



# *Scenarios and Use Cases under the SESAME vision*

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The 5G Infrastructure Public Private Partnership

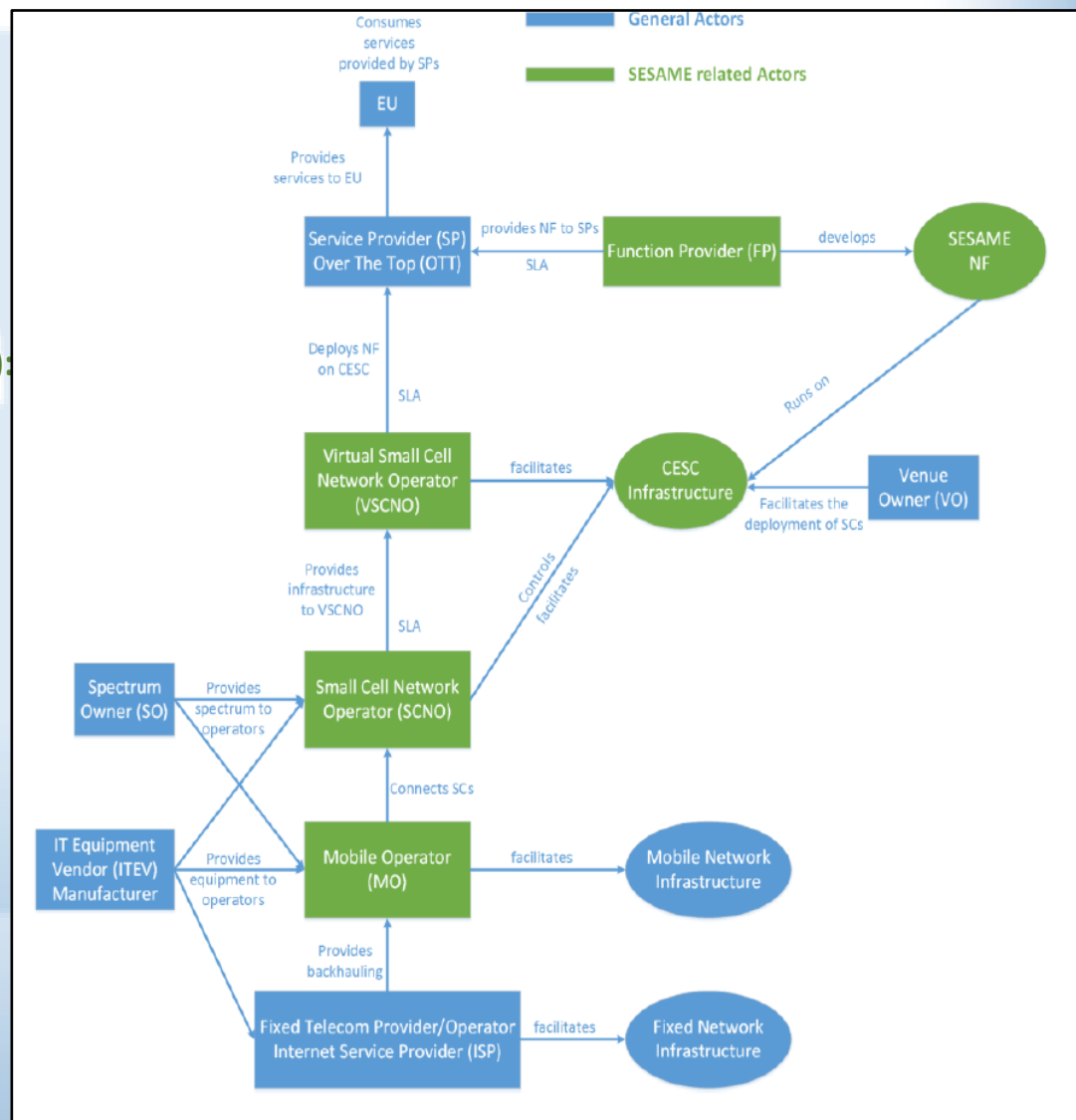


# Actor Description aligned with Architecture

- ❖ **Venue Owner (VO):** A mall or a stadium or an enterprise or a municipality, etc.
- ❖ **IT Equipment Vendor/manufacturer (ITEV):** Companies that develop and/or sell IT equipment.
- ❖ **Small Cell Network Operator (SCNO):** Companies/legal entities that possess the equipment so as to provide wireless communications services as well as to provide wireless access to end-users in wide areas, locally.
- ❖ **Virtual Small Cell Network Operator (VSCNO):** The term implicates companies/legal entities that do not possess the necessary equipment but lease it from another company/legal entity, so as to provide wireless communications services and deliver services to end-users.
- ❖ **Mobile Operator (MO):** The term implicates companies/legal entities that possess the equipment so as to provide wireless communications services and provide wireless access to end-users in wide areas.
- ❖ **Fixed Telecom Provider/Operator/Internet Service Provider (ISP):** The term implicates a provider of backhaul connection for the Small Cells.
- ❖ **Service Provider (SP):** An entity whose business is to provide telecom and other services to the end-user (corporate, residential or other).
- ❖ **Over-The-Top Player (OTT):** The term implicates third parties that produce, control and distribute services over the MNO (Mobile Network Operator) / VMNO (Virtual Mobile Network Operator).
- ❖ **Function Provider (FP):** The FP supplies virtual network appliances, gateways, proxies, firewalls, transcoders, etc., thus eliminating the need for the customer to acquire, install and maintain any kind of specialized hardware.
- ❖ **End-User (EU):** A person or an SME enjoying services through the SESAME network model.
- ❖ **Spectrum Owner (SO):** The company/legal entity that owns -or leases- spectrum for commercial exploitation purposes.

