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# **Tassen: Next Gen CUPS API Paper**

*Release Version 0.1*

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## INTRODUCTION AND MOTIVATION

Focus on the Telco World.

- Telco operators have an interest in using datacenter technologies ->CORD
- Operators want disaggregation, but incumbent vendors make it hard by defining CUPS APIs that are ambiguous and make integration painful
- New methodology: formally specify the forwarding pipeline of telco appliances (BNG, UPF) to facilitate interoperability
- We are not the first to propose this approach (Google using it for their fixed-function datacenter switches)
- Tassen and UP4 as concrete examples of this methodology

Other: \* It would be good to collect experiences from other projects where P4 was not used, e.g. any issue with porting Voltha from the Edgecore OLT to others while using OpenFlow without a formal pipeline definition? \* Benu networks in implementing PFCP?





## **BACKGROUND**

- Works on disaggregation of BNG and other devices e.g. UPF: to justify the need of CUPS API
- Standard CUPS api: PFCP: to present the current state of the art
- Google approach for fixed-function data center switches: to bring example of P4/P4Runtime for defining APIs
- Switch-Independent Architecture (SAI)?
- CORD: to present a project for DC technologies for Telco operators (can be left in the introduction)

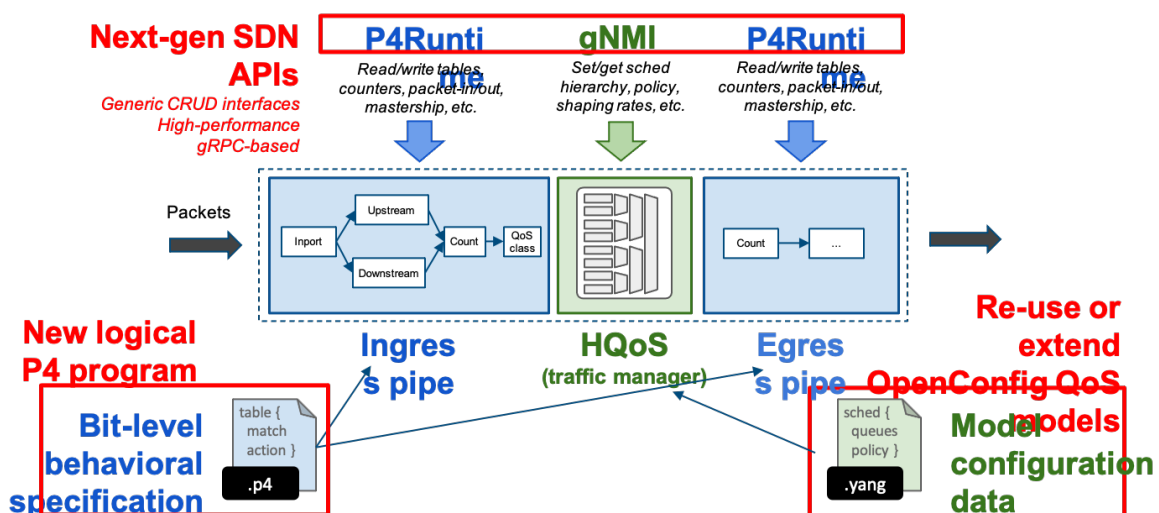


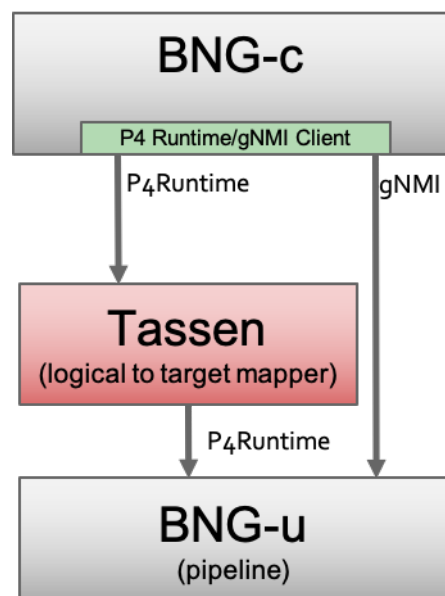
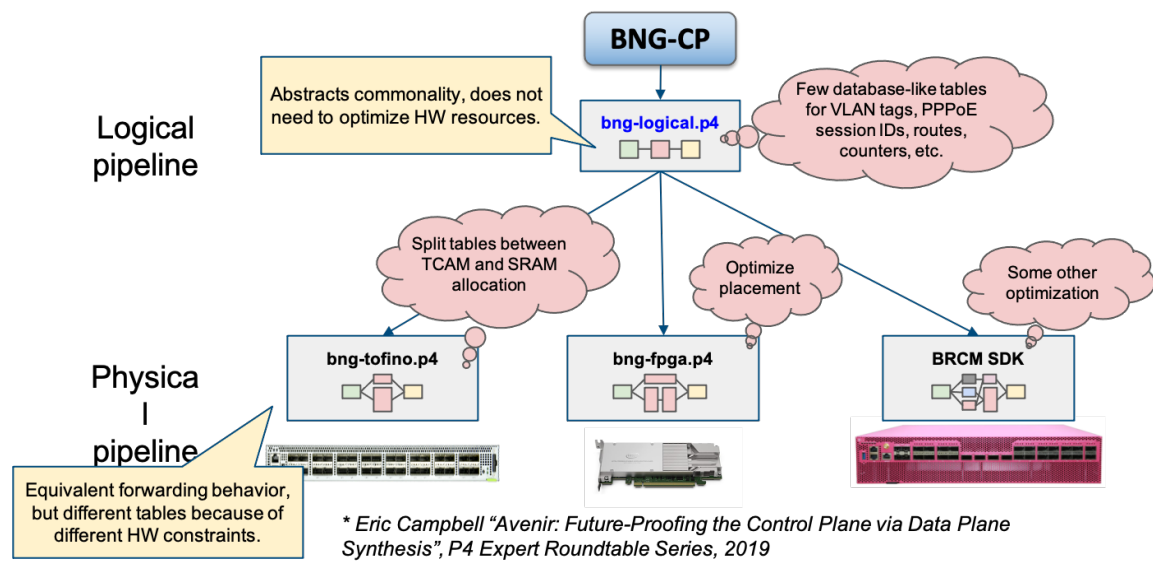
## ARCHITECTURE

- P4 description of a silicon independent pipeline (bng.p4)
- P4Runtime interface derived from P4 description
- Translation layer (mapr) -> from silicon independent to silicon dependent (e.g., Tofino) or other target (fpga, smartNIC)
  - Northbound: P4Runtime, communicates with the BNG Control Plane
  - Southbound: P4Runtime or other control plane protocol, dialogue with BNG Data Plane
- Integration with current CUPS api (PFCP)

