Autonomous Digital Infrastructure

GIO Round Table 7, Feb. 22, 2021
Luigi Licciardi (5GSA)

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5G SLICING ASSOCIATION

Agenda

- *Business Value of Autonomous Digital Infrastructure (Some Verticals use case)*
- *Autonomous Digital Infrastucture Arcitectural View*
- *Autonomous Digital Infrastucture and Autonomous Networks*
- *The importance of a coordination in the extended ecosystem*
- *The role of GIO*
- *GIO ADI WG main evidences from 2020*
- *The value of Intelligent Network Slicing for ADI*
- *GIO ADI WG Plan for 2021*
- *Questionnaire and survey*
- *Partners engagement*
- *Conclusions*

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Verticals need new ICT services with significant Autonomous Capabilities

	Manufacturing	Healthcare	Automotive	Smart Farming	Finance	Consumer	Education
Network-as-a-Service *Flexible commercial models, pay-go, revenue share, etc.*	High	High	High	High	Low	Low	Low
Custom Network Services *Precisely targeted network services customised to the use case and customer*	High	Medium	High	High	High	Medium	Low
On-Demand *Services when required, autonomous flexible scale-up or scale-down*	Medium	Medium	High	Medium	Low	Medium	High
Self-Service *Direct customer control of services*	High	High	High	Medium	High	Low	Low
Edge Cloud Convergence *Seamless orchestration of Cloud and Network services, Telco Edge Computing Federation*	High	High	High	High	High	Medium	Medium

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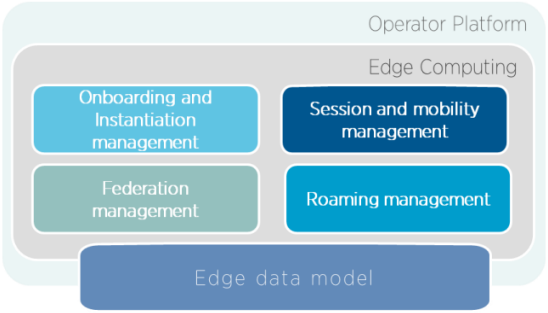
Automotive Industry

- 5G & Automation/AI & ML are transforming the automotive industry, the applications are
  - » **Smart Manufacturing** (introducing robots, wearable robots i.e. Hyundai for Kia…)
  - » **Safe and security driving**
  - » **Autonomous driving**
  - » **V2X vehicles, intelligent transport infrastructure**
  - » **Infotainment & Cloud services**

- Autonomous cars will generate 4,000 GB per day data to be accessed **on-demand** for:
  - » **Predictive maintenance**
  - » **Assisted driving**
  - » **Personalized Marketing & Adv**
  - » **Insurance & Emergency**
  - » **Fleet Management services**

- All the AN requirements are crucial for Automotive: **Reliable and Ultra-low-latency** Network, **edge cloud capabilities**, **Custom Network Services, Network As A Service, Security & privacy….**

- **Relevant role plays the Telco Edge Clouds federation** to deliver services globally from the edge of federated telco networks.



Functionality and data model of Operator Platform for Edge Cloud. (From GSMA document)

Sample Use Cases

Automation	Robotics and automated production require ultra-reliable low latency network, and high-capacity cloud compute for Digital Twins
Tracking	Tracking workers on-site to ensure safety and security Tracking tools and equipment across the campus to maximize assert utilization
Predictive Maintenance	Predictive maintenance for expensive production equipment Monitoring of equipment conditions (e.g. sensors for vibration, temperature, chemicals, etc.) with AI to predict failures.
Campus Network	Fully managed autonomous campus networks support multiple use cases, replacing wi-fi and scaling to meet IoT use cases
Assisted/Autonomous Driving	Sensors, cameras, mirrors, tracking tools, Intelligent maps, edge cloud infrastructure
Infotainment	Personalized location based services
Augmentation	Augmented reality (AR), head-up display to overlay information.

Smart Farming

- Smart farming is a variety of tech innovations in traditional farming (seeding, breeding, raising) to optimize the food production process and improve quality.
- Digital transformation in farming evolves the business models and shortens the production chain from production to consumer. (seeding, growing, harvesting, stocking, transforming/manufacturing (rice, wine…), distributing).
- Pandemic has accelerated the transformation of this industry and the automation adoption.

