



VSPERF Results

Release draft (a8f7b9a)

OPNFV

March 03, 2016

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OPNFV BRAHMAPUTRA SCENARIOS

Available Tests and aspects of scenarios:

Framework Test	Definition
phy2phy_tput	PacketLossRatio for Phy2Phy
back2back	BackToBackFrames for Phy2Phy
phy2phy_tput_mod_vlan	PacketLossRatioFrameModification for Phy2Phy
phy2phy_cont	Phy2Phy blast vswitch at x% TX rate and measure throughput
pvp_cont	PVP blast vswitch at x% TX rate and measure throughput
pvvp_cont	PVVP blast vswitch at x% TX rate and measure throughput
phy2phy_scalability	Scalability0PacketLoss for Phy2Phy
pvp_tput	PacketLossRatio for PVP
pvp_back2back	BackToBackFrames for PVP
pvvp_tput	PacketLossRatio for PVVP
pvvp_back2back	BackToBackFrames for PVVP
phy2phy_cpu_load	CPU0PacketLoss for Phy2Phy
phy2phy_mem_load	Same as CPU0PacketLoss but using a memory intensive app

Supported deployment scenarios:

- **Phy2Phy**: Physical port -> vSwitch -> Physical port.
- **PVP**: Physical port -> vSwitch -> VNF -> vSwitch -> Physical port.
- **PVVP**: Physical port -> vSwitch -> VNF -> vSwitch -> VNF -> vSwitch -> Physical port.

Loopback applications in the Guest can be:

- **DPDK testpmd**.
- **Linux Bridge**.
- **l2fwd**.

Supported traffic generators:

- **Ixia**: IxOS and IxNet.
- **Spirent**.
- **Dummy**.

OPNFV BRAHMAPUTRA RESULTS

The vsperf CI jobs that were used to obtain the results can be found at https://wiki.opnfv.org/wiki/vsperf_results.

The following table maps the results in the test dashboard to the appropriate test case in the VSPERF Framework and specifies the metric the vertical/Y axis is plotting. **Please note**, the presence of dpdk within a test name signifies that the vswitch under test was OVS with DPDK, while its absence indicates that the vswitch under test was stock OVS.

Dashboard Test	Framework Test	Metric	Guest Interface
tput_ovsdpdk	phy2phy_tput	Throughput (FPS)	N/A
tput_ovs	phy2phy_tput	Throughput (FPS)	N/A
b2b_ovsdpdk	back2back	Back-to-back value	N/A
b2b_ovs	back2back	Back-to-back value	N/A
tput_mod_vlan_ovs	phy2phy_tput_mod_vlan	Throughput (FPS)	N/A
tput_mod_vlan_ovsdpdk	phy2phy_tput_mod_vlan	Throughput (FPS)	N/A
scalability_ovs	phy2phy_scalability	Throughput (FPS)	N/A
scalability_ovsdpdk	phy2phy_scalability	Throughput (FPS)	N/A
pvp_tput_ovsdpdkuser	pvp_tput	Throughput (FPS)	vhost-user
pvp_tput_ovsvirtio	pvp_tput	Throughput (FPS)	virtio-net
pvp_b2b_ovsdpdkuser	pvp_back2back	Back-to-back value	vhost-user
pvp_b2b_ovsvirtio	pvp_back2back	Back-to-back value	virtio-net
pvvp_tput_ovsdpdkuser	pvvp_tput	Throughput (FPS)	vhost-user
pvvp_tput_ovsvirtio	pvvp_tput	Throughput (FPS)	virtio-net
pvvp_b2b_ovsdpdkuser	pvvp_back2back	Throughput (FPS)	vhost-user
pvvp_b2b_ovsvirtio	pvvp_back2back	Throughput (FPS)	virtio-net

The loopback application in the VNF used for PVP and PVVP scenarios was DPDK testpmd.

PERFORMANCE REPORT FOR OPEN VSWITCH WITH DPDK SUPPORT

3.1 Introduction

The objective of the OPNFV project titled “**Characterise vSwitch Performance for Telco NFV Use Cases**”, is to evaluate a virtual switch to identify its suitability for a Telco Network Function Virtualization (NFV) environment. As well as this, the project aims to identify any gaps or bottlenecks in order to drive architectural changes to improve virtual switch performance and determinism. The purpose of this document is to summarize the results of the tests carried out on the virtual switch in the Network Function Virtualization Infrastructure (NFVI) and, from these results, provide evaluations and recommendations for the virtual switch. Test results will be outlined in *details-of-LTR*, preceded by the *document-identifier* and the *scope* and *references*).

