PERFORMANCE REPORT FOR DPDK-OVS

Revision History

Revision	Date	Author	Description
1.0	Dec 12, 2019	Thuong Tran	Initial version

Table of Contents

1. Test Setup

- The device under test (DUT) consists of a system with an IntelÂ® architecture motherboard populated with the following:
  - A single or dual processor and PCH chip, except for System on Chip (SoC) cases
  - DRAM memory size and frequency (normally single DIMM per channel)
  - Specific Intel Network Interface Cards (NICs)
  - BIOS settings noting those that updated from the basic settings
  - DPDK build configuration settings, and commands used for tests
- Connected to the DUT is an STC (Sprient Test Center), a hardware test and simulation platform to generate packet traffic to the DUT ports and determine the throughput at the tester side. The STC is used to implement RFC2544 on the DUT.
- DPDK Testpmd Test Case: Documentation may be found at http://www.dpdk.org/doc/guides/testpmd_app_ug/index.html.
- The testpmd application can be used to test the DPDK in a packet forwarding mode and also to access NIC hardware features. Note in the Testpmd example if the â€“i argument is used, the first core is used for the command language interface (CLI).

2. Test Model

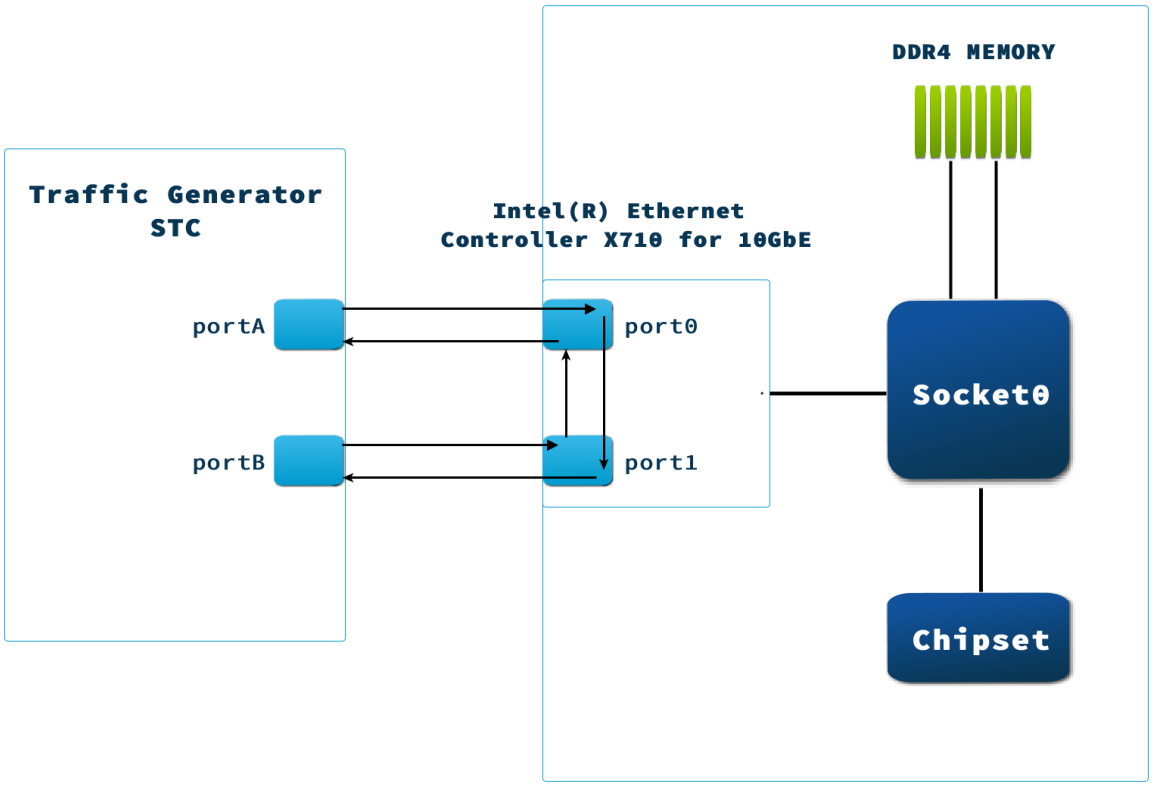


Figure 3-1 - Model Test

3. Test Environment

3.1 Hardware & Software Ingredients

Item	Description
Server Platform	Asus Z10PE-D8 WS
CPU	Intel(R) Xeon(R) CPU E5–2678 v3 @ 2.50GHz https://ark.intel.com/content/www/us/en/ark/products/81908/intel-xeon-processor-e5–2680-v3–30m-cache–2–50-ghz.html Number of cores: 48, Number of Threads:
Memory	Total 256GiB RIMM DDR4 Synchronous over 8 channels 2400 MHz (0.4 ns)
PCIe	
NICs	Intel (R) Ethernet Controller X710 for 10GbE SFP+ (4 x 10GbE) Chelsio Communications Inc T62100-CR Unified Wire Ethernet Controller (5 x 40/50/100Gb Ethernet) Intel (R) I210 Gigabit Network 4.15.0–63-genericrk Connection (2 x 1GbE)
Operating System	Ubuntu 18.04.3 LTS
BIOS	12/18/2015 American Megatrends Inc. 3204
Microcode	0x43
Linux kernel version	4.15.0–63-generic
Gcc version	gcc version 7.4.0 (Ubuntu 7.4.0–1ubuntu1_{18}.04.1) 7.4.0
DPDK version	18.11.2
Open vSwitch version	2.11.0

