# ISG ZSM PoC Proposal

# 1 PoC Project Details

## 1.1 PoC Project

| PoC Number: *(assigned by ETSI)* | 2 |
|---|---|
| PoC Project Name: | Automated network slice scaling in multi-site environments |
| PoC Project Host: | Telefónica S.A. |
| Short Description: | This PoC has the aim at demonstrating the capacity to automatically scale out a deployed network instance across multiple administrative domains. This will be achieved using the 5G assets of 5G-VINNI, which is a large-scale, end-to-end facility composed of several interworking sites, each deployed at a different geographic location and defining a single administrative domain. The management and orchestration capabilities of individual sites, and the enablers allowing for the interworking across them, are aligned with ZSM architectural design principles.<br><br>The PoC fits the end-to-end (E2E) service management scenario category detailed in ZSM 001, considering the slicing features specified in ZSM 003. |

## 1.2 PoC Team Members

| | Organisation name | ISG ZSM participant (yes/no) | Contact (Email) | PoC Point of Contact (*) | Role (**) | PoC Components |
|---|---|---|---|---|---|---|
| 1 | Telefónica S.A. | Yes | Jose Ordonez-Lucena joseantonio.ordonezlucena@telefonica.com Diego R. López diego.r.lopez@telefonica.com | X | Network/ service provider | -Use case definitions -Business model definition |
| 2 | Telenor ASA | Yes | Min Xie min.xie@telenor.com | | Network/ service provider | - Use case definitions -Business model definition |
| 3 | Universidad Carlos III (UC3M) | No | Carmen Guerrero carmen.guerrero@uc3m.es Adrián Gallego adrgalle@pa.uc3m.es | | University / Supplier | -VNFs provider -Integrator |
| 4 | University of Patras (UoP) | No | Spyros Denazis sdena@upatras.gr Dimitris Giannopoulos dimit.giannopoulos@upnet.gr Panagiotis Papaioannou papajohn@upatras.gr | | University / Supplier | -VNFs provider -Integrator |
| 5 | Openslice | No | Christos Tranoris tranoris@ece.upatras.gr Kostis Trantzas ktrantzas@upnet.gr | | Open source project | -Openslice framework |
| (*) Identify the PoC Point of Contact with an X. (**) The Role will be network/service provider, supplier, or other (universities, research centers, test labs, Open Source projects, integrators, etc…). | | | | | | |

All the PoC Team members listed above declare that the information in this proposal is conformant to their plans at this date and commit to inform ETSI timely in case of changes in the PoC Team, scope or timeline.

## 1.3 PoC Project Scope

### 1.3.1 PoC Topics

PoC Topics identified in this clause need to be taken for the PoC Topic List identified by ISG ZSM and publicly available in the ZSM WIKI. PoC Teams addressing these topics commit to submit the expected contributions in a timely manner.

| PoC Topic Description | Related WI | Expected Contribution | Target Date |
|---|---|---|---|
| Automation in Multi-Stakeholder Ecosystems | ZSM-001, ZSM-003 | Propose a solution to automate network slice scaling out operation. Multiple administrative domains participating in the scaling out operation. | 01/04/2021 |

### 1.3.2 Other topics in scope

List here any additional topic for which the PoC plans to provide input/feedback to the ISG ZSM.

| PoC Topic Description | Related WI | Expected Contribution | Target Date |
|---|---|---|---|
| | | | |

## 1.4 PoC Project Milestones

| PoC Milestone | Milestone description | Target Date | Additional Info |
|---|---|---|---|
| P.P.1 | PoC Presentation | 02/12/2020 | Presentation to ZSM NOC |
| P.S | PoC Proposal submission | 15/12/2020 | Official PoC proposal submission |
| P.P.2 | PoC Public Announce | 15/01/2021 | Public Web announce in 5G-VINNI media (web, twitter, etc.). *Once it is approved. |
| P.PU | PoC user story detailed | 22/01/2021 | Detailing use case, specifying actors, pre-conditions & post-conditions and exceptions. |
| P.PT | PoC Test Plan | 03/03/2021 | Testbed setup and running |
| P.D1 | PoC Demo | 17/03/2021 | Demo for showcasing at ETSI endorsed Webinar |
| P.C1 | PoC Expected Contribution | 17/03/2021 | Propose contributions to several topics at ZSM meeting (ZSM-Interim#08-e). |
| P.R | PoC Report | 01/04/2021 | PoC-Project-End Feedback |
| P.E | PoC Project End | 01/04/2021 | |

NOTE:    Milestones need to be entered in chronological order.