- Automation assists in:
  - **Reducing labor cost**
  - **Reducing the cost per unit**: Automation means faster and more output for a given period of time
  - **Mitigating risk**

- Agricultural are very **cost-sensitive**, with tiny percentage increases in efficiency/making major differences to profitability.
- **NaaS** is crucial for outdoor in rural areas and indoor sites with low radio propagation.
- **Robots and drones** play a crucial role in smart agriculture in all the process phases=> **Reliable and Ultra-low-latency** network characteristics are important.
- Smart Farming is an ideal sector for both on-premise and network-located **edge cloud capabilities**, bundled with network connectivity to provide rapid value.

Sample Use Cases

Monitoring & Analytics	Predictive and digital management through extensive usage of IoT, AI/ML Monitoring of fields, vineyards conditions (e.g. sensors for temperature, drought, etc.) with AI to predict.
Tracking	Autonomous driving machines (i.e. tractors, helicopeters) Tracking tools and equipment Tracking of whole product life cycle
Automation	Robotics, drones and autonomous driving machines require ultra-reliable low latency network
Eco-friendly environment	Automation means great precision in using of pesticides, bio treatments and in controlling product quality
Optimized Supply Chain	From fields to consumer table Dual Twins Augmentation via AR

Foundation of the digital economy: Autonomous Digital Infrastructure

Smart city

Smart industry

Smart Automotive

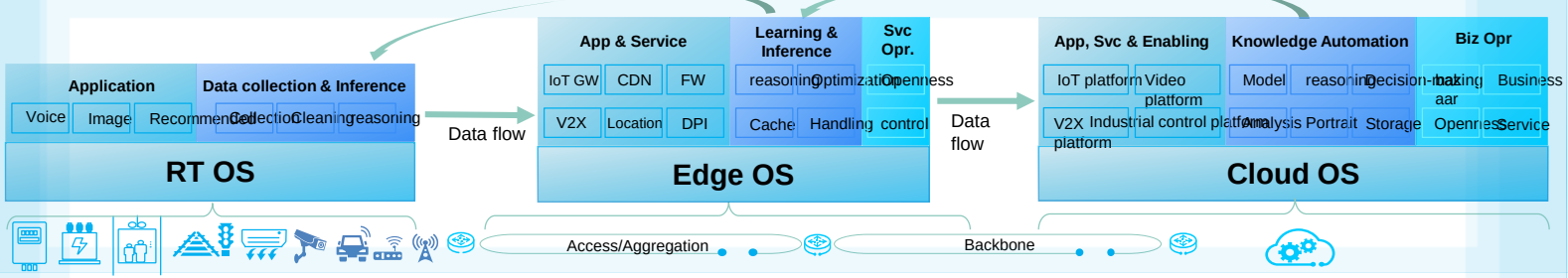
Smart farming...

ADI, ICT digital infrastructure: intelligence-ubiquitous platform

Intelligent suppling

- Smart production equipment & Smart producers services
- Material, energy, and usage efficiency
- Quality, and flexibility
- Security & privacy

