TeraFlow

Secured autonomic traffic management of a Tera of SDN Flows

This project has received funding from the European Union's H2020 research and innovation programme under the grant agreement No. 101015857

5G PPP

Motivation

SDN has been in the market for more than 10 years with great success, but Operators still have not adopted basic deployments.

Telco Cloud is evolving slowly and there is no clear path of SDN introduction in Operators.

Automation is needed for Network Operators in order to fully benefit SDN adoption.

With B5G Networks, massive SDN flows will be needed. Flow aggregation at the network core, is not efficient and does not provide specific services.

Computing and network resource shall be addressed in a unified way. There is the need to break VIM or WIM paradigm.

Networks need to be able to autonomously resist attacks.

Objective 1

TeraFlow

Adoption of SDN by Telecom Operators

Accelerate innovation in Optical and IP networks and ultimately help operators provide better connectivity for communities all around the world

5G Integration with L3VPN/L2VPN up to the edge

Multi-vendor Multi-domain	Multi-cast/ Unicast	IP+Optical	MPLS-TP or SR or GTP

Automated and Zero Touch Service Management for Transport Network Slices

Initialization	Auto-discovery and auto-configuration	Auto-provision

Objective 2

TeraFlow

Handle a Tera of flows

Cloud-native Network Operative System

IoT - a tera of flows – New cloud-native architectures, P4 introduction

Inventory, alarms, provisioning – Novel protocols (gNMI)

Objective 3

TeraFlow

Easily integrate with distributed computing through Transport Network Slices

Integration with:

- Telco Cloud
- MEC

Enabling:

- Cloud-native solutions
- 5G GTP flow definitions
- 5GCore

Inter-domain smart contracts

- B2B
- B2C

Objective 4

TeraFlow

Secure Operator Network

AI/ML based on

- ETSI ZSM
- ETSI ENI

Cybersecurity - MouseWorld

- Attack detection
- Reactive protection
- Synthetic attack generation

DLT

- Secure network element configuration
- Smart-contract-based verification and update
- Support for forensic evidence (in TeraFlow for network element configuration)

Objective 5

Impact

- Adoption of concepts by Standard Defining Organizations
- Contributions to Open-Source Software communities
- Influence vendor ecosystem.
- Clear product and exploitation roadmap.
- Multi-vendor interoperability events
- 5GPPP integration

TeraFlow OS

TeraFlow

- Open Source Software with Apache License
- Contributions to other OSS such as ONOS or ODL are expected.

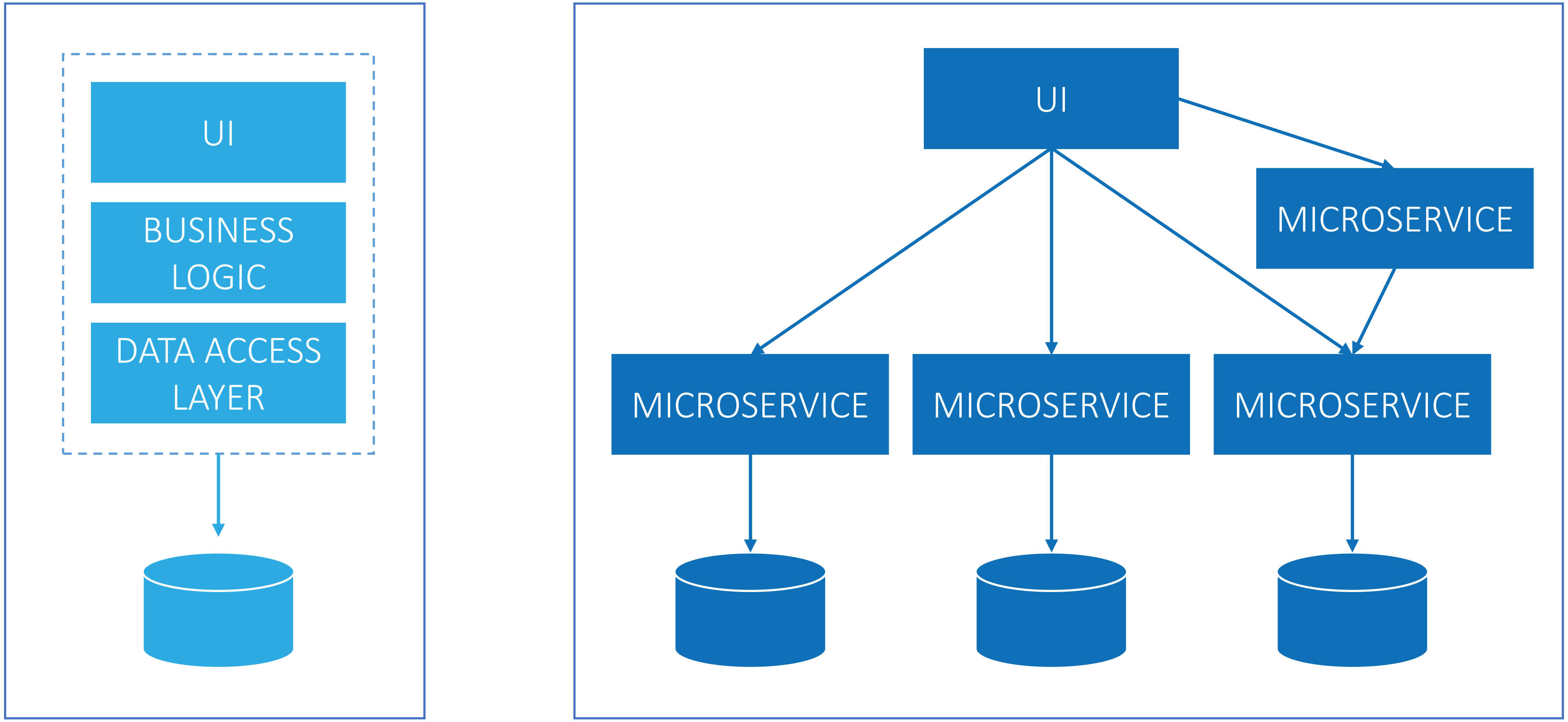
Use Case Driven for IP and Optical networks

Distributed smart connectivity with integrated with (edge) computing and storage resources.

