Reduce CPU Utilization by 10GbE CNA with Hardware iSCSI Offload

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Introduction

Nowadays, the iSCSI technology is moving towards to 10GbE networking infrastructures, the higher I/O throughput uses up more and more CPU utilization especially in reading I/O. With the software iSCSI initiator built-in on modern Windows OSs, it helps the iSCSI marketing share grows. But the problem is the software iSCSI initiator relies on the computing power of the host to handle the iSCSI protocol offload and the TCP/IP protocol offload. It has the consequence that the higher performance on iSCSI traffic consumes the higher CPU utilization.

Considering more and more 10GbE CNAs (Converged Network Adapter) with hardware iSCSI offload feature comes up and those vendors claim that they can help to offload the iSCSI and TCP/IP overhead from the CPU and reduce the computing power to the other applications, such as database or virtualization. According to the theory, we test a series of benchmark which is evaluating the CPU effectiveness for throughput (MBPS) and each percentage of CPU utilization. And we also compared the results between the Jumbo Frame enabled and disabled. The test results show that using the CNA with hardware iSCSI offload feature does reduce the CPU utilization obviously, it compares to the software iSCSI initiator with the 10GbE NIC. The test results also show that the CPU effectiveness for throughput with Jumbo Frame enabled is better than disabled. Let's see what we got in the results.

Testing Environment

Host OS	Windows 7
CPU:	Intel Xeon 5620 (2.4GHz/4-core/8-thread) x 1
Memory:	DDR3 1066 8GB
S/W iSCSI initiator	OS built-in
Benchmark tool	Iometer 2006.07.27
CNA/NIC	Emulex 10102-FX/Chelsio S320E-CR/Intel X520-SR2
iSCSI storage	Qsan P600Q-D316

The Iometer was used to generate the workload over the iSCSI volumes connected through each HBA and with or without the hardware iSCSI offload enabled. The testing configuration on Iometer is 100% read/write, 100% sequential, block size is 256KB, and outstanding is 8. The results are measured in megabytes per second/percentages of CPU utilization.

Testing Results

Emulex 10102-FX

For the sequential read test, we can see the CPU effectiveness for MBPS of each percentage of CPU utilization is much better when the hardware iSCSI offload is enabled on the Emulex CNA than the case when the hardware iSCSI offload is disabled. And the Jumbo Frame enabled also improves the CPU effectiveness.
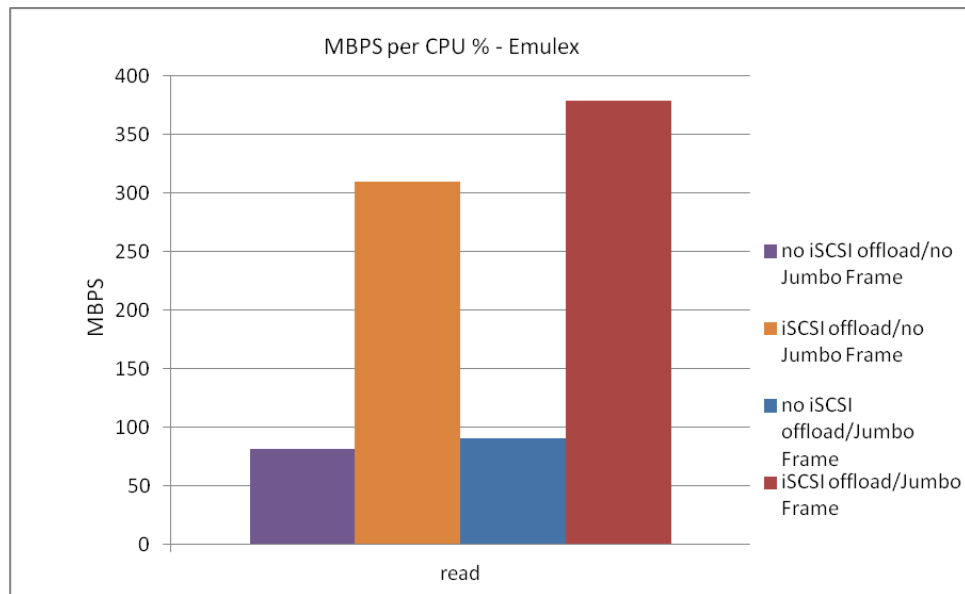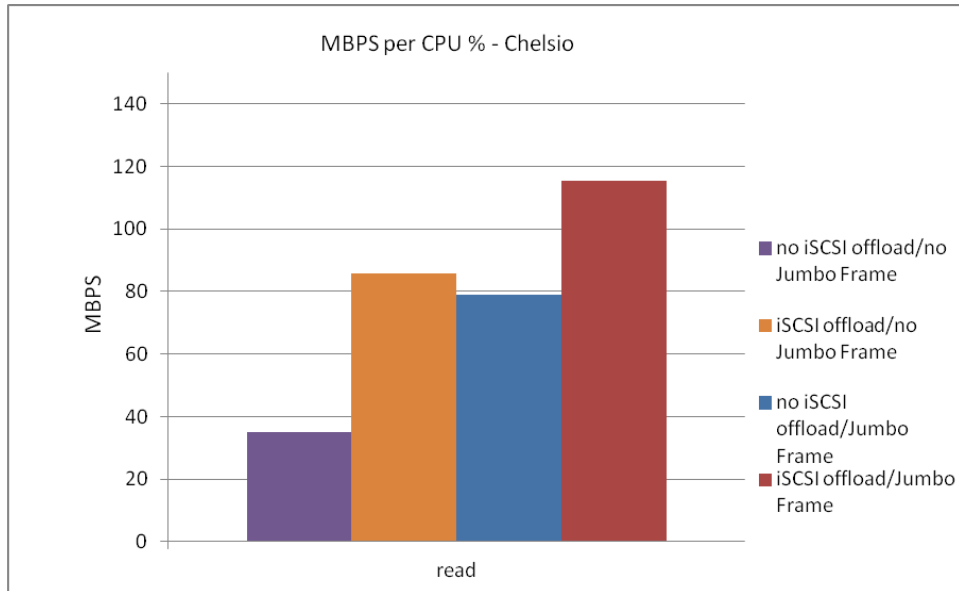

