



swarmchestrat

APPLICATION-LEVEL SWARM-BASED ORCHESTRATION ACROSS THE CLOUD-TO-EDGE CONTINUUM

D6.2 Dissemination, communication and exploitation activities

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Abbreviations

Term	Meaning
AI	Artificial Intelligence
CCC	Cognitive Computing Continuum
CEI	Cloud-Edge-IoT
CTOR	Click-to-Open Rate
D	Deliverable



Term	Meaning
D&C	Dissemination & Communication
DID	Distributed Identifiers
DoA	Description of Action
DOI	Digital Object Identifier
EC	European Commission
HEU	Horizon Europe
IoT	Internet of Things
M	Month
NRF Korea	National Research Foundation of Korea
R&I	Research & Innovation
SDO	Standards Developing Organisation
SME	Small-Medium Enterprise
SSI	Self-Sovereign Identity
T	Task
TOSCA	Topology and Orchestration Specification for Cloud Applications
UKRI	UK Research & Innovation
URL	Universal Resource Location
VC	Verifiable Credentials
W3C	World Wide Web Consortium
WP	Work Package

Executive Summary

The deliverable reports on the communication, dissemination, and exploitation activities of the Swarmchestr^{ate} project during the first half of the project duration. The “**Communication Activities Report**” section details the project's comprehensive communication strategy, which includes the development and active use of the project website to articulate goals and explain the four demonstrators and the value added to each one by Swarmchestr^{ate}, engagement via social media platforms, the distribution of a periodic newsletter, and the production of promotional videos and printed materials. Furthermore, it highlights the establishment of strategic liaisons with other projects funded under the same topic to co-organise impactful joint sessions in conferences, workshops, and webinars.

Subsequently, in the “**Dissemination Activities Report**” section the deliverable elaborates on the project's dissemination efforts, focusing on sharing Swarmchestr^{ate}'s advancements with relevant communities. This encompasses the open-access publication of scientific findings aimed at the research community, active participation in key industry and academic events, and the organisation of dedicated workshops, webinars, and training sessions designed to achieve visibility within the general public, including non-scientists and university students. Notably, this section also details the project's significant contributions to standardisation communities, particularly its active engagement with the Topology and Orchestration Specification for Cloud Applications (TOSCA), involving both the enhancement of the specification and its practical application for describing cloud-to-edge continuum applications.

The “**Exploitation Considerations**” section addresses the project's exploitation activities, presenting the updated individual exploitation plans from all consortium partners. These plans describe how each partner—whether a university, research centre, or SME—intends to leverage the project's results to enrich their offerings, advance their research capabilities, and enhance their organisational status and market position. This section also clearly identifies the project's Key Exploitable Results (KERs), ensuring these are in full alignment with the exploitation strategy defined in the Description of Action (DoA) and incorporate feedback received during the project's technical check, thereby providing a clear path towards future impact and valorisation of Swarmchestr^{ate}'s outcomes.

1. Introduction

1.1 Document Purpose

This document has been prepared in the context of WP6 “Establishing Dissemination, Communication and Exploitation” and reports on and highlights the work performed during the first 18 months of the project. It documents the project’s efforts in dissemination & communication activities. Furthermore, it addresses the project's exploitation activities, presenting the updated individual exploitation plans from all consortium partners, and identifies the project's Key Exploitable Results (KERs).

1.2 Dissemination and Communication Strategy in a Nutshell

The ambition behind the dissemination and communication activities of Swarmchestr^{ate} translates into the following overarching objectives:

- *Ensure broad visibility and raise awareness about Swarmchestr^{ate}, spread knowledge about the project and its results, establish a distinctive and recognizable identity that will support marketing efforts.*
- *Reach, stimulate and engage a critical mass of relevant stakeholders to ensure that the results of the project are effectively showcased, leading to validation, improvement and possibly further adoption of the developed technologies and concepts, especially towards target vertical sectors.*
- *Facilitate exploitation of the project’s outcomes and promote the development of innovative solutions based on the Swarmchestr^{ate} developed technologies and architectures.*
- *Foster impactful contribution to relevant standardisation bodies and open source communities as appropriate.*
- *Ensure close interaction with sister R&I projects in the DATA-01-04 call.*

1.3 Document Structure

The sections of the deliverable at hand are organised in the following manner:

Section 2 reports on the communication activities of the project.

Section 3 reports on the dissemination activities of the project.

Section 4 addresses the project's exploitation activities.

Section 5 concludes the document and discusses next steps.

2. Communication Activities Report

2.1 Project Website

Since its launch in May 2024, the official project website¹ has been established as the primary online platform. It serves as a central information hub designed to engage the project's community and its diverse network of stakeholders effectively. The website is dynamically structured to chronicle the project's core vision, objectives, activities, and key achievements as they unfold, ensuring content is consistently updated in line with the implementation timeline; it is also planned to function as a public repository after the project concludes.

The website offers comprehensive information covering various aspects of the Swarmchestrate initiative. Visitors can explore sections detailing the project's overall vision for revolutionising application management in the cloud-edge continuum and its specific research and innovation objectives. There is also a dedicated area introducing the consortium members, highlighting the collective expertise involved in achieving the project's ambitious goals. Furthermore, detailed pages describe the project's demonstrators, providing concrete examples of how the Swarmchestrate framework will be applied and validated in real-world scenarios.

In early 2025, the consortium welcomed Innorenew CoE as a new partner, expanding the project's application areas. This addition was promptly reflected on the website with Innorenew's inclusion on the Consortium page and the creation of a dedicated new page describing their "Urban Noise Classification" demonstrator. A related blog post was also published to introduce this new use case to stakeholders. This particular demonstrator focuses on utilising AI algorithms distributed across edge devices to classify different types of urban sounds in real-time, thereby enabling effective noise pollution monitoring within smart city contexts while showcasing Swarmchestrate's capabilities in orchestrating such distributed systems.

