Newsletter #5 July 2025

nephele

Part of EUCloudEdgeIoT.eu

A lightweight software stack and synergetic metaorchestration framework for the next generation compute continuum

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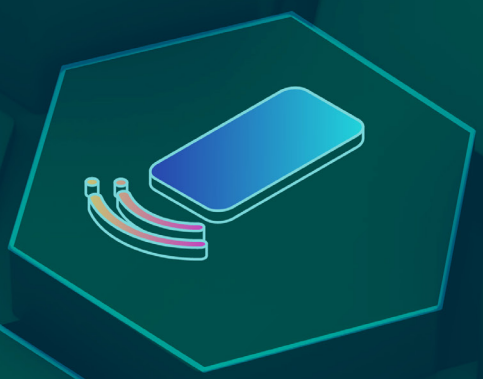

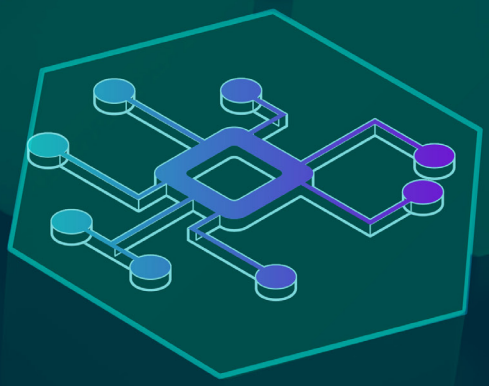

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NEPHELE'S OPEN SOURCE JOURNEY: FROM RESEARCH TO COMMUNITY IMPACT

CREATING IMPACT WITH OPEN SOURCE

The NEPHELE consortium has adopted an open source strategy designed to ensure the longevity and impact of its research outcomes. This strategy is built upon three core pillars: mapping and monitoring the open source landscape, implementing open source best practices, and dedicated community building:

1. Mapping and Monitoring the Open Source Landscape

To make informed and strategic decisions, NEPHELE actively maps and monitors the open source ecosystem. This process involves identifying relevant open source projects that can either be reused or contributed to, depending on the project's needs. It also includes recognizing and understanding the dynamics of communities that align with NEPHELE's goals. By thoroughly analyzing this landscape, the project avoids duplicating efforts, gains insight into existing solutions, and can align itself with active communities that share similar objectives.

