

# Next Generation IoT: Pain points and long term opportunities from a Telco perspective

## Smart Networks and Services Partnership Stakeholder workshop

NetWorld2020, 4<sup>th</sup> July, 2019

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(\*) The views shared in this presentation are those of my own, and not a Telenor company position. Although, being inspired from dialogue with several Telenor colleagues.

# The Telco future is uncertain

The typical Telco mission of today:

*Connecting you to what matters most*

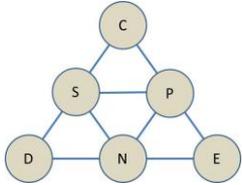
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*Empowering Societies (\*)*

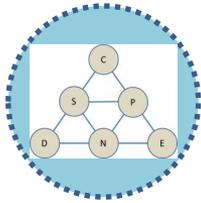
(\*) <https://www.telenor.com/about-us/our-culture/>

... and facing continued transformation

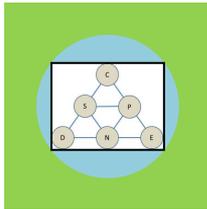
# Key topics today



Being part of the technology evolution

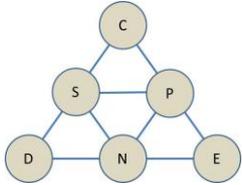


Evolving operational capabilities and customer engagement

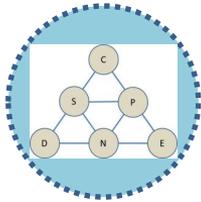


Contributing to the ecosystem evolution

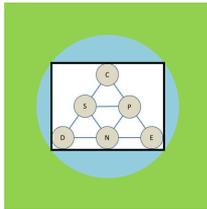
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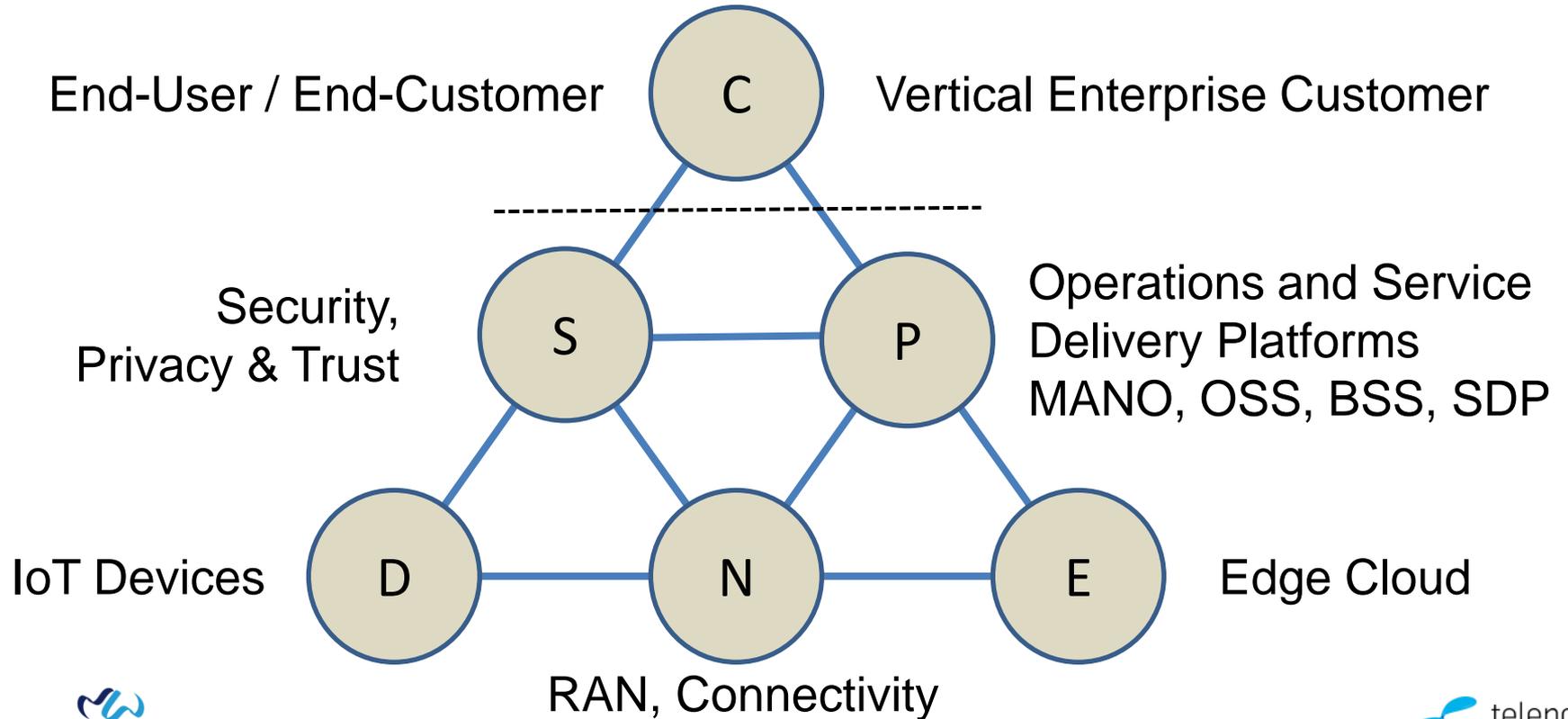