To keep audiences engaged, the website features regularly updated news items and press releases, alongside a curated list of relevant events which the project attends or organises. In an effort to shed light on specific project facets, dedicated blog post series are featured on the website. The first is a **technical article series**; it presents the developments in the technical working groups of the project, using concise and as much as jargon-free as possible language: it currently comprises of three articles, offering deep insights into core concepts like decentralised orchestration, decentralised trust and knowledge management relevant to the Swarmchestrate framework. The second is the **"Swarmchestrate Demonstrators Explained" series**; in this, each demonstrator partner explains one of the four project demonstrators, discusses the advantages and the disadvantages of the current implementation, and lays down how the demonstrator shall evolve by integrating Swarmchestrate and what shall be the added

¹ <https://www.swarmchestrate.eu/>

value, making the project's practical applications more accessible to wider audiences: it currently comprises of four blog posts, an example given in Figure 1.

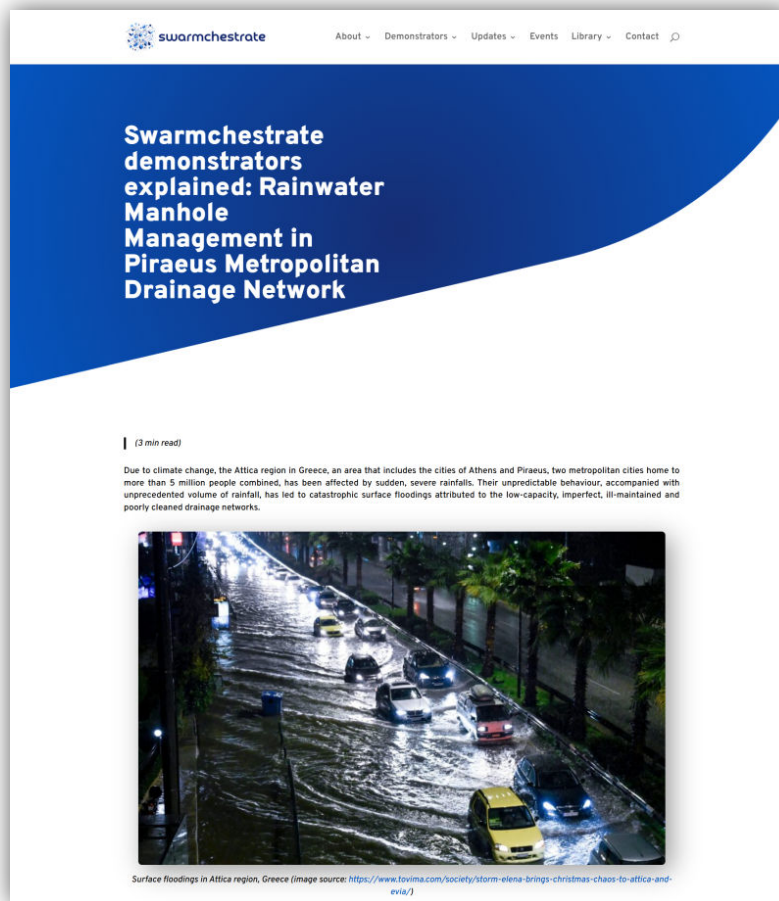


Figure 1 Swarmchestrat Demonstrators Explained blog post series

A crucial component is the resources repository, which consolidates access to academic publications, presentations from conferences or workshops, promotional materials including videos, and official public deliverables as they are released. Essential contact information is provided for inquiries, and the site properly acknowledges its funding support from the European Union, the UKRI and the NRF of Korea.

Between its launch and the end of June 2025, the website has attracted 1019 unique visitors, resulting in 3603 unique page views, with an average visit duration of 2 minutes and 26 seconds, demonstrating healthy engagement with the project's online presence.

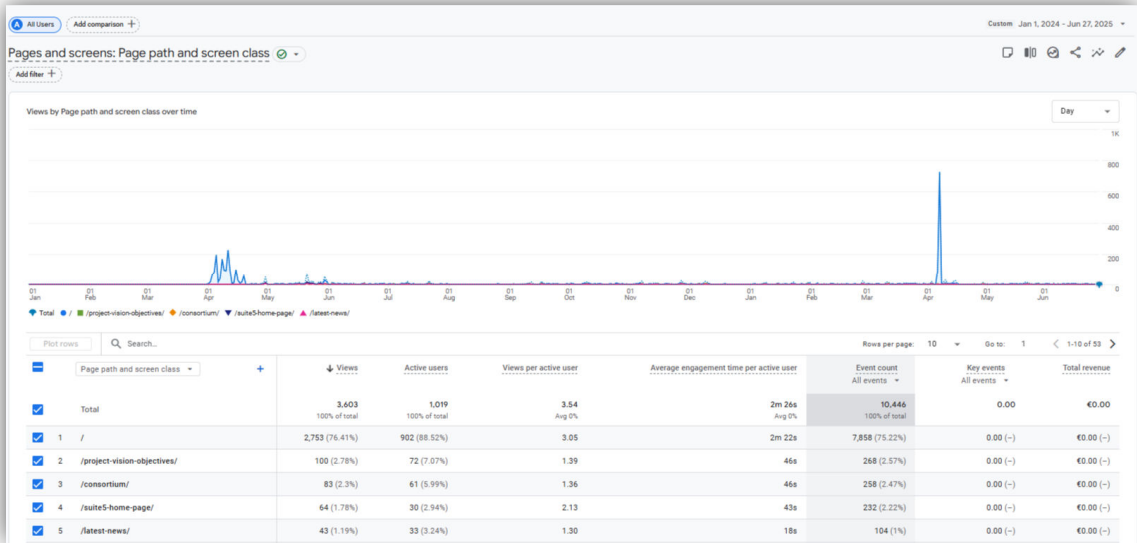


Figure 2 swarmchestrat.eu Website Analytics

Right from the website launch, we've consistently worked on making swarmchestrat.eu easy to find via search engines by focusing on relevant keywords. We've also been actively coordinating link exchanges with project partners and other relevant websites to help boost visibility and bring more visitors to our online hub.

2.2 Social Media

To enhance the project's visibility and disseminate its progress, dedicated social media accounts have been actively managed as key communication and marketing tools. These platforms are utilised to regularly promote Swarmchestrat's activities, such as events and project gatherings, share significant outputs, and stimulate wider discussion around the project's objectives and technological advancements.

