

PROVIDING NETWORK OPERATOR MULTI-TENANCY AND EDGE CLOUD SERVICES USING SMALL CELLS

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TRENDS IN TELECOM ARENA

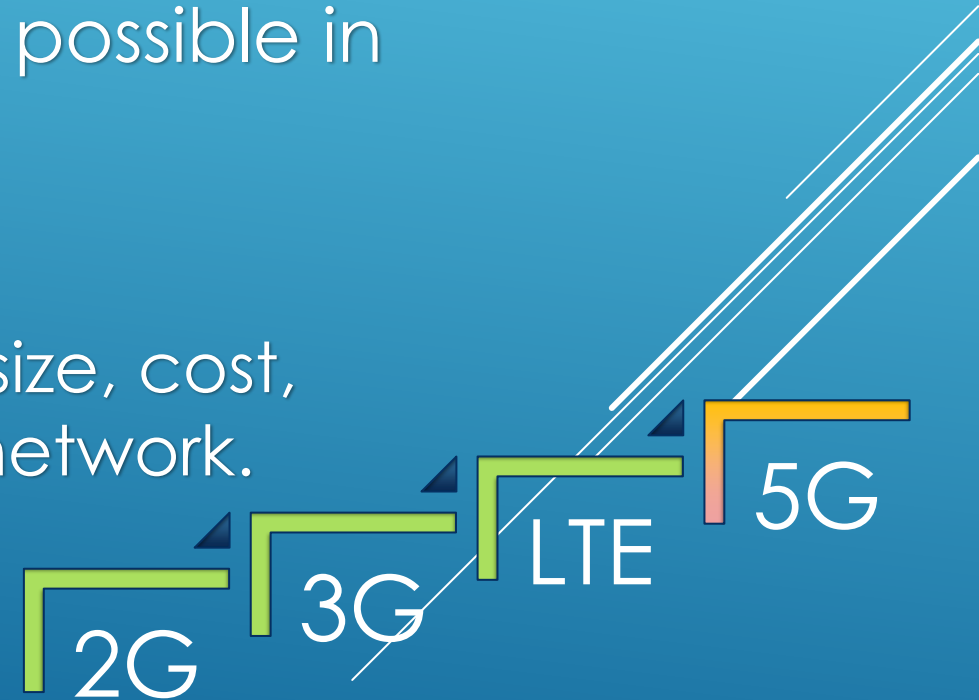
- ▶ Telecom companies try to monetize their infrastructure investments and to improve customers' experience
- ▶ Mobile network owners are scrambling to stay ahead of data demand

But

- ▶ Revenues are stagnating
- ▶ Mobile data traffic demands increases exponentially
- ▶ OTT players – video, audio, and other services, piggyback free on telecom systems

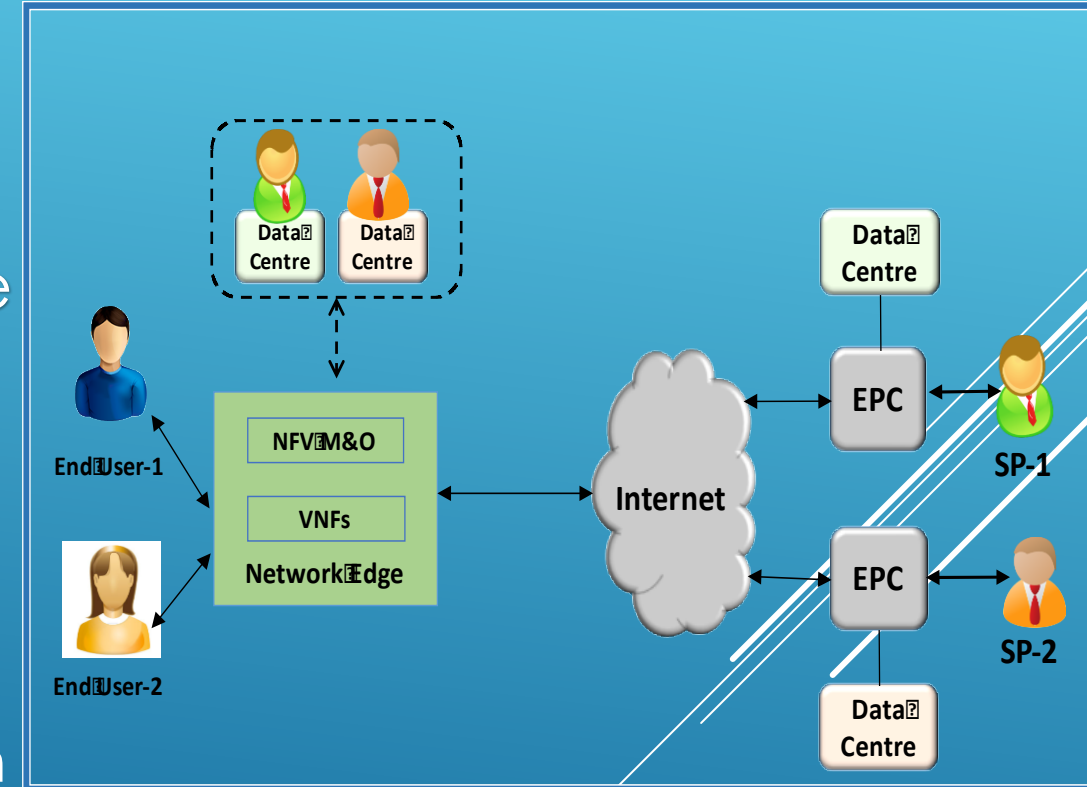
WHAT OPERATORS DO?

