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D6.2 – Intermediate Report on Impact Activities



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Executive Summary

During the first period of the project (M1-M16), aerOS has demonstrated a multifaceted approach to impact creation through its diverse set of activities. Communication activities played a pivotal role in ensuring widespread awareness and understanding of the project's objectives and achievements. Through strategically crafted press releases, active engagement on social media platforms, and a dedicated project webpage, aerOS successfully reached a broad audience, as monitored by multiple KPIs. These communication efforts not only elevated the project's visibility but also facilitated a two-way dialogue with other players in the development of technologies for the computing continuum, like EUCloudEdgeIoT, establishing a foundation for collaborative partnerships.

In tandem with communication activities, the project excelled in dissemination initiatives, emphasizing both scientific and practical outreach. Scientific dissemination efforts included peer-reviewed publications and conferences, showcasing the depth and rigor of the research outcomes. Additionally, the project leveraged platforms for project showcasing and industrial demonstrations, providing tangible examples of how the research findings can be applied in real-world scenarios. This approach not only bolstered the project's credibility within the academic community but also forged connections with industry partners, fostering a bridge between theoretical advancements and practical applications.

Furthermore, the project's commitment to standardization activities showcased its dedication to influencing and shaping industry norms. Through active contributions to Standard Development Organizations (SDOs), such as IETF or ISO, and pre-normative organizations, such as 5G-ACIA or AIOTI, the project played a role in shaping future industry standards. This not only underlines the project's commitment to best practices but also positions it as a thought leader in the field. Lastly, the report highlights the project's exploitation activities, focusing on innovation management and the identification of key exploitable results.

Besides reporting the successful development of impact-related tasks during the first part of the project, this deliverable contains also details of the strategic guidelines for the second period of the project (M17-M36). Building on top of the satisfying results obtained until today and guarantying the fulfilment of all the impact creation goals of the project.

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List of acronyms

Acronym	Explanation
3GPP	3rd Generation Partnership Project
5G	5th Generation
5G IA	5G Infrastructure Association
5G PPP	5G Public-Private Partnership
AI	Artificial Intelligence
AIOTI	Alliance for Internet of Things Innovation
ANSI/ISA	American National Standards Institute / International Society of Automation
BDVA	Big Data Value Association
CA	Consortium Agreement
CIS	Controls IoT Security
cPPP	contractual Public-Private Partnership
CSA	Coordination and Support Action
DLT	Distributed Ledger Technology
DoA	Description of Action
Dx.y	Deliverable No y of Work Package x
EC	European Commission
ENI	Experiential Networked Intelligence
ENISA	European Union Agency for Cybersecurity
ESCO	European Cyber Security Organisation
ETSI	European Telecommunications Standards Institute
FIWARE	Future Internet open-source platform
GA	General Assembly
GSMA	Global System for Mobile Communications
IEEE	Institute of Electrical and Electronics Engineers
IEEE SA	Institute of Electrical and Electronics Engineers Standards Association
IEC	International Electrotechnical Commission
IETF	Internet Engineering Task Force
IIRA	Industrial Internet Reference Architecture
IoT	Internet of Things
IRTF	Internet Research Task Force
ISG	Industry Specification Group
IT	Information Technology
ISO	International Organization for Standardisation

ITU-T	International Telecommunication Union Telecommunication
KPI	Key Performance Indicator
KVI	Key Validation Indicator
MEC	Multi-access Edge Computing
ML	Machine Learning
MS	Milestone
MVP	Minimum Viable Product
NGIoT	Next Generation Internet of Things
NFV	Network Function Virtualization
NGO	Non-Governmental Organisation
ONF	Open Networking Foundation
PC	Project Coordinator
PDL	Permissioned Distributed Ledger
PoC	Proof-of-Concept
RA	Reference Architecture
RAN	Radio Access Networks
RTO	Research and Technology Organisations
SAI	Securing Artificial Intelligence
SDN	Software Defined Networks
SDO	Standardisation Organisation
SEDIA	Single Electronic Data Interchange Area
SG	Standardisation Group or Study Group
SP	Special Publication
SRIA	Strategic Research and Innovation Agenda
STF	Standardisation Task Force
Telco	Teleconference
TF	Task Forces
TIC	Terminal Industry Committee
TM	Traffic Management
TSG	Technical Specification Groups
Tx.y	Task No y of Work Package x
W3C	World Wide Web Consortium

WG	Working Group
WPx	Work Package No x

1. About this document

1.1. Deliverable context

This document contains the objectives, plan, and related deliverables that are associated with Deliverable 6.2 according to the project's Description of Action (DoA).

Table 1. Deliverable context

Item	Description
Objectives	<p>Obj 7 - Global ecosystem creation, maximisation of impact and Open Call conduction</p> <p>For impact creation, aerOS, results will be presented/promoted within publications, conferences, website, social media, and workshops. Further, several exhibitions/showcases will take place, including small demonstrations, to engage stakeholders and potential clients from diverse verticals, mobilising key actors. Moreover, business models (aligned with use cases technical capabilities, ecosystem, and functionalities) that include market and sustainability strategy, supported by preliminary value proposition and pricing policy, will be proposed, with a starting point in the Cloud Industry Roadmap. The ecosystem building will be supported by two Open Calls, allowing new partners to join the Consortium and develop applications and/or aerOS components. Furthermore, an Advisory Board will be formed, with at least 4 key members from industry and academia. aerOS will track relevant standards bodies to be compliant with, and contribute to convergence of, so far scattered, initiatives throughout Europe (indicatively: DSBA, NGI, AIOTI, BDVA, AI4EU, FIWARE or Gaia-X) to set the basis of a common, open, platform independent meta operating system for the IoT edge-cloud continuum.</p>
Work plan	<p>This deliverable reports the status and development of the different tasks that belong to Work Package 6 (WP6), that deals with the generation and monitoring of impact. The different tasks are:</p> <ul style="list-style-type: none"> • T6.1: Communication activities (Lead: INF, Partners: ALL) • T6.2: Dissemination activities, project showcasing and industrial demonstrations (Lead: TTC, Partners: ALL) • T6.3: Standardisation and policies alignment (Lead: SIEMENS, Partners: UPV, NCSR, TTC, FF, TID, IQB, LMI, SRIPAS, ICT-FI, INF, PRO, ECTSL, S21Sec, JD, CF, MADE, SIPBB) • T6.4: Exploitation activities, IPR management, innovation, business, market operations and sustainability (Lead: 8BELLS, Partners: ALL) <p>Representatives of the lead partners of each task have provided the content of this deliverable, describing the current status through the use of KPIs defined by Task 5.3 (KPIs definition and setup of evaluation framework), and detailing the strategy for the remaining duration of the project. Representatives of SIEMENS have acted as editors of this deliverable, and the teams from LMI and FOGUS have performed the internal reviews.</p>
Deliverables	<p>D6.2 builds on the information provided by D6.1 (Impact activities planning), verifying the fulfilment of the plans laid out in it, and presents the strategies to be followed in the upcoming months, whose results will be reported by D6.3 (Final report on impact activities).</p>

	Apart from that, D6.2 complements D5.2 given that, together, both deliverables account for the status of all aerOS KPIs in the midterm of the project.
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1.2. Impact Key Performance Indicators KPIs in M16

The main objective of this deliverable is to report the details of the development of WP6 tasks in the midterm of the project. Before those details are reported in sections 2 to 5, **Table 2** offers a quick glance into the status of KPIs, with the purpose of providing a good insight into the successful work done so far.

Table 2. Status of impact KPIs in M16

KPI#	KPI	Task	Status (M16)	Next goal (M24)	Fulfilment
3.1.1	# of Website unique visitors / page views	T6.1	4,049/15,840	1500 / 5000	Exceeded
3.1.2	# of aerOS posts in social networks/ #of newsletters issued	T6.1	655/5	650/8	Partially exceeded
3.1.3	# of aerOS social-media community members across all-sites	T6.1	1237	700	Exceeded
3.1.4	# of videos delivered about aerOS technical and global advances / webinars-workshops organised	T6.1	8/14	12/3	Partially exceeded
3.1.5	# of interviews/articles/press releases with external relevant dissemination targets	T6.1	10	10	Met
3.1.6	# of liaison with other projects of the cluster including CSA events	T6.1	35	20	Exceeded
3.2.1	# of scientific papers published in conferences / Q1-Q2 journals	T6.2	5/9	10/3	Partially exceeded
3.2.2	# of activities towards Education institutions (courses, lectures, PhDs)	T6.2	3	9	On track
3.2.3	# of presentations and other activities in events/conferences/fairs by aerOS partners	T6.2	35	20	Exceeded
3.2.4	# of workshops organized / average participants in each workshop	T6.2	8/20	1/30	Partially exceeded
3.2.5	# of PhD and MSc theses started about aerOS	T6.2	8	5	Exceeded
3.3.1	# of contributions to SDOs	T6.3	17	6	Exceeded
3.3.2	# of entry points to SDOs or pre-normatives exploited	T6.3	15	15	Met
3.3.3	# of contributions to European pre-normatives	T6.3	2	1	Exceeded
3.3.4	# of contributions to data-related clusters and initiatives	T6.3	1	3	On track
3.3.5	# of contributions to relevant data spaces	T6.3	2	3	On track
3.4.1	# of contributions to OSS projects	T6.4	See 5.1.4	N/A (see footnote)	On track

3.4.2	# of business plans for exploitable assets, stakeholders and key alliances identified and contacted	T6.4	See 5.1	N/A (see footnote) ¹	On track
3.4.3	# of new business lines on aerOS by partners	T6.4	0	N/A (see footnote)	On track
3.4.4	# of startups adopting aerOS results as technological baseline for business	T6.4	0	N/A (see footnote)	On track
3.4.5	# of tech-transfer contracts signed based on aerOS	T6.4	0	N/A (see footnote)	On track
3.4.6	# of private investments in aerOS and related open technologies	T6.4	See 5.1.4	N/A (see footnote)	On track
3.4.7	Market share in edge-cloud-computing of Europe vs world	T6.4	See 5.1.4	N/A (see footnote)	On track

1.3. Deliverable structure

This deliverable is divided into 6 main sections, that offer the following contents:

- Section 1 introduces the reader to the deliverable, provides context for it and shows an overview of the status of KPIs related to impact creation in the month 16 of the project.
- Section 2 reports about the communication activities, led by Task 6.1, that include the management of communication channels, press releases, social media presence and cooperation with other projects and organizations.
- Section 3 describes the activities from the perspective of scientific and industrial dissemination of aerOS outcomes. These activities are promoted and monitored by Task 6.2.
- Section 4 provides information about the contributions coming from aerOS to spaces of technical standardization, pre-standardization, or industrial and technological association. These activities are promoted and monitored by Task 6.3.
- Section 5 offers details into the exploitation of aerOS outcomes by partners. Specific exploitation plans are reported by partner and a global analysis of the IPR, and innovation methodologies are presented. Also, Key Exploitable Results are touched upon. This section covers the advances of T6.4 so far.
- Section 6 concludes the deliverable.

2. Communication Activities

2.1. Communication in the first period of the project (M1-M16) and status of KPIs

The following sections provide a detailed update on the communication activities performed under the coordination of T6.1 during the period September 2022-December 2023 (M1-M16).

2.1.1. Updates on Channels of Communications

In this section the aerOS communication channels utilised during the period M1-M16 are presented along with the updates that they have undertaken in order to support additional project's activities/initiatives.

¹ These KPIs do not have a specified target for M24. All target values are referred to M36. See section 5.1.4 for more info.

2.1.1.1. Website

The aerOS project's website serves as the primary communication channel. It was established during the initial phase of the project, specifically in September 2022 (M1). Accessible at <https://aeros-project.eu/>, the official aerOS website functions as a portal for sharing comprehensive information about the project and its activities. Its primary role is to ensure widespread outreach across diverse industries and engage various stakeholders by providing detailed insights into the project's activities.

The aerOS website reflects the project's unified visual identity and encompasses its activities and accomplishments. Simultaneously, it serves as a platform for both internal and external audiences to explore the project's methodology, goals, structure, case studies, latest updates, upcoming events, ongoing activities, and key contact information for the consortium's coordination team.

For stakeholders interested in the project, the website serves also as a “business portal” for information, actions and impact creation. The website is focused on the Consortium's shared understanding of the project's scope and objectives, for creating impact through the efficient communication/dissemination of aerOS activities, results and achievements. aerOS website will be live for the entire lifespan of the project and for at least 3 years after its completion.

In detail, the aerOS website is:

- Developed using WordPress by the NCSR D (TM) and INF (WP6 and T6.1 leader) teams and its constantly updated to newer versions/releases,
- Domain name owned and hosted by the UPV (PC) for 6 years,
- Content constantly maintained and updated by the INF team as T6.1 leader,
- It has multiple menu options-buttons available for covering all types of project's activities,
- Compact and comprehensive webpages for easy navigation,
- It provides contact form, directly addressing the project coordinator, technical manager and WP6 leader,
- Google Analytics enabled for statistical monitoring of performance,
- It denotes in its footer that is part of EUCloudEdgeIoT through the corresponding tag image.

The website succinctly and comprehensively addresses the communication needs of the aerOS project, as the core communication channel, featuring an enhanced menu, well-organized webpages and sections, a lot of downloadable content, a detailed footer and an enriched dissemination menu. In specific, the menu conveniently initially grouped seven easily accessible options: Home, Objectives, Use Cases, Consortium, Dissemination, News, and Contact. Additional to these sections that were placed since the beginning of the project, a new menu option entitled Open Calls is now in place in order to support aerOS Open Call 1 since September 2023 (M13).

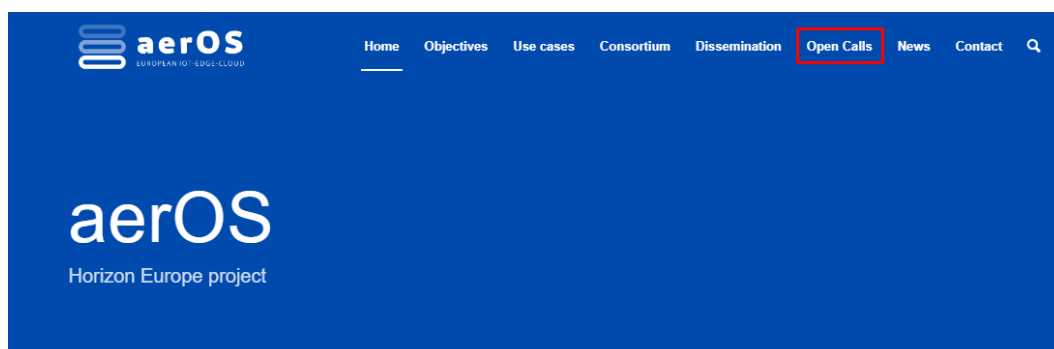


Figure 1. aerOS Open Call menu

This menu was created in order to facilitate the needs related to the Open Call of the project. It is consisted by 2 different sections, the one entitled “Open call #1” and the other “Open Call FAQ”.

The “Open call #1” sub menu provides all the related information about the aerOS 1st Open Call, along with instructions for submission and dedicated material for further downloading. The “Open Call FAQ” sub-menu is also in place since M13. In the Open Call FAQ webpage, any interested stakeholder (potential OC applicant) can find a set of at least 12 frequently asked questions (and continuously updated) along with the equivalent answers. In this Open Calls menu, we will add later (mid 2024) a new sub-menu entitled “Open call #2” when the project will launch its 2nd Open Call.

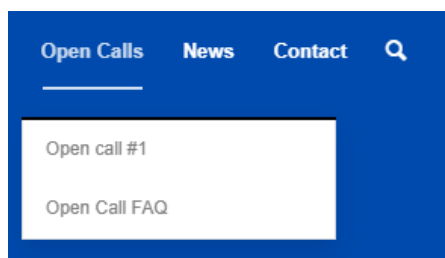


Figure 2. Open Calls Tab Menu

Apart from the Open Call webpage. The website had also two other extremely active pages. The one is news webpage (<https://aeros-project.eu/blog/>) which is updated on a weekly basis. Additional posts are being made in specific occasions such as plenary meetings and dedicated events. The other active webpage is the dissemination one (<https://aeros-project.eu/dissemination/>). There any interested stakeholder can find all the latest dissemination activities in the equivalent sub-sections.

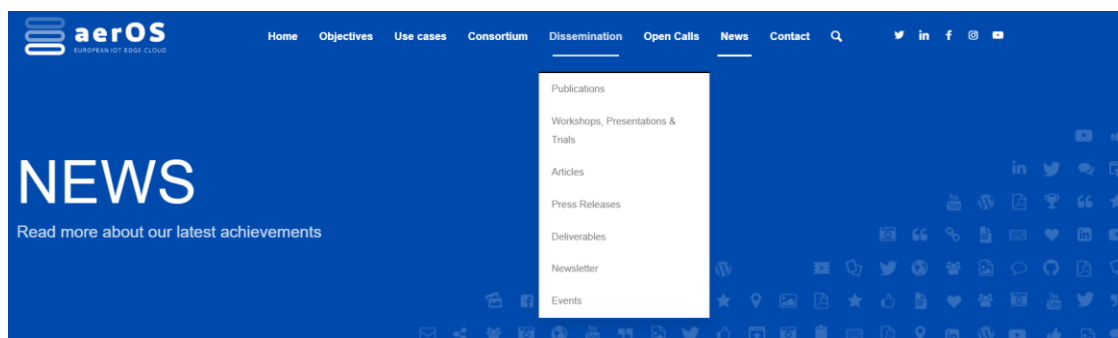


Figure 3. Dissemination Tab Menu

More details on the structure of the website and the details of its webpages have been provided in D6.1.

2.1.1.2. Social Media Channels

The social media channels constitute the second key pillar of aerOS communication. Establishing the project's presence across various social media platforms allows us a broad dissemination of the project's impact to diverse audiences in a cost-effective and efficient manner. This approach serves as an ideal means to share knowledge derived from aerOS achievements and key findings. However, reaching the widest audience needs a strategic management of social media to effectively engage both technical and non-technical audiences.

Outlined below is a provisional list enumerating the benefits of leveraging social media:

- Communication of project news, content, activities, and outcomes,
- Creation of a distinct project identity and branding, reaching a broad and diverse audience,
- Identification of potential new audience segments and stakeholders,
- Sustaining and fostering audience engagement through regular, weekly posts,

- Monitoring the project's impact,
- Establishing connections and affiliations with similar activities/initiatives/actions, projects, communities, and associations (e.g., EU, Horizon Europe, HiPEAC, EUCloudEdgeIoT, 6G-IA/SNS, working groups).

Table 3. Social Media Channels

LinkedIn	https://www.linkedin.com/in/aeros-project/
X (Twitter)	https://twitter.com/AerosProject
Facebook	https://www.facebook.com/aerosproject
Instagram	https://www.instagram.com/aerosproject/
YouTube	https://www.youtube.com/@aeros-project

2.1.1.2.1. LinkedIn Channel

LinkedIn serves as an online business platform where users can establish profiles and connect with others, forming a digital professional network. It is an effective tool for sharing achievements and activities across various industries, contributing to professional branding.

The aerOS project is actively building and expanding its audience on LinkedIn, leveraging connections interested in project-related content. The aerOS LinkedIn bio (<https://www.linkedin.com/in/aeros-project/>) provides concise details about the project, including a brief description, the call, and the number of connections. Additionally, any LinkedIn follower can easily review the account and interact with the shared content.



Figure 4. LinkedIn page

2.1.1.2.2. X (Twitter) Channel

X (former Twitter), a widely used social media platform, serves as a valuable tool for expanding the aerOS network across diverse audiences. The aerOS Twitter account (<https://twitter.com/AerosProject>) provides a brief overview of the project along with details on Followers, Following, etc.

Users can read posts, express their interest by liking, resharing, and commenting, enhancing the project's communication by reaching not only followers but also a broader audience. The concise format and character

limitations of X posts allow the project to effectively function as a news portal, enabling followers to access brief updates on project-related activities.



Figure 5. X account

2.1.1.2.3. Facebook Channel

The aerOS project maintains a presence on Facebook at <https://www.facebook.com/aerosproject>. Utilizing Facebook, one of the most widely used social media platforms, proves to be one of the simplest methods for enhancing brand value and expanding social media visibility, especially among the public. On Facebook, aerOS employs a strategy of sharing "more general interest" content.

This approach doesn't mean that the project's technological and innovative content or achievements are excluded; instead, such information is communicated using a non-technical, easily understandable language. Through the Facebook channel, users can stay updated on the project's recent activities, public news, and articles (Figure 6). Engagement is encouraged through various means, including likes, comments, shares, and the encouragement of users and connections to promote the project.

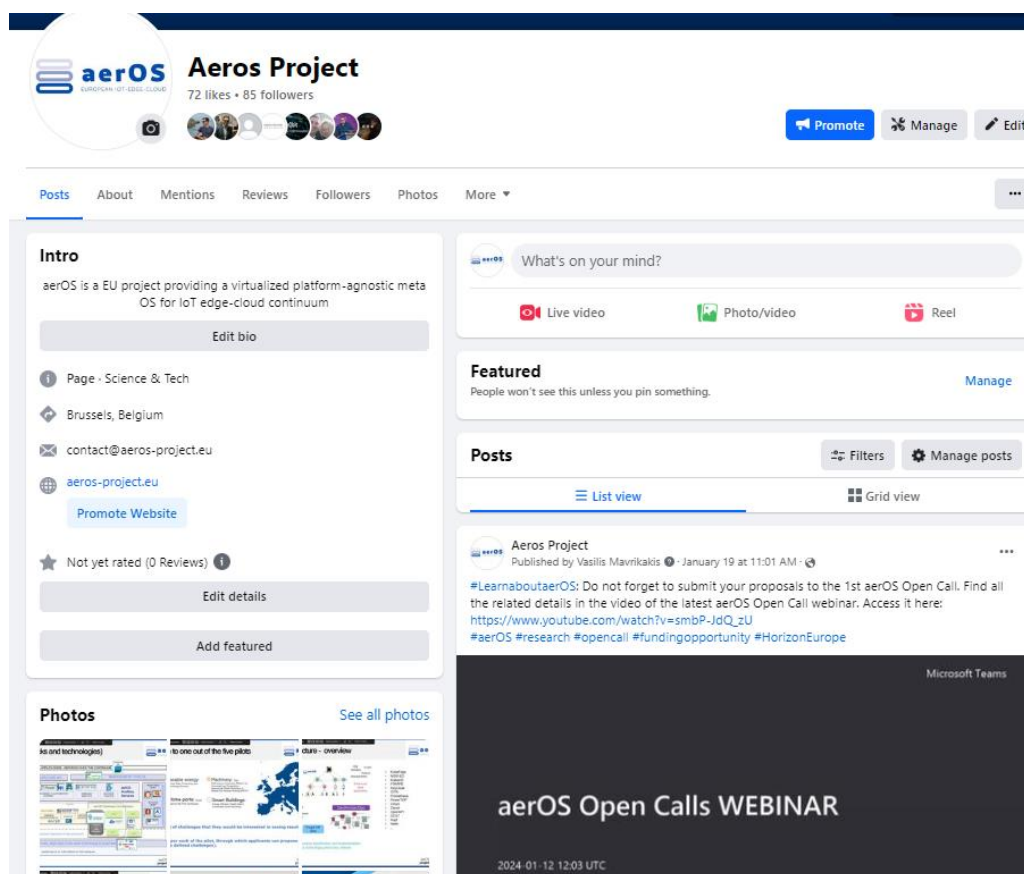


Figure 6. Facebook Account

2.1.1.2.4. Instagram Channel

The aerOS project actively also maintains presence on Instagram at <https://www.instagram.com/aerosproject/>. Instagram, being the most widely used platform for sharing images and videos, is strategically utilized by the aerOS to showcase project activities, achievements, and relevant content

t. This engagement aims to extend the reach of dissemination and communication efforts to new audiences. Leveraging the platform's emphasis on visual components, such as images and videos, allows for a more visually appealing and concise presentation of project-related information.

The communication strategy for Instagram involves incorporating less technical text, enriched with photos, to convey project content in a more accessible and visual manner. The Instagram account bio provides users with project information and a link to the website (or any regularly posted related activity link) for easy access.

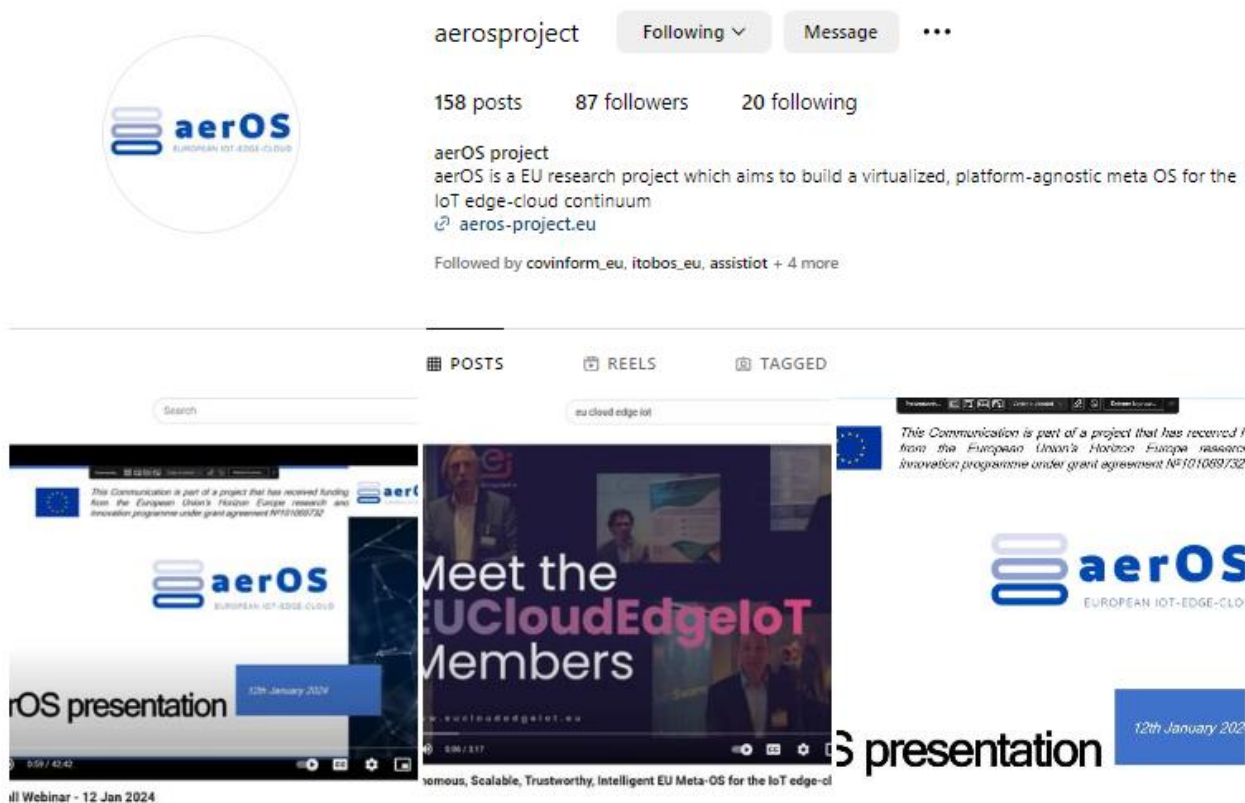


Figure 7. Instagram account

2.1.1.2.5. YouTube channel

YouTube, a major and widely recognized online video distribution platform, plays a crucial role in enhancing audience engagement, as videos tend to be more captivating than text and images. Leveraging YouTube allows the aerOS project to connect with a global audience and enhance discoverability through Google's search engine. Consistent production of video content throughout the project's duration is expected to boost audience engagement.

The aerOS YouTube channel, available at <https://www.youtube.com/@aeros-project>, is regularly updated with videos, with 6 already accessible at the time of the report (M16). The channel serves as a platform for promoting and showcasing project events.

Furthermore, the YouTube channel has been utilized to share videos from workshops and presentations. Employing the latest YouTube policy, the channel's handle is @aeros-project, providing a shorter and personalized link with the project name. This shorter link is more convenient for use and easier to remember when addressing communication initiatives.

Up to the moment of this deliverable was under editing, there were 6 videos uploaded in the project's YouTube Channel and by the end of the reporting period (Feb 2024) all five aerOS pilots are expected to have their own video uploaded, presenting an overview of the pilot, its infrastructure details and the developments made so far as part of the aerOS project and the use cases to be supported.

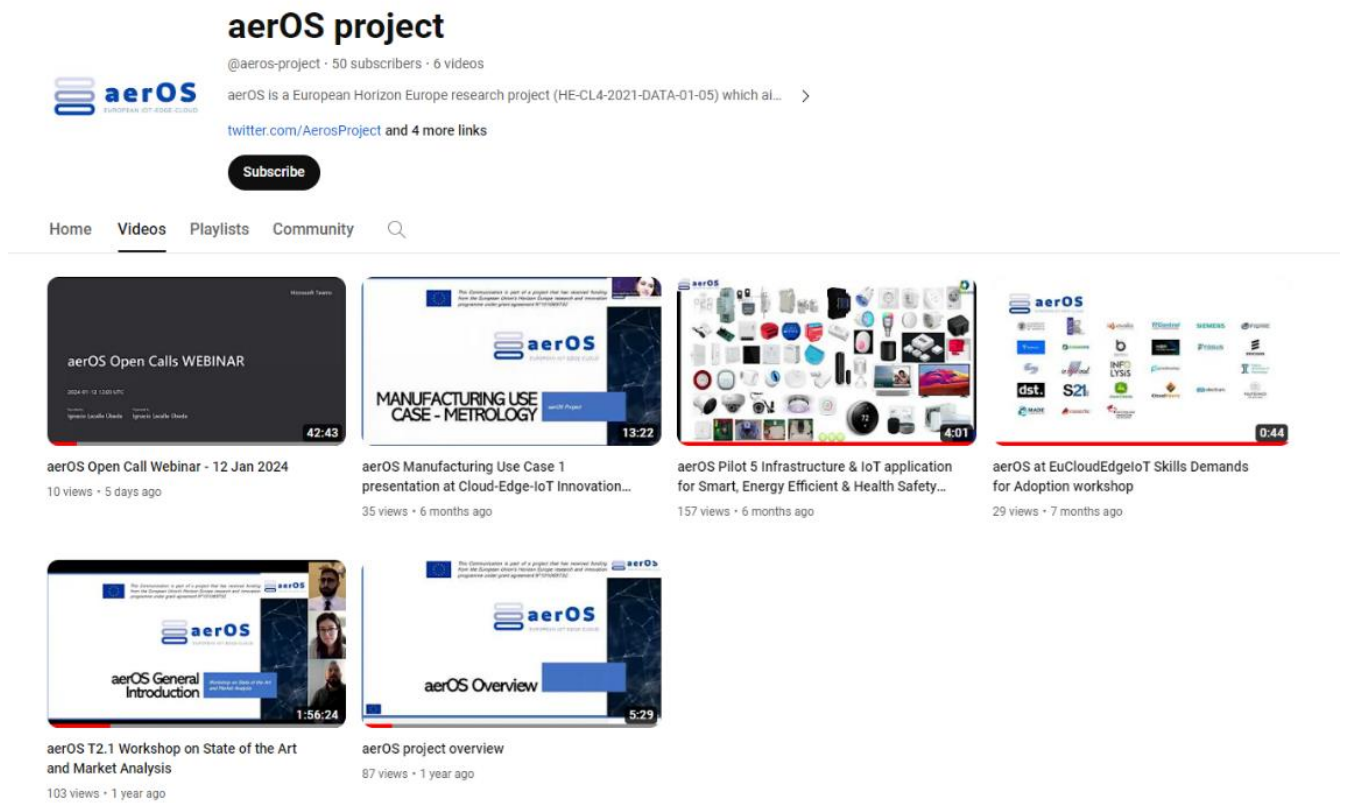


Figure 8. YouTube channel

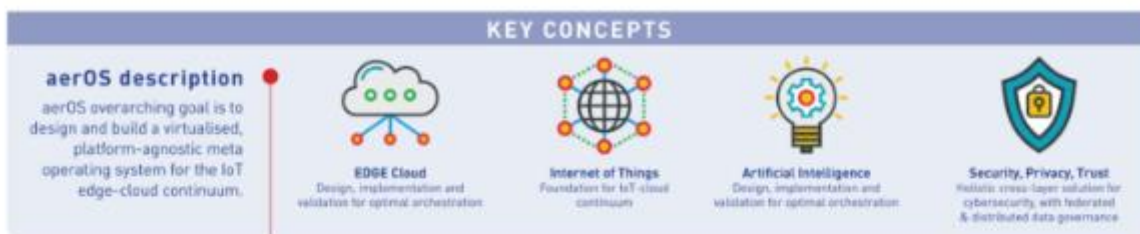
2.1.1.3. aerOS poster

In addition to its communication strategies, the aerOS project utilizes posters as a supportive tool. These posters, with the first aerOS poster accessible at https://aeros-project.eu/wp-content/uploads/2023/01/Poster-aerOS_A0_84x118cm_WEB.pdf, play a crucial role in various dissemination and communication initiatives such as workshops, booths, presentations, webinars, seminars, trainings, and trials.

