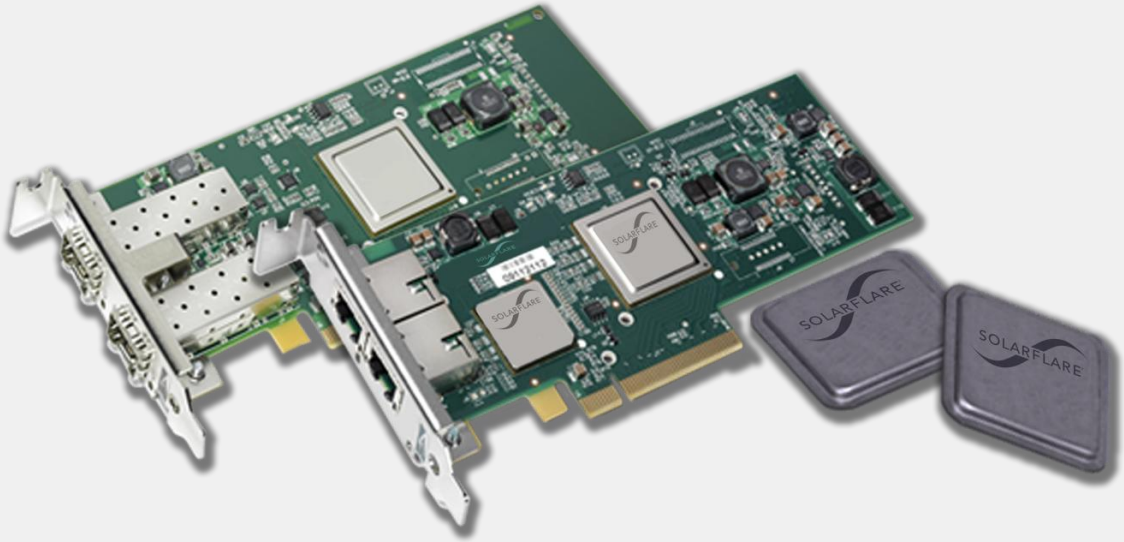
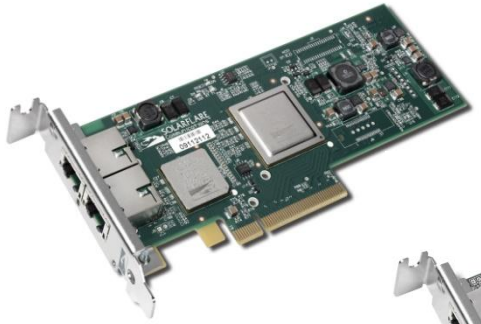


Solarflare and OpenOnload

Solarflare Server Adapter Family

Dual Port SFP+
SFN5122F & SFN5162F

Single Port SFP+
SFN5152F



Dual Port 10GBASE-T
SFN 5121T & SFN5161T

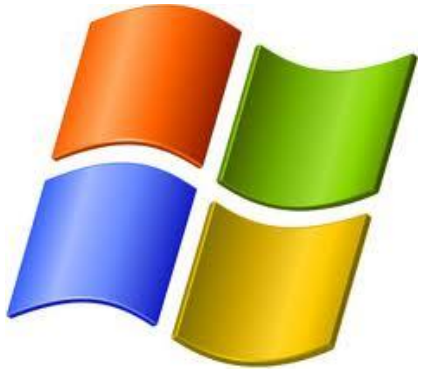
Single Port 10GBASE-T
SFN5151T

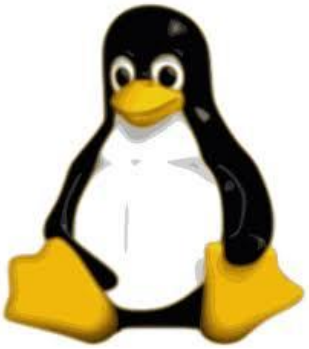
- High performance
- Lowest power: < 2.5W per port SFP+
- Linux (< 7 μsec), Windows, and Solaris
- Solarflare OpenOnload for ultra-low latency (< 4 μsec)
- Hardware-assisted, scalable virtualization: up to 2048 vNICs

10Gbps Enterprise Server Adapter

SOLARFLARE

Platforms





Microsoft® Hyper-V™

solaris

KVM

vmware®

Platform Support: Windows

- High performance, low-latency
  - < 11uS ½ RTT TCP latency
  - Bidirectional line rate, both ports (40G) with < 20% CPU load
  - Stateless offloads (TSO, LRO, RSS)
  - Performance scales with multiple CPU cores
- Enterprise feature set
  - VLAN and teaming (including 802.3ad link aggregation)
  - Unattended installation
  - SNMP MIB
- Comprehensive management
  - Command line and GUI (MMC snap-in integrated into OS)
  - Local and remote management

Platform Support: Linux

- High performance, low-latency
  - < 7uS ½ RTT UDP latency
  - Bidirectional line rate, both ports (40G) with < 20% CPU load
  - Stateless offloads (TSO, LRO, RSS)
  - Performance scales with multiple CPU cores
- Full integration into Linux kernel
  - Driver “intree” (kernel.org)
  - Wide distribution and kernel support
  - Integration with ethtool, MTD, hwmon (sensors)
- Actively improving Linux networking
  - Solarflare is the maintainer of “ethtool”
  - Implemented Linux kernel RFS hardware offload

Platform Support: Other

- Solaris 10
  - High performance low-latency Solaris GLDv3 driver
- Virtualization
  - VMware ESX 4.x high performance driver
  - SR-IOV support for highest performance
    - Citrix XenServer6, KVM, more coming
  - Windows Hyper-V VMQ acceleration
- BootROM
  - Full PXE and iSCSI boot support