3.2 BIOS & DPDK-OVS setting

Item	Description
BIOS Setting	*default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on iommu=pt isolcpus=1–21,28–48 nohz_full=1–21,28–48 rcu_nocbs=1- 21,28–48* **Note:** nohz_full and rcu_nocbs is to disable Linux* kernel interrupts, and it's important for zero-packet loss test. Generally, 1G huge pages are used for performance test.
BIOS	CPU Power and Performance Policy (Performance) CPU C-state Disabled CPU P-state Disabled Enhanced Intel (R) Speedstep (R) Tech Disabled Turbo Boost Disabled Intel VT Fordirected I/O(VT-d) Enable Intel Virtualization Technology (VT-x) Enable
DPDK Setting	DPDK version: 18.11.2 ovs-vswitchd (Open vSwitch): 2.11.0 Build ovs-vswitchd (Open vSwitch)

4. Testing Stage 1

4.1. Test case 1: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch with 1 flow, none HQOS

4.1.1 Configuration

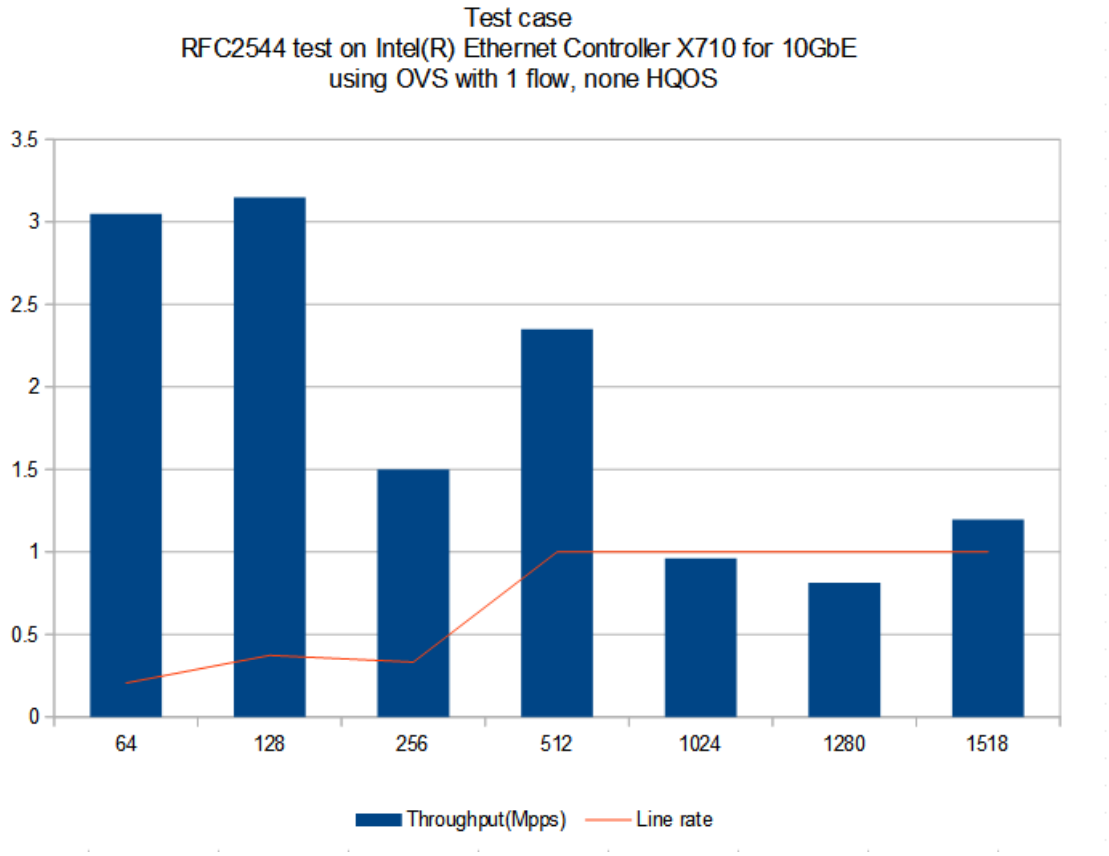
Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Open vSwitch with 1 flow, none HQOS
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh none_hqos_1flow.sh***

