AINA

NIEP: NFV Infrastructure Emulation Platform

Thales N. Tavares, Leonardo da C. Marcuzzo, Vinícius F. Garcia, Giovanni V. de Souza, Muriel F. Franco, Lucas Bondan, Filip De Turk, Lizandro Z. Granville, Elias P. Duarte Júnior, Carlos R. P. dos Santos, Alberto E. Schaeffer-Filho

Universidade Federal de Santa Maria
SEDES SAPIENTIÆ
1960

Summary

- **Introduction**
- **Related Works**
- **NIEP Architecture**
- **NIEP Evaluation**
    - Case Study Scenario
    - Experimental Results
    - Discussion
- **Conclusion**

Introduction

- **Network Function Virtualization (NFV)**
  - Network “softwarezation”
  - Decoupling network functions from its associated hardware
  - High elasticity and flexibility environment
  - Reduced CAPEX and OPEX
  - Network services creation (Service Function Chaining)
- **Emulation**
  - Common technique to evaluate applications
  - Reduced risks for production environment
  - Reduced learning curve

Related Works

- **EsCAPE**
    - Prototype and orchestrate VNFs and SFCs
    - UNIFY architecture
    - Click language
    - Container virtualization
    - Mininet for network emulation
- **MeDICINE**
    - Prototype and orchestrate VNFs and SFCs
    - Multi-PoP environments emulation
    - Click language
    - Container virtualization
    - ContainerNET for network emulation

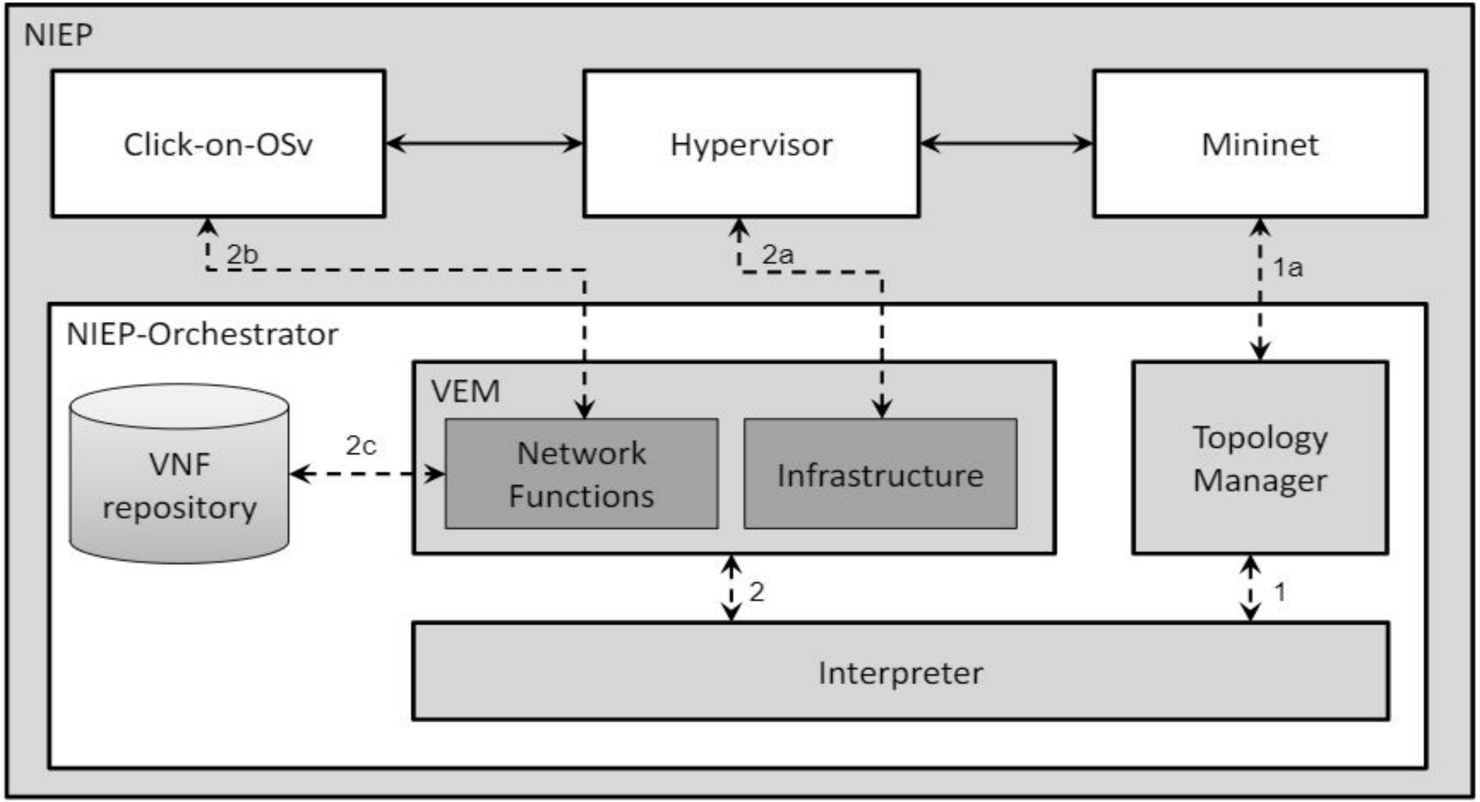
Related Works

- **EsCAPE and MeDICINE uses only container virtualization**
  - Dependency of native OS resources
  - Lack of portability and security
  - Necessary a homogeneous scenario
  - Single domain deployment
  - No way to deploy minimalist VMs with real VNFs platforms
    - ClickOS
    - Click-on-OSv