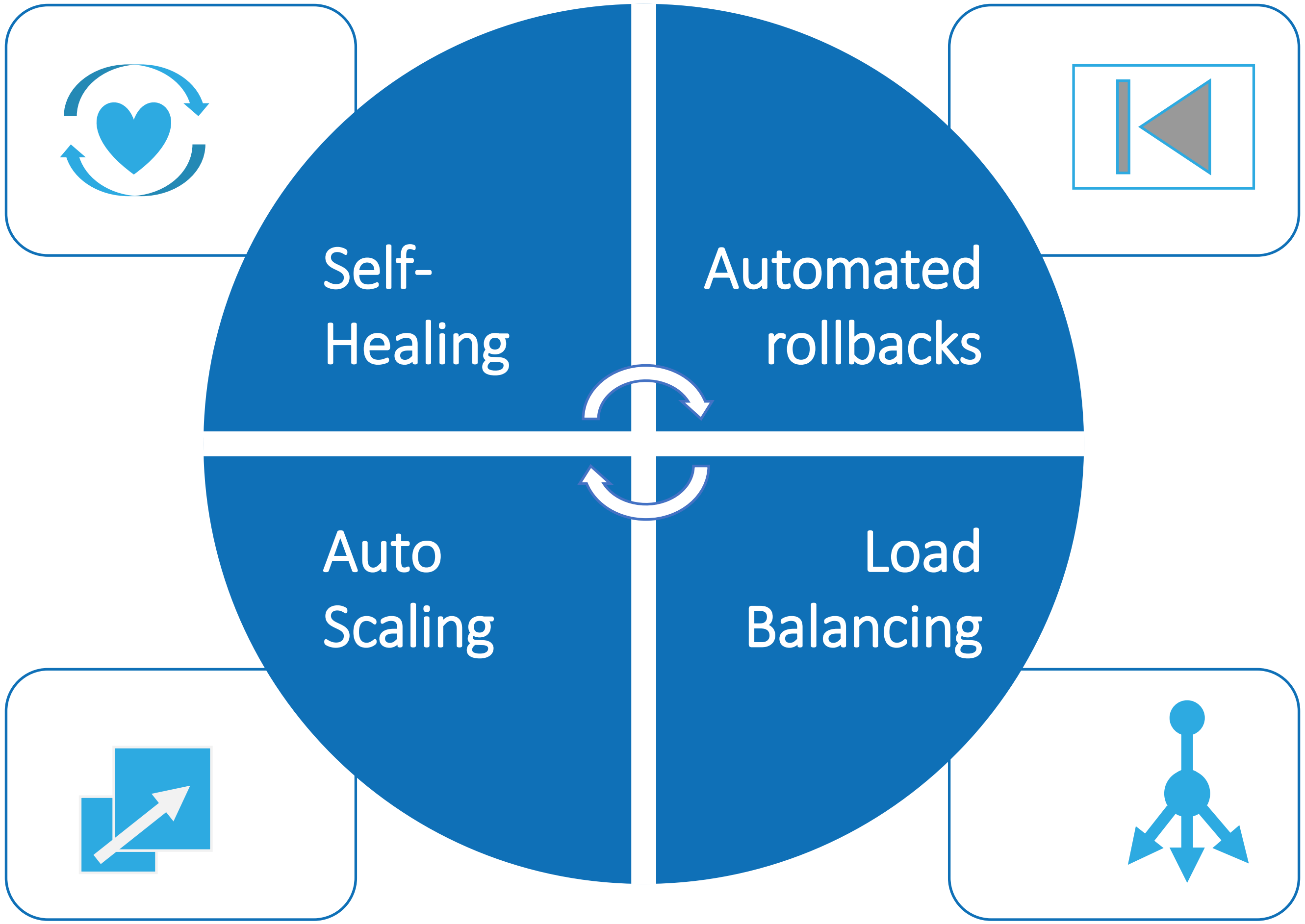
Dynamically adaptation based on flows and application requirements

Novel interaction between human and digital systems (e.g., In cars, doors, mirrors, appliances, etc.)

