AI-empowered Cloud Continuum for Mobile Networks

Future Networks Lab - Telefónica

21/05/24 – Discovery

About Telefónica

Founded in 1924, it's one of the largest Telecommunication Services Providers, offering fixed and mobile connectivity and digital services

~383 million subscribers

Operating in 12 countries in Europe and Latin America

Commercial presence in 170 countries

Headquartered in Madrid

100% listed company in the stock markets of Madrid, New York and Lima

>40,6 € billion revenues in FY 2023

>104.000 employees

M | O₂ | vivo

Germany
50.2 Mn

UK
55.9 Mn

Spain
40.1 Mn

Brazil
98.8 Mn

Hispam HispAm
110.4 Mn
Argentina, Chile, Colombia, Ecuador, México, Perú, Uruguay and Venezuela.

103,934 employees

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About Future Networks Lab

Accelerate the benefits of new Network Technologies

Team of Cloud and Network engineers to capture the opportunities that new technologies bring to Telefónica

AI Applications in a Telco Operator (non-exhaustive)

B2C

Marketing & advertising (inc. P&S dev.)
- ✓ Analysis & production of visual data to support on media and content generation
- ✓ Personalized recommend. engines to tailor prices
- ✓ Predictive analytics to optimize mkt campaigns
- ✓ Sentiment analysis to increase engagement

Sales
- ✓ Pers. recommendations on offering (individualization, bundling, …)
- ✓ Data analytics to predict churn
- ✓ Sentiment analysis on sales methods
- ✓ Virtual assistants to support agents

Billing & invoicing
- ✓ Automatic detection of anomalies on customer bills

Customer care
- ✓ Internal VA to support cust. service
- ✓ AI-analytics and customer sentiment analysis to upgrade serv. levels
- ✓ Automate and Integrate with transactions

B2B

Lead generation
- ✓ Customer Journey & recommendation engine
- ✓ Automatic lead generation by GenAI

Pre-sales
- ✓ Internal Virtual assistants to support in pre-sales processes (Engineering Knowledge center)

Sales
- ✓ Internal virtual assistants for commercial process
- ✓ Automated offering
- ✓ Account Plan Automation by GenAI

Ordering & Deliv.
- ✓ Ordering tool by internal VAs
- ✓ Int. VAs for workfield delivery & implementation

Billing & invoicing
- ✓ Proactive Bill & Collect

Reporting & Comm. planning
- ✓ Predictive & forecasting analysis of sales events, incidents, …

Customer care
- ✓ Internal virtual assistant to support and automate operations

Network & IT

Fulfillment
- ✓ IT systems
- ✓ Knowledge management & Co-pilot

Customer care
- ✓ IT systems
- ✓ Knowledge management & Co-pilot

Assurance and operations
- ✓ Observability & Diagnosis
- ✓ IT systems
- ✓ Optimization
- ✓ Knowledge management & Co-pilot

Network design
- ✓ IT systems
- ✓ Planning
- ✓ Optimization
- ✓ Workforce management
- ✓ Knowledge management & Co-pilot

Asset management
- ✓ IT systems
- ✓ Knowledge management & Co-pilot

Operations & Support

Procurement & Supply Chain
- ✓ Internal virtual assistants for functional support
- ✓ Knowledge management
- ✓ Predictive analytics

Risk & fraud
- ✓ Recognition of fraud patterns to detect risks, anomalies, uncollectible payments, …

Finance
- ✓ Automatization of financial reporting data
- ✓ Predictive models for FX interest rates
- ✓ Sentiment analysis & topic modelling for TEF earnings calls and others
- ✓ AI for financing (spreads/rating) & CF forecast

HR
- ✓ Predictive analysis of skills needs
- ✓ Person. recommend. engines for recruitment process and other cases

Cross-functions (inc. other functions such as legal, communication, ...)
- ✓ Int. virtual assistants (e.g., Chatbot, Copilot)
- ✓ Unification (Knowledge mgmt.) and automation of processes

Ensure optimized network with predictive and adaptive capabilities

Network observability & Diagnosis

Ensure optimized network with predictive and adaptive capabilities

Solution
- Network observability & diagnosis

Function/Domain
- NW & IT Assurance & Operations

Impact
- OPEX reduction
- Issue reduction
- TMO reduction
- QoS improvement
- QoE improvement

Feasibility & Data needs

Feasibility & *Current situation*
- Feasibility
- OB Scalability

Data Needs
- Mobile & Fixed network data, performance KPIs, alarms incidents (faults & tickets), NW usage (traffic, load..), HW & SW assets.

Partners

Current & main partners

Azure · Google Cloud · elastic · aws

Other main partners

Network Specialists (w/ Embedded AI)
NOKIA · ERICSSON · HUAWEI

Skills needs & Capabilities
- AI implementation requires **specialized roles**.
- **Reskilling and adapting policies** to attract and retain talent to ensure specialized skills are necessary.
- Promoting **autonomy in the network**, and providing capabilities to the technical areas to improve their core processes.

Must-have
- Data scientist
- MLOps/DevOps engineer
- Data engineer

Desirable
- GenAI specialists
- AI solution architect
- AI engineer

External reference

The adoption of AI techniques among major operators is predominantly widespread in the Asia and USA, whereas Europe exhibits a less mature AI landscape with fewer prevalent use cases.