Platforms collaboration for multiple vertical industries



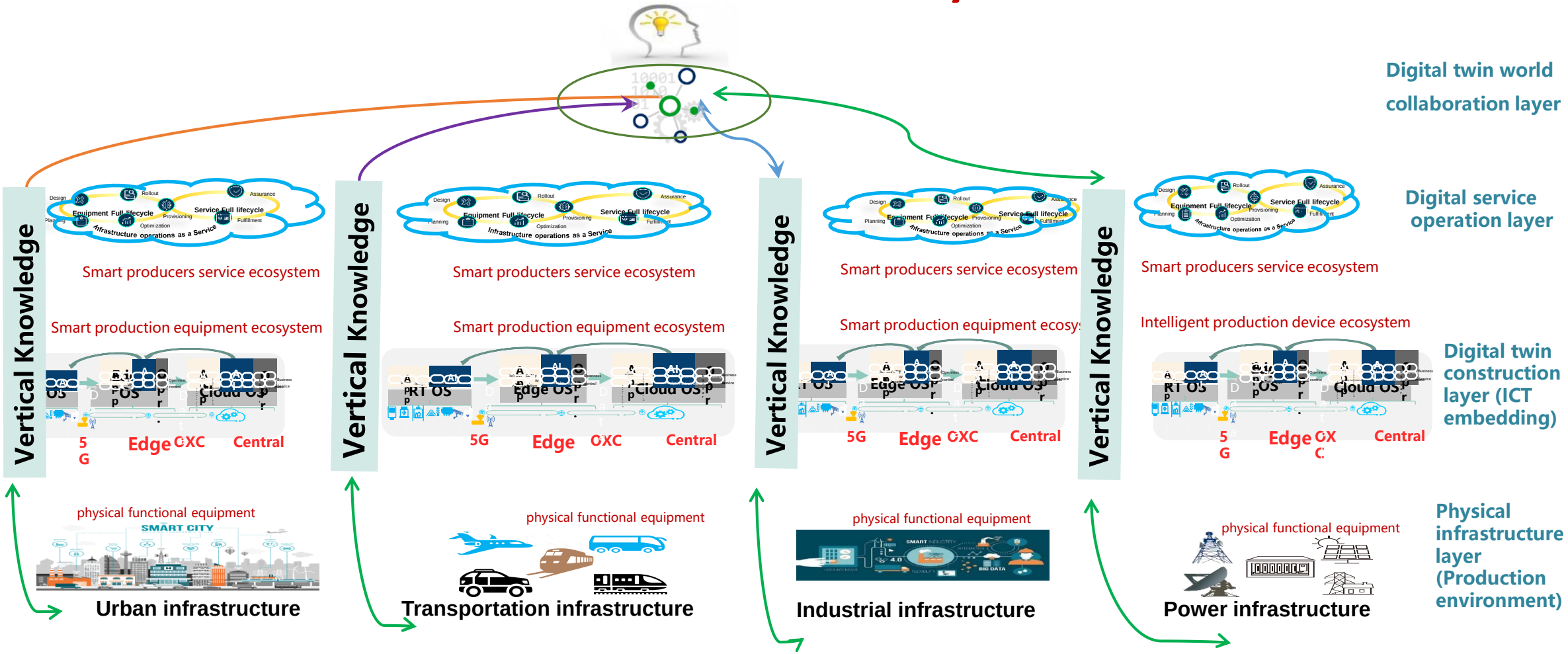
Autonomous Digital Infrastructure as Platforms Federation

Service personalization

- Intelligent Dynamic Slicing
- Deterministic network as a service
- Ubiquitous computing & AI as a service
- Flexible Production
- Distributed Agility
- Cost Structure optimization

Simplified architectures

Reference framework of Autonomous Industry Infrastructure



- The on-demand and flexible production mode of industry infrastructure services reduces costs and improves efficiency in production, transaction and diffusion in the whole society
- Data from the Production environment drive the Vertical Knowledge creation
- Intent driven collaboration across domains and across layers among all the ecosystem players

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Autonomous Digital Infrastructure

The ICT industry is going through a deep Digital Transformation, driven by changing customer demands and by the extension of the Ecosystem to new Business Partners (Verticals) enabled by the arrival of new technologies such as 5G, Artificial Intelligence and Multi-access Edge Computing.

The Fourth Industrial Revolution is announced.

In order to provide end to end solutions customized to the Customers and Business Partners needs, the increasing complexity of Networks and Platforms supported by innovative technologies require to introduce **a new Intelligent Framework with very high level of Automation in the Management and provisioning of services and Networks (Autonomous Digital Infrastructure - ADI).** Autonomous Digital Infrastructure is based on Autonomous Networks.

Autonomous Networks consist of a simplified network architecture, virtualized components, automating agents, intelligent decision engines and present self-dynamic capabilities to create intelligent business and network operations based on the concept of closed-loop controls (from TMForum)

Autonomous Digital Infrastructure will reduce the complexity of the usage of ICT technical stacks and offerings and make the collaboration easier between vertical industry and ICT. There is likely to have a ***COMMON Architecture Pattern,*** *that is the* ***Autonomous Industry Infrastructure (AII) based on Autonomous Production Domains****:* ***ADI embedded AII for Manufacturing should be the backbone of Manufacturing as a Service (MaaS) as well as ADI embedded AII for Digital Health should be the backbone of Digital Health as a Service (Haas)***

