Enabling the Virtualized Edge with Smart NIC Data Acceleration
Making Truly Programmable Networks a Reality

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CTO, Ethernity Networks
Agenda

✓ Introduction
✓ What is the Virtualized Edge?
✓ FPGA-Based SmartNIC Acceleration
✓ Ethernity Networks’ Solutions for the Virtualized Edge
✓ Q&A
Cloud-based Services Driving Data Growth

- Cloud-based services
  - Video, content delivery
  - Social media, messaging
  - Storage
  - Data Management
  - Big data processing
  - IoT services
- Rapidly growing network capacity
  - 5G/LTE,
  - Gigabit Broadband
  - Ethernet Services
- Services hosted in large and hyperscale data centers
- Virtualized infrastructure
  - Based on SDN and NFV
Many applications and services require processing close to the user
  – Low latency, high bandwidth, caching, localized services
  – Multi-access Edge Computing (MEC) is a key initiative

5G/LTE wireless
  – vRAN and Cloud RAN already being deployed carriers
  – The virtualized edge is built into the 5G architecture

Other applications
  – Broadband
  – Enterprise services
  – IoT Services
The Virtualized Network Edge

Wireless Edge
- vRAN
- RRH
- Virtual BBU

Residential Edge
- Virtual OLT

Edge Cloud
- Application Cache
- Virtual IoT Hub
- Virtual SecGW

Mobile Core
- Telco Cloud

Enterprise Edge
- Private Cloud

IoT Edge
- Virtual IoT Hub

Web Services
- Azure
- AWS
- Google

Virtual Cloud
- IoT Edge
- Mobile Core
- Enterprise Edge
- Private Cloud
Virtualized Edge

Operator survey: smart central offices to be in 85% of service provider networks this year

IHS Markit, Jan 2018

Remote Edge, Far Edge, Extreme Edge, Smart Edge, Distributed Cloud, Multi-Access Edge Computing (MEC), Central Office, Hub, Fog Computing, cRAN, vRAN
The Race to the Edge

Moving the cloud closer to the user

Lambda@Edge

Azure IoT Edge

Access Network

Virtualized Edge (vBNG, vEPC, vSecGW...)

Transport Network (Trusted/Untrusted)

Carrier Data Center

Cloud

Physical

Virtual

NFV @ edge

Smart phones

Businesses

Residential

Cloud

Amazon Cloud Front

Physical

Virtual

NFV @ edge

Smart phones

Businesses

Residential

Lambda@Edge

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Edge Related Open Source and Standardization Projects

- **openEDGECOMPUTING**
- **ETSI** (MEC)
- **CORD**
- **OPNFV**
- **StarlingX**
- **EDGE X FOUNDRY™**
- **AKRAINO EDGE STACK**
<table>
<thead>
<tr>
<th>Project</th>
<th>Description</th>
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<tr>
<td><strong>CORD</strong></td>
<td>Reference implementations in CO for residential, mobile, and enterprise use cases</td>
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<td><strong>OpenEdgeComputing</strong></td>
<td>Any application is able to utilize the nearby edge computing services independent of the communication bearer, the edge node technology, and the edge operator</td>
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<td><strong>OPNFV Multi-Access Edge</strong></td>
<td>Provide documentation, test, and scenario integration support for access hardware and VNFs for edge-deployment use cases</td>
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<td><strong>OPNFV Edge Cloud</strong></td>
<td>Focused on design and development of reference platform of edge cloud in OPNFV. Scope includes NFVI, VIM, MANO</td>
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<td><strong>OPNFV vCentral Office</strong></td>
<td>OPNFV PoC, similar to CORD, but using ODL, OCP, and OpenStack</td>
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<td><strong>StarlingX</strong></td>
<td>Part of OpenStack, open source contributed by Wind River, specially for the edge</td>
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<tr>
<td><strong>Akraino</strong></td>
<td>Akraino Edge Stack, a Linux Foundation project in formation, AT&amp;T contribution</td>
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<td><strong>EdgeXfoundry</strong></td>
<td>IoT framework simplifying the process to design, develop, and deploy solutions</td>
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<td><strong>Multi-Access Edge Computing</strong></td>
<td>ETSI ISG standardization effort, providing industry standards</td>
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Unique Needs at the Network Edge