The primary professional networking channel is **LinkedIn²**, which serves to engage stakeholders within the research, innovation, and industry communities. As of June 2025, the LinkedIn page has attracted 178 followers. Activity metrics recorded between January 2024 and June 2025 show considerable engagement, with 62 posts published, achieving 19,299 post impressions and 669 post reactions, while the LinkedIn page itself received 200 unique visitors and 385 page views during that period.

Regarding microblogging platforms, a strategic transition occurred during this reporting period. In April 2025, following a unanimous decision by the consortium partners, the project ceased activity on its **X (formerly Twitter)** account, which had posted 38 times and had gathered 33

² linkedin.com/company/swarmchestrat/

followers in total. Concurrently, a new project profile was established on the **Bluesky³** platform to explore engagement opportunities within this growing network. This new BlueSky account was created in April 2025 and has acquired an initial 14 followers as of June 2025, representing the foundational stage of building a community on this channel.

Furthermore, the project maintains a presence on **YouTube⁴**, with the Swarmchestrat channel already established in February 2024, in anticipation of video content creation. This channel was activated in May 2025, marked by the upload of the first official project video designed to introduce Swarmchestrat to a broader audience. This initiative fosters the use of video as a key dissemination tool, and more specific details regarding the content and performance of project videos will be offered in section 2.4.

Zenodo [1] is a general-purpose, open-access research repository that allows researchers from all disciplines to share and preserve various digital research outputs, including publications, data sets, research software, reports, presentations, and more. Every submission receives a persistent Digital Object Identifier (DOI), or is linked to its existing DOI, making it easily citable and discoverable.

Swarmchestrat has created a community in Zenodo⁵, where scientific publications and project public deliverables are uploaded. In addition to that, the "Swarmchestrat - Application-level Swarm-based Orchestration Across the Cloud-to-Edge Continuum" community has been included as a subcommunity of the **"EU Open Research Repository"**. Therefore, any research output that is uploaded in the Swarmchestrat community will automatically be indexed into the EU Open Research Repository. The Swarmchestrat project ensures that all uploads into the Zenodo community are (co-)funded by the project's funding sources, and that records are linked to the grant. Finally, all public records specify a license to compliant with Horizon Europe open science requirements, in particular 'Creative Commons Attribution 4.0 International'.

Table 1 Swarmchestrat URLs

Medium	URL
Project Website	https://www.swarmchestrat.eu/
LinkedIn page	https://www.linkedin.com/company/swarmchestrat/
BlueSky page	https://bsky.app/profile/swarmchestrat.bsky.social
YouTube channel	https://www.youtube.com/@swarmchestrat
Zenodo community	https://zenodo.org/communities/swarmchestrat/

³ bsky.app/profile/swarmchestrat.bsky.social

⁴ youtube.com/@swarmchestrat

⁵ zenodo.org/communities/swarmchestrat/

2.3 Newsletter

Direct communication with subscribed individuals is maintained through the periodic dispatch of project newsletters. These digital bulletins serve as a key tool for targeted dissemination, delivering curated information directly to interested parties. Each newsletter is designed to provide a concise overview of recent project progress, highlight significant milestones and innovations emerging from Swarmchestrat, and announce relevant upcoming events. Importantly, they also reinforce how the audience can engage further with the project or get in touch with the consortium.

Up to June 2025, three project newsletters have been published and distributed to the subscribers list. Performance analysis across these initial campaigns indicates positive engagement from the recipients. On average, the newsletters achieved a notable open rate of 61% and a click-through rate of 16%. Furthermore, the average click-to-open rate (CTOR) was 26%, suggesting that a significant portion of recipients who opened the emails were prompted to click on the content, reflecting a strong interest in the provided project updates.

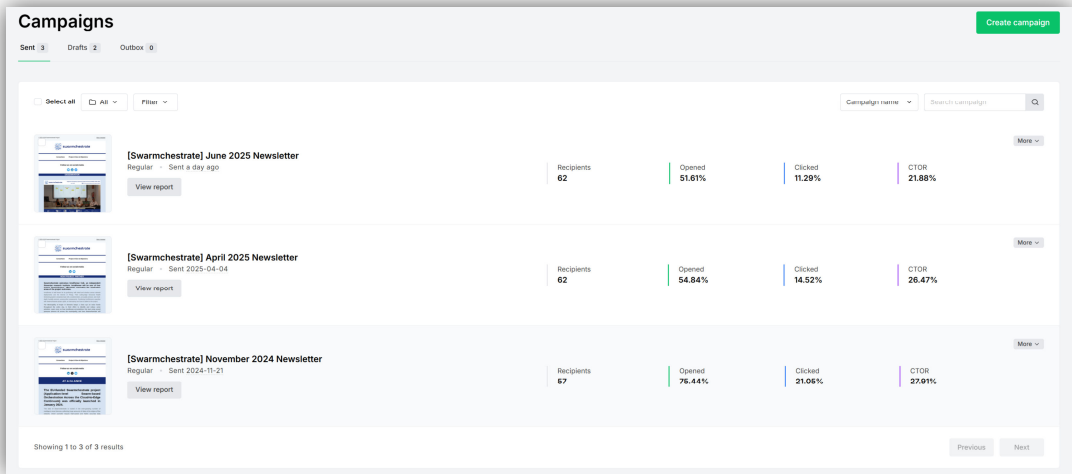


Figure 3 Newsletter Campaigns Dashboard

A subscription field for the Newsletter is available in both the home page of the website and in the Newsletter page of the website. A read-only copy of each Newsletter edition is uploaded to the Newsletter page of the website, after its original distribution to the subscribers.