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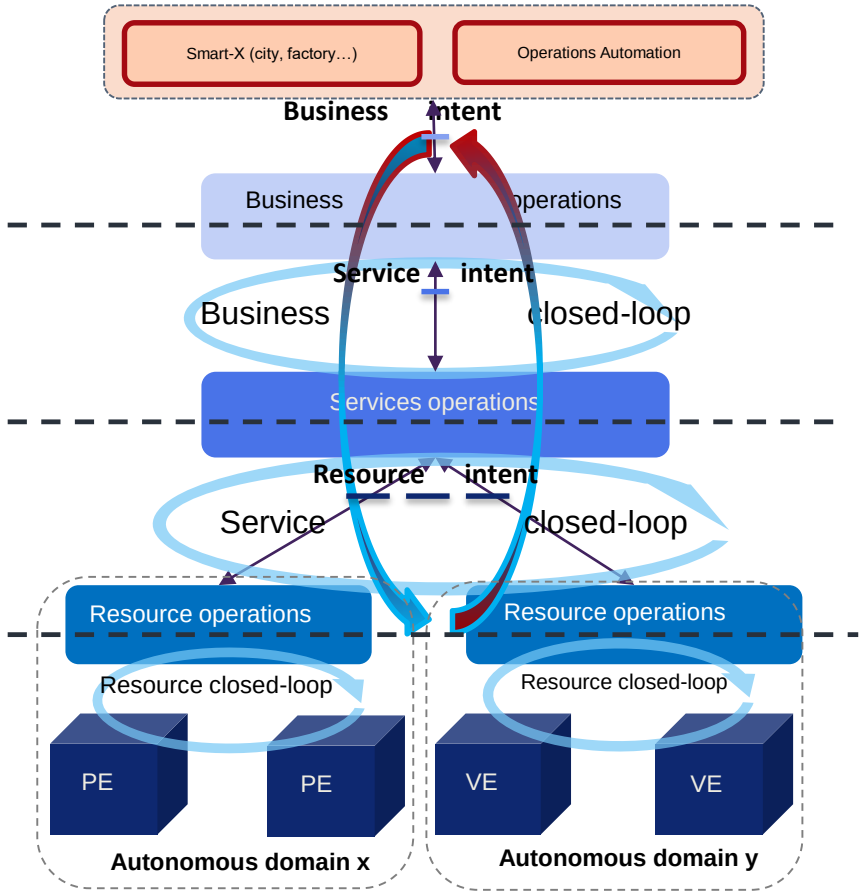
Autonomous Networks Basic Concepts