- ▶ They are scrambling to stay ahead of data demand
- ▶ Implement carrier aggregation, made possible in the 3GPP standards
- ▶ Employing network densification
 - ▶ and that means more environmental, size, cost, and power considerations across the network.
- ▶ Re-farm spectrum as fast as they can



MOBILE EDGE COMPUTING

- ▶ Offers application developers and content providers cloud-computing capabilities and an IT service environment at the 'edge'.
- ▶ The Cloud is co-located with or very near the access network
- ▶ Delivering unique services to the application level
 - ▶ Ultra low latency
 - ▶ Rich user context
 - ▶ Real-time access to radio network information
 - ▶ High bandwidth
 - ▶ Location awareness



A KEY TECHNOLOGY ENABLER FOR 5G

5G Use Cases Families and Related Examples
complemented by SDN/NFV

Increased
BW

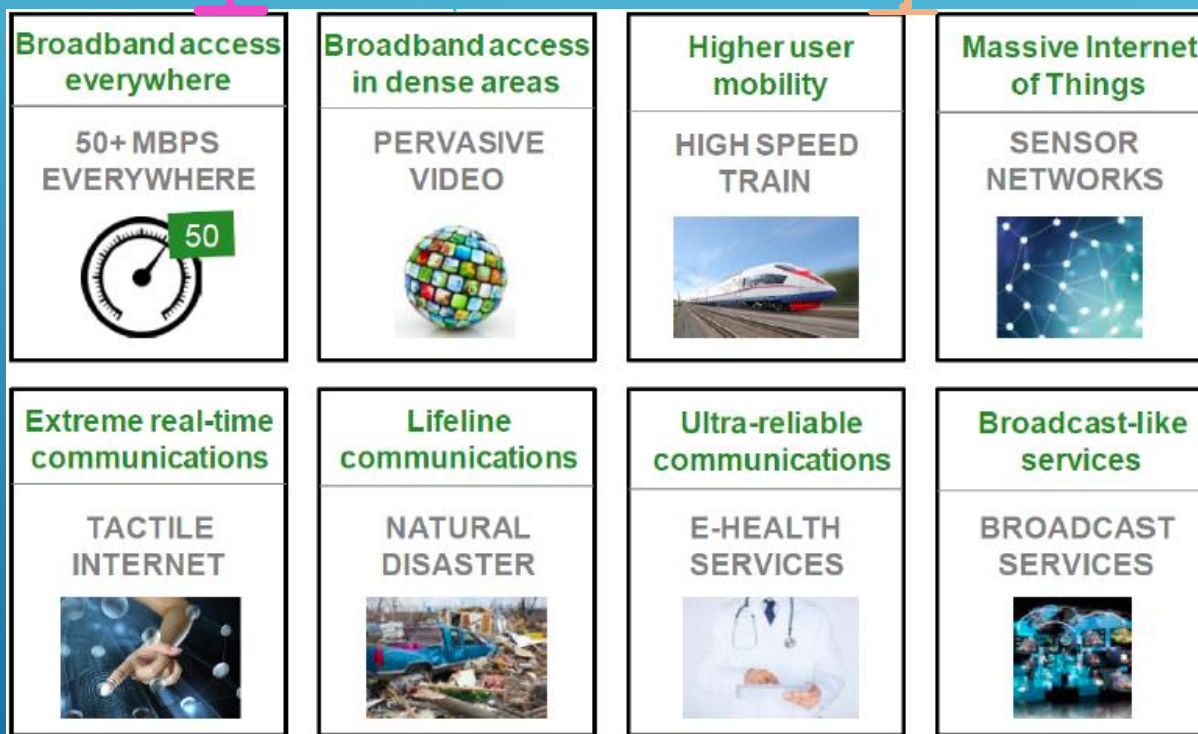
IoT analytics
via cloud
networks

- Backhaul and Transport savings (up to 35%)
- Improved QoE (20% improvement for loading a Web page)

- Dynamic Content Optimization based on real-time radio conditions or other factors
- Improved video quality and throughput

