SDC
STORAGE DEVELOPER CONFERENCE
SNIA ■ SANTA CLARA, 2014

Next Generation iSCSI
Enterprise Grade Data Integrity and Performance

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Outline

- iSCSI Overview
- iSCSI HBA Update
- Benchmarks and roadmap
  - Performance
  - Virtualization
- Data integrity protection

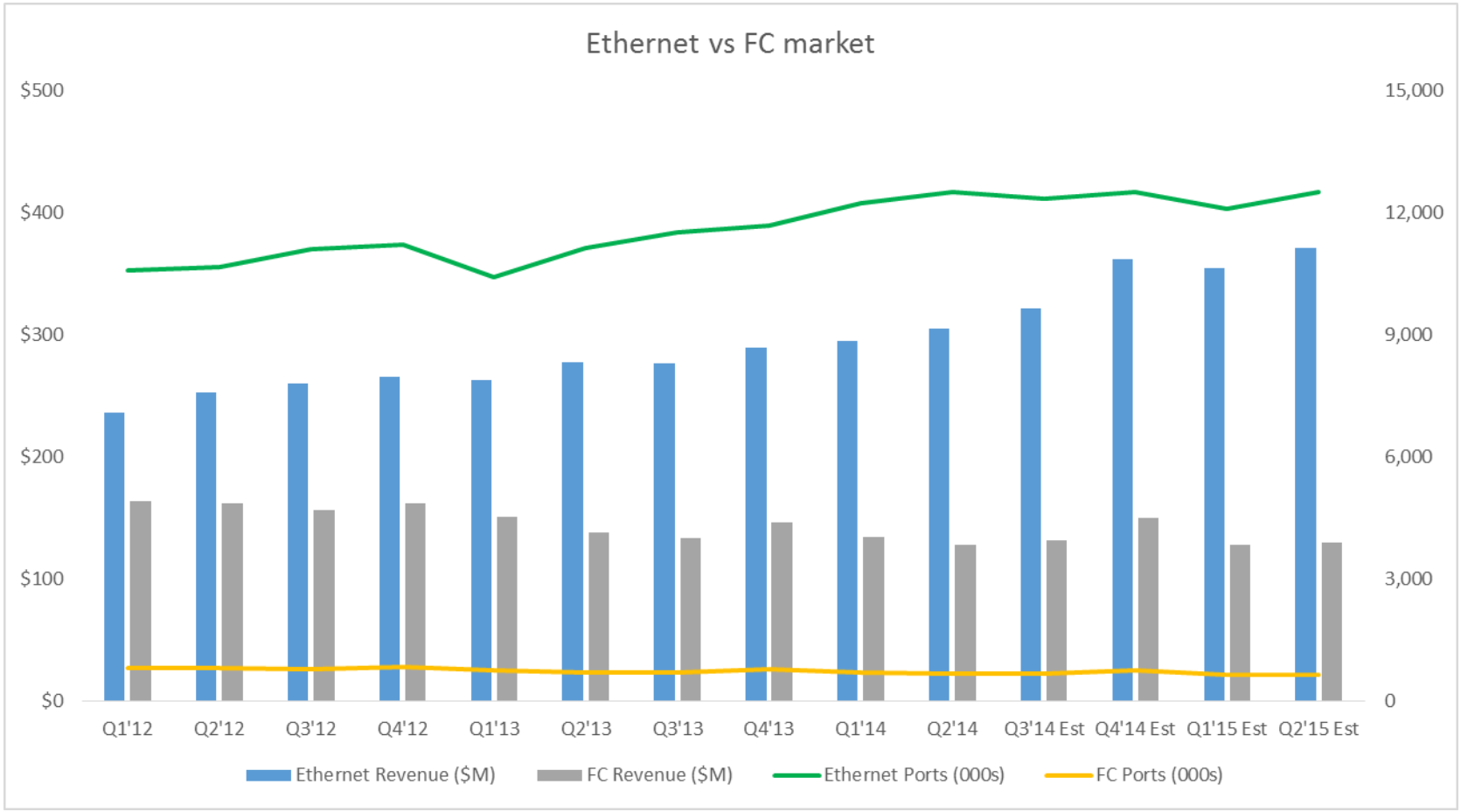
iSCSI Timeline

- RFC 3720 in 2004
  - Latest RFC 7143 in April 2014
- Designed for Ethernet-based storage area networks
  - Data protection
  - Performance
  - Latency
  - Flow control
- Leading Ethernet based SAN technology
  - In-boxed initiators
  - Plug-and-play
- Closely tracks Ethernet speeds
  - Increasingly high bandwidth
- 10GbE, IEEE 802.3ae 2002
  - First 10Gbps hardware iSCSI in 2004 (Chelsio)
- 40/100GbE, IEEE 802.3ba 2010
  - First 40Gbps hardware iSCSI in 2013 (Chelsio)
  - First 100Gbps hardware iSCSI expected in 2016
- 400GbE, IEEE P802.3bs
  - Task Force formed March 2014

iSCSI Trends

- iSCSI growth
  - FC in secular decline
  - FCoE struggles with limitations
- Ethernet flexibility
  - iSCSI for both front and back end networks
- Convergence
  - Block-level and file-level access in one device using a single Ethernet controller
  - Converged adapters with RDMA over Ethernet and iSCSI consolidate front and back end storage fabrics
- Hardware offloaded 40Gbps iSCSI aligns with migration from spindles to NVRAM
  - Unlocks potential of new low latency, high speed SSDs
- Virtualization
  - Native iSCSI initiator support in all major OS/hypervisors
  - Simplifies storage virtualization