This document is currently in draft form.

3.1.1 Document identifier

The document id will be used to uniquely identify versions of the LTR. The format for the document id will be: OPNFV_vswitchperf_LTR_rel_STATUS, the status is one of: DRAFT, REVIEWED, CORRECTED or FINAL. The document id for this version of the LTR is: OPNFV_vswitchperf_LTR_Brahmaputra_DRAFT.

3.1.2 Scope

The scope of this report is to detail the results of the tests that have been performed on the virtual switch. This report will also evaluate the results of these tests and, based on these evaluations, provide recommendations on the suitability of the virtual switch for use in a Telco NFV environment.

3.1.3 References

OPNFV_vswitchperf_LTD_Brahmaputra_REVIEWED

3.2 Details of the Level Test Report

This section provides a *test-results-overview*. Also included are the *rationale* and the *conclusions*.

3.2.1 Test ID: PHY2PHY_TPUT

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB
- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsDpdkVhost, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60
- DPDK Version: 2.2.0, GIT tag: a38e5ec15e3fe615b94f3cc5edca5974dab325ab

Below are test details:

- Test ID: phy2phy_tput
- Description: LTD.Throughput.RFC2544.PacketLossRatio
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	23546941.715
tx_rate_mbps	Unknown
throughput_rx_mbps	12056.034
tx_rate_percent	79.117
throughput_rx_percent	79.117
frame_loss_percent	0.000
min_latency_ns	6720.000
max_latency_ns	343840.000
avg_latency_ns	8509.000
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	31968
%usr	200.03
%system	0.04
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.03
majflt/s	0.00
VSZ	2668616
RSS	30338
%MEM	0.09
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	31967
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3352
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	15977429.962
tx_rate_mbps	Unknown
throughput_rx_mbps	16360.888
tx_rate_percent	94.586
throughput_rx_percent	94.586
frame_loss_percent	0.000
min_latency_ns	6060.000
max_latency_ns	132480.000
avg_latency_ns	10590.500
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	31968
%usr	200.03
%system	0.04
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.03
majflt/s	0.00
VSZ	2668616
RSS	30338
%MEM	0.09
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	31967
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3352
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	4699181.326
tx_rate_mbps	Unknown
throughput_rx_mbps	19247.847
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	37340.000
max_latency_ns	81300.000
avg_latency_ns	63934.500
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	31968
%usr	200.03
%system	0.04
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.03
majflt/s	0.00
VSZ	2668616
RSS	30338
%MEM	0.09
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	31967
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3352
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	2394602.400
tx_rate_mbps	Unknown
throughput_rx_mbps	19616.583
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	40700.000
max_latency_ns	84300.000
avg_latency_ns	67077.500
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	31968
%usr	200.03
%system	0.04
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.03
majflt/s	0.00
VSZ	2668616
RSS	30338
%MEM	0.09
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	31967
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3352
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1625465.525
tx_rate_mbps	Unknown
throughput_rx_mbps	19739.653
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	45020.000
max_latency_ns	87060.000
avg_latency_ns	70188.000
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	31968
%usr	200.03
%system	0.04
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.03
majflt/s	0.00
VSZ	2668616
RSS	30338
%MEM	0.09
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	31967
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3352
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

3.2.2 Test ID: BACK2BACK

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB

- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsDpdkVhost, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60
- DPDK Version: 2.2.0, GIT tag: a38e5ec15e3fe615b94f3cc5edca5974dab325ab

Below are test details:

- Test ID: back2back
- Description: LTD.Throughput.RFC2544.BackToBackFrames
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	19158
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	34010
%usr	200.03
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.75
majflt/s	0.00
VSZ	2668616
RSS	20062
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovssdb-server	
Statistic	Value
UID	0
PID	34009
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	87957
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	34010
%usr	200.03
%system	0.03
%guest	0.00
%CPU	200.07
CPU	•
minflt/s	13.75
majflt/s	0.00
VSZ	2668616
RSS	20062
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	34009
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	•
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	70488721
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vsitchd	
Statistic	Value
UID	0
PID	34010
%usr	200.03
%system	0.03
%guest	0.00
%CPU	200.07
CPU	•
minflt/s	13.75
majflt/s	0.00
VSZ	2668616
RSS	20062
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	34009
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	35919540
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	34010
%usr	200.03
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.75
majflt/s	0.00
VSZ	2668616
RSS	20062
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	34009
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	24382314
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	34010
%usr	200.03
%system	0.03
%guest	0.00
%CPU	200.07
CPU	•
minflt/s	13.75
majflt/s	0.00
VSZ	2668616
RSS	20062
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovssdb-server	
Statistic	Value
UID	0
PID	34009
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	•
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