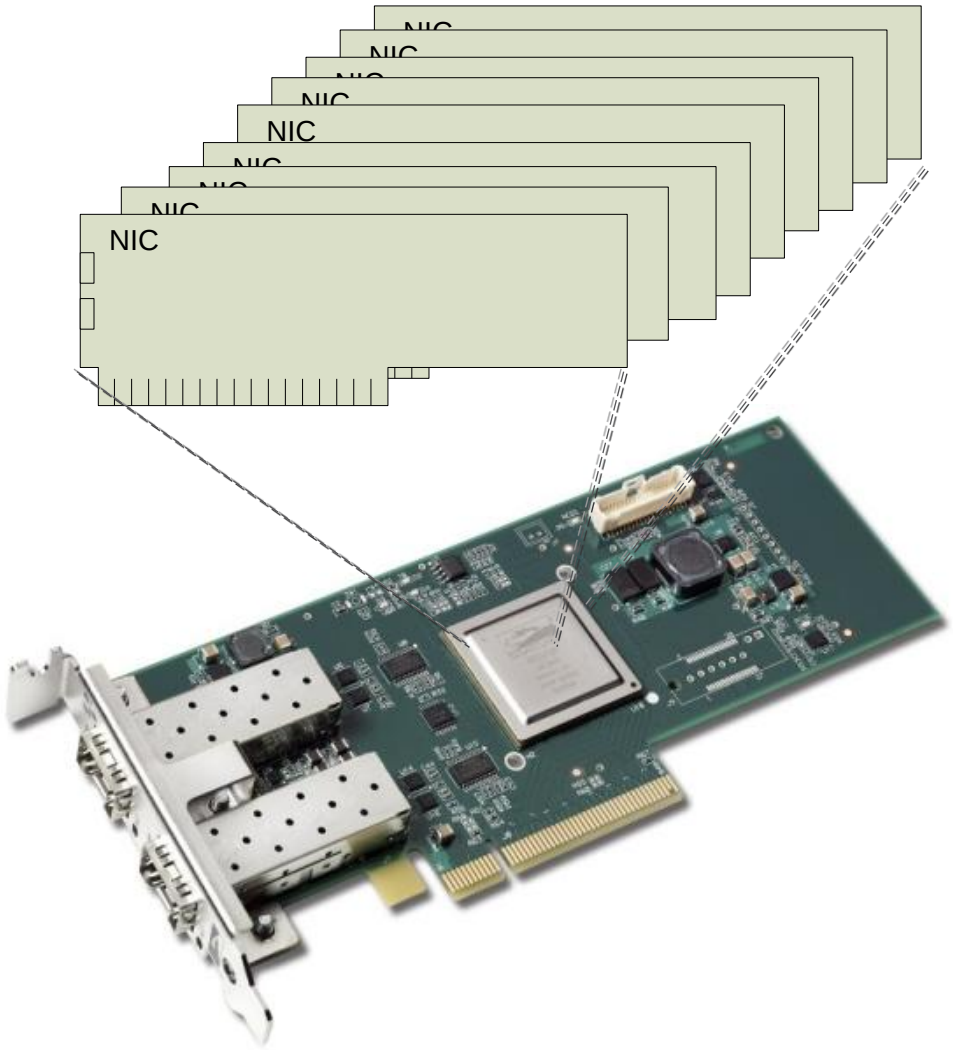
Deployments

- Wide range of deployments
  - Financial
    - Many major exchanges worldwide
  - Cloud
  - Enterprise
    - Several Fortune 100
  - Scientific/HPC

- Wide range of partners

vNIC

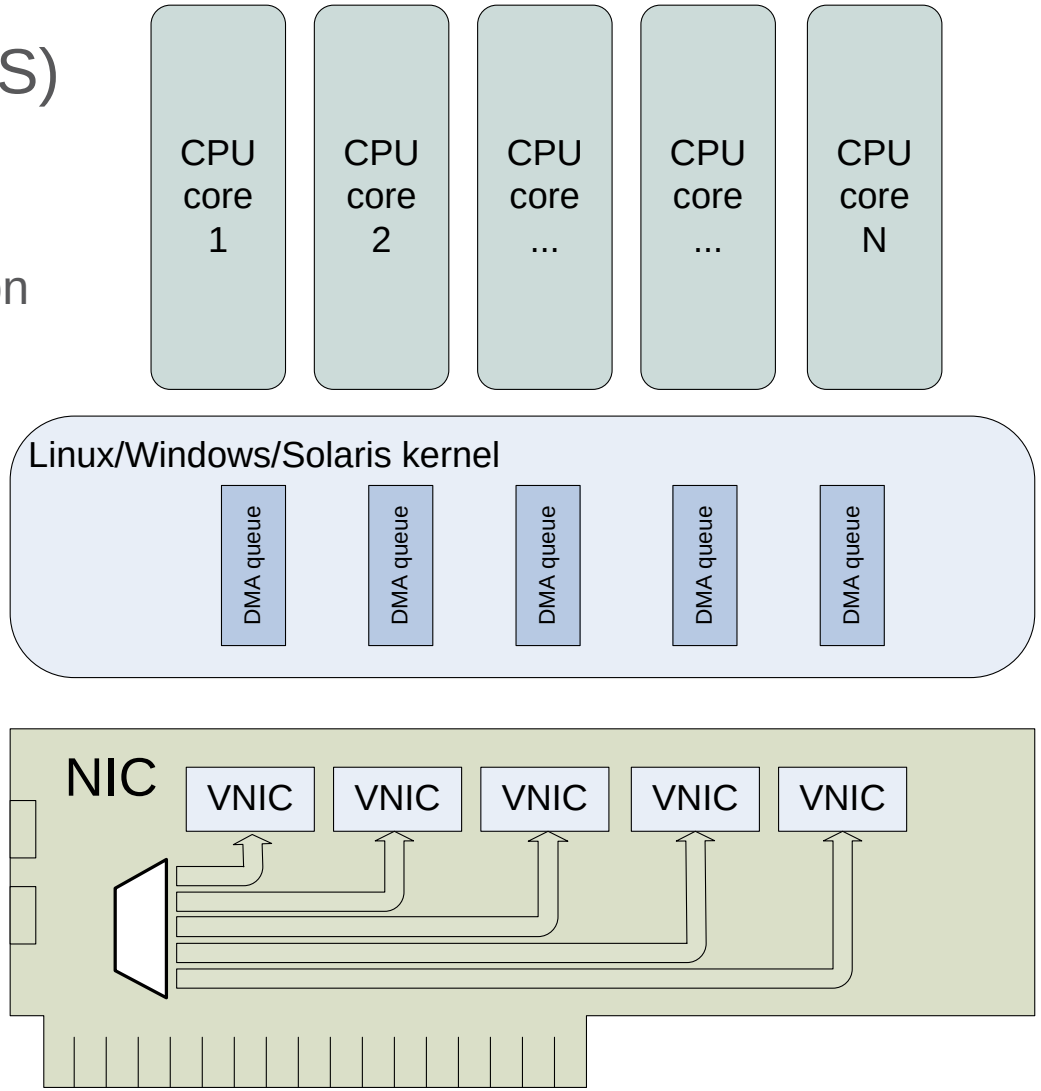
- Solarflare server adapters are “virtualisable”
  - 2048 vNICs
  - High performance in many domains