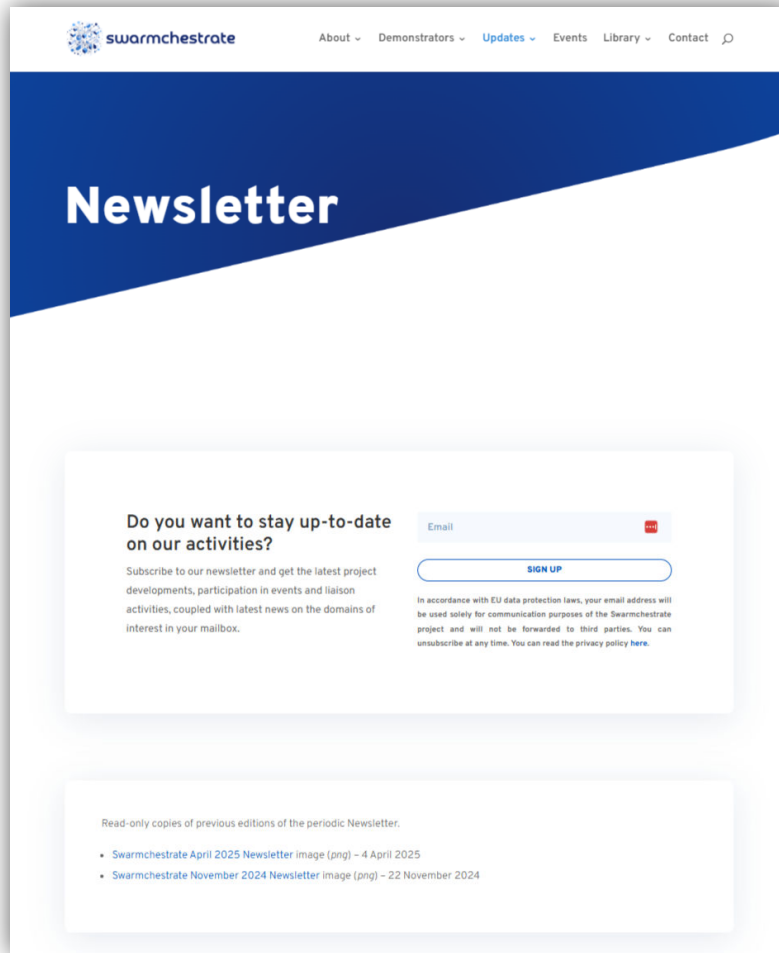


Figure 4 Newsletter section in *swarmchestrate.eu*

2.4 Videos

At the end of the 1st project year, the production of videos was initiated to efficiently promote the Swarmchestrate project. The first output of this activity was an introductory video, with a duration of approximately two minutes. This video is designed to provide a concise overview of the Swarmchestrate project, giving its funding sources, outlining the core concept by presenting both the challenges being addressed and the innovative solution offered, and briefly introducing the four project demonstrators.

The selected format for this promotional video is animation combined with professional narration. This stylistic choice was deliberately made to ensure the content is easily understandable, free from excessive technical jargon, and visually engaging for viewers from diverse backgrounds. The primary goal was to simplify complex information related to decentralised orchestration and swarm intelligence, making the project's purpose and potential impact accessible and appealing to a broad audience beyond technical experts.

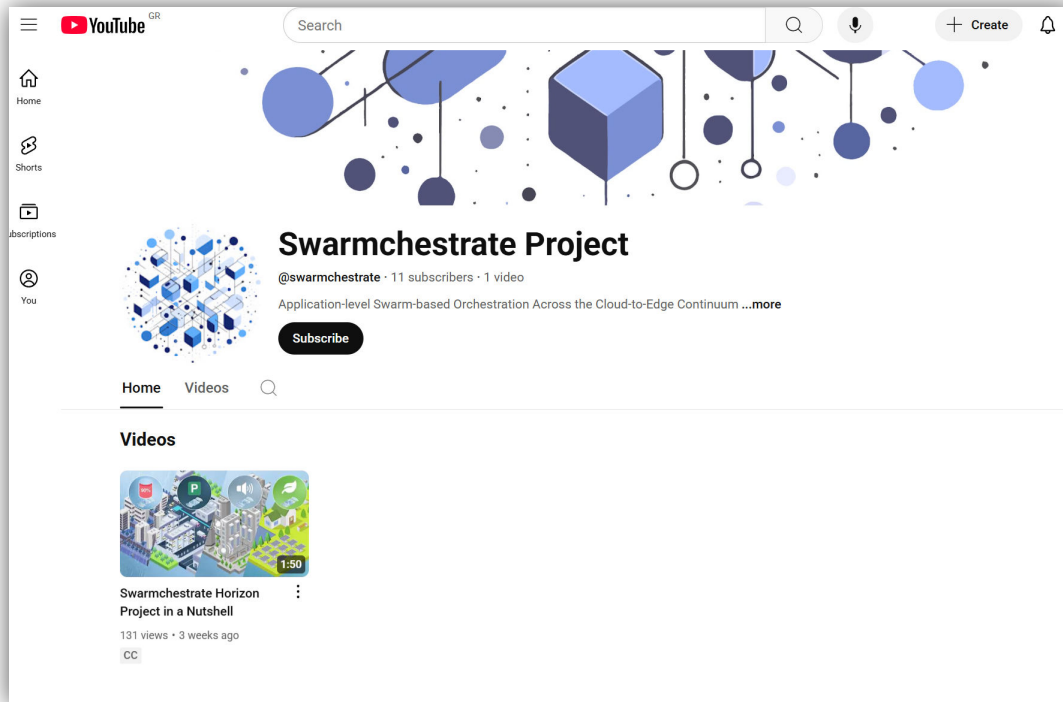


Figure 5 Swarmchestrat YouTube channel

To ensure a high-quality and coherent final product, a structured development process was followed. The first step involved the creation of a detailed storyline document, which systematically described the intended visuals and corresponding narration, logically divided across seven distinct scenes. Subsequently, based on the approved storyline, a comprehensive storyboard was developed. This storyboard served as a visual script, utilising mock-ups, reference images, and detailed notes on animations and transitions to provide a clear blueprint for the animators and guide the final video production phase.

The video was uploaded to Swarmchestrat YouTube channel, and it was further placed in the videos page of the project website. In its first two months online, the Swarmchestrat YouTube channel acquired 11 subscribers and the 1st Swarmchestrat video achieved 131 views with an average view duration of 58 seconds.



Figure 6 Videos section in *swarmchestr^{ate}.eu*

2.5 Promotional Materials

Engaging with press & online media serves as a critical pillar in the Swarmchestr^{ate} endeavour, facilitating enhanced project visibility and the communication of key achievements and innovations to media representatives and the public.