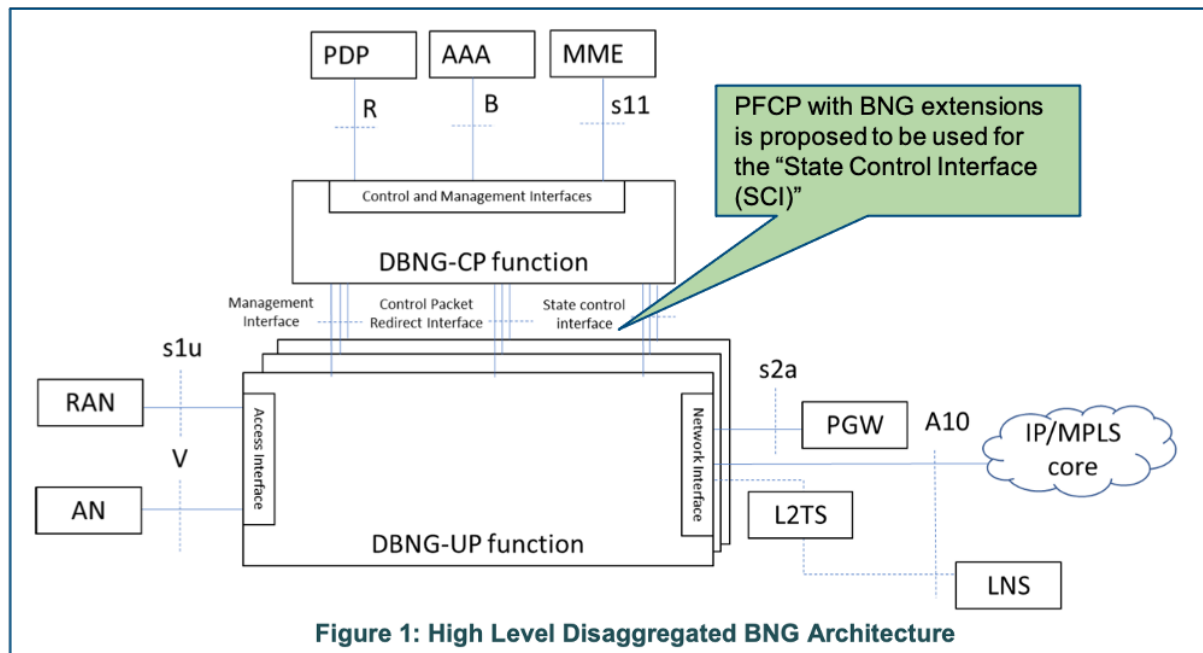
The proposed architecture tackles requirements one by one: \* Arguing and understanding requirements is much easier with formal P4 pipeline \* New requirement == patch to P4 code and corresponding PTF test \* Translation layer \* P4Runtime -> gRPC. Mapr: almost stateless, goLang, can horizontally scale \* PTF, fuzz testing with p4pktgen

