ICCLAB

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# Migrating an Application into the Cloud with Docker and CoreOS


Zurich University of Applied Sciences

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# Introduction

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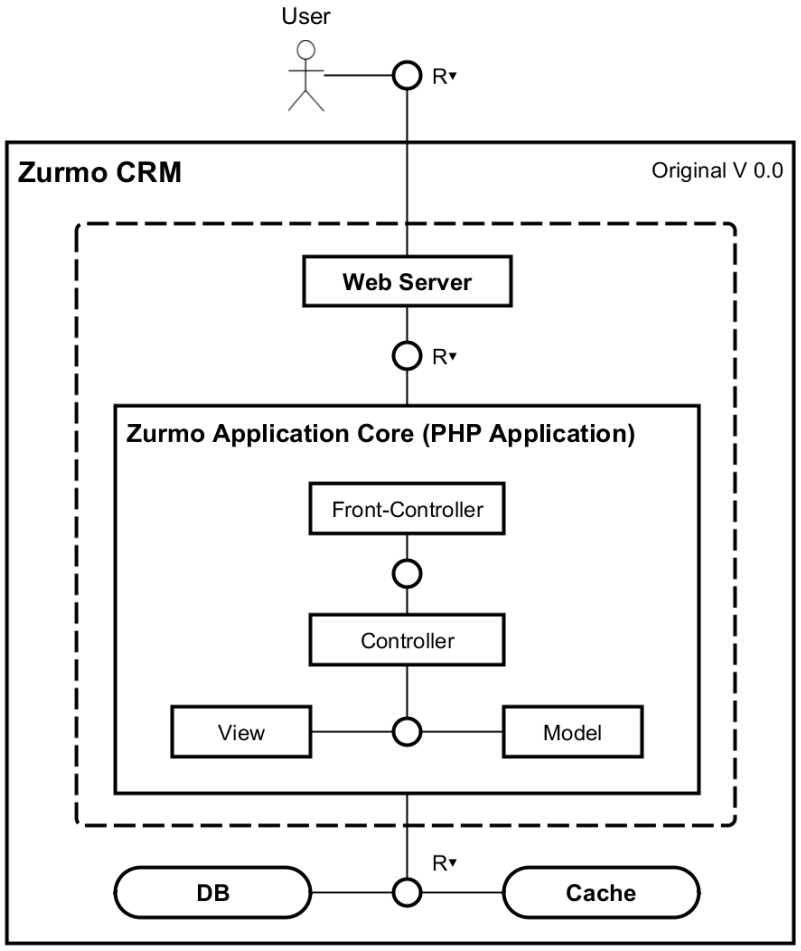
- InIT Cloud Computing Lab


- Initiative: Cloud Native Applications
- Current Project:
  - Transform Business Application to Cloud
  - Open-Source Application not designed for Cloud
  - Application Goal: Resiliency, Scalability

