TeraFlow SDN by ETSI

Secure zero-touch P4 device onboarding and exposure via resource orchestration APIs

Georgios P. Katsikas — UBITECH ubiquitous solutions

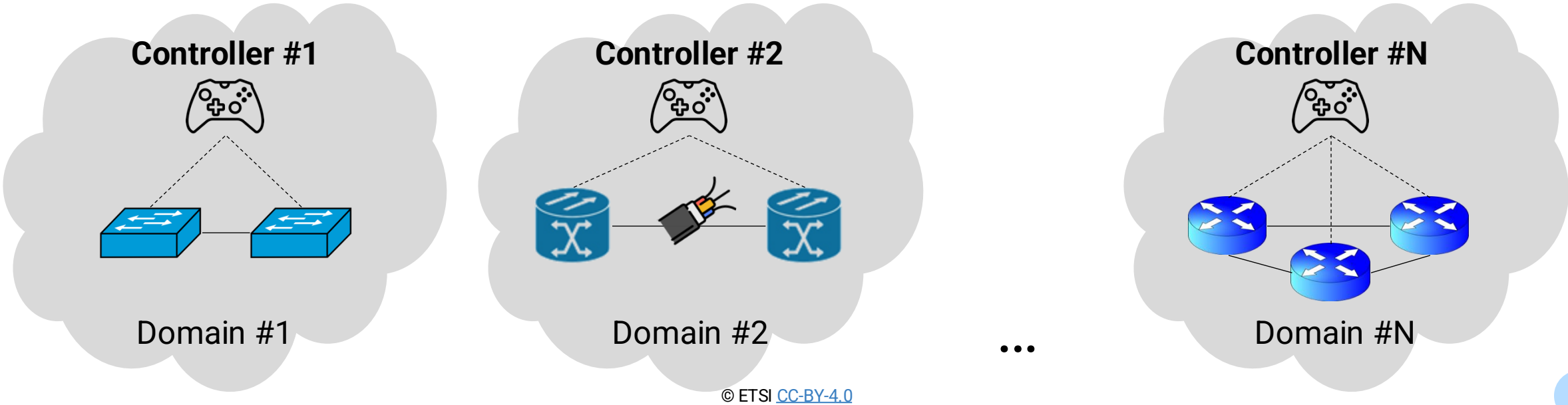
Kostis Trantzas — University of Patras

Felix Klaedtke — NEC

Problem

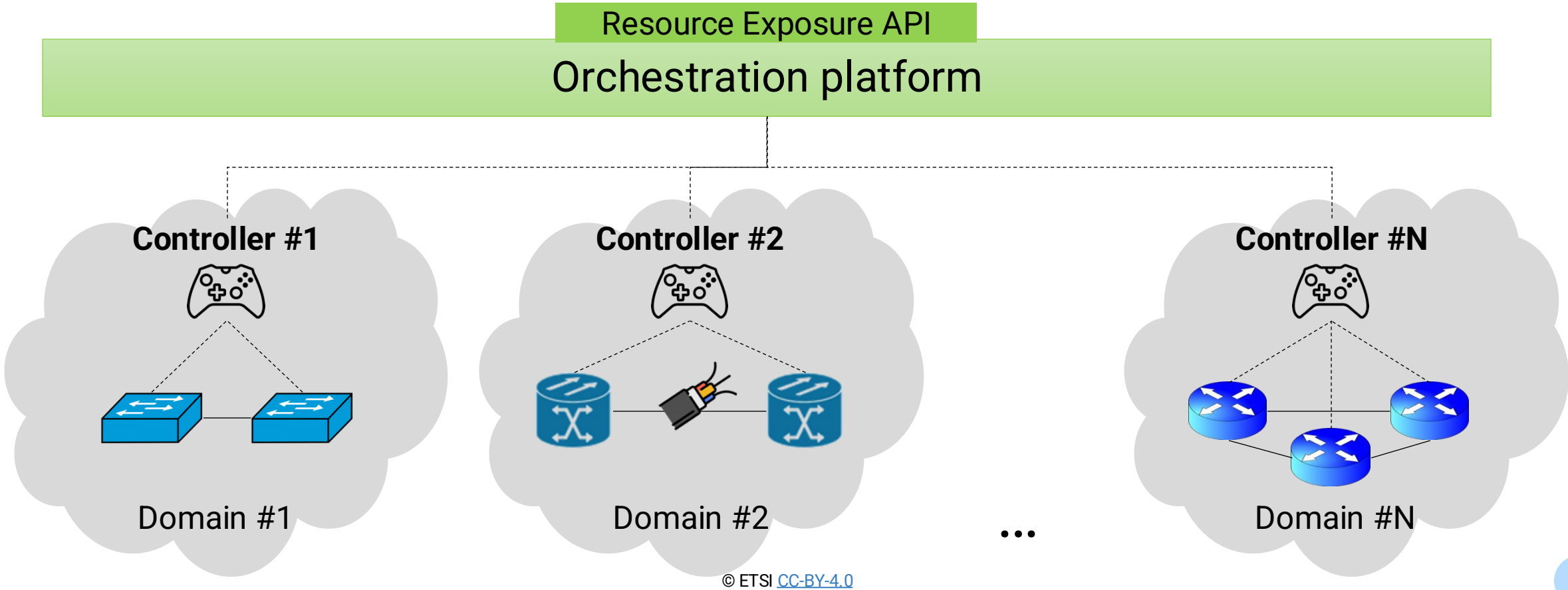
SDN controllers need to manage:

1. heterogeneous devices
2. across multiple domains



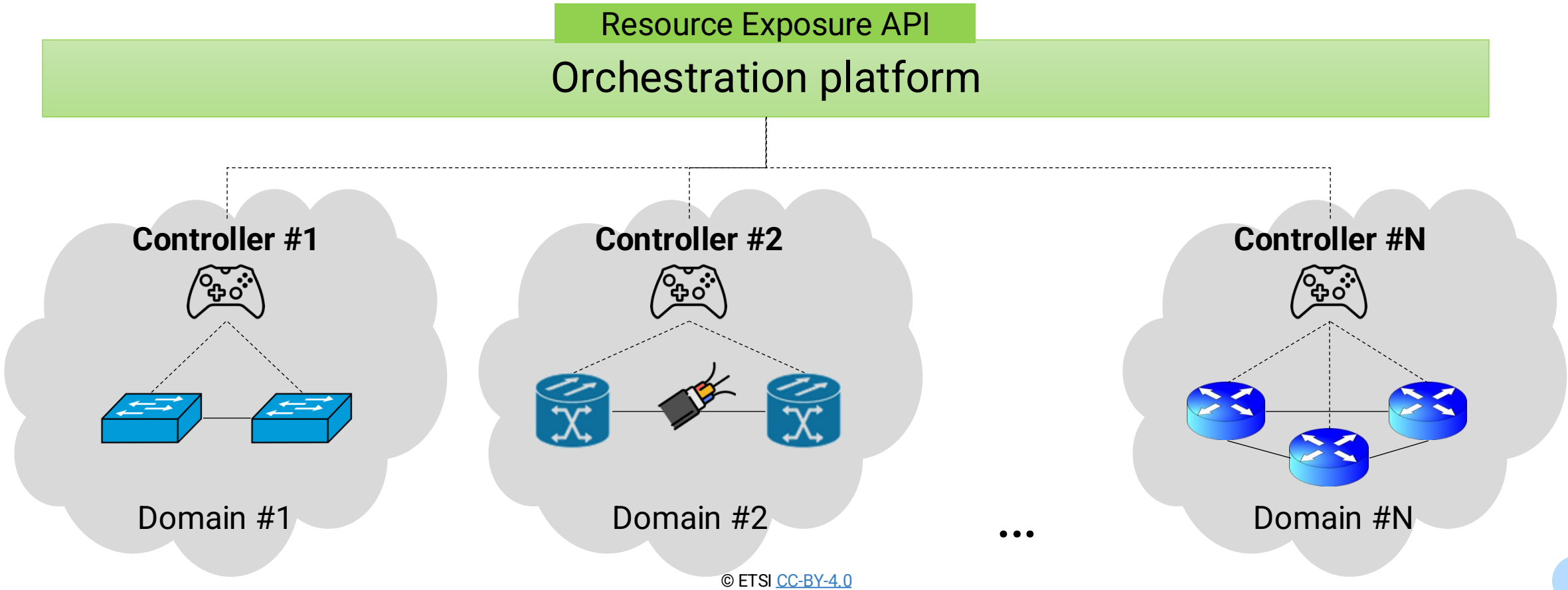
Problem

Allows to offer connectivity services as part of more complex services



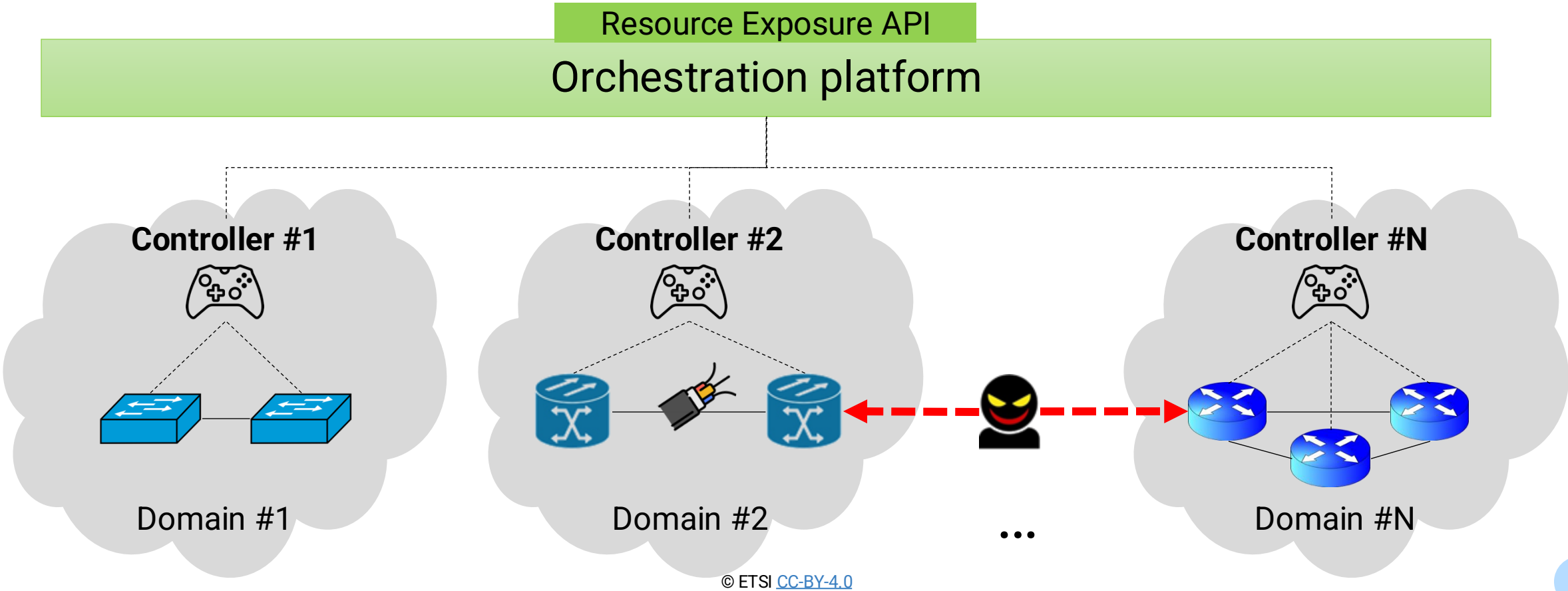
Problem

Question #1: Can we assume that all these devices are trusted?



