



Mellanox BlueField™ SmartNIC

High Performance Ethernet Network Adapter

Combining Arm® processing power with advanced network offloads to accelerate a multitude of security, networking and storage applications, and delivering world-leading performance, flexibility and efficiency

BlueField SmartNIC features the BlueField system-on-chip (SoC) — an innovative and high-performance programmable networking engine. Providing unmatched scalability and efficiency, the dual-port BlueField SmartNIC is the ideal adapter to accelerate the most demanding workloads in data center, cloud, service provider and storage environments. BlueField SmartNICs come in different speeds, numbers of CPU cores and PCIe widths—from dual-port 25GbE PCIe Gen4.0 x8 to dual-port 100GbE PCIe Gen4.0 x16, supporting 4/8/16 Arm cores.

POWERFUL & SMART NETWORK ADAPTER

BlueField SmartNIC adapters accelerate a wide range of applications through flexible data and control plane offloading. Enabling a more efficient use of compute resources, BlueField adapters empower the CPU to focus on running applications rather than on networking or security processing. Additionally, as software-defined adapters, BlueField SmartNICs ensure the ultimate flexibility by adapting to future protocols and features through a simple software update.

BLUEFIELD SYSTEM-ON-CHIP

BlueField is a Mellanox family of advanced SoC solutions that integrates a coherent mesh of 64-bit Armv8 A72 cores, a ConnectX network adapter front-end and a PCI Express switch into a single chip.

The powerful SoC architecture includes an Armv8 multicore processor array and enables customers to develop sophisticated applications and highly differentiated feature sets. BlueField leverages the rich Arm software ecosystem and introduces the ability to offload the x86 software stack.

At the heart of BlueField is the ConnectX-5 network controller with RDMA and RDMA over Converged Ethernet (RoCE) offload technology, which delivers cutting-edge performance for networking and storage applications such as NVMe over Fabrics. Advanced features include an embedded virtual switch with programmable access lists (ACLs), transport offloads and stateless protocols.

HIGHLIGHTS

- Intelligent programmable network adapter
 - Best-in-class hardware offloads with Arm processing power
 - Accelerated wide range of security, networking, storage and other workloads
 - Dedicated hardware offload for NVMe-over-Fabric (NVMe-oF)
 - Dual-port 25GbE PCIe Gen4.0 x8
 - Dual-port 100GbE PCIe Gen4.0 x16
 - 4/8/16 Arm A72 cores
 - 4GB/8GB/16GB on-board DDR4 memory
 - Different Form Factors - HHHH, FHHL and FH3/4L
 - Standard embedded Linux software stack

SECURITY APPLICATIONS

BlueField SmartNIC addresses the concerns of modern data centers by combining hardware encryption accelerators with embedded software and fully integrated advanced network capabilities, making it an ideal platform for developing proprietary security applications.

It enables a distributed security architecture by isolating and protecting each individual workload and providing flexible control and visibility at the server and workload level, controlling risk at the server access layer. BlueField builds security into the DNA of the data center and enables prevention, detection and response to potential threats in real time.

BlueField SmartNIC is capable of delivering powerful functionality, including encryption of data-in-motion, bare metal provisioning, stateful L4 firewall and more.

NETWORKING APPLICATIONS

BlueField SmartNIC offers a wide range of dedicated offloads to maximize virtualization scalability and efficiency. Data center administrators can benefit from better server utilization, allowing more virtual machines and more tenants on the same hardware, while reducing the TCO, power, and cable complexity.

Among its accelerations:

- Mellanox ASAP²-Accelerated Switching and Packet Processing™ for Open vSwitch (OVS) delivers flexible, highly efficient virtual switching and routing capabilities. OVS accelerations can be further enhanced using BlueField processing and memory. For example, the scale of OVS actions can be increased by utilizing BlueField internal memory, and more OVS actions and vSwitch/vRouter implementations can be supported.
- Network overlay technology (VXLAN, NVGRE, Geneve) offload, including encapsulation and decapsulation, allows the traditional offloads to operate on the tunneled protocols and also offload Network Address Translation (NAT) routing capabilities.

STORAGE APPLICATIONS

BlueField SmartNIC may operate as a co-processor offloading specific storage tasks from the host, isolating part of the storage media from the host, or enabling abstraction of software-defined storage logic, using both a BlueField-dedicated hardware offload for NVMe-over-Fabric and Arm cores.

On the storage initiator side, BlueField SmartNIC can prove an efficient solution for hyperconverged systems to enable the host CPU to focus on compute while all the storage interface is handled through the Arm cores.

Decoupling of the storage tasks from the compute tasks also simplifies the software model, enabling the deployment of multiple OS virtual machines while the storage application is handled solely by the Arm Linux subsystem.

SOFTWARE SUPPORT

BlueField SmartNIC is shipped with Mellanox BlueOS™ and a PXE driver pre-installed. BlueOS is a Linux reference distribution, which includes the Mellanox OFED stack, and is capable of running all customer-based Linux applications seamlessly. Note that BlueOS itself is based on the Yocto Project Poky distribution.

