Vertical's intent evolution at service runtime driving vCDN automated scaling

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NEXTWORKS
ENGINEERING FORWARD

Challenges and Vision

Motivation: increasing complexity of network infrastructure and services affecting Service Providers' management tasks

- Need for Vertical-oriented procedures towards a full automated provisioning, configuration and orchestration of service
- Support for heterogeneous services at run-time, when changing behaviours cannot be easily or manually handled and AI/ML techniques become fundamental for modelling operational trends

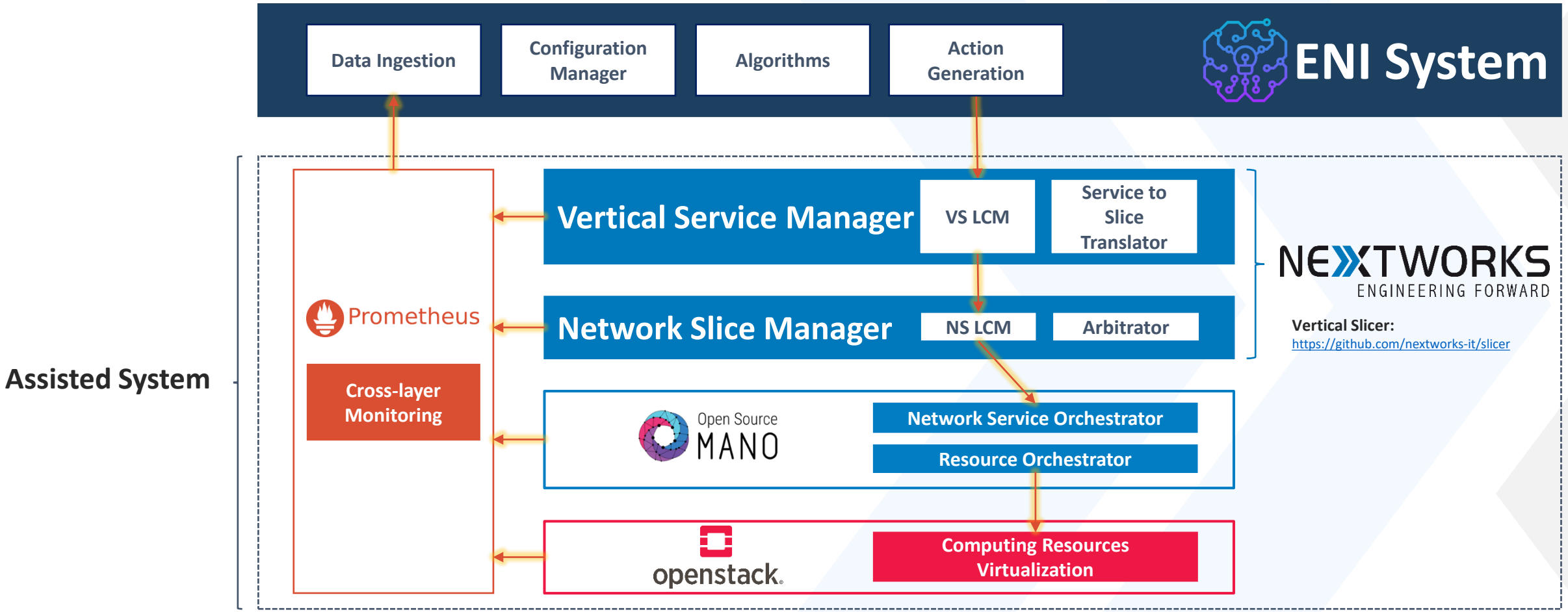
Goal: build upon orchestration, automation, analytics and AI/ML techniques for enabling network and service adaptation depending on a business logic

- Automated service profiling which is intent-based instead of infrastructure-based
- Automated closed-loop LCM operations for the run-time service adaptation and optimization → collected metrics will allow to identify an evolution in the service's intent to perform the needed adaptations

Nextworks NFV MANO Stack Architecture

Vertical Slicer, OSM R8, Monitoring Platform and ENI System

Assisted System & ENI System Architecture



Vertical Slicer: Support of Closed-loop Automations

- **Vertical Slicer:** Service-drive management and orchestration to allow **modelling** and **instantiation** of **vertical-driven services** across **5G network slices**
  - Automated **translation** from business/service requirements to network slices
  - Automated **arbitration** of resources based on tenants' SLAs at instantiation/scaling time