The main objective of these posters is to provide informational support by offering the audience compact and comprehensive insights into the project, its objectives, and the ongoing pilot activities.



aerOS: Autonomous, scalable, trustworthy, intelligent European meta Operating System for the IoT edge-cloud continuum

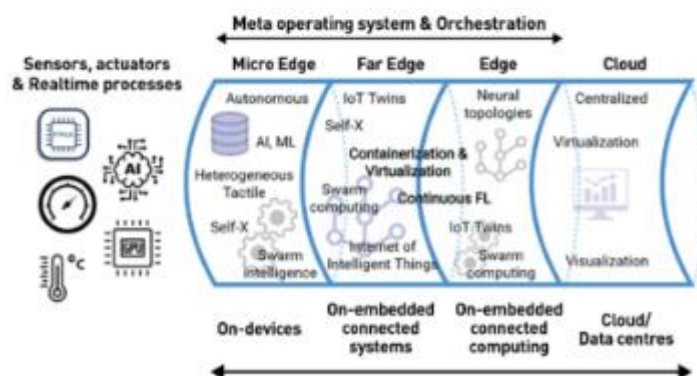


- Particularly, aerOS:**
- Delivers common virtualised services to enable orchestration, virtual communication, and efficient support for frugal, explainable AI and creation of distributed data-driven applications;
 - Exposes an API to be available anywhere and anytime, flexible, resilient and platform agnostic;
 - Includes a set of infrastructural services and features addressing cybersecurity, trustworthiness and manageability.

aerOS will be implemented as virtualised modules, executed on top of any operating system (e.g., Linux-based, Android, ROS, etc.) of an Infrastructure Element (IE) of the IoT edge-cloud continuum, e.g., a smart device, IoT gateway, edge node or network component.

Each aerOS IE deployment will consist of the following key modules: i) services and API; ii) virtualisation, abstraction and container runtime; iii) core aerOS modules; iv) supporting aerOS features; v) orchestration; vi) security, privacy and trust; and vii) management framework.

Five industry-driven heterogeneous use cases will demonstrate the value of aerOS



- Project's site: <https://aeros-project.eu/>
- Consortium: <https://aeros-project.eu/consortium/>
- Funding:** aerOS project has received funding from Horizon Europe, the EU's key funding programme for research and innovation, under grant agreement No 101069732



The grant has received funding from Horizon Europe, the EU's key funding programme for research and innovation, under grant agreement No 101069732.

Academic & SME & Industrial Partners



Figure 9. aerOS poster

2.1.1.4. aerOS Leaflet

aerOS leaflet is considered as the printed material designed for the purpose of conveying information and promoting the aerOS project. These leaflets can be distributed either digitally or in print and are commonly handed out at public events such as conferences and workshops.

Typically, leaflets offer concise information on a specific topic, including details like contact information, an overview of the project, or promotional offers. They serve to highlight and draw attention to the goals or causes associated with the aerOS project.

The initial version of the aerOS leaflet is already available in digital format on the aerOS website at https://aeros-project.eu/wpcontent/uploads/2023/01/aerOS_leaflet-v0.2.pdf.



Figure 10. aerOS leaflet 1st page

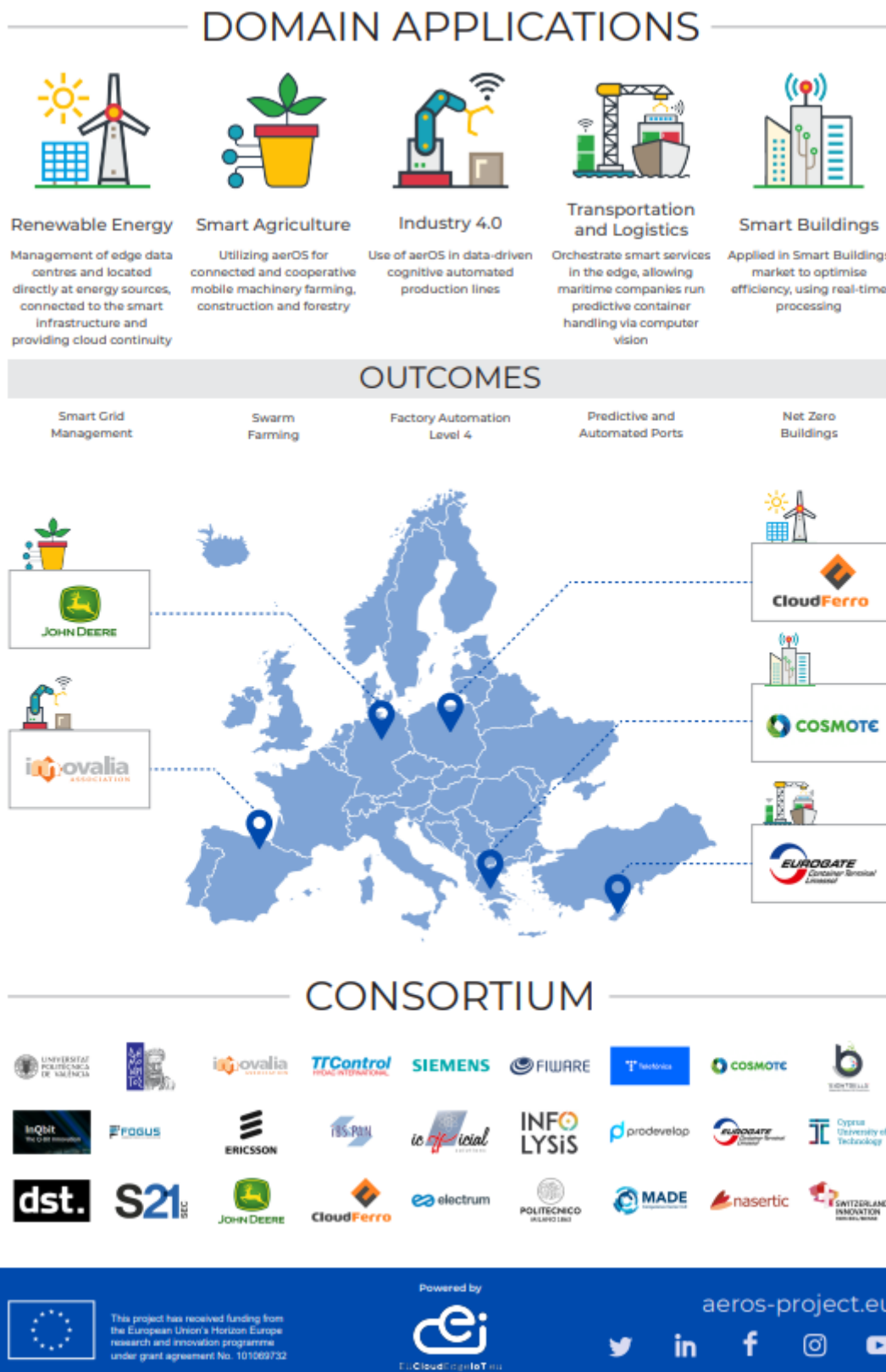


Figure 11. aerOS Leaflet 2nd page

2.1.1.5. aerOS Newsletter

The aerOS project release newsletters on a quarterly basis, with the inaugural issue already available at <https://aeros-project.eu/dissemination/newsletter/>. These newsletters serve as a means to briefly communicate the project's activities and achievements during each three-month period. Each newly published edition is uploaded on the project's website and shared across its social media channels. Stakeholders can conveniently access and download the newsletters for reading. Additionally, partners are notified of the release through internal mailing lists, ensuring they are kept informed about each new issue.

As we can see in Table 4; **Error! No se encuentra el origen de la referencia.**, up to M16, 5 issues have been released, while 1 is under editing (to be released middle of March 2024).

Table 4. aerOS Newsletter Issues

#	Newsletter Period	URL link
1	September – November 2022	https://aeros-project.eu/wp-content/uploads/2022/12/aerOS-newsletter-1.pdf
2	December 2022 – February 2023	https://aeros-project.eu/wp-content/uploads/2023/03/aerOS-newsletter-2.pdf
3	March – May 2023	https://aeros-project.eu/wp-content/uploads/2023/06/aerOS-newsletter-3.pdf
4	June – August 2023	https://aeros-project.eu/wp-content/uploads/2023/09/aerOS-newsletter-4.pdf
5	September – November 2023	https://aeros-project.eu/wp-content/uploads/2023/12/aerOS-newsletter-5.pdf
6	December 2023 – February 2024	Under editing

2.1.1.6. aerOS articles

The partners of the aerOS project have communicated information about the project through online articles, many of which have been widely shared on various news portals.

Up to M16, aerOS project has 9 articles spawned by the members of the consortium.

Table 5. aerOS articles

#	Media	URL link
1	upv.es	http://www.upv.es/noticias-upv/noticia-13836-proyecto-aeros-es.html
2	valenciaplaza.com	https://valenciaplaza.com/la-upv-lidera-un-proyecto-europeo-que-aplica-ia-y-computacion-para-energia-y-edificios-inteligentes

3	europapress.es	https://www.europapress.es/navarra/noticia-navarra-participa-proyecto-europeo-aeros-mejorar-gestion-datos-recursos-informaticos-ue-20220704110717.html
4	lasprovincias.es	https://www.lasprovincias.es/comunitat/lidera-proyecto-aplica-20221107004649-ntvo.html
5	gentedigital.es	http://www.gentedigital.es/valencia/noticia/3498265/la-upv-lidera-un-proyecto-europeo-que-aplica-ia-y-compu%e2%80%a6/
6	elmeridiano.es	https://www.elmeridiano.es/la-upv-lidera-un-proyecto-ue-para-el-desarrollo-de-un-meta-sistema-operativo/
7	mikrofwno.gr	https://mikrofwno.gr/2023/05/defea-2023/
8	EUCloudEdgeIoT.eu	https://eucloudedgeiot.eu/communication-horizon-context/
9	irisnavarra.com	https://www.irisnavarra.com/es/noticias/eres-una-pyme-o-una-entidad-investigadora-y-estas-desarrollando-una-propuesta-o-solucion

2.1.1.7. aerOS press releases

Multiple partners have unveiled the involvement in the aerOS project through official announcements and press releases featured on their company websites. These announcements likely provide detailed insights into the partner's role, contributions, and enthusiasm for being a part of the aerOS initiative.

Typically, these materials may highlight key aspects such as the significance of the project, the partner's specific contributions, and the collaborative efforts aimed at achieving the project's objectives. The use of announcements and press releases on individual company websites ensures that stakeholders, clients, and the public can access accurate and up-to-date information about the partner's engagement in the aerOS project.

Currently, 9 press releases have been made by specific consortium members.

Table 6. aerOS press releases

#	Release	URL Link
1	aerOS announced at Nasertic website	https://www.nasertic.es/es/proyectos#aeros
2	aerOS announced at Prodevelop website	https://www.prodevelop.es/en/ports/idi-puertos
3	aerOS announced at NCSR “Demokritos” website	https://www.iit.demokritos.gr/projects/autonomous-scalable-trustworthy-intelligent-european-meta-operating-system-for-the-iot-edge-cloud-continuum/
4	aerOS announced at 8Bells website	https://www.8bellsresearch.com/eight-bells-is-very-proud-to-participate-in-aeros-project/
5	aerOS announced at DST website	https://www.dstech.it/progetti-finanziati.html
6	aerOS announced at COSMOTE’s website	https://www.cosmote.gr/cs/otegroup/en/aeros.html

7	aerOS announced at FIWARE’s website	https://www.fiware.org/about-us/rd-projects/project/?id=aeros
8	aerOS announced at CloudFerro’s website:	https://cloudferro.com/en/news/cloudferro-in-aeros-project/
9	aerOS announced at Cyberwatching.eu	https://www.cyberwatching.eu/projects/3475/aeros

2.1.2. Control/Monitoring Mechanisms, Performance Monitoring, Special Communication actions

The aerOS consortium has set dedicated monitoring methods to meticulously monitor all scheduled communication and dissemination activities. These tools regularly evaluate the efficacy of the project’s website and social media platforms. Such monitoring mechanisms are crucial as they provide valuable insights, gauge the consortium’s impact, and illustrate the project’s progression. Moreover, these tools facilitate effective collaboration among the consortium’s members.

2.1.2.1. NextCloud, Online Repository and Coordination Files

The aerOS partners utilize the NextCloud platform as a collaborative instrument to facilitate the sharing of materials and content. This platform is structured into categorized sections comprising folders and sub-folders, allowing seamless distribution and enhanced organization of the project’s materials. The NextCloud platform plays a major role in enabling efficient communication and collaboration among members within the consortium. It incorporates multiple specifically designated folders corresponding to each Work Package and Task, along with the capability for online file editing—a feature significantly beneficial for documenting communication activities. More information about the NextCloud and its use as tool for WP6 can be found in [deliverable D6.1](#).

2.1.2.2. Google analytics and statistical dashboards

Google Analytics stands as an indispensable tool for monitoring and assessing website performance within any digital marketing strategy. Its capacity to offer detailed and sophisticated data, along with various metrics and functionalities, is invaluable for evaluating a website’s impact. However, it is the responsibility of the administrator to discern and prioritize the pertinent information aligned with the website’s objectives and communication strategy. Within the aerOS framework, the communication team utilizes Google Analytics to monitor the aerOS website’s performance monthly, and internally disseminate statistics on a quarterly basis. Prompt identification of any deviations or poor performance will prompt immediate corrective actions.

In the context of the aerOS project, Google Analytics serves not only to monitor and assess website efficiency but also as a data source for Looker Studio (ex-Google Data Studio). INFOLYSIS, has created tailor-made Website Statistical Dashboards to facilitate more comprehensive data analysis and visualization, focusing on specific metrics of website performance. This customized aerOS dashboards provide a holistic visual statistical overview of the website’s performance to all consortium members on a quarterly basis.

Table 7: Social media terminology

Term ²³	Explanation
Engagement	Engagement is any form of interaction with your brand on social media. Likes, comments, and shares are all forms of engagement.
Handle	Your handle is your username on social media. It is usually noted as @username. (see YouTube)

² <https://blog.hootsuite.com/social-media-definitions/>

³ <https://www.hotjar.com/google-analytics/glossary/sessions/>

Hashtag	A hashtag is a word or phrase preceded by the “#” sign. Hashtags are used on social media to tag posts as part of a larger conversation
Impressions	Impressions is a metric that counts how many times an ad or promoted posts is fetched from the server and displayed on a social network.
Reach	Reach refers to the total number of people who have been exposed to a social post or ad. This metric does not necessarily indicate that all of these people have actually seen your content. They could have scrolled right past it, for instance. Reach simply indicates that the content appeared in the user’s social feed at least once.
Session	Refers to the set of actions taken by a user on your website in a given time frame
User	The visitor who has initiated the session and visits the website

2.1.2.3. Website dashboards

The statistical dashboards on the website, depicted in Figure 12 and Figure 13, and created through Looker Studio (utilising data from Google Analytics), offer a comprehensive overview of the website's functionality and performance during the period from September 2022 to December 2023. Furthermore, details of the number of sessions (8,151), new user statistics, average session duration (1 minute and 31 seconds), and total views can be found. Additionally, Figure 12 outlines the pathways users followed to access the aerOS website. Indicatively, 1,924 visitors arrived directly, 1,284 through Google search, and 138 via LinkedIn.

Also, insights from **Figure 13** shed light on the geographical origins of users, with a majority coming from Spain (624) and Greece (512), while also attracted visitors from the USA (449).

Finally, the dashboard provides data on the devices used to access the website, revealing that 68.3% of aerOS visitors utilized desktops, 27.6% preferred mobile devices, and a mere 4.1% opted for tablets.



aerOS Website Dashboard September 2022 - December 2023 Statistics

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069732



The audience at a glance

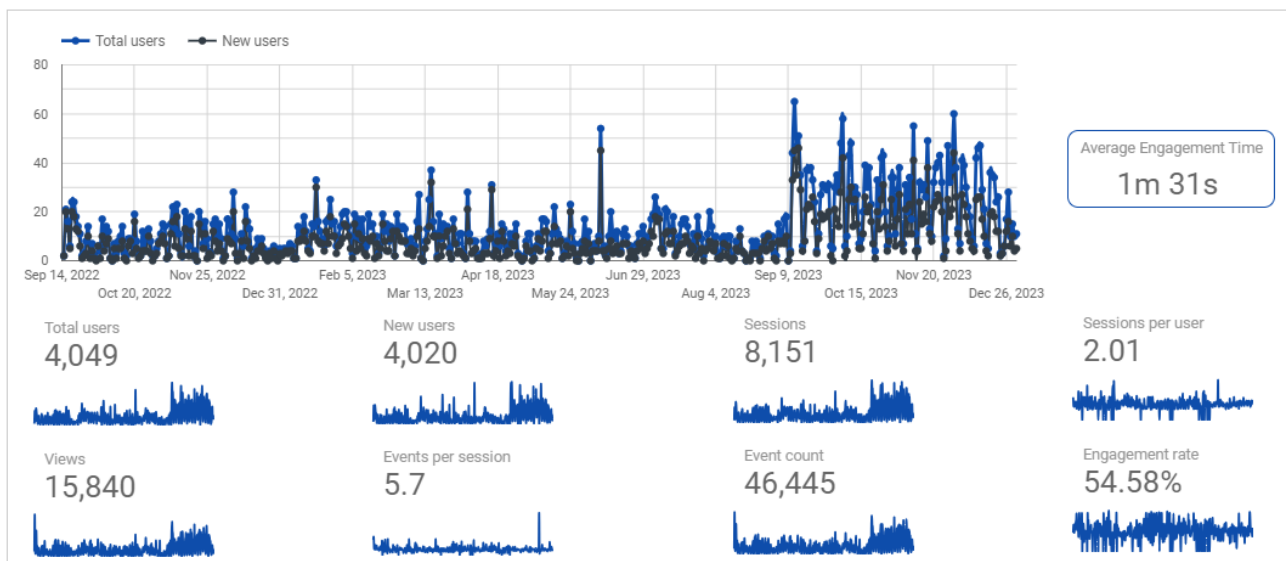


Figure 12. Website Statistical Dashboard 1

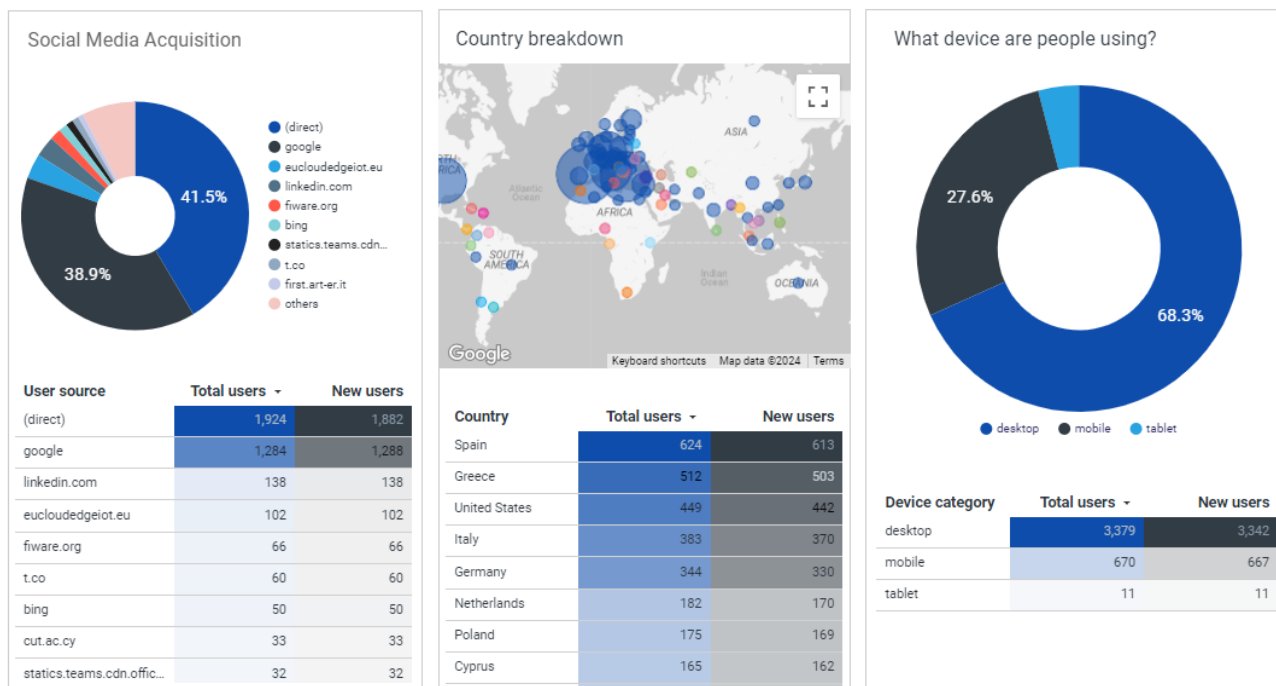


Figure 13. Website Statistical Dashboard 2

Find all the related information about the website M1-M16 dashboards here: <https://lookerstudio.google.com/u/0/reporting/61194230-991b-4f3f-9a40-c07c501187d9/page/pmtsB>

2.1.2.4. Social Media Statistical Dashboards

- **LinkedIn Dashboard**

Following the same methodology as in the website, the INFOLYSiS team utilized Looker Studio to craft the LinkedIn Dashboard, illustrated in **Figure 14**, designed for evaluating statistics related to the LinkedIn account. The dashboard comprises of an infographic showcasing post views, a dropdown list featuring posts recorded on the platform, allowing stakeholders to navigate between different posts. Positioned on the right side are the Period and Total Statistics sections, providing comprehensive data on the total number of posts, post views, likes, reshares, followers, and connections within the specified timeframe. It is crucial to note that all social media dashboards follow this consistent approach, presenting key metrics of interest.

The LinkedIn Dashboard can be accessed through the following link: <https://lookerstudio.google.com/u/0/reporting/3ae6046e-a5fd-4267-b7a7-7ae95cd915f9/page/1SSqB>

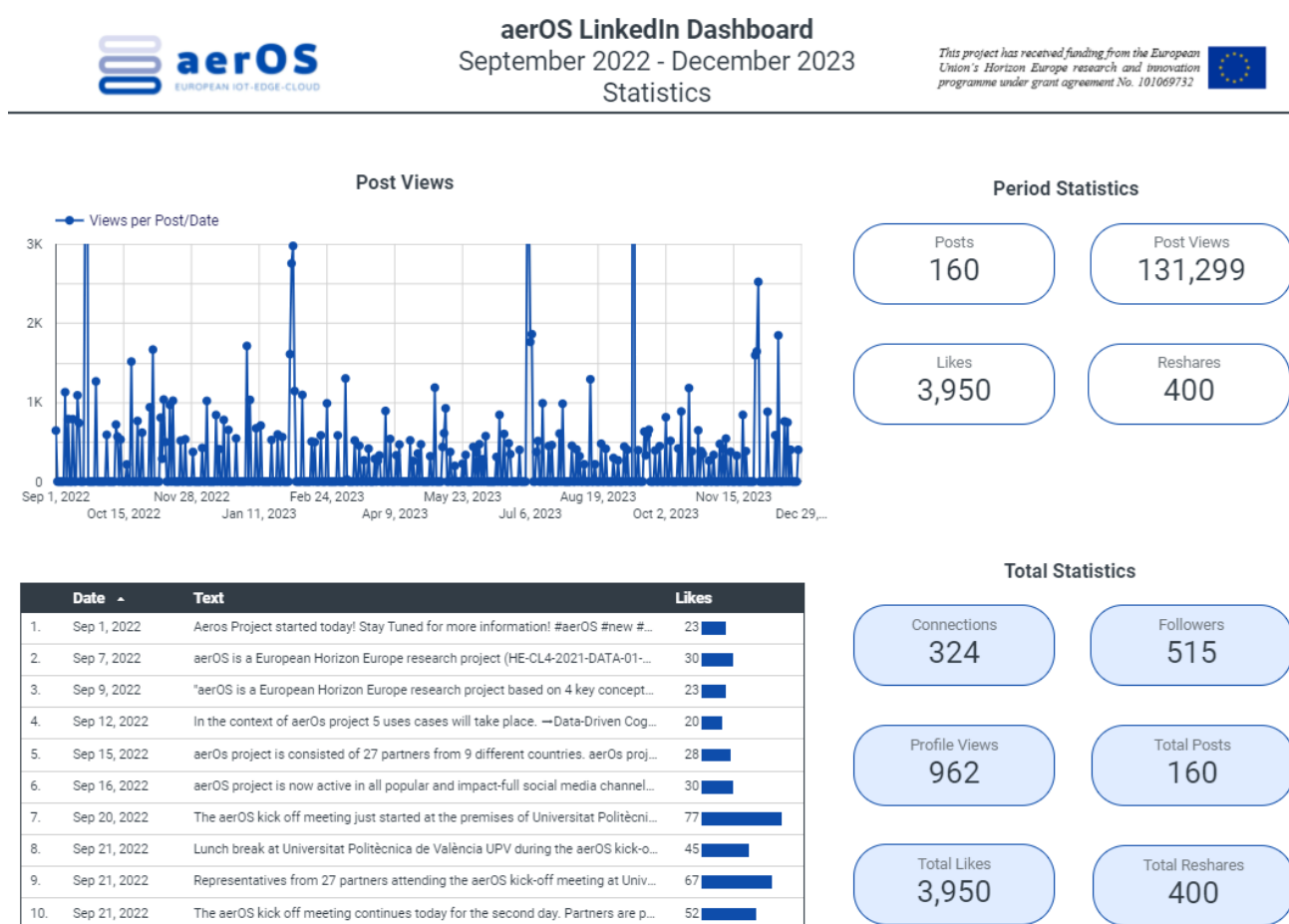


Figure 14. LinkedIn dashboard

Table 8 reports the basic statistics of the aerOS LinkedIn channel (M1-M16).

Table 8: LinkedIn stats

Posts	160
Connections	324
Followers	515
Profile Views	962
Likes	3,950

To provide a better understanding of the LinkedIn channel management, we provide a table with the most impactful posts in terms of LinkedIn likes. *Figure 15* shows the posts which earned the most likes in this 16-month period. As we can see the most “powerful” likes are the ones that are related with face-to-face meetings/activities of the project such as kick-off and plenary meetings.

	Post Like...	Date	Text	Likes
1.	92	Feb 2, 2023	Today is the last day of our first plenary meeting! In this final day of the meeting partners are having a joint workshop of WP3 and WP4 along with discussions about upcoming activities and action points. Partners had also the chance to take the traditional group photo! #aerOS #research #meeting #NGIoT #eucloudedgeiot #innovation #meeting EUCloudEdgeIoT	92
2.	77	Sep 20, 2022	The aerOS kick off meeting just started at the premises of Universitat Politècnica de València (UPV) and will last for two days! Partners have the chance to meet each other for the first time. Stay tuned for more! #aerOS #HorizonEurope #EU #new #project #GA #plenary #research #innovation	77
3.	67	Sep 21, 2022	Representatives from 27 partners attending the aerOS kick-off meeting at Universitat Politècnica de València (UPV) in #Valencia, Spain. Partners had the chance to take the first group photos of the project The best is yet to come! Stay Tuned! #aerOS #HorizonEurope #EU #new #project #beginning #research #innovation	67
4.	61	Jul 7, 2023	#LearnaboutaerOS: The 2nd plenary meeting of the aerOS project took place the previous days. The partners of our project had the chance to discuss the status of the project along with the upcoming plans and the next steps. Partners had also the chance to take the traditional group photo. #aerOS #IoT #meeting #athens #plenary #HorizonEurope NetworkEurope SME WG EUCloudEdgeIoT	61
5.	56	Jul 4, 2023	#LearnaboutaerOS: The 2nd aerOS Project plenary meeting has just started in the COSMOTE premises in Athens! Our project coordinator is giving some administrative information along with insights on the project status. #aerOS #IoT #NGIoT #eucloudedgeiot #HorizonEurope #athens #research EUCloudEdgeIoT Universitat Politècnica de València (UPV)	56

Figure 15. LinkedIn Top - 5 Posts

- **X Dashboard**

Using Looker Studio, the INFOLYSiS team developed a comprehensive X Dashboard that not only encompassing the previous mentioned data. Notable metrics featured in the dashboard include the number of tweets (189) and retweets (276), among other relevant information. Additionally, the "Total Statistics" section provides an overview of the Twitter account from the project's inception, presenting data such as the number of followers (176) and accounts being followed (110).

For further exploration, the X Dashboard for aerOS during the period of September 2022 to December 2023 can be accessed through the following link: <https://lookerstudio.google.com/u/0/reporting/37d97302-b4b0-4ce2-a8b3-eed229e2de19/page/4YFqB>



aerOS X (formerly Twitter) Dashboard September 2022 - December 2023 Statistics

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069732

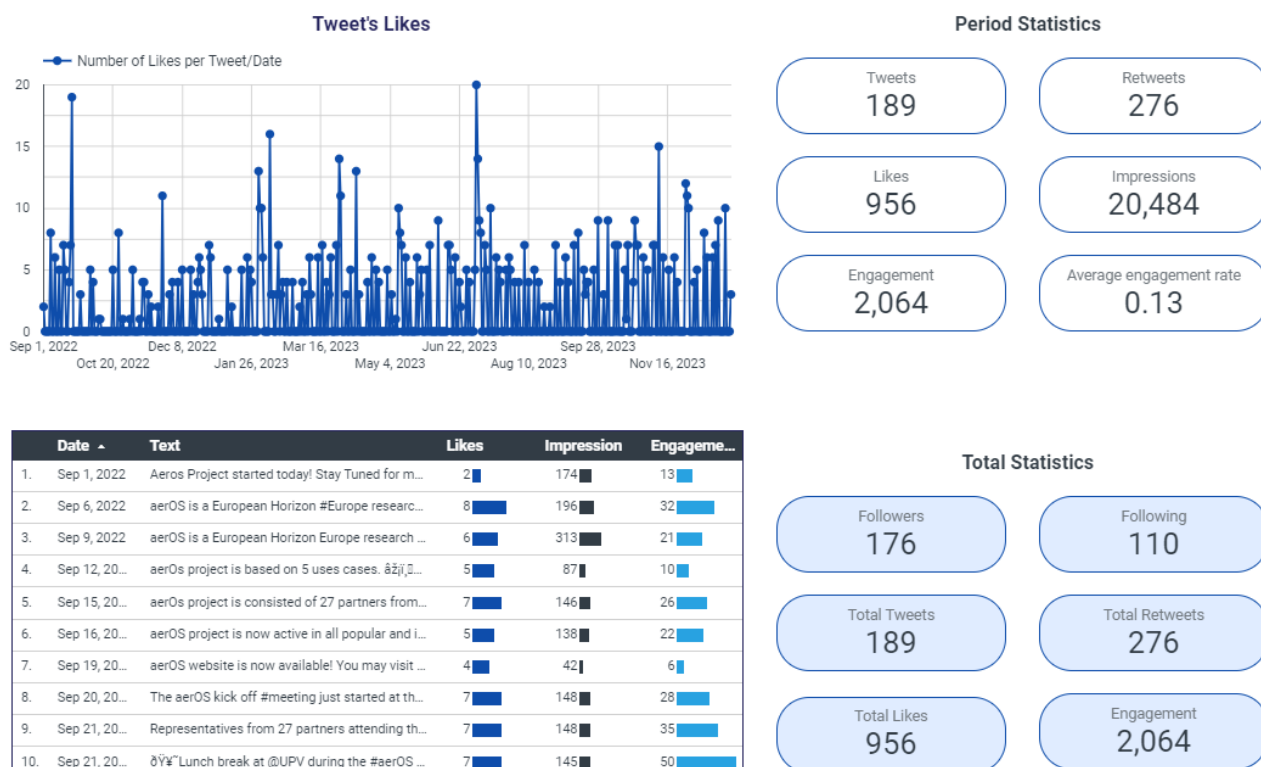


Figure 16. X dashboard

Table 9. X stats

Tweets	189
Followers	176
Retweets	276
Likes	956

Figure 17 shows the 5 most impactful posts on the X platform. In this channel we can see that the most liked posts are the ones that are related with the EUCloudEdgeIoT association launching (Feb 2023). Analysing the results we also realise that project related activities such as booth representation (DEFEA event), newsletters and plenary meetings are among the most impactful posts.