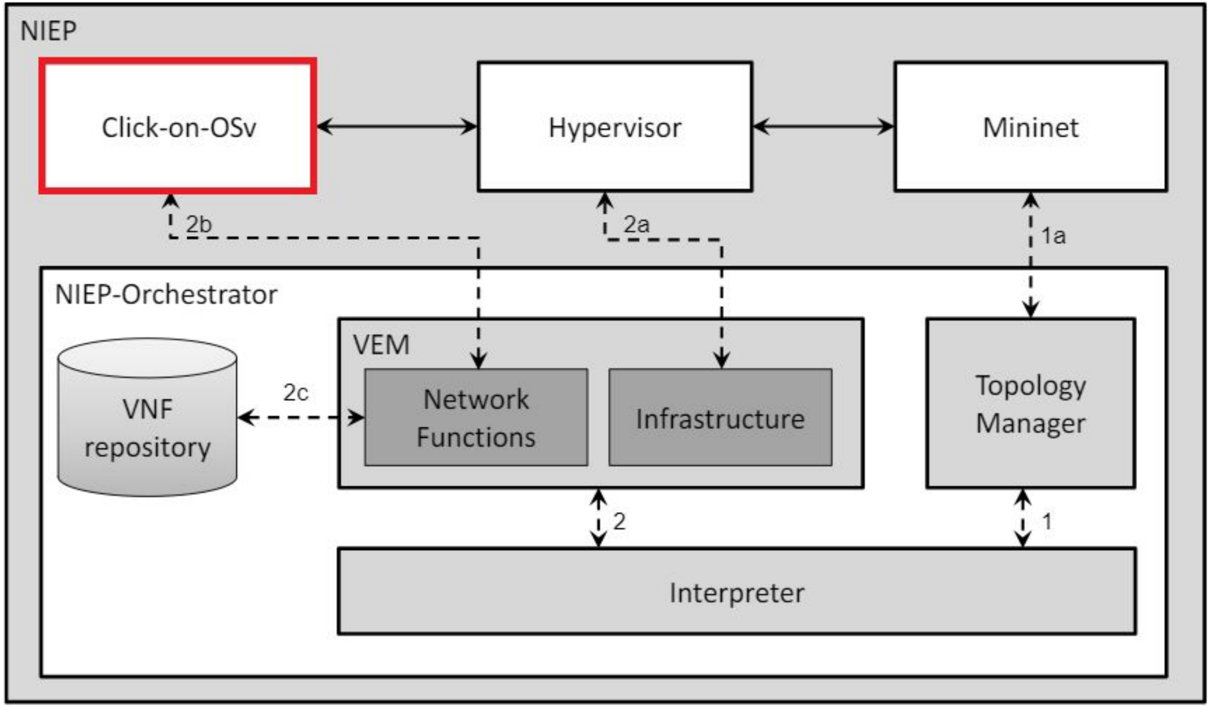
NIEP Simulation Requirements

- **Emulation**
    - Large-scale system evaluation
    - Reduced costs
- **NFV Emulation Requirements**
    - Scalability
    - Flexibility
    - Remodeling
    - Software execution

