Performance Evaluation of a Virtualized HTTP Proxy in KVM and Docker

RODRIGO EIRAS, RODRIGO COUTO, MARCELO RUBINSTEIN

Agenda

1. Introduction on NFV
2. NFV as Standard and Lightweight Virtualization
3. Performance Evaluation
4. Conclusion
5. Future Work

Introduction on NFV

NFV And SDN Investments Will Account For Over $5 Billion by 2020 – Market Trends, Scope and Implementation Across The Globe: MarketResearchReports.biz

MarketResearchReports.biz announces the addition of a new report to its vast repository of research studies. The report is titled "The NFV, SDN & Wireless Network Infrastructure Market: 2014 - 2020".

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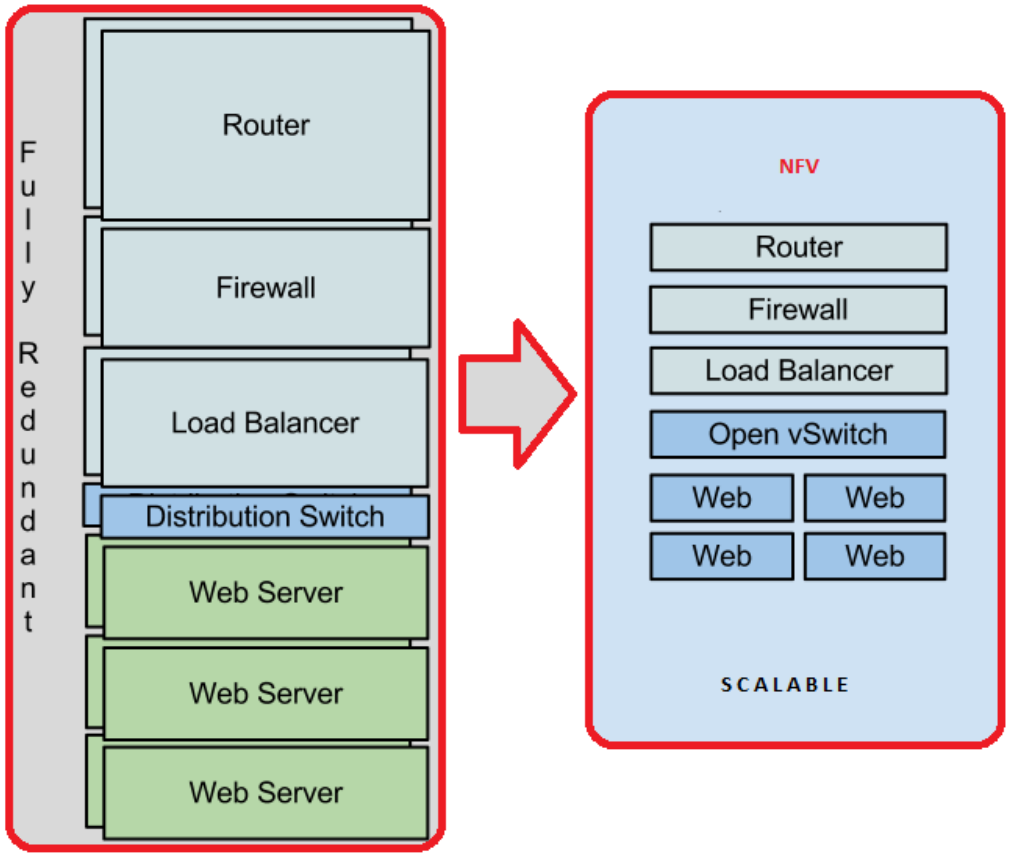
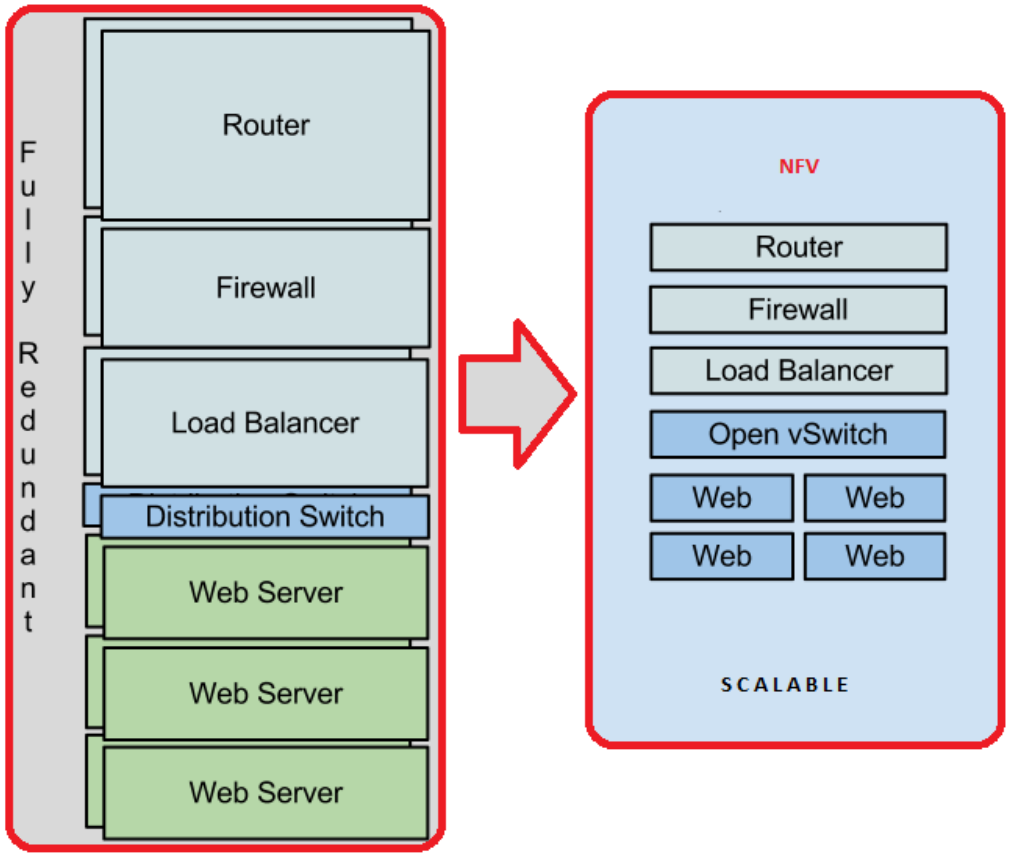
Introduction on NFV