iSCSI Trends

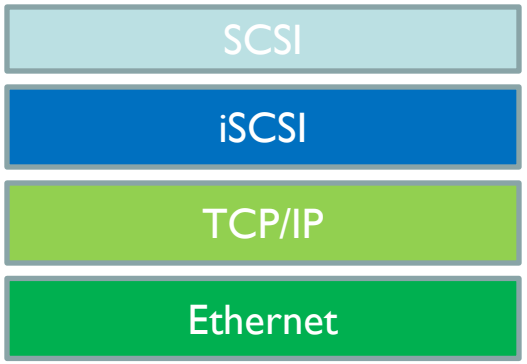


Source: Crehan Research - 2Q14 CREHAN Quarterly Market Share Tables

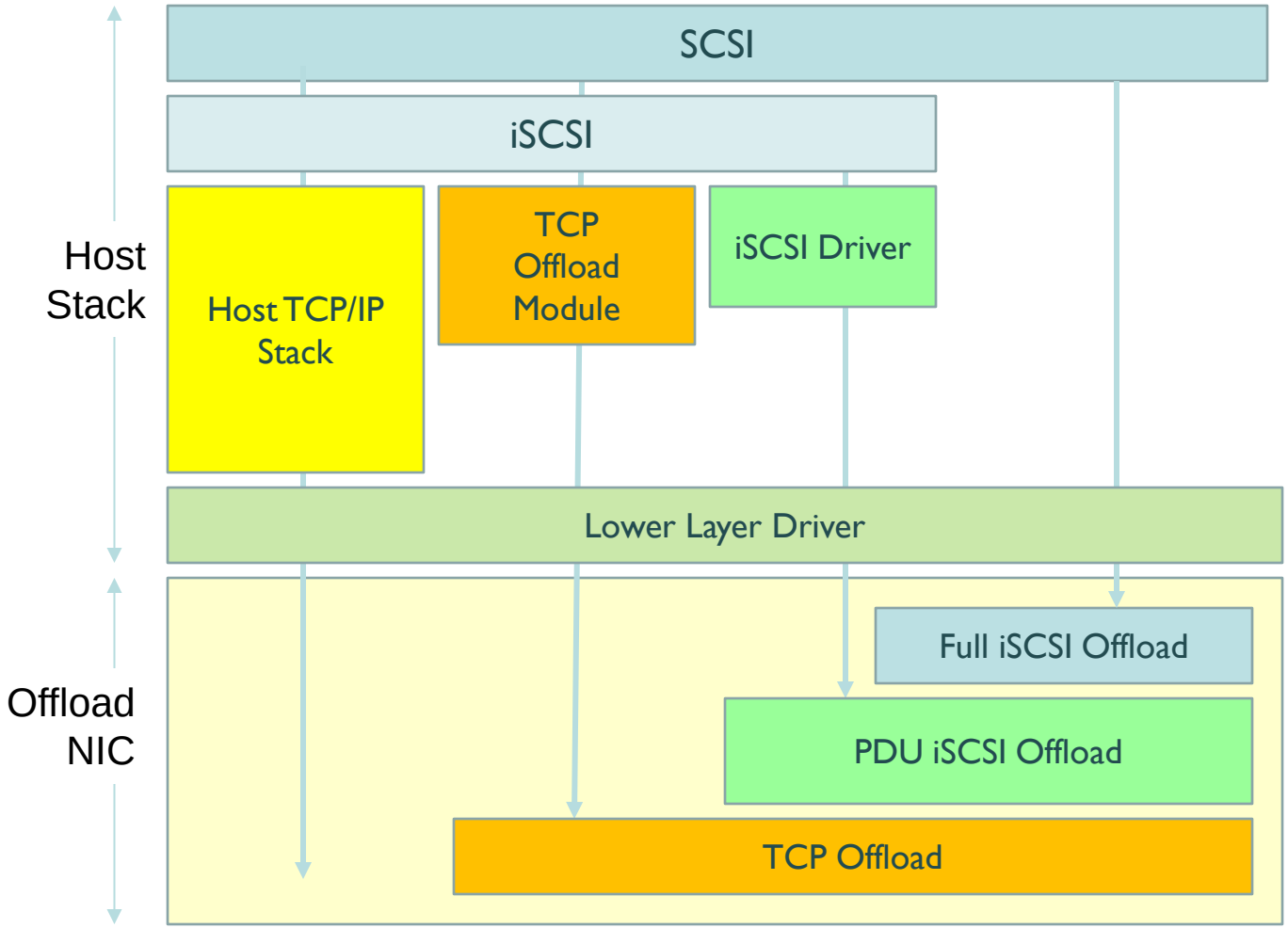
iSCSI Overview

- High performance
  - Zero copy DMA on both ends
  - Hardware TCP/IP offload
  - Hardware iSCSI processing
- Data protection
  - CRC-32 for header
  - CRC-32 for payload
  - No overhead with hardware offload

