

Practical Aspects Of State Machine Replication Virtualization

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Outline

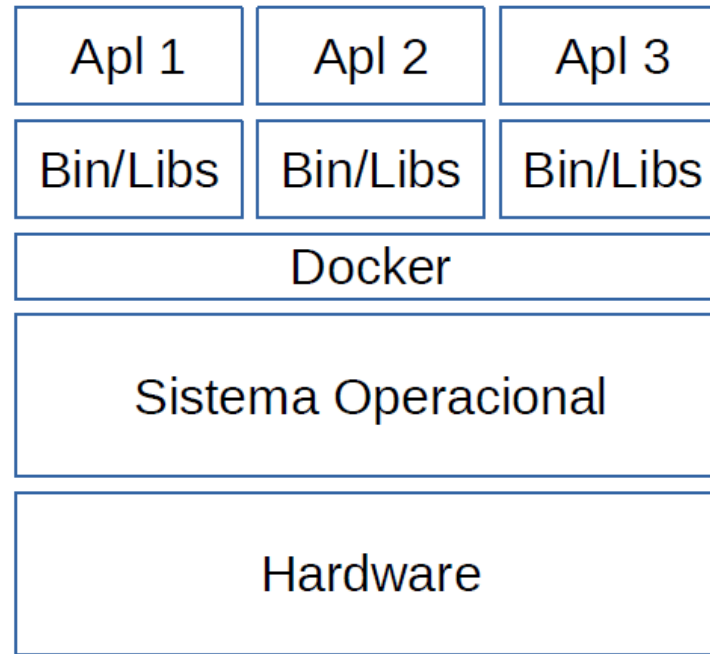
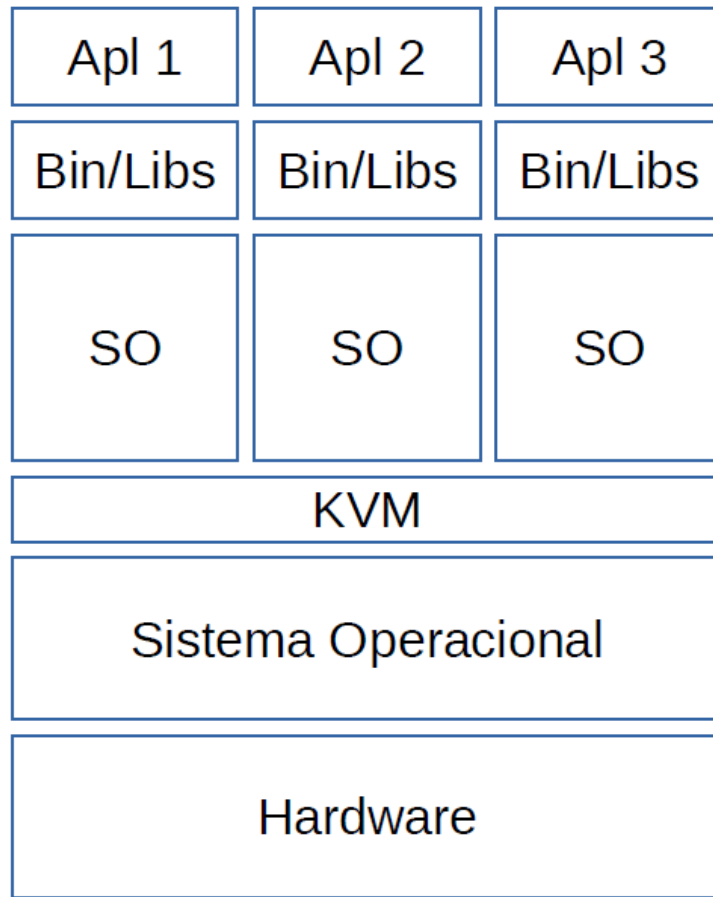
- Introduction
- Virtualization
- State Machine Replication
 - BFT-SMaRt
- Experiments
- Conclusions and Future Work

