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T E L E C O M

Technology Shaping the Future

IoT in the 5G and MEC era

Sergios Soursos
Master Research Engineer

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... let's dig into the acronyms



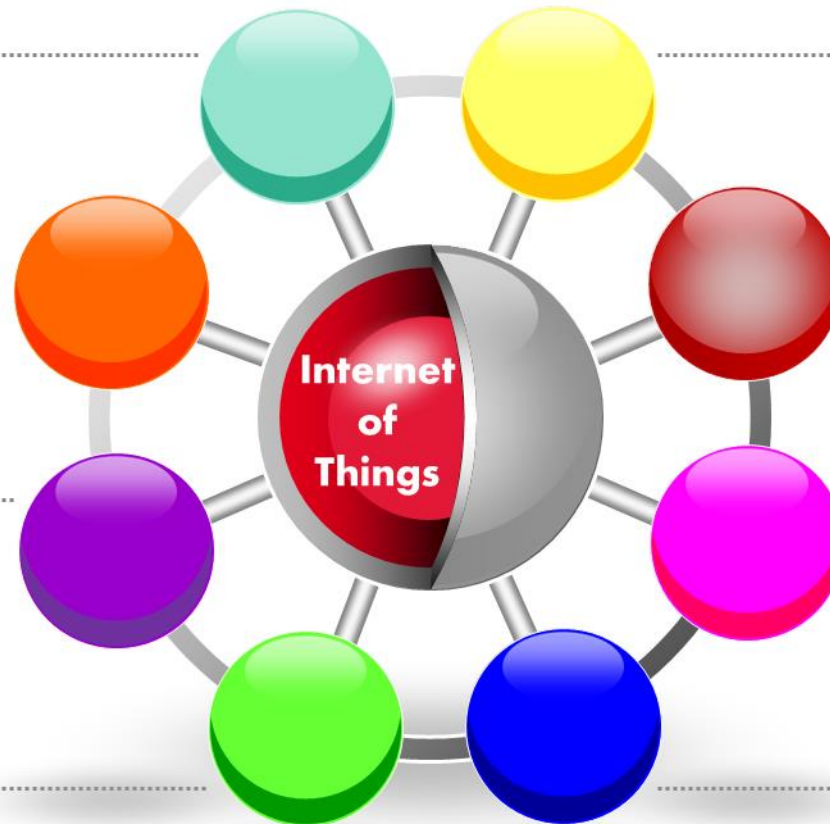
Source: xkcd

A dynamic global network infrastructure

with self configuring capabilities

based on standard and interoperable communication protocols

where physical and virtual "things"