Date	Text	Likes	Impression	Engagement
1. Feb 8, 2023	The official launch of the #EUCloudEgdeloT took place earlier today, and aerOS project was present! In this introductory #meeting participants had the chance to meet the coordination team and the new #Task #Forces! @NGloT4eu @EU_CloudEgdeloT @HorizonEU @Martel_Innovate https://t.co/NBYuUNWpEt	13	238	49
2. Apr 10, 2023	The latest issue of the @EU_CloudEgdeloT News Digest (Issue 5) is now available! In this issue you may find it all the latest information of all related projects, along with details about our co-organised workshop at ARES conference. https://t.co/wcQrlhvTOy @DigitalEU https://t.co/hQDBL0KYC5	13	139	19
3. Nov 24, 2022	aerOS is a #European research project which aims at transparently utilising the resources on the edge-to-#cloud computing continuum for enabling #applications in an effective manner while incorporating multiple services. https://t.co/SkWLbn9PQv @HorizonEU @NGloT4eu #video	11	208	26
4. May 10, 2023	#LearnaboutaerOS: @InQbit and @infolysis_gr partners are in the @DEFEA2023 promoting our project with communication material! Stay tuned for more material! @HorizonEU @SME_WG_NwEurope @SWforumEU https://t.co/xGfg9qwoT	10	119	15
5. Feb 2, 2023	Today is the last day of our first plenary meeting! In this final day of the meeting partners are having a joint workshop of WP3 and WP4 along with discussions about upcoming activities. Partners had also the chance to take the traditional group photo! @NGloT4eu @EU_CloudEgdeloT https://t.co/qNC9ZL77uo	10	116	22

Figure 17. X Top-5 posts

• Facebook Dashboard

Within the Facebook Dashboard, users can access data relation to the examined period, presenting period statistics that highlight various Key Performance Indicators (KPIs) relevant to the specified timeframe. Notable metrics include the number of posts (157) and page reach (5571). The Total Statistics section, covering the entire project duration, provides insights such as page followers (85) and total post likes (788).

For a detailed overview of Facebook analytics for the period of September 2022 to December 2023, the dashboard is accessible online at: <https://lookerstudio.google.com/u/0/reporting/0de8cc59-6096-407d-98a3-9324f1920c54/page/j5mpB>

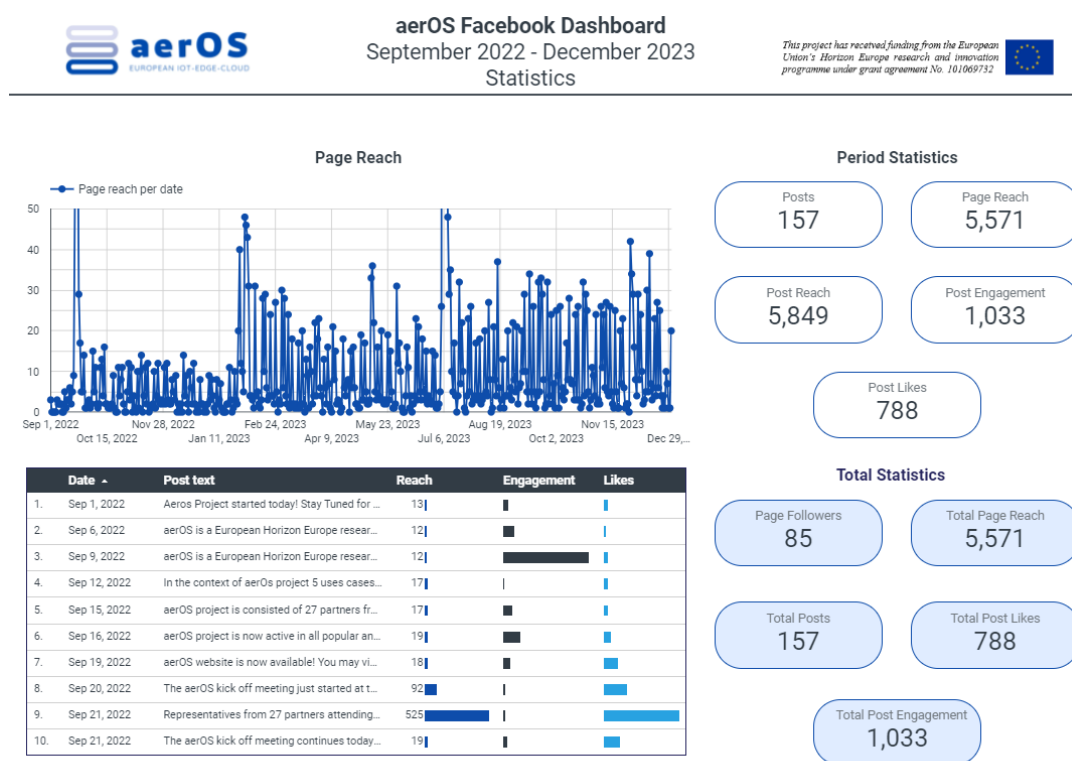


Figure 18. Facebook dashboard

Table 10 summarizes the Facebook activity for the 16 months of the project durations.

Table 10. Facebook stats

Posts	157
Page Followers	85
Page Likes	788
Total Page Reach	5,571

Figure 19 is providing details on the popularity of the most 5 impactful Facebook posts. The most popular post is related to the project’s kick-off, while most of the rest posts are related to face-to-face meetings and activity performed by our Project Coordinator (aerOS presentation at EuCloudEdgeIoT Concertation/Consultation meeting, Brussels, May 2023).

Date ^	Post text	Reach	Engagement	Likes
1. Sep 21, 2022	Representatives from 27 partners attending the aerOS kick-off meeting at Universitat Politècnica de València UPV in #Valencia, Spain. Partners had the chance to take the first group photos of the project The best is yet to come! Stay Tuned! #aerOS #HorizonEurope #EU #new #project #beginning #research #innovation	525	6	33
2. Feb 2, 2023	Today is the last day of our first plenary meeting! In this final day of the meeting partners are having a joint workshop of WP3 and WP4 along with discussions about upcoming activities and action points. Partners had also the chance to take the traditional group photo! #aerOS #research #meeting #NGIoT #eucloudedgeiot #innovation #meeting Next Generation Internet of Things - NGIoT	50	15	15
3. May 11, 2023	#LearnaboutaerOS: Our Project Coordinator, Professor Carlos Enrique Palau from Universitat Politècnica de València UPV presented yesterday during the Concertation and Consultation Meeting of #EUCLouDEGEIoT in Brussels, our project! #aerOS #IoT #NGIoT #H2020 #research #presentation	34	12	12
4. Jul 4, 2023	#LearnaboutaerOS: The 2nd Aeros Project plenary meeting has just started in the COSMOTE premises in Athens! Our project coordinator is giving some administrative information along with insights on the project status. #aerOS #IoT #NGIoT #eucloudedgeiot #HorizonEurope #athens #research	28	13	13
5. Jul 5, 2023	#LearnaboutaerOS: The second day of the Aeros Project plenary meeting started earlier today! In this second day of the meeting partners are discussing about the recent technical developments and about pilot specifications. Stay Tuned! #aerOS #research #HorizonEurope #plenary #GA #meeting #athens	401	12	12

Figure 19. Facebook Top-5 posts

- **Instagram Dashboard**

The Instagram Dashboard also provides relevant statistical and performance information. The dashboard also includes a line chart with the impression and reach per post and also a table with the number of likes per post over time.

In the following link one may access the aerOS Instagram Dashboard for the period of September 2022 – December 2023:

<https://lookerstudio.google.com/u/0/reporting/41594af0-3a69-403a-b4ed-bb3744441073/page/rKQqB>

During the reporting period (M1-M16), the aerOS Instagram account has collected 720 total likes, from total of 149 posts. It has gained at these four months 87 followers and 280 profile visits. It has also a total reach of 1236.



aerOS Instagram Dashboard September 2022 - December 2023 Statistics

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No. 101069732

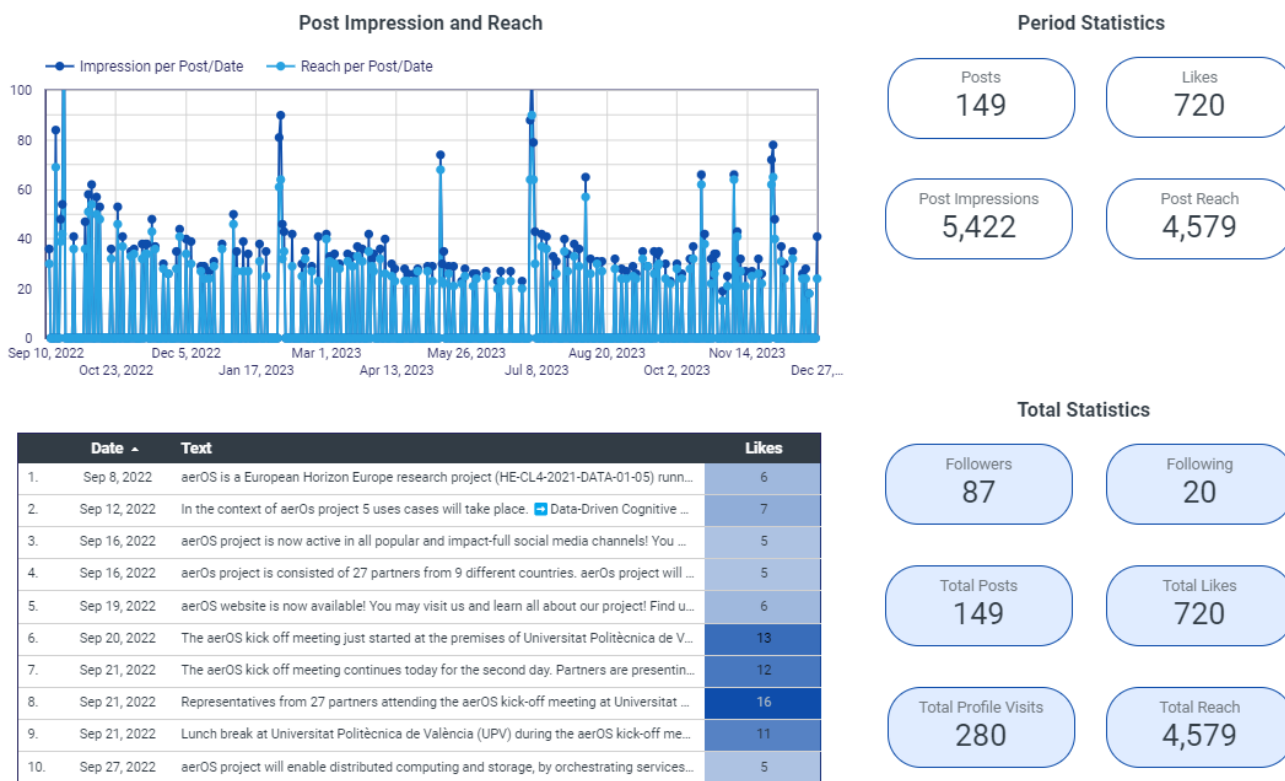


Figure 20. Instagram dashboard

Table 11 summarises the fundamental Instagram insights for this reporting period.

Table 11. Instagram stats

Total Posts	149
Total Likes	720
Total Reach	4,579
Followers	87
Total Profile Visits	280

Figure 21 showcases the posts that have gained the most likes in the aerOS Instagram channel. As this is a channel using images as a fundamental element, we can understand that most of the posts in this list are related to physical meetings or presentations, where photos from partners and activities were communicated.

	Date ^	Text	Likes
1.	Sep 20, 2022	The aerOS kick off meeting just started at the premises of Universitat Politècnica de València (UPV) and will last for two days! Partners have the chance to meet each other for the first time. Stay tuned for more! #aerOS #HorizonEurope #EU #new #project #GA #plenary #research #innovation	13
2.	Sep 21, 2022	Representatives from 27 partners attending the aerOS kick-off meeting at Universitat Politècnica de València UPV in #Valencia, Spain. Partners had the chance to take the first group photos of the project The best is yet to come! Stay Tuned! #aerOS #HorizonEurope #EU #new #project #beginning #research #innovation	16
3.	Sep 21, 2022	The aerOS kick off meeting continues today for the second day. Partners are presenting details about their role at Universitat Politècnica de València @instaupv. Harilaos Koumaras (NCSR "DEMOKRITOS"), our technical manager presents also, administrative and technical aspects of our recently started project. #aerOS #HorizonEurope #EU #new #project #GA #plenary #research #innovation	12
4.	Jan 31, 2023	The aerOS architecture workshop during our plenary meeting has just started! Partners from NCSR "DEMOKRITOS" are explaining the fundamental aspects of the project's architecture diagram! #aerOS #research #plenarymeeting #NGIoT #EUCLouDEdgeIoT #innovation #HorizonEurope Next Generation Internet of Things - NGIoT	12
5.	Feb 1, 2023	aerOS 1st plenary meeting continues today with more work package activities and task discussions! Stay Tuned for more! #aerOS #meeting #plenary #research #NGIoT #eucloudedgeiot	12

Figure 21. Instagram Top-5 posts

2.1.2.5. Liaison with EUCloudEdgeIoT, other associations and projects

The EUCloudEdgeIoT association is an initiative, which brings together projects from the IoT and metaOS sector. The EUCloudEdgeIoT initiative aims to realise a pathway for the understanding and development of the Cloud, Edge and IoT (CEI) Continuum by promoting cooperation between a wide range of research projects, developers and suppliers, business users and potential adopters of this new technological paradigm. In order to achieve this goal, it offers a variety of communication and dissemination opportunities.

For instance, every project has its own dedicated section (aerOS: <https://eucloudedgeiot.eu/members/european-research-and-innovation-projects/>) and, on a regular basis, EUCloudEdgeIoT releases news digest issues (<https://eucloudedgeiot.eu/news-digest-new/>) with project related activities.

The most important action that leads to the creation of a community between the related projects is through the monthly Task force 6 calls. Here, calls are organized under the supervision of the EUCloudEdgeIoT and in these sessions, presenters from all projects share findings and data from their projects, fostering an atmosphere of collaboration and progress.

A tentative summary of the aerOS participation in EUCloudEdgeIoT activities:

- EUCloudEdgeIoT Task Force 6 meetings: 9 meetings,
- aerOS presented in EUCloudEdgeIoT Newsflash issues: 3 times/issues,
- aerOS contributions to EUCloudEdgeIoT White Papers: 3 white papers,
- aerOS promoted through EUCloudEdgeIoT Website (News posts, articles etc.): 5 news posts,
- aerOS Presentations in EUCloudEdgeIoT events: 6 presentations,
- EUCloudEdgeIoT Events attended/participated: 7 events.

aerOS project has collaborated with other projects and organisations such as SNS (<https://smart-networks.europa.eu/>), Hipeac (<https://www.hipeac.net/#/>), Cyberwatching.eu platform (<https://www.cyberwatching.eu/>), Big Data Value Association (<https://www.bdva.eu/big-data-value-association>), SME Working Group (<https://www.networldeurope.eu/sme-wg/>) and sister cluster projects such as Nephele. A tentative list of collaborations between aerOS and these organisations and projects is the following one:

- aerOS project is featured in the Hipeac Info Magazine, October 2023. You may find the magazine online here: <https://www.hipeac.net/magazine/7166.pdf>,
- aerOS participated in the Hipeac Conference 2024 (<https://aeros-project.eu/2024/01/15/aeros-at-hipeac-event-2024/0>),
- aerOS is featured in the Cyberwatching.eu platform (<https://www.cyberwatching.eu/projects/3475/aeros>),
- aerOS & DataPorts collaboration announcement (<https://dataports-project.eu/newcollaborations-with-other-projects/>),

- aerOS Presentation in Big Data Value Association – BDVA (<https://aeros-project.eu/2023/11/15/big-data-value-forum-2023/>),
- aerOS project was represented by InQBit at the 6Gsec Common Path and Cardinal Points “6Gsec CP” event by SNS (<https://smart-networks.europa.eu/event/6gsec-common-path-and-cardinal-points-6gsec-cp%C2%B2-save-the-date/>),
- aerOS and NEPHELE project coorganise the 1st International Workshop on MetaOS for the Cloud-Edge-IoT Continuum (MECC 2024) in Athens (<https://meccworkshop.github.io/index.html>),
- aerOS Open Call Presentation at SME WG on 21st of November (<https://www.linkedin.com/analytics/post-summary/urn:li:activity:7132703791656673280/>).

It is important at this stage to mention that the above-mentioned list is a tentative one and it is used for highlighting the collaborations of our project with different organisations and projects. In the future, more collaborations may occur in the aerOS concept.

2.1.2.6. aerOS Open Call #1 – OC Communication plan – Targeted Communication

The Open Call is a vital activity for the aerOS success. In that manner the communication plan of the project had to be adopted and adjusted accordingly. The aerOS 1st Open Call communication was divided into three different phases. The first one was the announcement phase (September 2023), the second one was the main phase (October 2023 till the end of January 2024) where all the attention was to raise awareness and attract potential candidates to submit their proposals, and the third one (February - March 2024) is the communication of the results which will be devoted to reporting activities of the accepted proposals.

For each one of these phases, aerOS will follow a specific communication plan (already applied for OC1). It is of utmost importance to refer to some details about the open call communication plan. The first step, in order to have a consistent and consolidated open call communication plan, was the creation of a dedicated open call webpage (<https://aeros-project.eu/open-calls/open-call-1/>). Since September 2023, this webpage was live, sharing all the related information and documents about the open call. On this webpage, any interested stakeholder could find information about the open call timeline, the challenges, the eligibility and the funding. Also, there were four distinct buttons for downloading/accessing related material and forms (the template, the guide, the collaboration agreement and the submission button/process).

Administrative (and other) criteria are as follows:

- Proposals must be written in English in all their parts in order to be eligible.
- The applicants must base their proposals on original work and, going forward, any foreseen developments should be free from third party rights, or they are clearly stated in a specific section.
- Applicants are not allowed to submit multiple applications. If that is the case, only the first submitted application will be considered.
- No entity with economic interest, family or emotional ties or any other shared interest ('conflict of interest') towards aerOS Consortium partners will be accepted as candidates for funding.
- All cases of conflict of interest will be assessed case-by-case, based on pertinent EU stipulations.

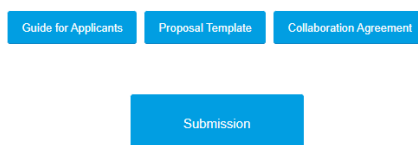


Figure 22. Open Call buttons

In the bottom of the open call webpage, we have created a separated section for the evaluators. This section worked as an express of interest for potential evaluators. Also, a dedicated button with guidelines was created for facilitating the process.

Guidelines for becoming aerOS Open Call Evaluator

Are you a professional or expert interested in becoming aerOS Open Calls evaluator?

For applying to be an evaluator of aerOS Open Calls, the candidates **must submit via email** to the address iglaub@upv.es the following documentation **before 31st January, 2024, 7pm CET**.

Please carefully read [the Guideline of Evaluators](#) for the application process details.

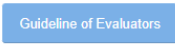


Figure 23. Evaluators section

Apart from the dedicated open call webpage, INFOLYSiS team, in collaboration with UPV, has created a special Open Call frequently asked questions (FAQ) Webpage (<https://aeros-project.eu/open-calls/open-call-faq/>).

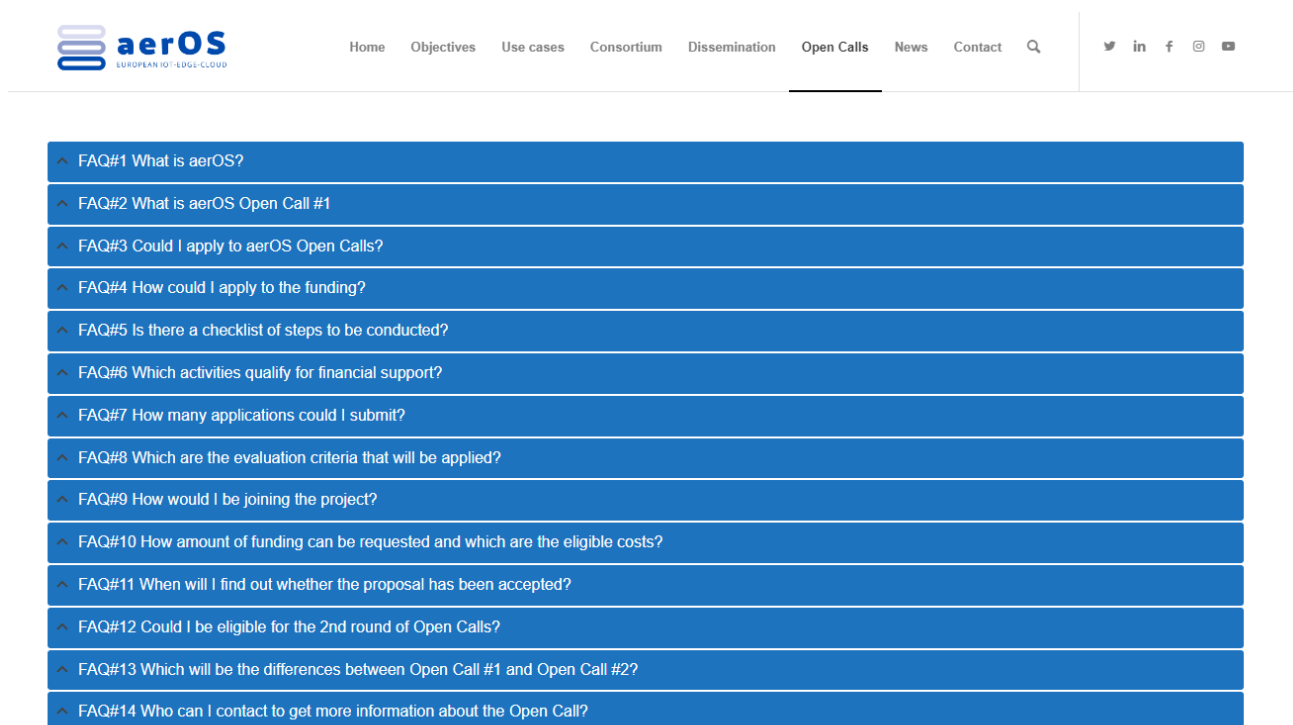


Figure 24. FAQ section

There, any interested stakeholder can find answered questions from responses to several queries that might have come to the surface when the potential applicants worked on preparing their proposals. The Open Call communication plan was not limited to the website update only.

To achieve the maximum visibility for the Open Call additional means and channels were found. For this purpose, aerOS project followed a new approach on social media channels. Since the Open Call announcement (October 2023) up to its closing (January 2023) the social media channels of the project were populated with posts related to the Open call details. They were aimed at triggering interest across the broadest relevant audience. Trying to create a community around the Open Call social media posts have been enriched with related hashtags such as #aerOSOpenCall #opencall and mention of related organizations and other projects with open call procedures like Hipeac and EUCloudEdgeIoT. To have an enhanced image of the Open Call, INFOLYSiS team has prepared several images in order to visualize in the best possible way the Open Call branding and communication. Besides the images, a short video (reel) was created for promoting the Open Call. It was a video that included all the relevant details, and it was available for social media use.



Figure 25. aerOS Open Call image

Besides, the social media actions, several presentations in different events took place trying to inform and attract potential candidates. In total the aerOS 1st Open Call, was presented in several different events. The most impactful of these events was the “Giving Energy an Edge: Showcasing the Edge to Cloud Continuum in Energy” event by EUCloudEdgeIoT. It was an event that took place in November 2023 with almost 100 attendees. At that event there were also presentations from the use case leaders. Apart from the invited presentations, aerOS project organized its own webinar on 12th of January 2024. It was a very successful webinar with almost 30 attendees. You may find the video from the webinar at aerOS YouTube channel (https://www.youtube.com/watch?v=smbP-JdQ_zU&t=3s).

The aerOS open call has also utilized several mailing lists, for reaching the broadest possible audience and spread the opportunity. Mailing lists of the EUCloudEdgeIoT, Hipeac, SNS, SME WG, 5GPPP, were used in the effort of disseminating the opportunity.

2.1.3. Communication of the first Period (M1-M16) and KPIs

The following table summarises the set of KPIs, and the targets set per time period as per DoA. It is of utmost importance to highlight at this point that the KPIs depicted are cumulative up to M36. The last column of this table gives to any interested stakeholder the status of the communication activities at M16. The end of period M1-M16 is located between M12 and M24 which mark the first two years of the project’s duration. An overall comment is that the communication activities are on track and as you can see in some occasions we have already reached the set targets/KPIs much before the project end.

Table 12: T6.1 KPIs timeline

KPI#	KPI	M12	M24	M36	Current Status at M16
KPI 3.1.1	# of Website unique visitors / page views	750/2000	1500 / 5000	4000/10000	4,049/15,840
KPI 3.1.2	# of aerOS posts in social networks/ #of newsletters issued	300/4	650/8	1000/12	655/5
KPI 3.1.3	# of aerOS social-media community members across all-sites	300	700	1000	1237

KPI 3.1.4	# of videos delivered about aerOS technical and global advances / webinars-workshops organised	5/1	12/3	20/6	8/14
KPI 3.1.5	# of interviews/articles/press releases with external relevant dissemination targets	5	10	30	10
KPI 3.1.6	# of liaison with other projects of the cluster including CSA events	5 actions	20 actions	35 actions	35

Table 13 provides a detailed summary of the collective communication impact generated across aerOS communication channels during the initial 16 months of the project, aligning with the established aerOS communication plan and strategy. This table provides information up to M16, which is the month that we have accumulated data from the statistical dashboards presented in previous sections.

Table 13. Summary of communication activities

Media	Channel - Section	URL	Activity (M16)
Website	News	https://aeros-project.eu/blog/	Website Posts >73
	Publications	https://aeros-project.eu/disseminations/publications/	22 publications of all types
	Workshops/ Presentations / trials	https://aeros-project.eu/disseminations/workshops-presentations-trials/	35 presentations 14 workshops
	Press Releases	https://aeros-project.eu/disseminations/press-releases/	10 press releases
	Events	https://aeros-project.eu/disseminations/events/	36 events attended
Social Media	Facebook	https://www.facebook.com/aerosproject	157 posts and 85 followers
	LinkedIn	https://www.linkedin.com/in/aeros-project/	160 posts and 515 followers
	X	https://twitter.com/AerosProject	189 tweets and 176 followers
	Instagram	https://www.instagram.com/aerosproject/	149 posts and 87 followers
	YouTube	https://www.youtube.com/@aeros-project	6 videos and 50 subscribers
Leaflets		https://aeros-project.eu/disseminations/	1 leaflet
Posters		https://aeros-project.eu/disseminations/	1 poster
Newsletters		https://aeros-project.eu/disseminations/newsletter/	5 issues + 1 under editing
Stickers			500 stickers
T-shirts			40 t-shirts

2.2. Plan for communication in the second period of the project (M17-M36)

The following chapters summarize the communication plan and the related KPIs for the upcoming period up to M36.

2.2.1. Communication framework and planning for the period M17-M36

This section outlines the communication action plan, along with the fundamental principles such as timelines, phases, activities, and utilized resources for ensuring successful and impactful communication across various channels and targeted audiences within the aerOS project. The plan encompasses a comprehensive and meticulously structured set of actions aimed at promoting and effectively communicating the developed concepts, technologies, pilots/trials, and overall project outcomes. It encompasses both offline and online communication strategies, digital presence enhancement, event organization and participation, engagement with EUCloudEdgeIoT and NGIoT associations, collaboration with pertinent national/local initiatives, and involvement in other European research and innovation ventures.

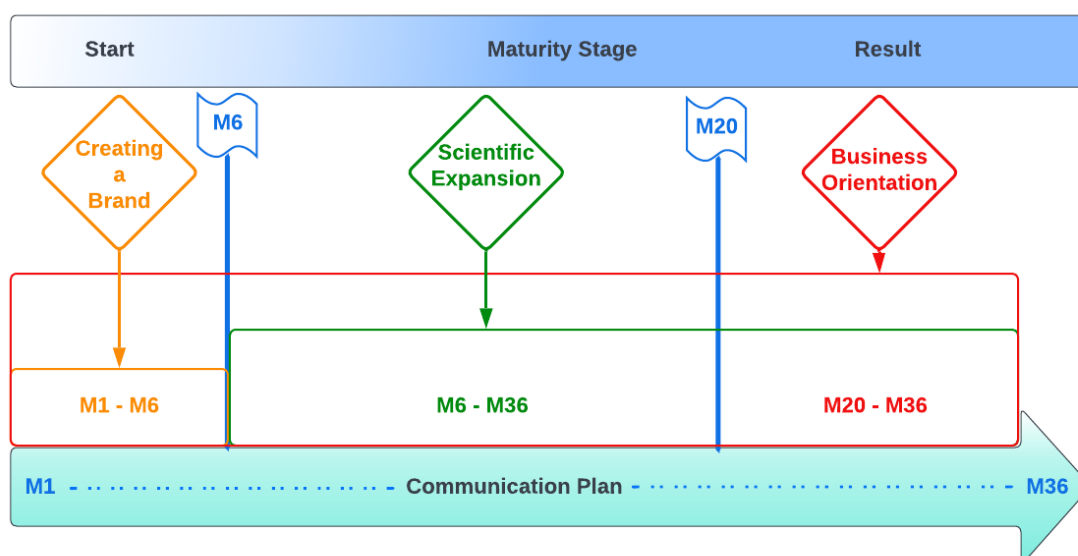


Figure 26. General aerOS communication plan

Stage 1 (already completed) - Creating a Brand (M1-M6): As it can be clearly seen from Figure 26 the main focus of the activities during the first months of the project (current period of the project) is to lay the foundation of the communication plan and establish the project's digital presence (raise awareness) by creating communication channels and performing initial impact activities. The first and most significant step in project image/branding is the establishment and maintenance of a website and social media channels, as well as the utilization of the project's logo and the definition of communication guidelines. Other activities, such as the poster, leaflet, newsletter and press release templates, have been created during this first period.

Stage 1 measures: Logo, visual and corporate identity messages and tones for each audience, production of digital communication materials, setup of aerOS social media channels, selection of tips and timeline for posting, aerOS webpage and presence in blogs, promotional material, templates (deliverables, presentations, newsletter, press release) – All completed by M3.

Stage 2 - Scientific Expansion (M6-M36): The main focus of the communication activities in the second period (M6-M36) shifts to actions that connect the nature of the project with the community. The primary goal is to reach the broadest possible audience and identify new essential stakeholders. In other words, the actions focus on establishing a connecting point with the community and the industry by addressing a larger audience and describing how the project may be exploited by specific communities, industry stakeholders, and society in general. As a result, the communication material/content will be more focused on the project's preliminary technical details and results on specifications, architecture, components, use cases etc.

Stage 2 measures: Supporting the organisation of and participation in conferences, networking, communication campaigns aligned with the objectives and execution pace of aerOS work packages and tasks.

Stage 3 - Business Orientation (M20 – M36): The third period of this plan focuses on communicating (in parallel to dissemination) project findings. Results from use cases and demonstrations will be revealed. As a result, the communication team's main objective will be to outline and promote them through dedicated channels using means for reaching the appropriate target audience and achieving maximum impact. For that reason, the main content that will be communicated, will be focused on the use cases final advances, tests and outcomes of the project.

Stage 3 measures: Enhances interaction with external members such as potential stakeholders and the Advisory Board, common strategy with European initiatives to promote among end users, intensify the presence in industrial events, alignment with dissemination/exploitation/innovation actions, intense communication of final dissemination events, showcasing and trials.

aerOS project establishes a strong communication policy based on its social media channels. Social media channels are a powerful tool to help us to achieve maximum visibility and reach maximum impact.

As previously stated, the primary objective of the aerOS communication plan is to enhance project visibility and raise awareness among a diverse audience, encompassing both technical and non-technical individuals. This will be achieved by delivering tailored materials to specific target audiences at appropriate times through suitable channels. Moreover, the content is and will be customized according to the needs and expertise of each audience group and aligned with the project's communication stages. Additionally, the frequency and depth of communication varies, correlating with the distinct phases of the project, including activities, milestones, and outcomes, as well as the utilization of different communication channels.

As it can be clearly understood from the previous section (2.1), the main two objectives for the upcoming period is on the one hand to reach the broadest possible audience and identify new essential stakeholders, and on the other hand the communication of projects findings and use case results. The upcoming reporting period has this double nature as it includes two different levels of the communication plan. The upcoming period also includes the scientific expansion of the project but also the business orientation of the period.

Based on this point in the following chapters we summarize the course of actions/strategy of the upcoming period.

2.2.1.1. Website

The aerOS project communicates its concepts, outcomes, and achievements through its dedicated project website (<https://aeros-project.eu/>), as it does since M1. All project partners contribute to the website's content to ensure a cohesive representation of the project. Regular updates were made to offer comprehensive insights into the project's significant activities and results.

Specifically, the News-Blog (<https://aeros-project.eu/blog/>) and Dissemination (<https://aeros-project.eu/dissemination/>) webpages are continuously and will continue to be updated frequently. These pages will feature community news, dissemination endeavors, as well as compiled project results and accomplishments. Specifically, during this period we expect more research publications (journal and conference) and more technical news posts, with activities and actions performed by partners (Figure 27).

“Emerging IoT Applications and Architectures for Smart Maritime Container Terminals” paper presentation

November 23, 2023 / in News, Papers / by Spyros Georgoulas

Michalis Michaelides (CUT) presented our paper “Emerging IoT Applications and Architectures for Smart Maritime Container Terminals” at the [WFloT2023](#) conference in the Special Session: Future Platforms for Cloud-Edge Continuum – Theoretical Foundations and Practical Considerations.



Figure 27. Indicative "More" technical post

2.2.1.2. Social media channels

Via social media platforms, aerOS actively promotes its goals, announces events, highlights its activities, and shares pertinent research findings. The content posted on these platforms significantly contributes to realizing the communication plan's objectives.

