# TeraFlow

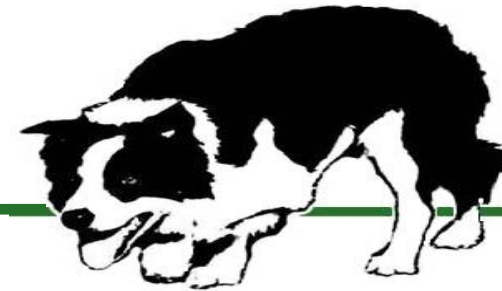## TeraFlow: Utilizing Optical Network Slicing to Connect Clouds for Autonomic 5G and Beyond Services

June 21, 2022

## TeraFlowSDN and open standards

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NGON & DCI World

5G PPP

# TeraFlow Applicability Scenarios

Network usage integration and optimised management of network resources.

Security and Resilience with Artificial Intelligence and Machine Learning Mechanisms.

Flexible Connect-Compute Technologies and Architectures.

Transport Network Slices, Smart Traffic Interconnection, and SLA Assurance.

Using Distributed Ledger and Smart-contracts.

ACCESS

BACKHAUL

CORE

RAN

EDGE COMPUTING

IP & OPTICAL TRANSPORT

MICROWAVE

AI & MACHINE LEARNING

AUTONOMICITY AND NETWORK/COMPUTE INTEGRATION

AI-BASED CYBERSECURITY

TRUSTED MULTI-TENANCY

Packet Slicing

Optical Slicing
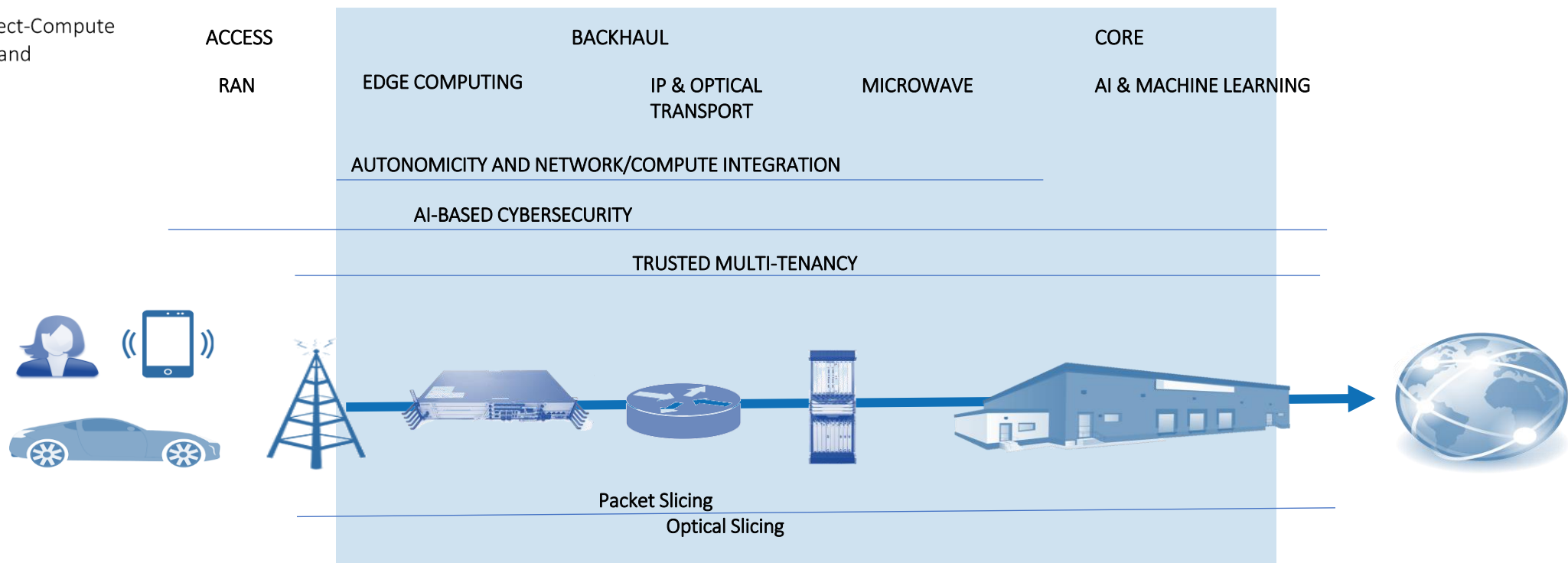
# TeraFlow Architecture and Partners Overview
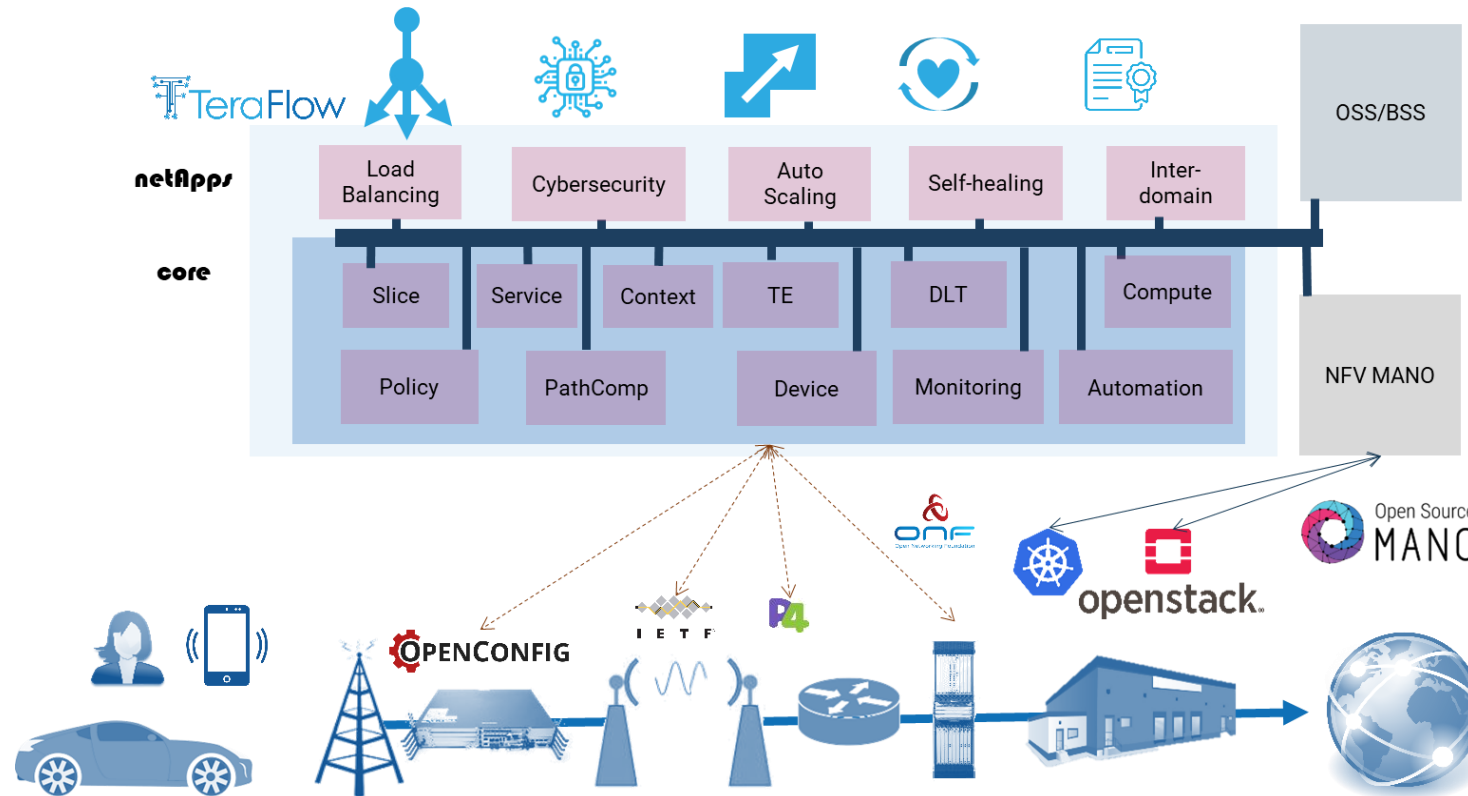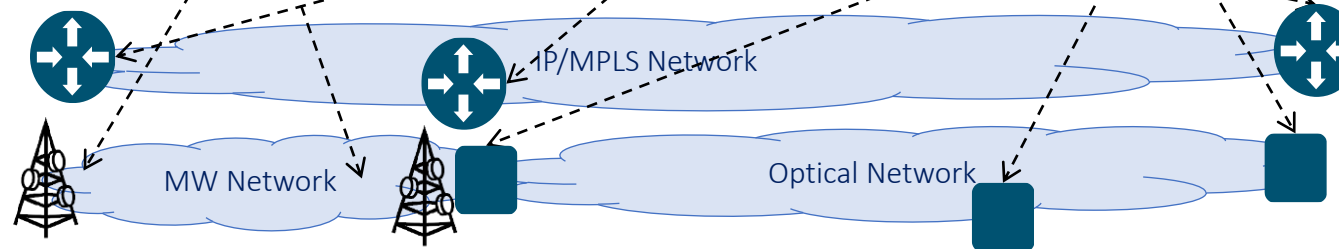


