The Standards People

GSMA/LFN CNTT F2F Meeting

ETSI NFV TST Discussion Slides

Presented by:

For:

July 2019

TST001

TST001 – Pre-Deployment Testing

Target audience:

- All companies wanting to validate new SW, SW updates
- CI/CD pipeline

Content summary

- Definition of SUTs (System Under Test)
- Test methods for pre-deployment validation of SUTs
- Pre-deployment validation of NFV Infrastructure
- Pre-deployment validation of VNFs
- Pre-deployment validation of Network Services

TST001 Highlights

Impact of virtualization on test methods

- How to isolate the System Under Test (SUT)
- HW vs SW test units

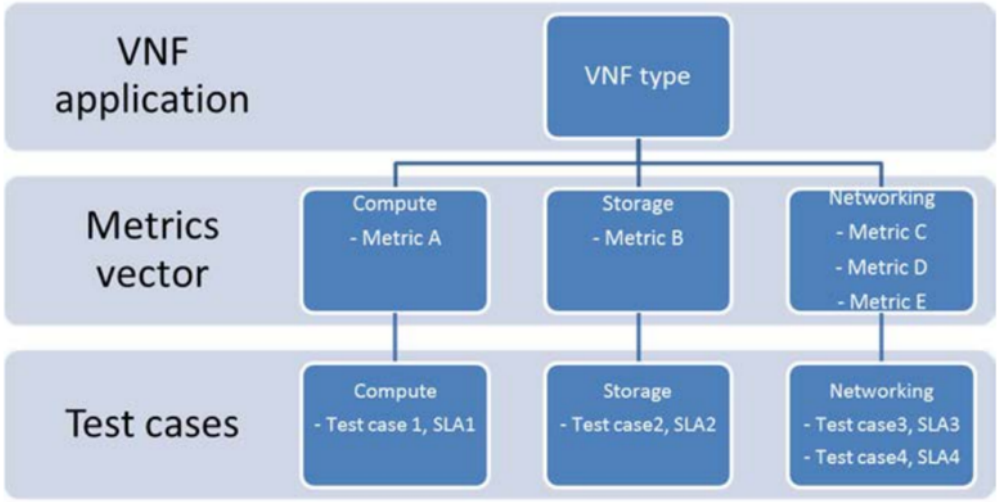
Workload type impacts: control vs data plane testing

VNF and NS validation

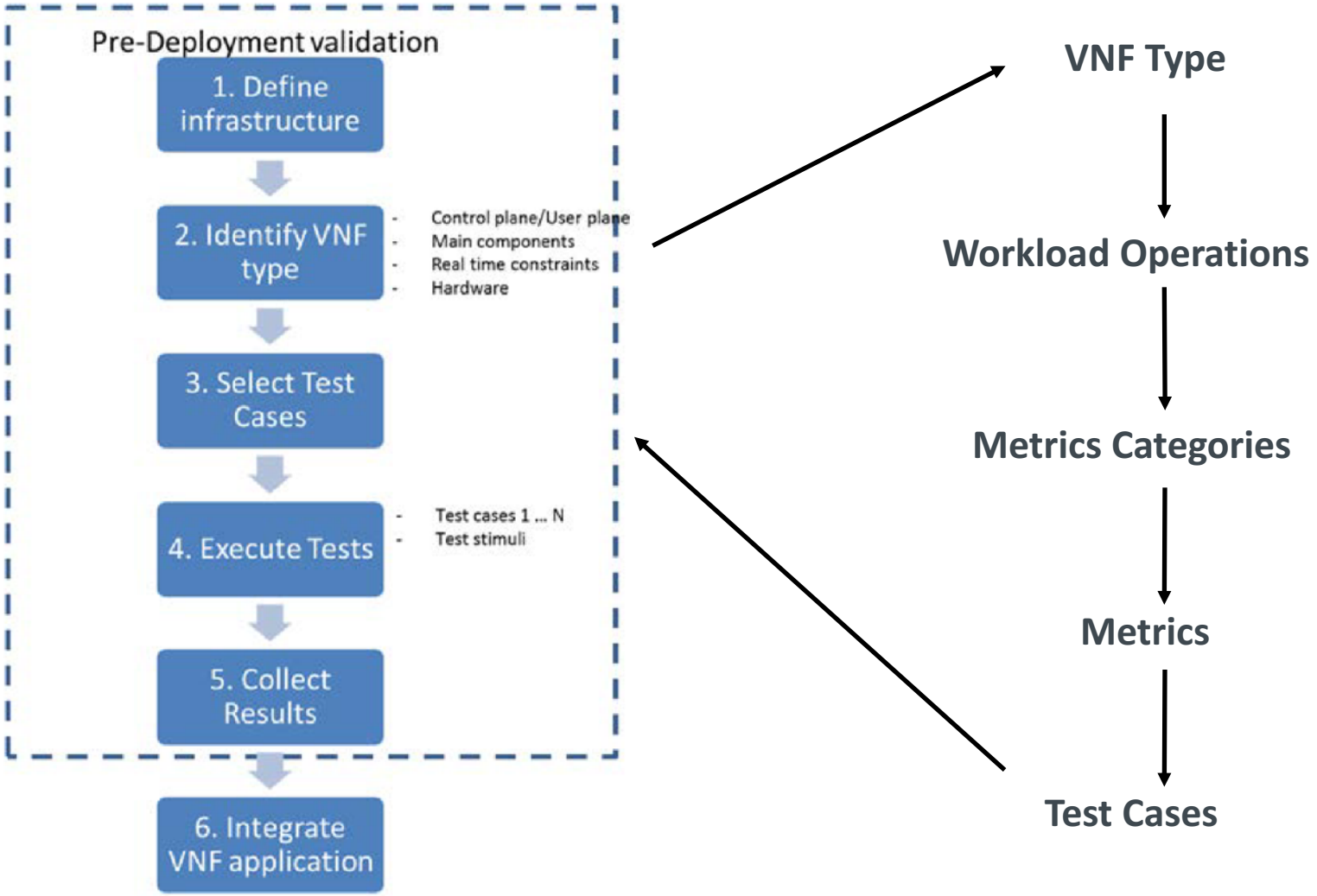
- Lifecycle, control & data plane, autoscaling

