



*This Communication is part of a project that has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°957258*



# assist - iot

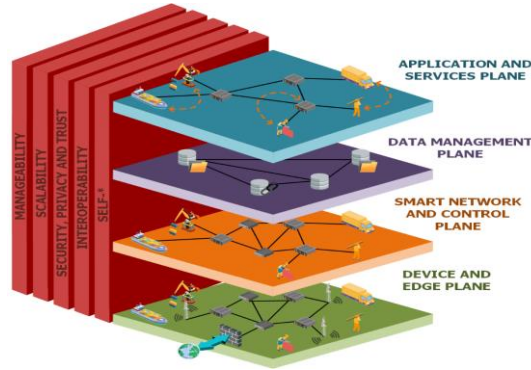
## Success Story

### **EU CEI Concertation Meeting**

Brussels, May 11<sup>th</sup>, 2023

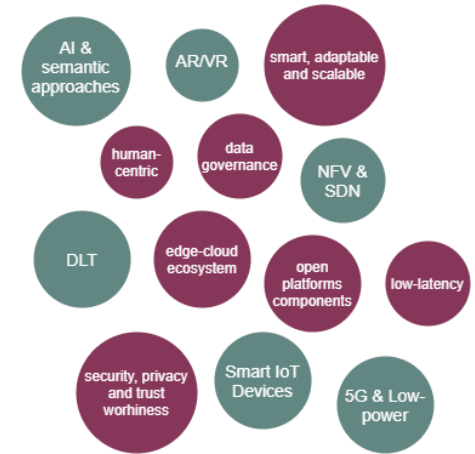
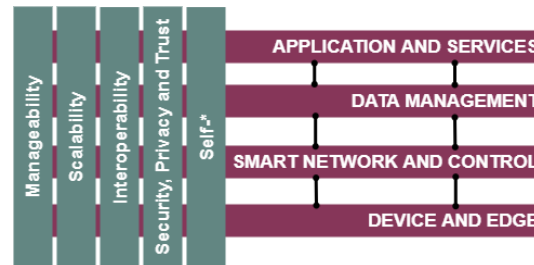
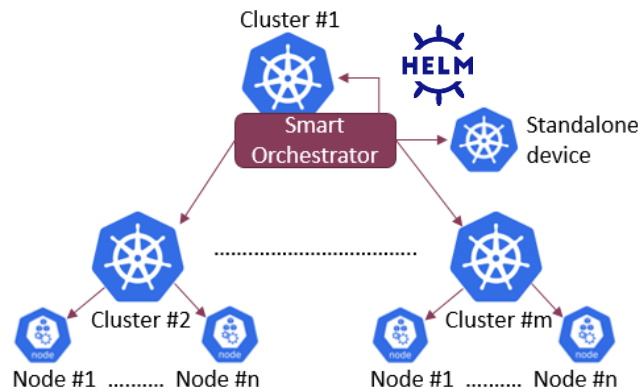
Dr. Ignacio Lacalle  
Researcher - UPV

# Brief project presentation and Main Challenges



- Delivering a blueprint NGIoT **multi-plane-oriented architecture**
- Supported by **key enablers** atop a smart network infrastructure, with low latency capabilities.
- Transferring **intelligence closer to the edge**.

- Micro-applications **enablers** grouping (functionality-directed)
  - Reduced (level of) granularity
- Security-guided communication architecture
  - Enabler-level: via standard-compliant entry points (encapsulation)
  - Component-level: only within enabler
- Core/optional enablers distinction (essentials)
  - possibility to manage enabler's "heaviness" / adapt to edge
- Cloud-nativeness approach - [Kubernetes](#)

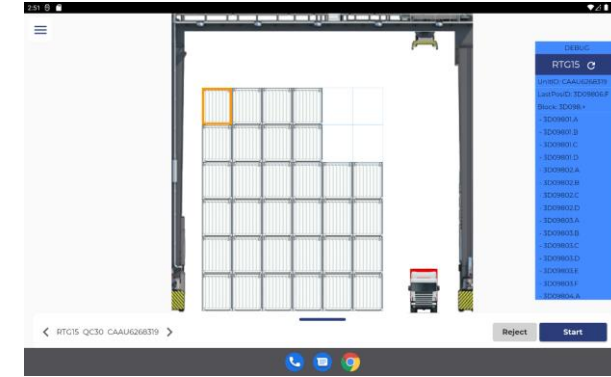
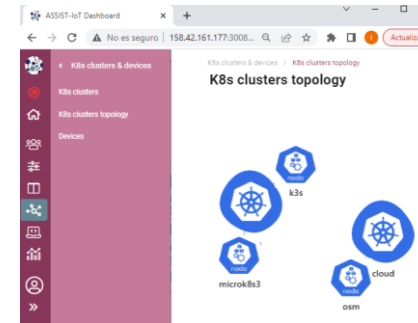


"Architecture for Scalable, Self-\*, human-centric, Intelligent, Secure, and Tactile next generation IoT"  
 Call: H2020-ICT-2020-1  
 Topic: ICT-56-2020  
 Type of action: RIA  
 Duration: 36 months  
 Start date: 1 November 2020  
 Partners: 15  
 Countries: 7



