

# Intel Ethernet' s Performance Report with DPDK 23.03

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**Author:** Intel DPDK Validation team



## Revision History

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| Date             | Revision | Comment                      |
|------------------|----------|------------------------------|
| April 20th, 2023 | 1.0      | Initial document for release |

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## Audience and Purpose

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The primary audience for this test report is architects and engineers implementing the Data Plane Development Kit (DPDK). This report provides information on packet processing performance testing for the specified DPDK release on Intel® architecture. The initial report may be viewed as the baseline for future releases and provides system configuration and test cases based on DPDK examples.

The purpose of reporting these tests is not to imply a single “correct” approach, but rather to provide a baseline of well-tested configurations and procedures with reproducible results. This will help guide architects and engineers who are evaluating and implementing DPDK solutions on Intel® architecture and can assist in achieving optimal system performance.

## Test Description

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The device under test (DUT) consists of a system with an Intel® 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 IXIA, a hardware test and simulation platform to generate packet traffic to the DUT ports and determine the throughput at the tester side. The IXIA is used to implement RFC2544 on the DUT.

Benchmarking a DPDK system requires knowledge of networking technologies including knowledge of network protocols and hands-on experience with relevant open-source software, such as Linux, and the DPDK. Engineers also need benchmarking and debugging skills, as well as a good understanding of the device-under-test (DUT) across compute and networking domains.

**DPDK L3fwd Test Case:** Documentation may be found at [http://www.dpdk.org/doc/guides/sample\\_app\\_ug/l3\\_forward.html](http://www.dpdk.org/doc/guides/sample_app_ug/l3_forward.html).

The application demonstrates the use of the hash and LPM libraries in the DPDK to implement packet forwarding. The lookup method is either hash-based or LPM-based and is selected at compile time. In this test case, the selected lookup method is the default LPM-based without modification, an LPM object is used to emulate the forwarding stage for IPv4 packets. The LPM object is used as the routing table to identify the next hop for each input packet at runtime.

The LPM lookup key is represented by the Destination IP Address field read from the input packet. The ID of the output interface for the input packet is the next hop returned by the LPM lookup. The set of LPM rules used by the application is statically configured and loaded into the LPM object at initialization time.

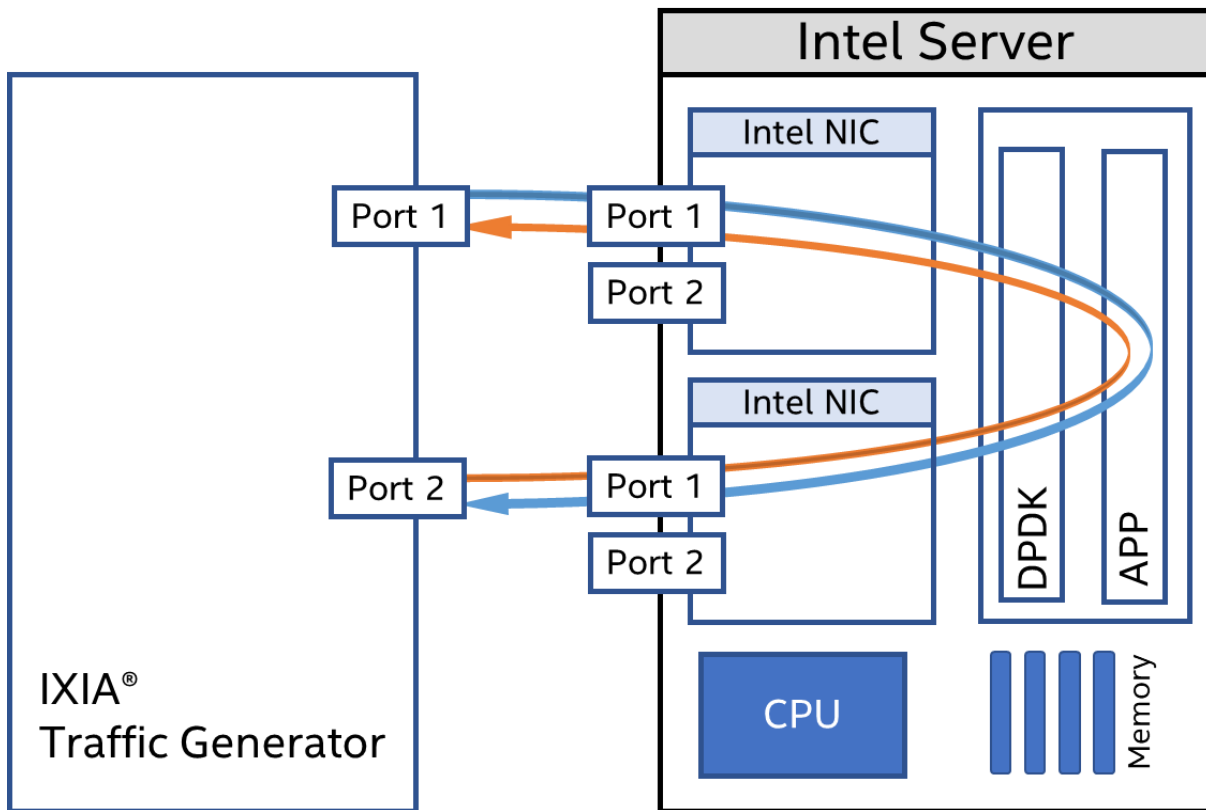
In the sample application, hash-based forwarding supports IPv4 and IPv6. LPM-based forwarding supports IPv4 only.

**DPDK Testpmd Test Case:** Documentation may be found at [http://www.dpdk.org/doc/guides/testpmd\\_app Ug/index.html](http://www.dpdk.org/doc/guides/testpmd_app Ug/index.html).

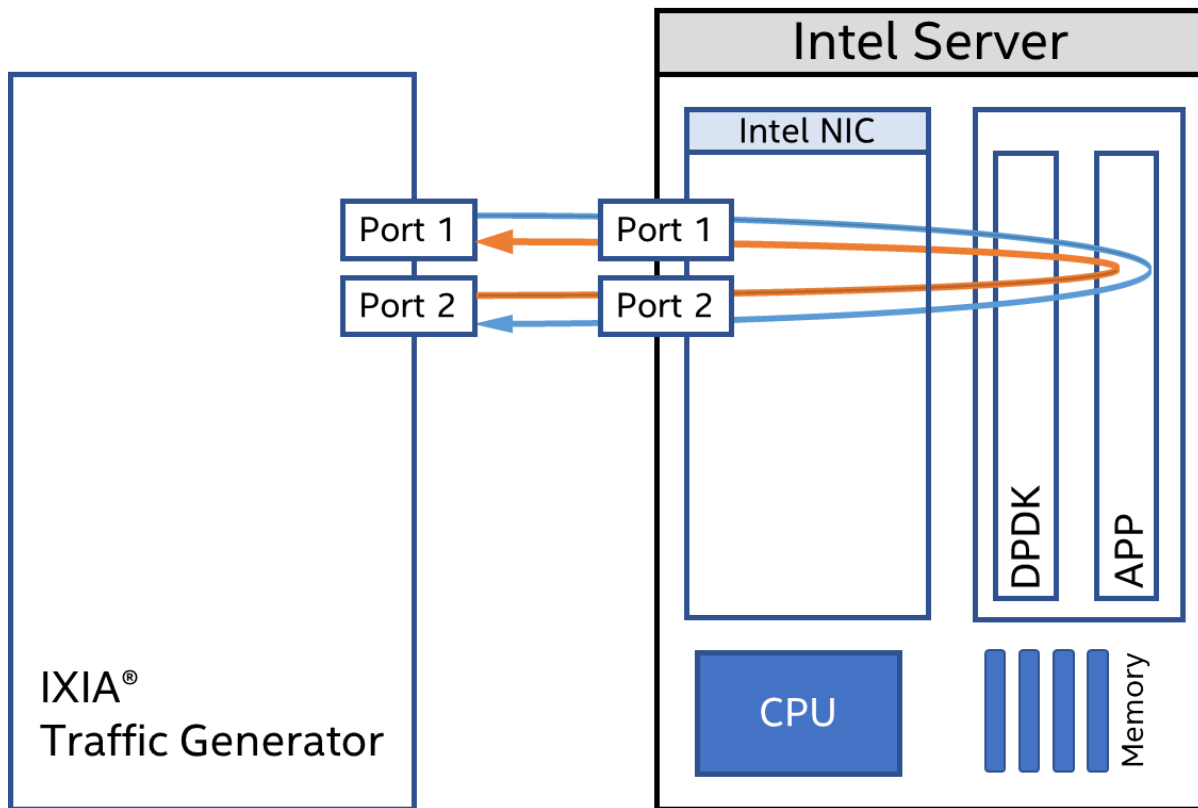
The testpmd application can be used to test the DPDK in a packet forwarding mode and also to access NIC hardware features. Note in the Testpmd example if the `-i` argument is used, the first core is used for the command language interface (CLI).

Below is an example setup topology for the performance test. Generally, NIC ports in DUT connect to the traffic generator ports directly. And we will send bi-directional traffic from traffic generators and calculate the aggregated throughputs at the traffic generator side for the overall throughput. Please note the NIC port connections to traffic generator would vary from case to case.

**Figure 1: DPDK NIC performance test setup (1 port per NIC)**



**Figure 2: DPDK NIC performance test setup (2 ports on 1NIC)**



**RFC2544 Zero packet loss test case:** Used to determine the DUT throughput as defined in RFC1242(<https://www.ietf.org/rfc/rfc1242.txt>). Note RFC6201 <https://www.ietf.org/rfc/rfc6201.txt> has updated RFC2544 and RFC1242. Please check the link for more details. In this report, RFC2544 test uses DPDK l3fwd as test application.

**Procedure:** Send a specific number of frames at a specific rate through the DUT and then count the frames that are transmitted by the DUT. If the count of offered frames is not equal to the count of received frames, the rate of the offered stream is reduced and the test is rerun. The throughput is the fastest rate at which the count of test frames transmitted by the DUT is equal to the number of test frames sent to it by the test equipment.

**Test settings:** IxNetwork 9.0 is used here for the test execution. The duration for each round is 60 seconds, and the acceptable packet loss rate is 0. The traffic is 256 flows per port.

**Single core test case:** Used to check the maximum IO throughput for a single core. The case requires at least 1x 100GbE ports for the ice DPDK Poll Mode Driver (PMD) and 3x 25GbE ports for the i40e DPDK PMD. In this case, we don't calculate the packet loss rate but record the average throughput within 60 seconds.

