SOLUTION BRIEF

Enterprises
Universal Customer Premises Equipment

Lanner, Enea Build High Performance NFV uCPE for Small Offices

Companies integrate complete network functions virtualization infrastructure (NFVI) solution for small remote branch offices on low-cost Luna-D125 server powered by an Intel Atom® C2000 processor.

Overview

Communications service providers (CommSPs) are looking at ways to lower their operating and capital expenses (OPEX/CAPEX) by delivering network services more efficiently. The disaggregation of hardware and software driven by network functions virtualization (NFV) enables them to deliver virtual network functions (VNFs) on small-footprint white box universal customer premises equipment (uCPE), rather than a mix of standalone point products.

uCPE platforms provide clear economic value for CommSPs, as they simultaneously address cost reduction and service agility. In August 2019, IHS Markit projected in its "uCPE Hardware Biannual Report"[1] that the uCPE market would increase from $7.7 million in 2017 to $1.02 billion in 2022. To demonstrate a solution that delivers on this promise, Intel® Network Builders ecosystem members Lanner Electronics Inc. and Enea have collaborated to specify an NFV-based uCPE system for the smallest branch offices.

Meeting Small Branch Office Needs

uCPEs are becoming popular as a way to deploy advanced networking capabilities, including software-defined WAN (SD-WAN) VNFs that deliver more secure access to both cloud services and traditional WAN connections.

This is especially a challenge at entry-level branch offices that have few users, but still need advanced networking and data security applications. Retailers, restaurants, banks, and other enterprises typically have hundreds or thousands of these locations within their network, which makes cost a critical component.

There are many applications where a very cost-competitive solution is important, and in these applications the CPU power needed to process the overhead of NFVI software makes it difficult to select a server that minimizes network costs. Using bare metal servers to bring the cost down is an alternative that eliminates the NFVI overhead. However, a virtualization platform that has optimized hardware and software enables lower server costs, since fewer cores and less memory are needed to deliver the requisite performance. Meanwhile, using virtualization gives CommSPs greater agility and flexibility through the ability to remotely install new software on the uCPE, rather than physically deploying new appliances or bare metal servers that need more skilled onsite installation and maintenance.

Lanner and Enea's Integrated Solution

The integrated uCPE solution from Lanner and Enea is based on Lanner's low-cost, entry-level, and ultra-lightweight uCPE white box solution and Enea NFV Access integrated NFVI software.

The hardware platform is Lanner's LUNA-D125 (Figure 1), which is the entry-level model in Lanner's Whitebox Solutions hardware portfolio. The LUNA-D125 features a two-core Intel Atom® C2316 processor, four Gigabit Ethernet ports, 2 GB of DDR3L memory, one RJ45 console port and two USB 2.0 ports. It also comes with one mini-PCIe, one M.2 3042, and one nano-SIM slot.

Figure 1. Lanner LUNA-D125 uCPE.[2]

The Intel Atom C2316 is part of the Intel Atom C2000 system-on-chip (SoC) product family for small servers. For security applications, the processor features Intel® QuickAssist Technology (Intel® QAT) for accelerating data compression and encryption.

For data-plane heavy VNFs, the Lanner LUNA-D125 supports the Data Plane Development Kit (DPDK), an open source family of software libraries that accelerate packet processing performance on Intel, and other general-purpose processors.

Enea NFV Access Provides Infrastructure

Enea NFV Access is used as the platform's NFV infrastructure. Enea NFV Access is a virtualization and management platform with minimal software footprint designed for uCPEs.

Optimized for VNFs that need high networking performance and a small form factor, Enea NFV Access is a virtualization software platform that minimizes uCPE footprint and latency while maximizing throughput. The software features integrated KVM for virtualization and Docker for containers, reducing virtualization overhead and complexity.

Enea NFV Access features built-in automation functionality to simplify management and large-scale deployments along with Ansible framework for automation of platform and VNF deployments. Enea uCPE Manager provides a powerful GUI as well as REST APIs for NFV orchestration integration and automation.

One component of this functionality is the VNF onboarding wizard that makes VNFs ready for deployment by describing the hardware resources a VNF should have and adding it to the VNF catalog. Once this is done, the deployment and lifecycle management can be automated using the automation framework or a third-party orchestrator.