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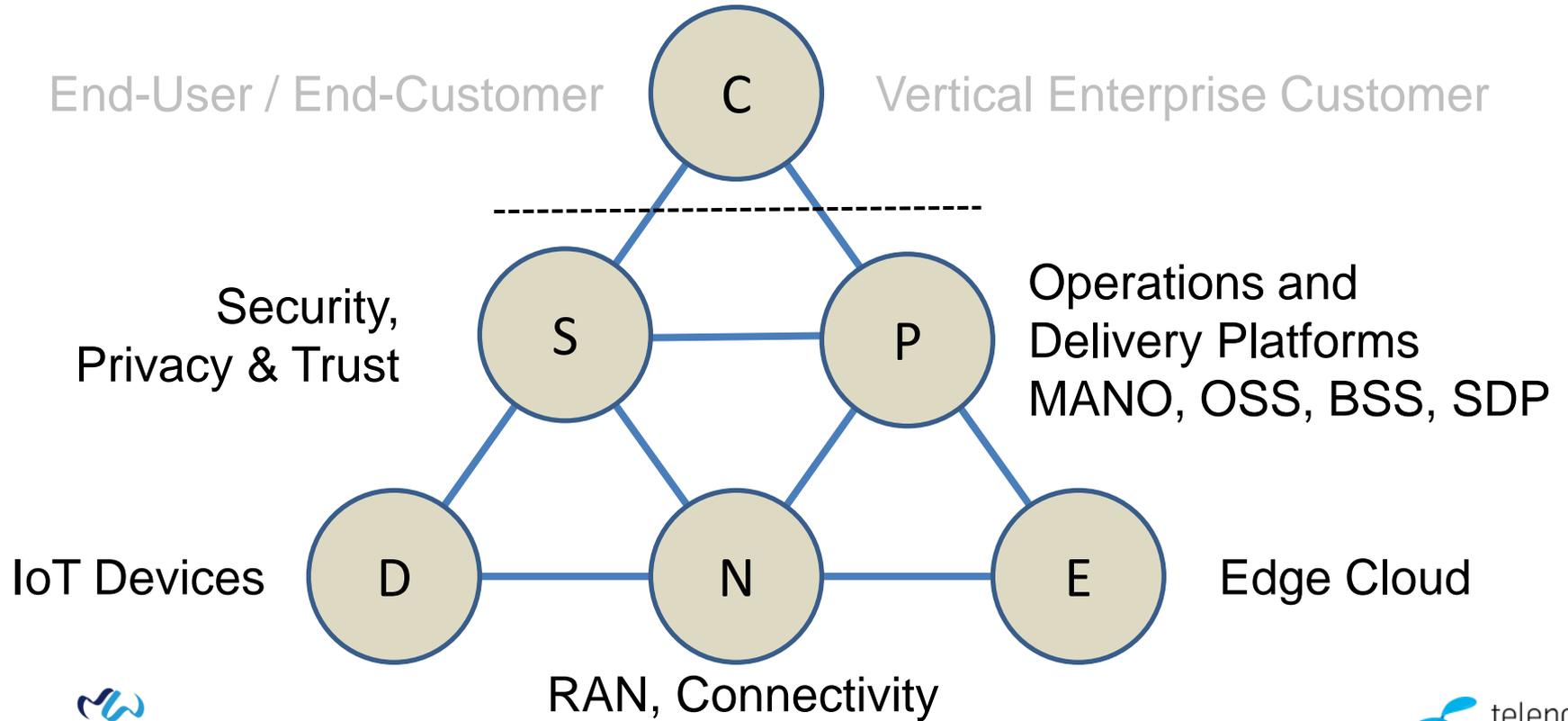