NFVI validation

Examples!



TST001 - NFVI Validation Execution Flow



TST001 – Examples of VNF types and workload operations

VNF Types
CPE
SBC
S/PGW
VPN
RAN

Workload Operations
Data tx/rx
Switching/Forwarding
Encryption
Session management
Authentication

TST001 - Infrastructure Metrics

	Performance	Capacity	Reliability
Compute	Latency for mem access	# of cores and threads	Processor availability
	Latency for cache read/write	Available mem size	Processor mean time to fail
	Processing speed	Processor utilization	Memory mean time to fail
Network	Latency between VMs	# of connections	NIC availability
	Latency per traffic flow	# of flows	Link availability
	Packet delay variation	Max throughput between NFVI nodes	Frame loss rate
Storage	Sequential read/write IOPS	Storage/disk size	Disk availability
	Random	Disk utilization	Mean time to failure
	Throughput	Max read/write IOPS	Number of failures

TST008

TST008 – NFVI Compute and Network metrics

Content summary

- Time and Time Intervals for Metrics
- Framework for Metric Definitions
- Compute Metrics
- Network Metrics
- Memory Metrics

Network Functions Virtualisation (NFV) Release 3;
Testing;
NFVI Compute and Network Metrics Specification

Rapporteur: Al Morton (AT&T Labs)

TST008 – Framework for Metrics Definitions

- Background
- Name
- Parameters
- Scope of Coverage
- Unit(s) of Measure
- Definition
- Method of Measurement
- Sources of Error
- Discussion

TST008 - Metrics

Compute:

- Processor Usage
- Processor Utilization

Network:

- Packet Count
- Octet Count
- Dropped Packet Count
- Errored Packet Count

Memory:

- Memory buffered
- Memory Cached
- Memory free
- Memory Slab
- Memory Total
- Memory Used
- HugePage (multiple - 7)

TST009

TST009 – NFVI Network Benchmarks and Measurement Methods

Expands the Requirements and Methods of RFC2544

- New reality of NFVI platforms are different than dedicated “boxes” of the past

Benchmark definition

Test setups

Test tool requirements

Methods of Measurement

**Network Functions Virtualisation (NFV) Release 3;
Testing;
Specification of Networking Benchmarks and Measurement Methods for NFVI**

Rapporteur: Al Morton (AT&T Labs)

