TeraFlow SDN by ETSI

Hackfest #3: P4 forwarding with TeraFlowSDN

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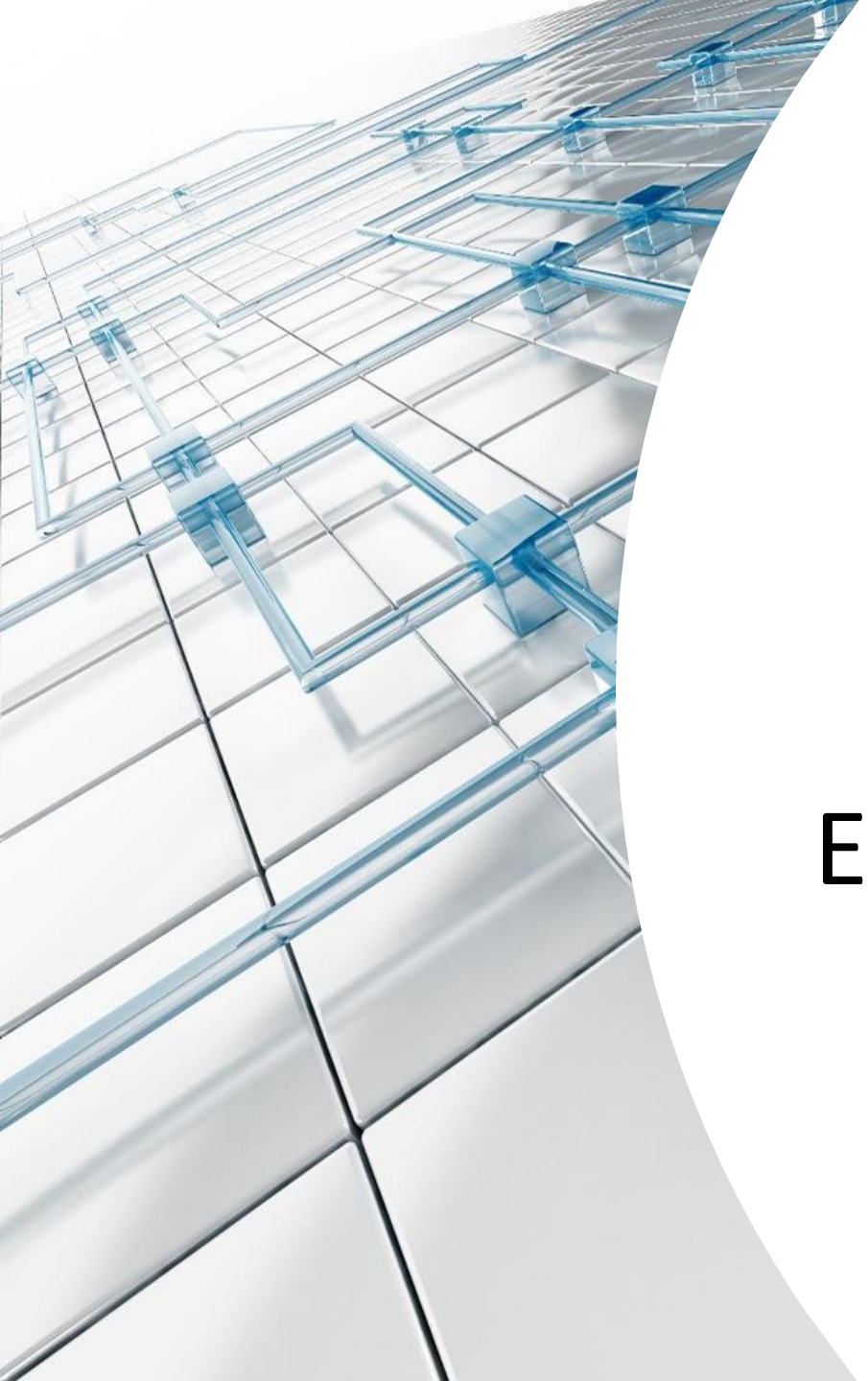
Hackfest Materials

For a perfect hands-on experience, a VirtualBox VM image is needed. Please download the hackfest VM from the link below and make sure the VM is installed and loads/starts up on your PC before the Hackfest:

- https://drive.google.com/file/d/1OaukXmAC1uaeIAChkEpvBB9mSkUHimsR/view (~15GB)
  - Download and unzip the RAR file.
- VM user/pass: **teraflow**/tfs123
- VM Networking:
  - Network adapter: Attached to NAT Network (as in the Wiki)
    - https://labs.etsi.org/rep/tfs/controller/-/wikis/1.-Deployment-Guide/1.2.-Configure-your-Machine/1.2.3.-Oracle-Virtual-Box
  - VM IP address: 10.0.2.X/24 <dhcp> / Gateway: 10.0.2.1 / DNS: 8.8.8.8, 8.8.4.4



TeraFlow SDN

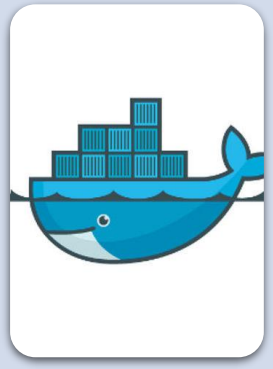
ETSI TeraFlowSDN 101

Do we need YET another Transport SDN controller?

TeraFlow SDN

Cloud-native SDN controller for supporting future networks beyond 5G.

Hosted by ETSI and based on results of the European Union-funded TeraFlow 5G PPP research project.



Micro-services architecture provides key benefits:

Scalability, Self-healing, Integrity

'Toolbox' for ETSI groups working on network transformation.

Supports use cases such as autonomous networks, inter-domain, and cybersecurity.

Enables the alignment of multi-SDO goals and helping to accelerate standardization cycles.

ETSI TeraFlowSDN to serve as reference implementation for Telecom Infra Project

The source code of TeraFlowSDN is publicly available under the Apache Software Licence.