For the sequential write test, the hardware iSCSI offload also has improvement in the CPU effectiveness, but less than the case of sequential read.
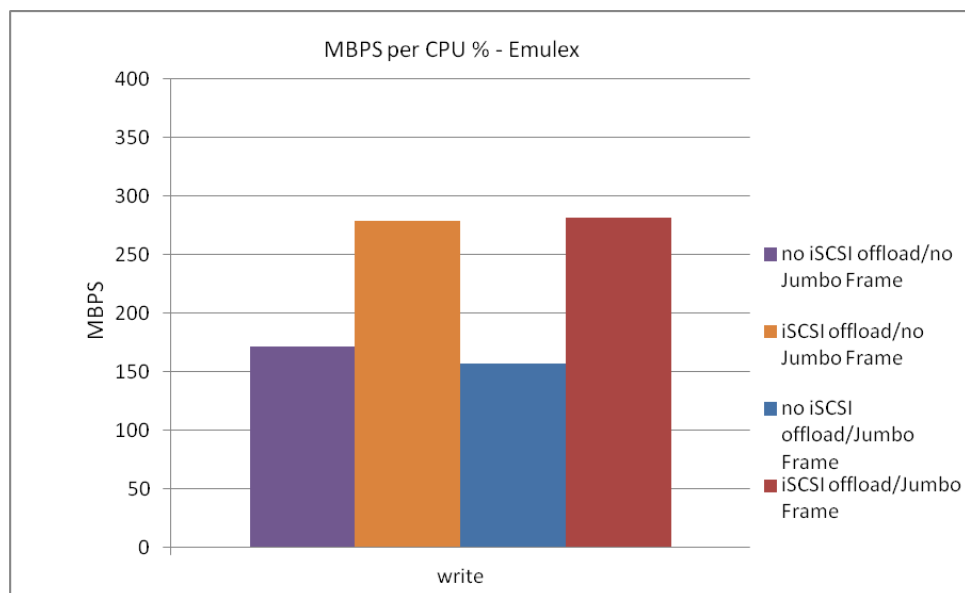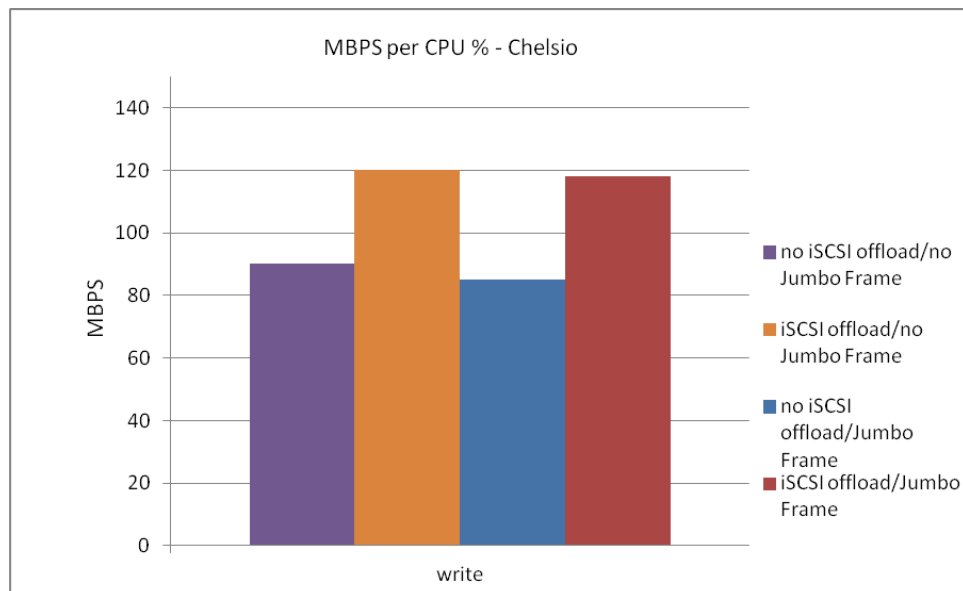
Chelsio S320E-CR

