Ethernity Networks Supports Network Migration to COTS Servers Using Xilinx FPGAs

ENET vRouter Appliance Lowers TCO While Delivering Deterministic, High Bandwidth Performance and Agility for Service Providers and Enterprises

AT A GLANCE:

Ethernity's ENET vRouter is a sophisticated network appliance that uses Xilinx's Kintex Ultrascale+ FPGA to accelerate a robust suite of bridging, routing, gateway, security, and network functions performed by Ethernity's flow processor and protocol software stack. The appliance enables cost-effective network infrastructure migration to x86-based, commercial-off-the-shelf (COTS) servers without compromising performance or the quality of experience that service providers and enterprises have grown accustomed to receiving from ASIC-based network equipment. It also provides a level of independence from vendors' technology roadmaps and product schedules and gives customers the agility to add new features using the FPGA's programmability.

Customer: Ethernity Networks

Industry: Communications

www.ethernitynet.com/

CHALLENGE:

Lower the total cost of ownership (TCO) for evolving programmable communication networks. Ensure carrier-grade, deterministic performance, especially low latency and jitter. Leverage COTS servers by incorporating comprehensive network protocol stack and flow processor with SmartNIC technology. (See figure 1).

SOLUTION:

Xilinx Kintex Ultrascale+ KU15P device that meets the cost constraints and connectivity performance requirements driving the communications market.

RESULTS:

High throughput, low latency, and low power consumption for both cloud and network edge installations.

Figure 1: ACE-NIC100 FPGA SmartNIC acceleration card

CHALLENGE:

Lower TCO with COTS Servers Differentiated by ENET Stack Running on FPGAs

Ethernity Networks is a 15-year old, public company that focuses on the development and commercialization of innovative, FPGA-based solutions for high-speed networking and security applications. During its history, the company estimates that its products have been successfully deployed in over 500,000 communication systems connecting more than 100 million users of wireless and wired networks.

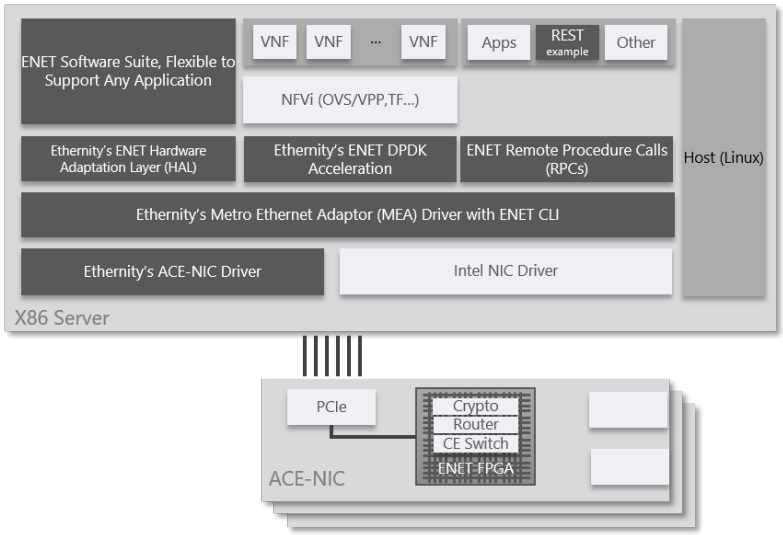

Figure 2: ENET software for ACE-NIC platform block diagram

While the company is no stranger to the use and design of FPGA hardware, its core competency lies in creating the patented communications firmware that runs efficiently on FPGA devices. Ethernity provides a range of turnkey solutions including SoCs, SmartNICs, and network appliances, all built around the rich capabilities of its Ethernity Networks Technology (ENET) Flow Processor. Ethernity's software stack includes a suite of layer 2 and 3 network control protocols for carrier Ethernet, performance monitoring, routing, security, MPLS, timing synchronization, and more. (See figure 2).

Ethernity recognized the needs of telco/cloud service providers, ISPs, and enterprise IT deployments to move to x86 architecture-based networking and COTS servers to operate more independently from traditional, ASIC-based network vendors and OEM equipment suppliers. Ethernity was challenged to leverage its full complement of experience in developing the ENET vRouter. ENET vRouter is a server-based, 100Gbps network appliance designed to accelerate performance without committing to a large investment in new hardware. The goal of the ENET vRouter is to lower the TCO, while preserving the quality of experience (QoE) that users of ASIC-based network equipment have come to expect. Adoption of COTS servers incorporating the ENET vRouter also liberates customers from being locked into a specific supplier's development roadmap and schedules.

"Everybody is talking about x86, but they're careful, because they prefer a migration path," said Eugene Zetserov, VP of product marketing at Ethernity. "As telcos and enterprises move to COTS server platforms for delivering their services, they want to be sure that they are getting something programmable, but with the same high quality of experience. Independence from silicon vendors enables them to deploy services very quickly and be more agile with their customers."

