TeraFlow

Deploying Intent-based Capabilities for Network Automation

Role of Standards in Automating Intelligent Optical Networks

Daniel King (ODC)
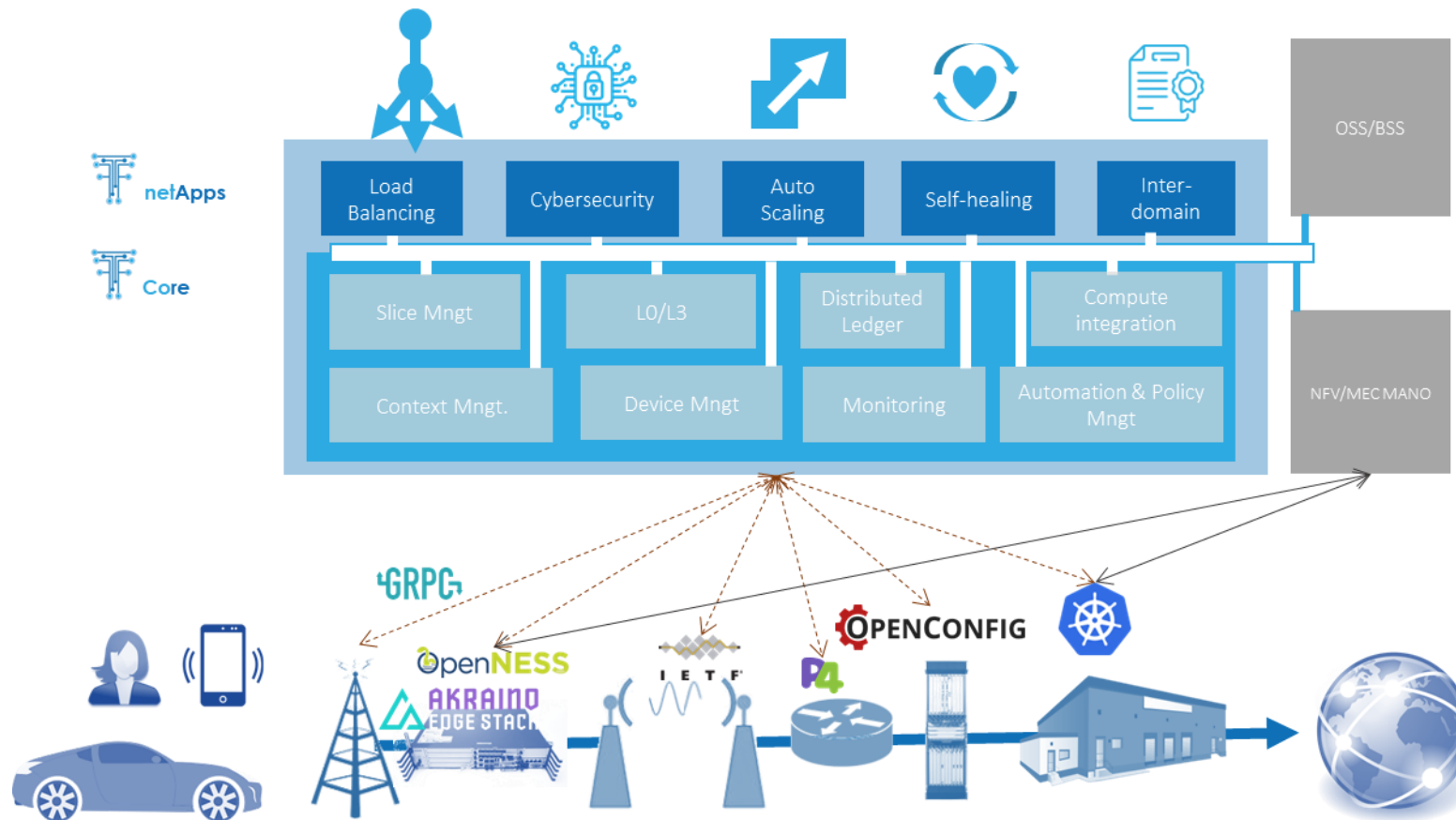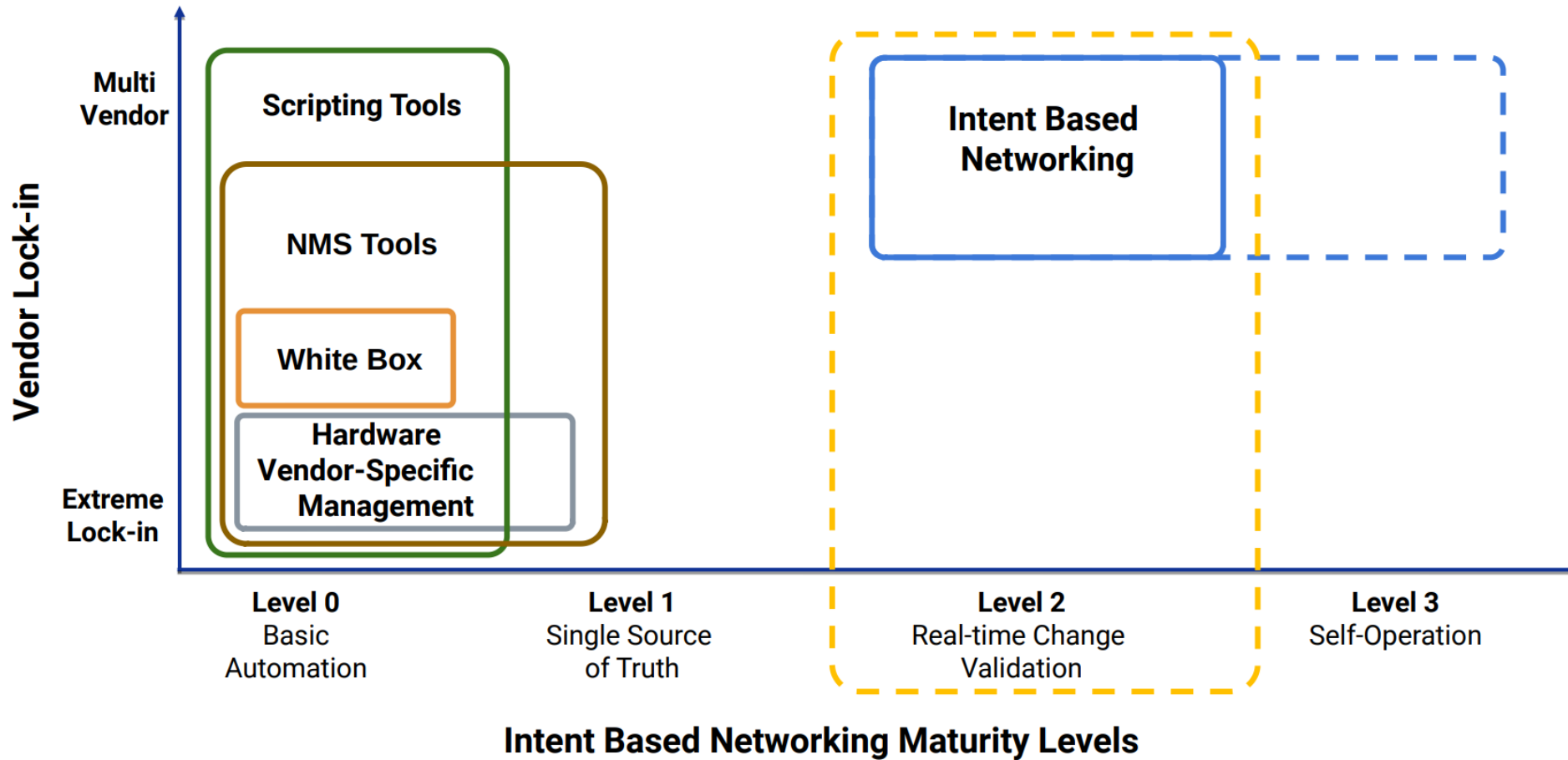TeraFlow Researcher

