eNewsletter #4

Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6G Networks

December 2024

Co-funded by the European Union

6GSNS

ADROIT6G project has received funding from the Smart Networks and Services Joint Undertaking (SNS JU) under the European Union's Horizon Europe research and innovation programme under Grand Agreement No 101095363.

Welcome to the 4th ADROIT6G's eNewsletter!

In the closing of the 2024, our project partners take pride in the new release of the 4th ADROIT6G newsletter. The present issue showcases the recent progress of the project and the advancements in 6G era, and the major achievements on the 6G systems architecture, as well as our preliminary research outputs in the 6G. The ADROIT6G Project, during the second half of 2024 has proceeded successfully in providing the core deliverables, updated the list of publications with high quality methodologies and results for the transition to 6G networks, as well as our partners were active in the 6G ecosystem, providing insights and sharing knowledge, through major global events and research conferences.

ADROIT6G (Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6G Networks) is a Smart Networks and Services Joint Undertaking (SNS JU) project supporting the European Commission's 6G policy by implementing the first phase of the 6G SNS roadmap towards the evolution of a 6G architecture. Briefly, ADROIT6G is an EU-funded project the world moves from the 5G towards the 6G era, 5G application types need to be redefined by morphing the classical service classes of URLLC, eMBB, and mMTC and introducing new services. ADROIT6G radical technological innovations, functionalities and performance will be validated through a set of representative extreme 6G use cases.

In particular, to evolve the existing service-based architectures of 5G mobile networks, and design, implement, and validate a fundamentally new approach for a future-proof, cognitive, next-generation 6G architecture by adopting a fully distributed AI-driven dynamic paradigm, with functional elements automatically deployed on-demand as virtual functions in cloud-native environments, across the far-edge, edge and cloud domains, operated by different stakeholders. This will ultimately lead to improved performance, a higher level of control, increased transparency in interactions with digital services, support of future-looking applications, and social acceptance.

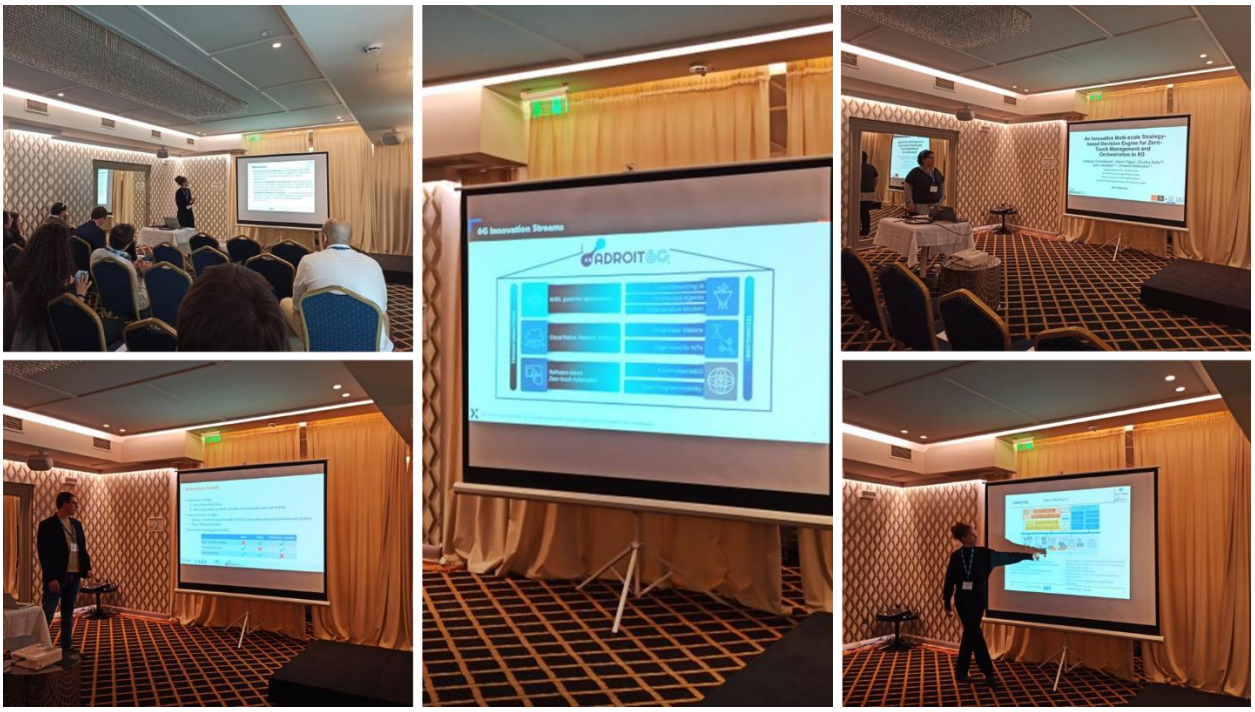
For more information about the project, please visit our website **adroit6g.eu**