ETSI TeraFlowSDN: A growing community

TeraFlow SDN

- Members

cttc Centre Tecnològic de Telecomunicacions de Catalunya
Telefónica
telenor
SMC siae microelettronica
NEC
POLITÉCNICA
it instituto de telecomunicações
Fraunhofer HHI
ΔΗΜΟΚΡΙΤΟΣ DEMOKRITOS
XFLOW RESEARCH

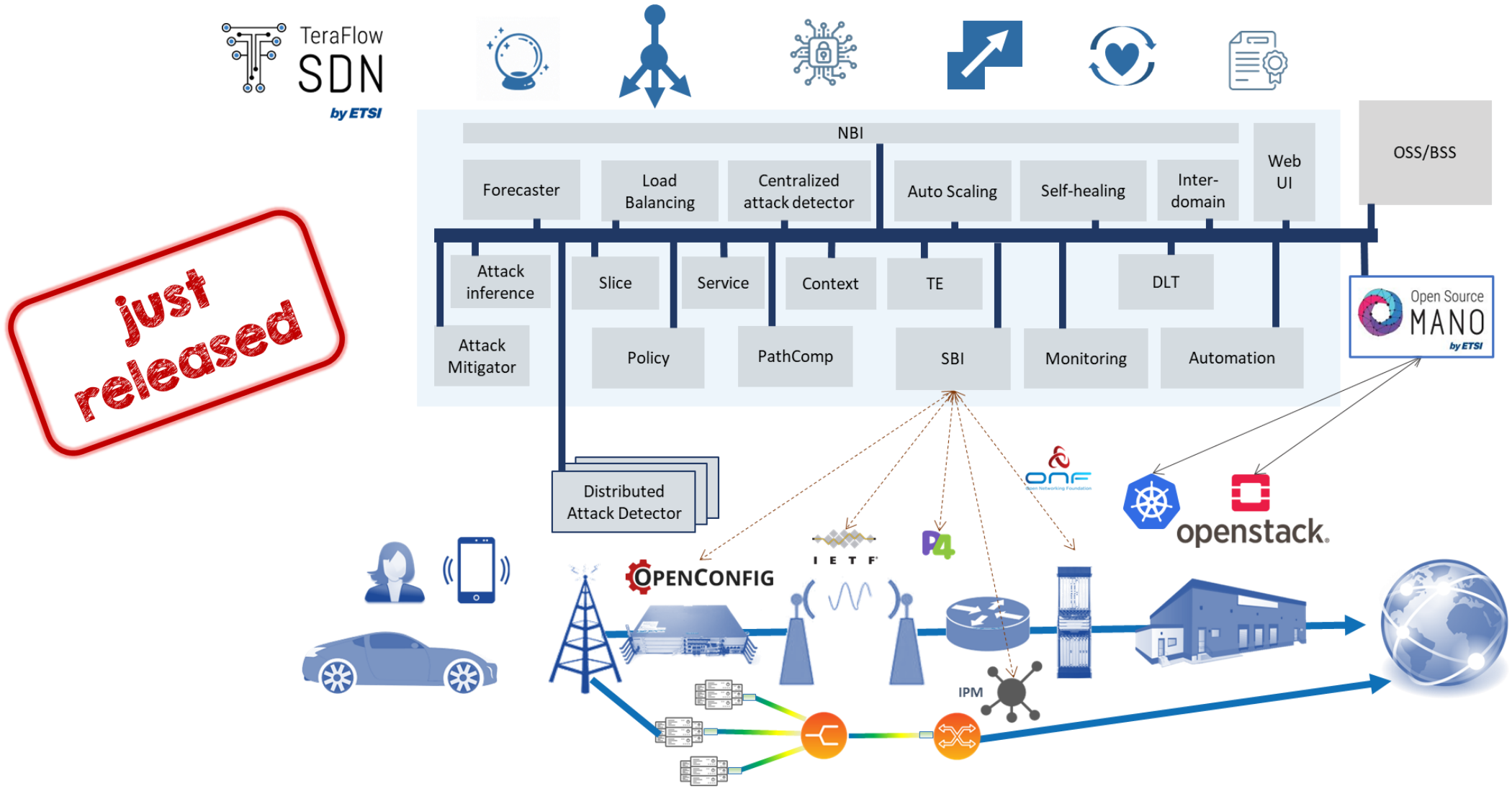
YOUR LOGO HERE

- Participants (Non-ETSI members)

ADVA
Infinera
Globe
CHALMERS UNIVERSITY OF TECHNOLOGY
NTNU Norwegian University of Science and Technology
OLD DOG CONSULTING
DIPL. PHYS. PEER STRITZINGER GMBH
UBITECH ubiquitous solutions
Atos

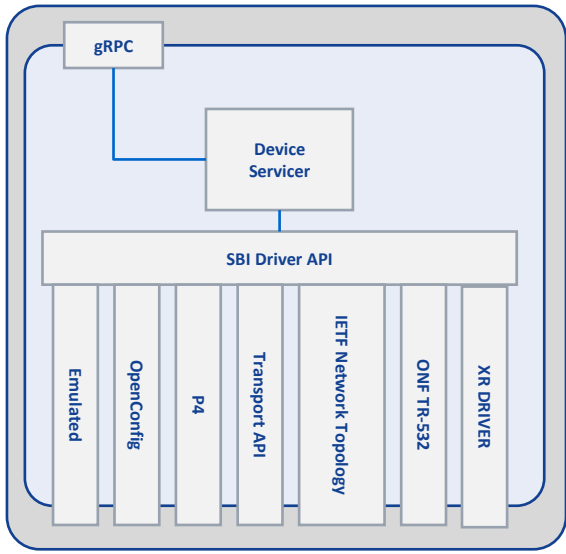
https://portal.etsi.org/TB-SiteMap/TFS/List-of-TFS-Members-and-Participants

