



**NETRONOME**

## Increase Application Performance with SmartNICs

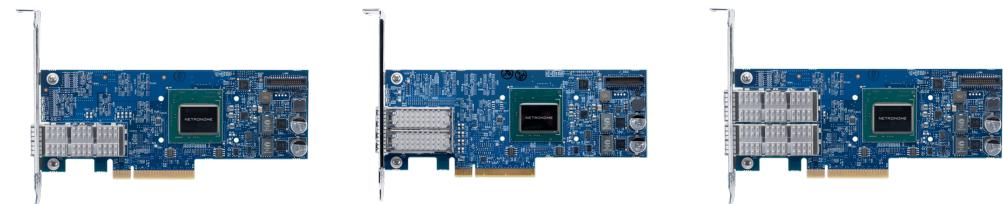
Ron Renwick, Sr. Director of Product Management

# Comprehensive SDN and NFV Acceleration

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## Agilio® Server-Based Networking Software



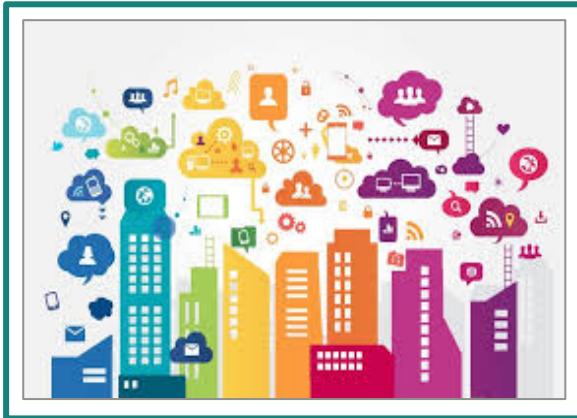
## Agilio® CX SmartNICs

Low profile PCIe Gen3x8 Adapters  
10/25/40/100GbE solutions

- Boosts network performance and frees up x86 CPU cores
- Brings the speed of software innovation to hardware
- Cloud networking using Open vSwitch, Contrail vRouter and eBPF applications

Accelerates performance in NFV and Cloud infrastructures

# Delivering Network Accelerators for High Growth Markets | NETRONOME



NFV Infrastructure



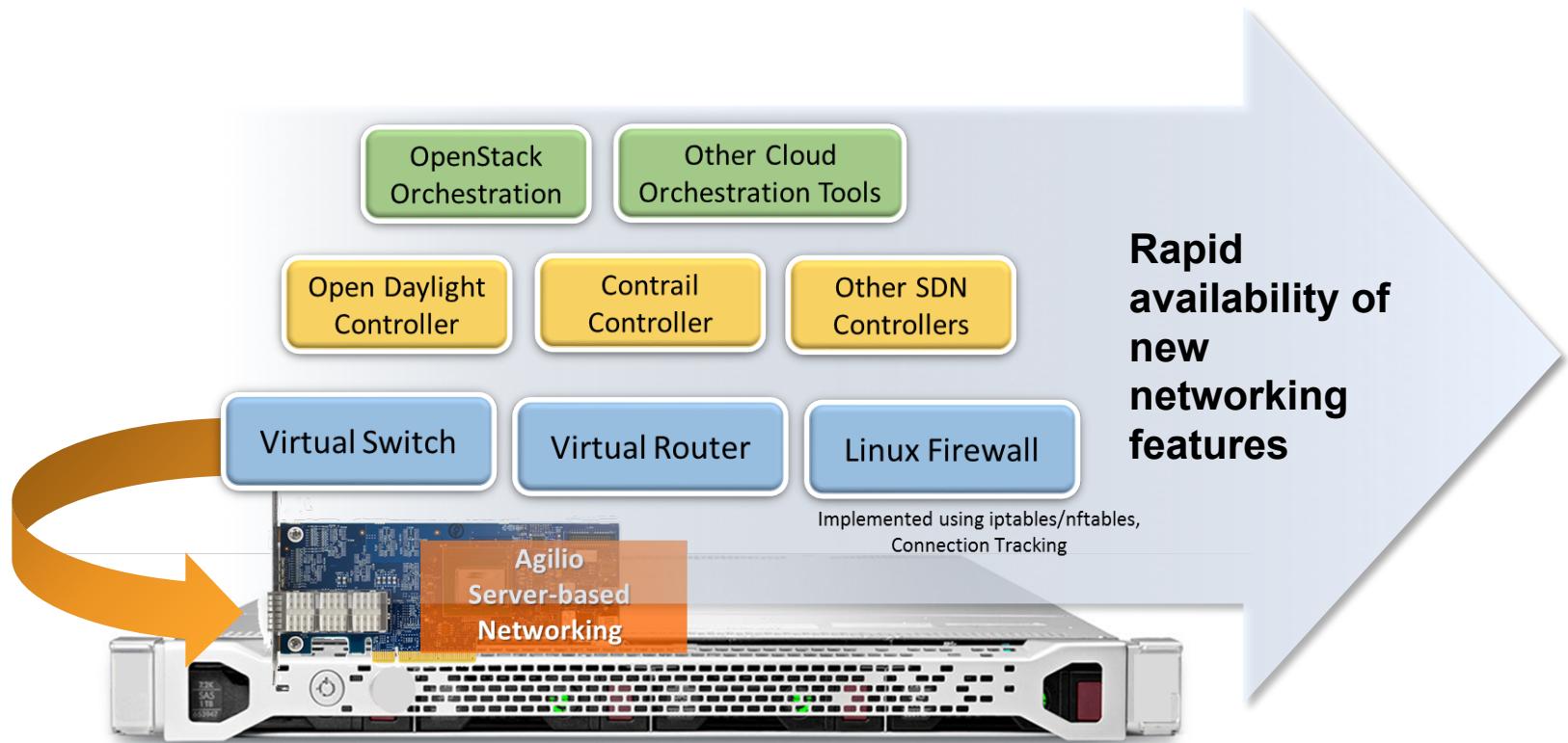
Security



Cloud Networking

# The Speed of Software Innovation on Hardware

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New production-level feature rollouts at needed performance every 4-6 months

# Cloud Adoption Driving New Server Workloads

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Distributed Storage (SSD, HCI)

Network Function Virtualization (NFV)

Distributed Security

Packet Processing

Machine Learning

Web Server & Search

Transaction Processing

Scientific Computing

Networking Workloads

Other Workloads

Diverse  
and  
Emerging  
Data  
Center  
Workloads

**76%**  
**Data center**  
**traffic driven by**  
**cloud-based**  
**workloads by**  
**2018**

Source: Cisco Global Cloud Index, 2015-2018

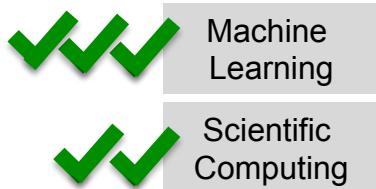
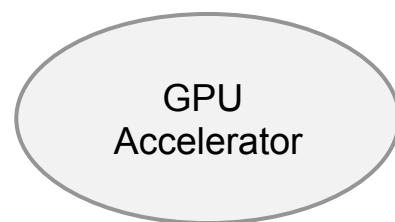
Source: Ericsson

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# Workloads that Benefit with Accelerator