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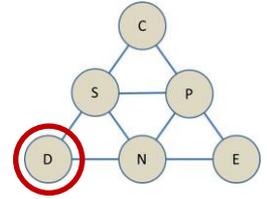
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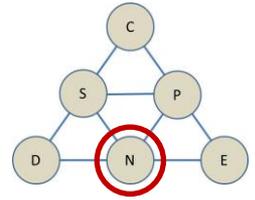


# Continuous evolution of Devices



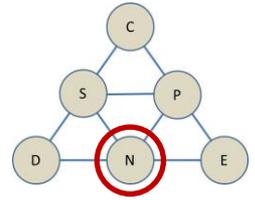
- Diverse capabilities and properties of devices, continuous innovation
- Energy consumption and life-time issues
- Over-The-Air configuration and upgrade
- Positioning
- Advanced radio techniques for IoT

# Continuous evolution of RAN and Spectrum conditions (1/2)



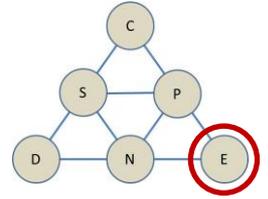
- SW Defined Radio, enabling advanced SON and Cognitive RAN systems
  - Automatic Neighbour Relation
  - Capacity and Coverage Optimization
  - Load Balancing
  - Mobility Robustness Optimisation
- Network Slicing for IoT

# Continuous evolution of RAN and Spectrum conditions (2/2)



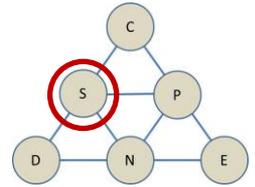
- In-band, guard-band, dedicated band
- Local conditions vs. country wide coverage
- In-door, out-door, heterogeneous networks
- IoT device population properties can be highly local, and evolving fast, even dynamically

# Introducing and evolving Edge Cloud



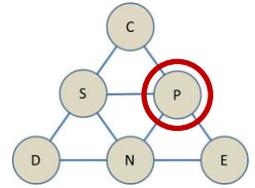
- Edge Cloud Services for IoT
- Hosting 3<sup>rd</sup> Party Applications
- IoT in need of Security capabilities
- Converged MANO across network & IT
  - NFV and Network Slicing
- Service Mesh that can support a managed approach to QoE
- Energy efficiency

# Evolving Security mechanisms, services and succeeding with Privacy and Trust



- Network slice isolation, truly end-to-end
  - Multi-slice access
  - Secure properties and security mechanisms in devices
- Data sharing; Data exchange; Data migration
- Secure ID management, supporting multi-domain
- Scalability issues, while supporting customization

# Evolving MANO & OSS & BSS & SDP (1/2)

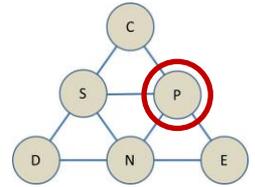


New IoT oriented service offerings across diverse markets

- The Brain for SLA management and service assurance end-to-end
- New actor roles, and business models
- Resource services facing and infrastructure management
- VNF management
- Inter-provider service management and automation

**MANO = Management and Orchestration (in NFV)**  
**OSS = Operations Support System**  
**BSS = Business Support Systems**  
**SDP = Service Delivery Platform**

# Evolving MANO & OSS & BSS & SDP (2/2)

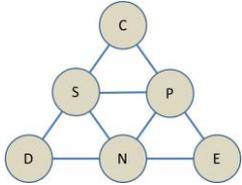


New IoT oriented automated and autonomous delivery and operations support across diverse markets

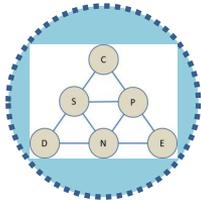
- Customer facing service delivery
- Customer self-service management
- Service assurance auditing
- Evolving APIs
- System evolution and migration support

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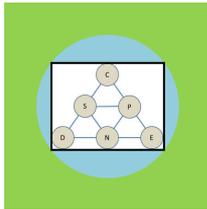
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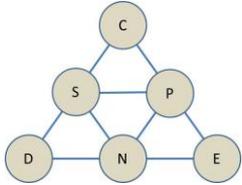