Orange
- Network monitoring service powered by AI.
- Automated reporting of AI tickets and an ongoing ML process for preventive maintenance.

China Telecom
- GenAI system for complex fault identification and precise root cause location

AT&T
- AI has been implemented for preventive maintenance: to identify breakpoints and aid in repairing them in an automated way.

AI-Empowered Cloud Continuum for 6G

What is it?

01

6G – Rising the bar

6G will bring Services that rise the bar for demanding Network Capabilities
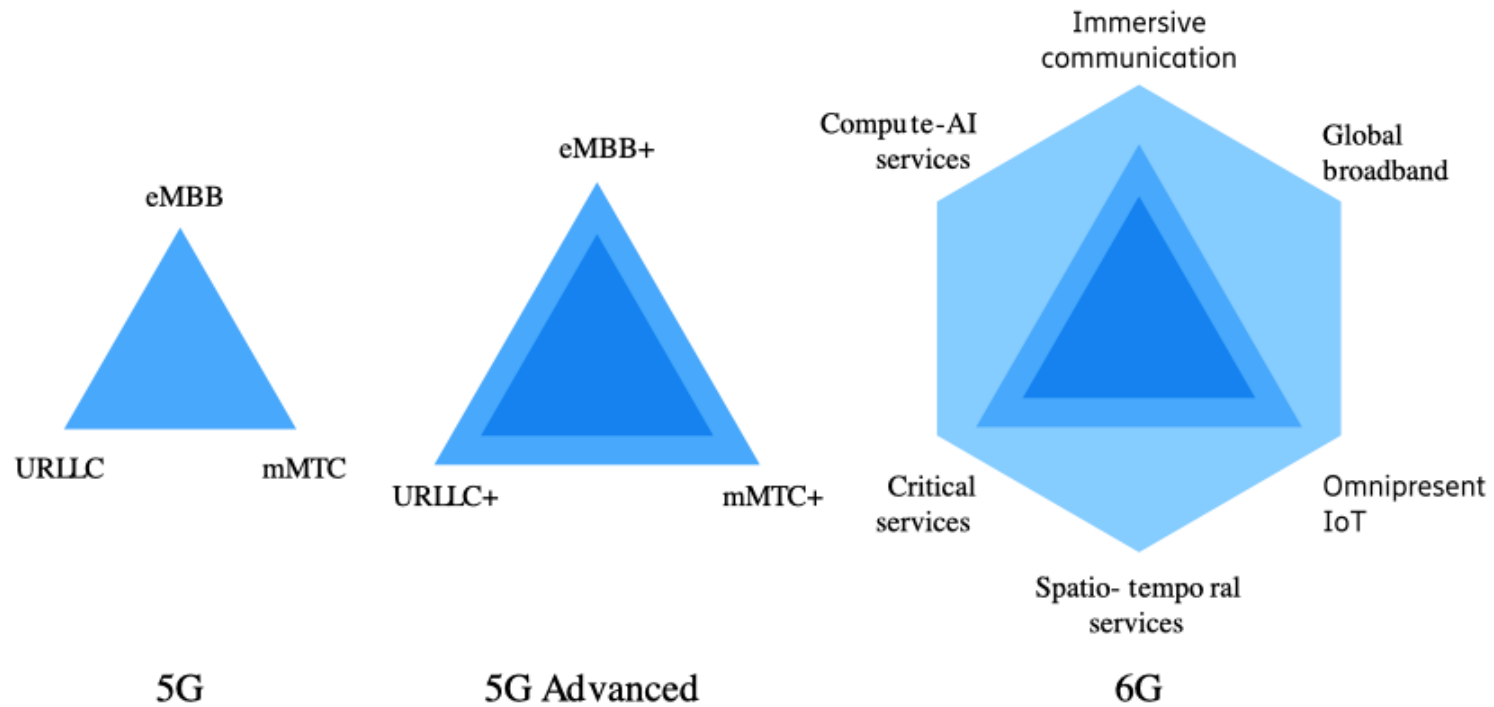
6G – The Role of AI in 6G

Some Potential Drivers for 6G: A table view

	Security	AI	Immersive Com	Sustainability, Energy Efficiency	Ubiquitous and resilient coverage	Sensing	"Smart life"	Native Vo6G	FWA-FWC	LPWA	Northbound API	Healthcare	Autonomous Driving	Positionning	Backward Compatibility
GSMA	✓	✓	✓	✓			✓								
NGMN	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓		✓	✓
5GAA	✓	✓	✓	✓	✓	✓						✓	✓		
5G-ACIA	✓	✓	✓	✓		✓					✓				✓
5G-MAG	✓	✓	✓	✓	✓	✓	✓				✓				
GSOA	✓				✓									✓	
TCCA	✓	✓			✓										✓
WBA	✓	✓			✓										
B5GPC	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	
6GForum	✓	✓	✓	✓	✓	✓	✓					✓	✓	✓	
IMT-2030RG	✓	✓	✓	✓	✓	✓	✓							✓	
B6GA	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓		✓
NextGA	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓			✓	
6GSNS-ICE	✓	✓	✓	✓	✓	✓	✓					✓		✓	
ITU	✓	✓	✓	✓	✓	✓	✓				✓		✓	✓	✓

https://www.3gpp.org/ftp/workshop/2024-05-08_3GPP_Stage1_IMT2030_UC_WS/Docs/SWS-240025.zip