from TM Forum White Paper

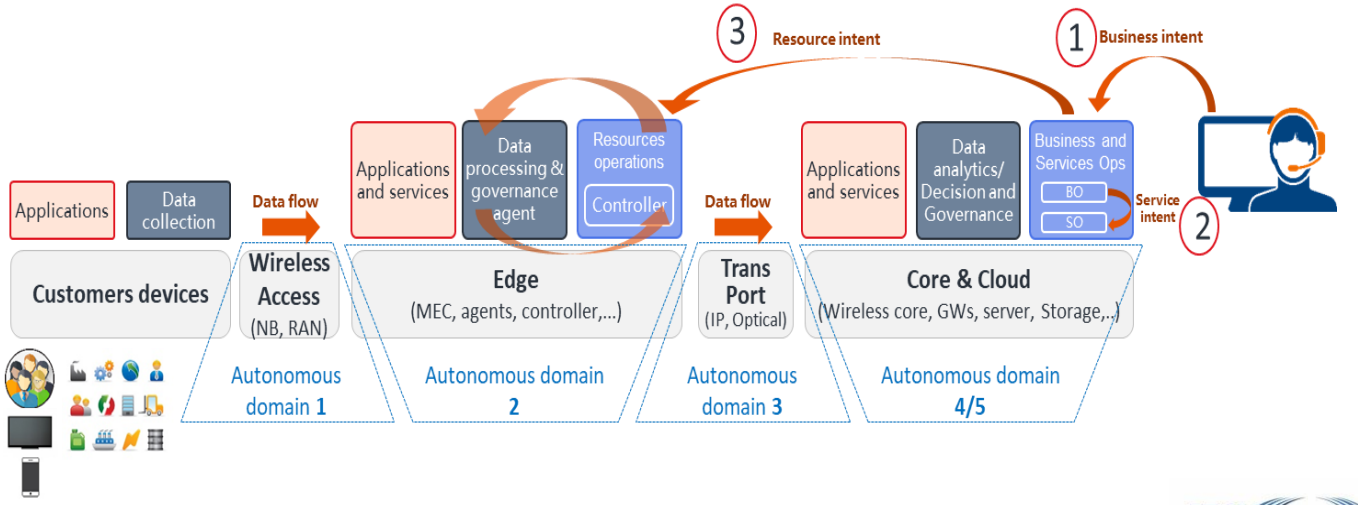
tmforum

Zero – X experience

- Zero-wait
- Zero-Touch
- Zero-Trouble

Self – X capability

- Self-service
- Self-fullfilling
- Self-assurance



from ETSI White Paper

ETSI

Closed loop

- Business CL
- Service CL
- Resource CL

Autonomous Domain based

- Autonomy
- Abstractation
- Collaboration

Intent driven

- Business
- Service
- Resource

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Call for Industry Collaboration to Push Forward about Autonomous Networks

1 Define the reference architecture

Technical Perspective

Unified language for technology and architecture

Define the reference architecture in a long-term view for future development, to ensure the frame stability and advancement.

2 Define industry SDOs collaboration

Business Perspective

Allocate the scope of work for industry players

Define the collaboration interface between various parties in the industry, allowing closed loop services for business objectives.

3 Define assessment system

Production Perspective

Setup the assessment system for autonomous networks & domains

Define measurable guidance for Autonomous Domains, Networks and Infrastructure

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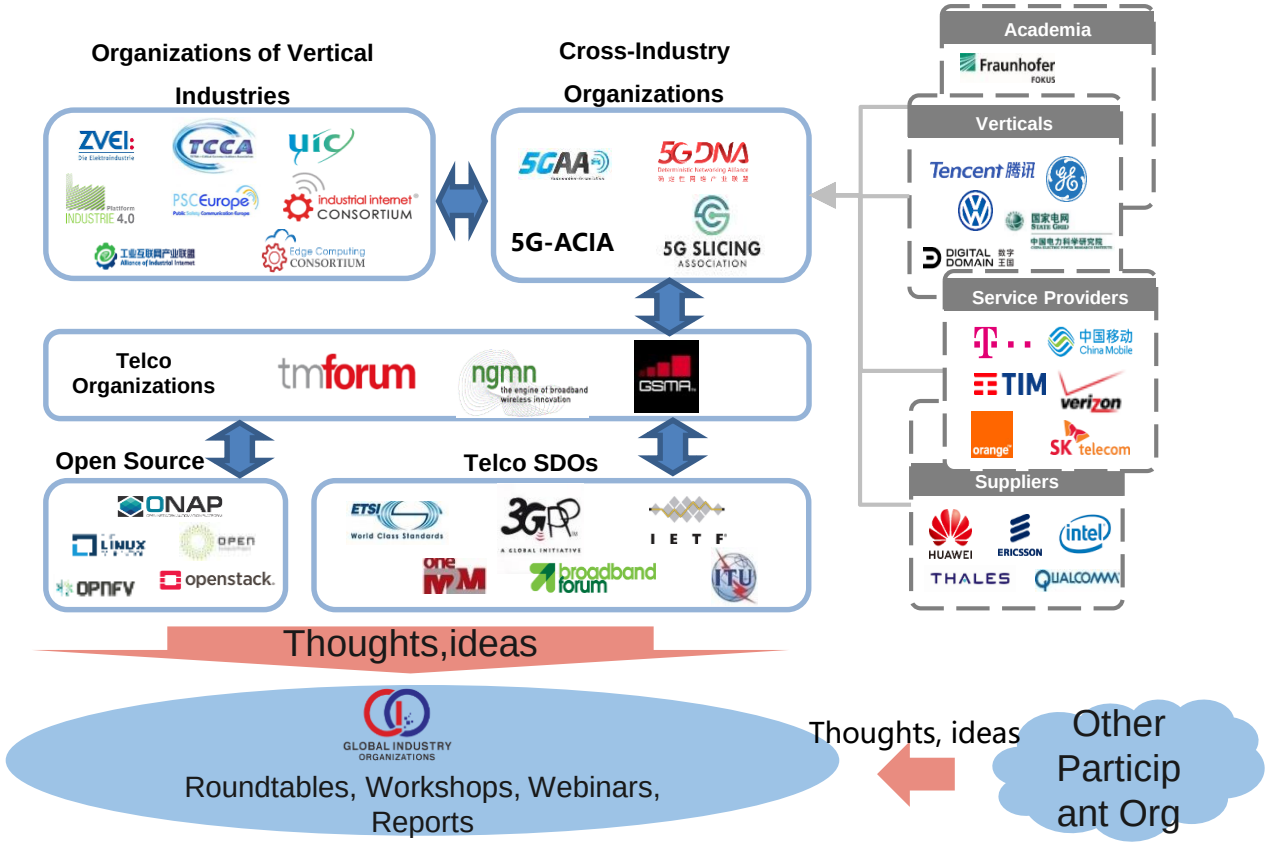
Cross-organization cooperation is mandatory

