Smart Network Processing for White Boxes

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EZchip Overview

- Fabless semiconductor company, NASDAQ listed (EZCH)
- Leading provider of Ethernet Network Processors (NPs) to the Carrier Ethernet (CE) market, especially for edge routers
- EZchip is a strategic supplier to the top Carrier Ethernet vendors
- Announced the NPS, a revolutionary line of NPs for the next wave of smart carrier and data center networks
- NPS stands out as the most powerful network processing silicon for carrier edge routers, data-center appliances and white-box solutions
- Founded in 1999; 200 employees, 160 in R&D in Israel
- Global offices in Israel (HQ); San Jose, CA; Boston, MA; and China
- Strong financial model; over $210M in cash, no debt
Definition of a White Box

From “AT&T Domain 2.0 Vision White Paper”,
November 13, 2013

“… the term White Box means a network data plane forwarding/processing element that is based on readily available networking hardware, such as merchant silicon, network processors, or ASICs. It is available from many suppliers, is interchangeable with other white boxes; and has both limited integrated control plane functions as well as support for SDN Control (decoupled control) through a standard, open interface.”

Benefits of White Boxes

- Off-the-shelf hardware from ODM versus a proprietary system
- Key differentiators are silicon & software
- Suitable for deployment in various areas such as top-of-rack switches or network appliances
- Drives down costs by enabling an ecosystem of hardware and software vendors
- Can be implemented in a variety of form factors: 1U, 2U, OCP
- Allows multiple vendors to compete with the same hardware
- Provides the end customer with choices
White Box

Value is in the silicon & software

Merchant Silicon

ISV Software

Simple White Box

Value is in the silicon & software

Fixed-Function ASIC

Limited L2 Functions

Mainly a business model change rather than a technology enabler
Smart White Box

Value is in the silicon & software

Programmable NPS

Any L2-L7 Functions

All the benefits of a white box plus

- Fully programmable NPS to implement any L2 to L7 system
- Software updates to enable new functions/features/protocols
- Drive performance for a variety of applications

NPS: A Game Changer NPU

400 Gbps NPU

C Programmable

Security & DPI

Hardware Accelerators

Linux OS

Traffic Management

Layer2-Layer7 Processing

NPU Performance
CPU Programmability
NPS Target Markets

For next gen L2-7 edge routers
- Leapfrogs merchant & in-house NPUs with L2-7 & C-programmability

For next gen cloud architectures
- Leapfrogs multi-core CPUs with 10x performance

Strongly differentiated technology
- Faster & smaller C-programmable processing cores
- 256 processors, 4096 virtual processors on one chip
- Large set of algorithmic accelerations
- Market leading traffic management technology

The Smart NPS White Box

- L2/L3 forwarding
- Data center bridging
- Fixed encapsulation protocols
- Limited scale

- L2/L3 forwarding & routing
- Data center bridging
- Multiple encapsulation protocols
  - VXLAN, NVGRE, STT, +++
  - OVS offload & OpenFlow 1.3 ++
  - Stateful flow table scaling to millions of flows
- Classification & access control (ACL)
- Load balancing
- Firewall, security (IPSEC, SSL)
- DPI / application awareness
- Traffic management
- SLA enforcement
- Network monitoring
- TCP acceleration / termination
- Service chaining
Use Case: ACL Offload

- Scenario: Hosting multiple tenants over same infrastructure
- Operator must ensure proper isolation as well as correct flow of packets based on virtual network, physical network, tenant, and application for every packet
- Requires a large number of ACLs and policies
- ACLs in high-performance networking equipment are typically implemented using specialized silicon such as TCAMs

- Performing ACL lookups in server software incurs a high overhead and can severely impact application performance
- With NFV, network functions are virtualized as VNFs in COTS servers and white box switches. NPS is ideal for an NFV fast path accelerator enabling COTS based solutions to scale
- NPS supports an on-chip TCAM with as well as TCAM algorithmic extension to external DRAM
  - Scales to millions of ACL rules and flow classifiers
  - Enables scalable NFV, SDN and OpenFlow networks

Use Case: Application Awareness

- NPS provides a high-performance, application-aware flow manager:
  - Classify traffic based on application
  - TCP ordering and termination
  - Able to look at higher level protocols, extract content, such as URLs, and match across multiple rules and strings
  - Apply stochastic rules such as BW, delay, jitter, packet size monitoring
  - Able to apply different service chains based on application
  - Supports different QoS profiles per application
  - Enables user-defined monitoring tools
  - Ensures service level agreements on a per application basis

- Can be seamlessly integrated with third party application recognition software (e.g. QOSMOS, Procera).
Use Case: Virtualized CPE & IPsec

- Scenario: Virtualizing CPE, access router, residential gateway
- Traditional model: Security functions such as firewall run on the CPE or GW device
- SDN / NFV migration: Security and other networking functions are implemented as VNFs on VM in carrier’s data center
- Requires a secure tunnel between VM and CPE/GW client
- This creates a large number of IPsec tunnels

- The NPS white box offloads and treats IPsec as an inline service at the start of the service chain in the white box, resulting in a significant offload
- White boxes which only perform L2/L3 forwarding cannot handle stateful operations such as encryption and decryption which must then be done on server
- The NPS white box accelerates security protocols to rates of 200Gbps
- Traffic management, DPI and more are offloaded to the NPS Smart White Box
- Higher performance, fewer servers, simpler management

Use Case: Lawful Interception

- Lawful interception requires the ability to observe, monitor, and take action on any flow based on any fields (L2-L7) in the flow including cross packet payload based signatures
- NPS contains powerful hardware to perform wire-speed processing
  - L7 application awareness
  - Stateful flow tables
  - TCP reassembly & termination
  - Hardware accelerated pattern matching

- The NPS Smart White Box provides high-performance searches and pattern matches based on fine-grained rules including URLs
- Tracks billions of user-defined statistics / sec
- Performs user-defined actions while maintaining state for millions of flows
EZchip NPUs support on-chip, carrier-grade, field-proven, traffic management enabling traffic engineering and SLA delivery

- Dynamic real-time hitless reconfiguration of service parameters
- Subscriber isolation, bandwidth allocation and fairness based on programmed policies
- Enables hierarchical traffic management for both physical and virtualized networks

Available Applications & Building Blocks

- Production-ready baseline applications
  - L2/L3
  - Data center bridging (VxLAN, NVGRE)
- Production-ready building blocks for higher level functions
  - DPI package
  - IPsec package
  - OVS package
  - OpenFlow package
  - TCP termination package
  - ACL package
- 3rd party ecosystem
  - Can offer plug-ins and applications via open API (QOSMOS, 6Wind, Procera, …)
- Support for open source (Quagga) or commercial SDN control plane
Smart TOR
Replace an ASIC-based TOR switch with a programmable smart NFV TOR:
• Network layer processing for VNFs
• Complete offload of vSwitch and network overlay
• Minimum server I/O overhead
• Significant reduction in cost and power

Cloud Appliance / Data Center Appliance
• Data plane services via high level API that can be accessed by various applications in the cloud
  – ACL, DPI, security, load balancing, traffic management, network monitoring, etc.
• Virtualized on-demand services per VNF
• Dynamic load balancing among distributed VMs & VNFs
• Security and services for north-south as well as east-west traffic
Summary

- NPS enables carrier edge routers, data-center appliances and white-box solutions
- The white box value lies in the silicon and the software
- SDN and NFV s/w based, programmable white boxes
- NPS programmable high-performance packet processing enables **Smart White Boxes**
- Smart white boxes with any L2-L7 functions at highest performance
- Smart white box TOR switches & cloud appliances