As part of its media engagement toolkit, the Swarmchestr^{ate} project utilises **press releases** as ready-to-publish documents designed to highlight objectives, recent achievements, and upcoming milestones. By June 2025, the project has successfully prepared and disseminated two such releases. The first marked the project's official commencement following the kick-off meeting in Budapest, while the second announced the strategic addition of Innorenew CoE as a new demonstrator partner.

A Swarmchestr^{ate} project flyer has been created; in double-sided, A4 format, it serves as a quick information card about the project's vision, objectives, consortium, funding sources, etc. The flyer is always available in the project website and shared as printed handouts during any relevant events. The flyer will be updated once (if necessary) until the end of the project.



Figure 7 Swarmchestrat flyer in double-sided, A4 format

An overarching, high-level project presentation, or **pitch deck**, has been developed to provide a concise overview of the Swarmchestrat project. This presentation offers a glimpse into the project's background, core goals, and potential impact. As of June 2025, this pitch deck is available in a read-only format on the project website for public access and free distribution. Furthermore, an editable version is maintained internally within the consortium, allowing partners to readily access and tailor the presentation for specific events or audiences where the project is being showcased.

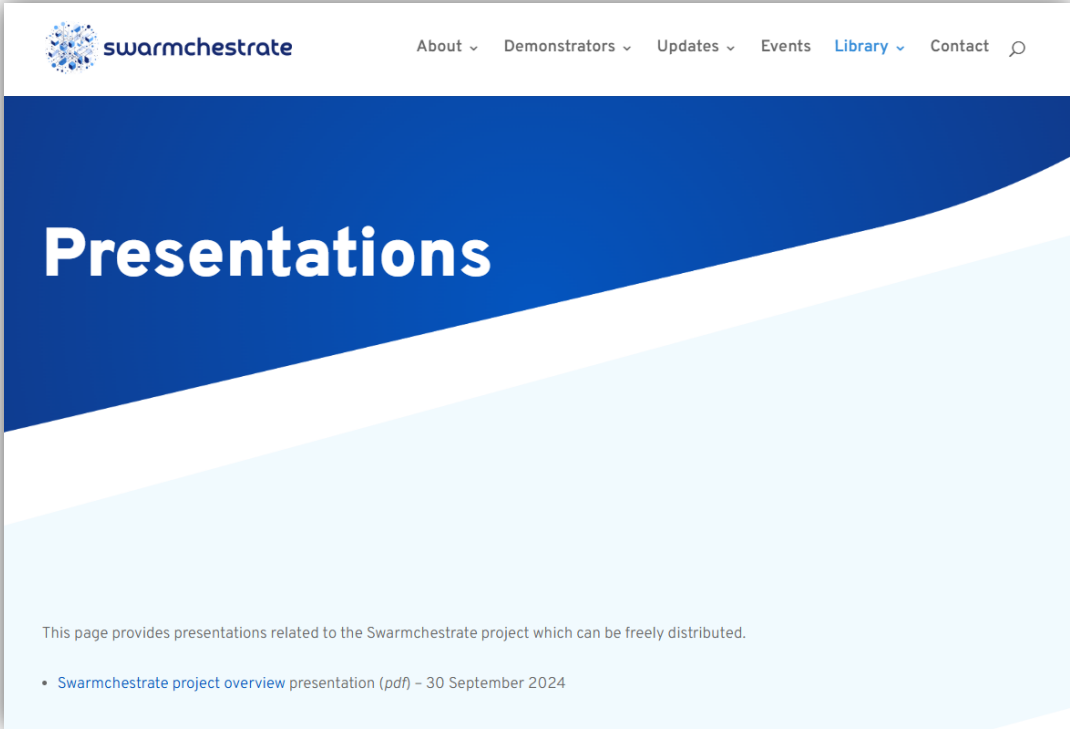


Figure 8 Presentations section in swarmchestrat.eu

To ensure consistent and professional representation across all communication channels, the Swarmchestrat project has established a comprehensive **visual identity**. A set of visual guidelines has been created and made available internally to all consortium partners. These guidelines are instrumental in maintaining a strong, unique, and immediately recognizable brand identity for the project, ensuring all visual outputs adhere to a unified standard.

Developed since June 2024, clear and impactful **key messages** have been coined to effectively convey the core values, objectives, and significant highlights of the Swarmchestrat project. They have been tailored to resonate with specific stakeholder groups, aiming to inform target audiences succinctly and inspire action or engagement relevant to the project's goals, ensuring the core narrative is consistently communicated. These can be found in section 2.2 of deliverable D6.1 [2] and are repeated here for the sake of completeness.

Table 2 Messages per Stakeholder Group

Key Stakeholder	Purpose	Message
Application developers/ owners	End users of the Swarmchestrat framework. As the main target users of the Swarmchestrat framework, this group is the primary stakeholder.	A novel decentralised framework is offered that provides new possibilities in the form of more efficient application deployment and run-time management.

Key Stakeholder	Purpose	Message
IoT device manufacturers	Added value when selling hardware devices.	Device manufacturers can utilise the Swarmchestrat framework to offer a fully managed solution on top of the IoT devices.
Companies developing and offering hyper-distributed data processing applications	Enhanced market competitiveness.	Introducing the elaborated mechanisms will simplify offering open and interoperable systems.
Companies in the public and private sectors using hyper-distributed data processing applications (e.g., manufacturing, traffic and utility service management)	Expanded application portfolio.	Utilising hyper-distributed data processing applications will open the possibility to currently not feasible application scenario(s).
End user companies of Cloud-to-Edge applications in manufacturing, public sector, and beyond	Solutions to large-scale, complex problems.	Our solutions will mitigate current data processing limitations in the Cloud Continuum.
Citizens, general public	Improved quality of life.	Swarmchestrat will demonstrate the benefit of its solutions in four selected use-cases.
Academia, Research communities, Other research projects, R&I departments of IT companies	Disseminating our findings and outputs. Enabling the utilisation of Swarmchestrat outputs to further improve science and technology.	Presenting our results throughout academia and research communities so we can collaborate with similar initiatives.
Open source associations, SDOs, Technology Clusters, Policy Makers	Awareness raising.	Our approach can be exploited via decision-making groups, and collaborations can be identified.