- **Cross-industry cooperation**: Cooperate with vertical industry organizations on key use cases.
- **Cross-organization collaboration**: Cooperate to research or reuse the work of other telco organizations to avoid industry fragmentation
- **Cross project Collaboration** within an organization: Some organizations have multiple relevant work groups that need coordination.
- **Core SDO (ETSI, TM Forum and 3GPP)** need to specify their work split and cooperation mode to accelerate the deliverables.
- **Joint innovation**: PoC to demonstrate high spectrum efficiency/energy efficiency/asset utilization/agility of production/customer experience .
- **Expanded influence**: Cooperate with other telco organizations working on public technologies and official organizations (ITU-T and CCSA).

GIO is a Roman-like Forum open to multiple industries/organizations

- to discuss and conduct research about digital transformation.
- To facilitate the collaboration between Vertical industries and ICT for Autonomous Digital Infrastructure, Smart Manufacturing and Digital Health.



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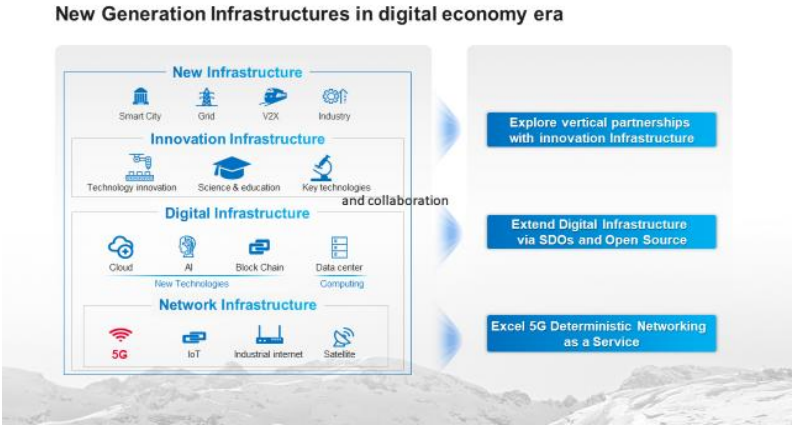
Key Takeaways from GIO webinar



- ADI **is a great business opportunity not only for CSPs**. **Operators will benefit in terms of strong cost reduction and new revenue opportunities**
- ADI evolution, standardization and deployment require a **large industry**
- **consensus**; SDOs need to collaborate to reduce the competitions and create synergy, GIO can help at all levels
- **Network Slicing is a key capability** for 5G; evolution and standardization of Autonomous Networks and ADI should take care of evolving Network Slicing in order to satisfy the Verticals requirements and needs
- **AI and Machine Learning will play a key role in ADI evolution**, these technologies will be everywhere from devices to edge/cloud, they are managed, produced and owned by different players, mixed ownerships is a point of attention and it requires security and trust
- **The evolution from Cloud computing to Edge Computing is the trend** and it will be the next battle-ground where Telcos can play an important role.
- **AN/ ADI is a Medium-Long Term evolution** the real products deployment with AI everywhere and a significant level of Autonomy (level 4/5) are expected in four/five years, however in 24 month time-frame tangible elements of AN, generating the first benefits, might be available (i.e. at Level 3 – partial autonomy).
- Standards should move fast to prepare the conditions of interoperability and commercial deployment of Autonomous Networks; **the Standard stabilization should be within 2 years** maximum time-frame