Benchmarks

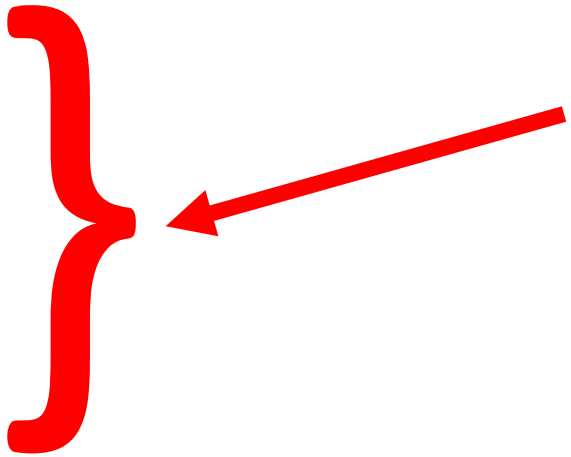
Throughput

- Offered Load Frame Size
- Offered Load Step Size
- Min Trial Repetition Interval
- Trial Duration
- Max X% Loss Ratio
- Max # of Trials

Latency

Delay Variation

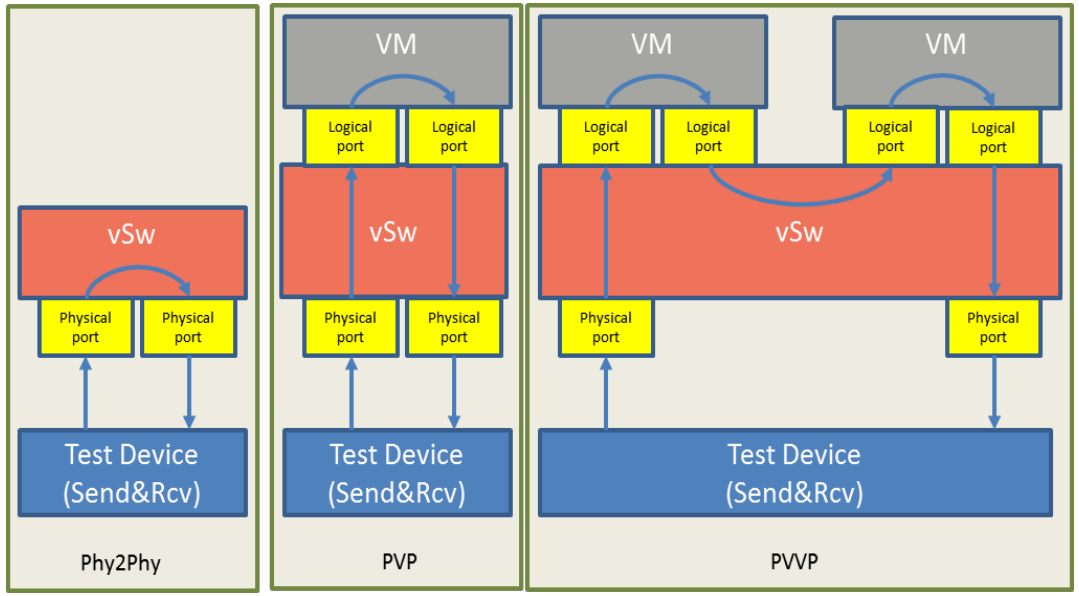
Loss