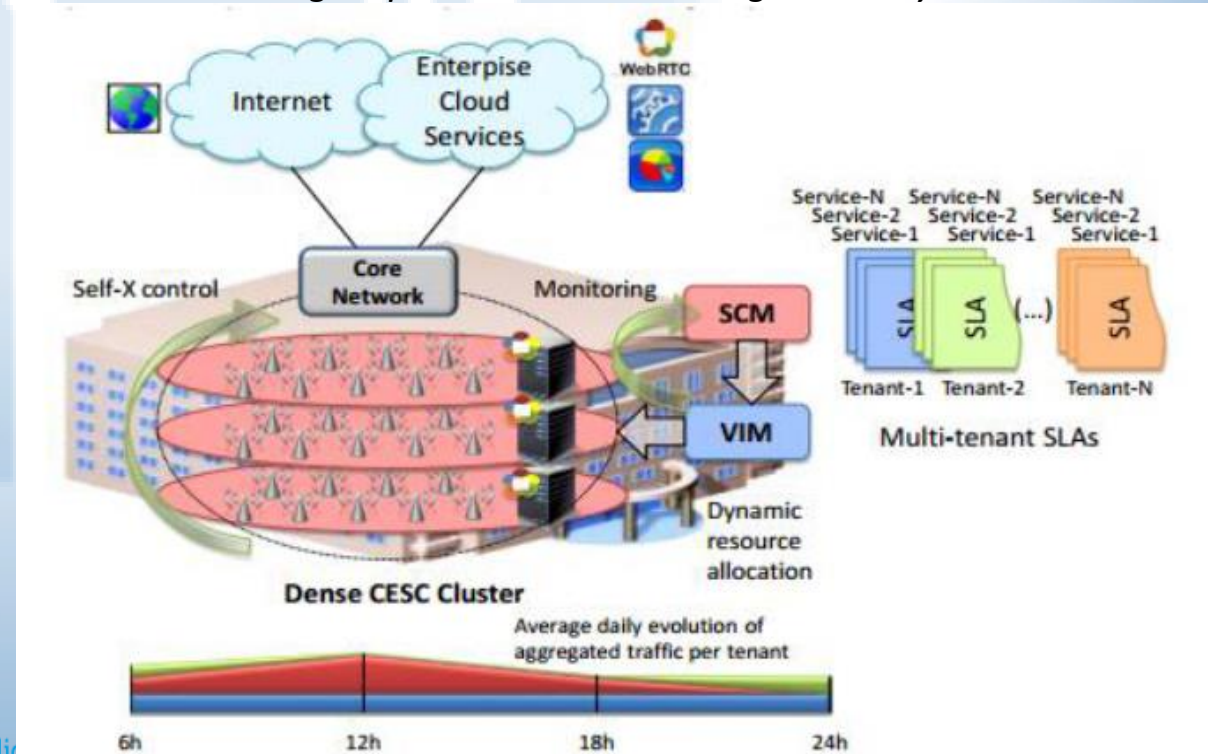
# Actor Interaction

- **End-Users (EU)**
- **Service Provider (SP) / Over-The-Top Player (OTT)**
- **Function Provider (FP):** The FP supplies virtual network appliances, gateways, proxies, firewalls, transcoders, etc.
- **Virtual Small Cell Network Operator (VSCNO):** The term implicates companies/legal entities that do not possess the equipment but lease it.
- **Small Cell Network Operator (SCNO):** A legal entity that provides the physical connection to Virtual Small Cells and CESC.
- **Mobile Operator (MO)**
- **Fixed Telecom Provider/Operator/Internet Service Provider (ISP)**
- **IT Equipment Vendor/manufacturer (ITEV)**
- **Spectrum Owner (SO)**
- **Venue Owner (VO).**



# Scenario 1: Enterprise Services in Multi-Tenant Large Business Centres

- ❖ One CESC provider owns, deploys and maintains the network infrastructure of Small Cells and of a Light DC, inside premises where different enterprises/legal entities are hosted.
- ❖ The CESC provider shall establish a Service Level Agreement (SLA) with each customer enterprise to enable enterprise users accessing different services such as:
  - Access to mail system and repositories
  - Web browsing and open and closed subscriber groups with embedded high security credentials.
  - Internet access
  - Voice communications
  - Video conferencing

