5GO.pt

Workshop PPS3

Containers and beyond: Reliable 5G Environments for Verticals

Daniel Corujo (ITAV)

Partners:

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Structure

- Introduction
- Motivation and Objectives
- Enabling Technologies
- Scenario Description and Architecture
- Reliability Mechanisms
- Evaluation
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Enabling Technologies

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Enabling Technologies

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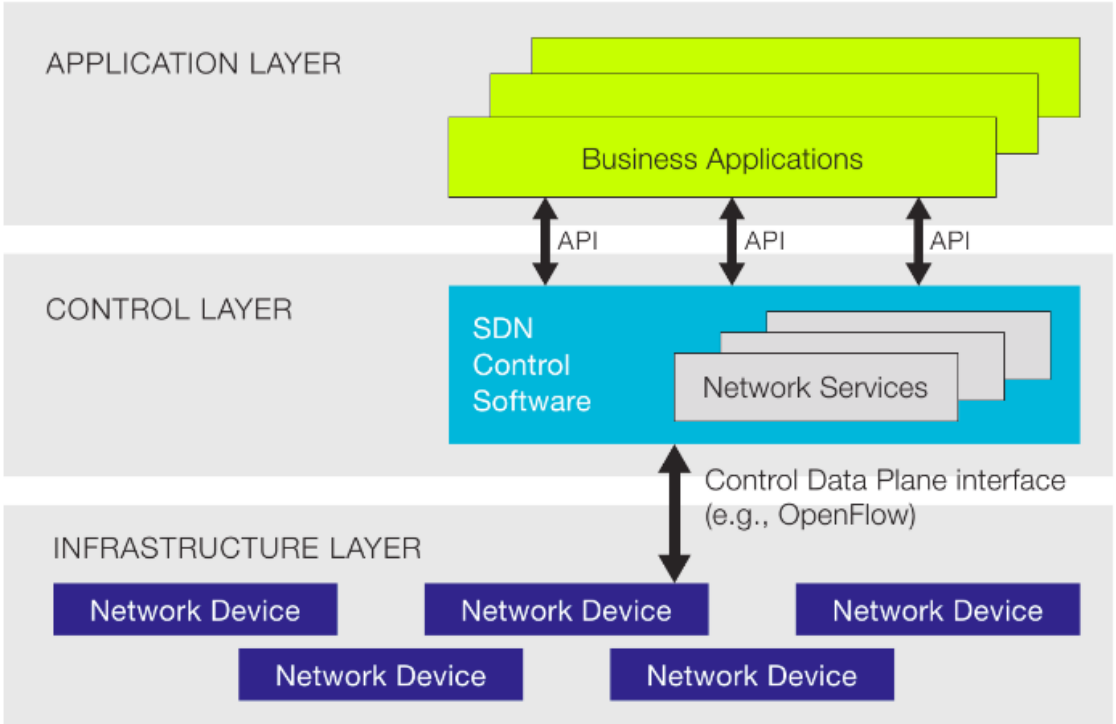
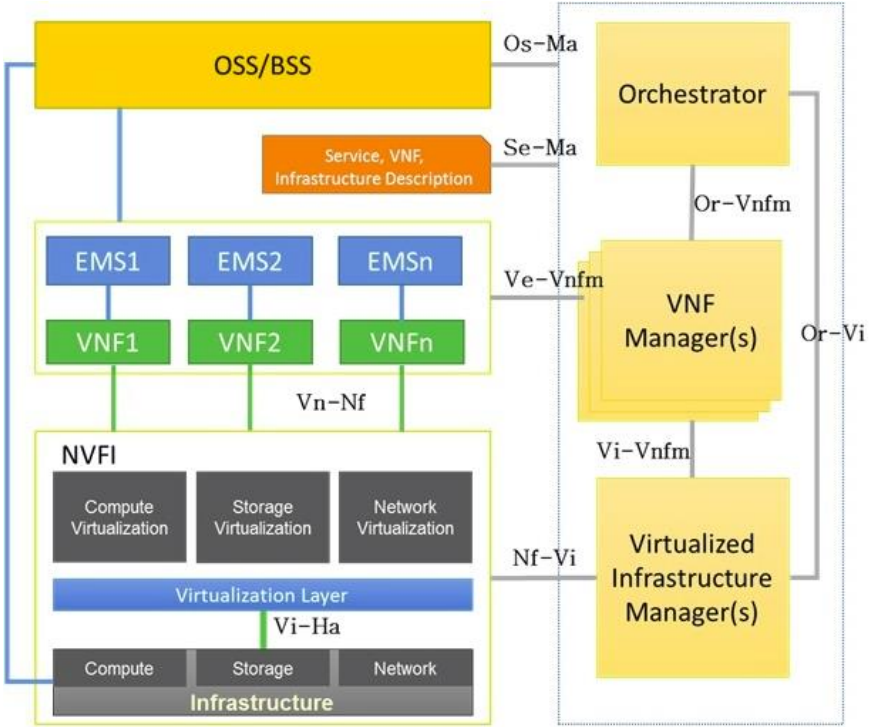
Software Defined Networks