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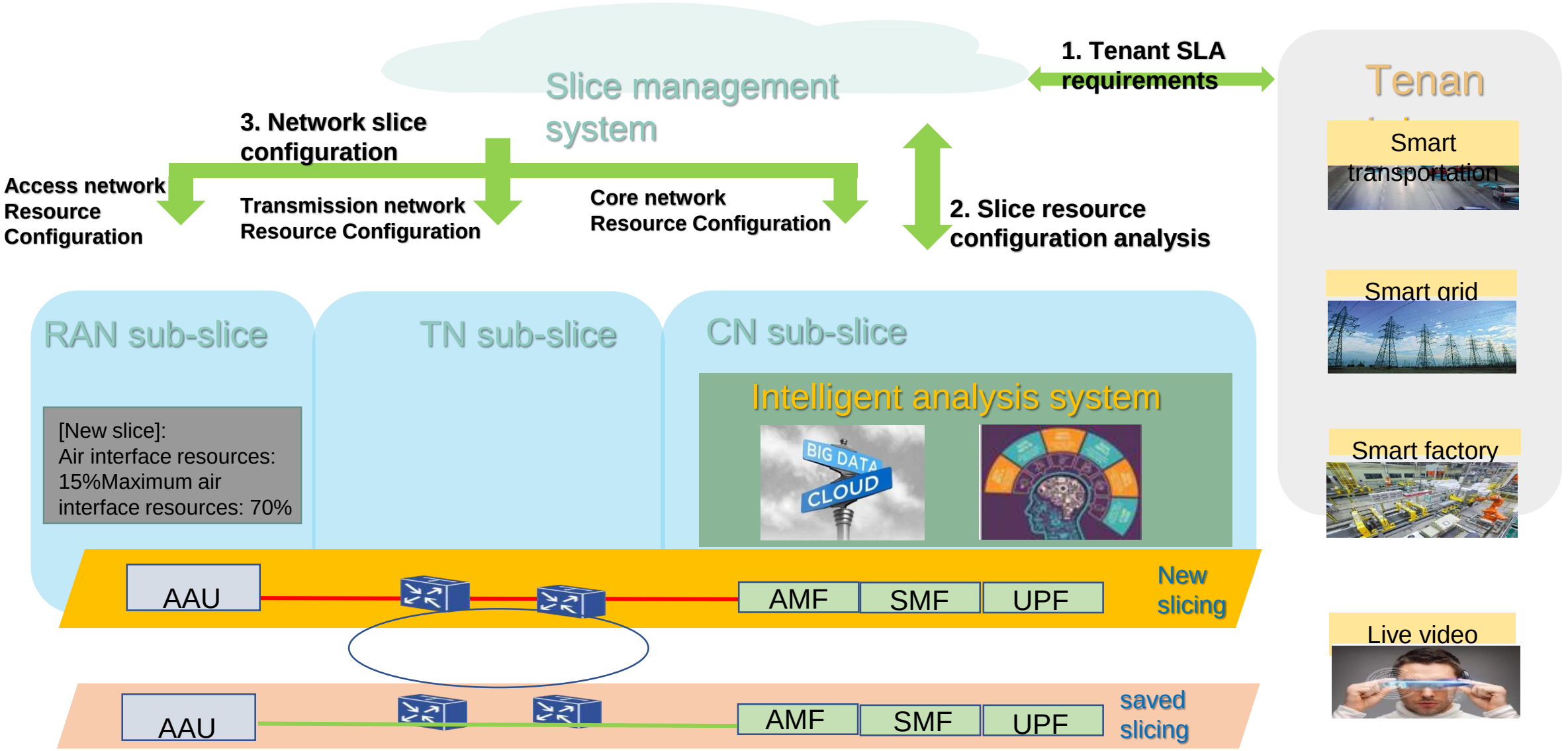
Intelligent Slicing Creation Process in AI Slicing Management and Orchestration



From Jennifer Zhang Jing's (CAICT, IMT 2020) presentation at GIO Webinar

Autonomous Digital Infrastructure (ADI) – Plan for 2021

The Working Group is focused on the promotion and launch of Autonomous Digital Infrastructure in a medium/long term perspective as a key enabler of Digital Transformation in the Industry.

