

The Value of P4 Programmability at the Network Edge

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The Cloud and the Edge: expectations and opportunities

The cloud model brings all the intelligence at the edge

- The network core is used as a simple Layer 2 or Layer 3 transport

The network edge can leverage the typical cloud scale out model

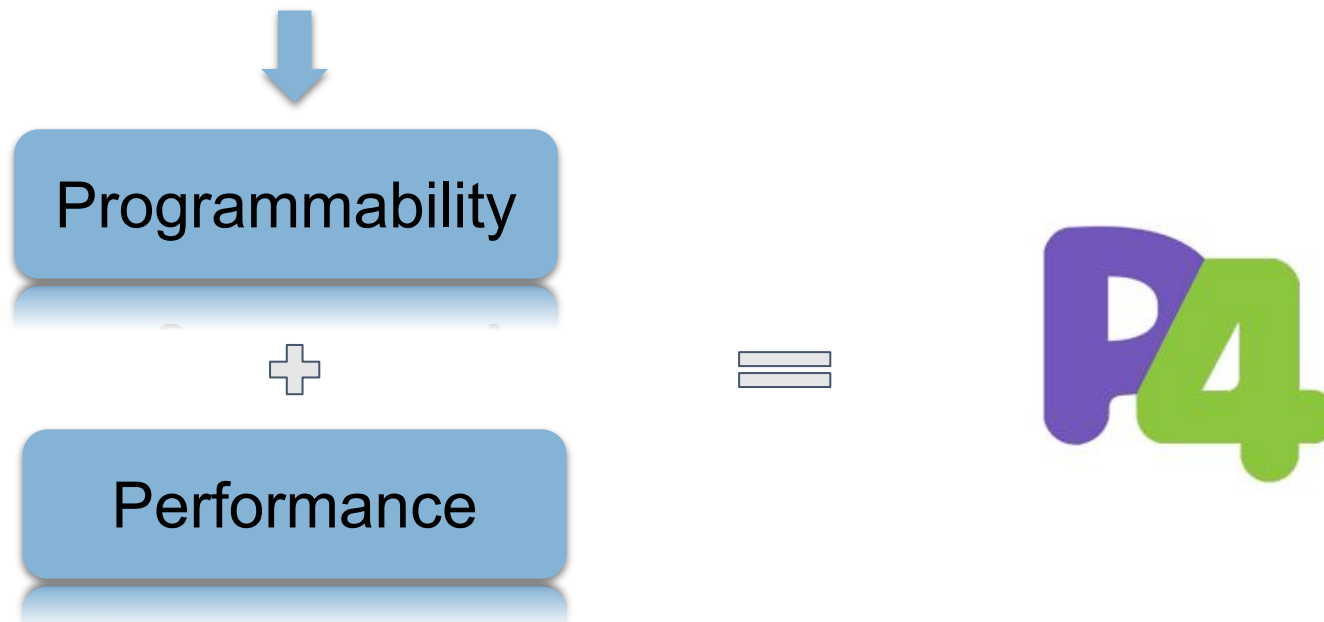
- Less traffic than in the core
- More resources per packet flow

Proximity to host and application opens up new possibilities

- TCP connection termination
- PCIe device emulation and virtualization

With power comes responsibility ... and programmability

- More processing power per packet
- New and sophisticated applications
 - Not based on established protocols and implementations
 - Evolving requirements for existing and new features



Pensando Distributed Services Platform

Centrally Managed

Policy and Services Manager


Policy



Orchestration & Provisioning

Automation



REST API

Observability



Troubleshooting & Security


Ecosystem




Compute, Analytics, IT Ops


Stateful Firewall


Encryption & TLS Offload


Micro Segmentation


Load Balancer


Networking


Storage Services

Telemetry 

Distributed Services Cards



Fully programmable SoC 

Fully Embracing Programmability

- Built a fully programmable SoC architecture
 - Key to address the requirements of the network edge
 - Sophisticated processing
 - Not on established protocols
 - Evolving requirements
 - Currently designing the third generation SoC
- P4-native pipelines for high performance packet processing
- Apply the principles of P4 programming at the host interface
 - Not a packet-based interface
 - The type of processing performed can benefit by a P4-like paradigm
 - Table match/action



Despite a long
history of
designing fixed
function chips!

Why P4?

Because of you!