3.2.3 Test ID: PHY2PHY_TPUT_MOD_VLAN

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- NIC(s):
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB
- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsDpdkVhost, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60
- DPDK Version: 2.2.0, GIT tag: a38e5ec15e3fe615b94f3cc5edca5974dab325ab

Below are test details:

- Test ID: phy2phy_tput_mod_vlan
- Description: LTD.Throughput.RFC2544.PacketLossRatioFrameModification
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : False

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	11428162.807
tx_rate_mbps	Unknown
throughput_rx_mbps	6216.921
tx_rate_percent	76.797
throughput_rx_percent	80.454
frame_loss_percent	0.000
min_latency_ns	5700.000
max_latency_ns	106020.000
avg_latency_ns	7622.000
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	36743
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	4.01
majflt/s	0.00
VSZ	2668616
RSS	22140
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	36742
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	8119356.566
tx_rate_mbps	Unknown
throughput_rx_mbps	8574.041
tx_rate_percent	96.133
throughput_rx_percent	98.731
frame_loss_percent	0.000
min_latency_ns	5140.000
max_latency_ns	55680.000
avg_latency_ns	5884.000
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	36743
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	4.01
majflt/s	0.00
VSZ	2668616
RSS	22140
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovssdb-server	
Statistic	Value
UID	0
PID	36742
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	2331452.048
tx_rate_mbps	Unknown
throughput_rx_mbps	9624.234
tx_rate_percent	99.227
throughput_rx_percent	99.973
frame_loss_percent	0.000
min_latency_ns	5880.000
max_latency_ns	30840.000
avg_latency_ns	9014.000
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	36743
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	4.01
majflt/s	0.00
VSZ	2668616
RSS	22140
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	36742
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1188058.693
tx_rate_mbps	Unknown
throughput_rx_mbps	9770.595
tx_rate_percent	99.227
throughput_rx_percent	99.607
frame_loss_percent	0.000
min_latency_ns	5920.000
max_latency_ns	24980.000
avg_latency_ns	6611.000
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	36743
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	4.01
majflt/s	0.00
VSZ	2668616
RSS	22140
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovssdb-server	
Statistic	Value
UID	0
PID	36742
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	806458.233
tx_rate_mbps	Unknown
throughput_rx_mbps	9819.435
tx_rate_percent	99.227
throughput_rx_percent	99.485
frame_loss_percent	0.000
min_latency_ns	6380.000
max_latency_ns	26780.000
avg_latency_ns	7018.000
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	36743
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	4.01
majflt/s	0.00
VSZ	2668616
RSS	22140
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	36742
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

3.2.4 Test ID: PHY2PHY_SCALABILITY

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB

- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsDpdkVhost, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60
- DPDK Version: 2.2.0, GIT tag: a38e5ec15e3fe615b94f3cc5edca5974dab325ab

Below are test details:

- Test ID: phy2phy_scalability
- Description: LTD.Scalability.RFC2544.0PacketLoss
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	22856325.506
tx_rate_mbps	Unknown
throughput_rx_mbps	11702.439
tx_rate_percent	76.797
throughput_rx_percent	76.797
frame_loss_percent	0.000
min_latency_ns	5660.000
max_latency_ns	272220.000
avg_latency_ns	8483.500
type	rfc2544
packet_size	64
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	39342
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.99
majflt/s	0.00
VSZ	2668616
RSS	22130
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	39341
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	16108021.614
tx_rate_mbps	Unknown
throughput_rx_mbps	16494.614
tx_rate_percent	95.359
throughput_rx_percent	95.359
frame_loss_percent	0.000
min_latency_ns	5200.000
max_latency_ns	128980.000
avg_latency_ns	11042.500
type	rfc2544
packet_size	128
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	39342
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.99
majflt/s	0.00
VSZ	2668616
RSS	22130
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	39341
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	4699173.979
tx_rate_mbps	Unknown
throughput_rx_mbps	19247.817
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	44400.000
max_latency_ns	93040.000
avg_latency_ns	76192.500
type	rfc2544
packet_size	512
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	39342
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.99
majflt/s	0.00
VSZ	2668616
RSS	22130
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	39341
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	2394598.480
tx_rate_mbps	Unknown
throughput_rx_mbps	19616.551
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	43280.000
max_latency_ns	91480.000
avg_latency_ns	74440.000
type	rfc2544
packet_size	1024
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	39342
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.99
majflt/s	0.00
VSZ	2668616
RSS	22130
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	39341
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1625463.087
tx_rate_mbps	Unknown
throughput_rx_mbps	19739.624
tx_rate_percent	100
throughput_rx_percent	100
frame_loss_percent	0.000
min_latency_ns	44540.000
max_latency_ns	90380.000
avg_latency_ns	74360.500
type	rfc2544
packet_size	1518
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	39342
%usr	200.04
%system	0.03
%guest	0.00
%CPU	200.07
CPU	.
minflt/s	13.99
majflt/s	0.00
VSZ	2668616
RSS	22130
%MEM	0.07
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	39341
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.00
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	47632
RSS	3348
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

3.3 Rationale for decisions

The tests conducted do not have pass/fail/conditional-pass criteria. The test is simply conducted and the results are reported.

3.4 Conclusions and recommendations

The test results are stable. The vsperf CI jobs that were used to obtain the results can be found at https://artifactory.opnfv.org/logs/vswitchperf/intel-pod3/2016-03-04_03-16-29/vswitchperf_logs_2016-03-04_03-16-29.tar.gz.

3.5 General

3.5.1 Glossary

- NFV - Network Function Virtualization
- Mbps - 1,000,000bps

3.5.2 Document change procedures and history

Document ID	Author	Date Modified
<i>OPNFV_vswitchperf_LTR_ver_1.0_Jan_15_CN_DRAFT</i>	Christopher Nolan	23/01/2015
<i>OPNFV_vswitchperf_LTR_ver_1.1_Jan_15_CN_DRAFT</i>	Christopher Nolan	28/01/2015

PERFORMANCE REPORT FOR OPEN VSWITCH

4.1 Introduction

The objective of the OPNFV project titled “**Characterise vSwitch Performance for Telco NFV Use Cases**”, is to evaluate a virtual switch to identify its suitability for a Telco Network Function Virtualization (NFV) environment. As well as this, the project aims to identify any gaps or bottlenecks in order to drive architectural changes to improve virtual switch performance and determinism. The purpose of this document is to summarize the results of the tests carried out on the virtual switch in the Network Function Virtualization Infrastructure (NFVI) and, from these results, provide evaluations and recommendations for the virtual switch. Test results will be outlined in *details-of-LTR*, preceded by the *document-identifier* and the *scope* and *references*).

This document is currently in draft form.

4.1.1 Document identifier

The document id will be used to uniquely identify versions of the LTR. The format for the document id will be: OPNFV_vswitchperf_LTR_rel_STATUS, the status is one of: DRAFT, REVIEWED, CORRECTED or FINAL. The document id for this version of the LTR is: OPNFV_vswitchperf_LTR_Brahmaputra_DRAFT.

4.1.2 Scope

The scope of this report is to detail the results of the tests that have been performed on the virtual switch. This report will also evaluate the results of these tests and, based on these evaluations, provide recommendations on the suitability of the virtual switch for use in a Telco NFV environment.

4.1.3 References

OPNFV_vswitchperf_LTD_Brahmaputra_REVIEWED

4.2 Details of the Level Test Report

This section provides a *test-results-overview*. Also included are the *rationale* and the *conclusions*.