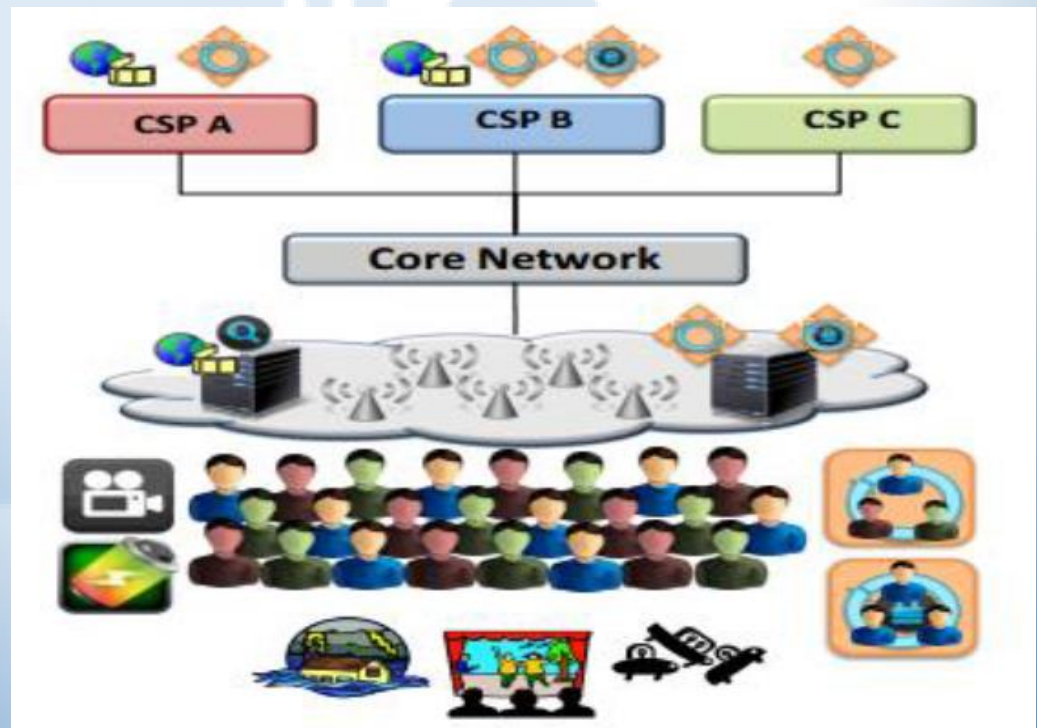






# Scenario 3: Service Provisioning in Flash Events

- ❖ This scenario aims to leverage the CESC cluster resources, which are essentially the collection of a number of CESCs (i.e., Small Cells with their micro-servers).
- ❖ Also, allows showing that **multi-tenancy can be considered as a built-in function of the system**. CESC infrastructure deployed by an infrastructure provider shall support different mobile operators in serving their customers. CESC cluster resources have to be provisioned to each tenant operator and, in order to efficiently handle the unexpectedly intense traffic generated by the users, self-organizing network techniques are required.



# Categorization of Use Cases

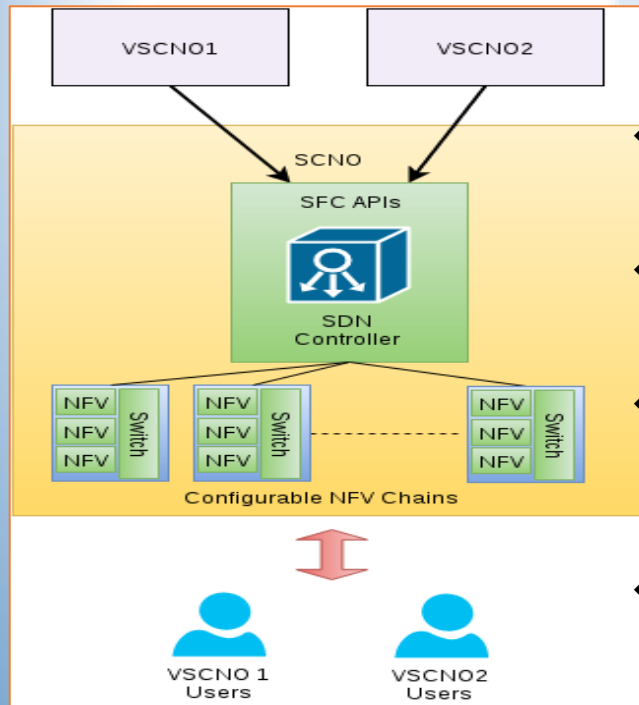
- ❖ **Residential:** This category includes small cells intended for home or small office applications.
- ❖ **Enterprise:** An Enterprise Small Cell deployment is described as generally indoor, premises-based deployment beyond home office, expectedly encompassing large geographic areas and high numbers of users.
- ❖ **Urban:** Urban small cells are defined as compact public-access base stations (BSs) deployed by operators to enhance capacity and coverage in dense environments such as city centre hot-zones, transportation hubs and retail.
- ❖ **Rural and remote:** Rural and remote small cells are oriented to “bring” mobile communication to hard-to-reach locations.

# SESAME Use-Cases

- #1** Service Function Chaining (SFC) in Multi-tenant and Multi-provider Network
- #2** Managing inter-tenant smart traffic classification and network optimization and intra-tenant service-aware routing, based on QoS differentiation
- #3** Optimized Radio Network Capacity Planning and Operation mechanisms of the Small Cell Network Operator
- #4** Multimedia services at the mobile edge and inter-operator edge caching
- #5** Sporadic Crowd Event
- #6** Blind Spot
- #7** SESAME Platform deployed for a moving hotspot
- #8** Wireless Critical Lifetime Communication
- #9** Communication in High-Density Areas
- #10** Indoor Small Cells
- #11** NF chaining for video conferencing service provisioning