6G – The Role of AI in 6G

- ## Network-design/performance:
  - Network optimization and automation (Intelligent Network management, Network Performance)
  - Energy efficiency/saving/ sustainability
  - AI-assisted air interface/ Radio Performance;
  - AI for improving positioning

- ## Enabling AI at the application level:
  - AI data management, model distribution for all AI-assisted "smart" areas (cities, industries, surgeries, robot control,
  - Manufacturing plant, rescue missions etc.
  - AI as a Service (AIaaS)
  - To implement a range of media's personalization and customization (sport TV program, etc)
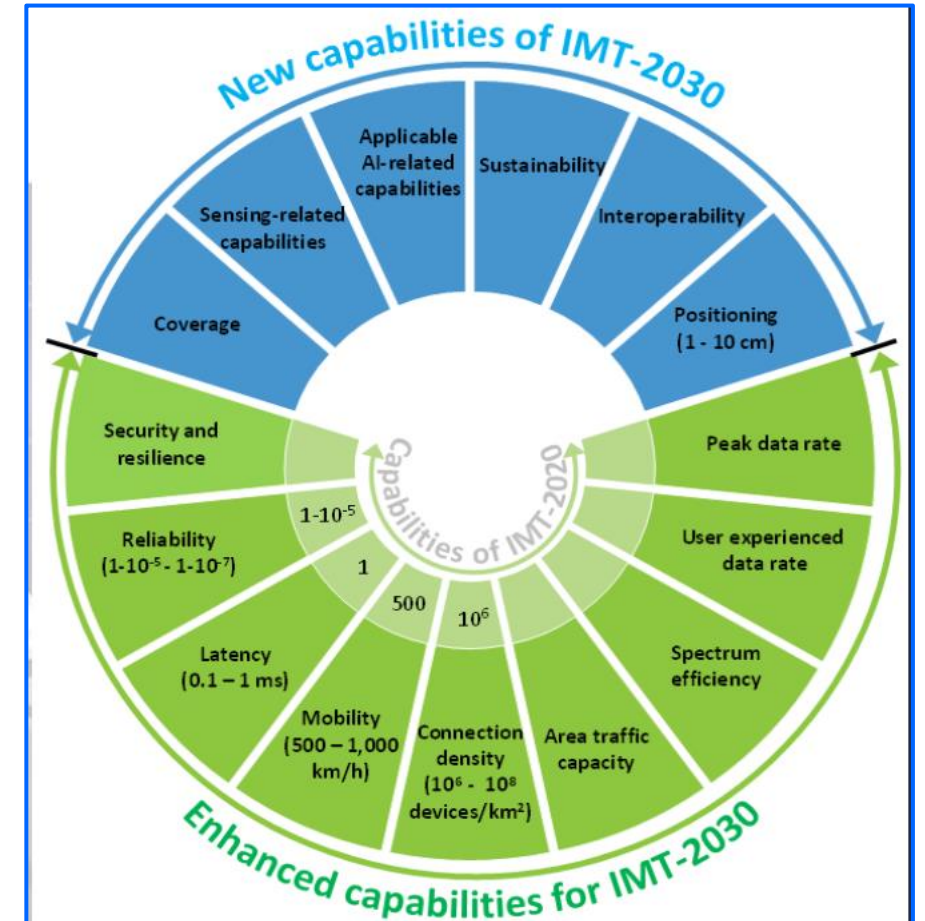
Cloud Continuum

Cloud Continuum can mean different things:

Continuity among Cloud Providers (from Private cloud to Public Cloud or Hybryd Clouds)
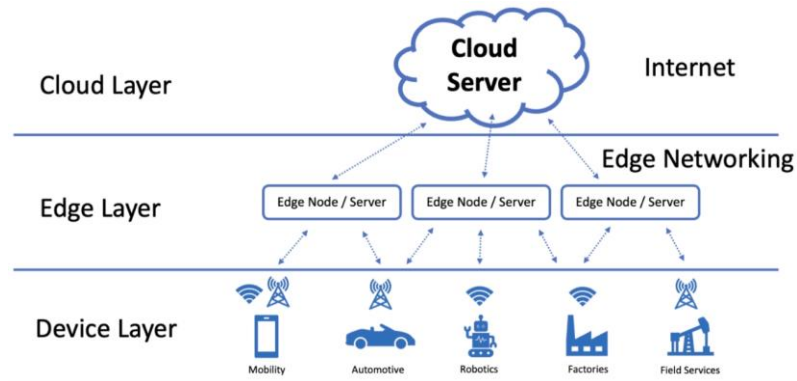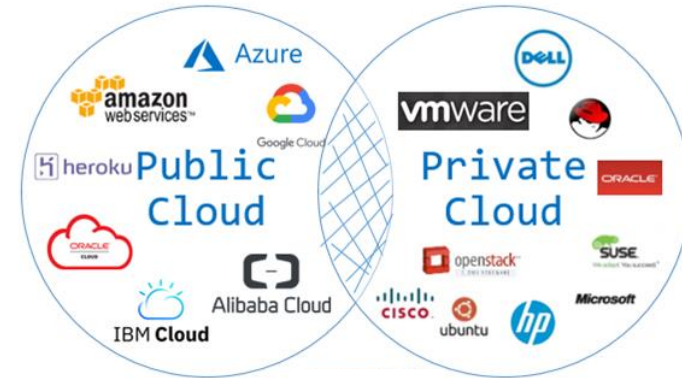
Continuity among Network Topology (Devices, Edge Computing, Network Core, Public Cloud)

