

# Building a Scalable Virtualized Data Center with the Solarflare SFN7002F 10GbE Server Adapter



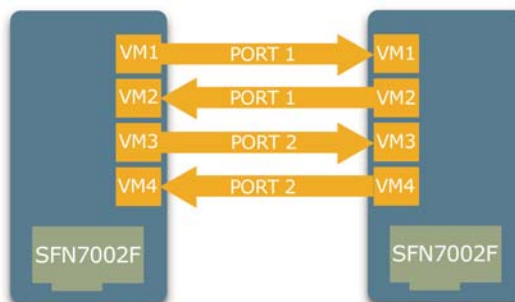
## Introduction

Virtualization enables IT managers to consolidate workloads on fewer physical servers increasing the utilization of each server and creating a more flexible, efficient, and dynamic data center environment. As a result, virtualization can lead to lower capital costs and lower ongoing operating costs. When building a scalable virtualized data center, the choice of the network adapter is a key element in maximizing the overall performance and scalability of the virtualization deployment. Solarflare's SFN7002F 10GbE server I/O adapter provides the industry's best price-performance and enables data center managers to consolidate more virtualized applications over fewer physical servers, increasing VM density and improved server ROI.

The SFN7002F dual-port 10GbE SFP+ server adapter is designed for enterprise data center, virtualization and cloud deployments. Key features and benefits are:

- High performance 40Gb/s bidirectional throughput and PCIe 3.0 x8 host interface for 8.0 GT/s bandwidth
- Lowest latency with sub 4μsec kernel driver latency using busy poll
- Power savings with <6W power (typical)
- Maximum multi-core server efficiency with 2048 DMA channels, event queues and MSI-X interrupt vectors
- Accelerated performance with hypervisor bypass (PCI passthrough and SR-IOV support)
- Virtualization scalability with 16 physical functions and 240 virtual functions
- Software upgradeable for Solarflare acceleration, monitoring and security applications (OpenOnload®, Precision Time, SolarCapture™, and SolarSecure™ Filter Engine)
- Comprehensive operating system/hypervisor support including
  - Linux 2.6 and 3.x kernels with KVM including Red Hat RHEL 5, 6, 7 and MRG, SUSE SLES 10, 11 and SLERT, and other Linux distributions including CentOS, Ubuntu, Gentoo, Fedora, Debian
  - VMware ESXi and vSphere 5.0, 5.1, and 5.5
  - Microsoft Windows Server 2008 R2, 2012 and 2012 R2 Hyper-V

Solarflare recently conducted a VM scalability and throughput test comparing performance between the SFN7002F and the Intel x520-DA2 10GbE adapter. The test configuration is illustrated in the figure at right.

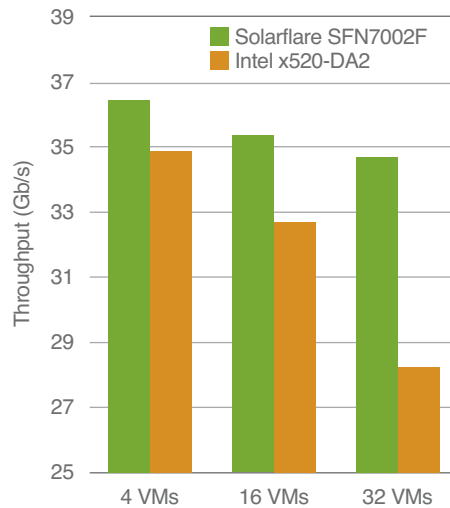


In this configuration, Ixia Chariot was used to drive bidirectional 64k msg size packets across both ports of the adapters. Each VM was configured as a single Chariot endpoint and the number of VMs were increased from 4, 16, 32 and 64 instances.

The physical servers used were identical dual 6-core Intel Xeon E5-2643 v2 @3.5GHz with 32GB RAM and configured in a back-to-back network topology. The hypervisor used in each server was VMware ESXi 5.5 with the Solarflare ESXi 4.0.2.6640 driver and the Intel 3.7.13.7.14iov-NAPI driver, both drivers with rx\_netqs=8. And each VM was configured as a 2 vCPU, 2 GB RAM guest running RHEL 6.4 with the VMXNET3 para-virtualized driver.

As shown at right, the test revealed more VM scalability with both consistent and consistently higher throughput with the Solarflare SFN7002F versus the Intel x520-DA2. At 32 VMs, the Solarflare SFN7002F had 18% higher throughput as the Intel could only sustain about 7Gbps throughput per port. For all tests, the CPU utilization for both adapters was comparable.

As shown in the table below, when compared to its competitors in multiple categories including I/O performance and virtualization features, the SFN7002F had significant benefits in the areas of host interface speed, power, scalability, latency and the number of both physical and virtual functions.



Feature	Solarflare SFN7002	Intel x520-DA2	Mellanox CX2/3	Benefit
<b>General</b>				
Host I/F	PCIe 3.0 x8 @8.0 GT/s	PCIe 2.0 x8 @5.0 GT/s	PCIe 3.0 x8 @8.0 GT/s	Faster connectivity with latest server technology
Hardware Time Stamping	7.5ns	12.8ns	N/A	Precise resolution for network visibility
IEEE 1588 PTP	✓	✓	Beta	Network time synchronization
<b>I/O Performance Features</b>				
Tx/Rx queues per port	1024	128	16	Distribute network traffic to all cores from multi-core systems
MSI-X interrupt vectors per port	1024	64 (non IOV) + 64 (IOV)	16	Allows efficient communication between queues and CPU processor cores
Receive Side Scaling (RSS) queues per port	64	16	16	Greater core scaling of network I/O performance
Accelerated Receive Flow Steering (RFS)	✓	✓	✓	Extends RSS by forwarding packets to optimal CPU core
<b>Virtualization Features</b>				
Physical Functions	16	2	2	Multiple full PCIe devices for NIC partitioning
Virtual Functions	240	128	32	Scalable hypervisor bypass (SR-IOV)
NetQueue, VMQ	✓	✓	✓	Hypervisor performance scaling w/CPU cores



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