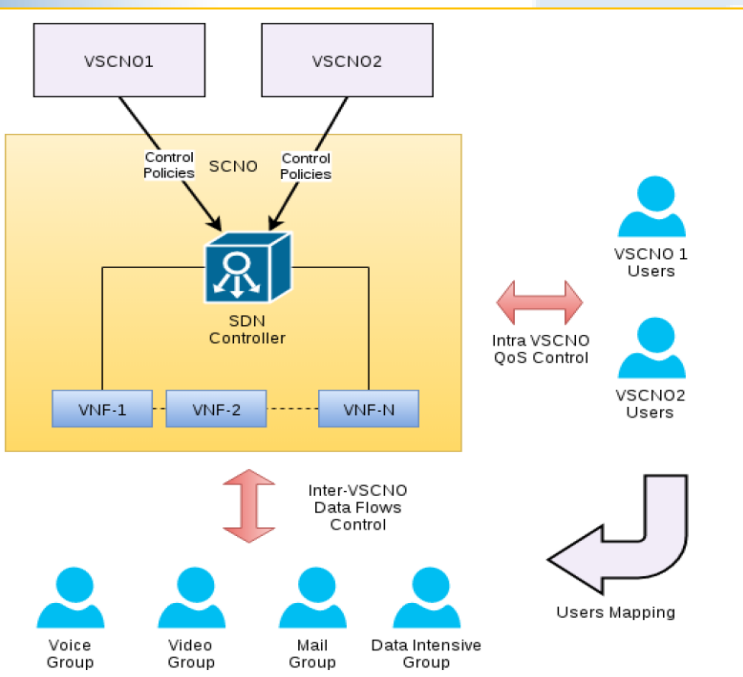


# Service Function Chaining (SFC) in Multi-tenant & Multi-provider Network



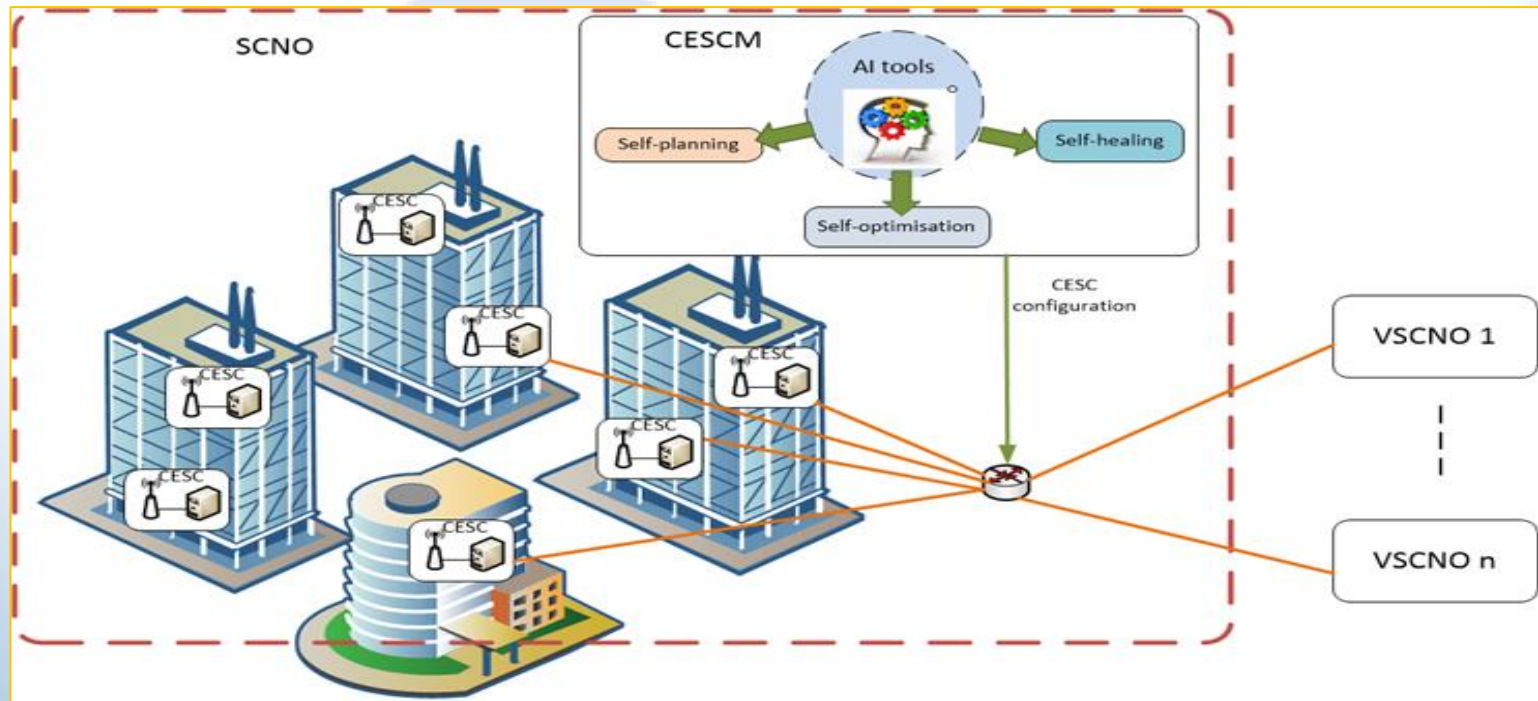
- ❖ A CESC provider is supporting two distinct mobile VSCNOs within its infrastructure (i.e.: VSCNO1 and VSCNO2)
- ❖ VSCNO1 and VSCNO2 “share” the infrastructure of the CESC and also serve their respective users (EU1, EU2)
- ❖ Mobile operators offer several NFVs (*e.g. load-balancer, HTTP proxy, firewall, NAT, DPI, data analytics, transcoding, traffic redirection, bandwidth management, etc.*)
- ❖ The CESC provider offers Service Function Chain for the different NFVs (*Service Functions (SF)*) as value-added service to VSCNO1 and VSCNO2
- ❖ Depending on the type of the service, the subscription model (*basic/premium users*) or the network specific requirements, the mobile providers VSCNO1 and VSCNO2 rely on the SF chains to offer several facilities (*e.g.: steer part of the traffic to specific applications, optimize service delivery, improve network performance, filter insecure traffic, ensure privacy, etc.*)

# Managing inter-tenant smart traffic classification and network optimization and intra-tenant service-aware routing, based on QoS differentiation