# Zurmo Architecture

- Core:
  - PHP Application
- Components:
  - Webserver
  - Database
  - Cache



# Target Architecture

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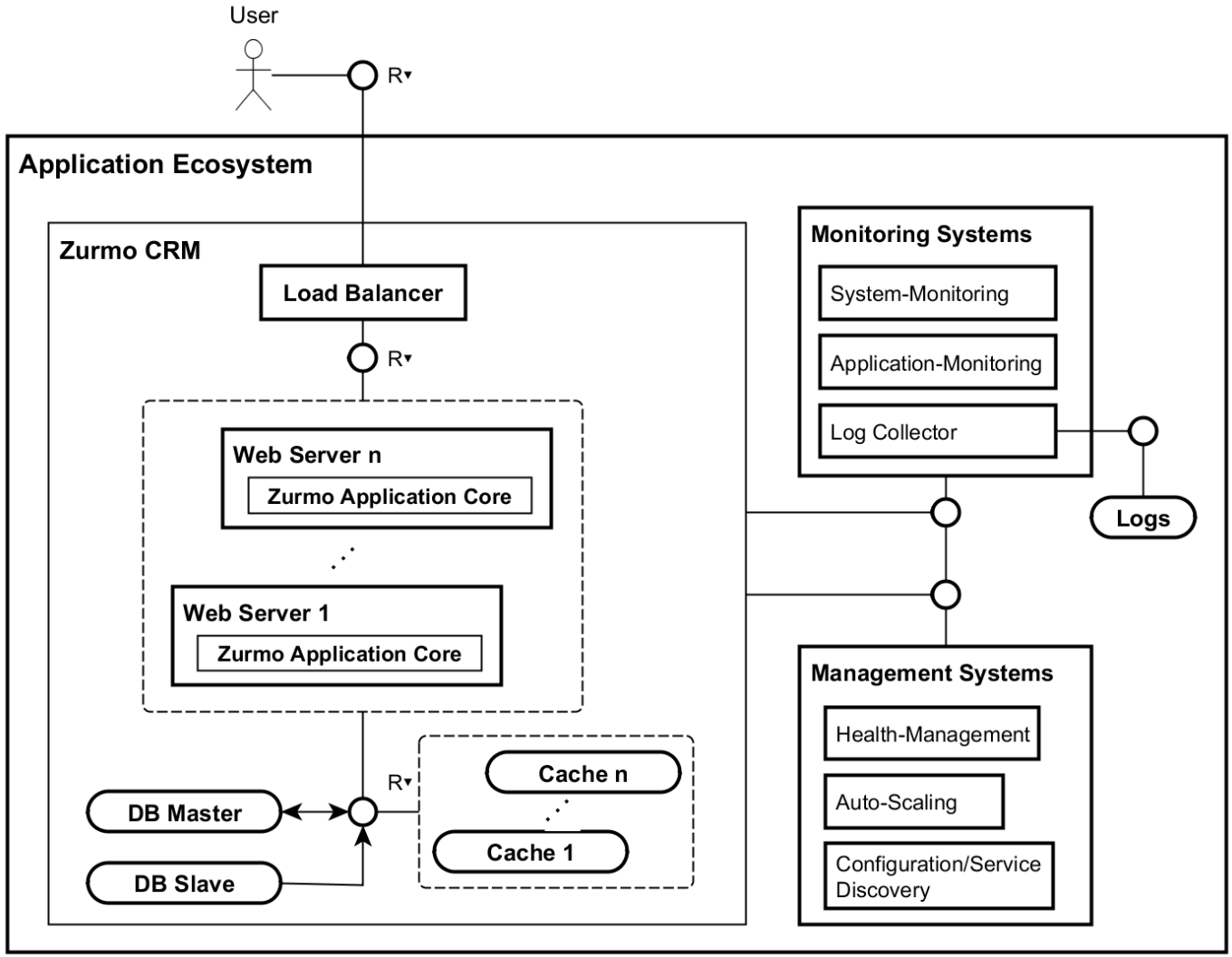


# Why docker?



- lightweight
- easy setup of environment
- testing applications on the fly
- fast startup
- fine grained scheduling

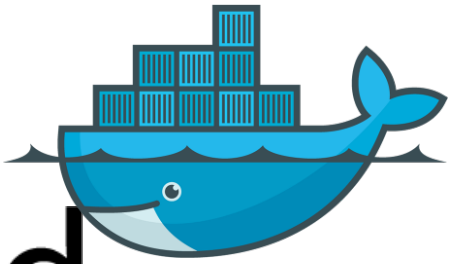

- reusable in cloud -> CoreOS

# CoreOS



- Linux Operating System
- Intended to be used with docker
- No package manager

- Preinstalled Tools
  - fleet → Run docker containers
  - etcd → Configuration Management
  - docker



# fleet



- distributed init system
- based on systemd (init system)
- declare services in fleet unit files
- declare dependencies of services
- declare environment of process
- control lifecycle of long running processes
  - start process/container
  - stop process/container
  - manage process/container

# fleet - example unit file

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```
[Unit]
Description=Apache web server service
Before=zurmo_apache_discovery@.service
After=etcd.service
After=docker.service
Requires=zurmo_config.service
Wants=zurmo_apache_discovery@.service

[Service]
TimeoutStartSec=0
Restart=always
EnvironmentFile=/etc/environment
ExecStartPre=-/usr/bin/docker kill zurmo_apache
ExecStartPre=-/usr/bin/docker rm zurmo_apache
ExecStartPre=/usr/bin/docker pull user_name/zurmo_apache
ExecStart=/usr/bin/docker run --name zurmo_apache -p 80:80 --volumes-from zurmo_config user_name/zurmo_apache
ExecStop=/usr/bin/docker stop zurmo_apache

[X-Fleet]
X-Conflicts=zurmo_apache*.service
MachineMetadata=public=true
```

**Dependencies**

**Process lifecycle management**