Enabled by
MEC

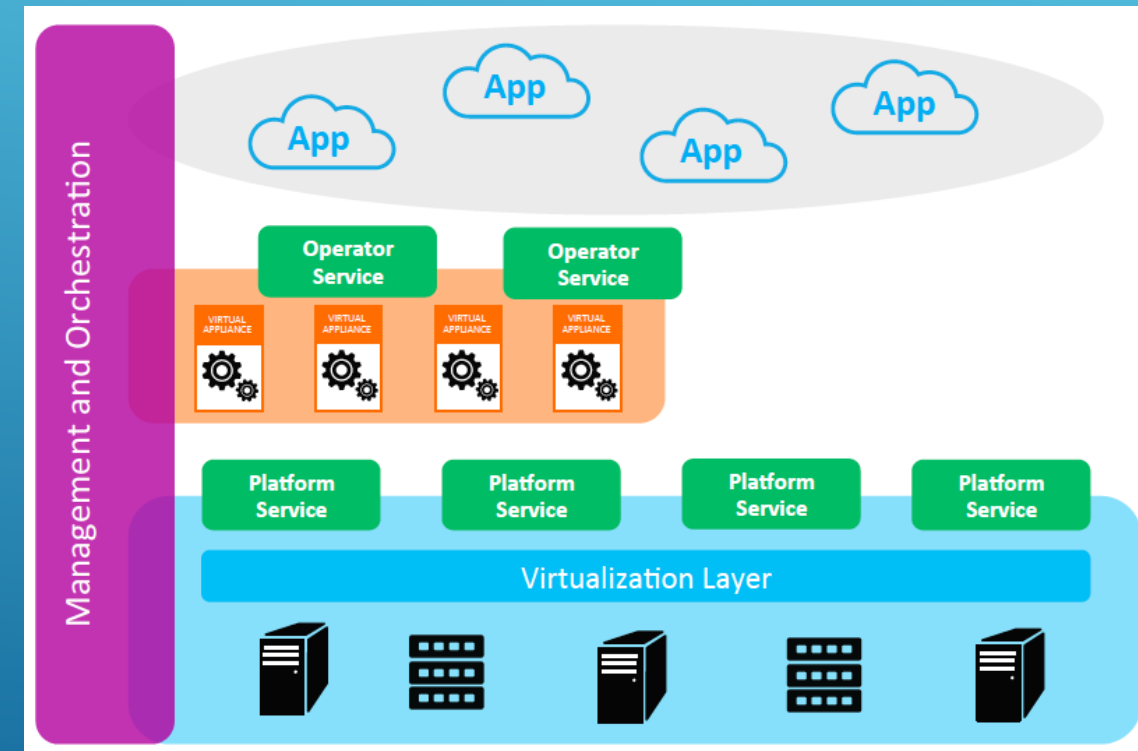
Efficiency
through the
enabled
services



A COMPLEX ECOSYSTEM

With beneficiaries at all levels...

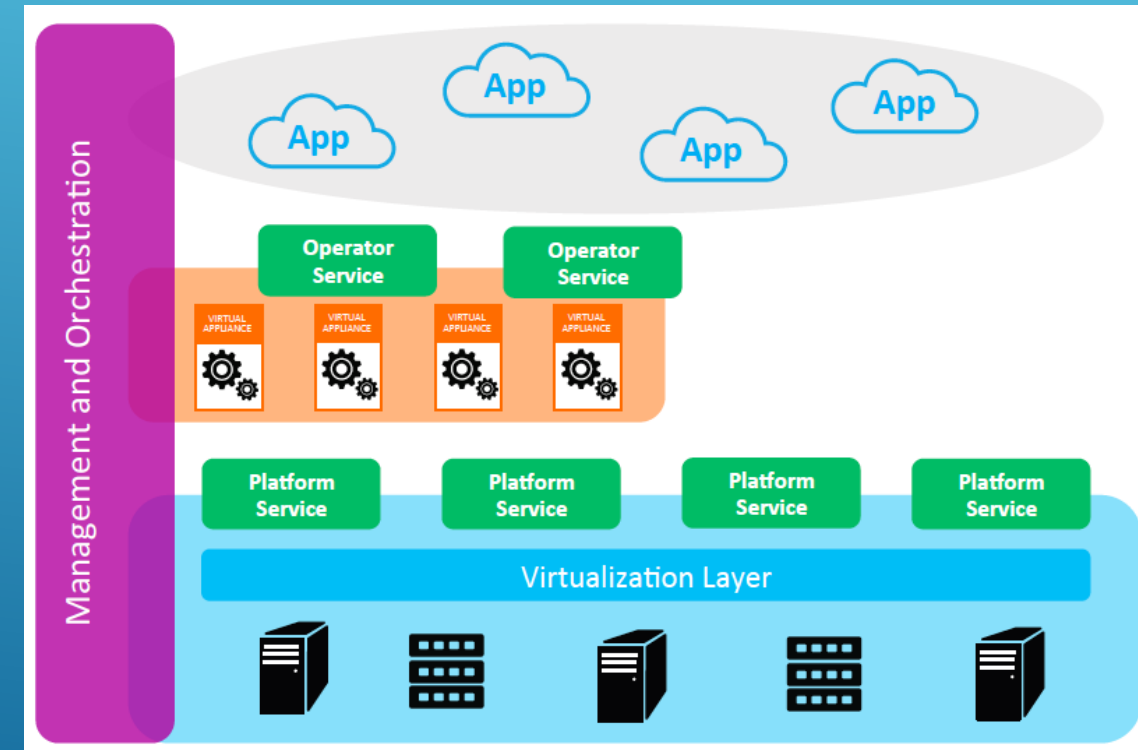
- ▶ Mobile operators, applications providers, application developers, content providers, OTT players, network equipment vendors, IT and middleware vendors can benefit from greater cooperation
- ▶ **Operators**
 - ▶ Optimize operations by deploying key functionalities at the edge and taking advantage of MEC services
 - ▶ Supplement standard MEC services with operator-specific value add services