NIEP Architecture



NIEP Architecture



Click-on-OSv

Minimalist OS designed for VNF implementation

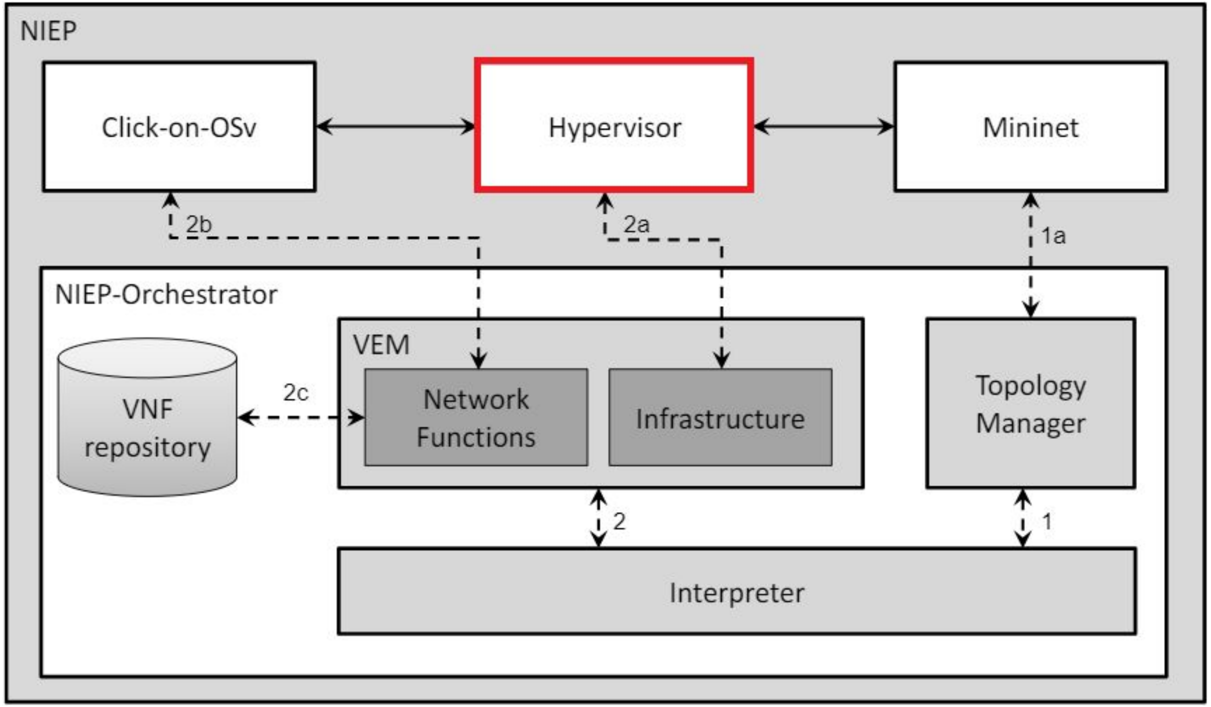
Click based functions

DPDK packet accelerator

REST EMS coupled in the VNF

Instantiated as a complete VM

NIEP Architecture



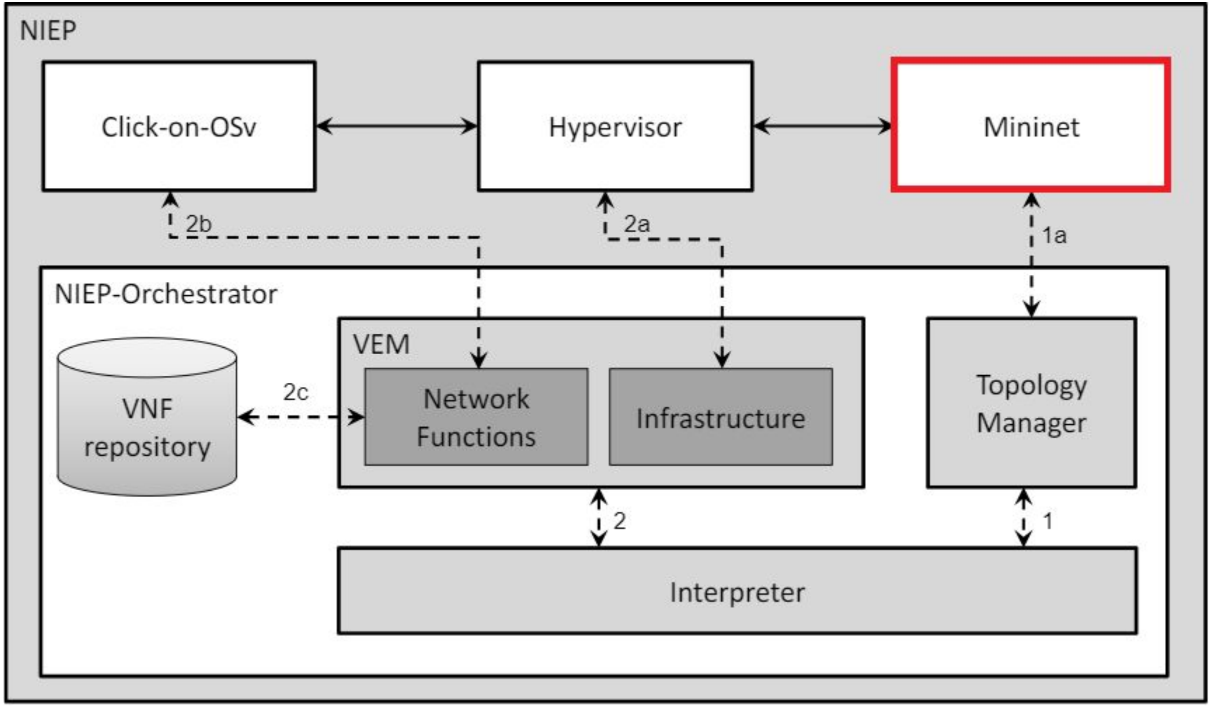
Hypervisor

