Solution Brief

Network Edge
Multi-access Edge Computing

CASwell Edge Appliance Offers Compute, Networking Performance

CASwell CAR-6011 combines performance of 2nd generation Intel® Xeon® Scalable processors with flexibility of up to 24 Ethernet ports for packet-based edge applications, including data security

The use of edge computing is growing due to increased demand for low latency data services, internet of things (IoT), local data processing mandates, and emerging 5G network deployments. Multi-access edge computing (MEC) servers deliver the compute power for these applications. But many of the edge applications involve significant packet processing and other networking requirements. The CAR-6011 from CASwell is part of a new breed of network appliance that combines Intel® architecture compute with Ethernet switching to deliver the right technology feature set for these applications.

Growth and Evolution of the Network Edge

A growing number of applications need low latency, including content streaming, voice over IP, robotics, artificial reality, analytics, gaming, and more. In addition, hosting popular cloud applications and content at the network edge instead of serving them multiple times from the origin server can dramatically reduce data requirements of the transport network.

The increase in CPU multicore processing power and the evolution of network functions virtualization and containerization has provided a foundation for servers to deliver compute functions at the edge.

Network appliances are server-switches that combine powerful multi-core CPUs with Ethernet switching at up to 100 Gbps. These network appliances can be deployed as either a bare metal server, or run virtualization or containerization software in order to simultaneously instantiate a number of virtual network functions.

Network appliances allow enterprises or communications service providers (CoSPs) to implement data security or packet processing applications at the edge of the network. Services such as firewall, unified threat management (UTM), caching, authentication, IP address management, and network address translation can now be done at the network ingress where a packet enters the network. This edge processing frees up downstream network capacity by eliminating data flows and by grooming traffic at the edge.

CAR-6011 Network Appliance

The CASwell CAR-6011 is designed with the CPU performance and network switching functionality needed to serve as a network appliance. Figure 1 shows a block diagram of the appliance.

The rackmount network appliance is based on the 2nd generation Intel® Xeon® Scalable processor family. With CPUs offering up to 28 cores, the Intel Xeon Scalable platform delivers next-generation edge network capabilities thanks to its disruptive levels of compute performance coupled with memory and I/O advances designed for compute-hungry and latency-sensitive applications.[1]

