Use Cases for the NPS – the Revolutionary C-Programmable 7-Layer Network Processor

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EZchip Overview

- Fabless semiconductor company, NASDAQ listed (EZCH)
- Leading provider of processors for carrier and data center networks
  - NPUs (Network Processors)
  - Multicore CPUs
  - Intelligent network adapters and network appliances
- EZchip is a strategic supplier of NPUs to the top routing vendors and the highest placed and fastest growing NPU vendor
- EZchip’s next gen NPU, the NPS, is the most powerful NPU for carrier edge routers, data-center appliances and white-box solutions
- Following the Tilera acquisition, developing the TILE-Mx, the highest core count multicore CPU with EZchip's networking accelerators
- Founded in 1999; 280 employees, over 200 in R&D
- Global offices in Israel (HQ); San Jose, CA; Boston, MA; and China
- Strong financial model; $189M in cash, no debt
Industry Trends

- Separation of control & data plane → Disaggregation / SDN
- Separation of hardware and software → NFV
- Move from proprietary systems to COTS, white boxes and open systems
- Customers desire to program their own networks
  - Tired of waiting months/years for vendors to implement features
  - Business needs demand demand changes in near real-time
- Large scale data centers and service providers driving the transition to direct merchant silicon suppliers, third party SW, and developing “white box” ecosystem
  - Google, Facebook, Amazon, Microsoft: public about their efforts
  - AT&T: over 75% of its network using the new architecture by 2020*
  - Verizon: plans to incorporate commodity hardware and many non-traditional vendors in their next-generation network*

* Source: Light Reading, “Carrier SDN and NFV Hardware and Software”
NPS: A Game Changer NPU

- 400 Gbps NPU
- C Programmable
- Security & DPI Hardware Accelerators
- Traffic Management
- Layer 2-7 Processing
- Linux OS

NPS
NPU Performance
CPU Programmability
NPS Value Proposition

Wire speed L2 & L3 switching and routing
  - SDN, OpenFlow, MPLS, IPv4, IPv6, VXLAN, NVGRE, GENEVE and any packet format and tunneling scheme

Scalable to support millions of subscribers & flows
  - Completely flexible flow classification, stateful tracking, ACLs and policy enforcement

Guaranteed SLAs
  - Highly granular traffic scheduling, priority enforcement and bandwidth allocation

Statistics collection for millions of programmable flows & events
  - NetFlow interface to any data collection and analysis tools

L4 – L7 services on top of L2 & L3
  - Load balancing, IPsec, access control, network monitoring, application recognition, DPI…

Best power & space efficiency
  - Single 1U NPS-based system is equivalent to a rack full of servers

Fully S/W programmable for adding new features & services on the fly
NPS based Applications and Use Cases

Scale Out Routers
SDN based disaggregated scalable router for carrier and data center edge and core

SDN and NFV Acceleration
Intelligent TOR and NFV appliances

In line Wire Speed DDOS prevention
For web scale and virtual cloud services

L7 Visibility and Control
Identify and drive new services, enforce intelligent policies and SLAs

L4-L7 Application Delivery and Load Balancing
Deep packet inspection, application awareness and in-line security

Flow awareness, Services Chaining
Stateful flow processing enables per flow services chaining and fast path offload
Use Case: Scale Out Router

Monolithic Router

Scale out Router

- Line cards (NPS SDN switch, 1RU form factors)
- Control and service cards (COTS servers)
- Spine
- Leaves

Control
Service Cards
Backplane
Line Cards

SDN allows for the creation of scale out routers!
Scale Out Router Benefits

- **Scalability**
  - Seamlessly grow and leverage off-the-shelf Ethernet fabric as the “backplane”

- **Modularity**
  - Mix and match any types and quantities of “line cards”, “service cards” and “backplane”

- **Flexibility/innovation**
  - Additional functionality may be added, e.g. service chaining of VNFs for 4G/5G EPC, DPI, FW, LB, NATs, new functionality

- **Dramatically reduced CAPEX and OPEX:**
  - No fork lifts to grow capacity due to various hard capacity limits such as backplane limitations, etc.
  - No vendor lock-in
  - Open source control plane
  - Standards based components (i.e. OpenFlow)
  - Multi-vendor forwarding plane
Use Case: SDN Smart Switch

- Latest OVS support through SW update
- Managed Open vSwitch integrated into TOR
- Server offload with switching and application services
- Tunneling to servers via VEB/VEPA
- Scalable
- Reduces system complexity