### 3.1 High Level Architecture

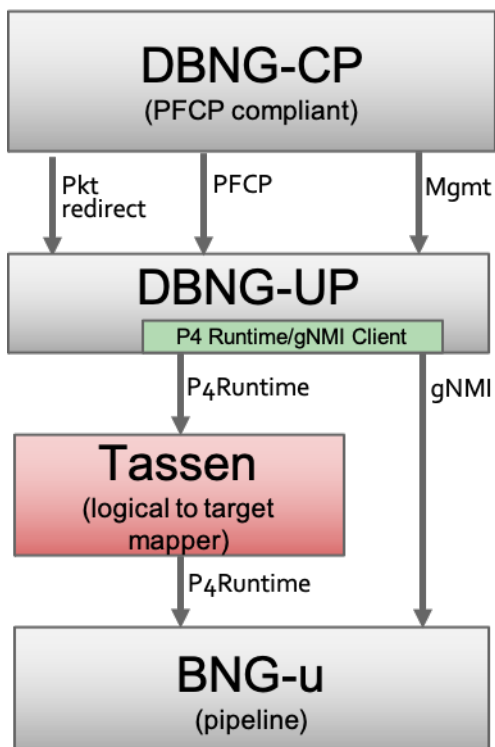




### 3.2 Tassen and the BBF Disaggregated BNG Architecture (WT-459)

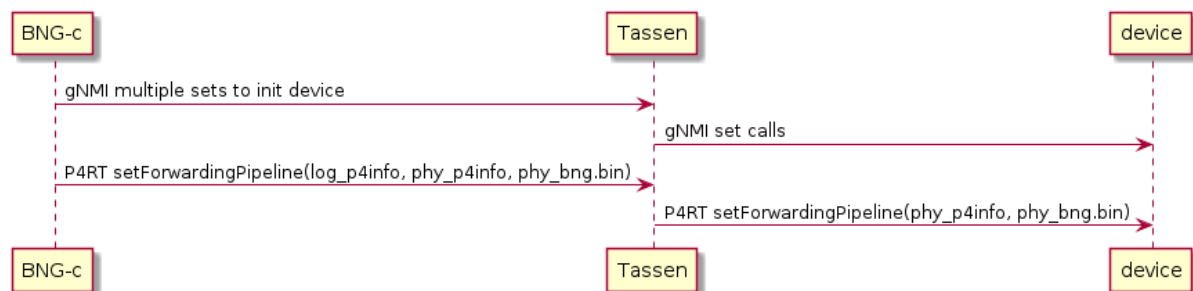


Note: This diagram is from the BBF WT-459 specification

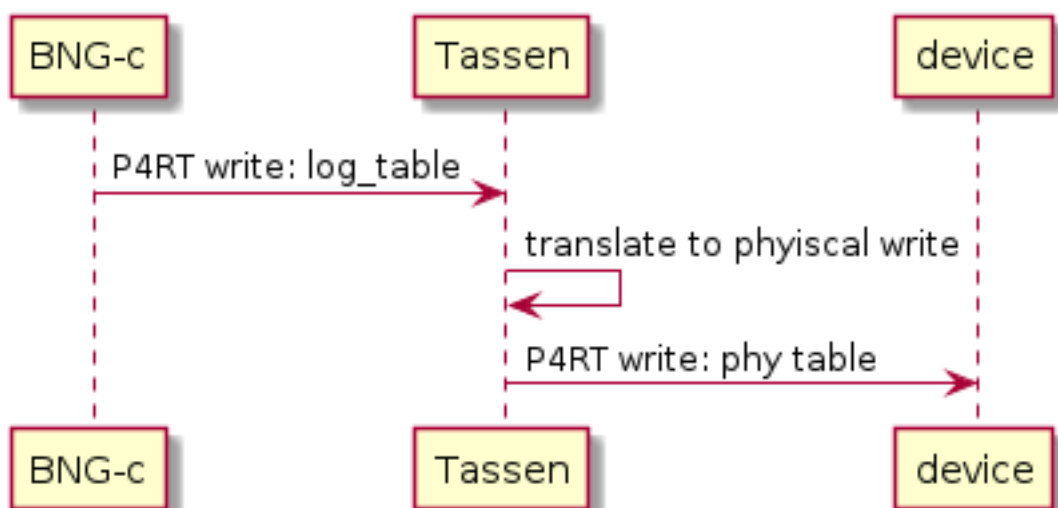


## 3.3 Sequence Diagrams

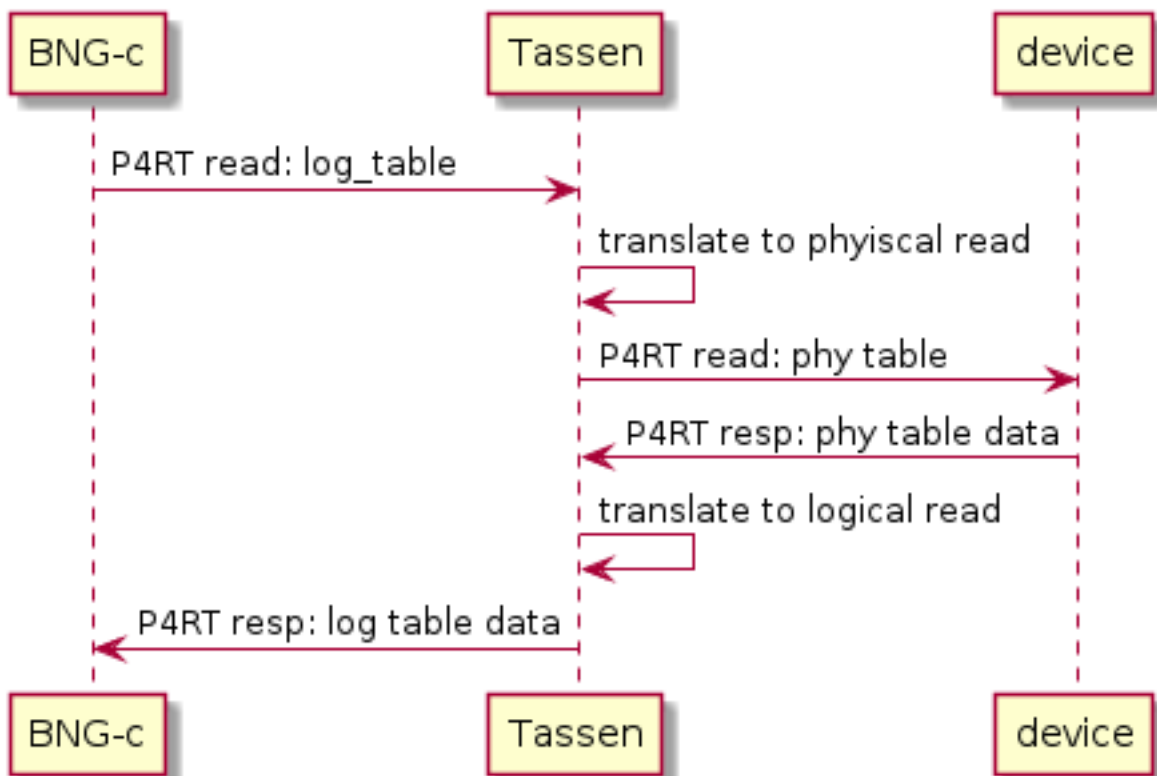
### 3.3.1 Initial pipeline setup



### 3.3.2 Write BNG tables



## 3.3.3 Read BNG tables

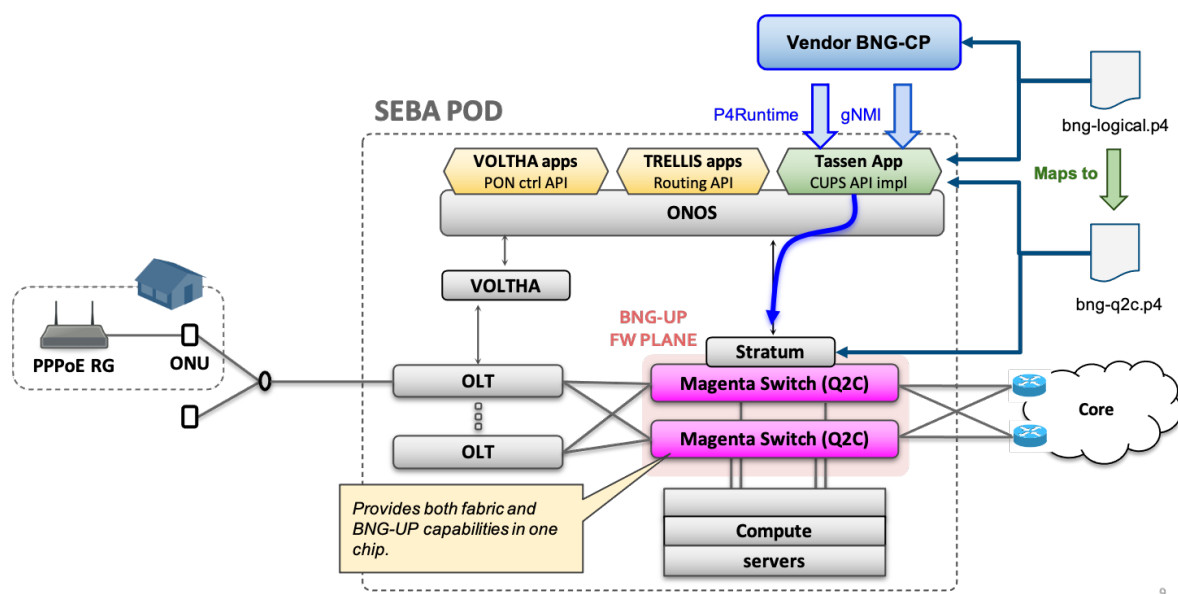




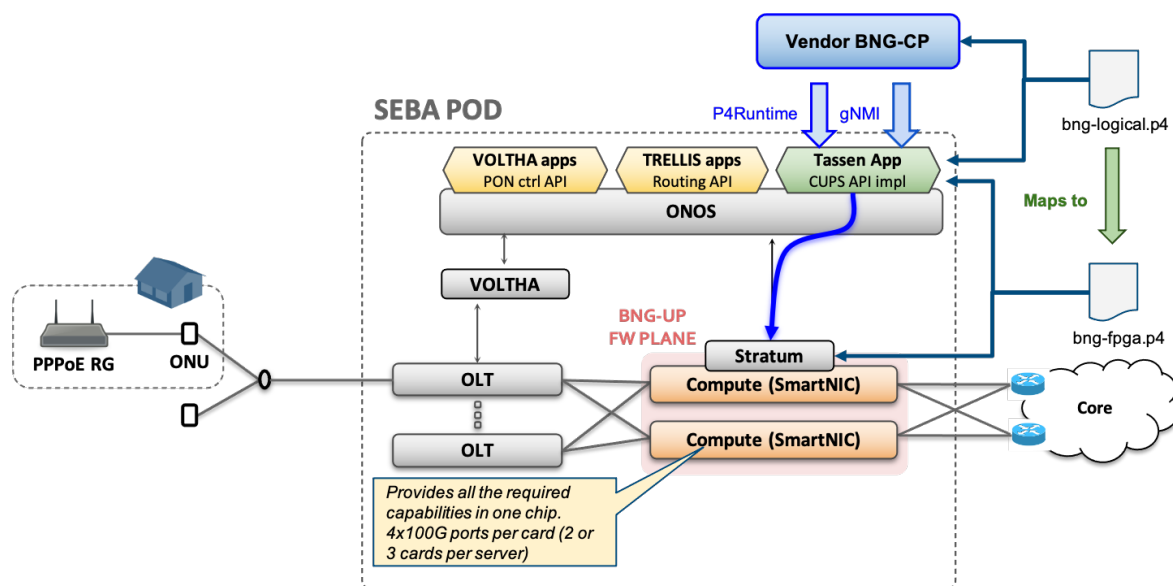


## 4.1 BNG

- high level pipeline description (block level)
- Talk about design rationale behind logical bng.p4 (few database-like tables)
- high level description of a target pipeline
- description of the mapping of some functionalities



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## 4.2 UP4

(SAME AS IN BNG?) Carmelo: worth of mention as the physical realization comprises downlink buffering as an off-device component, but abstracted as an action in the pipeline.

## **EVALUATION**

Any evaluation to perform?? Test the performance of mapr?



## **DISCUSSION**

Shortcomings of the P4 language: too low level redundant tables for uplink and downlink,



