



# BlueField<sup>®</sup>-2 SmartNIC for Ethernet

## High Performance Smart Network Controller Card

Mellanox BlueField-2 SmartNIC delivers advanced functionality, unmatched performance and agility for today's most demanding workloads.

Combining the industry leading ConnectX-6 Dx network adapter with an array of Arm<sup>®</sup> cores, BlueField-2 delivers a perfect blend of hardware and software accelerations.

BlueField-2 brings agile and high performance solutions for security, machine learning, cloud, edge computing and storage applications while reducing total cost of ownership.

BlueField-2 SmartNIC features the second generation BlueField-2 I/O Processing Unit (IPU) – an innovative and high-performance programmable networking engine. The IPU integrates an array of eight powerful 64-bit Armv8 A72 cores interconnected by a coherent mesh with a DDR4 memory controller and a dual-port Ethernet network controller.

BlueField-2 SmartNIC supports dual QSFP56 ports at link speeds of 10/25/40/50/100 GbE or a single port of 200GbE, a 1GbE out-of-band management port for the Arm subsystem, and includes an integrated 16-lane PCIe Gen 3.0/4.0 switch.

BlueField-2 SmartNIC complete portfolio includes a variety of form factors including HHHL (half height, half length), FHHL (full height, half length), and Open Compute Project Spec 3.0 (OCP 3.0 Small Form Factor).

At the heart of BlueField-2 SmartNIC is the industry-leading ConnectX-6 Dx network adapter with unprecedented built-in hardware functionality, performance and resiliency. BlueField-2 hardware accelerations include advanced RDMA/RoCE capabilities as well as innovative cryptography, storage and networking accelerations. Relying on these built-in offloads, the BlueField-2 powerful array of Arm cores can be programmed for sophisticated custom accelerations and control path manipulations. BlueField-2 also benefits from the rich Arm ecosystem to deliver complete solutions to cloud operators and service providers.

### Turning Zero Trust To Hero Trust

BlueField-2 SmartNIC delivers isolation, security and cryptography accelerations, enabling data center security at the endpoint with best-in-class performance, turning zero-trust to hero-trust.

**Secure Hardware** – BlueField-2 SmartNIC hardware leverages Root-of-Trust secured boot and Arm TrustZone technology to ensure integrity of the firmware and hardware. Using hardware keys and a trusted execution environment, BlueField-2 can serve as the keys' safe box, providing anti-cloning and zero-trust access solutions.

### KEY APPLICATIONS

- Virtualized and bare metal cloud services
- NVMe storage virtualization
- Network Function Virtualization (NFV) applications
- Security applications such as DDoS and Deep Packet Inspection (DPI)
- Microservers built for Edge-computing

### PORTFOLIO

- Dual ports of 10/25/50/100 GbE or a single port of 200GbE
- 8GB/16GB on-board DDR4 memory
- Various form factors: HHHL, FHHL and OCP 3.0

### KEY FEATURES

- Best-in-class hardware offloads with Arm processing power, including:
  - ASAP<sup>2</sup> switching and packet processing
  - NVMe SNAP<sup>™</sup> storage emulation
  - IPsec/TLS data-in-motion
  - AES-XTS data-at-rest
  - Regular expression (RegEx) and DPI accelerations
  - SHA 256-bit hardware acceleration
- Hardware Root of Trust (RoT)
- 1GbE out-of-band management port

**Isolation** – BlueField-2 SmartNIC functions as a “computer-in-front-of-a-computer,” unlocking unlimited opportunities for custom security applications on its Arm processors, fully isolated from the host’s CPU. In the event of a compromised host, BlueField-2 may detect/block malicious activities in real time and at wire speed to prevent the attack from spreading further.

**Cryptography Accelerations** – From IPsec and TLS data-in-motion inline encryption to AES-XTS block-level data-at-rest encryption and public key acceleration, BlueField-2 SmartNIC hardware-based accelerations offload the crypto operations and free up the CPU, reducing latency and enabling scalable crypto solutions. BlueField-2 “host-unaware” solutions may transmit and receive data, while BlueField-2 acts as a bump-in-the-wire for crypto.

**Securing Workloads** – BlueField-2 SmartNIC accelerates connection tracking with its ASAP<sup>2</sup> technology to enable stateful filtering on a per connection basis. Moreover, BlueField-2 includes a Titan IC regular expression (RXP) acceleration engine supported by IDS/IPS tools to detect host introspection and Application Recognition (AR) in real time.

## Efficient and High-Performance Cloud Deployments

**Virtualized Cloud** – By leveraging BlueField-2 SmartNIC virtualization offloads, data center administrators can benefit from better server utilization, allowing more virtual machines and more tenants on the same hardware, while reducing the TCO and power consumption.

BlueField-2 SmartNIC virtualization accelerations include:

- Mellanox ASAP<sup>2</sup> for Open vSwitch (OVS) with flexible, highly-efficient virtual switching and routing capabilities. OVS accelerations can be further customized using BlueField-2 Arm processing power to offload the control path.
- Network overlay technology (VXLAN, NVGRE, Geneve) offloads, including encapsulation and decapsulation, over tunneled protocols and Network Address Translation (NAT) routing capabilities.

