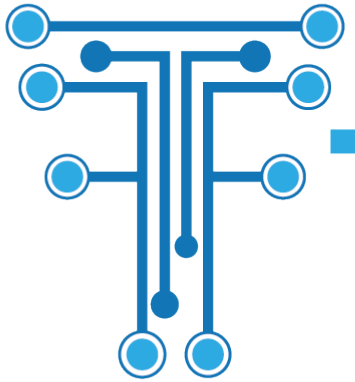

TeraFlow

TeraFlow use cases for a novel cloud-native SDN controller for beyond 5G networks

ICT-52 Workshop on 6G

Dr. Ricard Vilalta

03/02/2022

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5G PPP

Motivation

- **Open Transport Solutions Are being deployed**
  - Potential volumes are high, but they require integration with existing and future SDN controllers

- **Industry Fragmentation**
  - Several organizations driving SDN initiatives
  - Competing standards addressing same areas and use cases

- **Slow Market Adoption**

- **High Costs**
  - Slow and costly integration and API development
  - High operational overhead

Applicability Scenario

ACCESS

RAN

BACKHAUL

EDGE COMPUTING

IP & OPTICAL TRANSPORT

MICROWAVE

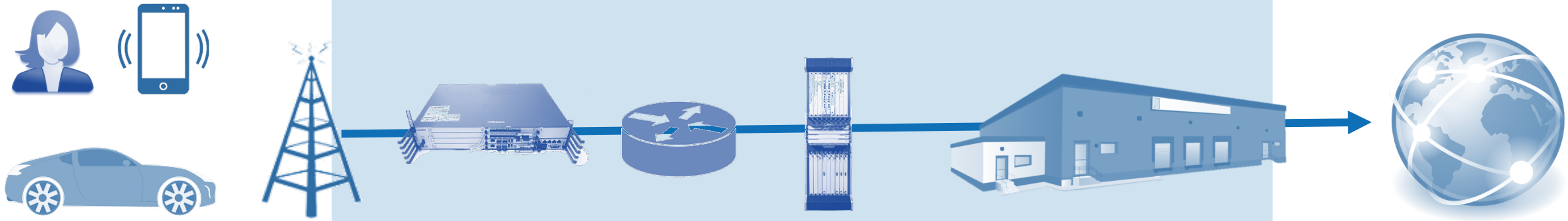
CORE

AI & MACHINE LEARNING

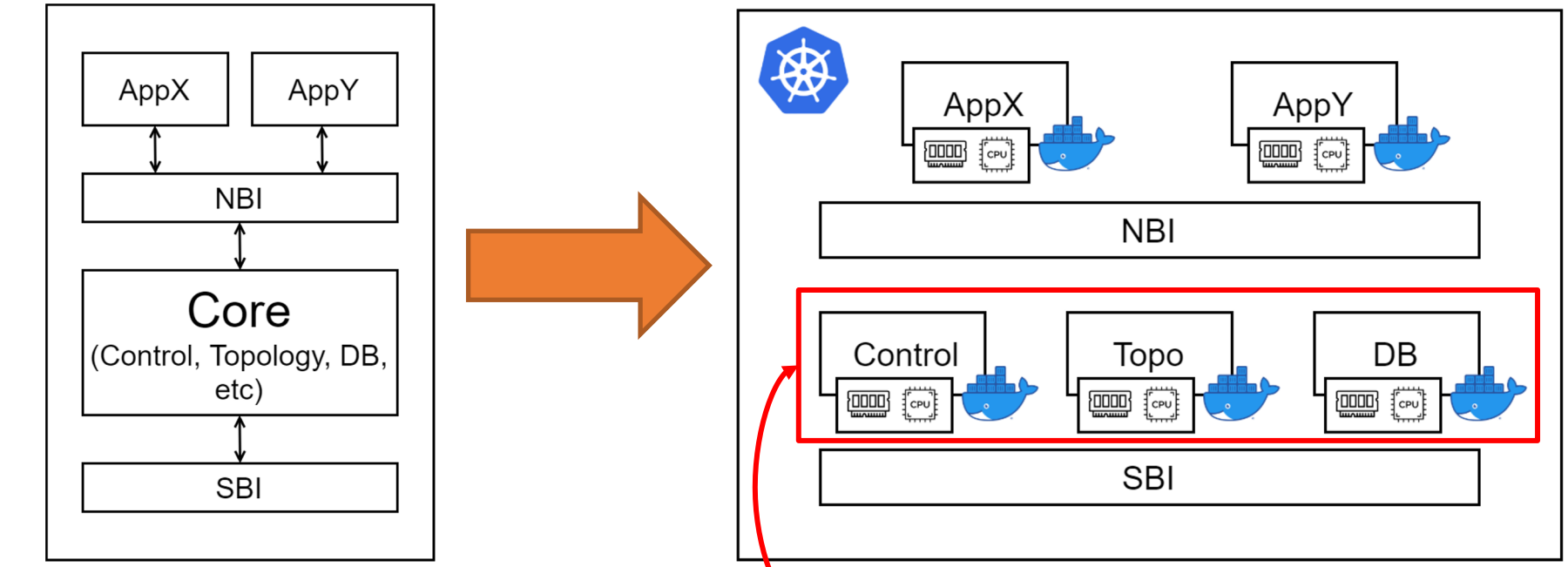
AUTONOMICITY AND NETWORK/COMPUTE INTEGRATION

AI-BASED CYBERSECURITY

TRUSTED MULTI-TENANCY



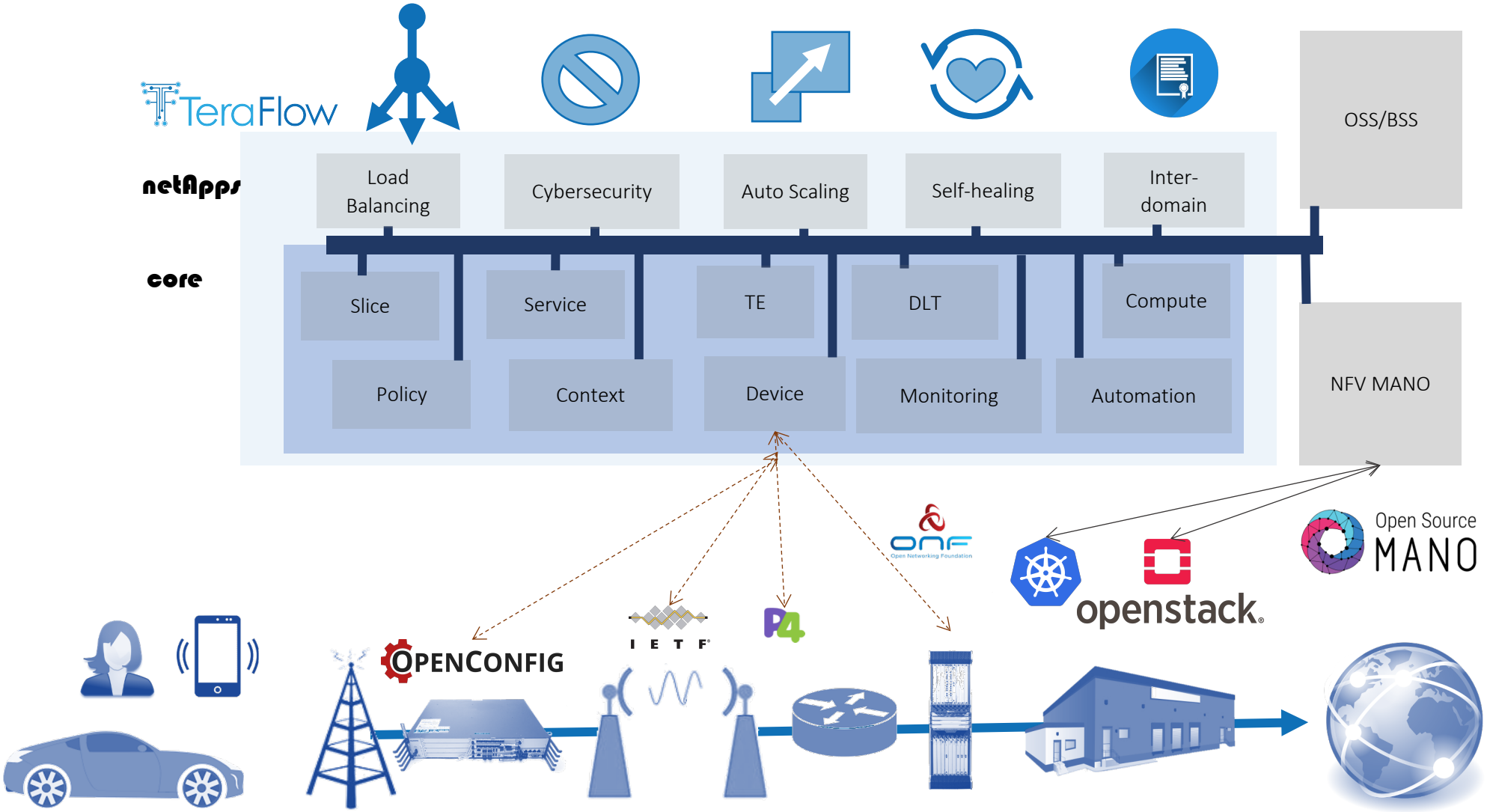
High performance SDN framework



Objective

Key control operations should scale individually

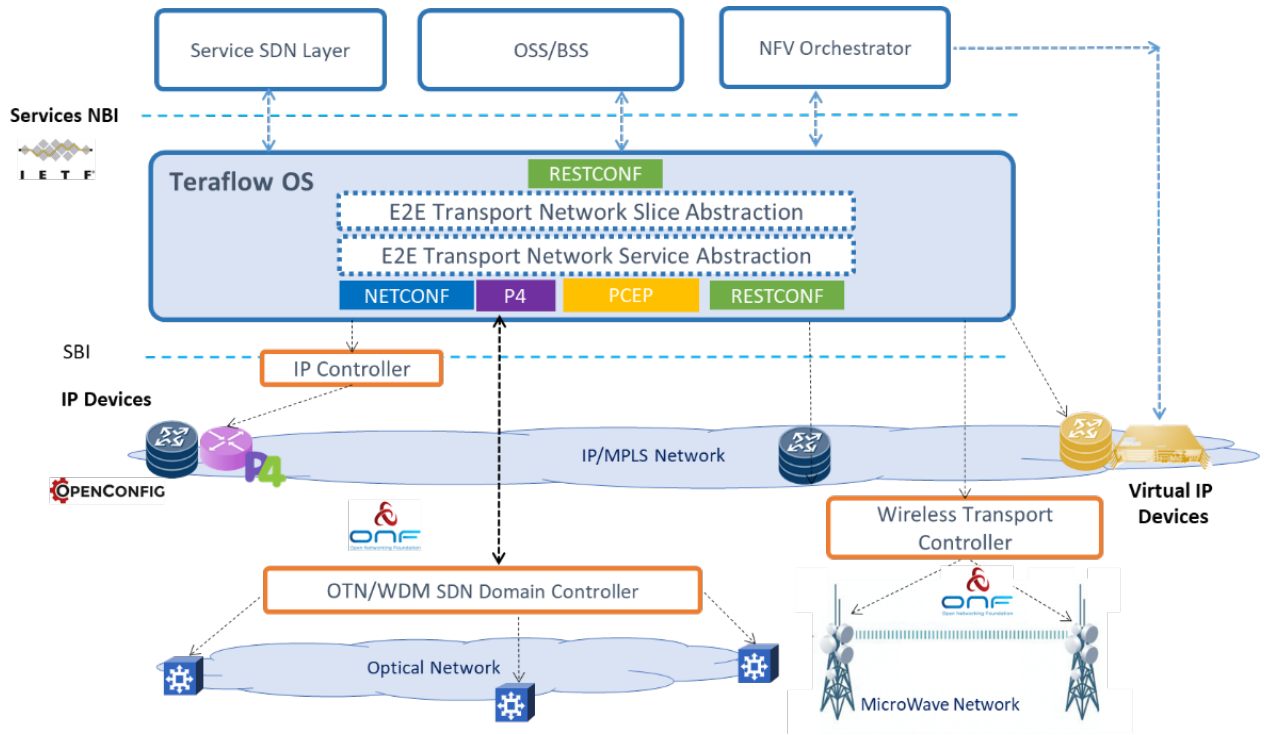
TeraFlow Architecture



SC1: Autonomous network beyond 5G

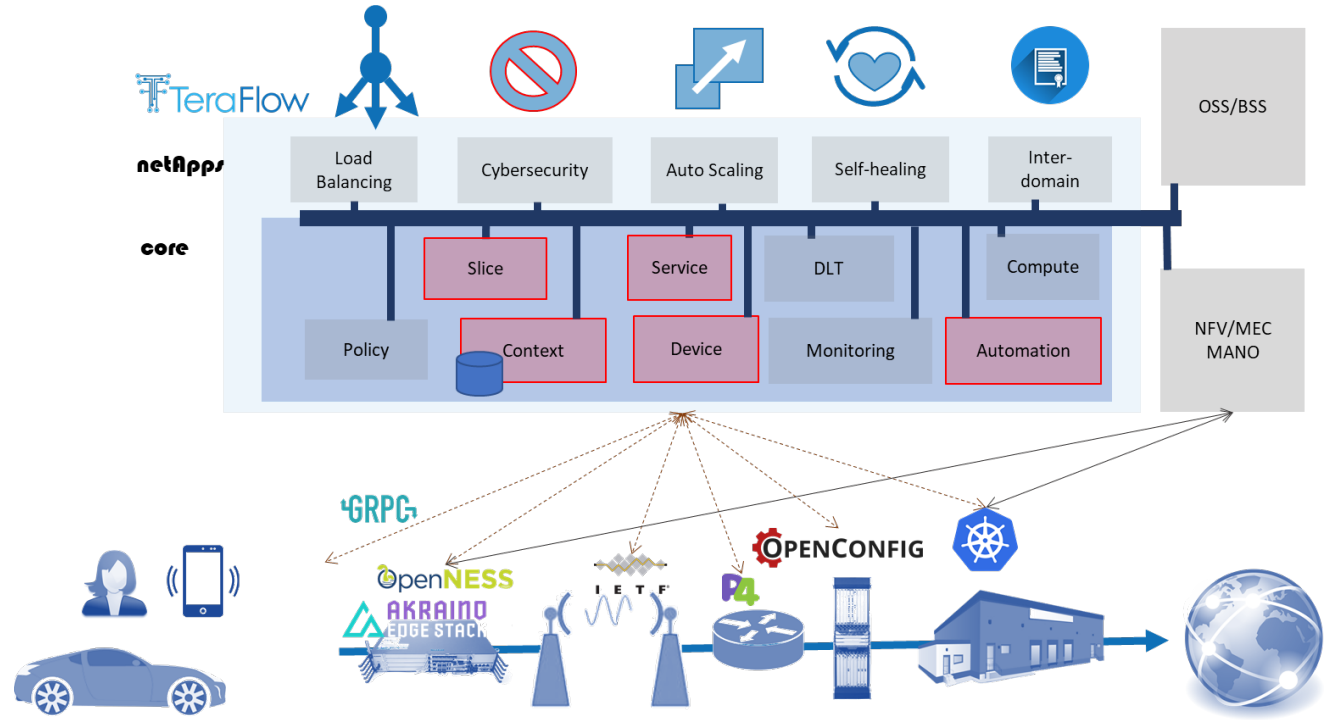
Challenges to be addressed:

- Provide functionalities to address the programmability needs of the transport network elements
- Develop agents for the north and south bound interface
- Autonomously on-board network equipment using zero-touch principles



SC1: component and use cases

- Components to be used in the scenario:
  - *Slice*
  - *Context*
  - *Service*
  - *Device*
  - *Automation*
  - *Policy*
- Use cases
  - *Inventory*
  - *Topology*
  - *Service*
  - *Transport Network Slicing*
  - *Automation*



Automation

Basis:

- Event-driven triggering of automation operations from:
  - Policy Management component or
  - External entities (e.g., a panel, telco provider CLI, etc.)