TFS Release 2 Architecture



Controlled and managed network elements/domains

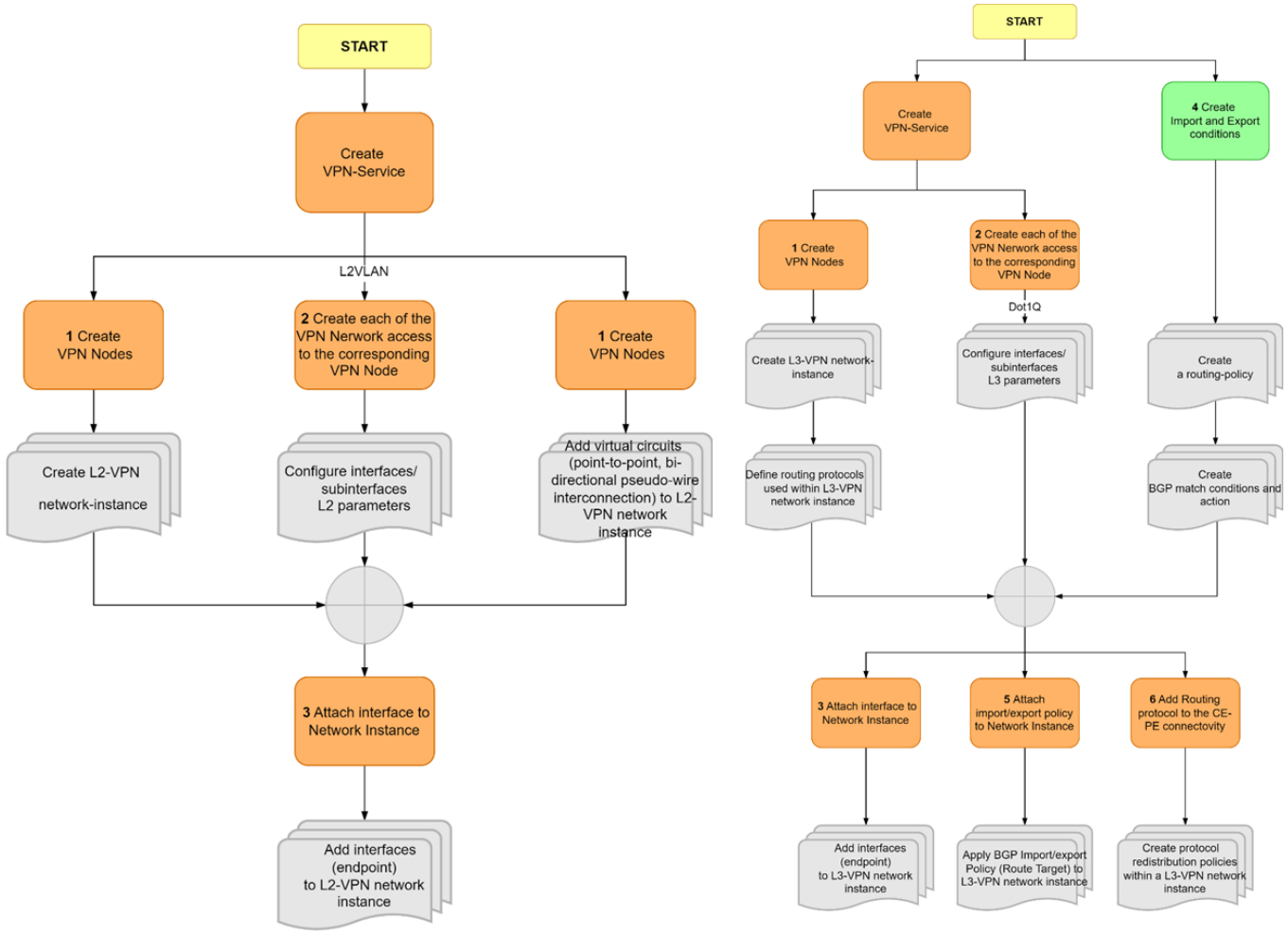
- The TeraFlowSDN controller uses its North-Bound Interface (NBI) component (previously known as Compute) to receive:
  - Layer 2 Virtual Private Network (L2VPN) requests and convert them to necessary connectivity services
  - Transport Network Slices via the Slice and Service components.
- The Service component is responsible for selecting, configuring, and deploying the requested connectivity service through the South-Bound Interface (SBI). To this end, the SBI component interacts with the network equipment through pluggable drivers. In addition, a Driver Application Programming Interface (API) has been defined to facilitate the addition of new network protocols and data models to the SBI component. TeraFlowSDN Release 2 provides extended and validated support for:
  - OpenConfig-based routers. Interaction with optical SDN controllers through the Open Networking Foundation (ONF) Transport API (TAPI).
  - Integration for microwave network elements (through the Internet Engineering Task Force - IETF - network topology YANG model).
  - Point-to-Multipoint integration of XR optical transceivers.
  - Support for P4 routers that includes loading a P4 pipeline on a given P4 switch; getting runtime information (i.e., flow tables) from the P4 switch; and pushing runtime entries into the P4 switch pipeline, thus allowing total usage of P4 switches.



Support for OpenConfig Whiteboxes

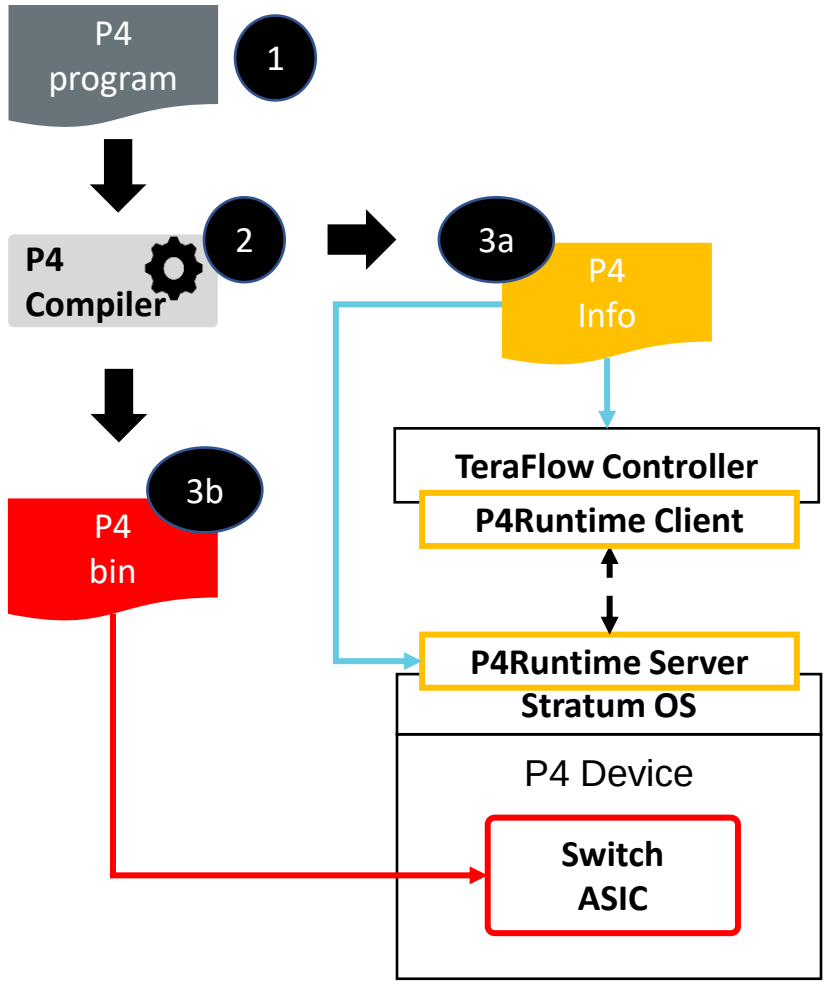
- Support for L2/L3 VPN Network Models

- Control of whiteboxes with NOS based on OpenConfig. Validated with:
  - Infinera
  - ADVA
  - Emulated
  - More in the pipeline…