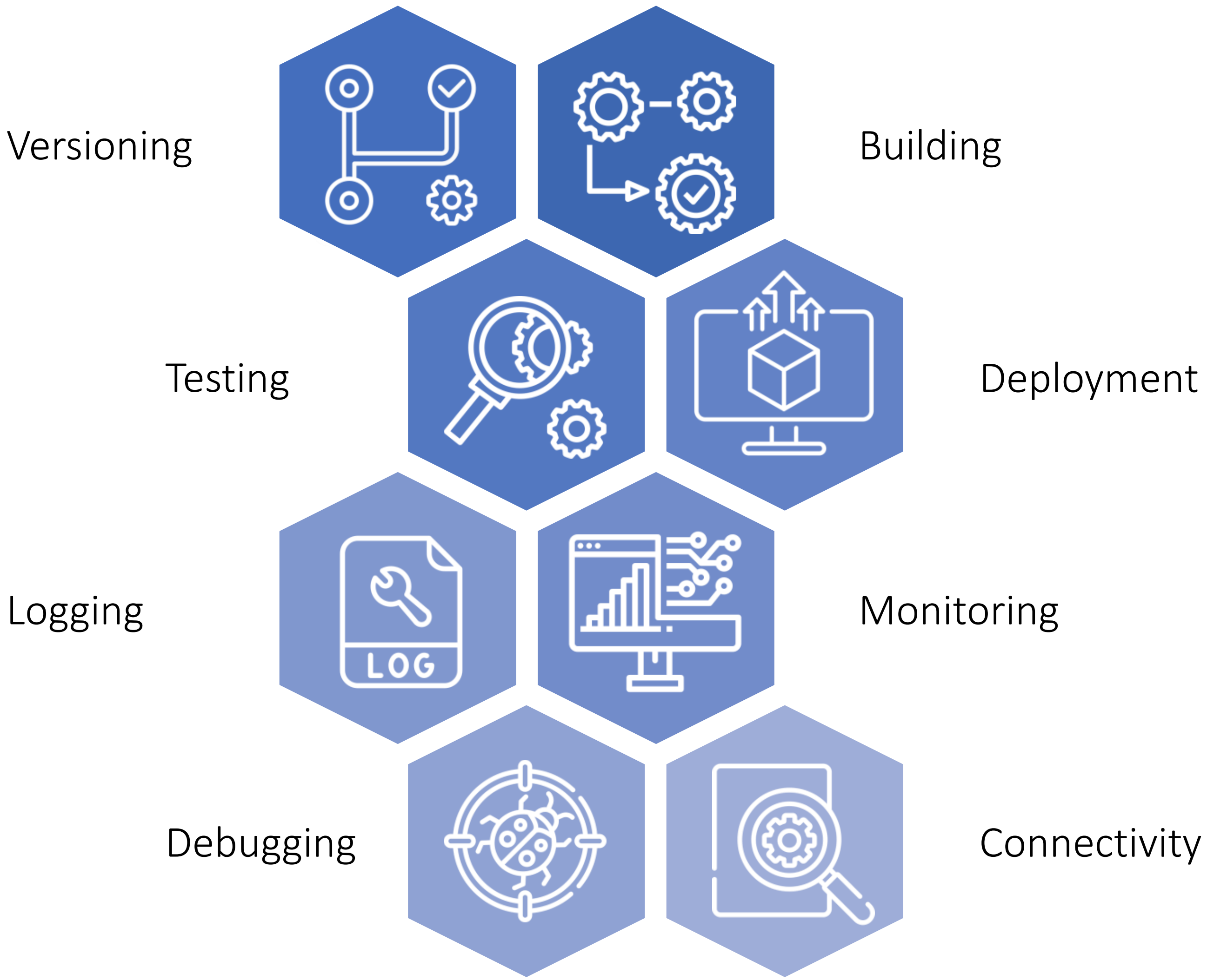
Monolithic vs. Micro-services



Cloud-native benefits



Cloud-native challenges



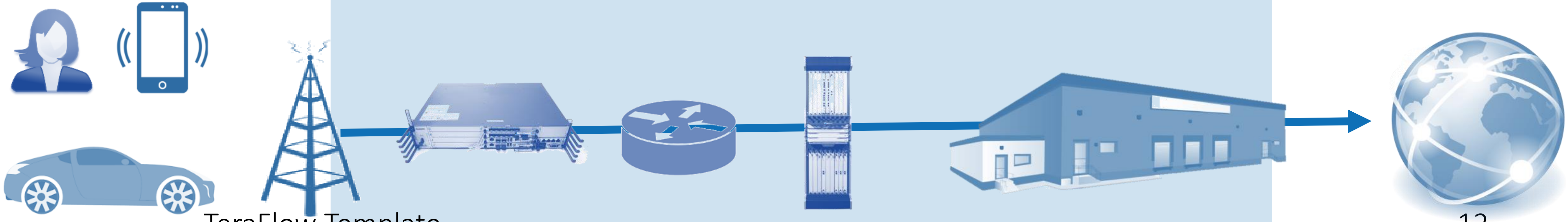
Applicability Scenario

ACCESS	BACKHAUL			CORE
RAN	EDGE COMPUTING	IP & OPTICAL TRANSPORT	MICROWAVE	AI & MACHINE LEARNING

AUTONOMICITY AND NETWORK/COMPUTE INTEGRATION

AI-BASED CYBERSECURITY

TRUSTED MULTI-TENANCY



TeraFlow Template

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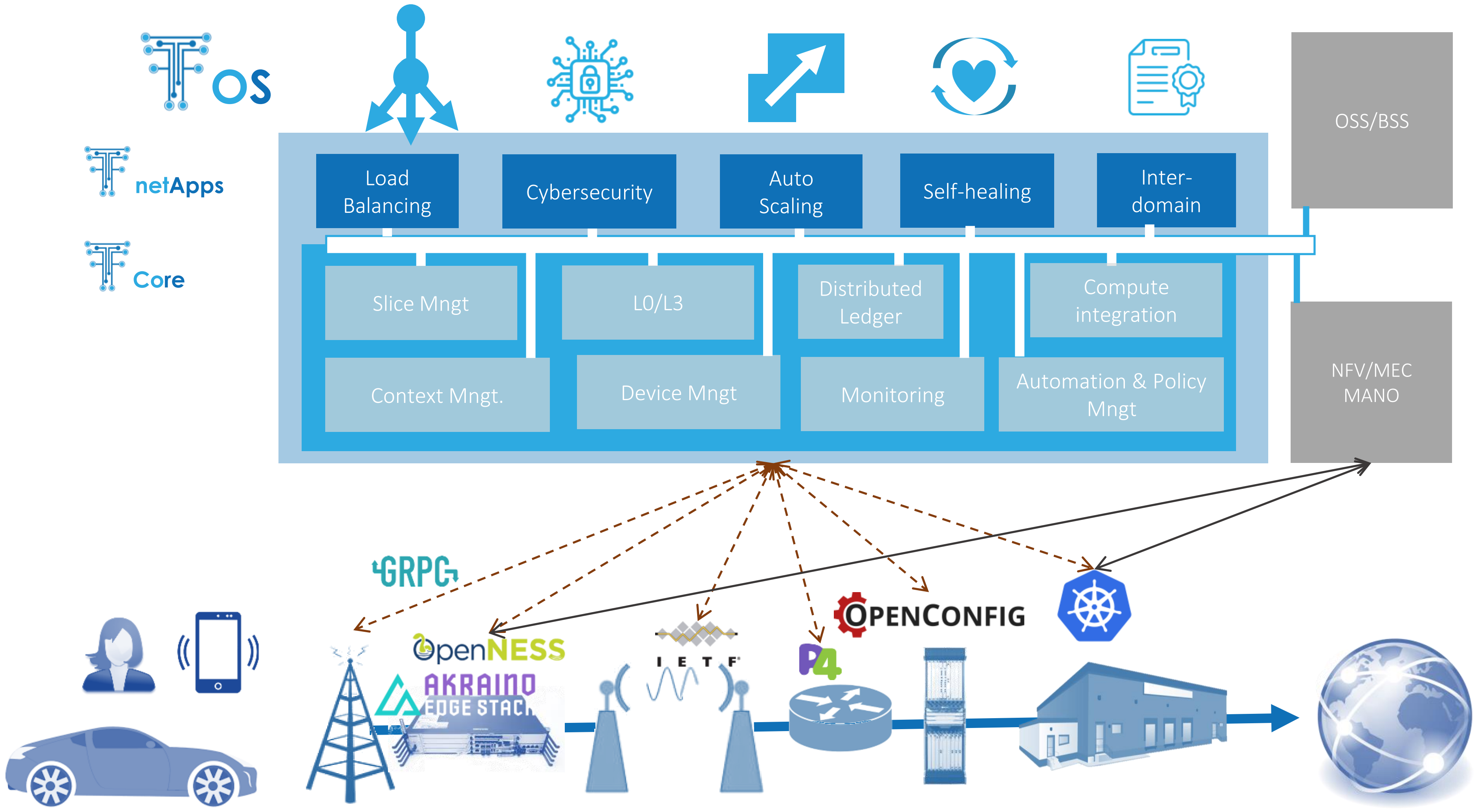
TeraFlow Architecture



