

Windows iSCSI Initiator Performance at 100Gbps

Zero Copy Performance using iSCSI Offload

Introduction

In 2003, Microsoft introduced the iSCSI initiator on Windows Client and Server. Not coincidentally, iSCSI soon after became a legitimate and powerful storage protocol that is among the most popular in use today. Unlike Fibre Channel, iSCSI didn't need an HBA thanks in large part to the software based Microsoft iSCSI initiator. At the speeds of 1Gb/s, this software based iSCSI storage protocol stack could handle the traffic on the host CPU.

On the target side though, there is a different story. Speeds were higher, typically 10 Gb/s aggregating hundreds if not thousands of connections. As a result, most popular iSCSI storage vendors chose to offload iSCSI onto an HBA to handle the throughput needs of 10 Gb/s and up to thousands of connections. Storage vendors more than not turned to Chelsio for their iSCSI offload needs on the target side.

Fast forward to today's datacenter and cloud, where speeds and feeds have dramatically increased. It's not uncommon now to have leading storage vendors ship with 100 Gb/s iSCSI target offload adapters. These HBAs are almost exclusively provided by Chelsio in the market.

On the iSCSI initiator side, increasingly software based iSCSI initiators (as efficient as they may be, even Microsoft's) are not able to keep up at higher speeds on compute/server nodes. Chelsio has an excellent solution on Windows Client and Server that solves this problem by offloading the iSCSI initiator.

iSCSI Adapters that meet the Requirements

Two options are available from Chelsio to meet the most stringent iSCSI use cases on Windows over a wide range of link speeds (1/10/25/40/50/100 Gb/s). The SO line of T6 based adapters offload up to 256 connections at peak performance, great for the initiator side. The second option utilizes adapters that offload up to 16K connections also at peak performance, and are great for the target side.

Of the two types, the new offering from Chelsio is the economical CNA based SO line (the 25G T6225-SO-CR & the 100G T62100-SO-CR). It's an alternative to using the target based adapters on the initiator side, saving costs but still meeting the typical requirements on compute/server nodes. Chelsio offers CNA and Unified Wire adapters that are not limited to iSCSI. Chelsio enables running iSCSI, SMBDirect (S2D/WSSD), NVMe-oF initiator, TCP, VxLAN/NVGRE, etc. all simultaneously on all ports on all adapter offerings without special firmware or licensing.

Test Overview

This paper presents 100 Gb/s iSCSI performance using Chelsio's T62100-CR Unified Wire adapter on a Windows Server 2019 server running Chelsio's iSCSI initiator offload driver. A sweep was

performed across various I/O sizes on a single initiator. As can be seen in the results graph further below, with an I/O size of 8K (a typical real world workload IO size), over a half a million IOPs on reads and 575 thousand IOPs on writes were achieved. Smaller I/O sizes improved from there. On throughput, line rate (over 97 Gb/s) was achieved for both reads and writes.

Test Results

The following graph plots the iSCSI read and write throughput and IOPs performance across I/O sizes that range from 512 bytes to 512 Kbytes. Using Iometer (a popular benchmarking tool), an access pattern of random reads and writes was performed.