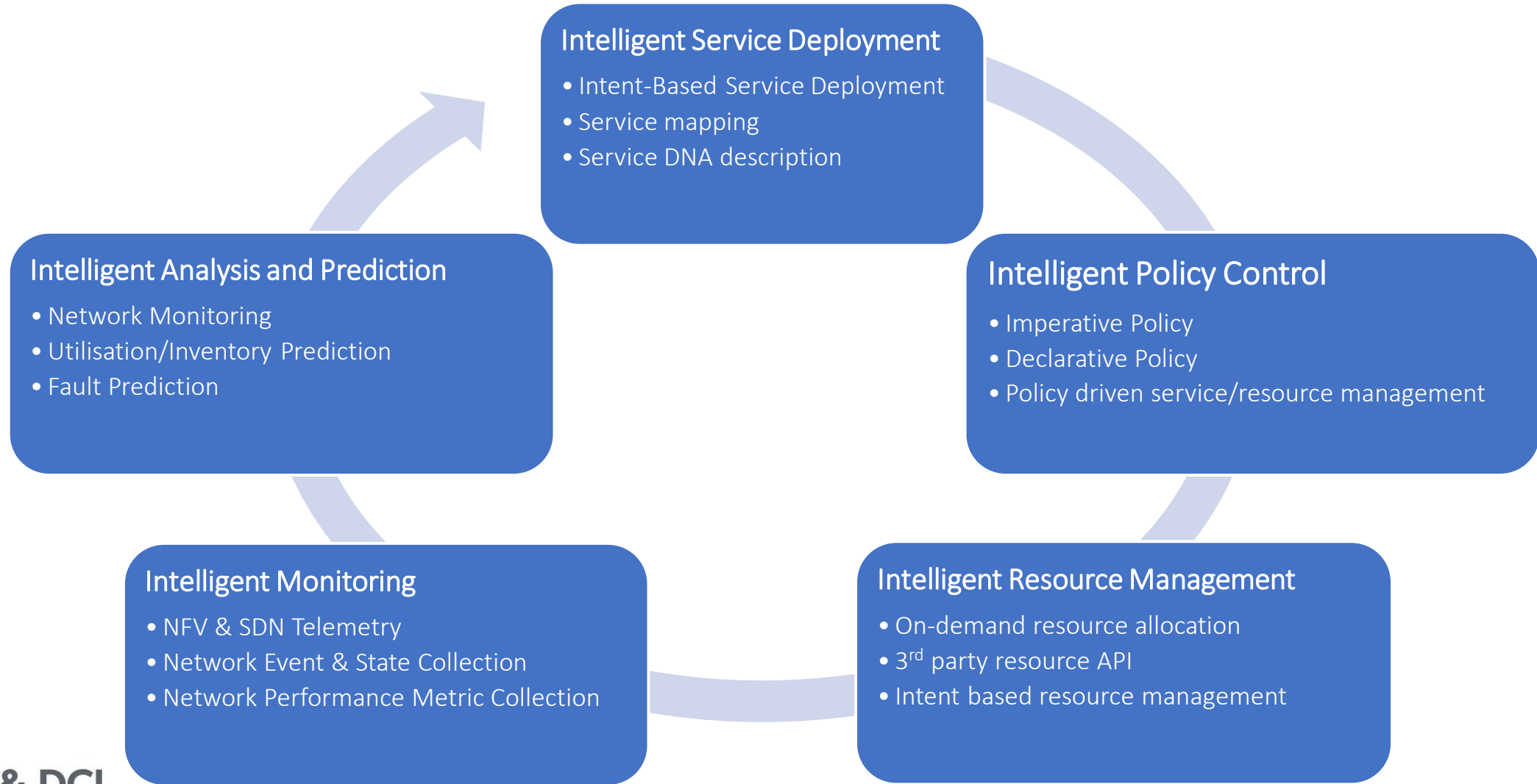# TeraFlow Overview

Project Partners

What Is Intent?

- An evolutionary step towards autonomous intelligent networks.

- Intent would enable the management of optical infrastructure as a whole.

- A Service to Network component that facilitates translation of "**What you want**" (intent) to "**How to deploy it**" (policy).

- This would facilitate:
  - Automating human-dependent decision-making processes about technology usage and service path layer and resource placement
  - Defining how best to utilise network and function resources and improve network maintenance and operation
 - Provide true automation of end-to-end services

Evolution of Intent

Intent Based Networking Maturity Levels

How Will We Use Intent?

