Pacific Northwest
NATIONAL LABORATORY

Docker based VOLTTRON Deployments

August 30, 2019

Craig H. Allwardt
Software Engineer

VOLTTRON™

Pacific Northwest
NATIONAL LABORATORY

Agenda

- What docker is and why we are using it?
- Custom installation script for installation on ubuntu based systems
- Starting a VOLTTRON docker container
- Docker compose
- Bootstrapping of agents in the platform_config.yml file
- Connected homes use case

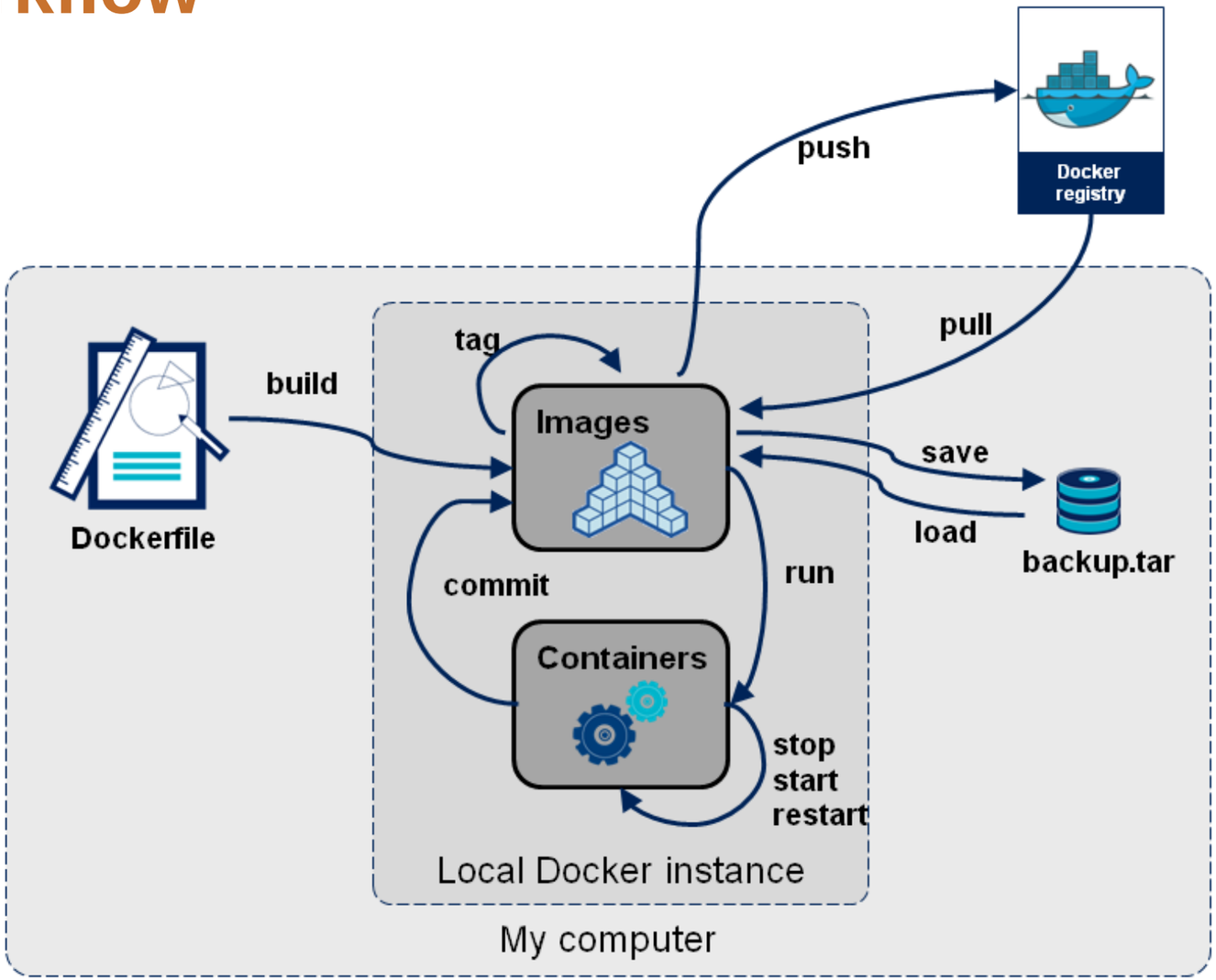
What is Docker?