ADROIT6G @ CAMAD 2024

ADROIT6G was actively organized as special session on the 21st to 23rd of October 2024, in Athens, Greece, in the context of 2024 IEEE International Workshop on Computer Aided Modeling and Design of Communication Links and Networks. engaging with global leaders in communications and networking.

This year's IEEE CAMAD brought together in Athens market experts and researchers to share their insights and experiences on the future of connectivity, and ADROIT6G was proud to be part of this dynamic gathering.

Within the context of IEEE CAMAD, ADROIT6G co-organised with CENTRIC project a special session during the event dedicated on "***Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6G Networks***". IEEE CAMAD 2024 was an invaluable event for the ADROIT6G consortium to exchange knowledge, connect with fellow researchers, and discuss the exciting path of 6G. Through these sessions, presentations, and the live demo, ADROIT6G reinforced its commitment to advancing 6G research and building a collaborative ecosystem for next-generation networks.

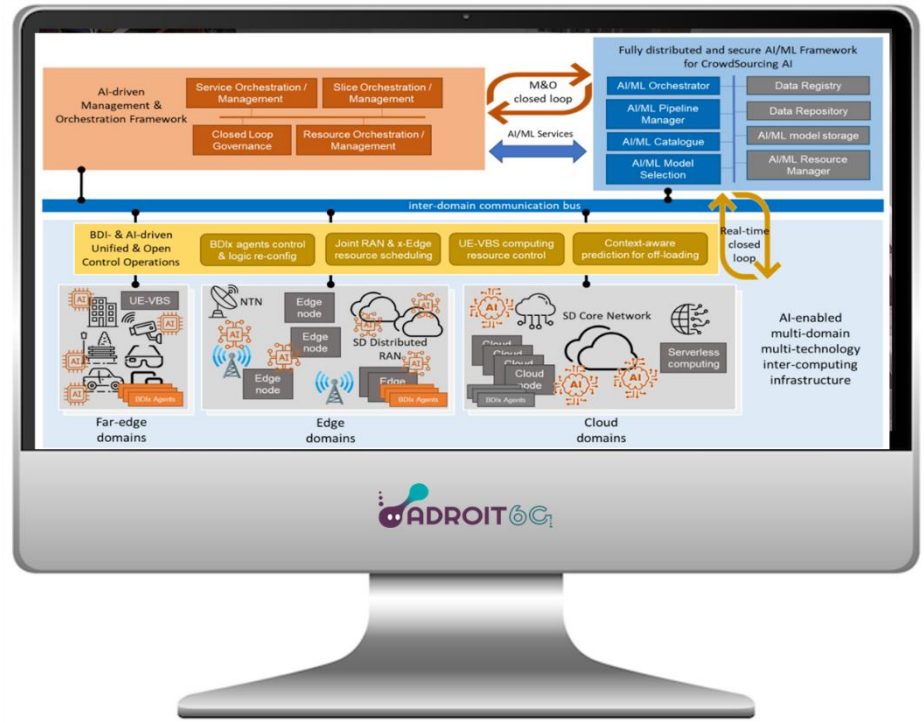


All information about ADROIT6G's activities during IEEE CAMD 2024 is accessible in our **News & Events** and on our **LinkedIn** pages!