have identities, physical attributes, and virtual personalities

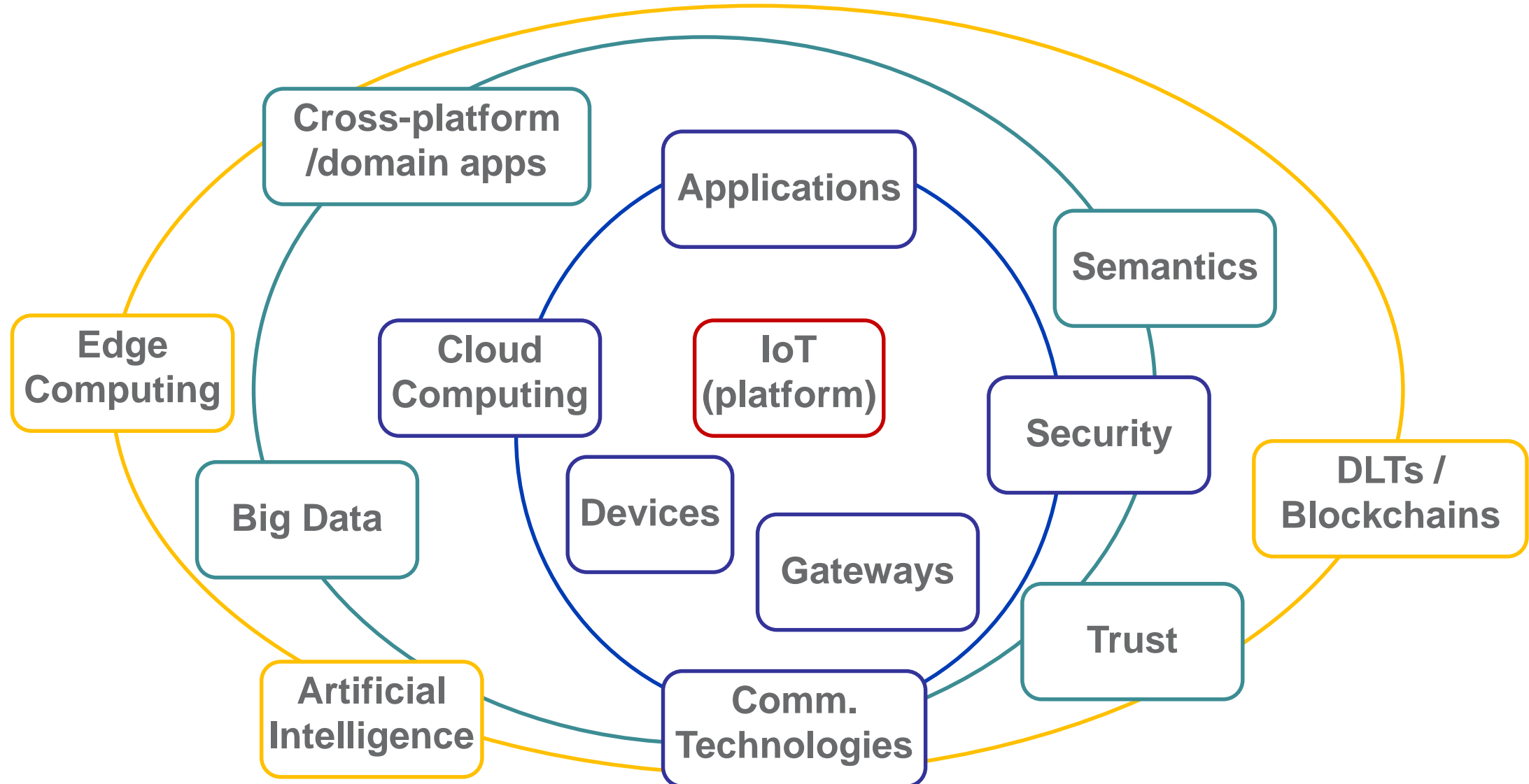
use intelligent interfaces,

and are seamlessly integrated

into the information network.

Source: IERC

IoT & adjacent domains



▶ 5th generation of mobile networks

- Evolution of today's 4G LTE network, **higher speed, lower latency, better connectivity**

▶ Use Cases / Profiles

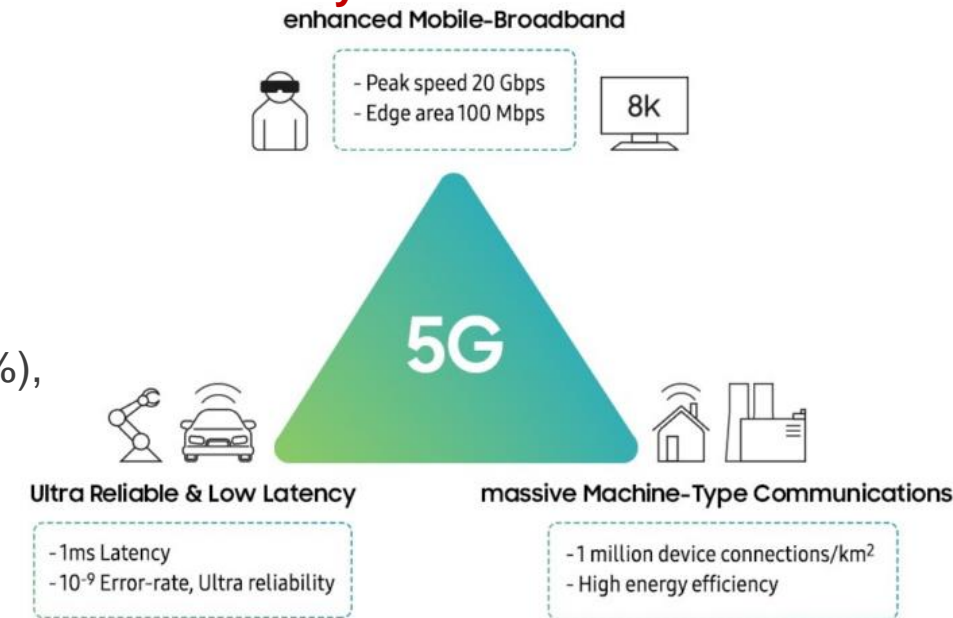
- **Enhanced Mobile Broadband (eMBB):** 10-20 Gbps peak data rates, 10000x more traffic, macro/small cell support, 500 Kmph mobility support, 100x energy savings
- **Ultra-Reliable Low Latency Communications (URLLC):** <1ms air latency, 5ms e2e latency (UE ↔ gNB), six nines availability (99.9999%), 50kbps-10Mbps data rates
- **Massive Machine Type Communications (mMTC):** 1 million devices / km², long range, 1-100 kbps data rates, 10 years battery life

▶ **Radio Access Network**

- Small cells, 5G macro cells ('massive' MIMO antennas, >100 elements, elevation/azimuth beamforming)

▶ **Core Network**

- Service Based Architecture (SBA), software-defined network (SDN), network function virtualization (NFV), network slicing