Use Cases

TeraFlow

Autonomous network B5G

Carrier grade. Industry validated

L3 Infinera/Volta Networks

L0 SMOptics

TID, SMOptics, Infinera, Volta, CTTC

Transport SDN – TID Juan

Automotive

Tera of Flows validation

Cloud-scale

Multi-domain

ATOS, **CTTC**, Telenor, NTNU

CTTC Testbed

CyberSecurity

AI

DLT

TID, **UPM**, Chalmers, NEC

MouseWorld – TID Antonio

Methodology

- Use case definition
- Requirement licitation
- Data model definition
- SDN Integration and standardization
- Provider proof-of-concept
- Final delivery

Work Package breakdown

TeraFlow

WP1 Project Management

WP6 Standardization, Dissemination and Exploitation

WP2 Use cases, Requirements, Architecture, Business models analysis and Data Models

WP3 Life-cycle automation and high performance SDN components

- T3.1 High performance SDN framework
- T3.2 Hardware and L0/L3 multi-layer integration
- T3.3 SDN Automation
- T3.4 Transport Network Slicing and Multi-tenancy

WP4 Network security and interworking across B5G networks

- T4.1 Cyberthreat Analysis and Protection
- T4.2 Distributed Ledger and Smart Contracts
- T4.3 Interworking across Beyond 5G Networks

WP5 Prototype integration, demonstration and validation

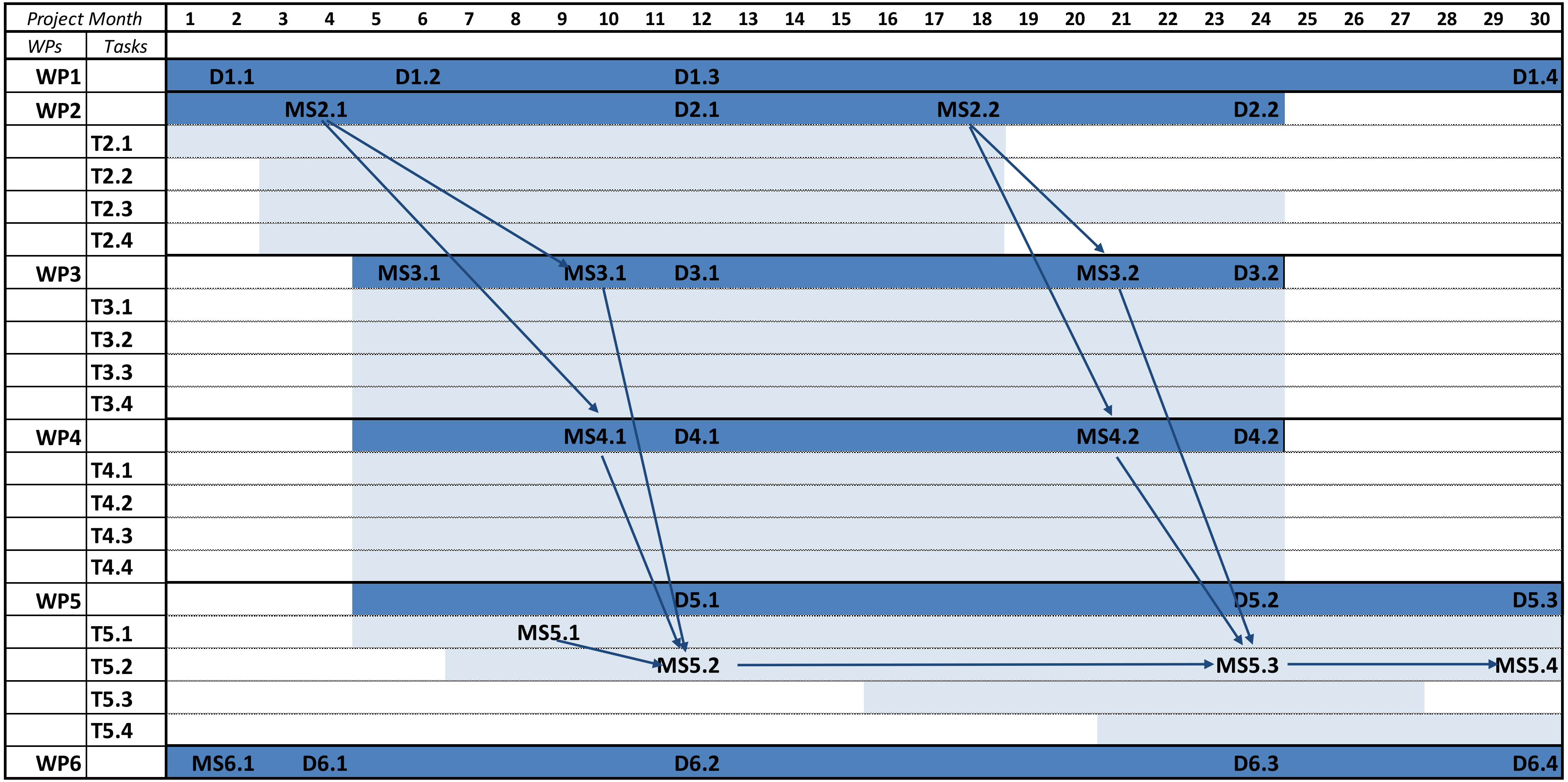
- T5.1 Infrastructure and testbeds
- T5.2 TeraFlow OS integration
- T5.3 Use case integration and demonstration
- T5.4 Performance assessment and KPI validation