**Bare Metal Deployments** – BlueField-2 SmartNIC in bare metal deployments presents several distinct advantages. For instance, it enables cloud providers to provision servers while retaining the ability to control them and deploy policy rules in an isolated and secured manner, totally transparent to the tenant.

**More Smarts in the Edge** – The BlueField-2 SmartNIC broad set of capabilities delivered in a compact design is perfectly positioned for delivering microserver applications at the edge of the network.

## Virtualize Your Storage with NVMe SNAP™

Mellanox NVMe SNAP logically presents networked storage as a local NVMe drive on the PCIe bus to host software, thus bringing virtualized storage to bare metal clouds, making composable storage simple, while promoting CAPEX and OPEX savings. It enables the efficient disaggregation of compute and storage to allow fully optimized resource utilization.

## Software Environment

BlueField-2 SmartNIC can be shipped with Ubuntu – a Linux commercial operating system – which includes the Mellanox OFED stack, and is capable of running all customer-based Linux applications seamlessly.

BlueField-2 SmartNIC also supports CentOS and has an out-of-band 1GbE management interface.

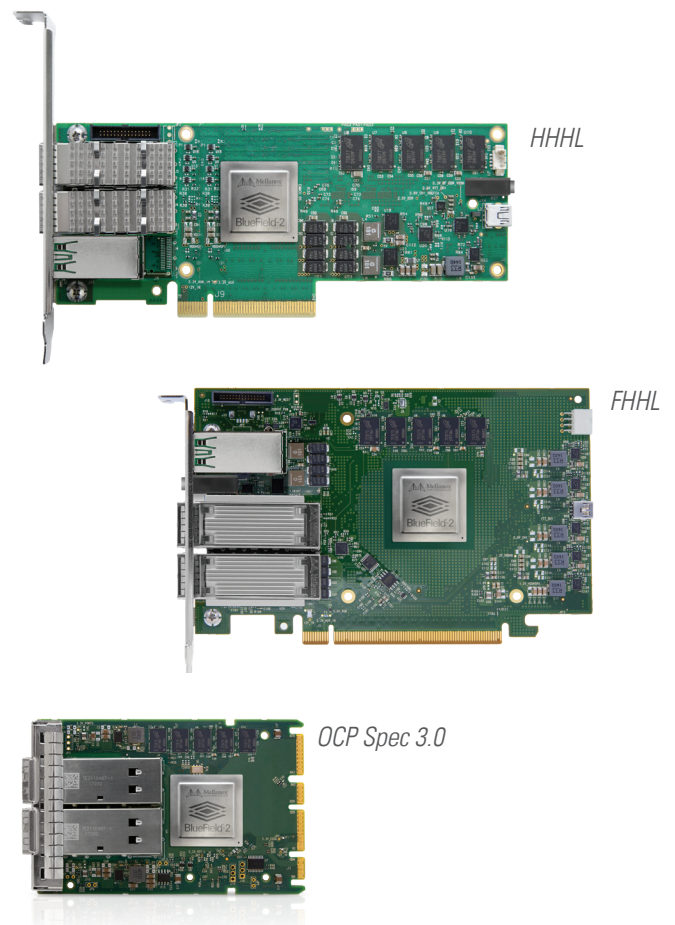


Figure 1: BlueField-2 SmartNIC is available in several form factors †

## Features

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

### NETWORK AND HOST INTERFACES

#### Network Interfaces

- Dual ports of 10/25/40/50/100 GbE, or
- Single port of 200GbE

#### PCI Express Interface

- 8 or 16 lanes of PCIe Gen 3.0/4.0
- PCIe switch with up to 8 downstream ports
- Support for MSI/MSI-X

### ARM/DDR SUBSYSTEM

#### Arm Cores

- Up to 8 Armv8 A72 cores (64-bit) pipeline
- Arm NEON™ 128b SIMD execution unit
- Arm VFPv4 single and double precision floating point acceleration (IEEE 754)
- Cache coherent mesh interconnect
- Each 2 Arm cores share 1MB L2 cache
- 6 MB L3 cache with plurality of eviction policies

#### DDR4 DIMM Support

- Single DDR4 DRAM controller
- 8GB/16GB on-board DDR4
- ECC error protection support

### HARDWARE ACCELERATIONS

#### Security

- IPsec/TLS data-in-motion encryption
  - AES-GCM 128/256 bit key
- AES-XTS 256/512 bit data-at-rest encryption
- SHA 256 bit hardware acceleration
- Regular expression (RegEx) acceleration
- Arm A64, A32 & T32 cryptography instructions for:
  - AES, SHA-1, SHA-224, and SHA-256
  - Finite field arithmetic
- Hardware Public Key Accelerator
  - RSA, Diffie-Hellman, DSA, ECC, EC-DSA, EC-DH