- Network Function Virtualization (NFV) is a recent paradigm
- Many Network Functions (NFs), such as firewalls, load balancers, proxies and NATs can be implemented as VNFs

Introduction on NFV



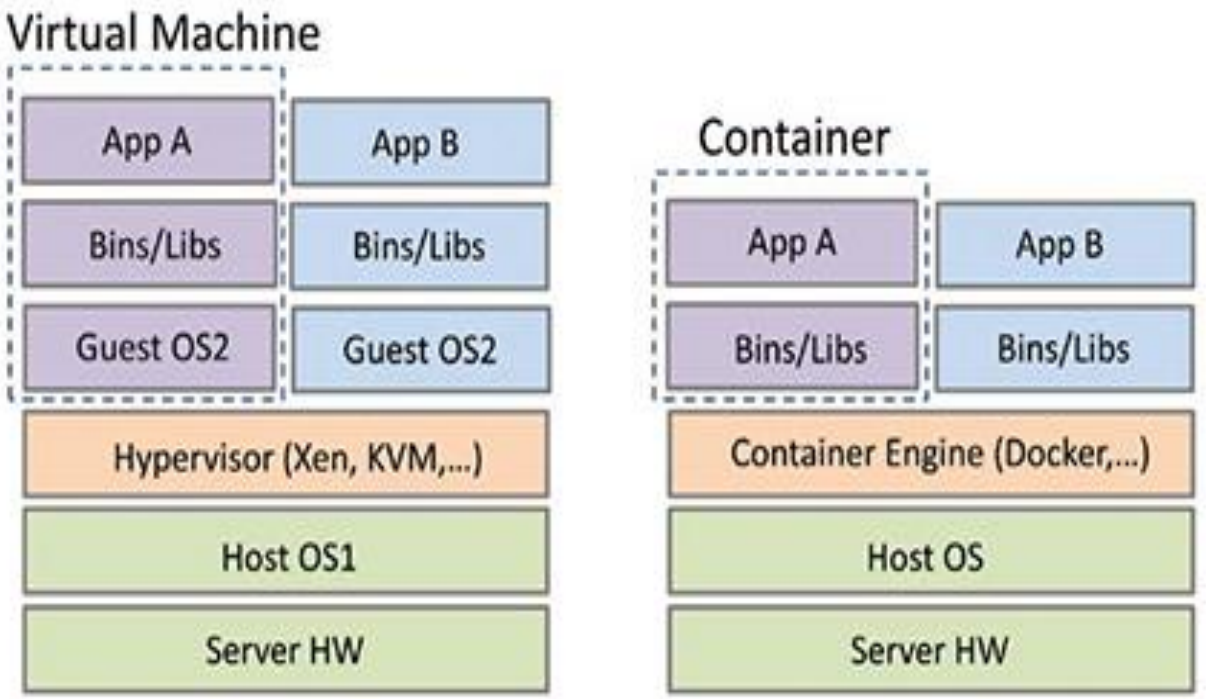
- The challenge of NFV is to provide similar performance when compared to dedicated hardware solutions

Motivation & Objective

- Our goal is identify if the container solution can be a good alternative to deploy HTTP Proxy service as VNF

- In addition, we evaluate the proxy service working as cache service and packet forwarder using the NFV approach

NFV as Standard and Lightweight Virtualization



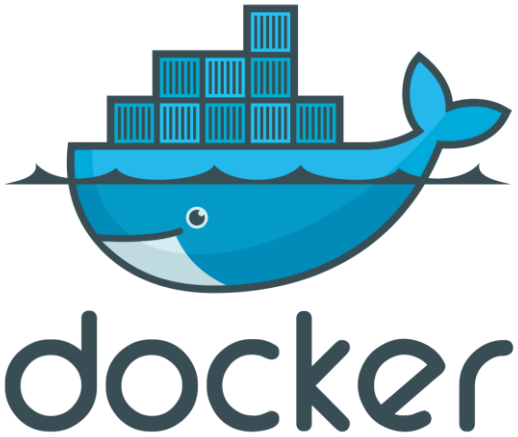
- As NFV employs the virtualization concept, VNFs can run on top of virtualization solutions originally developed for datacenters