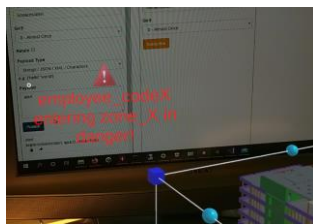
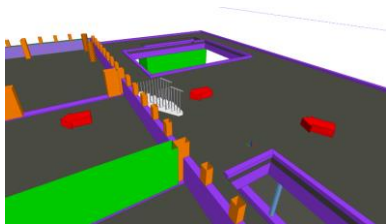
- Port automation** Improve efficiency, safety and profitability of new port processes
- Smart Safety of workers** Make provisions for predicting potentially dangerous situations in construction
- Cohesive vehicle monitoring and diagnostics** Increase monitoring capabilities in individual cars and at a fleet scale

# Lessons learned and Success Stories

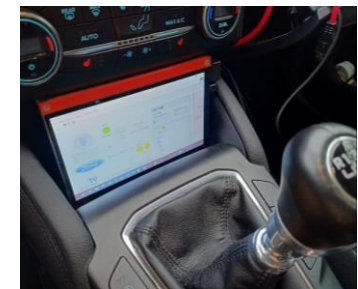
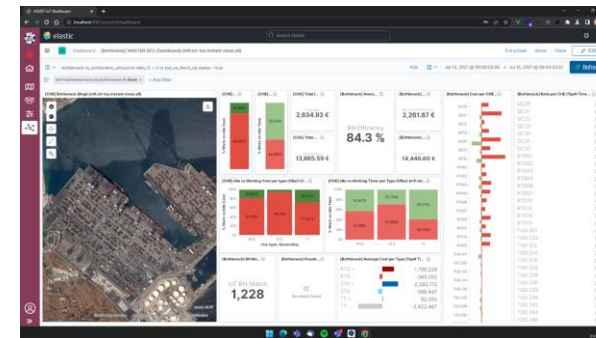


- Installation of ASSIST-IoT's software and hardware in hard environments.
- Open Calls experience: communication, publicity, integration, announcement, anticipation and tracking.

- Utilization in TRL5 pilots
- Management of decentralized data and scalability to fleet of controlled elements.

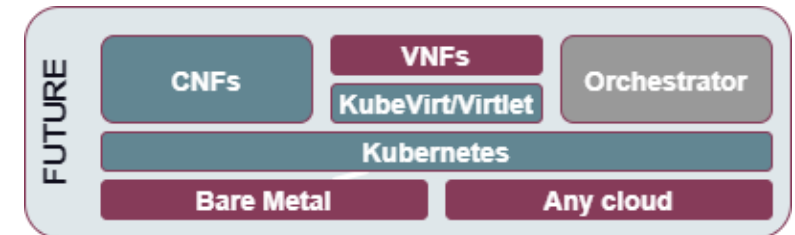
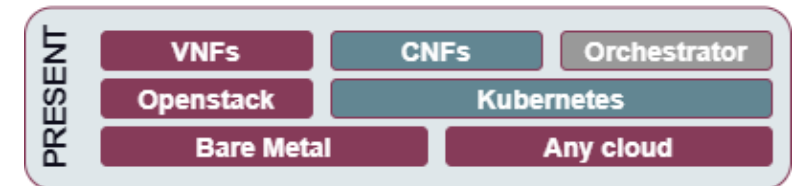


- Integration of tactile AR equipment with Ngiot architecture.
- Manuals and guidelines of the integrated system.



# Recommendations for the future

- The continuum will not become a reality until it would be easy for developers and for users.
- Heavy workloads make the continuum very energy-inefficient (to run a Python script, even with a lightweight alternative to virtual machines – Docker – there is a lot of overhead)
- IoT and the continuum are not only Linux-based. FPGAs, STM and other devices **MUST BE PART** of the continuum
- Interdisciplinarity of the research in the continuum must be reinforced during the coming years, incorporating investigation on (prominently) trustworthy AI, energy efficiency (e.g., batteries), environment (e.g., shared continuum footprint) and Social Science and Humanities (e.g., human-robot interaction), among others
- Further development of mechanisms for autonomous detection, diagnosis, and correction of hardware and software failures, ensuring uninterrupted service and enhanced system resilience.
- Automatic semantic annotation of data, and autonomous metadata and schema discovery
- Open source technologies are advancing at a fastest pace than scientific papers, Industry or formal validated channels. Therefore, a clear bid on those kind of outputs must be made by Europe.