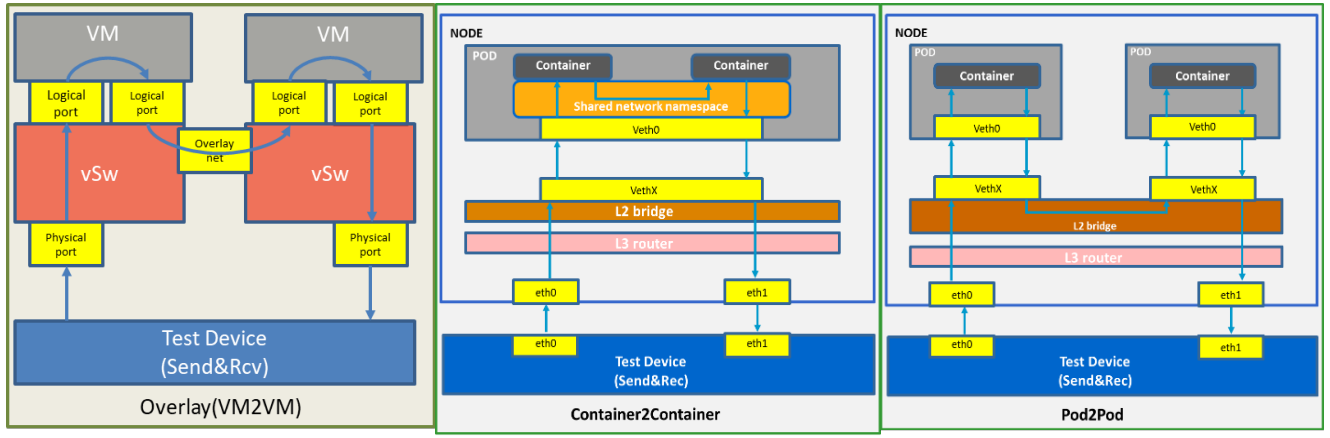


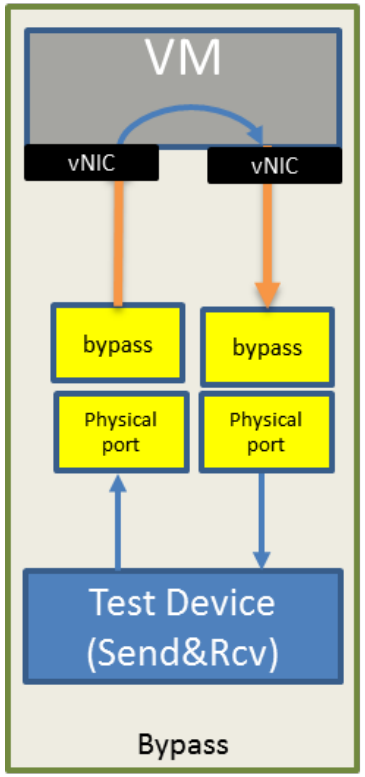
For each Benchmark:

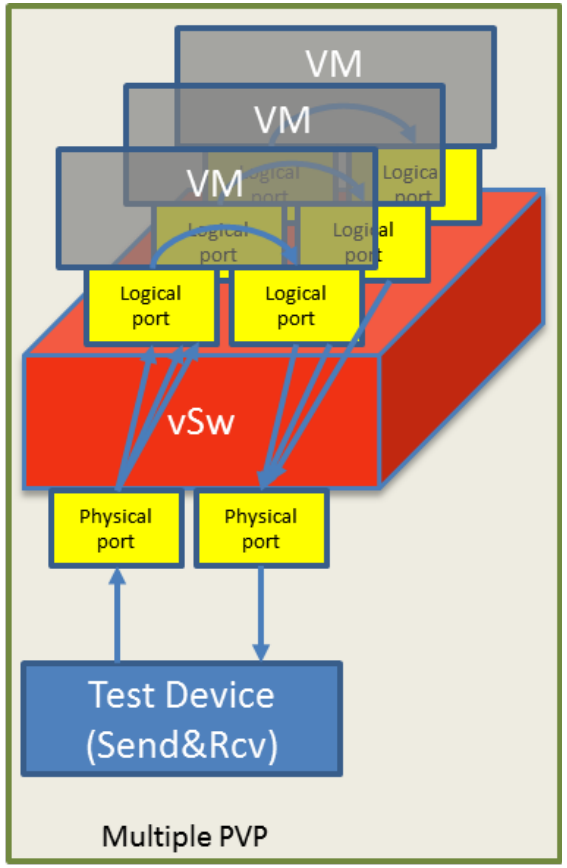
- Background
- Name
- Parameters
- Scope
- Units of Measure
- Definition
- Units of Measure
- Sources of Error
- Discussion
- Reporting Format

