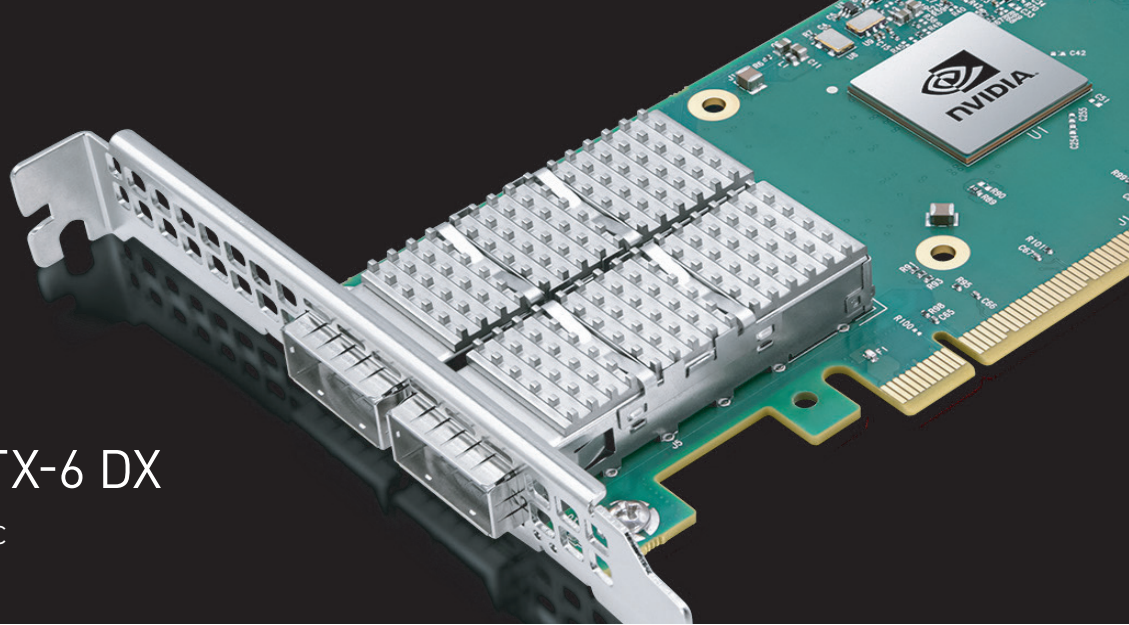# NVIDIA CONNECTX-6 DX

Lenovo Ethernet Smartnic

NVIDIA® ConnectX®-6 Dx SmartNIC is the industry's most secure and advanced cloud network interface card to accelerate mission-critical data-center applications, such as security, virtualization, SDN/NFV, big data, machine learning, and storage. The SmartNIC provides up to two ports of 100Gb/s Ethernet connectivity and delivers the highest return on investment (ROI) of any smart network interface card.

ConnectX-6 Dx is a member of the world-class, award-winning ConnectX series of network adapters powered by leading 50Gb/s (PAM4) and 25/10Gb/s (NRZ) SerDes technology and novel capabilities that accelerate cloud and data-center payloads.

Security From Zero Trust To Hero Trust

In an era where privacy of information is key and zero trust is the rule, ConnectX-6 Dx adapters offer a range of advanced built-in capabilities that bring security down to the endpoints with unprecedented performance and scalability, including:

> Probes & DoS Attack Protection – ConnectX-6 Dx enables a hardware-based L4 firewall by offloading stateful connection tracking through NVIDIA ASAP² - Accelerated Switch and Packet Processing®.

> NIC Security – Hardware Root-of-Trust (RoT) Secure Boot and secure firmware update using RSA cryptography, and cloning-protection, via a device-unique secret key.

Advanced Virtualization

ConnectX-6 Dx delivers another level of innovation to enable building highly efficient virtualized cloud data centers:

> Virtualization – ASAP² technology for vSwitch/vRouter hardware offload delivers orders of magnitude higher performance vs. software-based solutions. ConnectX-6 Dx ASAP² offers both SR-IOV and VirtIO in-hardware offload capabilities, and supports up to 8 million rules.

> Advanced Quality of Service – Includes traffic shaping and classification-based data policing.
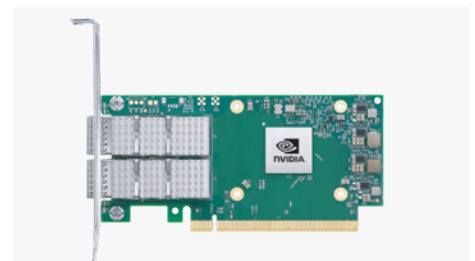
SMARTNIC PORTFOLIO

> 1/10/25/40/50/100Gb/s Ethernet, PAM4/NRZ
> PCIe low-profile form factor
> QSFP56 connectors
> PCIe Gen 3.0/4.0 x16 host interface

KEY FEATURES

> Up to 100Gb/s bandwidth
> Message rate of up to 215 Mpps
> Sub 0.8 usec latency
> Flexible programmable pipeline for new network flows
> ASAP² - Accelerated Switching and Packet Processing for virtual switches/routers
> Overlay tunneling technologies
> Hardware Root-of-Trust and secure firmware update
> Connection Tracking offload
> Advanced RoCE capabilities
> Best in class PTP for TSN applications
> GPUDirect® for GPU-to-GPU communication
> Host chaining technology for economical rack design
> Platform agnostic: x86, Power, Arm
> ODCC compatible

Industry-leading RoCE

Following the ConnectX tradition of industry-leading RoCE capabilities, ConnectX-6 Dx adds another layer of innovation to enable more scalable, resilient and easy-to-deploy RoCE solutions.