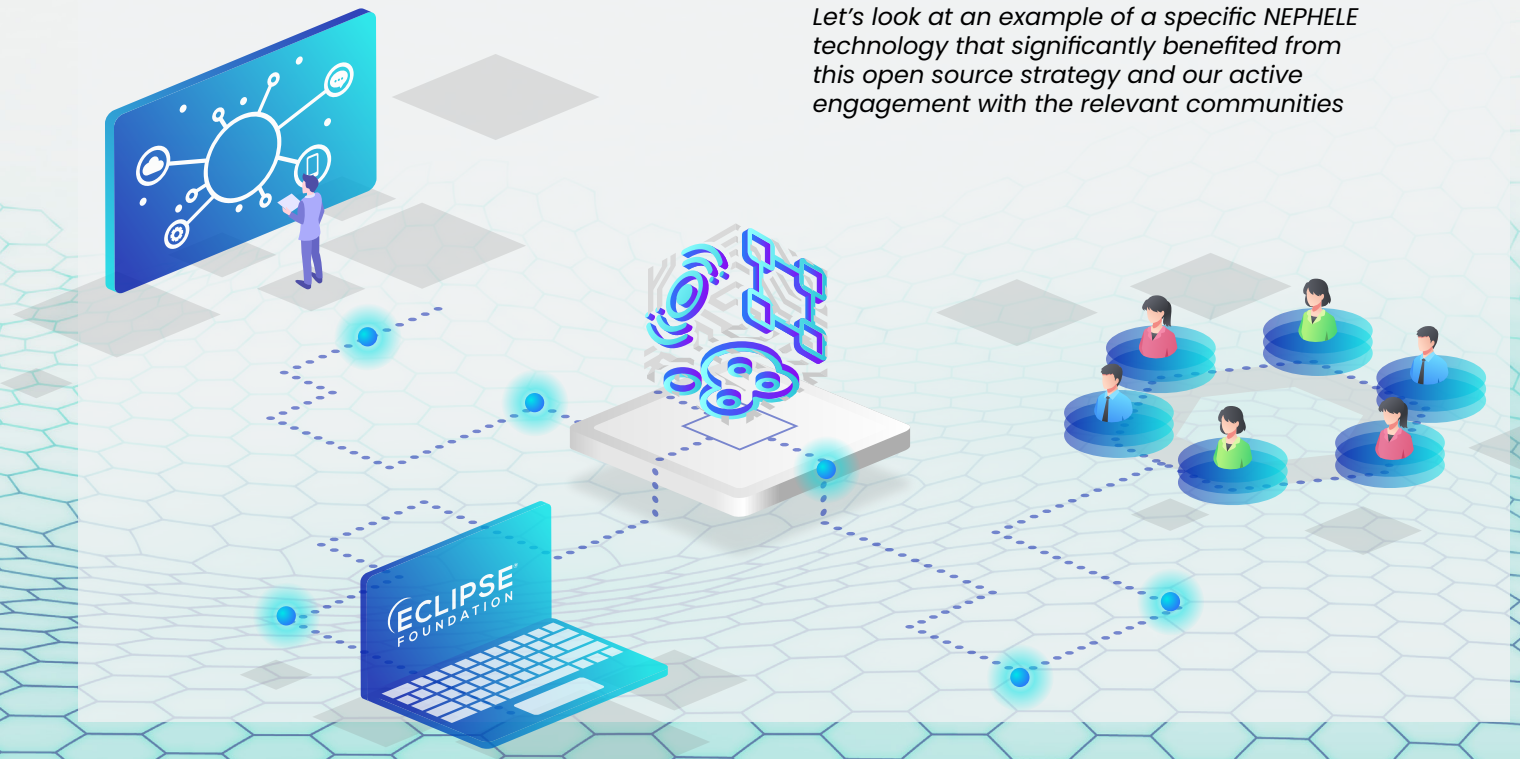
2. Implementing Open Source Best Practices

To foster robust and collaborative development, NEPHELE adheres to established open source best practices. This includes hosting project code in a public repository under the umbrella of the Eclipse Foundation, ensuring all project components are properly licensed and verifying that any third-party software integrated into the project has licenses compatible with NEPHELE's chosen license (MIT) through regular third-party license checks. These practices foster trust and support adoption by both internal partners and external developers.

3. Community Building

A key part of NEPHELE's open source strategy is proactive community engagement. For research projects, simply making code public isn't enough; impact requires visibility and interaction. Researchers must actively connect with relevant open source communities, engaging with developers, participating in discussions, contributing to shared efforts, and being present where these communities gather. Building these relationships fosters momentum, collaboration, and long-term sustainability.

Let's look at an example of a specific NEPHELE technology that significantly benefited from this open source strategy and our active engagement with the relevant communities



NEPHELE VO-WOT AND ECLIPSE THINGWEB

Virtual Object and Virtual Object Stack

The Virtual Object (VO) and Virtual Object Stack (VO Stack) are core concepts of the NEPHELE platform. The VO is a software service that extends the properties, attributes, and functionalities of real-world physical devices within the digital infrastructure of the network. Each VO is a part of a distributed application in the edge-cloud infrastructure, and it is orchestrated as a containerized stateless micro-service making it an extension of the IoT physical device in the virtualized infrastructure of the edge-cloud continuum. The VO Stack is focused on development of specified functionalities to support IoT interoperability and cooperation in the context of edge-cloud continuum in a device-independent way. Such an implementation supports computing and network function virtualization at the edge, and in IoT application scenarios.