- **Closed-loop support:** the Vertical Slicer has been extended for
  - Performing the **dynamic configuration of the Vertical Service's components** through an integrated NFVO Service → runtime configuration/re-configuration of VNFs and PNFs composing the service (Day 1/ Day 2)
  - Performing the **dynamic configuration of service-specific alerts** (i.e., based on service-related parameters in the VSB) in Prometheus through an integrated Configuration Manager
  - **Scaling the Vertical Service** upon the selection of a different Vertical Service Descriptor that is performed by the ENI System upon received alerts

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DEMO

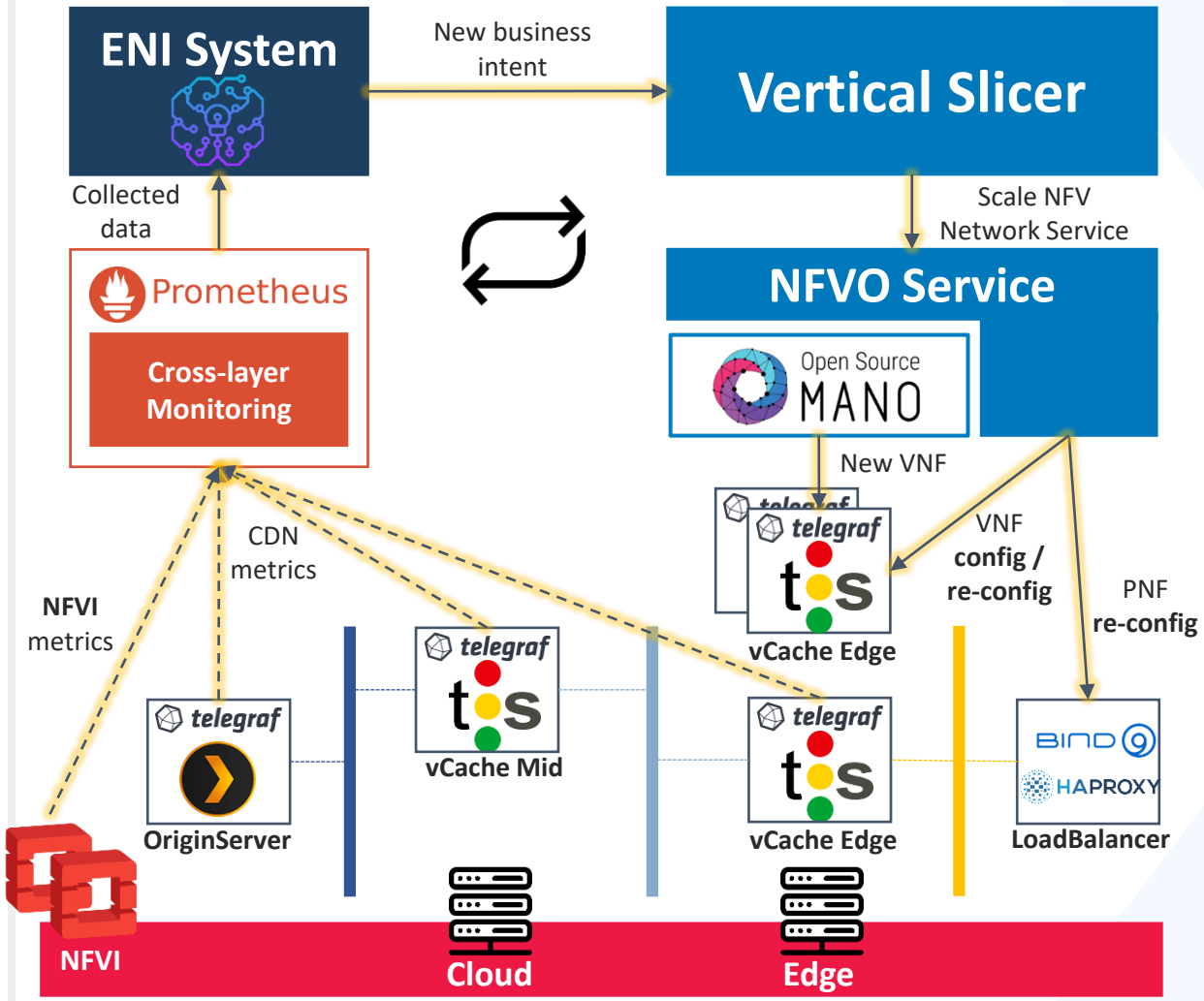
DEMO Rationale & Goal

- **Obj#1:** Demonstrate the **intent-based vCDN** on-demand service **deployment** and **configuration** via Vertical Slicer + OSM
  - Improve the elasticity and flexibility of the service lifecycle on a per-business logic