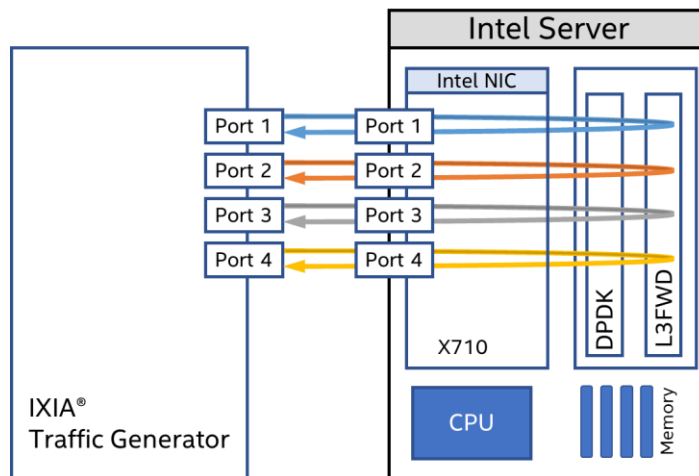
More details about the DPDK setup and BIOS information can be found at [http://dpdk.org/doc/guides/linux\\_gsg/nic\\_perf\\_intel\\_platform.html](http://dpdk.org/doc/guides/linux_gsg/nic_perf_intel_platform.html)

# Test#1 RFC2544 zero packet loss test on 1x Intel® Ethernet Converged Network Adapter X710-DA4

**Table 1: Test #1 Setup**

| Item                       | Description   |
|----------------------------|---|
| Test Case                  | Test#1 RFC2544 zero packet loss test on 1x Intel® Ethernet Converged Network Adapter X710-DA4   |
| Server Platform            | Intel® Server Board S2600WFT  |
| CPU                        | Intel® Xeon® Platinum 8180 CPU @ 2.50GHz<br>28 CPU cores * 2 NUMA nodes   |
| Memory                     | 48GB: 8GB x 6 DIMMs x 2 NUMA nodes @ 2666MHz  |
| NIC                        | 1x Intel® Ethernet Converged Network Adapter X710-DA4   |
| BIOS                       | SE5C620.86B.00.01.0013.030920180427   |
| Microcode                  | 0x2006d05   |
| Operating System           | Ubuntu 20.04.5 LTS  |
| Linux kernel version       | 5.15.0-69-generic   |
| GCC version                | gcc version 9.4.0 (Ubuntu 9.4.0-1ubuntu1~20.04.1)   |
| Intel NIC Device ID        | 0x1572  |
| Intel NIC Firmware version | 9.20  |
| DPDK version               | 23.03   |
| Test configuration         | 1 NIC card attached to the first processor.<br>1 port assigned per logical core using 1 queue.<br>Totaling 4 logical cores, 4 queues for 4ports |

**Figure 3: Test #1 Setup – 1x Intel® Ethernet Converged Network Adapter X710-DA4 connected to IXIA (4 ports on 1 NIC)**



**Table 2: Test #1 Setting**

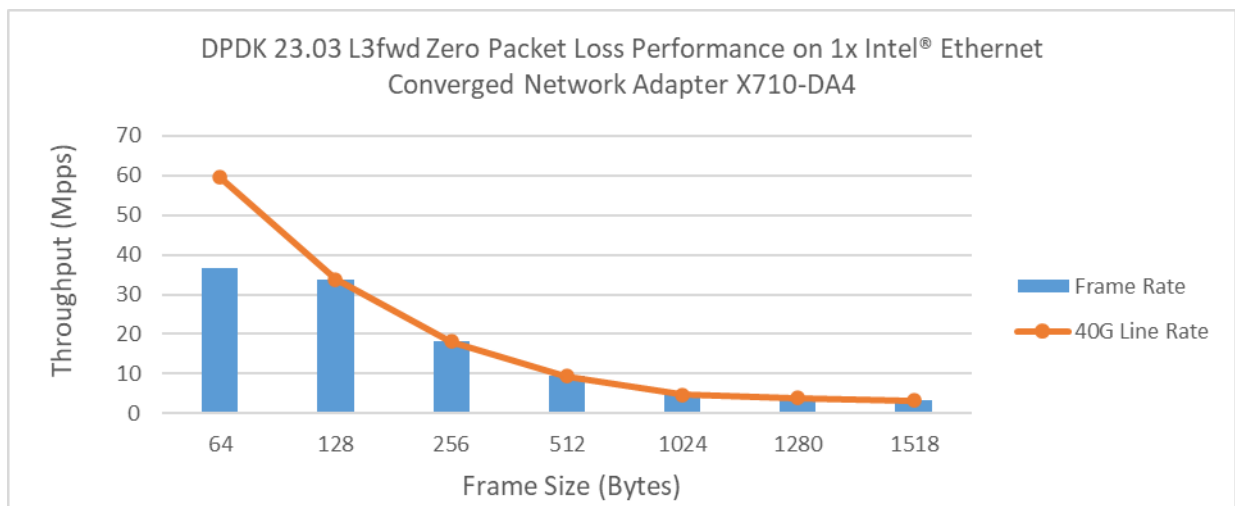
| Item          | Description  |
|---------------|--|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Disabled<br>Turbo Boost Disabled   |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-21,28-48 nohz_full=1-21,28-48 rcu_nocbs=1-21,28-48  |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_I40E_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 5-8 -n 6 -a 0000:18:00.0 -a 0000:18:00.1 -a 0000:18:00.2 -a<br>0000:18:00.3 -- -p 0xf --config '(0,0,5),(1,0,6),(2,0,7),(3,0,8)' --tx-queue-size 2048 --<br>rx-queue-size 2048 |

## Test Results

**Table 3: Test #1 Result**

| Frame Size (Bytes) | Line Rate[4x10G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|-------------------------|-------------------|-------------|
| 64                 | 59.52                   | 36.51             | 61.33       |
| 128                | 33.78                   | 33.78             | 100         |
| 256                | 18.12                   | 18.12             | 100         |
| 512                | 9.40                    | 9.40              | 100         |
| 1024               | 4.79                    | 4.79              | 100         |
| 1280               | 3.85                    | 3.85              | 100         |
| 1518               | 3.25                    | 3.25              | 100         |

**Figure 4: Test #1 Result - RFC2544 zero packet loss test on 1x Intel® Ethernet Converged Network Adapter X710-DA4**



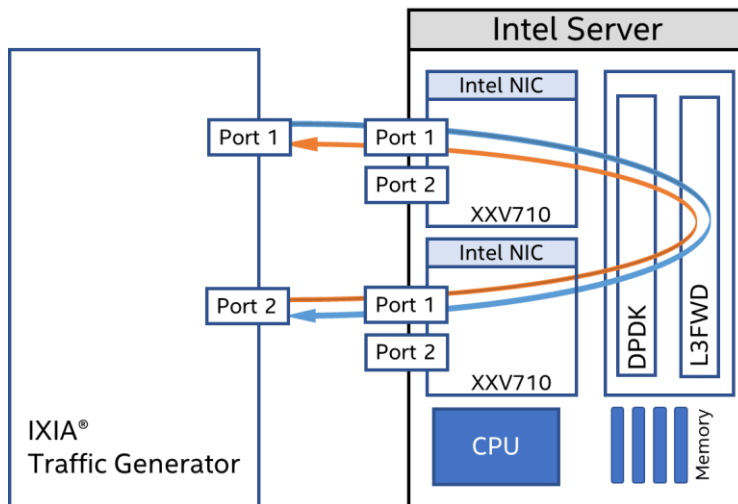


# Test#2 RFC2544 zero packet loss test on 2x Intel® Ethernet Network Adapter XXV710-DA2

**Table 4: Test #2 Setup**

| Item                       | Description  |
|----------------------------|--|
| Test Case                  | Test#2 RFC2544 zero packet loss test on 2x Intel® Ethernet Network Adapter XXV710-DA2  |
| Server Platform            | Inspur® Server Board NF5280M6  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes  |
| Memory                     | 128GB: 32GB x 2 DIMMs x 2 NUMA nodes @ 3200MHz   |
| NIC                        | 2x Intel® Ethernet Network Adapter XXV710-DA2; PCIe 3.0 x8   |
| BIOS                       | 05.01.01   |
| Microcode                  | 0xd000389  |
| Operating System           | Ubuntu 22.04.1 LTS   |
| Linux kernel version       | 5.15.0-69-generic  |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)   |
| Intel NIC Device ID        | 0x158b   |
| Intel NIC Firmware version | 9.20   |
| DPDK version               | 23.03  |
| Test configuration         | 2 NIC cards attached to the first processor only 1st port used of each NIC.<br>Each port has 2 queues assigned for a total of 4 queues<br>1 queue assigned per logical core.<br>Totaling 4 logical cores, 4 queues for 2 ports |

**Figure 5: Test #2 Setup – 2x Intel® Ethernet Network Adapter XXV710-DA2 connected to IXIA (1 port per NIC)**



**Table 5: Test #2 Setting**

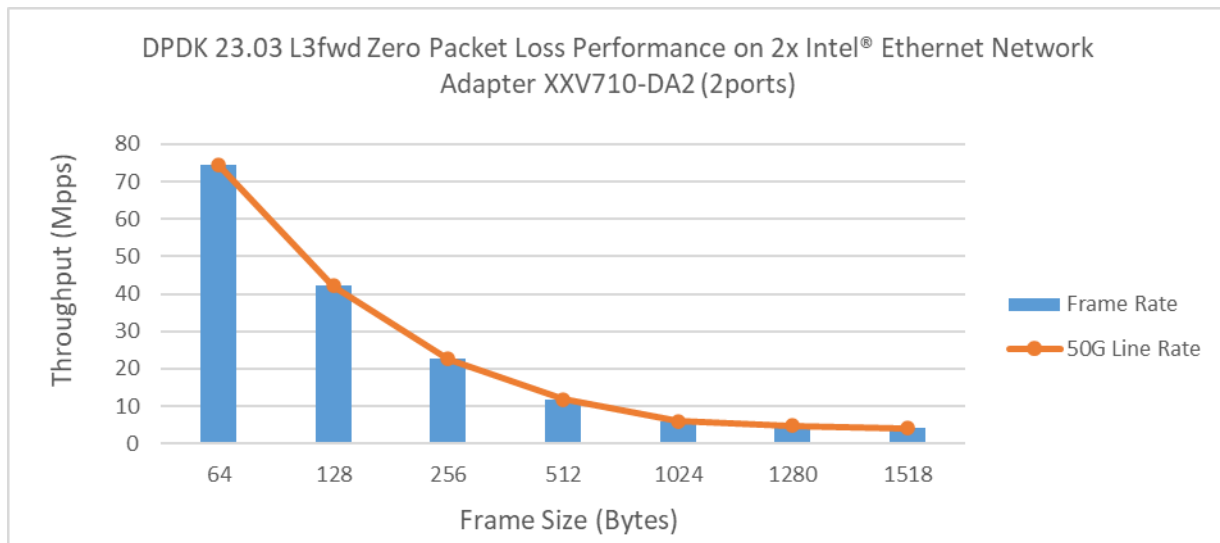
| Item          | Description  |
|---------------|--|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Disabled<br>Intel® Hyper-Threading Tech Enabled<br>Turbo Boost Disabled                              |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-35,81-115,41-75,121-155 nohz_full=1-35,81-115,41-<br>75,121-155 rcu_nocbs=1-35,81-115,41-75,121-155 |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_140E_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 42,43,122,123 -n 6 -a b1:00.0 -a ca:00.0 -- -p 0x3 --config<br>'(0,0,42),(0,1,43),(1,0,122),(1,1,123)' --tx-queue-size 2048 --rx-queue-size 2048                             |