Test Setup Examples

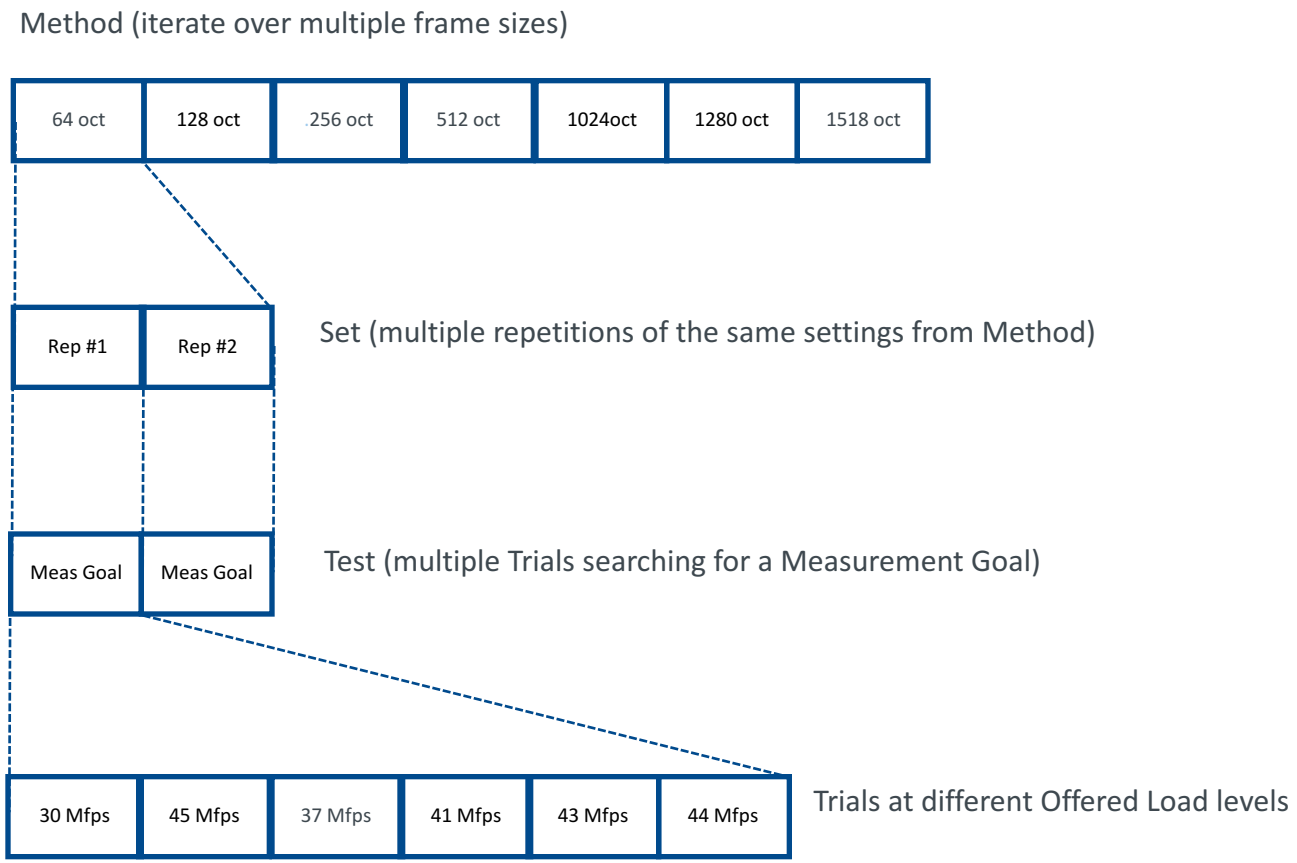




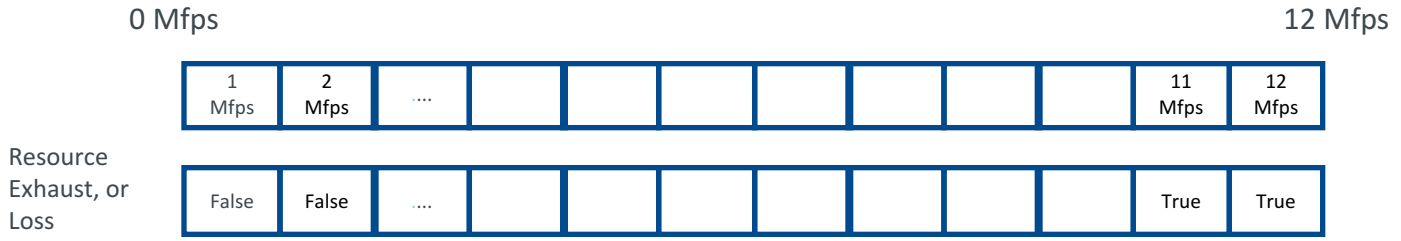


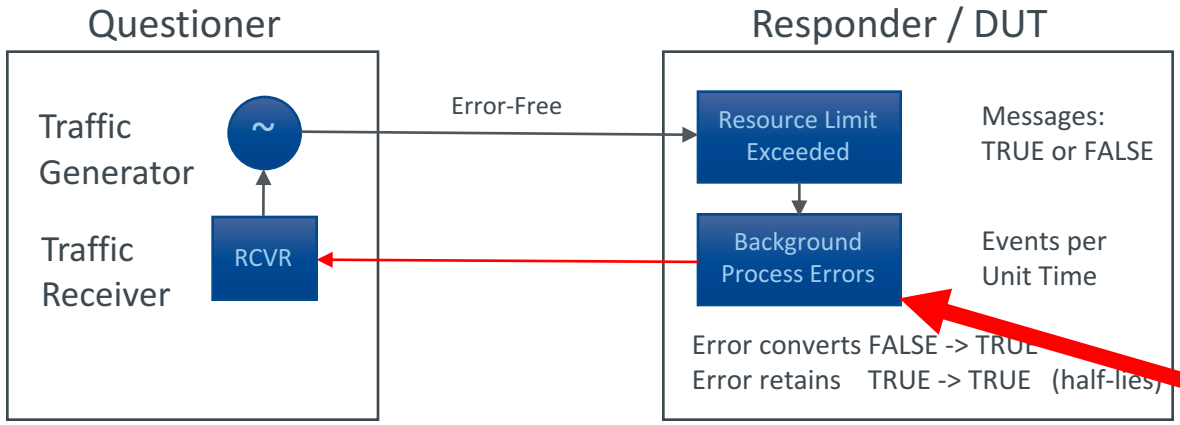


Methods of Measurement: Core Procedures



Mitigating Background Processes that Cause Errors (Loss)





Because of the nature of NFVI platform

Andrzej Pelc, "Searching games with errors— fifty years of coping with liars ", Theoretical Computer Science 270 (2002) 71–109. Available from https://www.gwern.net/docs/statistics/comparison/2002-pelc.pdf

Binary Search with Loss Verification

Goal

- Separate resource exhaustion and loss due to transient processes
- They are dealt with in separate ways

Solution

- If a trial fails because of loss (< z), run the trial again with the same stimulus (Max (r) = 2)
- Keep trials short to avoid transients
- Isolate loss due to transients
  - Run long duration tests to characterize effects and frequency