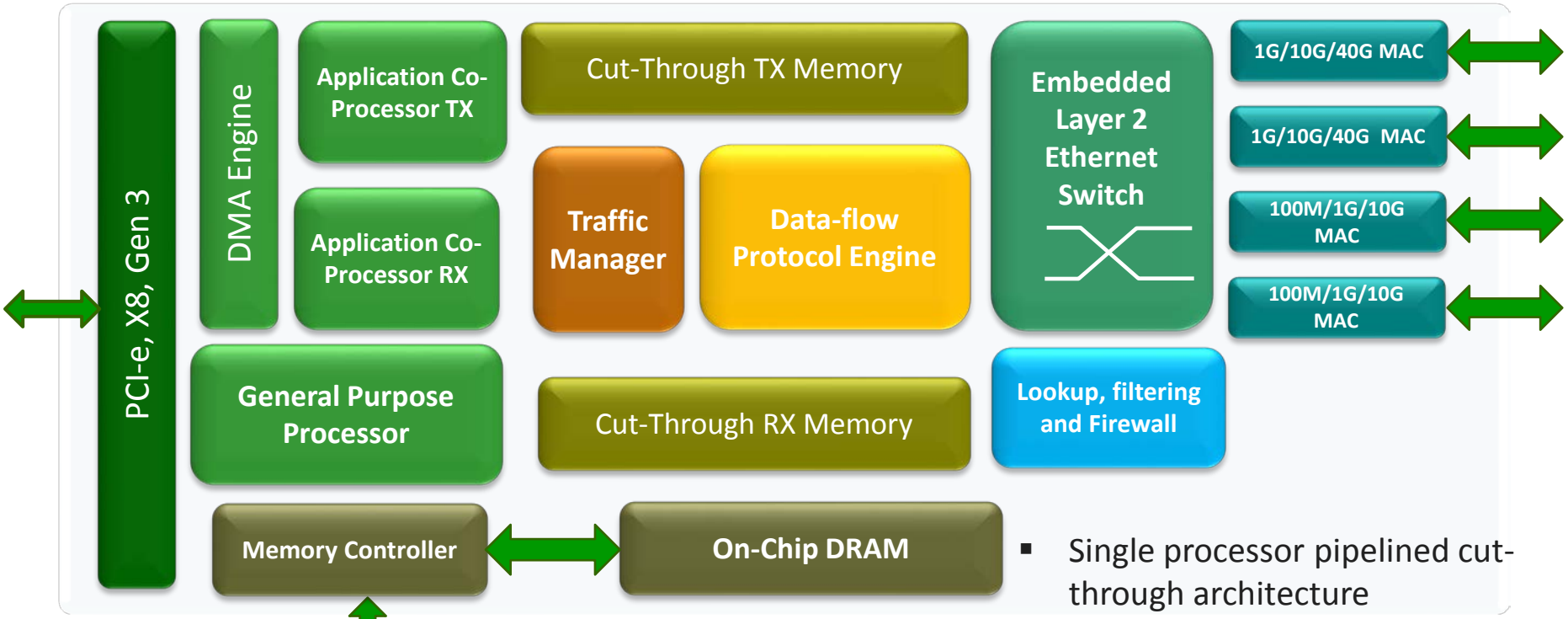
- Scalable TCP/IP foundation
  - IP routability to datacenter, WAN and Cloud scales
  - Reliability/robustness even over wireless links
  - Congestion and flow control
  - Leverages all infrastructure