## Test Results

**Table 6: Test #2 Result**

| Frame Size (Bytes) | Line Rate[2x25G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|-------------------------|-------------------|-------------|
| 64                 | 74.40                   | 74.40             | 100         |
| 128                | 42.23                   | 42.23             | 100         |
| 256                | 22.65                   | 22.65             | 100         |
| 512                | 11.75                   | 11.75             | 100         |
| 1024               | 5.99                    | 5.99              | 100         |
| 1280               | 4.81                    | 4.81              | 100         |
| 1518               | 4.06                    | 4.06              | 100         |

**Figure 6: RFC2544 zero packet Loss test for 2x Intel® Ethernet Network Adapter XXV710-DA2**

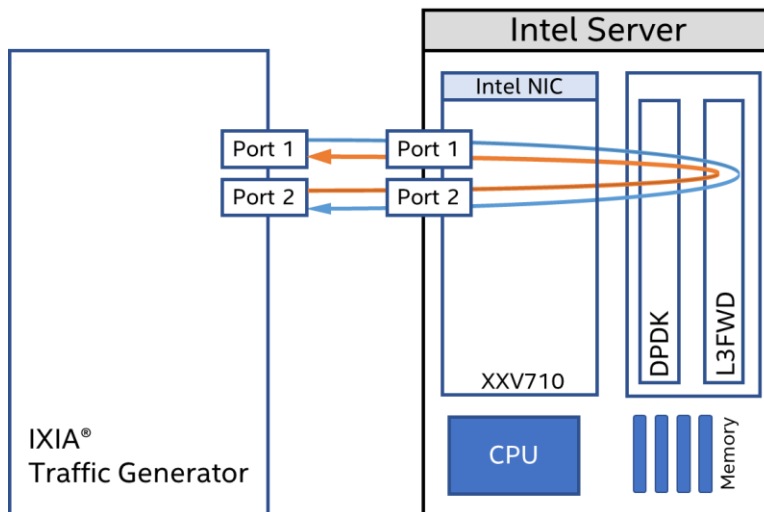


# Test#3 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter XXV710-DA2

**Table 7: Test #3 setup**

| Item                       | Description  |
|----------------------------|--|
| Test Case                  | Test#3 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter XXV710-DA2  |
| Server Platform            | Inspur® Server Board NF5280M6  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes  |
| Memory                     | 128GB: 32GB x 2 DIMMs x 2 NUMA nodes @ 3200MHz   |
| NIC                        | 1x Intel® Ethernet Network Adapter XXV710-DA2; PCIe 3.0 x8   |
| BIOS                       | 05.01.01   |
| Microcode                  | 0xd000389  |
| Operating System           | Ubuntu 22.04.1 LTS   |
| Linux kernel version       | 5.15.0-69-generic  |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)   |
| Intel NIC Device ID        | 0x158b   |
| Intel NIC Firmware version | 9.20   |
| DPDK version               | 23.03  |
| Test configuration         | 1 NIC cards attached to the first processor and 2 ports of the NIC are used.<br>Each port has 1 queue assigned for a total of 2 queues<br>1 queue assigned per logical core.<br>Totaling 2 logical cores, 2 queues for 2 ports |

**Figure 7: Test #3 Setup – 1x Intel® Ethernet Network Adapter XXV710-DA2 connected to IXIA (2 ports used on 1 NIC)**



**Table 8: Test #3 Setting**

| Item          | Description  |
|---------------|--|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Disabled<br>Intel® Hyper-Threading Tech Enabled<br>Turbo Boost Disabled                              |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-35,81-115,41-75,121-155 nohz_full=1-35,81-115,41-<br>75,121-155 rcu_nocbs=1-35,81-115,41-75,121-155 |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_I40E_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 42,122 -n 6 -a b1:00.0 -a b1:00.1 -- -p 0x3 --config '(0,0,42),(1,0,122)'<br>--tx-queue-size 2048 --rx-queue-size 2048   |

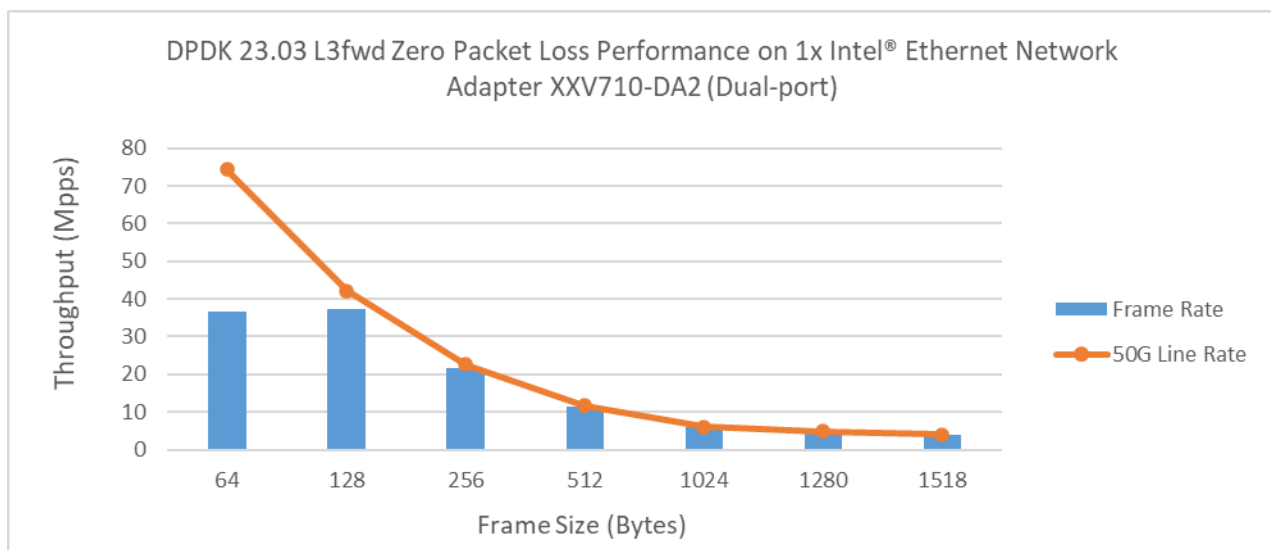
## Test Results

**Table 9: Test #3 Result**

| Frame Size (Bytes) | Line Rate[2x25G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|-------------------------|-------------------|-------------|
| 64                 | 74.40                   | 36.74             | 49.38       |
| 128                | 42.23                   | 37.18             | 88.05       |
| 256                | 22.65                   | 21.69             | 95.78       |
| 512                | 11.75                   | 11.42             | 97.19       |
| 1024               | 5.99                    | 5.86              | 97.88       |
| 1280               | 4.81                    | 4.71              | 97.90       |
| 1518               | 4.06                    | 3.98              | 97.91       |

Note: Due to hardware limitation, the throughput at large packets can only reach 95%-97% line rate.

**Figure 8: RFC2544 zero packet Loss test for 1x Intel® Ethernet Network Adapter XXV710-DA2**

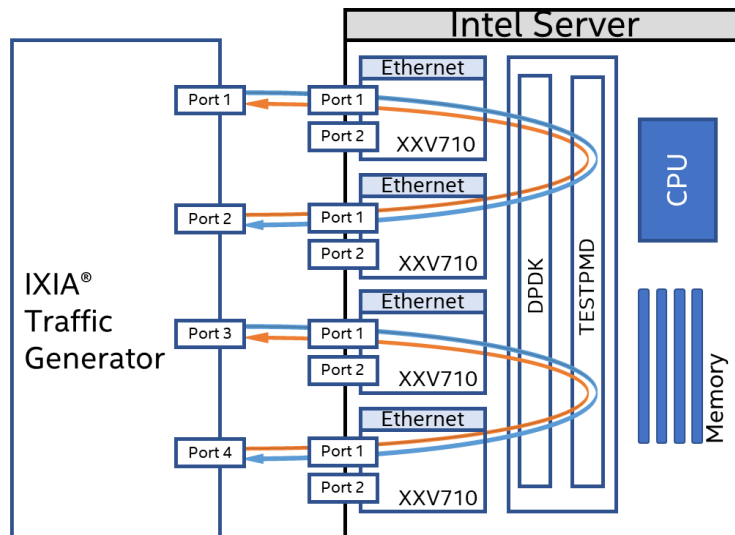


# Test#4 i40e PMD Single core performance test

**Table 10: Test #4 setup**

| Item                       | Description   |
|----------------------------|---|
| Test Case                  | Test#4 i40e PMD Single core performance test  |
| Server Platform            | Intel® Server Board NF5280M6  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes   |
| Memory                     | 128GB: 32GB x 2 DIMMs x 2 NUMA nodes @ 3200MHz  |
| NIC                        | 4x Intel® Ethernet Network Adapter XXV710-DA2; PCIe 3.0 x8  |
| BIOS                       | 05.01.01  |
| Microcode                  | 0xd000389   |
| Operating System           | Ubuntu 22.04.1 LTS  |
| Linux kernel version       | 5.15.0-69-generic   |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)  |
| Intel NIC Device ID        | 0x158b  |
| Intel NIC Firmware version | 9.20  |
| DPDK version               | 23.03   |
| Test configuration         | 4 NIC cards attached to the same processor and 1 port used of each NIC. Each port has 1 queue assigned for a total of 4 queues. All queues are assigned to the same logical core. The first core defined is for the CLI of the Testpmd example due to the -i argument. I40e Vector PMD and IO forwarding is used for the test. Test duration is 60 seconds. |

**Figure 9: Test #4 Setup – 4x Intel® Ethernet Network Adapter XXV710-DA2 connected to IXIA (1 port per NIC)**



**Table 11: Test #4 Setting**

| Item          | Description   |
|---------------|---|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Enabled<br>Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled  |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on iommu=pt<br>isolcpus=1-35,81-115,41-75,121-155 nohz_full=1-35,81-115,41-75,121-155 rcu_nocbs=1-35,81-115,41-75,121-155                            |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_I40E_16BYTE_RX_DESC --default-library=static x86_64-native-linuxapp-gcc  |
| Command line  | dpdk-testpmd -l 42,43 -n 6 -a 0000:b1:00.0 -a 0000:ca:00.0 -a 0000:e3:00.0 -a 0000:e4:00.0<br>-- -j --txd=2048 --rxd=2048 --forward=io -a<br>add "--force-max-simd-bitwidth=512" if using AVX512, default is AVX2 |