Focus on zero-touch:

- device onboarding
- service instantiation

Policy Management

Basis:

- Event-Condition-Action policy model (IETF draft by ODC)

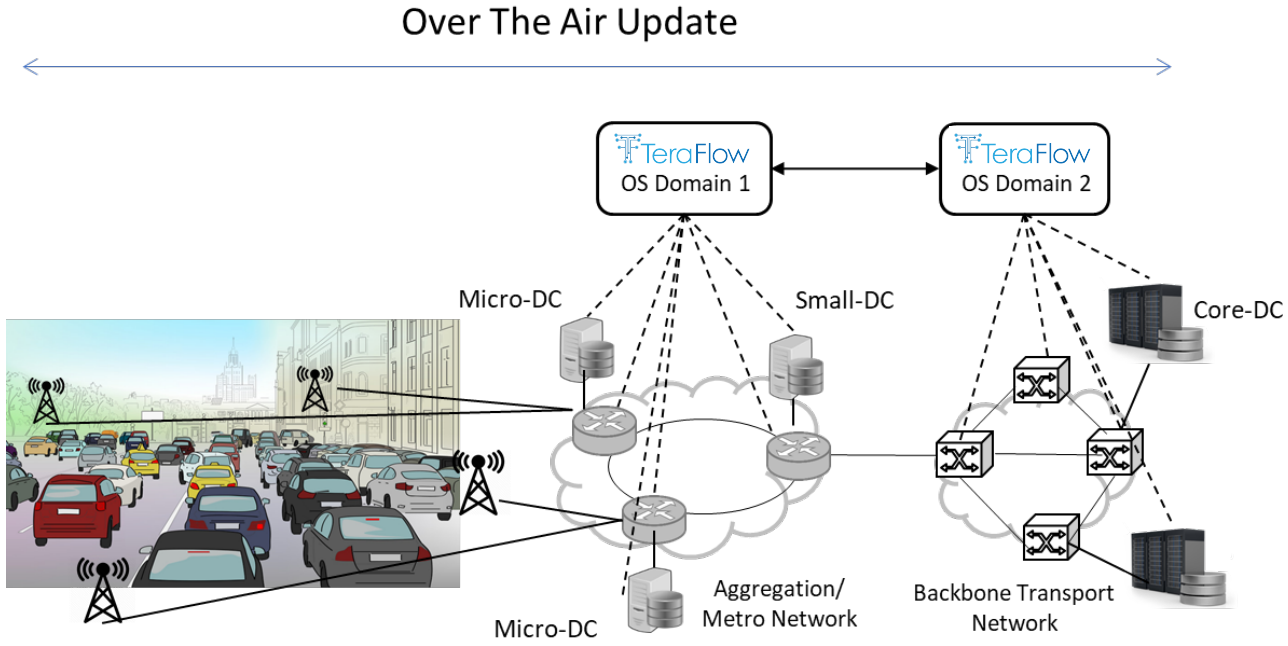
Focus on:

- relevant network events indicated by network operators
- device-level policies
- collaboration with the automation component
- monitoring use cases

SC2: Inter-domain

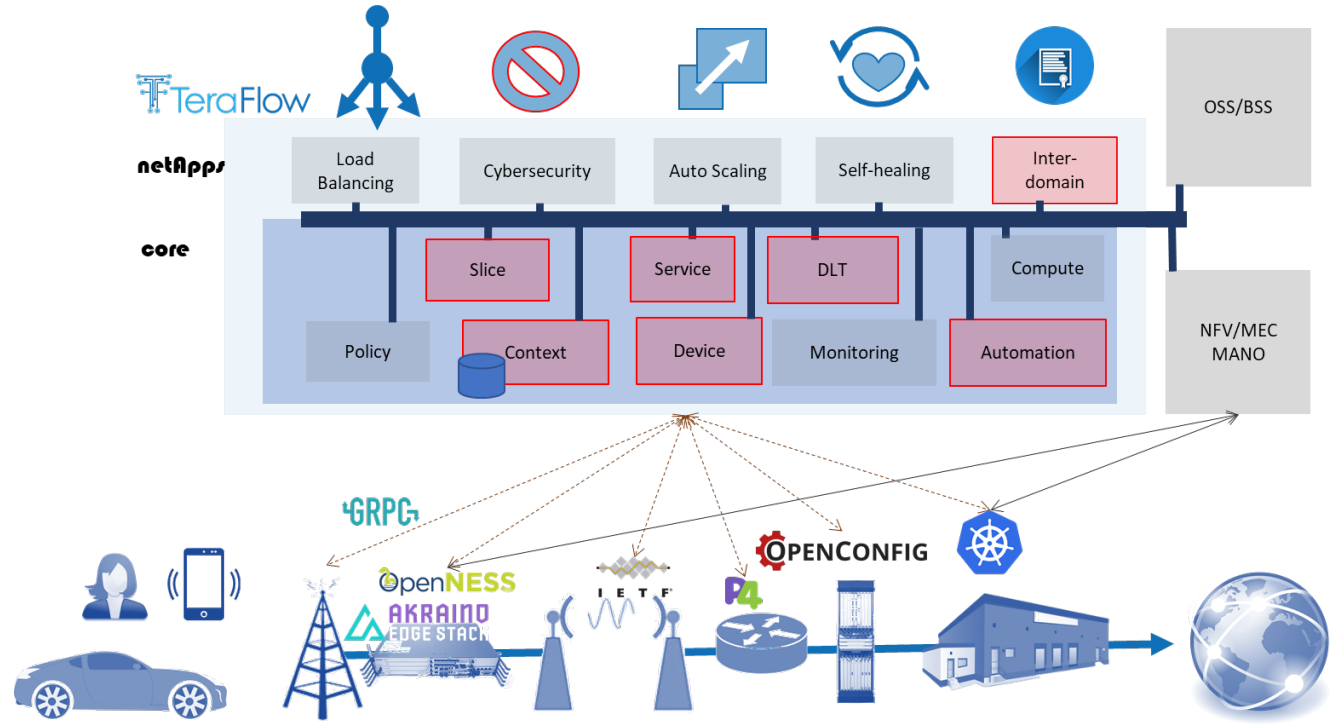
Challenges to be addressed :

