from=buildenv \  
    --chown=usgs-user:usgs-user \  
    /earthquake-eventpages/dist/ \  
    /usr/share/nginx/html/BASE_HREF/  
  
COPY --from=buildenv \  
    --chown=usgs-user:usgs-user \  
    /earthquake-eventpages/metadata.json \  
    /usr/share/nginx/html/BASE_HREF/metadata.json
```

HEALTHCHECK

Necessary to avoid downtime during upgrades.

- timeout
- interval
- start-period
- retries
- command

```
HEALTHCHECK \
  --interval=20s \
  --timeout=5s \
  --start-period=1m \
  --retries=2 \
  CMD \
  ${HEALTHCHECK_SCRIPT}
```

Healthchecks

```
1 #!/bin/bash -e
2
3 host=$(hostname -i || echo '127.0.0.1');
4 user="${POSTGRES_USER:-postgres}";
5 db="${POSTGRES_DB:-$user}";
6 export PGPASSWORD="${POSTGRES_PASSWORD:-}";
7
8 args=(
9     --host "${host}"
10    --username "${user}"
11    --dbname "${db}"
12    --quiet --no-align --tuples-only
13 );
14
15 select=$(echo 'SELECT 1' | psql "${args[@]}");
16 result=$?;
17
18 if [[ $result -eq 0 && $select -eq 1 ]]; then
19     echo '[HEALTHCHECK] Database up and accepting connections.';
20     exit 0;
21 fi
22
23 echo '[HEALTHCHECK] Database not healthy.';
24 exit 1;
25
```

```
1 #!/bin/bash -e
2
3 host=$(hostname -i || echo '127.0.0.1');
4 port="${PORT:-8000}";
5 mount_path="${MOUNT_PATH:-/ws/designmaps}";
6
7 args=(
8     -s
9     -o /dev/null
10    -w '%{http_code}'
11    -A 'Internal Healthcheck'
12    "http://${host}:${port}${mount_path}/"
13 );
14
15 http_code=$(curl "${args[@]}");
16 result=$?;
17
18 if [[ $result -eq 0 && $http_code -eq 200 ]]; then
19     echo '[HEALTHCHECK] Webserver up and accepting connections.';
20     exit 0;
21 fi
22
23 echo '[HEALTHCHECK] Webserver not healthy.';
24 exit 1;
25
```

Another example: [healthcheck.sh](#)

Demo

<https://github.com/emartinez-usgs/dvlp-dnvr-demo/tree/master/healthcheck>

ENTRYPOINT / CMD

- Use *exec* form of ENTRYPOINT instruction to specify how the container starts
 - Include *required* arguments here
- Use *exec* form of CMD instruction to specify defaults for optional arguments
- Important to understand the difference

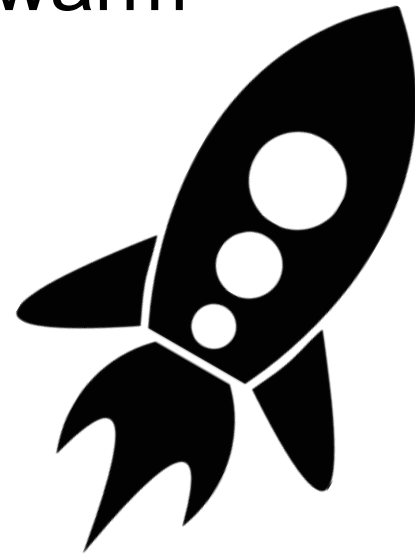
Configuration / Bootstrapping

Example: [docker-entrypoint.sh](#)

- Take action during container startup
 - Read configuration, environment, secrets
 - Write configuration, update deployment
- Manage signal processing
 - Important if main process does not handle natively

Deployment

- Deploy application as stack in swarm
- Use YAML configuration file
- Use environment variables
- Use config/secret
- Service discovery



Example

```
$ env  
  IMAGE_NAME=my/image:latest  
  REGISTRY=dtr.internal.domain  
  ...
```

```
$ docker stack deploy \  
  --prune \  
  --with-registry-auth \  
  --resolve-image always \  
  -c deployment.yml \  
  my-cool-app
```


YML File

```
version: "3.5"
services:
  nginx:
    image: ${REGISTRY}/${IMAGE_NAME}
    deploy:
      replicas: 3
      placement:
        constraints:
          - node.labels.some-label == value
      restart_policy:
        condition: any
        delay: 5s
        max_attempts: 2
        window: 60s
    update_config:
      parallelism: 1
      delay: 5s
      failure_action: rollback
      order: start-first
```