TeraFlow

Intelligent Service Deployment
- Intent-Based Service Deployment
- Service mapping
- Service DNA description

Intelligent Policy Control
- Imperative Policy
- Declarative Policy
- Policy driven service/resource management

Intelligent Analysis and Prediction
- Network Monitoring
- Utilisation/Inventory Prediction
- Fault Prediction

Intelligent Monitoring
- NFV & SDN Telemetry
- Network Event & State Collection
- Network Performance Metric Collection

Intelligent Resource Management
- On-demand resource allocation
- 3rd party resource API
- Intent based resource management

NGON & DCI
World

Intent Applied

Declarative: Goal- or Intent-based
Express **What** should be done,
not **How** to do it
Specifies criteria for choosing acceptable
states, each of which has a binary value

ANY of these states
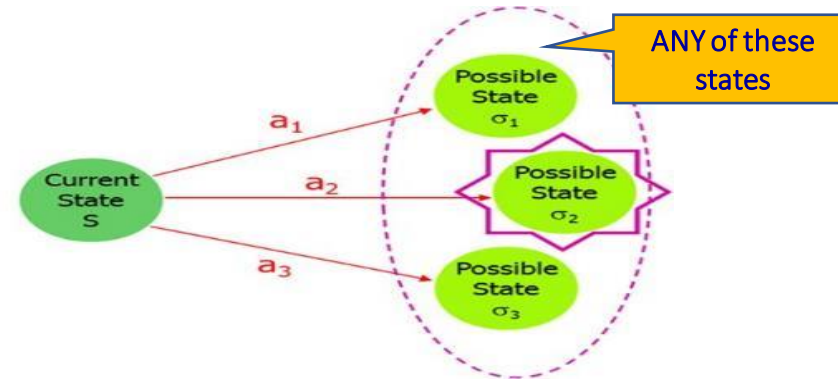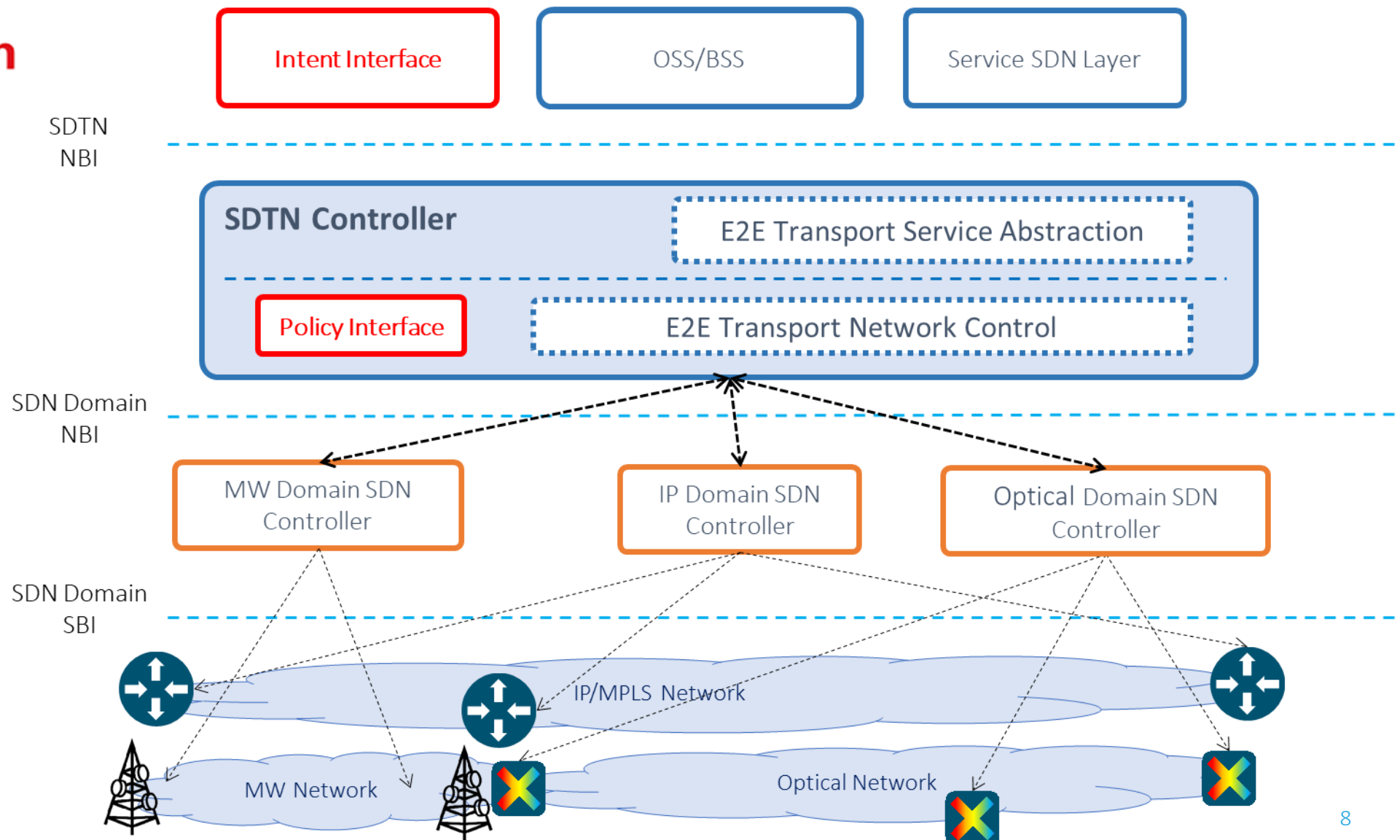
Intent to Policy Mapping