All in All, Operators want to offer **Best Customer Experience to Customers** (Latency, Throughput, Privacy, Data Location, App responsiveness, …)

IPCEI Cloud - Europe Edge Transformation

EU Commission approves up to €1.2 billion of State aid by seven Member States for an Important Project of Common European Interest in cloud and edge computing technologies

*The IPCEI approved today is crucial to deliver breakthrough innovation on Cloud and Edge technologies that fulfil European requirements for interoperability, data privacy, sustainability and cybersecurity. It will also provide the technologies and solutions to reach our Digital Decade Strategy 2030 objectives: a **75% of cloud uptake** by EU enterprises and more than **10.000 edge nodes across Europe**. With this IPCEI, Europe will reinforce its innovation leadership in next generation data processing services.*

Commissioner Thierry Breton

https://ec.europa.eu/commission/presscorner/detail/en/ip_23_6246

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IPCEI Cloud - Europe Edge Transformation

What is a "Multi-Provider Cloud-Edge Continuum"?

*A cloud is an external data storage facility that provides resources via the internet. **Cloud computing** offers numerous advantages, including scalability, flexibility and cost efficiency. However, cloud access is dependent on internet access and real-time data transfer is not possible due to the distance between servers. **Edge computing**, on the other hand, brings computing power closer to the data source, reduces latency times and offers advantages such as lower data transfer costs. In addition, data can be processed securely at the point of origin. However, edge resources are much more limited. **The "Multi-Provider Cloud-Edge Continuum" represents a seamless integration of cloud and edge computing**.*

***Resources and applications are moved both to the cloud and to the edge of the network**. This enables dynamic distribution of data processing tasks as required.*

https://www.bmwk.de/Redaktion/EN/Artikel/Industry/ipcei-cis.html

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Innovación Digital

AI-Empowered Cloud Continuum for 6G: Challenges

02

Challenges

When Moving Applications across **different domains** we face several challenges:

1. **Business Relationships**

2. Connectivity Model

3. **Edge Computing Applications**

4. Data management

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Business Relationship

ASP - End User agreement

ASP - ECSP agreement

MNO subscription

ECSP - MNO agreement

Application Service Provider

End Users

Edge Computing Service Provider

Mobile Network Operator
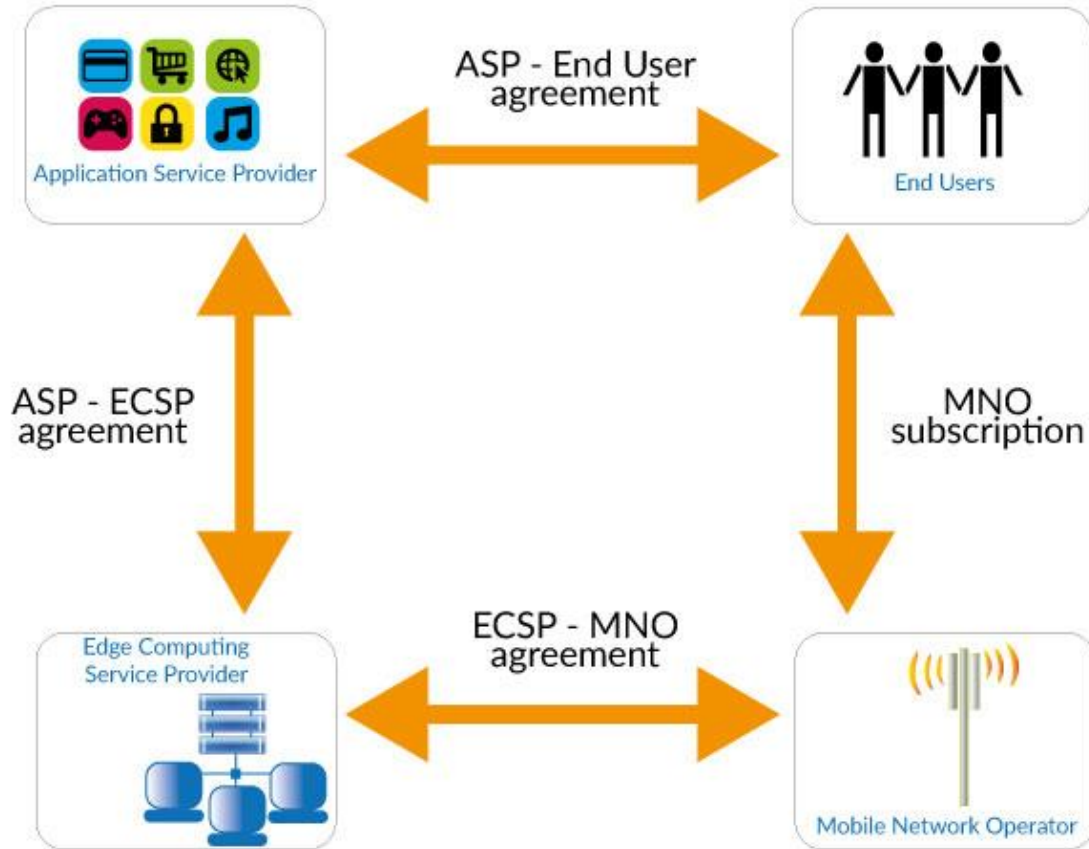
Business Relationships do not happen Realtime