- **Obj#2:** Demonstrate the **integration** between the **Assisted System** and the **ENI System** towards closed-loop automations
  - Assisted System with an integrated monitoring platform based on Prometheus (application and infrastructure metrics)
  - Dynamic configuration of service-specific alerts within Prometheus for monitoring intent-related metrics and triggering the ENI System
  - Automated generation of new business intents upon received alerts at the ENI System

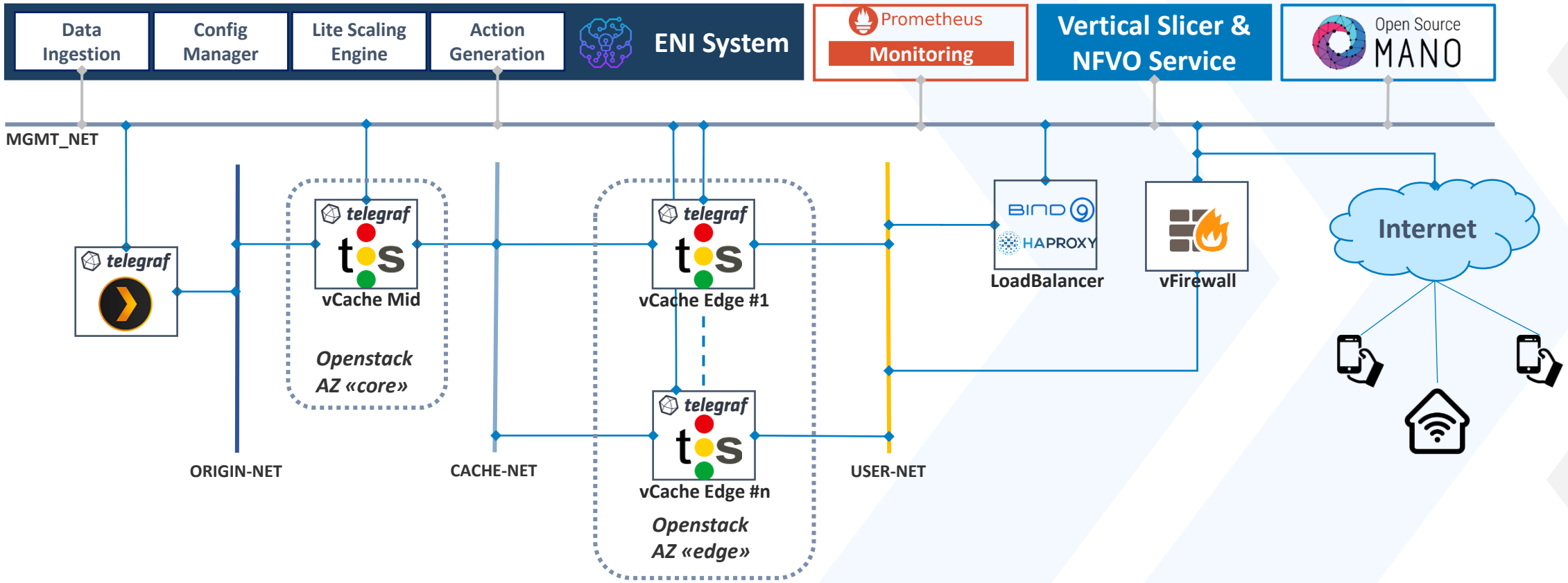
- **Obj#3**: Demonstrate vCDN media service **dynamic scaling** based on the run-time intent evolution
  - Fine-grained media service optimization (scaling and re-configuration) at the edge driven by new business intents