- Always behind the latest OVS specs
- Typical ASIC based SDN TOR switches have **limited scalability**
  - OpenFlow connections to each Open vSwitch in each server
  - Non-scalable scheme (10K-100K OpenFlow connections)
Use Case: NFV Acceleration

These NFV use cases require:
- Traffic Management & SLA enforcement
- Stateful Flow Awareness
- Application Awareness & DPI
- User Awareness
- Carrier Speeds: 10 / 40 / 100 / 400 Gbps

NPS can offload all of these at the required scale

An NPS accelerated NFV solution providing the OPEX required for large scale NFV deployments
NPS Enables High Performance NFV

Application
X86 GP code

PCIe
Eth

App Offload
TCP, Sec, DPI

VNF-ODP
Switch, Router, FPO

Cloud Mgmt
OpenStack, OVS

L2-L3
DCB
Use Case: DDOS Prevention

- Web scale and cloud providers face increasing challenges from DDOS attacks and have to provide mechanisms to protect their end users.
- DDOS mitigation techniques include:
  - Minimize the attack surface area
  - Be ready to scale to absorb the attack
  - Safeguard exposed resources
  - Learn normal behavior
  - Create a plan for attacks
- DDOS prevention needs to be applied in line at wire speed
NPS Enables DDOS Prevention

- DDOS systems need to sit inline
  - Single NPS handles up to 800Gb/s of traffic across tens of millions of flows
- Require strong traffic filtering
  - NPS algorithmic TCAM enables millions of policies, rules, white & black lists, across all headers and fields from L2 to L7
- Require strong traffic rate limiting
  - Control of connections establishment and number of connections, through range policers and shapers
- Require ability to provide network metrics and network warnings
  - NPS provides unlimited number of counters using low cost memory subsystem
- Require ability to protect the server’s networking stack
  - NPS can splice the TCP sessions in between the client and the server
- Require application recognition and content filtering offload
  - NPS enables application recognition and DPI at unprecedented rates enabling full analysis of the traffic prior to the servers
NPS enables L7 application visibility and control at unprecedented rates up to 400Gb on the router/switch:

- Identify how the network is used
- .. and through that:
  - Identify and drive new services
  - Enforce intelligent policies and SLAs
  - Optimize the network usage
- All without adding new appliances to the network

```plaintext
class-map match-all p2p-app
  match protocol attribute p2p-technology p2p-tech-yes
policy-map control-policy
  class p2p-app
    police 8000 conform-action transmit exceed-action drop
```
Use Case: L4-L7 Application Delivery and Load Balancing

- Hardware accelerated mapping of traffic based on ACLs, flows, L7 applications and service chains
- Dynamic load balancing among:
  - Distributed VMs
  - VNFs
  - Blades
- Reference application uses on board HTTP parser to control traffic steering
Stateful Flow Processing enables per flow services chaining and fast path offload.

DPI based Application Recognition
- Developed on top of the SFT
- Provides application recognition at rates up to 400Gbps

Client applications do not need to repeat SFT & AR for every service.

- Develops as if there is a single stream (i.e. flow)
- ... and seamlessly scales to 4096 threads.

• Functionality
• Robustness
• Feature Velocity
• Scale
Use Case: Flow Awareness, Services Chaining (cont.)

- NPS handles L2-L7 flow processing:
  - Classification, crypto, DPI, tunneling, statistics, QOS, and all packet handling
- Service chaining can be performed within NPS or distributed to VNFs running on servers
  - Less computation per VM
  - Larger VM density
  - Lower power & OPEX
The Smart NPS White Box Switch
Supporting All L2-L7 Use Cases

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

- L2 /L3 forwarding & routing
- Data center bridging
- Any encapsulation protocols
  - VxLAN, NVGRE, Geneve, ...
- OVS offload
- OpenFlow 1.3 and any subsequent rev (e.g. P4)
- Stateful flow classification
- Scaling to millions of flows
- Access control (ACL)
- Load balancing
- DDOS, Firewall, IPsec
- DPI / application awareness
- Traffic management & SLA enforcement
- Network monitoring
- TCP acceleration / termination
Summary

Large scale data centers and service providers are driving the transition to direct merchant silicon suppliers, third party SW, and “white box” ecosystems.

NPS provides a rich set of software libraries and infrastructure built on dedicated state of the art hardware accelerators.

The scale and flexibility of NPS based L2-L7 services that this allows are without precedent.

NPS programmable packet processing enables the deployment of services at new rates and locations:
- Opening new revenue opportunities
- Allowing improved manageability, lowering OPEX
- Increasing the scale of NFV solutions
- All without the need to deploy extra appliances