Introduction

- State Machine Replication (SMR) is a technique widely used to implement dependable systems
- Virtualization also could be seen as a technique that helps the development of dependable systems
 - Some works proposed the integration of protocols for SMR and virtualization (both, virtual machines or containers)
- Our goal: Use a SMR library to implement an application for assess its performance and resources consumption when deployed in both, virtual machines and containers

Virtualization

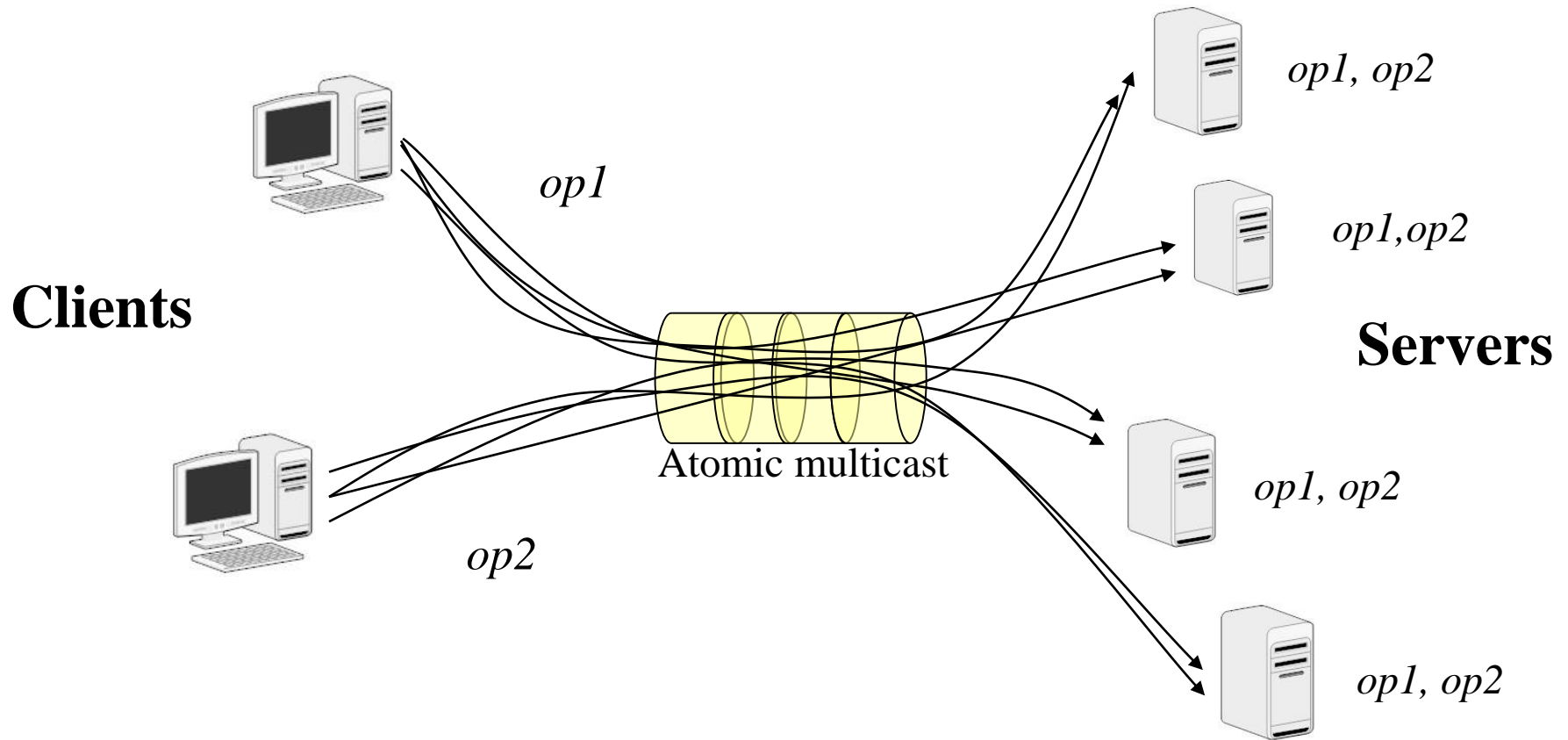
- Virtual Machines (KVM) vs. Containers (Docker)