Virtual NICs for performance scaling

VNIC per CPU core (RSS)

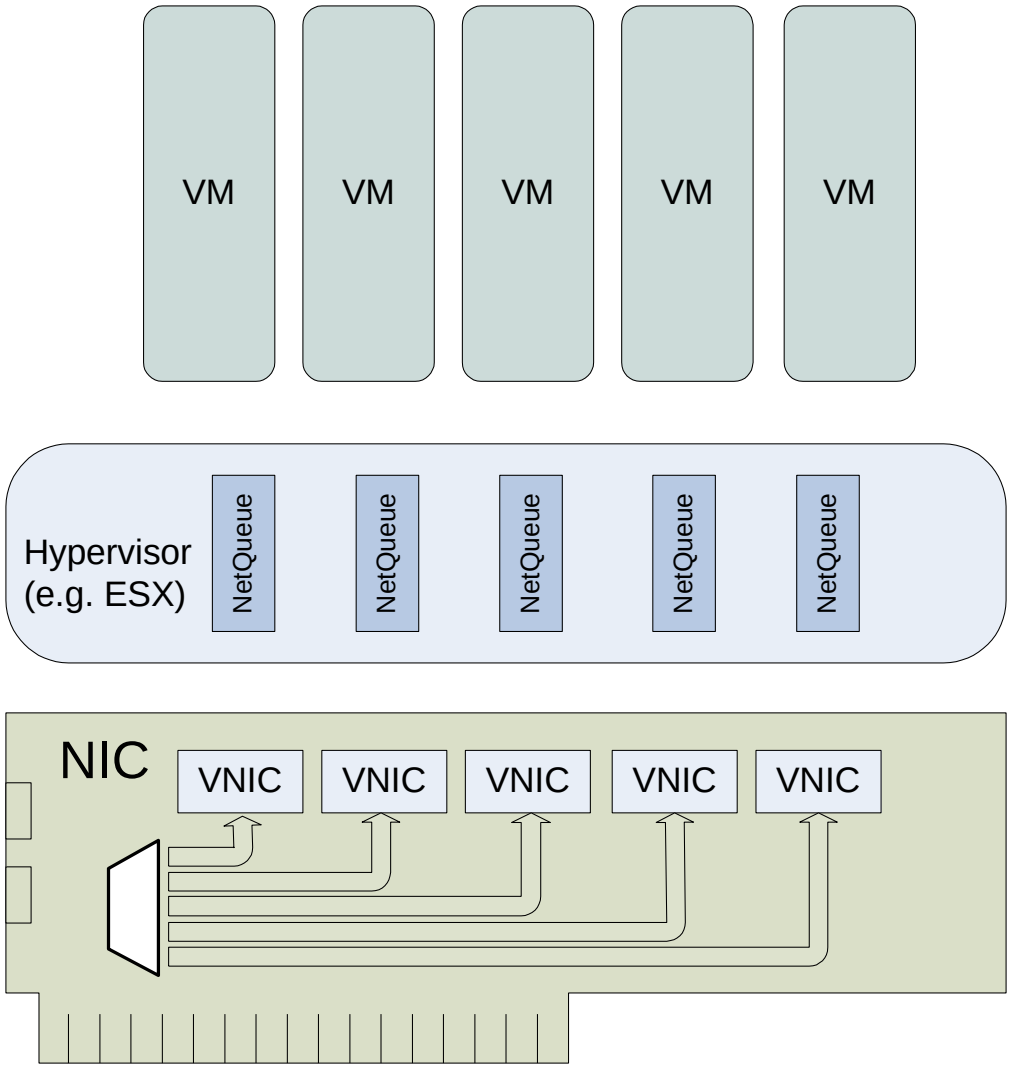
- RX queue per CPU core
- TX queue per CPU core
- Complete CPU core separation
- Performance scales across CPUs