NFV as Standard and Lightweight Virtualization

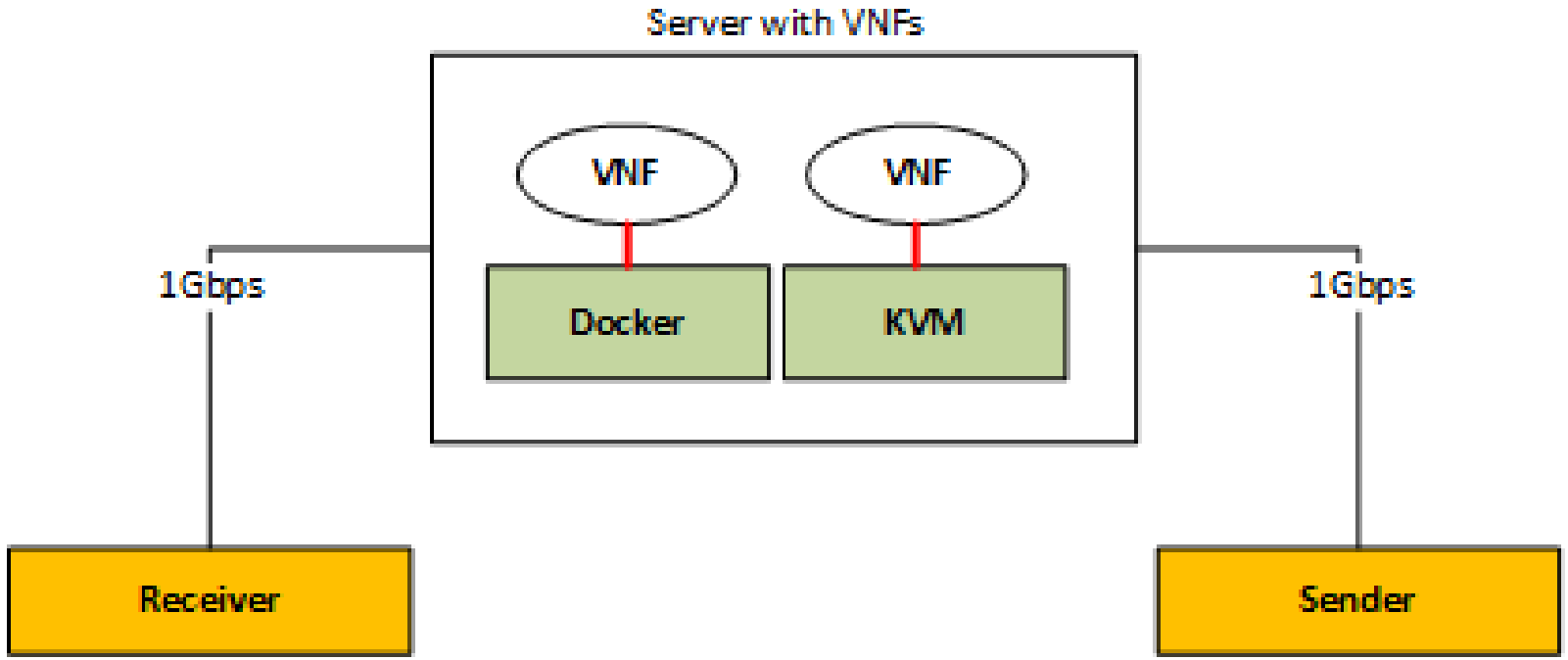
- The main issues regarding the adoption of hypervisor-based approaches, such as KVM, is the performance bottleneck that they impose in VMs

NFV as Standard and Lightweight Virtualization

- Lightweight virtualization, also called container-based virtualization, provides a different level of abstraction in terms of virtualization and isolation, when compared with hypervisors