Prototyped with OPNFV
Showed marked
success in repeatability

Long Duration Testing

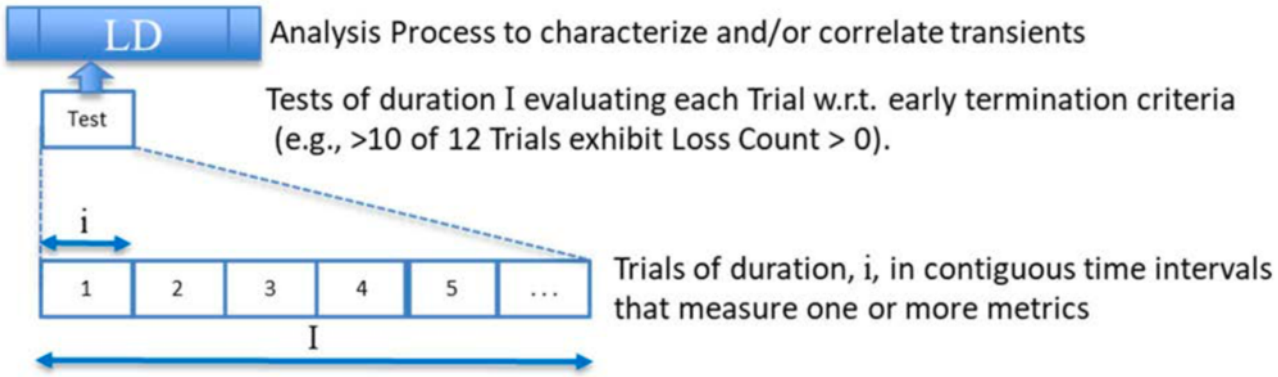


Figure 12.4-1: Trials and Tests for Long Duration Testing

i: duration of the short evaluation intervals (or Trials)
I: duration of the Long Duration Test, comprised of many consecutive Trials
LD: array of results, where each row contains the start time for each Trial, and the measured value of the metrics of interest

Once the intervals with Trials encountering Transients are correlated with interfering processes, then system engineers can either seek to reduce the prevalence of such Transients, or take other steps to mitigate their effects, such as increasing the size of strategically-located buffers. Such configuration changes are expected to require additional Long Duration Testing to determine their effectiveness, and repetition of the Benchmarks under the new configuration.