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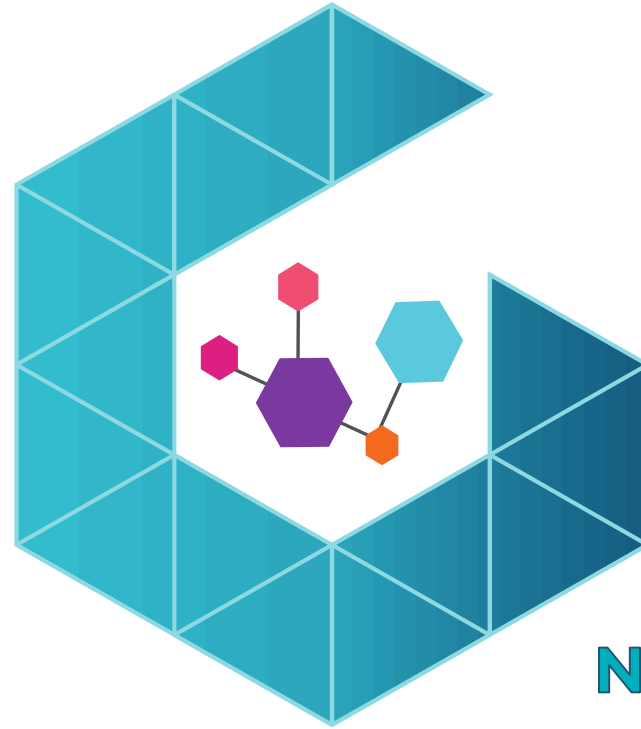
**Thank You  
Questions?**

**Dr. Ignacio Lacalle**  
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NGI



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**NEXT-GENERATION IoT SOLUTIONS  
FOR THE UNIVERSAL SUPPLY CHAIN**

**Nuria Molner - Universitat Politècnica de València (UPV)**

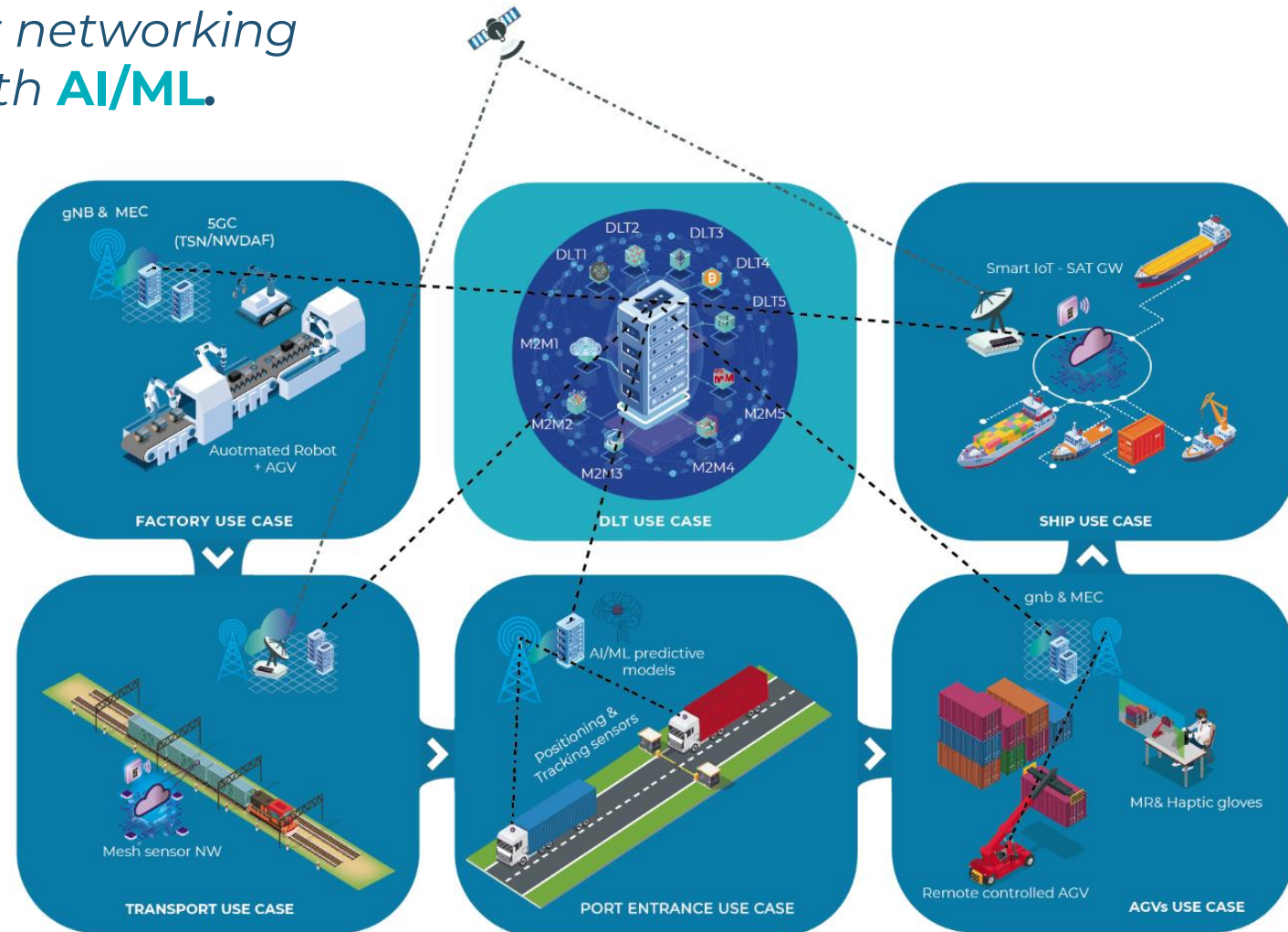
**10th May 2023**

# PRESENTATION & MAIN CHALLENGES

“*INGENIOUS aims to design and evaluate the NG-IoT solution, with a particular emphasis on 5G and the development of Edge and Cloud computing extensions for IoT in addition to providing smart networking and data management solutions with AI/ML.*”