Support for P4

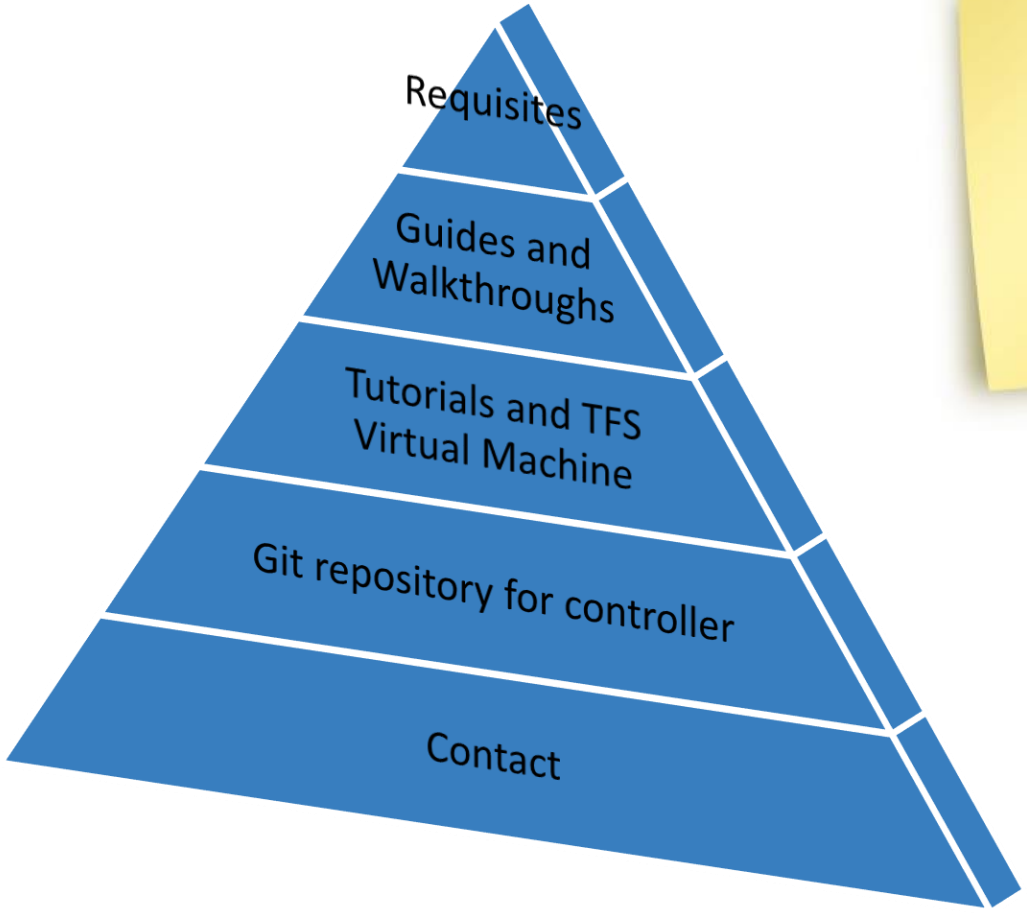
- The desired P4 program needs to be written (step 1) by a network developer and compiled (step 2) by a P4 compiler.
- The P4 compiler generates two outputs:
  - A “P4 Info” file (step 3a) which describes the “schema” of the P4 pipeline for runtime control. This schema captures P4 program attributes such as tables, actions, parameters, etc, in a target-independent format (I.e., same P4Info for a software switch, ASIC, etc.);
  - A target-specific “P4 bin” binary (step 3b) used to realize a switch pipeline, such as a binary configuration for an application-specific integrated circuit (ASIC), a bitstream for a field-programmable gate array (FPGA), etc.
- At runtime the TeraFlowSDN controller uses a gRPC-based P4Runtime interface to manage the match-action pipelines specified in the P4 program.



NBI Extensions

- New NBI interfaces
  - Extend IETF Slice/L2VPN/L3VPN
  - IETF Topology
  - Device Inventory
  - ONF Transport API
  - MEC BWM API