- “Docker is a tool designed to make it easier to create, deploy, and run applications by using containers.” (https://opensource.com/resources/what-docker)
- Developers **build** images from a Dockerfile and then can **push** images to a repository.
- The main public repository storing and retrieving docker images for distributions, applications, and services is https://hub.docker.com/.
  - Examples of images available are VOLTTRON, crate, postgres, mysql, Debian, apache webserver, Grafana, Kibana…etc.
- Docker runs on many different architectures and can cross build multiple images for different architectures, for VOLTTRON we have images for x86-64, armv7 (32-bit) and armv8 (64-bit).
- Docker features we use
  - Auto restart of container during power cycle (similar to upstart, system V but not platform specific)
  - Configuration and state is maintained externally from mounted host files and folders.
  - Image is reusable in both testing and deployment environments.
  - Paired down volttron install to only include what is necessary for the specific use cases (such as examples, .git folder etc)
  - Consistent image across the network of machines

Docker Build Workflow

Docker File

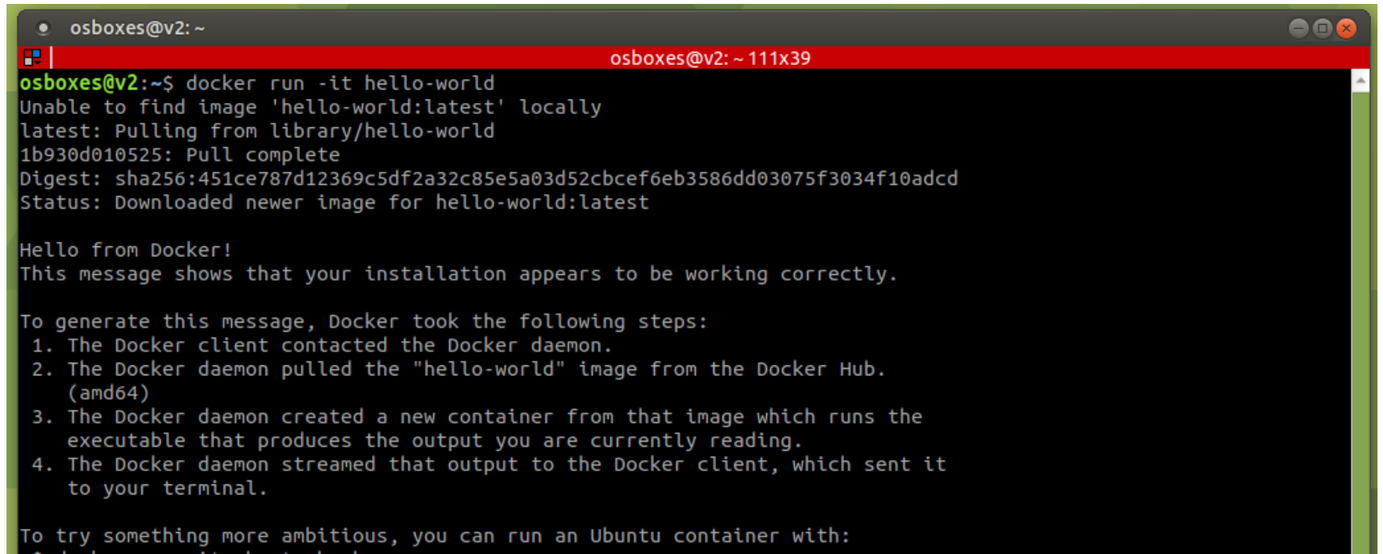
```
1   ARG image_user=amd64
2   ARG image_repo=debian
3   ARG image_tag=buster
4
5   FROM ${image_user}/${image_repo}:${image_tag} as volttron_bas
6
7   SHELL [ "bash", "-c" ]
8
9   # --no-install-recommends \
10  USER root
11  RUN set -eux; apt-get update; apt-get install -y --no-install
12      procps \
13      gosu \
14      vim \
15      tree \
16      build-essential \
17      python-dev \
18      openssl \
19      libssl-dev \
20      libevent-dev \
21      git \
22      gnupg \
23      dirmngr \
24      apt-transport-https \
```



https://blog.octo.com/en/docker-registry-first-steps/

Docker and Docker Compose Installation

- Specific platform instructions are available https://docs.docker.com/install/linux/docker-ce/
- Script to install on ubuntu and add the current user to the docker user group
  - wget https://raw.githubusercontent.com/VOLTTRON/volttron-docker/master/docker_install_ubuntu.sh
  - bash docker_install_ubuntu.sh
- Logout and login to refresh permission for docker.
- Test installation
  - docker run -it hello-world