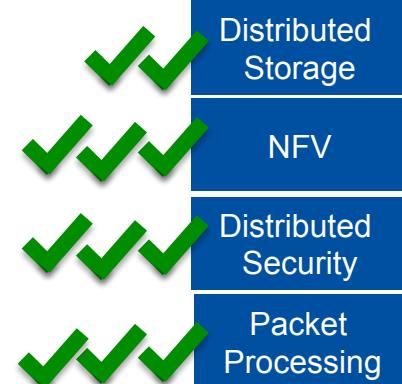
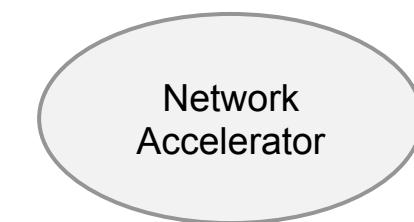
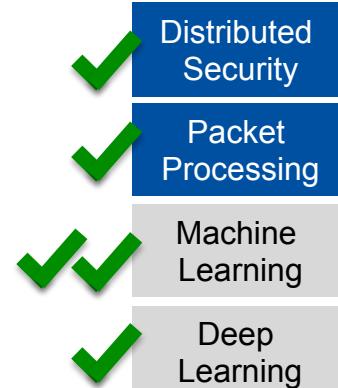


Workload optimized accelerators work as co-processors to general x86 compute



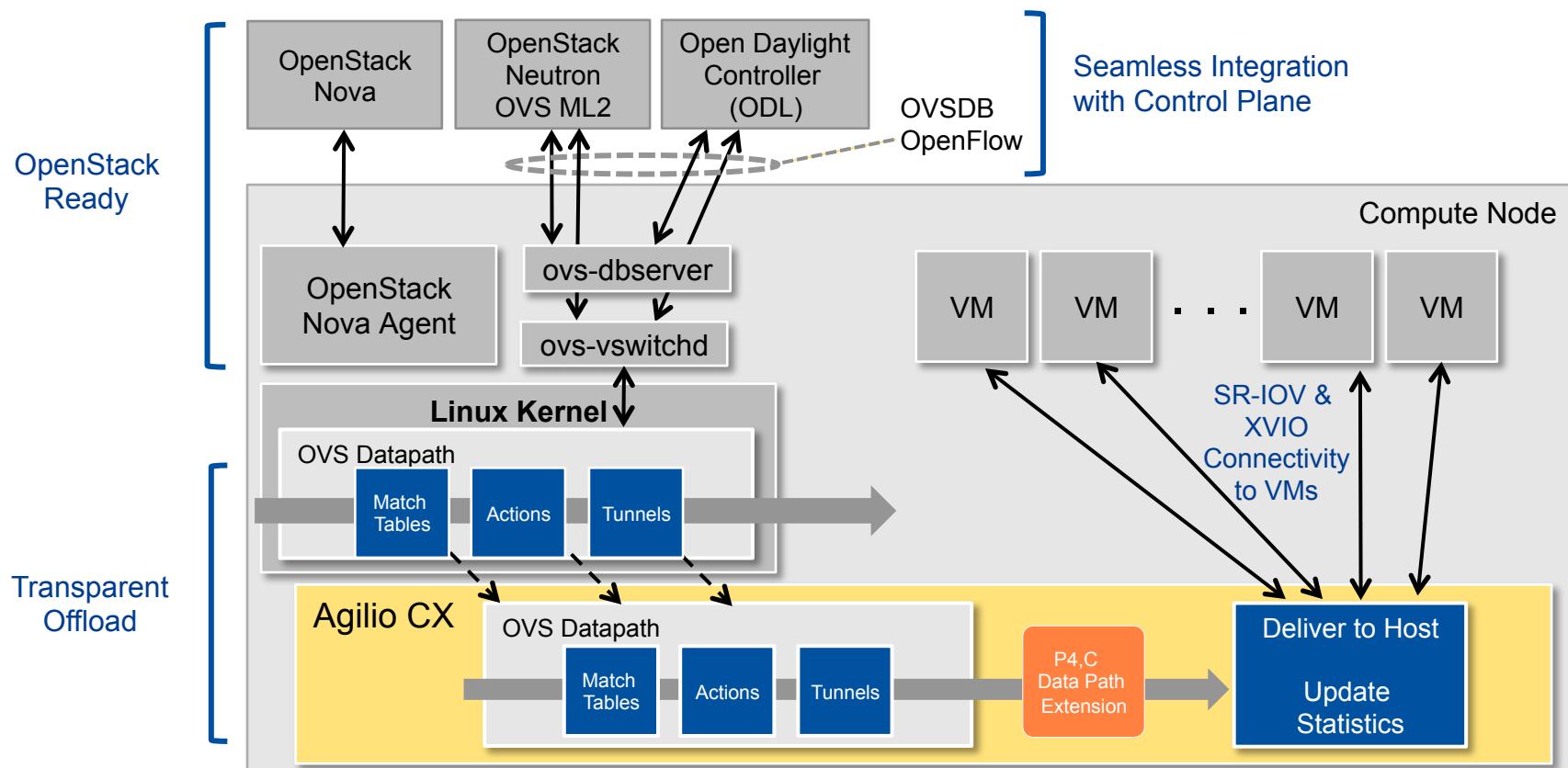
Networking Workloads

Other Workloads



# Open vSwitch Datapath Acceleration

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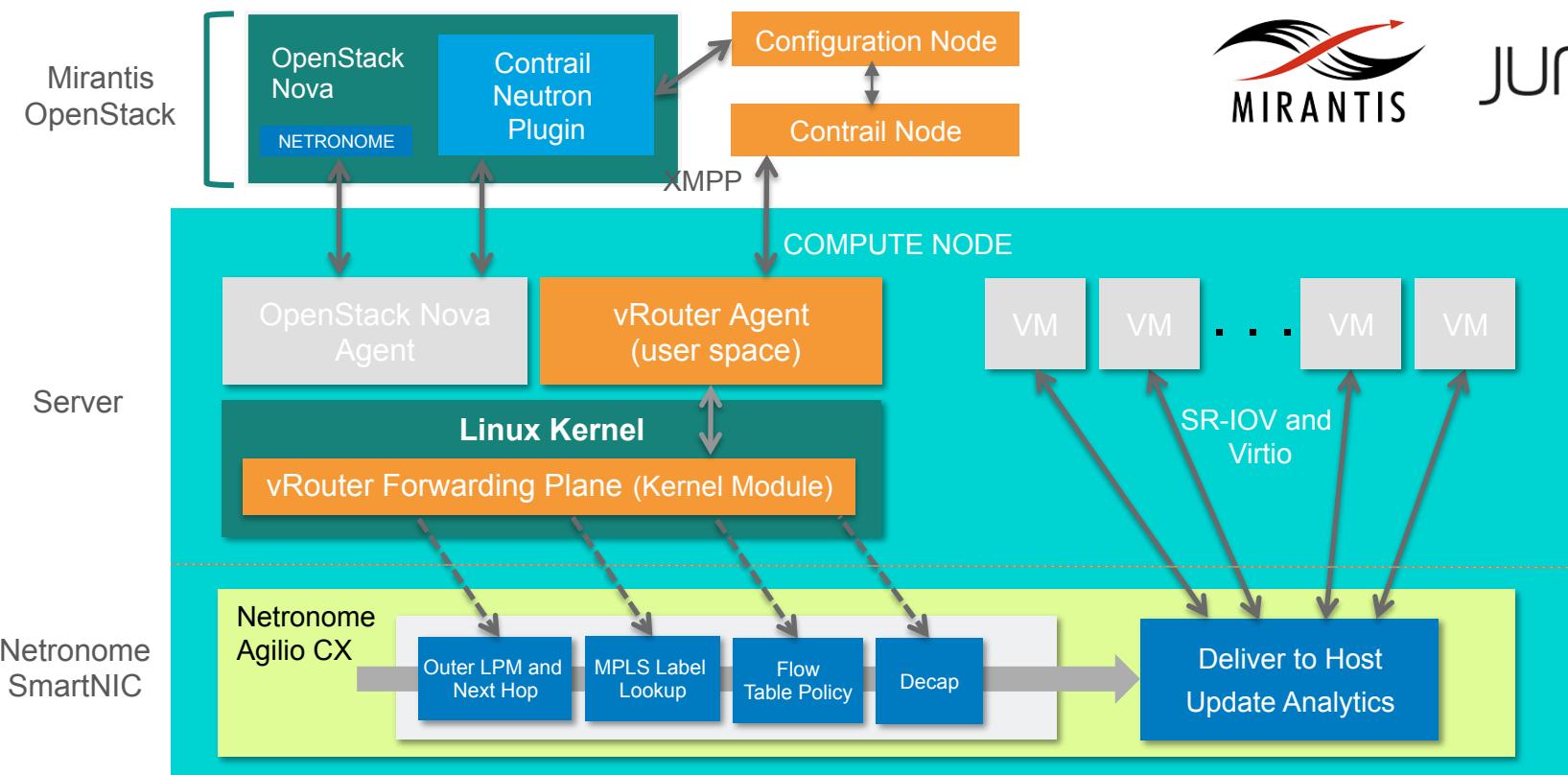


