High Performance iSCSI at 40GbE

Chelsio T5 iSCSI solution delivering 5M IOPS

Executive Summary

The demonstration shows Chelsio T5 cards enabling 5 million IOPS (input/output instructions per second) iSCSI performance for a cost-effective enterprise-class storage target solution built with volume, off-the-shelf hardware and software components.

Showcasing the iSCSI hardware offload capabilities of the Chelsio T5 Unified Wire adapters, the demonstration shows how all-flash and hybrid storage array OEMs can easily enable such arrays with industry-leading iSCSI target performance. Fully compatible with the existing iSCSI ecosystem and seamlessly leveraging routable and reliable TCP/IP as a foundation, iSCSI allows highly scalable and cost effective installations using regular Ethernet switches.

The Chelsio iSCSI Offload Solution

The Terminator 5 (T5) ASIC from Chelsio Communications, Inc. is a fifth generation, high performance 4x10/2x40Gbps unified wire engine which offers storage protocol offload capability for accelerating both block (iSCSI, FCoE) and file (SMB, NFS) level storage traffic. Chelsio's proven TCP Offload Engine (TOE), offloaded iSCSI over T5 enjoys a distinct performance advantage over regular NIC. The entire solution, which includes Chelsio's iSCSI Offload software, the T5 adapter, and an off-the-shelf computer system – including a high end disk subsystem, provides industry leading performance, with both IOPS and bandwidth the highest available today. The resulting solution is highly competitive with special purpose systems and storage infrastructure currently on the market in both performance and cost.

The Terminator 5 (T5) unified wire engine offers PDU iSCSI offload capability in protocol acceleration for both file and block-level storage (iSCSI) traffic. Furthermore, iSCSI support is part of a complete, fully virtualized unified wire offload suite that includes FCoE, RDMA over Ethernet, TCP and UDP sockets and user space I/O.

Chelsio iSCSI storage solution enables largest target & initiator ecosystem and most of the native initiator drivers are in-boxed in all major operating systems and hypervisors. This testing is based on Linux LIO iSCSI target driver. Chelsio supports iSCSI target drivers for both Linux and FreeBSD platforms.

The Demonstration

The iSCSI setup consisted of a target storage array connected to 6 iSCSI initiator machines through a 40Gb switch using single port on each system. MTU of 9000B was used.
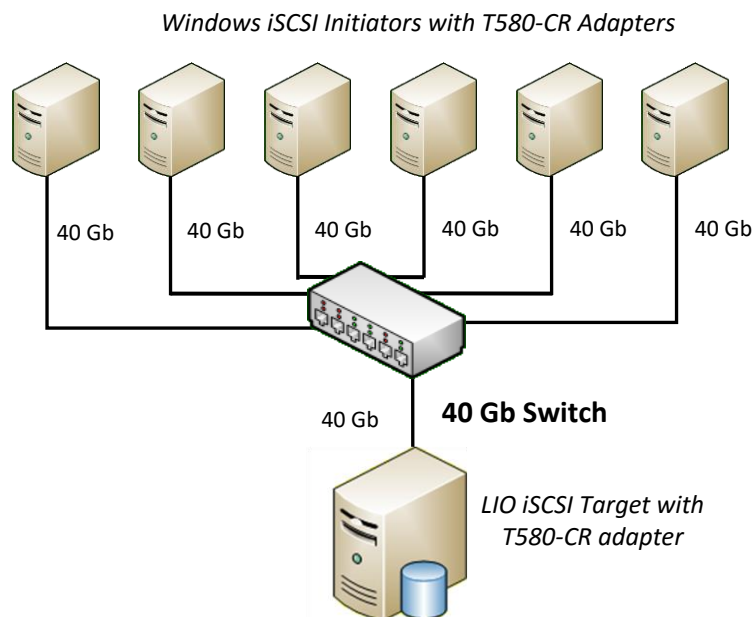
- The **storage array** was configured with two Intel Xeon CPU E5-2687W v3 processors running at 3.10GHz clock speed (HT enabled) and 128 GB of RAM. Chelsio's iSCSI LIO target driver

v1.0.0.3 was installed with RHEL 6.5 operating system. LIO Target was configured in offload mode using T580-CR adapter.

- The **initiator machines** were each setup with an Intel Xeon CPU E5-1660 v2 processor running at 3.70GHz clock speed (HT enabled) and 64 GB of RAM. T580-CR adapter was installed in each system with Windows server 2012 R2 operating system. Chelsio's Network Driver v5.5.11.0 was installed and MS iSCSI Initiator was used on each machine.

The storage array contains 30 iSCSI *ramdisk* targets, each of size 512 MB. Each initiator connects to 5 targets.