ADROIT6G System Architecture

ADROIT6G aims to apply intelligence in multiple network layers and propose a disruptive 6G wireless system architecture, tailored to the performance requirements of new future-looking applications, by adopting a fully distributed and dynamic paradigm with distributed computing nodes at the far-edge, edge, and cloud domains, while it integrates the 6G terrestrial and non-terrestrial communications into a robust network.

The distributed computing nodes at the far-edge, edge, and cloud domains, are used to deploy virtual functions of software-defined disaggregated RAN and core network, virtual applications, as well as AI agents, which are orchestrated dynamically as part of the overall network control and management strategies.



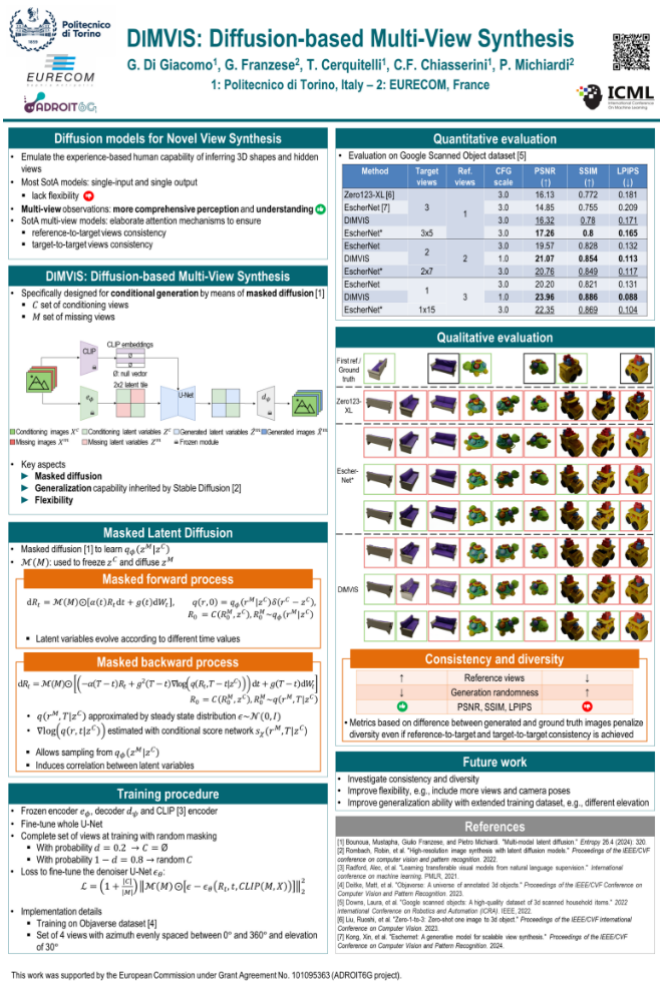
More specifically, the architecture overview of ADROIT6G is depicted in Figure 1. where; the ADROIT6G approach comprises three main frameworks: the AI- driven Management and Orchestration Framework, the Fully distributed and secure AI/ML Framework for CrowdSourcing AI Framework, the BDI- & AI-driven Unified & Open Control Operations Framework. In addition, we also define the Closed-Loop Functions approach of the ADROIT6G solution.

These four blocks work in synergy to create a sophisticated and dynamic 6G network ecosystem able to achieve the ambitious goals set for 6G, ensuring the realization of a future-ready 6G network landscape.

For more information on the ADROIT6G innovative architecture for 6G stay tuned **here**!

ADROIT6G New Poster

In the context of the ADROIT6G project's participation in the ICML 2024 Workshop on Structured Probabilistic Inference & Generative Modeling.



ADROIT6G project participated at ICML 2024 Workshop on Structured Probabilistic Inference & Generative Modeling, with a poster presentation by our consortium partners CNIT and EURECOM. The Workshop took place in Vienna, Austria, on the 26th of July, 2024.

The workshop focuses on theory, methodology, and application of structured probabilistic inference and generative modeling Probabilistic inference addresses the problem of amortization, sampling, and integration of complex quantities from graphical models, while generative modeling captures the underlying probability distributions of a dataset.

More information about ADROIT6G Poster is accessible **here**. In addition, the Abstract is accessible **here**, along with more info about the Workshop and the Conference **here**.