[https://www.netronome.com/media/redactor\\_files/WP\\_Agilio\\_SW.pdf](https://www.netronome.com/media/redactor_files/WP_Agilio_SW.pdf)

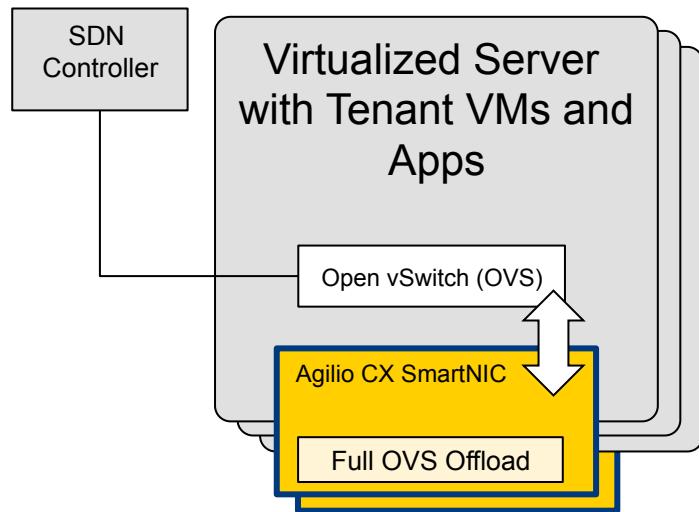
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# Integration with OpenStack and Contrail

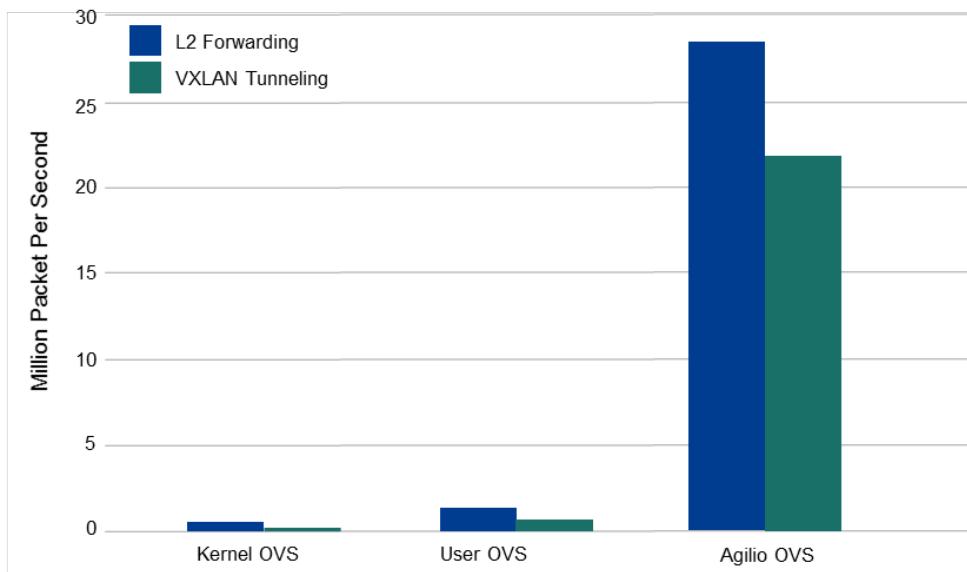
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# Per Server CPU Core Efficiency with Agilio Platform | NETRONOME