Performance Evaluation



Performance Evaluation

- Squid 3 Proxy as VNF
- Apache 2 HTTP Server
- Apache 2 Benchmarking Tool

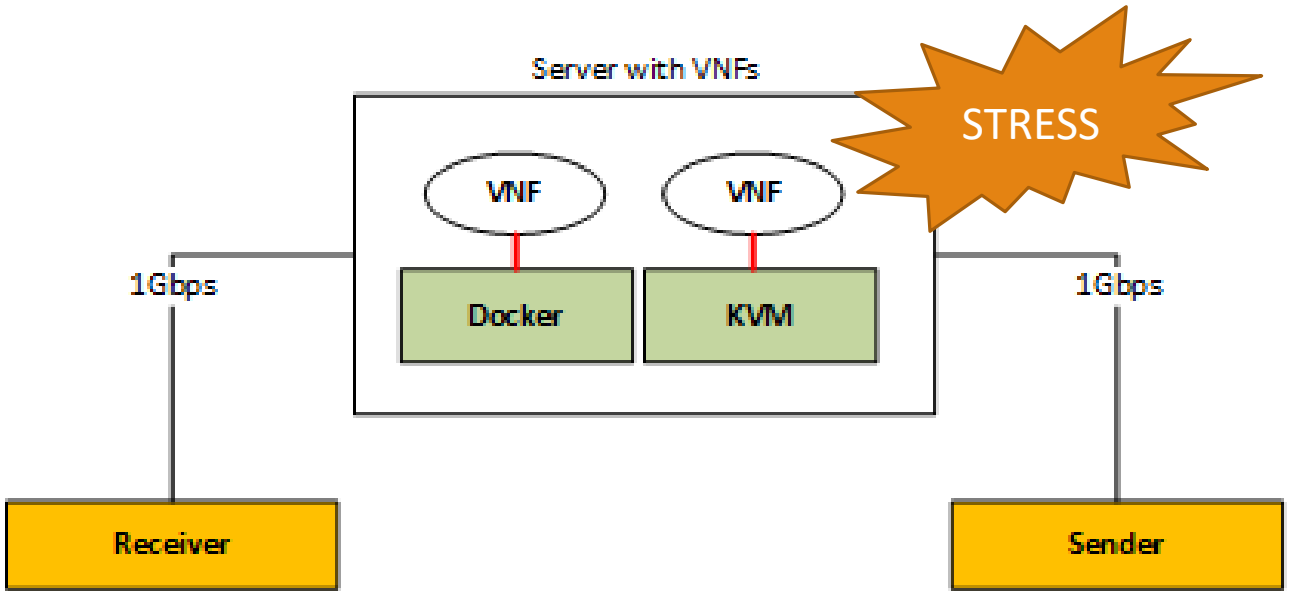
Performance Evaluation

- We evaluate the performance of KVM and Docker using proxy as a VNF. We also evaluate a proxy in a native Linux as a baseline

- Our tests focus on measuring the total time needed to receive responses for 10,000 requests

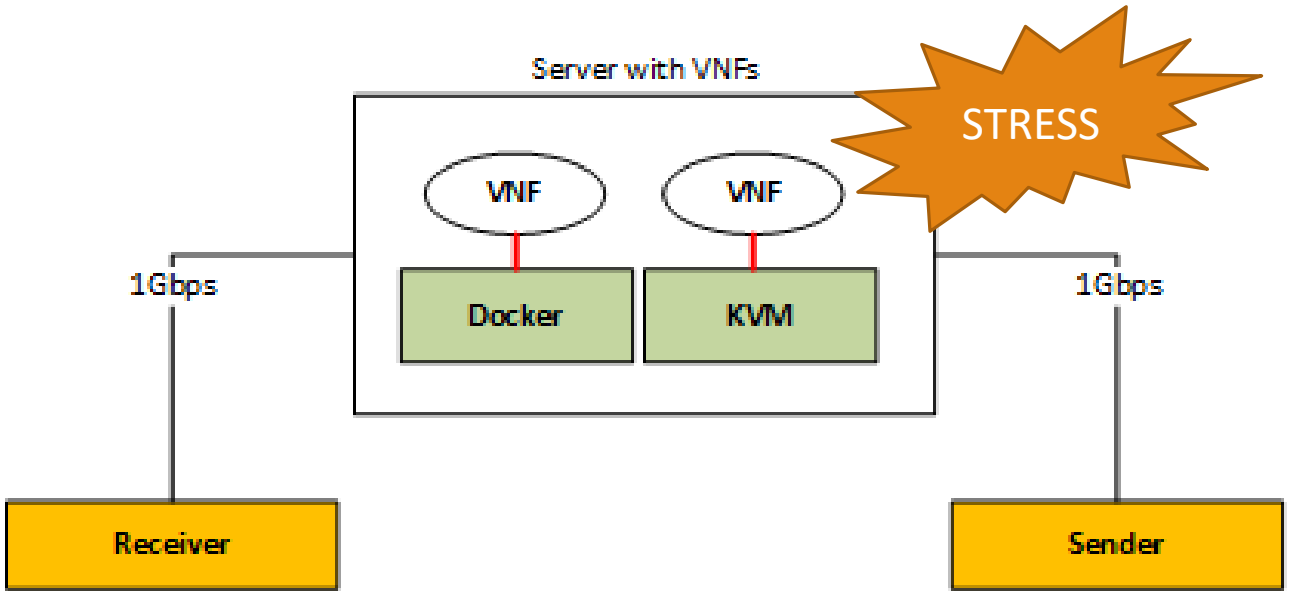
Performance Evaluation

- We insert in every test 12 fork processes on the physical server in which the proxy is executed



Performance Evaluation

- Each experiment is repeated 10 times and 95-confidence intervals were plotted



1st Case: Processing time [s] comparison with No Concurrency and No Cache System

Transfer Size	Linux (Native)	Docker (Routed)	Docker (NAT)	KVM
1 kB	6.98 ±0.02	7.48 ±0.02	7.48 ±0.02	9.24 ±0.27
10 kB	7.76 ±0.02	8.35 ±0.02	8.35 ±0.02	11.68 ±0.60
100 kB	15.81 ±0.02	17.28 ±0.03	17.29 ±0.03	32.53 ±1.99
1 MB	97.41 ±0.03	98.96 ±0.16	99.06 ±0.17	370.74 ±11.81
10 MB	903.63 ±0.29	913.93 ±0.80	914.76 ±0.83	2363.48 ±30.11