Autonomous network B5G

Automotive

Cybersecurity

Gantt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WPs
Tasks
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D1.1
D1.2
D1.3
D1.4
WP2
MS2.1
D2.1
MS2.2
D2.2
T2.1
T2.2
T2.3
T2.4
WP3
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MS5.3
MS5.4
T5.3
T5.4
WP6
MS6.1
D6.1
D6.2
D6.3
D6.4

TeraFlow Consortium

Project Coordinator: CTTC
Technical Manager: Telefónica

Vendors:

- Infinera
- SIAE
- NEC

Integrators:

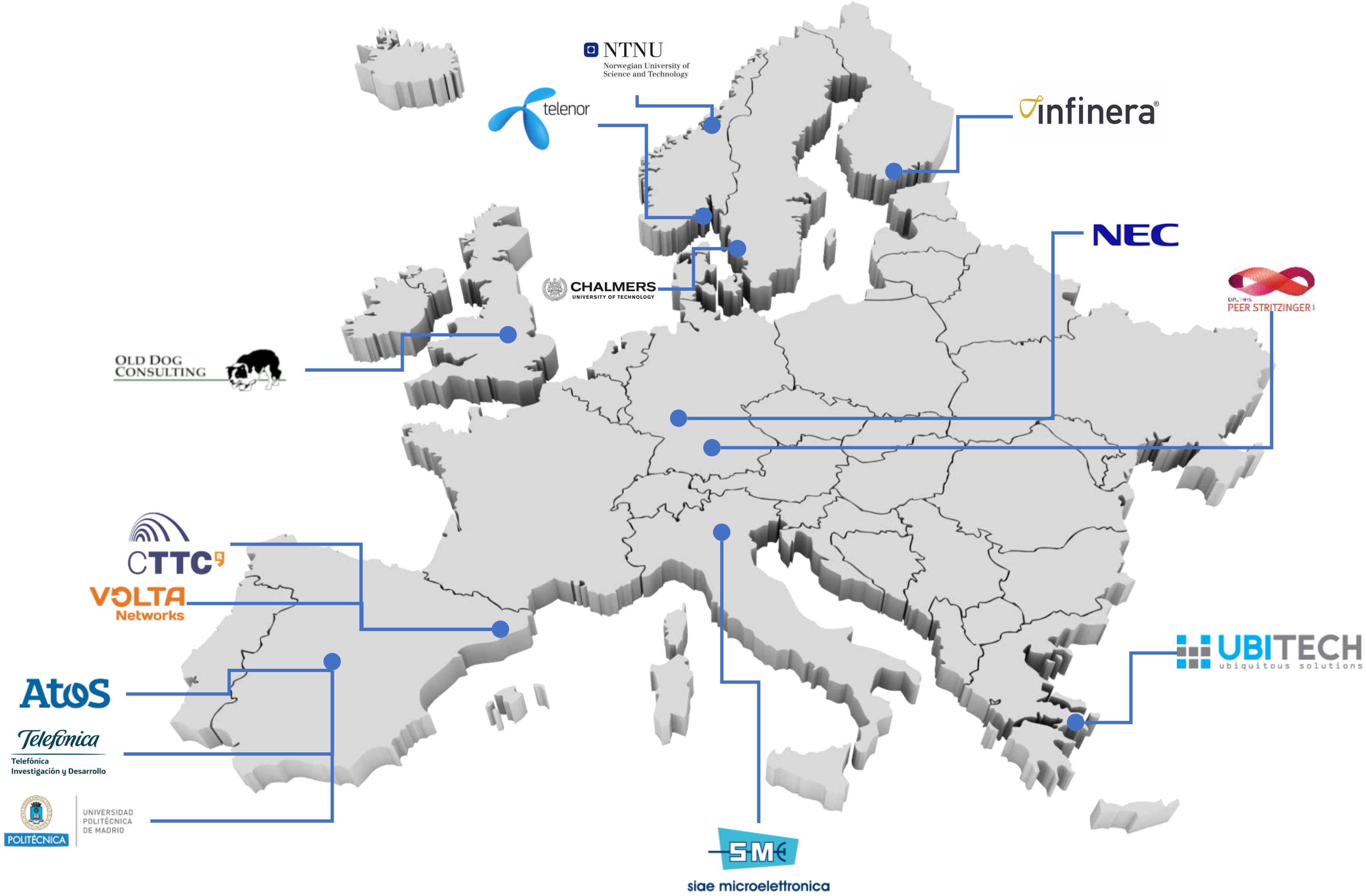
- Atos

Academia:

- Chalmers University
- UPM
- CTTC
- NTNU

SME:

- Volta Networks
- Ubitech
- Stritzinger
- Old Dog Consulting



TeraFlow

General Assembly

Project Coordinator:
Ricard Vilalta (CTTC)

External Advisory Board

Technical Manager:
Víctor López (TID)

Exploitation and Innovation Manager:
Esther Garrido (ATOS)

Quality Manager:
Adrian Farrel (ODC)

Steering Committee

WP Technical Group:
WP1 - Ricard Vilalta (CTTC) | WP2 - Víctor López (TID) | WP3 - Georgios Katsikas (UBI) | WP4 - Felix Klaedtke (NEC) | WP5 - Paolo Monti (CTH) | WP6 - Esther Garrido (ATOS)