2.6 Liaisons with Other Projects

Engaging in clustering activities and establishing liaisons with related projects and initiatives is a priority for the Swarmchestrat project. These collaborations are crucial for leveraging synergies, amplifying research impact, fostering knowledge exchange, and contributing to the broader European research and innovation landscape, particularly within the Cloud-Edge-IoT (CEI) domain.

Swarmchestrat participates in the **EUCloudEdgeIoT** initiative [3], a significant European effort aimed at fostering the development and understanding of the CEI Continuum. The initiative promotes cooperation between a wide range of research projects, developers and suppliers, business users, and potential adopters of this new technological paradigm. Within this framework, Swarmchestrat is a member of the "**Cognitive Computing Continuum**" (CCC) cluster. This cluster comprises seven projects in total, funded under the same HORIZON Europe call, specifically "*Cognitive Computing Continuum: Intelligence and Automation for More Efficient Data Processing*". This membership facilitates targeted collaboration and knowledge sharing within this specific technological area. Swarmchestrat was spotlighted on the official EUCloudEdgeIoT LinkedIn page in March 2025, increasing its visibility within the community.

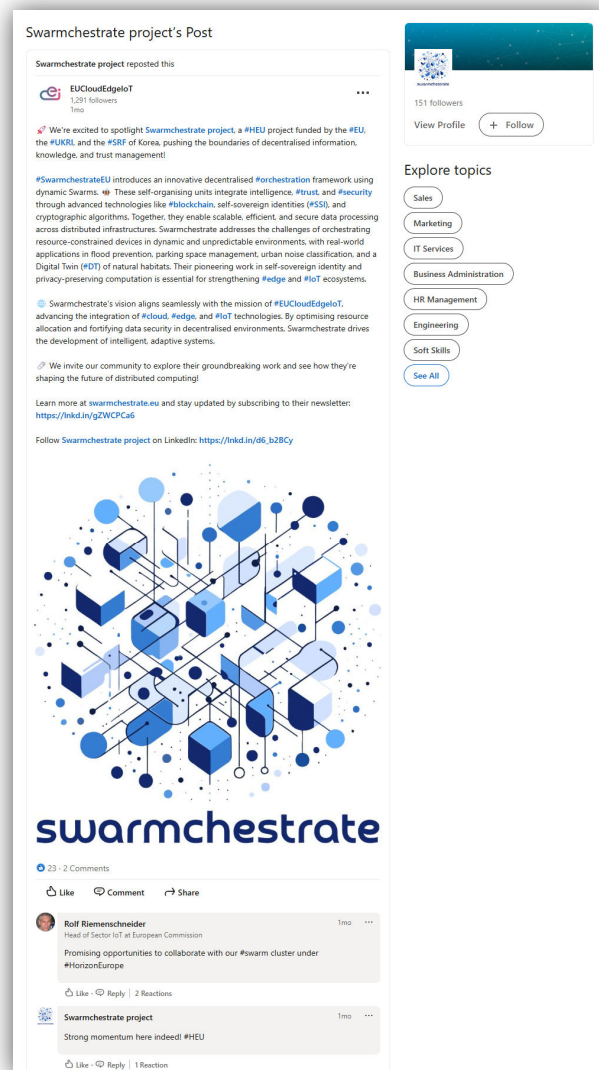


Figure 9 EUCloudEdgeIoT LinkedIn post spotlighting Swarmchestrat project

The first event co-organised by the CCC cluster took place during the **Madeira Digital Transformation Summit⁶**, on 26 June 2024. Representatives of four research projects; Swarmchestrate, ENACT, INTEND and EMPYREAN, took this opportunity to organise a panel session “**Cognitive Computing Continuum: Connecting 40 billion IoT devices with 200ZB of data (in the Cloud)**”, during which they discussed the latest advancements and challenges in dynamically connecting and orchestrating edge-cloud resources and the future of cognitive computing.

With its commitment within the CCC group on-going, Swarmchestrate actively participated in the joint webinar titled “**Get to know the research initiatives about Cognitive Computing Continuum: Intelligence and automation for more efficient data processing**” held in October 2024. This webinar showcased the innovative work of the seven cutting-edge projects within the cluster: HYPER-AI, INTEND, EMPYREAN, ENACT, MYRTUS, Swarmchestrate, and CoGNETs. The event highlighted the collaborative efforts and breakthroughs in the integration of the IoT-Edge-Cloud continuum, AI-driven resource management, and hyper-distributed computing ecosystems. Each project shared their future goals and expected contributions to advancing research in AI and the IoT-Edge-Cloud continuum, outlining the anticipated achievements within their respective domains.

Key outputs of this event, relevant to the cluster's objectives:

- Cutting-Edge Research: Discover the latest advancements from seven pioneering projects in cognitive computing and data processing funded by HORIZON Europe;
- IoT-Edge-Cloud Integration: Gain insights into how the integration of IoT, Edge, and Cloud technologies is revolutionising data processing and management;
- AI and Resource Management: Learn about AI-driven strategies for optimising resource management and enhancing efficiency in heterogenous computing environments; and
- Future Goals and Innovations: Understand the future goals and expected contributions of each project, offering a glimpse into the advancements that plan to shape the industry.

A comprehensive post-event report detailing the proceedings and outcomes was subsequently published on Zenodo, making the insights publicly accessible [4].

Building upon the collaborative activities within the CCC, Swarmchestrate was present at the **IEEE 31st International Conference on Engineering, Technology and Innovation⁷**, which took place in UPV Universitat Politècnica de València, Spain, from June 16th to 19th, 2025. A special session under the name “**Cognitive Computing Continuum**” hosted an insightful panel session exploring cutting-edge innovations in the edge-cloud continuum. Leading researchers and practitioners representing HYPER-AI, EMPYREAN, ENACT, MYRTUS, Swarmchestrate, and CoGNETs HEU projects, gave insights into dynamic connectivity and orchestration of edge-cloud resources, latest trends on AI-driven automation and adaptive resource management,

⁶ <https://mdtweek.digit-madeira.pt/summit/>

⁷ <https://ice-conference.org/>

strategies for security, privacy, and energy efficiency in distributed applications, and discussed challenges and solutions in application deployment optimisation. During this special session, Dr. Amjad Ullah of the Edinburgh Napier University represented Swarmchestrate, focusing mainly on the impact and results of the project: the decentralised approach to orchestration and the notion of self-organisation, the concept of swarms and the incorporation of trust and reputation into orchestration decisions.