## Challenges:

- **Factory UC:** end-to-end management + orchestration of 5G industrial networks
- **Transport UC:** defect detection using ML-based sensors trained on real-world data
- **Port Entrance UC:** data accessibility and ML model development to predict and optimize truck + container traffic in ports
- **AGVs UC:** immersive cockpit for good driver experience in tele-operated AGVs
- **Ship UC:** end-to-end tracking + real-time monitoring of shipping containers on both land and sea
- **DVL/DLT UC:** virtualization of machine-to-machine platforms for unified data access



# LESSONS LEARNED & SUCCESS STORIES

## Lessons learned

- **Real innovation impact:**
  - Innovative **SMEs** (advantages + risks)
  - **Complementary** partners per UC
  - Real **scenarios** for **validation**
- **Demos in real environments (ports)** have to be prepared (much) in advance
  - Requires **real interest** + commitment
  - **Disadvantages: licenses** and **permissions**
    - Not all countries have similar **laws**
    - **domestic language** for the bureaucracy
- Resiliency to **replanning:**
  - Act fast in case of **partner withdrawal**: Mitigation plan
  - Products **not delivered** on time

## Success story

- **AI system for predicting port-city container traffic rates:** Cloud-based AI system to predict vessel and truck traffic rates and turnaround times in sea ports
  - Relevant for **port-city traffic planning** and hinterland logistics operators
  - **First solution components** already offered as **commercial** services (TRL 8)
  - **System as a whole** deployed as an online demonstration (TRL 6) for **port of Valencia** → to be **piloted commercially** using a software as a service (SaaS) licensing and delivery model after completion of the project
  - Multiple ML-based prediction **modules**
  - **Data** from **heterogeneous IoT** and operations planning systems in the port ecosystem
  - **Cloud**-based ML operations infrastructure and services to allow **scalable** and **automated** ML model **training**
  - **Data integration** services to allow **online demonstration** of the system





# RECOMMENDATIONS FOR THE FUTURE

- **Use Cases** with **real interest**:
  - Find **interest**/commitment within **partners roadmap**
  - **Innovative SMEs**:
    - **Developing** new products
    - **Evolving** innovative products
  - **Complementary** partners
- **Demos**:
  - Prepare carefully the **timings** & field **requirements**
  - **Minimum viable product/solution**:
    - Previous **lab tests**
    - Early **integration**
    - **Iterate**: detect problems early
- Engage with **Advisory Board** stakeholders
  - Always keep **impact** of technical work in mind and communicate it clearly
  - Good for **SMEs** to find cooperations



# STAY UPDATE AND GET INVOLVED!



[www.ingenious-iot.eu](http://www.ingenious-iot.eu)



[@ingenious\\_iot](https://twitter.com/ingenious_iot)



[Linkedin group](#)



[YouTube channel](#)



[Slideshare](#)

zenodo

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# IntelloT

IntelloT - Intelligent, distributed, human-centered and trustworthy IoT environments



# Concept & Challenges

- Concept: Framework based on 3 pillars
  - Collaborative IoT, Human-in-the-Loop, Trustworthiness
  - Technologies: 5G Infrastructure distributed ledger, AR/VR, tactile internet and more
- Challenge: Integration of different use cases during Covid & broken Supply Chains
  - Agriculture UC: challenges in data acquisition as input for AI
  - Healthcare UC: delays in IoT device acquisition; challenging ethics clarifications
  - Manufacturing UC: delays in 5G hardware acquisition
- Challenge: Dissemination & Impact
  - Strongest Impact expected at the end of cycle 2 / TRL of RIA comparably low for fast commercialization
  - BUT: 25 KER identified already



# Lessons Learned & Success Stories

- Success: Working Demonstrators
  - All planned use cases and scenarios could have been validated (see healthcare)
- Success: Big interest among SME & the wider IoT Community
  - 350+ application during OC1 and OC2
  - Groups in W3C Community with strong growth
- Success: Proven applicability in additional domains
  - Framework is currently applied in three additional domains: Energy, Smart City, Construction
- Success: Academic Excellence
  - High Impact in Education, Track record in academic papers and publications



# Recommendations for the Future

- Stronger collaboration among the RIAs
- More alignment regarding OC / use cases
- Further joined standardization and dissemination activities to increase impact