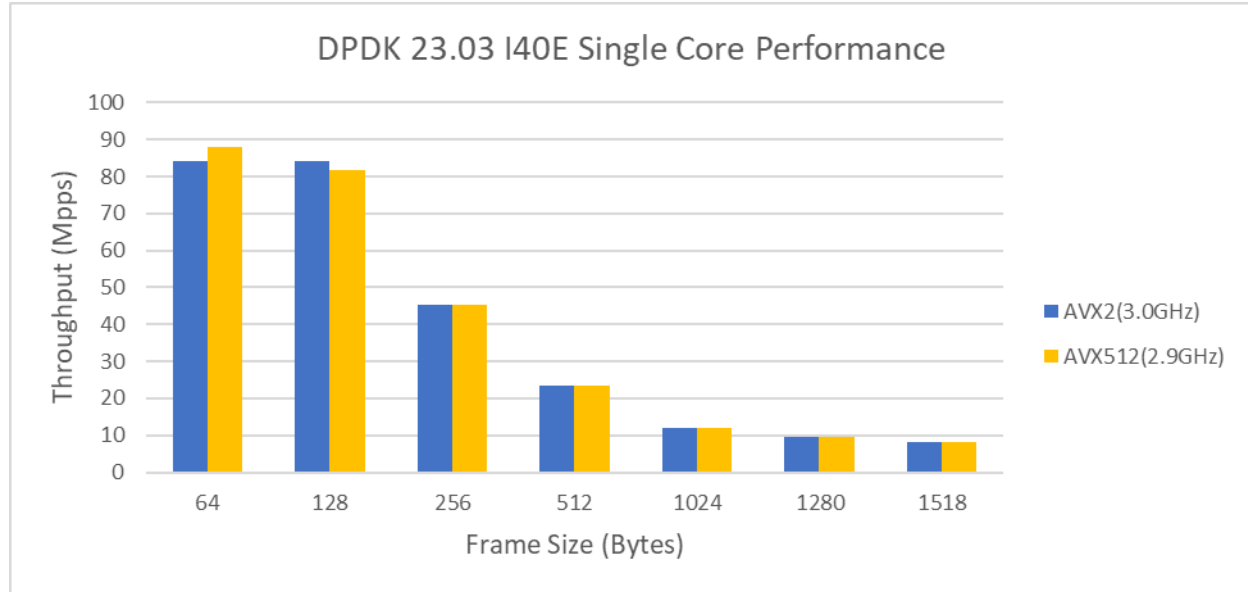
## Test Results

**Table 12: Test #4 Result**

| Frame Size (Bytes) | Line Rate [4*25G] (Mpps) | AVX2              |                                       | AVX512            |                                       | AVX512 vs. AVX2 cpp % lower is better |
|--------------------|--------------------------|-------------------|---------------------------------------|-------------------|---------------------------------------|---------------------------------------|
|                    |                          | CPU Freq          | 3.0                                   | CPU Freq          | 2.9                                   |                                       |
|                    |                          | Frame Rate (Mpps) | Cycles per Packet=CPU_freq/Frame_rate | Frame Rate (Mpps) | Cycles per Packet=CPU_freq/Frame_rate |                                       |
| 64                 | 148.81                   | 84.33             | 36                                    | 87.92             | 33                                    | 8.33                                  |
| 128                | 84.46                    | 84.05             | 36                                    | 81.75             | 35                                    | 2.78                                  |
| 256                | 45.29                    | 45.29             | -                                     | 45.29             | -                                     | -                                     |
| 512                | 23.5                     | 23.50             | -                                     | 23.50             | -                                     | -                                     |
| 1024               | 11.97                    | 11.97             | -                                     | 11.97             | -                                     | -                                     |
| 1280               | 9.62                     | 9.62              | -                                     | 9.62              | -                                     | -                                     |
| 1518               | 8.13                     | 8.13              | -                                     | 8.13              | -                                     | -                                     |

Note: All packet sizes over 256B reach line rate, so the single core is not fully stressed.

**Figure 10: i40e PMD Single core performance on 4x Intel® Ethernet Network Adapter XXV710-DA2**

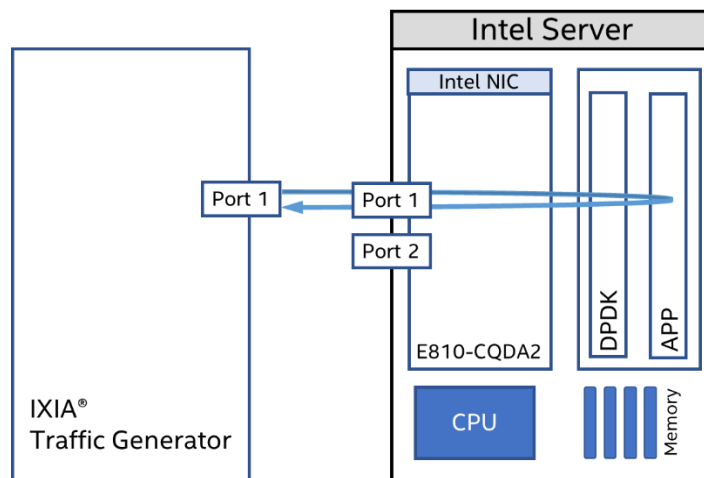


# Test#5 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2

**Table 13: Test #5 Setup**

| Item                       | Description   |
|----------------------------|---|
| Test Case                  | Test#5 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2   |
| Server Platform            | Supermicro® Server Board SYS-730A-I   |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40CPU cores * 2 NUMA nodes  |
| Memory                     | 256GB: 16GB x 8 DIMMs x 2 NUMA nodes @ 3200MHz  |
| NIC                        | 1x Intel® Ethernet Network Adapter E810-CQDA2; PCIe 3.0/4.0 x16   |
| BIOS                       | 1.1a  |
| Microcode                  | 0xd000389   |
| Operating System           | Ubuntu 22.04.1 LTS  |
| Linux kernel version       | 5.15.0-69-generic   |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)  |
| Intel NIC Device ID        | 0x1592  |
| Intel NIC Firmware version | 4.20  |
| Intel NIC Package          | 1.3.30.0  |
| DPDK version               | 23.03   |
| Test configuration         | 1 NIC card attached to the processor, and 1 port used.<br>Each port has 4 queues assigned for a total of 4 queues<br>1 queue assigned per logical core.<br>Totaling 4 logical cores, 4 queues for 1 port. |

**Figure 11: Test #5 Setup – 1x Intel® Ethernet Network Adapter E810-CQDA2 connected to IXIA (Single port)**





**Table 14: Test #5 Setting**

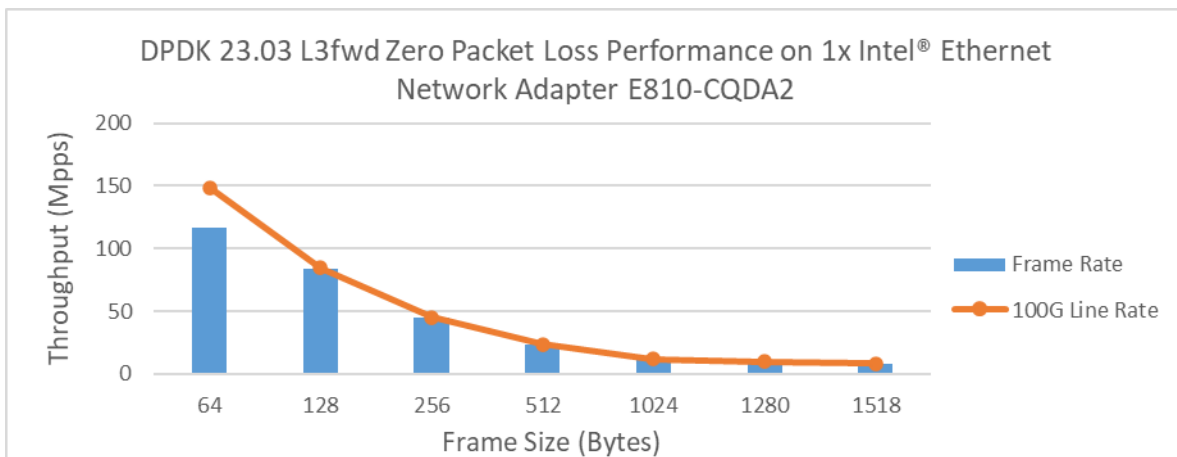
| Item          | Description   |
|---------------|---|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Enabled<br>Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled  |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-21 nohz_full=1-21 rcu_nocbs=1-21 idle=poll<br>nmi_watchdog=0 audit=0 nosoftlockup processor.max_cstate=0<br>intel_idle.max_cstate=0 hpet=disable mce=off tsc=reliable numa_balancing=disable |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_ICE_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 5-8 -n 8 --force-max-simd-bitwidth=512 -- -p 0x1 --config<br>'(0,0,5),(0,1,6),(0,2,7),(0,3,8)' --tx-queue-size 2048 --rx-queue-size 2048  |

## Test Results

**Table 15: Test #5 Result**

| Frame Size (Bytes) | Line Rate[100G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|------------------------|-------------------|-------------|
| 64                 | 148.81                 | 116.37            | 78.20       |
| 128                | 84.46                  | 83.87             | 99.30       |
| 256                | 45.29                  | 44.97             | 99.29       |
| 512                | 23.5                   | 23.5              | 100         |
| 1024               | 11.97                  | 11.97             | 100         |
| 1280               | 9.62                   | 9.62              | 100         |
| 1518               | 8.13                   | 8.13              | 100         |

**Figure 12: RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2**

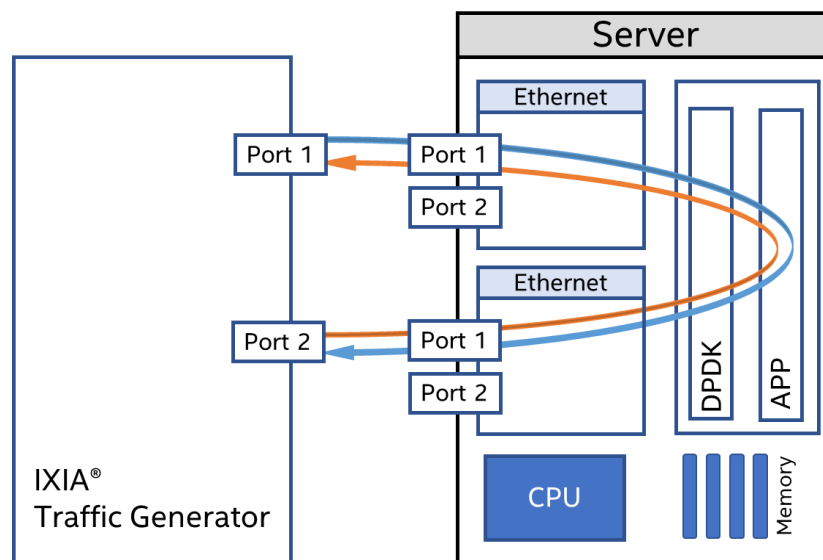


# Test#6 ice PMD Single core performance test

**Table 16: Test #6 Setup**

| Item                       | Description  |
|----------------------------|--|
| Test Case                  | Test#6 ice PMD Single core performance test on 2x Intel® Ethernet Network Adapter E810-CQDA2   |
| Server Platform            | Supermicro® Server Board SYS-730A-I  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes  |
| Memory                     | 256GB: 16GB x 8 DIMMs x 2 NUMA nodes @ 3200MHz   |
| NIC                        | 2x Intel® Ethernet Network Adapter E810-CQDA2; PCIe 3.0/4.0 x16  |
| BIOS                       | 1.1a   |
| Microcode                  | 0xd000389  |
| Operating System           | Ubuntu 22.04.4 LTS   |
| Linux kernel version       | 5.15.0-69-generic  |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)   |
| Intel NIC Device ID        | 0x1592   |
| Intel NIC Firmware version | 4.20   |
| Intel NIC Package          | 1.3.30.0   |
| DPDK version               | 23.03  |
| Test configuration         | 2 NIC cards attached to the same processor and 1 port used of each NIC.<br>Each port has 1 queue assigned for a total of 2 queues<br>All queues are assigned to the same core. |