Virtual NICs for Virtual Machines

VNIC per VM

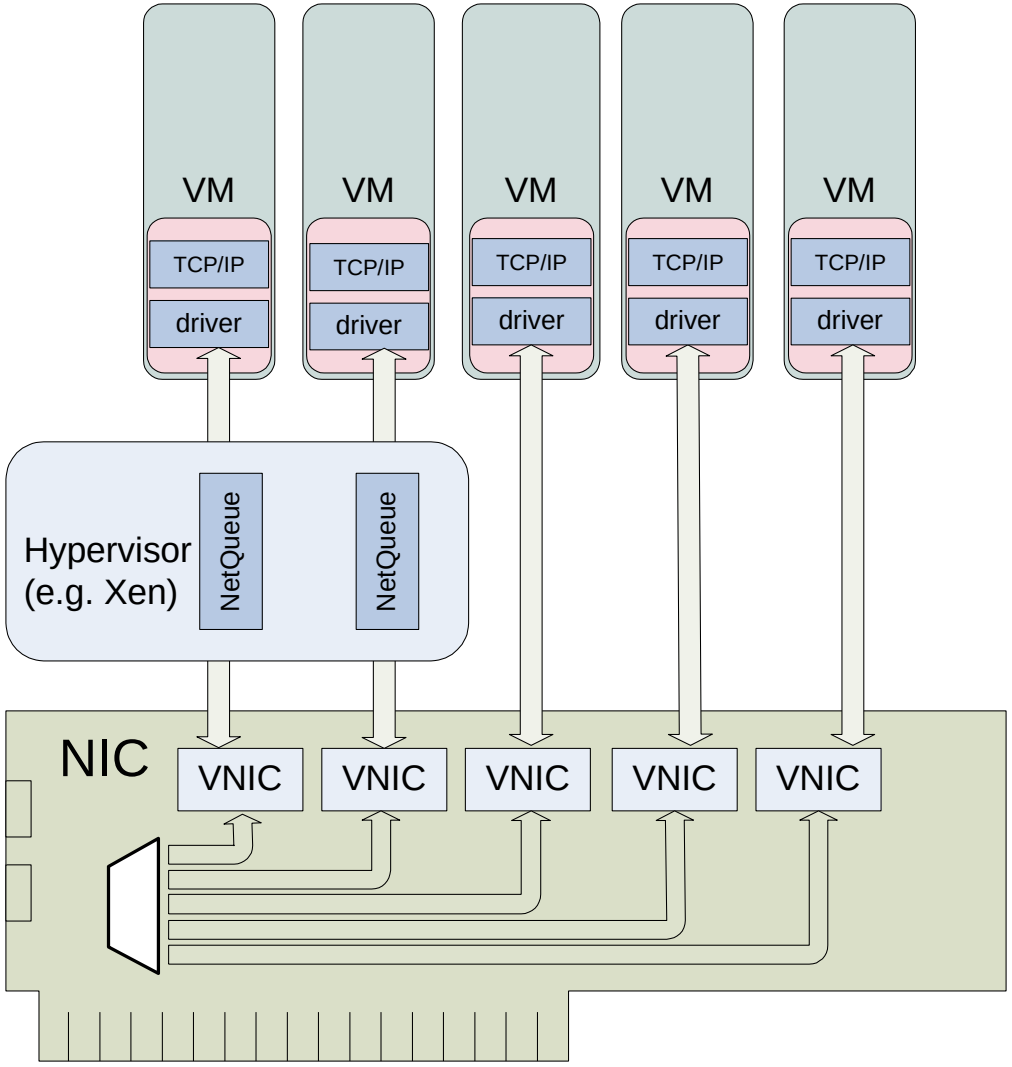
- RX queue per VM
- TX queue per VM
- VM separation
- Used for VMware NetQueue and Windows HyperV VMQ



Virtual NICs for Virtual Machines (2)

VNIC per VM

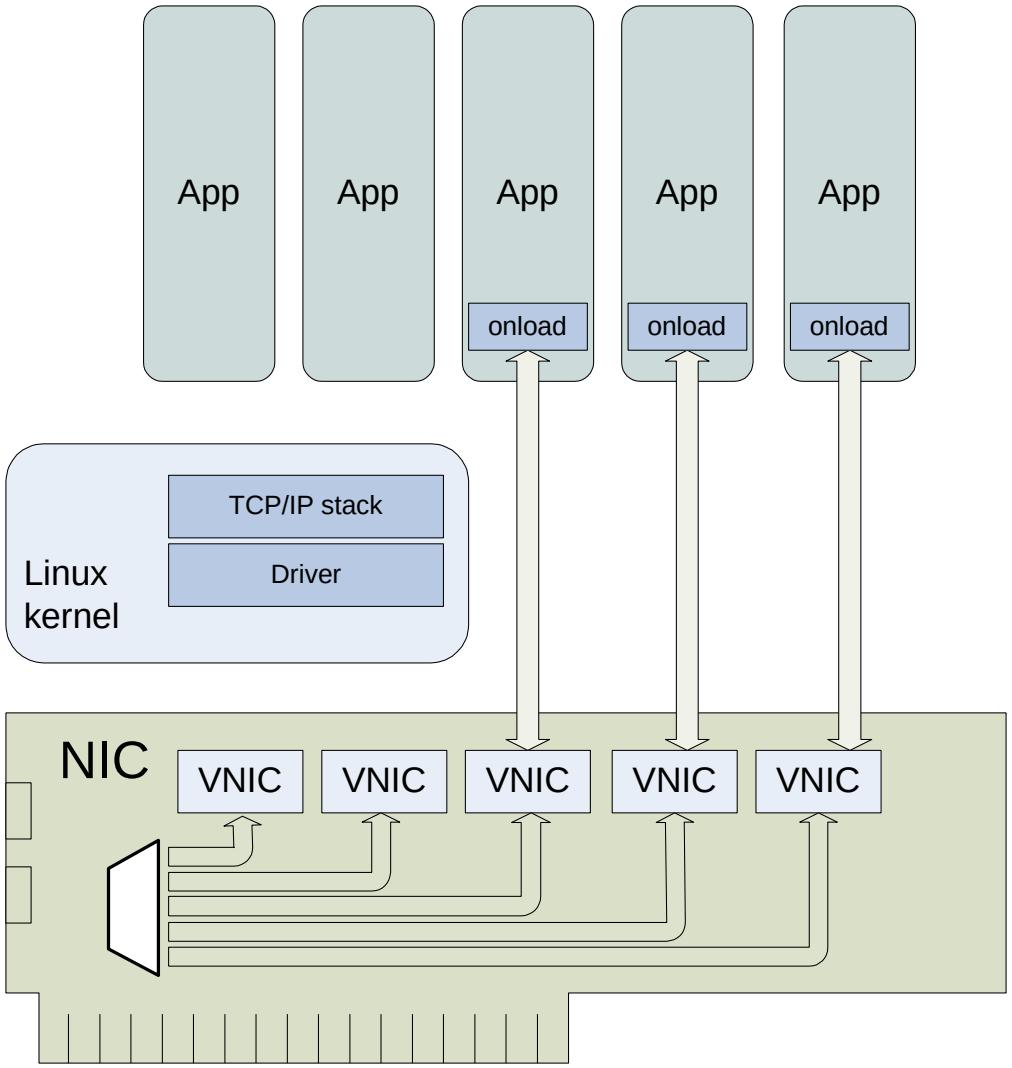
- Same model used for SR-IOV
- In this case VM has direct access to VNIC(s) via SR-IOV VF