## 1.5 Additional Details

H2020 5G-VINNI web portal [1] details information about project's scope and multiple references to implementation and design.

# 2 PoC Technical Details

## 2.1 PoC Overview

This PoC aims at demonstrating cross-domain network slicing management capabilities (see *E2E network and service management* scenario category in [2]) using the 5G-VINNI facility infrastructure.

### 2.1.1 5G-VINNI facility

5G Verticals INNovation Infrastructure (5G-VINNI) is a large-scale, end-to-end facility providing advanced 5G capabilities that are made available to industry verticals for use case trialling [1]. This facility provides every vertical with an isolated service experimentation platform, deployed in the form of a slice. This means that each vertical will use the provided slice to set up one or more use cases, assessing their KPIs under different load conditions through the execution of a set of tests.
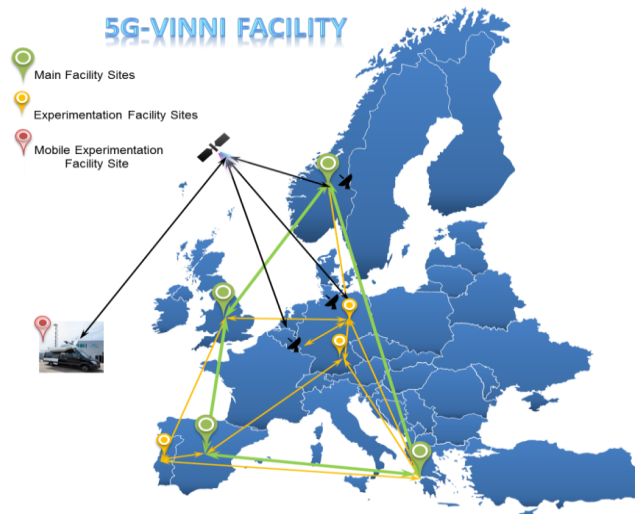


**Figure 1: 5G-VINNI facility sites**

According to Figure 1, 5G-VINNI facility is composed of several interworking sites, each deployed at a different geographic location and defining a single administrative domain. Every 5G-VINNI facility site includes the following components:

- A Service Orchestrator (SO), taking care of the lifecycle management of provided network slices at the application layer, i.e. network slice semantics.

- A Network Orchestrator (NFVO), which deploys and operates provided network slices at the resource layer.

- Infrastructure resources, including access, transport and core network functions. Some of these functions are physical, while some of them are executed on cloud environments as VNFs.
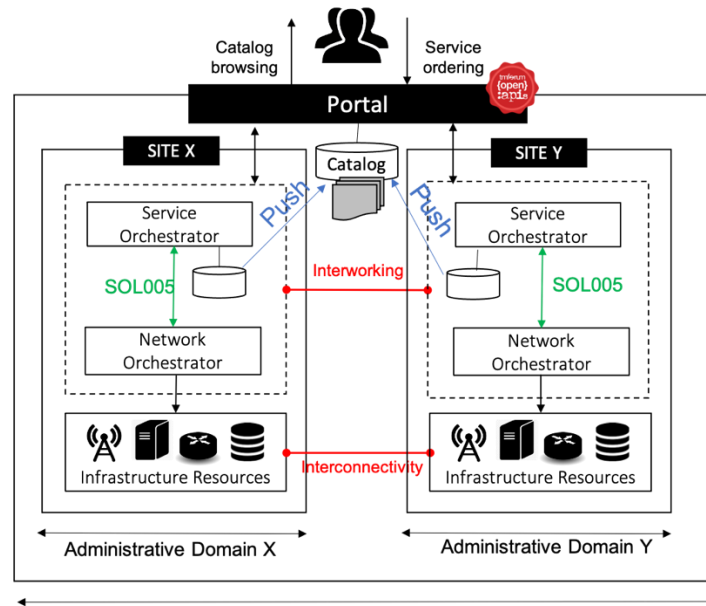