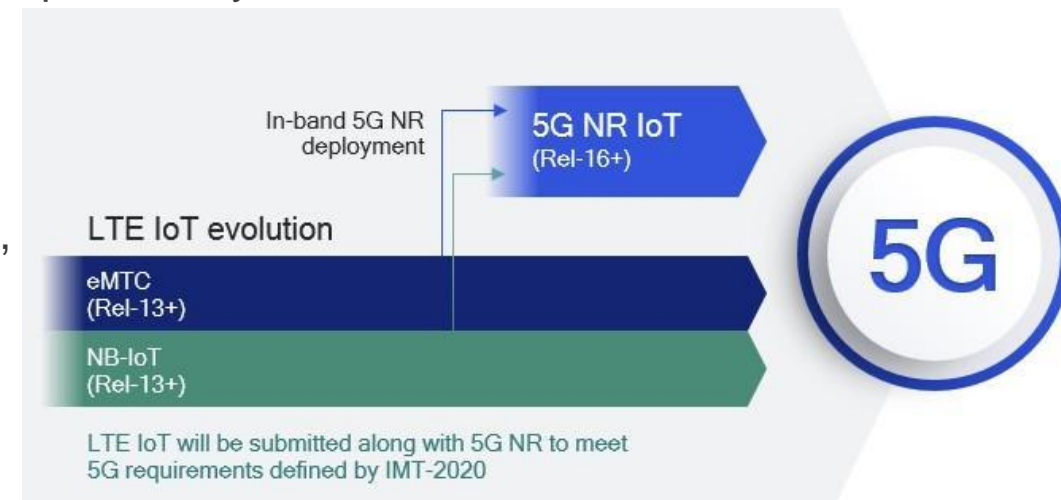


Source: Samsung

- ▶ **Radio access technology (RAT)** includes two frequency ranges: FR1 (<6 GHz) and FR2 (24 - 100 GHz)
- ▶ Utilizes **OFDM** (orthogonal frequency-division multiplexing), also used by both LTE and IEEE 802.11 (Wi-Fi)
- ▶ **Non-standalone** (NSA; 4G for control data and 5G for user data) vs **Standalone** (SA; fully 5G)

- ▶ **But:** IoT → lower power and wider coverage comms → LPWAN options such as SigFox, LoRa, and Weightless

- ▶ LTE IoT (part of the LTE Advanced Pro platform)
 - two narrowband technologies: LTE-M and NB-IoT, targeting complementary use cases
 - **LTE-M:** 1.4 MHz (Cat-M1) and 5 MHz (Cat-M2) bandwidth, offers relatively higher throughput, lower latency, connected mode mobility, better positioning and voice connections
 - **NB-IoT:** 200kHz bandwidth, eliminates the need for a gateway, targeting very low throughput and delay tolerant applications, offers extreme coverage
 - **3GPP Release 15:** supports a close coexistence between NR, LTE-M and NB-IoT



▶ **Multi-Access (Mobile) Edge Computing**

▶ Critical bridge between 5G networks and Cloud Computing infrastructure

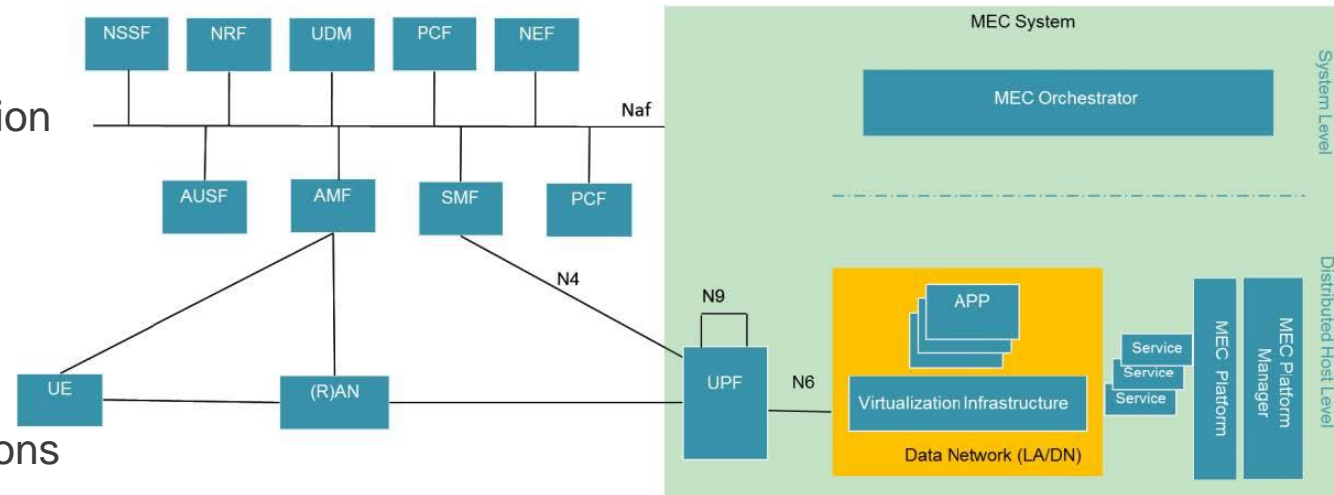
▶ By placing **compute and storage resources** in the **Radio Access Network (RAN)**, mobile network operators can optimize the delivery of latency-sensitive content and services to their users

- host not only network-level virtualized functions (VNFs),
- but also application-level virtualized functions (app-level VNFs, or VAFs(?))