Virtual NICs for application acceleration

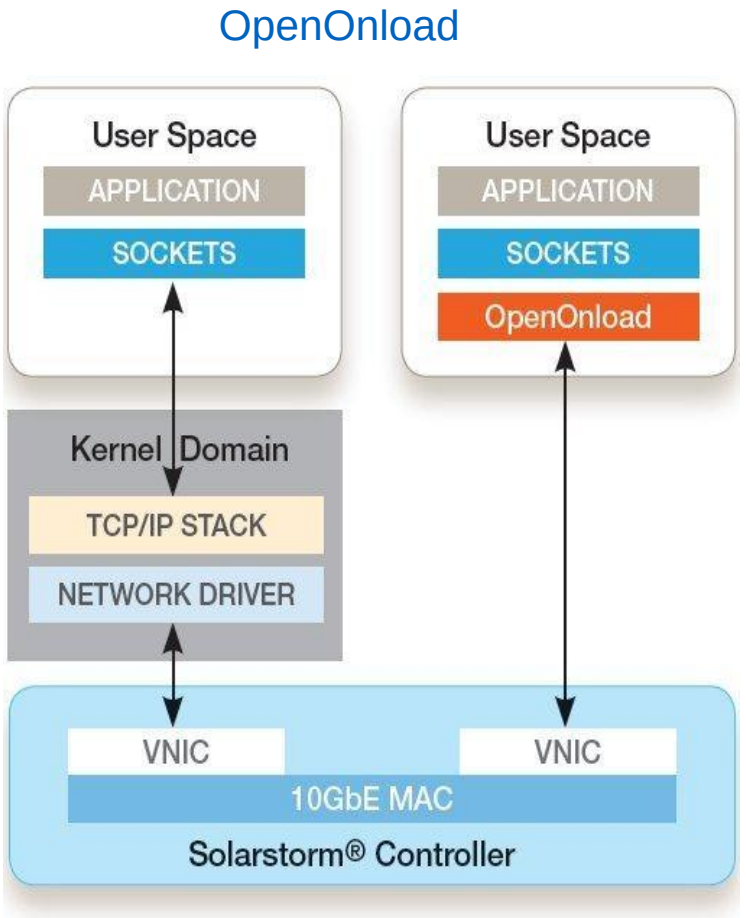
VNIC per application

– Used by OpenOnload



Solarflare OpenOnload® Application Acceleration Middleware

- TCP and UDP Acceleration
  - Kernel bypass
    - App gets direct access to hardware
    - Fewer context switches, copies
  - Benchmarks
    - Reduces latency by 50%
    - Increases message rates 2x to 3x
  - “Real” applications even more benefit
- Compatibility
  - No recompile/application mods
  - Regular Ethernet/IP network
  - Unicast and multicast
  - “Just works”



Solarflare OpenOnload® Application Acceleration Middleware

SOLARFLARE

- Trivial to deploy and to use
  - $ myapp arg1 arg2
  - $ onload myapp arg1 arg2
- Open source
  - GPL
  - Very wide range of kernels/distros supported
  - EnerpriseOnload
    - Bundled subscription and 24/7 support

Solarflare OpenOnload® Application Acceleration Middleware

- Just a library and a kernel module
  - **No** application changes
  - **No** recompile
  - **No** kernel patches
  - **No** protocol changes

