OVS-DPDK Performance Benchmark and Analysis with Multi-VMs
------ Last Level Cache(LLC) Part

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Two Challenge Part for High Throughput

For OVS-DPDK deployment with multi VMs, memory copy by vhost enqueue and dequeue cost large part of the CPU cycles . When packet size is large, LLC miss ratio is very important for memory copy efficiency.

Following two parts will impact the LLC hit ratio:

- DDIO: LLC miss caused by DDIO capacity
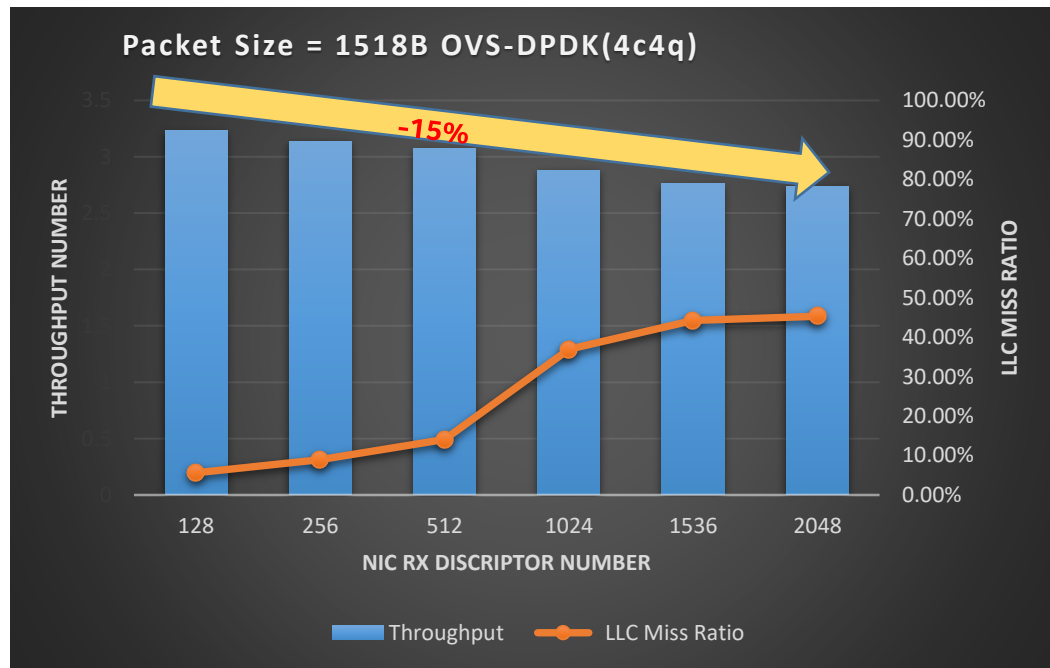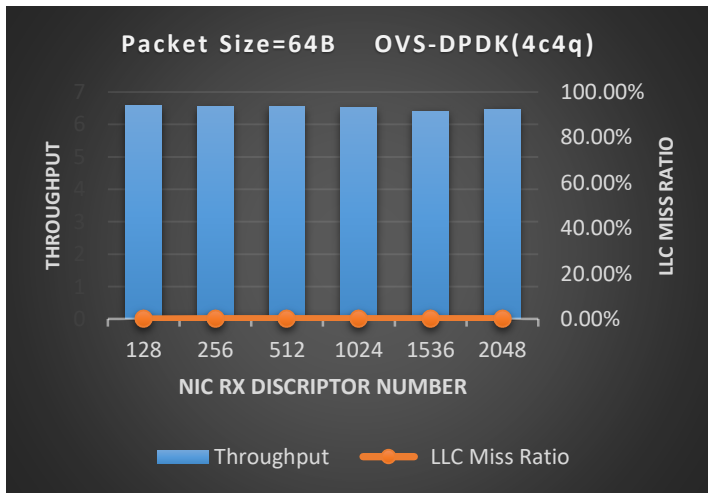
- Noise Neighbor: Workload on in VM