Imperative: Event-Condition-Action (ECA)
IF the Event clause evaluates to **TRUE**
IF the Condition clause evaluates to **TRUE**
THEN Execute Actions in Action Clause
ENDIF

ONLY this state
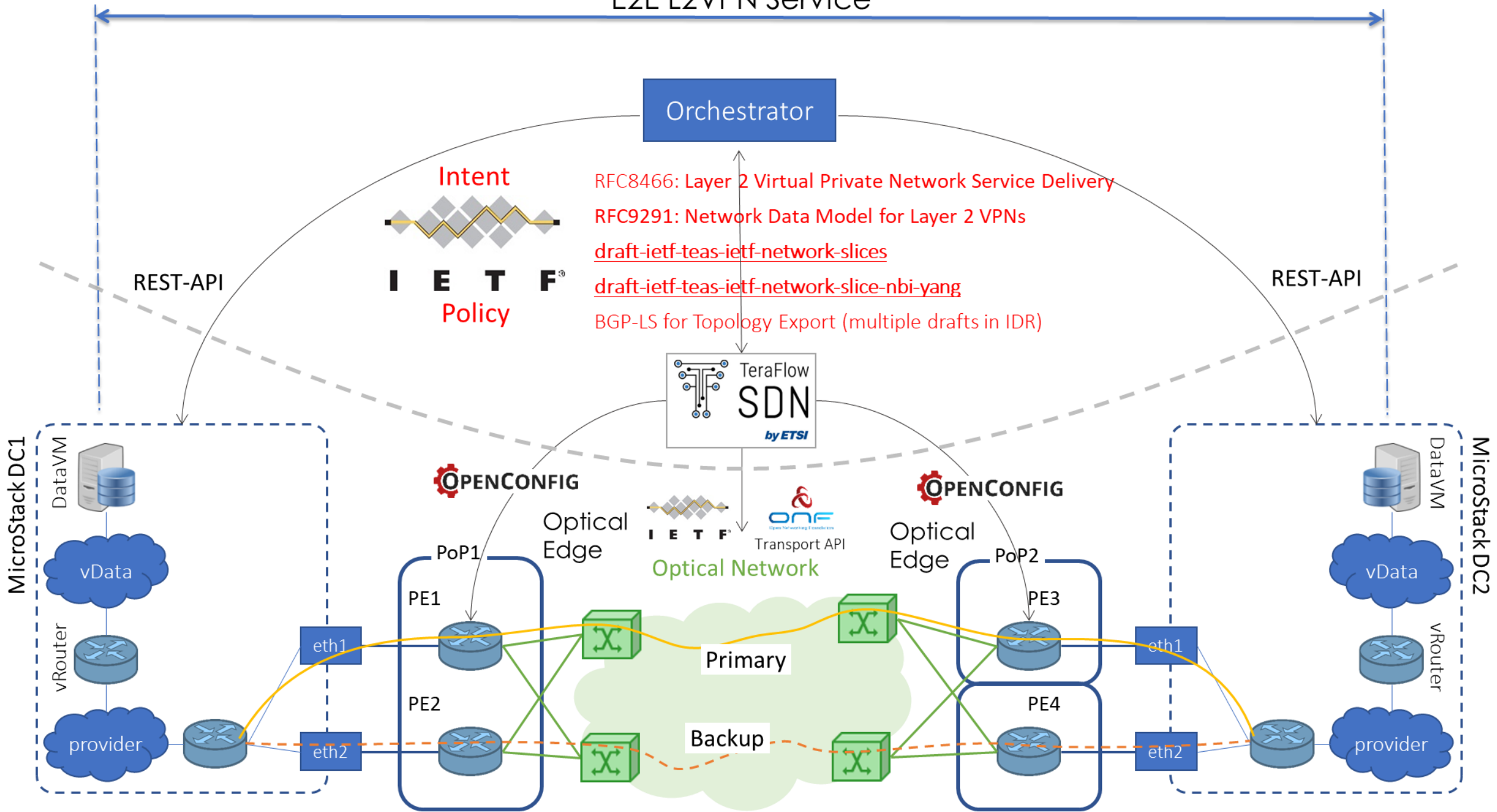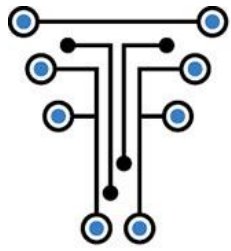
Intent to Event Condition Action Mapping
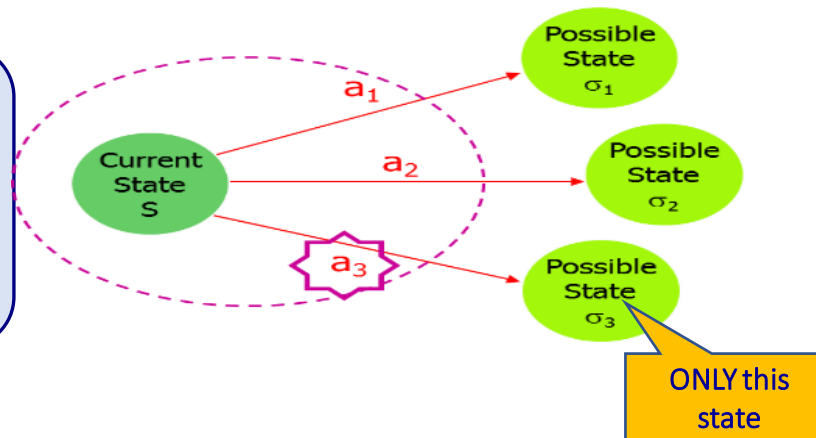
- ECA Enables event-based management
  - provide a useful method to monitor state change of managed objects

