

# VNF Benchmarking Methodology (draft-rosa-bmwg-vnfbench-00.txt)

BMWG - IETF 95

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# Motivation

- ▶ New paradigms of network services envisioned by NFV bring VNFs as software based entities, which can be deployed in virtualized environments

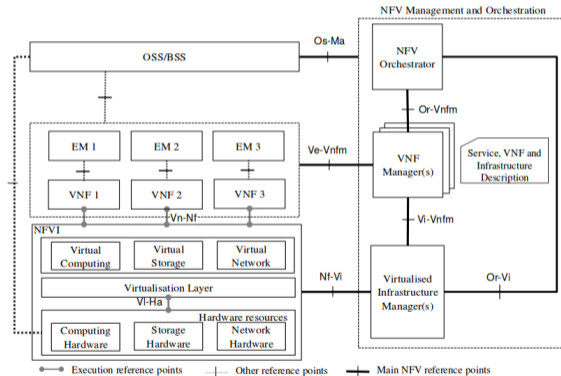
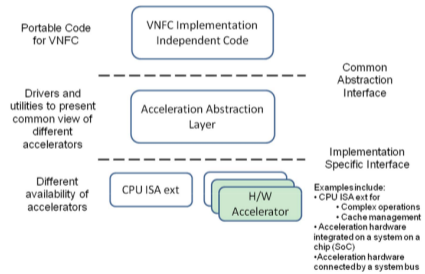


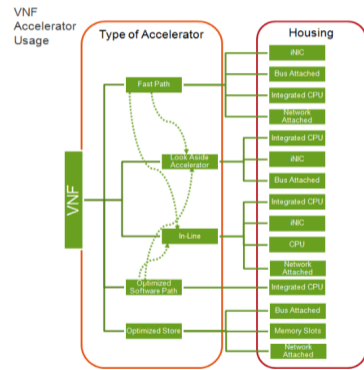
Figure : NFV Architectural Framework

# Motivation

- ▶ Virtualized environment (e.g., NFVI PoP) changes frequently in different places (e.g., platforms, hardware acceleration)



**Figure :** Use of acceleration abstraction layer (AAL) to enable fully portable VNFC code across servers with different accelerators



All accelerators shown are in the NFVI

**Figure :** VNF Usage of Accelerators

# Motivation

- ▶ VNFs need continuous development/integration
- ▶ VNF Descriptors can specify performance profiles containing metrics (e.g., throughput) associated with allocated resources (e.g., vCPU)

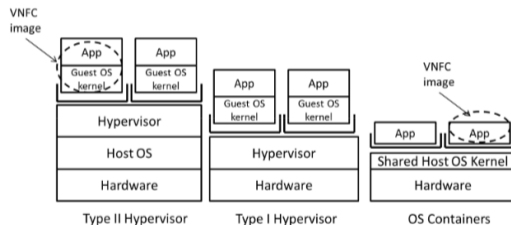


Figure : VNF Environment Examples

# Motivation

- ▶ Process for metrics extraction can be automated - on-going work VBaaS - <https://datatracker.ietf.org/doc/draft-rorosz-nfvrg-vbaas/>

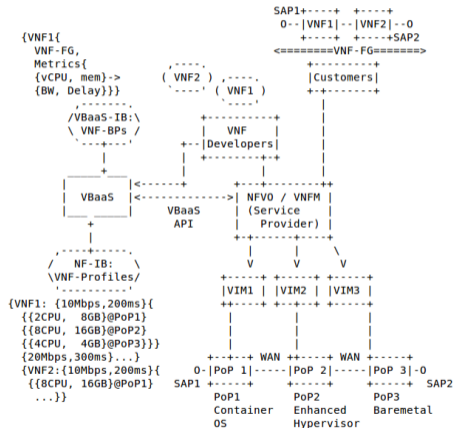


Figure : NFV MANO and VBaaS

# Motivation

- Analysis with and without instrumentation showed interesting results (e.g., vCDN)