A COMPLEX ECOSYSTEM

► 3rd party Application Providers

- Operators can open their Radio Access Network (RAN) edge to authorized third-parties, allowing them to flexibly and rapidly deploy innovative applications and services
- Deploy applications at the edge to benefit from low latency, high bandwidth, context, etc.
- New innovative applications and services towards mobile subscribers, enterprises and vertical segments



H2020 5G-PPP SESAME PROJECT

- ▶ Placement of network intelligence and applications in the network edge through NFV and Edge Cloud Computing.
- ▶ Consolidation of multi-tenancy in communications infrastructures. Allow several operators/service providers to engage in new sharing models of both access capacity and edge computing capabilities.
- ▶ Small Cells' evolution is already mainstream in 4G, but expected to deliver its full potential in the challenging dense deployment 5G scenarios.

OVERVIEW

SESAME proposes the Cloud-Enabled Small Cell (CESC) concept

CESC: a single device that

- ▶ is able to accommodate multiple operators/'tenants' in offering network capacity resources into logically isolated 'slices'
- ▶ provides a virtualized execution infrastructure, i.e. a Light DC at the edge of the network
- ▶ be offered on-demand to CSPs/VNOs

AREAS IN SCOPE

- ▶ **Small Cells:**

- ▶ Radio Architecture: MOCN
- ▶ Deploy virtualized infrastructure through HW acceleration (non x86 processors)

- ▶ **New network orchestration perspectives** in the 5G framework

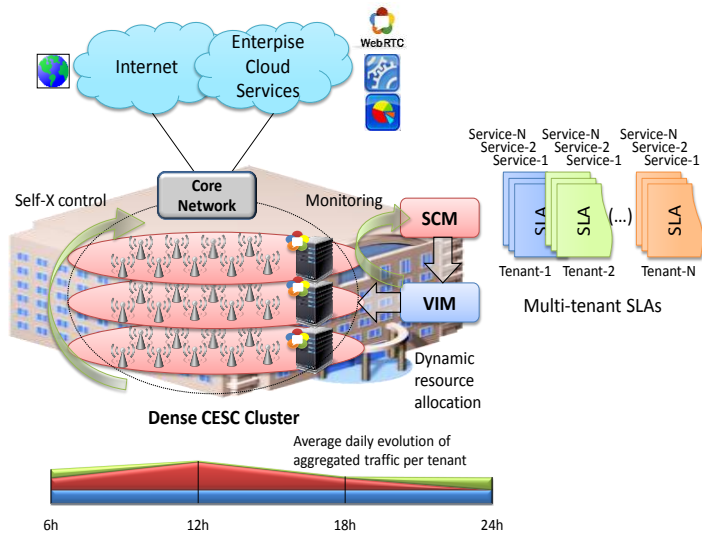
- ▶ **Network Function Virtualisation for Multi-tenancy & Network Management**

- ▶ **Self-x Features:** self-organizing, self-optimizing, self-healing, etc.

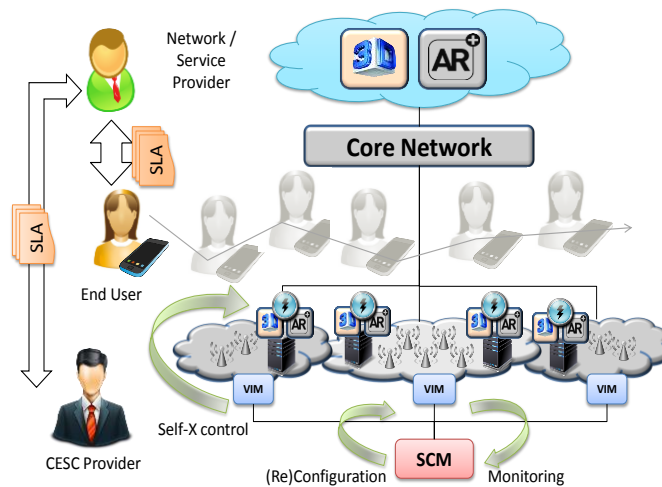
- ▶ **Cloud technologies:** execute novel applications and services inside the access network infrastructure