- It uses YANG to express network policy and provides rapid autonomic responses to specific conditions,
  - enabling self-management behaviors, including, self-configuration, self-healing, self-optimization, and self-protection.
  - Four type events are discussed, i.e., server event, datastore event, timer event, diagnostic event;

- ECA May be realized in two ways:
  - Centralized network management has its limitations
    - Huge resource consumption due to massive data collection and processing
    - Slow reaction to the network changes
    - Lack control on malfunction device
    - Scalability
  - Device Self Management: Move network management function to servers in the network
    - Provide continuous performance monitoring in the server
    - Detect defects and failures and take corrective action in the server.
    - Might require state management and "Computational Logic"

TeraFlow Architecture and SDO Relevance

E2E L2VPN Service

Orchestrator

Intent

IETF

Policy

RFC8466: Layer 2 Virtual Private Network Service Delivery

RFC9291: Network Data Model for Layer 2 VPNs

draft-ietf-teas-ietf-network-slices

draft-ietf-teas-ietf-network-slice-nbi-yang

BGP-LS for Topology Export (multiple drafts in IDR)

REST-API

REST-API

TeraFlow SDN
by ETSI

MicroStack DC1

DataVM

vData

vRouter

provider

OPENCONFIG

Optical Edge

PoP1

PE1

eth1

PE2

eth2

IETF

ONF
Transport API

Optical Network

Primary

Backup

OPENCONFIG

Optical Edge

PoP2

PE3

PE4

MicroStack DC2

DataVM

vData

vRouter

provider

eth1

eth2

- ETSI TeraFlowSDN (TFS) Controller
  - Cloud-native and microservice-based SDN controller.
  - Community-driven, open-source, scalable, flexible, and extensible.
    - Origins in the EU H2020 "TeraFlow" project
      - https://teraflow-h2020.eu/teraflowsdn
  - Supports multiple technologies and standardized protocols and interfaces.
    - IP-over-DWDM, Inter-domain, Security, etc.
    - NBI: IETF L2VPN, **IETF Slice Framework**, **IETF Service Models**
    - SBI: OpenConfig, P4, ONF Transport API,
  - Future support planned
    - IETF Optical Device Models
    - IETF Inventory Models
  - Purpose is proof of concept
    - This enables "product specification by software example"
    - Not intended to be the foundation of a product
- Project Overview and Project Signup
  - http://tfs.etsi.org
- ETSI TFS GitHub
  - https://labs.etsi.org/rep/tfs/controller