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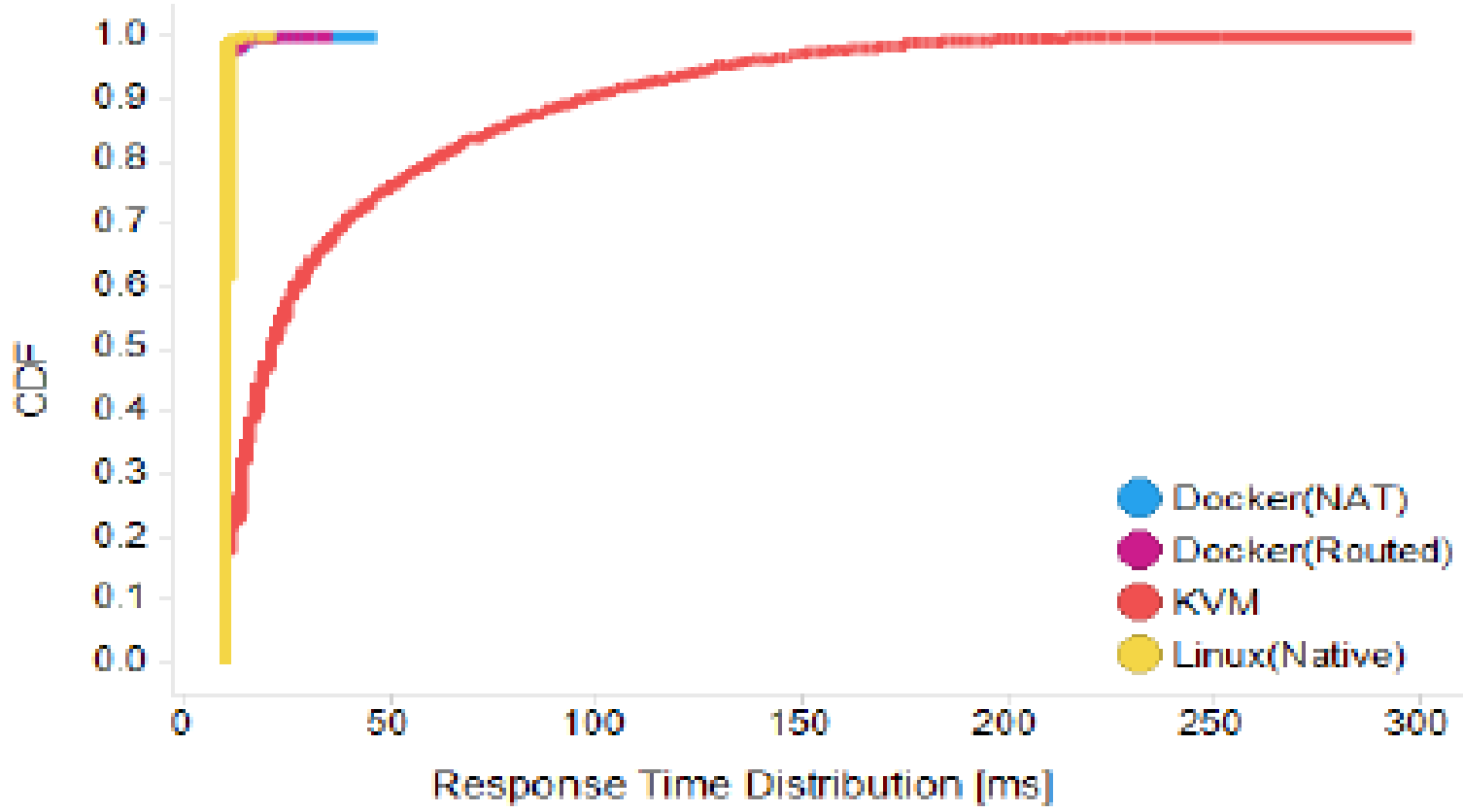

2nd Case: Processing time [s] comparison with 100 Concurrent Connections and No Cache System

Transfer Size	Linux (Native)	Docker (Routed)	Docker (NAT)	KVM
1 kB	2.05 ±0.01	2.38 ±0.01	2.49 ±0.01	3.33 ±0.02
10 kB	2.07 ±0.01	2.52 ±0.01	2.78 ±0.01	4.05 ±0.03
100 kB	8.66 ±0.05	8.53 ±0.03	8.70 ±0.04	16.99 ±0.15
1 MB	87.98 ±1.52	87.85 ±1.63	87.93 ±1.65	172.68 ±1.05
10 MB	878.06 ±20.26	877.83 ±19.06	877.75 ±19.02	1483.23 ±12.17