Large Fulfillment processes (TM Forum)

Fraud/Security play against agility

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Connectivity Model
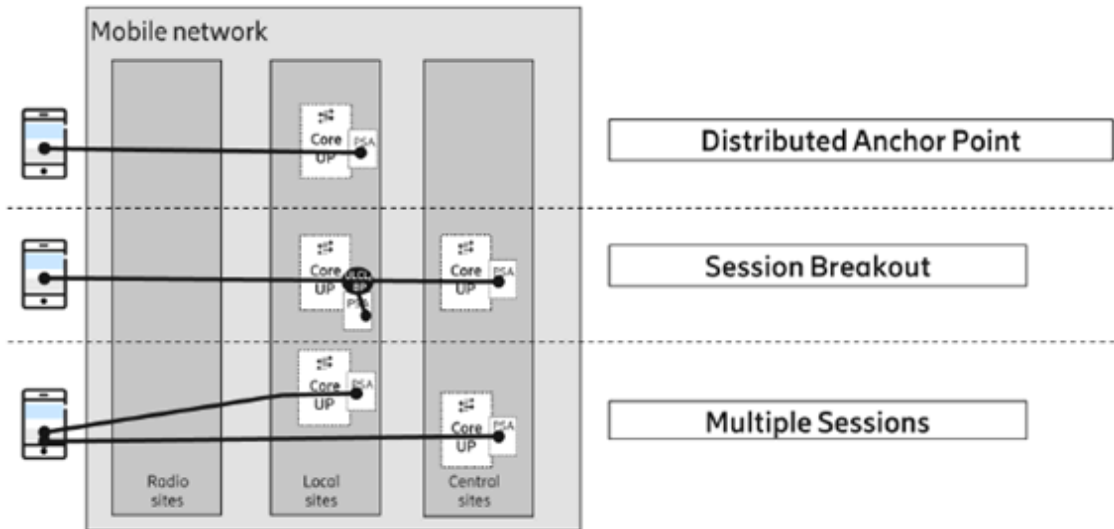
Session anchoring needs to be closer to Application for optimized user experience

Moving Session anchoring is defined in 3GPP

UPFs need to be deployed across the **Cloud Continuum** (Bizz rel)

Regulation implications on Lawful interception

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Edge Computing Applications
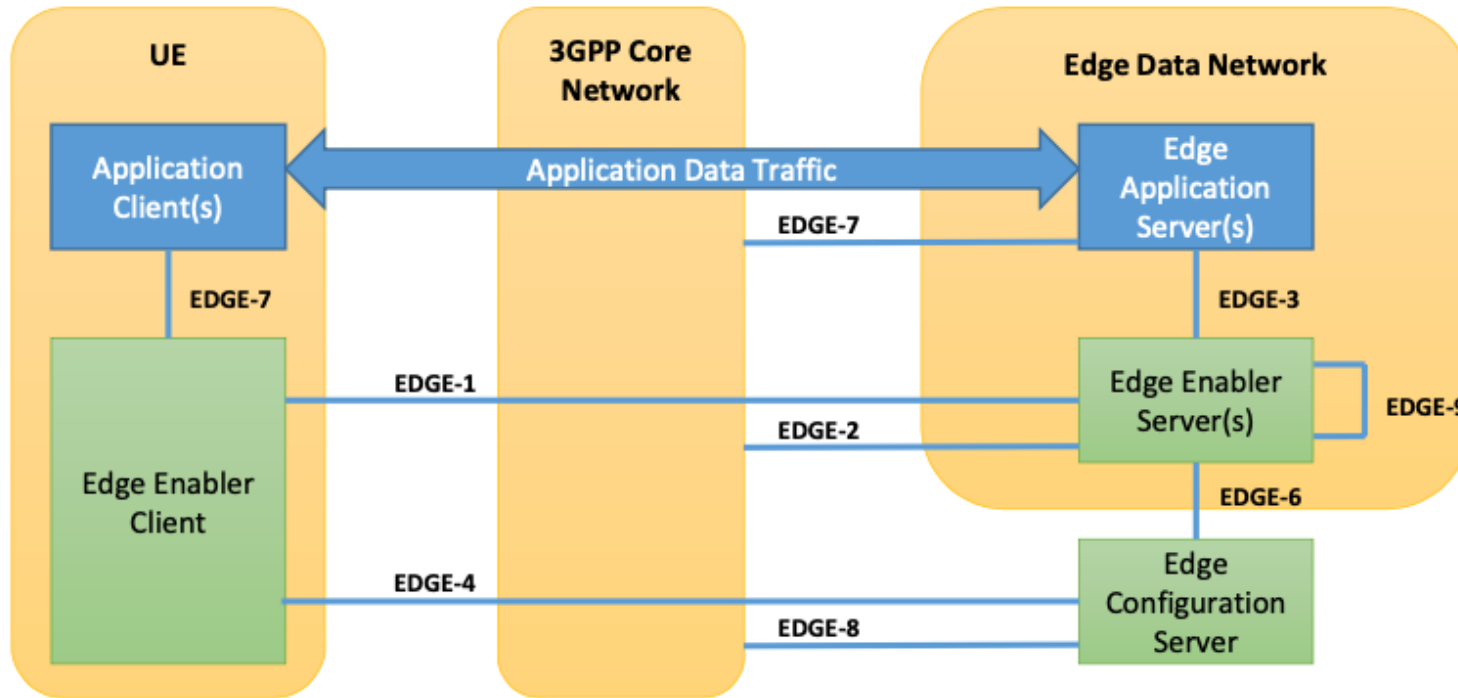
Edge Enabler Layer: 3GPP TS 23.558