KVM hypervisor

Good performance when associated to Click-on-OSv - VirtIO optimizations

Communication through Virsh tool

NIEP Architecture



Mininet

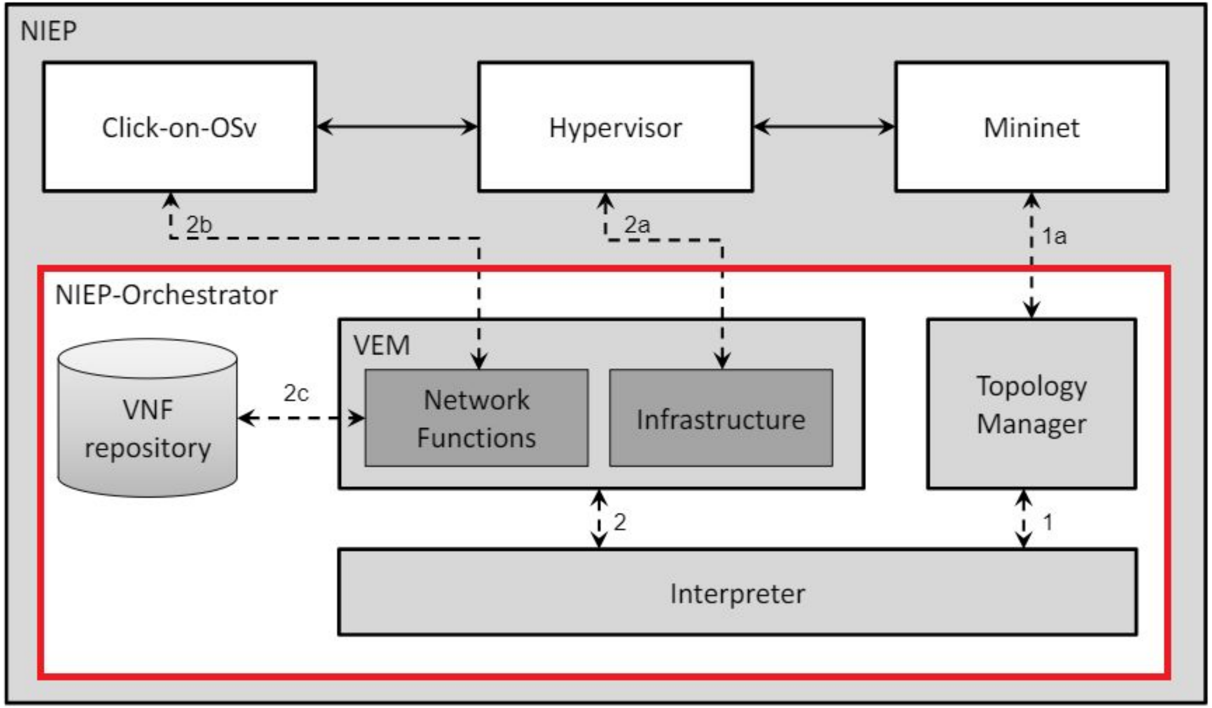
Network emulator

Process level virtualization

Large scale networks environments

OpenFlow support enabling SDN technology