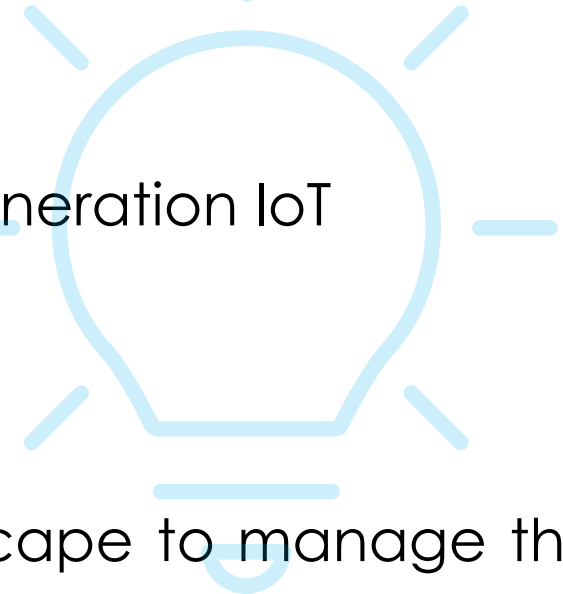


# IoT-NGIN

# IoT-NGIN in one slide



- Our goal:
  - *Bringing the IoT and modern technologies (5G, AI, DLT...) together in an optimal way, towards a sustainable ecosystem of European Technology and System providers*
- Our way:
  - Offer new tools and ecosystem to enable next-generation IoT
    - New services to existing platforms
    - New platform opportunities
    - New collaboration paradigms
    - New business potential
  - Prepare the technology & standardization landscape to manage the demands posed by large-scale IoT deployments





# Lessons Learned and Success Stories



- Edge intelligence has been applied and has a great potential in all 4 areas piloted (Smart City, Smart Agriculture, Smart Industry, Smart Energy)
- The application of federated learning in real environments has a great potential
- Private 5G has been tested in Industry 4.0 settings
- Contributions have been made towards ambient intelligence through ML-based collision avoidance and UWB/VLP techniques in Industry 4.0
  - also Augmented Reality assisted build-to-order assembly piloted in ABB
- Data sovereignty has been realized through distributed interledger solutions and digital identities
- Cybersecurity issues have been addressed in IoT settings, applying Federated Learning

# Recommendations for the Future



- Continuous enhancements of AI techniques/models with new data and more effective methods for learning will further support the penetration of AI in real-life applications towards smooth integration to everyday operations
- Privacy and data sovereignty have to be integrated by design at all levels, as AI penetrates devices at the continuum
- Homogenized resource management at all levels of IoT, edge, cloud
- Homogenization of data representation across administrative domains/data spaces
- Commercial device interoperability/support for advanced 3GPP features has to be fully realized, as now is a barrier to adoption of new technologies
- Cybersecurity at all levels (IT/OT or IoT/edge/Cloud or for compute/network) needs always special care, especially in the context of homogenized integration of resources
- Emphasis on APIs and SDKs will accelerate the adoption of new technologies, without the need of awareness of backend operations
- Interoperability
  - Support state of the art and/or standardized communication protocols, and thus easy integration with existing IoT/edge and cloud solutions
  - Develop platform-independent and open-source solutions
- DevSecOps/MLOps approach for software updates at deployment sites significantly reduces the required effort
- Openness of any developed software
  - Open-source code availability (public GitLab instances)
  - Adoption of well-known open-source licenses
  - Extensive and comprehensive documentations



Thank you for your attention

Name, Presenter



# nexT gEneRation sMArt INterconnectEd IoT

Presenter: Prof. Panagiotis Sarigiannidis, Project Coordinator



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957406.



# Project Identity and Main Challenges

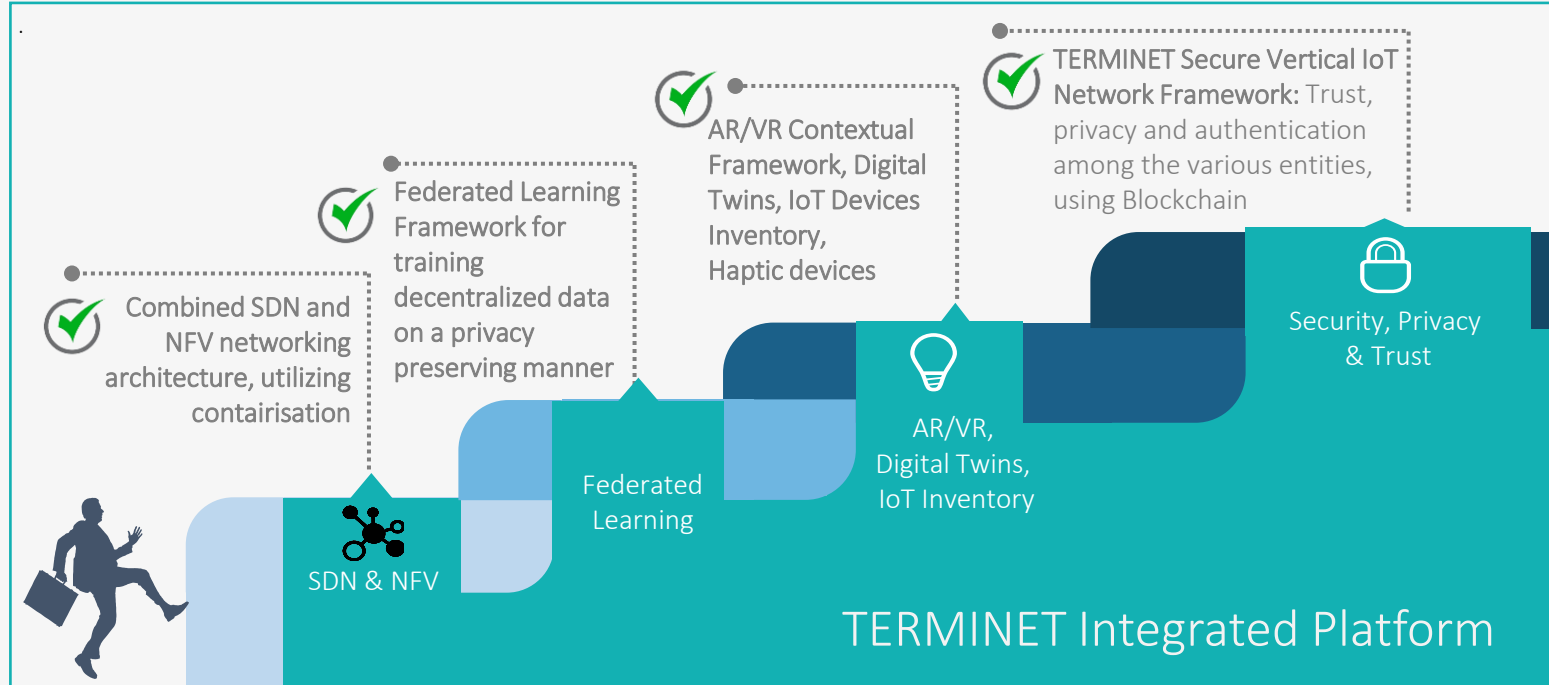
- ✓ Call: H2020-ICT-2018-20
- ✓ Topic: ICT-56-2020
- ✓ Type of action: RIA
- ✓ Total Budget: € 8.000.000,00
- ✓ Active period: 1 Nov 2020 – 31 Oct. 2023