▶ **ETSI ISG MEC** defines how to integrate MEC architecture with 3GPP's 5G specifications

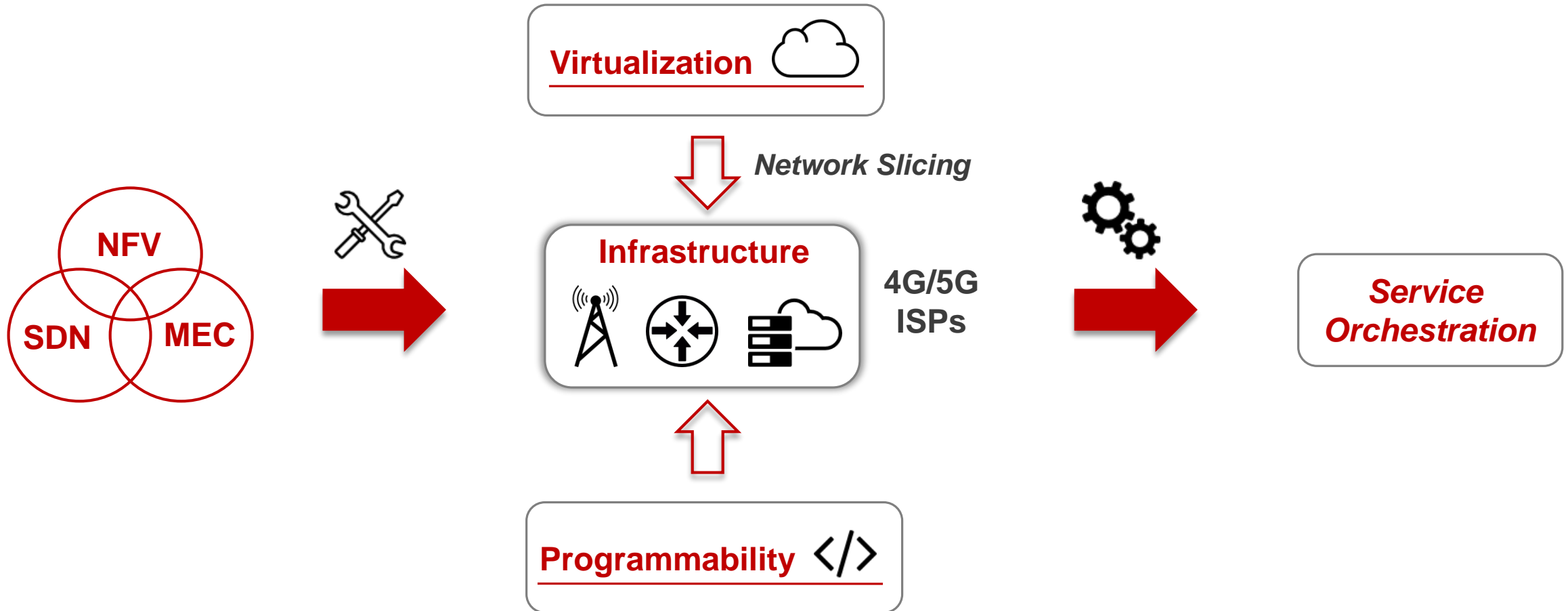
▶ **MEC deployment scenarios**

- MEC + local UPF → collocated at the Base Station
- MEC + possibly local UPF → collocated at a transmission node
- MEC + local UPF → collocated at a network aggregation point
- MEC → collocated with the Core Network functions (at the same data center)