ADROIT6G Proof-of-Concepts

The purpose of the ADROIT6G PoCs is to validate the capabilities of both the 6G technology and representative Use Cases of vertical industries with end-to-end results that require 6G performance capabilities. To this end, a unique and innovative architecture has been set so that the requirements and related needs can be addressed. The testing is performed in lab environments over appropriate testbeds, to allow their technological readiness for commercial exploitation. Each one of the PoCs aims to deploy a layered testing practice to drive development, involving significant representative tests, verifications, and validations such as:

PoC 1: Immersive eXtended Reality (XR) (Extreme eMBB)

PoC2: Industrial IoT 2a: Terrestrial 6G IIoT

PoC2: Industrial IoT 2b: NTN (Extreme mMTC + NTN)

PoC 3: Collaborative robots (cobots) in construction (Extreme URLLC + extreme mMTC)

- tests using specific UCs oriented for covering all service classes of specific vertical industries that are expected to be served by 6G technologies;
- test, measurements, validation, and demonstration of the PoCs in lab settings.

The expected outcomes target low TRL (2-4) technology advancement as required for future 6G systems. This means, at most, “technology validated in lab”. Therefore, the UCs presented in the PoCs will generate experiments that will be proven in a combination of the testbeds and simulators and/or emulators. Finally, the applicability, performance, and viability of ADROIT6G’s technological solution will be validated across the following PoCs:

Stay tuned on the ADROIT6G PoCs for real-life 6G implications **here**!

Project's News and Events

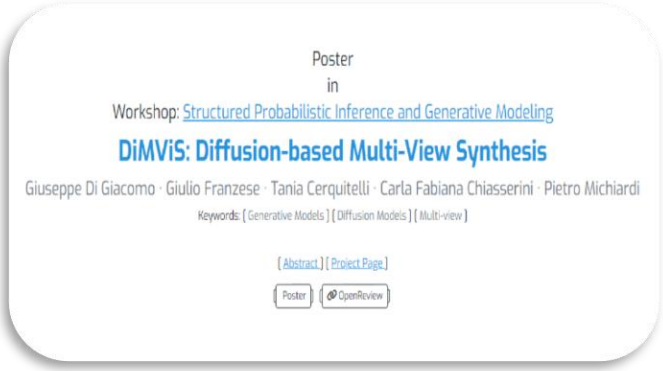
ADROIT6G participated in the INFOCOM World 2024
ISI/ATH showcased a VR Demo over 6G at the INFOCOM World 2024. Read more **here**.

ADROIT6G Organised a Special Session in CAMAD 2024
ADROIT6G co-organised with CENTRIC a Special Session in CAMAD 2024. Read more **here**.

ADROIT6G at HEXA-X-II Workshop
Our Project Coordinator, Prof. Christos Verikoukis presented on Architecture and Standards. Read more **here**.

ADROIT6G Demo at the ETSI Conference & Hackfest
Nextworks S.r.l participated in the conference and presented a Demo. Read more **here**.

ADROIT6G at the IEEE HPSR, Pisa, 2024
NEXTWORKS represented ADROIT-6G at the IEEE HPSR conference. Read more **here**.



ADROIT6G ICML 2024 Workshop
CNIT and EURECOM presented ADROIT6G and a Poster at the ICML 2024 Workshop. Read more **here.**

Project's News and Events

ADROIT6G at EUCNC 2024
ADROIT6G participated in 2024 EUCNC , on June 3-6, 2024. Read more **here**.

ADROIT6G at IoT Solutions World Congress
ADROIT6G showcased its ground-breaking solutions and cutting-edge technologies. Read more **here**.

ADROIT6G at IEEE IC on Computer Communications
CNIT presented ADROIT6G at IEEE International Conference on Computer Communications on 20-23 May 2024. Read more **here**.

ADROIT6G at AIIoT 2024 Workshop
OULU presented ADROIT6G at AIIoT 2024 Workshop on 3-4 May 2024. Read more **here**.

ADROIT6G at IEEE ICMLCN
OULU presented ADROIT6G at IEEE ICMLCN on 5-8 May 2024. Read more **here.**

Project's Scientific Publications

Please find below the latest papers submitted and accepted during the period 2024, that acknowledge of ADROIT6G project. For the complete list of research papers, please visit our dedicated webpage **here**.

