

# XtremeScale™ X2541

**The World's Lowest Latency 100G Ethernet NIC**  
**The Industry's 1st 100G NIC with HW Security**

The X2541 single-port 10/25/40/50/100GbE Ethernet NIC is the most powerful member of the X2 family of XtremeScale products that redefine the price/performance of standard NICs for modern data centers.

Designed from the ground up for virtualized dense server environments, Solarflare XtremeScale X2 adapters are the most cost-effective NICs in the industry for Ethernet connectivity. At the same time, XtremeScale acceleration provides record-breaking low latency and throughput needed for today's modern class of applications. X2 is the most secure standard NIC with integrated hardware firewalls. XtremeScale X2 is the only general-purpose NIC with 2,048 Virtual NICs, programmable packet processing engine for network off-load and real-time packet/flow capture required by your network performance management and analytics platforms.

## Summary of Features and Benefits

**Acceleration Services Allow Distributed Apps to Scale-Out** – The challenge with distributed apps is keeping hardware and system latency low, while scaling to thousands of tasks running across thousands of cores. The X2541 harnesses kernel bypass acceleration technology to deliver superior small packet performance with latency as low as one-half microsecond. Solarflare kernel bypass technologies include Onload™, ScaleOut Onload and DPDK acceleration services provide servers the headroom needed to handle more processes in the same amount of time and/or with less servers.

Solarflare acceleration technology can also be used in to build ultra-low latency NVMe all-flash storage fabrics. X2541 NICs configured for NVMe over standard TCP--and with kernel bypass acceleration--provide the same performance as NVMe fabrics based on special-purpose RDMA fabrics.

**Precision Time Stamping for Accurate Synchronization** - The X2552 supports the precision timing protocol (PTP) fabric service for apps that require synchronized time stamping of packets down to the single-digit nanosecond.

**Protect Traffic “Inside” the Data Center by Deploying the Industry’s 1st Standard NICs with HW Security On-Board** – ServerLock™ technology inside every standard X2541 NIC complements firewall perimeter security. It is now possible to scale security inside your data center by using micro-segmentation to scale packet surveillance, filtering, cloaking and firewalling with every server.

**Real-Time Telemetry Feeds NPM & Analytics** - The X2541 provides real-time monitoring, inspection and capture of packets needed for network performance management, security analytics, or compliance. Packet data can be forwarded to a libpcap API or saved to a file with hardware timestamps.

**A Platform for Micro-Segmented NIC Fabric Services** - For modern data centers, X2541 lays a new foundation for NIC-based network virtualization needed for their highly distributed applications with thousands of inter-connected web server, machine learning and big data workloads. X2541 is the first and only standard NIC platform that can establish ultra-scale connectivity to thousands of virtual NICs, while at the same time providing real-time packet and flow information. The combination of ultra-high bandwidth, ultra-low latency, ultra-scale connectivity and packet telemetry, allows X2541 NICs to serve as the Industry’s first commercial platform for micro-segmented NIC fabric services that scale with each server, VM or container.

**The Most Cost Effective NICs in the Industry** – Solarflare makes data center-wide deployment of these capabilities cost-effective. Although X2541 NICs provide superior performance and the SmartNIC-like ability to enable network services, a 100GbE X2 NIC from Solarflare offers a cost advantage over comparably configured NICs from market share leaders Broadcom, Intel and Mellanox.



## The Solarflare Advantage

- **Lower Cost** – We invite you to compare. The X2541 is flat-out the most cost-effective 100G NIC.
- **Scale Higher** - The only standard 100G NIC with half-microsecond latency, and the ability to segment a single NIC into thousands of vNICs or 8x competitive NICs.
- Together, ultra-low latency and ultra-scale connectivity power a more efficient data center that scales higher with more workloads per server and/or less servers.
- See how the X2541 accelerates [NGINX load balancing by 400%](#), [Redis database caching by 400%](#), and [NGINX web servers by 40%](#).
- **Secure Every Server** - The first and only solution allowing IT organizations to deploy a layer of security on every server using a general-purpose NIC.
- **Network Visibility** - Only standard NICs from Solarflare provide valuable real-time packet and flow data for you to monitor, capture and analyze