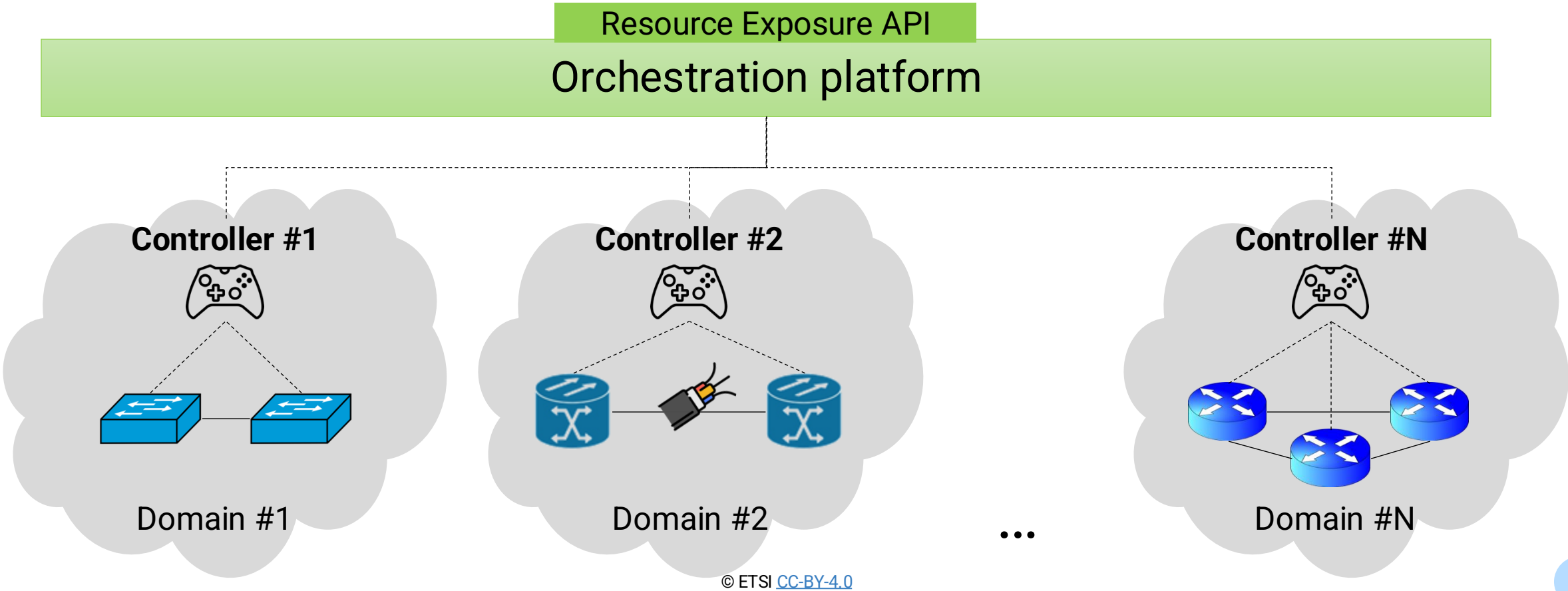
Problem

What if a compromised device attempts to be onboarded?



Problem

Question #2: Can we automate time-consuming operations, such as device onboarding, monitoring, and service provisioning?



TeraFlow SDN

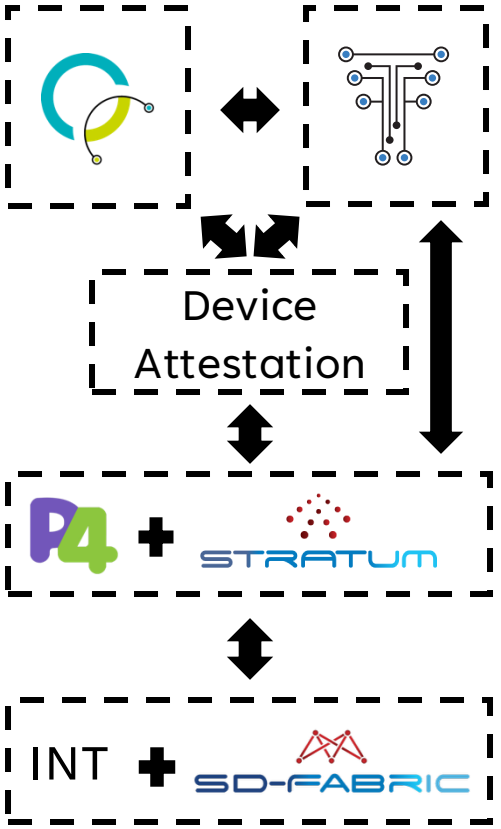
Objective

Objective

TeraFlow SDN

Use an open orchestration platform to automate:

- Device attestation for enabling secure & trusted onboarding
- Device onboarding onto the platform's resource inventory
- Deep device visibility for better resource management
- L2/L3 connectivity



TeraFlow SDN

Relation with ETSI

Why is this relevant for ETSI SDGs?

What is new?	Relevance with ETSI SDGs and other open-source projects and/or standards
Integration between ETSI OSL and ETSI TFS via the TFS NBI (connectivity)	OpenSlice by ETSI; TeraFlow SDN by ETSI
Integration between ETSI OSL and Device Attestation service (security)	OpenSlice by ETSI; Keylime
New capabilities and bug fixes introduced at the TFS SBI P4 driver	TeraFlow SDN by ETSI; P4
3x new TFS P4 services for L2, L3, and INT based on SD-Fabric	TeraFlow SDN by ETSI; SD-FABRIC
TFS integration with Stratum-based P4 switches (i.e., bmv2)	TeraFlow SDN by ETSI; STRATUM
1x new Telemetry backend collector for gathering and reporting INT data	TeraFlow SDN by ETSI; INT spec v0.5

TeraFlow SDN

Workflow

Workflow steps

TeraFlow SDN

1. Initial system state

   Clean state OSL, TFS, Attestation, P4 switch

2. Onboard TFS topology in a secure & trusted manner

   Service design 

   Attest P4 device 

   P4 topology onboarding 

3. Telemetry & connectivity service provisioning

   Service design 

   Initiate In-band Network Telemetry (INT) 

