

NEXCOM NSA3190A Designed with 2.5G Ethernet for Wi-Fi 6

Network appliance features Intel® Xeon® W-1290 CPU for flexible, high-performance server with up to 16 2.5 GbE ports for connectivity. Tests show that built-in support for Data Plane Development Kit improves wire rate throughput.



To support the performance of Wi-Fi networks, organizations have connected their wireless access points (APs) using Gigabit Ethernet. But the latest Wi-Fi standards support backbone speeds higher than 1 Gbps. To connect these new Wi-Fi 6 access points, network appliances need to support 2.5 Gbps to offer higher bandwidth that is still cost effective.

Faster Wi-Fi Creates Access Challenge

In 2014, when Wi-Fi was last updated with IEEE standard 802.11ac, the vast majority of US households had three or more internet-connected devices.¹ Today, that number has skyrocketed to an average of 11 connected devices per US household.² That increase puts significant pressure on Wi-Fi networks in their ability to connect all of those devices with consistent speeds.



Wi-Fi has received a much needed update with IEEE standard 802.11ax, or Wi-Fi 6, which provides a major boost in speed when compared with the previous generation. In fact, Wi-Fi 6 is expected to improve the average throughput for each user by at least four times in congested environments.³

What makes Wi-Fi 6 so much faster are two key upgrades—multi-user, multiple input, multiple output (MU-MIMO) antennas and Orthogonal Frequency Division Multiple Access (OFDMA). MU-MIMO allows wireless access points (APs) to communicate with multiple devices simultaneously without issues of congestion. Orthogonal Frequency Division Multiple Access (OFDMA) is a new multi-user version of Orthogonal Frequency Division Multiplexing (OFDM) and allows a wireless channel to be divided into multiple sub-channels.

With these upgrades, Wi-Fi 6 will be able to support many more devices and provide improved capacity in environments with many connected devices, such as stadiums and other large venues.

But Wi-Fi APs need Ethernet to connect users to resources and the internet, and Wi-Fi 6 is faster than the 1 GbE connection that was used for 802.11ac and preceding Wi-Fi standards. Legacy network appliances and switches cannot support the throughput required by Wi-Fi 6 today and future wireless networks, and so have become the traffic bottleneck for Wi-Fi 6 transmissions.

To operate a Wi-Fi 6 network smoothly, 2.5 GBASE-T Ethernet is the minimum speed. Wi-Fi APs need network appliances that can support the higher throughput needed by Wi-Fi 6.

Intel® Network Builders partner NEXCOM has developed its new NSA3190A network appliance to deliver the high throughput demanded by Wi-Fi 6. Through benchmark testing using the open source Data Plane Development Kit, the NSA3190A is shown to deliver significant throughput to meet the needs of Wi-Fi 6 networks.

NEXCOM NSA3190A Network Communication Appliance

The NSA3190A is a network communication appliance equipped with an Intel® Xeon® W processor, up to 16 2.5 GbE ports, fast error-correcting code (ECC) DDR4 memory, and advanced technologies to deliver an extra performance boost at a low power envelope for efficient energy use. In addition to support for Wi-Fi 6 networks, the NSA3190A is an ideal edge server or a network security appliance in small and medium business (SMB) networks.

The 1U rackmount appliance measures 430 mm x 300 mm x 44 mm (WxDxH). The NSA3190A utilizes an Intel Xeon W-1290 processor, part of the Intel Xeon W processor family designed for outstanding performance, security, and reliability. The 10th Generation Intel Xeon W-1290 processor features 10 cores and 20 threads for improved throughput. For branch office applications, the processor family supports thermal design power (TDP) ranges between 35 W and 65 W. Complemented by other Intel technologies, built-in hardware accelerators, AI capabilities, and a vast partner ecosystem, the Intel Xeon W processor family brings enhanced performance and workload convergence to network appliance platforms.⁴