Table 3 HEU-funded projects participating in the Cognitive Computing Continuum Cluster

HEU project name	Website URL
CoGNETs	https://cognets.eu/
EMPYREAN	https://empyrean-horizon.eu/
ENACT	https://enact-horizon.eu/
HYPER-AI	https://hyper-ai-project.eu/
INTEND	https://intendproject.eu/
MYRTUS	https://myrtus-project.eu/
Swarmchestr ate	https://www.swarmchestrate.eu/

Finally, Swarmchestrate has also gained significant external recognition by being prominently featured in the **"Technological Trends and Disruptive Developments"** section of the **DISCOVER-US vision paper**, which was recently published on Zenodo [5]. This recognition explicitly highlights the project's perceived potential to revolutionise Distributed Computing and Swarm Intelligence and underscores Swarmchestrate's commitment to driving innovation in decentralised information, knowledge, and trust management. DISCOVER-US is a transatlantic initiative funded by HORIZON Europe [6], bringing together researchers from Europe and the United States to foster pre-competitive research in key areas such as the compute continuum, distributed computing, AI, and swarm intelligence. The vision paper itself explores crucial forward-looking topics, including managing complexity through abstraction, pioneering new concepts for distributed computing and swarm intelligence, developing AI-based self-organised management approaches, and establishing collaborative programming frameworks.

3. Dissemination Activities Report

3.1 Scientific Publications

As a key component of its dissemination strategy, the Swarmchestrat project actively shares its research findings and innovations. The first year of the project (M1-M12), belonged to **Phase 1 - Awareness creation and marketing foundation**, and concentrated on establishing the project's visibility and relevance within the scientific landscape. Efforts during this time were dedicated to strategically identifying key scientific and practitioner communities and evaluating the optimal channels—including esteemed peer-reviewed journals and influential conferences—to effectively communicate the project's existence, scope, and core objectives.

Building upon this work, the first half of the second project year (M13-M18) marked the transition into **Phase 2 - Community outreach and engagement bootstrap**. Here, the Swarmchestrat consortium strategically shifted focus towards presenting tangible project outcomes and innovations to the previously identified target audiences. Recognising peer-reviewed publications as a particularly effective channel for stimulating engagement and discussion around emerging results during this stage, academic partners concentrated their efforts on developing and submitting project findings for presentation, aiming to cultivate deeper interest and interaction regarding the project's specific advancements.

The following scientific publications have been published by Swarmchestrat partners on M18 of the project, acknowledging the project's funding sources:

- **“Attribute-Based Threshold Issuance Anonymous Counting Tokens and Its Application to Sybil-Resistant Self-Sovereign Identity”** by R. Rabaninejad, B. Abdolmaleki, S. Ramacher, D. Slamanig and A. Michalas. 46th IEEE Symposium on Security and Privacy, 12-14 May 2025
- **“Enhancing Machine Learning-Based Autoscaling for Cloud Resource Orchestration”** by I. Pintye, J. Kovács and R. Lovas. Journal of Grid Computing, Volume 22, Article number 68, Published 19 October 2024
- **“FE[r]Chain: Enforcing Fairness in Blockchain Data Exchanges Through Verifiable Functional Encryption”** by C. Foucault, R. Rabbaninejad, T. Dimitriou and A. Michalas. 29th ACM Symposium on Access Control Models and Technologies (SACMAT), 15-17 May 2024
- **“Synergizing Fuzzy-based Task Offloading with Machine Learning-driven Forecasting for IoT”** by A. Markus, V. D. Hegedus, J. D. Dombi and A. Kertész. 8th IEEE International Conference on Fog and Edge Computing 2024 (ICFEC 2024), 6-9 May 2024
- **“Swarmchestrat: Towards a Fully Decentralised Framework for Orchestrating Applications in the Cloud-to-Edge Continuum”** by T. Kiss, A. Ullah, G. Terstyanszky, O. Kao, S. Becker, Y. Verginadis, A. Michalas, V. Stankovski, A. Kertész, E. Ricci, J. Altmann, B. Egger, F. Tusa, J. Kovács, R. Lovas. Proceedings of the 38th International Conference on Advanced Information Networking and Applications (AINA-2024), Volume 5, 17-19 April 2024

- At the time of writing this deliverable, three more scientific publications have been submitted by Swarmchestrat partners; those will be made available online once published and reported in the upcoming project deliverables.

The above-mentioned scientific publications are publicly available through a dedicated section of the project website (Figure 10).