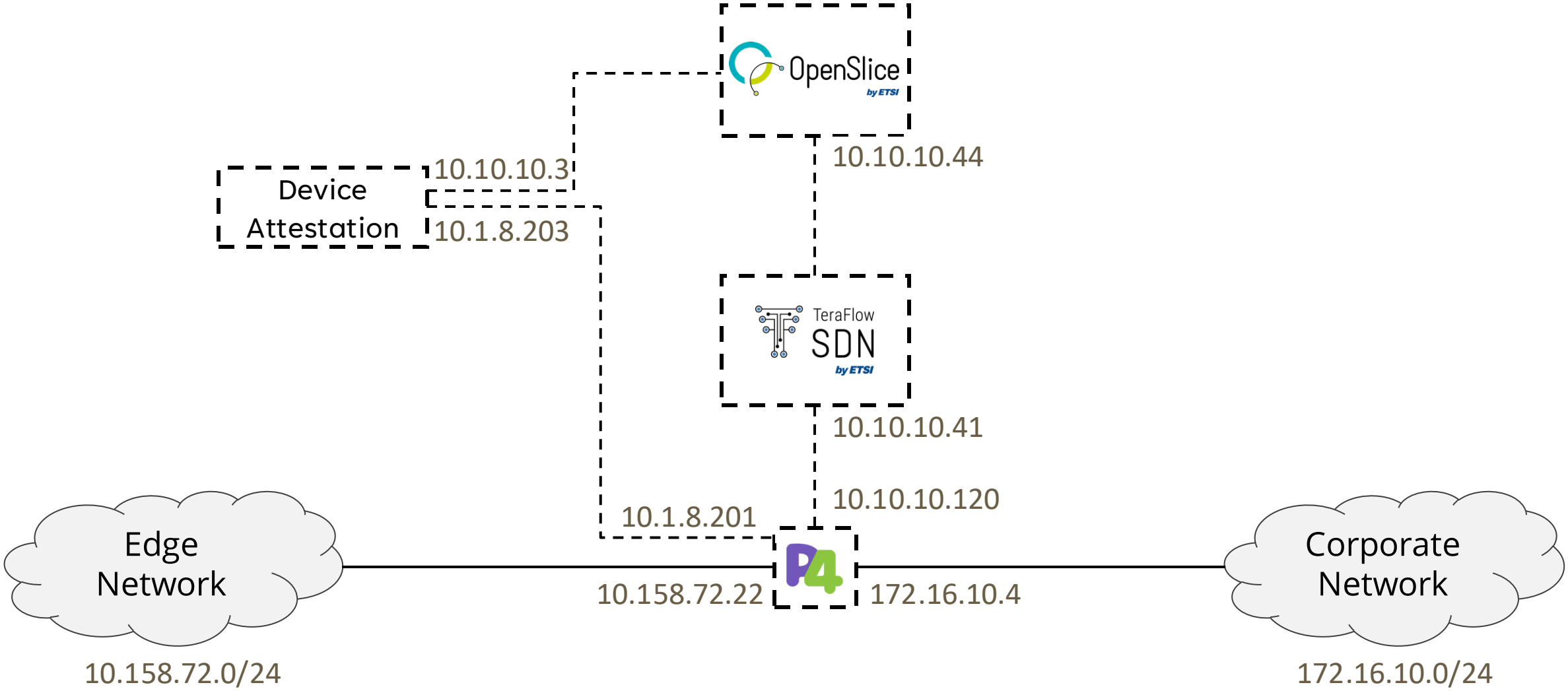
   Provision connectivity services 

TeraFlow SDN

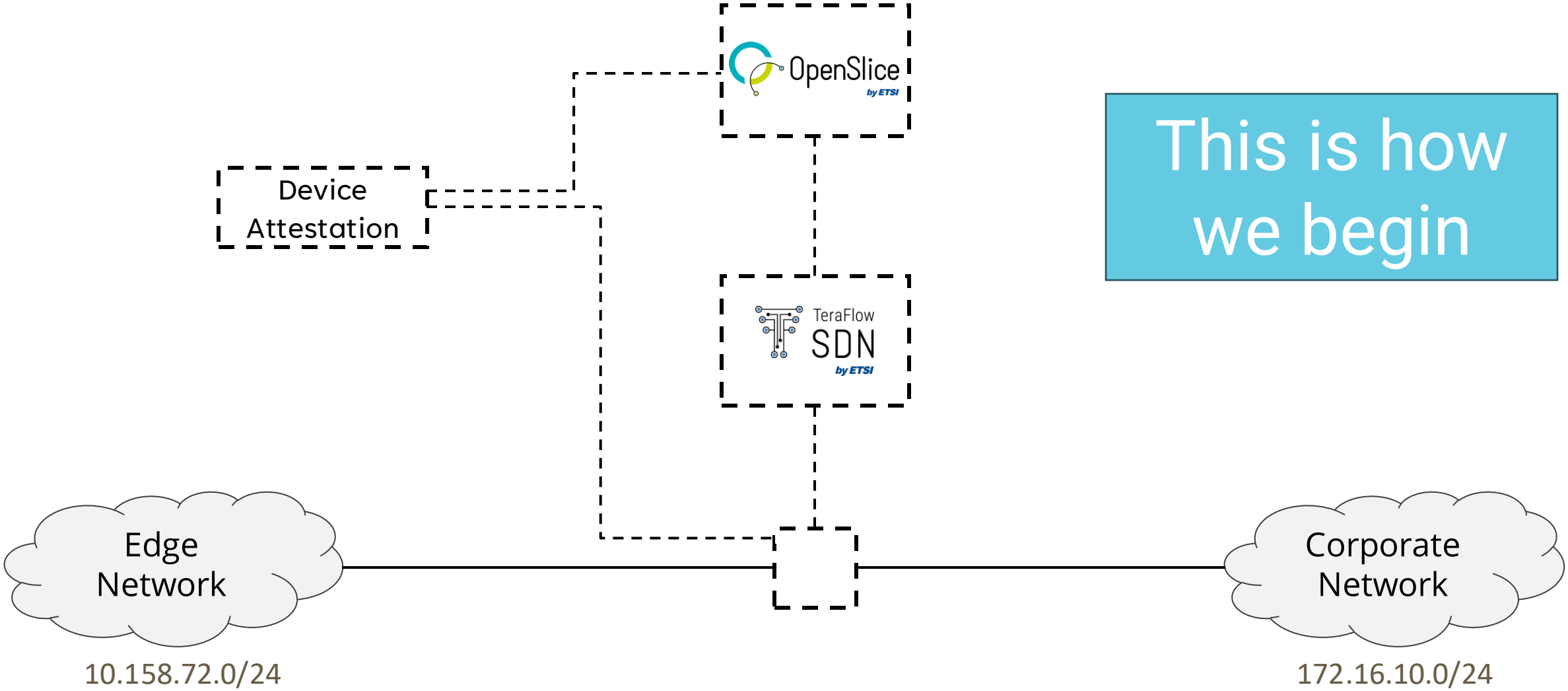
Set Up

Initial system state

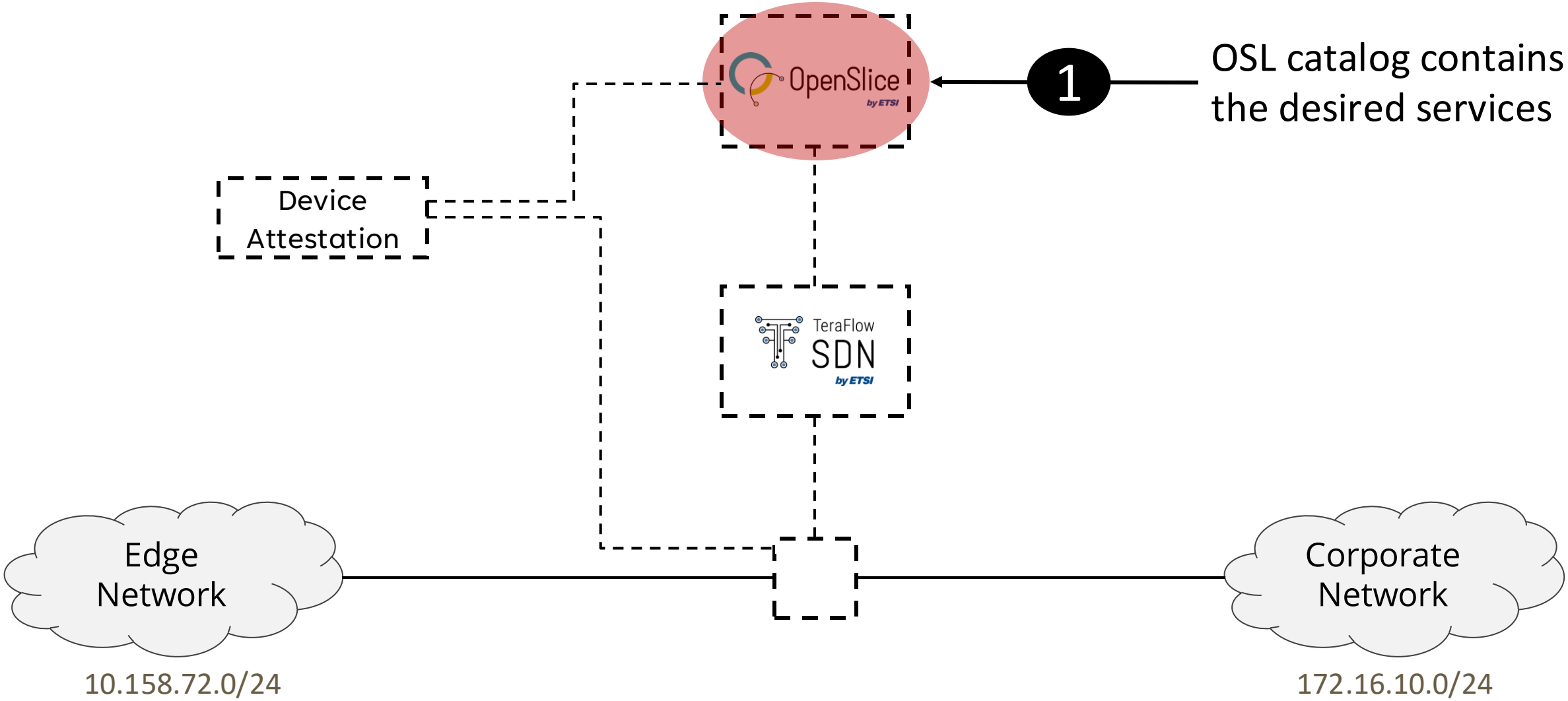
Setup



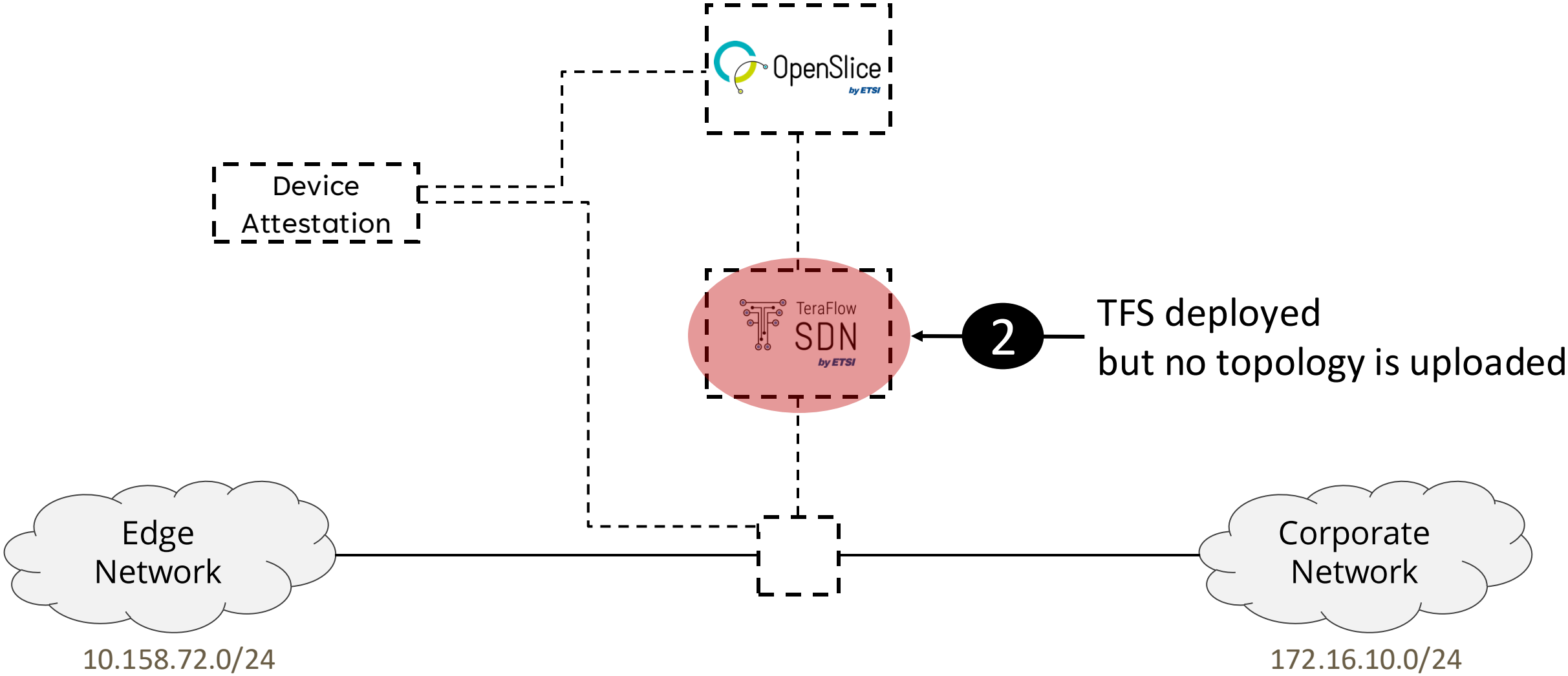
Initial state



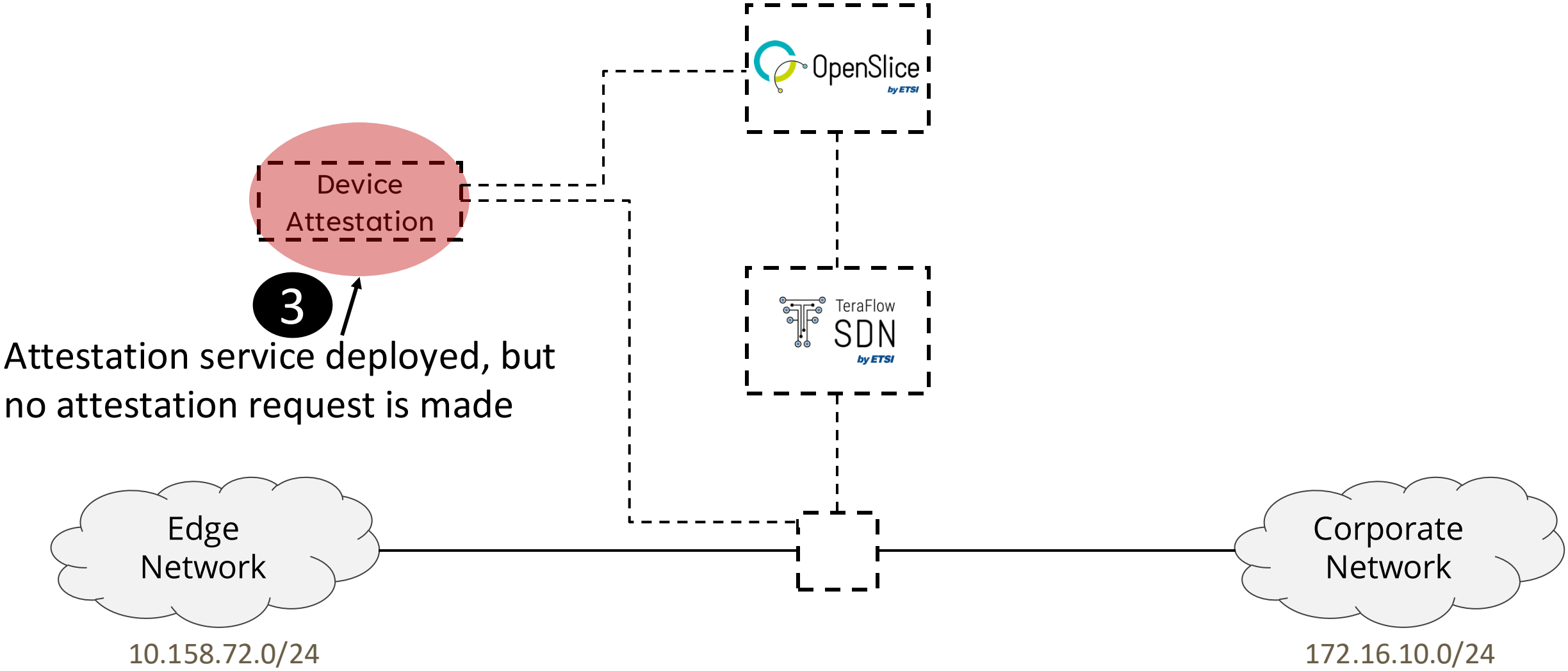