```
environment:
  - DB_HOST
  - POSTGRES_USER=${DB_USER}
  - PGPASSWORD=${DB_PASSWORD}
ports:
  - "80"
configs:
  - source: update-config
    target: /update-config.sh
  - source: remove-config
    target: /remove-config.sh
configs:
  update-config:
    file: ./update-config.sh
  remove-config:
    file: ./remove-config.sh
```

Service Discovery

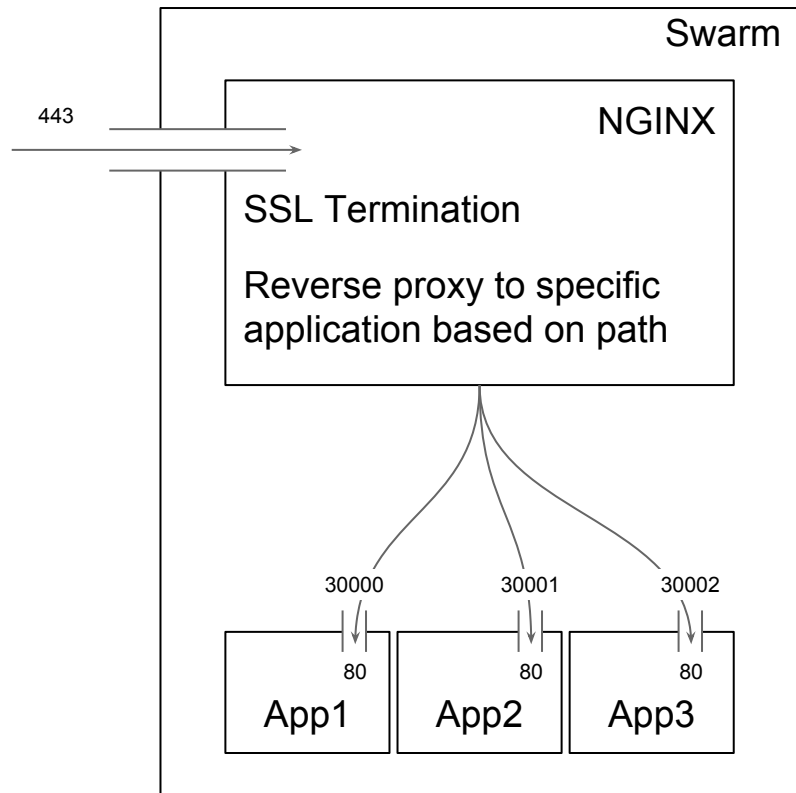
Discover port exposed port for application

```
$ docker inspect --format \
'{{index .Endpoint.Ports 0}.PublishedPort}}' \
my-cool-app
```

Reconfigure NGINX

```
upstream my-cool-app_nginx {
    server worker1:30000;
    server worker2:30000;
    server worker3:30000;
}

location /some/path/ {
    proxy_pass http://my-cool-app_nginx;
    proxy_set_header Host my.website.example;
    proxy_set_header X-Client-IP $remote_addr;
}
```



Questions?

[Demo](#)

Earthquake Hazards Program

← Latest Earthquakes

M 4.4 - 4km N of La Verne, CA

2018-08-29 02:33:28 (UTC) | 34.136°N 117.775°W | 5.5 km depth

Overview

Interactive Map

Regional Information

Impact

Felt Report - Tell Us!

Did You Feel It?

ShakeMap

PAGER

Ground Failure

Technical

Origin

Moment Tensor

Focal Mechanism

Waveforms

Download Event KML

View Nearby Seismicity

Earthquakes

Hazards

Data & Products

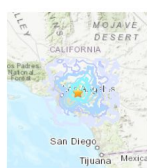
Learn

Monitoring

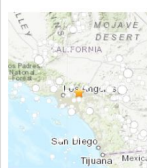
Research

Search...

Interactive Map

Contributed by CI²

Regional Information

Contributed by CI²

Felt Report - Tell Us!

0 0 6 6 3 2

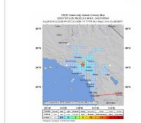
Responses

Contribute to citizen science.
Please [tell us](#) about your experience.

Citizen Scientist Contributions

Did You Feel It?

V



Community Internet Intensity Map

Contributed by US³

ShakeMap

Estimated Intensity

V

Perceived Shaking

Moderate

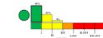
Potential Damage

Very light

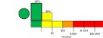
Contributed by CI²

PAGER

GREEN



Estimated Economic Losses



Estimated Fatalities

Contributed by US³

Ground Failure

Landslides



Little or no area
affected
Little or no population
exposed

Liquefaction



Little or no area
affected
Little or no population
exposed

Contributed by US³

Origin

Review Status
REVIEWEDMagnitude
4.4 mwDepth
5.5 kmTime
2018-08-29 02:33:28 UTCContributed by CI²

Moment Tensor



Fault Plane Solution

Contributed by CI²

Tsunami



U.S. Tsunami Warning System

To view any current tsunami
advisories for this and other
events please visit
<https://www.tsunami.gov>.

NOAA

View Nearby Seismicity

Time Range



± Three Weeks

Search Radius



250.0 km

Magnitude Range



≥ 1.0

ANSS Comcat

Contributors

1. [National Tsunami Warning Center](#)
2. [California Integrated Seismic Network: Southern California Seismic Network \(Caltech, USGS Pasadena, and Partners\)](#)
3. [USGS National Earthquake Information Center PDE](#)

Additional Information

- [ANSS Comprehensive Earthquake Catalog \(ComCat\) Documentation](#)
- [Technical terms used on event pages](#)

[Questions or comments?](#)[Facebook](#) [Twitter](#) [Email](#)

Thank You

So long, and thanks for all the fish.