Closed-loop automation for vCDN scaling

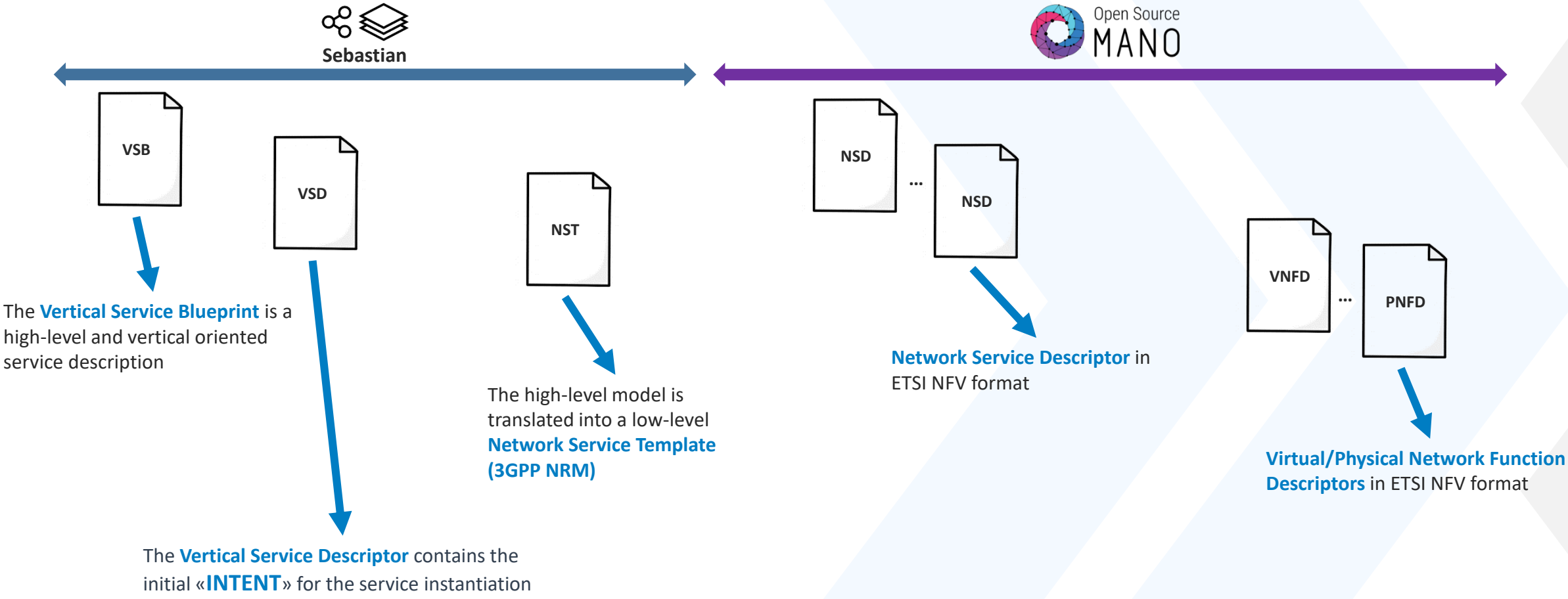


- **Dynamic** and **automated detection** of customer's **intent evolution** at service runtime
  - Based on **application (# of connected users)** and **virtual infrastructure metrics**
- **Automated optimization actions** based on real-time business intents
- **ENI-driven translation** of evolving intents into **service requirements** and **configuration** at the application and NFVI level
  - Automated **scaling** and **configuration** of **edge vCaches**
  - Automated **re-configuration** of **LoadBalancer**

Environment & Service Overview



Templates & NFV Descriptors Overview



DEMO Workflow

PHASE 1:
Environment Overview

PHASE 2:
Service Instantiation & Configuration

PHASE 3:
Application Running & Intent Evolution

PHASE 4:
Application Scaling & Re-configuration

DEMO

Future Work & Conclusions

- Leverage OSM integration with Kubernetes for performing a hybrid deployment, where edge vCaches are instantiated as KNFs, reducing the Service Provisioning and Scaling time
- Support simultaneously multiple services with resource constraints → extensions to Vertical Slicer's arbitration functionalities
- Support the AI/ML-driven runtime modification of Translation Rules for dynamically selecting the most appropriate Network Slice Template among available ones
- Support the AI/ML-driven service scaling also at the network level, e.g. reconfiguring the transport network in case of QoS degradation

THANKS!