Lanner Luna-D125 Enea NFV Access Benefits

- Enables cost-effective solutions
- Optimized and hardware-accelerated data plane
- Minimal CPU and memory footprint
- Open source–based uCPE software platform
- NETCONF- and Yang-based management
- Infrastructure management
- Zero-touch provisioning
- Lifecycle management
- Virtualization through KVM and Docker
- Service function chaining (SFC)
- Open and standard interfaces
- Integrates with any VNF and orchestration
- Range of deployment and VNF automation features
- Hardware platform agnostic

Performance Test Setup

Enea recently tested the LUNA-D125 with Enea NFV Access to demonstrate its native forwarding and packet termination performance and show that an NFVI platform can deliver full Gigabit line rate performance on a single core.[3] In a real-world application the remaining core and RAM can be used for a VNF.

To measure packet forwarding and packet termination performance, Enea loaded the Pktgen VNF on one LUNA-D125 as a packet generator, and the Testpmd VNF on the device under test (DUT) LUNA-D125 to receive the packets. For the packet termination tests, Testpmd measured performance; in the packet forwarding tests, Testpmd forwarded packets back to Pktgen, while measuring the throughput (Pktgen generated packets at 97% of 1 Gbps line rate). The test setup can be seen in Figure 2.

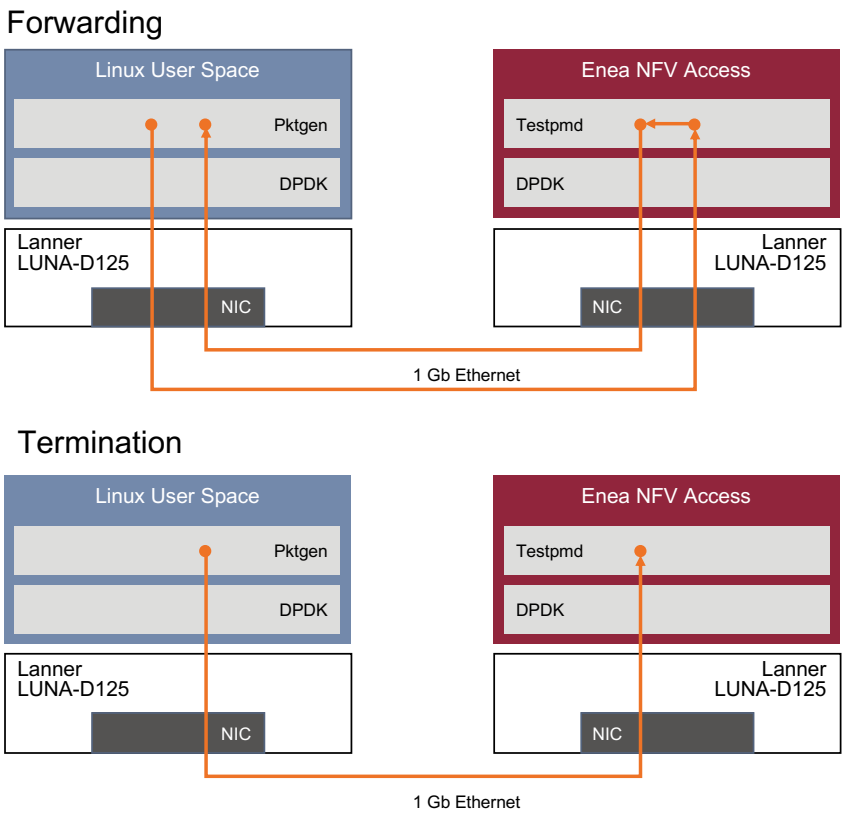

Figure 2. Test configurations for traffic forwarding test (top) and traffic termination test (bottom).[4]

Performance

The results from both the termination test and the forwarding test show that the throughput is near or at 100% for all packet sizes, even at the smallest packet sizes. The throughput is measured as the received packets (RX) count divided by the transmitted (TX) packets count. Figures 3 and 4 demonstrate the percentage throughput results for the tests.