**Figure 13: Test #6 Setup – 2x Intel® Ethernet Network Adapter E810-CQDA2 connected to IXIA**



**Table 17: Test #6 Setting**

| Item          | Description   |
|---------------|---|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Disabled  |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-21 nohz_full=1-21 rcu_nocbs=1-21 idle=poll<br>nmi_watchdog=0 audit=0 nosoftlockup processor.max_cstate=0<br>intel_idle.max_cstate=0 hpet=disable mce=off tsc=reliable numa_balancing=disable |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_ICE_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |

## Test Results

### Subcase #1: Turbo boost comparison

Advanced setting:

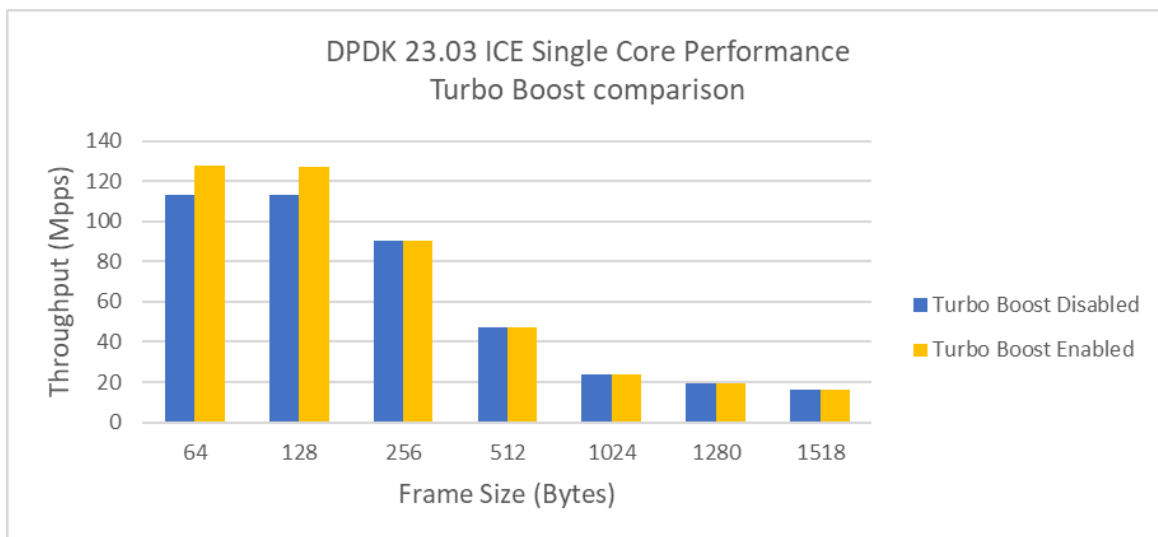
| Item         | Description  |
|--------------|--|
| BIOS         | Intel® Hyper-Threading Tech Disabled<br>Turbo Boost changed in the test  |
| Command line | <code>dpdk-testpmd -l 5,6 -n 8 --force-max-simd-bitwidth=512 -a 0000:31:00.0 -a 0000:4b:00.0 --<br/>-i --portmask=0x3 --rxq=1 --txq=1 --txd=1024 --rxd=1024 --forward=io -a</code> |

**Table 18: Test #6 Subcase #1 Result**

| Frame Size (Bytes) | Line Rate [2*100G] (Mpps) | Turbo Boost Disabled |  | Turbo Boost Enabled |  | Disable vs. Enable % |
|--------------------|---------------------------|----------------------|--|---------------------|--|----------------------|
|                    |                           | CPU Freq             | 2.3                                    | CPU Freq            | 2.9                                    |                      |
|                    |                           | Frame Rate (Mpps)    | Cycles per Packet=CPU _freq/Frame_rate | Frame Rate (Mpps)   | Cycles per Packet=CPU _freq/Frame_rate |                      |
| 64                 | 297.62                    | 113.49               | 20                                     | 128.04              | 23                                     | 12.82                |
| 128                | 168.92                    | 113.11               | 20                                     | 127.26              | 23                                     | 12.51                |
| 256                | 90.58                     | 90.58                | -                                      | 90.58               | -                                      | -                    |
| 512                | 46.99                     | 46.99                | -                                      | 46.99               | -                                      | -                    |
| 1024               | 23.95                     | 23.95                | -                                      | 23.95               | -                                      | -                    |
| 1280               | 19.23                     | 19.23                | -                                      | 19.23               | -                                      | -                    |
| 1518               | 16.26                     | 16.26                | -                                      | 16.26               | -                                      | -                    |

Note: All packet sizes over 256B reach line rate, so the single core is not fully stressed.

**Figure 14: ice PMD Single core performance on 2x Intel® Ethernet Network Adapter E810-QCDA2 with turbo boost comparison**



Subcase #2: Instruction comparison

Advanced setting:

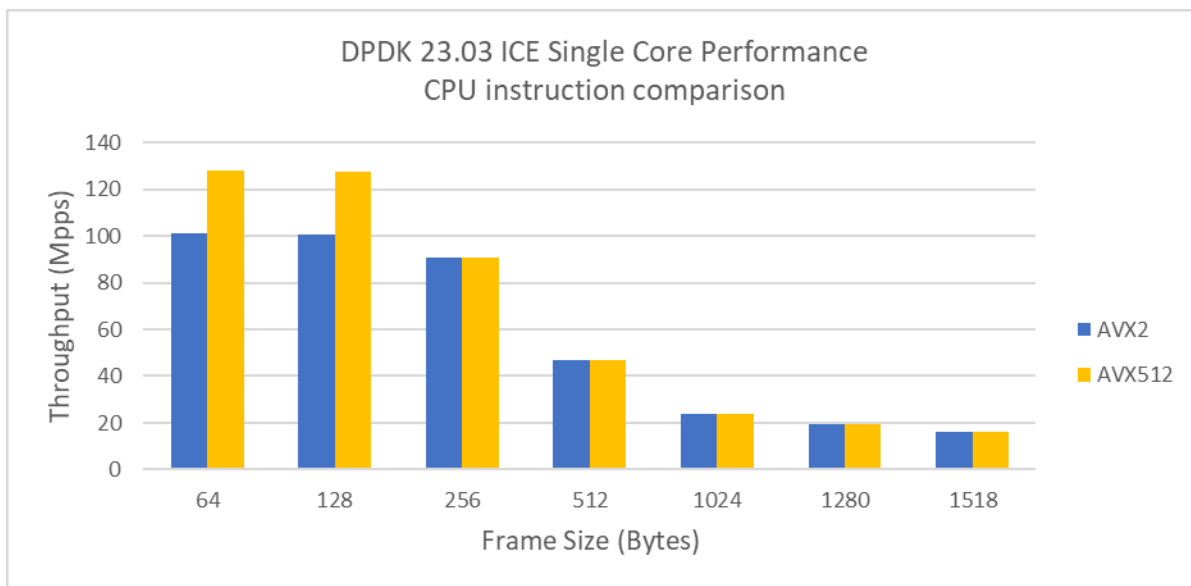
| Item         | Description   |
|--------------|---|
| BIOS         | Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled   |
| Command line | dpdk-testpmd -l 5,6 -n 8 -a 0000:31:00.0 -a 0000:4b:00.0 -- -i --portmask=0x3 --rxq=1 --txq=1 --txd=1024 --rxd=1024 --forward=io -a<br>add "--force-max-simd-bitwidth=512" if using AVX512, default is AVX2 |

Table 19: Test #6 Subcase #2 Result

| Frame Size (Bytes) | Line Rate [2*100G] (Mpps) | AVX2              |  | AVX512            |  | AVX512 vs. AVX2 cpp % lower is better |
|--------------------|---------------------------|-------------------|--|-------------------|--|---------------------------------------|
|                    |                           | CPU Freq          | 3.0                                    | CPU Freq          | 2.9                                    |                                       |
|                    |                           | Frame Rate (Mpps) | Cycles per Packet=CPU _freq/Frame_rate | Frame Rate (Mpps) | Cycles per Packet=CPU _freq/Frame_rate |                                       |
| 64                 | 297.62                    | 101.01            | 30                                     | 128.04            | 23                                     | 23.33                                 |
| 128                | 168.92                    | 100.52            | 30                                     | 127.26            | 23                                     | 23.33                                 |
| 256                | 90.58                     | 90.58             | -                                      | 90.58             | -                                      | -                                     |
| 512                | 46.99                     | 46.99             | -                                      | 46.99             | -                                      | -                                     |
| 1024               | 23.95                     | 23.95             | -                                      | 23.95             | -                                      | -                                     |
| 1280               | 19.23                     | 19.23             | -                                      | 19.23             | -                                      | -                                     |
| 1518               | 16.26                     | 16.26             | -                                      | 16.26             | -                                      | -                                     |

Note: All packet sizes over 256B reach line rate, so the single core is not fully stressed.

Figure 15: ice PMD Single core performance on 2x Intel® Ethernet Network Adapter E810-QCDA2 with instruction comparison



Subcase #3: Hyper-threading comparison

Advanced setting:

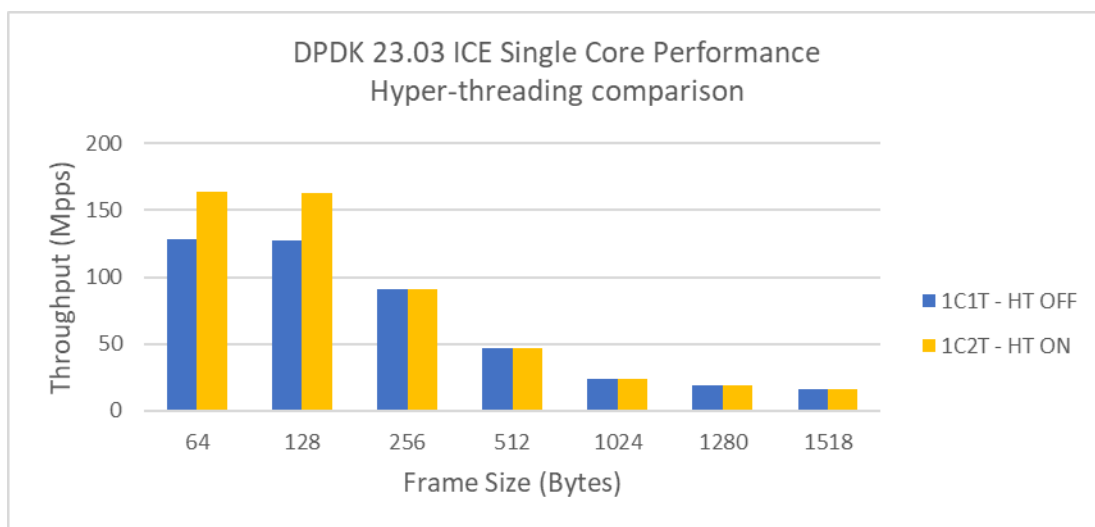
| Item         | Description  |
|--------------|--|
| BIOS         | Intel® Hyper-Threading Tech changed in the test<br>Turbo Boost Enabled   |
| Command line | 1C1T: dpdk-testpmd -l 5,6 -n 8 --force-max-simd-bitwidth=512 -a 0000:31:00.0 -a 0000:4b:00.0 -- -i --portmask=0x3 --rxq=1 --txq=1 --txd=1024 --rxd=1024 --forward=io -a<br>1C2T: dpdk-testpmd -l 5,6,86 -n 8 --force-max-simd-bitwidth=512 -a 0000:31:00.0 -a 0000:4b:00.0 -- -i --portmask=0x3 --rxq=1 --txq=1 --txd=1024 --rxd=1024 --forward=io -a -<br>-nb-cores=2<br>Note: 6 and 86 come from the same physical core. |

Table 20: Test #6 Subcase #3 Result

| Frame Size (Bytes) | Line Rate [2*100G] (Mpps) | 1C1T              | 1C2T              | 1C2T vs. 1C1T % |
|--------------------|---------------------------|-------------------|-------------------|-----------------|
|                    |                           | Frame Rate (Mpps) | Frame Rate (Mpps) |                 |
| 64                 | 297.62                    | 128.04            | 163.53            | 27.72           |
| 128                | 168.92                    | 127.26            | 163.10            | 28.16           |
| 256                | 90.58                     | 90.58             | 90.58             | -               |
| 512                | 46.99                     | 46.99             | 46.99             | -               |
| 1024               | 23.95                     | 23.95             | 23.95             | -               |
| 1280               | 19.23                     | 19.23             | 19.23             | -               |
| 1518               | 16.26                     | 16.26             | 16.26             | -               |

Note: All packet sizes over 256B reach line rate, so the single core is not fully stressed.