- Deploy services over a set of integrated and optimized resources (i.e., cloud + connectivity)
- Multidomain service provisioning with privacy preserving features



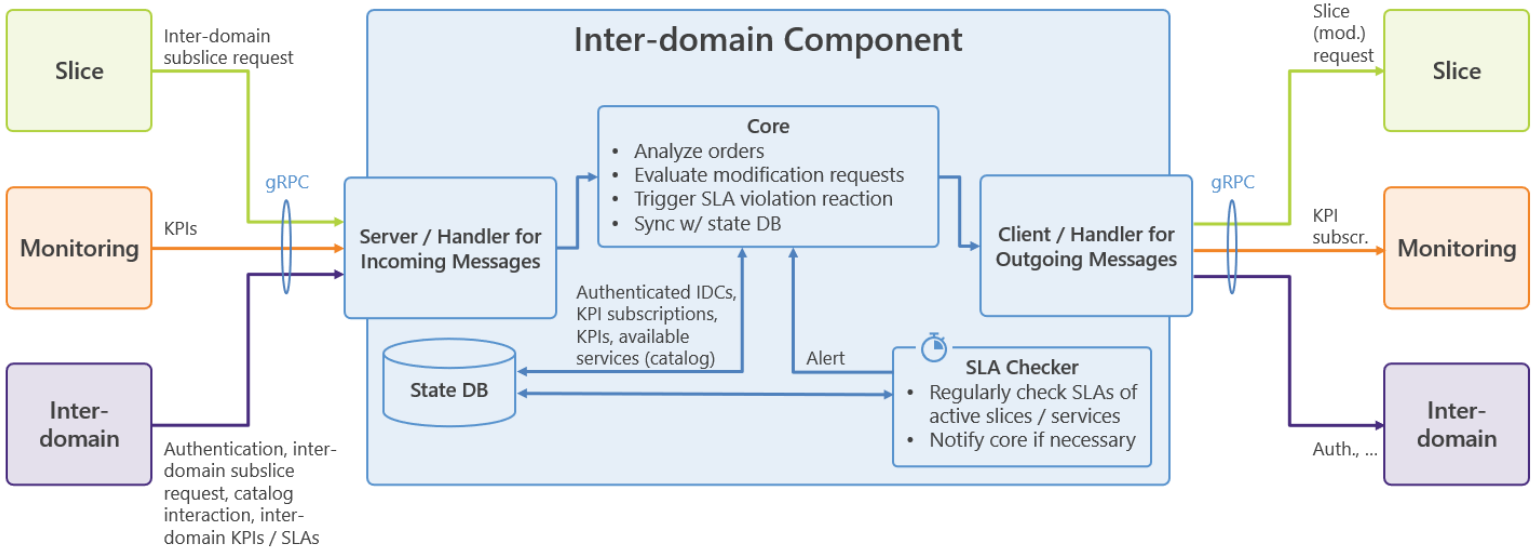
SC2: components and use cases

- Components to be used in the scenario are same one as in B5G with the addition of:
  - *DLT*
  - *Inter-domain app*
- Use cases
  - *Distributed ledger and smart contracts*
  - *Inter-domain*



Inter-Domain Component

- Objective: to enable QoS-aware inter-domain connectivity services via the interaction of peer Teraflow OS instances
- Develop a dedicated Inter-Domain component (IDC) within the Teraflow OS
  - IDCs hosted at different Teraflow OSs managing individual domains interact (using a defined interface and workflow)