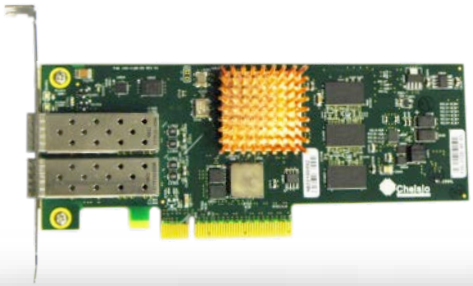


iSCSI Layering



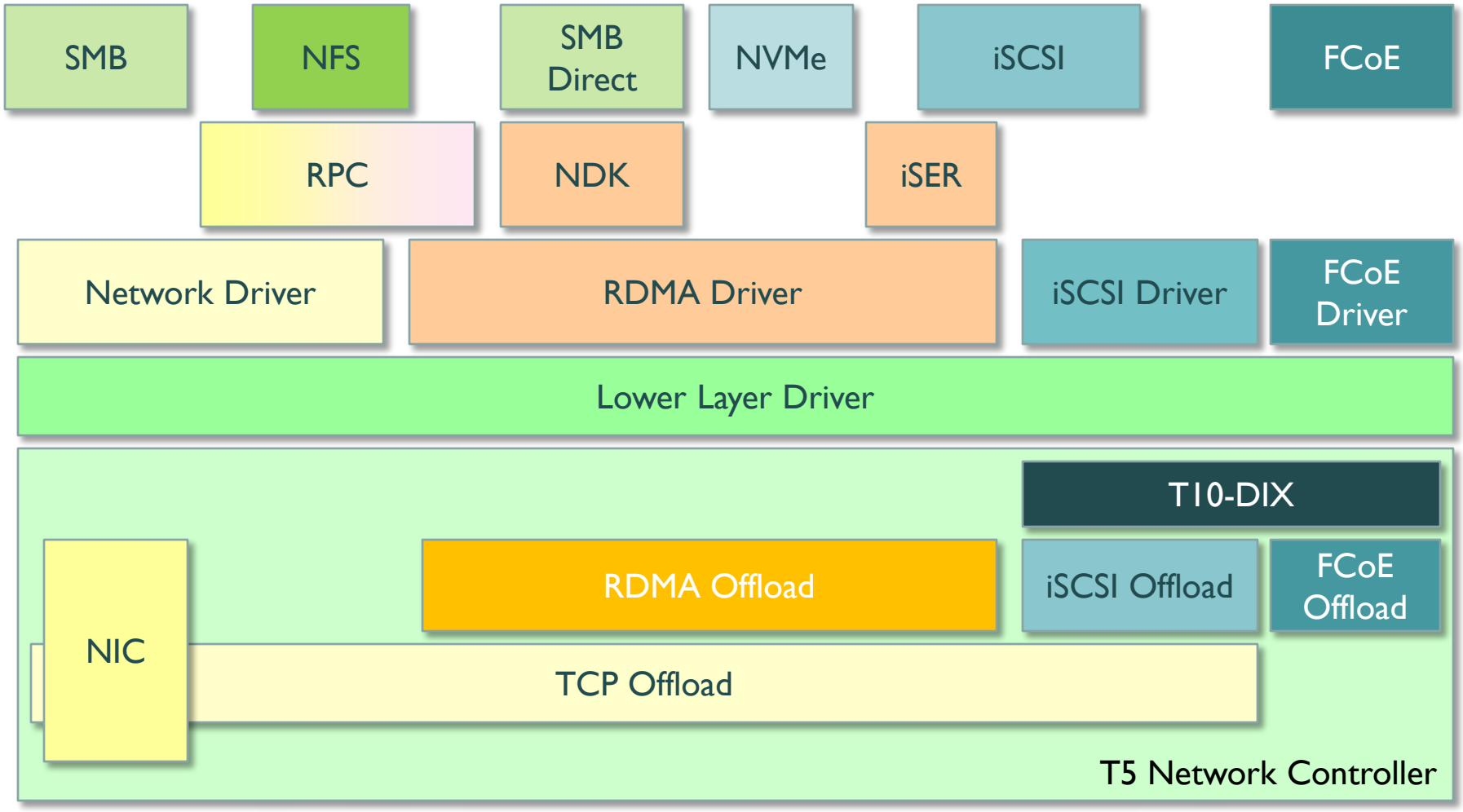
Chelsio T5 Ethernet Controller ASIC



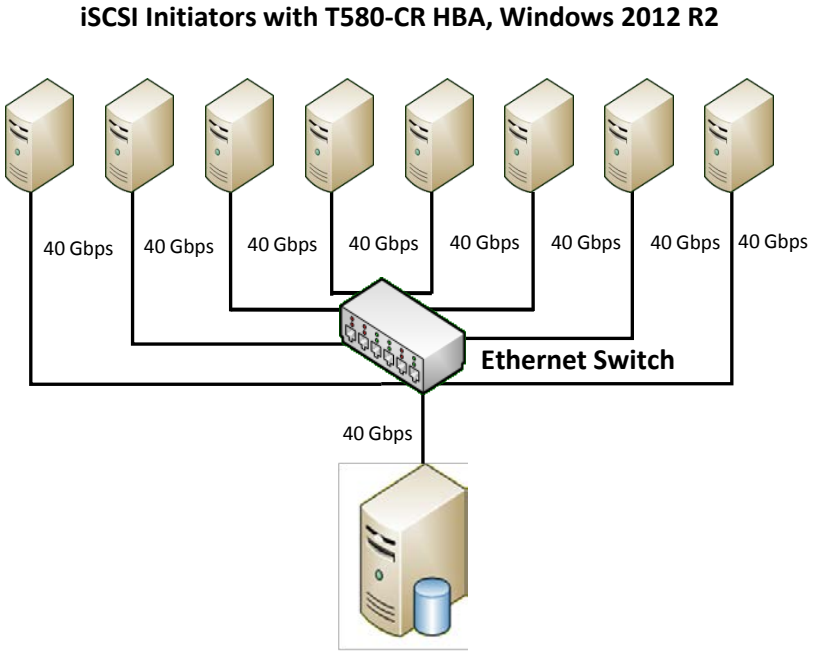


- Single processor pipelined cut-through architecture
- Up to 1M connections
- Concurrent multi-protocol operation
- Full TCP/IPv4|IPv6 offload in 4CLK @500MHz