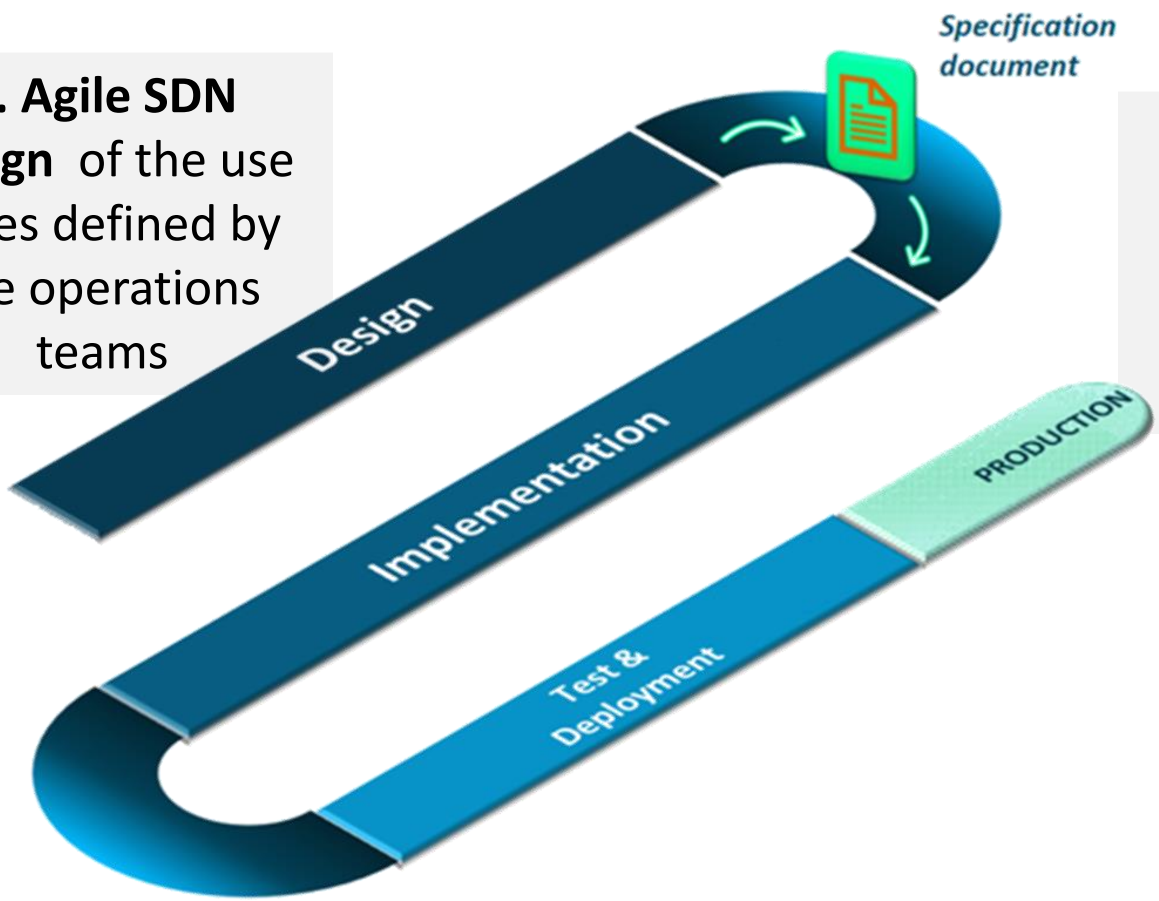
Task technical Group

Use Case Leaders:
Autonomous network B5G (TID), Automotive (CTTC), Cybersecurity (UPM)