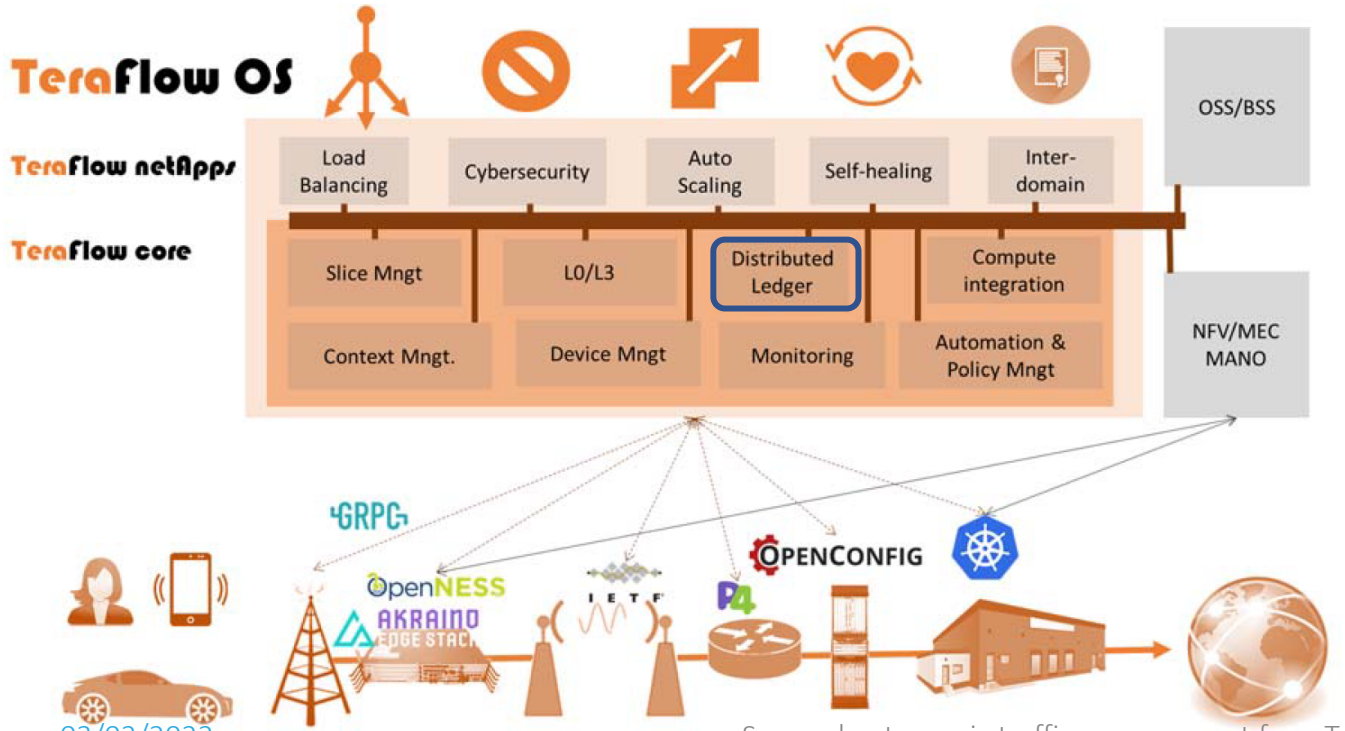


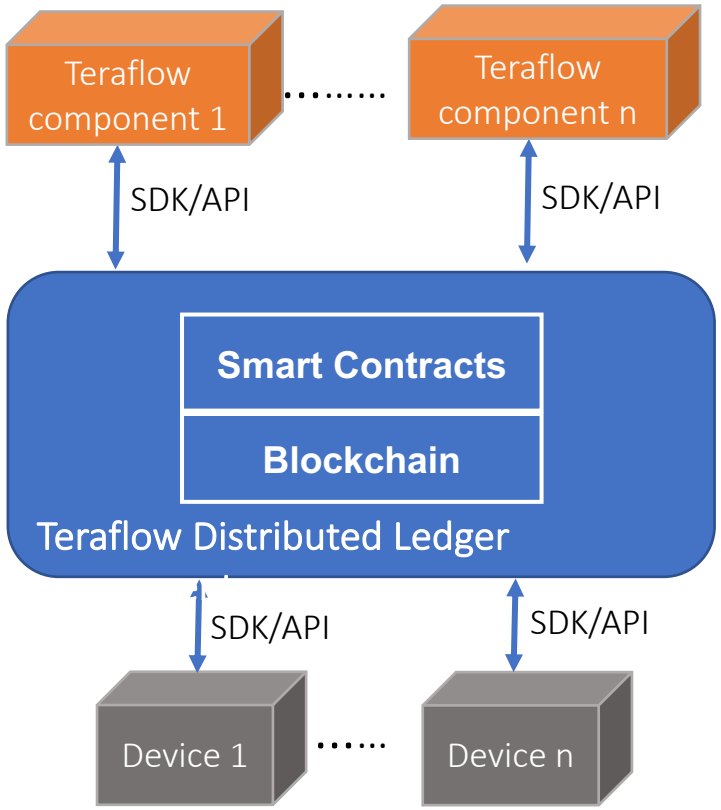
Supported Operations:

- Authentication, connection between IDCs
- Get catalogue of supported services
- Create, insert and modify services in the catalogue
- Request/Delete a inter-domain service
- Exchange KPIs/SLAs information

Distributed Ledger: Objectives

- Develop permissioned blockchain that records
  - Runtime information (e.g. remote attestation, tamper detection)
  - Software state (e.g. software/firmware version)
- Develop SDK/API to communicate with the blockchain
- Develop blockchain Smart Contracts
  - Use device and topology information to assess security