- Strong community
- Increasing support of various targets
- Growing ecosystem of developers
- Significant interest by end-users

**We believe
in a large
partner ecosystem**

Pensando and P4 - A phased approach

Pensando develops turn-key solutions for customers

- Integration through APIs available

Third parties agents supported on the DSC

Customers can fully own (i.e., modify, re-use code) Pensando developed solutions

Third party development supported on the DSC

Customer and third party features plugged into Pensando developed solutions

Today

Time

PENSANDO

P4 at the Network Edge

Features not traditionally supported by P4 are needed

- Writable table entries
- Tables accessible by multiple stages
 - Even in different pipelines
- Non-packet processing
- Support for large tables
 - For example, stored in large DDR memory
- Run-to-completion
 - An edge device can afford this
 - Not the case with a switch



Included in PNA

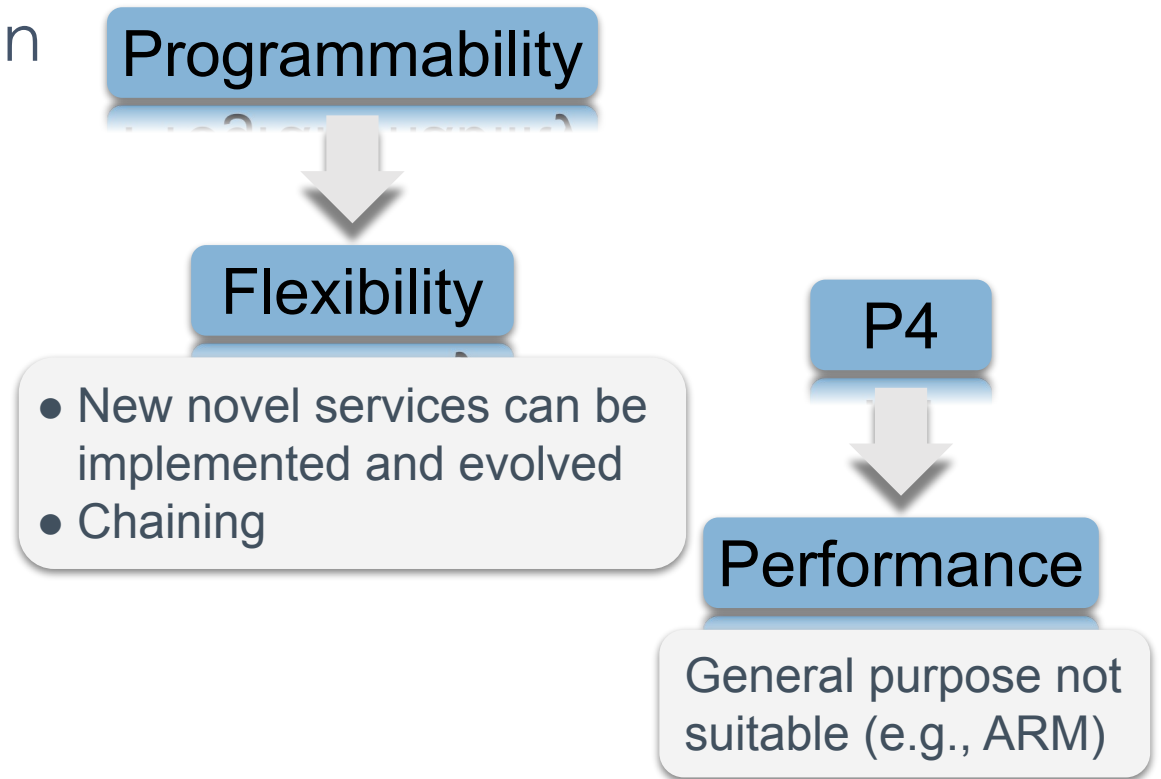
Discussed in the PNA WG



New Opportunities at the Network Edge

A P4 programmable device at the network edge is *uniquely positioned*

- Optimize host/network interaction
 - VirtIO/vDPA/DPDK
- Offload device virtualization
 - NVMe-oF
- Offload resource intensive tasks
 - Compression/Encryption



Sample Customer Use Case Addressed with P4

- SDN services for a cloud provider fully implemented in P4
 - VPC, Security groups, Routing Tables
 - Advanced services: Load balancing, NAT, VPN
 - Advanced Telemetry with per-flow state
 - Upgrade with downtime below 100 ms
- Order of magnitude performance improvement compared to general purpose execution
 - Packets per second (PPS), connections per second (CPS), and scale
- Flexible and adaptable for changing cloud SDN requirements
 - Customer can dictate and change requirements without sacrificing performance
- Capability to implement innovative algorithms at any time
 - Including in real production deployment with non-disruptive upgrade

In Summary

The network edge has the potential for sophisticated services

- Less traffic → more processing power per packet
- Strategically positioned close to applications and hosts

Edge devices must be programmable and fast

Open standard



Portable

Beyond packet processing



THANK YOU

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