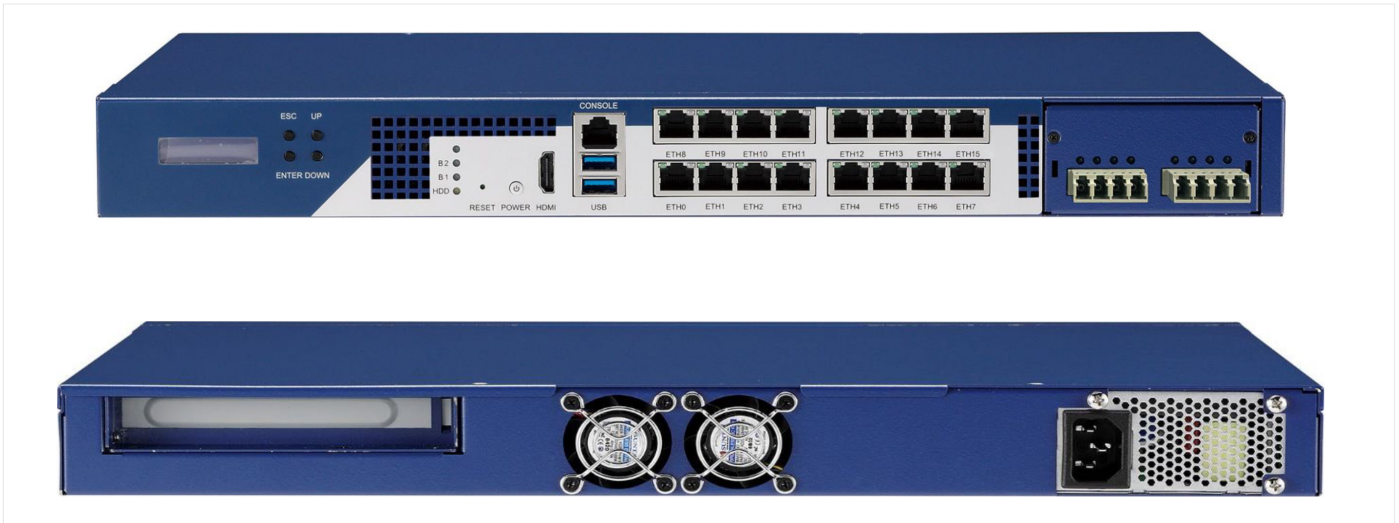


Figure 1. Front and rear view of NEXCOM NSA3190A network appliance.

Memory and Connectivity

The appliance has memory capacity up to 32 GB with two DDR4 DIMM sockets and features an onboard PCIe x8 expansion slot, as well as an optional rear PCIe x8 expansion slot.

Network connectivity is provided by an Intel® Ethernet Controller I225 that fits into the NSA3190A PCIe expansion slot. The controller provides a compact, single-port integrated multi-gigabit (up to 2.5 G) copper Ethernet interface for 2,500 BASE-T, 1,000 BASE-T, 100 BASE-TX, 10 BASE-TE connections. The controller is designed for use in constrained spaces and includes advanced interrupt-handling features to reduce CPU overhead. Other performance-enhancing features include offloading TCP/UDP (for both IPv4 and IPv6) checksum calculations and performing TCP segmentation. Advanced features such as jumbo frame support for extra-large packets and receive side scaling (RSS)-based network drivers are also supported.

Data Security

The compute performance built into the NSA3190A allows it to run security applications to help protect other virtual network functions (VNFs) on the system. Network security is further strengthened by the availability of Intel® Security Essentials, a framework of hardware-based security capabilities designed for Intel processors to establish root of trust. NEXCOM has also developed an optional trusted platform module (TPM) for the NSA3190A.

For applications with heavy encryption needs, the NSA3190A supports Intel® QuickAssist Technology (Intel® QAT). Intel QAT provides hardware acceleration for compute-intensive workloads, such as cryptography and data compression, freeing the processor to focus on other workload operations.

The NSA3190A leverages the open source Data Plane Development Kit (DPDK), a set of data plane libraries and network interface controller drivers for fast packet processing. DPDK enables very fast networking functions and accelerated packet processing.

For very cost-sensitive applications, the NSA3190A can also be ordered with non-server (workstation/client segment) processors, such as Intel® Pentium® or Intel® Celeron® processors. This brings the total cost down, while providing targeted performance and throughput, so the price/performance ratio can be improved for use in cost-constrained use cases.