Initial state



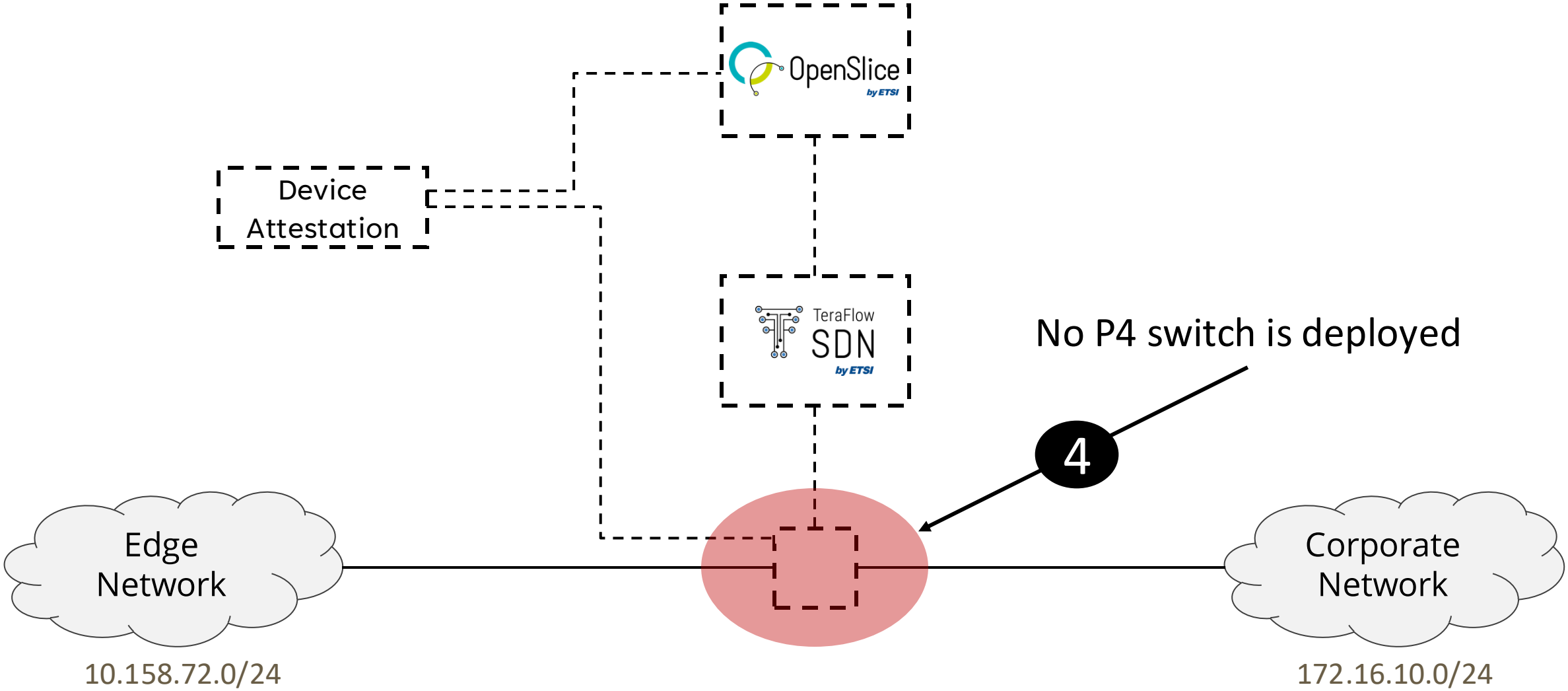
Initial state



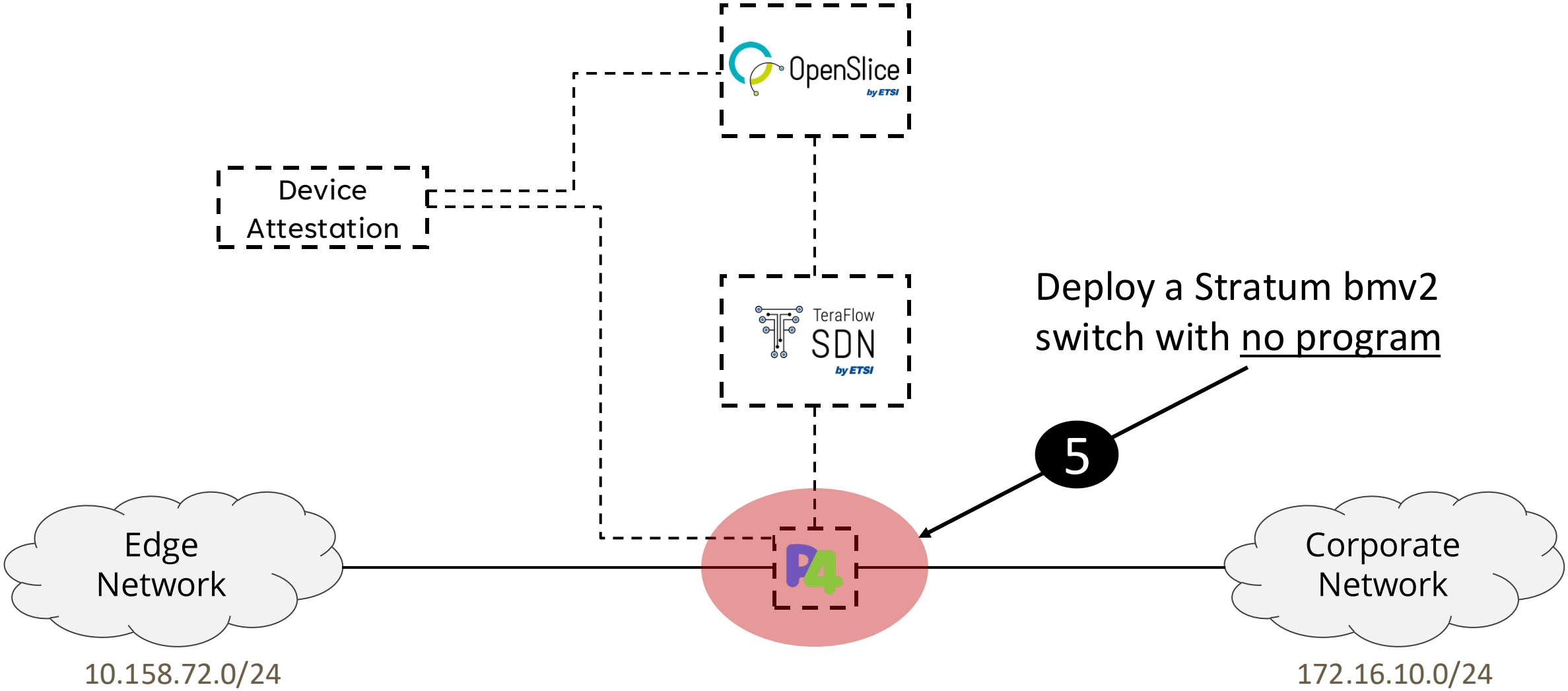
Initial state



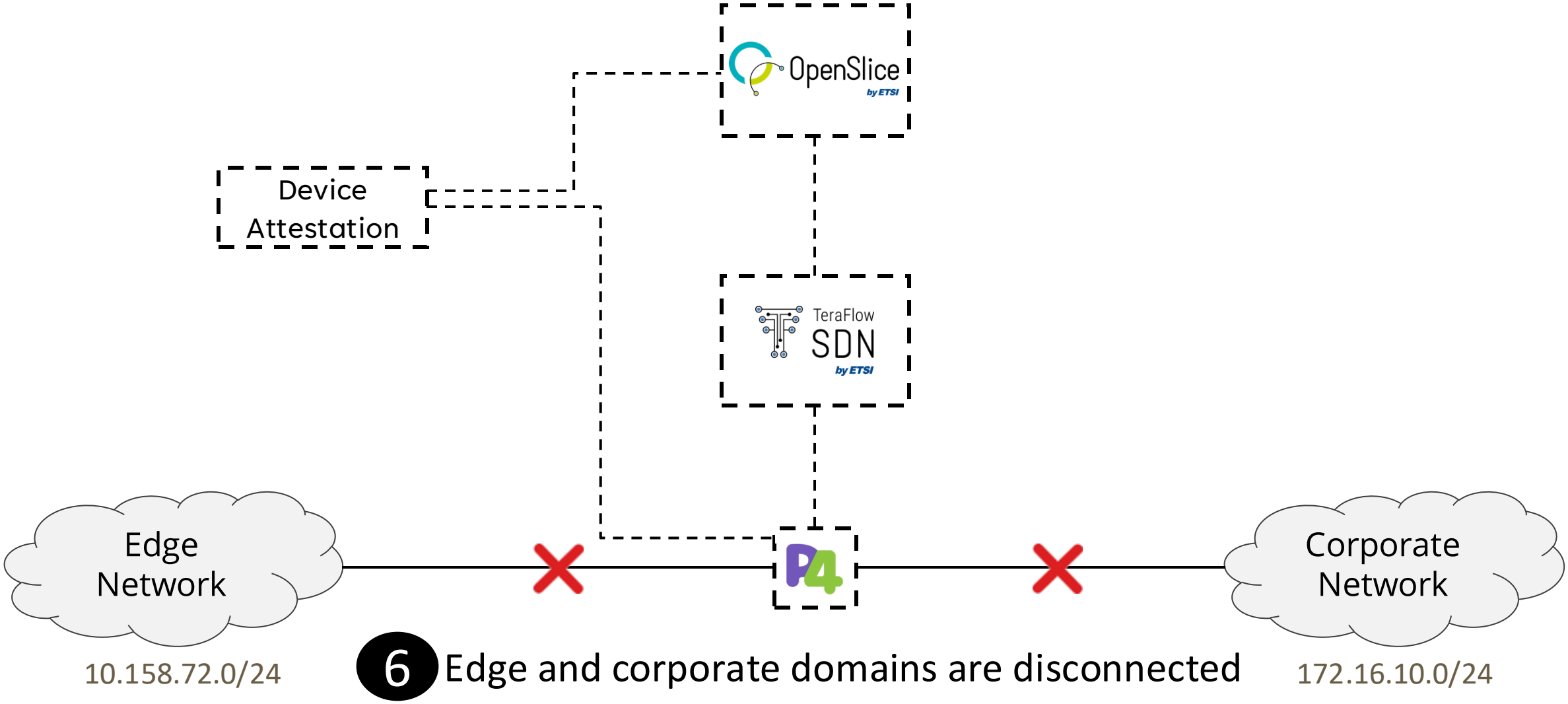
Initial state



Initial state



Initial state



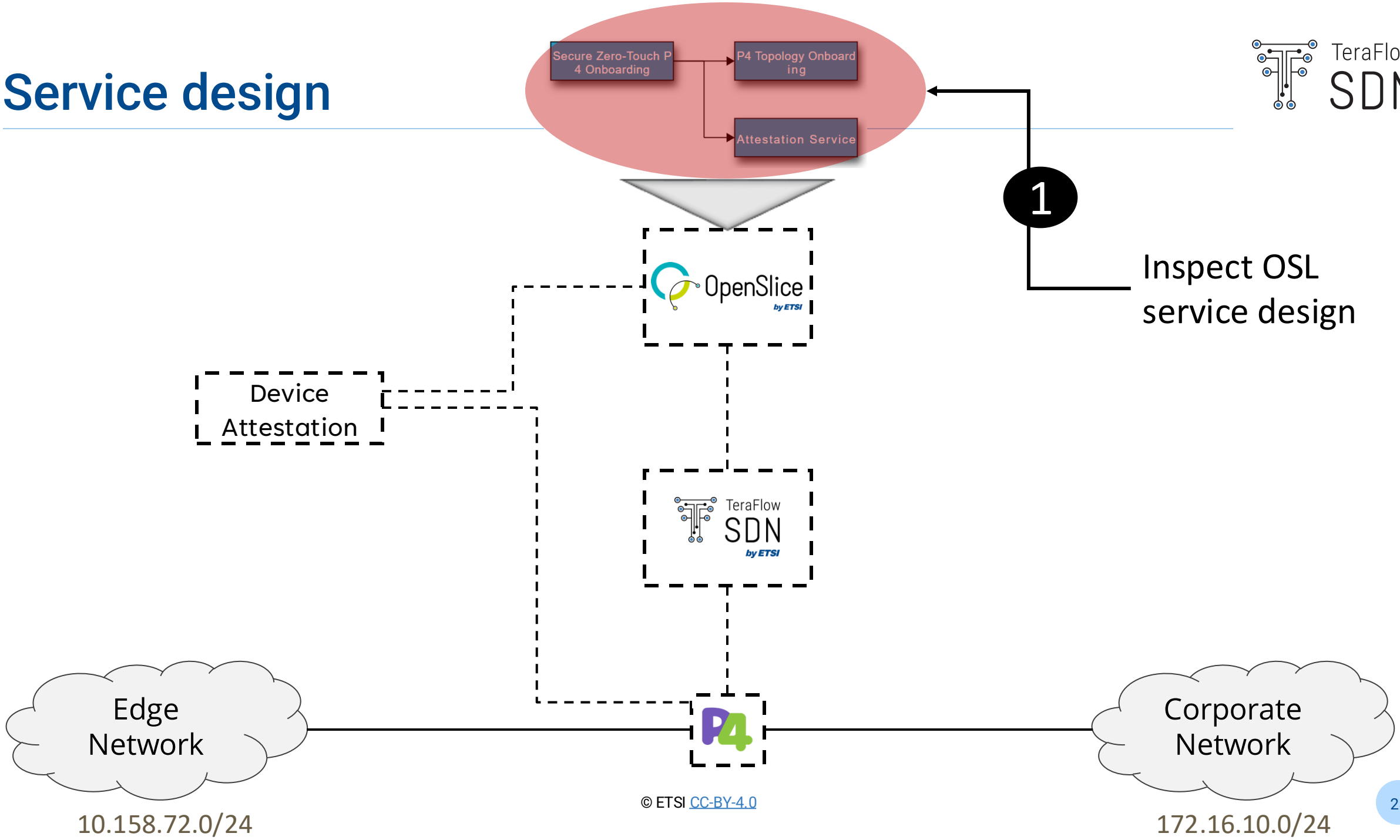
Initial state – Demo

TeraFlow SDN

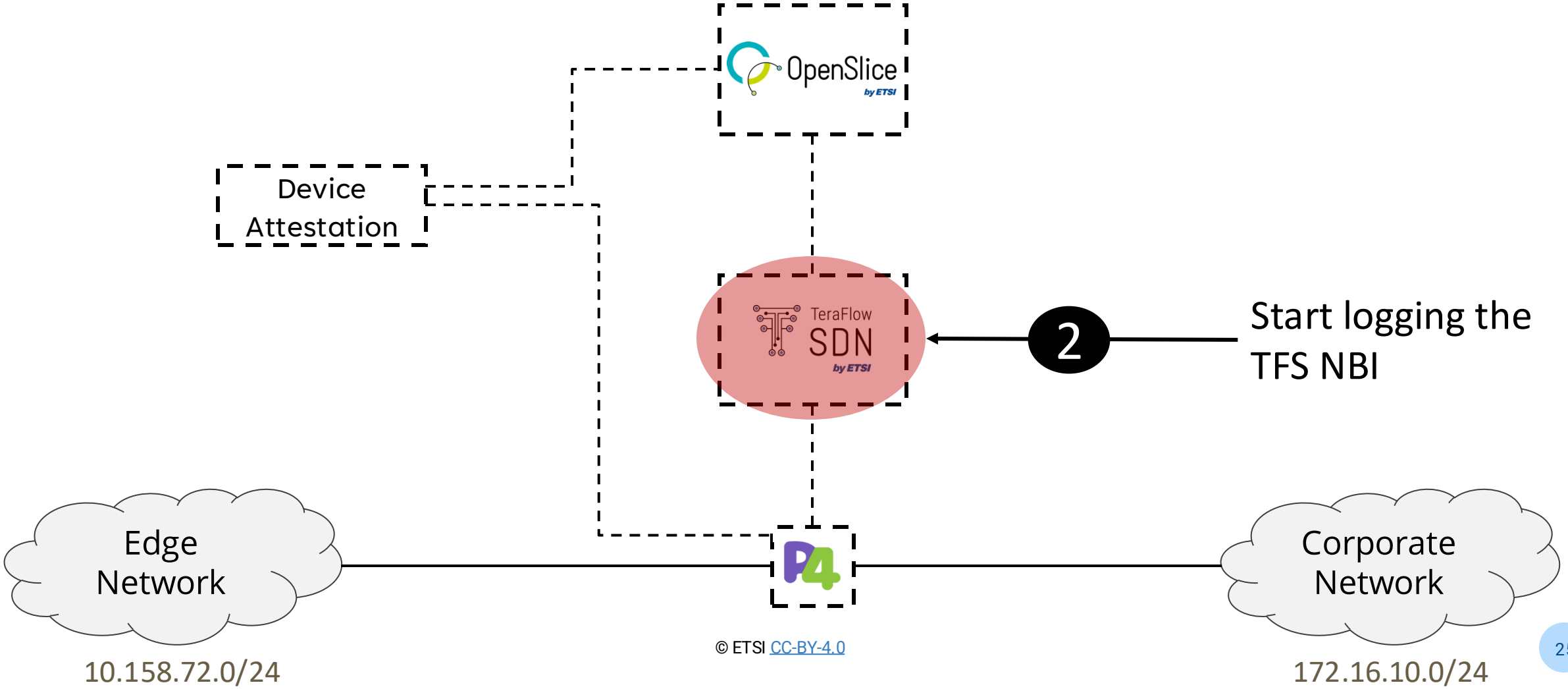