Methodology

1. Improve in small steps
<u>Value based</u> design of next use case **<u>with operations teams</u>**

2. Agile SDN design of the use cases defined by the operations teams

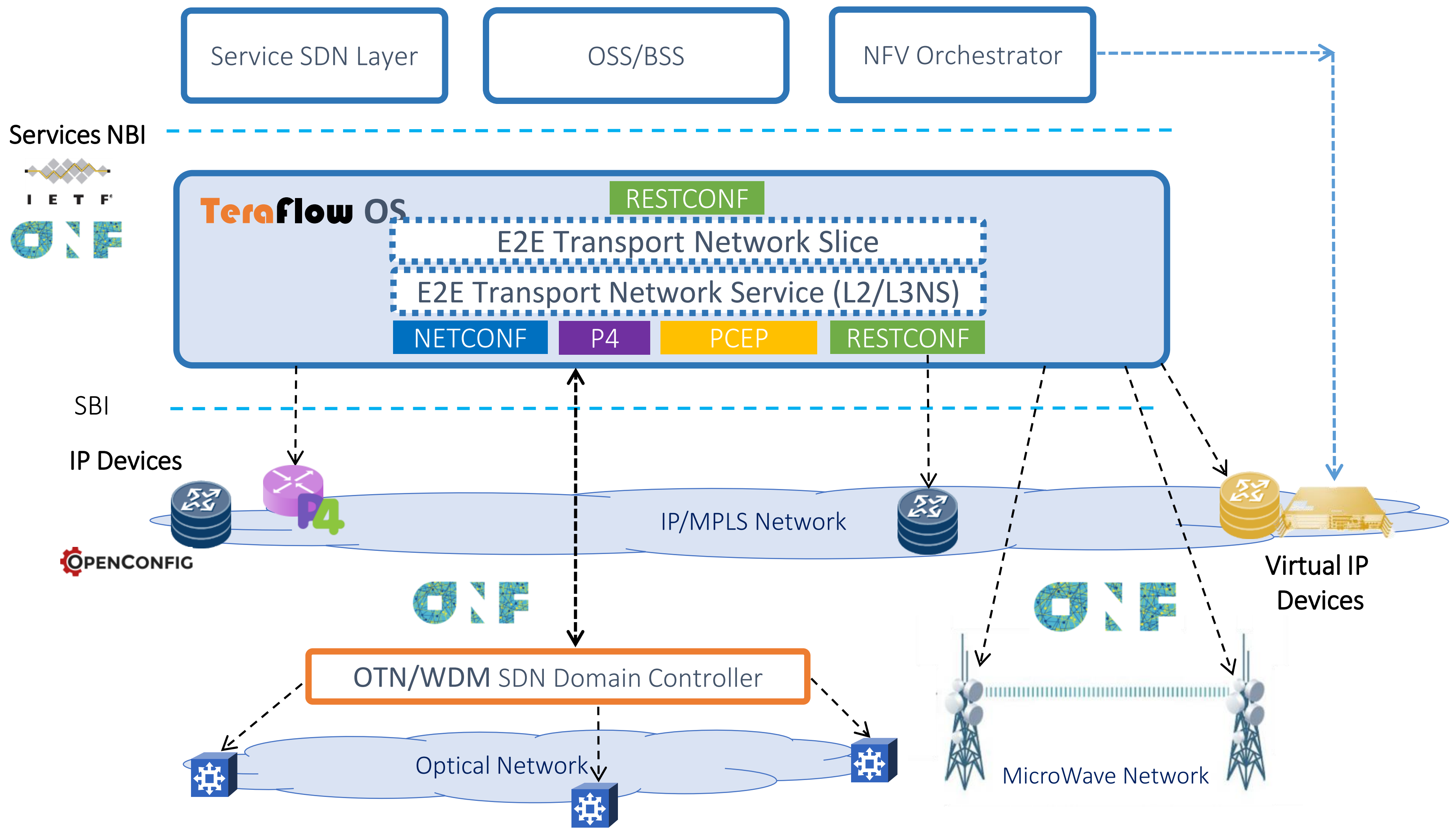


3. Open Knowledge. Technical specification based on standard modelling of the use cases

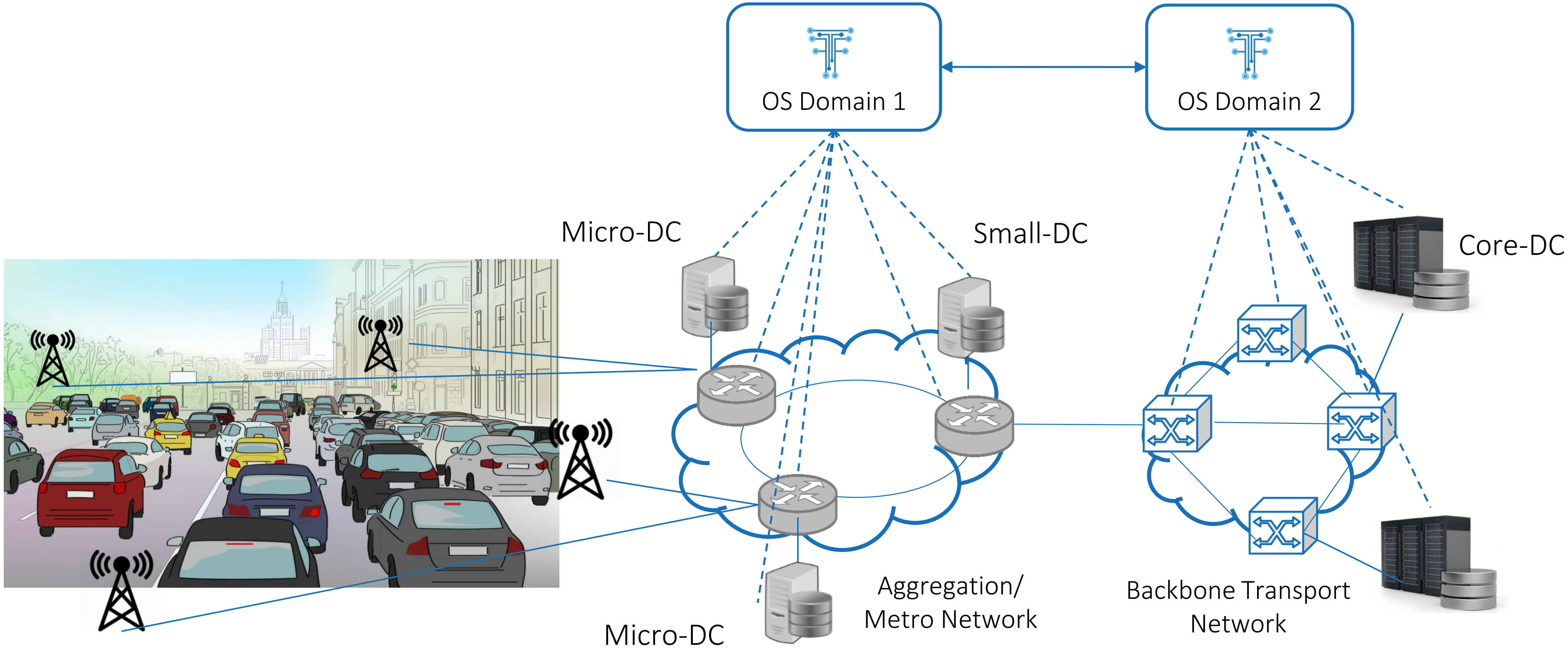
4. Implementation as part of vendor product roadmap

