Architectural Cloud Enabled Models for Network Virtualization Environments

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The 5G Infrastructure Public Private Partnership

SESAME-*based* Special Session
Infocom World 2016, Athens, Greece
November 02, 2016

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UNIFY – Introduction

- UNIFY **targets** on:
  - **Sustainable** and **agile** solutions for handling the **current challenges** of mobile network.
  - Approach for **flexible service creation** within the **context** of ***unified Cloud and Carrier Networks.***

- UNIFY and **SDN technologies**:
  - The appearance of ***SDN*** and ***evolution*** of ***networking*** **enable a new control architecture and operation practices with fine granular control** *over advanced value-added services by the* ***service provider***.
  - **Service providers leverage these technologies** and **offer functionality** that previously provided by **over-the-top providers** (*e.g. content caching, multi tenancy virtual infrastructure*), or by **CPEs** (***firewall, NAT, parental control***) **as value-added services bound to the connectivity services.**

UNIFY - Conceptual Approach

- **UNIFY extends the virtualization layer of the network, *thus enabling a cloud environment across the whole telecom carrier field.***

- **UNIFY Framework** and **Principle idea of *"Service Chaining"***
  - **The basic idea of the *"Service Chaining"*** is that ***the network services can build blocks of clustered topologies which are chained across the unified infrastructure.***
  - **The UNIFY framework,** *by using "**Service Chaining**",* **controls the entire network starting at CPE up to the associated data-center entities** and, *thus*, **it enables the creation of service functions anywhere in the network** *where the* ***service provider*** *deems appropriate.*

UNIFY - Architectural Model (1/2)

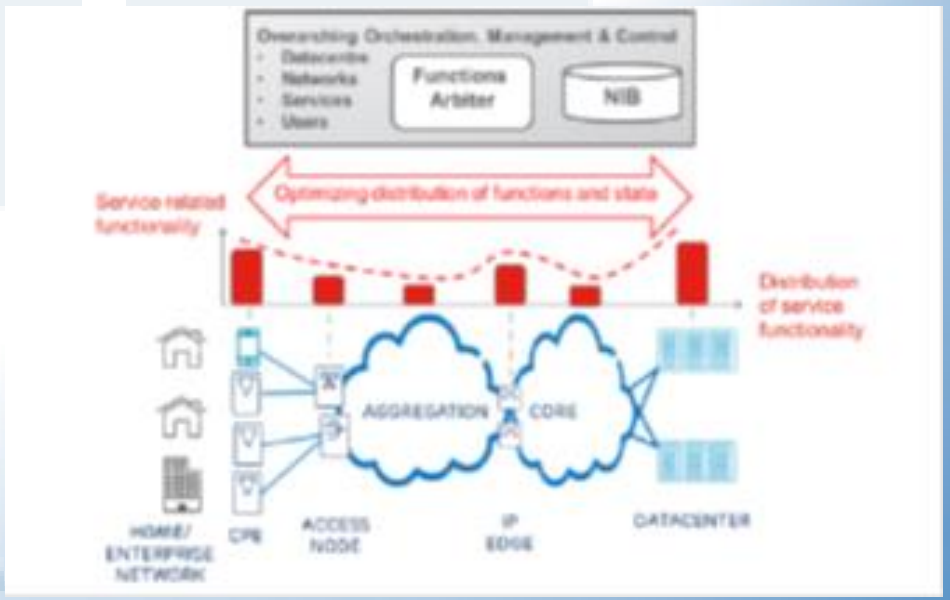
- **Architecture targets on:**
  - Lowering the technical entry barriers for **resources' sharing** and services of the **access /aggregation domain**.
    - This action includes a **variety of different services** starting from **the typical functions** of a transport network (*such as packet forwarding, etc.)* up to more **advanced services components** (e.g. *WAN optimizers, network address translation, performance-enhancing-proxies, firewalls, as well as application specific-gateways*).
  - **Instantiating of dynamically network functions and services as needed in centralized locations** like data centre **or distributed in the access/aggregation network domain,** even including customer premises equipment.
  - **Enabling sharing and scaling in/out of hardware resources**, **automation levels of network functions** and **management of their optimizations** as well as sophisticated control approach.
  - **Bringing** certain **services closer to the user**.