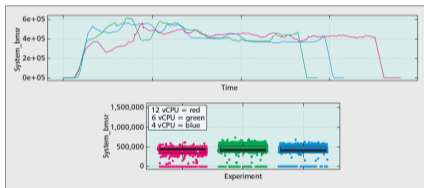


Figure : Bytes worked on per millisecond ration of vCDN

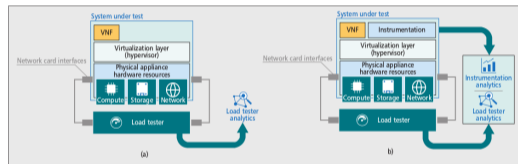
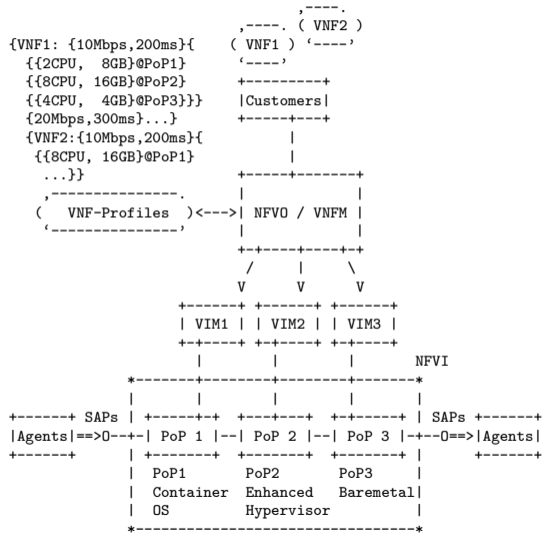


Figure : NFW Testing Framework:  
a) no instrumentation; b) embedded instrumentation

An Instrumentation and Analytics Framework for Optimal and Robust NFW Deployment, IEEE Comm Magazine 2015

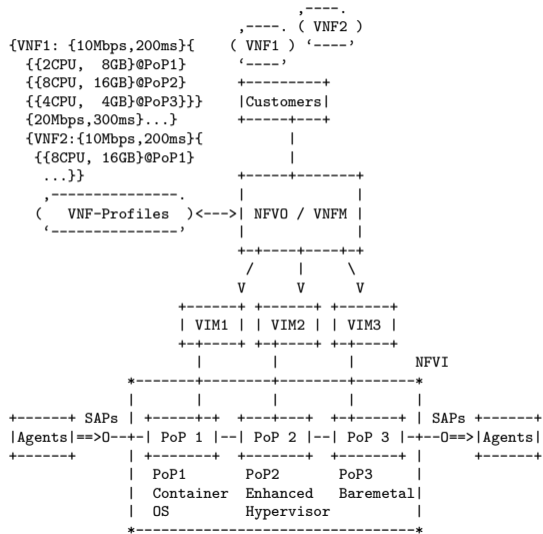
# Assumptions



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## Problem to be solved:

- Gain information about VNFs' performance metrics with given reserved resources at given VIM (NFVI PoP).





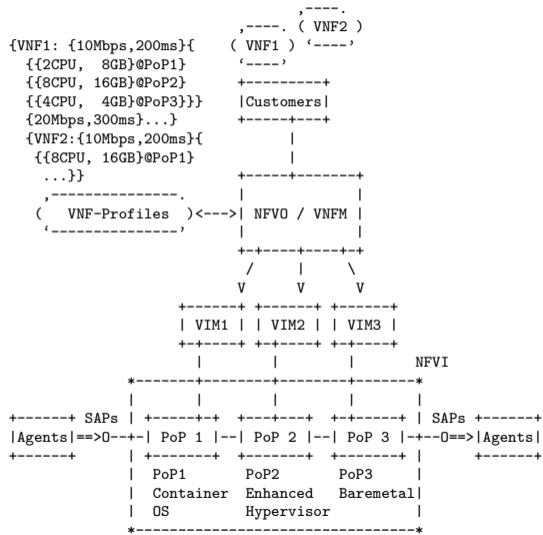
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## Problem to be solved:

- ▶ Gain information about VNFs' performance metrics with given reserved resources at given VIM (NFVI PoP).

## An important usage:

- ▶ Orchestration (e.g., NFVO) needs to know throughput, latency, among other metrics, performance values for a given resource allocation (cpu, memory, storage) of a VNF at a VIM.



# VNF Benchmarking Considerations

## Adopt VNF benchmarking considerations draft

Follow additional considerations proposed by ETSI documents (e.g., pre-deployment testing draft)

## Black-Box SUT with Black-Box Benchmarking Agents

In virtualization environments neither the VNF instance nor the underlying virtualization environment nor the agents specifics may be known by the entity managing abstract resources. This implies black box testing with black box functional components, which are configured by opaque configuration parameters defined by the VNF developers or alike for the benchmarking entity (e.g., NFVO)

Considerations for Benchmarking Virtual Network Functions and Their Infrastructure

<https://datatracker.ietf.org/doc/draft-morton-bmwg-virtual-net/>

# Testing Methodologies

## Benchmarking

To measure VNF's throughput, latency, frame loss rate metrics for given cpu, memory, storage reservation at given VIM.

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## Dimensioning

To determine cpu, memory, storage reservation metrics for given VNF at given VIM for target throughput, latency, frame loss rate parameters.

# Testing Methodologies

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## Dimensioning

To determine cpu, memory, storage reservation metrics for given VNF at given VIM for target throughput, latency, frame loss rate parameters.

## Verification

To assess if given throughput, latency, frame loss rate metrics of a VNF is met with given cpu, memory, storage reservation at given VIM.