State Machine Replication

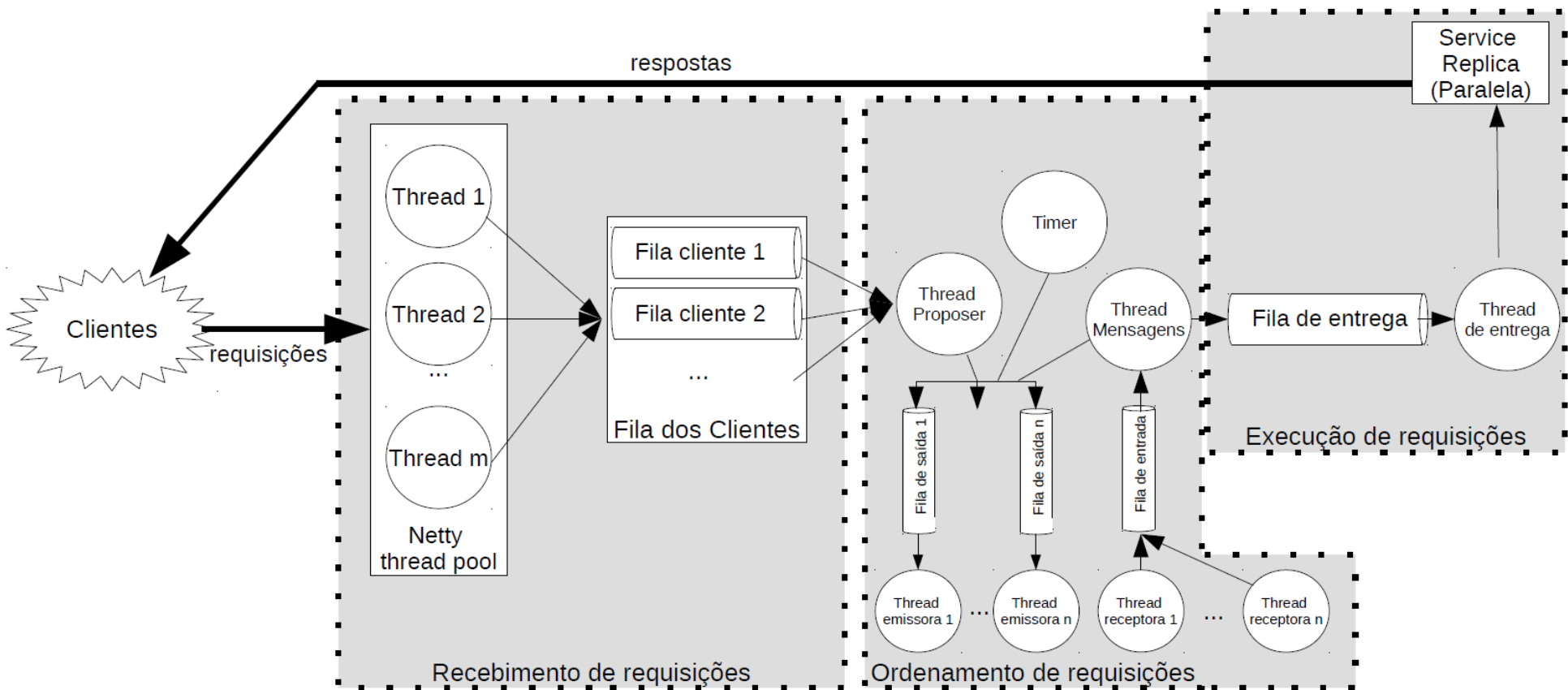
- Approach that replicates the servers and coordinates the interactions among clients and servers
 - Same state evolution
- Provide replica determinism:
 - All replicas (**1**) starting with the same state and (**2**) executing the same set of operations in the same order, (**3**) reach the same final state