OVS Throughput with single server CPU core



**50X** Efficiency Gain vs. Kernel OVS

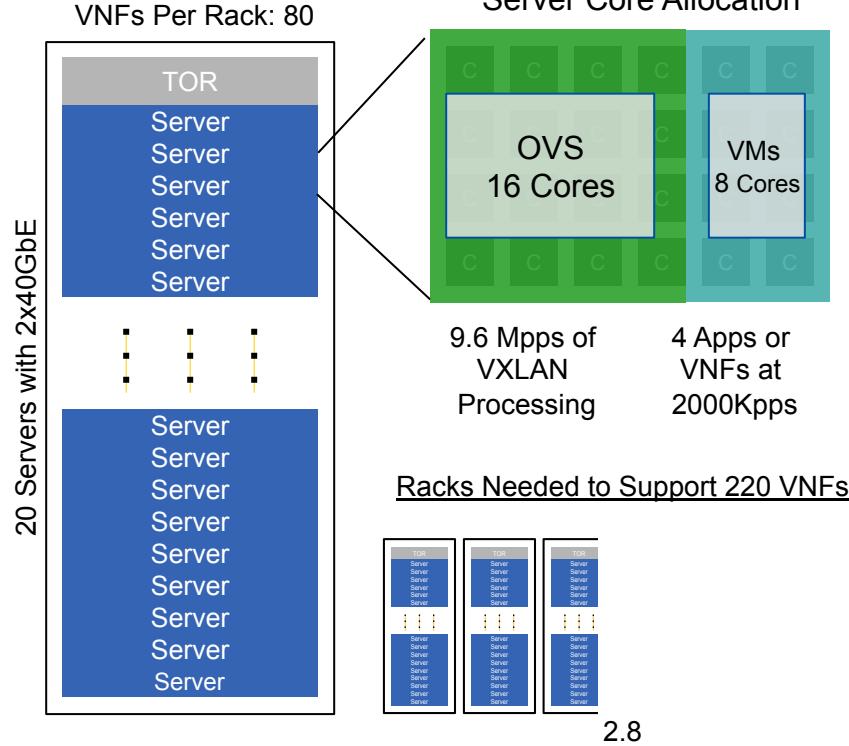
**20X** Efficiency Gain vs. User OVS

# NFV Use Case: 2,000Kpps per VNF or Application



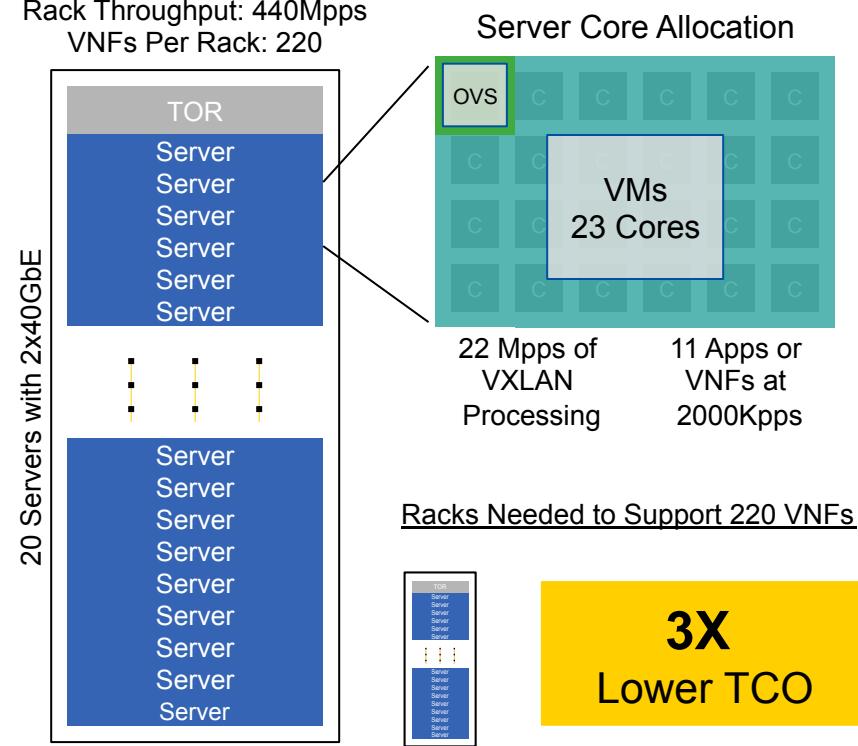
Ericsson Cloud SDN with OVS in User Space and Traditional NIC

Rack Throughput: 168Mpps  
VNFS Per Rack: 80



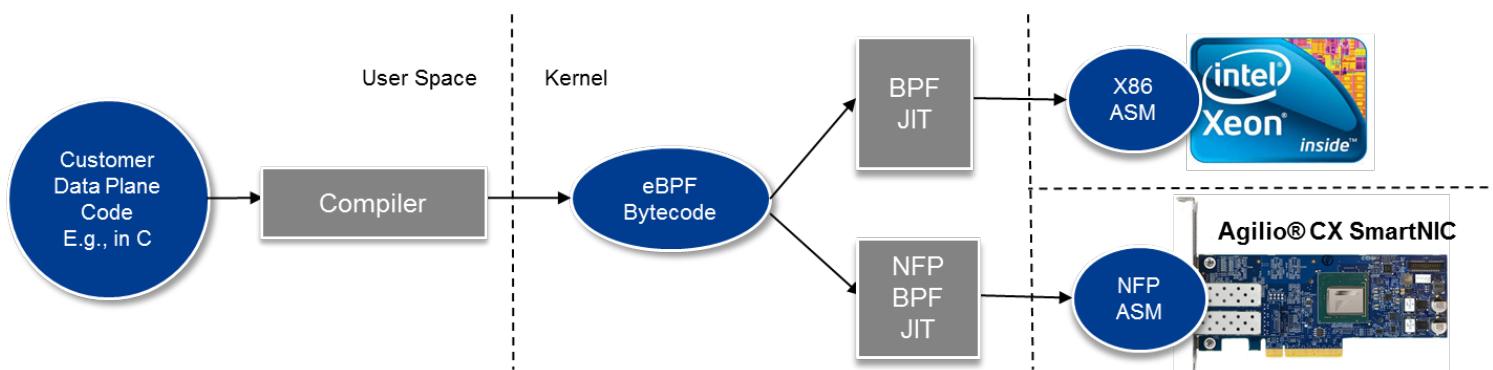
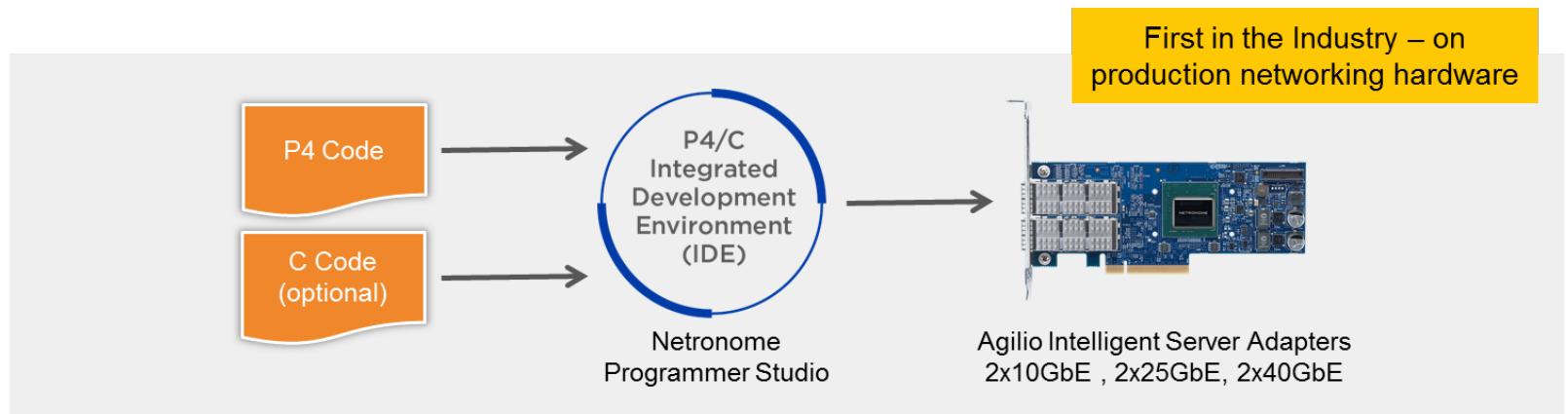
Ericsson Cloud SDN with OVS running on Netronome Agilio Platform

Rack Throughput: 440Mpps  
VNFS Per Rack: 220

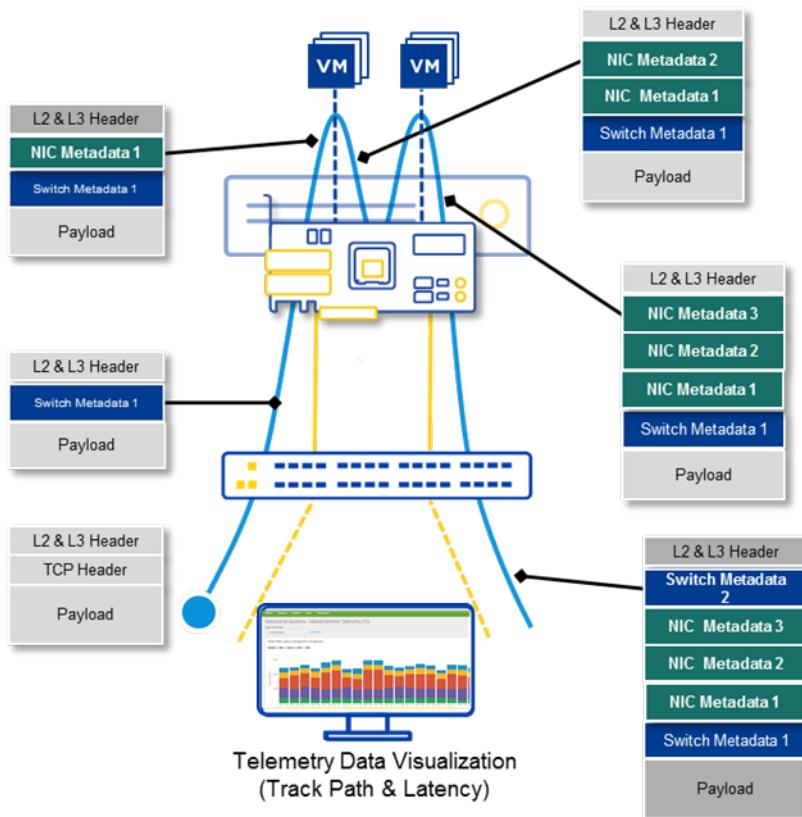


# P4 and eBPF-based Rapid SDN Innovation

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# Accurate, High Performance Network Telemetry