List of participant organisations (in 2020)

5GSA
5G-DNA
TM Forum
ETSI
CCSA & 5GAIA

List of participant professionals/experts

Luigi Licciardi--5GSA
George Glass--TMForum
David Boswartick--ETSI
Ms. Zhang Jing--CCSA
Mr. Dai Jisheng--5GDNA
Martin Creaner--GIO

Objective: increase participant organisations and professionals

- GIO RT#7 Autonomous Digital Infrastructure WS and 2021 Plan (Feb. 22, 2021)
- Questionnaire (Feb. 26, 2021) and Survey on ADI (Mar., 2021)
- Selection of main topics for GIO in 2021 (Mar. 2021)
- Webinar 2: *Autonomous Networks – SDO main achievements* (Apr. 2021 - to be confirmed)
- Web. 2 Report and Newsletter (Apr.2021)
- White Paper 1: *Autonomous Networks*: *Architecture evolution and Business Opportunities* (Mar. 2021 – end June 2021, pub. Jul. 2021)
- Web. 3: *The evolution from Autonomous Networks to Autonomous Digital Infrastructure: Vertical use cases* (Jul. 2021, to be confirmed)
- Web. 3 Report and Newsletter (Jul. 2021)
- GIO RT#8 ADI WG Presentation of main results (Sep. 2021)
- White Paper 2: *Autonomous Digital Infrastructure: business opportunities and requirements* (Sep.2021 – end Nov. 2021, pub. Dec. 2021)

Questionnaire and survey

Objective of the questionnaire: interview Partners, ICT players and Verticals on business value, innovative enabling technologies and use cases on Autonomous Digital Infrastructure and soliciting contributions to actively participate the ADI WG deliverables.
A survey is going to be delivered to GIO partners collecting answers and suggestions

The questionnaire is based on 3 main sections:

- Information on the Partner/ Company and its business / competence focus
- 5G and Key technologies plan and interest
- Autonomous Networks (status of the initiatives, results and plan) and Autonomous Digital Infrastructure (perspective and opportunities)

The interest in attending the ADI WG is also checked as well as the area / deliverable to contribute and some suggestions are collected on the best way of working/ contributing (depending on the deliverable to be produced)

The questionnaire will be delivered after the GIO RT#7 by GIO Operation Team

After a reasonable time frame (3-4 weeks) to answer the questionnaire, a survey collecting the answers will be delivered to GIO partners by the GIO Operation Team

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Conclusions

- **Autonomous Networks (AN) is gaining momentum and consensus** in most significant SDOs and is in continuous progress
  - TM Forum launched a coordination table among SDO working on the subject
  - ETSI launched a OCG ad hoc subGroup for synchronization and coordination of ISG/TC dealing with AN
  - NGMN launched the Project *Network Automation and Autonomy*
  - ITU-T launched a Focus Group
- **Autonomous Digital Infrastructure (ADI) is a further step forward** – being AN a primary foundation for ADI
- **ADI** includes Provisiong, Business Assurance, Offer management, Customer and Party Management... **It is beyond connectivity**
- **ADI includes Computing, Edge Cloud, Federation of Edge and Cloud, connectivity and services... It is Cross-Connectivity**
- **ADI requires committment and engagement of Business Partners** (Verticals) for use cases and requirements
- **ADI could be the backbone of MaaS** (Manufacturing as a Service), **HaaS** (Health as a Service), **ADCaaS** (Autonomous Driving Car as a Service)....
- **Intelligent and dynamic E2E ADI Slicing**, SLA driven, is a key element for ADI
- **ADI should provide the capabilities to create Vertical specific Digital Twin**
- **ADI is business driven and opens new innovative business scenarios** and opportunities with Verticals
- **GIO can engage Vertical Partners** through Vertical/ Cross Vertical Alliances (5GAA, 5GDNA, 5GSA, IIC, 5G-ACIA...) and provide the right Forum to co-operate

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Thank you

For questions and information
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