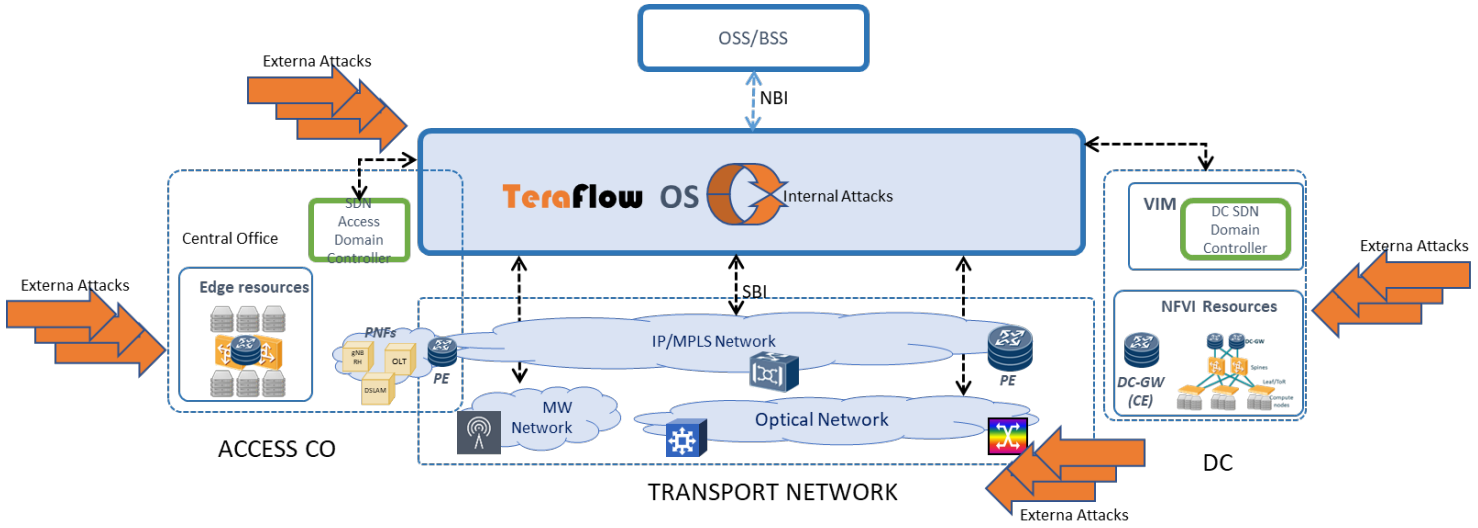




SC3: Cybersecurity

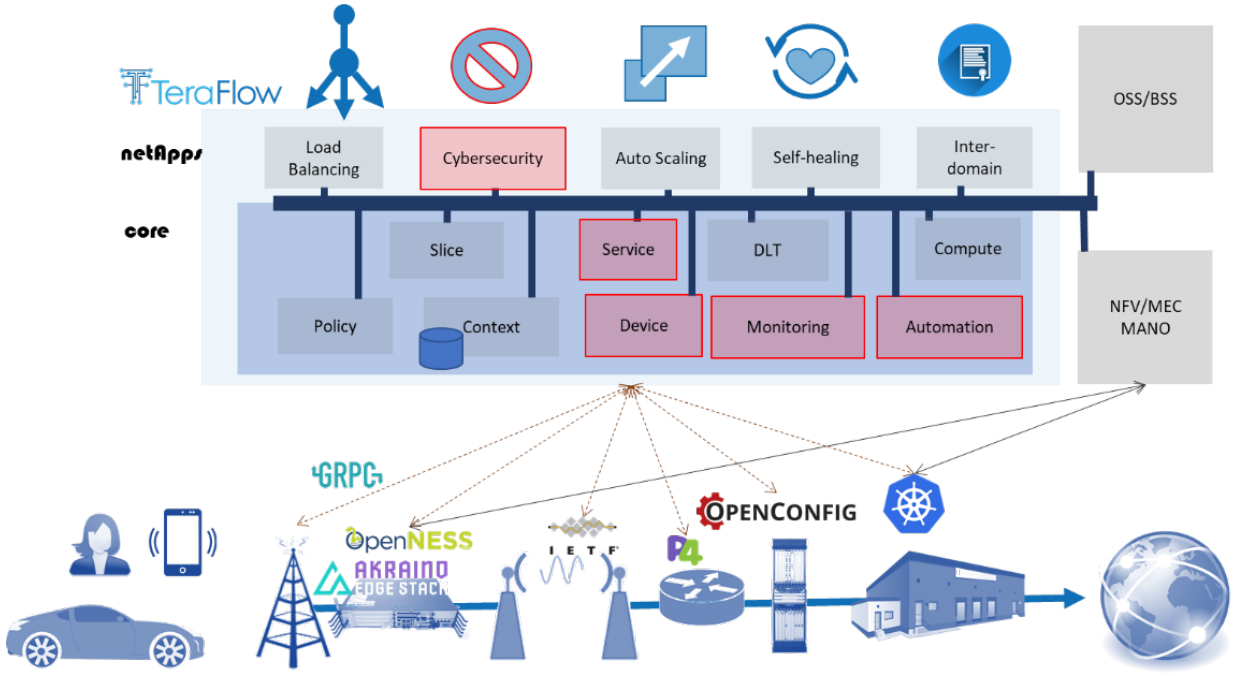
Challenges to be addressed:

- *IP layer*: design distributed packet inspection for an efficient and effective attack detection
- *Optical layer*: designing accurate and fast optical attack detection, identification, and mitigation mechanisms to minimize data losses and breaches

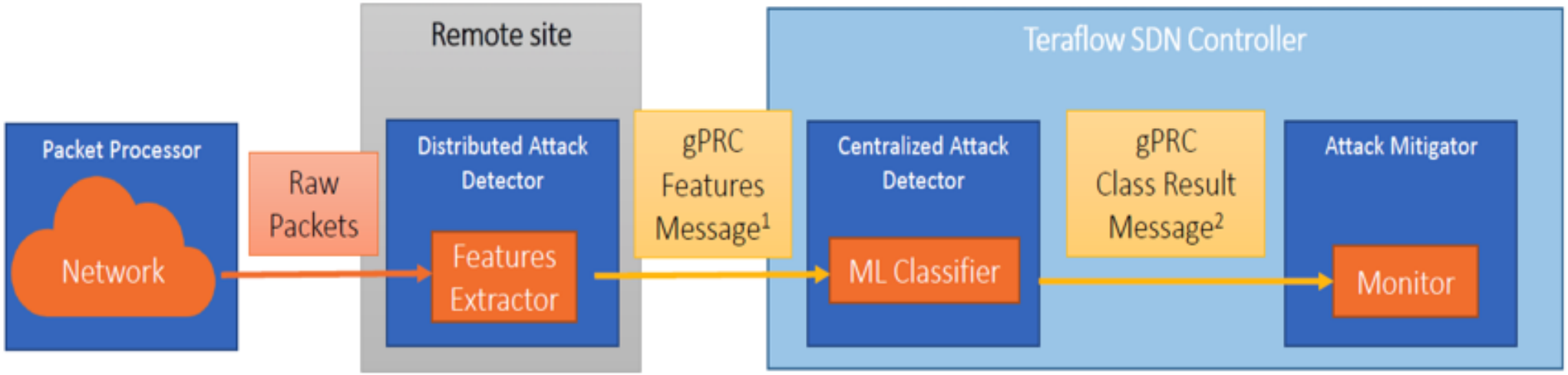


SC3: components and use cases

- Components to be used in the scenario are same one as in B5G (except Slice and Context) with the addition of:
  - *Monitoring*
  - *Cybersecurity app*
- Use cases
  - *Monitoring*
  - *Automation*
  - *Service*