Performance Testing

The Wi-Fi 6 use case envisioned for the NSA3190A, where its 2.5 GbE ports are used to handle the Wi-Fi 6 connectivity in an enterprise network, requires a higher speed connection for back up to the internal database/external data center. The appliance supports a 10 GbE NIC expansion card to provide uplink/downlink connection for this backup. A LAN bypass function is supported on this 10 GbE module, and on four out of the eight 2.5 GbE ports, providing an additional layer of protection against internet-based cyberattacks. Figure 2 is a block diagram of this bypass function.

NEXCOM has tested the performance of the 10 GbE NIC for this paper because its throughput has a large impact on the overall performance of the NSA3190A.

Test Setup

NEXCOM conducted lab testing that showed the throughput of the NSA3190A 10 GbE LAN module with zero packet loss, complying with IEEE RFC 2544. The tests were set up by connecting the two devices under test (DUTs) to an IxNetwork (version 8.50.1501.9EA) test system and using the Ixia packet generator function. DPDK testPMD was used as the test application. The performance of the NSA3190A with DPDK turned on was measured compared to the same tests run with DPDK turned off.

As shown in Figure 3, the DUT is connected to the Ixia packet generator, which generates traffic toward the NX 140F NIC at 10 Gbps. The data traffic is passed through DPDK to the test application testPMD and is redirected to the opposite direction on the same port. Ixia measures throughput and packet loss.

The packet generator was used to transmit a flow of packets matching a specified data rate and packet size toward the DUT. The packets were switched back to the packet generator by testPMD using another port and then were received and counted by the packet generator. Throughput results recorded in this test were determined by the maximum achievable transmit frame rate and the average throughput within the test duration. The duration for each round is 60 seconds with 8192 IP flows generated per port.

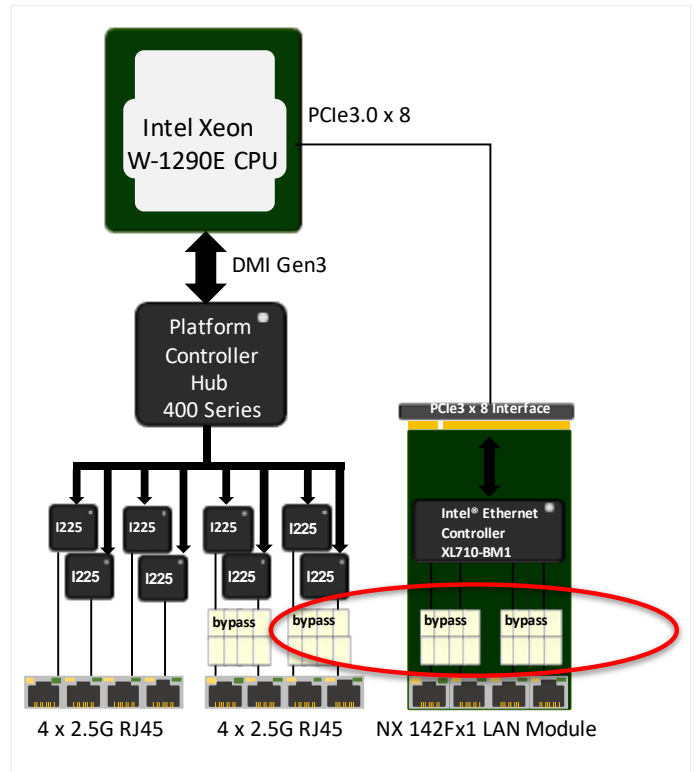


Figure 2. Block diagram of LAN bypass function built into NIC functions of the NSA3190A.