VOLTTRON Docker Image

- Docker hub image format
  - user/imagename:tag or imagename:tag for official images
  - For example ubuntu:bionic
- Create a VOLTTRON docker container the background
  - docker run -v ./mounted_volttron_home:/home/volttron/.volttron \
    -v ./platform_config.yml:/platform_config.yml \
    -v ./configs:/home/volttron/configs \
    -p 22916:22916 -p 8080:8080 \
    -e LOCAL_USER_ID=$UID \
    -e CONFIGS=/home/volttron/configs \
    --name volttron -d -it volttron/volttron:zmq-develop
- Connect to the container to execute commands
  - docker exec --user volttron -it volttron bash
  - volttron-ctl status

Docker Compose

Standard docker compose file for a deployment.

```
 1 version: '3'
 2 services:
 3   volttron:
 4     image: volttron/volttron:develop
 5     # only needed if external access needed to this volttron
 6     # ports are mapped from the host to the container.
 7     #ports:
 8     #  - 22916:22916
 9     volumes:
10       - ./platform_config.yml:/platform_config.yml
11       - ./configs:/home/volttron/configs
12       - ./mounted_volttron_home:/home/volttron/.volttron
13     environment:
14       - CONFIG=/home/volttron/configs
15       # Must export UID in the shell before it is available
16       # to docker-compose
17       - LOCAL_USER_ID=${UID}
18
```

Use Case Requirements

- Goal
  - Test the efficacy of agent applications in 5 non-controlled house environment.
  - Monitor the agent and it's publishes through an administrative interface.
- Need
  - Easy testable environment that can be deployed and redeployed without homeowner interaction.
  - Git repository for configuration of each house.
- Infrastructure
  - Amazon cloud based deployment for central connectivity
  - 5 raspberry pis with docker and autossh with a reverse tunnel from the amazon cloud.
- Docker
  - A volttron central base cloud deployment
  - A collector image with master driver, forwarder, agent applications, and volttron central platform.

Deployed Configuration - Collector

```
# Properties to be added to the root config file
# the properties should be ingestable for volttron
# the values will be presented in the config file
# as key=value
config:
  volttron-central-address: https://hostincloud
  volttron-central-serverkey: secret

# Agents dictionary to install.  The key must be a valid
# identity for the agent to be installed correctly.
agents:

  # Each agent identity.config file should be in the configs
  # directory and will be used to install the agent.
  forwarder:
    source: $VOLTTRON_ROOT/services/core/ForwardHistorian
    config: $CONFIG/forwarder.yaml

  platform.actuator:
    source: $VOLTTRON_ROOT/services/core/ActuatorAgent

  historian:
    source: $VOLTTRON_ROOT/services/core/SQLHistorian
    config: $CONFIG/historian.config

    # Master driver configuration
  platform.driver:
    source: $VOLTTRON_ROOT/services/core/MasterDriverAgent
    config_store:
      fake.csv:
        file: $VOLTTRON_ROOT/examples/configurations/drivers/fake.csv
        type: --csv
      devices/fake-campus/fake-building/fake-device:
        file: $VOLTTRON_ROOT/examples/configurations/drivers/fake.config
```

Pacific Northwest
NATIONAL LABORATORY

Deployed Configuration - Central

```
# Properties to be added to the root config file
# the properties should be ingestable for volttron
# the values will be presented in the config file
# as key=value
config:
  vip-address: tcp://0.0.0.0:22916
  bind-web-address: http://0.0.0.0:8080

# Agents dictionary to install.  The key must be a valid
# identity for the agent to be installed correctly.
agents:

  historian:
    source: $VOLTTRON_ROOT/services/core/CrateHistorian
    config: $CONFIG/crate.config
  emailer:
    source: $VOLTTRON_ROOT/services/ops/EmailerAgent
    config: $CONFIG/emailer.yaml
  threshold:
    source: $VOLTTRON_ROOT/services/ops/ThresholdDetectorAgent
    config: $CONFIG/threshold.yaml
  watcher:
    source: $VOLTTRON_ROOT/services/ops/TopicWatcher
    config: $CONFIG/topic-watcher.yaml
  agent_watcher:
    source: $VOLTTRON_ROOT/services/ops/AgentWatcher
    config: $CONFIG/agent-watcher.yaml
  volttron.central:
    source: $VOLTTRON_ROOT/services/core/VolttronCentral
    config: $CONFIG/vc.yaml
  platform.agent:
    source: $VOLTTRON_ROOT/services/core/VolttornCentralPlatform
    config: $CONFIG/vcp.yaml
```

Pacific Northwest
NATIONAL LABORATORY

Thank you