Applications movement in the Cloud Continuum requires infrastructure support (EDGEAPP, MEC, …)

Stateless vs Stateful Services

Application Data management increases **complexity**

EDGEAPP vs Bizz Rel

Business Relationships combined with **EDGEAPP** Framework generates interesting matrix

3GPP considers mainly scenarios where Edge Infrastructure is managed by Operators

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Data & Privacy Management

Ubiquity of Applications increases complexity

Data Location restricts Application movement

Data Conflicts: **who is the owner** of the data?

Operator vs Edge Provider vs Application Provider
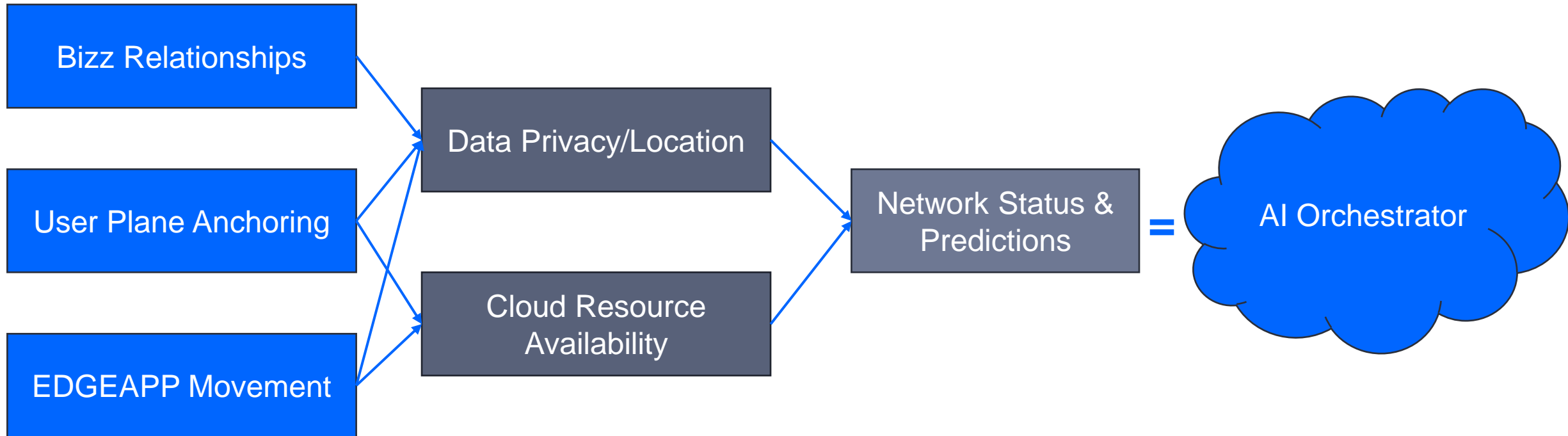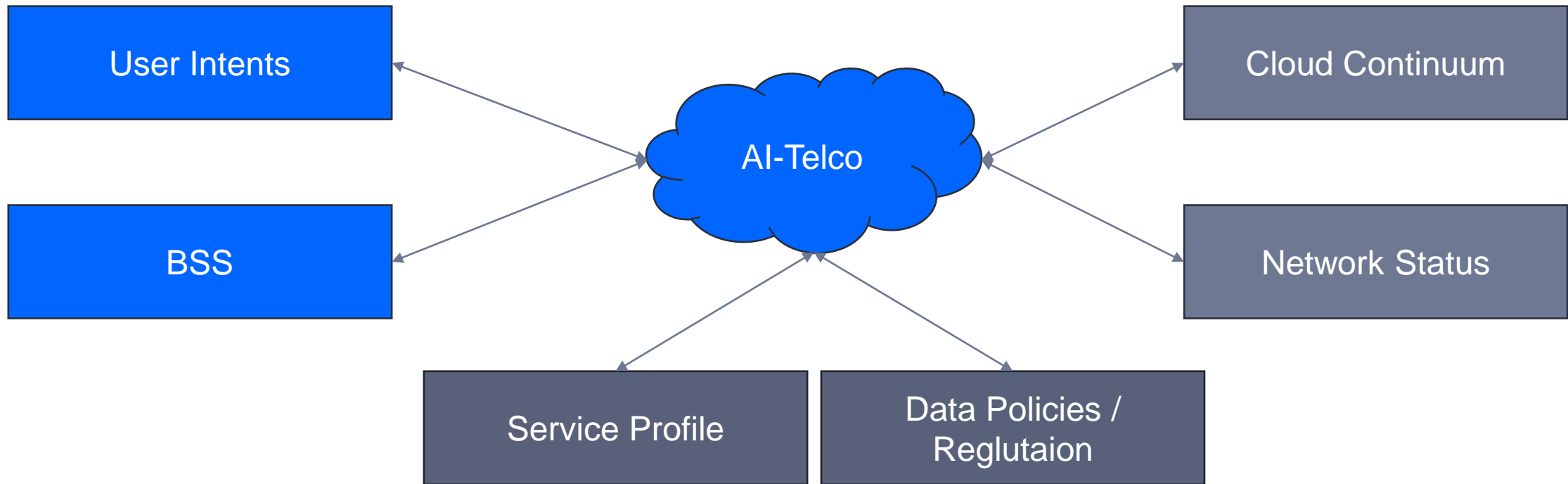
Regulation: Mixed regulated – non regulated parties **need harmonization**
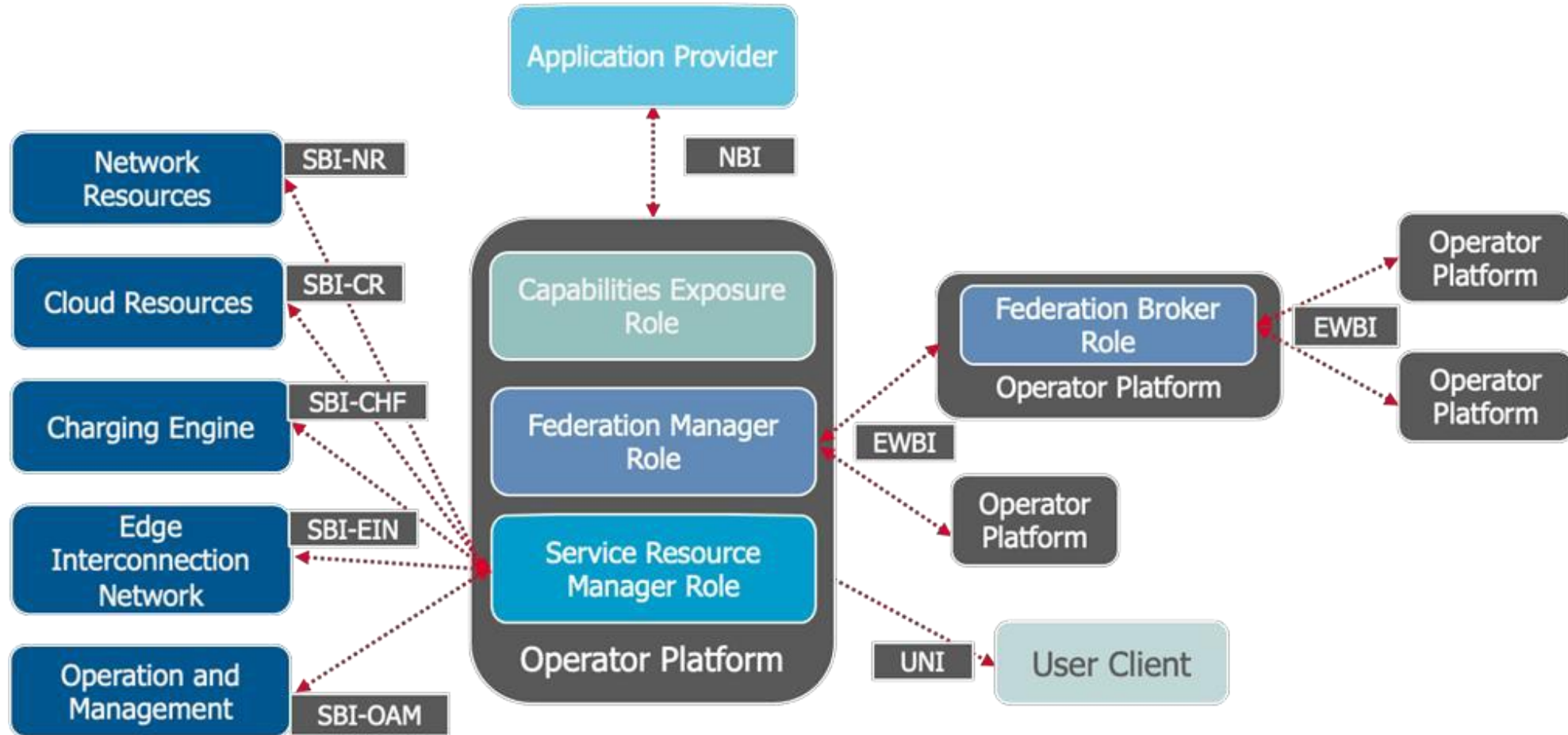
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Mixing the Cocktail