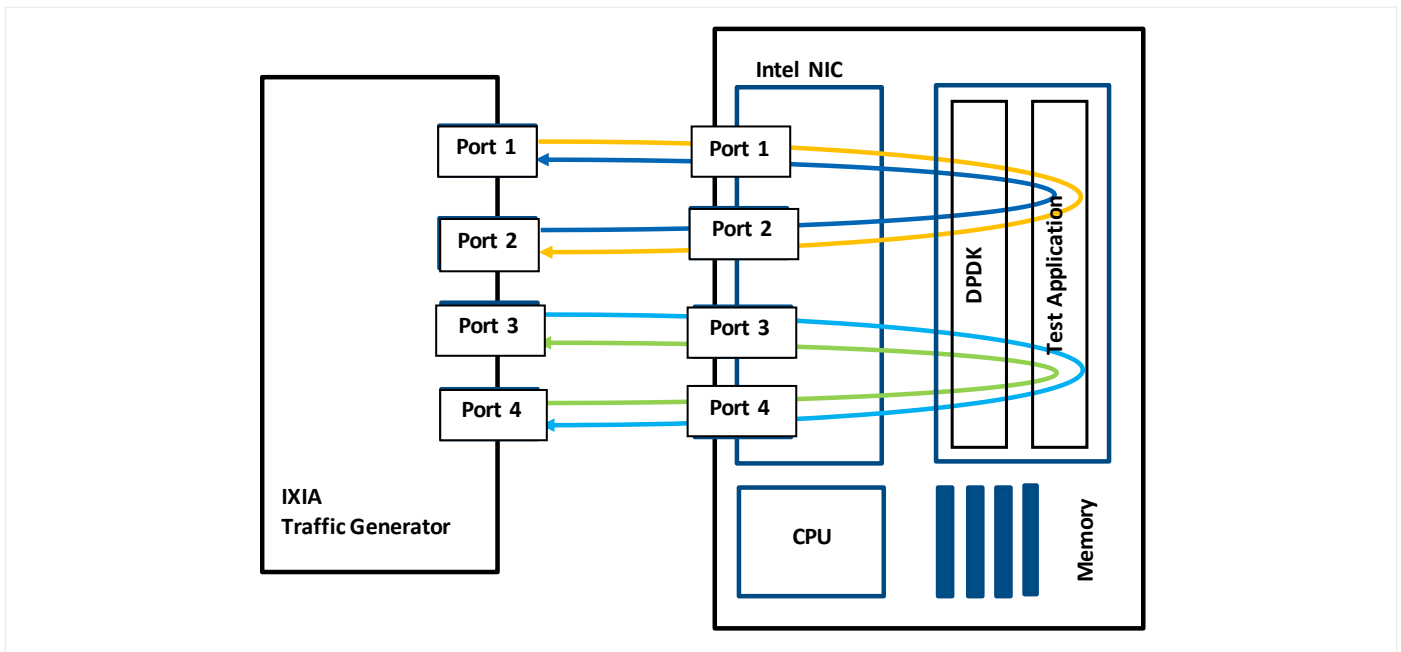


Figure 3. RFC 2544 test setup for NSA3190A.

Test Results

As can be seen in Figure 4, in tests where DPDK was turned off, wire rate throughput was reached at 1,280 byte packet sizes and higher, although the throughput rate for 512 and 1,024 byte packets was nearly line rate at 94.59% and 98.45% respectively. It is typical for smaller packet sizes to not reach theoretical maximum due to the packet processing overhead, and in these tests, with DPDK turned off, 64 byte

packets reached up to 16.47%, 128 byte packets reached 28.07%, and 256 byte packets reached 51.27% of the theoretical maximum throughput.⁵

When DPDK was turned on, all packet sizes above 256 bytes reached RFC 2544 maximum performance of 100% frame rate throughput without a dropped packet, while 64 byte packets reached up to 55.88% and 128 byte packets reached 95.61% of theoretical maximum.