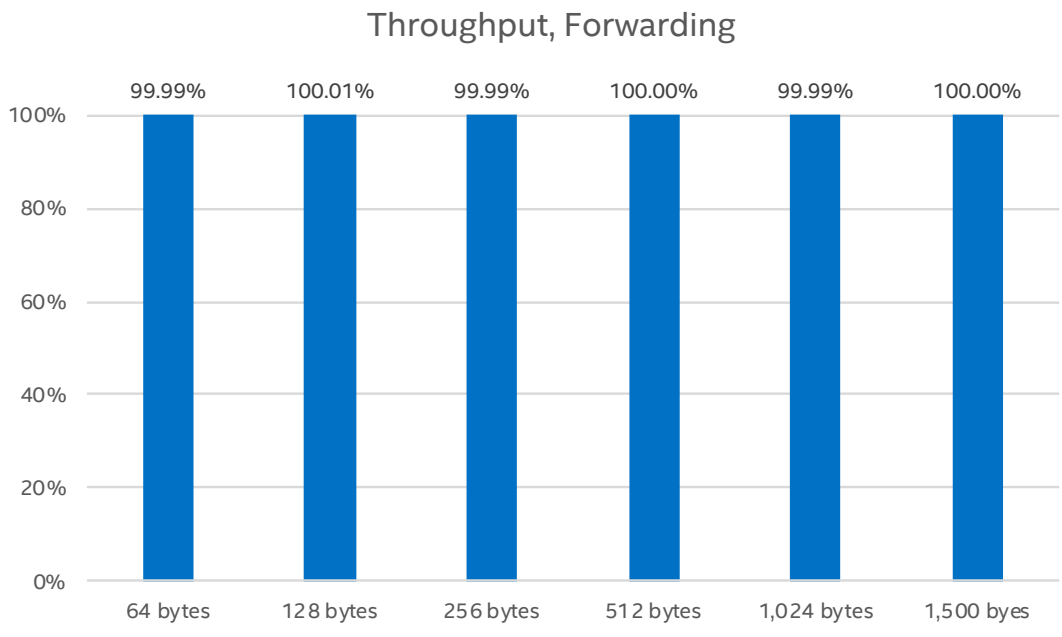

Figure 3. Throughput results from tests on LUNA-D125 with Enea NFV Access.[3]