## With Agilio Solution

Real time data collection

In packet, wire-speed

Physical & virtual network

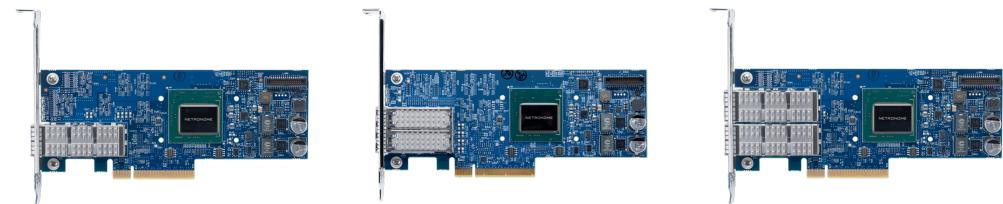
Triangulate server, VM, switch

Gather data at each hop

Increase Service  
Levels with Inband  
Network Telemetry



## Agilio® Server-Based Networking Software



## Agilio® CX SmartNICs

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10/25/40/100GbE solutions

- Boosts network performance while freeing up x86 CPU cores
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- Cloud networking using Open vSwitch, Contrail vRouter and eBPF applications

Delivers compelling TCO in NFV and Cloud infrastructures



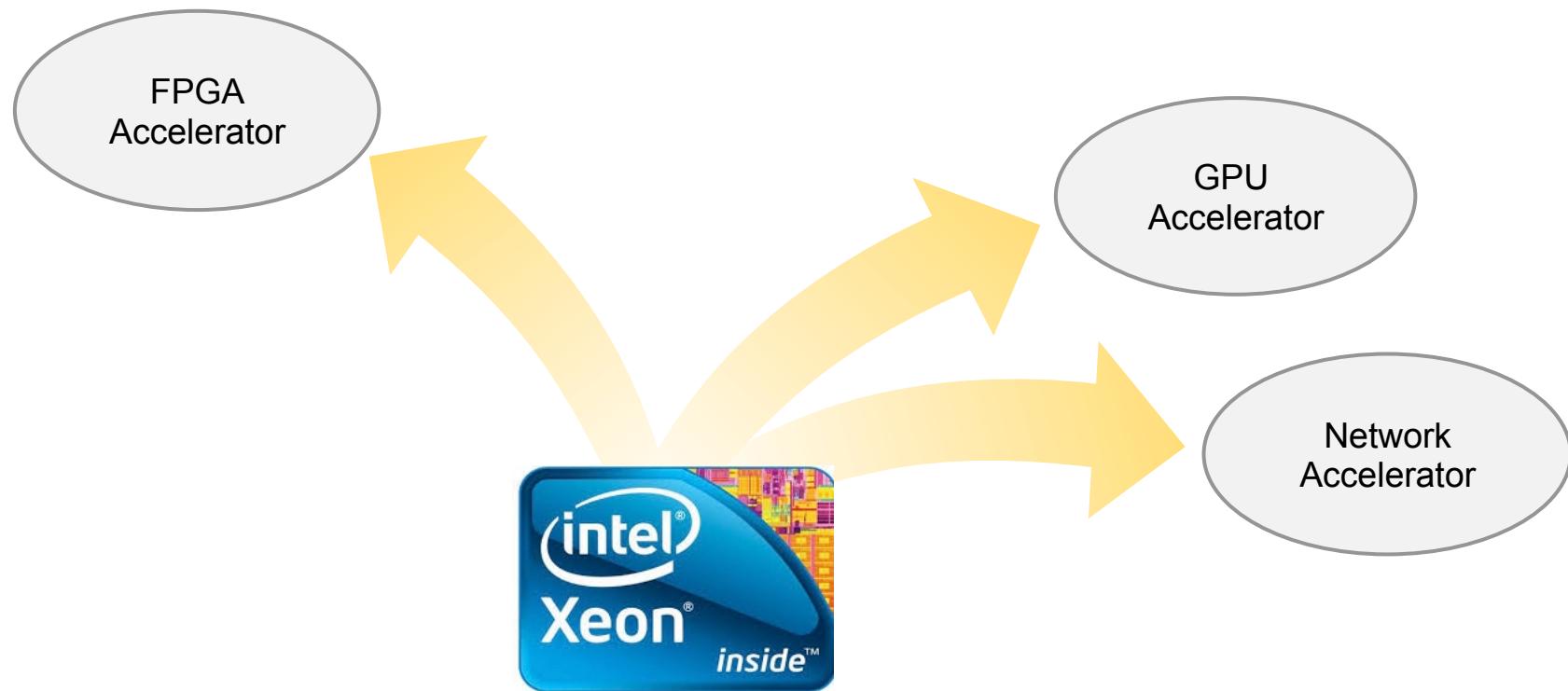


## Using OpenStack to increase application performance with SmartNICs

SmartNICs improve performance by offloading and accelerated the datapath for server based networking. We will discuss controlling and managing SmartNICs in an OpenStack environment to provide increased application and network performance.

# Workloads TAM Shifting from x86 to Accelerators

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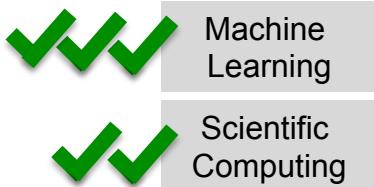
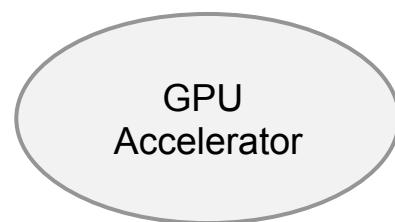


Sources: Intel, Altera, AMD

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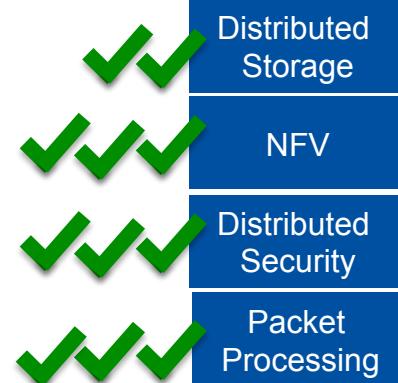
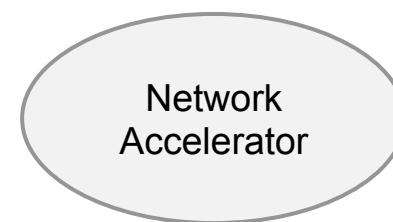
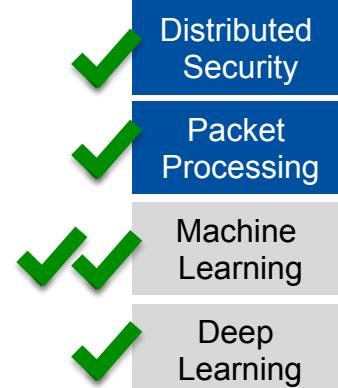
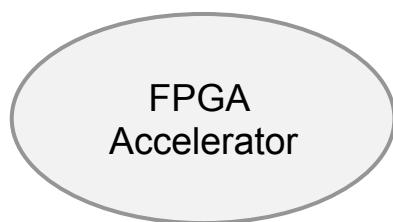
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Workload optimized accelerators as co-processors to general x86 compute