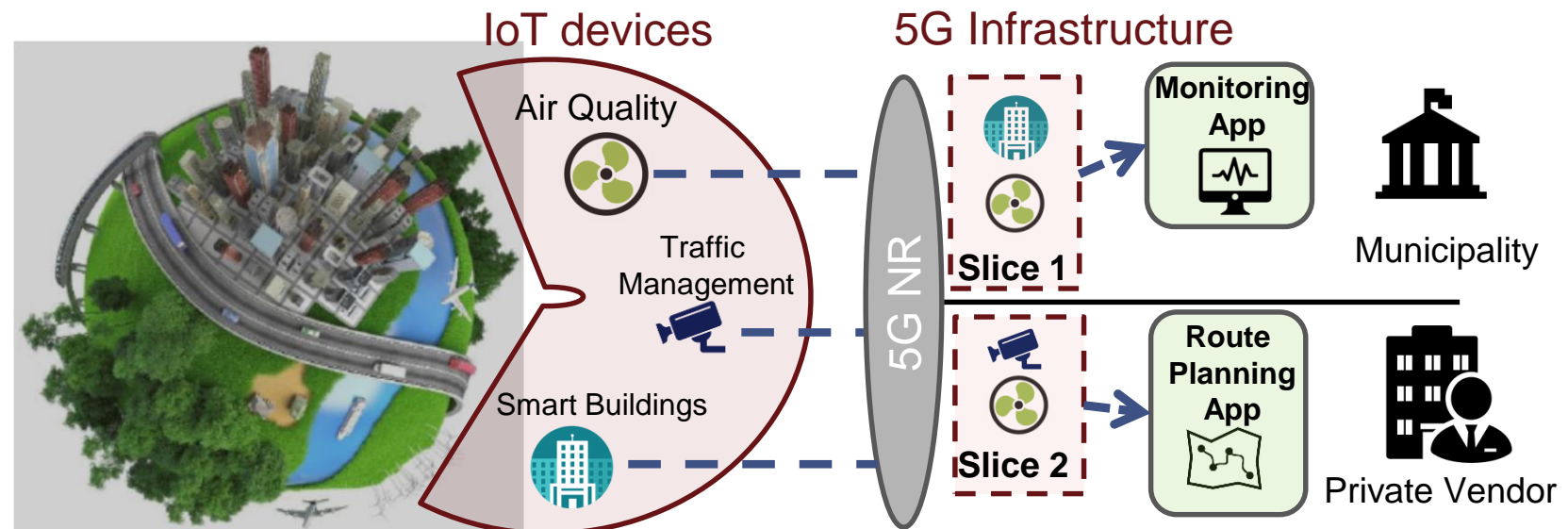
Source: ETSI

Techs and concepts in 5G - Overview



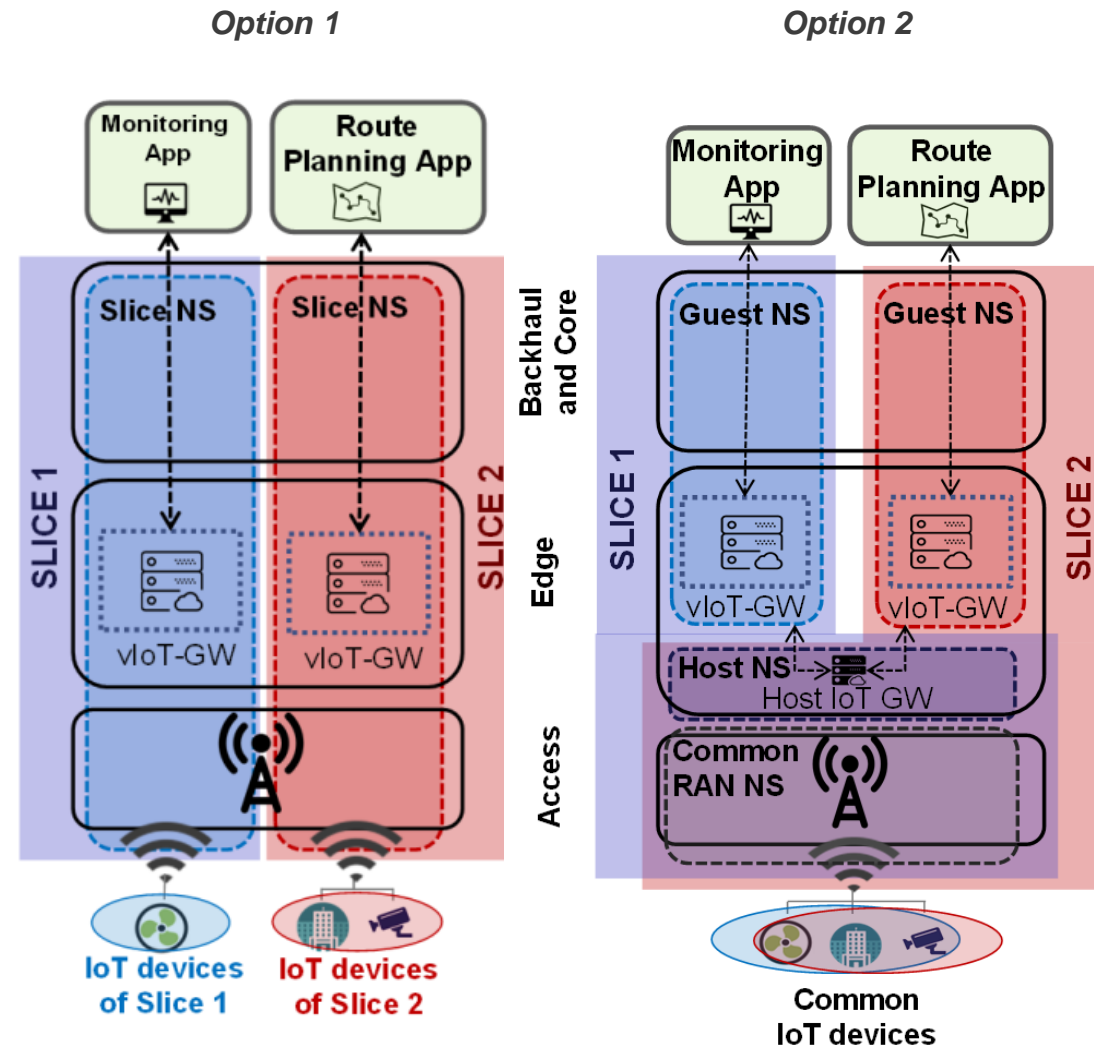
*... so, what's next?
(our vision)*

- ▶ **Motivation:** Benefit from the virtualization technologies in 5G and MEC
 - decrease the digital footprint by **virtualizing (parts of) the IoT gateways**
 - enable **sharing of physical infrastructure**, following the network slicing concept
- ▶ **Approach:** offer IoT gateway (IoT GW) functionality as a VNF
 - allow for **mediated access** to IoT devices
 - reduce **IoT market entry barriers**
 - enable **IoT data marketplaces**
 - create **new revenue streams**



IoT Slicing (II)

- ▶ **How:** Split IoT gateway functionality into two parts
 - **Host IoT GW** (lightweight physical device)
 - interfaces with IoT devices
 - performs device management and access mediation
 - **Guest IoT GW** (virtualized; one per slice)
 - performs data-related activities (semantics,)
- ▶ **Option 1**
 - Assign different physical IoT gateways to different slices
 - IoT solution provider owns the devices and IoT gateways; asks only for communication services from CSP