UNIFY - Architectural Model (2/2)

- **UNIFY addresses the flexibility and complexity of services by considering the entire network, *from home networks up to data centre, as a*** This **approach** opens the potential of ***virtual "unified production environment".***
- **Utilization, programmability/automation** to the **infrastructure** of the provider and guarantees an unprecedented level of **agility** for **network** operations and for deploying new, secure and **quality** of **experience** aware **services**, with **seamless instantiation** across the **entire infrastructures.**
  - This architectural approach constitutes a **service-*oriented* carrier-grade** for the **Future Internet (FI)** and **brings virtualized services** *in the most efficient, secure and quality-aware way to the end-users.*

UNIFY focuses on enablers of such unified production environment and develops an automated, dynamic service creation platform, leveraging a fine-granular service chaining architecture.

  - ***A service abstraction model and a proper service creation language will enable the dynamic and automatic placement of networking, computing and storage components across the infrastructure.***



SESAME – Introduction

- **SESAME project focuses on Small Cell-as-a-Service (SCaaS) virtualization concept**
  - **Leverage on the separation between traditional market roles**, *with the aim of making resources available through network virtualization.*

- **SESAME Concept and Benefits**
  - **Maximize the opportunities offered by opening small cells to multi-tenancy.**
    - *In opposition to the typical use case, where the mobile operators deploy their own network infrastructure in competition with others.*
  - **Operators can differentiate based on their service offers, rather than on network connectivity.**
  - **Operators can manage the dense of Small Cell network, including mitigating interference and assign resources dynamically.**
  - **The flexible and dynamic concept allows operators to reduce CAPEX and OPEX *as required in the next generation of mobile networks.***

SESAME – Small Cell coordination and multi – tenancy services

- ***SESAME virtualization approach***
  - **Enables network scalability** in terms of supporting a large number of mobile communications.
  - **Decouples control data planes** and **abstracts network functions** from the underlying physical infrastructure.
  - **Brings flexibility** and **efficiency** to radio and compute resources in Radio Access Network *(RAT evolution).*
  - **Develops** and **demonstrates** an **innovative architecture**, capable of providing small cells (SC) networks to multiple operators.
  - **Fosters** the concept of **logical partitioning** of the **SC network in multiple isolated slices**, **virtualizing** and **partitioning small cells capacity** to **multiple tenancy**.
  - **Allows** new **SC operators** (*companies, municipalities, etc*.) to **enter the value chain**, by deploying access infrastructure in specific high traffic demanding areas, and acting as neutral host providers, offering to mobile operators on-demand access to network resources.

SESAME – Design Principles

- **Mobile network operators (MNOs)** can succeed in a lower threshold cost, by combining own resources with outsourced access capacity and computing.
- **Virtual mobile network operators (VMNOs)** can make profit without having any physical infrastructure of wireless services.
- **Venue Owners,** as new market entrants, can benefit from becoming local network operators.
- **End Users** can enjoy personalised services, with superior quality of experience.
- In SESAME approach, **network virtualization requirements must be met** via efficient operation and management technologies, *which yield the following **benefits** to **mobile operators***:
  - *Network Scalability;*
  - *Network capacity;*
  - *Network flexibility;*
  - *Network Security;*
  - *Spectrum management, and;*
  - *Automated system management and configuration - Self-Organizing Network (SON)*

SESAME – Architecture (1/2)

High-Level Architecture

- **SESAME architecture is based on the concept of Cloud-Enabled Small Cell (CESC),** a new multi-operator enabled **small cells** (**SC**) that integrates a **virtualized execution platform** (**Light DC**) ***for deploying VNFs*****,** supporting **automated network management** and executing **novel applications and services** inside the access network infrastructure.
- **The CESC is composed of two co-located and network-connected physical devices:**
  - A ***Small Cell Physical Network Function (SC PNF),*** which implements the radio interface and main protocol aspects of the **LTE (H)eNB**.
  - A ***micro-server platform,*** which forms a node in the distributed **Light Data Centre.**