The social media strategy is summarised in the following key points (as initially planned and updated during the M1-M16 period):

- aerOS social media channel are run and maintained by the INF communication team daily,
- Posts made on a regular basis (maintaining at least 2 posts on a weekly average),
- Higher frequency of posts during events, meetings, conferences, etc.,
- M19–M36: More technical posts focused on aerOS developments, results, tests,
- More intense communication of dissemination activities,
- Event based posts (pre-event and after-event),
- M19–M36: Different strategy and posts per channel,
 - LinkedIn/Twitter: More Technical and project focused posts,
 - Facebook/Instagram: Non-Technical audience – posts of general interest
- M19–M36: Close collaboration with organizations such as EUCloudEdgeIoT and task forces, HiPEAC, SNS, SME Working Group, other related projects.
- Since M6: Special series of posts with dedicated hashtag **#LearnAboutaerOS** focused exclusively on project information and achievements. – Intensifying its use
- More Technical Hashtags involved in the posts (e.g. #edgecloud, #technovation #continuum),
- More videos on the project's YouTube channel (especially ones related to pilots – a specific plan is in place to produce 3 videos per pilot – highlighting the aerOS key achievements).

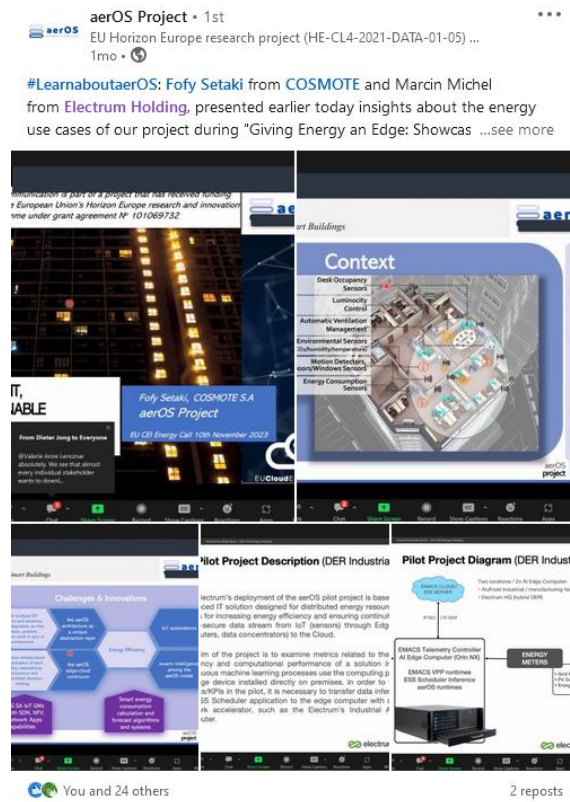


Figure 28. aerOS technical post

2.2.1.3. Collaboration with other projects and associations

Collaboration with other projects and associations is one of the best ways to enrich project outcomes and gain more visibility. Common events and activities also boost the engagement rates of the project. Liaisons with organisations such as EUCloudEdgeIoT and Hipeac are a powerful mean to highlight the project’s work. This is considering the fact that, as the project evolves, more technical achievements will come to surface. So, such collaborations will help us to accumulate more interest and attract more stakeholders.

An additional mean of creating more impact, is the collaboration with other projects which will be further enhanced during the next period. We refer specifically to projects of the same call, but also other European projects in general. This collaboration can be either a single post, our re-share in the social media, or in the level of events. Co-organised events or invited to other projects events is by far one of the most useful means for reaching different audiences and new stakeholders. An indicative example is MECC (Figure 29) which will take place in April 2024 in Athens. It is an event co-organised between several MetaOS projects such as FLUIDOS, ICOS, NebulOuS, NEPHELE, NEMO and of course aerOS.



Figure 29. MEEC workshop

2.2.2. Communication KPIs for M17-M36

The following table summarizes the KPIs for the remaining period. It also provides information about the initial KPIs of each period.

Table 14. T6.1 KPIs for M19-M36 period

KPI#	KPI	M24	M36
KPI 3.1.1	# of Website unique visitors / page views	1500 / 5000	4000/10000
KPI 3.1.2	# of aerOS posts in social networks/ #of newsletters issued	650/8	1000/12
KPI 3.1.3	# of aerOS social-media community members across all-sites	700	1000
KPI 3.1.4	# of videos delivered about aerOS technical and global advances / webinars-workshops organised	12/3	20/6
KPI 3.1.5	# of interviews/articles/press releases with external relevant dissemination targets	10	30
KPI 3.1.6	# of liaison with other projects of the cluster including CSA events	20 actions	35 actions

3. Dissemination activities, project showcasing and industrial demonstrations

In the first 18 months of project implementation, this task followed the activities as outlined in “D6.1 Impact Activities Planning”. We have followed the dissemination plan, worked towards achieving – and when possible, even overachieving – the stated KPIs for this task. The purpose of this section is to provide details about task 6.2 in the first half of the project and at the same time provide an outlook for the second half of the project.

Dissemination activities focus on sharing project results, once they are available, with relevant audiences. Therefore, there are always more dissemination activities in the second half of the project than in the first one, because the project results are available towards the end. The dissemination task has a strong link to the communication task (6.1) which supports dissemination through its communication channels. Some activities of the consortium can be classified both as dissemination and communication. This is also a point of strong cooperation between tasks 6.1 and 6.2 to identify such activities and agree on their proper classification.

Dissemination in aerOS is carried out through publications, events and educational activities to transfer knowledge/results and to enable their uptake. The workflow focuses on informing researchers, industry, potential customers and other stakeholders (e.g. device or software end-users or e.g. associations, policy makers, etc.) about the technical achievements of aerOS and about the benefits from their implementation in different applications.

As we have five different pilots in the aerOS project, we put a strong focus in this task on industrial demonstrations. We link all project showcasing activities with one or more industrial demonstrations (one or more use cases to be presented). As a research and innovation action, aerOS puts a large effort into scientific publications – all research partners are encouraged to write project-related scientific publications, preferably with Open Access, or alternative, according to their possibilities.

For this reason, we have broken down the dissemination task into the following core activities:

- LEADING-EDGE (RESEARCH) MATERIAL suitable for publication in high-impact scientific journals, and web-based media or white papers.

- DEMONSTRATION EVENTS to demonstrate results e.g., promoting aerOS concept and methodology, use cases, acquired knowhow, incl. also talks/panels at relevant international conferences, workshops, technical events, industrial forums, and cooperation with EU stakeholders.
- EDUCATIONAL ACTIVITIES such as university courses, lectures, activities for PhDs.

For recording the dissemination activities, the consortium is using the central tool of the dissemination task, the so called “Dissemination Register”. In this register we keep track of project-related publications and dissemination activities (events) and check them with partners during monthly WP6 telcos. The dissemination register is designed to match the requirements of the EU portal – partners are requested to fill in all information about their dissemination activities and publications that the EU portal is requesting. At this point, all publications and dissemination activities completed in M18 are duly recorded in the register, and as soon as each event takes place, or a publication is accepted or published, TTTech transfers all data on behalf of the partners to the corresponding SEDIA (Single Electronic Data Interchange Area) tables online. The submitted papers are also circulated within a consortium. We agreed about a silent approval of the partners (no reply means “organization agrees to the publication by a partner”, as in accordance with CA there is an approval within the Consortium, just in case of any objection or extension. All authors are requested to add the note regarding the aerOS funding in their publications as this:

“This research work is (partially) supported by the European Union’s Horizon Europe program for Research and Innovation through the aerOS project under Grant No. 101069732.”

The publications are also publicly available on the project website at <https://aeros-project.eu/dissemination/publications/>

Figure 30 below shows dissemination activities as recorded in EU Portal:

Dissemination Activity Name	What? Type of dissemination activity	Who? Target audience Reached	Why? Description of the objective(s) with reference to a specific project output (max. 200 characters)	Status of the dissemination activity	Actions
3rd International Workshop on Advances on Privacy	Conferences	Research communities	an aerOS co-organised workshop primarily for Cybersecurity pi	Delivered	✗
MADE Competence Center Industry 4.0	Other	Investors	To show MADE Competence Center's facilities and uses cases f	Delivered	✗
7th Workshop on Internet of Things - Enablers, Cha	Other scientific collaboration	Research communities	The WS is current implementation efforts, research results, as	Delivered	✗
Publication of the project on the website	Other	Industry, business partners	To show MADE Competence Center's involvement in the projec	Delivered	✗
The Autonomous	Conferences	EJ Institutions, Industry, business partners, innovators	At the annual 'The Autonomous' conference, the TTTech tear	Delivered	✗
4th International Conference on Electrical and Ele	Conferences	Research communities	Keynote presentation presenting the aerOS general approach	Delivered	✗
Webinar organised by EUCEC TF4	Clustering activities	Research communities	To very briefly present the Open Calls of aerOS (1st round)	Delivered	✗
INCOGNITO & SECONDO Summer School	Education and training events	Specific end user communities	Dissemination of the project's scope and objective in students	Delivered	✗
INDEXUS: Where Navarra meets Europe	Conferences	Research communities, Industry, business partners	The main objective is to present aerOS' core goal and archite	Delivered	✗
IETF 117	Other	Industry, business partners	Presentation during NHRG session. Sharing aerOS data fabric i	Delivered	✗
International Workshop on Embedded Digital Intell	Other scientific collaboration	Research communities	The technical scope of MxEDI included the following topics: i	Delivered	✗
IVT Expo 2023 Köln	Other	Industry, business partners	IVT Expo is an annual international exhibition that showcases t	Delivered	✗
Informative Session on Horizon Europe Work Program	Collaboration with EU-funded projects	Other	We will expose the project's architecture and goal to foster ir	Delivered	✗
Webinar of AIOI about Open Calls	Clustering activities	Research communities	To present the Open Calls of aerOS (1st round).	Delivered	✗
Dependable Systems university course - 01/2023	Education and training events	Specific end user communities	This course is run by Dr. Wilfried Steiner at the Vienna Univer	Delivered	✗
Program mobile robots with Low-Code tools	Education and training events	Specific end user communities	Challenge if Low-Code tools are up for the task to do automat	Delivered	✗

Figure 30. Screenshot from EU Portal showing the recorded dissemination activities (selection – full list cannot be displayed)

Additionally, Figure 31 shows publications as recorded in the EU Portal:

Type	Title	Authors	Title of the Journal or equivalent	Number	Peer-reviewed	Was the publication available in open access through the repository at the time of publication	PID (publisher version of record)	PID of deposited publication	Actions	
2	Article in Journal	AI/ML Service Enablers & Model A	K. Sandanis, A. Nait Abbou, J. Sor	IEEE Network Magazine	True	True	10.1109/MNET.129.2200417		✗	
3	Article in Journal	Berth Allocation Considering Mult	Sheraz Adnan, Michael P. Michael	Journal of Marine Science and En	2023, 11(7), 1280	True	10.3390/jmse11071280		✗	
4	Article in Journal	Cloud-Native Workload Orchestral	Rafael Yellio, Ignacio Lacalle, Piotr	NDPI Sensors	2023, 23(4), 2215	True	10.3390/s23042215		✗	
5	Article in Journal	Heterogeneous Edge Caching Bas	C. Wang, R. Li, J. Wang, T. Tabei,	IEEE Transactions on Network Sci	True	True	10.1109/TKDE.2023.3268802		✗	
6	Article in Journal	IDADET: Iterative Double-sided Au	Y. Yu, W. He, J. Liu, Y. Shen, T. Tu	IEEE IoT Journal	True	True	10.1109/JOT.2023.3236968		✗	
7	Article in Journal	Novel Combinatorial Multi-Armed I	Z. Shu, H. Feng, T. Taleb, and Z. J	Ebenier Computer Networks	True	True	10.1016/j.comnet.2023.109783		✗	
8	Article in Journal	Probabilistic-Assured Resource Pr	Q. Guo, R. Gu, H. Yu, T. Taleb, an	IEEE TNSM	True	True	10.1109/TNSM.2022.3219865		✗	
9	Article in Journal	Self- capabilities of heterogeneo	Raul S-Julian, Ignacio Lacalle, Rafi	NDPI Sensors	2023, 23(6), 2931	True	True	10.3390/s23062931		✗
10	Publication in conference proced	Adversarial Machine Learning Attr	Pantelakis, V., Bountasak, R., Farai	18th International Conference on	True	False	10.1145/3600160.3605086		✗	
11	Publication in conference proced	Network Slice Mobility for 6G Net	H. Yu, Z. Wang, C. Wang, and T. Ta	IEEE Int'l Conference on Commu	True	True			✗	

Figure 31. Screenshot from EU Portal showing the recorded publications (selection – full list cannot be displayed)

Additionally, the dissemination register contains a list of candidate conferences and journals for publications and a list of candidate industrial events, so that partners have a pool of possibilities to choose to disseminate the results of the project. Of course, the register also contains the list of KPIs which is constantly being updated. TTTech is mainly responsible for preparing and cleaning up this data collector, and the consortium partners are actively supporting this process and are sharing the info about publications and event either offline or in the WP6 teleconferences.

All in all, this practical tool and cooperation with the communication task makes it for the dissemination task easy to keep track of all relevant dissemination activities of the project partners. In the upcoming section we will report about the concrete achievements of the project so far in terms of dissemination.

3.1. Dissemination in the first period of the project (M01-M16) and status of KPIs

In the first period of the project, we have seen a promising publication activity among the partners. As of December 2023, 14 scientific publications have been published (11 by M12) and several planned publications have been announced. Most of the publications have been articles in journals (9), while slightly less have been publications in conference proceedings (5). We expect that the number of publications in conference proceedings will rise as the project progresses and more results can be shown and shared. We already have many publications in diverse IEEE journals (which are highly ranked scientific editors) including a variety of research and innovation topics.

In terms of dissemination activities, there have been many diverse activities carried out by partners during the first 18 months (please, note that this deliverable only reports up to M16 – for deliverable writing reasons; a full picture of M1-M18 will be provided in the mid-term project review).

There have been 8 collaborations with other EU-funded projects and initiatives (such as for example EU Cloud-Edge-IoT and many others) and clustering activities, aerOS has initiated and organized 8 workshops at conferences (including IEEE conferences and others), industry partners presented the project at 5 fairs/industry events (such as Agritechnika, The Autonomous, etc.) and through education and training activities (3). The information about project use cases and solutions have been brought to university students and PhDs.

For instance, Siemens organised a 4-day workshop “Program mobile robots with Low-Code tools” for students in March 2023 (see below in [Figure 33](#)). In addition to that, TTTech’s Corporate Scientist Dr. Wilfried Steiner is also lecturer of Dependable Systems Course at TU Vienna. He uses aerOS to present an example of building dependable computer systems and distributing resources between edge and cloud. This educational activity took place in the summer semester of 2023 and continues also in the winter semester 2023/2024. Scientific partners have initiated new cooperations through their presence in scientific conferences and publications. We find all these activities extremely important to promote the project, its results, but also to increase awareness of students about their potential research in similar areas.

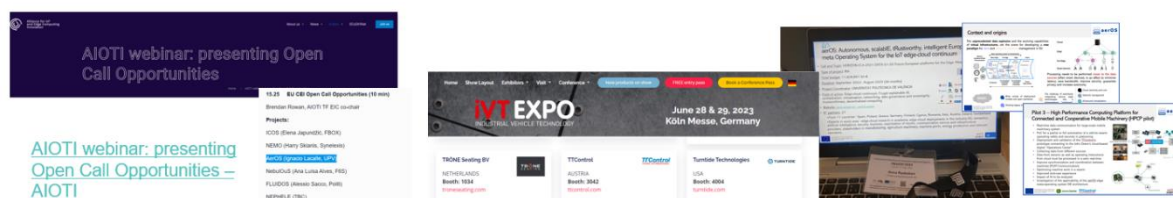


Figure 32. Examples of workshops and presentations of aerOS and their public announcements

Overview
Participate
Terms

4 Program mobile robots

10 Feb 2023 until 01 Apr 2023

#4 Program mobile robots with Low-Code tools


Short description:

You look it to be into the world of mobile robotics. Normally this requires months of training before something moves.

With our OSS based Low-Code approach and Plug & Play electronic, you can start in minutes. Let's tap into the world of software engineering and help us to learn our robot some new tricks!

Programming experience is still recommended.


Pictures




Impact areas:

- Industrial Automation
- Boost Idea2Creation Process
- Behavior Trees, Open Source, ROS2
- Software Engineering
- Sense & Act

Contact: Florian Graml (Siemens)



Function: Innovation Manager
Topics: Applied innovation with ready-made industrial products through OSS
Background: M.Sc. in Applied Research on software engineering in automation



aerOS

EUROPEAN IOT-EDGE-CLOUD

Any student, no matter what discipline, is welcome to participate in our challenge. We have developed a "Low Code tool" that makes robot programming much easier. Each robot "task" will be presented as a building block. The user will assign the task of the mobile robot in a graphical user interface. We will introduce this tool in more detail at the beginning of the challenge.

For our more programming skilled team members, we will offer the opportunity to do more challenging C++ programming with the help of our Siemens mentees. The challenge of the programmers will then be to extend the robot with further capabilities to solve your use case. We try to provide you with enough initial functionalities in our low-code tool, so that a broad use-case scenario can already be addressed.

This project has received funding from the European Union's Horizon
Europe research and innovation programme under grant agreement No.
101069732




Figure 33. Screenshot from Siemens website – announcement of the educational activity “Program mobile robots with Low-Code tools” in March 2023

Dissemination events delivered...



... just a few examples

This Communication is part of a project that has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement N°101069732

aerOS project 7

Figure 34. Examples of dissemination events delivered by project partners

Since our KPIs have been defined in 12-monthly periods, we present here the official numbers as achieved per M12 (end of August 2023) compared to the plan. Additionally, we also provide the status quo as per M16 (December 2023):

Table 15. T6.2 KPIs timeline

KPI#	KPI	PLAN for M12	ACHIEVED by M12	ACHIEVED by M16
KPI 3.2.1	# of scientific papers published in conferences / Q1-Q2 journals	3/1	2/9	5/9
KPI 3.2.2	# of activities towards Education institutions (courses, lectures, PhDs)	3	3	3
KPI 3.2.3	# of presentations and other activities in events/conferences/fairs by aerOS partners	4	9	35
KPI 3.2.4	# of workshops organized / average participants in each workshop	0	5/25	8/20
KPI 3.2.5	# of PhD and MSc theses started about aerOS	n/a	n/a	8

NB: please note our calculation method for KPIs:

- # of presentations and other activities in events/conferences/fairs by aerOS partners: educational activities and workshops organized by aerOS are excluded from the count,
- # of workshops organized: only events labeled as such are counted,

- # of activities towards Education institutions (courses, lectures, PhDs): only events labeled as such are counted,
- # of PhD and MSc theses started about aerOS: the target value is 6 theses by the end of the project.
- No entry is counted in more than one KPI category.

3.2. Plan for dissemination in the second period of the project (M17-M36)

For the upcoming period, the project partners have plans to publish in high-profile scientific journals and disseminate the project in dissemination events. As the project progresses, more achievements can be shown, and results can be shared more actively. The partners have altogether well-established internal dissemination plans and contacts to publishers and organisers of relevant events. Therefore, they will continue to use every opportunity to submit project-related papers to journals and conferences and give aerOS proper visibility. The same applies to dissemination events – the annual events (conferences, trade shows) will be attended by the respective project partners as they did in the first half of the project. And of course, the consortium will put every effort on attending also non-annual relevant dissemination events. For this purpose, we have established and keep updating a pool of candidate conference/journals and industrial events in the shared dissemination register. The delivered activities and accepted publications will be kept up to date by TTTech in the EU portal as in the first half of the project.

As concerns the KPIs, we will have two internal cut-off dates in the upcoming period – M24 and M36 as follows:

Table 16. T6.2 KPIs for the second period of the project

KPI#	KPI	PLAN for M24	PLAN for M36
KPI 3.2.1	# of scientific papers published in conferences / Q1-Q2 journals	10/3	20/8
KPI 3.2.2	# of activities towards Education institutions (courses, lectures, PhDs)	9	15
KPI 3.2.3	# of presentations and other activities in events/conferences/fairs by aerOS partners	20	35
KPI 3.2.4	# of workshops organized / average participants in each workshop	1/30	3/60
KPI 3.2.5	# of PhD and MSc theses started about aerOS	5	6

As a consortium of fully dedicated and experienced partners, we are convinced that we will be able to achieve (and possibly even over-achieve) these KPIs until end of the project.

4. Standardization and policies alignment

4.1. Standardization in the first period of the project (M01-M16) and status of KPIs

As described by the plan laid out in D6.1, the standardization and policy alignment task (T6.3) in the first period of the aerOS project (M01-M16) focussed on exploiting the strong connections that some of the consortium partners maintain with Standardization Developing Organizations (SDOs), and pre-normative groups. These connections are internally referred to as “entry points”. To achieve the most efficient exploitation of entry points, a census was performed among consortium partners, where details of those interactions were described. At the time, the census reported that the consortium attended a total of 19 SDOs and pre-normative

organizations, a significant number that has served as a very good starting point to guarantee the impact of the aerOS project in standardization spaces.

4.1.1. Status of KPIs

Task 5.3, namely the KPI definition and setup of evaluation framework for the aerOS project, describes five KPIs related to the impact creation via standardization, those are:

- KPI-3.3.1: Contributions to standardization bodies
- KPI-3.3.2: Exploitation of entry points into standardization bodies
- KPI-3.3.3: Contributions to European pre-normatives
- KPI-3.3.4: Contributions to data-related clusters and initiatives
- KPI-3.3.5: Contributions to relevant data spaces

KPI-3.3.1 refers to measurable and palpable impact to the activities of SDOs, for example proposing amendments, contributing to drafts, providing use cases or specific application scenarios, or even being referenced by SDOs as a showcase for their standards. In contrast to that, KPI-3.3.2 covers all efforts to use the collected information about entry points to SDOs to look for potential impact opportunities. The rest of the KPIs count contributions to specific types of organizations that relate to the technological space of aerOS.

¡Error! No se encuentra el origen de la referencia. Table 17 shows the planned evolution of those KPIs on the 12th month (August 2023), the 24th (August 2024) and finally the 36th month (August 2025). After that, Table 18 displays the status of those KPIs on the 16th month (December 2023) in comparison with the next milestone, the 24th month.

Table 17. Planned evolution of KPIs related to impact through standardization activities

KPI#	KPI	M12	M24	M36
KPI 3.3.1	Contributions to SDOs	0	6	12
KPI 3.3.2	Entry points exploited	5	15	25
KPI 3.3.3	Contributions to European pre-normatives	0	1	3
KPI 3.3.4	Contributions to data-related clusters and initiatives	0	5	10
KPI 3.3.5	Contributions to relevant data spaces	0	5	10

Table 18. Current status of KPIs related to impact through standardization activities

KPI#	KPI	Status M16	Next goal (M24)
KPI 3.3.1	Contributions to SDOs	17	6
KPI 3.3.2	Entry points exploited	15	15
KPI 3.3.3	Contributions to European pre-normatives	2	1

KPI 3.3.4	Contributions to data-related clusters and initiatives	1	3
KPI 3.3.5	Contributions to relevant data spaces	2	3

As seen in Table 18 the status of KPIs shows an excellent development of the task. Highlighting that, for instance, the expected number of contributions to SDOs for the whole duration of the project was already surpassed. Likewise, the partners are performing very well in the exploitation of entry-points, and the contributions to specific technology spaces.

Details about the specific activities that are summarized in the status column of Table 18 are provided in the following sections. Section 4.1.2 provides insights into the contributions that have been already catalogued, and represent ongoing efforts that showcase interesting results from the aerOS project in relevant standardization spaces. After that, section 4.1.3 details the steps that have been taken to exploit some of the collected entry-points, apart from the ones described in section 4.1.2.

4.1.2. Standardisation activities

4.1.2.1. AIOTI (Towards ISO/IEC JTC 1/SC 41)

During the first 6 months of the project, there has been an intense activity by aerOS partners involved in the Alliance for Internet of Things Initiative (AIOTI). The main partners of aerOS that overseen delivering this contribution have been SIEMENS and UPV.

The activity has concentrated on showcasing aerOS benefits and progress in several aspects, especially on technical architecture, technological developments, pilot structure and goals and on Open Calls. In most cases, the participation in periodic teleconferences/meetings organised by AIOTI has been leveraged as opportunities to pitch aerOS. In other cases, specific actions such as the issue of specialized reports or whitepapers led by AIOT working groups (WG) have also been tackled.

In particular, the following actions highlight as the main contributions by aerOS via AIOTI initiative. Please, note that these are not the only ones:

- AIOTI HLA – High Level Architecture – Periodic attendance to architecture discussions, ensuring the alignment of aerOS IoT perspective with the directives and recommendations of AIOTI HLA. The activity was mostly focused in the “IoT, edge computing and digital twins” group,
- Participation in the webinar “Webinar: IoT, Cloud, Edge Computing Continuum from Research to Deployment”, 30th November 2022,
- AIOTI Business Forum – aerOS partners participated in this initiative by AIOTI via exposing the demand vs. supply side of meta–Operating Systems,
- Voluntary participation in the preparatory actions of the “Replicability Initiative” for the creation and assessment of the “Feasibility, Replicability and Scalability Assessment Tool”. This ended in a contribution to the AIOTI White Paper Replicability and Scalability Assessment Tool,
- Participation in the Semantic Interoperability Expert Group in January 2023,
- Following and participating in the issuing of SRIA of AIOTI 2023,
- Active contribution in the Working Group of Privacy and Security,
- Continuous participation in the WG of Standardization of AIOTI, providing inputs on the current development trends and in the barriers found whenever deploying computing continuum solutions. Within the frame of this WG, and in collaboration with EUCloudEdgeIoT, the most relevant on-going action was born in the inner group (within Standardization WG) of High-Level Architecture of IoT.

While all the previous can be considered “contributions to SDOs” (if AIOTI is deemed as a SDO entity), none of them were qualified to be moved to a pre-normative initiative issuing. However, AIOTI liaised with EUCloudEdgeIoT initiative for moving forward a tentative to standardise the architecture of the Computing Continuum in Europe.

4.1.2.2. EUCloudEdgeIoT

Two Coordination and Support Actions (CSAs) were funded in 2021 to cluster the communication and collaboration of the RIA projects coming out of the DATA-01-02 (cognitive cloud), DATA-01-03 (swarm computing) and DATA-01-05 (meta operating systems). These CSAs were UnlockCEI and OpenContinuum, that started their activity in late 2022. Only a few months in their activity, it was decided for them to join forces (act collaboratively) and follow up on the good job done by their predecessors (i.e., EU-IoT and NGIoT), thus encompassing the advances of many other projects (calls ICT-56-2019, among others). The collaborative action between the two CSAs was born as EUCloudEdgeIoT, whose main objective is to bring together all European research around the computing continuum (and surrounding fields) towards aligning with EC objectives and long-term goals. These goals include standardization.

On the light of this combination, their action was structured in different task forces. Every task force is devoted to a specific area of collaboration interest and is led by one of the entities belonging to the two mentioned CSAs. Task forces (TFs) are: TF1 – Strategic Liaisons, TF2 – Open-Source Engagement, TF3- Architecture, TF4 – Ecosystem Engagement, TF5 – Market & Sectors and TF6 – Communications.

It is within the scope of TF3 where aerOS has focused its contribution during the first half of the project. The main current activity of TF3 is to move forward the creation of a standard to determine the design and deployment of the computing continuum. The goal is to establish the conceptual, technological, methodological and adoption guidelines for the computing continuum, growing upon the experience and success stories of the RIA projects funded by the EC in the abovementioned calls. The ideation of this standard is being tackled as a collective collaborative effort between representatives of the projects, that propose their ideas (drawing from the developments in their projects), that are then debated and agreed thereof.

Ultimately, when this activity will conclude (currently on-going), **it will be transferred into the ISO/IEC JTC 1/SC 41 for including it as an ISO standard**. This link is being reinforced by one of the partners participating in OpenContinuum (TRIALOG), and, when finalised, will have a major impact in the community.

In this regard, aerOS **has been invited (and will participate) into the next ISO/IEC JTC 1/SC 41 Plenary Meeting in Helsinki on May 2024**, to present the advances on this standard, and specifically the role of aerOS in it. This is considered an outstanding opportunity for the project to contribute to the most relevant standardization action in the field of computing continuum.

This pre-standardisation action is structured in different working groups, that are defining the concepts and technological blocks that form the computing continuum. A set of images of the current status of definition of those blocks are included below:

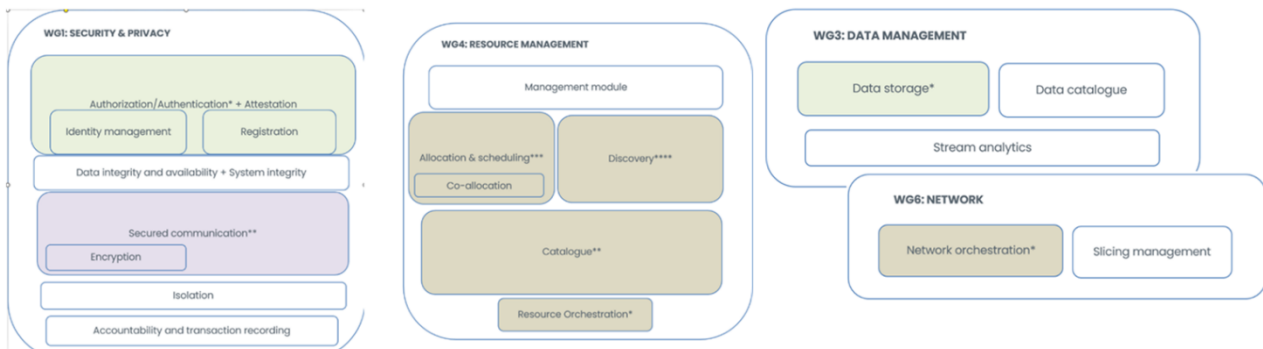


Figure 35. EUCloudEdgeIoT – TF3 – pre-standardisation initiatives – WG1, WG3, WG4 blocks

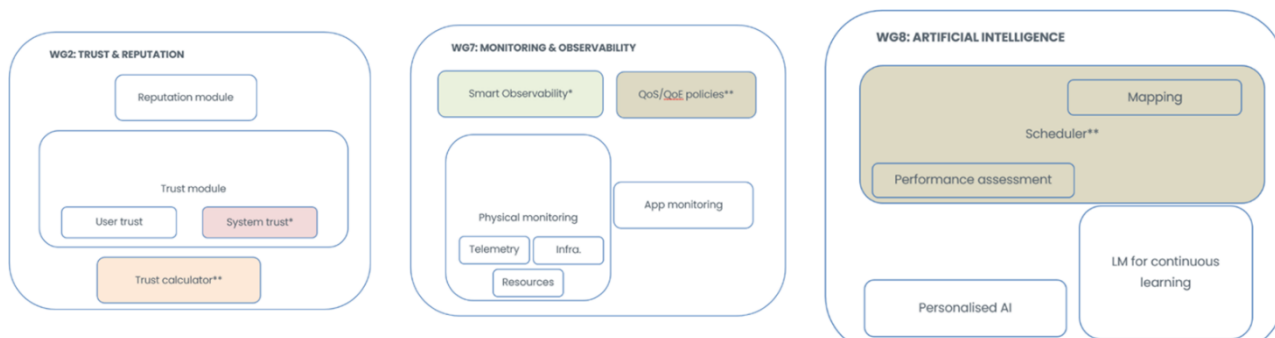


Figure 36. EUCloudEdgeIoT – TF3 – pre-standardisation initiatives – WG2, WG7, WG8 blocks

Remarkably, each of the WG is led by one of the RIA projects. aerOS is leading the Orchestration building block. This way, the project is contributing greatly to the future outlook of the Orchestration block in the to-be standard ISO/IEC JTC 1/SC 41.

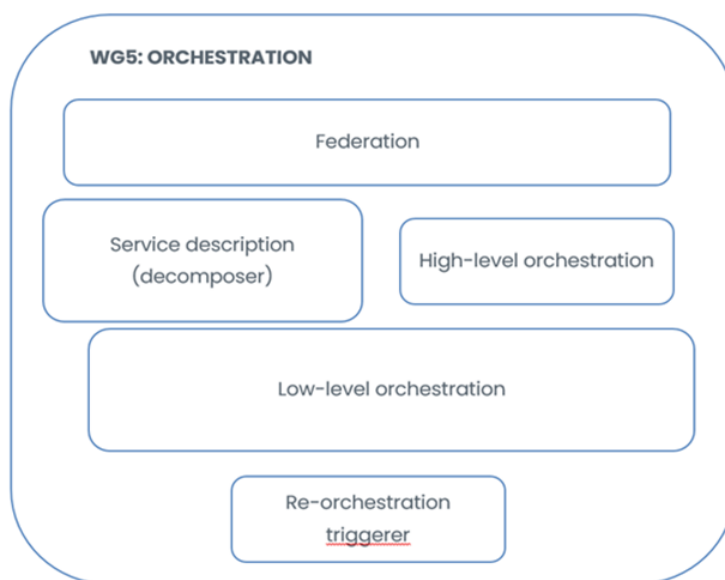


Figure 37. EUCloudEdgeIoT – TF3 – pre-standardisation initiatives – WG5 block

4.1.2.3. ETSI

The standardisation activities conducted by Telefónica Investigación y Desarrollo (TID) within ETSI have targeted the ETSI ISG CIM thus far by extending the NGSI-LD API (ETSI CIM 009) with several contributions in multiple releases.