4.2.1 Test ID: PHY2PHY_TPUT

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB
- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsVanilla, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60

Below are test details:

- Test ID: phy2phy_tput
- Description: LTD.Throughput.RFC2544.PacketLossRatio
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	988189.555
tx_rate_mbps	Unknown
throughput_rx_mbps	505.953
tx_rate_percent	3.320
throughput_rx_percent	3.320
frame_loss_percent	0.000
min_latency_ns	4240.000
max_latency_ns	1763160.000
avg_latency_ns	23556.500
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	42460
%usr	0.18
%system	0.44
%guest	0.00
%CPU	0.62
CPU	.
minflt/s	0.49
majflt/s	0.00
VSZ	1300912
RSS	8823
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	42459
%usr	0.00
%system	0.01
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1214105.191
tx_rate_mbps	Unknown
throughput_rx_mbps	1243.244
tx_rate_percent	7.188
throughput_rx_percent	7.188
frame_loss_percent	0.000
min_latency_ns	4060.000
max_latency_ns	3896040.000
avg_latency_ns	76256.500
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	42460
%usr	0.18
%system	0.44
%guest	0.00
%CPU	0.62
CPU	.
minflt/s	0.49
majflt/s	0.00
VSZ	1300912
RSS	8823
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	42459
%usr	0.00
%system	0.01
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1101020.005
tx_rate_mbps	Unknown
throughput_rx_mbps	4509.778
tx_rate_percent	23.430
throughput_rx_percent	23.430
frame_loss_percent	0.000
min_latency_ns	5000.000
max_latency_ns	2078480.000
avg_latency_ns	85388.500
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	42460
%usr	0.18
%system	0.44
%guest	0.00
%CPU	0.62
CPU	.
minflt/s	0.49
majflt/s	0.00
VSZ	1300912
RSS	8823
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	42459
%usr	0.00
%system	0.01
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	931475.219
tx_rate_mbps	Unknown
throughput_rx_mbps	7630.645
tx_rate_percent	38.898
throughput_rx_percent	38.898
frame_loss_percent	0.000
min_latency_ns	6460.000
max_latency_ns	1790740.000
avg_latency_ns	34993.000
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	42460
%usr	0.18
%system	0.44
%guest	0.00
%CPU	0.62
CPU	.
minflt/s	0.49
majflt/s	0.00
VSZ	1300912
RSS	8823
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	42459
%usr	0.00
%system	0.01
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1022031.303
tx_rate_mbps	Unknown
throughput_rx_mbps	12411.548
tx_rate_percent	62.875
throughput_rx_percent	62.875
frame_loss_percent	0.000
min_latency_ns	7000.000
max_latency_ns	1370640.000
avg_latency_ns	65721.000
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	42460
%usr	0.18
%system	0.44
%guest	0.00
%CPU	0.62
CPU	.
minflt/s	0.49
majflt/s	0.00
VSZ	1300912
RSS	8823
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	42459
%usr	0.00
%system	0.01
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

4.2.2 Test ID: BACK2BACK

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB

- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsVanilla, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60

Below are test details:

- Test ID: back2back
- Description: LTD.Throughput.RFC2544.BackToBackFrames
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	5108
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	44892
%usr	0.20
%system	0.39
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	1.98
majflt/s	0.00
VSZ	1300916
RSS	7447
%MEM	0.02
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	44891
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	3382
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	44892
%usr	0.20
%system	0.39
%guest	0.00
%CPU	0.59
CPU	•
minflt/s	1.98
majflt/s	0.00
VSZ	1300916
RSS	7447
%MEM	0.02
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovssdb-server	
Statistic	Value
UID	0
PID	44891
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	•
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	1613
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vsitchd	
Statistic	Value
UID	0
PID	44892
%usr	0.20
%system	0.39
%guest	0.00
%CPU	0.59
CPU	•
minflt/s	1.98
majflt/s	0.00
VSZ	1300916
RSS	7447
%MEM	0.02
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	44891
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	1370
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	44892
%usr	0.20
%system	0.39
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	1.98
majflt/s	0.00
VSZ	1300916
RSS	7447
%MEM	0.02
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	44891
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
b2b_frames	1860
b2b_frame_loss_percent	0.0
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	44892
%usr	0.20
%system	0.39
%guest	0.00
%CPU	0.59
CPU	•
minflt/s	1.98
majflt/s	0.00
VSZ	1300916
RSS	7447
%MEM	0.02
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	44891
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	•
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

4.2.3 Test ID: PHY2PHY_TPUT_MOD_VLAN

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- NIC(s):
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB
- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsVanilla, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60

Below are test details:

- Test ID: phy2phy_tput_mod_vlan
- Description: LTD.Throughput.RFC2544.PacketLossRatioFrameModification
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : False