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100 kB	8.66 ±0.05	8.53 ±0.03	8.70 ±0.04	16.99 ±0.15
1 MB	87.98 ±1.52	87.85 ±1.63	87.93 ±1.65	172.68 ±1.05
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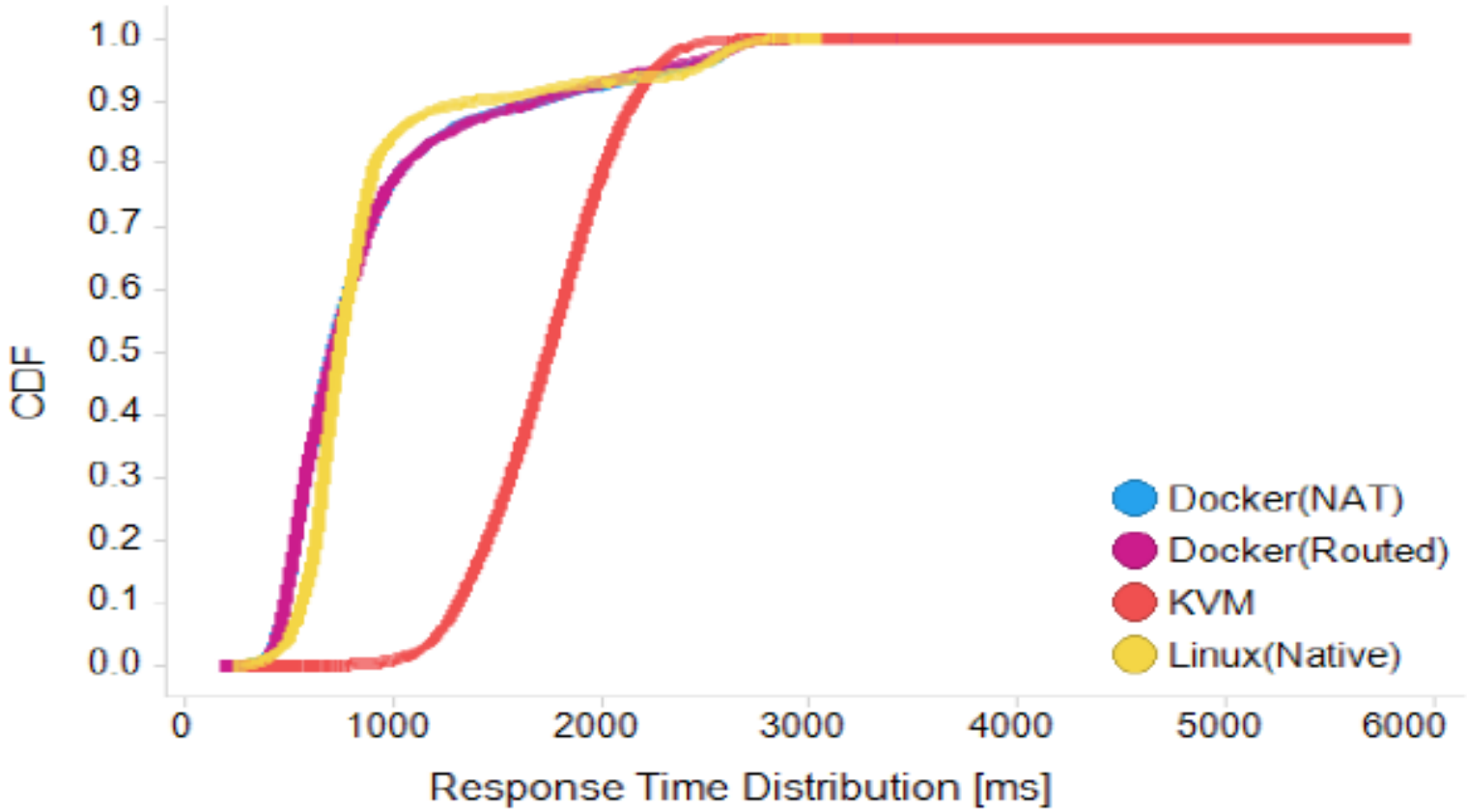
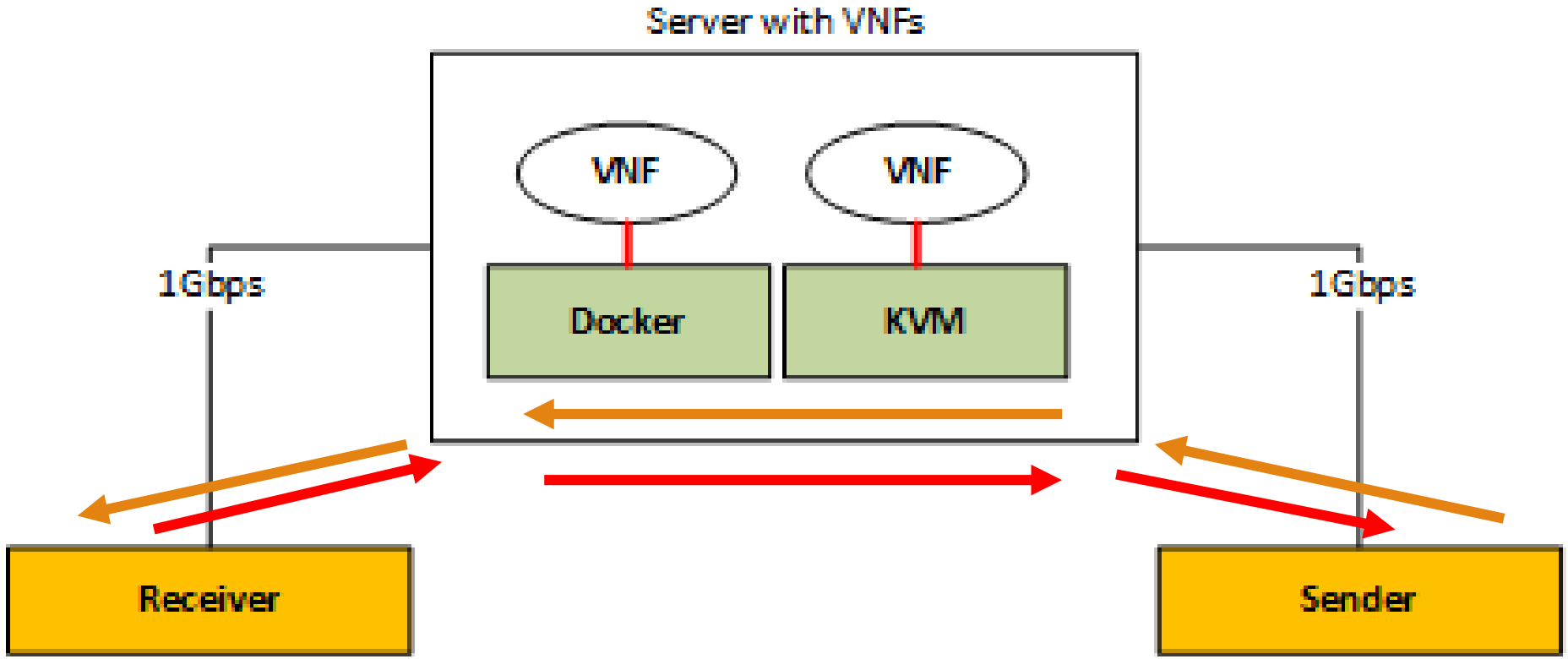