State Machine Replication



BFT-SMaRt

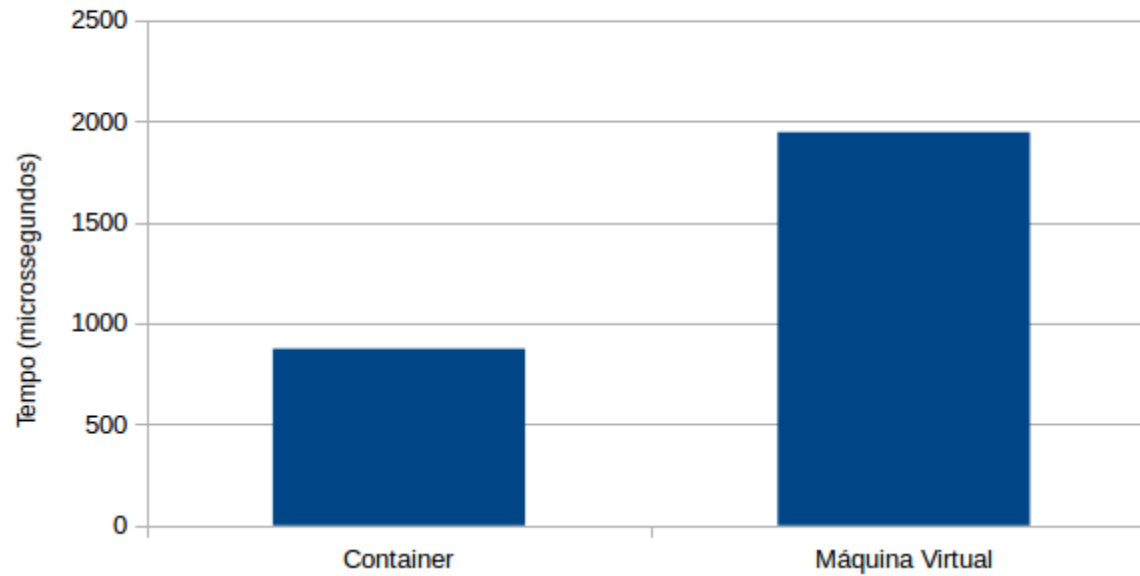
- Java library used to implement replicated applications (SMR)