5. Get quick benefits
Deploy agreed case and make **<u>immediate use</u>** of it

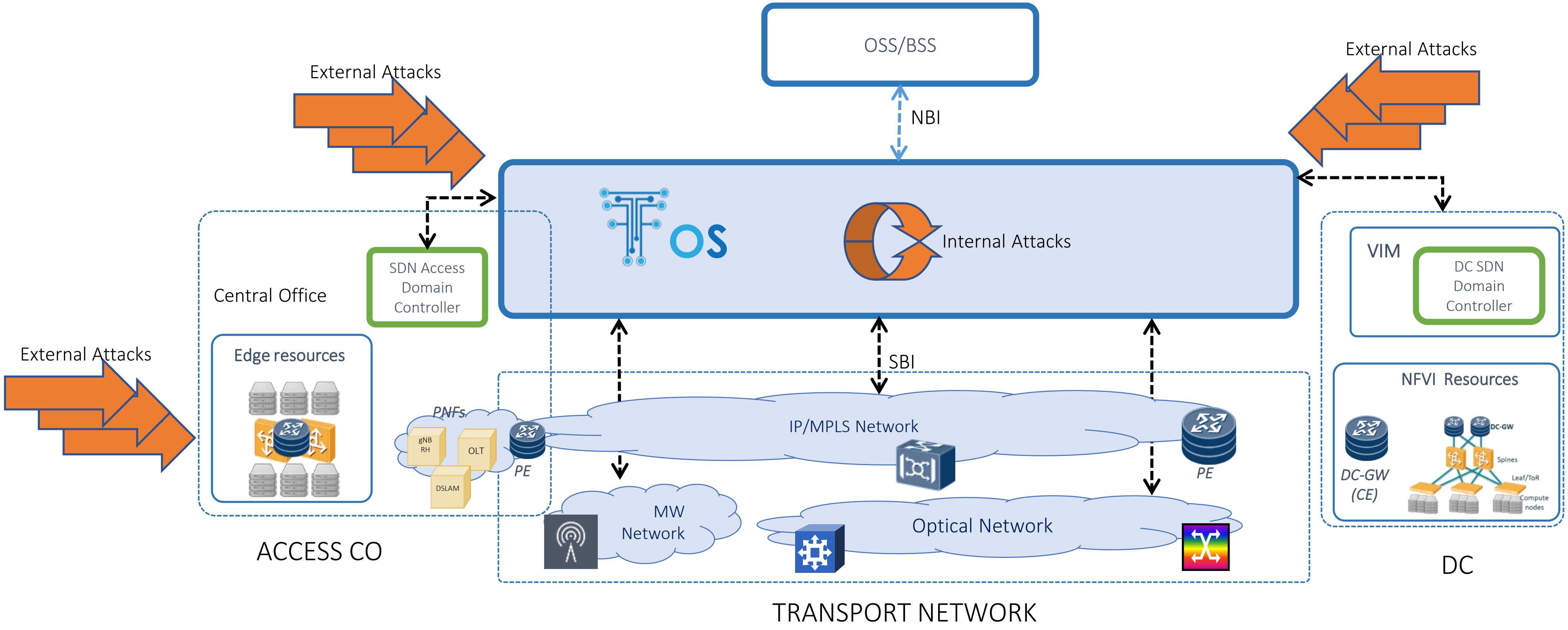
UC1: Autonomous network B5G



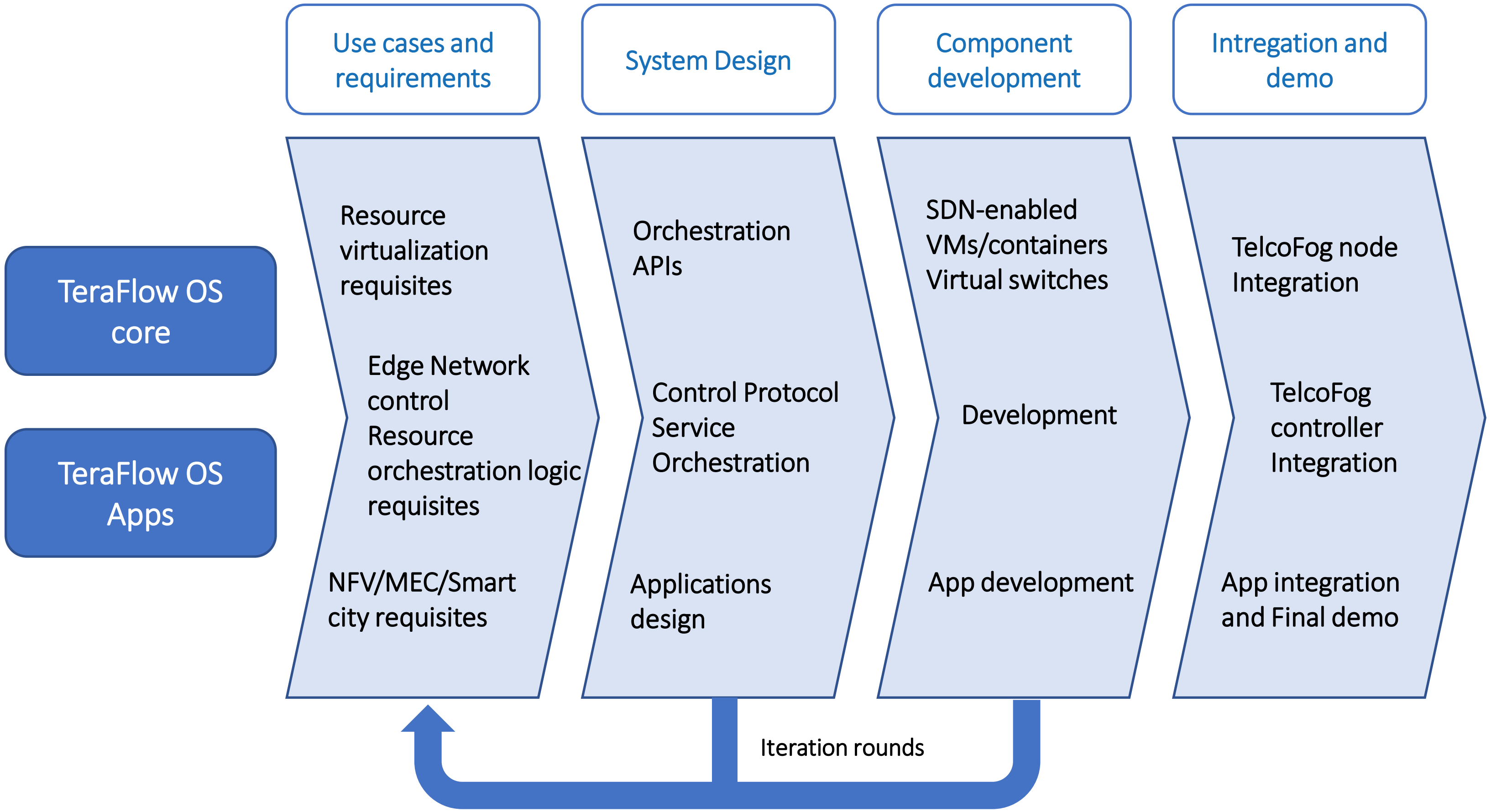
UC2: Automotive



UC3: Cybersecurity



TeraFlow Methodology



Thank you!

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