Supporting multi-domain resource orchestration in 5G networks

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One 5G Network – Multiple Industries

From dedicated physical networks with dedicated control and dedicated services and resources for different applications...

...to a “network factory” where resources and network functions are traded and provisioned: new infrastructures and services are “manufactured by SW”
• The slice concept as the basic building block
• An homogeneous infrastructure
  – Separating capacity (HW) and functionality (SW) => NFV
  – Programmable, recursive and composable control => SDN
• Software Networks are key to achieve it
Programmability Enabling 5G

Service Agility
Shorten the time for service creation and service adaptation (e.g., scaling).

Service Diversity
Share a single infrastructure among multiple services with wide range of requirements.

Resource Efficiency
Dynamically allocate the right amount of resources when and where needed.

Source: Ahmad Rostami at al. (Ericsson)
Recursion in Slicing
NFV: The Model and the Framework Architecture
Orchestration Layers

- Apply separation of concerns
- Incorporate WAN aspects
- Service logic
  - Tenant
- Resource allocation
  - Provider
- Facilitate resource sharing

• Virtualization
  - Tenant
• Resource orchestration
• Orchestration
  - Provider
• Facilitate resource sharing

Technology adapters

- Network Service Orchestrator (NSO)
- Resource Orchestration (aggregated virt res)
- Orchestration and Optimization (virt res)

Domain Spec. Adapt.
Multi-Provider NFVOs
Multi-Domain Use Cases

01. Connectivity
   - Consumer has access to connectivity
   - Transport Function

02. VNFAaaS
   - Consumer has access to the (V)NF
   - Application Function

03. SlaaS
   - Consumer has access to virtual infrastructure resources
   - 5G Slice
Multi-Provider Operation: SlaaS

- **Control plane**: Management and orchestration plane
- **Data plane**: (Legacy) Control plane
- **Network Controller**: VIM
- **Packet/Opto**: SDN
- **Legacy nets.**: Packet

**Recursion of the Resource Slice programming interface**

**Global information exchange**

**Request Resource Slice as a Service (SlaaS) with (SLA)**

**Program Resource Slice**

**Customer (Tenant)**

**Multi-provider Orchestrator Administration**

- **Administration A**
  - Operator A administration
- **Administration B**
  - Operator B administration
- **Administration C**
  - Operator C administration

**Resource Slice as a Service (SlaaS)**

1. **Operator A**
   - VIM
   - Network Controller
   - Customer

2. **Operator B**
   - VIM
   - Network Controller
   - Customer

3. **Operator C**
   - VIM
   - Network Controller
   - Customer

**Global information exchange**

**Recursion of the Resource Slice programming interface**

**Request Resource Slice as a Service (SlaaS) with (SLA)**

**Program Resource Slice**
Resource Slice Programming

Management and orchestration plane

Multi-provider Orchestrator Administration A

Multi-provider Orchestrator Administration B

Multi-provider Orchestrator Administration C

Customer (Tenant)

Request Resource Slice as a Service (SlaaS) with (SLA)

Program Resource Slice

Global information exchange

Data plane

SDN nets.

Legacy nets.

Packet/Opto

Network Controller

Datacenter

VNF

Operator A administration

Operator B administration

Operator C administration

Red VNF not used by the Customer

Red shared VNF used ALSO by the Customer

Customer’s dedicated VNF

Red IS the ONLY customer seen by Blue/Green

Global information exchange

Multi-provider Orchestrator Administration A

Multi-provider Orchestrator Administration B

Multi-provider Orchestrator Administration C

VIM

VNF

Network Controller

Datacenter

Packet

Program Resource Slice

Resource Slice Programming

Red VNF not used by the Customer

Red shared VNF used ALSO by the Customer

Customer’s dedicated VNF

Red IS the ONLY customer seen by Blue/Green
The Gatekeeper Approach

- Direct collaboration within the 5G PPP
- Relying on the need of NFV DevOps for a trustworthy service lifecycle
  - Accountability in all its aspects
- A mediation element enforcing policies set by the NSP is a feasible approach
  - In any collaboration scenario
- The gatekeeper can be applied not only to VNF and NS management
  - Slice support via horizontal and vertical recursion
The 5GEx Fact Sheet

- Enable business and technical cross-domain service orchestration over multiple administrations,
- Realize composite services by combining cross-domain network, computing and storage resources,
- Develop suitable business models for operators to optimally buy, sell, and integrate 5GEx services,
- Build and deploy a proof-of-concept system prototype, implementing the “Sandbox Exchange”,
- Contribute to relevant standard forums and Open Source communities.

http://www.5gex.eu
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