TARGET SCENARIOS IN BRIEF

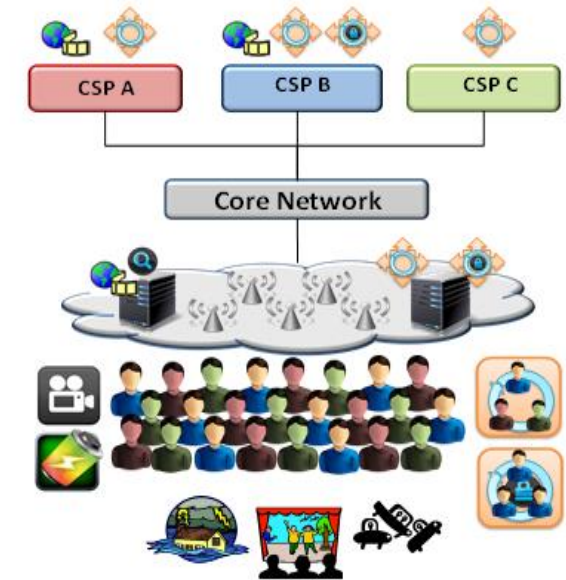
Multi-tenancy at medium-scale venues



Enhanced mobility support

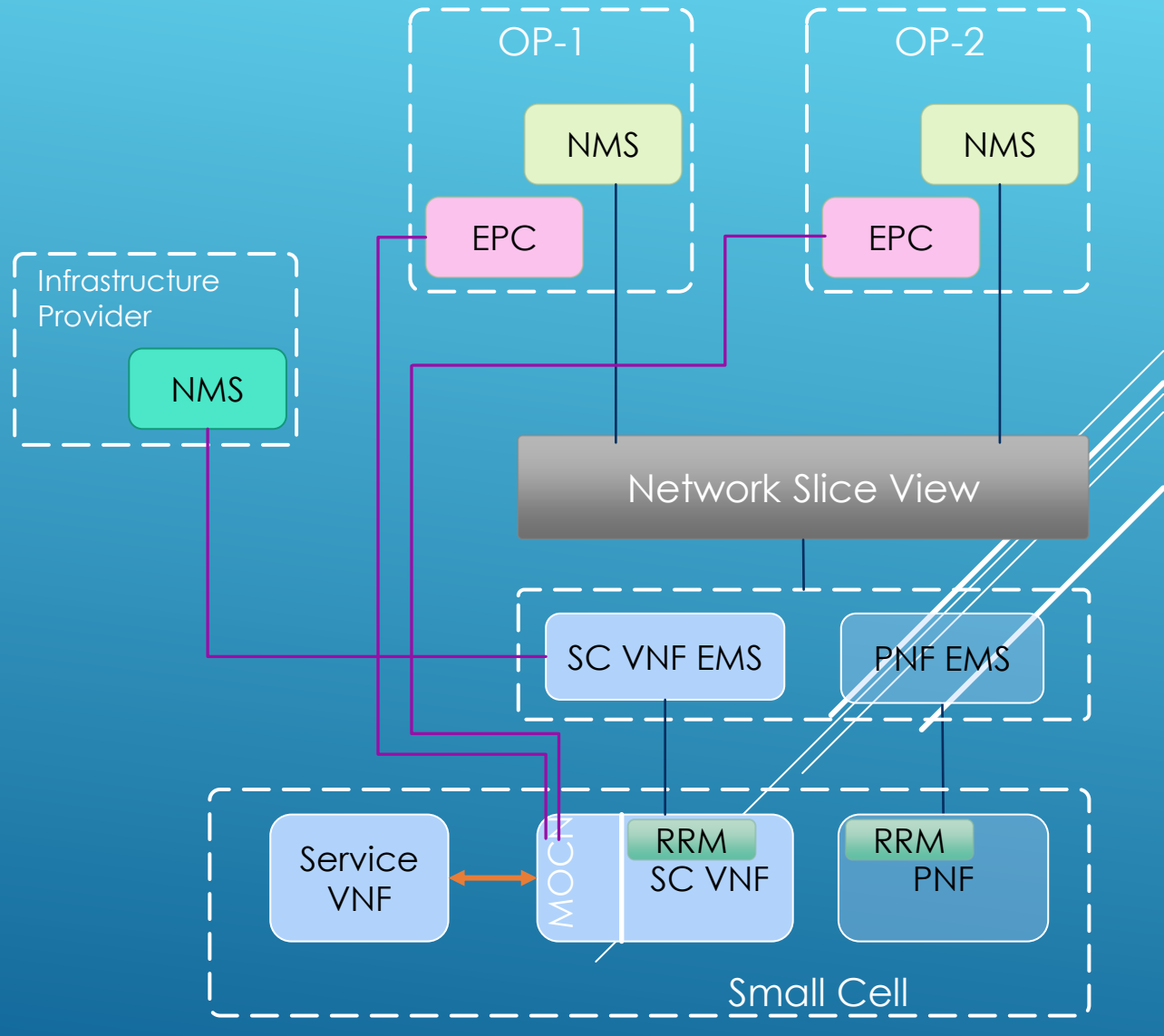


Flash Crowd events

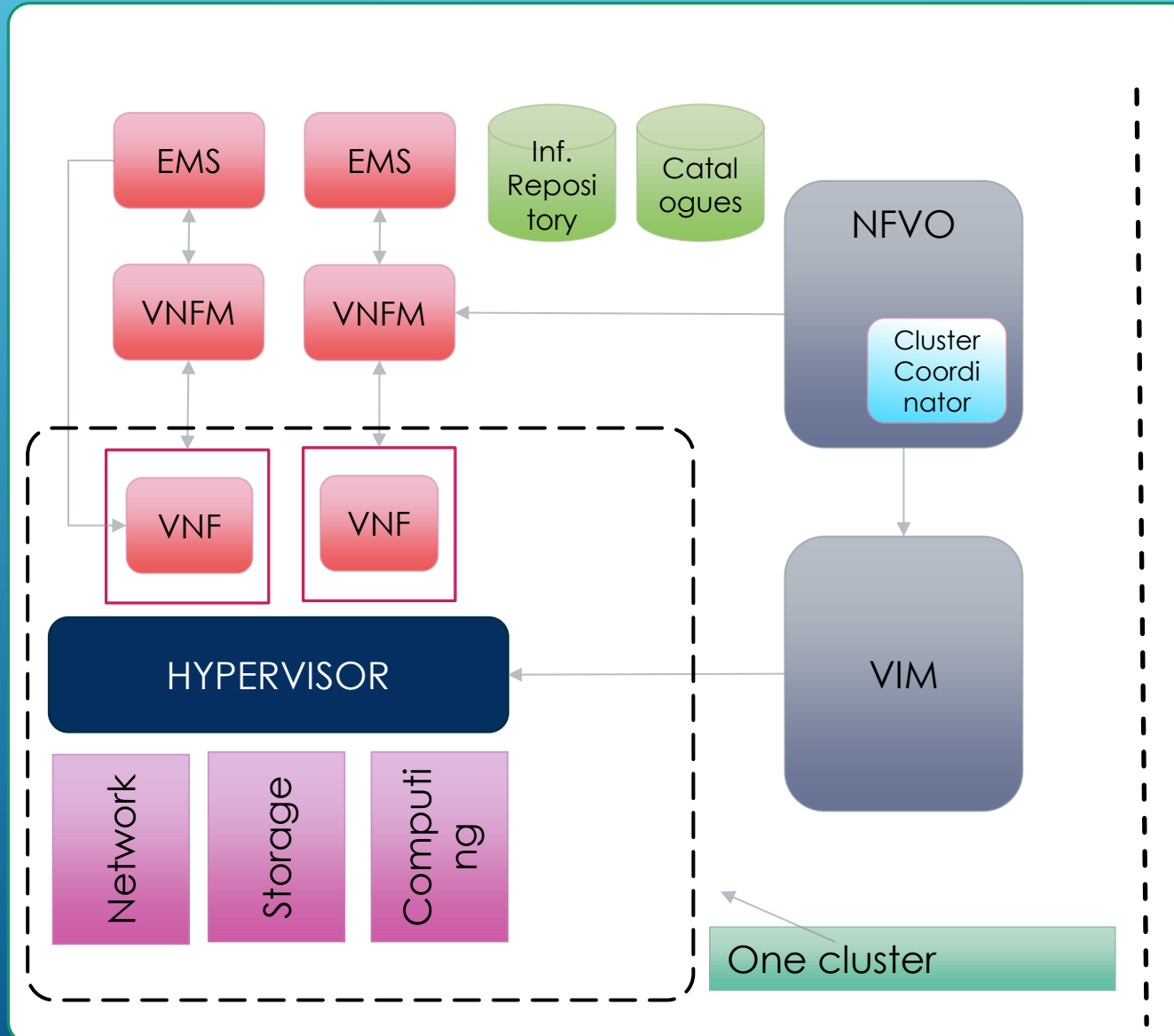


LTE WORLD

- A Small Cell network capable to support more than one network operator is envisaged.
- 3GPP specifications have already added some support for Radio Access Network (RAN) sharing and Multi-Operator Core Network (MOCN), where the shared RAN is directly connected to each of the multiple operator's core networks, has been identified as the exclusive enabler for multitenancy features in SESAME platform.
- The infrastructure consists of a number of Small Cells and the corresponding SC network functions such as gateways and management systems.