Our single point of entry: https://tfs.etsi.org



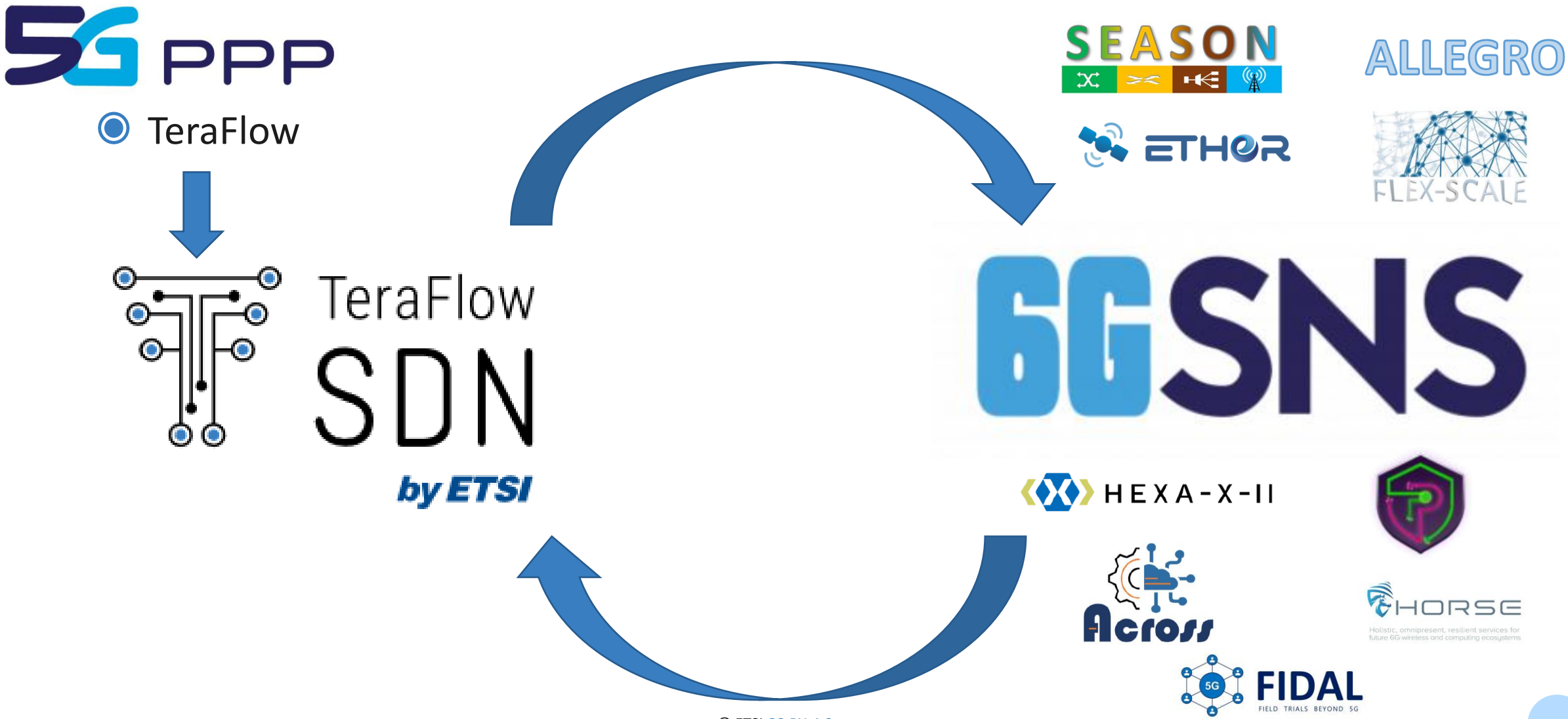
TFS#3 Hackfest:

- 16-17 October 2023, Castelldefels (Spain).

TFS#3 Ecosystem day:

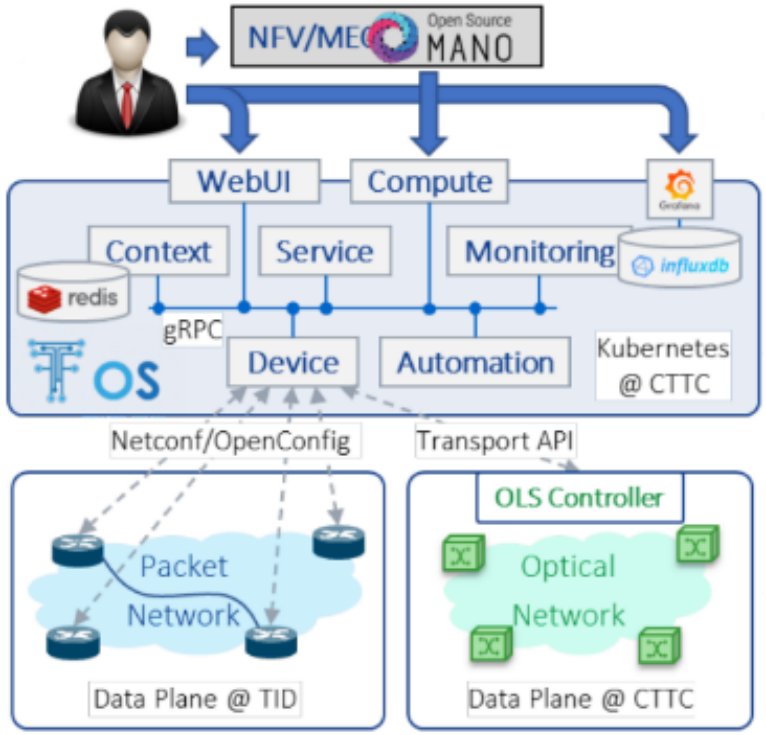
- 18 October, Castelldefels (Spain)

Bridges to Research – Building the TFS ecosystem



TeraFlowSDN
Demos and Use cases

ETSI OpenSourceMANO and ETSI TeraFlowSDN integration



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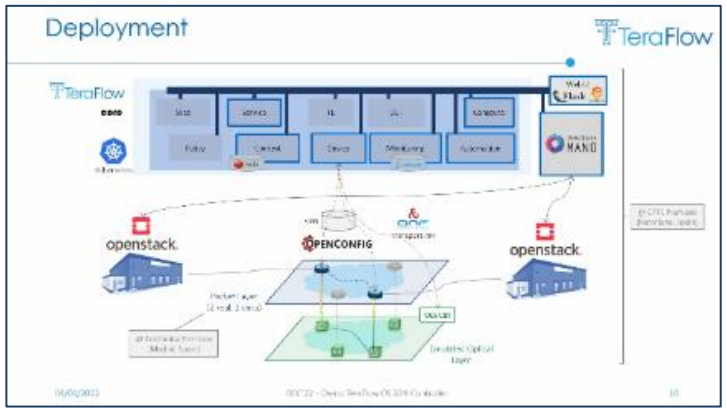
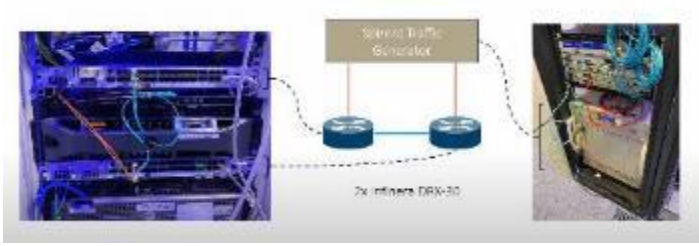
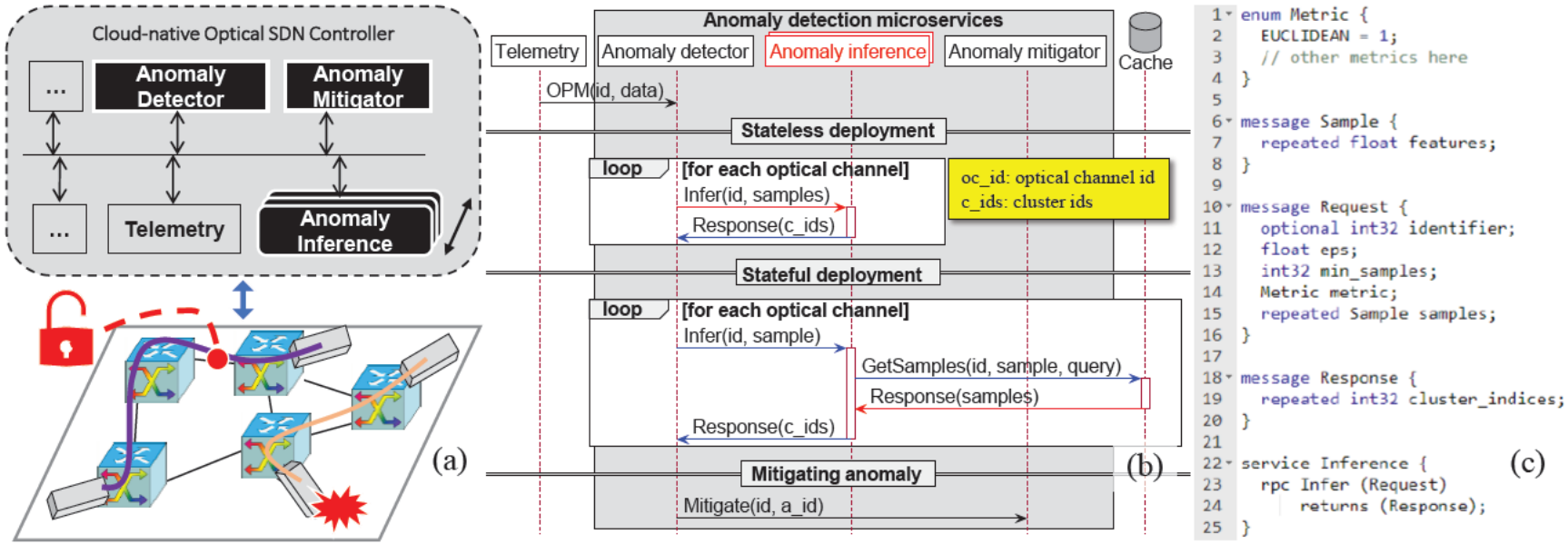