```
# ExecStartPost     -> what to do after starting the process
# ExecReload        -> what to do on reload
# ExecStopPost      -> what to do after stopping the process
```

**Scheduling constraints**

# fleet - start/stop services



- ***fleetctl***: command line tool

## make the service known to fleet

> fleetctl submit <*unit_file*>

## schedule the service on a machine

> fleetctl load <*service_name*>

## start / stop service

> fleetctl start <*service_name*>

> fleetctl stop <*service_name*>

# fleet - using templates

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- In fleet (save as zurmo_apache@.service)

*[...]*
ExecStartPre=-/usr/bin/docker kill zurmo_apache_**%i**
ExecStartPre=/usr/bin/docker pull user_name/zurmo_apache_**%i**
ExecStart=/usr/bin/docker run --name zurmo_apache_**%i**
user_name/zurmo_apache_**%i**
*[...]*

- Start instance based on template

*> fleetctl start <template_name**@instance_name**.service>*
*> fleetctl start zurmo_apache**@0.**service*

# etcd



- distributed key value store
- designed for: shared configuration & service discovery
- implements *Raft consensus algorithm*
- handles machine failures, master election etc.
- actions: read, write, listen
- data structure
  - /folder
  - /folder/key
- REST-API
- easy to use client: *etcdctl*

# etcd - example



## read/write a value

> etcdctl get /folder/key

> etcdctl set /folder/key

## read/create directory

> etcdctl mkdir /folder

> etcdctl ls /folder

## listen to changes

> etcdctl watch /folder/key

> etcdctl exec-watch /folder/key -- /bin/bash -c “touch /tmp/test”

# etcd - service discovery

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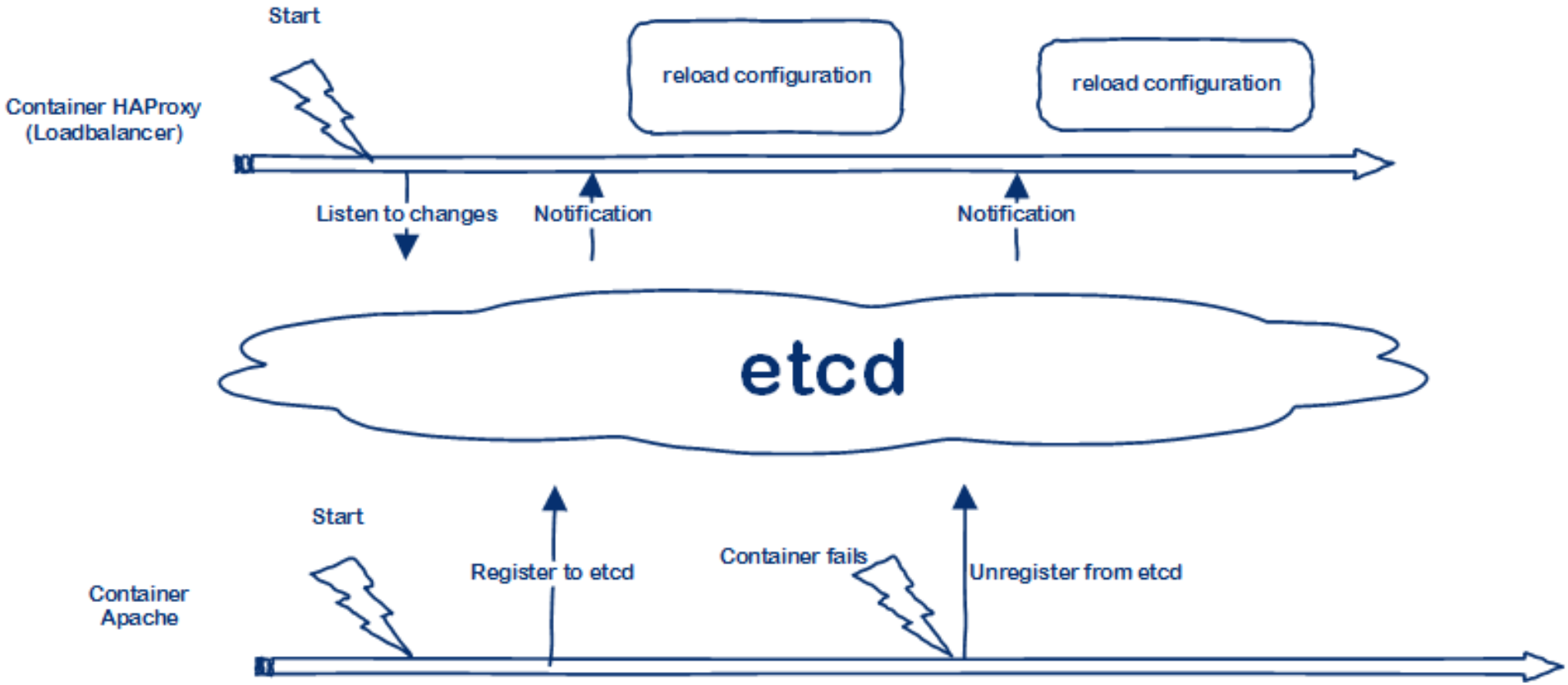


# etcd - service discovery

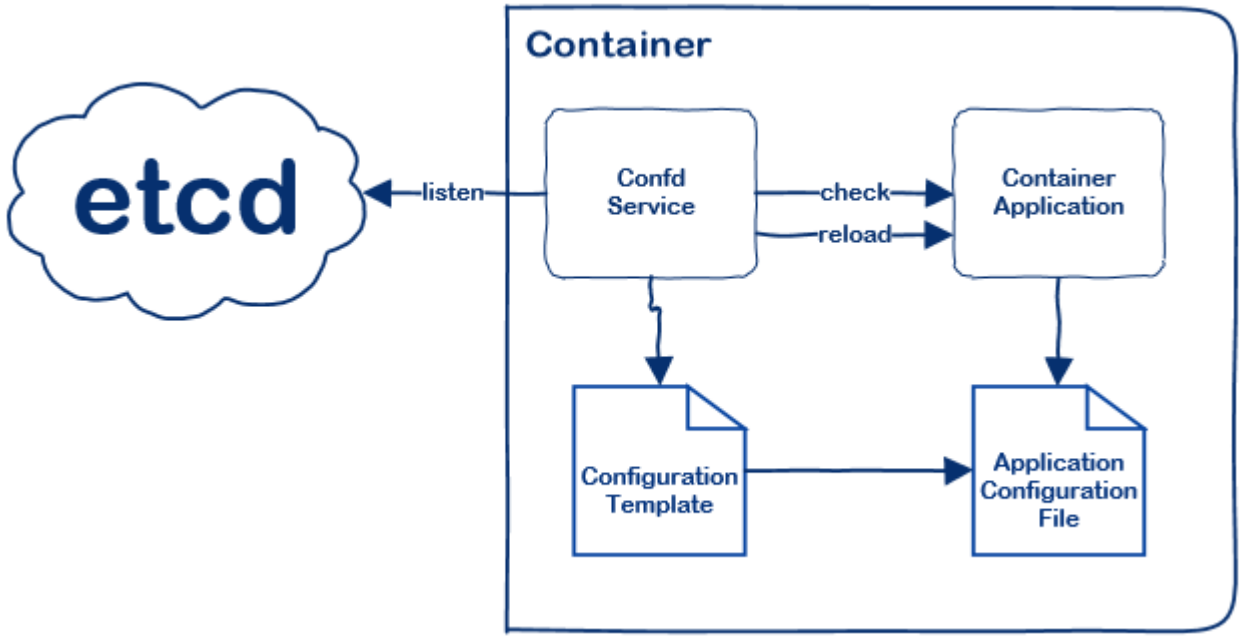


/services/cache
/services/cache/f7d43e22-2e11-4d29-a5a4-c55741bcae99
/services/cache/f7d43e22-2e11-4d29-a5a4-c55741bcae99/host
/services/cache/f7d43e22-2e11-4d29-a5a4-c55741bcae99/port
/services/cache/f7d43e22-2e11-4d29-a5a4-c55741bcae99/ip
/services/loadbalancer
/services/loadbalancer/9259e4d8-f3a0-4947-9d9f-48b98d731cda
/services/loadbalancer/9259e4d8-f3a0-4947-9d9f-48b98d731cda/port
