PoC#9: Autonomous Network Slice Management for 5G

Autonomous Network Slice Management for 5G Vertical Services
PoC in a nutshell

► Ambition
  ► Empower the creation of 5G Vertical Service with ENI principles
  ► Apply AI/ML to Vertical Service Management and Network Slice Management functions

► Technical goals
  ► Identify characteristics and profiles of 5G network slices in an automatic manner to meet the requirements of vertical services
    ► Exp. impact/outcome: Intent based interface
  ► Manage composition, sharing and actions for automated lifecycle of 5G network slices through AI/ML
    ► Exp. impact/outcome: ENI procedures and interfaces
## Members

<table>
<thead>
<tr>
<th>Role</th>
<th>Organization</th>
<th>R&amp;D track of origin for PoC</th>
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</thead>
<tbody>
<tr>
<td>Manufacturer</td>
<td>SAMSUNG</td>
<td>![5G_EUR] ![5GROWTH] ![5G_EU]</td>
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<tr>
<td>Other</td>
<td>Universidad Carlos III de Madrid</td>
<td>![5G_EUR] ![5GROWTH] ![5G_EU]</td>
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<tr>
<td>Other</td>
<td>NEXTWORKS ENGINEERING FORWARD</td>
<td>![5G_EUR] ![5GROWTH] ![5G_EU]</td>
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PoC Goals
Defined by the ENI Framework
Detailed Goals

► Use case #2-8: Automatic service and resource design framework for cloud services
  ▶ Extend the concepts of this use case from cloud services to 5G services, deployed across radio and transport, edge and cloud domains
  ▶ Additional modeling items for descriptors:
    ▶ network connectivity requirements in terms of virtual links capacity
    ▶ QoS characteristics at the transport network level
    ▶ service profiles expected at the radio access segment
  ▶ Highly context-dependent:
    ▶ action change depending on the network status

► Use case #3-2: Intelligent network slice management
  ▶ Automation of the management of 5G network slices associated with multiple, concurrent Vertical Services
  ▶ Meet service-level requirements, while optimizing the usage of the underlying 5G infrastructure, jointly considering access, core, edge, cloud resources
  ▶ Design and implement algorithms that will be fed and assisted by the ENI system, based on short-term and long-term profiles
PoC Assessment

- Major functionalities of the ETSI ENI system to be validated:
  - **Ingestion and normalization** of multi-source, heterogeneous input data, related to service demands, service application performance, physical and virtual infrastructure utilization and NFV orchestration
  - **Processing of input data** to build a cross-domain knowledge about the trends of service demands, resource utilization, application and infrastructure performances and about how these elements are correlated
  - **Decision-making procedures**, generated through the Policy Management functional block
  - Assessment of the system through the **Performance Diagnostics** component which will be part of the Situational awareness module
PoC Technical Details
PoC Overview

► **Goal:** Design, develop and validate an ENI-assisted system for the intelligent management of network slices in support of vertical services operating over 5G network infrastructures

► **Software components**
  
  ▶ A reference implementation of the ENI System, compliant with the architecture defined in ETSI GS ENI 005
    
    ▶ ingestion and normalization of input data
    
    ▶ knowledge management and processing
    
    ▶ policy management
  
  ▶ A multi-layer ENI-assisted system, implemented as an extended NFV MANO platform, for the management of vertical services and network slices in 5G network infrastructures.

► The offered services will use eMBB and URLLC network slice types
PoC Architecture

Validated through the usage of a vertical use case: enhanced visit to a Museum or itinerant orchestra
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PoC Architecture

Validated through the usage of a vertical use case: enhanced visit to a Museum or itinerant orchestra
## PoC Success Criteria

<table>
<thead>
<tr>
<th>Goal to be verified</th>
<th>KPI</th>
<th>Stand-alone mode</th>
<th>ENI-assisted mode</th>
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<tbody>
<tr>
<td>Translation between intent-based Vertical Service definition and resource-based descriptor of the end-to-end 5G network slice</td>
<td>Service performance (see note 1)</td>
<td>Translation based on static rules preconfigured by the system administrator</td>
<td>Translation rules dynamically modified through policies injected by the ENI system, according to historical data about relationships between network slice characteristics and service performance</td>
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<td>Enhanced strategies for sharing and composition of network slices.</td>
<td>Utilization of the 5G infrastructure.</td>
<td>Static rules for network slice composition and sharing, applied at the provisioning time only and based on the current resource utilization and the currently active network slices.</td>
<td>Slice composition and sharing rules are dynamically modified through policies injected by the ENI system, according to short-term and long-term predictions for future service demands.</td>
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<td>Automation of scaling and migration procedures for self-re-optimization of the global set of network slices.</td>
<td>Utilization of the 5G infrastructure. Total amount of resources used by the global set of network slices, for radio, transport, edge and core computing resources. Service performance (see note 1).</td>
<td>Feature not supported. Network slices are scaled manually or automatically, based on the real-time performance of single services following a threshold-based mechanism.</td>
<td>Suggested commands for network slice re-optimization are triggered from the ENI system, according to cross-layer and cross-domain monitoring data feeding a decisions process related to the entire set of network slices.</td>
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Note 1: Service performance will be measured through application-based KPIs, to be defined for each of the services adopted in the PoC.
PoC Stages and Milestones
Timeline

- **PoC start:** Jan-2020
  - Definition of PoC scenarios

- **Milestone 1:** Mar-2020
  - Design of the system and its interfaces

- **Milestone 2:** Jun-2020
  - Public demonstration of a reduced functionality system (intent based)
  - EuCNC 2020, Dubrovnik

- **Milestone 3**
  - Final demonstration of the full functionality
  - ETSI ENI Meeting or scientific conference, TBC
PoC Status
Current Status

► Architecutral Work
  ► Mapping of the developed modules to the ENI Architecture
  ► Definition of the initial interactions

► Implementation Work
  ► Definition of the implementation interfaces across modules
  ► Definition of the software architecture platform

► Use case application to the framework
  ► Mapping of the vertical services to the PoC Specifics
  ► Selection of the best use case

► Exp. impact/outcome: ENI procedures and interfaces
Initial Architecture
Software Architecture

Diagram showing the architecture with various components:
- **Service Layer**
- **Frontend**
- **RBAC**
- **Backend**
- **IWL**

Key components include:
- DCS
- ELM
- Catalogue Service
- Exp. Descriptor
- VSB/VSD
- ECB/ECD
- DCM
- Runtime Config.
- Multi-site Network Service Orchestrator
- Multi-site Catalogue
- Multi-site Inventory
- Data Shippers
- Local Catalogue
- Site Facility 1
- Site Facility 2
- Performance Diagnostic
Implementation work

- Work is taking place on the two different interfaces
- E-oss-eni-cmd from the vertical service manager and the ENI assisted system will be on the focus
- The MANO implementation that will be used is Open Source Mano (OSM) based
- The work has started on the two interfaces
  - From the vertical service translation to the intent-based interface
  - From the monitoring interfaces using a pub/sub mechanisms
- Work on the AI modules that populate the decision Situational Awareness and the Context Awareness blocks will start soon
Timeline

► We could complete the initial milestone on the architecture definition
► We are now facing problems for the intermediate milestones
  ► The Use case we were envisioning was cancelled (the itinerant orchestra)
  ► Also EuCNC could be cancelled
► Still we plan to have remote integration session to find possible solutions
► The fall milestones seem to be reachable
Questions?