TERMINET aims at providing *a novel next generation reference architecture* based on cutting-edge technologies such as *Software Defined Networking (SDN)*, *multiple-access edge computing (MEC)*, and virtualisation for next generation IoT. In addition, TERMINET introduces *new, intelligent IoT devices* for *low-latency, market-oriented* use cases. Finally, TERMINET intends to bring more **efficient and accurate decisions to the point of interest to better serve the final user.**



1. UC #1: User-Centric Devices in Smart Farming
2. UC #2: Pathway of Personalized Healthcare
3. UC #3: Smart, Sustainable and Efficient Buildings
4. UC #4: Prediction and Forecasting System for Optimizing the Supply Chain in Dairy Products
5. UC #5: Group Training Surgery Using VR enabled IoT Technologies
6. UC #6: Mixed Reality and ML Supported Maintenance and Fault Prediction of IoT based Critical Infrastructure



<https://terminet-h2020.eu/>

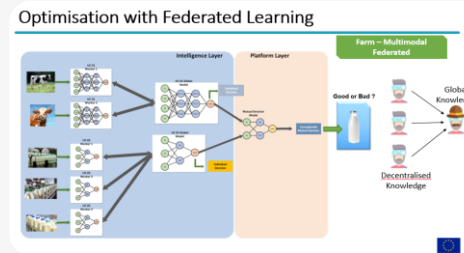




# Lessons Learned and Success Stories

## Achievements so far

- 38 Scientific publications
- 6 Datasets published
- 3 Whitepapers
- 22 Active PhDs
- 10 Invited talks and keynotes
- 28 Exploitable Items
- The application of state-of-the-art federated learning procedures can significantly improve the quality of AI models used in the TERMINET use cases, while sustaining reasonable resource containments.
- Interoperability through multi-access distributed edge networks supported by novel orchestration schemes is found to be applicable in a variety of commercial and industrial applications that TERMINET explores through its use cases.
- Experimental results showed that utilizing small compound datasets can achieve measurable results by employing novel model optimization techniques accompanied by model personalisation.
- Through the correct pathways and channels TERMINET showed that smooth intrusion in commercial fields, such as Smart Agriculture and Healthcare by using advanced technological means in a non-obstarctive manner.



## AGROMINDS – Qualitative Results

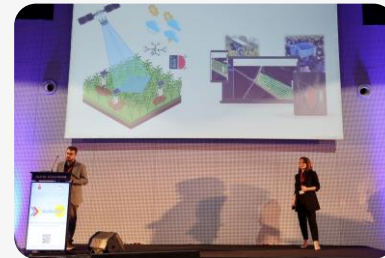
The three user interfaces were evaluated by **farmers and agronomists** based on five aspects:

Average Farmer Opinion Scores					
	Ease of Use	Utility	Availability	Responsiveness	Recommendation
Dashboard	4	4,5	4,5	5	4,25
Mobile Dashboard	4,25	4,5	4,75	4,25	4,25
AR Glasses	4,75	4,5	5	4,75	4,75