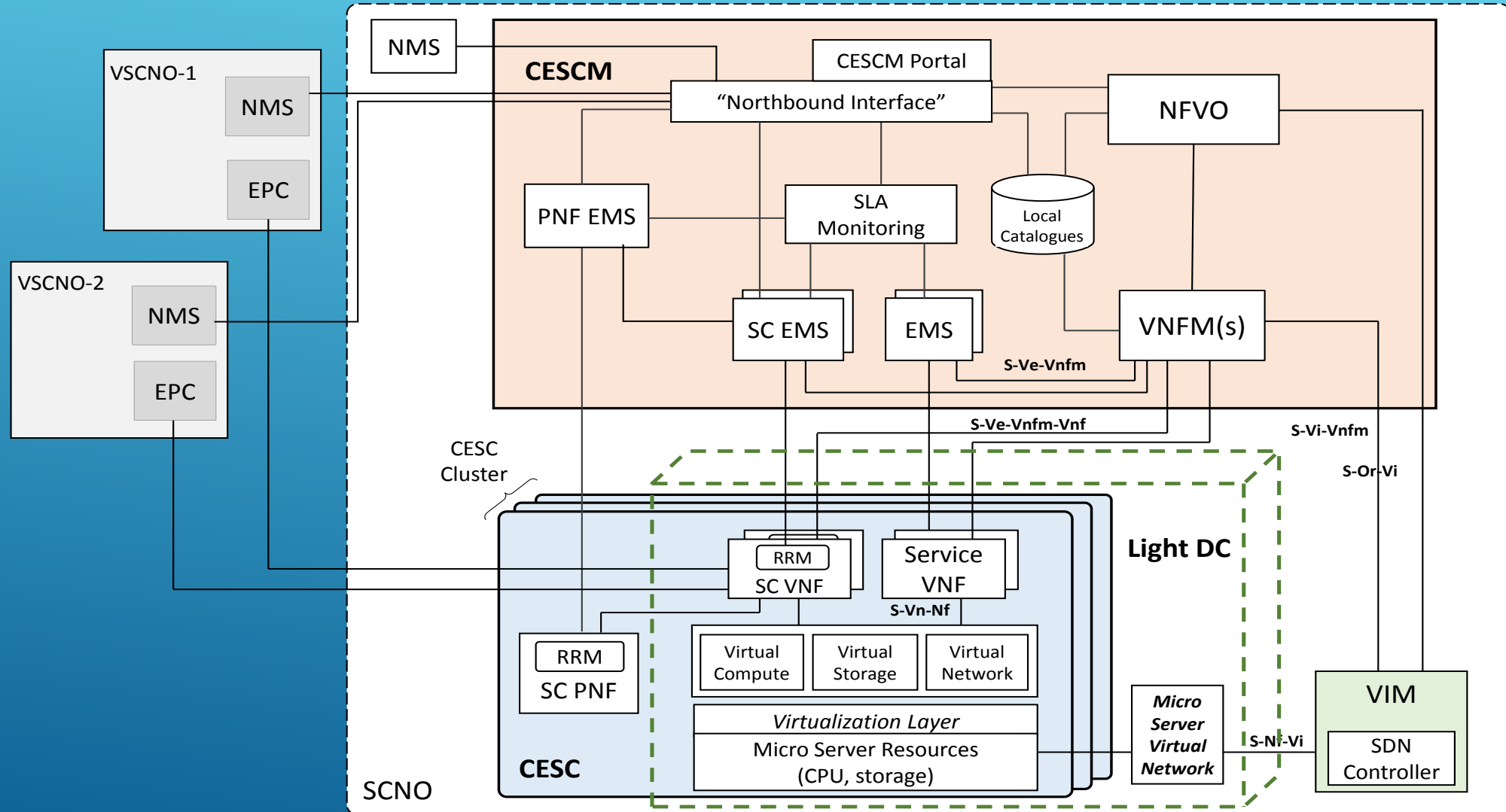


NFV WORLD



- The NFV concept is going to be used as an enabler that will offer a virtualisation platform and meet the requirements of SESAME, namely NFV-driven small cell functions and NFV-based network services.
- The figure presents the MANO framework for the NFV part.