Mixing the Cocktail
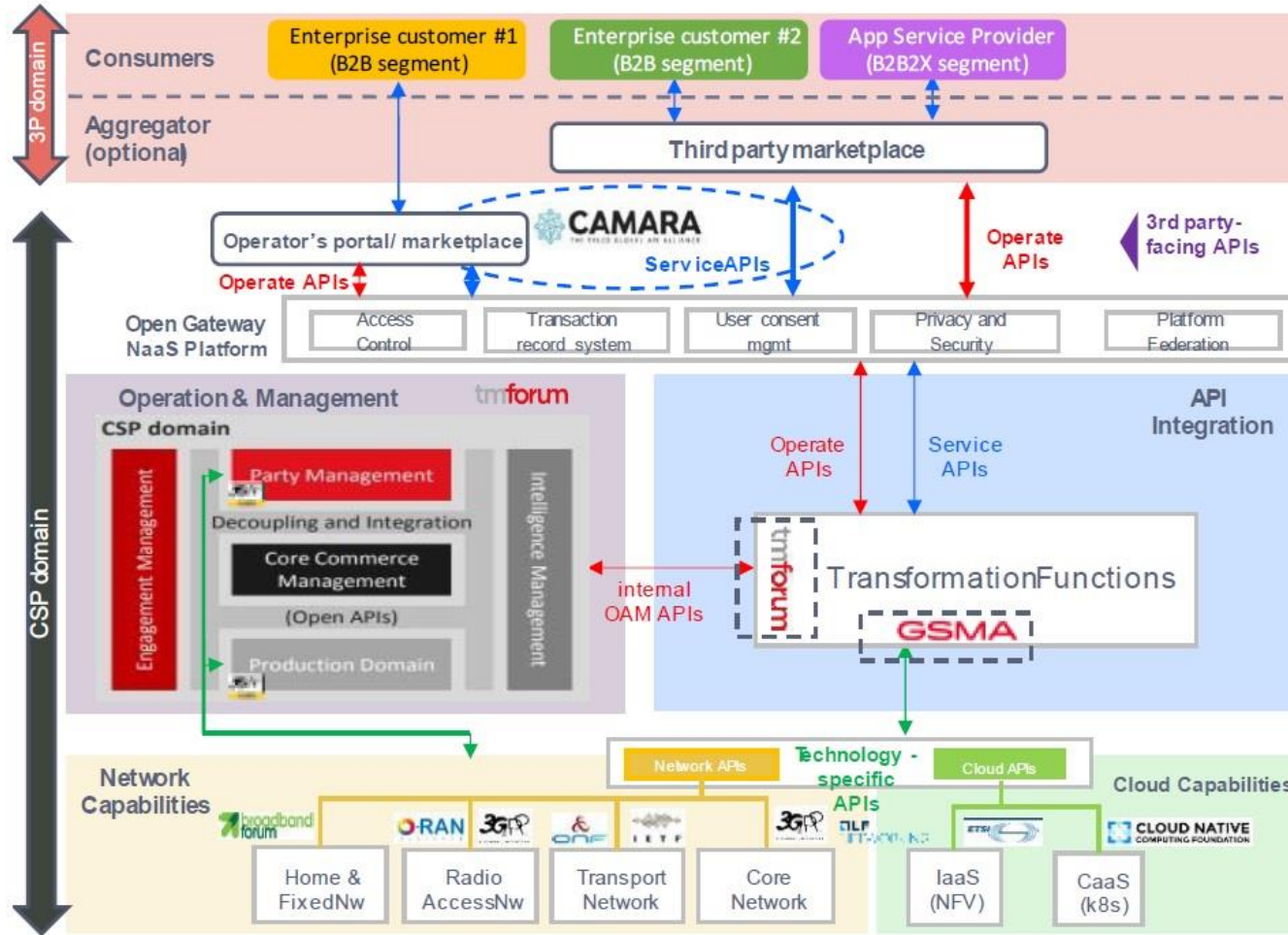
Industry Initiatives

Not enough

03

GSMA Operator Platform

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Open Gateway

SYLVA (Linux Foundation)

	Technology	Business	Ecosystem	Regulation / Security
Current Threats for Telcos	Technological backwardness	Proprietary solutions Lock In	Fragmentation of solutions	Strong regulation
	Slow innovation	High prices	Hyperscallers entry	High cyber risk
Opportunities through Sylva	Open-source instead of proprietary solutions	Reduce cost (open source, mutualization)	Common Telco Cloud technology	Compliance with European regulation
	Simplify & automate the operational model	Interoperability (validation program, large adoption)	Convergence of the telco cloud layer	High security standards

Validation Completed

ORACLE   NOKIA
6WIND   ERICSSON
casa systems   Hewlett Packard Enterprise

PCF, VSR, UPF, NRF, EMS/UDM, SIG

Validation in progress

ERICSSON   NOKIA
6WIND   fogsphere
casa systems

SMF, SIG, video analytics, ZTS+AUSF_UDM, VSR

#01 Telco Cloud Stack	#02 Validation Center	#03 EUCS Security
Mathieu Rohon *Orange*	Luis Velarde *Telefónica*	Théophile Debauche *Orange*
#04 Energy Efficiency	#05 Communication & Adoption	#06 Evolution of Governance
S Kannan *Nokia*	Andre Antunes *Celfocus*	Théophile Debauche *Orange*

Technical Steering Committee with Orange, DT, TIM, TEF, Vodafone, Nokia & Ericsson at the board

Sylva Co-Chairman : Giuseppe Ferraris (TIM) & Guillaume Nevicato (Orange)

https://sylvaproject.org

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Conclusions

AI to the Rescue

04

AI-Telco is needed for 6G

Existing Technology presents serious challenges to develop 6G Vision

GSMA Initiatives do not address them

6G needs to introduce Paradigm shifts to integrate AI natively

Cloud Technologies are simpler and better positioned

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