Demonstration of Zero-touch Device and L3-VPN Service Management using the TeraFlow Cloud-native SDN Controller, Ll. Gifre, C. Natalino, S. Gonzalez-Diaz, F. Soldatos, S. Barguil, C. Aslanoglou, F. J. Moreno-Muro, A. N. Quispe Cornelio, L. Cepeda, R. Martinez, C. Manso, V. Apostolopoulos, S. Petteri Valiviita, O. Gonzalez de Dios, J. Rodriguez, R. Casellas, P. Monti, G. P. Katsikas, R. Muñoz, and R. Vilalta

TeraFlowSDN release 1 and cybersecurity

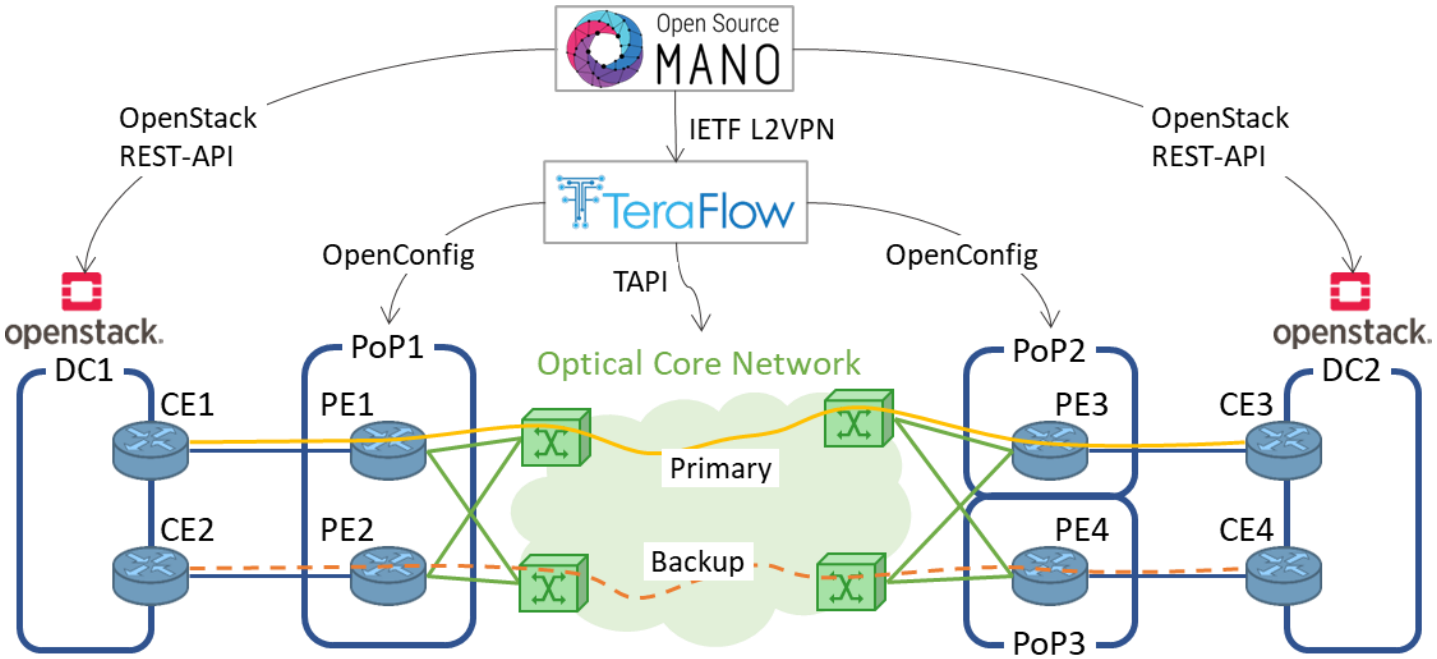


Microservice-Based Unsupervised Anomaly Detection Loop for Optical Networks, Carlos Natalino, Carlos Manso, Lluis Gifre, Raul Muñoz, Ricard Vilalta, Marija Furdek, Paolo Monti