Figure 16: ice PMD Single core performance on 2x Intel® Ethernet Network Adapter E810-QCDA2 with hyper-threading comparison

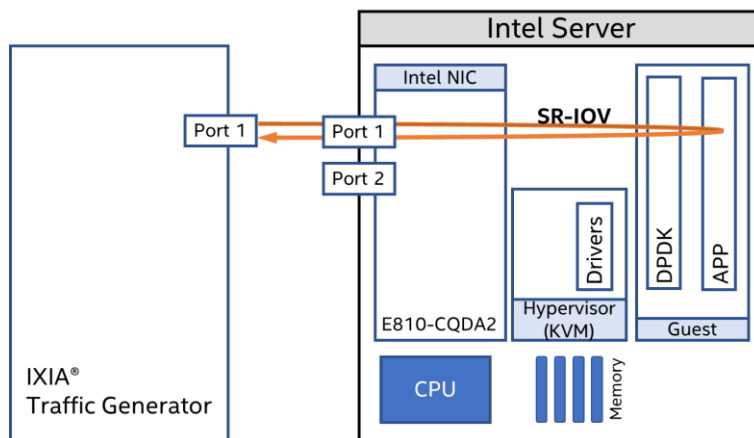


# Test#7 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2 using SR-IOV over KVM

**Table 21: Test #7 Setup**

| Item                       | Description   |
|----------------------------|---|
| Test Case                  | Test#7 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2 using SRIOV over KVM  |
| Server Platform            | Inspur® Server Board NF5280M6   |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes   |
| Memory                     | 256GB: 16GB x 8 DIMMs x 2 NUMA nodes @ 3200MHz  |
| NIC                        | 1x Intel® Ethernet Network Adapter E810-CQDA2; PCIe 3.0/4.0 x16   |
| BIOS                       | 1.1a  |
| Microcode                  | 0xd000389   |
| Hypervisor                 | Ubuntu 22.04.1 LTS<br>QEMU emulator version 6.2.0 (Debian 1:6.2+dfsg-2ubuntu6.6)  |
| Hypervisor kernel version  | 5.15.0-69-generic   |
| Hypervisor Intel Driver    | ice-1.11.14   |
| Guest Operating System     | Ubuntu 22.04.1 LTS  |
| Guest kernel version       | 5.15.0-69-generic   |
| Guest GCC version          | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)  |
| Intel NIC Device ID        | 0x1592  |
| Intel NIC Firmware version | 4.20  |
| Intel NIC Package          | 1.3.30.0  |
| DPDK version               | 23.03   |
| Test configuration         | 1 NIC card attached to the processor and 1 port used to generate 1 VF.<br>VF has 4 queues, 1 queue per logical core.<br>Totaling 4 logical cores, 4 queues for 1VF. |

**Figure 17: Test #7 Setup – 1x Intel® Ethernet Network Adapter E810-CQDA2 connected to IXIA (Single port)**



**Table 22: Test #7 Setting**

| Item                     | Description  |
|--------------------------|--|
| BIOS                     | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Enabled<br>Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled<br>Intel® Virtualization Technology Enabled<br>Intel® VT for Directed I/O Enabled   |
| Hypervisor Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on iommu=pt<br>isolcpus=1-21 nohz_full=1-21 rcu_nocbs=1-21 intel_pstate=disable idle=poll   |
| Hypervisor settings      | <pre> 1, creating VF echo 1 &gt;/sys/bus/pci/devices/0000\:18\:00.0/sriov_numvfs  2, setting VF MAC ip link set ens785f0 vf 0 mac A6:9C:BB:07:55:C0  3, binding VF to vfio-pci ./usertools/dpdk-devbind.py -b vfio-pci 0000:18:01.0  4, mount hugepage mount -t hugetlbfs nodev /mnt/huge  5, launch qemu qemu-system-x86_64 -name vm0 -enable-kvm --monitor stdio -monitor unix:/tmp/vm0_monitor.sock,server,nowait -device e1000,netdev=nttsip1 -netdev user,id=nttsip1,hostfwd=tcp:127.0.0.1:6013-:22 -device vfio- pci,host=0000:18:01.0,id=pt_0 -cpu host -m 32768 -object memory-backend- file,id=mem,size=32768M,mem-path=/mnt/huge,share=on -numa node,memdev=mem -mem-prealloc -smp cores=10,sockets=1 -chardev socket,path=/tmp/vm0_qga0.sock,server=on,wait=off,id=vm0_qga0 -device virtio-serial -device virtserialport,chardev=vm0_qga0,name=org.qemu.guest_agent.0 -vnc :10 -drive file=/home/image/ubuntu2004.img,if=virtio,index=0,media=disk  6, vcpu pinning 6.1 get vcpu thread ids by qemu monitor (qemu) info cpus * CPU #0: thread_id=6106 CPU #1: thread_id=6107 CPU #2: thread_id=6108 CPU #3: thread_id=6109 CPU #4: thread_id=6110 CPU #5: thread_id=6111 CPU #6: thread_id=6112 CPU #7: thread_id=6113 CPU #8: thread_id=6114 CPU #9: thread_id=6115 6.2 pin thread ids to logical cores taskset -pc 9 6115 taskset -pc 8 6114 taskset -pc 7 6113 taskset -pc 6 6112                     </pre> |



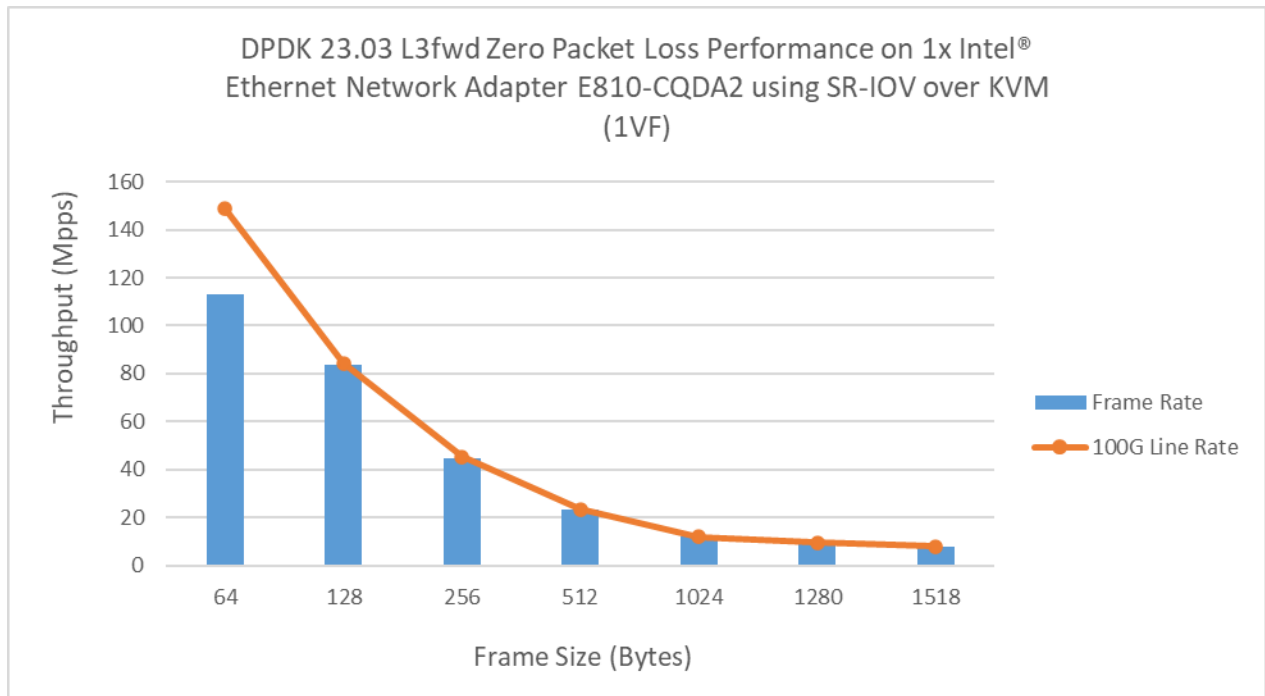
|                                   |   |
|-----------------------------------|---|
|                                   | <pre>taskset -pc 5 6111 taskset -pc 4 6110 taskset -pc 13 6109 taskset -pc 12 6108 taskset -pc 11 6107 taskset -pc 10 6106</pre>  |
| Other optimizations on Hypervisor | <pre>echo -1 &gt; /proc/sys/kernel/sched_rt_period_us echo -1 &gt; /proc/sys/kernel/sched_rt_runtime_us echo 10 &gt; /proc/sys/vm/stat_interval echo 0 &gt; /proc/sys/kernel/watchdog_thresh</pre>  |
| Guest Boot settings               | <pre>default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on iommu=pt isolcpus=4-9 nohz_full=4-9 rcu_nocbs=4-9 intel_pstate=disable idle=poll processor.max_cstate=0 intel_idle.max_cstate=0</pre>  |
| Other optimizations on Guest      | <pre>echo 1 &gt; /sys/module/vfio/parameters/enable_unsafe_noiommu_mode echo -1 &gt; /proc/sys/kernel/sched_rt_period_us echo -1 &gt; /proc/sys/kernel/sched_rt_runtime_us echo 10 &gt; /proc/sys/vm/stat_interval echo 0 &gt; /proc/sys/kernel/watchdog_thresh</pre> |
| DPDK Settings on Guest            | <pre>CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd --default-library=static x86_64-native-linuxapp-gcc</pre>   |
| Command line on Guest             | <pre>dpdk-l3fwd -l 4-7 -n 6 -a 00:04:0 -- -p 0x1 --config '(0,0,5),(0,1,6),(0,2,7),(0,3,4)' --parse-ptype</pre>   |