## Success stories:

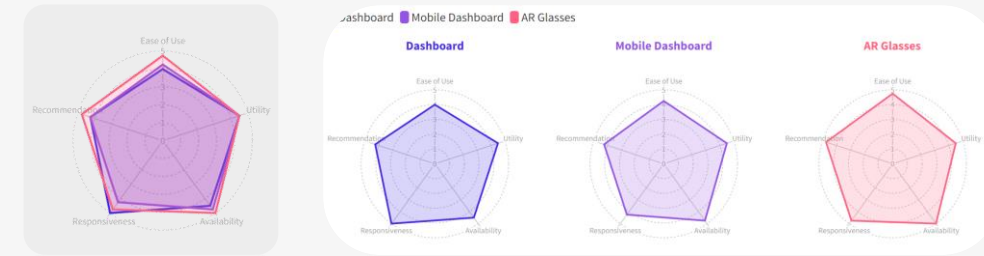
### 1. TERMINET AR-assisted End-to-End Smart Precision and Smart Animal Monitoring Platform (AGROMINDS)

- Utilised in UC1: User Centric Devices in Smart Farming aiming to provide a complete solution for Smart Animal Husbandry capable of monitoring different kinds of productive animals such as cows, sheep, goats and horses in real – time.
- TERMINET UC1 is the flagship of the project and it was significantly highlighted by Mr. Jan Komarek, Policy Officer of the European Commission, during the Webinar: IoT, Cloud, Edge Computing Continuum From Research to Deployment – AIOTI (<https://aioti.eu/events/webinar-iot-cloud-edge-computing-continuum-from-research-to-deployment/>) that took place online at Nov. 30th 2022.



2. The AGROMINDS tool was a finalist in the "Accelerator Program for Start-ups in the Field of Agriculture between China and the Countries of Central and Eastern Europe. - APACCCEEC".

3. Best Oral Presentation in 10th International Conference on Modern Circuits and Systems Technologies (MOCASST): Paper -> T. Sachinidis, A. -A. A. Boulogeorgos and P. Sarigiannidis, "Dual-hop Blockchain Radio Access Networks for Advanced Coverage Expansion," MOCASST, 2021, pp. 1-5, doi: 10.1109/MOCASST52088.2021.9493339.





# Recommendations for the Future

## Architectural challenges

- Cross-architecture Federated edge management to enhance fairness and efficiency of B5G infrastructures, leveraging also QoS improvement
- Open interfaces and white box hardware for the Next Generation SDN (NG-SDN)
- Common standards for network integration towards enabling virtualised Multi-access Edge Computing (vMEC)
- Novel Federated datasets
  1. C. Chaschatzis, I. Siniosoglou, A. Triantafyllou, C. Karaiskou, A. Liatifis, P. R. Grammatikis, D. Pliatsios, V.i Kelli, T. Lagkas, V. Argyriou, P. Sarigiannidis, September 28, 2022, "Cherry Tree Disease Detection Dataset", IEEE Dataport, doi: <https://dx.doi.org/10.21227/ehfm-9j20> .
  2. C. Chaschatzis, I. Siniosoglou, A. Triantafyllou, C. Karaiskou, A. Liatifis, P. R. Grammatikis, D. Pliatsios, V. Kelli, T. Lagkas, V. Argyriou, P. Sarigiannidis, November 23, 2022, "Peach Tree Disease Detection Dataset", IEEE Dataport, doi: <https://dx.doi.org/10.21227/w67n-0q72> .
  3. G. Stavropoulos, D. Ioannidis, C. Kaliakatsos, & C.s Kontoulis, 'Smart house measurements (1.0)' [Data set], 2023, Zenodo. <https://doi.org/10.5281/zenodo.7628298>
  4. D. Iatropoulos, K. Georgakidis, I. Siniosoglou, C. Chaschatzis, A. Triantafyllou, A. Liatifis, D. Pliatsios, T. Lagkas, V. Argyriou, P. Sarigiannidis, April 19, 2023, "Dairy Supply Chain Sales Dataset", IEEE Dataport, doi: <https://dx.doi.org/10.21227/smv6-z405> .
  5. P. Radoglou-Grammatikis, K. Ropolos, T. Lagkas, V. Argyriou, P. Sarigiannidis, September 23, 2022, "IEC 60870-5-104 Intrusion Detection Dataset", IEEE Dataport, doi: <https://dx.doi.org/10.21227/fj7s-f281>.
  6. P. Radoglou-Grammatikis, V. Kelli, T. Lagkas, V. Argyriou, P. Sarigiannidis, November 22, 2022, "DNP3 Intrusion Detection Dataset", IEEE Dataport, doi: <https://dx.doi.org/10.21227/s7h0-b081> .

## Technological challenges

- Novel bandwidth-saving approaches, for handling huge traffic demands despite the resource constraints.
- Edge to Cloud data localisation and cognitive processing offloading by incorporating AI-based recourse management
- Latency-aware dynamic resource allocation
- Novel AI-powered Intrusion Detection and Prevention (IDPS) systems
- Decentralised Smart Contracts through Blockchain Technology



## Social and ethical challenges

- Societies need to employ self-regulation frameworks able to detect and mitigate ethical and social risks by design.
- Design and deployment of unbiased AI systems. Avoiding undesired discrimination of vulnerable groups.
- Decrease in the amount of greenhouse gas (GHG), new ways of charging batteries and daily charging routines





Thank you for your kind attention

Questions?