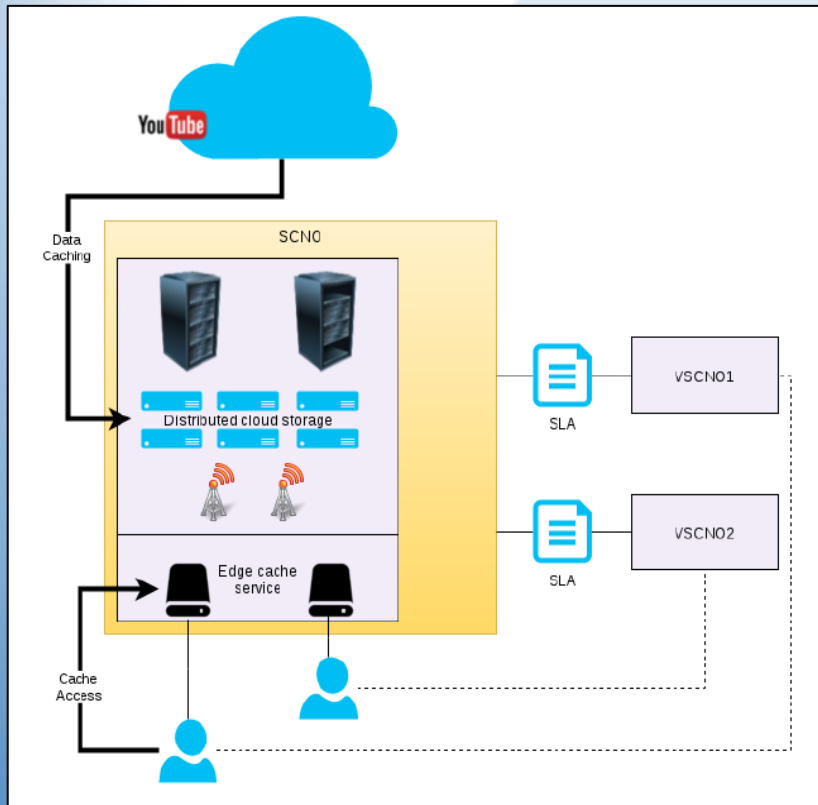
- ❖ An SCNO is supporting two distinct VSCNOs within its infrastructure (i.e.: VSCNO1 and VSCNO2)
- ❖ VSCNO1 and VSCNO2 “share” the infrastructure of the CESC and serve their respective users (EU1, EU2). The services for the users (EU1 and EU2 from the VSCNO1 and VSCNO2) are organised in tenant groups, depending on the various enterprises’ needs for service differentiation (*e.g.: real-time communication, voice, video-conferencing, mail clients, etc.*)
- ❖ The SCNO introduces SDN controller intercepting the communication from the two different VSCNOs in order to manage the network resources (VNFs), *by implementing smart traffic routing techniques to optimize network overheads and to increase network throughputs.* **The SDN Controller also executes QoS policies with the tenants to achieve assignment of resources in the most optimal way.**

# Optimized Radio Network Capacity Planning & Operation mechanisms of the Small Cell Network Operator



- ❖ An SCNO deploys a number of CESC and it uses these dedicated CESC to provide service to certain VSCNOs, properly “matching” their needs.
- ❖ The VSCNOs establish a set of SLAs with the SCNO, in order to deliver services to their end users through the CESC.

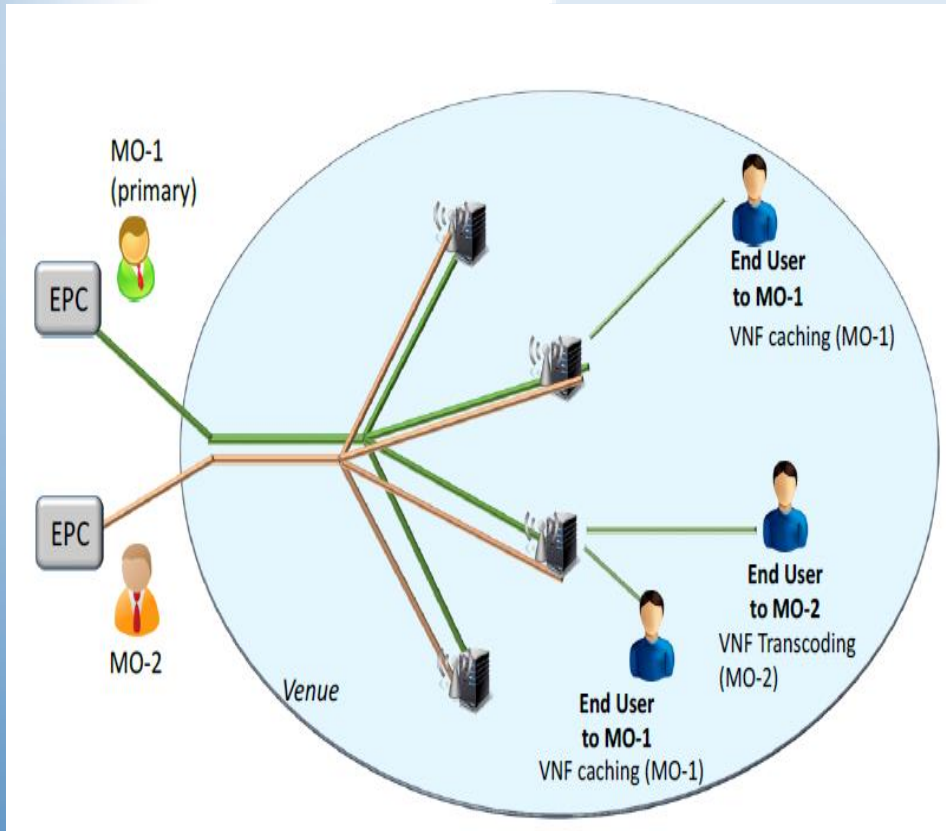
# Multimedia services at the mobile edge and inter-operator edge caching



