



Container and Microservice Driven Design for Cloud Infrastructure DevOps

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Context of the research



- Cloud Infrastructure
- Microservice Driven Design
- Container
- DevOps

Context of the research

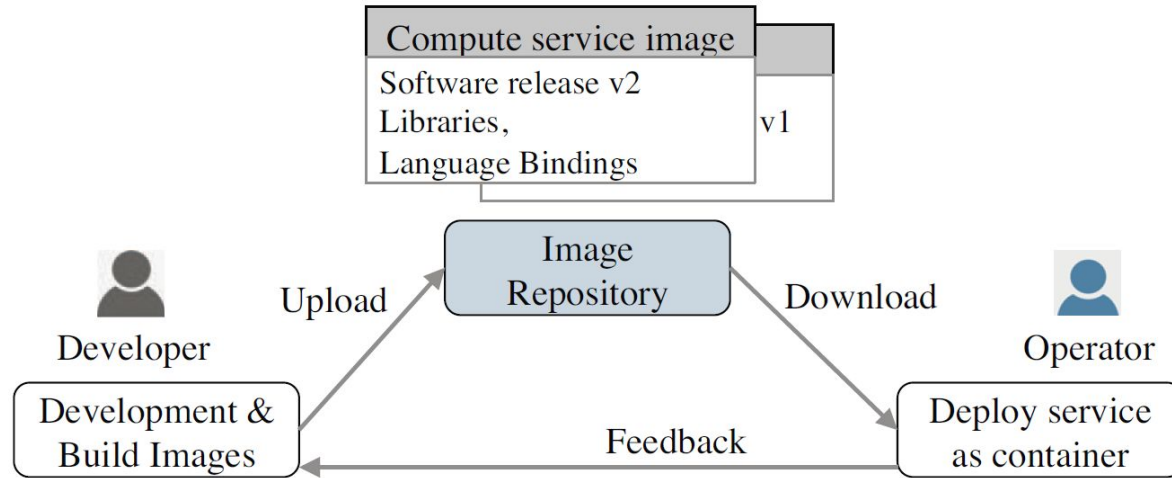


Fig. 1. Lifecycle management of infrastructure code using container images.