4.2.1 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mpps)	Line rate(%)
64	3.05	20.52
128	3.15	37.31
256	1.5	33.21
512	2.35	99.97
1024	0.961	100
1280	0.812	100
1518	1.197	100

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch with 1 flow, none HQOS



4.2. Test case 1.1: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch with 1024 flows, none HQOS

4.2.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Open vSwitch with 1024 flows, none HQOS
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh none_hqos_1024flows.sh***

4.2.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mpps)	Line rate%
64	0.767	5.16
128	0.769	9.11
256	0.764	16.88
512	0.747	31.81
1024	0.754	63.01
1280	0.758	78.88
1518	0.757	93.26

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch with 1024 flows, none HQOS

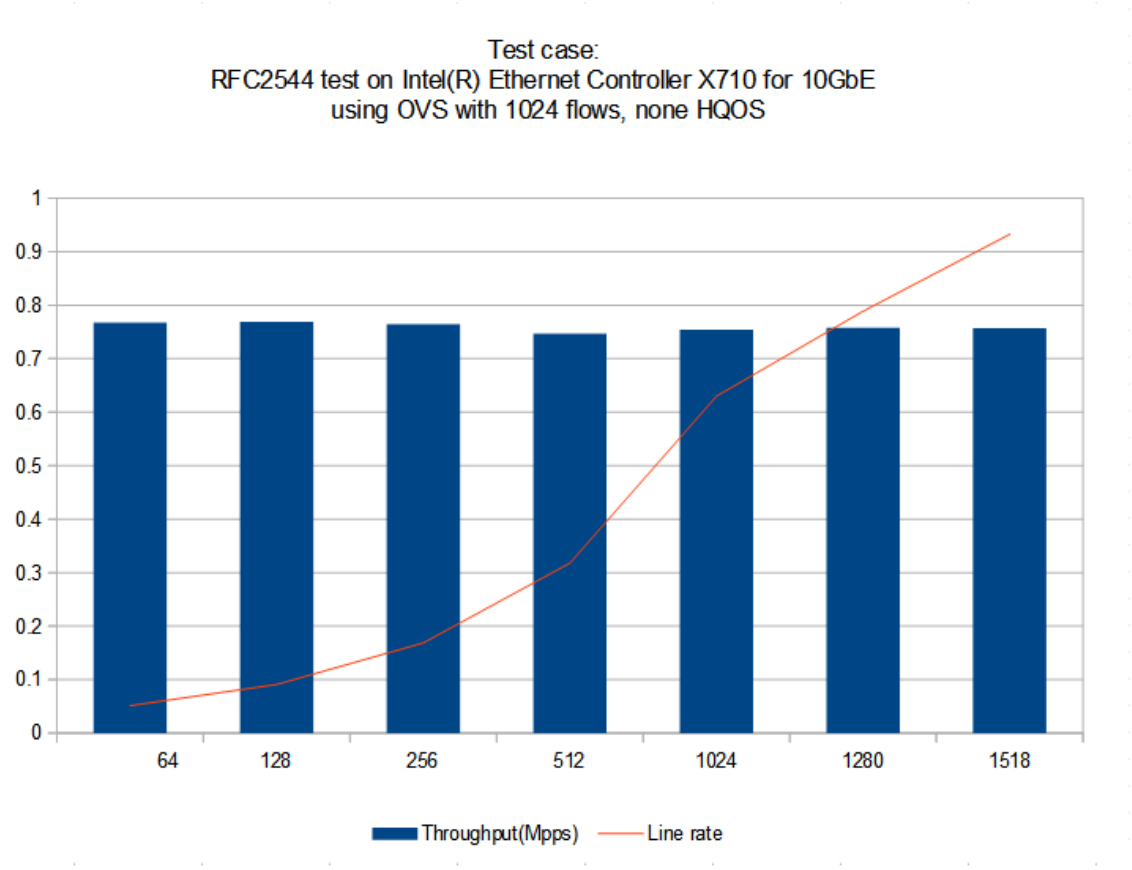


Figure 5-1 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch with 1024 flows, none HQOS

4.3. Test case 2: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 1024 flows with POLICER

4.3.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Open vSwitch 1024 flows with POLICER
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	# Config QOS for Policer *QueueID 1–7,9–128,822–999: type=egress-policer-rfc2698 cir=2097152 cbs=20048 pir=2197152 pbs=20048 ydropt=true* *QueueID 8,129–512: type=egress-policer-rfc2698 cir=125000 cbs=20048 pir=1058576 pbs=20048 ydropt=true* *QueueID 513,514: type=egress-policer-rfc2698 cir=2048 cbs=2048 pir=10240 pbs=2048 ydropt=false* *QueueID 515–820: type=egress-policer-rfc2698 cir=1024 cbs=2048 pir=10240 pbs=2048 ydropt=false* *QueueID 821,1000–1024: type=egress-policer-rfc2698 cir=8192 cbs=2048 pir=10240 pbs=2048 ydropt=true*
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh policer_1024flows.sh*** *#Add Root Node QOS for model* *ovs_mini_tools.py add_leaf_to_root_node_qos –hqos-template-file=hqos_template_file –root-qos-uuid=**uuid***