**Figure 2: 5G-VINNI facility baseline architecture**

All the components defined in a given site are from the same or different vendors, and all managed by a single operator. Despite this per-site description, the whole facility shall be viewed as a single platform from the verticals' side. This brings the need to implement adaptation layers, which unify the behaviour and features offered in the different sites, abstracting underlying implementation details on each site. In this context, 5G-VINNI provides verticals with a single entry-point to the facility by means of a portal. As shown in Figure 2, this portal allows any vertical to browse the service catalogue and trigger corresponding service orders. On the one hand, the service catalogue is used by 5G-VINNI to announce its service offerings, which are network slices to be delivered under the Network Slice as-a-Service (NSaaS) model. On the other hand, service ordering is triggered by the vertical, and consists in selecting a service offering and issuing the request towards the 5G-VINNI facility. In this request, the vertical can specify where he wants the slice deployed: in a single site or across different sites. In the latter, the portal should split (decompose) the service orders across requested sites.

To allow a vertical to specify the characteristics of the slice he wants, 5G-VINNI defines a model-based slice template called 5G-VINNI Service Blueprint (VINNI-SB). The VINNI-SB defines a common information model for the entire 5G-VINNI facility, in order to enable a site-agnostic design of network slices. This not only enables reproducibility (the ability to generate repeatable instances of a given network slice at different 5G-VINNI facility sites), but also cross-site deployments. The VINNI-SB defines a set of attributes aligned with GSMA GST/NEST [3]. For more information on the VINNI-SB structure, see [4].

## 2.1.2   PoC scope

The present PoC will use 5G-VINNI facility and components described to demonstrate the capacity to manage a slice when deployed across multiple administrative domains. Specifically, the PoC will demonstrate how to automatically scale out a network slice instance in multi-site environments.  For this use case, it is assumed that:

- There is an existing (running) network slice instance. This instance has been deployed across two different 5G-VINNI facility sites (site #X and site #Y), each hosting a portion of the network slice instance, i.e. a network slice subnet instance
  - The network slice consists of one or more NFV network services. The composition of individual network services (e.g. single-VNF network service vs multi-VNF network service) and their arrangement into network slice subnets depend on the design criteria.
  - There exists L3 connectivity between the two 5G-VINNI facility sites, so that in-slice connectivity can be ensured along the entire data path.
- The behavior of existing (running) network slice instance is continuously monitored
  - Policy-based performance management on individual facility sites.
  - There are pre-defined policy rules that allows triggering the need for scaling out operation based on collected metrics.
- When certain policy rules are met at the 5G-VINNI facility site #X, a scaling out operation is triggered. This operation applies to the entire network slice instance.
  - Consistency is a must: increasing capacity on one network slice subnet (i.e. the one deployed at the facility site #X) requires modifying the capacity of the other network slice subnet (i.e. the one deployed at the facility site #Y) accordingly.
  - This means that although the scaling out operation is triggered by the facility site #X, this operation needs to be propagated to the facility site #Y accordingly.

## 2.2 PoC Architecture

The PoC architecture is articulated around different components, including:

- Open Source MANO (OSM) [5]. It is an ETSI-hosted project that develops a community-driven, production-quality SO+NFVO stack for the telco cloud, capable of modelling and provisioning virtualized services following 'Network-as-a-Service' delivery model, including NFV network services and network slices. OSM architecture solution is built upon six principles: (i) unified northbound interface (SOL005-based), extended for slicing support; (ii) service-based management architecture, with a message bus for asynchronous communication between constituent services; (iii) lightweight lifecycle manager; (iv) common data base, time-series data base and object storage; (v) integrated components for policy, fault and performance management; (vi) complete control through CLI and stand-alone UI. A description on how OSM framework fits with ZSM reference framework can be found in ZSM004 [6], Annex B.
- Openslice [7]. It is a prototype open source, operation support system that provides cross-domain management capabilities, allowing interworking between the management and orchestration stacks from different 5G-VINNI facility sites. To that end, it makes use of TM Forum OpenAPIs together with some supporting services (e.g. authentication, logging, service registry, service order manager). Apart from allowing for request-response interactions between stacks from different sites, OpenSlice also facilitates interaction with the verticals in NSaaS scenarios. It exposes the 5G-VINNI facility to verticals as a unified service platform rather than an interconnection of individual administrative domains, hiding the mechanisms, protocols and technologies in every site for this end, thereby playing the role of 5G-VINNI portal (see Figure 2).