- ❖ A SCNO supports two distinct VSCNOs
- ❖ The CESC is decentralized and offers edge services with low latency for the end-users
- ❖ VSCNO1 and VSCNO2 access the same content
- ❖ A distributed storage cache is implemented at CESC (cluster) and accessed by both VSCNOs
- ❖ After U1 of VSCNO1 has accessed content C1, user U2 of VSCNO2 tries to retrieve the same resource
- ❖ VSCNO2 looks-up the shared distributed cache and finds a valid reference to C1
- ❖ VSCNO2 offers C1 to U2 with high bandwidth and low latency over a local link (U2 request is terminated at the CESC)



# Sporadic Crowd Event

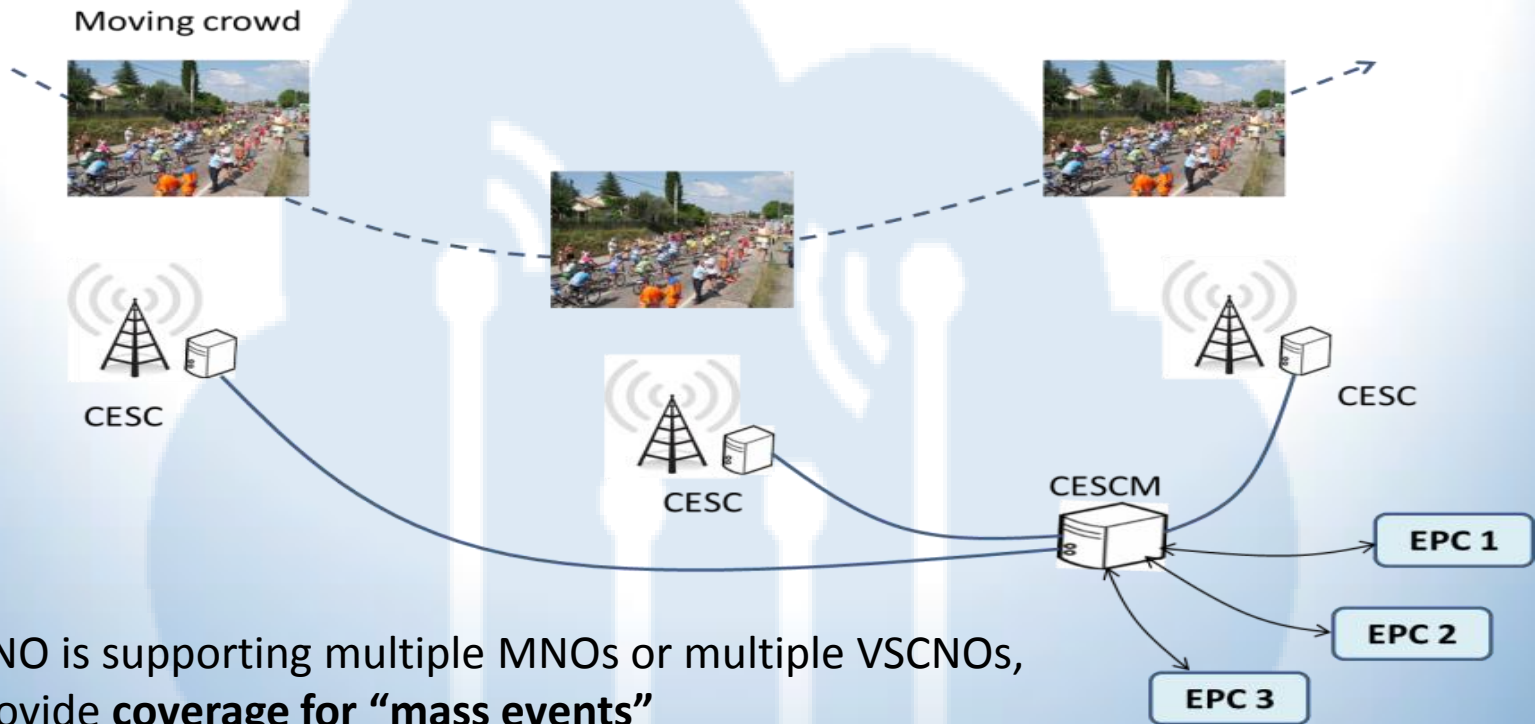


- ❖ Serving high density of users/visitors due to an “event” (*festival, concert, etc.*)
- ❖ The VO purchases CESC from the ITEV (*IT Equipment Vendor*) and installs them to the venue
- ❖ The SCNO asks the VO to lease space and install the CESC
- ❖ The VO -or SCNO- installs backhaul connection through an ISP and the equipment with the CESC and VIM