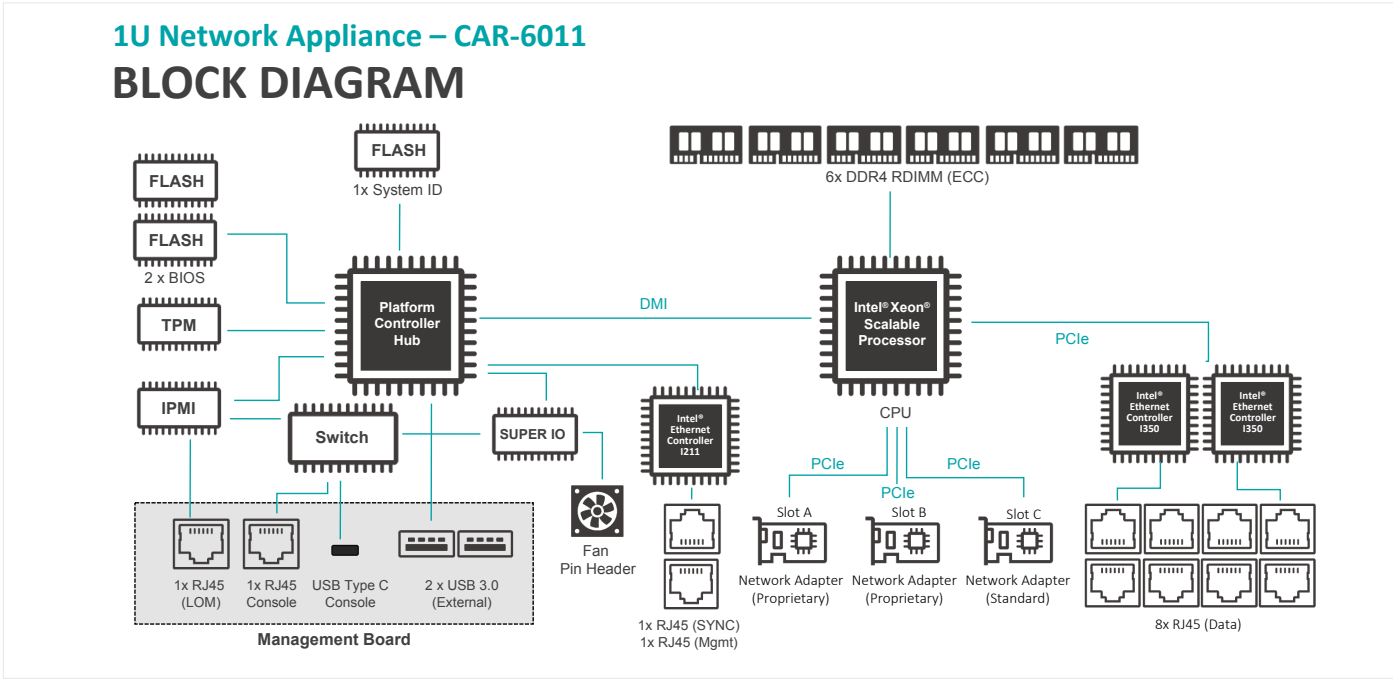

Figure 1. CAR-6011 network appliance block diagram.

CASwell supports a wide range of Intel Xeon Scalable processors. For network appliance applications, the company recommends the balance of high performance and low power consumption provided by the Intel Xeon Gold 6252N CPU, with 24 cores, or the Intel Xeon Gold 5218N CPU, with 16 cores. These processors were designed for typical networking workloads and systems designed for the strict power budgets that are a fact of life in remote locations where power availability can be challenging.

Optional Accelerators

When needed for applications that require maximum performance, the CAR-6011 features Intel® QuickAssist Technology (Intel® QAT) as well as optional support via a PCI Express x8 slot for an Intel® FPGA Programmable Acceleration Card (Intel® FPGA PAC) N3000.

Intel QAT accelerates encryption/decryption performance in cloud, networking, big data, and storage applications—for data in motion and at rest. Intel QAT improves performance across applications and platforms. That includes symmetric encryption and authentication, asymmetric encryption, digital signatures, RSA, DH, and ECC, and lossless data compression.

Intel FPGA PAC N3000 is a highly customizable SmartNIC platform for multi-workload networking infrastructure and application acceleration. It has the right memory mixture designed for network functions, with integrated network interface card (NIC) in a small form factor that enables high throughput, low latency, and low power/bit for custom networking pipeline.[2]

Flexible Network Architecture

The CAR-6011 provides a flexible network architecture, featuring eight built-in Gigabit Ethernet ports that are based on integrated Intel® Ethernet Controller I350-AM4, and two frontloading slots for CASwell's family of Network Interface Plug-in (NIP) modules that provide additional network connectivity options. These include the NIP-83040 with four 10 Gigabit Ethernet links, the NIP-83080 that features eight 10 GbE links, and the NIP-88010 module that features two 100 GbE ports. These modules can be added to the appliance as needed and each NIP is connected to the processor by PCI Express 3.0 x8 interface for very high throughput.

CAR-6011 Delivers Edge Security

Data security is a critical need for the network edge, helping to protect data in motion and at rest, and reducing the attack surface for hackers by helping protect edge computing hardware, software, applications, data, and networking functions. The CASwell CAR-6011 is designed with the packet processing performance and features needed to serve as a hardware platform for edge security applications, including the following:

Firewall: The foundation of network security, network firewalls monitor north-south traffic to provide perimeter security functionality. Edge firewalls extend the security perimeter to the edge of the network and provide access control processing with very low latency when compared to a centralized or cloud-based firewall.

Edge Unified Threat Management (UTM): Edge UTM VNFs provide a suite of network security functions with a single interface for threat analysis and system management. Some of these features include network firewall, intrusion detection systems, intrusion prevention systems, anti-virus, deep packet inspection, web/email filtering, data loss prevention, and more.

Executing VNFs requires a significant amount of RAM, and the CAR-6011 can support up to six DDR4 ECC memory modules for a main memory of up to 1.0 TB. Alternatively, some or all of these slots can be equipped with Intel® Optane™ persistent memory for even more RAM or storage cache as Intel Optane memory modules come in up to 512 GB capacity.

For storage, the CAR-6011 features two hot-swappable front slots for 2.5-inch traditional hard drives or solid state drives for high-performance storage options. The dual drives provide added storage or a backup capability in case of failure.

Two redundant 500 watt power supply units provide power for the appliance and can be configured in redundant mode to maintain system availability in the event of a power supply failure.

Wire Speed RFC 2544 Throughput

In a test to show the level of throughput with zero packet loss (conforming to IETF RFC 2544), CASwell engaged testing company Xena Networks to set up a bidirectional throughput test of the CAR-6011. The test used all IEEE default packet sizes and utilized 10 Gigabit Ethernet ports. The goal of the test was to see how much throughput the system offers before packets drop.