# Testing Methodologies

## Benchmarking

To measure VNF's throughput, latency, frame loss rate metrics for given cpu, memory, storage reservation at given VIM.

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To assess if given throughput, latency, frame loss rate metrics of a VNF is met with given cpu, memory, storage reservation at given VIM.

## Observation

Dimensioning and verification boil down to benchmarking operation(s).

# VNF Benchmarking Methodology

## Approach

- ▶ Definition of VNF-BPs for each testing procedure and its consequent output, VNF-Profile
- ▶ Information about Benchmarking Methodology for Network Interconnect Devices (RFC2544)
- ▶ IP Performance Metrics (IPPM) Framework (RFC2330)

# VNF Benchmarking Methodology

## VNF Benchmarking Profile

The specification how to measure a VNF Profile. VNF-BP may be specific to a VNF or applicable to several VNF types. The specification includes structural and functional instructions, and variable parameters (metrics) at different abstractions (e.g., vCPU, memory, throughput, latency; session, transaction, tenants, etc.).

## VNF Profile

Is a mapping between virtualized resources (e.g., vCPU, memory) and VNF performance (e.g., throughput, latency between in/ out ports) at a given NFVI PoP. An orchestration function can use the VNF Profile to select a host (NFVI PoP) for a VNF and to allocate necessary resources to deliver the required performance characteristics.



# Throughput

## Objective

Provide, for a particular set of resources allocated, the throughput among two or more VNF ports, expressed in VNF-BP

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## Prerequisite

VNF (SUT) must be deployed and stable and its allocated resources collected. VNF must be reachable by agents. The frame size to be used for agents must be defined in the VNF- BP

# Throughput

## Procedure

1. Establish connectivity between agents and VNF ports
2. Agents initiate source of traffic, specifically designed for VNF test, increasing rate periodically
3. Throughput is measured when traffic rate is achieved without frame losses

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## Reporting Format

Must contain VNF allocated resources and throughput measured (aka throughput in [rfc2544])

# Latency

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Provide, for a particular set of resources allocated, the latency among two or more VNF ports, expressed in VNF-BP

## Prerequisite

VNF (SUT) must be deployed and stable and its allocated resources collected. VNF must be reachable by agents. The frame size and respective throughput to be used for agents must be defined in the VNF-BP

# Latency

## Procedure

1. Establish connectivity between agents and VNF ports
2. Agents initiate source of traffic, throughput and frame size specifically designed for VNF test
3. Latency is measured when throughput is achieved for the period of time specified in VNF-BP

# Latency

## Procedure

1. Establish connectivity between agents and VNF ports
2. Agents initiate source of traffic, throughput and frame size specifically designed for VNF test
3. Latency is measured when throughput is achieved for the period of time specified in VNF-BP

## Reporting Format

Must contain VNF allocated resources, throughput used for stimulus and latency measurement (aka latency in [rfc2544])



# Frame Loss Rate

## Objective

Provide, for a particular set of resources allocated, the frame loss rate among two or more VNF ports, expressed in VNF-BP

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## Objective

Provide, for a particular set of resources allocated, the frame loss rate among two or more VNF ports, expressed in VNF-BP

## Prerequisite

VNF (SUT) must be deployed and stable, its allocated resources collected specifying any particular feature of the underlying VNF virtualized environment, provided by NFVO/VIM or independently extracted. VNF must be reachable by agents. Rate of source traffic and frame size used for agents stimulus must be defined in VNF-BP

# Frame Loss Rate

## Procedure

1. Establish connectivity between agents and VNF ports
2. Agents initiate source of traffic, specifically designed for VNF test, achieving rate of source traffic defined in VNF-BP
3. Frame loss rate is measured when pre-defined traffic rate is achieved for period of time established in VNF-BP

# Frame Loss Rate

## Procedure

1. Establish connectivity between agents and VNF ports
2. Agents initiate source of traffic, specifically designed for VNF test, achieving rate of source traffic defined in VNF-BP
3. Frame loss rate is measured when pre-defined traffic rate is achieved for period of time established in VNF-BP

## Reporting Format

Must contain VNF allocated resources, rate of source traffic used as stimulus and frame loss rate measurement (aka frame loss rate in [rfc2544])

# Summary

## Messages

1. Open discussions about VNF benchmarking methodology
2. Interesting to work on separate documents: terminology and applicability

## Next Steps

T

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## Next Steps

- ▶ VNF scaling

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- ▶ VNF scaling
- ▶ VNF instantiation time

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# Summary

## Messages

1. Open discussions about VNF benchmarking methodology
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## Next Steps

- ▶ VNF scaling
- ▶ VNF instantiation time
- ▶ Improve VNF Benchmark Profile concept (e.g., topology)

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