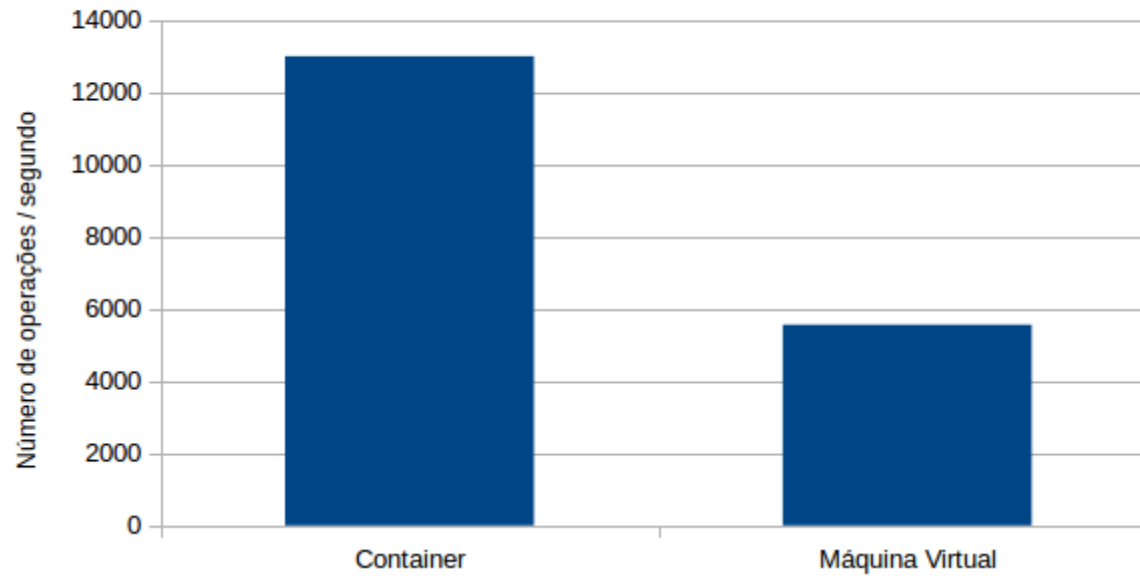
Experiments

- We used one server and deployed a set of containers or virtual machines
 - Virtual Machines: KVM
 - Containers: Docker
- BFT-SMaRt was configured with 3 servers ($f=1$)
 - 10 clients executed in a different machine
- Application: linked list
 - Operations: ADD, REMOVE, GET and CONTAINS
 - Initialized with 100k entries
 - 25000 requests (25% for each type)