 - 1-1 mapping of devices to slices, silo-like operation
- ▶ **Option 2**
 - Share common infrastructure among stakeholders
 - Slicing offers virtual isolation



- ▶ **ETSI ISG MEC** loosely defines *location service*
 - Collect, process and provide **geo-location** and **network location** info to verticals
 - Examples
 - Support for **location-based services** by identifying set of user devices in a certain area
 - Support for service continuity in **mobile video streaming** scenarios
- ▶ Can provide additional information on
 - **Radio resource availability**
 - **Bandwidth availability**

▶ Backend-as-a-Service, Function-as-a-Service

▶ Integrated Edge Computing platform

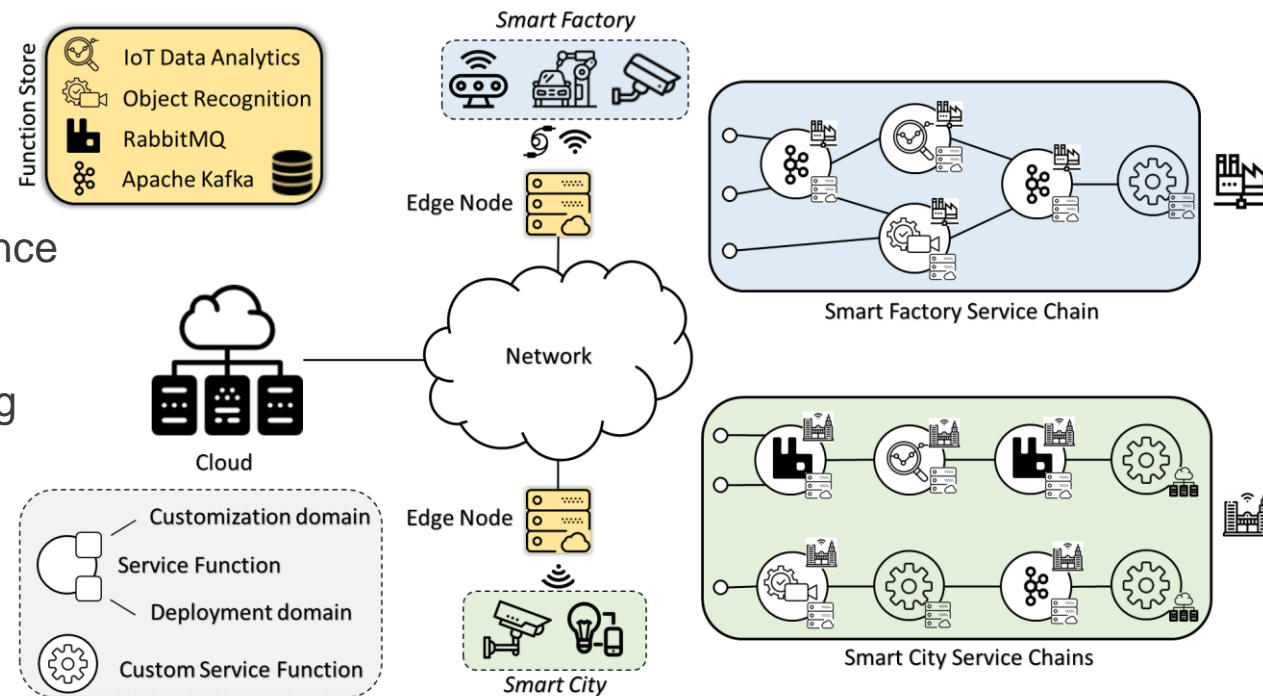
- Simplify the **establishment, management, control and monitoring** of services running at the edge
- Offer new functions, modules and use existing ones → **broader service function chains**
- **Interconnect service function chain components** with
 - locally available devices, i.e., for data processing, and
 - remote chain elements. i.e., centralized cloud-based backend systems