Network Function Virtualization



Virtualization Techniques

Virtualization Techniques	Pros	Cons
Virtual Machines	Isolation from host; Orchestration solutions available.	High memory overhead; Number of instances can be a problem; A whole OS is virtualized.
Containers	Fast boots; Orchestrations solutions available; Dynamic resource allocation;	Low isolation between the containers and the host as the kernel is shared; Less secure.
Unikernels	Lightweight VM; Specialized machine; Isolation from host; Higher security.	Limited deployment possibilities; Resource allocation is static; Lack of orchestration solutions; Low maturity for production.

Use Case Scenario and Architecture

Consortium Leader
Altice Labs, S.A.

info@5go.pt
@5Go.pt
@5go_pt
@5GO.PT

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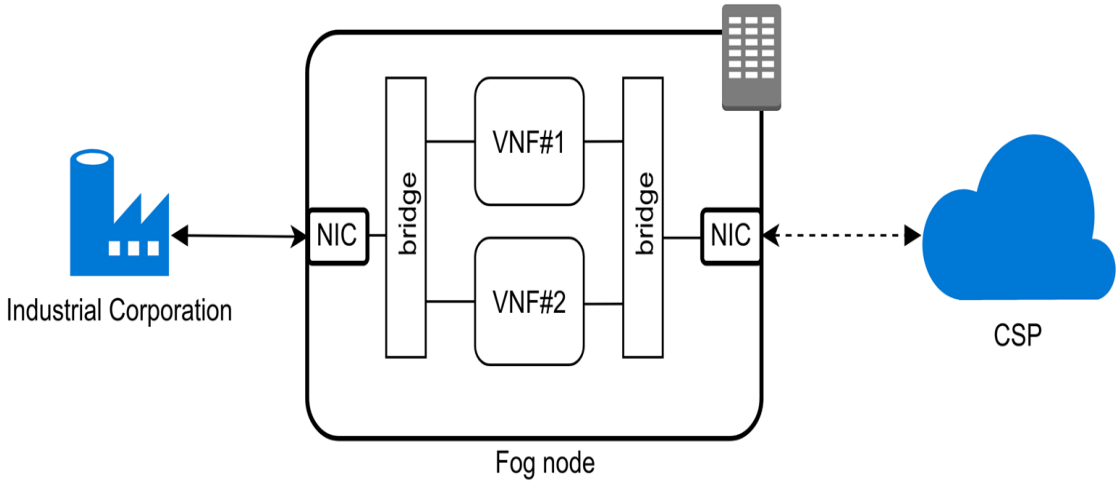
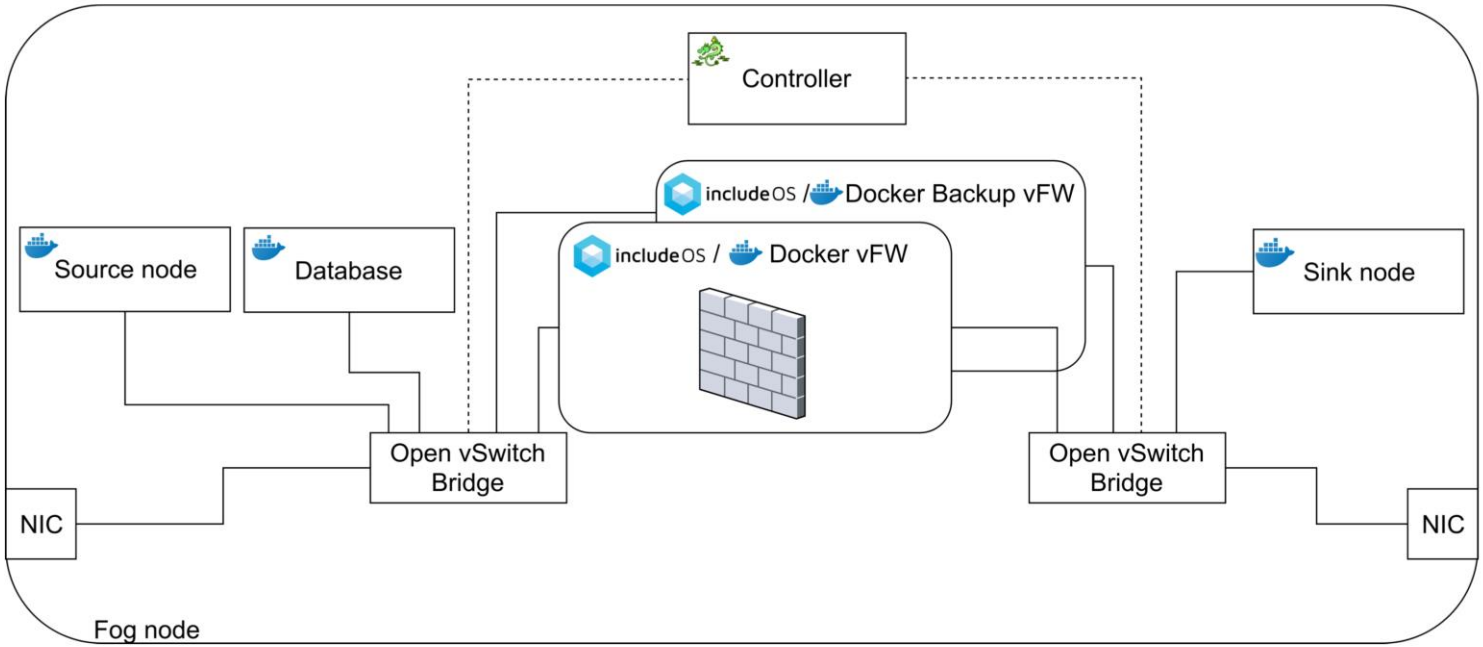
- Cloud Service Provider
- Host Critical VNFs
- Ensure reliability



Baseline Architecture

- Deployment for proof-of-concept evaluation:



VNF - Firewall

Docker FW	includeOS FW
Alpine Container with iptables package (TinyOS); FW filters the packets according to the iptables rules specified in a bash file; Total image size – 16.4 MB.	Binary file compiled via a C++ code where the firewall rules are programmed; Launched by QEMU-KVM; Total image size – 3.2 MB.