Research challenge addressed by the authors



- Minimize Cross-configuration
- Maintain State
- Provide Host Resource Access

Results obtained

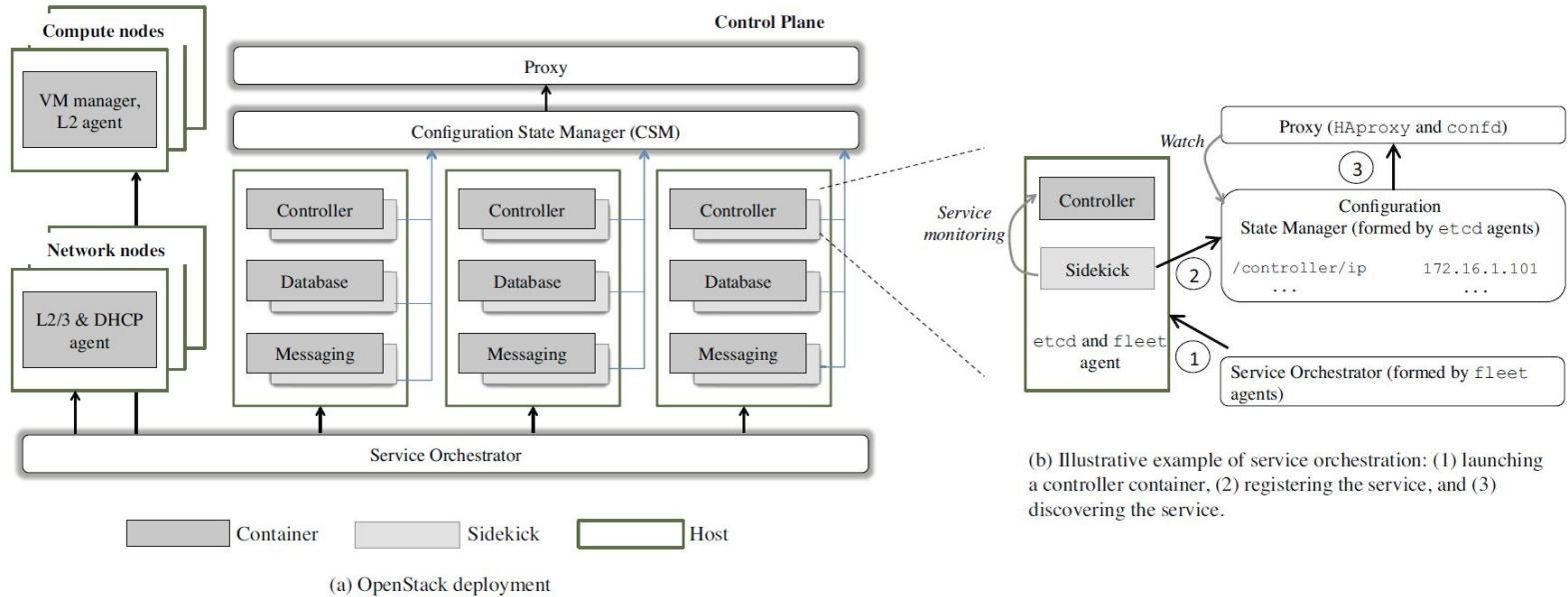


Fig. 2. A container-based microservice architecture of OpenStack. (a) OpenStack deployment, (b) Service registration and discovery in microservice architecture

Results obtained



TABLE I. NUMBER OF CONFIGURATION POINTS IN DEPLOYING OPENSTACK: CHEF-BASED VS DOCKER IMAGE-BASED APPROACHES.

Complexity metric	Chef-based	Docker-based
Dependencies	22	5
Download links	> 50 https	6 images
Configurable variables	80	26

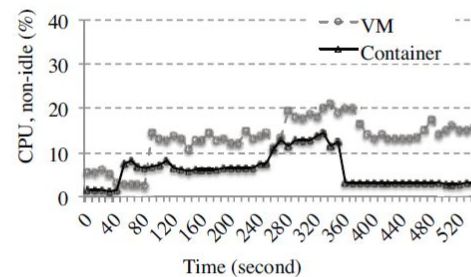
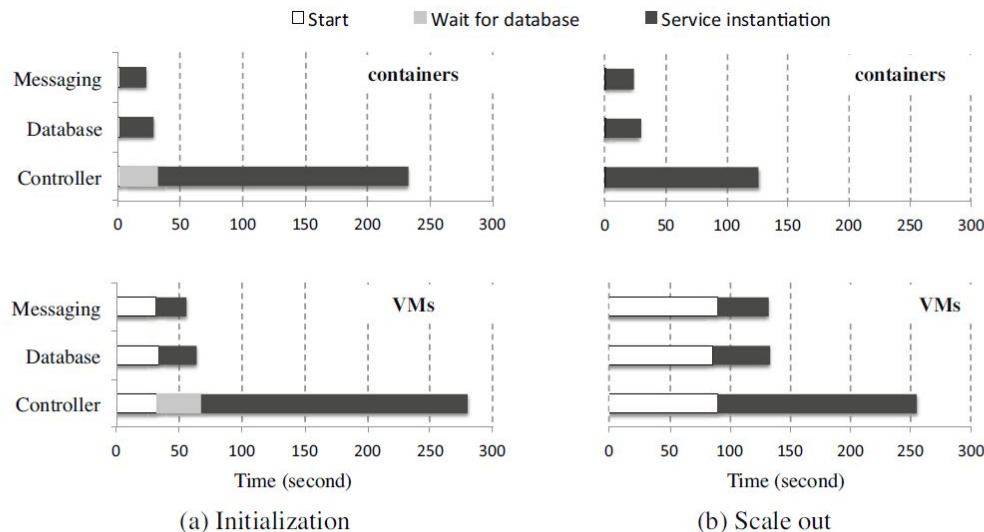
Results obtained



TABLE IV. EXECUTION TIME OF OPENSTACK DEVOPS TASKS: VM OR CONTAINER-BASED APPROACHES (IN SECOND)

DevOps Tasks	VM	Container
Deployment	535	358
Upgrade the three controller instances	326	207
Failure recovery of a MySQL instance	74	32

Results obtained



(c) CPU utilization of one host during deployment

Fig. 3. Deployment comparison: containers vs. VMs. (a) Deploy one instance of each type on three hosts respectively; (b) Scale out instances on three hosts; (c) Host CPU utilization.