Distributed attack detector



Distributed detection using ML-based components

Advantages:

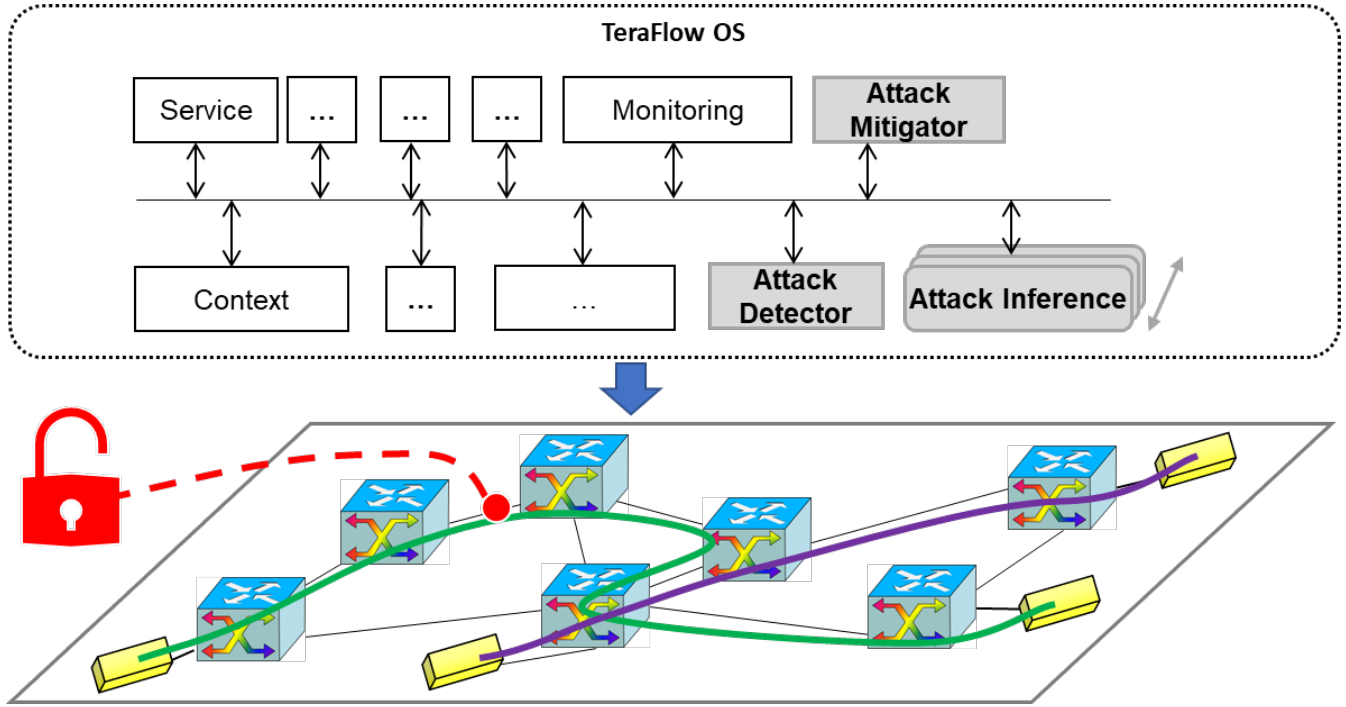
- Scalability at Teraflow controller
- Reduce bandwith

Distributed attack detector:

- V1.0 (Y1): Feature extractor
  Group packets per connection and extract statistical features
- V2.0 (Y2): Compact ML components
  Increase Latency response (local response at the edge)
  More complex detection in the SDN Controller (e.g. attack coming from different entry points)

Optical cybersecurity

- Performs attack detection and identification at the optical layer
  - Leverages the Optical Performance Monitoring (OPM) data collected by the monitoring component
  - Uses machine learning inference to detect and identify attacks
  - Computes and performs contextual attack mitigation



Events

- MWC 21
- 3rd ONFIRE Symposium
- TIP OOPT MUST
- OSM Ecosystem Day
- 5G-PPP Webinar
- MASTEAM Seminar
- CodeBeam STO 2021
- OFC 2021
- EuCNC | 6G Summit
- ONDM 2021
- IETF-111 side meeting
- OMNET++ Community Summit
- PSC 2021
- Nit Europea de la Recerca
- ECOC 2021
- CNSM 2021
- NetCentric 2021
- NoF2021
- TIP OOPT MUST
- IEEE NFV-SDN 2021
- NGON DCI 2021

More information:
https://www.teraflow-h2020.eu/news-events/events

Contribution to standards and open-source

- ETSI ISG PDL
- ETSI ISG ZSM
- ETSI mWT ISG
- ETSI SAI
- Telecom Infra Project (TIP OOPT MUST: IP track, Wireless Backhaul)
- ONF
- IETF
- ITU-T FG-AN
- OpenConfig

- TeraFlow SDN Controller
- ETSI OpenSource MANO
- ONF ONOS and Stratum
- HyperLedger

When all this will be available?

- First TeraFlow OS release: This month
- Available source-code:

https://gitlab.com/teraflow-h2020/controller

Thank you!

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