The OpenAPI specification for NGSI-LD API 1.6.1 has been developed and uploaded to the official ETSI Forge repository [1]. This specification has become the baseline for the next releases of the NGSI-LD API, which will be developed in the Expertise Specialist Task Force (STF) 676 (ISG CIM), starting in January 2024.

In the release ETSI CIM 009 v1.7.1 [2], the data types defined by the NGSI-LD API have been thoroughly refined, identifying inconsistencies in the specification as well as in the documentation following best practices in REST API modelling.

Lastly, in the upcoming ETSI CIM 009 v1.8.1 [3], the NGSI-LD API has been extended to support filtering based on the *datasetId* parameter for read operations. Context Consumers now can directly retrieve only the values of NGSI-LD Properties and Relationships that match the specified *datasetId*. This enhancement unlocks new potential features like “graph views”, where different views or projections of an NGSI-LD Entity can be represented using *datasetId*.

As TID, the FIWARE Foundation is also an active contributor to ETSI ISG CIM, providing a substantial amount of code and improvements to the NGSI-LD API specification. Some ideas coming from aerOS were already implemented by FIWARE in version 1.7.1, those were:

- New type of NGSI-LD Attribute: VocabularyProperty,
- Change of simplified representation in multi-attribute case,
- More detailed aspects to be specified in Context Registrations,
- Defined special NGSI-LD roles for Context Source Registrations,
- Clarifications regarding user @context,
- Add Batch Query to “Federation Ops” group,
- Relaxing of tenant name requirements.

Likewise, some new improvements will appear in the version 1.8.1 that will be released in March 2024, such as:

- Distributed Entities Query, using entity maps,
- Entity graph retrieval (include in the response entities referred via relationships),
- Follow relationship entities in the query language,
- Relationship object as array of URIs, not just a single string,
- Local requests without any other specifier (?local=true),
- New type of NGSI-LD Attribute: JsonProperty (expand values),
- New URL parameters for GET /entities: pick/omit + idsOnly ("pick" deprecates "attrs"),
- New endpoints “/info” + “/info/sourceIdentity”,
- Usage of the Via HTTP header for loop detection in distributed operations.

4.1.2.4. IETF

During the first period of the project, TID made the following contributions in different areas and groups of the IETF.

In the IETF IVY group, the Asset Lifecycle Management and Operations: A Problem Statement [4] draft was submitted. This document tackles the lifecycle management of network assets by presenting use cases and defining an information model to support network operator’s work.

In the Ops Area, there has been contributions to improve the provenance and contextual understanding of YANG data. The Applying COSE Signatures for YANG Data Provenance [5] proposes COSE as new mechanism for verifying the integrity and provenance of YANG data. The Data Manifest for Contextualized Telemetry Data [6] draft defines new YANG models that capture metadata related to the network device from which the YANG telemetry data is received, along with the details on the configured subscription to stream of data.

Lastly, in the IETF NETMOD working group, the Mounting YANG-Defined Information from Remote Datastores [7] introduces mechanisms for federating access to YANG data, building upon principles like data virtualization and data integration, which aerOS is following in the implementation of the aerOS Data Fabric for the continuum.

4.1.2.5. IRTF

With regards to IRTF, the research around data management conducted by TID within the scope of aerOS has led to a few contributions to NMRG.

During the IETF 117 event, the presentation “Data Management Paradigms: Data Fabric and Data Mesh” [8] introduced to the network community some of the data management paradigms that aerOS is following, and their potential applicability in network management.

In the following IETF 118 event, the presentation “Knowledge Graphs for Network Management” [9] focused on raising awareness of knowledge graphs. This presentation showed how aerOS is building a knowledge graph

based on the ETSI CIM standard for the implementation of the aerOS Data Fabric that provides a uniform access to the data available in the continuum.

4.1.2.6. 5G-ACIA (Towards 3GPP)

SIEMENS is presenting aerOS’ requirements on deterministic communication technologies for the continuum in the Working Group 3 of 5G-ACIA. Some technical requirements have been identified and discussed, such as:

- Determinism across different technology domains. E.g., Ethernet, WLAN, 5G,
- Deterministic and cost-effective establishment of new streams, providing, for example:
 - Online re-scheduling,
 - Timely application of new configurations.
- Standardized and sufficient north-bound interfaces for domain controllers,
- Real-time behaviour of network resources in endpoints hosts.

The intention is to collect views from other partners of the association and generate a liaison statement to 3GPP, for consideration in their upcoming releases.

4.1.2.7. Others

Lastly, INNOVALIA leverages its leadership position in several data-related initiatives to showcase the impact of the aerOS proposals. For instance, they contribute to the CEN/CENELEC CWA Trusted Data Transactions, sit on the International Manufacturing-X Council (alongside SIEMENS), work on the 5G-PPP Technology Board and participate on the Data Space Support Centre (DSSC).

4.1.3. Exploitation of entry points to other SDOs

Apart from the cases already described in 4.1.2, additional efforts have been made during the first period of the project to look for potential contribution opportunities into standardization spaces. Some of them already show promising results. Those efforts are summarized in the table below:

Table 19. Summary of exploitation of entry points to SDOs during the first period of the project (Excluding those mentioned in Section 4.1.2)

Entry points	Activities	Potential Contributions	Driving partner	Supporting partners
Smart Data Models	<ul style="list-style-type: none"> • Presentation to aerOS WP4 partners about how to create and submit new Smart Data Models • Several technical discussions about required data models 	Several data models for the use case of the computer continuum can be standardized.	FIWARE / TID	All participants of WP4
ISO/IEC JTC 1/SC 41	Arrangement of presentation about aerOS enablers in the ISO/IEC JTC 1/SC 41 Plenary meeting in Helsinki (27.05.2024)	Presenting aerOS as a source of concepts to write ISO standards on the computer continuum	SIEMENS	UPV

Linux Foundation	Presentation of the aerOS project to Siemens' representatives in the Linux Foundation	Positioning of the continuum as a use case for developing features for Meta-Operating Systems	SIEMENS	
IEEE Switchgear Committee	Presentation of the aerOS project to the Chairman of the IEEE Switchgear Committee	Presenting aerOS' vision on energy efficient, health safe and sustainable smart buildings as a use case for the virtualization of control functions for high-power applications	SIEMENS	
W3C	Presentation of the aerOS project to Siemens' representatives in the W3C.	Positioning aerOS' data-related needs in the context of the continuum as requirements for standardization efforts in the area of semantic interoperability	SIEMENS	SRIPAS

4.2. Plan for standardisation in the second period of the project (M17-M36)

During the first period of the project, T6.3 has focused on monitoring and promoting direct contributions to SDOs or pre-normatives that have close liaisons with SDOs. And thanks to the very active work of the project partners, those expectations have been greatly surpassed. This means, that for the second period of the project, the focus must be shifted towards contributing to special spaces primarily related to data. This will impact directly the KPIs 3.3.4 and 3.3.5, allowing for the fulfilment of all expectations on the task in a comfortable manner.

To achieve that, the aerOS project leverages two important advantages: The former is the convenient position of some of its partners in data-related spaces. For instance, FIWARE represents a big common effort, led by prominent companies and independent contributors, towards achieving open standards in various verticals; INNOVALIA participates also in several relevant data-spaces, as GAIA-X; and other partners report interesting entry-points as well.

The latter advantage is the status of the pilots. Conveniently, the pilots have reached a very interesting stage of development where the impact of aerOS is clearly manifested. This means that real-world data coming from the different verticals represented by the pilots will be generated, and their data models will be put to the test in the implementations. This will allow the aerOS project to contribute verified data tools to the relevant organizations that are backed with sufficient evidence.

To realize this shift of focus and active contributions to data spaces, task 6.3 will also perform an analysis of the resources invested by the different partners until now and look for the maximum use of the remaining efforts. This means that, partners that have had a less active involvement in the task until now, will be allocated a higher responsibility in the activities to come.

5. Exploitation Activities, IPR management and innovation

This section reflects on the advances performed in task T6.4 of aerOS since M12 (D6.1). It is divided in three main sections, illustrating (i) the IPR management in terms of assets, identification and Key Exploitation Results description, (ii) exploring the plan for exploitation of results expected by each partner and (iii) proposing a first attempt and the tentative plan for aerOS business analysis. It is accompanied with several complementary tables that can be found in the Annexes at the end of the deliverable.

5.1. Exploitation, IPR and innovation in the first period of the project (M01-M16) and status of KPIs

5.1.1. IP Assets

During the preliminary stage of the project, a deliberate effort was undertaken to gather a wide range of assets from all partners, acknowledging the distinct contributions that each entity could offer to the undertaking. Following this, a critical organizational measure was to precisely classify these accumulated assets into predetermined categories.

A person, group, or corporation that wants to successfully manage and protect its intellectual property assets must design and implement an intellectual property (IP) rights strategy. The term "intellectual property" refers to works of art, designs, trademarks, and other products of the mind that are capable of being legally protected by patents, copyrights, trademarks, and other intellectual property rights.

Background (BG) IP: BG can be outlined as knowledge, expertise, or information held or licensed by a project partner prior to the start of the project and required to carry out the action or capitalize on the project's outcomes. In essence, the term "BG", pertains to assets that a partner has cultivated and possesses before the commencement of the project. These assets encompass pre-existing intellectual property, resources, or strategic advantages that the partner brings into the project, contributing to its overall objectives and success.

Foreground (FG) IP: FG describes the outcomes produced via the execution of project operations, including data, resources, and knowledge. The concept of "FG" encapsulates an evolution from the BG as they are refined and developed within the project's framework. It encompasses both the adaptation and progress of existing BGs as they are applied to the project's context and the creation of entirely new assets or functionalities that emerge as a result of the project's activities.

Exploitable Result (ER): ER, utilizing research findings for purposes other than those covered by the activity in question, developing, producing, and selling a product or process, producing and offering a service, or engaging in standardization efforts are all examples of exploiting project outcomes. In simple terms, an exploitable result represents an asset or outcome generated within the project that holds value and utility beyond the project's timeline. These results are intended for post-project utilization, reflecting their long-term significance and potential for application or commercialization in a broader context.

Key Exploitable Result (KER): A KER is the asset that arises from exploitable results and possesses the highest degree of innovation and exploitable potential compared to others.

5.1.2. IPR Matrix

By making use of the intellectual property assets that were previously collected, a thorough IPR matrix has been constructed. The matrix functions as an all-encompassing and methodically structured depiction of the intellectual property terrain surrounding the project. It includes patents, trademarks, copyrights, and other pertinent assets. Four discrete tabs constitute the IPR Matrix, each of which serves a particular function.

Collecting Intellectual Property (IP) entails sending a detailed questionnaire to all project partners. Partners are asked about the technology they provided for the project, which is then categorized as Background (BG). Partners are also inquired about their intentions to either enhance the existing Background technology inside

the project or to create new technologies exclusively for the project, categorizing these as Foreground (FG). Furthermore, within the Foreground category, partners are required to specify which elements they intend to exploit further. These exploitable assets are catalogued as Exploitable Results (ER).

The IPR Matrix is comprised of three tables plus the KER table.

The first table is dedicated to the intellectual property **Background IP** and offers a concise summary of each asset, including a detailed description, the protection it is entitled to, and the requirements for its use both inside and outside the project. The content registered to this date on this table, can be seen in Table 25 in the annex.

The second table is dedicated to **Foreground IP** containing the same information as the background IP table. The available content of this table can be seen in Table 26, in the annex.

The third table is dedicated to **Exploitable results** that have the potential to be exploited further. This segment provides a glance of the assets obtained from the undertaking that demonstrate encouraging potential for further application or commercialization. Additionally, this table contains and information on how the other partners plan to use this result forming their individual exploitation plan. Its contents can be seen in Table 27, in the annex.

5.1.3. Key Exploitable Results

Within the context of a project, the Key Exploitable Results (KER) play a vital role as they are acknowledged as the project's most essential assets. Their distinguishing factor lies in their innovative nature and significant potential for commercialization, setting them apart from other project assets currently accessible. These unique characteristics make them outstanding contributors to the overall success of the project. The innovativeness of KER is characterized by the integration of state-of-the-art concepts, technologies, or techniques, which not only make them distinct but also have the potential to generate significant advancements.

The considerable potential for monetization adds an additional level of importance to these assets beyond their present worth. This possibility not only improves the project's financial viability but also highlights the strategic significance of these components in attaining commercial success. In addition, KER play a crucial role as major contributors of the business analysis tools that will be used in the next stages of the project. Their advice and data play a crucial role in guiding and shaping the commercialization plan, making them indispensable components. This emphasizes the vital role that these assets play in offering useful insights and information, enabling well-informed decision-making during the commercialization process. To construct the most successful business plan, we will utilize the Horizon Booster Services offered by the European Union. This strategic decision is based on acknowledging the valuable assistance and resources provided by these programs. The Horizon Booster Services are tailored to support enterprises at different stages by offering a complete set of tools for research, development, and innovation.

Aligning our business plan with Horizon Booster Services will provide us with knowledge, funding opportunities, and networking avenues to increase our project's success. Integrating the Horizon Booster Services into our company plan demonstrates a dedication to excellence and innovation. This collaboration enhances the legitimacy of our project and enables us to take advantage of new prospects in the European market. By using these services, we are guaranteeing that our business plan is not just strong and well-informed but also in line with broader efforts that support growth, sustainability, and technical progress.

The following table lists the KERs identified by the consortium, which constitute the most creative components of the aerOS project. The KERs provide a brief overview of the project's technical progress, highlighting the innovative improvements crucial for its success. Every outcome is a crucial element of the project's creativity, demonstrating the consortium's dedication to exploring the limits of technological capabilities. The consortium is actively involved in an ongoing process of identifying further KER to uncover more groundbreaking work. This ongoing investigation highlights the dynamic essence of the aerOS project, where innovation serves as a consistent driving factor. The consortium's commitment to discovering additional Key Events Relationships KER showcases a proactive stance, guaranteeing that the project remains at the cutting edge of technical advancement. As the research advances, the collaboration expects to offer comprehensive descriptions and optimize the results of these ongoing KER. This approach emphasizes the consortium's dedication to both present innovation and future advancements that may arise as the project progresses. By maintaining an iterative

and proactive approach, the aerOS project may effectively adapt and respond to new opportunities, thereby enhancing its influence and contribution to the technological field.

Table 20. List of identified KERs

A/A	KER	Description	Partners
KER1	aerOS MetaOS	The aerOS metaOS consists of the aerOS runtime, enabling the registration, management, and monitoring of minimal processing units (IE) as service execution units. Additionally, foundational services are provided to facilitate coordination and organization among diverse and dispersed computer resources. This includes integration, administration, and the management of data congestion for Edge IoT devices.	Consortium
KER2	aerOS Orchestration Stack	The aerOS orchestration stack is comprised by 2 level orchestrator components with decision engine (High-level-orchestrator) separate from enforcement layer (LLOs). LLO that can orchestrate computing resources over any runtime on top of K8s environment. Implemented as K8s operators capable to orchestrate resources based on CRD requests that may originate from different HLOs	Consortium
KER3	aerOS Data Fabric	Consist of data as a product methodology, tools data annotator, data translator. The context broker for holding current state of continuum and NGSILD extensions for federated continuum state (update and sharing)	Consortium
KER4	aerOS DevPrivSec	aerOS custom Methodology for CI/CD and aerOS scripts for pipelines implementation, plus software tools to support cloud native for continuous and progressive deployment of components	Consortium

5.1.4. KPI status

The Key Performance Indicators (KPIs) are on track. After doing the initial business and market analysis in the second phase of the project, useful insights will be gained and reported. This process aims to position aerOS within the broader market landscape, providing a comprehensive perspective that contributes to a more informed market strategy and overall project success.

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The KPI 3.4.1 indicates the contribution to the Open Source community by the consortium. The current technical status of the project shows that the technical partners are already creating software categorized as Open Source. The first report for KPIs is scheduled for Month 24, as outlined in the Grand Agreement, but already partners have report some their contributions reported in the below table.

The KPI 3.4.2 focuses on monitoring the business plans for assets that can be exploit further, which includes identifying and engaging with stakeholders and important partnerships. To effectively report this Key Performance Indicator a relevant business analysis of the project's achievable results must be carried out. This study will help identify the stakeholders and important coalitions that need to be involved. The business analysis has been planned for the next phase of the project.

Following the completion of the business analysis, KPI 3.4.3 will be closely monitored. The analysis will culminate in the formulation of the commercialization plan, aided by the Horizon Booster services. This plan will encompass potential new business lines that could be pursued by the aerOS partners for their advantage.

Aligned with KPI 3.4.3, KPI 3.4.4 emphasizes that the project's business analysis will provide the insights and opportunities necessary for startup companies to adopt aerOS technologies. The adaptation of aerOS from start-ups will ultimately indicate the technological advancement of aerOS.

The report for KPI 3.4.5, a pivotal technological milestone, is slated for release at the project's conclusion. It will offer a comprehensive overview of the holistic approach employed by aerOS, that will help the tech-transfer contracts to singed.

KPI 3.4.6 is tasked with overseeing private investments in aerOS and associated open technologies. It's crucial to note that aerOS's contribution to open technologies is anticipated to lead to advancements in the field, accompanied by expected monetary returns. The business and market analysis on the second phase of the project will help to identify and measure the contribution of the aerOS project to this direction.

Aligned with KPI 3.4.6, a market and business analysis scheduled for the M19-M36 period of the project will assist in strategically positioning aerOS within the broader landscape of the edge-cloud-computing market in both Europe and the global market.

Table 21. KPI status

KPI#	KPI	Target M36	Status
3.4.1	# of Contributions to OSS Projects	12	On track
3.4.2	Business plans for exploitable assets, stakeholders and key alliances identified and contacted	100%	On track
3.4.3	New business lines on aerOS by partners	2	On track
3.4.4	# of startups adopting aerOS results as technological baseline for business	2	On track
3.4.5	# of tech-transfer contracts signed based on aerOS	1	On track
3.4.6	Private investments in aerOS and related open technologies	10M	On track
3.4.7	Market share in edge-cloud-computing of Europe vs world	32%	On track

5.2. Plan for exploitation, IPR and innovation in the second period of the project (M17-M36)

5.2.1. Innovation Roadmap

Achieving the first three milestones sets the foundation for the subsequent phase in intellectual property rights management. A roadmap has been delineated, as shown in the image above.

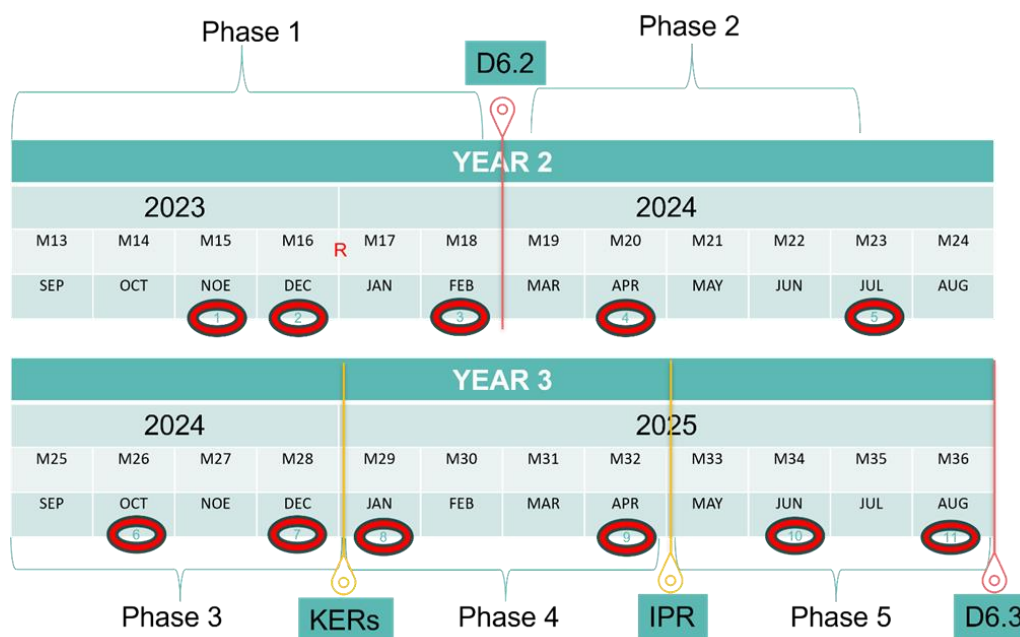


Figure 38. IPR & business management roadmap

The activities that have been carefully identified and strategically scheduled for the remaining time of the project comprise an extensive array of tasks that are vital for the innovation and exploitation strategy of the project.

During **Phase 2** of the project, a significant milestone is attained, affording each collaborator the independence to formulate well-informed choices concerning the commercialization of their distinct findings. To adequately prepare for this pivotal phase, it is necessary to devise individualized exploitation strategies that capitalize on the unique capabilities of each partner. Expanding upon deliverable D2.1, a comprehensive evaluation will be conducted to compile lists of stakeholders and competitors, thereby honing our strategic approach. This signifies a pivotal moment, during which collaborators are empowered and strategies for project success are refined. Milestone **MS4** mandates that collaborators delineate particular assets that are suitable for exploration, thereby facilitating the transition from conceptualization to market presence. This significant achievement establishes the foundation for an asset exploitation strategy that is dynamic and in line with our collective vision.

Drawing upon the knowledge gained in **MS4**, **MS5** endeavors to strengthen our foundation by constructing more exhaustive listings of stakeholders and competitors in comparison to those presented in document D2.1. By providing insights into the competitive landscape and facilitating the identification of key actors and collaborators, these refined profiles enhance our comprehension of the project ecosystem. As the undertaking progresses, strategic decisions are informed by this. **MS45** provides commercialization-oriented partners with the opportunity to utilize the Horizon accelerator services described in Section 3. These specialized services facilitate an efficient transition from research and development to the marketplace by streamlining the commercialization process and providing partners with customized assistance to strengthen their competitive advantage. According to **MS45**, if a partner expresses a notable inclination towards the commercialization of their assets, they have the option to leverage the Horizon booster services, as elucidated in the details provided in section 3. These specialized services serve as an invaluable resource for partners seeking to expedite and optimize the process of bringing their innovations to market. By harnessing the Horizon booster services, partners can benefit from a tailored support framework that not only streamlines the commercialization journey but also enhances their competitive edge, thereby facilitating a more efficient and effective transition from research and development to the marketplace.

Our principal objective for **Phase 3**, which is projected to be finished by the conclusion of 2024, is to definitively establish the Foreground (FG) and Key Exploitable Result (KER) lists, as they were initially delineated in the antecedent phases. An essential component of this stage entails the reevaluation of our Market Analysis, an undertaking commenced in Deliverable 2.1 (D2.1). It is crucial to conduct this revision in order to assess whether substantial alterations in the market environment may have an influence on the implementation and

achievement of our project. Our objective is to identify and evaluate potential hazards that may be linked to our project approach in consideration of the changing market conditions. This will allow us to make well-informed decisions and make strategic adjustments accordingly. Our principal objective in MS6 is to reexamine and reevaluate the market analysis, identifying changes in the market environment and accurately ascertaining the present status of the aerOS project. This comprehensive guides strategic judgments in order to position aerOS in an optimal manner in light of changing market dynamics, customer inclinations, and competitive elements. The primary objective of MS7 is to perform a risk assessment for the commercialization phase of the aerOS project. This assessment will involve an examination of challenges and uncertainties associated with market dynamics, technical factors, legislative obstacles, and competitive threats. By conducting this thorough analysis, it becomes possible to develop a resilient risk management strategy that aids in taking preventative actions to mitigate or resolve prospective problems. As a result, the probability of the aerOS project's commercial launch being successful is ultimately increased.

We have arrived at a critical juncture regarding the market positioning of our undertaking during **Phase 4**. By employing the business information tools that were chosen in Phase 1, and potentially integrating additional ones as well, we shall initiate a strategic discourse with the domain of business analysis. Our principal objective is to conduct a thorough evaluation of the extent to which aerOS corresponds with the existing market environment, thereby acquiring knowledge regarding technological aspects, competitive positioning, and prospective customers. At this juncture, it is crucial to comprehend aerOS's position within the market ecosystem, assess the competitiveness of its technology, and discern prospects for expansion and distinctiveness. By adopting a proactive approach, we lay the groundwork for our go-to-market strategy, which guarantees well-informed choices that contribute to the establishment of aerOS as a competitive and prosperous product. By leveraging well-established business tools, MS8 conducts an exhaustive analysis to determine the merits and drawbacks of specific aerOS components and the undertaking in its entirety. This analysis discerns domains of proficiency and possible obstacles, investigating business models that facilitate the prosperous integration of aerOS solutions into the marketplace. The objective is to optimize the alignment of product and service offerings with the demands of the market. After conducting extensive market, business, and risk assessments, MS9 offers a comprehensive perspective on the market standing of aerOS. The combined results of these evaluations provide a comprehensive understanding of aerOS's attractiveness to prospective clients, its pertinence in fulfilling their requirements, and its uniqueness within the market. This data enables strategic decision-making, improves the positioning of projects, and capitalizes on competitive advantages to efficiently attract the target market, thereby enhancing the probability of achieving success in a highly competitive business landscape.

During the **final stage (Phase 5)**, an essential undertaking is ascertaining the proprietorship of intellectual property that is linked to the aerOS project. This includes patents, copyrights, trademarks, and other forms of proprietary assets. Precise ownership rights are of utmost importance in safeguarding the interests of partners and the innovations of the project by delineating the future uses, licensing, and transfers of these assets. Concurrently, it is critical to prepare for the development of deliverable D6.3. D6.3 is expected to be a substantial document for the project, necessitating the aggregation, structure, and delivery of pertinent data and discoveries throughout the project's duration. This guarantees that the document is coherent, well-organized, and in line with the goals of the project. Both the ascertainment of intellectual property ownership and the formulation of D6.3 are essential components in the process of finalizing the project, safeguarding its resources, and recording the results of exploration and development endeavors and accomplishments. By concluding the business analysis in MS10, every project asset is effectively identified, underscoring the importance of establishing ownership of intellectual property rights (IPR) in order to safeguard valuable information uncovered throughout the analysis. The establishment of a clear definition of ownership guarantees controlled utilization, licensing, or transfer, thereby protecting intellectual property and enabling the open distribution of obligations, rights, and benefits among parties involved. After collecting crucial information and finalizing the IPR and innovation strategy in MS11, the attention turns to the smooth integration of this data and strategic insights into D6.3. At this pivotal moment, it is necessary to integrate project outcomes, information regarding intellectual property ownership, and novel approaches into a unified and well-organized manuscript. D6.3 functions as an all-encompassing documentation of the project, delineating accomplishments, and intellectual property, guaranteeing accurate recording and protection of intellectual property, and optimizing communication and subsequent decision-making concerning project results.

5.2.2. Individual Exploitation plans

The revised individual exploitation plans for each partner, which have been developed in accordance with deliverable D6.1, are detailed below.

5.2.2.1. Industrial, clustering and telco partners

INNOVALIA

Innovalia Association is a private and independent technological center that was created by Innovalia Group in order to articulate a critical mass capable of successfully achieving its long-term research ambitions and strategic objectives. Innovalia is an alliance for technology-based SMEs with headquarters in Spain. It has international presence with offices in Basque Country, Madrid, Catalonia, Canary Islands, Europe, Asia, the Middle East, and Central and South America. Since its foundation, Innovalia Association has developed a special sensitivity for and awareness of the characteristics of technology-based SMEs. Today, it has become a leader in the R&D area by and for SMEs in Spain. It also offers solutions for facilitating international innovation processes aimed at SMEs. As a technological agent of the Basque Country Technology Network (Innobasque), Innovalia brings together the skills, laboratories and resources of the companies that founded the association. Innovalia Association specializes in the development of ICT, Innovation Management and Meso, Micro & Nano-Technologies, parameterized according to the needs of each of the business units. In addition, Innovalia takes part in industry 4.0 and data spaces initiatives. aerOS will be exploited in following:

- Digital Factory Alliance (DFA). DFA was established in 2021 by BDVA Boost 4.0 and FoF (EFFRA) Qu4lity (big) data-driven digital transformation lighthouse initiatives. It is already at the crossroad of data and I4.0 and gathers a community of over 2000 stakeholders participating to the community open innovation activities “data open to all”. The DFA already provides 4 pillars to support both open and market driven innovation for accommodating the project assets and support market opportunity development. The DFA as a non-for-profit neutral stakeholder has already in place the necessary framework for immediate use by the community. It provides the manufacturing focused open innovation catalogues and partnership programmes to engage with the data space stakeholders (incl. DIHs and AI TEFs) and data space alliances for sharing knowledge (body of knowledge), ecosystem building assets (innovation campus), digital solution finding (flagship initiative) and engagement in business (business networks) at EU level, complementing national industry 4.0 initiatives activities and assets.

In this regard, aerOS will provide the framework for use reference models, certifications and provide effective data-sharing among the alliance.

- BAIDATA. The BAIDATA Association, led by Innovalia, is helping to drive the development of data sovereignty and the data economy. Founded in collaboration with the International Data Spaces Association (IDSA), BAIDATA implements research, development, and training activities to help build the public-private data ecosystem. BAIDATA stimulates and supports regional shared data space pilot actions and promotes data space connectivity and interoperability with other regional and national data spaces and with the common European data market linked to this initiative.

Baidata aims at connecting and providing an interface between European and Regional Data Spaces and their public-private ecosystems, bring stakeholders together to improve and accelerate the use of data through pilot actions and training, assessment, internationalization, and promotional activities and designing new data-driven business models to improve business productivity, sustainability, and efficiency.

aerOS will provide a blueprint for an effective and secure data sharing, providing an infrastructure for promoting and expanding BAIDATA technical activities.

On the other hand, Innovalia will exploit aerOS for its internal advanced metrology products:

- Using a low latency big data solution to acquire and process information in real time from production lines,
- Contribute to the improvement and innovation of advanced metrology systems within contactless measurements and virtual pieces for the industry 4.0,
- Deliver business innovation and advanced digital tools through aerOS, enabling IoT solutions, big data management, cloud and AI,
- aerOS will help in the development of technologies related with embedded systems and device integration, contributing to the overall behaviour of cyber physical systems.

FIWARE FOUNDATION

The FIWARE Foundation is the legal independent body providing shared resources to help achieve the FIWARE mission by promoting, augmenting, protecting, evolving, and validating the FIWARE technologies as well as the activities of the FIWARE community, empowering its members including end-users, developers and rest of stakeholders in the entire ecosystem. The FIWARE Foundation is open: anybody can join contributing to transparent governance of FIWARE activities and rising through the ranks, based on merit. FIWARE Foundation is a non-profit organisation that drives the definition and encourages the adoption of open standards (implemented using Open-Source technologies) that ease the development of smart solutions across domains such as Smart Cities, Smart Energy, Smart AgriFood and Smart Industry, based on FIWARE technology. Founded in 2016, the foundation has Atos, AWS, Engineering, Madinah, NEC, Red Hat, Telefónica, and Trigyn Technologies among its Platinum members. Only by truly eliminating the existing technical and commercial obstacles hindering the effective usage of meaningful data, smart digital solution providers will be able to move forward and drive the market up, based on FIWARE technology. Using FIWARE technologies, organisations can capture the opportunities that are emerging with the new wave of digitalisation brought by combining the Internet of Things with Context Information Management and Big Data services on the Cloud. Using FIWARE technologies, developers can gather context information at large scale from many different sources. FIWARE also helps to easily process, analyse and visualise managed context information, easing the implementation of the smart behaviour and the enhanced user experience required by next-generation Smart Applications.

Over the years of its existence and development FIWARE built a strong community presence in these three different consistent and strong programs FIWARE Marketplace, FIWARE iHubs, FIWARE Accelerators.

-FIWARE Marketplace helps users, and their customers find innovative and the best open-source-based products and services and grow revenue by identifying customer needs and repeatable solutions leveraging FIWARE technologies and FIWARE partner ecosystem, at scale,

-FIWARE iHubs focus on building communities that will, in turn, enable local digital businesses to thrive not only at a regional but on a global level. They support companies, cities, and developers in their innovation and digitalisation journey by offering easy access to Open-Source technologies, business development support, and community building,

-FIWARE Accelerator Program supports Incubators, Technology Parks, Venture Capital Companies and Digital Innovation Hubs with training and coaching services. It offers technical assistance and business opportunities to highly innovative SMEs and Startups with scalable business models,

-FIWARE is active in standardisation bodies like ETSI and is the core maintainer of the agile standardisation initiative Smart Data Models (<https://smartdatamodels.org/>). In ETSI, the NGSI-LD API is continuously evolving to support the interoperability of smart solutions. FIWARE is a de facto standard in domains like Smart Cities, and gaining adoption in other ones, like Manufacturing, Energy or Mobility.