3rd Case: Processing time [s] comparison with No Concurrency and Cache Enabled



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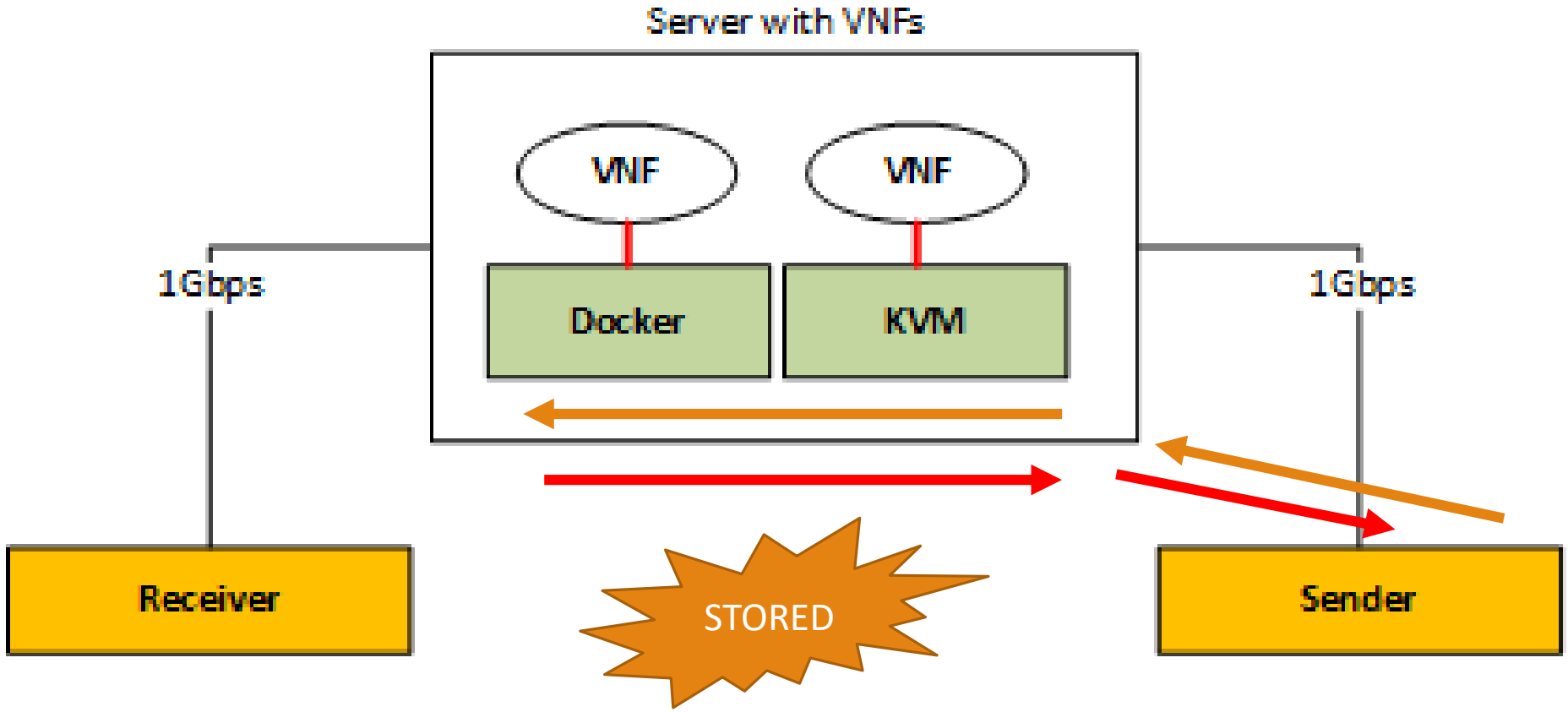