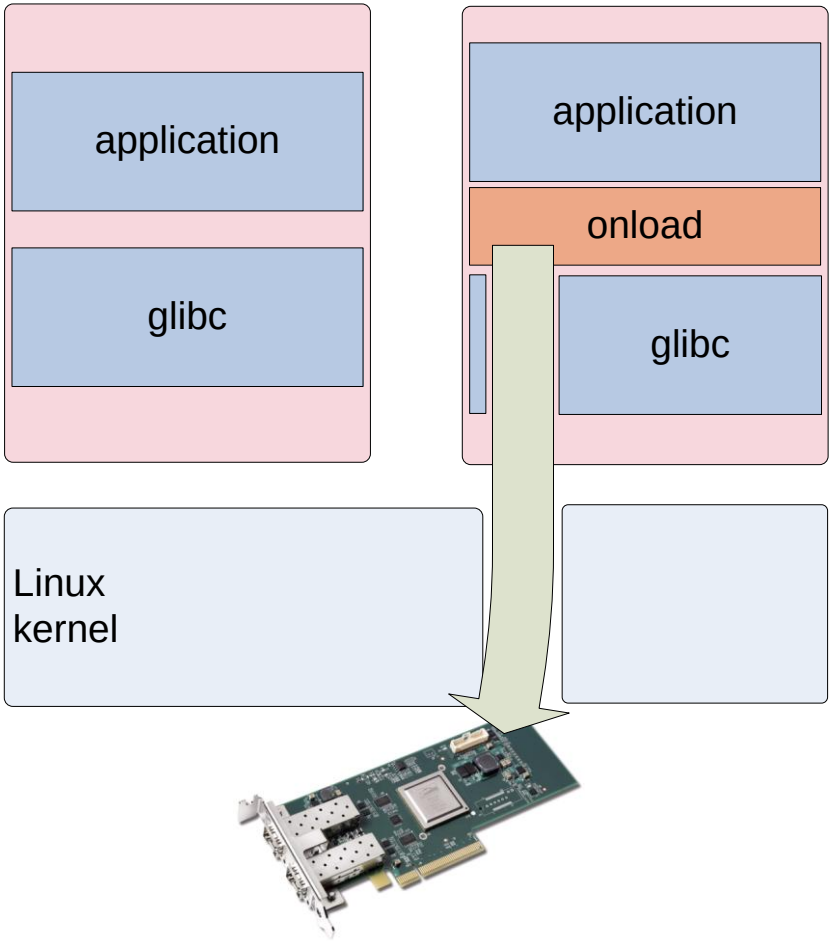
- Picks up existing Linux network configuration
  - IP addresses and route table
  - Bonding (aka teaming)
  - VLANs
  - Multicast (IGMP)
  - Kernel settings, e.g. socket buffer sizes

Solarflare OpenOnload® Application Acceleration Middleware

- Mature technology
  - 8+ years of development
- Goal is to make any application “just work”
  - Occasionally we find apps that do not; this is considered a “bug” in Onload and we fix it.
- ~ 100% coverage of API’s
  - epoll, poll, select
  - socket options
  - fork + exec
  - interop with non-Solarflare interfaces
    (via “hand-over” to kernel stack)