There are few main ways in which FIWARE will be able to exploit the results of the project:

-Implementing new core functions to Orion-LD Context Broker for distributed operations which will be available not only for FIWARE Foundation itself but for all FIWARE's users worldwide,

-The Marketplace is FIWARE's business tool, it currently hosts 200 solutions. AerOS pilots can be added to FIWARE Marketplace as they will be powered by the FIWARE technology. It will also be an added value for the project itself. The pilots will have global promotion, a visibility that will help position the solutions developed in the public administrations, but not limited, market more easily,

-Enhancing and extending FIWARE's Smart Data Models with new open and free models for Cloud, Edge, and telemetry domains. More than 1000 data models are currently in the smartdatamodels.org repository, contributed by more than 80 organisations and more than 120 contributors. New models will enlarge this common database of models widely used by the community,

-Improve or add new Generic Enablers in data Continuum, distributed security, and multi-plane analytics both in FIWARE's IoT enablers implementation and FIWARE Lab cloud federation.,

- Building Blocks that could be incorporated to the catalogue of components that the Data Spaces Support Centre is collecting for the deployment of data spaces in different domains in Europe,

-This is a great chance to gain Know-how and experience in Data Continuum, AI, Cybersecurity, and data governance which will benefit our FIWARE adopters.

FIWARE has implemented distributed operations in Orion-LD for aerOS, which is a result that can be exploited in any other project that needs distributed operations, which is a current trend in almost all projects developed in FIWARE. It is an important part of the NGSi-LD API that needs to be implemented for Orion-LD.

More specifically, the developments consisted in implementing:

- Distributed GET /entities w/ entity maps,
- Loop protection using the HTTP header "Via",
- Periodic notifications for subscriptions,
- And more elements in Orion-LD.

As a result, a network of context brokers can be created, where several components support the gathering and access to data, each of them holding entities, such as a digital twin of a real object (e.g. a bicycle). If the brokers are federated (by means of a 'registration'), it means that each broker knows what entities the other brokers have.

The advantage is that for an entity query it is enough to contact one of the many brokers. For example, "give me all entities (bikes) that have an attribute called 'speed' with a value between 90 and 120".

The broker that receives that request, as it knows what entities all other brokers have, can "forward" the request, query all the other brokers, and then return the entire set of matching entities to the initial "queree".

A case of use could be a city federating with all other cities in the country and letting their applications offer country-wide services, or even worldwide.

The users of the service are developers, developing apps, but these apps have end users (any citizen), so a whole population can benefit from the federation capabilities.

FIWARE will exploit the results developed in aerOS by updating the current technology to be used in most forthcoming projects. Additionally, to the general exploitation activities listed above, the team will include it in the FIWARE catalogue. The FIWARE Catalogue offers a curated set of open-source components contributed by the Open Source Community, which can be integrated together with 3rd-party software around a Context Broker to bring support to the development of smart solutions in multiple sectors.

Finally, the functionality will be pitched within presentations to cities, municipalities, public sector interlocutors, as well as any other party interested in the benefits of FIWARE solutions.

TELEFÓNICA INVESTIGACIÓN Y DESARROLLO (TID)

Telefonica has set the initiative of Autonomous Networks as one of the priorities in its innovation roadmap. With this new initiative the management of networks will become more efficient and will require less

intervention from humans. In this sense, Telefonica is heavily researching in new network paradigms like Digital Twins and closed-loop automation that will enable networks to work autonomously. But these paradigms require a data infrastructure that can integrate network monitoring data collected from different data sources while ensuring the governance over data by also integrating its metadata.

Following up on the results achieved in previous European projects like 5GROWTH, 5G-CLARITY, or PALANTIR, Telefonica will leverage the scope of the aerOS project to further evolve the Semantic Data Aggregator (SDA) as an implementation of a data infrastructure. The aerOS project, which targets the creation of a meta-operating system throughout the IoT-Edge-Cloud continuum, imposes challenges that will enable Telefonica to gain experience in managing highly distributed data. To cope with such challenges, Telefonica will extend the SDA to align with new data management approaches like data fabric or data mesh. The outcome of this research will be shared as contributions to standards ETSI CIM or IETF OPSAWG.

In addition, the wide variety of use cases addressed in aerOS, present a great opportunity for validating the novel data mesh paradigm, where one of its main principles is the ownership of data based on domains. In this regard, Telefonica, as Data Manager of the project as well as leader of the data governance task, will gain expertise in defining data domains and governance policies for the different use cases of the project. The lessons learned in the process will be applied to use cases which are specific to Telefonica business, and, in particular, to the initiatives related to the Network-as-a-Service (NaaS) paradigm.

In summary, the experience in data management gained with the aerOS project, will help Telefonica in developing a data infrastructure aligned with trends like data fabric and data mesh.

COSMOTE

An extensive presentation of COSMOTE's profile, the leading Mobile Network Operator of Greece launched in April 1998, was provided in D6.1 together with subtle evidence for the steps taken for commercial exploration of green, IoT and campus networks use cases. The company invests in the edge-cloud ICT enterprise solutions and seeks to assess new business models, exploring new revenue sources not only from building and operating networks but also profiting from the managed services to deliver and operate a wide set of network-aware enterprise applications. In this perspective, COSMOTE has a strong interest to explore the aerOS prototype, with special focus on the platform-agnostic, distributed intelligent edge that can accommodate federated, flexible, scalable IOT deployments building upon AI and the IOT-cloud technologies. As described in the initial plan, the developments of aerOS are evaluated in three perspectives:

- From the perspective of a technology supplier, to assume the role of edge-cloud provider and offer enterprise, beyond connectivity, services, supporting the vertical industries' digital transformation and capitalising the 5G network investments. COSMOTE intends to build upon its strong telecom and ICT competence to exploit the aerOS metaOS results offering federated, scalable, extensible, secure, distributed intelligent edge to support multiple use cases and enterprise domains.
- As a technology consumer, to exploit technology towards its own transformation, at the business level and for the network sustainability. The Cloud IoT continuum offered by aerOS can become a core platform to manage the telecom systems, services, and assets.
- To achieve its corporate sustainability targets. In this perspective, Pilot #5 for smart, energy efficient buildings are an attractive solution to be deployed in own telecom premises.

Drilling as part of the first-year activities into specific project developments that can support these perspectives, the focus is especially put on the following concrete project outcomes:

- The aerOS Context Broker developments based on the widely adopted standard NGSI-LD, to achieve a unified data fabric from heterogeneous IoT data, as well a unified network-compute fabric from the distributed, diverse cloud eco-system.
- The aerOS Orchestration that determines the optimal location to initiate the service deployment within the continuum (HLO) and once the appropriate infrastructure element of the continuum is selected, to

further deploy the service through the (LLO), while managing the elements of the ecosystem with self-* capabilities.

- The aerOS AI components, identified both from the perspective of the aerOS embedded analytics, as well as for the AI models developments for energy efficiency and health-safe buildings in focus of Pilot5.
- The integrated Pilot5 demonstrator that is prototyped in an existing COSMOTE enterprise building and as such stands as the pilot for further deployments in other COSMOTE premises.

Switzerland Innovation Park Biel/Bienne (SIPBB)

The Switzerland Innovation Park Biel/Bienne (SIPBB) is a private Swiss non-profit organisation that conducts and supports industry-related and primarily applied research and development. It encompasses four applied research centres covering topics related to healthtech, additive manufacturing, battery technology and smart factory. Besides research activities, the SIPBB offers test – and demonstration platforms for several applications. The largest platform is the Lighthouse factory industry 4.0, built with the help of over 40 companies and coordinated by the Swiss Smart Factory (SSF) research center. This is a production line for Quadro – and hexacopter which focuses on automation and human-machine interaction in the context of industry 4.0. Within this line, many IoT data points are available, which can be used for further computation. With aerOS the different data entries can be collected and exchanged with further data from the own production line as well as with other parties as suppliers, customers and other test and demo labs. From these opportunities the following exploitation purposes arise:

- Exchanging and computing IoT-data of demonstrators, sensors, edge-devices etc. within the production line for further insights and enhanced understanding.
- Exchanging and computing IoT-data with suppliers of drone parts (e.g., PCB's) for quality improvement and CO2-calculation of the drone.
- Exchanging and computing IoT-data with other test – and demo labs for exchanging information and common improving of the production line.
- Dashboarding of collected, exchanged, and computed IoT-data along the production line.

Given that the drone production line is constantly evolving to present up-to-date and relevant solutions accessible to companies facing digital transformation, the project results will help develop new use cases within the Lighthouse factory's Industry 4.0.

The Swiss Smart Factory is also part of the Digital Innovation Hub (DIH) ecosystem and contributes to other national, European and international projects related to Industry 4.0 topics such as data networks (RE4DY), data spaces (Circular TwAIn) and value networks (M4ESTRO). In this regard, results from aerOS will contribute to the development of other research projects.

In addition, the knowledge created through aerOS will be transferred to the partners of the Swiss Innovation Park Biel/Bienne, notably through guided tours, events and training courses organized in the Swiss Smart Factory, as well as within and beyond the innovation networks to which SIPBB and SSF belong.

NASERTIC

One of the most relevant lines of action in NASERTIC consists of the implementation of public Telco services deployed on top of our own ICT infrastructure. NASERTIC boosts all Telco projects commissioned by the Government of Navarra and is the reference partner for the Public Corporations in our Community for everything related with the deployment, assistance, and maintenance of ad-hoc Telco services.

This line of activity has allowed our community to carry phone coverage, Digital TV and high-speed Internet connectivity (among other services) to 99.5% of our territory, which is possible thanks to our own telecommunication centers and the management of the Government of Navarra's redundant data processing centers, which host all the ICT services demanded by society. Simply put, NASERTIC offers the infrastructure on top of which other entities deploy their own ICT services which contribute and add value to the Navarra's society.

Keeping always in mind NASERTIC's vocation of public service, aerOS can be yet another technology to offer to Navarra's ICT scene. By hosting dedicated aerOS infrastructure, we would enable the Government of Navarra and public entities (including ourselves) to develop new services that fully exploit aerOS' core concept: the continuum. The seamless and transparent integration of clouds, edges and IoT sensors and actuators can be leveraged in the development of services aligned with the Government of Navarra's S4+ strategy: electric and connected mobility, healthy and sustainable food, green energy industry, personalised medicine, sustainable tourism, and audiovisual industry.

In conclusion, we expect aerOS to strengthen the digitalization capabilities of our territory and to boost smart specialization strategies and inclusive growth (S4+), by incorporating the meta-operative system in our infrastructure and encouraging all actors in Navarra to leverage aerOS to create value added services for our society.

S21SEC

After the acquisition of S21Sec and ExcelliumSA by Thales Cyber solutions, under the holding company Maxive Cybersecurity, the group has become a global leader in advanced technologies and cybersecurity.

S21Sec Cyber Solutions by Thales, which is the new name for the corporate brand, will leverage Thales' leading Cyber Solutions business to enrich its offer and reinforce the capabilities of its Global Security Operations Center (SOC) in Madrid through Thales networks, to ensure greater efficiency in incident detection and response processes and better support international customers. With more than €1bn in sales generated in 2023 through an extensive cyber portfolio, Thales is involved at every step of the cyber value chain, offering solutions ranging from risk assessment to protection of critical infrastructure, supported by comprehensive threat detection and response capabilities. The portfolio provided for IT/OT & Cloud cybersecurity services can be grouped as follows:

- Advisory services (Compliance & Regulatory, Cyber security Ratings),
- Cybersecurity Infrastructure (Network, data, application, cloud security),
- Managed detection and response (SOCaaS, Threat Intelligence detection and response, Threat Hunting),
- Test, adapt and prevent (Red teaming, Vulnerability Management, Application testing/code review).

S21SEC intends to use the results of the aerOS research to improve the process of continuous integration and continuous deployment of managed cybersecurity services using the DevPrivSecOps methodology, supporting the company's strategy for S21SEC's SOC services provided globally.

S21SEC will deliver a DevPrivSecOps methodology that will ensure security by design in the software deployment process of the different software components for the aerOS IoT edge-cloud continuum platform and will particularly focus on the cybersecurity enablers to be applied in such architectures.

S21SEC will apply DevPrivSecOps methodology in Research and Development department enhancing the S21SEC internal corporate process helping to create environments for recurrent testing in R&D projects. Additionally, the experience and knowledge in DevPrivSecOps principles and practices will help to build a corporate offering of consulting services oriented to the assistance and implementation of DevPrivSecOps processes and methodology to be incorporated in the company's service portfolio.

S21Sec's role in aerOS will focus on the corporate strategy for the deployment of cybersecurity services, aligning the business strategy with the objectives of the aerOS project. S21SEC is responsible for the management of threats, detection and handling of breaches, the building of incident response and recovery capabilities in organizations, prevention techniques, education of the employees with the best cybersecurity practices, and alignment of business goals with the cybersecurity principles.

S21SEC will enhance with the results of aerOS their offer for managed security services in IoT edge-cloud continuum deploying these services both in the edge and also in the cloud of aerOS platform. For S21SEC it is crucial that new managed service offerings are designed to enhance, optimize and transform value creation along the entire value chain, both on the provider and user side. For instance, the self-security component, once

uploaded from TRL after the project, is expected to be used to provide cybersecurity incident detection services in S21SEC customers' cloud environments. This component can be used to monitor intrusions in S21SEC customers' cloud networks which are then reported to the SOC for analysis and response.

The implementation of security in decentralized edge-cloud IoT environments will enable the identification and development of new technology needs, allowing the services provided by the enterprise to be upgraded to meet the needs of next-generation networks. With aerOS, S21SEC will achieve a new position to their offering for managed security services.

5.2.2.2. SMEs

8BELLS

EIGHT BELLS Ltd is an independent high technology company providing innovative solutions, based in Nicosia, Cyprus and Athens, Greece. We specialize in selected parts of Information and Communication Technologies (in the fields of Defense, Security, Space, Telecommunications, Cybersecurity, eHealth and Environmental Protection, with disruptive IT solutions. Our technical capabilities include Systems Networks Engineering, Cloud Computing, Privacy, Security Data Protection and Software development.

8BELLS operates a privately-owned cloud based on comprehensive deployments of OpenStack and Kubernetes to manage bare-metal resources into virtual machines and containers, respectively. Our Everything-as-a-service (EaaS) philosophy is to be able to provide a high quality as-a-service approach to software and hardware resources. The entire architecture embeds scalability, high performance and security across all resources and tenants. In this sense and based on a perfect mixture of service orchestration and a best-of-breed DevOps approach, the platform is able to handle a multitude of workloads across Neural Networks, Blockchain, Big Data and other areas of distributed and cloud computing.

8BELLS plans to include aerOS results related services to the existing corporate portfolio making impact in core-aerOS, as well as in supporting features (TSF), extending its experience in data governance (e.g. DFF - Data Format Fusion), Softwarized Networks 5G & NetApps, APIs development & containerisation and predicting Self Maintenance mechanisms.

Another major part of aerOS was our contribution in the Kubernetes domains, this made us recognized the need to enhance the scalability and security of our company infrastructure, and to achieve this, we're planning to integrate Kubernetes (K8s) orchestration with the advanced networking capabilities of CNIs like Cilium.

In order to maximise the impact 8Bells will focus on setting up good practices and guidelines for transfer of knowledge. 8Bells has a proven track record in smart networking, benchmarking and evaluation and business strategy. More specifically, 8Bells will exploit technologies such as NFV (e.g., VNFs/CNFs), programmable networks and VPN will be adapted to distributed IoT edge-cloud continuums, with intelligent reconfiguration capabilities (supported by policy based and/or AI methods), ensuring dynamic, low-latency intra- and inter-domain communications.

INQBIT INNOVATIONS (IQB)

InQbit Innovations (IQB) was founded by an international team, achieving a harmonious balance of entrepreneurship, research, and engineering. This diverse group united with the objective of creating innovations that address societal and market needs. In addition to its individual endeavours, IQB is actively participating in several Horizon Europe projects, including H2020-ICT-41-2020-EVOLVED-5G, HORIZON-DATA-01-04-FAME, HORIZON-DATA-01-03-OASEES, H2020-ICT-40-2020-PHYSICS, and HORIZON-DATA-01-01-TRUSTEE. Through these projects and its connection to the research communities, IQB leverages opportunities to disseminate project outcomes, expand its network, and strengthen collaborations with IT-related SMEs and industries.

More specifically IQB will:

- Leverage the outcomes of aerOS within academic and scientific communities (e.g by organising workshops),

- Utilize the knowledge and expertise acquired from aerOS to enhance research and development efforts across Europe,
- Aim to identify new research areas that can enhance IQB's collection of innovative services.

As previously mentioned in aerOS Deliverable D6.1, IQB, through its involvement in the aerOS project, will concentrate on the cybersecurity aspects of the edge-cloud continuum and the development of trust management over IoT deployments. This involvement will enable IQB to enhance its expertise in security related to IoT devices and expand its understanding of the edge-cloud continuum. The outcomes of aerOS will be particularly valuable as they will represent our research implemented and utilized by the pilots.

IQB's participation in the aerOS project is primarily through its involvement in implementing the cybersecurity and trust management components. More specifically, as the task leader in Task 3.4, IQB has successfully implemented the authentication and authorization infrastructure of the project. This infrastructure consists of IAM, focusing on authentication and authorization, and the Secure API Gateway, which aims to strengthen the access control capabilities of aerOS and ensure that access rights are preserved. Additionally, as the task leader in Task 4.5, IQB is developing the trust monitoring tool to ensure trustworthiness in aerOS. As such, IQB's initial exploitation plans are centered around the following pillars:

- Encourage IQB research activities related to IoT trust management and multi-attribute optimization models for efficient and accurate trust score calculations for devices and network entities across the edge-cloud continuum,
- Create new partnerships in the EU research domain with the purpose of initiating new opportunities with the project's stakeholders.

FOGUS

FOGUS INNOVATIONS & SERVICES P.C. is a thriving SME in Greece that aims at integrating state-of-the-art technological advancements and cutting-edge research achievements, towards an immersive communication and computing experience. Founded by a group of industrial and academic experts covering a wide range of disciplines in Information and Communication Technologies (ICT), FOGUS exhibits strong research record and vast experience in managing and implementing ICT Research & Innovation actions. It provides a comprehensive set of services, including software development, simulation and experimentation set up, data analysis and tooling, and modelling and performance evaluation. FOGUS emphasizes on the optimization of core procedures and processes of network functions by integrating machine learning, big data analytics and cloud-empowered optimization. Holding experience that ranges from the design of mobile communication protocols to the development of custom-made software, FOGUS undertakes: i) end-to-end set-up of network simulation and emulation environments for IoT and User-centric services, ii) development of network functions end protocols for access and transport network domains, and iii) analysis of big data with expertise on mapping network and service performance parameters to user-experience metrics.

FOGUS is currently operating an end-to-end deployment of LoRa/LoRaWAN IoT infrastructure with a cloud-enabled and modular application and network managers. This supports two key research and service lines of the company, namely network and service performance evaluation and campus/experimentation infrastructure development.

By participating to aerOS project, FOGUS is expected to gain expertise in concepts like IoT edge-cloud continuum. In parallel, FOGUS testbeds and simulation infrastructure will be extended in the context of aerOS, towards being compatible with 5G and IoT standards. The fact that FOGUS monitors the activities in 5G-PPP and EFFRA associations will assist on that as well.

The company has already gained experience by their participation in key exploitable components of the aerOS platform, that can be integrated into other products, including the self-healing module that crystallises the capability of autonomously recovering affected parts of the system both at the hardware and software level caused by failures or abnormal states. It also can restart the system to pre-established routines scheduling, if necessary. FOGUS also supports the development and evaluation activities in aerOS pilot 5, by providing insights both to the communication infrastructure of the pilot and to all the data-related processes. For the communication part, FOGUS brings expertise in common protocols, such as MQTT, Webhooks, HTTP, and

others. Regarding the data processes, FOGUS has experience with all the common data processes, i.e., data gathering, data storage, data cleaning, data processing, data analysis; using well-established practices in the IoT field, i.e., gathering via push and pull models, storage using timeseries formatting, processing and cleaning using well-known frameworks and libraries, and visualizing using de facto tools (e.g., Grafana). All this experience will enforce the company's position in the market or future research projects. Finally, FOGUS is involved into the qualitative and quantitative assessment of the pilots, participating into the execution of different methodologies that can be adapted per case. Based on well established procedures, the pilots will be assessed according to specific targets and values. This approach is expected to be applicable into other similar environments in the future, contributing with a critical phase of a system integration and testing.

In general, the involvement of the company in aerOS project is expected to strengthen company's position against the competition in the fields of experimentation and benchmarking. Also, since FOGUS invests on training and consulting services, the know-how acquired by the aerOS project will be exploited by the training and consulting sector in FOGUS to devise new courses and training material.

ICTFICIAL

The primary goal of ICT-FI is to enhance its scientific and technical proficiency in cutting-edge research topics, with a focus on providing tangible benefits to its clients, particularly in the realm of edge computing and its management. The organization has successfully realized this ambition by integrating project results into the knowledge base of its staff. Specifically, the outcomes of aerOS have been instrumental in fortifying ongoing research and development initiatives and augmenting the company's solution portfolio. In pursuit of the first objective, ICT-FI strategically incorporates aerOS results into its staff's expertise, leveraging this knowledge to propel current R&D endeavours. Moreover, these outcomes serve as a catalyst, fostering the creation of additional research projects in pertinent scientific and technological domains.

Addressing the second objective, ICT-FI is actively engaged in crafting an orchestration system designed to create and manage diverse clusters across multiple cloud domains throughout their lifecycle. This forward-looking initiative aligns with the organization's commitment to staying at the forefront of technological advancements.

Concerning the third objective, ICT-FI has achieved success in securing additional funding, strategically utilizing the orchestration system under development as a cornerstone for attracting support. This proactive approach not only ensures continued financial backing but also positions ICT-FI as a key player in shaping future research and innovation activities.

The participation of ICT-FI in aerOS has proven instrumental in maintaining competitiveness for forthcoming research endeavours. The organization has been proactive in disseminating the outcomes of aerOS through publications in various scientific forums. This collaborative effort, undertaken in close cooperation with research collaborators, has further strengthened the ties between the company and academic institutions. In summary, ICT-FI's strategic integration of aerOS results, ongoing development of an orchestration system, and successful acquisition of additional funding underscore its commitment to excellence, innovation, and sustained collaboration within the ever-evolving landscape of scientific and technological advancements.

INFOLYSIS

As already stated in aerOS D6.1 as per INFOLYSIS initial exploitation plan, INFOLYSIS will capitalize on aerOS results by increasing INFOLYSIS' presence and penetration in the respective areas of research, as well as facilitating processes to ensure the project's maximum visibility and impact within the business and scientific communities, as well as within the chatbot apps and virtual assistants commercial markets, in order to ensure quick adoption of project outputs and easier commercialization of its chatbot-based services.

INFOLYSIS participation to the aerOS project, through the INFOLYSIS provision of smart networking/connectivity contributions, API communication and security services, as well as the development of a web app acting as an informative end-user virtual assistant within the framework of Pilot 5, combined with

the participation and outcomes of relevant IoT and 5G related projects (ASSIST-IoT, EVOLVED-5G, SECANT), will further:

- Foster INFOLYSIS IoT based R&D activities coupled with smart networking, communication APIs and virtual assistant/chatbot technologies,
- Enrich the know-how and the research expertise of the company in IoT, edge cloud continuum and AI technologies under several different environments with focus on smart buildings,
- Demonstrate gains of the aerOS architecture in an edge deployment for energy efficient, sustainable, flexible, and health-safe smart buildings,
- Create new virtual assistant apps and chatbot based products and services targeting new markets and sectors in the field of smart buildings,
- Enrich its end user products with new functionalities and processes addressing new customer needs for sustainable, flexible and health-safe working environments.

In parallel, INFOLYSIS will take advantage of its role as WP6 Impact and T6.1 Communication leader and use its expertise to gain full exposure and influence within the business, scientific and IoT communities to ensure that the project's outputs are easily and quickly adopted during the second period (M19-M36) and even after the project's end.

Within these communities, INFOLYSIS through its communication channels, will communicate project outcomes and opportunities, explore future expansion and exploitation in current markets, products, and services, enrich its collaboration with IT-related SMEs and industries. Second period impact activities will focus on relevant markets and industries in order to fully leverage the novel business opportunities in the smart buildings field, related activities and business processes as addressed/generated by aerOS.

In specific, INFOLYSIS will:

- Exploit aerOS results within scientific communities and chatbot apps markets,
- Enhance its participation in the evolving SMEs ecosystem and chatbot apps markets,
- Contribute to the newly formulated IoT/AI chatbots market landscape and societal impact,
- Participate in new SME accelerator communities and incubator programs through which INF will further disseminate aerOS developments, results, and experimentation opportunities,
- Use expertise gained in the research activities of ongoing IoT/5G related projects in which INFOLYSIS participates for further enriching and promoting aerOS project's outcomes,
- Target new research opportunities for further enriching INFOLYSIS portfolio with new innovative services,
- Acting as a liaison among different research projects' common activities and promoting the engagement of SMEs in mutually beneficial activities,
- Communicating aerOS activities to associations and working groups in which INF is member (e.g. NetworkEurope, SME WG, 5G-PPP/6G-IA Comms WG, EuCloudEdgeIoT association and communication task force, 6G-IA/SNS etc.) diffusing in this way project results among several SMEs and startups that may act as external third-party experimenters/stakeholders,
- Reuse the gained knowledge and expertise from aerOS to move forward the public awareness for sustainable, flexible, and health-safe buildings.

PRODEVELOP

PRODEVELOP has 30 years of experience offering digital solutions to the port sector, including Port Authorities or Container Terminals. aerOS will give the opportunity to Prodevelop to optimize our current software offering solutions to port terminals. The potential users of our aerOS results are container terminals, and in particular EUROGATE CTL. We expect that the outcomes of the project to be validated through the Port Continuum pilot will demonstrate the benefits of integrating aerOS cloud-edge-IoT orchestration functionalities into our digital solutions. aerOS results will be incorporated to the Big Data and IoT services and products in Prodevelop's portfolio, with special attention to POSIDONIA Terminal 4.0, our IoT and Big Data solution for

Smart Ports. To be more specific, the three main exploitation outcomes identified during the first half of the project are:

- Alleviate the bandwidth consumption required for data transmissions from port CHEs to central cloud servers for data analytics. Beyond the distributed orchestration, both data fabric and frugal AI services or aerOS are considered key pillars for this outcome,
- The management portal, in conjunction with the Embedded Analytics Tool plus the self-* services are seen as an optimum way to guarantee a proper and almost real-time platform performance monitoring, which is considered as one of our cornerstones for improving the maintenance of our digital big data platform,
- The automation tools to be provided from the DevPrivSecOps methodology of the project will help on reducing the deployment of new components or the upgrading of currently deployed ones in our customer premises, while guaranteeing that the data and services are not susceptible of being attacked or compromised.

DST

DST is an Italian system integrator and digital company active in research, development, and innovation projects. DST provides a wide range of digital services to EU players, it is a Digital Consulting company, and its main business is to support its customers in the development and maintenance of IT solutions, adopting a Cross-Pollination Methodology. With over 200 employees and collaborators, DST participates in several national and international R&I projects. The Research and Innovation division is fully dedicated to the conception and development of innovative solutions such as, for example, new e-commerce services, semantic technologies, Artificial Intelligence (AI) technologies, and Big Data analysis.

In this respect, the development of the next generation of higher-level (meta) operating systems for the smart Internet of Things embedded in a compute continuum from IoT-to-edge-to-cloud contributes to the advancement of DST know-how in the field. aerOS has the potential to affirm itself as a European platform of key value for the development of the computing industry at the European level. In this way it could represent a relevant technological solution to fill a gap in the computing sector. Furthermore, the project may support DST's R&D activities by fostering its expertise and project DST into the technologies of the future.

The solution might also improve DST's capacities to process data from distributed sources by leveraging the edge computing's high bandwidth and low latency. In this way, the solution will serve as an enabler for the creation of further digital solutions. Furthermore, the flexible architecture of aerOS will further enhance the possibility of employ it in several context and guaranteeing trust, security and privacy.

All of this will also translate in an enhanced capability of DST of providing further services to its clients needing to manage a vast amount of heterogeneous and unstructured data.

Finally, the knowledge gained via the aerOS project, and the project outputs may act as a catalyst for the development of further projects. Participation in these initiatives might also benefit aerOS because it would make the project more widely known to other key players.

MADE

MADE is one of the 8 Italian Competence Centers, selected by the Italian Ministry of Economic Development, acknowledged as Digital Innovation Hub by European Union. MADE provides a set of knowledge, methods, technical and managerial skills on digital technologies to support companies in their digital transformation towards Industry 4.0. On the other hand, thanks to the large demo-center of over 2000 m², it provides an I4.0 – based pilot production facility for pioneering test, demonstration, and development project realization.

MADE mission is to lead companies digital and sustainable transformation, leading a complete industry migration towards digital transformation by i) informing and showing Industry 4.0 technologies, ii) explaining them by specific training activities, and then iii) transferring and implementing technological solutions through projects (Test Before Invest). MADE is therefore proposed as a technical interlocutor to which companies can

turn not only to manage activities of innovation, technology transfer, applied research and assistance during the implementation of 4.0 technologies, but also to receive a suitable support to reconsider their organizational and business models. Finally MADE is a public-private consortium composed of more than 51 partners clustered in: 4 Universities, 2 research facilities, 43 Manufacturing Companies including software technology providers and one public entity.

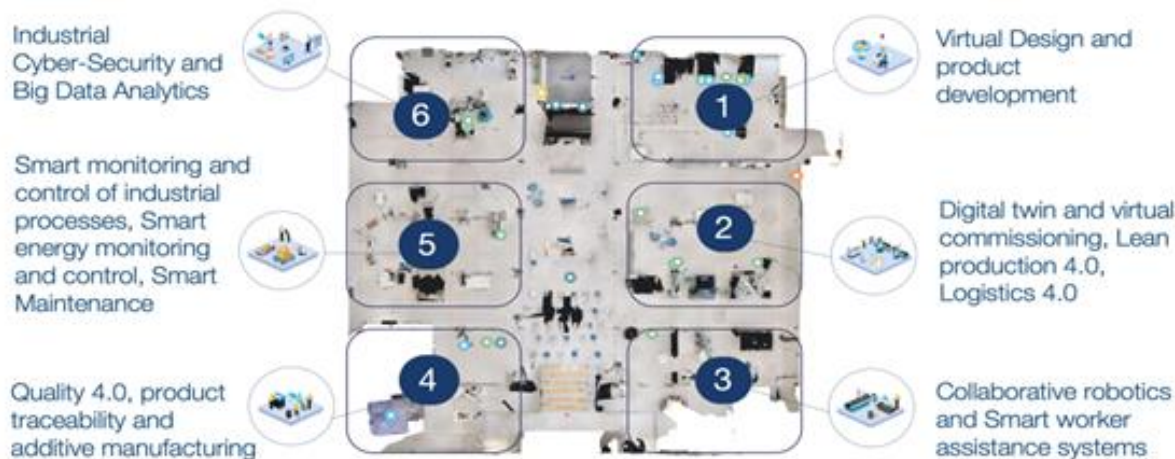


Figure 39. Area 2 digital simulation

Namely MADE testing facilities is composed by 25 technology use cases and 6 manufacturing technology scenarios simulating the integration of digital technologies in a complete manufacturing production process cycle. The second area is reserved for digital twins, lean production, and logistics 4.0 is a small compact plant, where the production of mechanical valves for the oil & gas industry is simulated, in a production chain. The area exploits, in a real production line, the advantages deriving from the use of digital tools such as Industrial IoT, Cloud, Data Analytics, Collaborative Robotics, Virtual Commissioning, Product and Process Digital Twin. The area includes robotics and mechatronics components, a transport line, AGVs for intralogistics, a machine tool and a station where individual components are assembled manually. The entire process is replicated in this area, where mechatronic processes and logistics can also be remodelled using the plant's virtual commissioning solutions. Materials are moved within the plant using logistics 4.0 and the product's progress can be traced in real time. A fleet of AGVs from different manufacturers is used to demonstrate various integrated single operator setups. An innovative indoor navigation system combined with a positioning system based on BLE beacons can be used to replan trajectories and identify the component used in the demonstration.

aerOS platform will improve the current status of the technological area introducing: (i) a more distributed (towards the edge-layers) computing power architecture that will enable real-time computing and permit to avoid transmission of huge amount of data to the cloud; (ii) introducing a Decentralized intelligence by Frugal AI/ML system that will contribute to increase network and orchestration efficiency; (iii) enable data interoperability and standardization for data coming from different third-party components and (iv) introducing ease of use and implementation of these applications by ad-hoc APIs that enable flexibility, scalability and versatility of the whole solution.

aerOS demonstration will allow MADE testing facilities to:

- Enable new technology scenarios and use case linked to IoT edge-cloud technology scenarios and data management,
- Demonstrate easy configuration of advanced networking and computing orchestration in the edge-cloud continuum,
- Demonstrate network and energy consumption efficiency concepts that industry 4.0 new technologies introduce,
- Update learning environment and infrastructure to nurture future teaching factory initiatives,

- Generate new knowledge to be transferred to MADE partners and ecosystem,
- Connect with European, national and international partner of Edge to Cloud innovation ecosystem. In addition, MADE will exploit aerOS knowledge within EDIH service portfolio and connect with the EDIH Manufacturing Network and AI Testing Facilities.