Secure Zero-Touch P4 Onboarding

Service design and service order

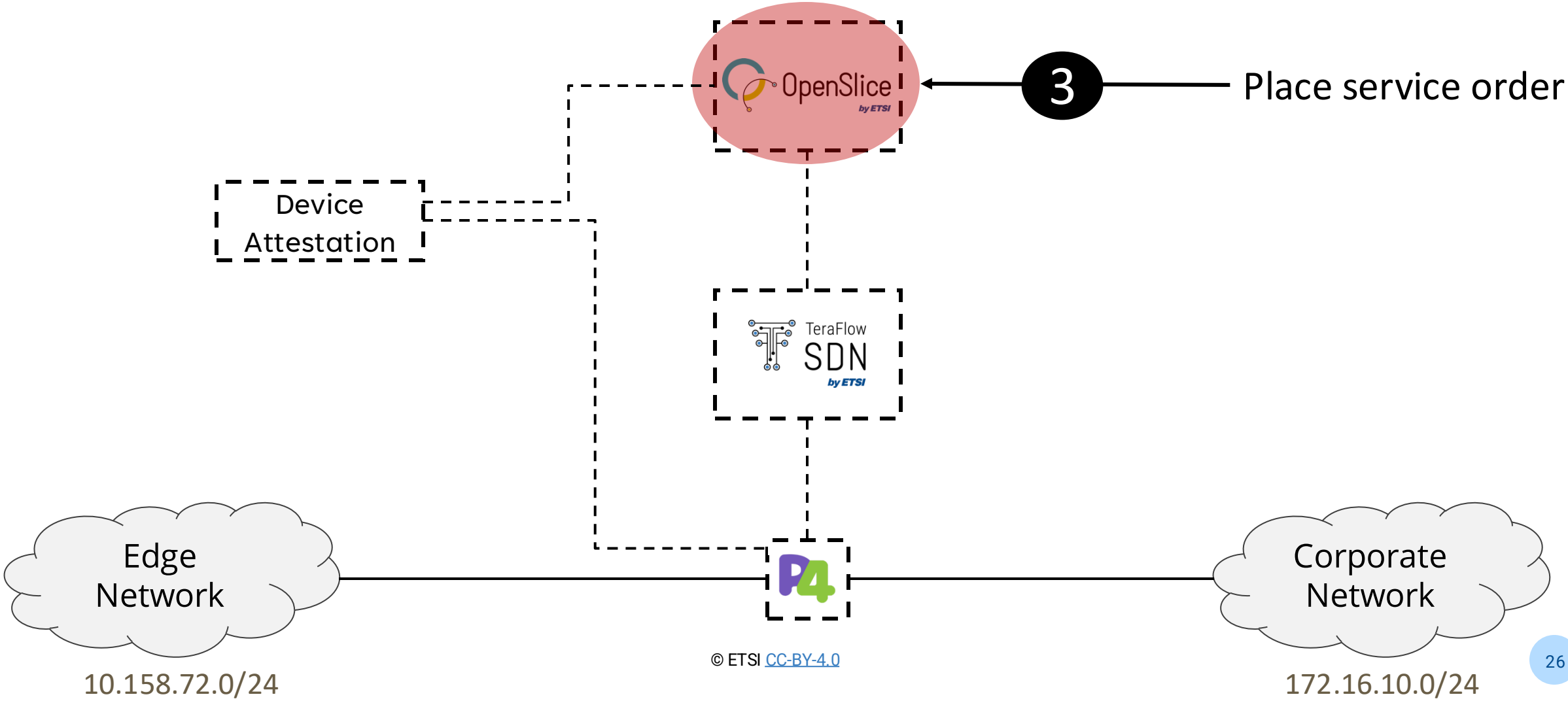
Service design



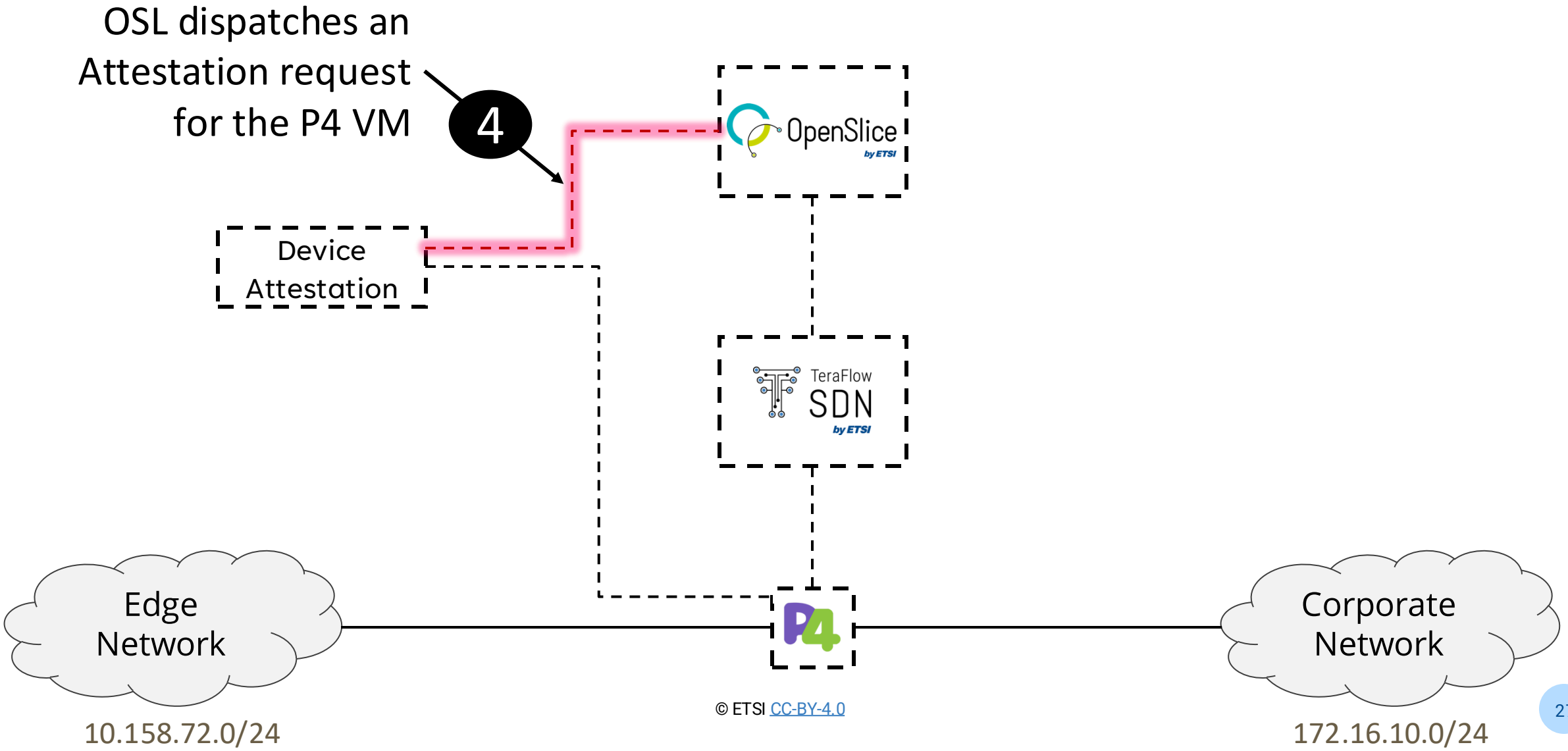
Ensure TFS readiness to capture requests



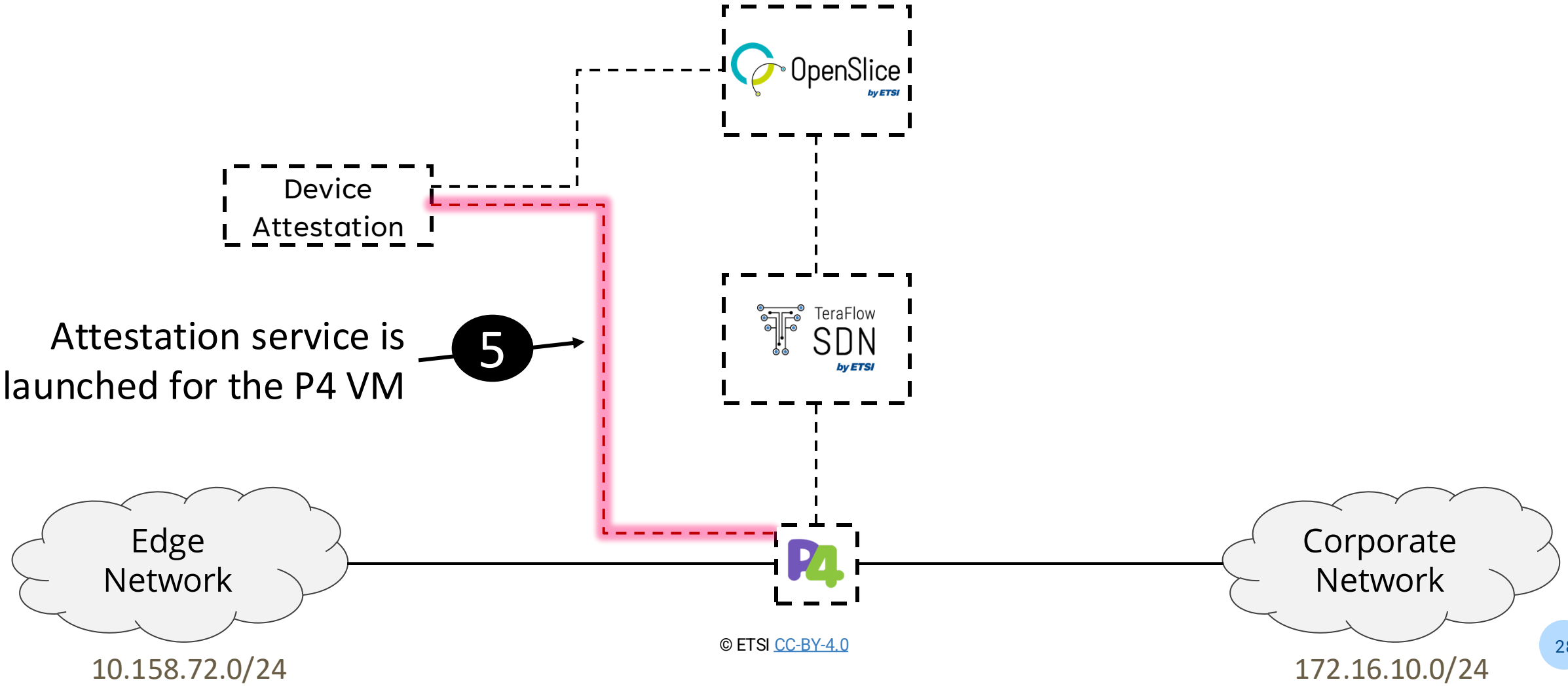
Order P4 onboarding service from OSL's catalog