4.3.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mpps)	Line rate%
64	0.767	5.16
128	0.769	9.11
256	0.764	16.88
512	0.747	31.81
1024	0.754	63.01
1280	0.758	78.88
1518	0.757	93.26

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 1024 flows with HQOS

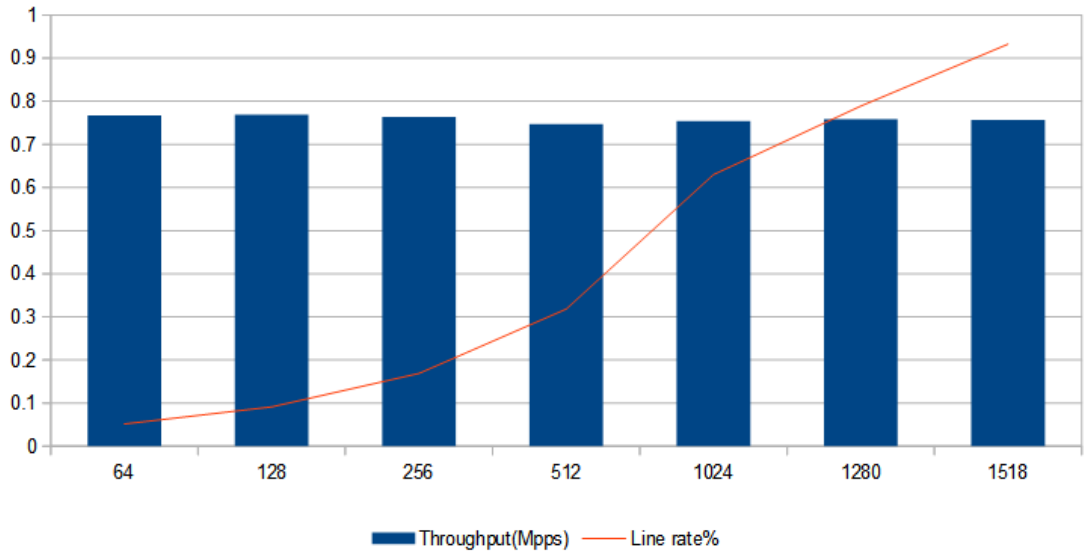


Figure 5-2 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 1024 flows with HQOS

4.4. Test case 3: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS

4.4.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Open vSwitch 4096 flows with HQOS
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh hqos_4096flows.sh***

4.4.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mpps)	Line rate%
64	0.642	4.32
128	0.651	7.71
256	0.616	13.62
512	0.632	26.92
1024	0.648	54.13
1280	0.634	65.99
1518	0.641	78.97

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS

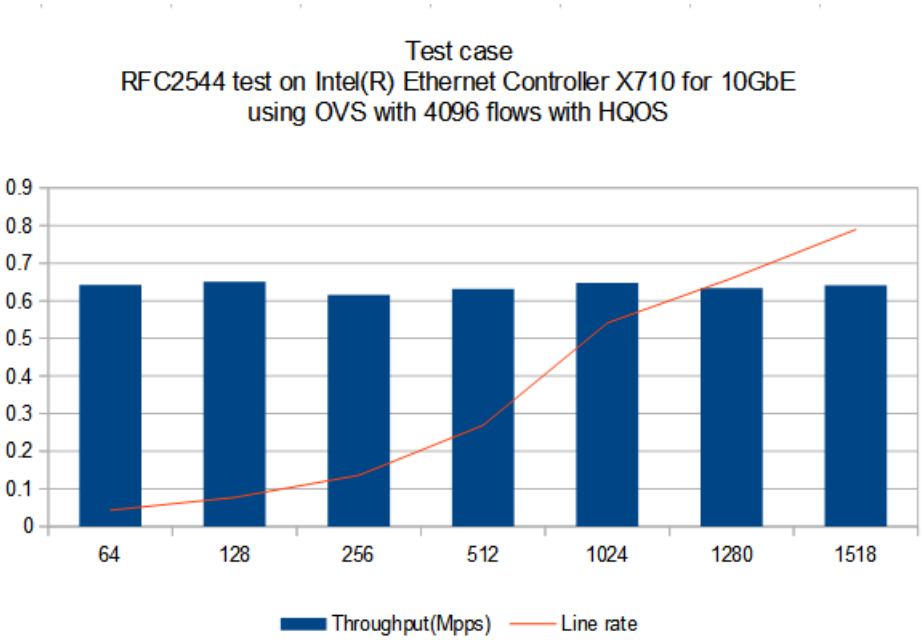


Figure 5-3 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS

4.5. Test case 4: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER

4.5.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Open vSwitch 4096 flows with HQOS & POLICER
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	Config Spirent Test Center for 4096 vlan and using vlan ID 4095 with config **type=egress-policer-rfc2698 cir=125000000 cbs=200048 pir=126000000 pbs=20048 ydropt=true** to show throughput
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh hqos_4096flows.sh*** *#Add Root Node QOS for model* *ovs_mini_tools.py add_leaf_to_root_node_qos –hqos-template-file=hqos_template_file –root-qos-uuid=**uuid***