Expected exploitable routes leverages MADE mission pillars that are:

- Awareness Raising, showing aerOS solution in webinars, guided tours and demonstration event organized with end users,
- Education, defining new teaching factory courses,
- Test Before Invest, enhancing the renewed scenarios in future R&D project at regional, national, European level; generate new advisory services related to Edge to Cloud Continuum; develop new pilot services exploiting gained aerOS dataset.

5.2.2.3. Digital Technology Providers

TTControl (TTC)

With the trend towards intelligent and automated farming or, in general, with the trend of (semi) autonomous mobile machinery operation, safe and secure computing HW/SW platforms for connected and cooperative mobile machinery (e.g. for farming, construction and forestry) are a necessary precondition. There is a significant interest for such systems claimed from agricultural OEMs such as John Deere being a partner in the project, or others (potential) customers of TTControl. TTControl aims at developing a safe and secure high-performance platform, including e.g. a main control module for safe operation, gateway module, or a local HMI with corresponding external infrastructure. This will close essential gaps in the high potential area of smart farming, construction machinery domain, with huge market potential. Moreover, replicating the same platform in several vehicles will allow for autonomous operation of an electric vehicle driver-less fleet, which has in turn, potential to reduce the CO2 footprint. In addition to that, precision farming technologies offer a pathway to reduce resources, increasing yields and quality of produced goods on one side, and by means of the digitalized approaches integrated control of machines involved in production or construction process can be realized. All this will be supported by the proposed by TTControl solution for more autonomy in a field or at a construction side.

The aerOS project greatly supports the mentioned development activities and is an important step for TTControl to approach relevant markets during the project duration and beyond, leveraging project results for commercial exploitation in the future. As done with other developments of TTTech Group, in a longer term the results shall be applied to other industrial sectors as well. Utilizing the results and transferring them to other additional areas will allow TTControl to grow and establish extended product line(s). TTControl will add the expected project outcome, as from other R&D projects to the company product portfolio using the same business model when the technology has been productized.

To conclude, as a key off-highway product supplier, TTControl can meet safe and secure computing platform requirements for autonomous operation. With this, TTControl plans, in general, to increase its turnover and support as well as generate highly qualified, long-term positions in Vienna, Austria. In the long term, TTControl will potentially offer a new product line addressing (partially) automated driving and operation for mobile machinery to stay competitive in the next 5 to 10 years. Furthermore, including the TTControl's technology the Tier1 suppliers and OEMs will be able to offer performant and cost-efficient products on the leading edge of technology and improve their competitiveness.

ERICSSON

Extending the exploitation plan described in D6.1, Ericsson is leveraging the knowledge and experience working with partners from several backgrounds with different network management challenges. In 2023

Ericsson sold the Ericsson IoT Accelerator, a management platform for IoT networks. However, this does not represent a diminished role of IoT in modern networks. IoT continues to be an expanding use case as shown by the variety and applicability of each aerOS pilot. These unique challenges and the development of solutions drive growth and new thinking in our research and innovation departments. These also increase our exposure to Far-Edge and Edge-Cloud domains which may allow Ericsson to better meet the requirements of existing and future customers.

The development of pre-packaged analytical functions as part of the Embedded Analytics Tool has fostered a new round of powerful lightweight serverless analytics which plan to be leveraged through future publications. The abstraction of analytical function interfaces has created a new focus on generalised models for common Machine Learning operations such as Anomaly Detection and the reliability of models working with dynamic data sets/sources. Introducing more flexibility into these models and allowing them to be more robust has started discussions around our model development approaches and internal “Best Practises”.

aerOS will continue to provide Ericsson with an opportunity to foster the growth of its research and innovation departments focused on IoT edge-cloud continuum. The dissemination of knowledge and experience with respect to the aerOS project will continue internally through presentations with fellow researchers and managers, introducing new perspectives through the analysis and adaptation of our processes and approaches in development and finally communicating our experiences from working with external companies with product leaders who engage directly with customers.

SIEMENS

Siemens, being the largest industrial manufacturing conglomerate in Europe, is involved in the development and application of innovative technologies for many areas, mainly industry, infrastructure, transport, and healthcare. Siemens creates solutions that add real value to the diverse customers and verticals that those areas represent. Often, those solutions involve services provided by distributed digital infrastructure elements, such as edge computers, controllers, sensors, actuators, or cloud-based applications. For that reason, novel solutions for the cloud-edge continuum as the ones developed by the aerOS project constitute a well of exploitation potential for Siemens’ activities.

Siemens has positioned itself as a leading Industrial Internet of Things (IIoT) vendor with its Siemens Industrial Edge Platform. The Siemens Industrial Edge Platform provides a ready-to-use edge computing platform for the industry. It enables companies using this platform to optimize their workflows, save resources and improve quality by gathering, structuring, and using a wide range of data from machines, IT systems, the cloud, and other resources. By evaluating quality parameters in real time, companies can respond to deviations immediately. In the context of the aerOS project, Siemens focuses on integrating its Industrial Edge Platform as one of the execution environments of aerOS.

Additionally, aerOS highlights the combination of various branch-independent use cases. Due to the setting of an industrial platform, it is also possible for other providers to integrate their solutions effortlessly for industrial customers.

Another interesting offer in Siemens’ portfolio is Mindsphere, a cloud infrastructure perfectly adapted to the needs of industrial environments, for example in terms of cybersecurity. By the combination of the Mendix, Mindsphere, and the Industrial Edge Platform, Siemens offers the whole state-of-the-art IT-infrastructure from edge to cloud and easy and flexible no-code/low-code user interface design. Using this infrastructure in the context of the aerOS project, Siemens evaluates approaches to overcome the classical three-layered approaches of cloud, edge, and IoT, to transition to a seamless cloud-edge continuum. That will make it easier than ever to design, implement and orchestrate complex use-case fulfilling all requirements of industrial domains, such as cybersecurity and reliability by default. In short, Siemens aims to tackle the challenge of industrial machine learning operations to enable the standardization of machine learning offerings ultimately utilizing the strengths of cloud, edge and IIoT environments joint seamlessly.

As showcased by its product portfolio, Siemens recognizes Industry 4.0, the smart factory, and the IIoT as the future of industrial manufacturing. However, the right communication frameworks should be used to achieve such goals of flexible production plants and intralogistics. It is in that regard where the 5G broadband cellular

networks and deterministic communication standards, such as TSN, open important new prospects for the company and its customers.

The performance of the infrastructure elements (devices or software applications) is key for an efficient deployment of 5G networks, especially in industrial and other mission-critical applications. For that reason, Siemens develops ultra-reliable communication elements such as the SCALANCE Industrial 5G routers. However, these solutions require higher layer communication technologies and services that leverage the potential of 5G deployments, gap that can be filled in many verticals by the aerOS meta operating system.

One of the goals of aerOS is TSN compliance. That aligns with Siemens' Time Sensitive Networking solutions, that aim to open new perspectives for highly agile and available communication for established industrial communication protocols, such as PROFINET or OPC UA.

Lastly, in the context of the aerOS project, Siemens also explores solutions for service and resource orchestration with the focus on resource and energy consumption optimization. This topic is especially relevant in the edge and far edge environment which is provided by the pilots of aerOS project. Originally, optimization problems were solved by Mixed Integer Linear Programming which is resource and time consuming. With the aerOS project, Siemens evaluates more efficient methods e.g., Deep Reinforcement Learning as orchestration approach.

5.2.2.4. End-Users-Stakeholders

ECTL

EUROGATE Container Terminal Limassol Ltd (ECTL) is part of the EUROGATE Group recognized as Europe's leading line-independent container terminal operator. The terminal is the island of Cyprus' main gateway to global trade, handling over 90% of containerized gateway cargo to the country. Since taking over the operations of the terminal the Company have invested heavily in modernizing the equipment and Operating Systems utilized in day-to-day operations.

The terminal's core operations are already digitized in a central Terminal Operating System (TOS), that aggregates data in real time from many different sources including vessel agent input, data from port authorities, customs and machinery operators or port workers, using field devices. The transfer of data is immediate to all relevant authorities upon confirmation resulting in reduced time for a container becoming available for pick-up.

Being a member of the EUROGATE Group currently operating twelve terminals in the wider European / Mediterranean region (so far), EUROGATE Limassol benefits from the growing focus in the Group for developing digital & automated solutions for automating terminal operations. (Twin Sim, T.I.C 4.0) Through these synergies the potential is amplified as technologies developed in one Terminal, could be transferred to the entire Group network.

ECTL participation in aerOS is considered an important step further testing & developing automated digital solutions in the terminal's operating procedures. The end focus is demonstrating to our valued customers the potential for enhanced quality of container handling services becoming possible through the growing digitization and the Company's willingness to modernize.

Even though port machinery are usually equipped with digital PLCs (programmable logic controllers), the data produced by the machinery is isolated on the machinery itself and only accessible on-site. Through the automated data collection and analysis through IoT devices and machine learning technologies, we expect that quality of service is elevated through higher operational efficiency. Specifically, if reduced machinery downtimes aimed through use case 1 (predictive maintenance) is expected to reduce the time a customer's ship spends in terminal thus minimizing their costs and making ECTL more competitive in the East Med region.

Container Terminals worldwide are already deploying propriety solutions utilizing optical character recognition and object detection to identify containers, cargo damages or container seals. aerOS will assist in providing a framework to deploy ML/AI models by utilizing a non-propriety an open infrastructure, allowing the faster deployment of ML/AI models or smart solutions. This is anticipated to automate container checks at the quay thus minimizing errors associated with manual checks and disputes with the customers.

The success in the deployment of the above aerOS enabled solutions within the EUROGATE Limassol operations, can result optimization of operation that ECTL can exploit going forward by promoting to its potential customers:

- The increase safety performance by automating high-hazard tasks (such as checking of the container seal) and removing the human factor from a high-risk area,
- The increase in the productivity of the port operations by eliminating the time required for manually checking containers for possible damages,
- The reduced downtime and increased maintenance efficiency through remote-diagnostics of port machinery that allow the deployment of ML predictive maintenance models. Higher machine utilization due to lower downtime is anticipated to increase productivity with all associated benefits to ECTL's customers,
- Promote a unified approach and technology stack for the collection of IoT data, throughout the Eurogate group, based on the experience gained through aerOS. This could reduce development costs, enhance security of IT infrastructure and enable further similar projects for optimizing operating processes,
- Provide immediate and 100% reliable information to cargo-owners, shipping lines or other interested parties of the condition of their cargo (via connection of the TOS and the aerOS stack),
- Eradicate errors associated with manual checks and any associated customer complaints thus avoiding customer service dissatisfaction and deterioration in service quality,
- Emphasize to existing and potential new customers ECTL's willingness to move along with the changing times and provide the best container handling services it can offer to them through implementation of automated & digitalized solutions,
- The results from the aerOS participation will also be promoted to the local economy through ECTL's social network accounts to demonstrate the improvements achieved in the operation of a critical country infrastructure.

John Deere (JD)

The flexible architecture of aerOS serves as a focal point for the development and delivery of a comprehensive range of AI and communication solutions for end users (such as construction companies and farmers), as well as regional partners including dealers, farming contractors, and machinery rings. Additionally, aerOS's flexible architecture offers a starting point for directly interconnecting core process systems like primary food production or road construction with preceding and succeeding processes throughout the entire value chain. aerOS will also act as the foundation for integrated closed-loop control of mobile machinery across multiple sectors, encompassing farming, road construction, and forestry.

With John Deere's strong presence in the EU region, along with collaboration from other industrial and research partners, significant benefits for the EU economy and research landscape can be anticipated. Potential product and service innovations will stem from the project's results, leading to the creation of joint ventures that identify cross-manufacturer or cross-supplier cloud connections of sensor technology, machine systems, and third-party applications with high market and customer value potential. Consequently, the results mark the first step towards bringing products and services to market maturity through several subsequent phases. Implementing robust sensor technology and communication networks to support autonomous smart applications of mobile machines offers a promising approach. Fundamentally, all results and developed software and hardware components can be applied across various sectors, with John Deere farming, construction (Wirtgen Group), and forestry (John Deere Forestry) showing significant promise.

Regarding agriculture, the market potential is as follows:

In many EU countries, the number of farms will decrease by about half over the next 20 years, leading to a continuous growth in the number and acreage of large farms. Besides farms, contractors, service providers, machinery rings, and others operate on agricultural land, facing challenges to produce effectively and in an environmentally friendly manner due to national and international competition and legal frameworks.

IT-based solutions will be essential for the demand-oriented supply of small sub-areas or individual plants, considering various environmental factors. Assuming the solutions developed using aerOS with their application for agriculture over several vegetation periods demonstrate significant improvements in efficiency, robustness, and practicality compared to existing processes, an increase in demand can be expected.

The anticipated improvements will provide project partners with a solid foundation for transferring potential developments into marketable products. For instance, John Deere has for some time been pursuing an approach of integrating various players, such as software companies, sensor manufacturers, or agricultural management system providers, into its Operations Center or software systems while maintaining its own data sovereignty. Many sensor manufacturers can already be incorporated into the system through partnering models and defined interfaces in a flexible and customer-specific manner. Successful and timely project results can be integrated into this framework and distributed to farmers via existing (not only John Deere internal) sales and dealer networks, ensuring rapid implementation.

Beyond the EU, countries such as Brazil or Canada, with large areas, low population density, and farm sizes often exceeding 10,000 hectares, are particularly relevant as potential application areas. Market potential in commercial horticulture and forestry is also high, as the sustainability and efficiency of cultivation rely on optimizing numerous influencing factors in conjunction with manual and technical resource management.

Economically, the widespread adoption of the project's results is expected to enhance farm competitiveness and significantly improve agriculture's ecological balance.

From John Deere's perspective, the following exploitation intentions underlie the project:

- Safety concepts for (partially) autonomous driving applications,
- (Edge-)cloud integration of own, as well as third-party, systems,
- Demonstrate software-as-a-service offerings and business models,
- Machine integration and networked machine interaction.

CloudFerro (CF)

CloudFerro, as a European cloud provider and an SME intends to capitalize on aerOS' positive effects in two aspects: i) obtained knowledge, expertise and experience during the project execution and ii) developed flexible metaOS architecture for building cloud-edge systems.

Firstly, most of the technologies and services operated by CloudFerro are open source based. With disparity in contributions to major open-source projects between European and global industry (major open software projects usually originate from US), it is difficult to find and build competence locally. Work planned in the aerOS project – thanks to its innovative and ambitious nature outlined in the proposal – will greatly enhance CloudFerro's team knowledge regarding designing and development of distributed systems. This progress does not rely solely on the scope of the project. There are significant positive spillovers. For an SME, positive results of working with industry leaders (such as John Deere, Siemens or Ericsson) cannot be overlooked. Without the framework of the project, establishing such relations would be extremely unlikely. Similarly, direct access to and close collaboration with established research institutions will enable transfer of knowledge.

However, overcoming market failures and expanding expertise is not the primary goal for the company. Considering the latest trends in the cloud industry, AerOS architecture can enable CloudFerro to build sophisticated cloud-edge and multi-site (over multiple traditional clouds) systems. Without the project, pursuing flexible, infrastructure-agnostic solutions would be too expensive.

CloudFerro currently operates several traditional public clouds in separate locations and couple of big Earth Observation data repositories. However, its capability to consciously manage computing and data storage across multiple sites is limited to establishing static replication or routing policies. And changing those manually. aerOS modules can be used by the company to automatically distribute workload between multiple traditional clouds in resource- and self-conscious way, or between traditional clouds and edge locations. Something that CloudFerro is actively pursuing.

Crucially, aerOS objectives are in-line with the goals of the biggest CloudFerro's R&D project: GEP (Green Edge Processing). It's a multi-year development program aiming to move computing resources to energy sources. It will distribute computing resources geographically, to locate it directly at renewable energy, with a direct connection to the source (wind or PV farm). The company's goal is to create a sustainable, non-emissive and cheap pool of resources for its Earth Observation data processing. Integrating aerOS with it brings a new source of workload and users. Because AerOS can distribute workload directly to a location, without intervention from GEP central mechanism, it offers more flexibility and independence to separate locations. Thus, it makes the resource utilization more efficient and cost-effective. Direct results of the project planned by CloudFerro are:

- Connecting two renewable energy locations with aerOS,
- Connecting one traditional cloud with aerOS.

Additionally, CloudFerro intends to present its work within the scope of the project:

- At least in 3 European conferences,
- CloudFerro's social media.

ELECT

Electrum is an APC - Alternative Power Creator offering creative engineering solutions at every stage of the investment for the renewable energy sector. We carry out projects along the entire value chain and throughout the life cycle of the project and assets: Development – EPCM – Asset Management & ESCO – Reinvestment & Repowering.

The aerOS project's exploitable outcome for Electrum are two test field locations where the implementation of the IoT-Edge-Cloud meta-operating system is to be deployed and tested across Fog Computing domain, with Electrum's software runtimes installed on-premises at PV and/or Wind power generating installations. The system's architecture assures secure initial data processing on-premises running on Industrial AI Edge Computers as well as Cloud High Performance Computing operations in the distributed container-based datacenters.

The result type of the outcome is a demonstrator (Outcome Category - Research Achievement), where the power management system EMACS and the Virtual Power Plant microservice component designed by Electrum for the distributed IoT-Edge-Cloud deployment, can be tested, validated and certified. The demonstrator will allow autonomous management of the power balance between grid connection and local renewable energy generation capacity across two or more power generating locations integrated for system tests.

The aerOS objectives are in-line with the goals of a major internal R&D project at Electrum - the development of the Virtual Power Plant Solution. The VPP solution was designed to manage the distributed energy mix with the highest possible economical and energy efficiency. Based on microservices and supported by Machine Learning Operations, the VPP solution is a completed software + hardware package delivered as Infrastructure as a Service and / or Software as a Service, offering ultimate data security and new autonomous features highly increasing the efficiency of the renewable energy mix. The platform architecture features data integration across Micro Edge - Far Edge IoT devices, Edge AI Computing and distributed Cloud / HPC data centers, providing virtually unlimited scalability. The Customer Segment that will benefit from the project outcome is reaching all energy market participants, including:

- Independent Power Producers,
- Distribution Network Operators,
- Power Producers, Consumers and Prosumers,
- Operating & Maintenance firms,
- Banks, Insurers, Crypto-Fiat Exchange,
- Energy Storage Systems operators,
- Infrastructure equipment manufacturers.

Additionally, Electrum will capitalise on the knowledge, expertise and experience gained via other achievements of the project outcome, such as legal and regulatory analysis of the data centers located on Distributed Energy Resource locations.

The direct result of the Electrum’s involvement in the project is development and test deployment of the microservice providing green energy availability schedule and price predictions to aerOS Orchestrator.

Electrum intends to present its work within the scope of the project:

- At least 1 white paper,
- At least 3 European conferences,
- 3 press releases published across social media.

5.2.2.5. Academic and Research Partners

UPV

UPV as Project Coordinator aims at enlarging its portfolio of successful projects and expects to make an impact in four technical areas related with the project goals. The research group will be supported by previous research and innovation actions led or with its participation. First, and the most prominent, UPV is expected to position aerOS results among the main contributions in the definition of the IoT-edge-cloud computing continuum architecture and principles. Second, it is expected to integrate and customise (to some extent) the capabilities of smart networking and self-* capabilities in the edge computing field (taking advantage of virtualisation and software-definition, besides the utilisation of modern orchestration technologies such as KubeEdge and lightweight distributions of K8s). Third, UPV aims to gain huge experience in the federation of AI/ML services among heterogeneous nodes, in the cloud continuum, from the device till the cloud going through the edge and far edge nodes. Four, UPV expects to enlarge the test base of fruitful integration of distributed computing technologies in different verticals with special focus in transportation and logistics, energy, and Industry 4.0.

From an exploitation perspective, it must be considered that UPV is a public and dynamic academic institution. Therefore, it can be realised that the “business” issues that can be solved (needs that can be met) by the execution of aerOS are (i) enhancing the knowledge of specific technological fields developed in the project, (ii) gaining expertise and know-how with regards to actual deployments of technologies, (iii) augmenting the volume of the research team and consolidating that number, (iv) exploring new research lines and (v) envisioning potential continuation of the research through market-oriented actions (like technology transfer, consulting actions, start-ups or spin-offs creation). Considering this context, aerOS will allow UPV research team to:

- A. Improve research indicators of research team (Project Coordinator and researchers) due to scientific contributions to the community,
- B. Enhance and excel the current knowledge on the established fields of edge computing, CI/CD, orchestration, IoT, interoperability, self-* capabilities of heterogeneous computing nodes, machine learning, data science, distributed real-time systems and global communications and networking,
- C. Consolidate the knowledge gained during the last few years about Tactile Internet, Data sovereignty, computing fabric, Big Data, DLT and 5G technologies,
- D. Reinforce the orientation of the group towards practical application of the orchestration of the continuum and other technologies (aerOS is pilot-oriented and human-centric by design), through technology transfer actions,
- E. Keep a stable team of 4/5 researchers devoted to aerOS throughout the project duration,
- F. Establish a new research line of the group: self-* capabilities of federated computing nodes as part of the continuum,
- G. Tighten the gap with the market via exploring the creation of associated spin-offs out of the results of the participation in aerOS, including potential patenting and OSS initiatives contribution,
- H. Leverage the participation in aerOS for granting industrial contracts (tech-transfer or consulting activities), or, at least, put the group in a better position for endorsing this line of work.

Apart from the operative exploitation exposed above, other relevant results that will help UPV to improve its presence and impact in the field would be the following:

- At least 2 PhD theses will be conducted under the scope of aerOS,
- Attendance to multiple scientific conferences,
- Presentation of multiple scientific papers in journals and conferences focused various technological domains,
- Lecture at the university about the project and its most relevant findings,
- Organisation of conferences and seminars within the University (including posters).

Among the already identified exploitable results of UPV in aerOS are:

- aerOS Federator,
- Continuum-IOTA-message-management,
- Self-scaling,
- Self-monitoring-and-orchestration-suite,
- SmartWorkloadAllocation-AI-Algorithm.

Other results are still in observation and will be reported in the next deliverable of the WP.

NCSR D

Participation in aerOS, as Technical Coordinator of the project, is seen by NCSR DEMOKRITOS (NCSR D) as a direct step toward establishing a strong research and scientific position in the field of future network architectures and cloud systems. Based on the experience gained by aerOS trials, NCSR D will gain experience and expertise in novel cloud continuum infrastructures and related technologies, leading to the development of an automated federated framework for continuum orchestration on top of cloud infrastructures. Such tools that will be developed by NCSR D within aerOS are planned to be further exploited as services offered by NCSR D to external SMEs in the framework of the digital innovation hub Ahedd (<https://ahedd.demokritos.gr/>) that operates within NCSR D premises. Furthermore, NCSR D is home to the "Lefkipos" Technical Park, which houses many private companies and startups in the fields of IT and telecommunications, where the results of aerOS will be promoted, looking for possible synergies and joint ventures.

NCSR D participates as lead contributor in the development of the AI system of the Pilot 5 "Energy Efficient, Health Safe & Sustainable Smart Buildings". The development of new AI algorithms is going to enhance NCSR D's capacity and expertise in Artificial Intelligence. A wide range of algorithms are going to be developed that will later be used for further research purposes and potentially lead to new scientific publications in the sector of IoT.

Moreover, NCSR D foresees further exploitation opportunities of the expertise gained in 5G and cloud continuum by the signed partnership agreement with 5G Ventures Société Anonyme ("5G Ventures SA") that has been established pursuant to Article 93 of Law n. 4727/2020 (Government Gazette A' 184) and is a direct subsidiary of the Hellenic Corporation of Assets and Participations (HCAP SA). The purpose of the 5G Ventures SA is the establishment and management of Phaistos Investment Fund, based on the provisions of Article 7 of Law n. 2992/2002 (Government Gazette A' 54), according to prevailing market conditions, with guarantees for full transparency and accountability and complying with International Financial Reporting Standards (IFRS). The objective of the Phaistos Investment Fund is the public investment in businesses that are actively involved in 5G-related research and/or development of products and/or services in Greece, in sectors such as transport and logistics, manufacturing, public goods and utilities, health, tourism, information and media. As a result, NCSR D by exploiting the AEROS Platform through this collaboration will be able to support the development of services and products for the cloud continuum and 5G ecosystem.

Finally, NCSR plans to exploit further the Cloud Continuum/5G expertise by innovation activities related to entrepreneurship and for this reason has proceeded to a collaboration agreement with the Municipality of Egaleo, and more specifically with the Entrepreneurship hub (<https://hub.egaleo.gr/>) for fostering further the development of innovative products and services related to 5G and Cloud Continuum by startups and young teams that are willing to get involved in the field.

SRIPAS

Participation of SRIPAS in the aerOS project will enlarge its portfolio of international projects and will allow to gain new and advance existing experience in the project's technical areas, e.g. semantic data processing and data homogenisation, autonomous systems, ML/AI and distributed AI (including ML/AI at the edge and federated learning). As a result, SRIPAS's standings and ranking in the academic area will be increased and a stronger scientific position around Next Generation IoT will be established.

SRIPAS research group dedicated to Next Generation IoT technologies, as a result of this project, will advance its research portfolio and toolset library. Specifically, its members will: (i) improve their knowledge of specific research and technological fields related to the project, (ii) improve research indicators for team members, as a result of new publications, (iii) possibly extend the research team, (iv) explore new research areas and potential of participation in new project initiatives (funded by the EC, or nationally) and/or market-oriented actions, (v) build collaboration with the industry.

Since SRIPAS is a research institution, it will be intensively involved in dissemination activities including:

- Master's and PhD theses pursued within the scope of aerOS,
- Preparation of scientific publications and conference attendance,
- Communication at the Institute and within its network of contacts, about the project and its most relevant findings,
- Possible participation in tech-transfer and consulting activities based on gained knowledge.

Having aerOS in the project portfolio will enable SRIPAS to attract new PhD students, and young researchers, interested in up-to-date innovative research and working on topics with practical applicability in real life pilot use cases.

CUT

CUT is a relatively new but vibrant public university in Cyprus with several schools and state-of-the-art research laboratories. As a partner of aerOS, CUT mainly contributes to the project by participating in the use case "Smart Edge Services for the Port Continuum". The team from CUT brings to aerOS previous experience with successful projects related to the maritime sector (e.g., STM, STEAM, MARI-Sense, etc.) and innovative research capacity. The CUT team is primarily responsible for the Logistics/ Port Pilot deployment and validation in the EUROGATE Container Terminal (EGCTL), Port of Limassol together with Prodevelop, Spain. The researchers from CUT aim to facilitate the digitalization of the container terminal, as well as develop machine learning models for predictive maintenance of quay cranes/straddle carriers and computer vision applications (e.g., detect container damage, distinguish sealed from non-sealed containers).

In terms of exploitation, CUT plans to exploit the results of aerOS in the following ways:

- Deepening of knowledge of current state-of-the-art technologies together with the developed tools and methods, and the highly theoretical and dense results from desk and field research conducted by the partners of the aerOS project,
- Applying the developed methods in different use cases related to the maritime industry,
- Establishing new collaborations with different stakeholders and partners, e.g., from the maritime industry, especially Port of Limassol, EGCTL, and Prodevelop,

- Updating relevant courses taught on all levels with aerOS-related material.
- Pursuing of PhD and master's theses within the scope of aerOS,
- Developing of new ideas for future research based on the outcomes of the aerOS project,
- Disseminating the results in national/international workshops/conferences and journals,
- Organizing seminars/webinars for academia and end users to enhance the impact of aerOS.

In addition, CUT plans to further exploit the results of aerOS by:

- Leveraging the findings and outcomes of the aerOS project to make a significant impact within the scientific community, and at the same time, disseminating the knowledge gained to enhance the understanding of cutting-edge technologies and practices related to Port activities, i.e., damage/fault prediction, fostering collaboration and information exchange,
- Capitalizing on the expertise acquired through the research activities of existing marine related projects in which CUT is actively involved, e.g., MDigi-I, and applying the knowledge and insights gained to further enhance and promote the outcomes of the aerOS project, creating synergies between different research initiatives,
- Exploring possible avenues where the aerOS project's outcomes can be applied, opening new opportunities for ground-breaking research and development, thus ensuring that CUT remains at the forefront of technological advancements in this area,
- Collaborating with industry partners, including the Port of Limassol, EGCTL, and Prodevelop, to design and implement specialized training programs, tailored to address the specific needs of the maritime industry, providing professionals with hands-on experience and knowledge transfer from the aerOS project.

POLIMI

The participation in aerOS means a valuable achievement for POLIMI in terms of constitution of a web of knowledge. Despite the topics of software architectures for far-edge systems are already in the technical background of the university, the involvement of the department of Management, Economics and Industrial engineering is aimed at constituting a body of knowledge for the deployment aspects and the effective results of an implementation of these technologies. The innovative aspect of this research makes also the topics addressed as particularly valuable in terms of sharing of knowledge and following from a close point of view the manufacturing application will give POLIMI the opportunity to publish scientific papers about manufacturing acceptance of these technologies as well as to increase the testbed pool to measure the most effective roadmaps for industrial digitalization.

Furthermore, the methodologies eventually developed to deploy aerOS solution in the manufacturing domain will be embodied by POLIMI and will be spread through its spinoff MIRAITEK in the context of Small and Medium Enterprises, which constitute the backbone of European manufacturing and usually are left behind in the digitalization journey.

Finally, the importance for aerOS in terms of academic perspective is not to be underestimated. It is highlighted the possibility to leverage on the expertise gained during the duration of the project to give students a new point of view on the modern challenges of manufacturing. The exploratory nature of the project in terms of acceptance of technology in manufacturing domain is already being included in PhD research and the effort scheduled on POLIMI's side has already led POLIMI to open the first of a series of research positions.

5.3. Business analysis

5.3.1. Business analysis roadmap

Business analysis tools are essential resources for organizations as they facilitate the methodical collect, processing, and examination of data to aid in well-informed decision-making, optimize processes, and

streamline operations. These tools enable professionals such as business analysts and data analysts to derive valuable insights from a wide range of data sources, thereby promoting the implementation of data-driven strategies and proactive resolution of problems. Through the consolidation of data and provision of diverse analytical methodologies, these tools facilitate the recognition of patterns, the reduction of hazards, and the enhancement of interdisciplinary cooperation, thereby ultimately bolstering the competitive edge and long-term viability of an organization.

A systematic data collection procedure has been initiated during this phase by means of questionnaire distribution to all project partners. The principal aim is to amass exhaustive data regarding the assets of each collaborator, including a comprehensive examination of intellectual property rights, technological advancements, innovations, and other relevant components associated with the project. Furthermore, the questionnaires have been strategically crafted to extract preliminary insights regarding the business prospects of every partner, thereby illuminating their respective capabilities, strengths, and strategic advantages in relation to the undertaking. By employing this methodical strategy for gathering data, we establish a fundamental basis for comprehending the varied resources and possibilities present in the collaborative network. These insights are crucial in shaping the subsequent stages of the undertaking. Through active participation of all collaborators in this process of sharing data, the project guarantees a comprehensive and all-encompassing viewpoint, promotes cooperation, and optimizes the application of combined expertise and capacities to achieve the greatest possible outcome for the undertaking.

During the subsequent stage of our endeavor, we will utilize a sequence of exhaustive questionnaires with the purpose of collecting detailed information. The purpose of these questionnaires is to conduct an in-depth investigation into multiple facets, guaranteeing a comprehensive examination that will produce valuable outcomes. The information gathered during this stage will be of paramount importance in our subsequent business analysis. The objective is to extricate insightful information that can contribute to the overall success of the project and inform strategic decision-making. A thorough examination will be conducted on the gathered data to detect patterns, trends, and critical determinants that may influence the trajectory of the aerOS initiative. Moreover, in addition to aiding in the refinement of our business strategies, the obtained results will provide an exhaustive synopsis of the advancements implemented via the aerOS project. This comprehensive understanding will be crucial in formulating successful strategies for commercialization. Our objective is to maximize the commercial viability of the aerOS project by corresponding our approaches to the knowledge acquired from the questionnaires.

5.3.2. Business analysis tools

The business analysis for the aerOS project will be performed utilizing a curated collection of tools that have been specifically designed to efficiently extract, process, and interpret the gathered data. The subsequent instruments will be crucial in guaranteeing a thorough and perceptive analysis:

SWOT Analysis:

Organizations may employ a SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis to assess their internal strengths and vulnerabilities in addition to external opportunities and threats. The process encompasses an assessment of the organization's strengths and weaknesses relative to its competitors, in addition to an examination of external factors that may impact the organization's performance. After acquiring this knowledge, tactics are formulated to address deficiencies, capitalize on advantages, exploit favourable circumstances, and mitigate risks [10].