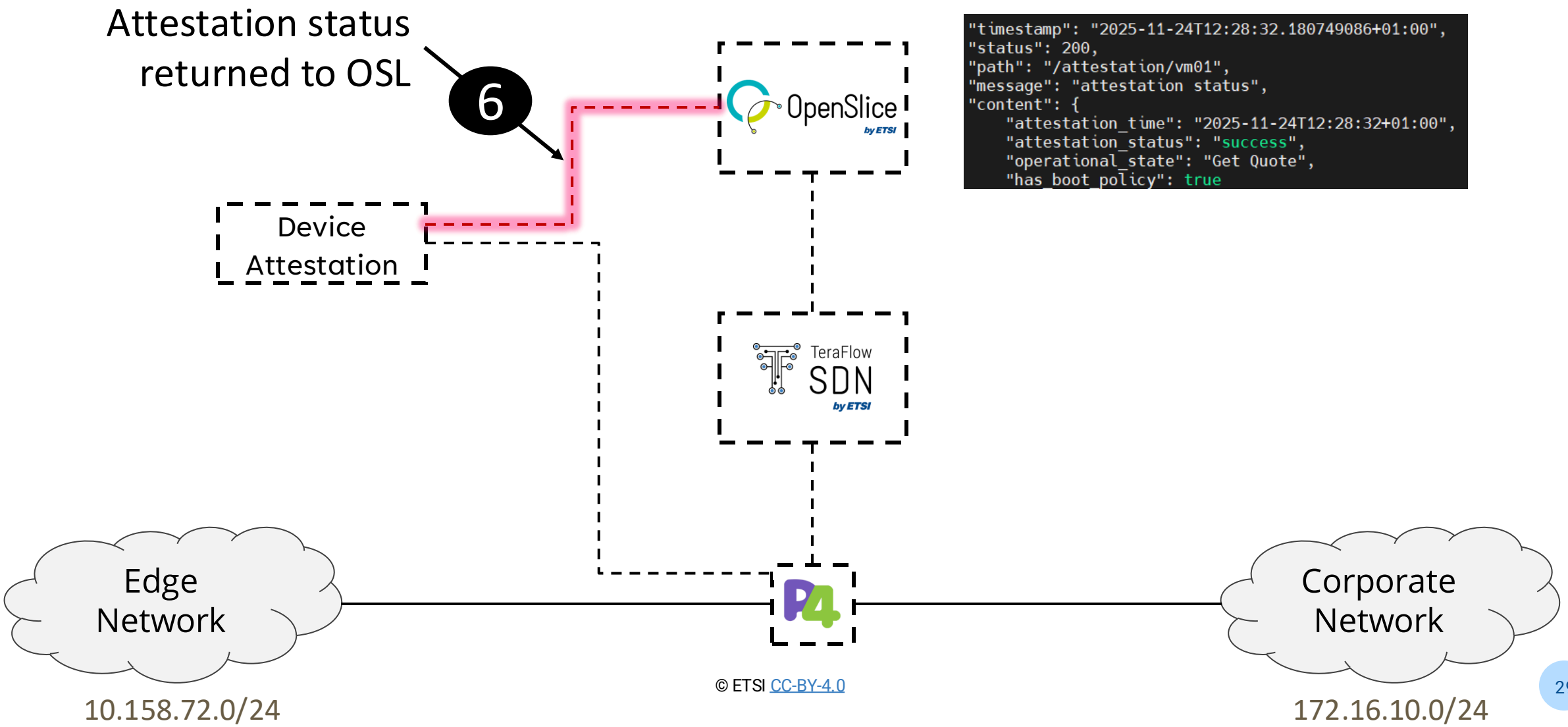
Attestation service invocation



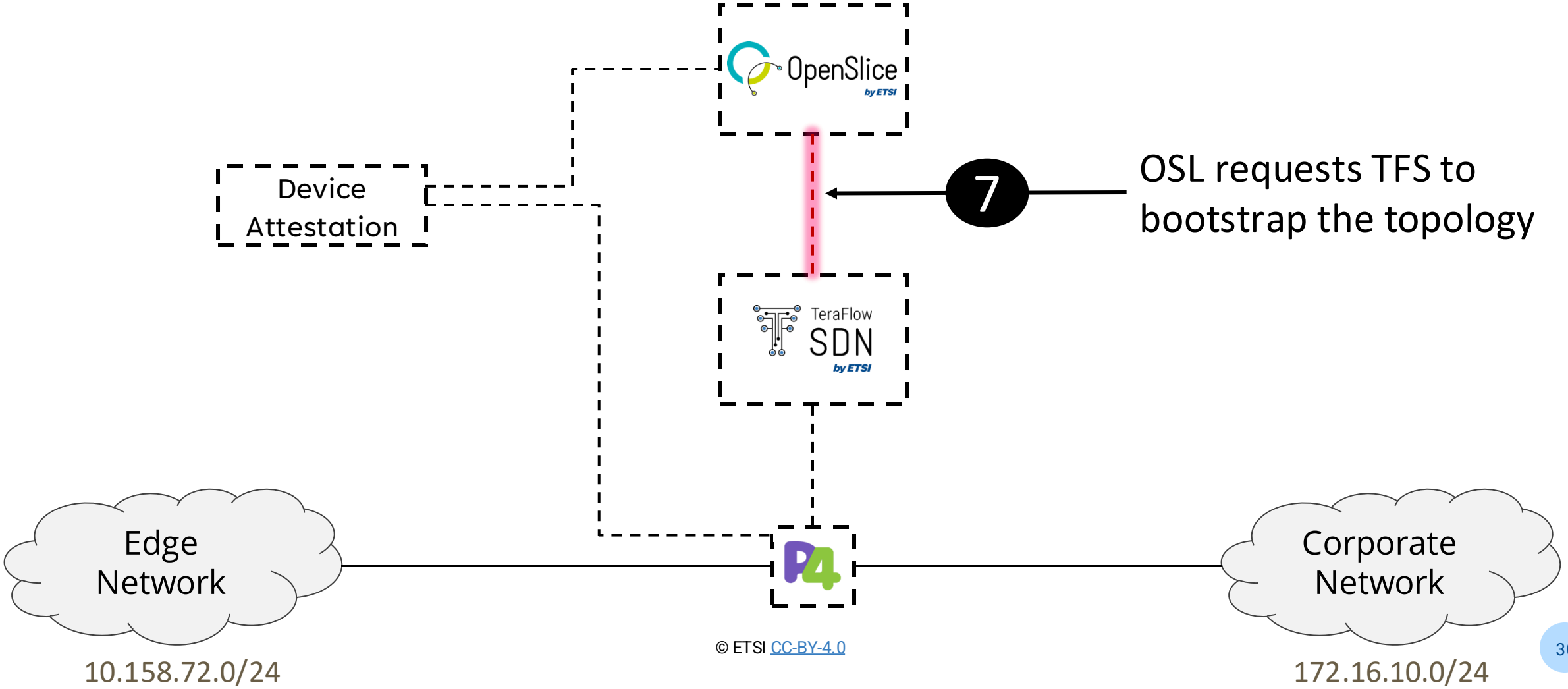
P4 device attestation



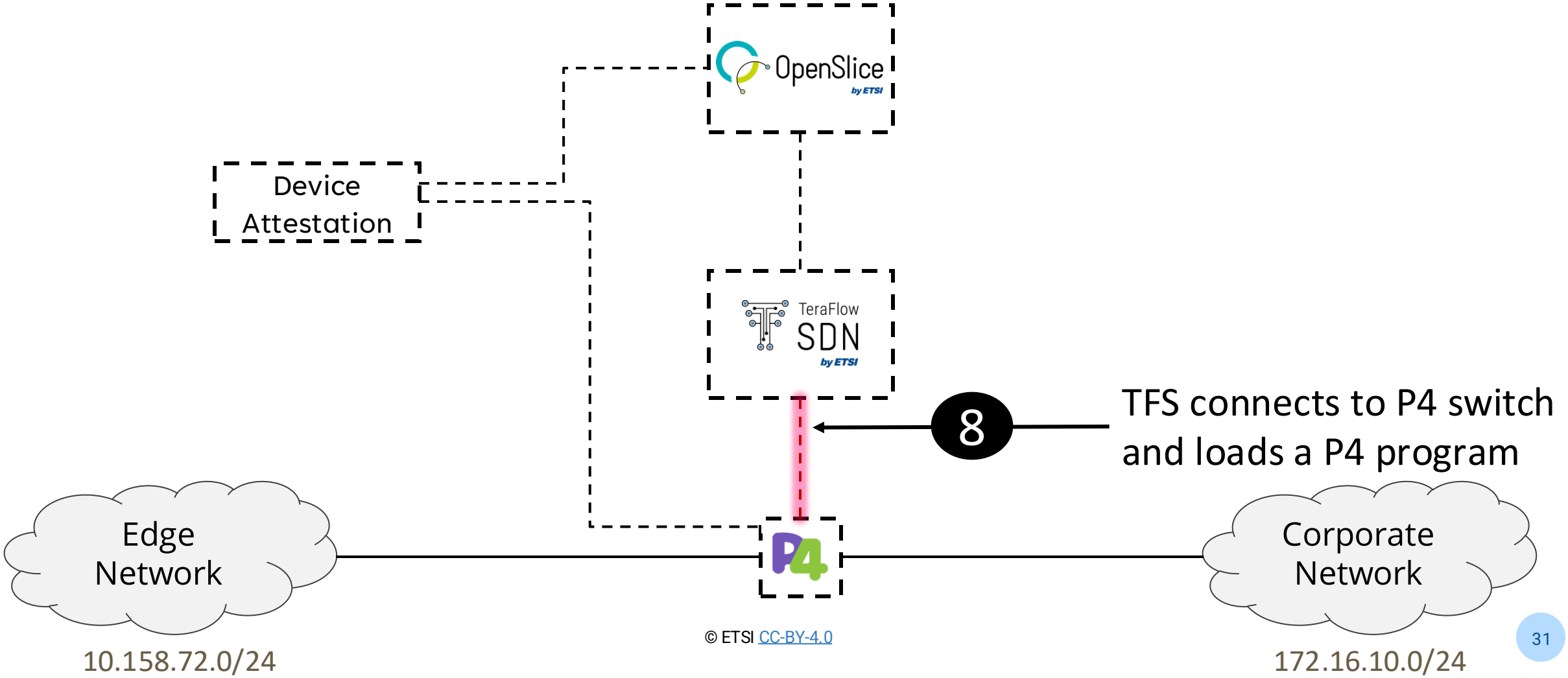
Attestation status report



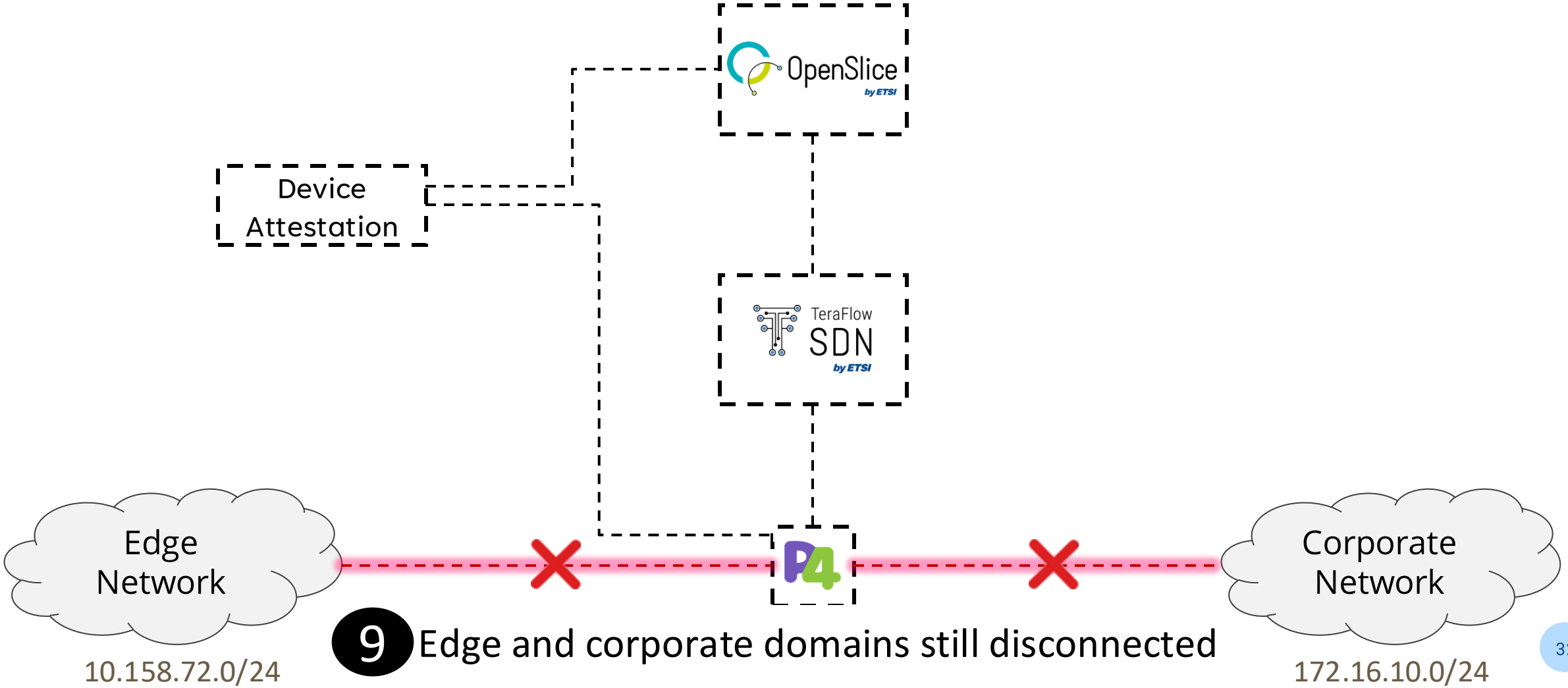
TFS topology onboarding invocation



TFS topology onboarded



Connectivity still missing



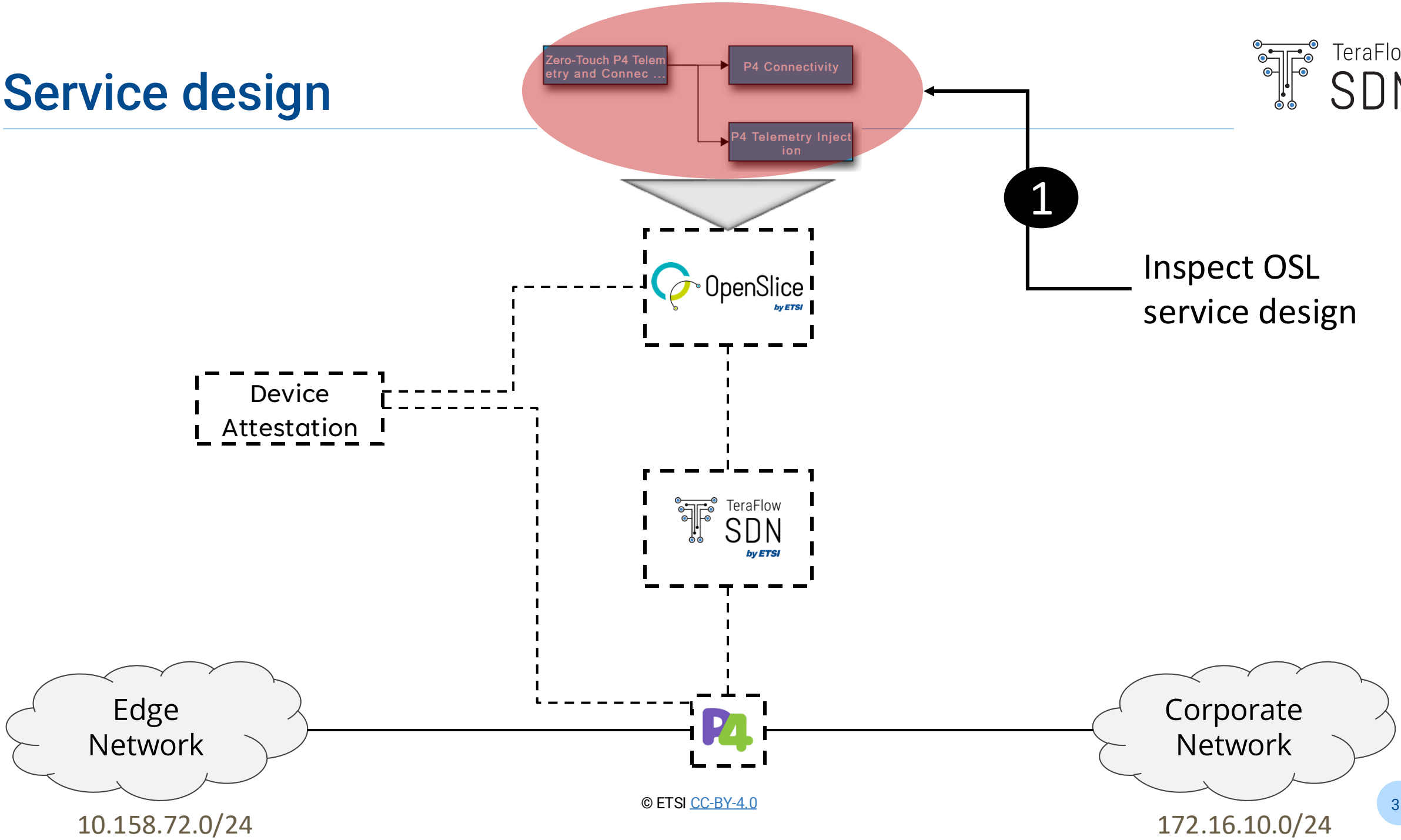
Secure zero-Touch P4 onboarding – Demo

TeraFlow SDN

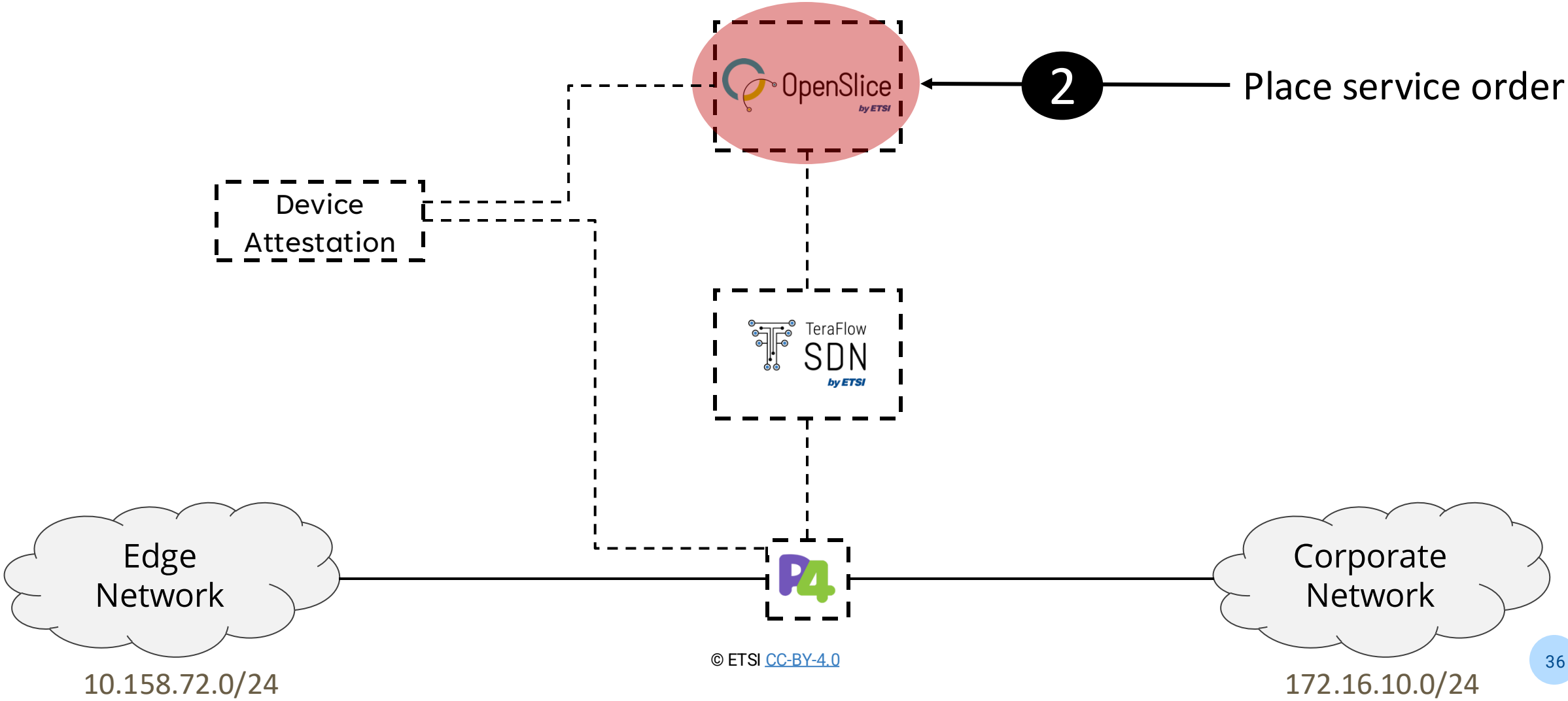
Zero-Touch P4 Telemetry & Connectivity

Service design and service order

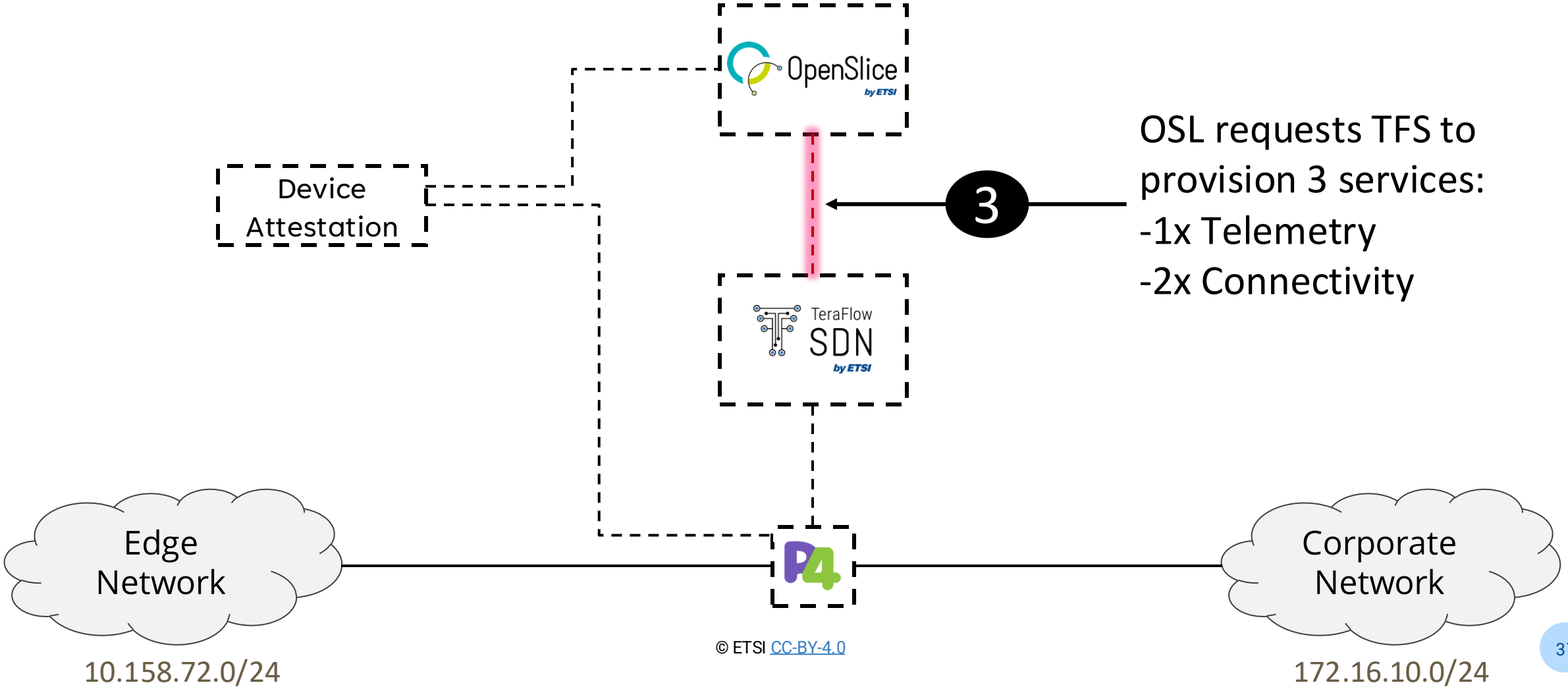
Service design



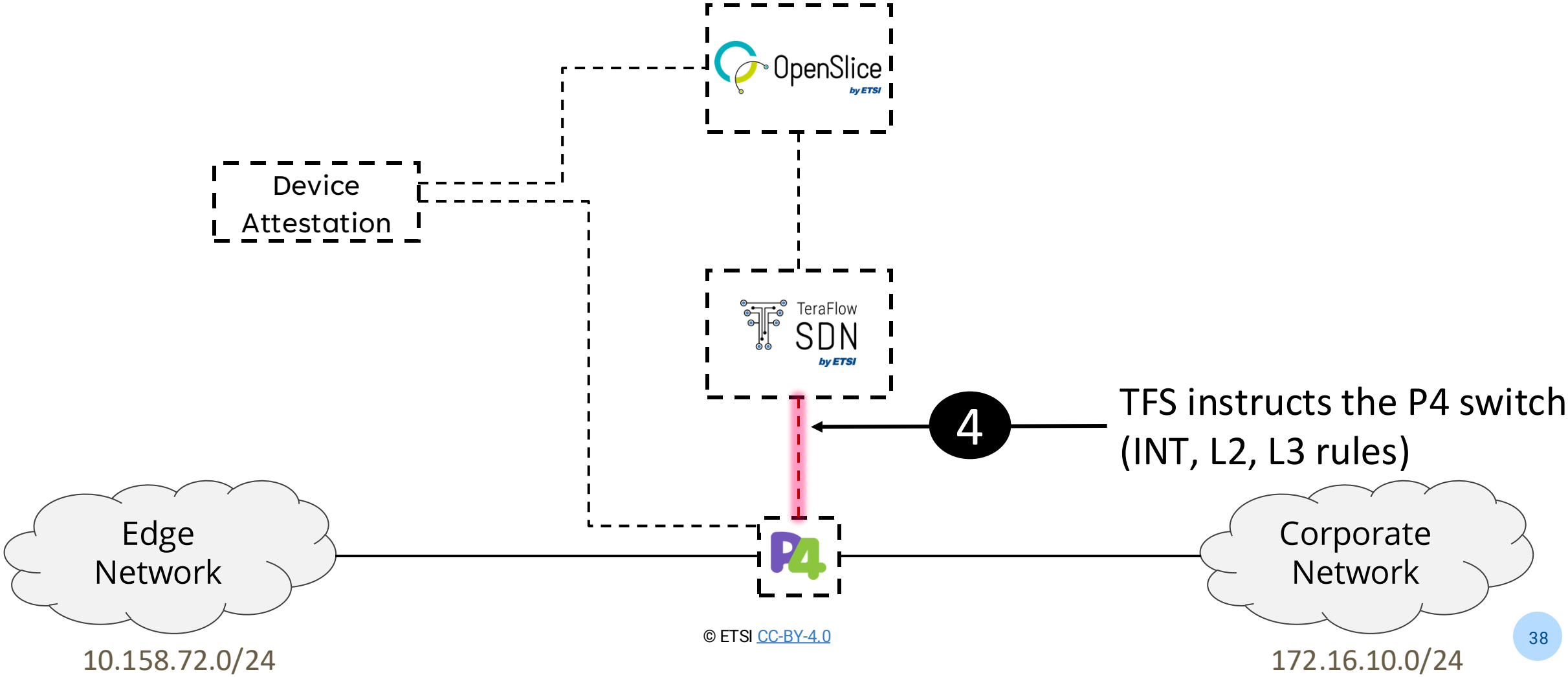
Order P4 telemetry + conn. service from OSL's catalog



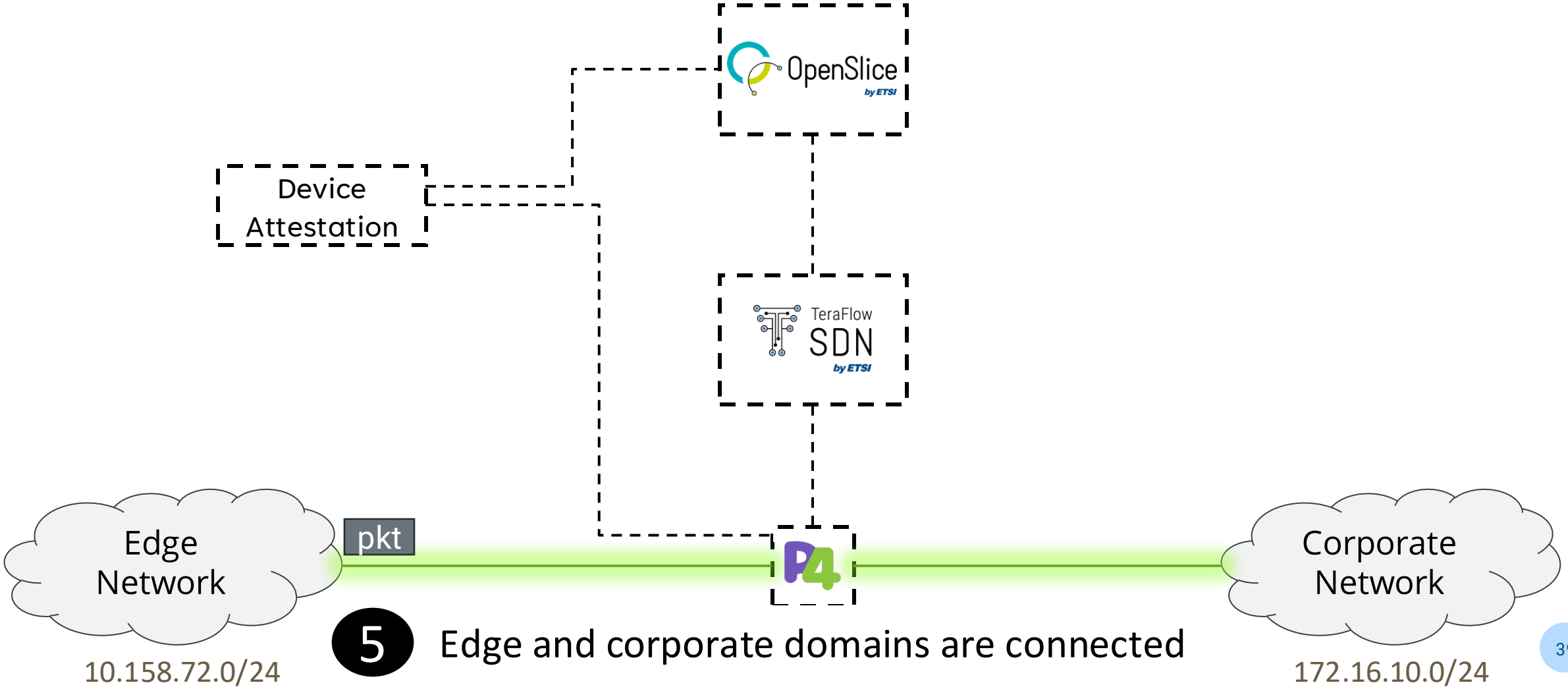
TFS service provisioning invocation



TFS service setup