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	609190.921
tx_rate_mbps	Unknown
throughput_rx_mbps	331.400
tx_rate_percent	4.094
throughput_rx_percent	4.289
frame_loss_percent	0.000
min_latency_ns	4200.000
max_latency_ns	2681320.000
avg_latency_ns	99650.000
type	rfc2544
packet_size	64
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	47890
%usr	0.18
%system	0.38
%guest	0.00
%CPU	0.55
CPU	.
minflt/s	0.55
majflt/s	0.00
VSZ	1300920
RSS	10932
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	47889
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	607053.673
tx_rate_mbps	Unknown
throughput_rx_mbps	641.049
tx_rate_percent	7.188
throughput_rx_percent	7.382
frame_loss_percent	0.000
min_latency_ns	4360.000
max_latency_ns	3459100.000
avg_latency_ns	101048.000
type	rfc2544
packet_size	128
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	47890
%usr	0.18
%system	0.38
%guest	0.00
%CPU	0.55
CPU	.
minflt/s	0.55
majflt/s	0.00
VSZ	1300920
RSS	10932
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	47889
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	495991.288
tx_rate_mbps	Unknown
throughput_rx_mbps	2047.452
tx_rate_percent	21.109
throughput_rx_percent	21.268
frame_loss_percent	0.000
min_latency_ns	4840.000
max_latency_ns	938820.000
avg_latency_ns	48934.000
type	rfc2544
packet_size	512
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	47890
%usr	0.18
%system	0.38
%guest	0.00
%CPU	0.55
CPU	.
minflt/s	0.55
majflt/s	0.00
VSZ	1300920
RSS	10932
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	47889
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	512040.656
tx_rate_mbps	Unknown
throughput_rx_mbps	4211.022
tx_rate_percent	42.766
throughput_rx_percent	42.929
frame_loss_percent	0.000
min_latency_ns	6120.000
max_latency_ns	1033540.000
avg_latency_ns	53504.000
type	rfc2544
packet_size	1024
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	47890
%usr	0.18
%system	0.38
%guest	0.00
%CPU	0.55
CPU	.
minflt/s	0.55
majflt/s	0.00
VSZ	1300920
RSS	10932
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	47889
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	517299.334
tx_rate_mbps	Unknown
throughput_rx_mbps	6298.637
tx_rate_percent	63.648
throughput_rx_percent	63.814
frame_loss_percent	0.000
min_latency_ns	6540.000
max_latency_ns	1445320.000
avg_latency_ns	54000.000
type	rfc2544
packet_size	1518
traffic_type	udp

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	47890
%usr	0.18
%system	0.38
%guest	0.00
%CPU	0.55
CPU	.
minflt/s	0.55
majflt/s	0.00
VSZ	1300920
RSS	10932
%MEM	0.03
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	47889
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

4.2.4 Test ID: PHY2PHY_SCALABILITY

Test Environment

Below is the environment that the test was performed in:

- OS: centos 7.2.1511 Core
- Kernel Version: 3.10.0-229.14.1.el7.x86_64
- **NIC(s):**
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
 - Intel Corporation 82599ES 10-Gigabit SFI/SFP+ Network Connection (rev 01)
- Board: Intel Corporation S2600JF [2 sockets]
- CPU: Intel(R) Xeon(R) CPU E5-2690 0 @ 2.90GHz
- CPU cores: 32
- Memory: 32727096 kB

- Virtual Switch Set-up: p2p
- vswitchperf: GIT tag: a8f7b9adcd4aea96fd44b201c483b7fab08ce658
- Traffic Generator: IxNet, Version: 7.50.1009.20, GIT tag: None
- vSwitch: OvsVanilla, Version: 2.5.90, GIT tag: 02ab4b1a6a173979a51cabd7000a34546d517e60

Below are test details:

- Test ID: phy2phy_scalability
- Description: LTD.Scalability.RFC2544.0PacketLoss
- Deployment: p2p
- Traffic type: rfc2544
- Bidirectional : True

Test results for packet size: 64

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1218381.190
tx_rate_mbps	Unknown
throughput_rx_mbps	623.811
tx_rate_percent	4.094
throughput_rx_percent	4.094
frame_loss_percent	0.000
min_latency_ns	3920.000
max_latency_ns	2305520.000
avg_latency_ns	33733.500
type	rfc2544
packet_size	64
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	50195
%usr	0.17
%system	0.42
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	2.43
majflt/s	0.00
VSZ	1300920
RSS	20431
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	50194
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 128