> Zero Touch RoCE – Simplifying RoCE deployments, ConnectX-6 Dx allows RoCE payloads to run seamlessly on existing networks without requiring special configuration on the network (no PFC, no ECN). New features in ConnectX-6 Dx ensure resiliency and efficiency at scale of such deployments.

> Configurable Congestion Control – API to build user-defined congestion control algorithms, best serving various environments and RoCE and TCP/IP traffic patterns.

Best in Class PTP for Time Sensitive Applications

NVIDIA offers a full IEEE 1588v2 PTP software solution as well as time sensitive related features called 5T45G. PTP and 5T45G software solutions are designed to meet the most demanding PTP profiles. ConnectX-6 Dx incorporates an integrated Hardware Clock (PHC) that allows the device to achieve sub-20 nsec accuracy while offering various timing related functions, including time-triggered scheduling or time-based SND accelerations (time based ASAP²). Furthermore, 5T45G technology enables software applications to transmit front-haul (ORAN) compatible in high bandwidth. The PTP solution supports slave clock, master clock, and boundary clock.

Efficient Storage Solutions

With its NVMe-oF target and initiator offloads, ConnectX-6 Dx brings further optimization to NVMe-oF, enhancing CPU utilization and scalability. Additionally, ConnectX-6 Dx supports hardware offload for ingress/egress of T10-DIF/PI/CRC32/CRC64 signatures.

Ordering Information

Max Network Speed	Interface Type	Supported Ethernet Speeds [GbE]	Host Interface [PCIe]	NVIDIA OPN	Lenovo OPN
2 x 100 GbE	QSFP56	1/10/25/40/50/100	Gen 4.0 x16	MCX623106AS-CDAT	4XC7A08248

Features*

Network Interface
> 2 x 25/50/100GbE

Host Interface
> PCIe Gen 4.0, 3.0, 2.0, 1.1
> 16.0, 8.0, 5.0, 2.5GT/s link rate
> 16 lanes of PCIe
> MSI/MSI-X mechanisms
> Advanced PCIe capabilities

Virtualization/Cloud Native
> Single Root IOV (SR-IOV) and VirtIO acceleration
  > Up to 1 K VFs per port
  > 8 PFs
> Support for tunneling
  > Encap/decap of VXLAN, NVGRE, Geneve, and more
  > Stateless offloads for Overlay tunnels

ASAP²
> SDN acceleration for:
  > Bare metal
  > Virtualization
  > Containers
> Full hardware offload for OVS data plane
> Flow update through RTE_Flow or TC_Flower
> OpenStack support
> Kubernetes support
> Rich classification engine (L2 to L4)
> Flex-Parser: user defined classification
> Hardware offload for:
  > Connection tracking (L4 firewall)
  > NAT
  > Header rewrite
  > Mirroring
  > Sampling
  > Flow aging
  > Hierarchial QoS
  > Flow-based statistics

Platform Security
> Hardware root-of-trust
> Secure firmware update

Stateless Offloads
> TCP/UDP/IP stateless offload
> LSO, LRO, checksum offload
> Receive side scaling (RSS) also on encapsulated packet
> Transmit side scaling (TSS)
> VLAN and MPLS tag insertion/stripping
> Receive flow steering

Advanced Timing and Synchronization
> Advanced PTP
  > IEEE 1588v2 (any profile)
  > PTP hardware clock (PHC) (UTC format)
  > 16 nsec accuracy
  > Line rate hardware timestamp (UTC format)
> Time triggered scheduling
> PTP based packet pacing
> Time based SDN acceleration (ASAP²)
> Time sensitive networking (TSN)

Storage Accelerations
> NVMe over Fabric offloads for target
> Storage protocols: iSER, NFSoRDMA, SMB Direct, NVMe-oF, and more
> T-10 Dif/Signature Handover

RDMA over Converged Ethernet (RoCE)
> RoCE v1/v2
> Zero Touch RoCE: no ECN, no PFC
> RoCE over overlay networks
> Selective repeat
> Programmable congestion control interface
> GPUDirect®
> Burst buffer offload

Management and Control
> PLDM for Monitor and Control DSP0248
> PLDM for Firmware Update DSP026
> I²C interface for device control and configuration

Remote Boot
> Remote boot over Ethernet
> Remote boot over iSCSI
> UEFI support for x86 and Arm servers
> PXE boot

Standards
> IEEE 802.3cd, 50, 100 and 200GB Ethernet
> IEEE 802.3bj, 802.3bm 100GB Ethernet
> IEEE 802.3by, 25, 50GB Ethernet supporting all FEC modes
> IEEE 802.3ba 40GB Ethernet
> IEEE 802.3ae 10GB Ethernet
> IEEE 802.3az Energy Efficient Ethernet (supports only "Fast-Wake" mode)
> IEEE 802.3ap based auto-negotiation and KR startup
> IEEE 802.3ad, 802.1AX Link Aggregation
> IEEE 802.1Q, 802.1P VLAN tags and priority
> IEEE 802.1Qaz (ETS)
> IEEE 802.1Qbb (PFC)
> IEEE 802.1Qbg
> 25/50 Ethernet Consortium "Low Latency FEC" for 50GE/100GE/200GE PAM4 links
> PCI Express Gen 3.0 and 4.0

* This section describes hardware features and capabilities. Please refer to the driver and firmware release notes for feature availability.

Learn More

Learn more about the **NVIDIA ConnextX-6 Dx** at **www.pny.eu**