NVIDIA® Mellanox® ConnectX®-6 Dx SmartNIC IC is the industry’s most intelligent and secure cloud Ethernet network adapter (NIC) ASIC, accelerating mission-critical cloud applications, such as security, virtualization, SDN/NFV, big data, machine learning, and storage, and delivering the highest return on investment (ROI).

ConnectX-6 Dx is a member of the award-winning ConnectX series of network adapters whose novel capabilities accelerate cloud and data-center payloads with unprecedented world-class performance and resiliency. ConnectX-6 Dx adapters are equipped with either dual ports of 10/25/40/50/100 GbE or a single port of 200 GbE, delivering sub-800 ns latency and up to 215 million messages per second.

ADVANCED VIRTUALIZATION

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

- Virtualization – Mellanox ASAP² - Accelerated Switch and Packet Processing® 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.

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 Attacks Protection – ConnectX-6 Dx enables a hardware-based L4 firewall by ASAP² offloading of stateful connection tracking.

Features & Applications

- 10/25/40/50/100/200 Gb/s Ethernet, PAM4/NRZ
- Up to 200 Gb/s bandwidth
- Message rate of up to 215 Mpps
- Sub 0.8 usec latency
- Mellanox Multi-Host with advanced QoS
- ASAP² - Accelerated Switching and Packet Processing for virtual switches/routers
- Supports a variety of overlay tunnels
- Network service chaining acceleration for SDN and NFV
- Stateful rule checking for connection tracking
- IPsec and TLS in-line crypto acceleration
- Block crypto acceleration for data-at-rest
- Hardware Root-of-Trust and secure firmware update
- Advanced RoCE capabilities
- Best in class PTP for TSN applications
- Host chaining technology for economical rack design
- Platform agnostic: x86, Power, Arm
INDUSTRY-LEADING ROCE

Following the Mellanox 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.

MACHINE LEARNING AND BIG DATA

Machine learning applications are based on training a deep neural network, which requires complex computations and fast and efficient data delivery. Mellanox solutions enable smart offloading such as RDMA, GPUDirect® and more advanced capabilities that dramatically improve neural network training performance and overall machine learning applications. GPUDirect was developed to dramatically improve GPU-to-GPU communication, reducing latency and increasing performance and CPU utilization.

EFFICIENT STORAGE SOLUTIONS

The evolving NVMe over Fabric (NVMe-oF) protocol leverages RDMA connectivity to remotely access NVMe storage devices efficiently, while keeping the end-to-end NVMe model at lowest latency. With its NVMe-oF target and initiator offloads, ConnectX-6 Dx brings further optimization to NVMe-oF, enhancing CPU utilization and scalability. ConnectX-6 Dx supports hardware offload for ingress/egress of T10-DIF/Pi/CRC32/CRC64 signatures. Additionally, ConnectX-6 Dx enables Host Chaining, an innovative storage rack design by which different servers can be connected without a switch.
FEATURES*

Network Interface
> 2 x 25/50/100 GbE; 1 x 200 GbE

Host Interface
> PCIe Gen 4.0, 3.0, 2.0, 1.1
> 16, 8, 8, 5, 2.5 GT/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

Mellanox ASAP2
> SDN acceleration for:
  > Bare metal
  > Virtualization
  > Containers
> Full hardware offload for OVS data plane
> Flow update through RTE_Flow or TC_Flow
> 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
  > Hierarchal QoS
  > Flow-based statistics

Cyber Security
> Inline hardware IPsec encryption and decryption
> AES-GCM 128/256 bit key
> IPsec over RoCE
> Inline hardware TLS encryption and decryption
> AES-GCM 128/256 bit key
> Data-at-rest AES-XTS encryption and decryption
> AES-GCM 128/256 bit key
> 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 & Synchronization
> Advanced PTP
  > IEEE 1588v2 (any profile)
  > PTP Hardware Clock (PHC) (UTC format)
  > 16 nsec accuracy
  > Line rate hardware timestamp (UTC format)
  > PPS In and configurable PPS Out
  > 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 Di/Signature Handover

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

Management and Control
> NC-SI, MCTP over SMBus and MCTP over PCIe - Baseboard Management Controller interface
> PLDM for Monitor and Control DSP0248
> PLDM for Firmware Update DSP026
> i²C interface for device control and configuration
> General Purpose I/O pins
> SPI interface to flash
> JTAG IEEE 1149.1 and IEEE 1149.6

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

* This section describes hardware features and capabilities. Please refer to the driver and firmware release notes for feature availability.
IEEE 802.3bs, 200 Gb/s
IEEE 802.3cd, 50, 100 and 200 Gb/s
IEEE 802.3bj, 802.3bm 100 Gb/s
IEEE 802.3by, 25, 50 Gb/s supporting all FEC modes
IEEE 802.3ba 40 Gigabit Ethernet
IEEE 802.3ae 10 Gigabit Ethernet
IEEE 802.3az Energy Efficient Ethernet (supports only "Fast-Wake" model)
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
25G/50G Ethernet Consortium "Low Latency FEC" for 50/100/200GE PAM4 links
PCI Express Gen 3.0 and 4.0

**STANDARDS**

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>IC Network Interface</th>
<th>PCI Express Interface</th>
<th>Additional Features Supported</th>
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</thead>
<tbody>
<tr>
<td>2 x 50GbE</td>
<td>PCIe 3.0/4.0 x16</td>
<td>-</td>
<td>MT28928A0-NCCF-GE</td>
</tr>
<tr>
<td>2 x 100GbE</td>
<td>PCIe 3.0/4.0 x16</td>
<td>Crypto enabled</td>
<td>MT28928A0-CCCF-CE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mellanox Multi-Host</td>
<td>MT28928A0-NCCF-CEM</td>
</tr>
<tr>
<td>1 x 200GbE</td>
<td>PCIe 3.0/4.0 x16</td>
<td>Crypto enabled, Mellanox Multi-Host or Socket Direct</td>
<td>MT28928A0-CCCF-CEM</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crypto enabled</td>
<td>MT28924A0-CCCF-VE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mellanox Multi-Host</td>
<td>MT28924A0-NCCF-VE</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Crypto enabled, Mellanox Multi-Host or Socket Direct</td>
<td>MT28924A0-CCCF-VE</td>
</tr>
</tbody>
</table>

Only Crypto enabled devices can perform IPSec/TLS/AES_XTS encryption and decryption offload. All ConnectX-6 Dx IC devices support optional secure boot; contact Mellanox support for information on secure boot enablement and provisioning processes.

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

Learn more at [www.mellanox.com/products/ethernet-adapter-ic/connectx-6-dx-ic](http://www.mellanox.com/products/ethernet-adapter-ic/connectx-6-dx-ic)

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