T5 Storage Protocol Support

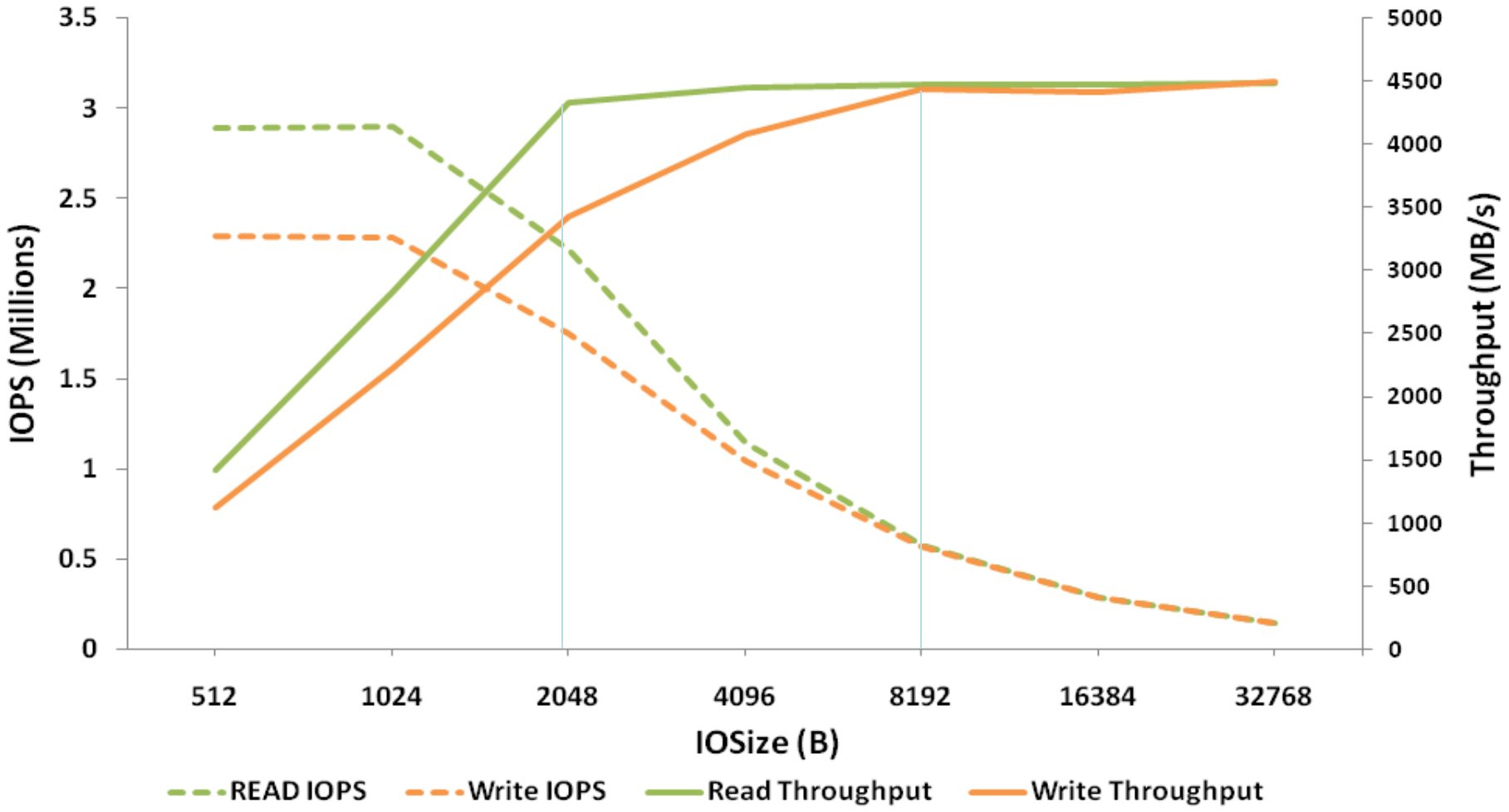


iSCSI Performance at 40Gbps

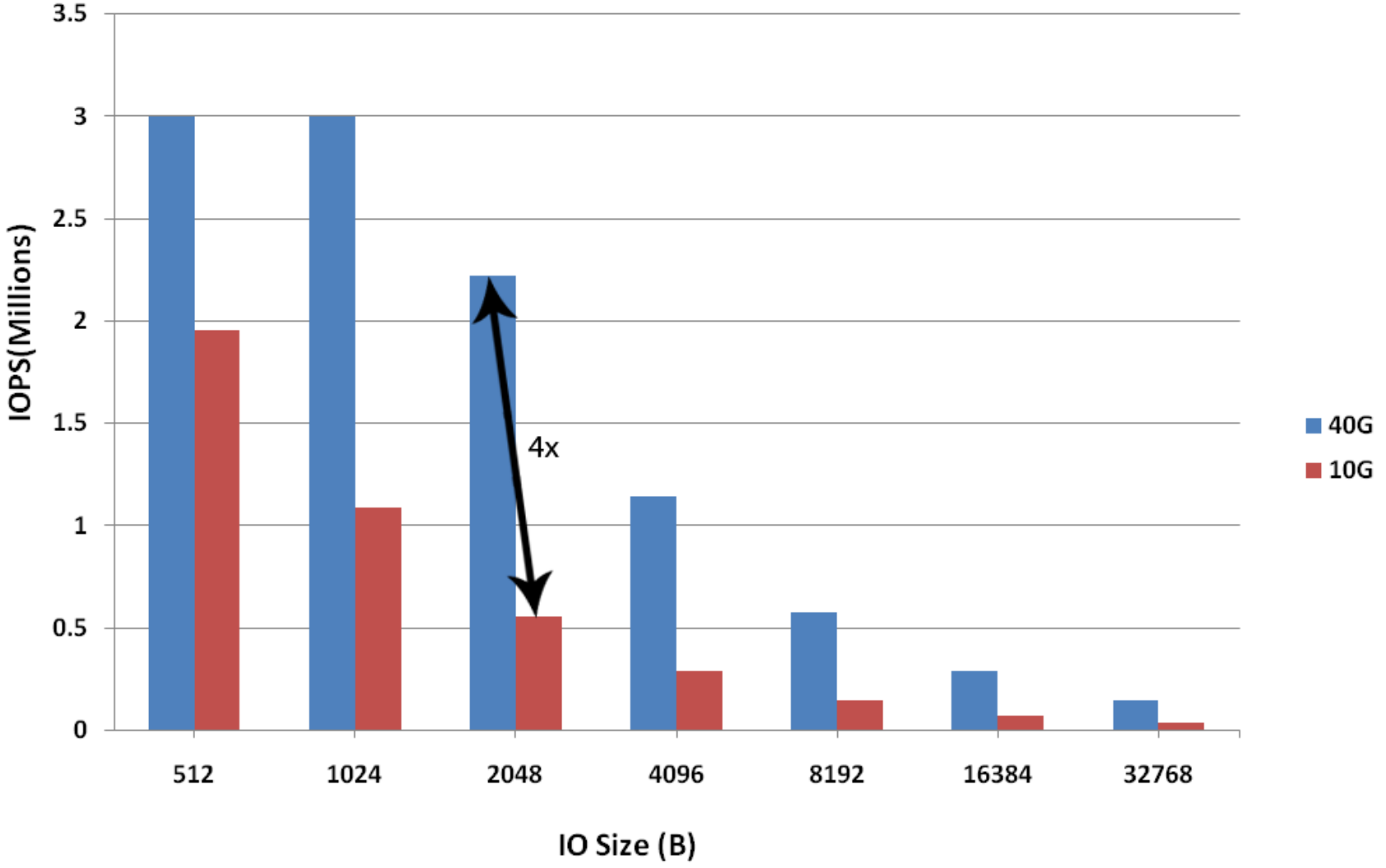


- Storage array with 64 targets connected to 8 initiator machines through 40Gbps switch
  - Targets are *ramdisk null-rw*
  - Each initiator connects to 8 targets
- Iometer configuration on initiators
  - Random access pattern
  - 50 outstanding IO per target
  - 8 worker threads, one per target
  - IO size ranges from 512B to 32KB