COMBINED – SESAME ARCHITECTURE

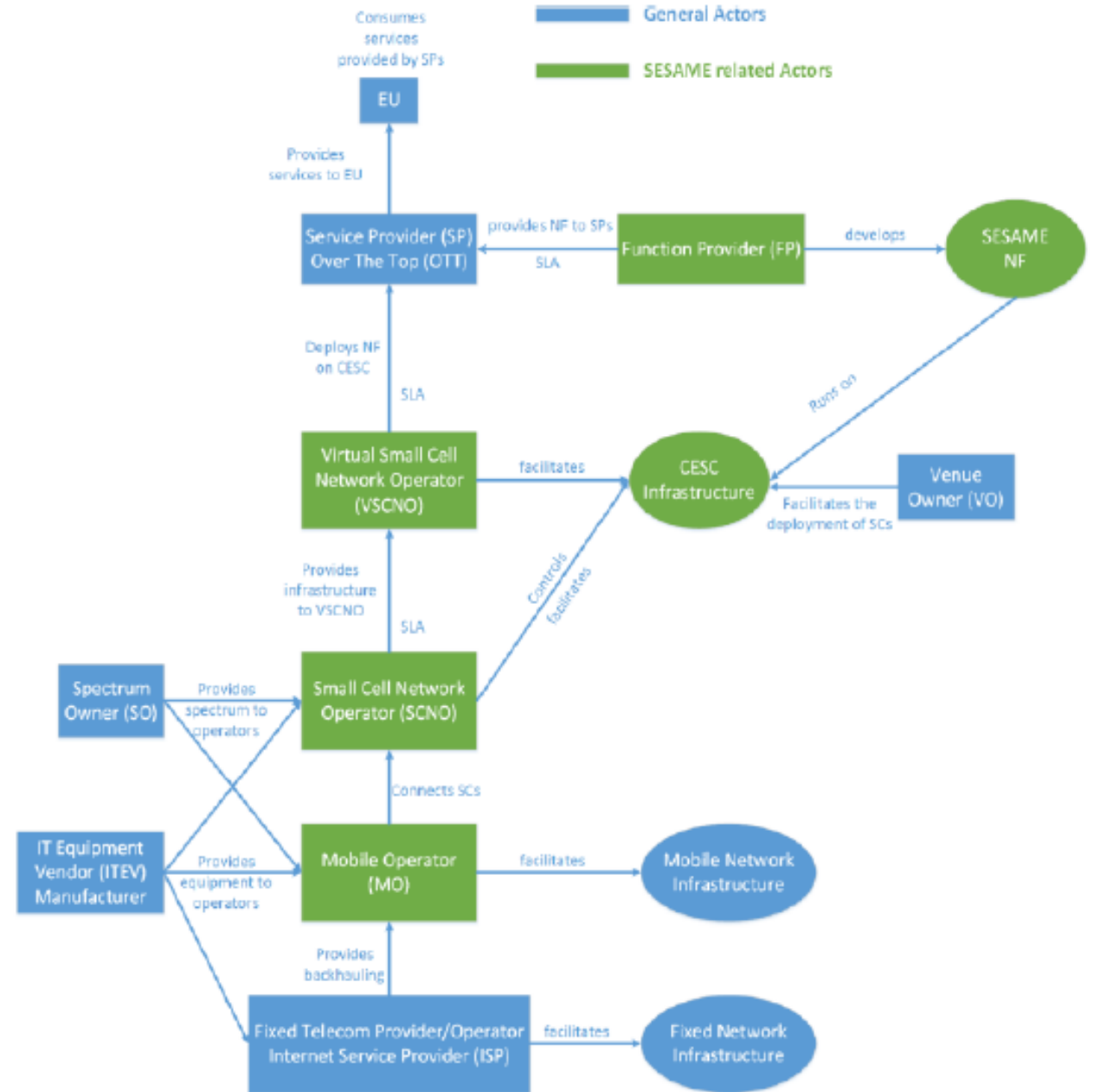


CLOUD ENABLED SMALL CELL (CESC) ATTRIBUTES

- ▶ The CESC exposes different views of the network resources: per-tenant small cell view, and physical small cell substrate,
- ▶ The physical small cell part is managed by the SCNO, and decouples the management of the virtual small cells from the platform itself.
- ▶ Rather than providing multiple S1 (or Iu-h interface) connections from the physical small cell to different operators' EPC network elements such as MME and SGW, such fan-out is done at the micro server.
- ▶ The CESC is further the termination of multiple S1 interfaces connecting the CESC to multiple MME/SGW entities as in S1-Flex.
- ▶ It offers the possibility to offload traffic from congested macrocells, allowing for a variety of value-added services

ACTORS

- ▶ Infrastructure / Venue Owner
- ▶ Small Cell Network Operator (SCNO)
- ▶ Virtual Small Cell Network Operator (VSCNO)
- ▶ Mobile Operator (MO)
- ▶ Service Provider (SP)
- ▶ Over-The-Top Player (OTT)
- ▶ Function Provider (FP)
- ▶ End-Users (EU)



KEY GOALS

- ▶ Development and demonstration of innovative architecture, capable of providing Small Cell coverage to multiple operators, “as-a-Service”.
- ▶ Logical partitioning of localized Small Cell network to multiple isolated slices, as well as their provision to several tenants.
- ▶ In addition to virtualizing and partitioning Small Cell capacity, SESAME supports enhanced multi-tenant edge cloud services by enriching Small Cells with “micro servers”.
- ▶ Apart from benefits offered to existing market players, the SESAME approach allows new stakeholders to dynamically enter the network value chain

INNOVATION POTENTIAL OF SESAME

- ▶ SESAME creates a standardized, open environment allowing efficient & seamless third-party application integration across multi- vendor platforms
- ▶ SESAME envisions network neutrality, multi-tenancy whereas is not practical to densify existing networks, and places where dense concentrations of users place extreme demand.
- ▶ SESAME delivers several computational, storage and networking resources via VNFs empowered by HW accelerators. High performance required at lower costs and with lower power consumption.
- ▶ SESAME Orchestrator will build services (e.g., service function chaining, billing, or even SLA management) over multiple clusters of virtualised small cells.

THANK YOU

SESAME Project website:

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