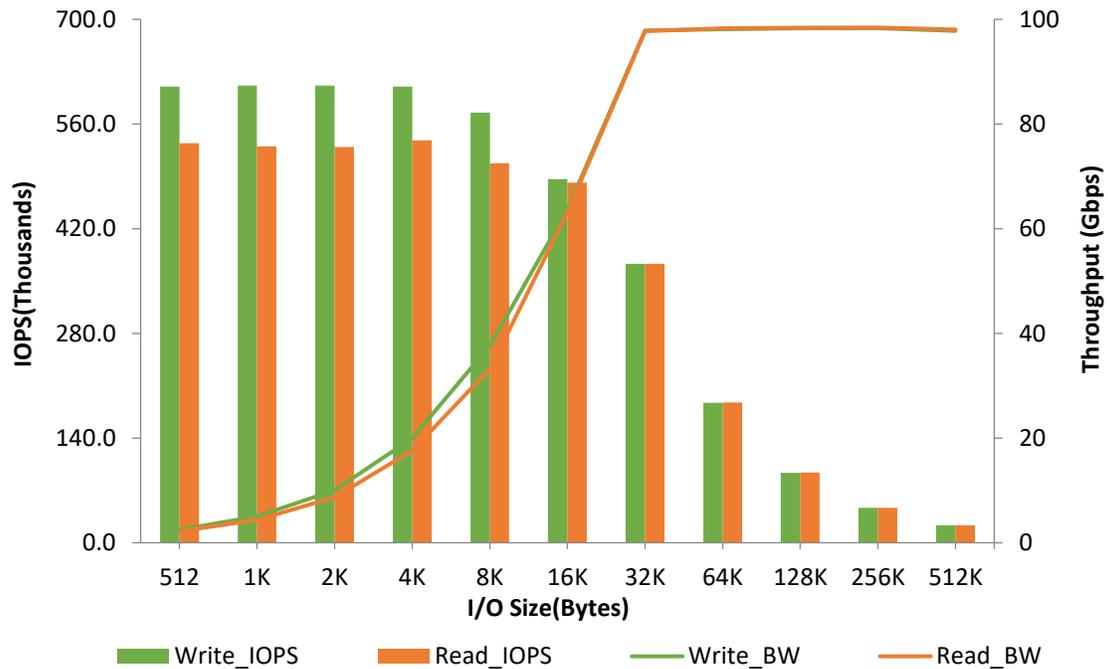


Figure 1 – Throughput and IOPS vs. I/O size

The results above were achieved with the CPU utilization of ~6% for 512Kbytes IO size and up to ~15% for 512bytes IO size. This highlights the value of iSCSI offload, where high IOPs and high throughput can be achieved with low CPU utilization. This in turn frees up the server node for application use.

Test Configuration

The setup consists of a single Windows iSCSI initiator machine connected to two LIO (Linux based) iSCSI target machines through a 100GbE switch using single port on each system. MTU of 9000B was used. The latest Unified Wire drivers for Windows and Linux were installed on the initiator and target machines respectively.

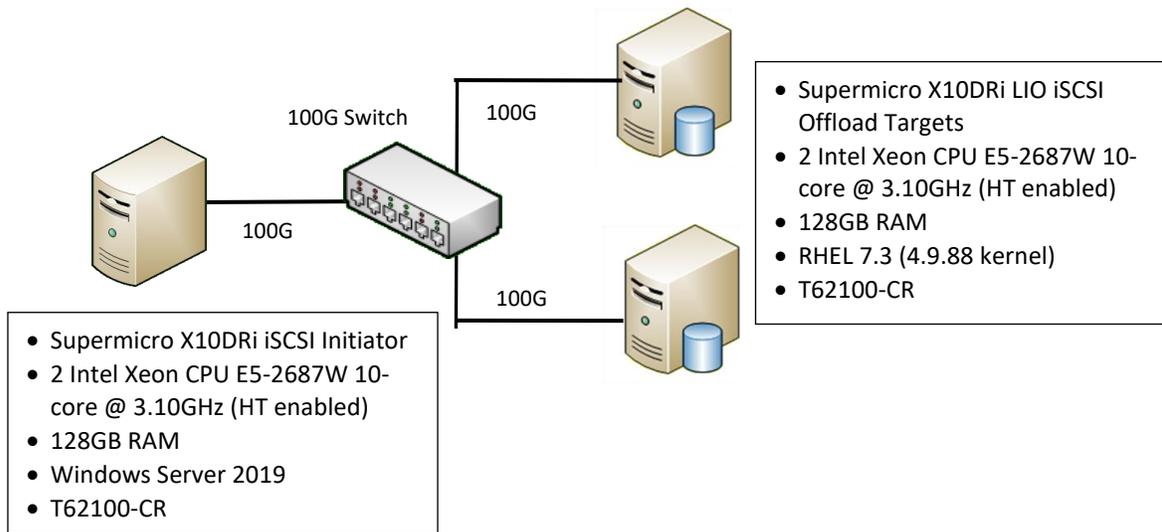


Figure 2- Test Setup

Storage Topology and Configuration

Each LIO target is configured in offload mode with 8 Ramdisk LUNs, each of 600MB size. The iSCSI initiator connects to the targets and lomometer is run with single worker thread per target device and 8 outstanding I/Os.

Conclusion

Chelsio has become an HBA leader with iSCSI target appliance vendors. With the introduction of the SO line of T6 based adapters (the 25G T6225-SO-CR & the 100G T62100-SO-CR), Chelsio has lowered the cost while maintaining performance on the iSCSI initiator side. This paper showed the outstanding performance that is easily achieved in out-of-box Chelsio iSCSI offload adapters. The benchmark results show line rate @ 100 Gb/s and over a half a million IOPs achieved from a single iSCSI initiator.

Related Links

[Chelsio Adapters](#)

[Microsoft Windows Unified Wire and CNA Solutions](#)

[Demartek Evaluation: Chelsio Terminator 6 \(T6\) Unified Wire Adapter iSCSI Offload](#)

[Dell EMC Storage Center & Chelsio](#)