3rd Case: Processing time [s] comparison with No Concurrency and Cache Enabled

Transfer Size	Linux (Native)	Docker (Routed)	Docker (NAT)	KVM
1 kB	3.28 ±0.01	3.76 ±0.01	3.77 ±0.01	14.59 ±1.22
10 kB	3.84 ±0.01	4.24 ±0.01	4.21 ±0.01	17.88 ±1.38
100 kB	12.8 ±1.86	13.37 ±3.16	13.60 ±3.17	24.91 ±3.01
1 MB	92.96 ±3.12	93.54 ±3.76	93.58 ±3.86	106.68 ±3.98

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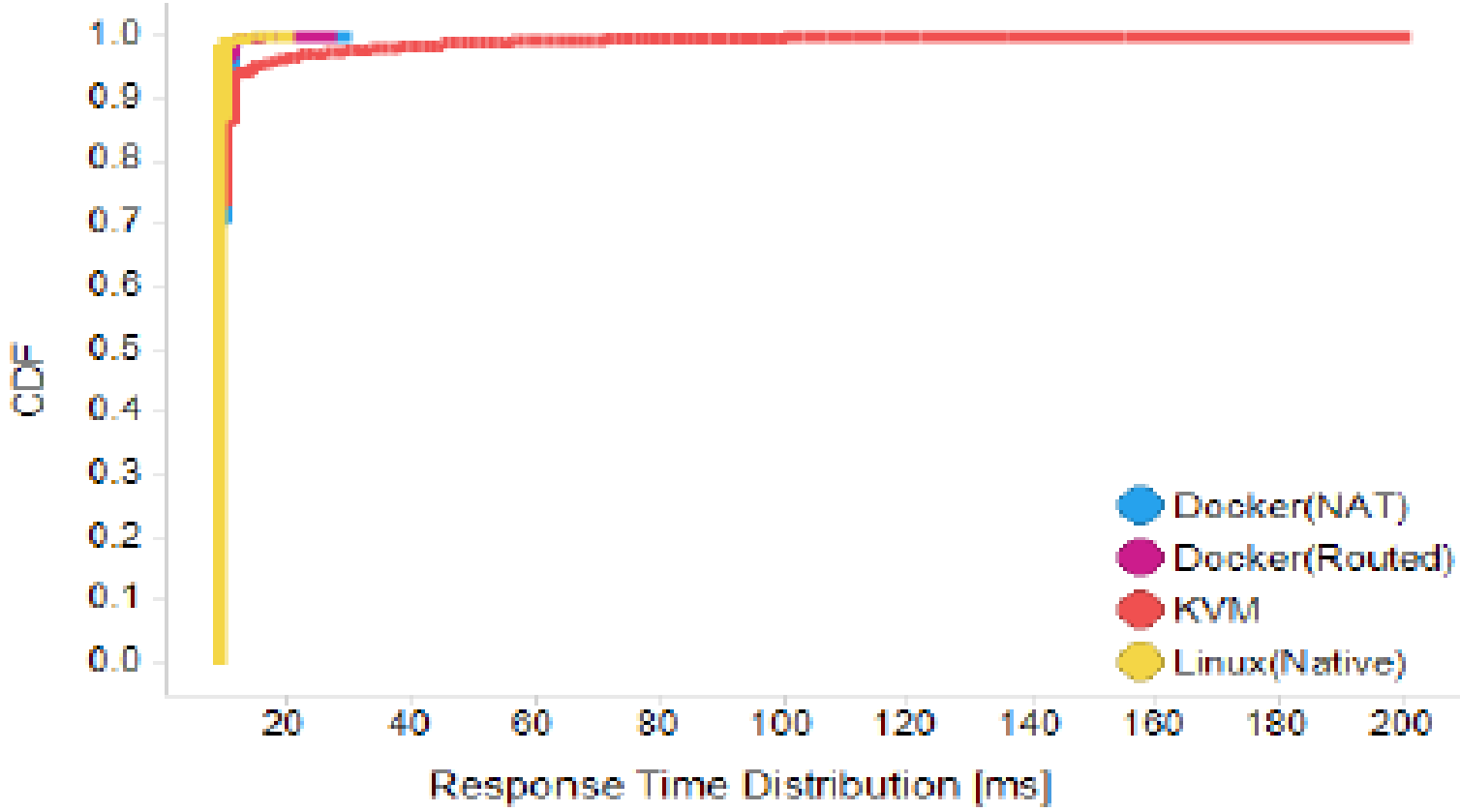

Conclusion

- We provided a performance analysis of an NFV application using Squid 3 proxy for two different types of state-of-the-art virtualization technologies

- It is possible to conclude that Docker can be a good alternative to work as HTTP proxy in a NFV environment

Future Work

- We will analyze Docker scalability

- We will perform the experiments using more than one instance for each VNF to naturally stress the physical computer and evaluate the performance in an environment closer to a production network

Thank you!

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