4.5.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mpps)	Line rate%
64	1.856	12.557
128	2.174	25.657
256	2.361	52.207
512	2.348	99.887
1024	1.197	99.957
1280	0.961	100
1518	0.813	100

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER

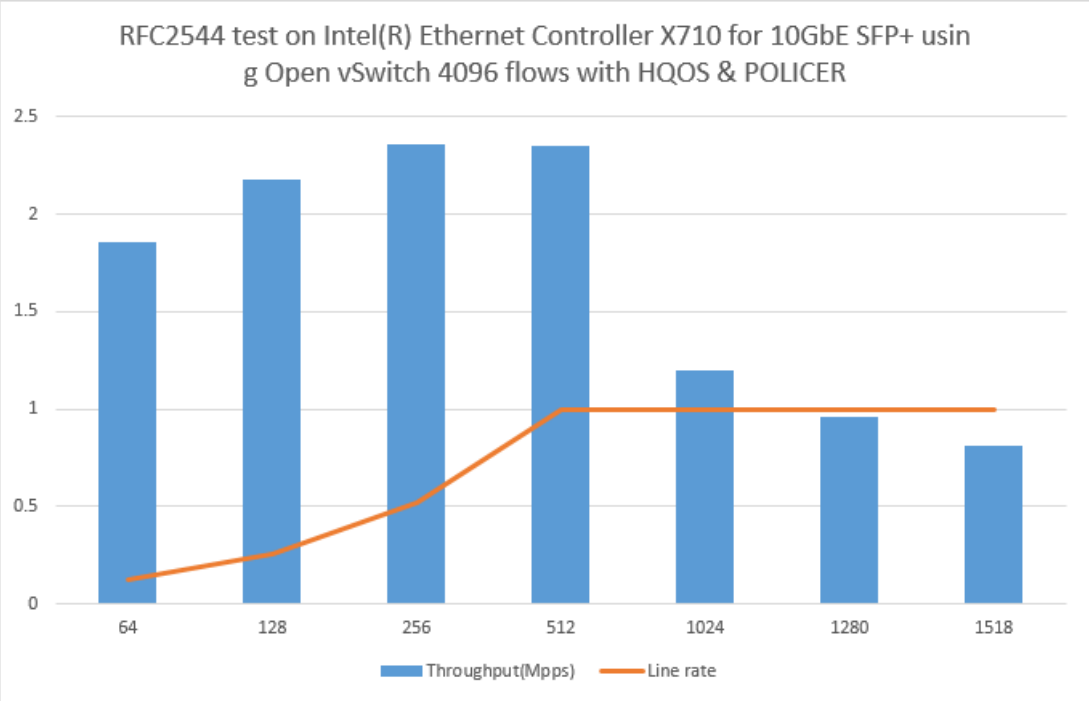


Figure 5-4 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER

5. Testing Stage 2

5.1. Test case 1: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Non QoS (1 Flow)

5.1.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Non QoS (1 Flow)
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	Setup Spirent Test Center with 4096 vlan
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh non_hqos_1_flow.sh***

5.1.2 Test Result

- Result of Dropped Packets Rate (Average)

Packet Size (Bytes)	Total Transfer Packets	Time 1	Time 2	Time 3	Time 4	Time 5	Average Dropped Packets
64	1024 x 12288	9,559,764	9,622,694	9,698,407	9,592,648	9,600,633	9,614,829
	2048 x 12288	21,219,876	21,071,367	21,246,232	21,136,827	21,196,557	21,174,171
	3072 x 12288	32,188,971	32,116,838	32,181,653	32,160,393	32,160,326	32,161,636
	4096 x 12288	42,870,834	42,649,550	42,853,772	42,812,110	42,760,603	42,789,373
128	1024 x 12288	9,732,697	9,734,271	9,746,067	9,724,182	9,726,495	9,732,742
	2048 x 12288	19,125,502	19,152,051	19,176,843	19,185,876	19,274,957	19,183,045
	3072 x 12288	28,166,978	28,195,449	28,131,336	27,989,321	28,287,594	28,154,135
	4096 x 12288	36,742,255	36,727,232	36,654,341	36,833,708	36,793,159	36,750,139
256	1024 x 12288	7,343,436	7,143,557	7,324,395	7,329,942	7,360,575	7,300,381
	2048 x 12288	13,006,398	12,952,723	12,819,317	12,544,201	12,775,445	12,819,616
	3072 x 12288	18,141,242	18,097,328	18,233,992	18,177,535	18,147,097	18,159,438
	4096 x 12288	23,090,056	22,924,411	22,664,742	22,676,429	23,436,367	22,958,401
512	1024 x 12288	382,898	430,234	394,734	446,606	405,821	412,058
	2048 x 12288	17,768	11,978	14,174	15,616	15,146	14936
	3072 x 12288	115,429	11,176	14,848	13,314	11,122	33177
	4096 x 12288	22,913	17,632	20,171	22,416	19,778	20582
1024	1024 x 12288	1,895	1,884	1,360	1,370	1,715	1644
	2048 x 12288	3,104	4,375	3,302	1,553	1,615	2789
	3072 x 12288	1,538	1,499	2,750	3,008	1,556	2070
	4096 x 12288	1,560	2,060	2,823	2,065	3,084	2318
1280	1024 x 12288	208	64	0	0	147	83
	2048 x 12288	645	862	861	785	386	707
	3072 x 12288	1,919	1,879	848	877	345	1173
	4096 x 12288	0	0	0	0	0	0
1518	1024 x 12288	234	0	0	0	0	47
	2048 x 12288	0	0	0	0	0	0
	3072 x 12288	3,346	0	0	0	0	669
	4096 x 12288	0	0	0	0	0	0