Transport Network Slicing with SLA Using the TeraFlowSDN Controller

TeraFlow SDN

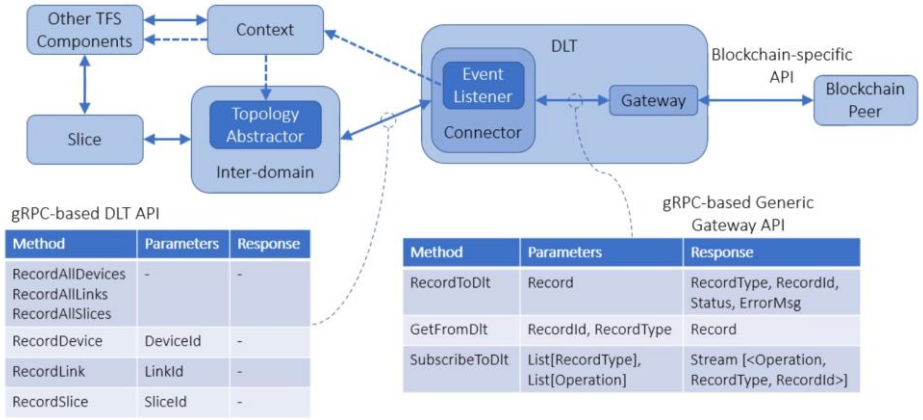
This demo presents the TeraFlowSDN controller as a solution to provide dedicated transport network slices with SLAs. To this end, the demo details how the interface between an NFV orchestrator and the SDN controller can provide transport network slices using protected disjoint paths.



Experimental Demonstration of Transport Network Slicing with SLA Using the TeraFlowSDN Controller
Ll. Gifre, D. King, A. Farrel, R. Casellas, R. Martinez, J.-P. Fernández-Palacios, O. González-de-Dios, J.-J. Pedreno-Manresa, A. Autenrieth, R. Muñoz, R. Vilalta

DLT-based End-to-end Inter-domain Transport Network Slice with SLA Management Using Cloud-based SDN Controllers

TeraFlow SDN

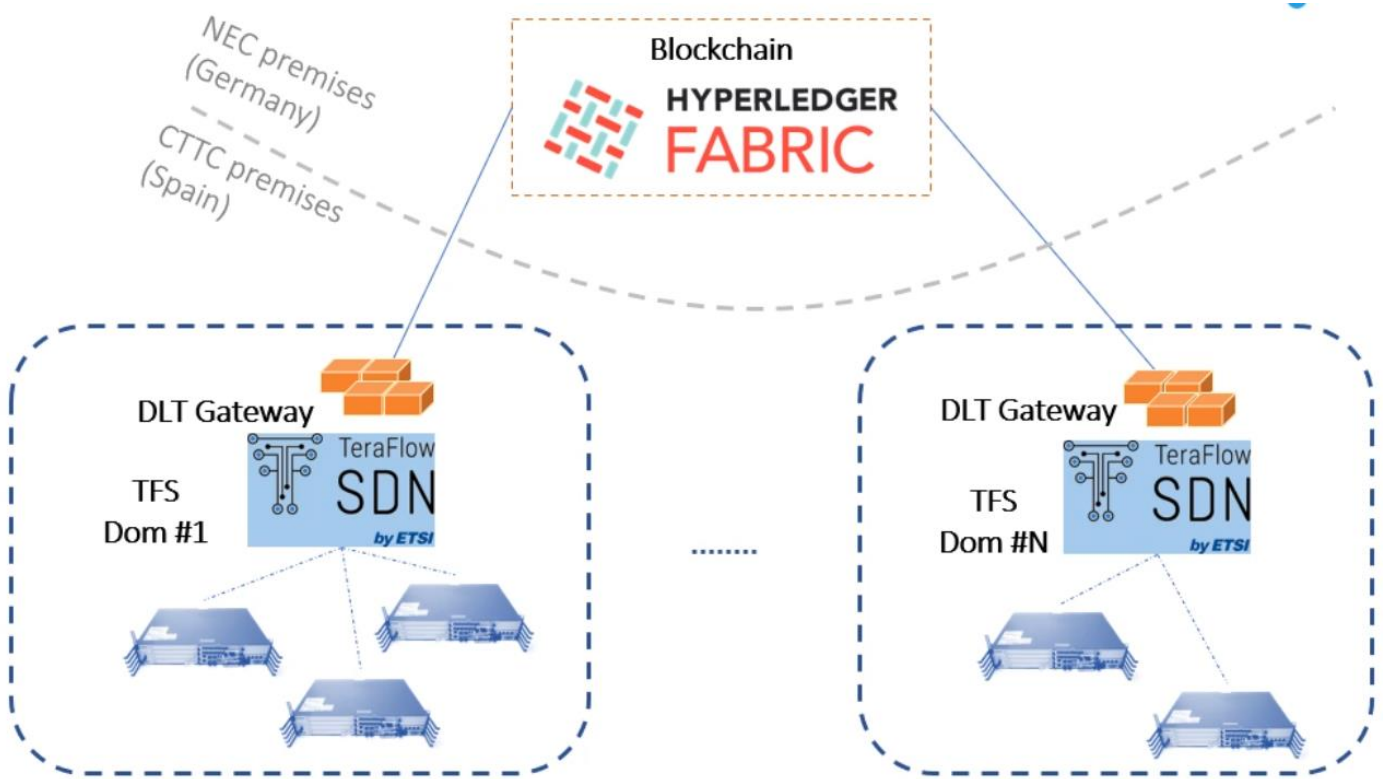


gRPC-based DLT API

Method	Parameters	Response
RecordAllDevices RecordAllLinks RecordAllSlices	-	-
RecordDevice	DeviceId	-
RecordLink	LinkId	-
RecordSlice	SliceId	-