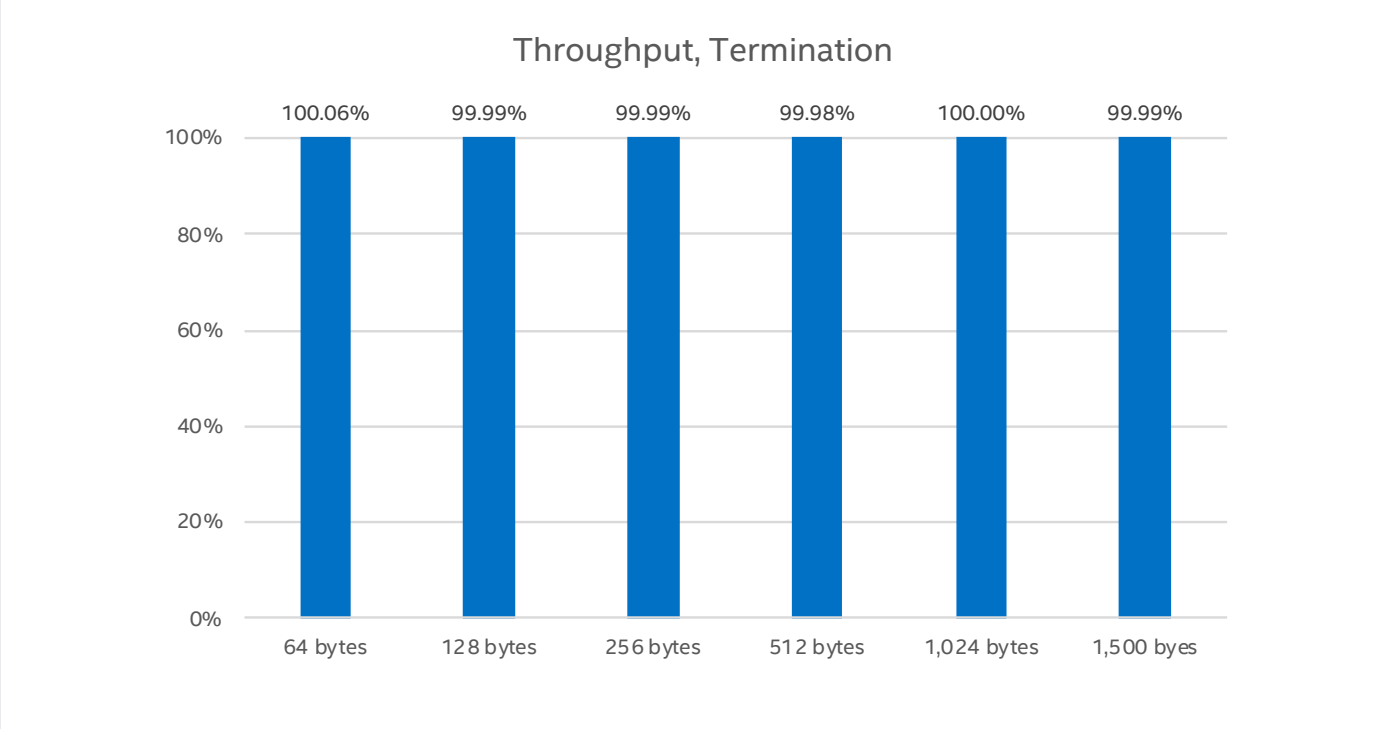

Figure 4. Termination results from tests on LUNA-D125 with Enea NFV Access.[3]

Table 1 shows the actual testing performance.[5]

		FORWARDING	TERMINATION
64 BYTES	TX pps	1,448,200	1,483,076
	RX pps	1,448,142	1,484,088
	Throughput (%)	99.99%	100.06%
128 BYTES	TX pps	835,329	841,715
	RX pps	835,380	841,674
	Throughput (%)	100.01%	99.99%
256 BYTES	TX pps	450,474	452,027
	RX pps	450,463	452,003
	Throughput (%)	99.99%	99.99%
512 BYTES	TX pps	234,586	234,646
	RX pps	234,591	234,599
	Throughput (%)	100.00%	99.98%
1,024 BYTES	TX pps	119,698	119,659
	RX pps	119,688	119,664
	Throughput (%)	99.99%	100.00%
1,500 BYTES	TX pps	82,217	82,221
	RX pps	82,220	82,218
	Throughput (%)	100.00%	99.99%

Table 1. Packet Throughput Test Results for Luna-D125 DUT[3]

Conclusion

The dynamic networking requirements of today's branch office WANs is increasing the need for ultra-compact servers that can deliver high performance virtualized computing. Lanner and Enea have demonstrated that a cost-effective and easy-to-manage alternative is to combine Enea NFV Access with the power of Intel® processors and Lanner's innovative hardware design. The result is a true small branch office uCPE that allow carriers to deploy a range of service-provisioning VNFs.

For More Information

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

Lanner Whitebox Solutions: http://www.lannerinc.com/x86-desktop-network-appliances/white-box-hardware-solutions

Enea NFV Access: https://www.enea.com/products/nfv-virtualization-platforms/enea-nfv-access

[1] https://technology.ihs.com/605919/universal-cpe-a-new-market-and-new-deployment-model-for-managed-services

[2] Figure provided courtesy of Lanner.

[3] Testing conducted by Enea on November 11, 2019. Configurations: Server was the Luna D125A powered by the 1.5 GHz Intel Atom® C2316 SoC (Microcode: 0x12a). The server featured 2GB of 1600MHz RAM with four port of Gigabit Ethernet connectivity via the SoC-embedded Intel® Ethernet Controller I354 and Intel® Ethernet Controller I211. System ran Enea NFV Access OS (kernel: Linux 4.14.123-intel-pk-standard OS). Other software included: Libvirt (4.2.0), QEMU (2.11.1) and Open vSwitch (2.9.0).

[4] Figure provided courtesy of Enea.

[5] In some tests received packets are higher than transmitted packets. This is because packets are coming from another source. For example if the second Luna running Testpmd issues a request and gets an answer back this would be recorded by Testpmd but not by the packet generator.