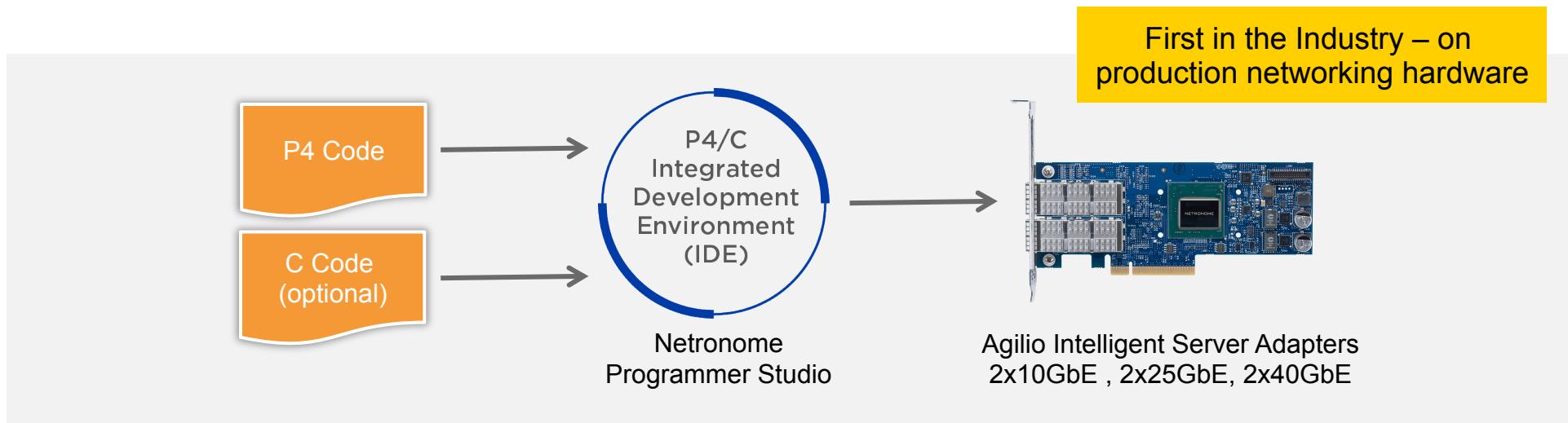


Networking Workloads

Other Workloads



Seamless programming of SDN applications into the production Agilio solution  
Utilizes open source P4 compiler, language from the P4 Language Consortium  
Extensions enable optional C-based modules for sophisticated functions



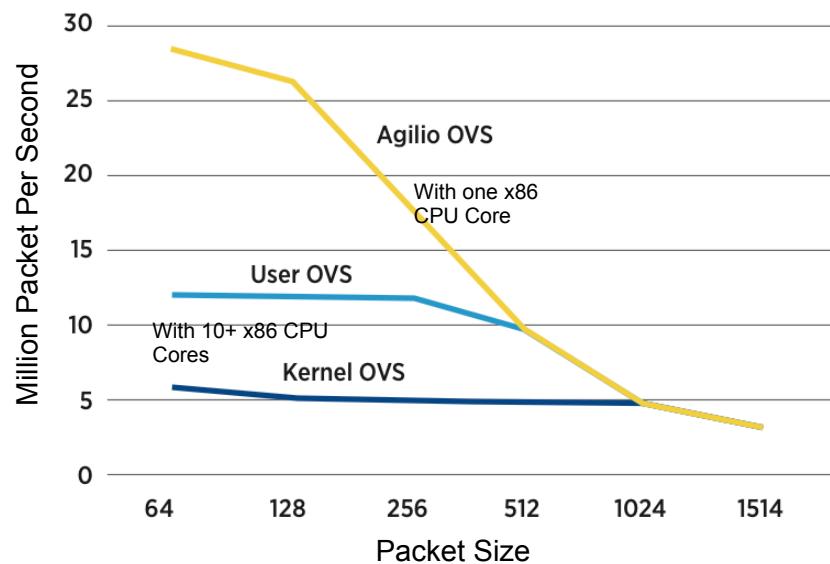
P4/C IDE is generally available. Industry-wide open R&D at [www.Open-NFP.org](http://www.Open-NFP.org)

# OVS Benchmark Throughput Results



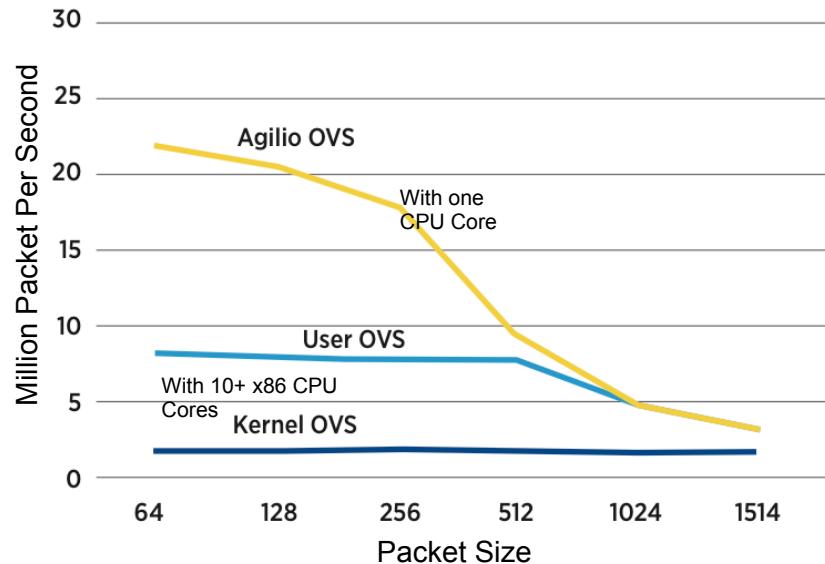
- 1000 Wildcard Flow Rules (match on MAC DA)
- 64,000 Exact Match Micro-flows
- Bursting with 10 packets/Micro-flow

## OVS L2 Forward to VMs



- 1000 Wildcard Flow Rules (Match on VNI+MAC DA)
- 64,000 Exact Match Micro-flows
- Bursting with 10 packets/Micro-flow