Project Partners

# TeraFlow TFS Architecture and SDO relevance
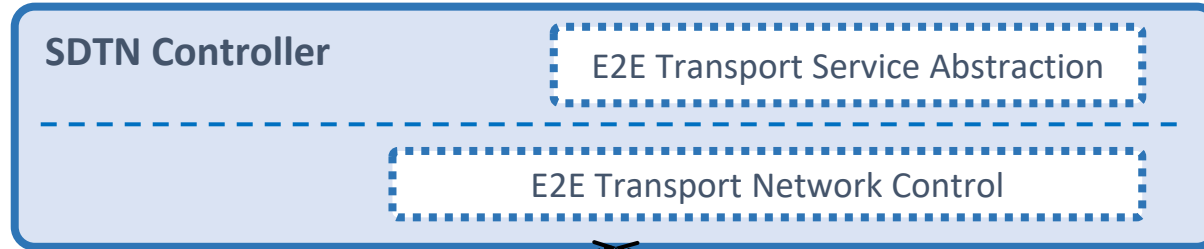
# Building the optical underlay

- Hierarchical SDN Architecture widely adopted by Industry
  - TIP Open Transport SDN architecture
  - IETF Abstraction and Control of TE Networks (ACTN)
    - Defined in RFC 8453
    - A management architecture and YANG models for building Virtual Network services
- ONF Transport API to NBI of optical networks
  - Topology Service
  - Connectivity Service
  - Path Computation Service
  - Virtual network Service
  - Notification Framework
  - Optical Transport (OTN, DWDM)
- Optical Integration
  - Accessing Cloud via Optical Network Problem Statement
    - draft-liu-rtgwg-optical2cloud-problem-statement
  - Framework and Data Model for OTN Network Slicing
    - draft-zheng-ccamp-yang-otn-slicing
  - Applicability of Abstraction and Control of Traffic Engineered Networks (ACTN) to Packet Optical Integration (POI)
    - draft-ietf-teas-actn-poi-applicability
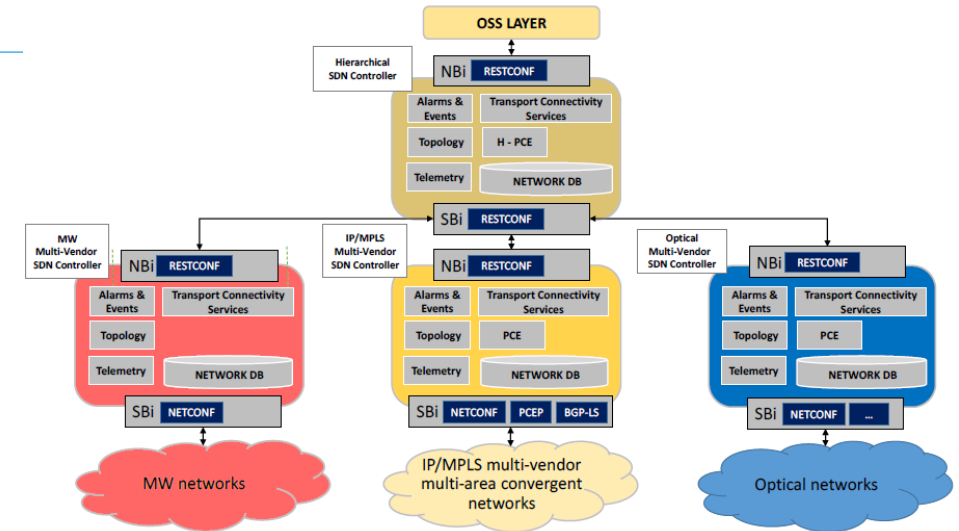
Telecom Infra project Open Transport SDN architecture