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1214106.517
tx_rate_mbps	Unknown
throughput_rx_mbps	1243.245
tx_rate_percent	7.188
throughput_rx_percent	7.188
frame_loss_percent	0.000
min_latency_ns	4580.000
max_latency_ns	2776040.000
avg_latency_ns	58319.500
type	rfc2544
packet_size	128
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	50195
%usr	0.17
%system	0.42
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	2.43
majflt/s	0.00
VSZ	1300920
RSS	20431
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	50194
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 512

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1101019.793
tx_rate_mbps	Unknown
throughput_rx_mbps	4509.777
tx_rate_percent	23.430
throughput_rx_percent	23.430
frame_loss_percent	0.000
min_latency_ns	4960.000
max_latency_ns	2317660.000
avg_latency_ns	50729.500
type	rfc2544
packet_size	512
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	50195
%usr	0.17
%system	0.42
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	2.43
majflt/s	0.00
VSZ	1300920
RSS	20431
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	50194
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1024

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1005562.641
tx_rate_mbps	Unknown
throughput_rx_mbps	8237.569
tx_rate_percent	41.992
throughput_rx_percent	41.992
frame_loss_percent	0.000
min_latency_ns	6080.000
max_latency_ns	1533620.000
avg_latency_ns	44985.000
type	rfc2544
packet_size	1024
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	50195
%usr	0.17
%system	0.42
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	2.43
majflt/s	0.00
VSZ	1300920
RSS	20431
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	50194
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Test results for packet size: 1518

A detailed summary of the main results is outlined below.

Results/Metrics Collected

The following are the metrics obtained during this test:

Metric	Result
tx_rate_fps	Unknown
throughput_rx_fps	1022027.981
tx_rate_mbps	Unknown
throughput_rx_mbps	12411.508
tx_rate_percent	62.875
throughput_rx_percent	62.875
frame_loss_percent	0.000
min_latency_ns	6920.000
max_latency_ns	531260.000
avg_latency_ns	66774.000
type	rfc2544
packet_size	1518
traffic_type	udp
stream_count	8000
match_type	L4
pre-installed_flows	No

Statistics collected

The following system statistics were collected during testcase execution:

Process: ovs-vswitchd	
Statistic	Value
UID	0
PID	50195
%usr	0.17
%system	0.42
%guest	0.00
%CPU	0.59
CPU	.
minflt/s	2.43
majflt/s	0.00
VSZ	1300920
RSS	20431
%MEM	0.06
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Process: ovsdb-server	
Statistic	Value
UID	0
PID	50194
%usr	0.00
%system	0.00
%guest	0.00
%CPU	0.01
CPU	.
minflt/s	0.00
majflt/s	0.00
VSZ	45760
RSS	2996
%MEM	0.01
kB_rd/s	0.00
kB_wr/s	0.00
kB_ccwr/s	0.00

Anomalies

No anomalies were detected during the course of this test.

Testing Activities/Events

pidstat is used to collect the process statistics, as such some values such as %CPU and %USER maybe > 100% as the values are summed across multiple cores. For more info on pidstat please see: <http://linux.die.net/man/1/pidstat>.

Known issues: Some reported metrics have the value “unkown”. These values are marked unknown as they are not values retrieved from the external tester (traffic generator). They were incorrectly derived in a way that made assumptions about packet sizes, as such they have been deprecated from vsperf and marked as unknown. They will be resolved in the next release.

4.3 Rationale for decisions

The tests conducted do not have pass/fail/conditional-pass criteria. The test is simply conducted and the results are reported.

4.4 Conclusions and recommendations

The test results are stable. The vsperf CI jobs that were used to obtain the results can be found at https://artifactory.opnfv.org/logs/vswitchperf/intel-pod3/2016-03-04_03-16-29/vswitchperf_logs_2016-03-04_03-16-29.tar.gz.

4.5 General

4.5.1 Glossary

- NFV - Network Function Virtualization
- Mbps - 1,000,000bps

4.5.2 Document change procedures and history

Document ID	Author	Date Modified
<i>OPNFV_vswitchperf_LTR_ver_1.0_Jan_15_CN_DRAFT</i>	Christopher Nolan	23/01/2015
<i>OPNFV_vswitchperf_LTR_ver_1.1_Jan_15_CN_DRAFT</i>	Christopher Nolan	28/01/2015