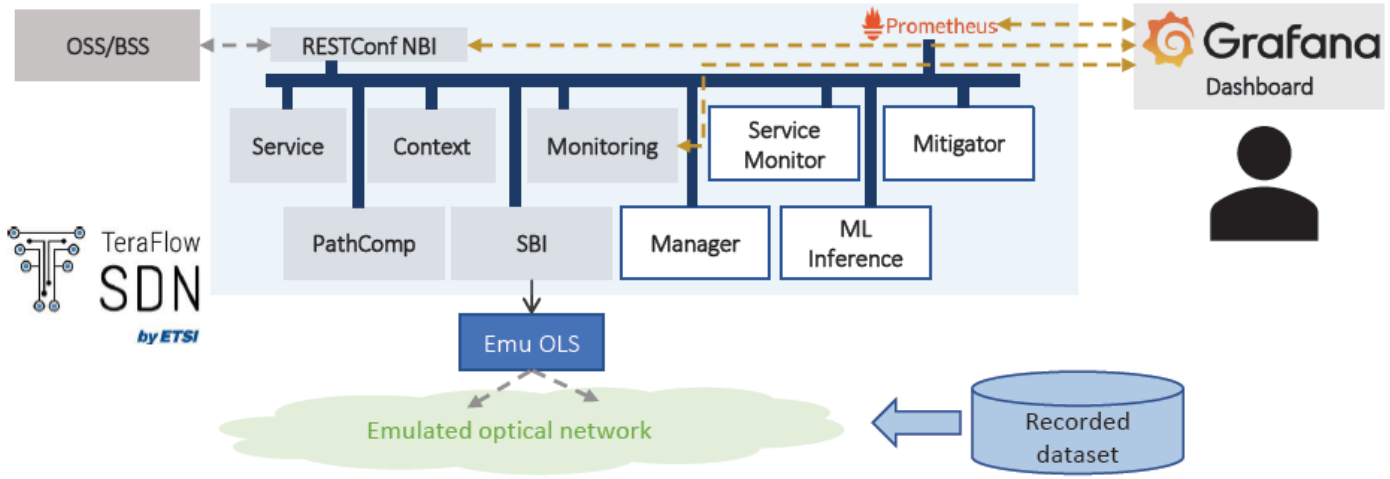
gRPC-based Generic Gateway API

Method	Parameters	Response
RecordToDlt	Record	RecordType, RecordId, Status, ErrorMsg
GetFromDlt	RecordId, RecordType	Record
SubscribeToDlt	List[RecordType], List[Operation]	Stream [<Operation, RecordType, RecordId>]



Network Security

We demonstrate a scalable processing of OPM data using ML to detect anomalies in optical services at run time. A dashboard will show operational SDN controller metrics, raw OPM data, and the ML assessment results

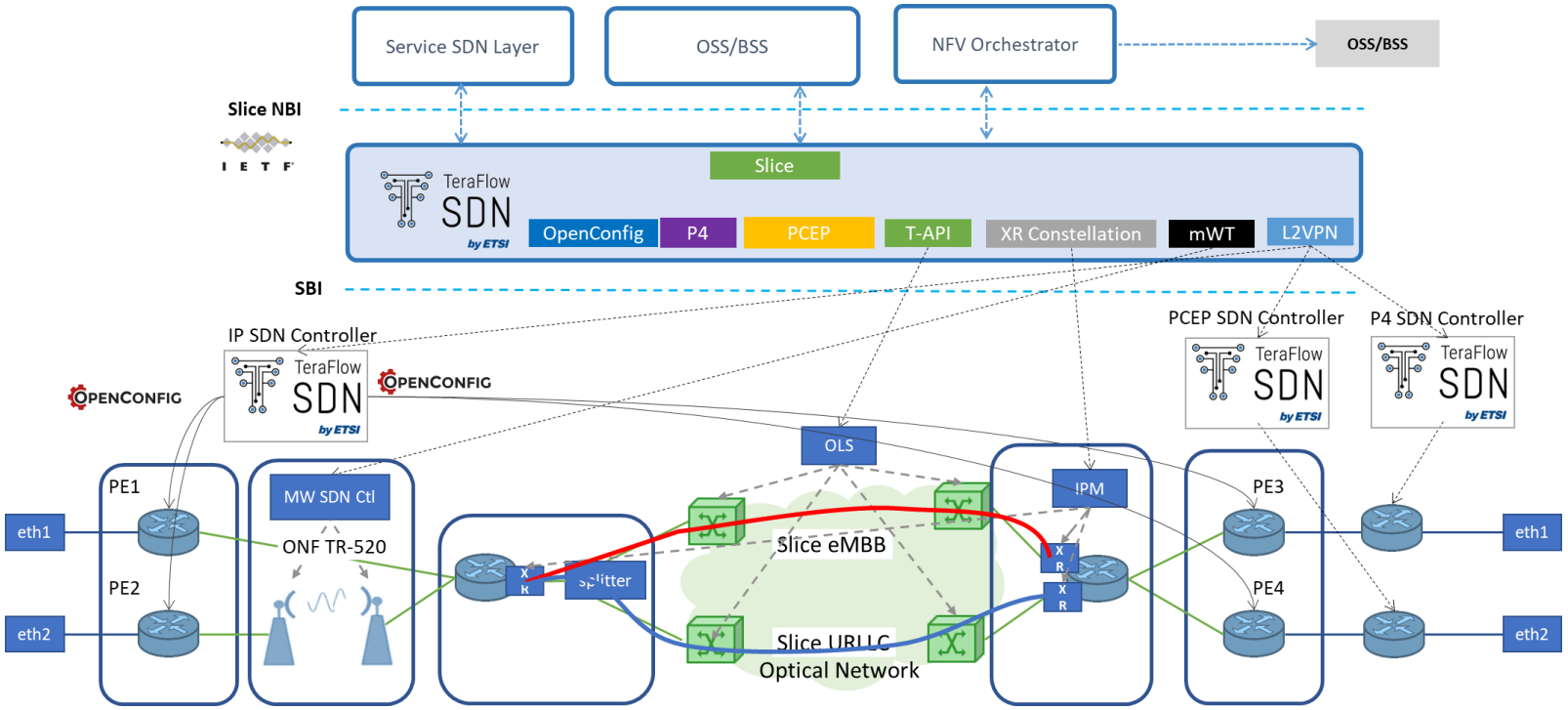


Carlos Natalino, Lluis Gifre, Raul Muñoz, Ricard Vilalta, Marija Furdek, Paolo Monti, “Scalable and Efficient Pipeline for ML-based Optical Network Monitoring”, Demo Zone OFC 2023

OFC2023

Bringing network automation in transport networks

This demonstration showcases how TeraFlowSDN provides support for hierarchical control of multiple heterogeneous SDN domains (through IP, microwave and optical technologies). Different transport slices are offered with multiple SLAs and grouped to optimize resources



Ll. Gifre, R. Vilalta, J.C. Caja-Díaz, O. Gonzalez de Dios, J.P. Fernández-Palacios, J.-J. Pedreno-Manresa, A. Autenrieth, M. Silvola, N. Carapellese, M. Milano, A. Farrel, D. King, R. Martinez, R. Casellas, and R. Muñoz, “Slice Grouping for Transport Network Slices Using Hierarchical Multi-domain SDN Controllers”, Demo zone OFC 2023.

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Thank You!