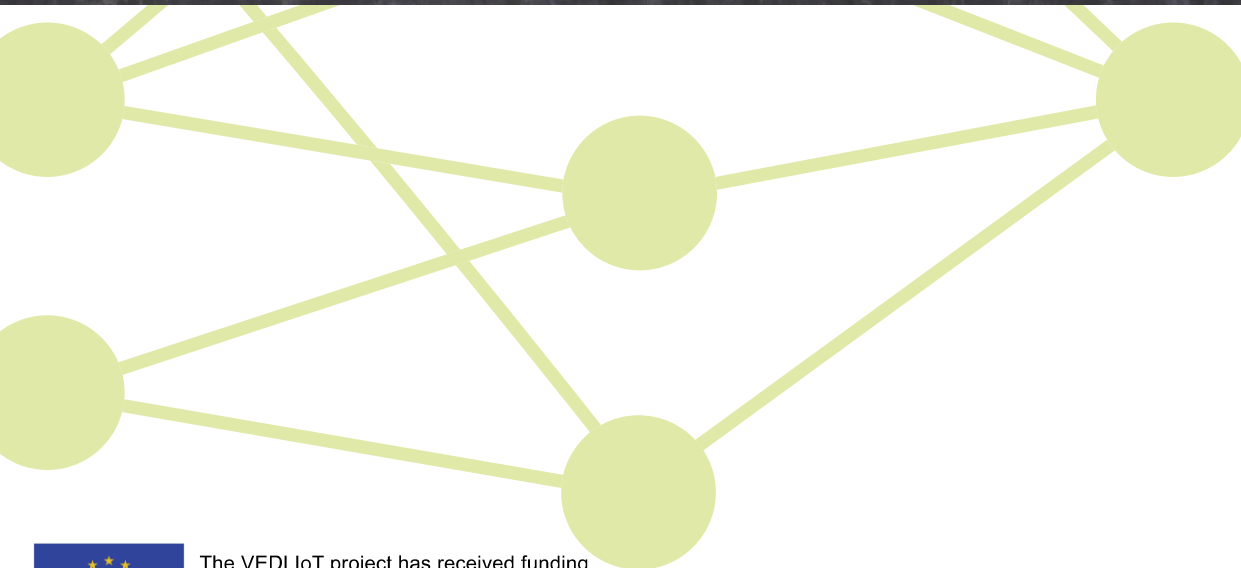
# VEDLIoT

EC Concertation and Consultation Event

Success Stories Session

Jens Hagemeyer, Carola Haumann

10 May 2023



The VEDLIoT project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957197

# VEDLIoT - Big Picture

Requirements

Smart Home

Industrial IoT

Automotive AI

Security & Safety

Applications



Modelling & Verification

Middleware

Toolchain

embed

Emulation

RENODE

Benchmarking & Deployment

Kenning

Trusted Execution & Communication

Microserver & Accelerators



Xilinx Kria

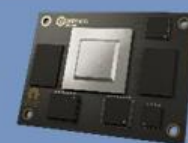


Coral SoM

COM-HPC  
Xilinx Zynq  
UltraScale+



Jetson AGX  
NVIDIA Xavier



RPI CM4  
ARVSOM

SMARC  
Xilinx Zynq  
UltraScale+



Monitoring

Hardware Platforms

Embedded/  
Far Edge



u.RECS

Near Edge

t.RECS



Cloud

RECS|Box



RISC-V extensions

Safety & Robustness

# VEDLIOT - Success Stories



- **Collision detection/avoidance scenario:**

- AI processing distributed over the entire chain, from embedded via edge to cloud
- Challenges: Security, safety and explainability for AIoT



- **AIoT hardware platform**

- Heterogeneous, modular, scalable microserver system



- Challenges: Supporting the full spectrum of IoT from embedded over the edge towards the cloud

- **A compositional architecture framework for AIoT**

- Requirement engineering for systems involving AI and ML
- Challenges: Verification and explainability for AIoT

# VEDLIOT - Recommendations for the Future



- **Standardization on hardware level**

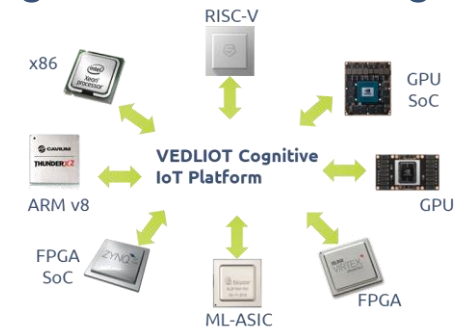
TF1 - Standardization

- Currently, most standardization activities are happening on software/interface level
- VEDLIoT is active workgroup member in PICMG standards COM Express and COM-HPC
- Next step: Establish a European Edge Micro Datacenter alliance (EEMDA), pushing standards for edge microserver

- **Heterogeneity is key**

TF3 - Architecture

- Only way to make cognitive computing for edge and cloud efficient and effective
- Seamless combination of different architectures enables sovereignty and prevent vendor lock-in



- **Dependability is key**

- Enables use of AIoT for mission critical applications
- Builds on security, safety and explainability

Thank you for your attention.



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ASSOCIAÇÃO PARA A INVESTIGAÇÃO E DESENVOLVIMENTO DE CIÊNCIAS



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