Functional Split in Small Cells

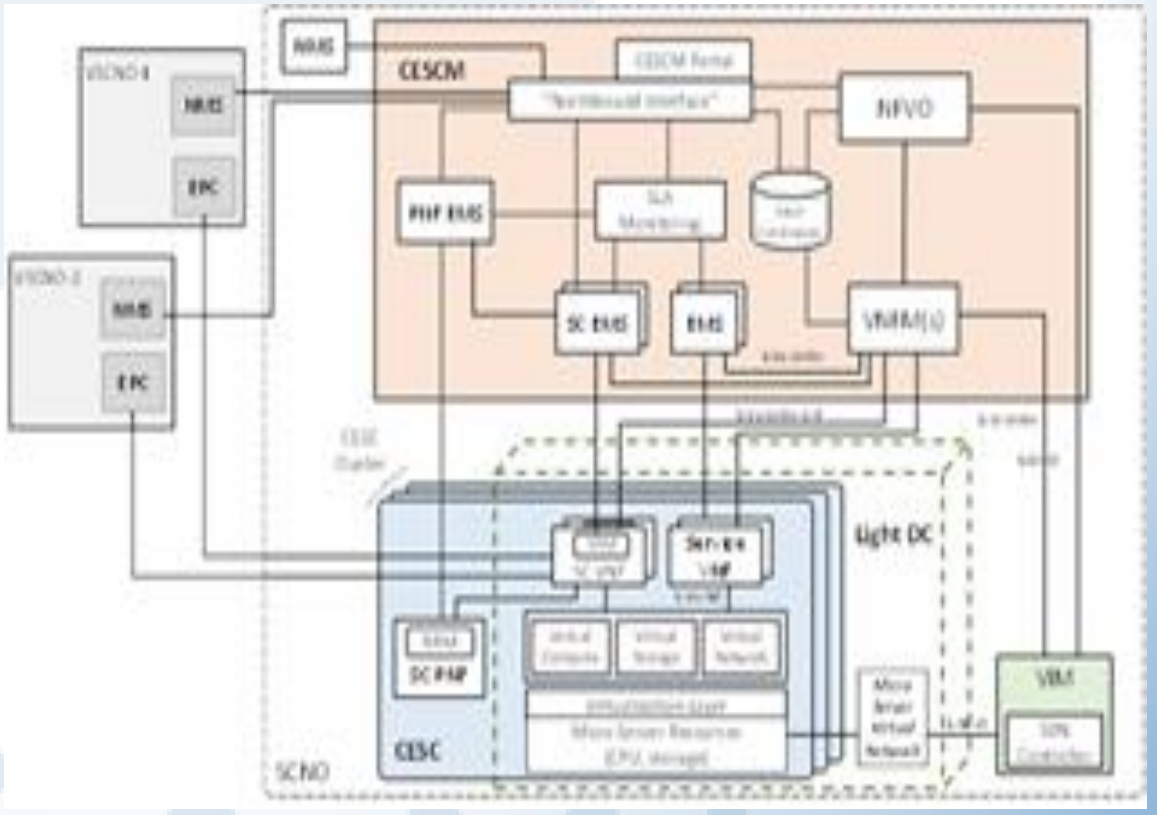
The **functional split** of SESAME project **divides small cell in two main blocks** and provides **several advantages** to mobile platform:

- ***Improving coordination*** *of the radio functions;*
- ***Enhancing scalability*** *of small cell deployments with simplified management;*
- ***Accelerating life-cycle upgrade****, enabling new features, and;*
- ***Flexibility*** *to optimally make the workload placement.*

SESAME – Architecture (2/2)

SESAME architecture:

*SESAME architecture features the Light Data Centre (**Light DC**), which is composed of the collection of **micro-servers** which form part of each CESC within a **CESC cluster**.*



- **The Light DC hosts the virtualization environment** for the Virtual Network Functions (**VNFs**) *which provide both per-operator network views of the small cells and the value-added service functions for those operators and their subscribers.*

UNIFY – SESAME Devolution (1/2)

UNIFY and SESAME extend virtualization and automation enabled approach in cloud environments across the telecom infrastructure.

Common aspects:

- **Architectural approach of both projects leverage network virtualization, *by using suitable network techniques:***
  - ***SDN*** *(OpenDayLight controller)*
  - ***NFV*** *approach and*
  - ***Cloud Computing***

- **Allow decoupling network services (NS) from the backhaul system and bring network functions (NFV) to the mobile edge** *by using cloud computing*.

UNIFY – SESAME Devolution (2/2)

Improvements:

- **SESAME decouples the network services from the backhaul, improving the networking and virtualization approach of the original UNIFY architecture implementation *with a new multi-operator enabled small cells (SC) and a virtualized execution platform (Light DC)* for deploying VNFs.**
  - *Automated network management.*
  - *Executing services in mobile network infrastructure.*

- **SESAME network enhancements over UNIFY:**
  - *Coordination on radio resources.*
  - *Service Chain functionality by SESAME Orchestrator.*
  - *Flexibility of mobile network deployments (Small Cells).*
  - *Scale in/out of the physical resources.*
  - *Enabling new features.*

Thank you for your attention!

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SESAME Project website:

http://www.sesame-h2020-5g-ppp.eu/