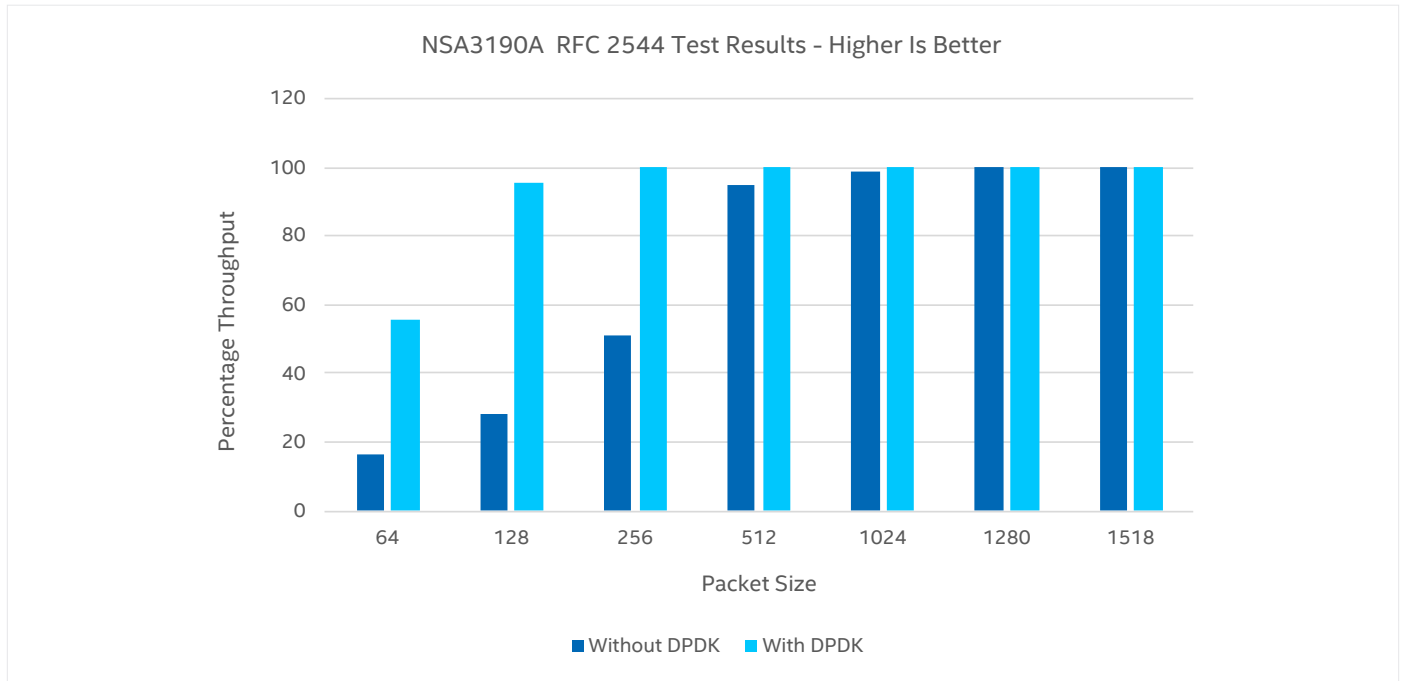


Figure 4. Test results comparing RFC 2544 throughput for NSA3190A with DPDK turned off (dark blue) and turned on (light blue).

The test results show that the Tx and Rx rates realized significant improvement when the DPDK technology was applied.

Conclusion

Wi-Fi 6 offers an exciting boost in speed to support multiple users and devices and congested environments. In order to truly benefit from this next generation wireless technology though, Wi-Fi APs need Ethernet that can support the throughput required by Wi-Fi 6. Through this test, NEXCOM has shown that the NSA3190A network appliance can deliver the high throughput needed.

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¹ <https://www.vox.com/2014/11/18/11632960/more-than-90-percent-of-u-s-households-have-three-or-more-devices>

² <https://variety.com/2019/digital/news/u-s-households-have-an-average-of-11-connected-devices-and-5g-should-push-that-even-higher-1203431225/>

³ <https://itpeernetwork.intel.com/fastest-wi-fi-three-things-know-about-802-11ax/#gs.py539z>

⁴ <https://www.intel.com/content/www/us/en/products/docs/processors/xeon/xeon-w-1200-processor-brief.html>

⁵ Tests conducted by NEXCOM in Dec. 2020: Server configuration was a NSA3190A that featured a 10-core Intel Xeon W-1290E processor (microcode: 0xA0654 revision C6) with Intel Hyper-Threading Technology turned off. BIOS version was G780T010. System memory totaled 32 GB comprising two 16 GB UDIMM modules. Network connectivity was provided by a NEXCOM NX 140F 4-port 10 GbE SFP+ network adapter (Firmware v6.01). Ubuntu v18.04.4 LTS was the server operating system with kernel version 5.3.0-28. DPDK version was 18.04.4LTS.

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