NIEP Architecture



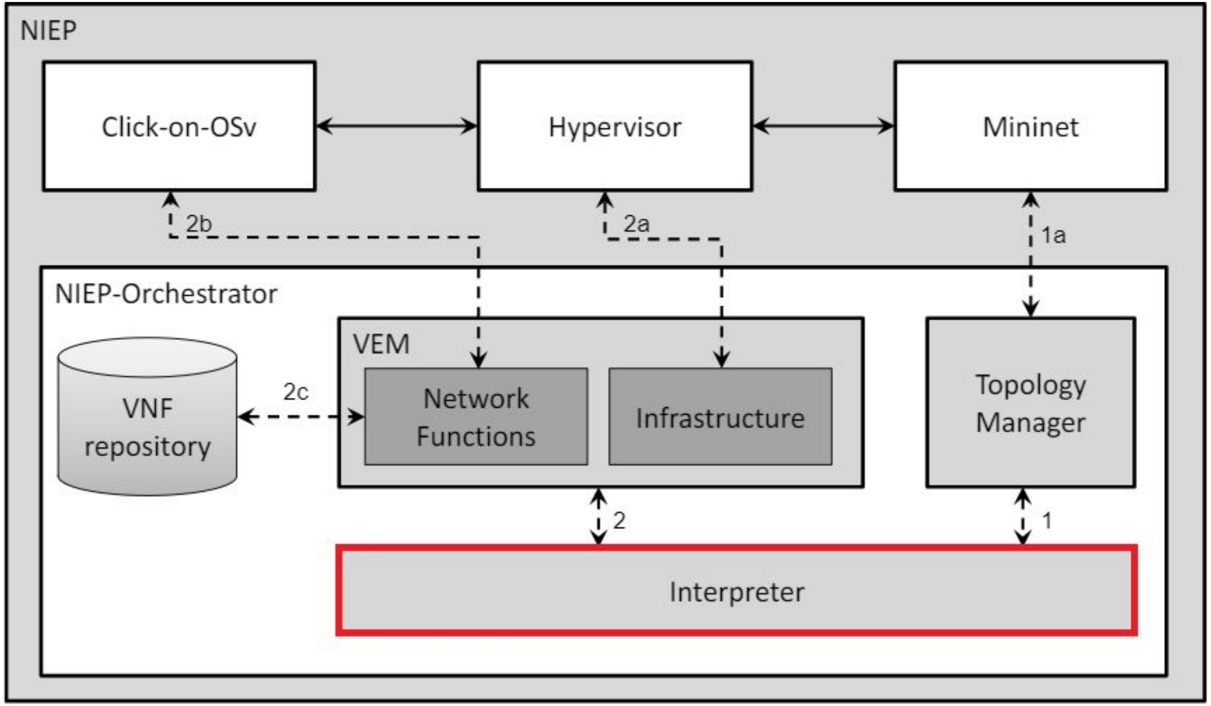
NIEP Orchestrator

Topologies instantiation and management

General VMs lifecycle

Four main sub modules

NIEP Architecture



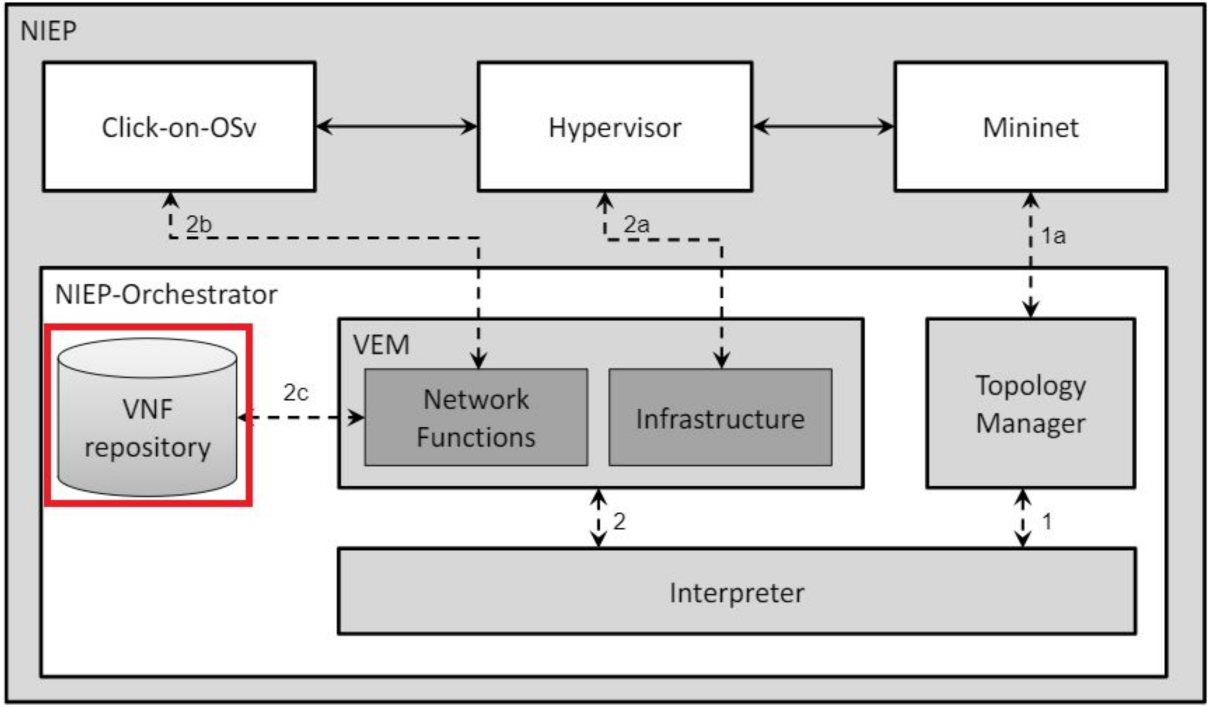
Interpreter

Receives JSON topology requests and validate them

Handle user requests for a topology management