Similar test result can also be found on the Chelsio CNA; it is just the CPU effectiveness gap between the hardware iSCSI offload enabled and disabled is not as huge as the Emulex CNA.


For the sequential write test, the hardware iSCSI offload also has improvement in the CPU effectiveness.

Chelsio S320E-CR

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Intel X520-SR2

Intel X520-SR2 does not have the hardware iSCSI offload, we only compares the cases of Jumbo Frame enabled and disabled. And we can see the CPU effectiveness is better when Jumbo Frame is enabled, no matter in sequential read or write test.
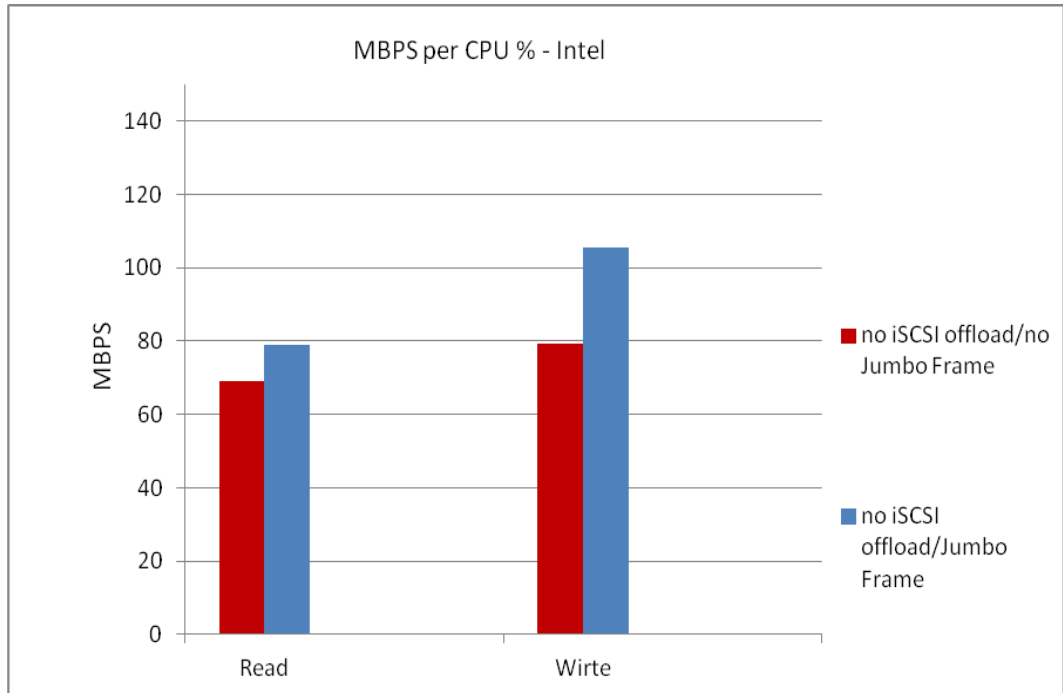
Summary

For the computing resources demand applications, such as database and virtualization, it is always the priority to preserve the CPU resources as much as possible. A 10GbE CNA with hardware iSCSI offload would be a good solution to meet the requirement. If the CNA is not possible to get because of the budget limitation, using the Jumbo Frame will also help to reduce the CPU loading.

Look at the test results above, although the Emulex CNA has better CPU effectiveness for MBPS of each percentage of CPU utilization, it does not mean it has the best performance among the testing scenarios on these three HBAs. In the case, one HBA has the best performance, but also uses high CPU utilization; that gives bad result in terms of CPU effectiveness.