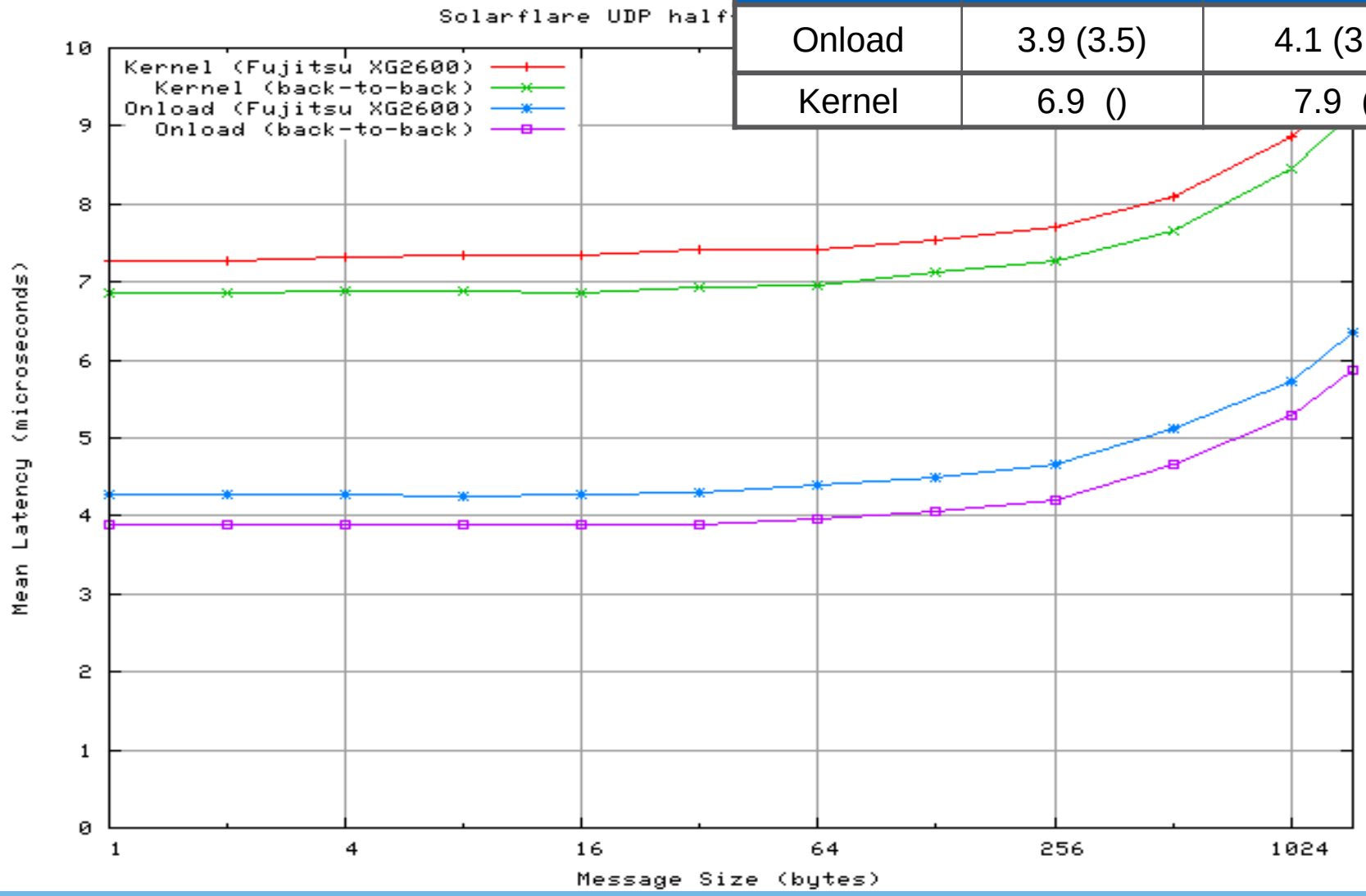
Onload implementation

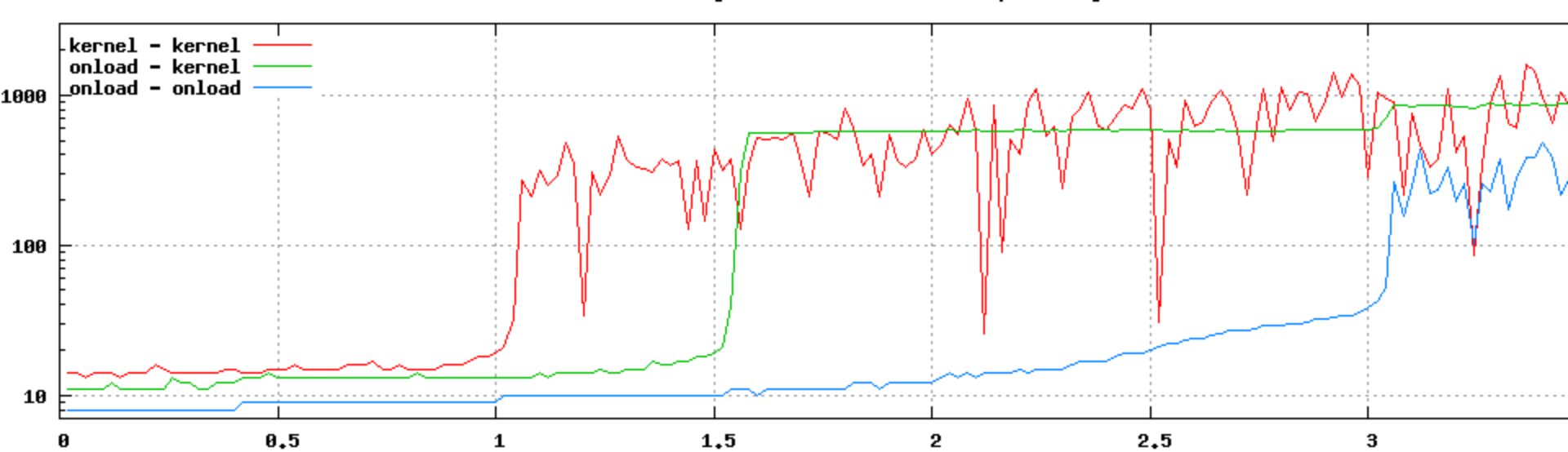
- Uses **`LD_PRELOAD`** to intercept libc calls
  - **socket()**
  - **bind()**
  - **accept()**
  - **recvmsg()**
  - **setsockopt()**
  - **poll(), select(), epoll()**
  - many others…



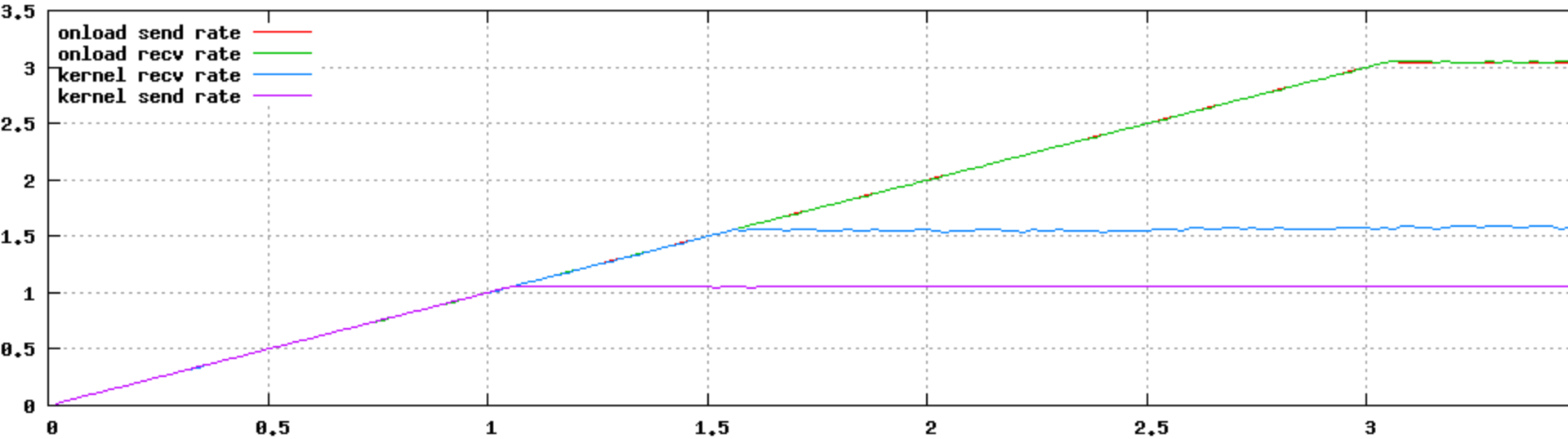
Solarflare for Ultra Low Latency

Latency	UDP (µs)	TCP (µs)
Onload	3.9 (3.5)	4.1 (3.9)
Kernel	6.9 ()	7.9 ()