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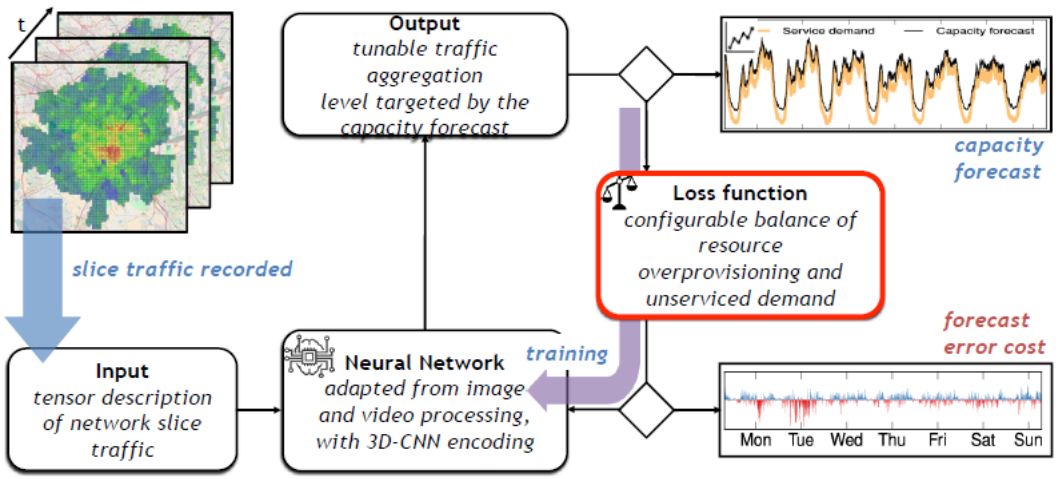
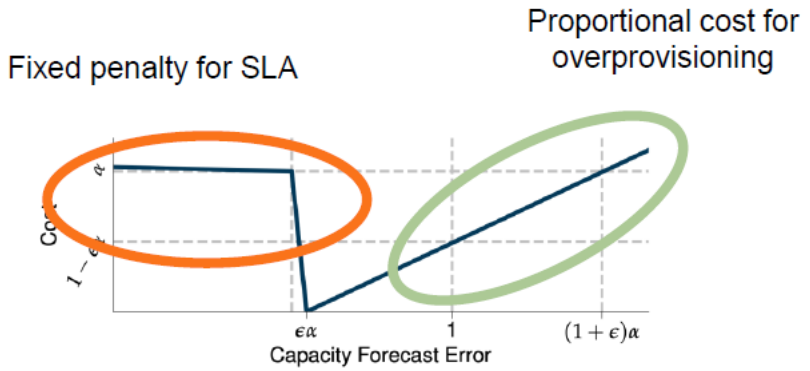
Cognitive Vertical Service Management



Configurable with user parameters



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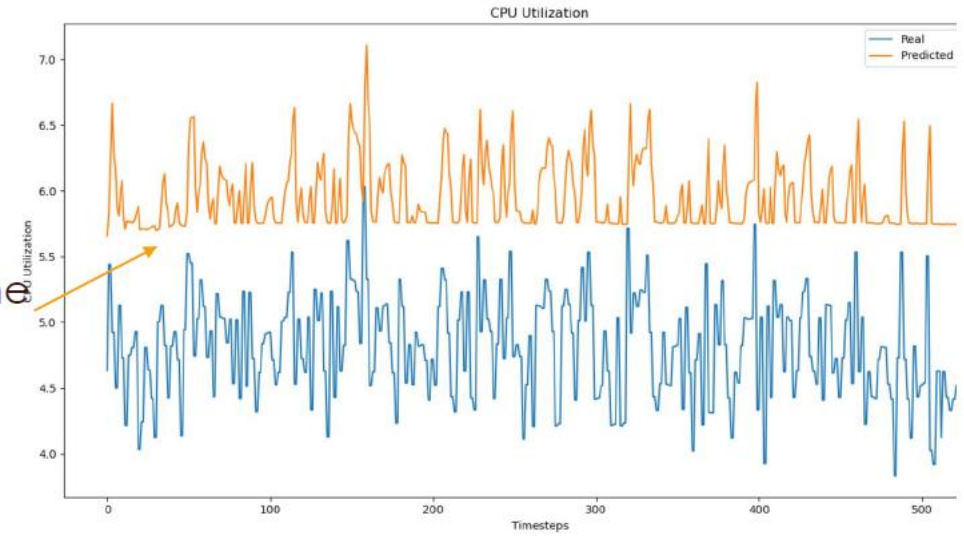
Load Forecasting for VNF Scaling

- We are performing fine tuning of the Deep Neural Network to provide the best forecasting

- Guard level configurable by the vertical



- Translated into scaling decisions

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