Topology and Configuration

Windows iSCSI Initiators with T580-CR Adapters

Figure 1 – Test Setup

I/O Benchmarking Configuration
iometer was used to assess the storage capacity of a configuration. The I/O sizes used varied from 512B to 512KB with an I/O access pattern of random READs and WRITEs.

Parameters passed to Iometer
- 32 outstanding IO per target.
- 2 worker threads per target.

Test Results
The following graphs shows the READ, WRITE IOPS and throughput numbers obtained varying the I/O sizes using the **iometer** tool. The maximum IOPS numbers reaches approximately 5M at small I/O sizes and achieving line rate throughput for both READ and WRITE.
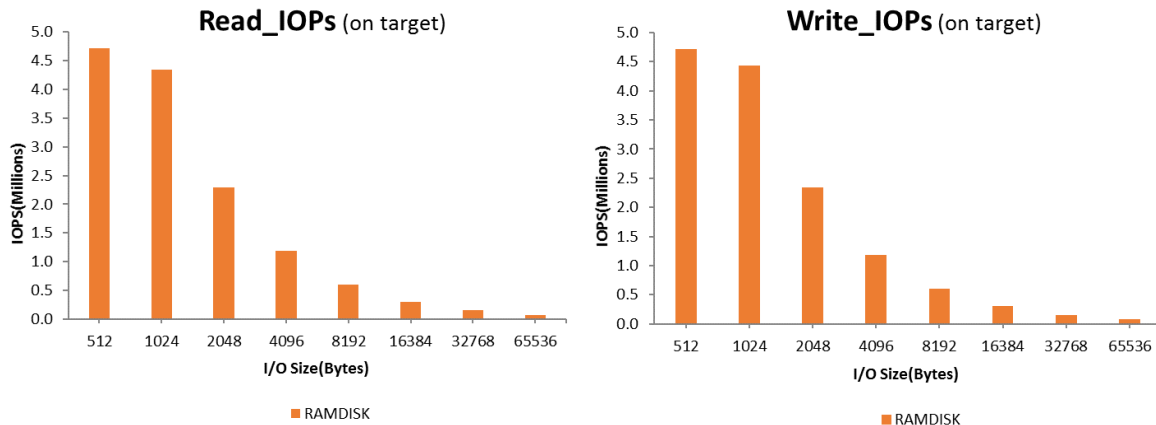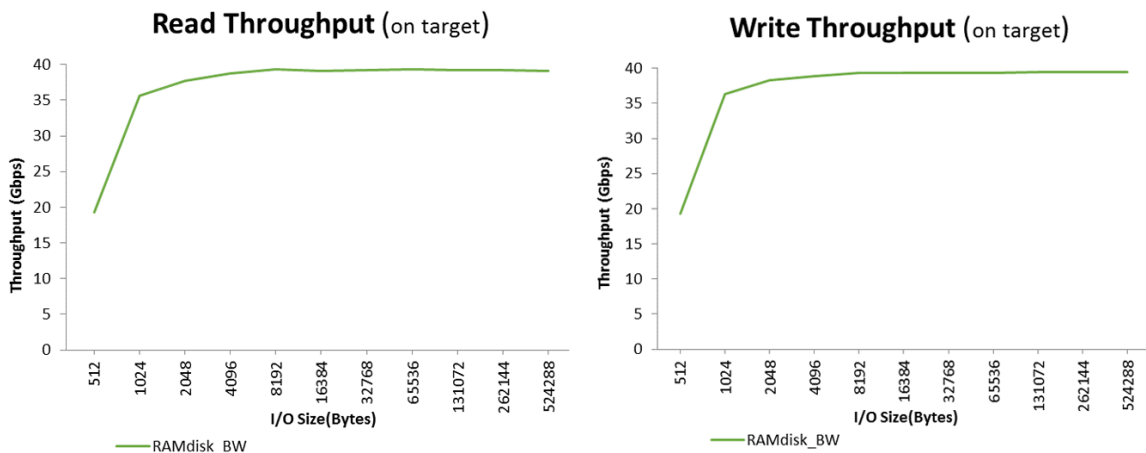
Figure 2 - Read / Write IOPS

Figure 3 - Read / Write Throughput

Summary

This paper provided 40GbE iSCSI IOPS and Throughput performance results for Chelsio's 40GbE Unified Wire adapter (T580-CR). The adapter performs consistently under load and delivers 5M IOPS while achieving line rate throughput for both READ and WRITE. Chelsio T5's iSCSI solution provides an all-round SAN solution with exceptional I/O performance and efficiency.

Related Links

Building Enterprise-Class Storage Using 40GbE
ESXi iSCSI Performance at 40Gbps
Linux OpenStack iSCSI at 10GbE
Linux NIC and iSCSI Performance over 40GbE
iSCSI Heritage and Future