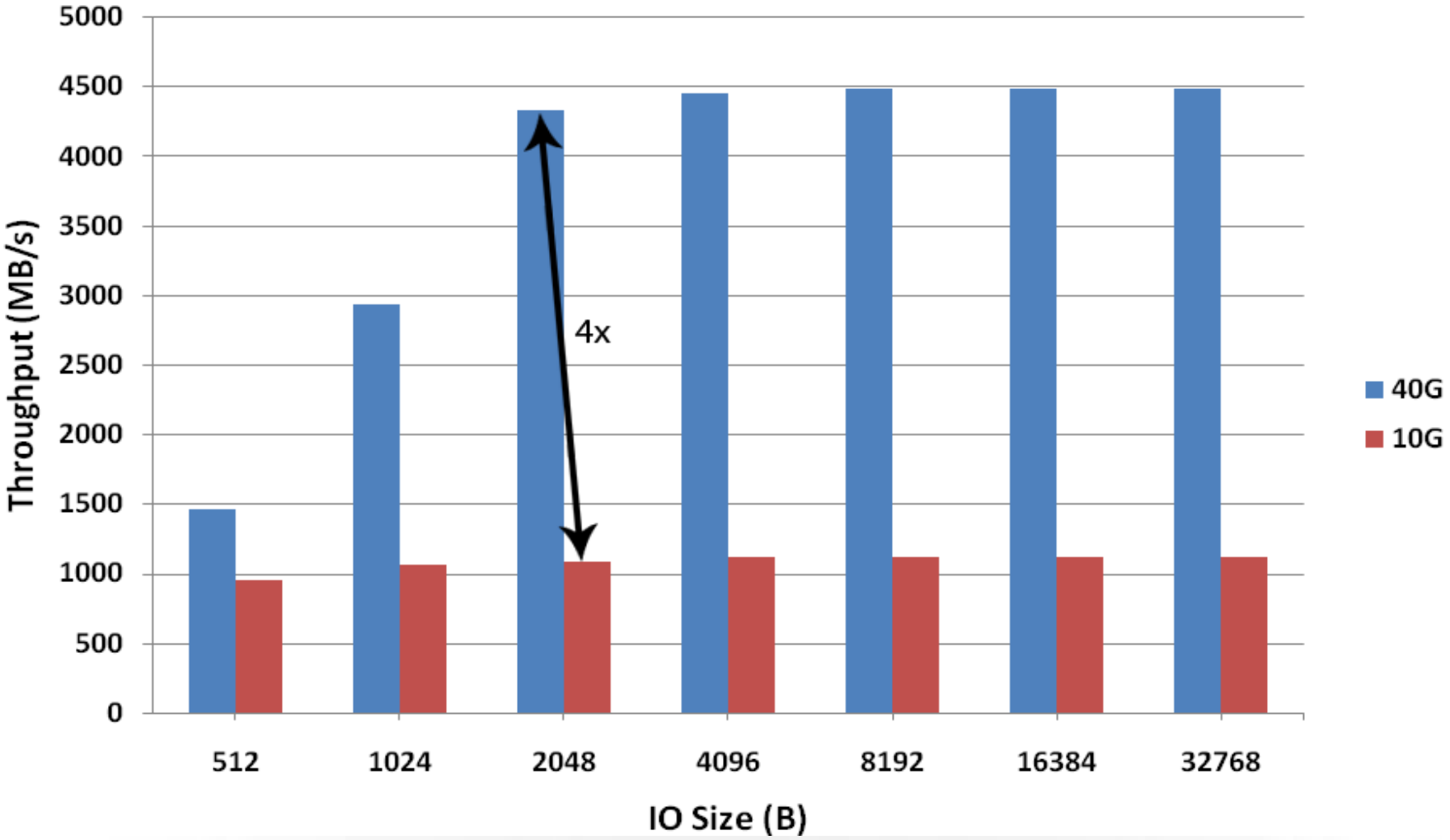
iSCSI Performance at 40Gbps



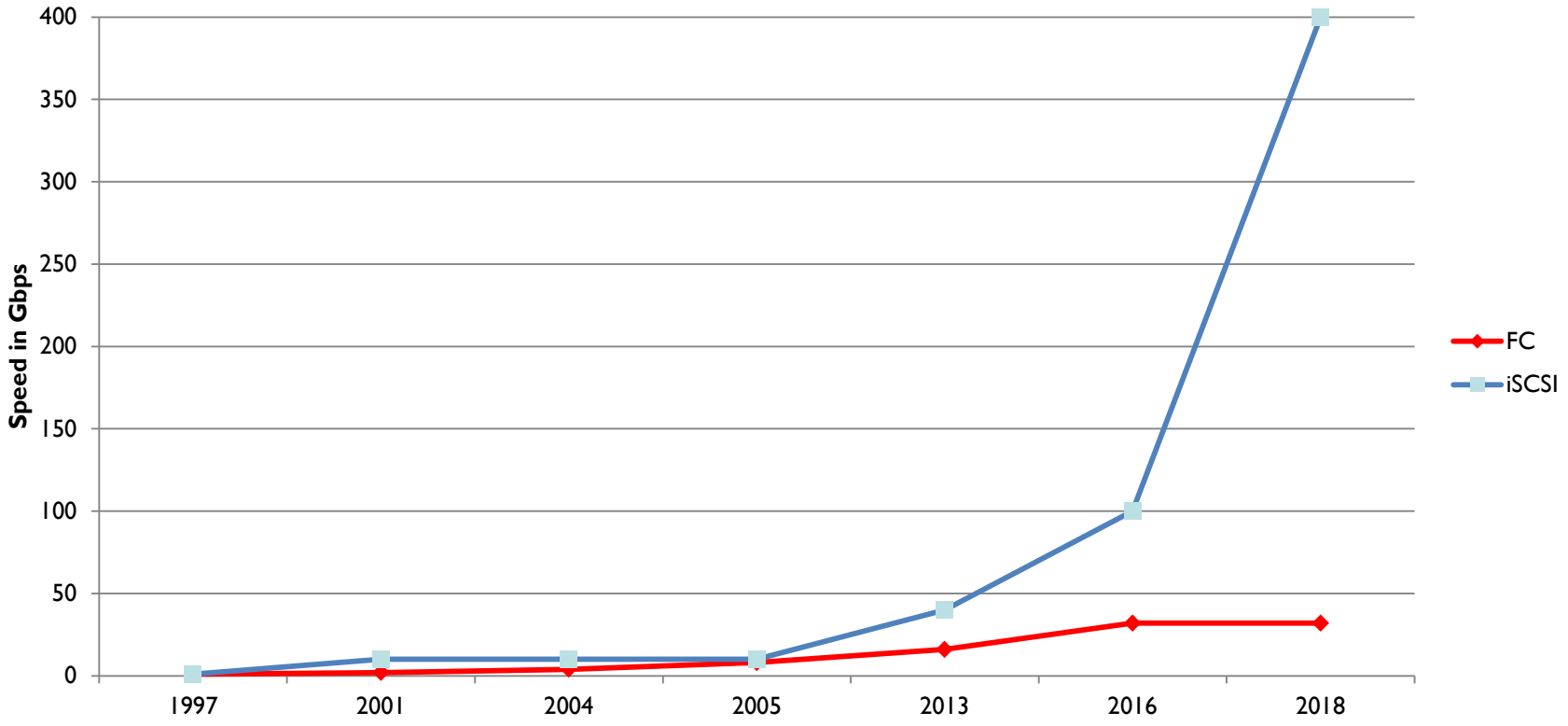
iSCSI READ IOPS – 10Gbps vs. 40Gbps



iSCSI READ BW – 10Gbps vs. 40Gbps

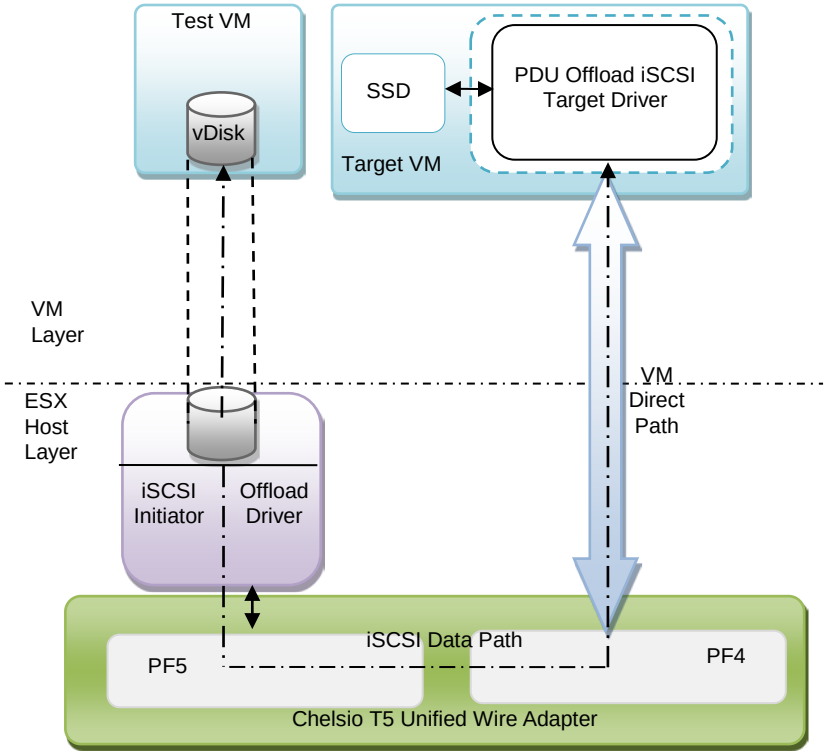


iSCSI Bandwidth Roadmap



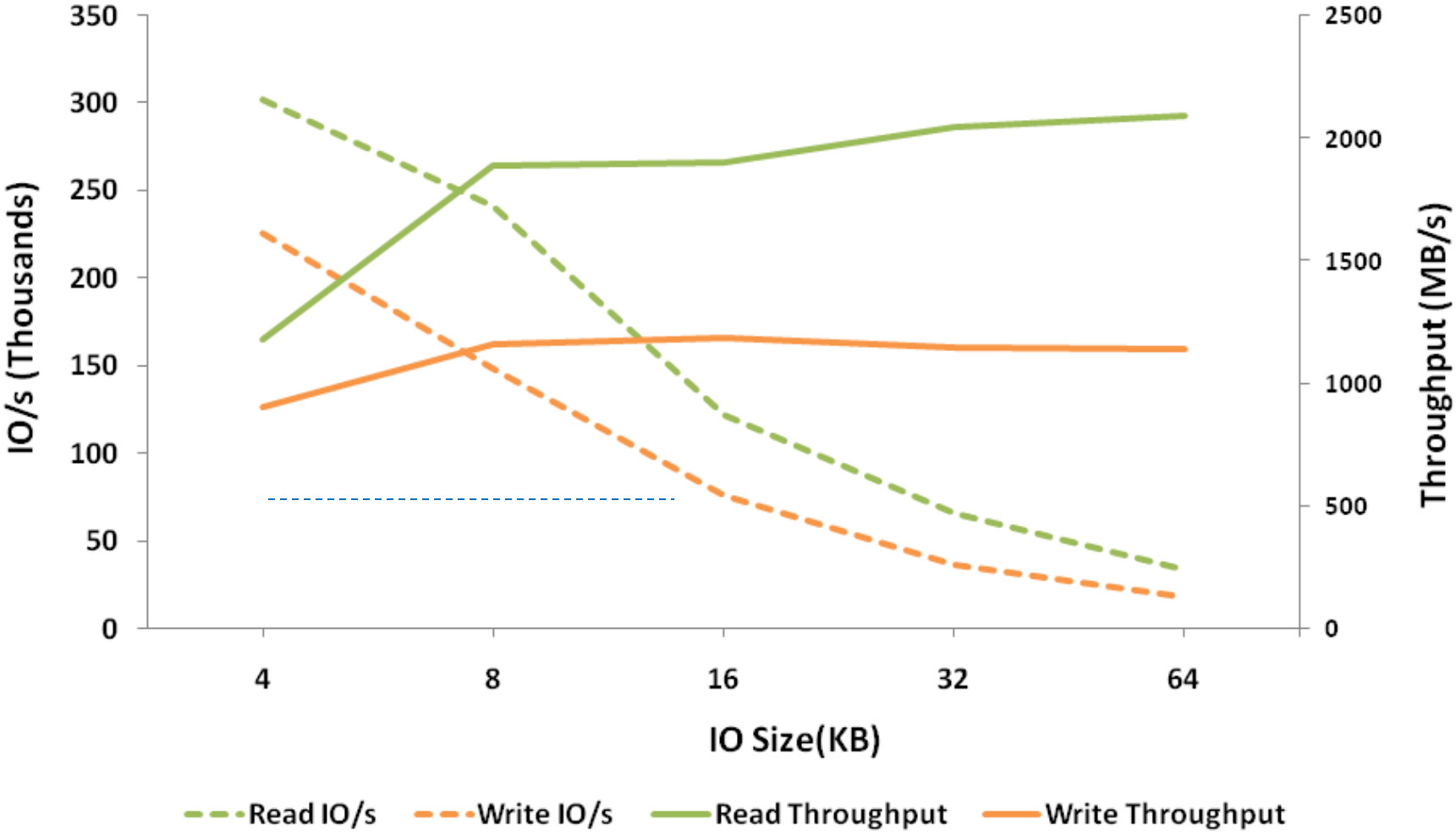
As of 2013, T5 offload engine iSCSI PDU processing capacity sufficient for standard frames at 400Gbps rate.

Virtualized iSCSI



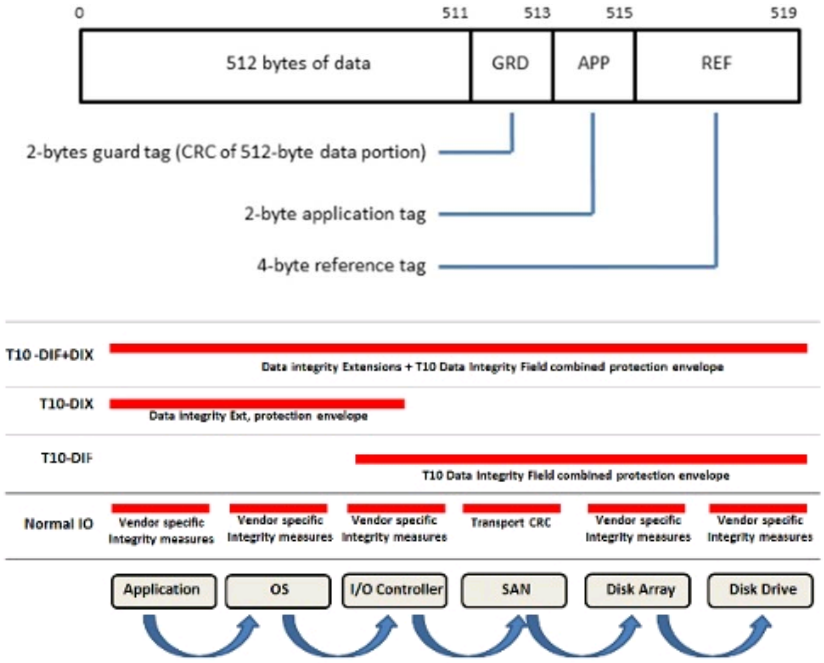
- Initiator VM and target VM running on the same system
- Communication through T5 on-chip embedded switch
- Target VM communicates through VM Direct Path to the T5 adapter