5.2. Test case 2: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using HQoS (1 Flow)

5.2.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using HQoS (1 Flow)
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh hqos_1flows.sh***

5.2.2 Test Result

- Result of Dropped Packets Rate (Average)

Packet Size (Bytes)	Total Transfer Packets	Time 1	Time 2	Time 3	Time 4	Time 5	Dropped Average Packets
64	1024 x 12288	9,385,931	9,493,937	9,520,446	9,495,922	9,395,922	9458431
	2048 x 12288	21,425,286	21,411,829	21,434,016	21,435,264	21,418,266	21424932
	3072 x 12288	32,989,748	32,940,135	32,916,460	32,991,382	32,937,059	32954956
	4096 x 12288	44,274,531	44,260,495	44,230,118	44,299,551	44,236,715	44260282
128	1024 x 12288	10,027,753	10,023,822	10,008,309	10,017,118	10,013,118	10018024
	2048 x 12288	20,421,487	20,504,585	20,416,640	20,445,229	20,621,667	20481921
	3072 x 12288	30,704,770	30,757,986	30,622,978	30,540,402	30,374,554	30600138
	4096 x 12288	40,684,570	40,522,410	40,435,024	40,702,326	40,598,411	40588548
256	1024 x 12288	8,607,504	8,658,310	8,734,455	8,609,059	8,660,036	8653872
	2048 x 12288	16,552,682	16,381,257	16,248,718	16,248,895	16,314,609	16349232
	3072 x 12288	23,616,684	23,976,860	24,026,085	23,843,265	23,687,099	23829998
	4096 x 12288	31,225,134	31,187,773	31,225,859	31,260,769	31,412,764	31262459
512	1024 x 12288	4,225,453	4,323,864	3,910,786	3,992,445	4,001,912	4090892
	2048 x 12288	7,015,555	7,045,109	7,041,694	6,836,231	6,825,332	6952784
	3072 x 12288	9,633,041	9,771,949	9,870,573	9,938,295	9,934,228	9829617
	4096 x 12288	12,299,207	12,721,404	12,555,284	12,599,247	12,501,920	12535412
1024	1024 x 12288	58,522	60,910	66,861	61,027	57,144	60892
	2048 x 12288	127,394	109,072	106,907	106,495	103,318	110637
	3072 x 12288	163,015	161,631	159,136	161,128	160,317	161045
	4096 x 12288	188,773	197,045	199,811	199,067	204,409	197821
1280	1024 x 12288	30,396	30,937	29,057	24,583	26,840	28362
	2048 x 12288	56,139	51,839	59,581	57,376	52,995	55586
	3072 x 12288	79,324	82,004	82,651	76,802	81,725	80501
	4096 x 12288	101,199	106,551	105,841	106,584	110,208	106076
1518	1024 x 12288	14,569	17,932	15,088	16,339	16,286	16042
	2048 x 12288	45,540	37,293	36,323	45,907	37,537	40520
	3072 x 12288	51,509	52,843	49,937	47,661	47,352	49860
	4096 x 12288	60,417	59,299	57,510	64,093	64,686	61201

■ Figure: Compare Model

RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Non HQoS (1 Flow) and using HQoS (1 Flow)