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SEVEN**

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**CONCLUSION**





## GLOSSARY

**BNG** Broadband Network Gateway terminates broadband subscribers.

**BNG-c** the control plan component of a disaggregated BNG

**BNG-d** the data plan component of a disaggregated BNG

**FW** Firewall network function.

**gNMI** gRPC Network Management Interface uses OpenConfig models to configure/monitor a network device over gRPC.

**gRPC** Google's Remote Procedure Call (RPC) interface.

**IETF** The Internet Engineering Task Force (IETF) is an open standards organization, which develops and promotes voluntary Internet standards, in particular the standards that comprise the Internet protocol suite (TCP/IP).

**IP** the Internet Protocol.

**LB** Load Balancer network function.

**NETCONF** The Network Configuration Protocol (NETCONF) is a network management protocol developed and standardized by the IETF.

**NF** Network Function (i.e. BNG, UPF, LB, FW, etc).

**NF-c** Control plane part of a disaggregated Network Function.

**NF-d** Data plane part of a disaggregated Network Function.

**NG-SDN** Next Generation Software Defined Network

**OpenConfig** Vendor-neutral, model-driven network management designed by the OpenConfig working group <http://openconfig.net>.

**P4 Runtime** Control plane protocol used to communicate between a controller (i.e. the client) and a data plane node (i.e. the server).

**Protobuf** a serialisation protocol normally used to serialise/deserialise data over a gRPC interface.

**SDN** Software Defined Network

**SmartNIC** A more intelligent NIC that generally has a hardware accelerated and programmable programmable forwarding engine (PFE) along with CPU cores on the same NIC that can handle control plane functions (i.e. loading, programming and configuring the forwarding pipeline).

**SNIC** Abbreviation for SmartNIC

**TCP** the Transport Control Protocol.

**UPF** User Plane Function of a 5G solution.

**YANG** YANG is a data modeling language used to model configuration and state data manipulated by either the NETCONF or gNMI protocols.

## REFERENCES

[Ref 1] - Software-Defined Networks: A Systems Approach <https://sdn.systemsapproach.org>



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