- True Random Number Generator (TRNG)
- Hardware Root of Trust
  - Cerberus compliant

#### Storage

- Mellanox NVMe SNAP™
- NVMe over Fabric offloads

#### RDMA/RoCE

- Zero-touch RoCE configuration
- Selective repeat
- Collective / vector collective operations
- GPUDirect®
- Enhanced atomic operations
- 16 million I/O channels

#### TCP/IP Transport

- Stateless offloads for:
  - TCP/UDP/IP
  - LSO/LRO/Checksum/RSS/TSS/HDS
  - VLAN insertion/stripping

#### Hardware-based I/O Virtualization

- SR-IOV
  - Up to 1K Virtual Functions
  - Up to 56 Physical Functions per host
- VirtIO
- Multi-function per port
- VMware NetQueue support
- Virtualization hierarchies
- Virtualizing physical functions on a physical port
- 1K ingress and egress QoS levels
- Guaranteed QoS for VMs

#### Overlay Networks

- Hardware offload of encapsulation and decapsulation of NVGRE, VXLAN and GENEVE
- Header rewrite (NAT)

### BOOT OPTIONS

- Secure boot (RSA authenticated)
- Remote boot over Ethernet
- Remote boot over iSCSI
- PXE and UEFI

### SOFTWARE

#### Software Development Toolchain

- Native and cross-compile GNU toolchain
- Compatible with Arm DS-5 and other commercial development and profiling tools

#### Software Support

- CentOS
- Ubuntu Commercial Linux Distribution
- Yocto-based Linux Distribution
- OpenFabrics Enterprise Distribution (OFED)
- Arm-optimized versions of all Mellanox drivers and software stack
- IDS/IPS tools such as Snort and Suricata
- Optimized Arm DPDK and ConnectX PMD

Table 1 - Part Numbers and Feature Set Breakdown

OPN	Max. Speed	No. of Ports	PCIe Support	Cores Speed	Crypto*	DDR Memory	1GbE OOB	Form Factor
MBF2M322A-AENOT	25GbE	2x SFP56	Gen 3.0/4.0 x8	2.0GHz	Crypto disabled	8GB on-board	Yes	HHHL Tall Bracket
MBF2M322A-AEEOT					Crypto enabled			
MBF2M332A-AENOT	25GbE	2x SFP56	Gen 3.0/4.0 x8	2.0GHz	Crypto disabled	16GB on-board	Yes	
MBF2M332A-AEEOT					Crypto enabled			
MBF2H322A-AENOT	25GbE	2x SFP56	Gen 3.0/4.0 x8	2.5GHz	Crypto disabled	8GB on-board	Yes	
MBF2H322A-AEEOT					Crypto enabled			
MBF2H332A-AENOT	25GbE	2x SFP56	Gen 3.0/4.0 x8	2.5GHz	Crypto disabled	16GB on-board	Yes	
MBF2H332A-AEEOT					Crypto enabled			
MBF2M912A-AENAB	25GbE	2x SFP56	Gen 3.0 x16	2.0GHz	Crypto disabled	8GB on-board	No	OCP Spec 3.0
MBF2M912A-AEEAB					Crypto enabled			
MBF2M922A-AENAB	25GbE	2x SFP56	Gen 3.0 x16	2.0GHz	Crypto disabled	16GB on-board	No	
MBF2M922A-AEEAB					Crypto enabled			
MBF2H526A-CENOT	100GbE	2x QSFP56	Gen 4.0 x16	2.5GHz	Crypto disabled	8GB on-board	Yes	FHHL Tall Bracket
MBF2H526A-CEEOT					Crypto enabled			
MBF2H516A-CENOT	100GbE	2x QSFP56	Gen 4.0 x16	2.5GHz	Crypto disabled	16GB on-board	Yes	
MBF2H516A-CEEOT					Crypto enabled			
MBF2M526A-CENOT	100GbE	2x QSFP56	Gen 4.0 x16	2.0GHz	Crypto disabled	8GB on-board	Yes	
MBF2M526A-CEEOT					Crypto enabled			
MBF2M516A-CENOT	100GbE	2x QSFP56	Gen 4.0 x16	2.0GHz	Crypto disabled	16GB on-board	Yes	
MBF2M516A-CEEOT					Crypto enabled			

Note: \* Hardware Root of Trust (RoT) or secure boot is not supported on these models, please contact Mellanox for additional information.

Table 2 - Licenses Sold Separately

OPN	Description
BF1-NVMESNAP-BNS-1	One perpetual license to use NVMe SNAP on one adapter of BlueField-2. Includes Mellanox Technical Support and Warranty – Silver, 1 Year.
Contact Mellanox	One perpetual license to use RegEx acceleration on one adapter of BlueField-2. Includes Mellanox Technical Support and Warranty – Silver, 1 Year.

**Support**

For information about Mellanox support packages, please contact your Mellanox Technologies sales representative or visit our [Support Index page](#).