The BlueField adapter execution environment is fully isolated from the x86 server and network environment, and can run the Open vSwitch Database (OVSDB) or other virtual switches to create a secure solution for bare metal provisioning.

The software package also includes support for DPDK, and applications for encryption and a stateful L4-based firewall.



FEATURES

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

Network Interfaces

- Dual-port SFP28 or two QSFP28 Ethernet ports
- Integrated PHYs seamlessly connect to all standard copper and fiber media

PCIe Interface

- x16/x8 PCIe Gen 3.0/4.0
- Fall-back to 4, 2, or 1 lane

Powerful Arm Processor Cores

- Armv8 A72 cores (64-bit)
- Superscalar, variable-length, out-of-order pipeline
- Each core supports NEON™ 128b SIMD execution unit
- Arm VFPv4 single and double – precision floating point acceleration (IEEE 754)
- Per core 48KB I-cache and 32KB D-cache
- Cache coherent mesh interconnect of CPUs, I/O and memory – each tile contains 2 cores and 1 MB L2 cache
- 6 MB L3 cache, sophisticated eviction policies

On-Board Memory

- Single channel 4GB/8GB/16GB DDR4 DRAM with ECC

Encryption Acceleration

- Armv8 cryptography extensions: A64, A32, and T32 instructions for: AES, SHA-1, SHA-224, and SHA-256
 - Finite field arithmetic used in algorithms such as Galois/Counter Mode and Elliptic Curve
- Hardware Public Key accelerator
 - RSA, Diffie-Hellman, DSA, ECC, EC-DSA and EC-DH
- True Random Number Generator with entropy source

Enhanced Features

- PeerDirect RDMA (aka GPUdirect) communication acceleration
- Enhanced Atomic operations
- Registration-free RDMA memory access
- NVMe-over-Fabric hardware acceleration

Transport Offloads

- RDMA over Converged Ethernet (RoCE)
- TCP/UDP/IP stateless offload
- LSO, LRO, checksum offload
- RSS (also on encapsulated packets), TSS, HDS, VLAN insertion/stripping, Receive Flow Steering
- Intelligent interrupt coalescence
- TCP/UDP, MPLS, VxLAN, NVGRE, GENEVE
- SRP, iSER, NFS RDMA, SMB Direct

Hardware-based I/O Virtualization

- SR-IOV
- Multi-function per port
- Multiple queues per virtual machine

Management and Control

SDN management interface for managing the eSwitch eMMC memory controllers

Software Development Toolchain

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

Software Support

Arm Environment

- BlueOS: Commercial grade Yocto-based Arm Linux distribution
- Commercial Linux distributions supported
- Delivered with OpenFabrics Enterprise Distribution (OFED)
- Arm-optimized versions of all Mellanox drivers and software stack
- Accelerated NVMe over Fabrics target stack
- Optimized Arm DPDK and ConnectX PMD

Connected Host (Network Adapter Environment)

- Linux
- Windows
- FreeBSD
- VMware
- OpenFabrics Enterprise Distribution (OFED)
- OpenFabrics Windows Distribution (WinOF-2)

Table 1 - Part Numbers and Descriptions

OPN	Description	Form Factor
MBF1M332A-ASNAT	BlueField™ SmartNIC 25GbE dual-port SFP28, PCIe Gen3.0/4.0 x8, BlueField™ G-Series 16 Cores, Crypto disabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	HHHL
MBF1M332A-ASCAT	BlueField™ SmartNIC 25GbE dual-port SFP28, PCIe Gen3.0/4.0 x8, BlueField™ G-Series 16 Cores, Crypto enabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	
MBF1M332A-AENAT	BlueField™ SmartNIC 25GbE dual-port SFP28, PCIe Gen3.0/4.0 x8, BlueField™ G-Series 8 Cores, Crypto disabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	
MBF1M332A-AECAT	BlueField™ SmartNIC 25GbE dual-port SFP28, , PCIe Gen3.0/4.0 x8, BlueField™ G-Series 8 Cores, Crypto enabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	
MBF1L332A-AFNAT	BlueField™ SmartNIC 25GbE dual-port SFP28, PCIe Gen3.0/4.0 x8, BlueField™ G-Series 4 Cores, Crypto disabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	
MBF1L332A-AFCAT	BlueField™ SmartNIC 25GbE dual-port SFP28, PCIe Gen3.0/4.0 x8, BlueField™ G-Series 4 Cores, Crypto enabled, 16GB on-board DDR, tall bracket, HHL, ROHS R6	
MBF1L516A-CSNAT	BlueField™ SmartNIC 100GbE, Dual Port QSFP28, PCIe Gen4.0 x16, BlueField™ G-Series 16 cores, Crypto disabled, 16GB on-board DDR, FHHL, Single Slot, ROHS R6, Tall Bracket	FHHL
MBF1L516A-CSCAT	BlueField™ SmartNIC 100GbE, Dual Port QSFP28, PCIe Gen4.0 x16, BlueField™ G-Series 16 cores, Crypto enabled, 16GB on-board DDR, FHHL, Single Slot, ROHS R6, Tall Bracket	

Note: All tall-bracket adapters are shipped with the tall bracket mounted and a short bracket as accessory.

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