Intel® Data Direct I/O Technology (Intel DDIO) is a platform technology that enables I/O data transfers that require far fewer trips to memory. RX side as following:
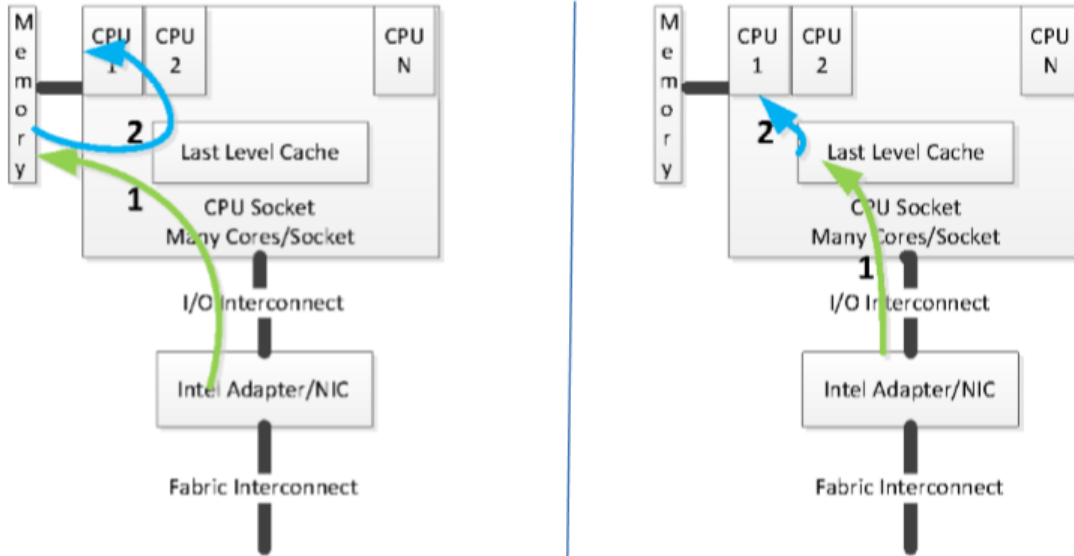
1. DDIO: Calculation the Cache Budget

Take Intel Intel(R) Xeon(R) Platinum 8180 as example. LLC size is 38.5MB, when packet size=1518B,

the total packet can be hold in DDIO capacity $\approx \frac{38.5MB*10\%}{1518}$=2656

Default rxd number of OVS-DPDK is 2048, is it suitable for all scenario and settings?

2. Noise Neighbor

All the cores on the same socket will share the LLC. Workload such as memory r/w in VM will impact the LLC miss ratio of OVS core
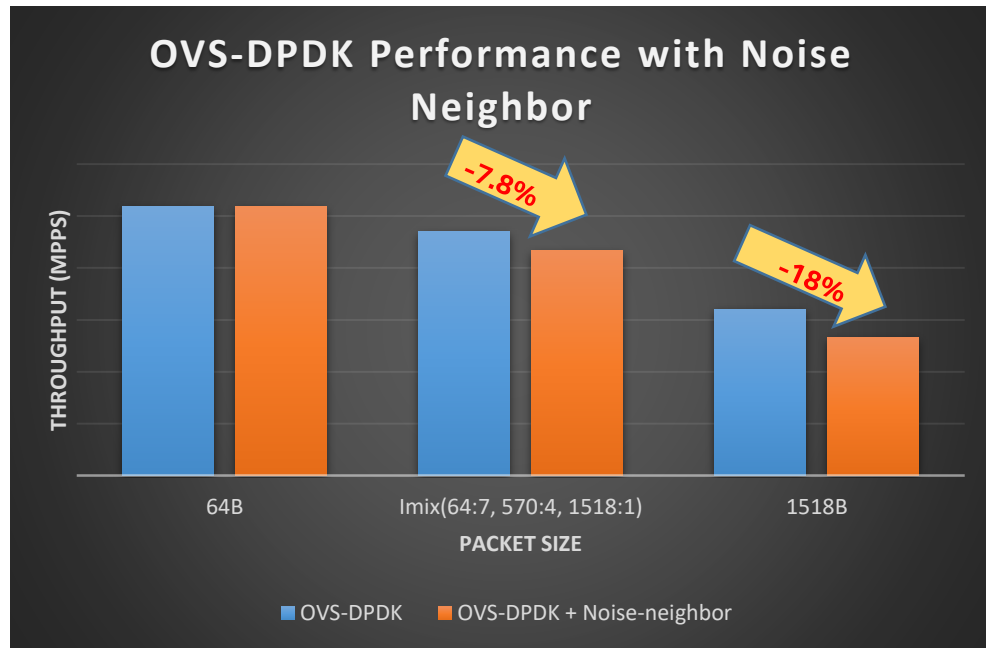
Settings:
OVS-DPDK (4 core). 32 local VM(16C/32T)
Noise-neighbor: stress-ng --vm-rw