Limited power and space

Many users and exponential growth in number of devices, especially as 5G approaches
More Challenges for Virtualizing the Edge

- Security
- Openness
- Futureproof
- Multiple applications per site
- Low latency
Accelerating Traffic, Mainly Video

- 3Mbps for SD video
- 10Mbps for HD video
- 25Mbps for 4K UHD video (Netflix recommendation)

Ericsson Mobility Report June 2018
Smart NIC Acceleration

• Smart NICs accelerate application performance
• Replacing standard NICs
  – Hyperscale data centers
  – Edge computing
• Multi-host CPU offload
  – Applications
  – Network functions
• FPGA or processor based
• I/O controller integrated or separate
SmartNIC – Accelerating SDN
Smart NICs
Networking and Security Acceleration Options

- Fully programmable
- Open
- Disaggregation

Fat pipes issue
Vendor lock-in
Scalability issue

Not programmable → Not a SmartNIC
FPGAs demonstrate the “... performance characteristics of an ASIC, but the programmability and reconfigurability inherent in a software solution like a SoC.”

“We stopped burning CPU cores to run the network datapath... Host cores show less than 1% utilization...” after implementing FPGA SmartNICs
FPGA-Based SmartNICs for the Virtualized Edge

- Scalability: millions of users/devices
- Low power and minimal space: less servers, lower CPU load
- Security: flow isolation
- Open: Intel and Xilinx, easily ported
- Future proof: HW updates at the pace of SW development
- Compact: multiple applications in a single server
- High performance: deterministic, low latency
Two Typical Offloading Options

II. VNF offload

- VNF #1
  - VM/Container #1

- VNF #2
  - VM/Container #2

- VNF #n
  - VM/Container #n

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DPDK (with Carrier-class Networking Extensions)

vSwitch: OVS-DPDK, VPP or Tungsten Fabric vRouter

HyperVisor

X86 Server

SmartNIC #1

SmartNIC #n

agent

SR-IOV

SDN Controller
Just Released: ACE-NIC100 SmartNIC

PR: Ethernity Networks Releases the 100G ACE-NIC100 FPGA-based Smart NIC

• FH/HL
• Fully programmable, FPGA-based
• 10G, 25G, 40G, 100G ports
• PCIe Gen3 x16, DDR4 for packet buffering
• Complete networking IP for the edge: vCPE, vEPC, vBNG/vBRAS, vFW, SecGW, SD-WAN
• Carrier-class DPDK acceleration
Example: Accelerated vs. SW-Only vBNGs

- This analysis is based on Intel’s figures and Ethernity Networks’ tests.
- Assuming 3Mbps user rates and 8,300 users in the 50Gbps case. Higher user rates are significantly more challenging for server-only solutions.
- Not covered above, server-only consumes more real estate and has over 100microsec delay and large delay variation (EANTC and Nokia tests). Deterministic performances with less than 15microsec are assured by ACE-NIC HW acceleration.

**ACE-NICs make vBNG realistic!**
Example: Tap as a Service

- Flow-based tapping of flows to monitor/probe
- Flexible flow classification
- Can tap any flow (n-tuple)
- Programmable tunnels
- Millions of flows
Multi-Access Edge Computing (MEC)

- 1U server-based solution with HW acceleration
- Optimal for network edge deployment
- High performance, fully programmable, future-ready

VM/Container #1: vEPC
VM/Container #2: vBNG
VM/Container #3: vSecGW
VM/Container #4: SG-XHaul

ENET Flow Processor
FPGA
ACE-NIC100
ACE-NIC100
About Ethernity Networks

✓ Leading innovator of network processing technology and products
  ✓ Systems-on-Chip (SoCs) – IP licensing
  ✓ SmartNICs and innovative server-based network appliances

✓ Over 500,000 systems already deployed with Ethernity’s data processing technology, connecting over 100M end users

✓ Unique patented networking technology, FPGA-based

✓ Founded in 2004, public company traded on AIM of the London Stock Exchange

✓ HQ in Israel, sales offices in North America and Asia
Takeaways

✓ Virtualization is happening at the edge
✓ The virtualized edge has some unique requirements
✓ FPGA-based SmartNICs address the virtualized edge requirements
✓ Ethernity Networks has a full solution for the virtualized edge
Questions and Answers?

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Heavy Reading

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Thank you
For your attention

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