SOLUTION:

FPGAs Key to Deterministic Performance and New Feature Upgrades

Ethernity's ENET vRouter is a combination of its ACE-NIC100 FPGA SmartNIC acceleration card with comprehensive embedded vRouter software, FPGA firmware, and virtual router management that offers deterministic (low-jitter), low-latency, high-bandwidth performance. With Ethernity's FPGA-based data plane acceleration and network function virtualization offloads, the ENET vRouter further enhances networking performance. Moreover, by completely offloading the networking data plane to the ACE-NIC100, the ENET vRouter dramatically improves CPU core utilization, freeing those cores to handle compute functions. (See figure 3).

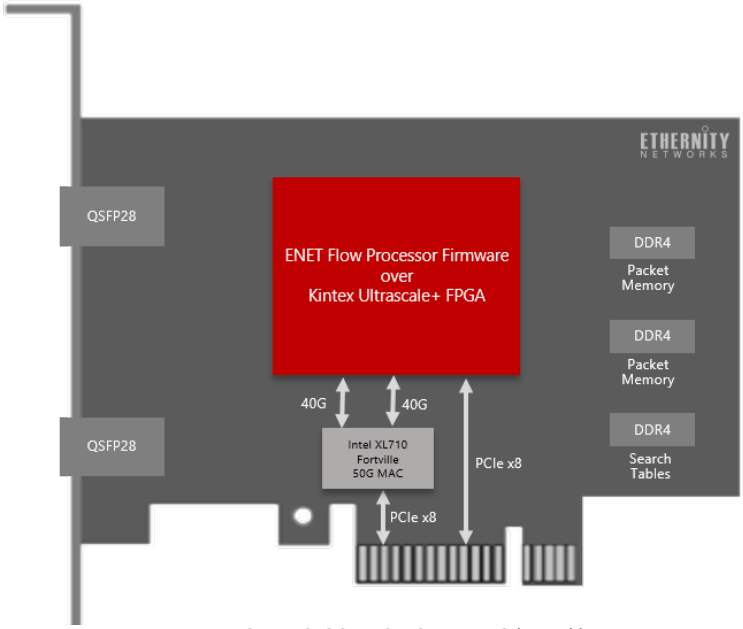

Figure 3: ACE-NIC100 FPGA SmartNIC board layout

When Ethernity began the ENET vRouter project, it first determined the price point of existing multi-core chip solutions, then searched for an FPGA that could meet both the cost and connectivity requirements driving the communications market. Ultimately, the decision was to use the Xilinx Kintex Ultrascale+ KU15P device in its SmartNIC, not only to deliver the needed performance/cost ratio, but also to provide the flexibility customers desired.

Zetserov stated, "You need to think about total cost of ownership which is a primary consideration for our end customers. We have our technology patents that enable us to use logic in a very conservative style. For the same features, we use fewer internal logical and memory elements than others. We also have our own method to work with external memory. Dealing with those factors, we decided on Kintex mainly because of the combination of cost and FPGA size for the logical elements to run our engines and DDR controllers."

Using the Kintex FPGA also allows Ethernity to allocate space to add new capabilities through product upgrades. The telco and cloud markets are characterized by customers who are rapidly evolving their networks from 25/40 Gbps to 100Gpbs interfaces, rolling out new services, and handling growing application databases. This places a premium on working with external memory. "You always want to save 30 percent logic for additional features. Those requirements of connectivity and intensive work with databases were our most difficult technological challenges. We worked a lot with the Xilinx support team to address issues we encountered working with external DDR4 memory."

> "For specific functions we have experienced very low latency, for example, with packet forwarding on the order of a few microseconds. "

RESULTS:

Top Throughput, Latency, and Power Metrics in the Cloud and Network Edge

Ethernity achieved top performance metrics for the ENET vRouter in both cloud and edge deployment scenarios. The appliance delivers full gateway networking of IPSec plus its standard routing features with latency measurements under 10 microseconds. Zetserov noted, "For specific functions we have experienced very low latency, for example, with packet forwarding on the order of a few microseconds. For databases, we measure the appliance performance in millions of flows and have reached throughput of nearly 40 mega packets per second on big databases."

From a telco customer perspective, the challenge for the appliance is to measure up in terms TCO, but judged differently depending upon type of deployment. In the cloud, TCO is measured by rack space, whereas on the network edge it is measured by power consumption of a single server and by efficient handling of many applications, such as augmented reality/virtual reality, machine-to-machine (M2M) communication, and machine learning/AI inference. The SmartNIC card in the appliance uses around 30 watts, so "we are totally reducing electricity requirements at the edge which is very important." Zetserov continued, "From a scalability perspective, we could run multiple network adapters, meaning more than one of our SmartNICs in the same server, which also makes our solution attractive for efficient use of space."

CONCLUSION:

Cooperation on IP Integration for Next-Generation, 5G Networks

In the future, Ethernity sees "many more points of cooperation" with Xilinx, particularly when it comes to 200 and 400Gbps networks. They are evaluating the Virtex Ultrascale+ HBM devices and believe these FPGAs will be "a very good platform for telcos evolving their networks." Ethernity also views cloud radio access network (CRAN) as a technology area where the two companies can collaborate around their respective intellectual property to deliver advanced solutions. Zetserov commented, "5G requires architecture changes to the network, moving more information to the edge, as well as disaggregating and virtualizing functions in order to better support customer services. Networks with many distributed functions running in software with acceleration in programmable logic will represent a good opportunity for us to not only use FPGAs, but also to combine IPs."