## ΟΜΙΛΟΣ ΕΤΑΙΡΕΙΩΝ



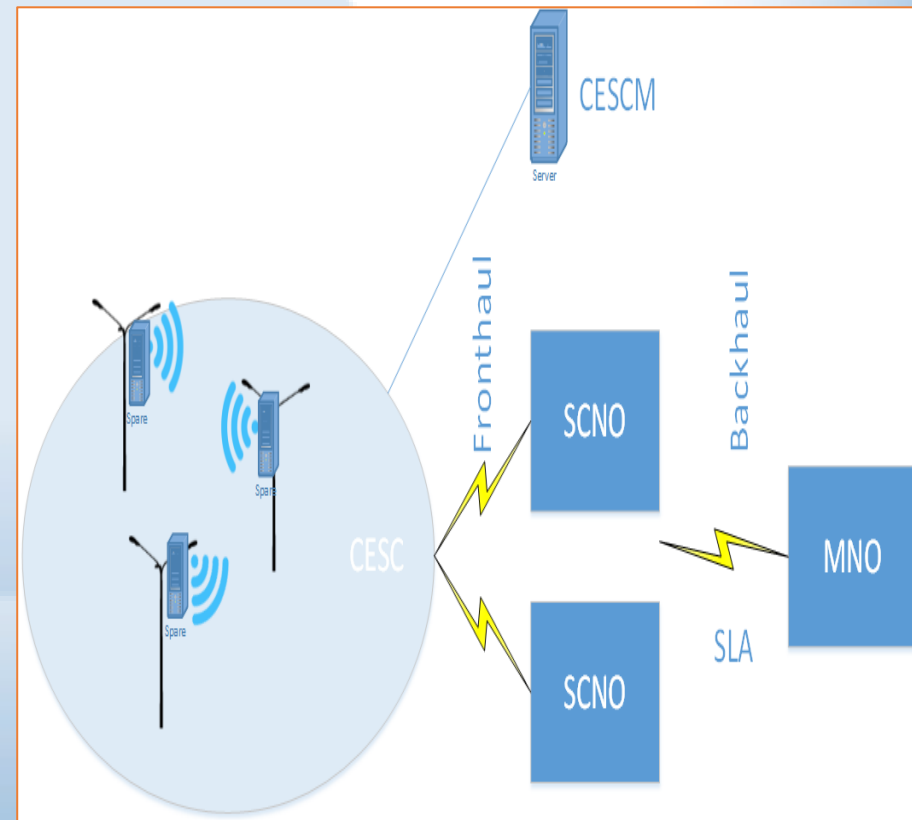
# SESAME Platform deployed for a moving hotspot



- ❖ A SCNO is supporting multiple MNOs or multiple VSCNOs, to provide **coverage for “mass events”** (e.g., walking demonstrations or cycling events)
- ❖ Remote applications are executed in CESC, **while the SCNO also offers MEC for low latency and compute intensive applications/ services.**

# Wireless Critical Lifetime Communication

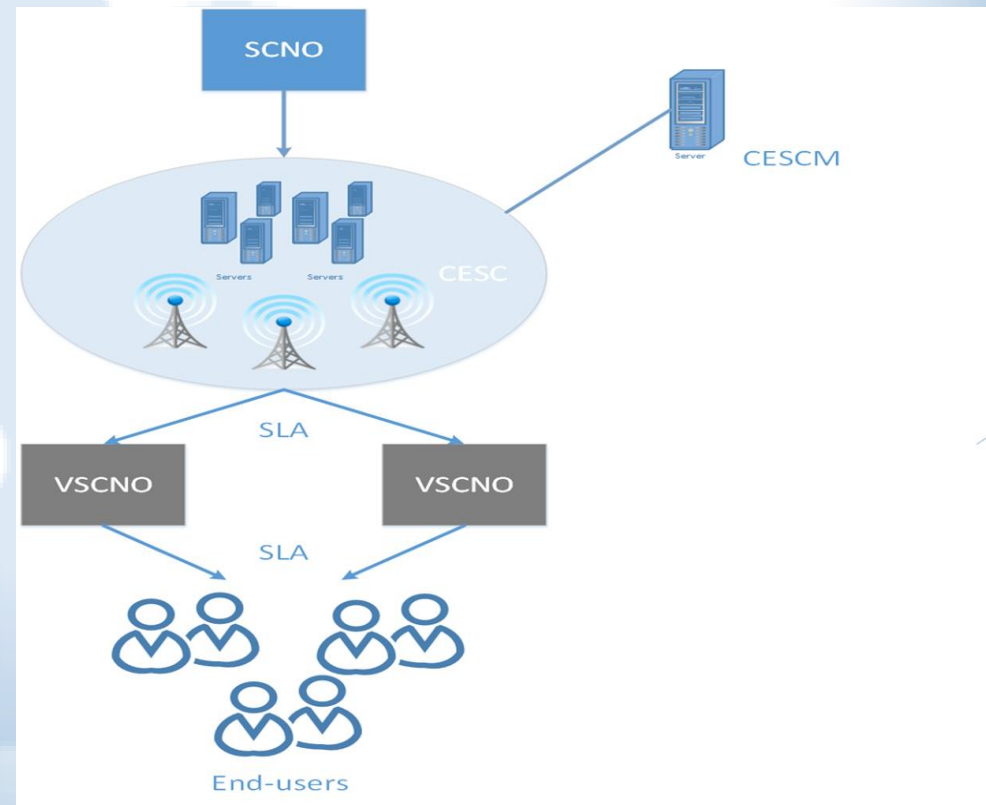
- ❖ **Provision of reliable communications after a natural disaster event.**
- ❖ Need for fast deployment while terminals must have as low power consumption as possible, to operate the longest possible time interval.
- ❖ Survivors and injured people should be able to announce their location, with high accuracy.