## Test Results

**Table 23: Test #7 Result**

| Frame Size (Bytes) | Line Rate[100G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|------------------------|-------------------|-------------|
| 64                 | 148.81                 | 113.23            | 76.09       |
| 128                | 84.46                  | 83.87             | 99.30       |
| 256                | 45.29                  | 44.97             | 99.29       |
| 512                | 23.5                   | 23.5              | 100         |
| 1024               | 11.97                  | 11.97             | 100         |
| 1280               | 9.62                   | 9.62              | 100         |
| 1518               | 8.13                   | 8.13              | 100         |

**Figure 18: RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-CQDA2 using SRIOV over KVM**

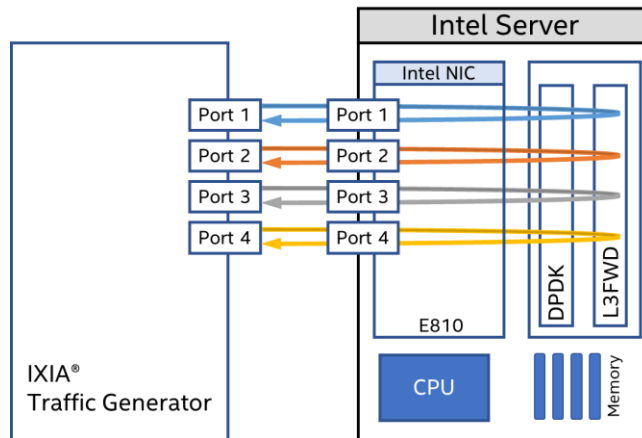


# Test#8 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-XXVDA4

**Table 24: Test #8 Setup**

| Item                       | Description  |
|----------------------------|--|
| Test Case                  | Test#8 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-XXVDA4   |
| Server Platform            | Supermicro® Server Board SYS-730A-I  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes  |
| Memory                     | 256GB: 16GB x 8 DIMMs x 2 NUMA nodes @ 3200MHz   |
| NIC                        | 1x Intel® Ethernet Network Adapter E810-XXVDA4; PCIe 3.0/4.0 x16   |
| BIOS                       | 1.1a   |
| Microcode                  | 0xd000389  |
| Operating System           | Ubuntu 22.04.1 LTS   |
| Linux kernel version       | 5.15.0-69-generic  |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)   |
| Intel NIC Device ID        | 0x1593   |
| Intel NIC Firmware version | 4.20   |
| Intel NIC Package          | 1.3.30.0   |
| DPDK version               | 23.03  |
| Test configuration         | 1 NIC card attached to the processor and 4 ports used.<br>Each port assigned 1 core and using 1 queue.<br>Totaling 4 logical core, 4 queues for 4 ports. |

**Figure 19: Test #8 Setup – 1x Intel® Ethernet Network Adapter E810-XXVDA4 connected to IXIA (4 ports of 1 NIC)**



**Table 25: Test #8 Setting**

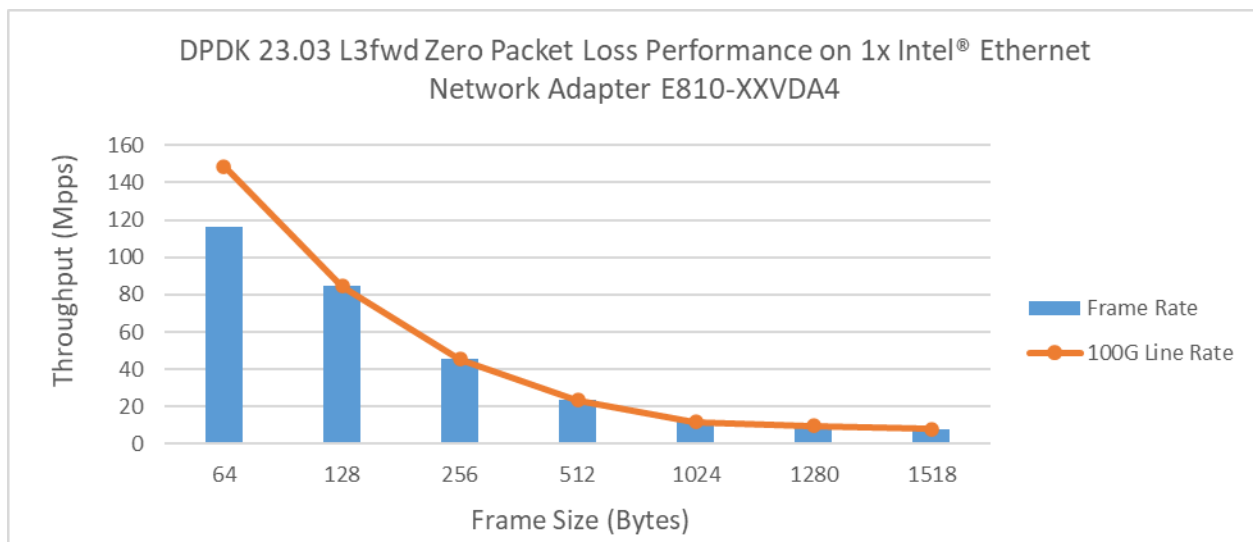
| Item          | Description   |
|---------------|---|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Enabled<br>Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled  |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-21 nohz_full=1-21 rcu_nocbs=1-21 idle=poll<br>nmi_watchdog=0 audit=0 nosoftlockup processor.max_cstate=0<br>intel_idle.max_cstate=0 hpet=disable mce=off tsc=reliable numa_balancing=disable |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_ICE_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 5-8 -n 8 --force-max-simd-bitwidth=512 -- -p 0xf --config<br>'(0,0,5),(1,0,6),(2,0,7),(3,0,8)' --tx-queue-size 2048 --rx-queue-size 2048  |

## Test Results

**Table 26: Test #8 Result**

| Frame Size (Bytes) | Line Rate[4*25G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|-------------------------|-------------------|-------------|
| 64                 | 148.81                  | 116.37            | 78.20       |
| 128                | 84.46                   | 84.46             | 100         |
| 256                | 45.29                   | 45.29             | 100         |
| 512                | 23.5                    | 23.5              | 100         |
| 1024               | 11.97                   | 11.97             | 100         |
| 1280               | 9.62                    | 9.62              | 100         |
| 1518               | 8.13                    | 8.13              | 100         |

**Figure 20: RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-XXVDA4**

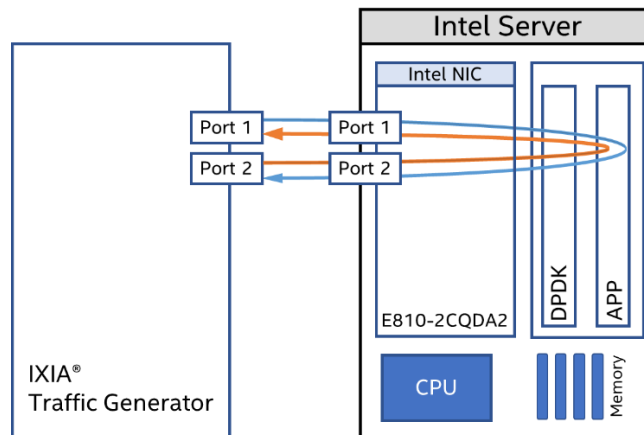


# Test#9 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-2CQDA2

**Table 27: Test #9 Setup**

| Item                       | Description  |
|----------------------------|--|
| Test Case                  | Test#9 RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-2CQDA2   |
| Server Platform            | Supermicro® Server Board SYS-730A-I  |
| CPU                        | Intel® Xeon® Platinum 8380 CPU @ 2.30GHz<br>40 CPU cores * 2 NUMA nodes  |
| Memory                     | 128GB: 16GB x 4 DIMMs x 2 NUMA nodes @ 3200MHz   |
| NIC                        | 1x Intel® Ethernet Network Adapter E810-2CQDA2; PCIe 4.0 x 16  |
| BIOS                       | 1.1a   |
| Microcode                  | 0xd000389  |
| Operating System           | Ubuntu 22.04.1 LTS   |
| Linux kernel version       | 5.15.0-69-generic  |
| GCC version                | gcc version 11.3.0(Ubuntu 11.3.0-1ubuntu1~22.04)   |
| Intel NIC Device ID        | 0x1592   |
| Intel NIC Firmware version | 4.20   |
| Intel NIC Package          | 1.3.30.0   |
| DPDK version               | 23.03  |
| Test configuration         | 1 NIC cards and 2 ports of the NIC are used.<br>Each port has 4 queues assigned, 1 queue per logical core.<br>Totaling 8 logical cores, 8 queues for 2 ports |

**Figure 21: Test #9 Setup – 1x Intel® Ethernet Network Adapter E810-2CQDA2 connected to IXIA ( 2 ports used on 1 NIC)**



**Table 28: Test #9 Setting**

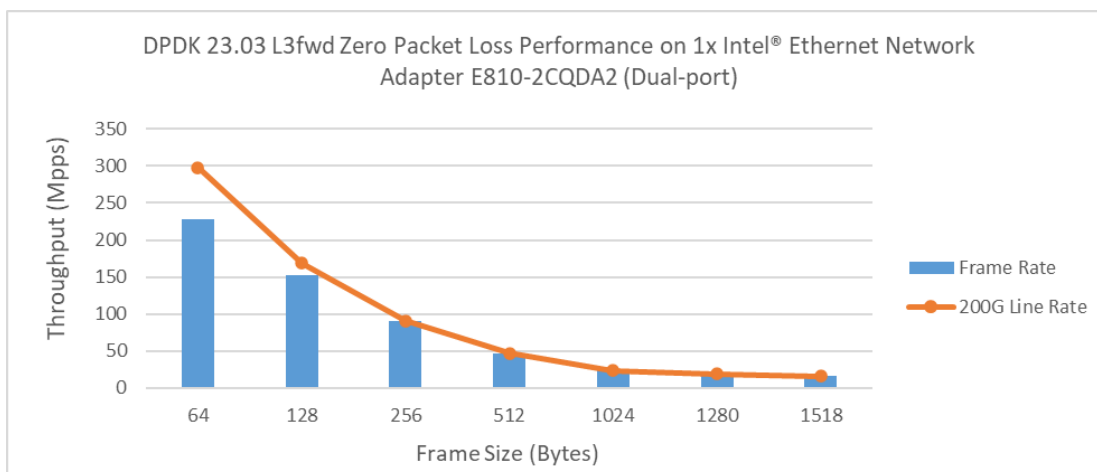
| Item          | Description   |
|---------------|---|
| BIOS          | CPU Power and Performance Policy <Performance><br>CPU C-state Disabled<br>CPU P-state Enabled<br>Intel® Hyper-Threading Tech Disabled<br>Turbo Boost Enabled  |
| Boot settings | default_hugepagesz=1G hugepagesz=1G hugepages=16 intel_iommu=on<br>iommu=pt isolcpus=1-21 nohz_full=1-21 rcu_nocbs=1-21 idle=poll<br>nmi_watchdog=0 audit=0 nosoftlockup processor.max_cstate=0<br>intel_idle.max_cstate=0 hpet=disable mce=off tsc=reliable numa_balancing=disable |
| DPDK Settings | CC=gcc meson -Dlibdir=lib -Dexamples=l3fwd -Dc_args=-<br>DRTE_LIBRTE_ICE_16BYTE_RX_DESC --default-library=static x86_64-native-<br>linuxapp-gcc   |
| Command line  | dpdk-l3fwd -l 5-12 -n 8 --force-max-simd-bitwidth=512 -- -p 0x3 --config<br>'(0,0,5),(1,0,6),(0,1,7),(1,1,8),(0,2,9),(1,2,10),(0,3,11),(1,3,12)' --tx-queue-size 2048 --<br>rx-queue-size 2048  |