Reliability Mechanisms

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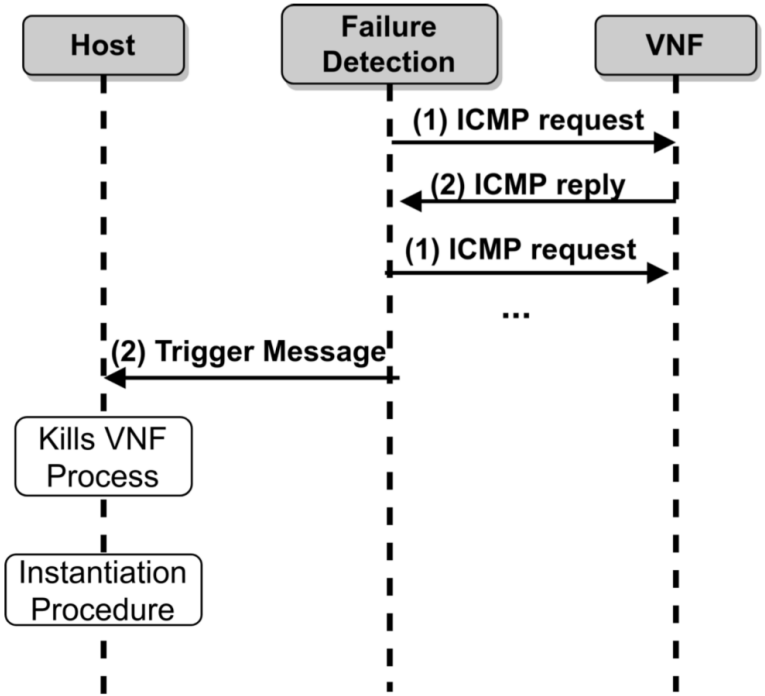
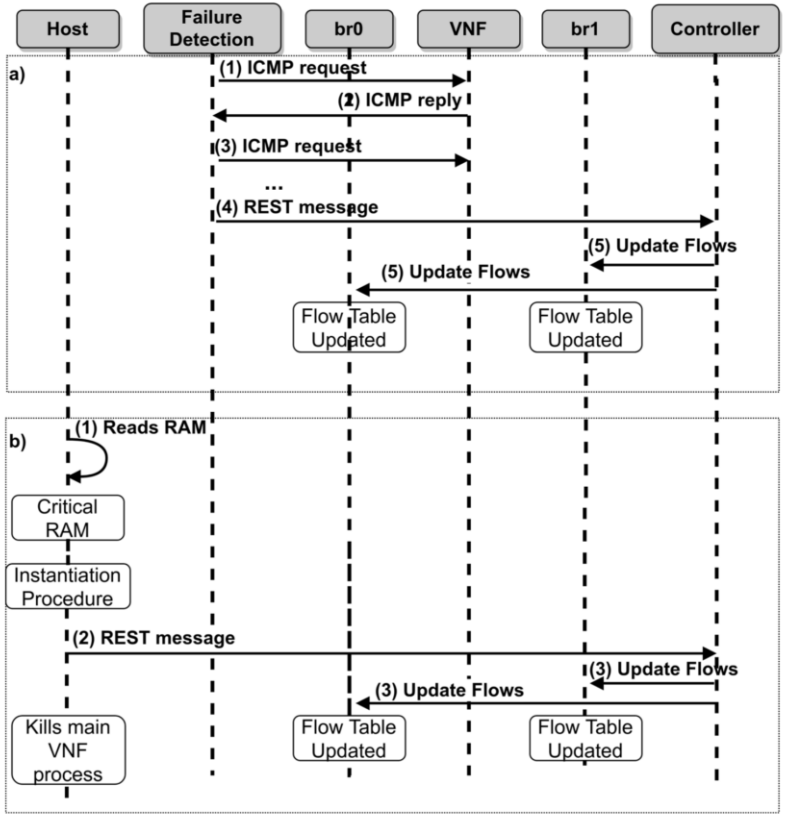
Failure Detection Mechanism



SDN-based datapath update

a) Switch to backup VNF already running

b) Dynamic preemptive new VNF instantiation



Evaluation

Consortium Leader
Altice Labs, S.A.