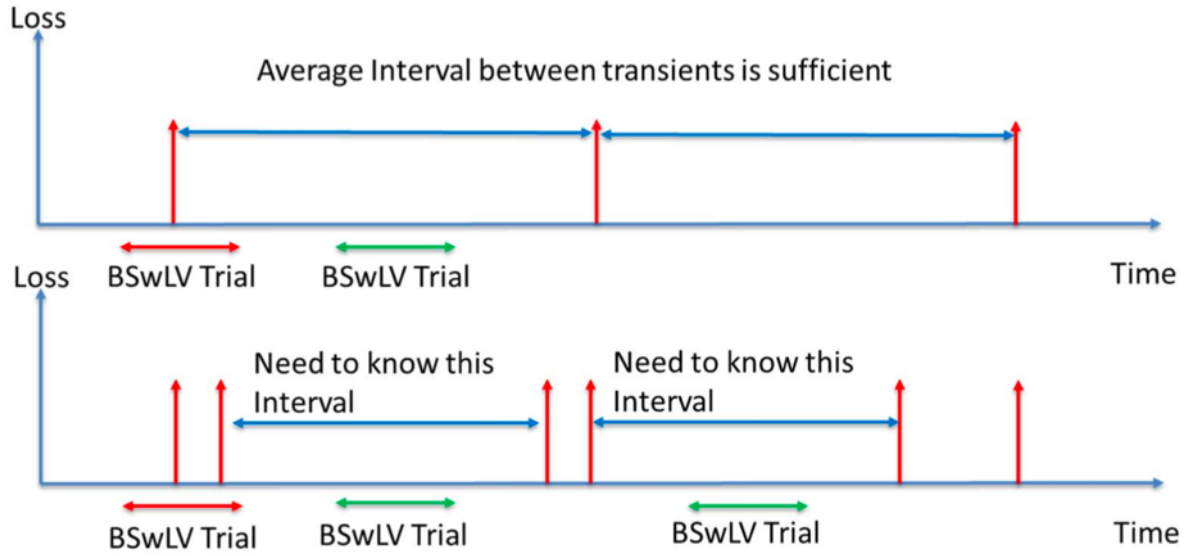


Figure 12.4-2: Illustration of Isolated and Correlated Transients

Cross-NUMA Node Testing

When considering the various allocations of the PVP test setup (clause 6.2), there are nine different scenarios that allow testing of most possibilities with two NUMA Nodes.

Note that the vSwitch remains on NUMA Node 0 in all example scenarios, and other components share the same Node, occupy the other Node, or their allocation spans cores in both Nodes.

TST012

DRAFT

TST012 - VIM & NFVI Control and Management Performance Evaluation

DRAFT

Focus on the control plane performance of VIM + NFVI

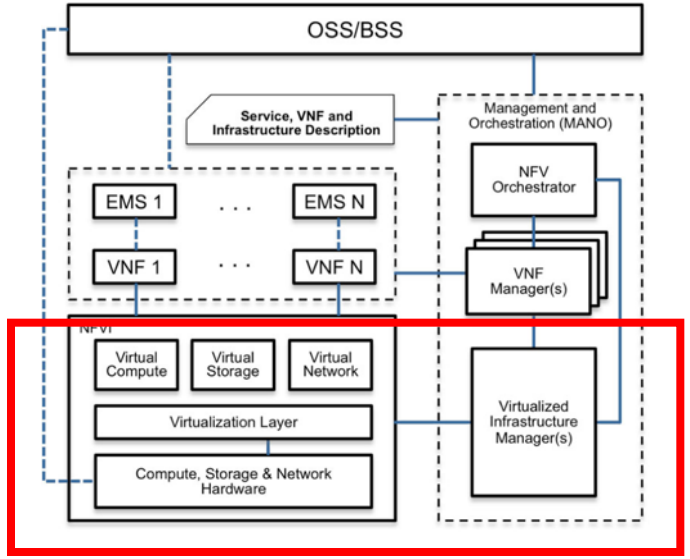
Based on functional requirements in ETSI GS NFV-IFA010

Potential Metrics:

- Virtualization container instantiation
- Scaling
- Migration

Delicate!

- VNFs can impact these metrics
- Care will be taken to define the metrics and methods to be independent of VNF (maybe use standard samples)



TST012 – Current Metrics

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- Duration of compute resource allocation
- Duration of compute resource termination
- Duration of compute resource scaling
- Duration of compute resource migration