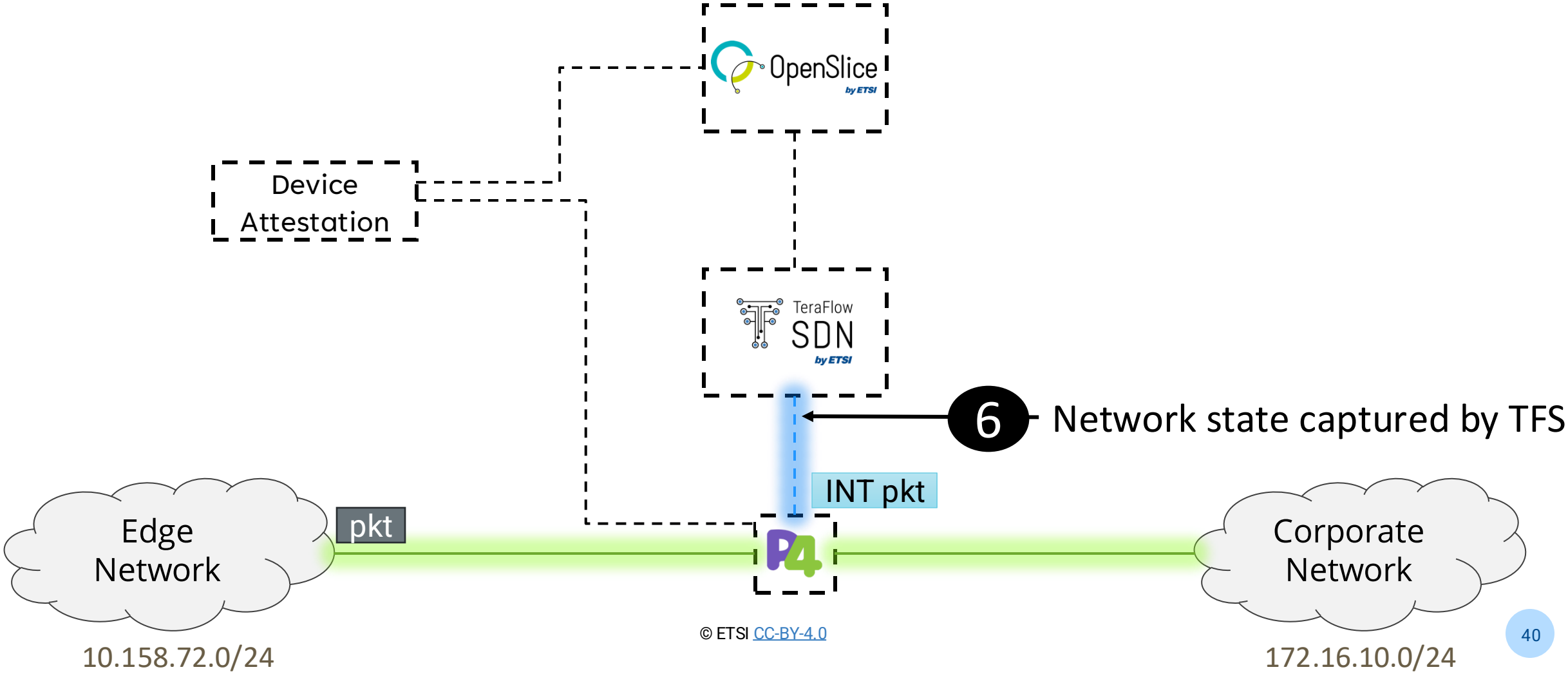


Edge and corporate domains are connected!



5 Edge and corporate domains are connected

In-band Telemetry data flows to TFS



Zero-Touch P4 telemetry & connectivity - Demo

TeraFlow SDN

Team behind the PoC

Contributors

Georgios P. Katsikas
NSS Technical Leader

Kostis Trantzas
ETSI OSL TSC Chair

Felix Klaedtke
Principal Res. Scientist

TeraFlow SDN

Impact

Open-Source Systems and Related Standards

Open-source component	Standard	Partner
Operations Support System (OSS) for Network-as-a-Service https://osl.etsi.org/	tmforum, ETSI World Class Standards	University of Patras
Disaggregated SDN Controller https://tfs.etsi.org/	IETF	UBITECH, CTTC
ONF SD-Fabric https://github.com/stratum/fabric-tna		UBITECH
ONF Stratum https://github.com/stratum/stratum		UBITECH
In-band Network Telemetry (INT) specification v0.5 https://p4.org/p4-spec/docs/INT_v0_5.pdf		UBITECH

Closed-Source Systems

Closed-source component	Partner
Device Attestation service	NEC

Trusted Platform Module

Linux kernel

CIMA: Extended Integrity Measurement Architecture (IMA) to support containers

eBPF hooks into system calls for security information extraction

TeraFlow SDN by ETSI

Georgios P. Katsikas
NSS Technical Leader
ETSI TFS TSC member
ETSI OSL TSC member

gkatsikas at **ubitech** dot **eu**

Thank You!

TFSsupport@etsi.org

Acknowledgements

EU-funded Research and Development

HORIZON-JU-SNS-2022 **ACROSS** project with grant agreement number 101097122

Programming Platform for intelligent COllaborative DEployments over heterogeneous edge-IoT environments (**P2CODE**) under GA No. 101093069