Returns operations results for the user

NIEP Architecture



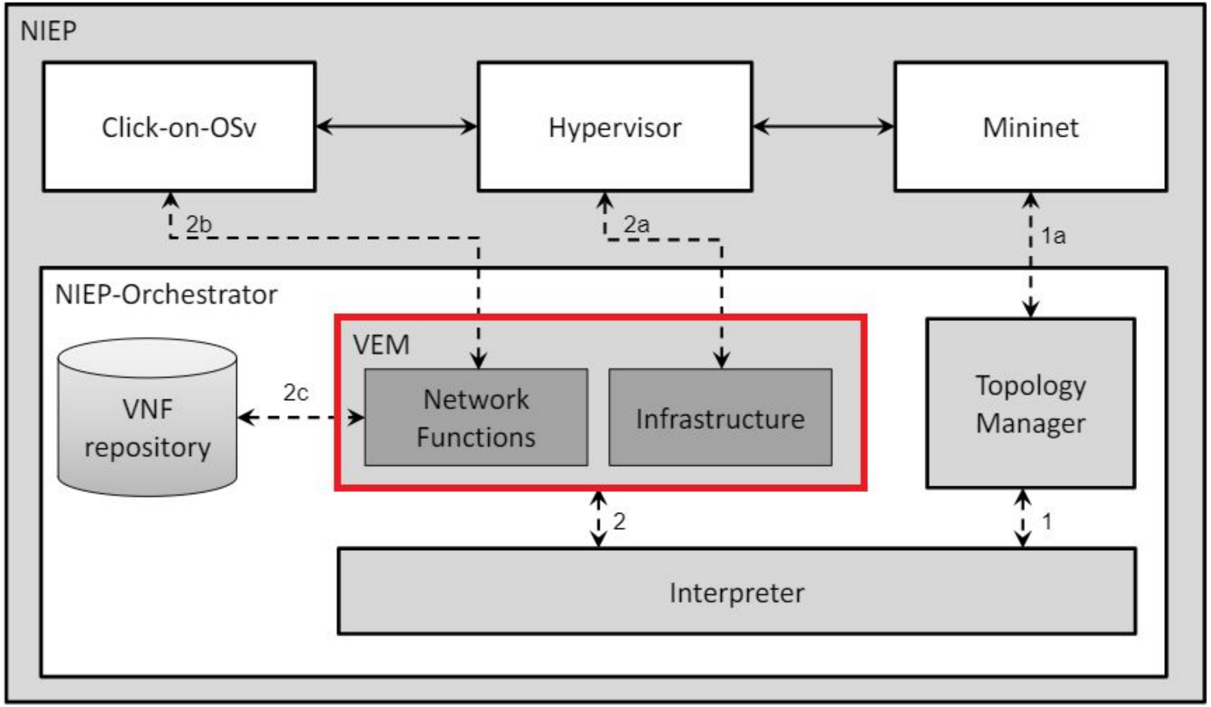
VNF Repository

Stores network Click network functions

Local personal repository

Widely accessible repositories (HDFS, HTTP)

NIEP Architecture



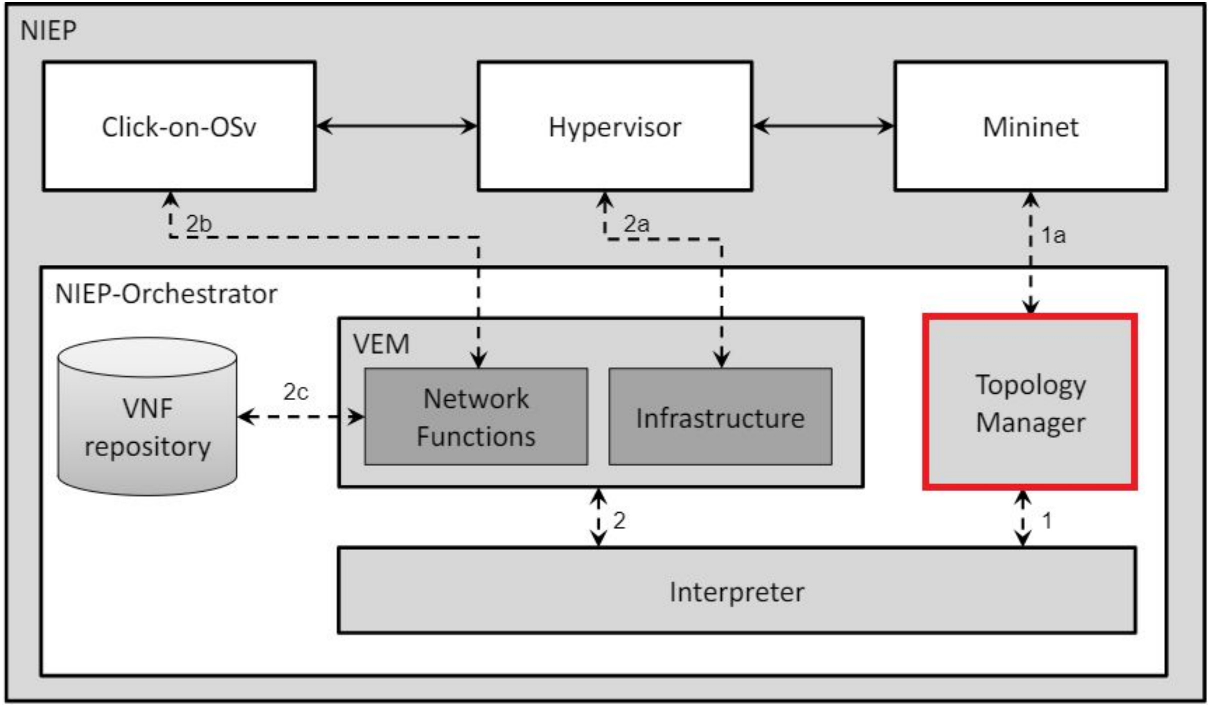
Virtual Element Manager (VEM)