Evolving operational capabilities and facilitating customer engagement

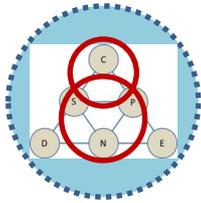


Contributing to the ecosystem evolution

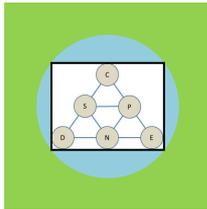
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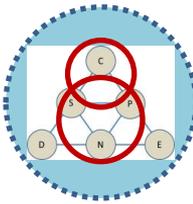


Evolving operational capabilities and facilitating customer engagement



Contributing to the ecosystem evolution

# Evolving operational capabilities and facilitating customer engagement



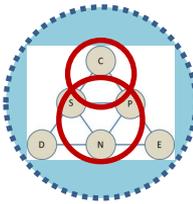
## Civil engineering and construction industry (Just one example)

- Highly diverse population of IoT devices
- Multi-actor business landscape
- BIM – «Digital Twin»  
Customer's Information Model of what to build or maintain
- Contract duration; e.g. 20+ Years

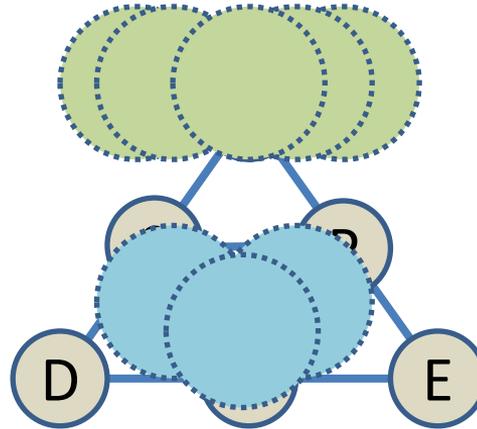
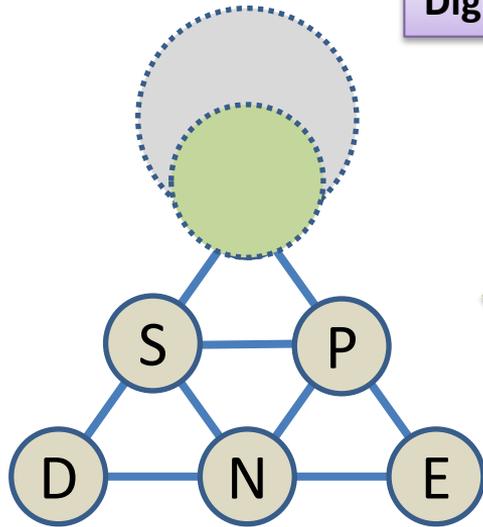
Digital Twin as an integral part of the IoT service offer

<https://www.novapoint.com/norway-lead-model-use-road-construction>

# Evolving operational capabilities and facilitating customer engagement



Digital Twins... all over the place

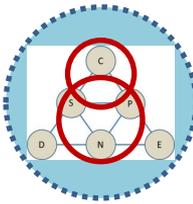


Customer-facing Digital Twins

Internal Resource-facing Digital Twins

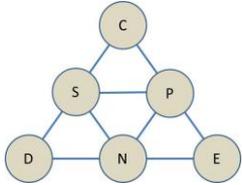
Analytics and AI to drive planning and operations

# Evolving operational capabilities and facilitating customer engagement

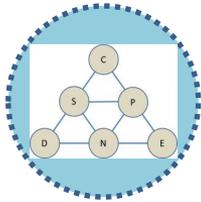


- Experimental facility as a Service
- Co-creation
- Service Design principles
  
- SLA management, Service Assurance, Managed QoE
- Continuous system improvement and evolution
- Enabled by Analytics and AI
  - Example: Signalling storms; in-bound roamers

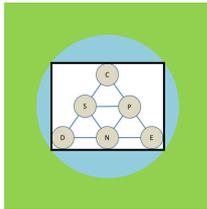
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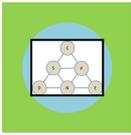
Being part of the technology evolution