IETF ACTN Architecture
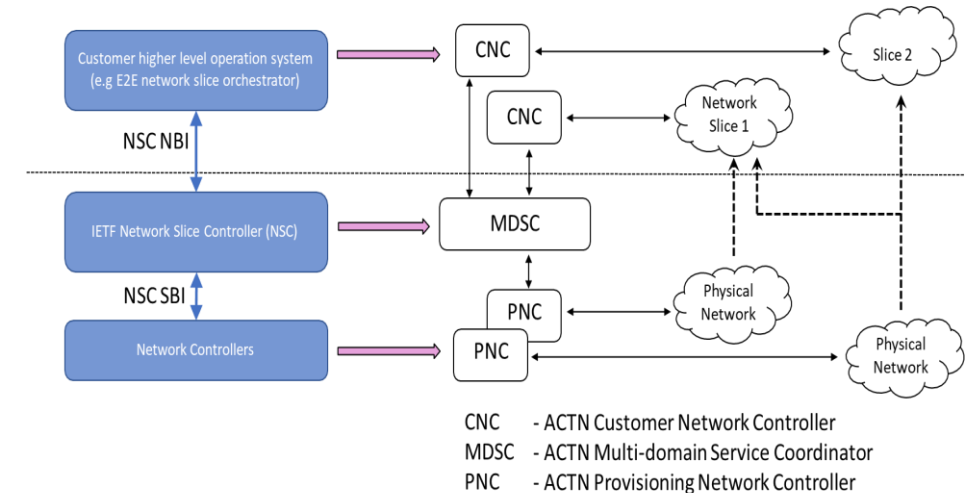
# Slicing Standards