As can be seen in Figure 2, wire rate throughput is reached at 256 byte packet sizes and higher, with 64 byte packets reaching 50.44% of theoretical maximum and 128 byte reaching 67.22% of the theoretical maximum. It is typical for smaller packet sizes to not reach theoretical maximum due to the packet processing overhead.[3]

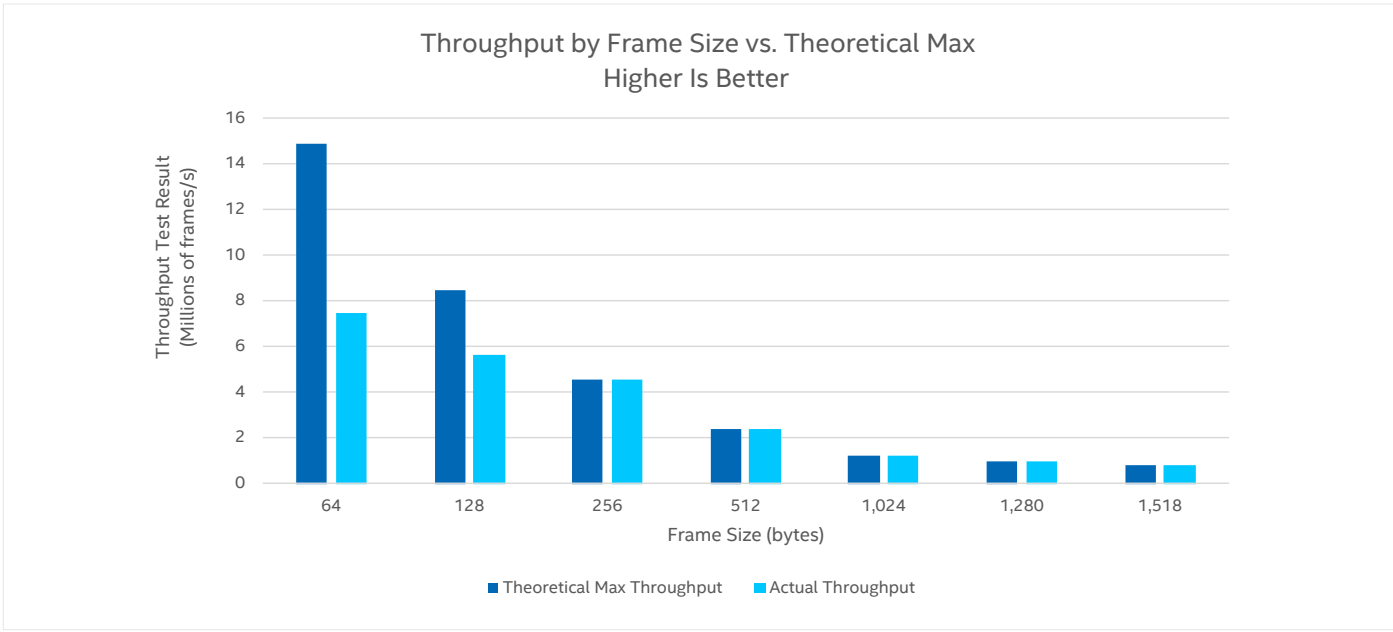

Figure 2. IETF RFC 2544 test results for CAR-6011.