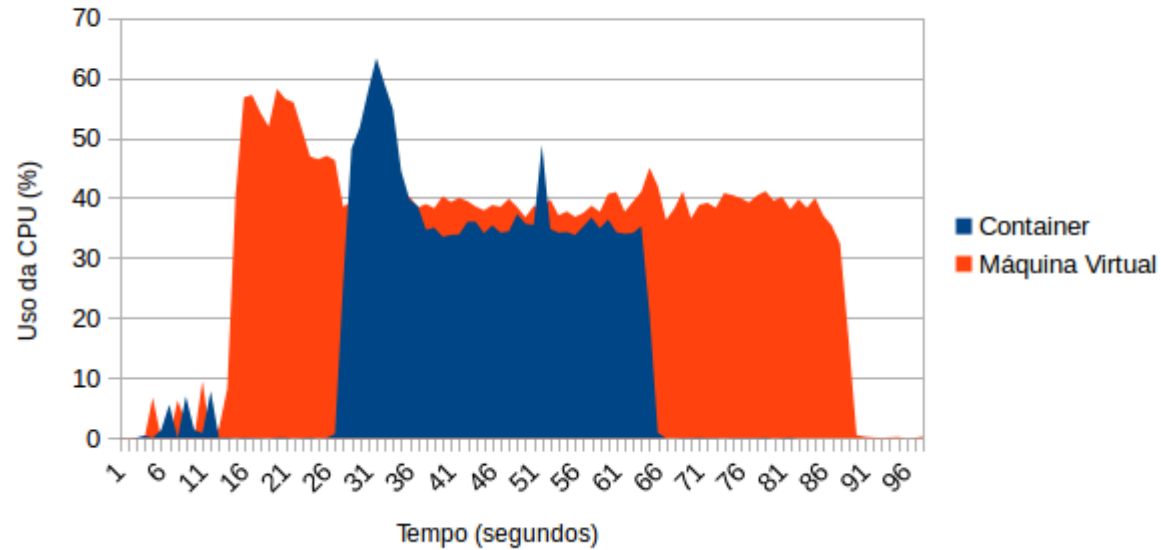
Experiments: Latency



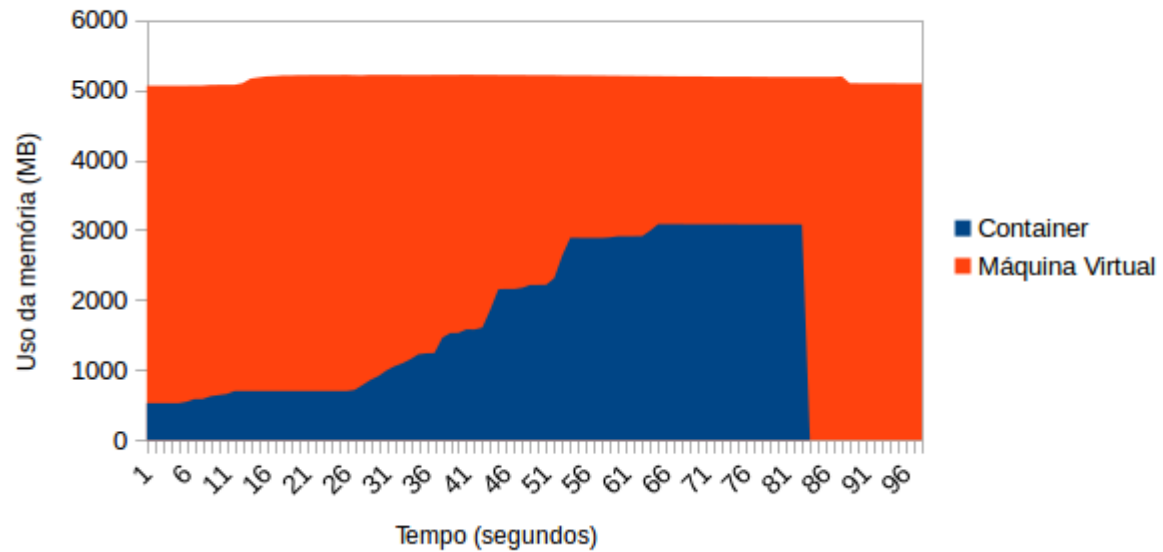
Experiments: Throughput



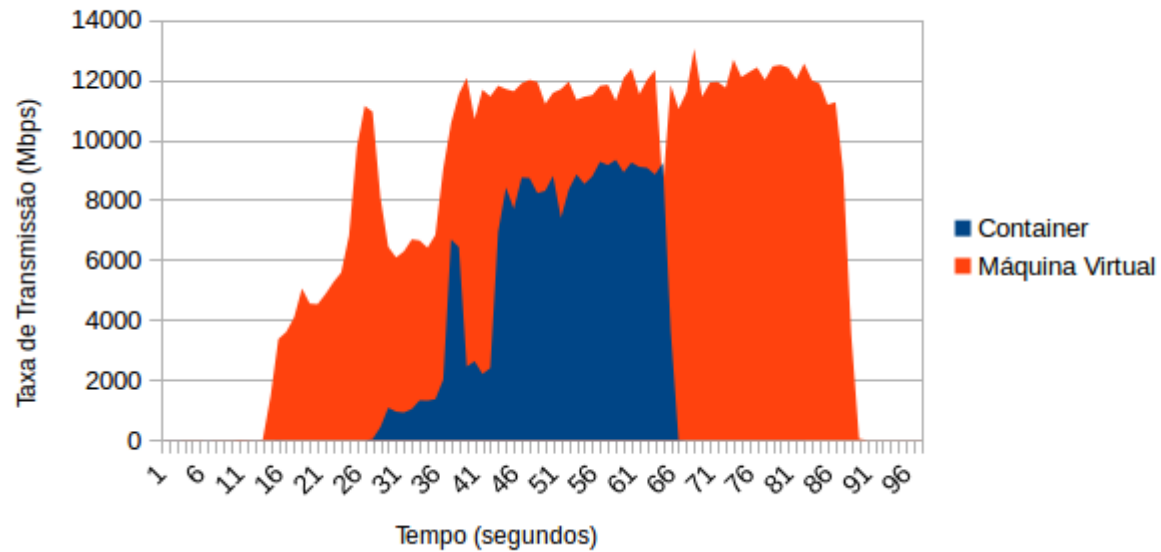
Experiments: CPU



Experiments: Memory



Experiments: Network



Conclusions and Future Work

- We analysed the performance and the resources consumption of an application replicated using the SMR approach
 - Containers vs. Virtual Machines
 - We found that containers perform better than virtual machines and, at same time, require less resources
 - Important for a cloud computing scenario, where you pay for what you use
- Future work
 - Integrate the SMR approach in the Kubernetes, a manager of containers
 - Compare these scenarios with the use of physical machines
- BFT-SMaRt: <http://bft-smart.github.io/library>