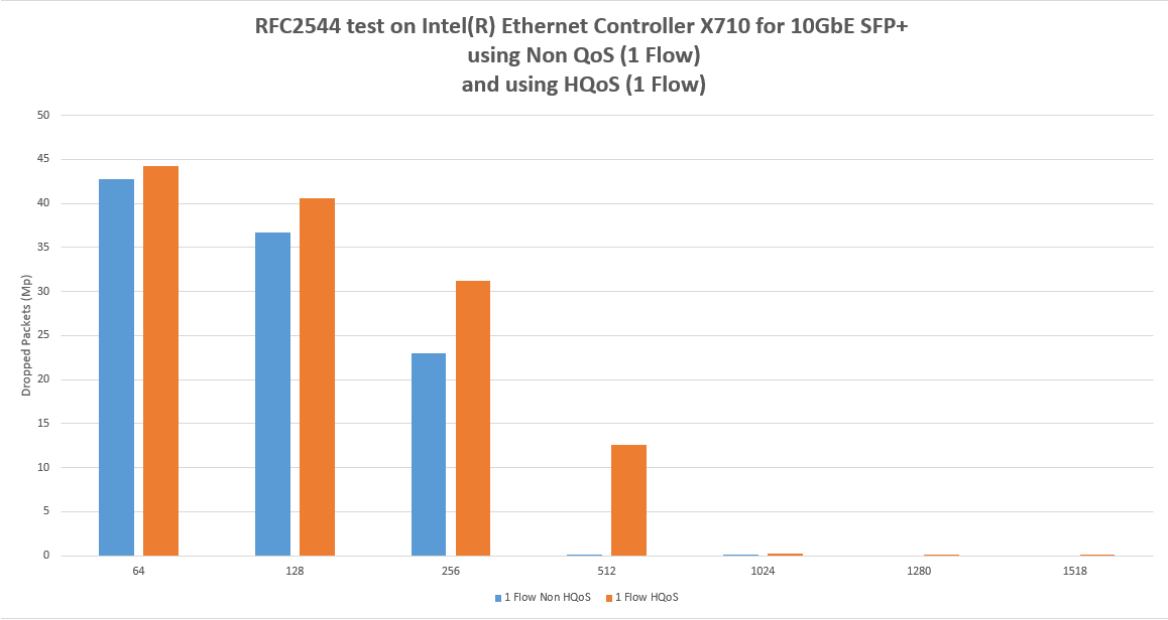


Figure 7-1 - Compare Model
RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Non HQoS (1 Flow) and using HQoS (1 Flow)

5.3 Test case 3: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Non HQoS with 4096 flows

5.3.1 Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using Non QoS with 4096 flows
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* ***sh non_hqos_4096flows.sh***

5.4.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mbps)	Line rate%
64	976.55	12.70
128	2,270.22	25.96
256	4,906.67	52.65
512	9,614.28	99.94
1024	9,808.43	99.99
1280	9,846.15	99.99
1518	9,869.96	100

5.4 Test case 4: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using HQoS with 4096 flows

Configuration

Item	Description
Test case	RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ (2 x 1GbE) using HQoS with 4096 flows
NIC	Intel (R) Ethernet Controller X710 for 10GbE SFP+
Driver	i40e DPDK PMD (base on igb_uio)
Device ID	
Device Driver/ Firmware	Driver version: 2.9.21
Test configuration	
Command line	*# Start Open vSwitch by Bash shell scripts* *sh hqos_4096flows.sh*

4.5.2 Test Result

- Result of Throughput (Mpps)

Packet Size(Bytes)	Throughput(Mbps)	Line rate%
64	959.79	3.71
128	2,255.47	25.78
256	4,898.58	52.35
512	9,624.06	99.91
1024	9,808.43	99.97
1280	9,846.16	99.99
1518	9,869.96	99.99