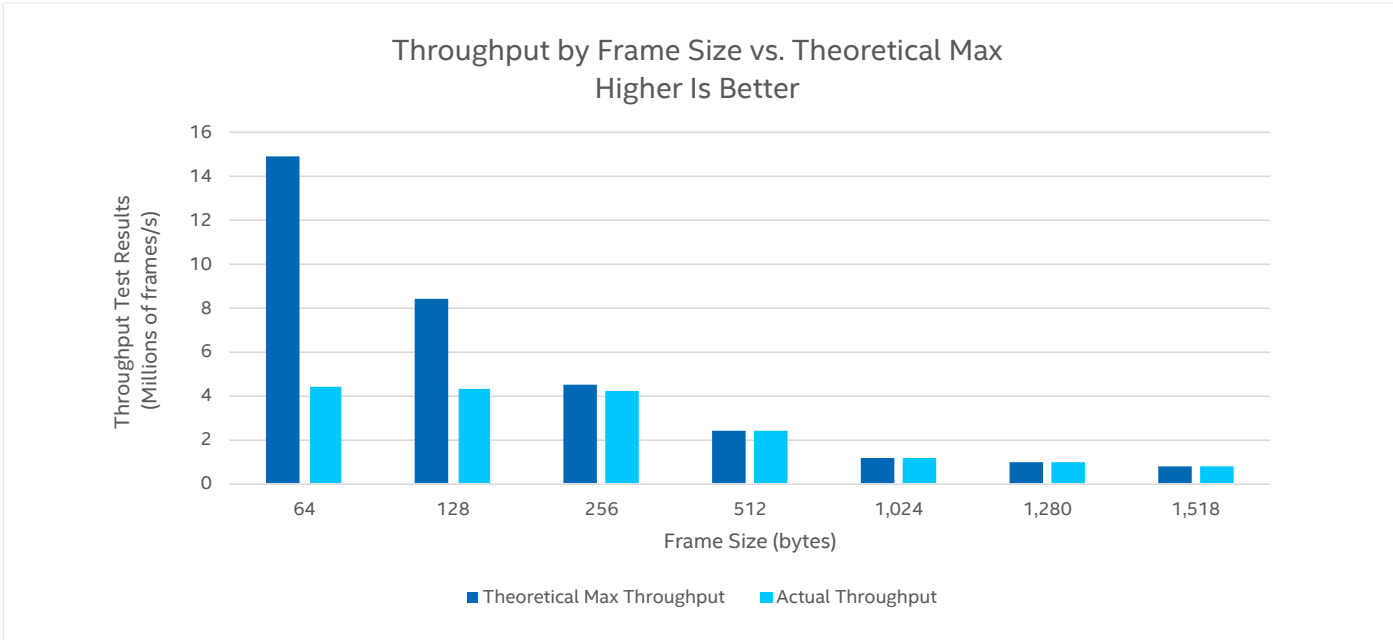

Figure 3. IETF RFC 2544 test results for CAR-5040.

To show the performance increase in the CASwell CAR-6011, CASwell also commissioned the same RFC 2544 tests on the CAR-5040 that is powered by an Intel Xeon E5-2620 v4 processor. Figure 3 shows the performance improvement in packet sizes of 256 byte and smaller. The CAR-5040 achieved 93% throughput of 256 byte packets compared to full line rate in the CAR-6011. At smaller packet sizes, the CAR-6011 showed 32.2% greater throughput for 128 byte packets and 69.5% greater throughput for 64 byte packets.

Conclusion

Network edge applications need a hardware server platform with the CPU performance, Ethernet switching capability, low power consumption and flexible RAM, networking, and storage to run packet processing VNFs. This appliance can help groom traffic and provide security and other advanced applications—in addition to service-provisioning VNFs. The CAR-6011 has performance from the 2nd generation Intel Xeon Scalable processor, and if needed the Intel® FPGA Programmable Acceleration Card N3000. CASwell has built innovation into the solution through the use of Intel Optane persistent memory, which can dramatically expand total RAM capacity. Combined, these features create a network appliance that is able to deliver the compute power and networking flexibility required for low-latency applications that are driving growth in the use of edge computing.

Learn More

CASwell Inc.: https://www.cas-well.com

CASwell CAR-6011: https://www.cas-well.com/products/network-security-and-management/1u-network-appliance/car6011.html

Intel® Xeon® Scalable processors: https://www.intel.com/xeonscalable

Intel® FPGA Programmable Acceleration Card N3000: https://www.intel.com/content/www/us/en/programmable/products/boards_and_kits/dev-kits/altera/intel-fpga-pac-n3000/overview.html

Intel® Optane™ Persistent Memory: https://www.intel.com/optanememory

Intel® Network Builders: https://networkbuilders.intel.com

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[1] https://www.intel.com/content/www/us/en/products/docs/processors/xeon/2nd-gen-xeon-scalable-processors-brief.html

[2] https://www.intel.com/content/www/us/en/programmable/products/boards_and_kits/dev-kits/altera/intel-fpga-pac-n3000/overview.html

[3] Tests conducted by CASwell in August 2020: Server configuration one was a CAR-6011 server that featured a 24-core Intel® Xeon® Gold 6252N processor (microcode: 05002F01) with Intel® Hyper-Threading Technology turned on. BIOS version was R0.04 and best known configuration version was 2020ww07. System memory totaled 192 GB comprising 12 16 GB 2,400 MT/s RDIM modules. The system featured 16 GB of boot storage and 16 GB of application storage. Network connectivity was provided by a CASwell NIP-83040 4-port 10 GbE SFP+ network adapter. CentOS Linux 7 was the core operating system with kernel version 3.10.0-862.el7.x86_64. Workload was the Intel® Network Adapter Driver i40e-2.7.29.

Server configuration two was a CAR-5040 server that featured an eight-core Intel Xeon E5-2620 v4 processor (microcode: 0xB00002E) with Intel Hyper-Threading Technology turned on. BIOS version was R1.10. System memory was composed of a 16 GB 2,400 MT/s RDIM module. The system featured 16 GB of boot storage and 16 GB of application storage. Network connectivity was provided by a CASwell NIP-83040 4-port 10 GbE SFP+ network adapter. CentOS Linux 7 was the core operating system with kernel version 3.10.0-862.el7.x86_64. Workload was the Intel Network Adapter Driver i40e-2.7.29.

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