## OVS VXLAN + L2 to VMs



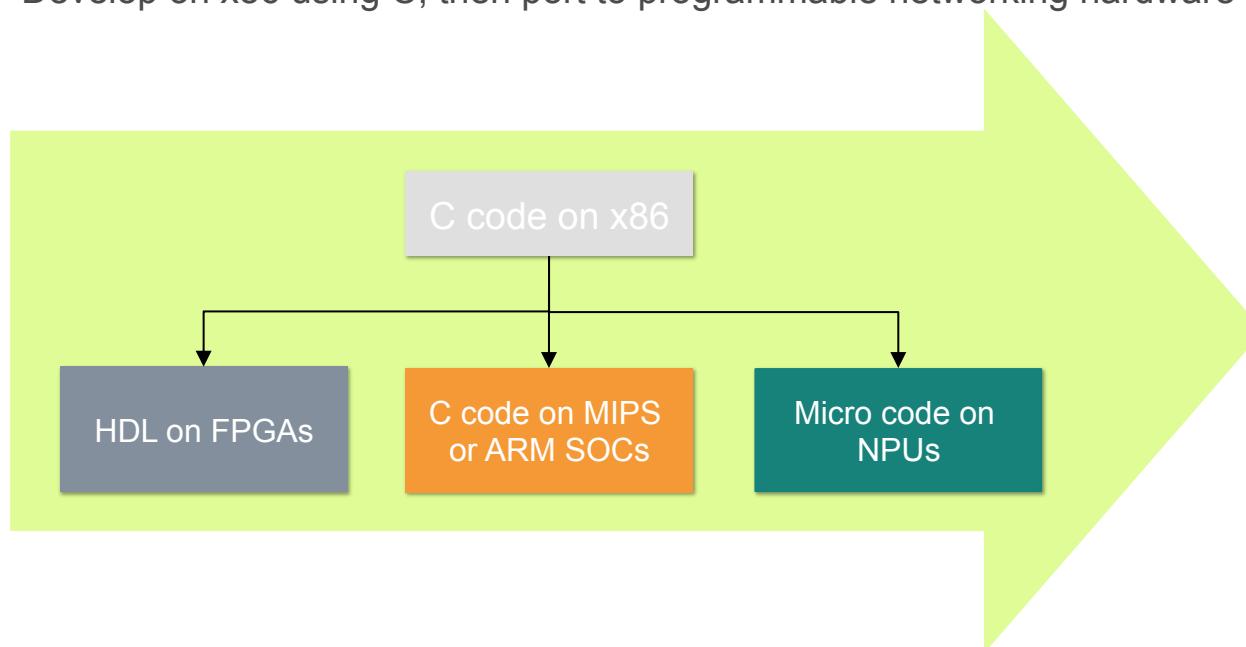
[https://www.netronome.com/media/redactor\\_files/WP\\_OVS\\_Benchmarking.pdf](https://www.netronome.com/media/redactor_files/WP_OVS_Benchmarking.pdf)

# Custom Features Dev Entails Unpredictable ROI | NETRONOME

SDN and NFV require many networking features

Data center operators and OEMs want to differentiate

Develop on x86 using C, then port to programmable networking hardware



- Unpredictable or poor performance
- Long time to market
- Vendor lock-in

New algorithms and application architectures demand specialized compute

Data in-flight can be per-processed for highly parallel computations

Programmable NICs providing CPU offloads are cost effective method for increasing server compute capacity

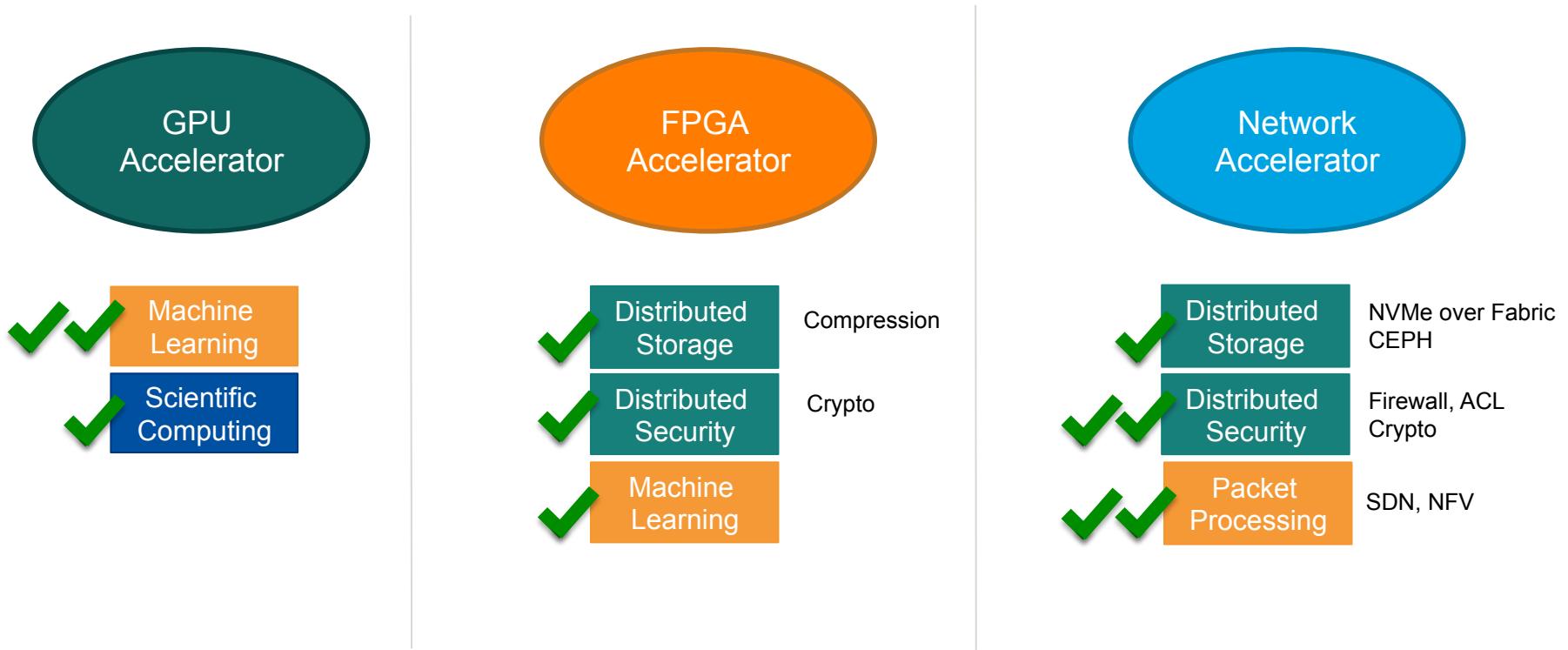
Meets needs of IoT and NFV market



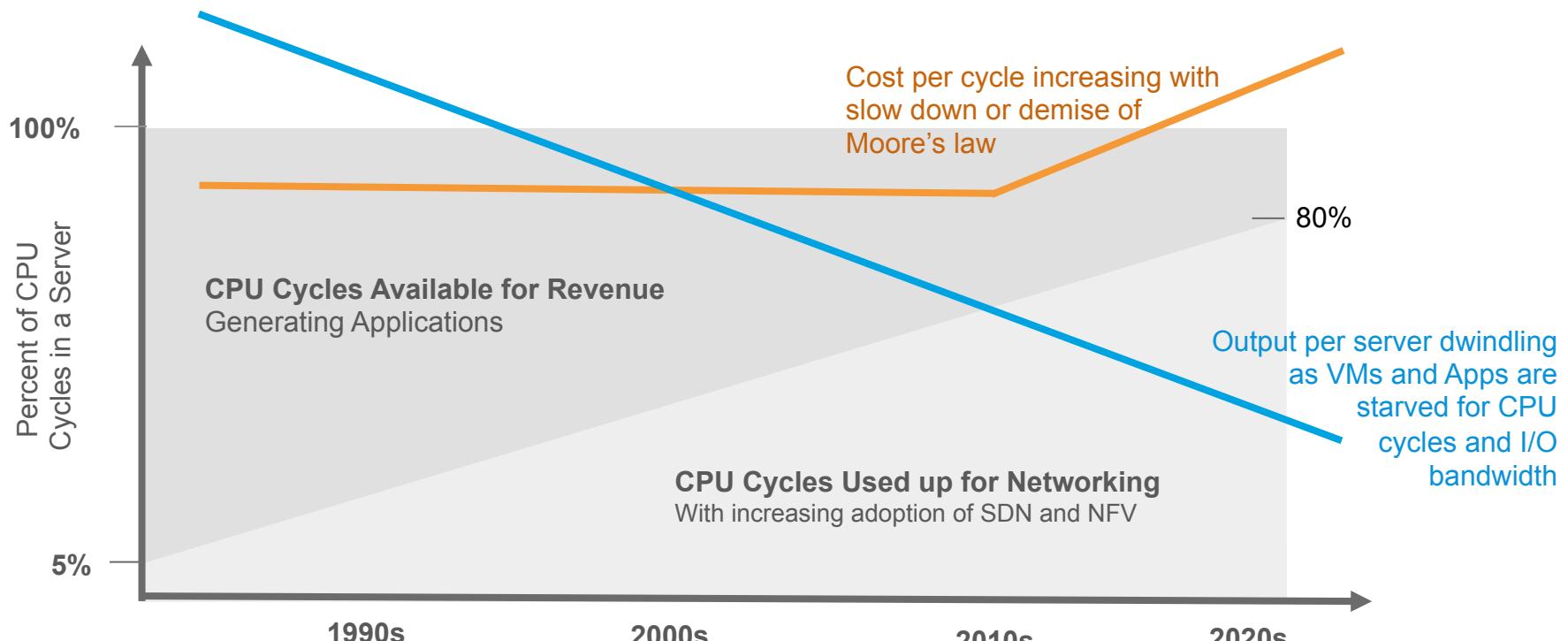
# Accelerators for Heterogeneous Computing