Journal Publications

Title	Journal	Partner	Year
Towards Bridging the FL Performance-Explainability Trade-Off: A Trustworthy 6G RAN Slicing Use-Case	IEEE Transactions on Vehicular Technology	ISI/ATH	2024
BayGO: Decentralized Bayesian Learning and Information-Aware Graph Optimization Framework	IEEE Transactions on Signal Processing	OULU	2024
Multi-Modal Latent Diffusion	MDPI Entropy	EURE	2024
DeepRISBeam: Deep Learning-Based RIS Beam Management for Radio Channel Optimization	IEEE Access	CYENS	2024
AI/ML-aided capacity maximization strategies for URLLC in 5G/6G wireless systems: A survey	Computer Networks	CYENS	2024
DIN: A Decentralized Inexact Newton Algorithm for Consensus Optimization	IEEE Transactions on Machine Learning in Communications and Networking	OULU	2024

Conference Publications

Title	Journal	Partner	Year
Towards Accelerating the Network Performance on DPUs by optimising the P4 runtime	32nd Euromicro International Conf. on PDP 2024	CYENS	2024
Performance Evaluation of Machine Learning Cluster Metrics for Mobile Network Augmentation	International Conference WISPNET 2024	CYENS	2024
Balancing Energy Efficiency and Distributional Robustness in Over-the-Air Federated Learning	IEEE International Conference ICMLCN 2024	OULU	2024
Fed-Sophia: A Communication-Efficient Second-Order Federated Learning Algorithm	IEEE International Conference on Communications 2024	OULU	2024

Project's Deliverables

After the compilation of the successful Interim Review, ADROIT6G has released the 1st series of public technical deliverables, that include the core frameworks of ADROIT6G, a) the System Architecture, b) Distributed AI for Crowdsourcing and c) its AI-driven Management, Orchestration and Control Framework.

Deliverables		Lead Partner
D6.1	**Project website and social media presence**	eBOS
D2.1	**Requirements, use cases and system architecture - Initial**	CAFA/ IQU
D2.2	**System Architecture**	IQU
D3.2	**Distributed AI framework for CrowdSourcing AI - initial**	CNIT
D4.1	**AI-driven Management & Orchestration and Control frameworks - Initial**	NWX
D6.2	**Dissemination, communication, standardisation, exploitation, IPR, clustering – Initial**	eBOS

For the complete list of the published deliverables, please visit our dedicated webpage **here**. Stay tuned on the updates of the developments of ADROIT6G for awareness of the recent developments in the 6G era.

ADROIT6G Promotional Video

Find the promotional video of ADROIT6G on the Distributed Artificial Intelligence-Driven Open & Programmable Architecture for 6G Networks and stay tuned by subscribing on our YouTube channel **here**.

Meet our ADROIT6G Partners

eBOS is an innovative client-focused software company providing state-of-the-art RegTech and Fintech solutions that automate risk and compliance management for organisations on a worldwide basis. eBOS has a long history of engaging with international research and technology organisations, industrial leaders, universities, governmental and non-governmental organisations and SMEs to drive collaborative technological innovation and bring best-of-breed technologies to enterprise customers, which add real business value in the most challenging corporate environments.

NOVA is a telecom operator and provider of services to end users. The company is one of the largest alternative fixed operators that provide broadband and pay TV services in Greece, using state-of-the art technologies and designing services for the next generation of mobile network architectures. NOVA, as part of the industrial partners of the project will contribute in the definition and evaluation methodology of the KPIs/KVIs. Furthermore, NOVA will contribute in the trials offering high quality content and broadcasting expertise to validate the system capabilities and performance.

Iquadrat, based in Barcelona, provides ICT services since 1997. Iquadrat offers innovative and customizable platforms that integrate cutting-edge telecommunications and networking technologies for a wide portfolio of emerging applications (Smart homes/cities, energy management, industrial applications, etc.). IQU offers global services: Smart monitoring solutions, 5G and beyond Network planning & Simulation, Wireless Networking, Custom IoT deployments, Custom Web Apps development and Zoho CRM integration.

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