vBNG dataplane in P4-programmable FPGA-based acceleration card

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BNG in SEBA

SEBA POD

All control software deployed as containers on compute nodes using Kubernetes.

Network Edge Mediator (NEM)

Providing FCAPS & Inventory

ONAP
OSAM-Central
OSAM-Local
EMS/NMS-adaptor

ONOS Cluster

-vOLT
-dhcp
-mcast
-SR
-FPM
-T3

Redfish

ONU

OLT

Subscriber traffic ‘fast-path’ to Internet

AGG Switch

AGG Switch

Compute

BNG is a workload option
- External physical BNG
- vBNG in compute
- BNG in Agg switches
- BNG in OLT boxes

Image source: https://www.opennetworking.org/seba/
vBNG in compute

✓ Software flexibility - upgrade, bugfix, customize
✓ Scales with the number of servers (assuming load balancing)
✓ Can be standalone

● CAPEX, OPEX per Gbps?
Our plan

FPGA accelerators available as a config option when buying a server.

Use commodity servers with FPGA accelerator to run optimized vBNG.

Use P4 to implement the vBNG data plane in FPGA.

Use CPU cores to run vBNG control plane.
Integration (and servers): Dell

vBNG software: Benu Networks vBNG

FPGA firmware: Netcope P4

Hardware: Intel PAC N3000
vBNG Architecture

Most traffic **processed only in FPGA** *(red)*

First packets and exception traffic (ex. DHCP) **forwarded locally** to control plane *(green)*

Image credit: Craig Stevens, Dell
vBNG pipeline in FPGA

Using P4 code from https://github.com/opencord/p4se

- Complex
  - ~30 Match Action Tables
  - ~25 Counter arrays
  - Many #ifdefs (INT, IPv6, SPGW, VRF, ...)

- Does not cover features outside P4 language spec (QoS)
  - Set as output metadata
Results (focused at P4 on FPGA)

Features

Throughput

Subscribers
Next Steps

Use on-board DRAM to implement

- Large-capacity tables
  - Millions of entries
  - => Support more subscribers

- HQoS
  - Separate FPGA module, controlled by P4 output metadata

Full integration

- Using open standards for extensibility (P4, P4Runtime, DPDK)
Thank you for attention.

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