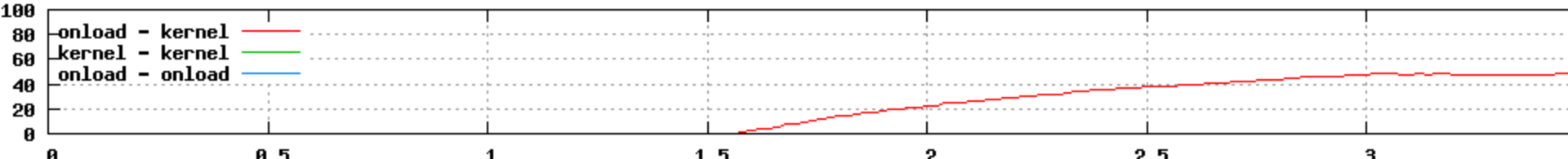




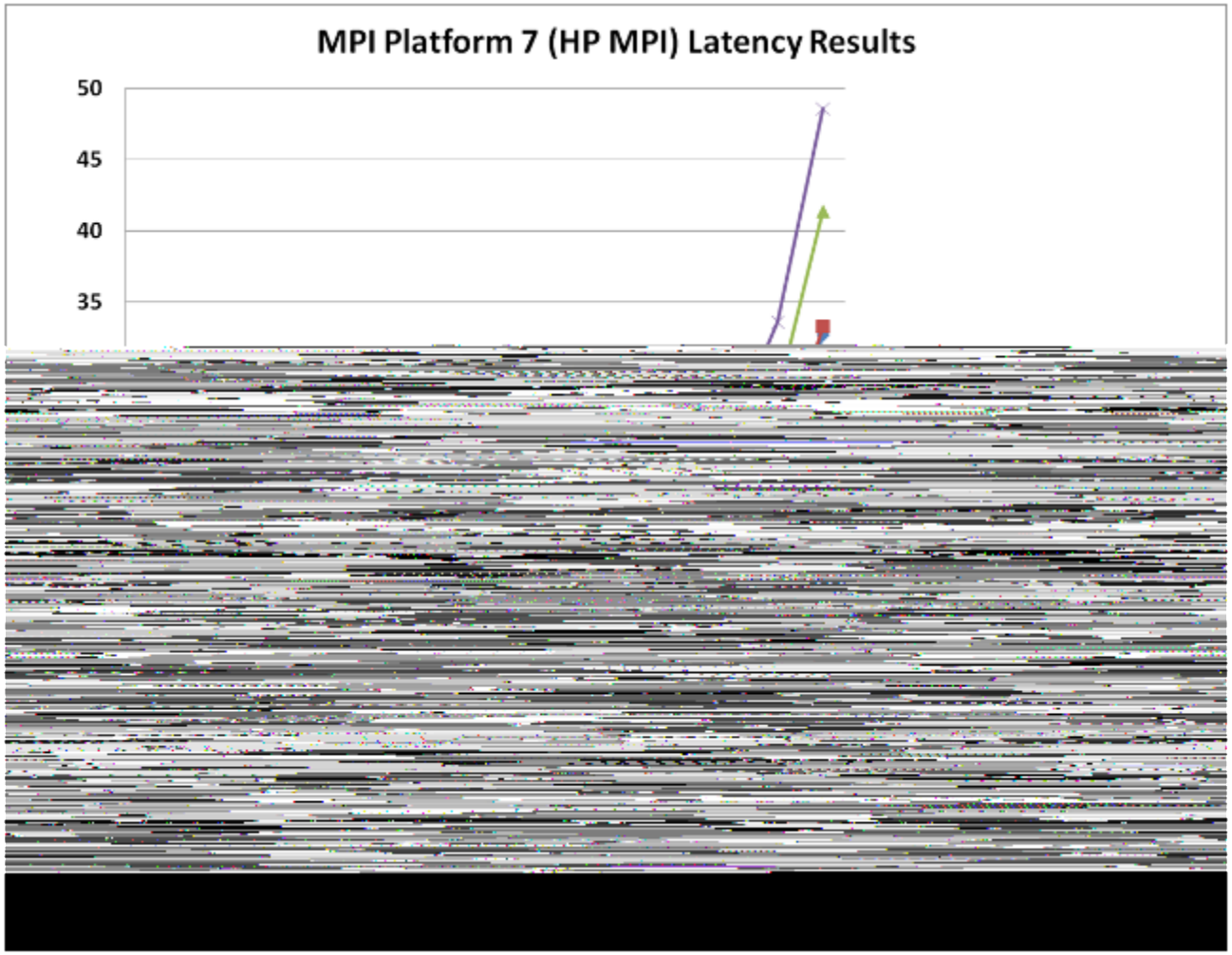
Message rate achieved



Drop rate



Low Latency HPC



2x CPU E5620 @ 2.4GHz 8 Cores, 8, 6GB RAM, Intel 5500 chipset

SFP+, Back-to-back, 1500MTU - RHEL 5.5 x86_64 HPMPI MPI + IMB / Pallas

Summary

- Solarflare: the gold-standard for high performance Ethernet
- Excellent support for: Linux, Windows, Solaris, VMware, BSD,…
  - OpenOnload for even higher performance on Linux
- No “B.S.”
  - Customers achieve the numbers we show in presentations like this!
  - See the “Low Latency Quick Start Guide” at http://download.solarflare.com/