▶ Enable **Intelligence at the Edge**

- Cascading analytics, collective/collaborative intelligence

▶ Example domain: **(Industrial) Internet of Things**

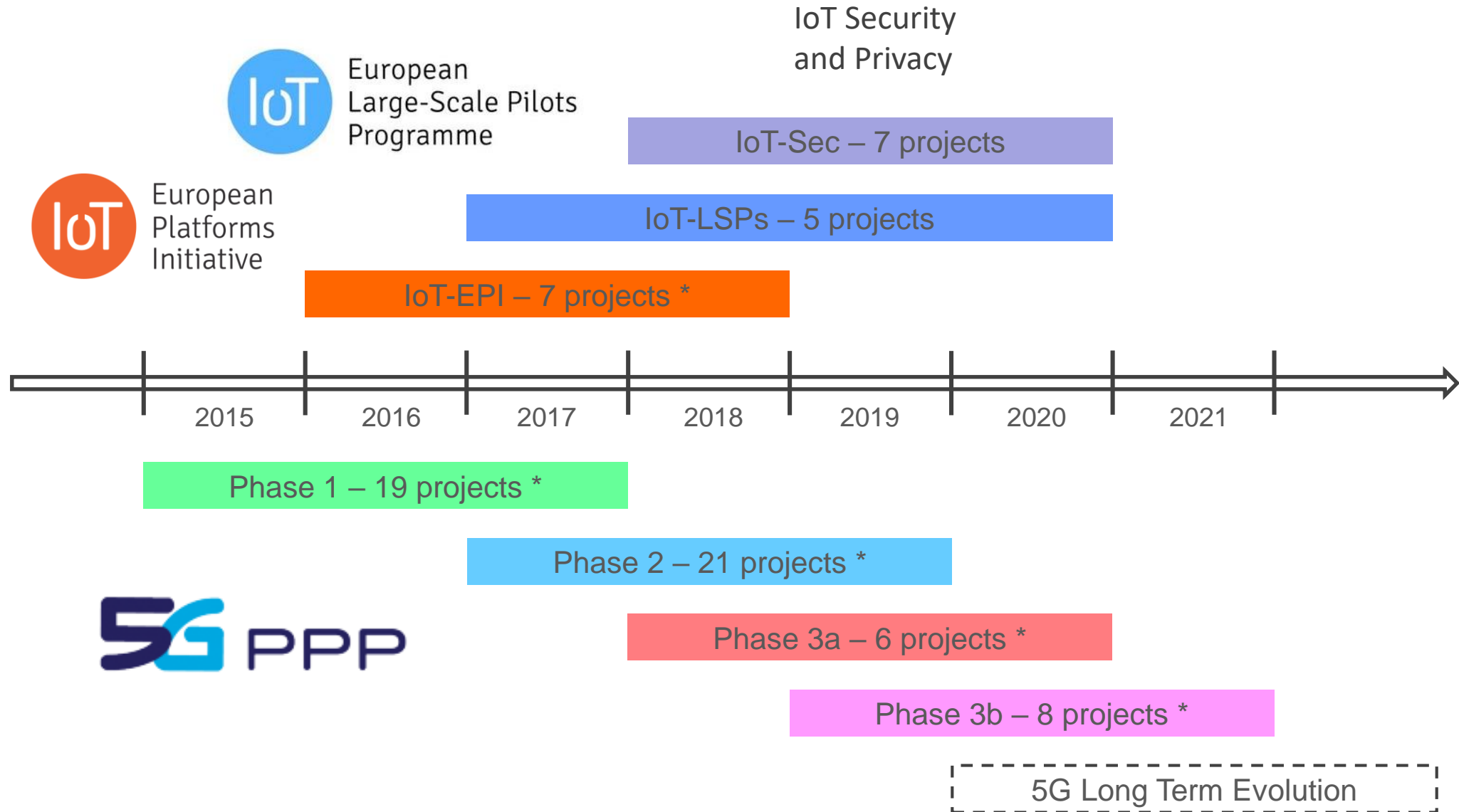
- Device management, data collection, data processing