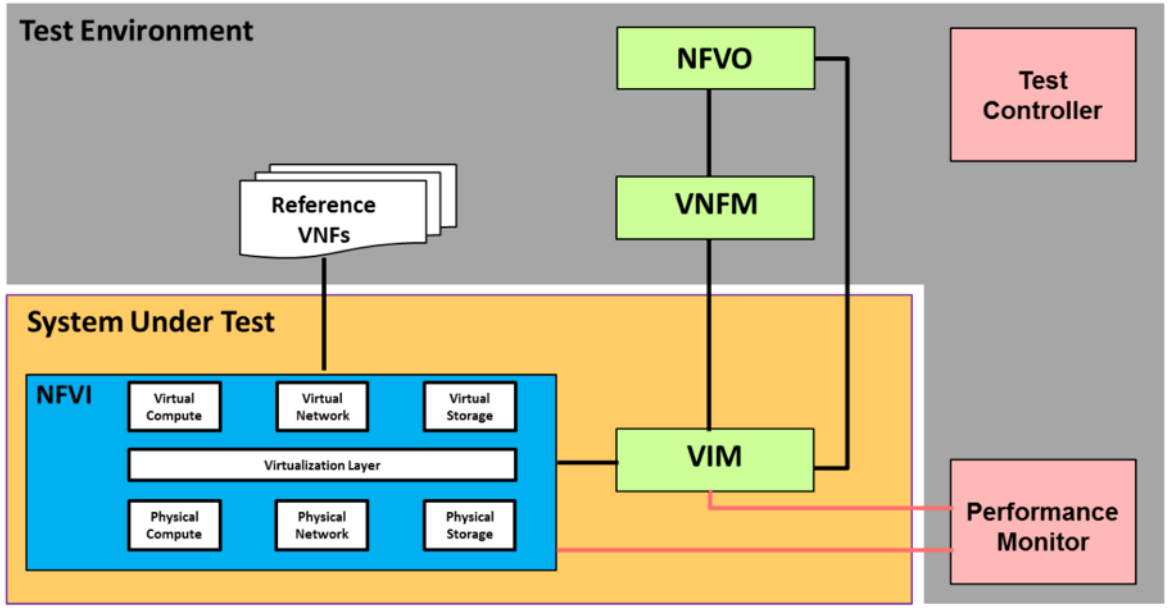

Figure 6-X: System Under Test and Test Environment

INF010

ETSI GS NFV-INF 010 Service Quality Metrics

Metrics that impact VNF user service quality

Service quality metrics for

- Virtual machines
- Virtual network interface
- Technology component
- Orchestration

Recommendations

Can become the basis for all subsequent testing

INF010 - NFV Service Quality Metrics

Service Metric Category	Speed	Accuracy	Reliability
Orchestration Step 1 (e.g. Resource Allocation, Configuration and Setup)	VM Provisioning Latency	VM Placement Policy Compliance	VM Provisioning Reliability VM Dead-on-Arrival (DOA) Ratio
VirtualMachine operation	VM Stall (event duration and frequency) VM Scheduling Latency	VM Clock Error	VM Premature Release Ratio
Virtual Network Establishment	VN Provisioning Latency	VN Diversity Compliance	VN Provisioning Reliability
Virtual Network operation	Packet Delay Packet Delay Variation (Jitter) Delivered Throughput	Packet Loss Ratio	Network Outage
Orchestration Step 2 (e.g. Resource Release)			Failed VM Release Ratio
Technology Component as-a-Service	TcaaS Service Latency		TcaaS Reliability (e.g.defective transaction ratio) TcaaS Outage

Other (Non-TST)

Other Related ETSI NFV Documents

- ETSI NFV-IFA002 “Network Functions Virtualisation (NFV); Acceleration Technologies; VNF Interfaces Specification” (Rel-2)
- ETSI NFV-IFA004 “Network Functions Virtualisation (NFV);Acceleration Technologies; Management Aspects Specification” (Rel-2)
- ETSI NFV-IFA018 “Network Functions Virtualisation (NFV);Acceleration Technologies; Network Acceleration Interface Specification” (Rel-3)
- ETSI NFV-IFA019 “Network Functions Virtualisation (NFV);NFV Acceleration; Acceleration Resource Management Interface Specification” (Rel-3)
- ETSI NFV-IFA029 Report on the Enhancements of the NFV architecture towards “Cloud-native” and "PaaS"
- GS NFV-EVE 001 Hypervisor requirements
- GS NFV-EVE 007 Hardware Interoperability Requirements

Security Related Documents

SEC021 - Network Functions Virtualisation (NFV) Release 2; Security; VNF Package Security Specification

SEC014 - Security Specification for MANO Components and Reference points

SEC013 - Security Management and Monitoring specification

SEC012 - System architecture specification for execution of sensitive NFV components

SEC010 - Report on Retained Data problem statement and requirements

SEC009 - Report on use cases and technical approaches for multi-layer host administration

SEC007 - Report on Attestation Technologies and Practices for Secure Deployments

SEC005 - Report on Certificate Management