For the use case described in section 2.1.2, the PoC will consider two 5G-VINNI facility sites, each having a SO+NFVO stack. The selected 5G-VINNI facility sites are Madrid (Spain) and Patras (Greece), both using OSM on their administrative domains. The interactions among individual OSM-based SO+NFVO stacks (individual ZSM management domains) and the OpenSlice framework (ZSM E2E service management domain) in the present use case are captured in Figure 3.
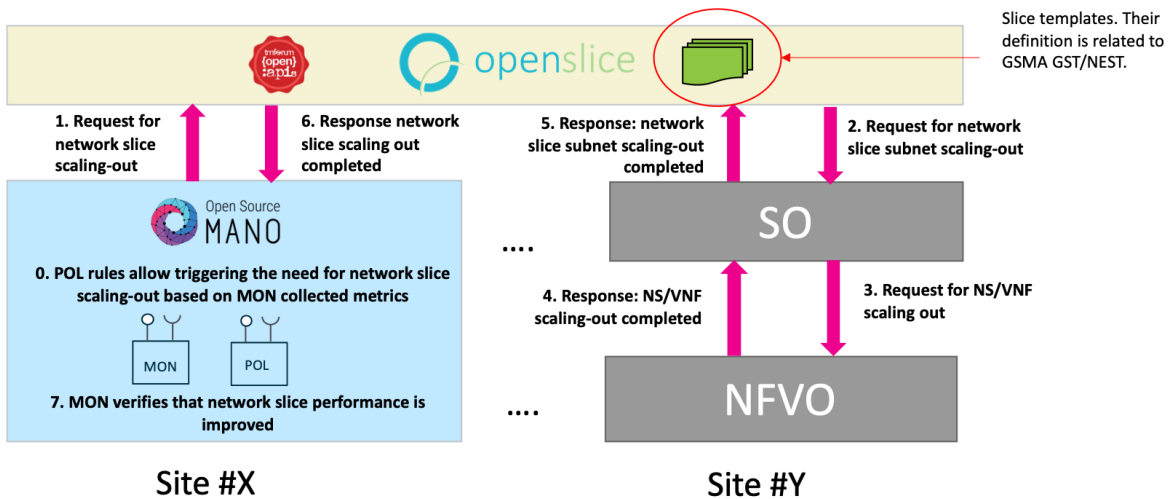
**Figure 3: PoC Architecture**

To enable automation in the scaling out operation, the use of the MON and POL modules are required.  For more information on these two OSM modules, please see [8].

## 2.3     Additional information

The references used throughout this document are listed below.

[1]        5G-VINNI project [Online]. Available: https://www.5g-vinni.eu/
[2]        ETSI GS ZSM 001: "Zero-touch network and Service Management (ZSM); Requirements based on documented scenarios"
[3]        GSMA PRD NG.116, "Generic Network Slice Template v3.0"
[4]        5G-VINNI Deliverable D3.1, "Specification of services delivered y each of the 5G-VINNI facilities" [Online]. Available: https://zenodo.org/record/3345612#.X70Chy-ZNTY
[5]        ETSI Open Source MANO (OSM) [Online]. Available: https://osm.etsi.org
[6]        ETSI GR ZSM 004: "Zero-touch network and Service Management (ZSM); Landscape"
[7]        Openslice project [Online]. Available: http://openslice.io
[8]        ETSI Open Source MANO (OSM): "OSM Autoscaling" [Online]. Available: https://osm.etsi.org/docs/user-guide/05-osm-usage.html#autoscaling