Results obtained

TABLE VI. SNAOPSHOT/MIGRATION COMPARISON OF VM AND CONTAINER (THE SERVICE INSIDE IS MYSQL HANDLING OPENSTACK KEYSTONE USER CREATION REQUESTS)

Snapshot/migration cost	VM	Container
Image size	530MB	107MB
Snapshot duration	7s	< 1s
Restore duration	2s	< 1s
Image transfer duration (via scp)	5s	< 1s

Results obtained

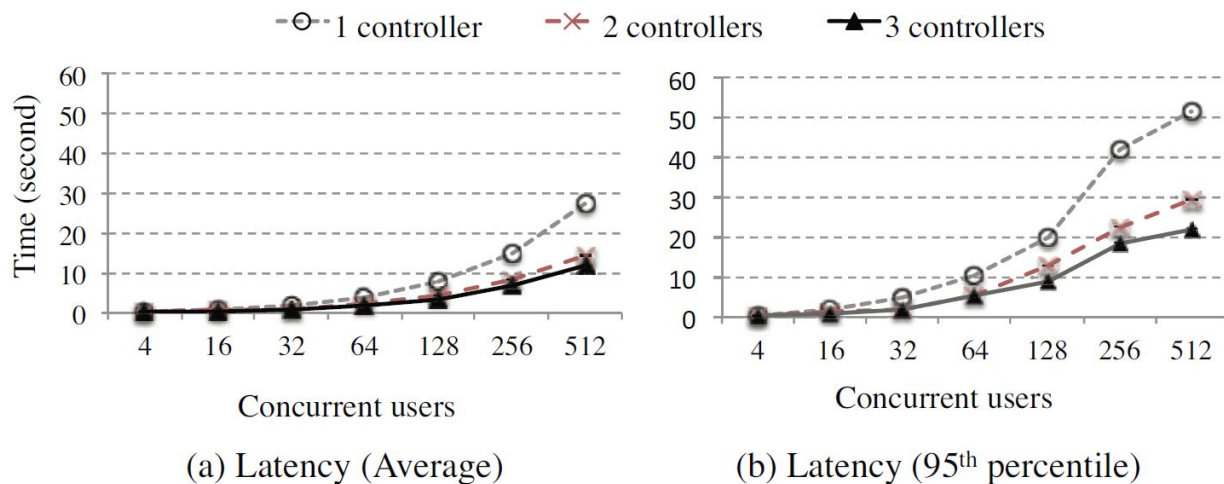


Fig. 5. Average and 95th percentile latency of user authentication under different number of controller containers (lower is better)

Results obtained

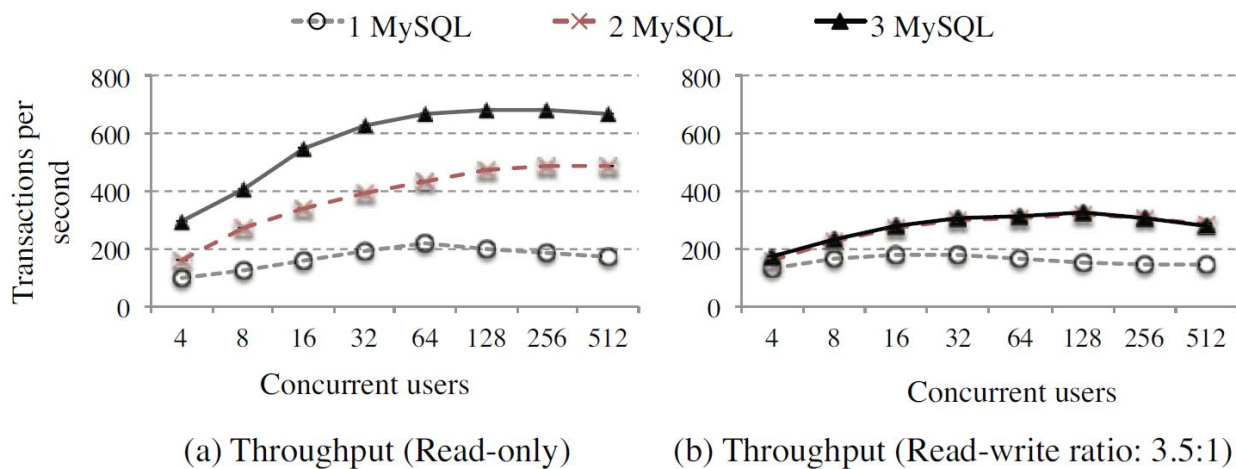


Fig. 6. Scale the database performance (higher is better) by increasing the number of MySQL containers under increased workload with fixed number of controller containers (three controller containers).

Threats to validity



- One case study (OpenStack)

Analysis of the obtained result



Pros :

- Performance
- Isolation process
- Portable

Cons :

- Security
- In-memory state