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Workload optimized accelerators as co-processors to general x86 compute

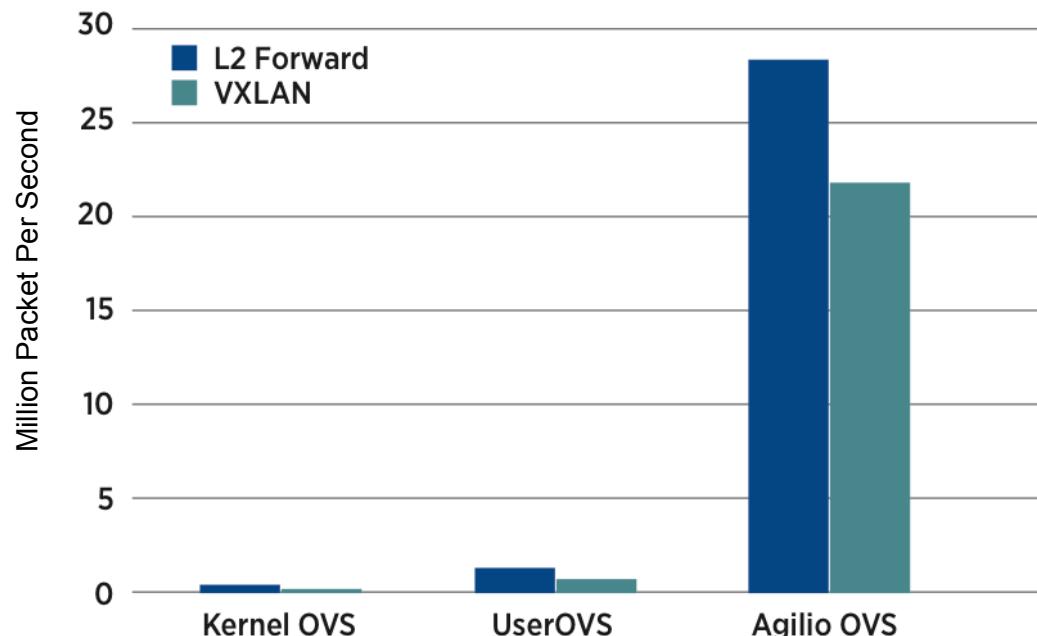


# From Free CPU Cycles to Application Starvation



Netronome solutions return expensive CPU cores to revenue generating VMs

## Throughput with single Server CPU Core



- 50X Efficiency Gain vs. Kernel OVS
- 20X Efficiency Gain vs. User OVS

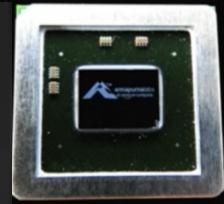
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## Need for Accelerators Validated by Mega-Scale Operators | NETRONOME



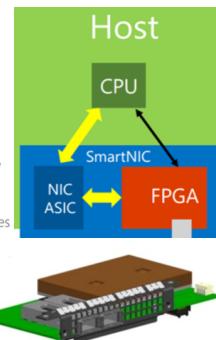
### 2016 CUSTOM SILICON

- Custom Si & 25GbE
- 2x 25GbE cheaper & higher bandwidth than 40GbE
- Amazon Annapurna ASIC
- Second generation Enhanced Networking
- AWS controls silicon, hardware & software
- AWS pace of innovation



### Azure SmartNIC

- Use an FPGA for reconfigurable functions
  - FPGAs are already used in Bing (Catapult)
  - Roll out Hardware as we do software
- Programmed using Generic Flow Tables (GFT)
  - Language for programming SDN to hardware
  - Uses connections and structured actions as primitives
- SmartNIC can also do Crypto, storage acceleration, and more



Google

Tensor Processing Unit



Large R&D budgets, deep acceleration software expertise  
Proprietary silicon & hardware-based acceleration

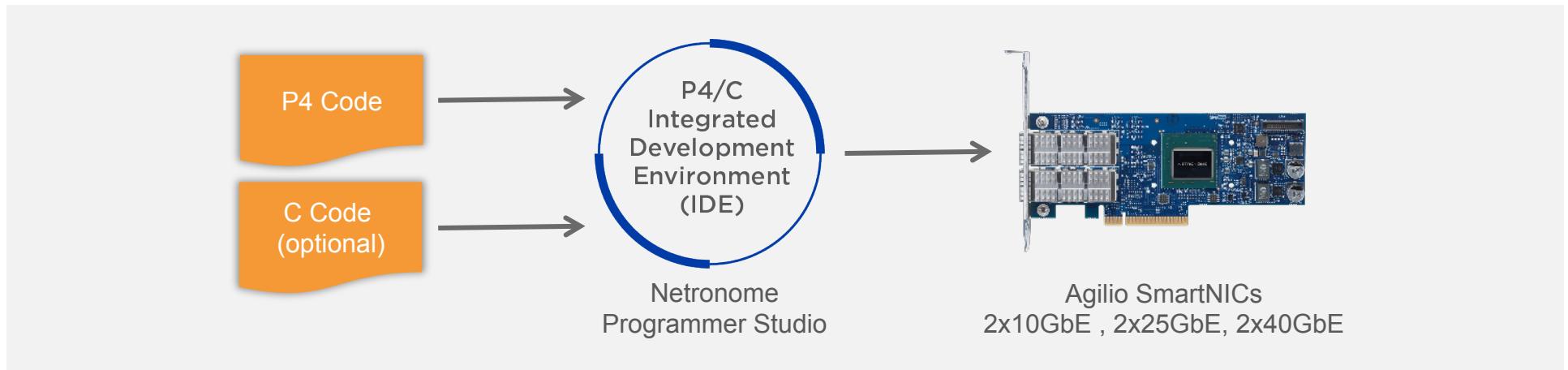
Everyone else needs off-the-shelf solutions

# Custom Datapath with P4/C Integrated Dev Env (IDE)

Seamless programming of SDN applications into the production Agilio solution

Utilizes open source P4 compiler, language from the P4 Language Consortium

Extensions enable optional C-based modules for sophisticated functions



**P4/C IDE is generally available. Industry-wide open R&D at [www.Open-NFP.org](http://www.Open-NFP.org)**