- ▶ Within the BaaS/FaaS @ Edge context
- ▶ Establish **cross-slice/tenant interactions**
 - Facilitate **secure and optimized communication** between next gen services
 - **Across network slice borders** in 5G networks
- ▶ Allows for **B2B interactions** between vertical application operators
 - Produce and consume services from each other
- ▶ Involves **discovery, placement, communication establishment and management** application of cross-slice operations
 - Considering low latency, isolation and security requirements
- ▶ Examples
 - Different IoT platforms want to exchange data when collocated deployments are involved
 - AR-enabled touristic guide can integrate feed from social networking service

The European landscape

IoT and 5G research activities



- ▶ The **Private parts** in the Public Private Partnership (PPP)
 - shape Strategic Research Innovation Agendas and roadmaps
 - offer consultation, recommendations and support to EC and member states

- ▶ **Alliance for Internet of Things Innovation (AIOTI)**

- <https://aioti.eu/>



- ▶ **5G Infrastructure Association (5GIA)**

- <https://5g-ia.eu/>



- ▶ **Convergence of IoT and 5G**

- On Mar 25, 2019, 5GIA and AIOTI published a **joint vision paper**
- On Oct 1, 2019, 5GIA and AIOTI published a **common topics document** for a common SRIA

About us

74%

international
activities



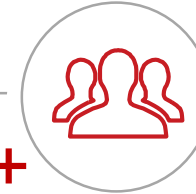
18

countries with
local presence



1,700+

employees
worldwide



A global telecommunication systems and solutions vendor with extensive know-how and a proven track record.

70

countries we
export to



3

R&D
centers



40

years of
experience



International Presence



Core Offerings



Wireless Access & Transmission

Intracom Telecom products employ the most advanced field-proven technologies achieving and exceeding the level of performance required by the modern applications for wireless access and backhaul.



Telco Software Solutions

Intracom Telecom has been building and enriching a wide portfolio of advanced telco software solutions, enabling Operators to generate new revenues and boost their Customers' Experience.



ICT Services & Smart City Solutions

Intracom Telecom strategically focuses on the delivery and operation of top-notch services for converged networking and cloud computing solutions. The company also offers a range of Smart City solutions.



Energy Solutions

Intracom Telecom designs, installs and commissions energy-related systems, providing Smart Grids and Energy Management solutions.

Markets Served



Telecom Operators



Utility Companies



Large Enterprises



Healthcare Institutions



Public Authorities



1/3

of personnel work in
R&D and Production

- ▶ **Vertical organization from idea-to-market capability**
- ▶ **Own Production Facilities**
- ▶ **Research labs** with state-of-the-art infrastructure, for design, rapid prototyping and validation of advanced telecom products:
 - Microelectronics
 - DSP & System Modeling
 - Microwave & mmWave design
 - Embedded Software & NMS development
 - Sophisticated mechanical design
 - Big Data Analytics & SDN/NFV
- ▶ **Continuous R&D presence in EU research frameworks**
 - Strong participation in EU 5G networks flagship initiative
 - Focus areas:
 - SDN/NFV
 - Advanced Wireless Network infrastructure
 - Intelligent Network Management
 - Information-Centric Networking
 - Internet of Things
 - Smart Grids
 - Big Data
 - e-Health



- ▶ Vertical specific e2e solutions with selected partners
- ▶ Horizontal **IoT enablement & monetization**
 - **Unified IoT services Orchestration Platform as a Service**
 - **IoT Revenue and Partner management**
 - **Domain specific Analytics**
- ▶ Connectivity/Network: Planning and configuration
- ▶ Professional Services: Consultancy, Development, Implementation, Ongoing Support
- ▶ Managed services and Cloud hosting
- ▶ **Own and 3d party products in e2e solutions** - strong integration & project delivery capabilities

A comprehensive approach to Smart City



Unified IoT services Orchestration Platform

- Smart Lighting
 - Smart Parking
 - Waste Mgt
 - Sound and Noise Monitoring
 - Energy Mgt
 - Water Mgt
 - Traffic Monitoring
 - Environmental apps
 - Content push
 - SOS Button
 - vWiFi
- Smart apps**

Smart Water Smart Lighting Smart Energy Traffic Monitoring Sound detectors Smart Parking sensors Waste Mgt sensors Smart Environment



Our research activities in 5G/MEC

Context Awareness

BaaS/FaaS

Cross-slice comms

Simple **Location Service** as a VNF

5G MANO enabled **Virtual IoT Gateway**

5G MANO enabled **360-video streamer + object recognition**

Pro-/re-active **video optimizations** in mobility use case

5G MANO enabled **infotainment enablers**

Service catalogue + monitoring + placement

Cross-slice implementation



MESON



thank
you

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