Provides the communications interfaces and control the VNFs life cycle

Infrastructure functional block controls the KVM hypervisor (2a)

NF functional block that retrieves the network functions (2c) and controls the VNF using the REST interface (2b)

NIEP Architecture



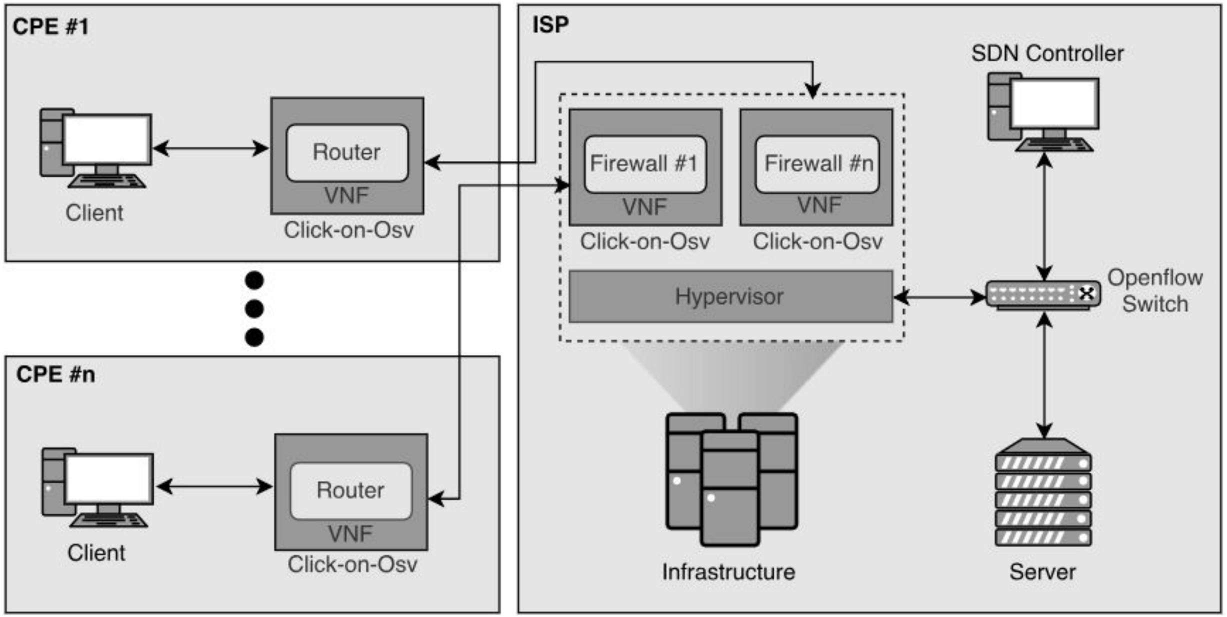
Topology Manager

Create and initialize the Mininet network topology

Manage and provides an user interface through the Mininet API

Receives requests from Interpreter (1), translate to commands and send to Mininet (1a)

Case Study Scenario



CPEs

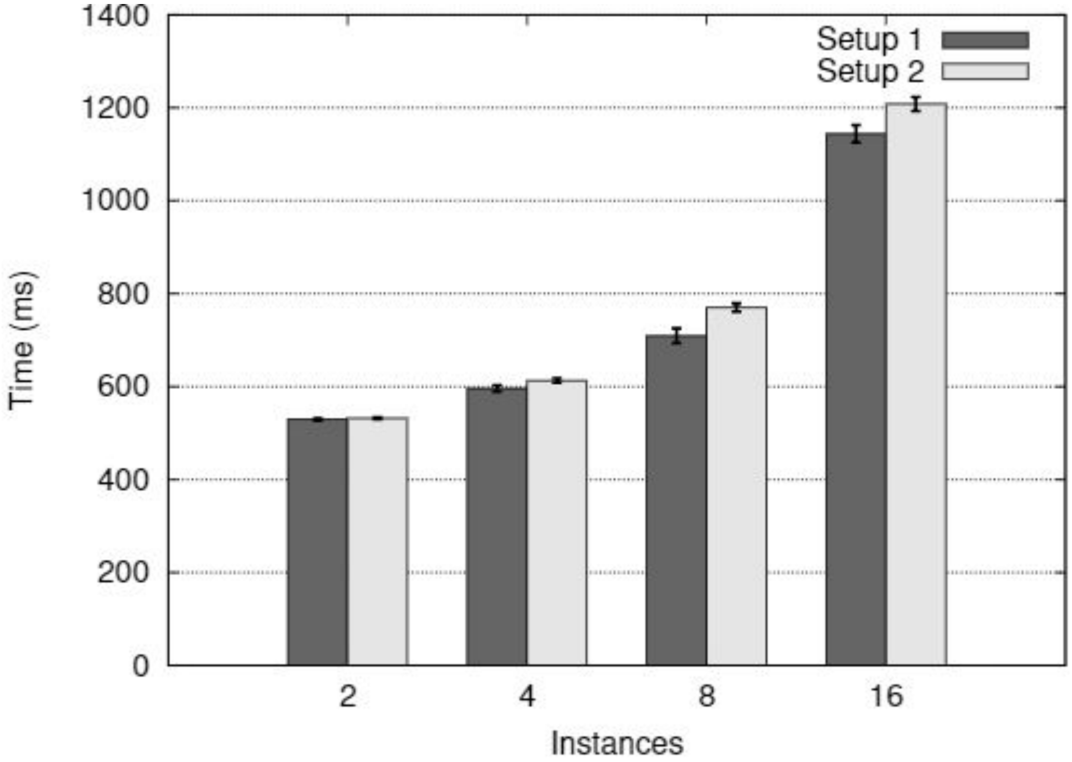
Intel Core i7-6700k@4.00GHz server, with 8GB RAM DDR4, 4 cores, and running CentOS 7, 1 Gbps network interface