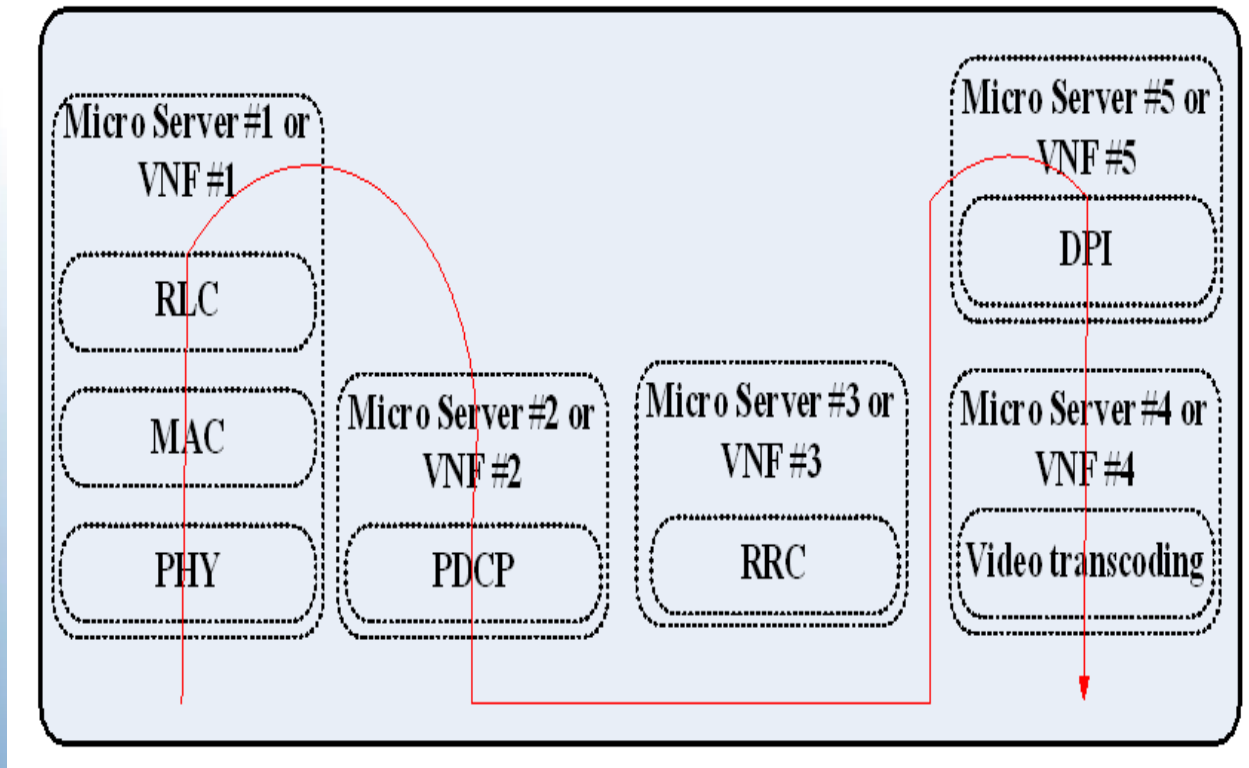


# Communication in High-Density Areas

- ❖ Examines the provision of services in “highly dense” areas.
- ❖ These areas are usually relative “small outdoor areas”, with different sizes, where a high number of people can be concentrated (e.g., a stadium or city squares)



# VNF chaining for video conferencing service provisioning

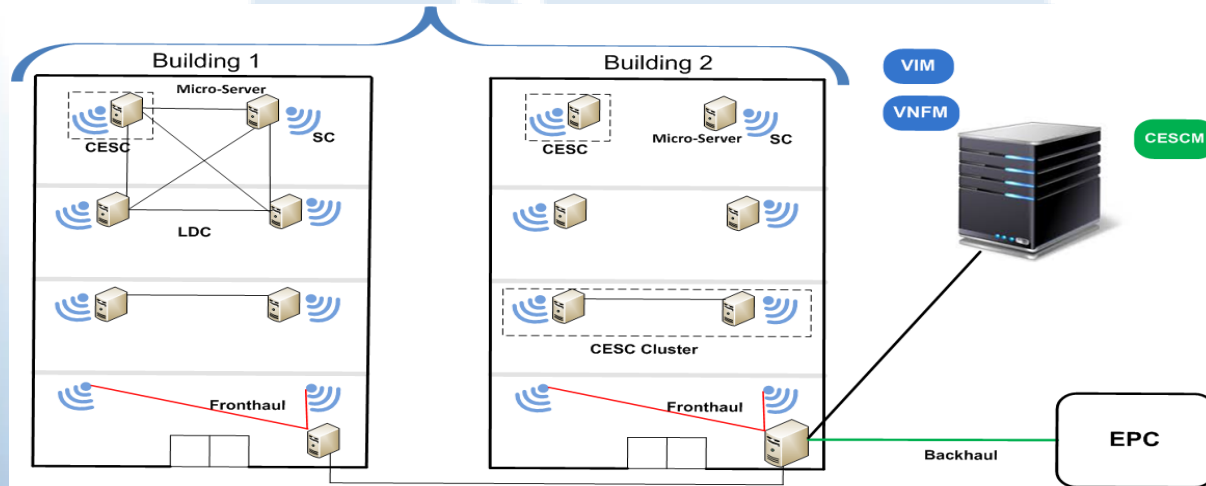


# Indoor Small Cells

## Indoor Small Cells

*Business Centre Small Cells*

*Hotel Wants Quality Cellular Service*



## Evaluation of Use Case

- ❖ CESC network capacity, data rate, delay and jitter and QoS related metrics
- ❖ Coverage area, blocking probability and signal-to-interference-plus-noise-ratio
- ❖ Multi-tenancy: i.e., via the inclusion of a number of supported tenants
- ❖ Dynamic load and orchestration of services to “match” depending on the size of the demonstrator
- ❖ Advantages from edge caching of contents

Thank you!

# Questions / Answers

## **For further information:**

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**SESAME Project website:**

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