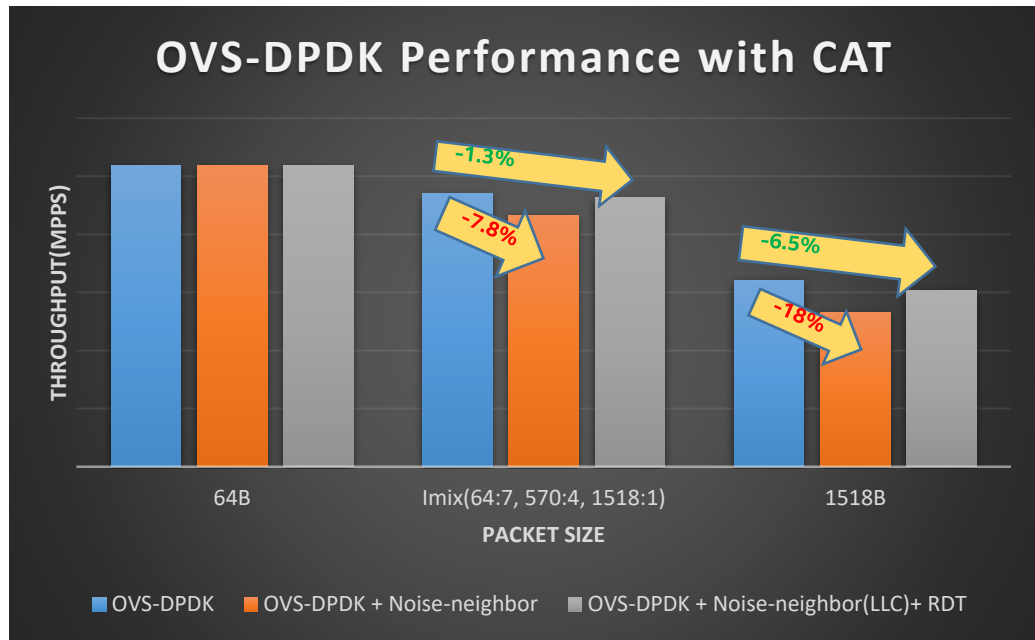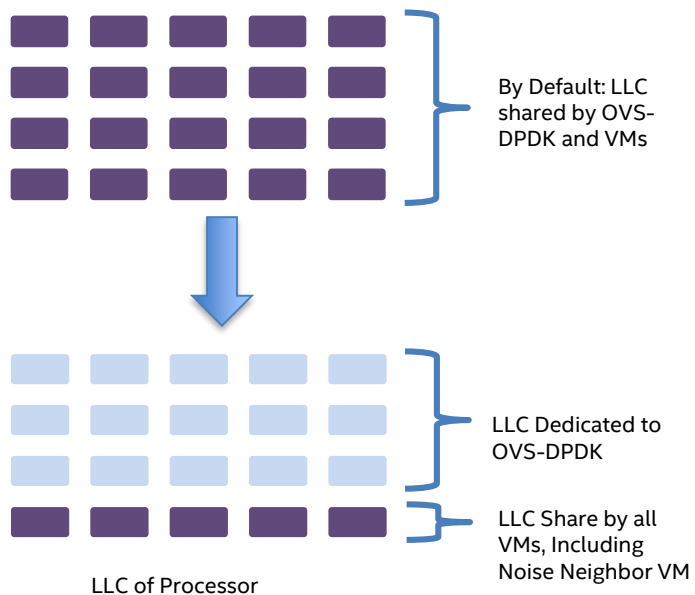CPU: Intel(R) Xeon(R) CPU E5-2699 v4 @ 2.20GHz
LLC Size: 55MB
LLC Ways: 20