ISP

Intel Xeon E3-1220v6@3.00GHz, 8GB RAM DDR4, 4 cores, running Ubuntu 14.04, 1 Gbps network interface

Two Setup Scenarios

Experimental Results



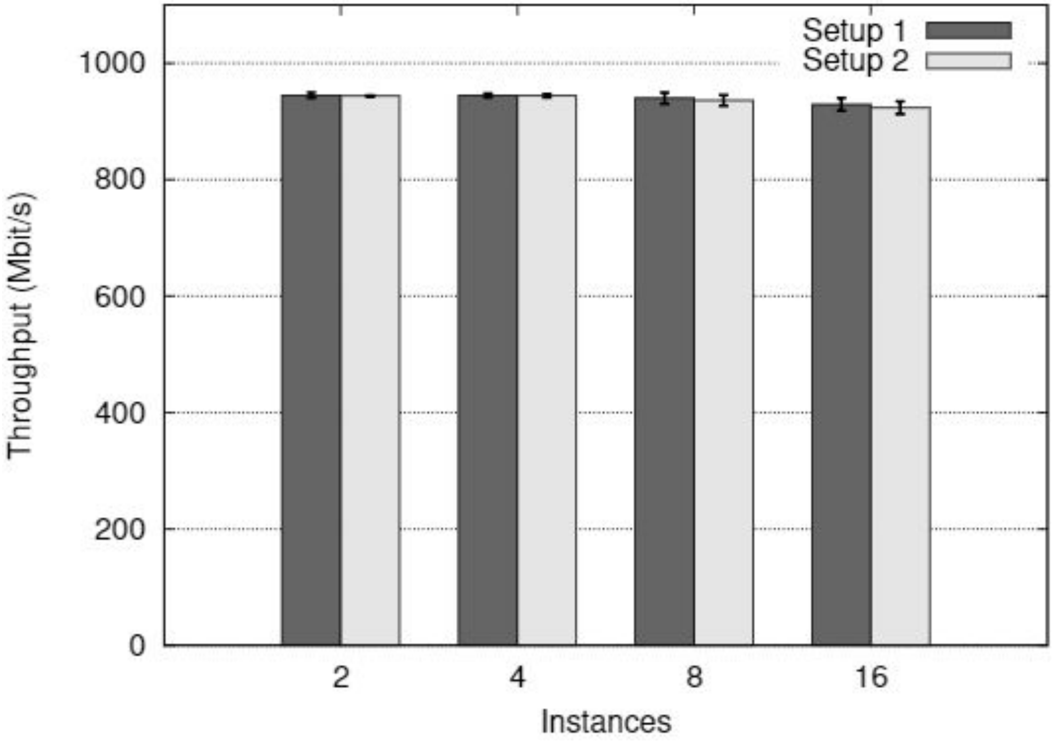
NIEP Boot Time

Longest boot time in the CP side once there are several instantiations in there

The VNFs number in the ISP changes only between setups

Mininet time plus the VNFs instantiation time, VNFs instantiate in parallel

Experimental Results



NIEP VNFs Throughput

CPs sharing a 1 Gbps link

Check if external factors (CPU, memory) causes processing bottlenecks

Evaluation of scalability related to the processing capacity

Discussion

- **Complex Scenario Emulation**
  - Topology scalability
  - VNFs scalability
- **Multi Domain Deployment**
  - Remote control through an agent
- **Simplified Topology Description**
  - JSON structure
- **Full Virtualization**
  - Heterogeneous environments
  - Security improvement

Conclusion

- **NIEP Viability**
  - Realistic scenario emulation
  - Real VNF platform
  - Good performance results
  - Exclusive characteristics when compared to others VNF and SFC emulators
- **Future Works**
  - User-friendly web user interface
  - Different VNFs technologies support
  - Placement and migration emulation modules

DeMONS: A DDoS Mitigation NFV Solution

Thanks!!

Carlos R. P. dos Santos
csantos@inf.ufsm.br