Open Standards (W3C WoT) and Open Source Implementations (Eclipse ThingWeb)

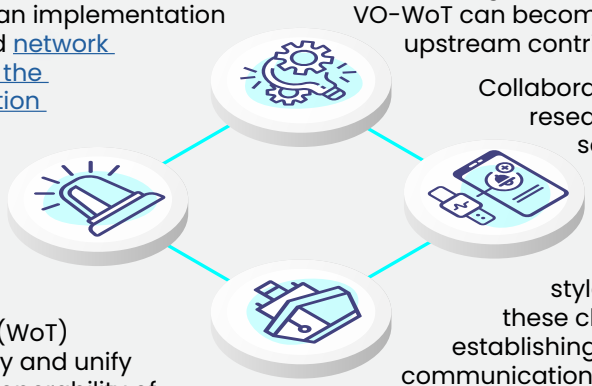
The W3C Web of Things (WoT) standard aims to simplify and unify the integration and interoperability of IoT devices across different platforms and vendors. It provides a common framework based on existing web technologies, enabling devices to interact using standard protocols. By promoting a web-based abstraction layer, WoT facilitates scalability, reusability, and automation, ultimately accelerating the development of open, decentralized IoT ecosystems.

The Eclipse ThingWeb project is an open-source implementation of W3C WoT. It provides a suite of tools and runtimes that enable developers to create, expose, and consume WoT-compliant Things using standard web technologies. The project aims to foster experimentation and adoption of WoT principles by offering reference implementations, development tools, and support for various communication protocols such as HTTP, CoAP, and MQTT.

Collaborating across different worlds

W3C WoT was an almost natural choice for implementing NEPHELE VO/VOStack, not only because it matches the technical requirements of the project but also because it is an open standard allowing for free adoption and even extension. Eclipse ThingWeb, being a community-driven open source project hosted at the Eclipse Foundation, heavily influenced the development of the NEPHELE VO-WoT implementation, which is a fork of the original wot-py repository. Wot-py is an experimental implementation of a W3C WoT Runtime and the W3C WoT Scripting API in Python, inspired by the exploratory implementations provided by Eclipse ThingWeb. Moreover, the VO-WoT repository is part of the W3C WoT Software and Middleware solutions.

During the course of the NEPHELE project we have established fruitful collaboration between NEPHELE researchers and the Eclipse ThingWeb community. As NEPHELE benefits a lot from the open source community, we are now elaborating how NEPHELE and especially VO-WoT can become a valuable upstream contribution.



Collaboration between researchers and open source communities can be challenging due to differences in goals, timelines, and communication styles. Overcoming these challenges requires establishing shared goals, clear communication, and mutual respect for each other's processes. Building trust through small, early collaborations, contributing to community needs, and aligning research outputs with real-world use cases can help bridge the gap and create meaningful, productive partnerships.

This is not the end – it's where the journey begins!

All NEPHELE code (including VO-WoT) is available under MIT license in the Eclipse Research Labs GitLab repository . As described in this article, in this final phase of the project, we are working to transition NEPHELE results into community-driven open-source project(s) under the Eclipse Foundation. Being an Eclipse Project means joining an open-source community which provides resources, governance, and infrastructure for sustainable software development. It helps to gain access to a vast network of industry leaders, partners, and developers, facilitating collaborations and further exploitation opportunities.

In terms of sustainability and exploitation, this step marks just the beginning of the project's journey in open source, not its end.

HIGHLIGHTS OF THE PERIOD

PUBLICATION OF THE AIOTI WORKSHOP ON SEMANTIC INTEROPERABILITY

This report summarises the results of the AIOTI workshop on Semantic Interoperability held on 5-6 February 2025 hosted by ERCIM in Sophia Antipolis, France, with support from Inria, the NEPHELE and SmartEdgeProject.

The workshop was aimed at advancing the field of semantic interoperability and laying the groundwork for the next generation of information systems, with an emphasis on practical solutions for real-world. It focused on solutions for industry along with encouraging greater take-up of semantic technologies, including controlled vocabularies, taxonomies, and ontologies. Semantic interoperability is essential for supply chains as well as for repairs and recycling in relation to the plans for the circular economy as part of the EU's Green Deal.

The report can be downloaded from here.

NEPHELE CONSORTUM MEETING IN PORT OF KOPER

NEPHELE had a consortium meeting in Port of Koper, Slovenia! These meetings are always a pleasant opportunity to connect but also to work together very hard to achieve the project objectives, different perspectives and shared goals.