/services/loadbalancer/9259e4d8-f3a0-4947-9d9f-48b98d731cda/host
/services/loadbalancer/9259e4d8-f3a0-4947-9d9f-48b98d731cda/ip
/services/webserver
/services/webserver/87e60800-9b3f-43f9-875a-0954ac04059a
/services/webserver/87e60800-9b3f-43f9-875a-0954ac04059a/host
/services/webserver/87e60800-9b3f-43f9-875a-0954ac04059a/port
/services/webserver/87e60800-9b3f-43f9-875a-0954ac04059a/ip
[...]

# confd - configuration reloading



- tool to rewrite configuration files if etcd key changes
- not part of CoreOS (used in containers)



# Current Implementation

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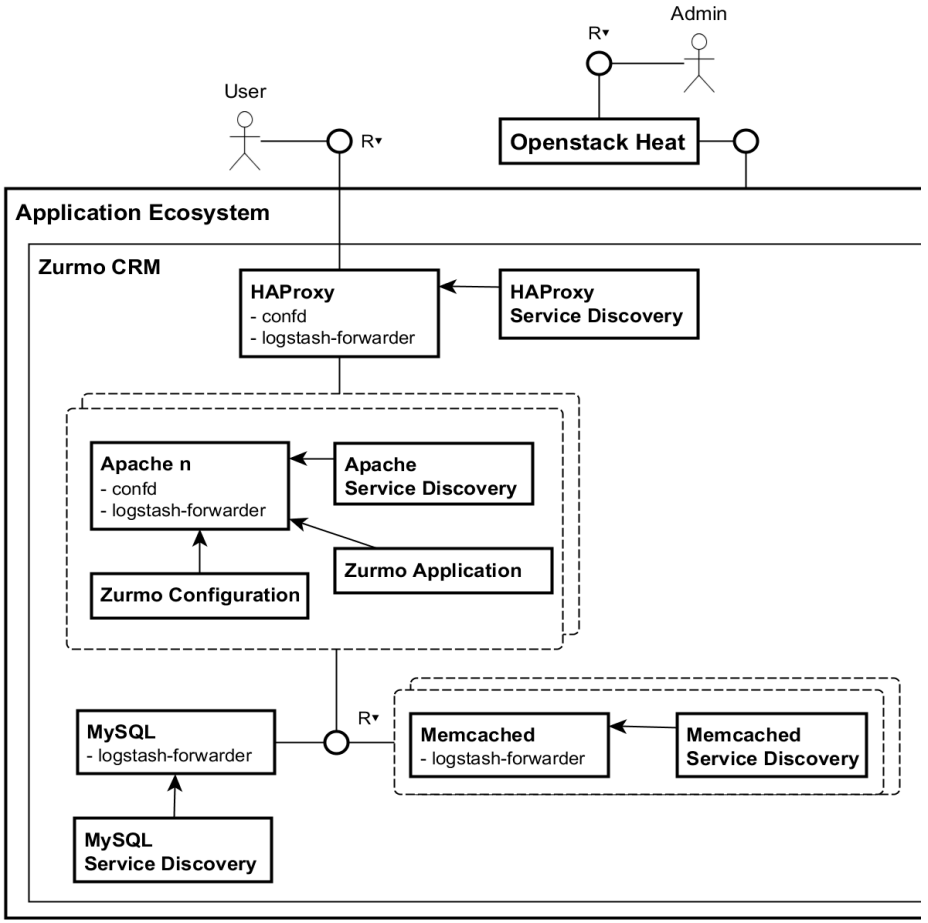
Containers & fleet files for:

- HAProxy
- Apache
- Zurmo Application
- Zurmo Configuration
- Memcached
- MySQL

Sidekicks

- Service Discovery



# Deployment

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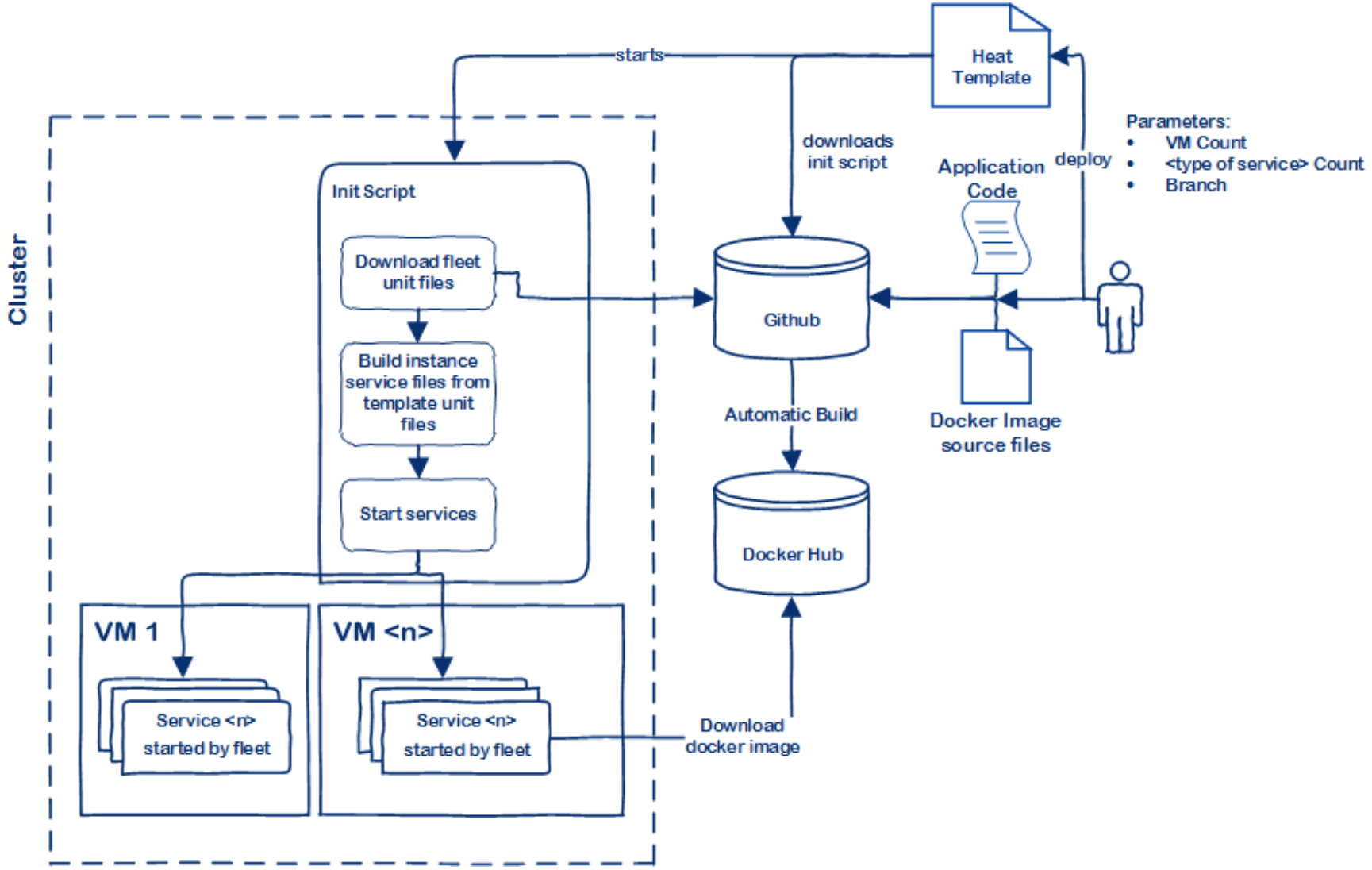

# Demo



Zurmo in Action

- Service Discovery
  - Stopping Service
- Resilience
  - Container failure
  - VM failure

# Conclusion / Next Steps

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Status

- Running cluster with core of application (OpenStack, Vagrant)
- Resiliency implemented with CoreOS, fleet, etcd, docker and confd
- Now implementing logging

Problems faced

- Time to build/download docker images
- Managing multiple git branches
- Complexity compared to size of application

Future challenges

- Stateful containers (e.g database)
- Scaling (tools like kubernetes)

# Links



ICCLab:

- http://blog.zhaw.ch/icclab/

Cloud-Native Applications Initiative:

- http://blog.zhaw.ch/icclab/category/research-approach/themes/cloud-native-applications/

ZHAW InIT

- http://init.zhaw.ch/en/engineering/institutes-centres/institute-of-applied-information-technology.html

Docker Hub - Docker Images

- https://hub.docker.com/u/icclabcna/

GitHub Repository

- https://github.com/icclab/cna-seed-project

# Links II



Operating System: CoreOS

CoreOS components: etcd, fleet

Tools: confd

Software in Containers: MySQL, Memcached, Apache HTTP Server, HAProxy

Web-Services: docker hub, github

Cloud-Software: OpenStack

CRM-Software: Zurmo

# Questions