Evolving operational capabilities and customer engagement



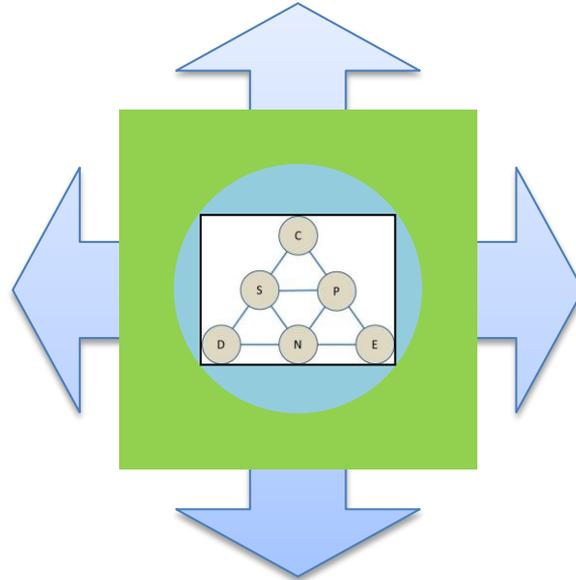
Contributing to the ecosystem evolution



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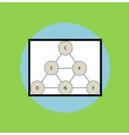
Human Factors & Societal Challenges

Technology  
Standardization  
in Telco and  
Vertical sectors



Multi-stakeholder  
Business Processes,  
Business Enabler APIs,  
and Automation

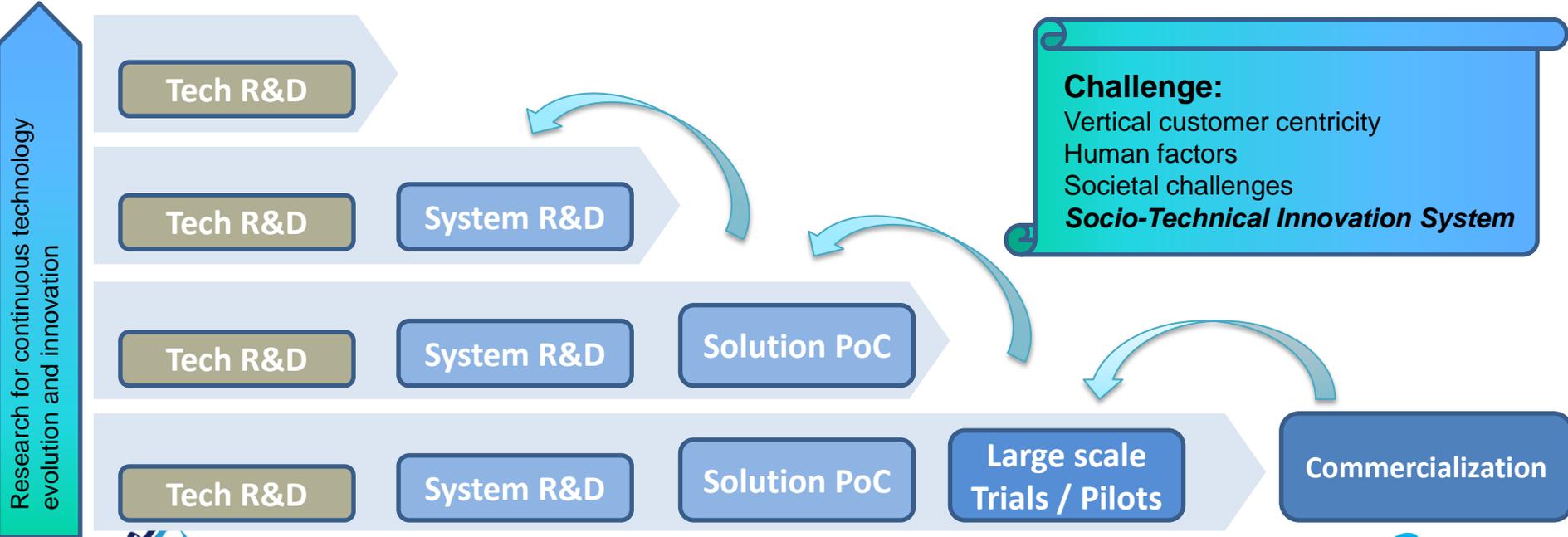
Supplier and Support Ecosystem



# Scoping, phasing and bridging the gaps

IoT Technology Components  
Advancement and Opportunities

Research for continuous IoT ecosystem  
innovation and evolution



# Concluding remarks

The typical Telco mission in 2029?

Connecting you and your things and facilitate for what matters most

... and still facing continued transformation

Empowering Societies!

# Thank You!



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