## Specifications

### Acceleration

Universal Kernel Bypass

- DPDK Poll Mode Driver - Packet (Cloud, Telco)
- ScaleOut Onload - TCP (Cloud, Telco, Enterprise)
- Onload - TCP/UDP (Fintech)
- TCP Direct - TCP/UDP (Fintech)

MSI-X Support

Interrupt Coalescing

### Security

ServerLock™ Local Hardware Filtering - Monitor, report, analyze, filter and enforce policies

Tamper resistant adapter – Digitally signed firmware and secured private keys

### Time Synchronization and Hardware Timestamping

Hardware timestamping for all packets, sent and received including PTP.

On-board Stratum 3 compliant oscillator

Solarflare Software PTP Daemon delivers enhanced stability and clock synchronization accuracy and can be used to synchronize the adapter clock to external time source.

### Stateless Offloads

- TCP/UDP Checksum Offload (CSO)
- TCP Segmentation Offload (TSO)
- Giant Send Offload (GSO)
- Large Send Offload (LSO)
- Large Receive Offload (LRO)
- Receive Side Scaling (RSS)
- Receive Segment Coalescing (RSC)

### Manageability and Remote Boot

PXE and UEFI

Solarflare Secure Boot

Tamper resistant Secure Firmware Upgrade

NC-SI over MCTP SMBus

PLDM over MCTP SMBus

MCTP PCIe VDM

### Management and Utilities

Ethtool Support

vCenter Plug-in

Solarflare Boot Manager

### Adapter Hardware

PCIe Gen 3.1 x16

100G QSFP28 direct attach copper or optical transceiver

XtremeScale™ SFC9250 Ethernet Controller

### Hardware Certifications

FCC, UL, CE

RoHS - Complies with EU directive 2011/65/EU

### Traffic Engineering

XtremePacket™ Engine for dedicated parsing, filtering, and flow steering

TCP/UDP/IP, MAC, VLAN, RSS filtering

Accelerated Receive Flow Steering (ARFS)

Transmit Packet Steering

### Storage

NVMe-TCP Plug-in for low latency, high performance storage networking on standard Ethernet fabric

### Virtualization

Linux Multiqueue

VMware NetQueue

Microsoft Hyper-V Virtual Machine Queue (VMQ)

SR-IOV: 16 physical functions; 240 virtual functions

2048 Guest OS protected vNICs

Full hardware switch fabric in silicon capable of steering any flow based on Layer 2 to Layer 4 protocols, between physical and virtual interfaces.

VXLAN, NVGRE, and GENEVE tunneling offloads; adaptable to custom overlays.

VLAN and VLAN Q-in-Q Insertion/Stripping

### Ethernet Standards

IEEE802.3-2012 Ethernet Base Standard, including 802.3bx

IEEE 802.3ad, 802.1AX Link Aggregation

IEEE 802.1Q, 802.1P VLAN Tags and Priority

IEEE 1588-2008 PTPv2

Jumbo Frame support (9000 bytes)

### OS Support

Red Hat RHEL, SUSE SLES, Debian, Ubuntu

Windows Server

VMware ESXi

For complete list of supported OS versions visit:

<http://support.solarflare.com>

### Physical Dimensions

L: 16.75 cm (6.6 in)

W: 6.9 cm (2.7 in)

End bracket height: PCI Express standard, 12.0 cm (4.725 in)

PCI Express low-profile: 7.92 cm (3.12 in)

### Environmental Requirements

Temperature:

Operating: 0°C to 55°C (32°F to 131°F)

Storage: -40°C to 65°C (-40°F to 149°F)

Humidity:

Operating: 10% to 80%

Storage: 5% to 90%

### Ordering Information

X2541, X2541-PLUS

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Note: Feature availability is dependent on software release support. Please contact Solarflare support for details.