■ Figure: RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER

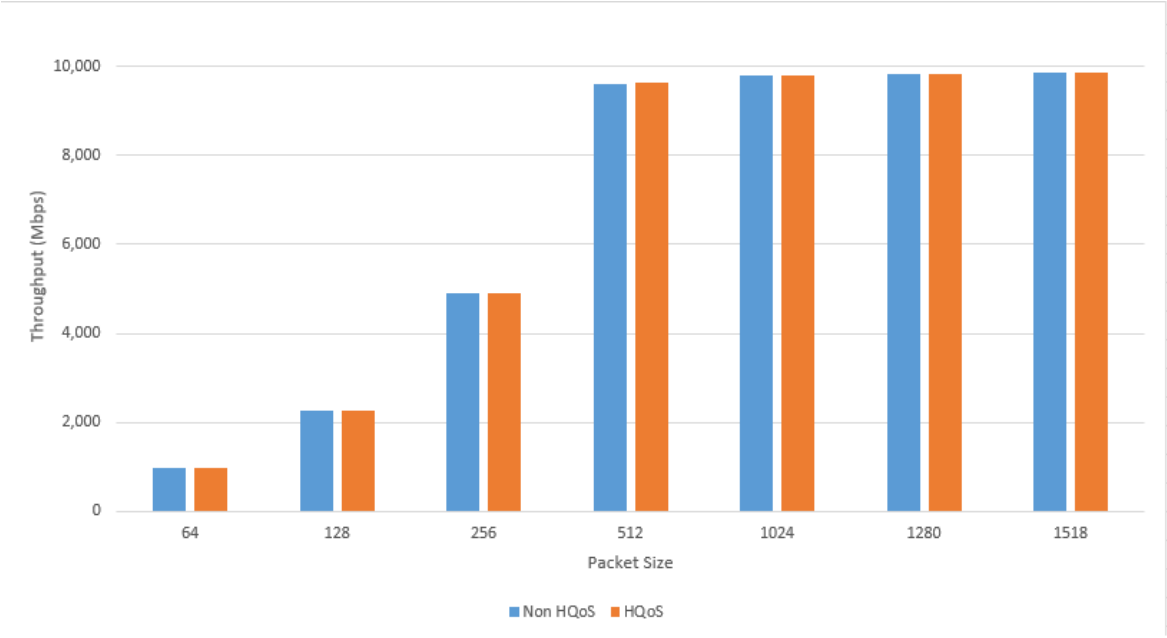


Figure 9-1 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER - Compare Throughput (Mbps)

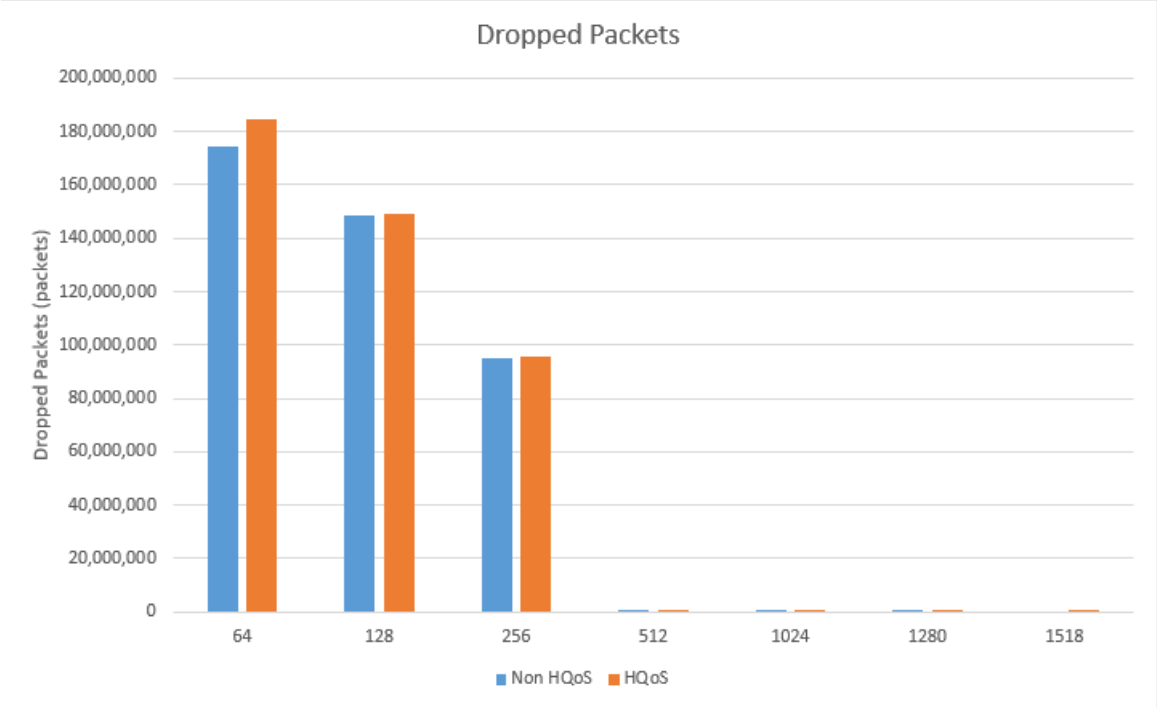


Figure 9-2 - RFC2544 test on Intel(R) Ethernet Controller X710 for 10GbE SFP+ using Open vSwitch 4096 flows with HQOS & POLICER - Compare Dropped Packets (Packets)

References

(1) https://fast.dpdk.org/doc/perf/DPDK_19_08_Intel_NIC_performance_report.pdf

About Arrive

Arrive is a broadband semiconductor solutions company with a broad portfolio of highly integrated systems-on-a-chip products combining voice, data, Internet and multimedia content for worldwide telecommunications companies.

Our CodeChip(TM) replaces inflexible fixed-silicon ASICs with a programmable carrier-class FPGA solution. It includes a SoC FPGA Image with a full software development kit, including APIs and Drivers, and is backed by the integration and testing experience of Arrive.

For more information on our Carrier Ethernet CodeChip(TM) product, go to: www.arrivetechnologies.com/af5/

North America Headquarters
4031 White Mill Crescent Road
Roseville, CA 95747
USA
(888) 864–6959

Vietnam
Floor 10, E-Town Building,
364 Cong Hoa Street
Ward 13, Tan Binh District,
Ho Chi Minh City, Vietnam