This meeting had a very intense agenda! It lasted from 27th to 30th May - four whole days. As usual, the two first days were focused on working together, keeping a proactive approach, listening attentively to other partners, asking clarifying questions, offering their expert insights to their colleagues, participating actively in productive discussions and proposing solutions for every topic. The exploitation team was also executing the most important aspects of the exploitation plan.

The technical team was working mainly in the deployment of the use cases and demonstrations that will be showed in the IoT Expo week in September 2025.

See the gallery of pictures:

NEWS & EVENTS

PAST EVENTS

2nd Workshop on MetaOS for the Cloud-Edge-IoT Continuum (MECC 2025)

31 March 2025, Rotterdam (The Netherlands).

This workshop co-organised by the MetaOS cluster - FLUIDOS, NEPHELE, aerOS, NebulOuS, NEMO and ICOS EU funded projects - was co-hosted at the ACM EuroSys 2025.

DATA 25 - Design, Automation and Test in Europe Conference | The European Event for Electronic System Design & Test

31 March - 2 April 2025, Lyon, (France).

The paper: "The NEPHELE Meta-Orchestration Approach for Distributed Applications in the Computing Continuum" by Manolis Katsaragakis, Orfeas Filippopoulos, Christos Sad, Dimosthenis Masouros, Dimitrios Spatharakis, Ioannis Dimolitsas, Nikos Filinis, Anastasios Zafeiropoulos, Kostas Siozios, Dimitrios Soudris, and Symeon Papavassiliou - with acknowledge to NEPHELE was presented on this conference.

International Conference in Optimization and Learning (OLA2025)

23-25 April, Dubai (UAE).

The paper "*Overlay_dx - Automating forecasting evaluation*" by our colleagues Long H. Ngo, Mohammed Amine Chamli, Jonathan Rivalan and Thomas Jaillon (SMILE) with acknowledge to NEPHELE was presented on this conference.

WiOpt 2025 - 23rd International Symposium on Modeling and Optimization in Mobile, Ad hoc, and Wireless Networks

26-29 May 2025, Linköping (Sweden).

The paper "*Multi-Robot Exploration via Flocking Coordination and Machine Learning-Driven Connectivity Assessment*" by Hazem Chaabi and Nathalie Mitton from Inria with acknowledge to NEPHELE was presented on this conference.

Third International Workshop on Intelligent and Adaptive Edge-Cloud Operations and Services (Intel4EC 2025) - in conjunction with 39th IEEE International Parallel and Distributed Processing Symposium (IPDPS 2025)

4 June 2025, Milan (Italy).

The paper "Online Learning Techniques for Occupancy Detection on Resource Constrained Devices" by Flavio Renzi, Haoyu Ren, Alessio Bernardo, Giacomo Ziffer, Darko Anicic and Emanuele Della Valle - some NEPHELE colleagues from SIEMENS – was presented on this workshop.

IEEE ICC 2025 (Next-Generation Networking & Internet Symposium)

8-12 June 2025, Montreal (Canada)

The paper "Joint Placement and Scheduling for Time-Sensitive Applications in Edge Computing" with acknowledgement to NEPHELE was presented here.

International Conference on Distributed Computing in Smart Systems and the Internet of Things (IEEE DCOSS-IoT 2025)

9-11 June 2025,Tuscany (Italy).

The paper "Distributed Multi-Robot Exploration Approach With Connectivity Maintenance" by Hazem Chaabi and Nathalie Mitton from Inria - with acknowledge to NEPHELE - was presented on this conference.

Artimino Conference on Medical Ultrasound Technology

15-18 June 2025, Lyon (France).

Our colleagues Antonio Passalacqua and Marco Crocco from ESAOTE mentioned NEPHELE during their presentation "Delocalized Image Processing in Medical Ultrasound" showcased by Marco in session "Beamforming & Signal Processing I" of this event.

10th International Conference on Smart and Sustainable Technologies

16-20 June 2025, Split and Bol (Croatia).