Intel Cache Allocation Technology (CAT) helps address shared resource concerns by providing software control of where data is allocated into the last-level cache (LLC)

By Default: LLC shared by OVS-DPDK and VMs

LLC Dedicated to OVS-DPDK

LLC Share by all VMs, Including Noise Neighbor VM

LLC of Processor

OVS-DPDK Performance with CAT

- -1.3%
- -7.8%
- -6.5%
- -18%

THROUGHPUT(MPPS)

PACKET SIZE

64B   Imix(64:7, 570:4, 1518:1)   1518B

■ OVS-DPDK   ■ OVS-DPDK + Noise-neighbor   ■ OVS-DPDK + Noise-neighbor(LLC)+ RDT

How much LLC way should be dedicated to OVS-DPDK?

OVS-DPDK Performance with Different LLC Way
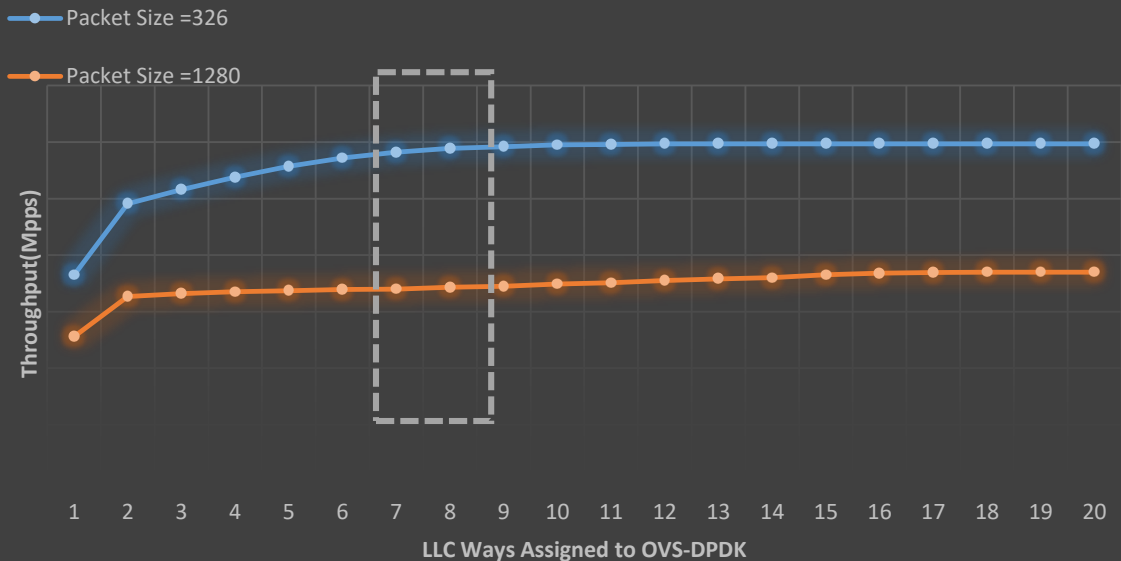
Sample command for CAT:
./pqos -e "llc:0=0x000ff"
./pqos -e "llc:1=0xfff00"
./pqos -a "llc:0=1-4"
./pqos -a "llc:1=0,5-21"

Dedicate the first 8 LLC ways to OVS core(1-4)

Conclusion:

LLC Miss Ratio will impact the OVS-DPDK throughput when packet size is large. Two optional way to avoid this situation:
1. Keep the total NIC RX descriptor number within the Processor's DDIO budget.
2. Dedicate part of the LLC to the OVS-DPDK core to avoid noise neighbor impact

Thanks!