- Initiator VM runs a paravirtualized driver to utilize the fully offloaded T5 initiator

Virtualized iSCSI IOPS and Throughput



Advanced Data Integrity Protection

- Above and beyond iSCSI CRC-32
- Data Integrity Field (DIF) protects against silent data corruption with 16b CRC
  - Adds 8-bytes of Protection Information (PI) per block
- Data Integrity Extension (DIX) allows this check to be done between application and HBA
- T10-DIF+DIX provide a full end-to-end data integrity check
  - iSCSI CRC-32 handoff possible
- T5 supports hardware offloaded T10-DIF+DIX for iSCSI (and FCoE)



Martin Petersen, Oracle, https://oss.oracle.com/~mkp/docs/dix.pdf

iSCSI Summary

- Mature protocol with wide industry support
- Native initiator in-boxed in all major operating systems/hypervisors
  - Back-end and front-end applicability, virtualization
- Hardware offloaded iSCSI shipping at 40Gbps
  - High IOPS and throughput
  - Low latency
- Robust TCP/IP foundation allows operation over Wireless, LAN and WAN networks
  - Hardware offload eliminates overhead
  - No specialized cables, equipment, switches, or forwarders
  - True network convergence
- Roadmap to 100Gbps, 400Gbps and beyond
- Hardware based end-to-end data integrity protection

Thank You

Ask about Chelsio's 40Gbps iSCSI evaluation program at: *sales@chelsio.com*

Visit www.chelsio.com for more info