Multi-Domain Slice Provision and Federation in MEC and Telco Cloud environments

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<th>Participant No</th>
<th>Part. short name</th>
<th>Participant organization name</th>
<th>Country</th>
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<td>1 (Overall Co-ordinator)</td>
<td>UPC</td>
<td>Universitat Politècnica de Catalunya</td>
<td>Spain</td>
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<td>2</td>
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<td>3</td>
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<td>University of Macedonia</td>
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<td>6</td>
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The Journey

- Programmability
- Virtualization
- Automation
- Slicing
But, wait...., what is a **Slice**?
What do we mean by Network Slices?

**Network Slice** – A Network Slice is a managed group of subsets of resources, network functions / network virtual functions at the data, control, management/orchestration, and service planes at any given time. The behaviour of the network slice is realized via network slice instances (i.e. activated network slices, dynamically and non-disruptively re-provisioned). A network slice is programmable and has the ability to expose its capabilities.

→ A network slice supports at least one type of service.
→ A network slice may consist of cross-domain components from separate domains in the same or different administrations, or components applicable to the access network, transport network, core network, and edge networks.
→ A resource-only partition is one of the components of a Network Slice, however on its own does not fully represent a Network Slice.
→ Underlays / overlays supporting all services equally (‘best effort” support) are not fully representing a Network Slice.
Next Great Challenge: Multi-Domain Slicing

Current wholesale and interconnection services and mechanisms are not enough in the era of virtualization and programmability

- Vertical customers can request services that lay outside the footprint of their primary provider
  - How to resolve this?
- Dynamic and automated interaction with other providers are needed but ...
  - How we can charge and bill for that service?
  - How we can ensure SLAs among providers?
  - How we can know about the capabilities of other providers for e2e service provision?

![Diagram showing network provider interaction and service function]

- Resources (incl. SFs) need to be allocated for the new situation
- Proper Control and Mngmt Interfaces should be offered by the remote domain
- Need for scaling SFs in the origin domain
  - It could not be sufficient
Scope

- Cross-domain management of network slices in network infrastructure and service functions
NECOS Objectives

- Develop and experiment with Lightweight Slice Defined Cloud (LSDC)
- LSDC Key High Level Characteristics:
  - creating the Cloud Slice concept across all of resources in a set of federated data centres.
  - providing a uniform management of the currently separated computing, connectivity and storage resources.
- LSDC Key Enablers:
  - new service model – the Slice as a Service - dynamic mapping of service components to a slice.
  - easy reconfiguration and adaptation of logical resources in a cloud networking infrastructure (i.e. accommodate the QoS demand of the Slice).
  - managed via software for all aspect of the cloud environment – from the networking between virtual machines to the SLAs of the hosted applications.
  - use of the Slice as a Service concept for federation: ability for a specific cloud provider to federate his own infrastructure with other cloud providers with different configurations in order to realize virtualized services.
  - The main usage of LSDC platform and APIs: individuals seeking to create a Slice, or other cloud infrastructure providers seeking to form a federated virtual cloud in order to participate in the mechanisms to provide the Slice as a Service.
  - Develop and use two use cases (Telco Cloud and Mobile Edge Computing) to derive requirements for the design of the architecture and also to test the developed systems and to demonstrate the validity of the NECOS solution.
NECOS Use Cases and Scenarios

- Provider oriented
  - 5G Networks
  - vCPE

- End-user oriented
  - Touristic services
  - Emergency scenario
Types of Slices and Control Responsibilities

- **External / Tenant-managed Slices**
  - Tenant monitoring the slice and the services

- **External / Provider-managed Slices**
  - Provider monitoring the slice and tenants monitoring the services

- **Internal Slices**
  - Provider monitoring the slice and the services

Source: A Network Service Provider Perspective on Network Slicing. Luis M. Contreras and Diego R. López. IEEE Softwarization, January 2018
Slicing Models & Approaches

**Business (Application & Service) plane**

- **NFs**
- **L7 Apps**

**Control & Management plane**

- **Network Service Orchestration**
  - **Slicing**
    - Vertical Slicing
    - Service-based Slicing [Mode 3] [Service Slice aaS]
  - **Monitoring**

- **Network Resources**
  - **Slicing**
  - **VIM**
  - **VIM-dependent Slicing** [Mode 1] [Resource Slice aaS]

- **Compute Resources**
  - **Slicing**
  - **NIM**
  - **NIM-dependent Slicing** [Mode 2] [NFV aaS]

- **Service-based Slicing** [Mode 3] [Service Slice aaS]

**Infrastructure**

- **VIM-independent Slicing** [Mode 0] [Infrastructure Slice aaS] ("Bare-metal")
Why slice-ready federation is needed?

• Vertical customers can request **services** that lay **outside the footprint** of their **primary provider**

• Interaction with other providers are needed but ...
  – How we can **charge** and bill for that service?
  – How we can **ensure SLAs** among providers?
  – How we can **know about the capabilities** of other providers for a comprehensive e2e service provision?

• The current interconnection models is **not aware of peer’s** network **resources** (i.e., load conditions, etc)

• All these **environments are static**, requiring long interactions for setting up any inter-provider connection

• **Automation** for both the **interconnection** sessions and the **service deployment** on top of that is needed to reach the goal of **flexibility and dynamicity**
Size matters
Providers’ infrastructures are not ubiquitous

**Operation 1**

- EU – 80% of the nodes < 75 km
- Latam – 75% of the nodes < 200 km

**Operation 2**

**Operation 3**

Complementary cloud facilities are required to satisfy service needs
General Discussion, Q&A

http://www.h2020-necos.eu/