## Test Results

**Table 29: Test #9 Result**

| Frame Size (Bytes) | Line Rate[2x100G] (Mpps) | Frame Rate (Mpps) | % Line Rate |
|--------------------|--------------------------|-------------------|-------------|
| 64                 | 297.62                   | 228.56            | 76.80       |
| 128                | 168.92                   | 152.29            | 90.15       |
| 256                | 90.58                    | 90.58             | 100.00      |
| 512                | 46.99                    | 46.99             | 100.00      |
| 1024               | 23.95                    | 23.95             | 100.00      |
| 1280               | 19.23                    | 19.23             | 100.00      |
| 1518               | 16.26                    | 16.26             | 100.00      |

**Figure 22: RFC2544 zero packet loss test on 1x Intel® Ethernet Network Adapter E810-2CQDA2**

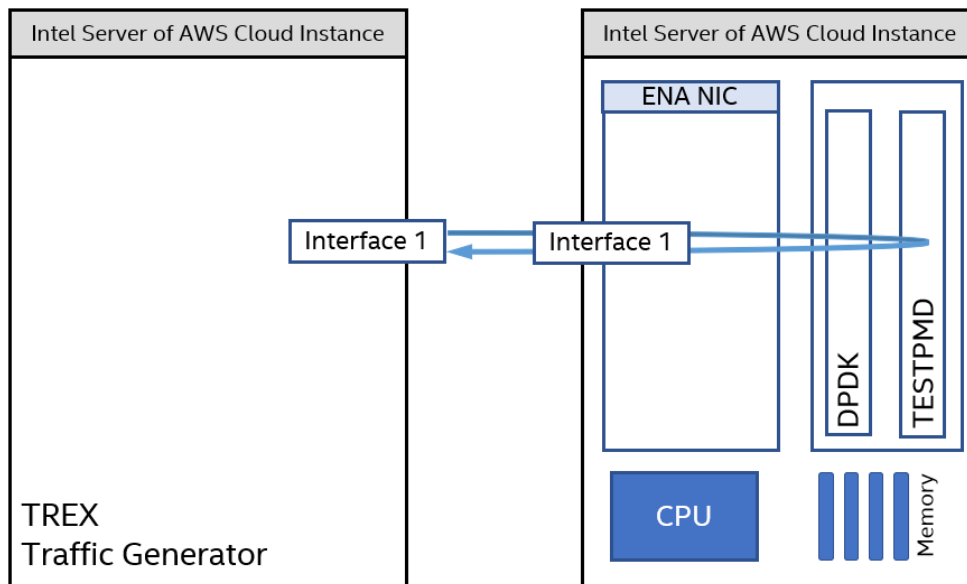


# Test#10 Zero packet loss test on Intel server of c6in.8xlarge AWS cloud instance

**Table 30: Test #10 Setup**

| Item                 | Description  |
|----------------------|--|
| Test Case            | Test#10 Zero packet loss test on 1x Amazon.com, Inc. Elastic Network Adapter & Intel(R) Xeon(R) Platinum 8375C CPU @ 2.90GHz |
| Server Platform      | Amazon EC2 c6in.8xlarge  |
| CPU                  | Intel® Xeon® Platinum 8375C CPU @ 2.90GHz  |
| Memory               | 64GB (1x64GB DDR4 3200 MT/s )  |
| vCPU                 | 32   |
| NIC                  | Elastic Network Adapter (5.15.0-1033-aws)  |
| BIOS                 | 1.0  |
| Microcode            | 0xd000390  |
| Operating System     | Ubuntu 20.04.6 LTS   |
| Linux kernel version | 5.15.0-1033-aws  |
| GCC version          | gcc version 9.4.0(Ubuntu 9.4.0-1ubuntu1~20.04.1)   |
| NIC Device ID        | 0xec20   |
| DPDK version         | 23.03  |
| Test configuration   | Interface 1 of each AWS instance's NIC is connected, and bandwidth is 50Gbps.  |

**Figure 23: Test #10 Setup – 1x Elastic Network Adapter connected to TREX on both Intel server of m6id.metal AWS cloud instances**



**Table 31: Test #10 Setting**

| Item          | Description   |
|---------------|---|
| BIOS          | Hyper-Threading Enabled<br>Turbo Boost Enabled  |
| Boot settings | intel_iommu=on iommu=pt default_hugepagesz=1G hugepagesz=1G<br>hugepages=16   |
| Command line  | <p>1C1Q: dpdk-testpmd -l 0,1 -a 0000:31:00.0 -- -i --forward-mode=mac --txd=1024 --rxq=1024 --txq=1 --rxq=1 --eth-peer=0, XX:XX:XX:XX:XX:XX --nb-cores=1 --rss-udp</p> <p>2C2Q: dpdk-testpmd -l 0,1,2 -a 0000:31:00.0 -- -i --forward-mode=mac --txd=1024 --rxq=1024 --txq=2 --rxq=2 --eth-peer=0, XX:XX:XX:XX:XX:XX --nb-cores=2 --rss-udp</p> <p>4C4Q: dpdk-testpmd -l 0,1,2,3,4 -a 0000:31:00.0 -- -i --forward-mode=mac --txd=1024 --rxq=1024 --txq=4 --rxq=4 --eth-peer=0, XX:XX:XX:XX:XX:XX --nb-cores=4 --rss-udp</p> <p>8C8Q: dpdk-testpmd -l 0,1,2,3,4,5,6,7,8 -a 0000:31:00.0 -- -i --forward-mode=mac --txd=1024 --rxq=1024 --txq=8 --rxq=8 --eth-peer=0, XX:XX:XX:XX:XX:XX --nb-cores=8 --rss-udp</p> <p>Note: core 0 is used for control path, remained cores are used for data path.<br/>--eth-peer=0,XX:XX:XX:XX:XX:XX, set the MAC address XX:XX:XX:XX:XX:XX of the peer interface 1, NIC doesn't support promiscuous mode.</p> |

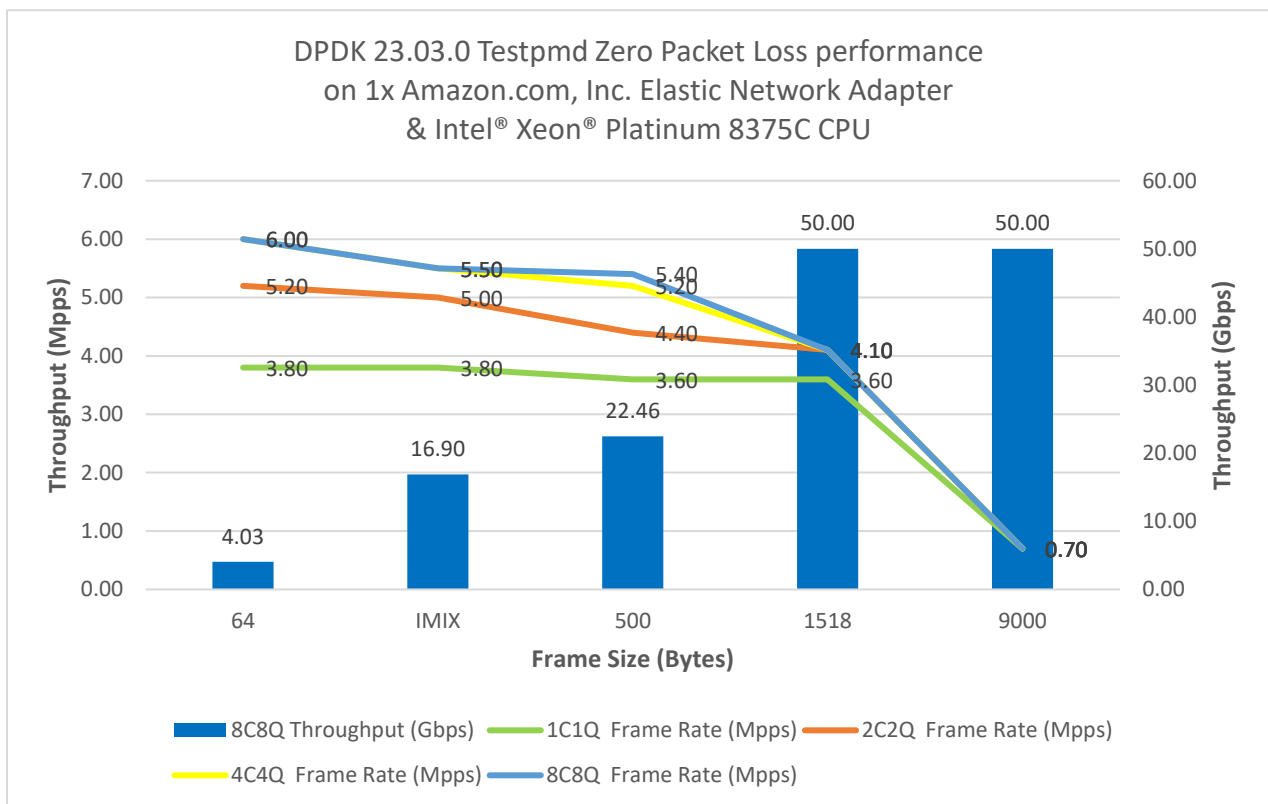


## Test Results

**Table 32: Test #10 Result (1C1Q, 2C2Q, 4C4Q, 8C8Q)**

| Frame Size (Bytes) | 1C1Q Frame Rate (Mpps) | 2C2Q Frame Rate (Mpps) | 4C4Q Frame Rate (Mpps) | 8C8Q Frame Rate (Mpps) | 8C8Q Throughput (Gbps) | % Line Rate |
|--------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-------------|
| 64                 | 3.80                   | 5.20                   | 6.00                   | 6.00                   | 4.03                   | 8.06%       |
| IMIX               | 3.80                   | 5.00                   | 5.50                   | 5.50                   | 16.90                  | 33.79%      |
| 500                | 3.60                   | 4.40                   | 5.20                   | 5.40                   | 22.46                  | 44.93%      |
| 1518               | 3.60                   | 4.10                   | 4.10                   | 4.10                   | 50.00                  | 100%        |
| 9000               | 0.70                   | 0.70                   | 0.70                   | 0.70                   | 50.00                  | 100%        |

**Figure 24: Test #10 Result – Zero packet loss test on 1x Amazon.com, Inc. Elastic Network Adapter & Intel® Xeon® Platinum 8375C CPU**



Note: Throughput is limited by the AWS instance configuration on ENA NIC driver.



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