Other operational areas, including human resources, marketing, operations, and economics, can influence the strengths and weaknesses of a business. External variables such as new regulations, changes in consumer behaviour, market or industry developments, and others, have the potential to generate both favourable circumstances and difficult circumstances.

An organization can enhance its comprehension of its internal and external environments through the implementation of a SWOT analysis. The organization can then utilize this information to determine its subsequent course of action. The research can be employed to identify opportunities for expansion and areas that require development within the organization. Utilizing a SWOT analysis is imperative for an organization to thrive in the contemporary business landscape and sustain its competitive edge.

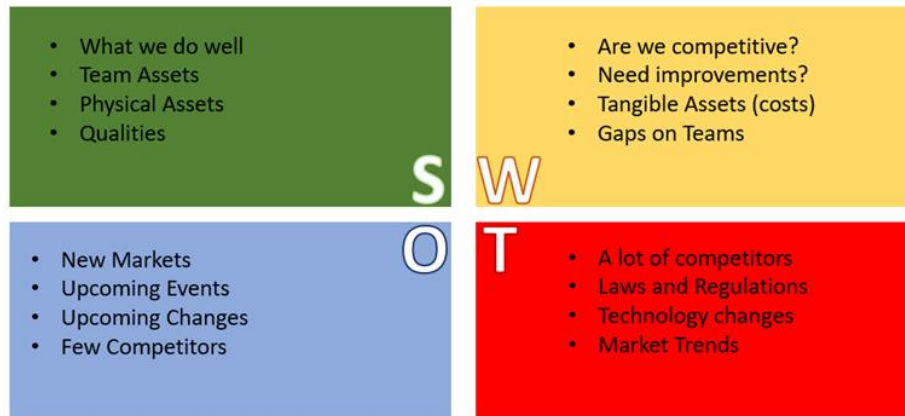


Figure 39. SWOT analysis

Lean Model Canvas

The lean model canvas is a graphical representation of all critical strategic factors that facilitates a basic, structured understanding of a business model. The critical activities and challenges associated with the identified initiative, along with the interrelation among the constituent elements, are delineated in the LEAN model canvas. Like the external factors of the SWOT analysis, the customer or market is the focal point of the right side of the canvas, whereas the business is the subject of the left side. The value proposition, which symbolizes the exchange of value between a business and its consumers, is positioned in the middle [11].

Table 22. Lean model canvas

KER: #				
Problem	Solution	Unique value Proposition	Unfair Advantage	Customer Segments
List the top 3 Problems Existing Alternative How these problems Are solved today	Outline a possible solution for each problem	Single, clear, compelling message that states why you are different and worth paying attention	Something that can't be easily copied or bought	Target customers
	Key Metrics		Channels	Early Adopters List of ideal customers
	List the key numbers that tells you how your innovation is doing		Path to customers	
Cost Structure		Revenue Streams		
Customer Acquisition Costs, Distribution Costs, Hosting People etc.		Revenue Model, Lifetime Value, Revenue, Gross Margin		

Porter’s Five Forces Framework

Michael Porter, a professor of strategy, developed the Five Forces Framework, which enables an organization to conduct an exhaustive analysis of its competitors and every hazard that could affect its profitability in any market.

Table 23. Porter’s five forces framework

Force	Remarks	Input
Competitive Rivalry.	<ul style="list-style-type: none"> • Number and strength of identified competitors. • How many rivals do you have? • Who are they, and how does the quality of their products and services compare with yours? 	
Supplier Power.	<ul style="list-style-type: none"> • How easy it is for your suppliers to increase their prices? • How many potential suppliers do you have? • How unique is the product or service that they provide? • And how expensive would it be to switch from one supplier to another? 	
Buyer Power.	<ul style="list-style-type: none"> • How many buyers you have? • How big are their orders? • How much would it cost them to switch from your products and services to those of a rival? • Are your buyers strong enough to dictate terms to you? 	

Threat of Substitution.	<ul style="list-style-type: none"> • Is there a likelihood of your customers finding a different way of doing what you do? • For example, if you supply a unique software product that automates an important process, people may substitute it by doing the process manually or by outsourcing it. • A substitution that's easy and cheap to make can weaken your position and threaten your profitability. 	
Threat of New Entry.	<ul style="list-style-type: none"> • Competitor’s ability to enter your market can affect your position in the market. • Strong and durable barriers to entry can potentially preserve a favourable position and take fair advantage of it. • Is it relatively easy for a new competitor to gain a foothold in your industry or market? • How much would it cost, and how tightly is your sector regulated? • Do new entrants come and go regularly? Or is the industry dominated by a few, big players? 	

Plan-DO-Check-Act

The Plan-Do-Check-Act (PDCA) methodology is a well-established management approach consisting of four distinct phases. It's often referred to as the Shewhart Cycle or the Deming Cycle in certain circles [12]. The key to PDCA's effectiveness lies in its repetitive nature, emphasizing the need for continuous application to achieve ongoing improvements in processes and products. Let's break down each step in a more conversational manner:

1. Plan: Create a strategic blueprint to kick things off, the first step is all about setting the stage. You need to define the problem or goal clearly and establish the procedures required to address it effectively. This is where you plan out the necessary activities, allocate resources, and set specific dates for execution.
2. Do: Task execution with the plan in hand, it's time to put things into action—but not on a grand scale just yet. Start small, implementing the proposed changes or improvements cautiously. The aim here is to minimize risks and disruptions as you test the waters. And don't forget to document your actions and collect data along the way to understand the impacts and results.
3. Check: Analyse the results once you've executed your plan, it's time to see how things panned out. Evaluate the outcomes against the objectives you set during the planning phase. Dive into the data you've gathered and analyse it thoroughly. Look for improvements and deviations from your expectations.
4. Act: Standardize or adjust now that you've assessed the results, it's decision time. Determine whether the changes should become standard practice or if further adjustments are needed. If improvements are necessary, you loop back to the "Plan" phase, armed with the insights gained from the previous cycle, and make the necessary modifications. If the changes prove beneficial, incorporate them into your regular procedures and practices. The PDCA cycle emphasizes the importance of a systematic and continuous approach to improvement. It encourages organizations to learn from their experiences, adapt their strategies based on those experiences, and consistently aim for better performance. Its iterative nature makes it a valuable tool across various industries, including quality management, project management, and business process improvement.

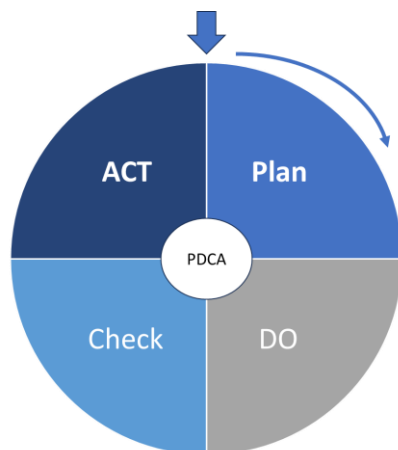


Figure 42. PDCA cycle

Llava Matrix

Through the incorporation of user experiences and business models into the innovation process, the LLAVA Matrix is a framework that was developed with the intention of fostering innovation within Living Labs organisations. It is based on a hypothesis-driven methodology, which means that the creation of new technologies or services is driven by iterations of developing, testing, and refining hypotheses about user needs and business models.

The process entails engaging with users and stakeholders in order to validate assumptions, making use of feedback in order to develop the innovation, and iteratively enhancing both the solution and the business model. Specifically, it is a process that is organized to ensure that innovations are not only technically possible but also appealing for users and economically sustainable for enterprises.

CUSTOMER SEGMENT	WHAT IS THEIR COMMON CHARACTERISTIC IN WHAT WAY DO THE DIFFERENT SEGMENTS DIFFER
COMMON NEED	WHAT IS THEIR COMMON NEED, PAIN OR ASPIRATION WHAT MARKET OR SOCIETAL TRENDS WILL AMPLIFY THAT NEED
VALUE PROMISE	WHAT IS YOUR VALUE PROPOSITION WHAT IS YOUR MARKETING MESSAGE
SOLUTION	CORE COMPONENTS FUNCTIONALITIES <div style="display: flex; justify-content: space-between; align-items: center;"> <div style="border: 1px solid black; padding: 2px; font-size: 8px;">SPECIFIC COMPONENTS</div> <div style="border: 1px solid black; padding: 2px; font-size: 8px;">GENERIC ENABLERS</div> <div style="border: 1px solid black; padding: 2px; font-size: 8px;">SPECIFIC COMPONENTS</div> </div>
VALUE NETWORK	COMPONENTS ↔ E2E SOLUTION ROLES ↔ VALUE CREATION, DELIVERY, CONSUMPTION & CAPTURING
COMPETITION	WHO ARE YOUR COMPETITORS AND ALTERNATIVES HOW DO YOU DIFFERENTIATE FROM THEM
WILLINGNESS TO PAY (WTP)	PRICING MODEL PRICING LEVEL

Figure 40. The Llava Matrix

6. Conclusion / Future Work

This deliverable reported on the development and evolution of all activities related to the generation of impact from the aerOS project. Those activities are organized in four tasks grouped in WP6.

Communication activities have been characterized by the consolidation of the aerOS brand through diverse channels and scenarios, the position of aerOS as a notable discussion partner around the Cloud-Edge-IoT continuum and in general the next generation of IoT, and the strong presence of aerOS in technical collaborative spaces. The expectations on these activities have mostly been exceeded, as recounted by their associated KPIs, therefore the strategy for the second period of the project will consist mainly of the application of the current successful approaches.

With regards to dissemination activities, a similar scenario is observed, in which most of the expectations on them, now, have been surpassed. The high-quality research production of aerOS and the advantaged position of its partners in their respective markets, have positioned aerOS as a reference for the development of technology for the continuum. The strategy for the second period of the project will be then the maximum leverage of the strong dissemination opportunities already identified by the partners.

In the case of the activities related to standardization, the project also profited from the strong activity and prominent positions of several of its partners in standardization and prenormative spaces, exceeding some of the KPIs targets by an important margin. The future guidelines will represent a shift of focus towards those kinds of scenarios where aerOS has had a lesser (but still significant) impact, namely, the data-related organizations and associations. The aerOS partners working in those organizations will increase their contributions, with the support of those partners with deep knowledge of the data-related components of the aerOS technology.

Lastly, the exploitation activities have been characterized by a deep analysis of aerOS' potentials and the considerable amount of work that entails coordinating and managing the expectations of all the partners and stakeholders. That has resulted in a solid plan for the second part of the project, helped by the fact that during this period, the implementations of the pilots will serve as evidence of the groundbreaking ideas developed by aerOS.

Considering the previously mentioned, the state of the impact tasks that was reported in this deliverable, justifies a very optimistic outlook about what will come in the second period of the project. Deliverable 6.3 will offer details about those results

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8. Annexes including IP background and foreground

Table 24. Background IP registry

#	Relevant Background	Contributing Partner	Background Number (First number refers to WP relevance, second number refers to assets order)	Short Description of BG	Type of Protection (patent, copyright, TM, Utility model , Open source...)
1	Network Data Fabric	TID	BG 3.1	Data fabric platform for the integration of data collected from the network. The implementation of the data fabric will be based on knowledge graphs technologies and standards such as W3C RDF and ETSI NGSI-LD. This work is the evolution of the former Semantic Data Aggregator (SDA) component that was developed in previous European projects.	open-source
2	End-to-end IoT	COSMOTE	BG5.5	End-to-end IoT solution of COSMOTE (incl. sensors, gateways, backend infrastructure for measurements' storage, processing and visualization).	Copywrite
3	ContinuumIOTAMessages	UPV	BG 4.1	A custom mechanism that takes place utilizing IOTA Tangle so that Infrastructure Elements of aerOS form a DAG (Dyirected Acyclic Graph) to exchange certain specific (critical) messages and the trust score of such IEs.	TBD
4	Self-scalingASSIST-IoT	UPV	BG 3.2	A customized software based on Kubernetes' HPA (Horizontal Pod Autoscaler) that is able to improve the horizontal scalability (in replicas) whenever a computing element surpasses an overloading threshold.	Apache 2.0

5	SmartOrchestratorASSIST-IoT	UPV	BG 3.3	It is a custom software based on open source ETSI OSM for deploying virtualized workloads (Docker containers) over Kubernetes clusters (and multi-cluster scenarios) based on policies and tiny predictions. This was developed by UPV in the context of project ASSIST-IoT.	Apache 2.9
6	M3 Software	INNOVALIA	BG 5.1	M3 software and its point cloud analysis capability brings enough potential to analyse and extract geometric elements, as well as the ability to compare different point clouds and CAD objects. The tool provides the possibility to extract geometric shapes in both 2D and 3D and through its analysis obtain information relevant to decision making in the process of manufacturing parts.	Copyright
7	Trust Manager	IQB	BG 4.2	Trust Management for cloud native services, including static security assessment of containers and dynamic assessment based on real time data and behaviour analysis of containers and nodes and detection of anomaly patterns.	open-source
8	Recommendation System	FOGUS	BG 5.3	Recommendation System is a software component of pilot 5, that outputs a list of recommended workstations to an employee.	TBD
9	IE self-healing capability	FOGUS	BG 3.4	IE self-healing capability is a software component of an IE that provides the capability to recover from abnormal states. It is part of a greater self-* capabilities suite, that allows an IE to be self-managed.	Apache License, Version 2.0

10	Web app virtual assistant	INFOLYSIS	BG 5.4	A web application that will act as virtual assistant/information portal for the users of a smart building and will also initiate an effective and easy-to-use automated chat-based interaction/communication between the end-user and the building’s smart characteristics/features. This chat-based web app will be developed to support aerOS Pilot 5.	Proprietary License
11	Self-security	S21Sec	BG 3.5	Self-security module it enables malfunctions and vulnerabilities to be detected at the node level to ensure correct operation or secure incorporation into the computing continuum. It does this by monitoring the network traffic of the IE's network interfaces, checking against updated threat databases or applying rules to detect attacks. The attack information is sent to the self-diagnose component.	Other (internall usage for clients services in S21Sec)
12	Tillage AI Model	John Deere		AI model for optimizing cultivator working depth in secondary tillage.	Copywrite
13	Smart Networking	NCSR D	BG 3.6	Script-based programmability on exposed capabilities for optimised and intelligent service mesh networking	Open-source
14	DSTech-Management Portal	DST	BG 4.3	A Portal for the management of information extracted from every deployed domain in the edge-cloud continuum.	open-source
15	Posidonia Terminal 4.0	PRO			

16	Semantic Translator	SPIRAS	BG 4.4	Semantic Translator offers a service, that transforms RDF data according to rules provided by the user. The translation can be performed either in batch or utilizing (reactive) streaming interface. Both Apache Kafka and MQTT brokers can be used as input/output.	open-source
17	Semantic Annotator	SPIRAS	BG4.5	Semantic Annotator offers a syntactic transformation service, that annotates data in JSON, XML or CSV formats and lifts it into RDF. The annotation is done through persistent configurable streams on Apache Kafka and/or MQTT brokers. Transformations are defined with CARML, which is a dialect of RML - RDF Mapping Language	open-source
18	Model Reduction Service	SPIRAS	BG4.6	Services exposing functions that can be used to reduce/compress ML model to address frugality requirements.	open-source
19	Decentralized AI	SPIRAS	BG4.7	Interacting components allowing to perform federated learning or deploy a model for inference.	open-source
20	Explainability Service	SPIRAS	BG4.8	Service wrapping popular methods to explain/interpret ML models.	open-source

21	aerOS Service Allocation with AI	SIEMENS	BG3.7	This IP asset includes the approaches, algorithms, and components needed to allocate services in a dynamic network to achieve the Quality-of-Service requirements of service users. We focus mainly on using AI, specifically Reinforcement Learning, to solve the optimization problem more efficiently than state-of-the-art methods like Mixed Integer Programming problems, as described in D3.1.	Proprietary License
22	Machine Learning Operations Pipeline	SIEMENS	BG3.8	This IP asset includes the concepts and components needed to provide a machine learning operation pipeline for AI services. This allows a user to train, track, deploy and monitor the machine learning approach in a scalable manner, as described in D3.1.	Proprietary License
23	aerOS Integration Service	SIEMENS	BG3.9	Integration services act as essential connectors, bridging diverse systems with different protocols to facilitate seamless communication and data exchange. These services play a crucial role in streamlining the connection of heterogeneous data from IoT devices, described in D3.1.	Proprietary License

24	aerOS TSN Integration	SIEMENS	BG3.10	<p>This IP encompasses all software components and algorithms needed to achieve the integration of the aerOS Smart Networking functionalities with a TSN (Time Sensitive Networking) network. This means at least two basic components, an aerOS TSN Auxiliary Service and the template for a TSN-capable aerOS Service, both described in D3.1.</p>	Proprietary License
25	Network Data Fabric	TID	BG 4.9	<p>Data fabric platform for the integration of data collected from the network. The implementation of the data fabric will be based on knowledge graphs technologies and standards such as W3C RDF and ETSI NGSI-LD. This work is the evolution of the former Semantic Data Aggregator (SDA) component that was developed in previous European projects.</p>	open-source

Table 25. Background IP registry

Work Package	PR number	Project Result (PR) /Achievement	Main Contributing Partner	Further Contributing Partner(s)	Related Background Number	Short Description of FG	Foreground Number
WP3	PR 3.1	Self toolsuite	UPV			A set of functionalities (in the form of inter-connected microservices) that complement each other and that enhance the capacity of self-managing (monitoring, orchestration, diagnose) of an Infrastructure Element in an aerOS continuum.	FG 3.1
	PR 3.2	Self-scalingASSIST-IoT	UPV		BG 3.2	A customized software based on Kubernetes' HPA (Horizontal Pod Autoscaler) that is able to improve the horizontal scalability (in replicas) whenever a computing element surpasses an overloading threshold.	FG 3.2
	PR 3.3	SmartOrchestratorASSIST-IoT	UPV		BG 3.3	It is a custom software based on open source ETSI OSM for deploying virtualized workloads (Docker containers) over Kubernetes clusters (and multi-cluster scenarios) based on policies and tiny predictions. This was developed by UPV in the context of project ASSIST-IoT.	FG 3.3
	PR 3.4	IE self-healing capability	FOGUS	UPV, All T3.5 partners	BG 3.4	IE self-healing capability is a software component of an IE that provides the capability to recover from abnormal states. It is part of a greater self-* capabilities suite, that allows an IE to be self-managed.	FG 3.4
	PR 3.5	Smart Networking	NCSR		BG 3.6	Script-based programmability on exposed capabilities for optimised and intelligent service mesh networking	FG 3.5

	PR 3.6	Self-security	S21Sec		BG 3.5	Self-security module it enables malfunctions and vulnerabilities to be detected at the node level to ensure correct operation or secure incorporation into the computing continuum. It does this by monitoring the network traffic of the IE's network interfaces, checking against updated threat databases or applying rules to detect attacks. The attack information is sent to the self-diagnose component.	FG 3.6
	PR 3.7	aerOS Service Allocation with AI	SIEMENS		BG3.7	This IP asset includes the approaches, algorithms, and components needed to allocate services in a dynamic network to achieve the Quality-of-Service requirements of service users. We focus mainly on using AI, specifically Reinforcement Learning, to solve the optimization problem more efficiently than state-of-the-art methods like Mixed Integer Programming problems, as described in D3.1.	FG3.7
	PR 3.8	Machine Learning Operations Pipeline	SIEMENS		BG3.8	This IP asset includes the concepts and components needed to provide a machine learning operation pipeline for AI services. This allows a user to train, track, deploy and monitor the machine learning approach in a scalable manner, as described in D3.1.	FG3.8

	PR 3.9	aerOS Low Code Tools	SIEMENS		-	Low-code tools, emphasizing behavior trees, streamline application development by minimizing manual coding. Behavior trees offer a visual, node-based approach for defining application logic, simplifying the creation and modification of behaviors. This low-code paradigm facilitates rapid prototyping, accelerates development cycles, and promotes collaboration between technical and non-technical team members.	FG3.9
	PR 3.10	aerOS OpenAPI	SIEMENS		-	OpenAPI, or the OpenAPI Specification (OAS), is a standard for documenting RESTful APIs. It uses JSON or YAML to describe API structure, endpoints, parameters, and authentication. This standardized documentation streamlines API development, making it easier for developers to understand, collaborate, and integrate applications across different platforms.	FG3.10
	PR 3.11	aerOS Integration Service	SIEMENS		BG3.9	Integration services act as essential connectors, bridging diverse systems with different protocols to facilitate seamless communication and data exchange. These services play a crucial role in streamlining the connection of heterogeneous data from IoT devices, described in D3.1.	FG3.11

	PR 3.12	aerOS TSN Integration	SIEMENS		BG3.10	This IP encompasses all software components and algorithms needed to achieve the integration of the aerOS Smart Networking functionalities with a TSN (Time Sensitive Networking) network. This means at least two basic components, an aerOS TSN Auxiliary Service and the template for a TSN-capable aerOS Service, both described in D3.1.	FG3.12
	PR 3.13	Self-realtimeness prototype implementation for time-aware orchestration in the cloud-to-edge continuum	TTC	TCAG	-	This software will enable application developers to specify soft real-time requirements for their application(s) in form of an expected time-utility that should be guaranteed during runtime. On a self-realtimeness enabled infrastructure element an operating system extension monitors the time-utility of deployed applications. If the time-utility of an application drops below the user-specified requirement, the infrastructure element will trigger a reorchestration request. Additionally, the infrastructure element frequently reports applications' and the total time-utility to the orchestrator so that time-utility is taken into account during orchestration decisions.	FG 3.13
WP4	PR 4.1	ContinuumIOTAMessages	UPV	IQB	BG 4.1	A custom mechanism that takes place utilizing IOTA Tangle so that Infrastructure Elements of aerOS form a DAG (Dyrected Acyclic Graph) to exchange certain specific (critical) messages and the trust score of such IEs.	FG 4.1

	PR 4.2	aerOS Federator	UPV	FIWARE		This will be a custom software that will be in charge of creating, updating and maintaining the cross-registrations, publications/subscriptions and the proper configurations upon the distributed state repository and Data Fabric Context Brokers (ORIONs). It will be the heart that will allow the abstraction (federation) of domains and IEs across the continuum in aerOS.	FG 4.2
	PR 4.3	Trust Manager	IQB		BG 4.2	Trust Management for cloud native services, including static security assessment of containers and dynamic assessment based on real time data and behaviour analysis of containers and nodes and detection of anomaly patterns.	FG 4.3
	PR 4.4	DSTech-Management Portal	TDST	UPV, INF, NCRSD	BG 4.3	A Portal for the management of information extracted from every deployed domain in the edge-cloud continuum.	FG 4.4
	PR4.5	Semantic Translator	SPIRAS		BG 4.4	Semantic Translator offers a service, that transforms RDF data according to rules provided by the user. The translation can be performed either in batch or utilizing (reactive) streaming interface. Both Apache Kafka and MQTT brokers can be used as input/output.	FG4.5

	PR4.6	Semantic Annotator	SPIRAS		BG4.5	Semantic Annotator offers a syntactic transformation service, that annotates data in JSON, XML or CSV formats and lifts it into RDF. The annotation is done through persistent configurable streams on Apache Kafka and/or MQTT brokers. Transformations are defined with CARML, which is a dialect of RML - RDF Mapping Language	FG4.6
	PR4.7	Model Reduction Service	SPIRAS		BG4.6	Services exposing functions that can be used to reduce/compress ML model to address frugality requirements.	FG4.7
	PR4.8	Decentralized AI	SPIRAS		BG4.7	Interacting components allowing to perform federated learning or deploy a model for inference.	FG4.8
	PR4.9	Explainability Service	SPIRAS		BG4.8	Service wrapping popular methods to explain/interpret ML models.	FG4.9

	PR 4.10	Network Data Fabric	TID		BG 4.9	Data fabric platform for the integration of data collected from the network. The implementation of the data fabric will be based on knowledge graphs technologies and standards such as W3C RDF and ETSI NGSI-LD. This work is the evolution of the former Semantic Data Aggregator (SDA) component that was developed in previous European projects.	FG 4.10
WP5	PR 5.1	M3 Software	INNO-VALIA		BG 5.1	M3 software and its point cloud analysis capability brings enough potential to analyse and extract geometric elements, as well as the ability to compare different point clouds and CAD objects. The tool provides the possibility to extract geometric shapes in both 2D and 3D and through its analysis obtain information relevant to decision making in the process of manufacturing parts.	FG 5.1
	PR 5.2	HPCP Prototype extended with the NVIDIA-based support packages	TTC		BG 5.2	A suite of software libraries to support the Pilot 3 integration and to allow to follow best coding practices, like writing the code that works consistently across different versions and devices so that the partner working with the TTC’s HPCP prototype can focus on their code they care about, like e.g. AI-supported models, etc.	FG 5.2

	PR 5.3	Recommendation System	FOGUS	All pilot 5 partners	BG 5.3	Recommendation System is a software component of pilot 5, that outputs a list of recommended workstations to an employee.	FG 5.3
	PR 5.4	Web app virtual assistant	INFOLYSIS		BG 5.4	A web application that will act as virtual assistant/information portal for the users of a smart building and will also initiate an effective and easy-to-use automated chat-based interaction/communication between the end-user and the building's smart characteristics/features. This chat-based web app will be developed to support aerOS Pilot 5.	FG 5.4

Table 26. Background IP registry

ER number	Exploitable Result (ER)	Short Description	Main Partner(s)	Contributing Partners
ER1	aerOS	Operating system as a whole. This KER entails the essential, bare minimum software modules that any aerOS compliant deployment must have.	Consortium	
ER2	aerOS FOM	Orchestration module, integrated in R1 but with separate planned protection and exploitation. Ground-breaking European product.	Consortium	
ER3	aerOS FAI	Frugal AI- This result will be a combination of methodology and software, elaborating an actionable framework to deliver AI in IoT/Edge.	Consortium	
ER4	aerOS TSF	A series of supporting features to deploy on top of R1, that will increase the performance and technical traits of an aerOS deployment.	Consortium	
ER5	DevPrivSec	Process and data flow, including techniques and open source technologies that, combined, improve current DevSecOps de-facto standards.	Consortium	
ER6	ContinuumIOTAMessages	A custom mechanism that takes place utilizing IOTA Tangle so that Infrastructure Elements of aerOS form a DAG (Directed Acyclic Graph) to exchange certain specific (critical) messages and the trust score of such IEs.	UPV	IQB
ER7	Self-scalingASSIST-IoT	A customized software based on Kubernetes' HPA (Horizontal Pod Autoscaler) that is able to improve the horizontal scalability (in replicas) whenever a computing element surpasses an overloading threshold.	UPV	

ER8	SmartOrchestratorASSIST-IoT	A customized software based on Kubernetes' HPA (Horizontal Pod Autoscaler) that is able to improve the horizontal scalability (in replicas) whenever a computing element surpasses an overloading threshold.	UPV	
ER9	Self toolsuite	A set of functionalities (in the form of inter-connected microservices) that complement each other and that enhance the capacity of self-managing (monitoring, orchestration, diagnose) of an Infrastructure Element in an aerOS continuum.	UPV	
ER10	aerOS Federator	This will be a custom software that will be in charge of creating, updating and maintaining the cross-registrations, publications/subscriptions and the proper configurations upon the distributed state repository and Data Fabric Context Brokers (ORIONs). It will be the heart that will allow the abstraction (federation) of domains and IEs across the continuum in aerOS.	UPV	FIWARE
ER11	M3 Software	M3 software and its point cloud analysis capability brings enough potential to analyse and extract geometric elements, as well as the ability to compare different point clouds and CAD objects. The tool provides the possibility to extract geometric shapes in both 2D and 3D and through its analysis obtain information relevant to decision making in the process of manufacturing parts.	INNOVALIA	

ER12	HPCP Prototype extended with the NVIDIA-based support packages (software)	A suite of software libraries to support the Pilot 3 integration and to allow to follow best coding practices, like writing the code that works consistently across different versions and devices so that the partner working with the TTC's HPCP prototype can focus on their code they care about, like e.g. AI-supported models, etc.	TTC	
ER13	Trust Manager	Trust Management for cloud native services, including static security assessment of containers and dynamic assessment based on real time data and behaviour analysis of containers and nodes and detection of anomaly patterns.	IQB	
ER14	Recommendation System	Recommendation System is a software component of pilot 5, that outputs a list of recommended workstations to an employee.	FOGUS	All pilot 5 partners
ER15	IE self-healing capability	IE self-healing capability is a software component of an IE that provides the capability to recover from abnormal states. It is part of a greater self-* capabilities suite, that allows an IE to be self-managed.	FOGUS	UPV, All T3.5 partners
ER16	Web app virtual assistant	A web application that will act as virtual assistant/information portal for the users of a smart building and will also initiate an effective and easy-to-use automated chat-based interaction/communication between the end-user and the building's smart characteristics/features. This chat-based web app will be developed to support aerOS Pilot 5.	INFOLYSIS	INFOLYSIS

ER17	Self-security	Self-security module it enables malfunctions and vulnerabilities to be detected at the node level to ensure correct operation or secure incorporation into the computing continuum. It does this by monitoring the network traffic of the IE's network interfaces, checking against updated threat databases or applying rules to detect attacks. The attack information is sent to the self-diagnose component.	S21Sec	
ER18	Smart Networking	Script-based programmability on exposed capabilities for optimised and intelligent service mesh networking	NCSRSD	
ER19	Management Portal	A Portal for the management of information extracted from every deployed domain in the edge-cloud continuum.	DST	UPV, INF, NCSRSD
ER20	Semantic Translator	Semantic Translator offers a service, that transforms RDF data according to rules provided by the user. The translation can be performed either in batch or utilizing (reactive) streaming interface. Both Apache Kafka and MQTT brokers can be used as input/output.	SPIRAS	
ER21	Semantic Annotator	Semantic Annotator offers a syntactic transformation service, that annotates data in JSON, XML or CSV formats and lifts it into RDF. The annotation is done through persistent configurable streams on Apache Kafka and/or MQTT brokers. Transformations are defined with CARML, which is a dialect or RML - RDF Mapping Language	SPIRAS	
ER22	Model Reduction Service	Services exposing functions that can be used to reduce/compress ML model to address frugality requirements.	SPIRAS	
ER23	Decentralized AI	Interacting components allowing to perform federated learning or deploy a model for inference.	SPIRAS	

ER24	Explainability Service	Service wrapping popular methods to explain/interpret ML models.	SPIRAS	
ER25	aerOS Service Allocation with AI	This IP asset includes the approaches, algorithms, and components needed to allocate services in a dynamic network to achieve the Quality-of-Service requirements of service users. We focus mainly on using AI, specifically Reinforcement Learning, to solve the optimization problem more efficiently than state-of-the-art methods like Mixed Integer Programming problems, as described in D3.1.	SIEMENS	
ER26	Machine Learning Operations Pipeline	This IP asset includes the concepts and components needed to provide a machine learning operation pipeline for AI services. This allows a user to train, track, deploy and monitor the machine learning approach in a scalable manner, as described in D3.1.	SIEMENS	
ER27	aerOS Low Code Tools	Low-code tools, emphasizing behavior trees, streamline application development by minimizing manual coding. Behavior trees offer a visual, node-based approach for defining application logic, simplifying the creation and modification of behaviors. This low-code paradigm facilitates rapid prototyping, accelerates development cycles, and promotes collaboration between technical and non-technical team members.	SIEMENS	

ER28	aerOS OpenAPI	OpenAPI, or the OpenAPI Specification (OAS), is a standard for documenting RESTful APIs. It uses JSON or YAML to describe API structure, endpoints, parameters, and authentication. This standardized documentation streamlines API development, making it easier for developers to understand, collaborate, and integrate applications across different platforms.	SIEMENS	
ER29	aerOS Integration Service	Integration services act as essential connectors, bridging diverse systems with different protocols to facilitate seamless communication and data exchange. These services play a crucial role in streamlining the connection of heterogeneous data from IoT devices, described in D3.1.	SIEMENS	
ER30	aerOS TSN Integration	This IP encompasses all software components and algorithms needed to achieve the integration of the aerOS Smart Networking functionalities with a TSN (Time Sensitive Networking) network. This means at least two basic components, an aerOS TSN Auxiliary Service and the template for a TSN-capable aerOS Service, both described in D3.1.	SIEMENS	
ER31	Network Data Fabric	Data fabric platform for the integration of data collected from the network. The implementation of the data fabric will be based on knowledge graphs technologies and standards such as W3C RDF and ETSI NGSI-LD. This work is the evolution of the former Semantic Data Aggregator (SDA) component that was developed in previous European projects.	TID	

ER 32	Self-realtimeness prototype implementation for time-aware orchestration in the cloud-to-edge continuum	This software will enable application developers to specify soft real-time requirements for their application(s) in form of an expected time-utility that should be guaranteed during runtime. On a self-realtimeness enabled infrastructure element an operating system extension monitors the time-utility of deployed applications. If the time-utility of an application drops below the user-specified requirement, the infrastructure element will trigger a reorchestration request. Additionally, the infrastructure element frequently reports applications and the total time-utility to the orchestrator so that time-utility is taken into account during orchestration decisions.	TTC	TCAG
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