info@5go.pt
@5Go.pt
@5go_pt
@5GO.PT

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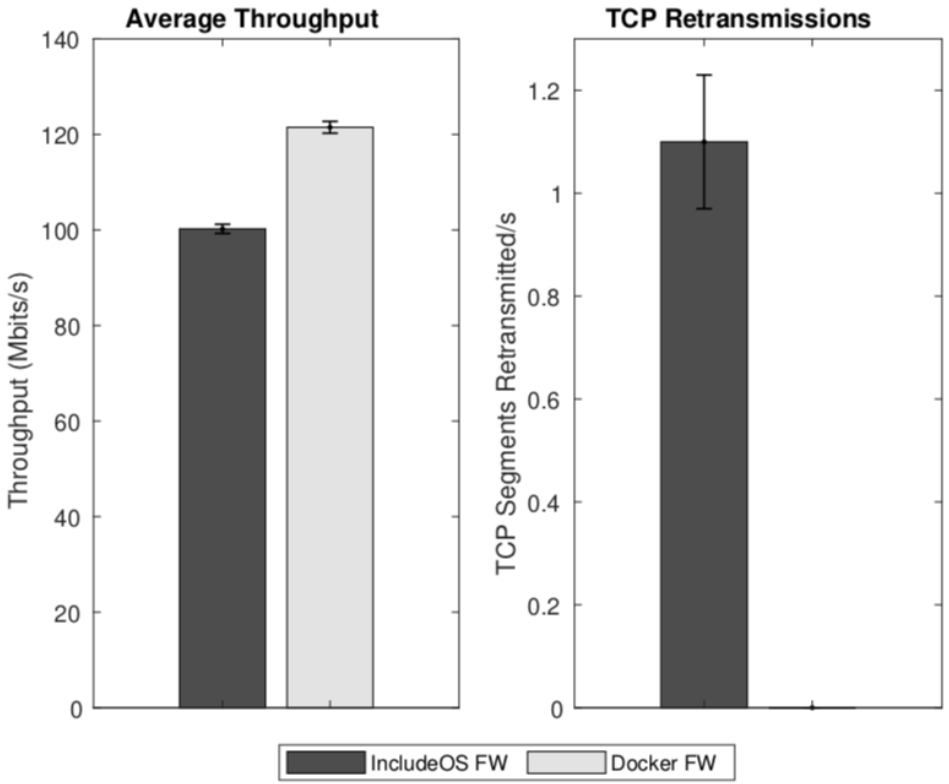
Instantiation Time

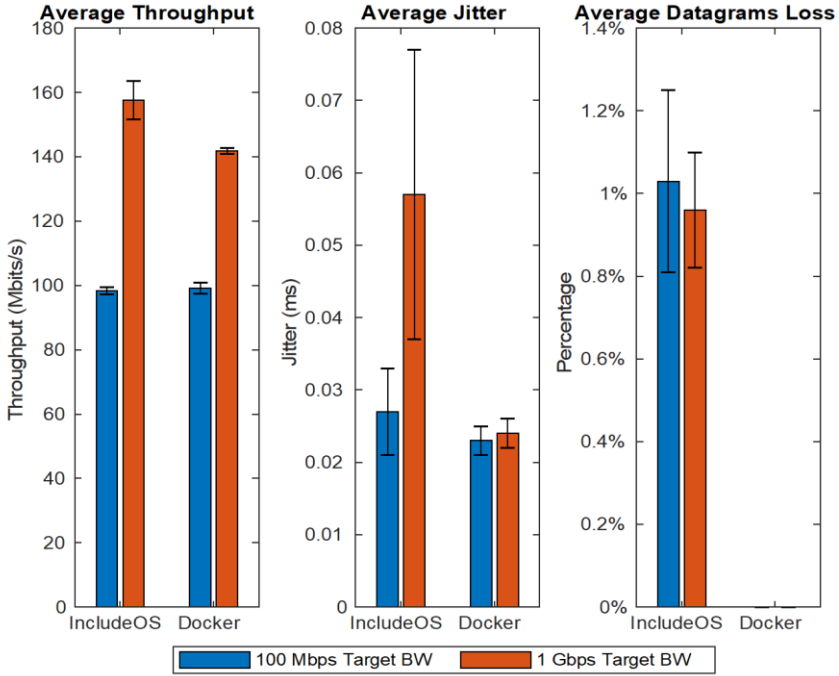
VNF	Size (MBytes)	Instantiation delay (s)	Traffic latency (ms)
Docker Firewall	16.4	3.02 ± 0.05	0.27 ± 0.02
IncludeOS Firewall	3.2	4.44 ± 0.10	0.79 ± 0.03

TCP Performance



Traffic Traversing VNF

UDP Traffic:



SDN Recovery Mechanism

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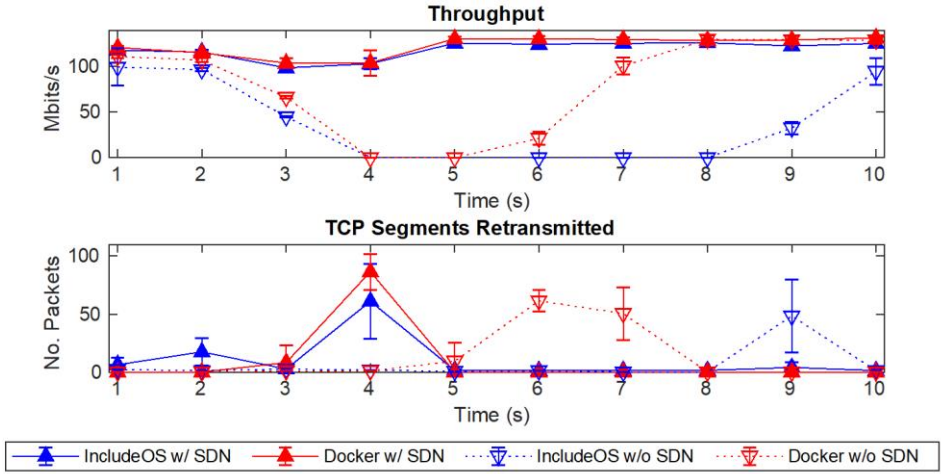
SDN Recovery Mechanism Evaluation

TCP Traffic with Backup VNF Running in Parallel:

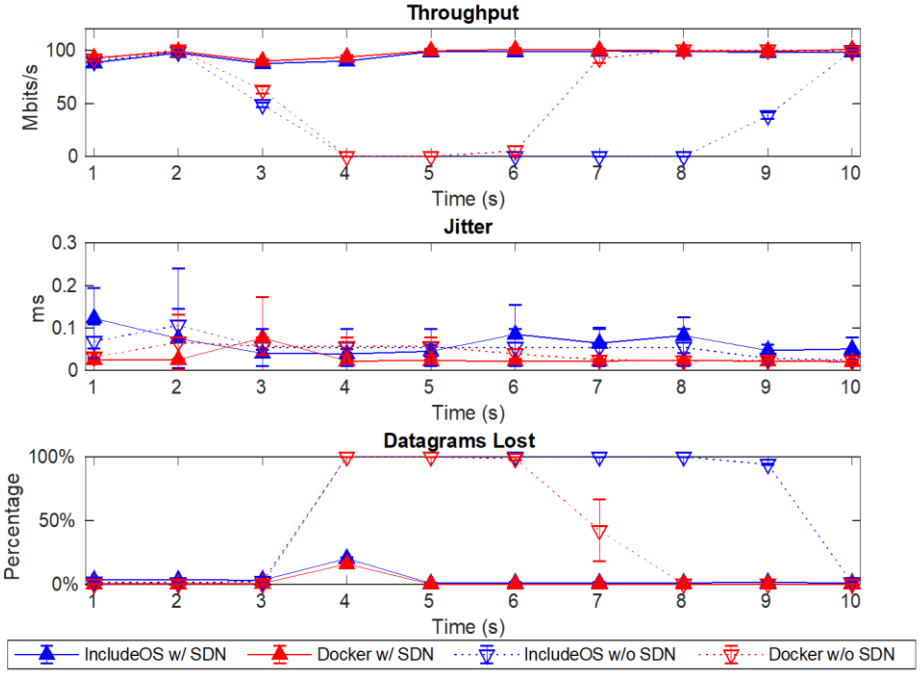
- Failure induced at Time = 3 sec.



SDN Recovery Mechanism Evaluation

UDP (100 Mbps) Traffic with Backup VNF Running in Parallel:

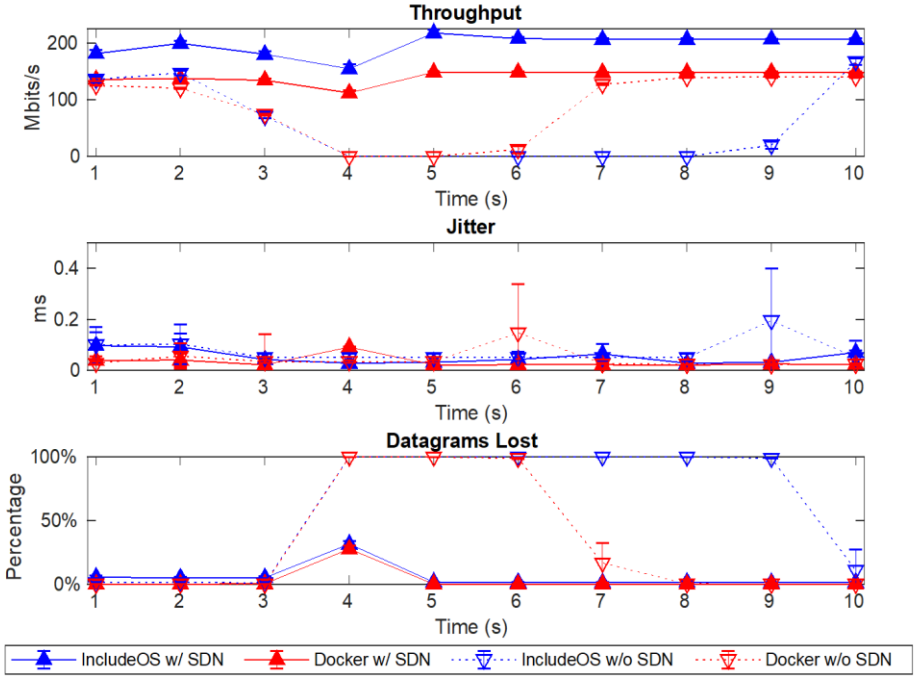
- Failure induced at Time = 3 sec.



SDN Recovery Mechanism Evaluation

UDP (1 Gbps) Traffic with Backup VNF Running in Parallel:

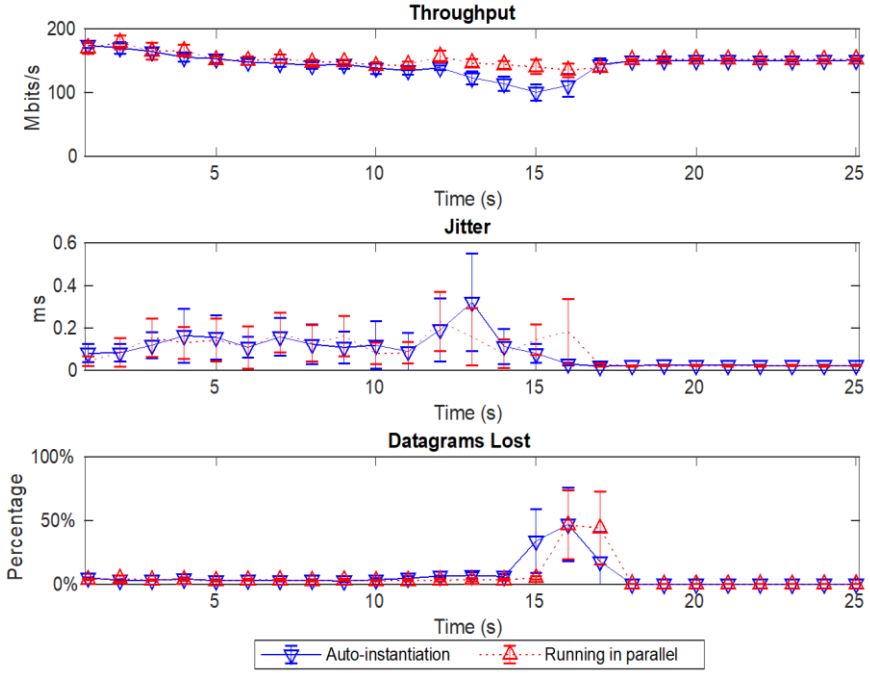
- Failure induced at Time = 3 sec.



SDN Recovery Mechanism Evaluation

UDP (1 Gbps) Traffic with Backup VNF Dynamically Instantiated:

- RAM reaches critical values at Time = 10 sec.



Conclusion

- Docker containers proved to be a better platform than IncludeOS unikernels for the instantiation of critical VNFs for the use-case presented in this work;
- The proposed reliability mechanisms were able to achieve near zero downtime for the evaluated service.

Future Work

- Other types of VNFs, such as DNSs, CDNs could be compared between these two different virtualization technologies.
- Not only other VNFs could be tested, but other containers and unikernels could also be evaluated.
- Another complement to the proposed architecture would be to take into account the scalability of the VNFs running in the data-center.

Thank you for your attention! Questions?

- dcorujo@av.it.pt

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