The paper "NEPHELE - Remote Healthcare Services, Ultrasound Medical Device Dematerialization" by our colleagues Antonio Passalacqua, Giacomo Pedemonte, Silvia Volta, and Alessandro Carrega was presented on this conference.

SAMOS XXV - 25th International Conference on Embedded Computer Systems: Architectures, Modeling and Simulation

June 28 - July 3, 2025, Vathi (Greece).

The paper "The NEPHELE Meta-Orchestration Approach for Distributed Applications in the Computing Continuum" with acknowledgement to NEPHELE was presented on this conference.

IEEE International Workshop on Distributed Intelligent Systems (DistInSys 2025) - in conjunction with the 30th IEEE Symposium on Computers and Communications (ISCC 2025)

2-5 July 2025, Bologna, Italy.

The paper "IoRT ROS2 Applications: Evaluating Zenoh and VPN for Robotic Networking in the Edge-Cloud Continuum" by our colleagues L. Fu, G. Kapoor, L. Militano, G. Toffetti, M. Bohnert" (ZHAW) and with acknowledgement to NEPHELE was presented on this conference.

UPCOMING EVENTS

IoT Tech Expo 2025

24-25 September 2025, Amsterdam (The Netherlands).

NEPHELE will join an exhibition booth with all the other MetaOS sibling projects that have been funded by the European Commission. NEPHELE will also participate in the room sessions for the presentation of the MetaOS ecosystem. This event will be coincident with the end of the project.

MEET OUR PARTNERS

THIS SECTION WILL BE PRESENTING THE PARTNERS OF THE CONSORTIUM, THEIR PROFILE, MAIN EXPERTISE AND CONTRIBUTION TO THE PROJECT.

ESAOTE

esaote

Esaote is the main Italian manufacturer of diagnostic imaging systems. With more than 1200 employees, 3 production sites (in Genoa, Florence and Sittard), 3 R&D centres and 14 branches all around the world, Esaote is one of the world leaders in the areas of ultrasound, dedicated magnetic resonance and software for the management of the diagnostic process.

Esaote is an optimal center of gravity between technology and healthcare as a pole of aggregation of industrial, research and clinical skills ready for the digital transformation of ultrasound medical imaging in a cloud first approach.

In NEPHELE, Esaote will participate in IoT devices management, virtualization and ad-hoc clouds formulation requirements; use cases specification and data processing requirements; use cases framework definition, planning, monitoring and coordination; and design, implementation and evaluation of the remote healthcare services use case.

NEPHELE USE CASE 4: REMOTE HEALTHCARE SERVICES

Virtualise an ultrasound trolley: move from an all-in-one / standalone healthcare solution (ultrasound trolley) to a delocalized solution with specific modules running in different places.

Esaote will also participate in dissemination, communication and exploitation activities.


Marco Crocco


Antonio Passalacqua


Massimiliano Omero


Fabio Vacchino


Pietro Amorettli


Renato F. Sollam

LUKA KOPER

LUKA KOPER
Port of Koper

The company Luka Koper provides port and logistics services in the port of Koper, Slovenia. The Port of Koper is a multi-purpose port, equipped and prepared for handling and warehousing all types of goods. The basic port activity is carried out at specialised terminals, which are technically and organisationally suitable for handling and warehousing of specific cargo groups.


Jurij Mirnik

In NEPHELE, Port of Koper participates in two of our use cases:

USE CASE 1: POST DISASTER IN A CONTAINER TERMINAL - EMERGENCY/DISASTER RECOVERY

Simulation of partial implementation in a port (e.g. : container fall and monitoring of suspicious substance).

USE CASE 2: AI-ASSISTED LOGISTIC OPERATIONS IN A PORT

Optimise the routing of containers from the Container terminal yard or Depo area to different Container Freight Stations (CFS) within the port, where the cargo is stuffed/ stripped, and vice-versa. This is one of the most important operations in the port in terms of reduced routing times, lower CO2 emissions, higher truck/forklift utilization, and service level agreements (e.g., times of delivery, compliance with goods sensitivity, etc.)

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