- Complete the **deployment** the SDN domain controllers
- **Network Slicing:** ongoing debate in the industry. Yang models / APIs still in definition.
- Hierarchical controller including the Slice controller are the pieces to tight all layers together.
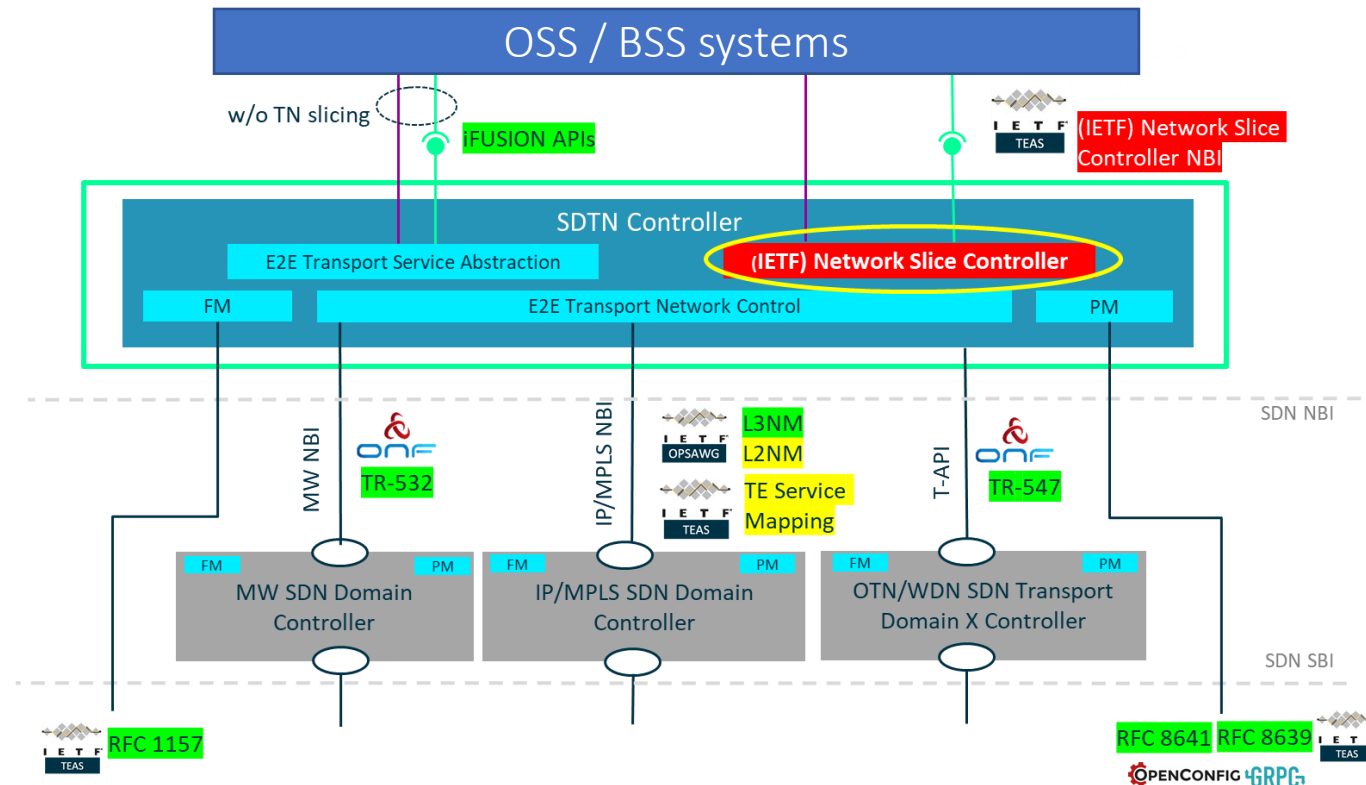


Telefonica Architecture to deploy automation using TFS

# TeraFlow SDO Activity for Slicing Techniques and Objectives

- TeraFlow uses a combination generic service models and SDO device models, for network slicing deployment
- IETF Network Slicing Northbound Interface (NBI), it needs to express
  - Customer details
  - Endpoints
  - Connectivity matrices
  - SLOs and SLEs
- Abstraction and Control of TE Networks (ACTN) RFC 8453
  - A management architecture and YANG models for building Virtual Network services for slicing
- Framework for IETF Network Slices
  - draft-ietf-teas-ietf-network-slices
- Early work on a NBI Slice YANG specification
  - draft-wd-teas-ietf-network-slice-nbi-yang
- Layer 2 VPN Network and Enhanced VPNs (VPN+) are defined in
  - draft-ietf-opsawg-l2nm
  - draft-ietf-teas-enhanced-vpn
- ACTN can be used to deliver IETF Network Slices
  - draft-ietf-teas-applicability-actn-slicing
- Segment Routing Policies (SR-TE) are a way of delivering IETF Network Slices in an SR network
  - draft-ietf-spring-sr-for-enhanced-vpn
  - draft-bestbar-teas-ns-packet
  - draft-bestbar-teas-yang-slice-policy