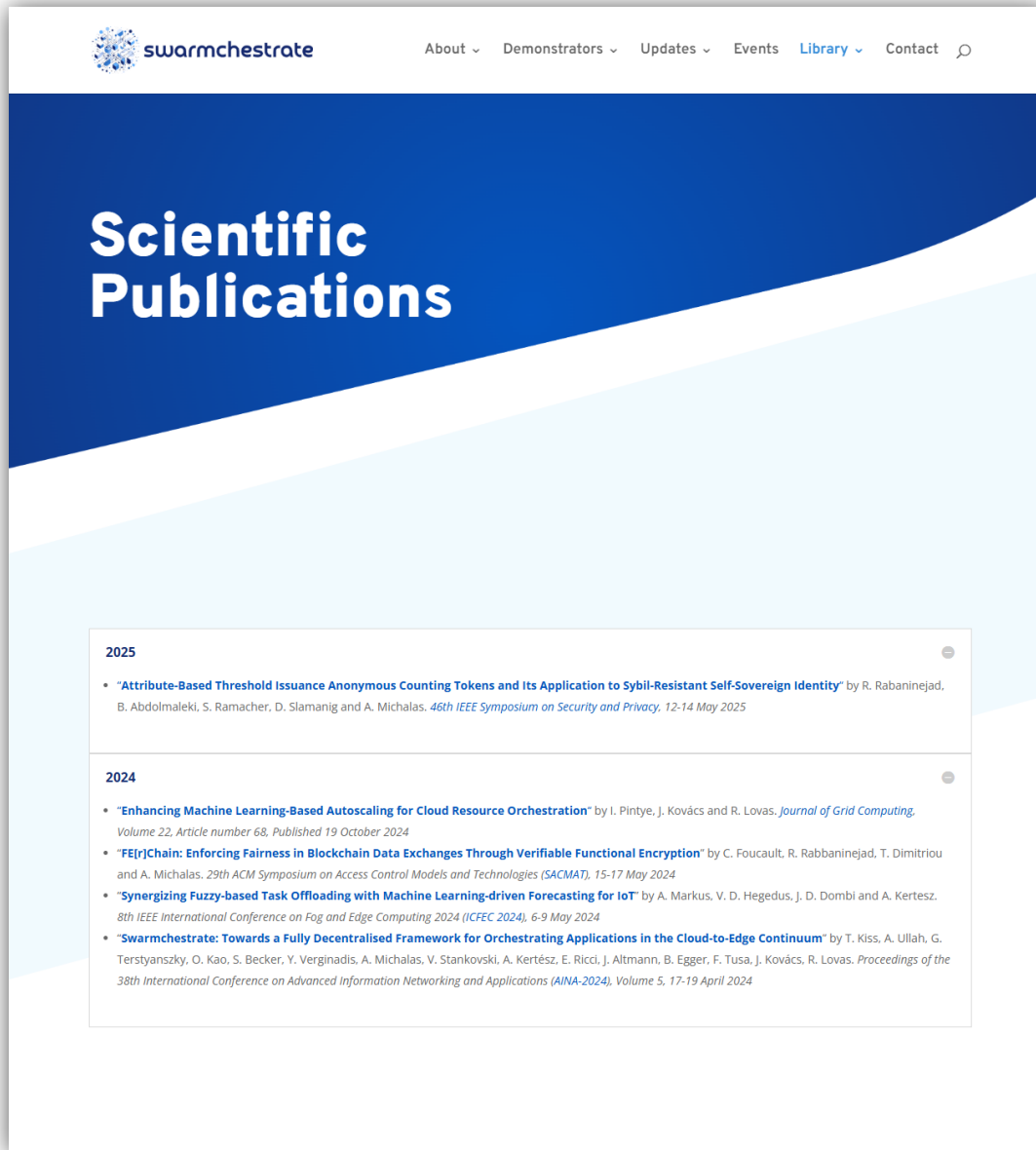


Figure 10 Scientific publications section in swarmchestrat.eu

Furthermore, the scientific publications are available through the Swarmchestrat and the EU Open Research Repository communities in Zenodo (see section 2.2 above).

3.2 Events

In addition to the Events attended in the context of liaising with other project and initiatives, the Swarmchestrate project has participated in the following events:

- UoW presented the Swarmchestrate project results, such as the decentralised approach to orchestration, the notion of self-organisation and the concept of swarms during the 17th International Workshop on Science Gateways, hosted at London, UK, on 17 June 2025.
- SZTAKI delivered a presentation titled: *"Swarmchestrate - Decentralised Swarm-based Application Orchestration in the Cloud to Edge Continuum "*, which outlined the first results of the project regarding the feasibility of the decentralised orchestration and its interconnection with the creation and management of swarms based on distributed intelligence to the participants of the EGI 2025 event, hosted at Santander, Spain, between 2 – 6 June 2025.
- Suite5 prepared an overview presentation of the Swarmchestrate project, which was showcased during the second *"European Convergence Summit"* which took place in Brussels, on 9 April 2025. This *"AI-Data-Robotics-Association"* CSA-funded event, aimed at identifying how AI, robotics, and big data combined can provide assistance in addressing socio-economic issues of interest to Europe, its citizens and its economy.
- UoW delivered a keynote speech titled *"The evolution of application orchestration in the Cloud-to-Edge continuum"*, including the presentation of the objectives and the architecture of the Swarmchestrate project, during the Eighth International Conference on Parallel, Distributed and Grid Computing (PDGC), on 19 December 2024. The conference was hosted at the Department of Computer Science & Engineering and Information Technology of the Jaypee University of Information Technology, in India.
- SZTAKI delivered an online presentation titled: *"Energy-optimisation techniques for complex workloads from the Swarmchestrate project"*, presenting the Swarmchestrate endeavour to the participants of the EGI 2024 event, hosted at Lecce, Italy, between 30 September – 4 October 2024.
- UoW delivered an overview of the Swarmchestrate project goals and conceived architecture, focusing on its early results to science gateway in front of research software engineers, researchers, academics and individuals who work with or are interested in research software, during the 5th edition of the RSLondonSouthEast workshop, hosted at Imperial College London's South Kensington Campus, on 16 July 2024.
- FrontEndART Ltd. delivered a speech titled: *"The integration of Fog Computing, Blockchain, and Federated Learning for the management of IoT Applications"*, during the CERCIRAS closing conference, hosted at the University of Maribor, Slovenia, between 2-5 July 2024.
- UoW presented the Swarmchestrate project during the 16th International Workshop on Science Gateways, hosted at Toulouse, France, on 19 June 2024.
- FrontEndART Ltd. presented the paper *"Synergizing Fuzzy-based Task Offloading with Machine Learning-driven Forecasting for IoT"* during the 8th IEEE International

Conference on Fog and Edge Computing 2024, hosted at Philadelphia, USA, between 6-9 May 2024.

- ICCS presented the paper “*Swarmchestrat: Towards a Fully Decentralised Framework for Orchestrating Applications in the Cloud-to-Edge Continuum*”, during the 38th International Conference on Advanced Information Networking and Applications (AINA-2024), in April 2024.

All the events where the Swarmchestrat project participates, or (co-)organises, are presented in a dedicated section of the project website (Figure 11).



Figure 11 Events section in swarmchestrat.eu

3.3 Workshops, Webinars & Training

During the Madeira Digital Transformation Summit, in June 2024, representatives of four research projects; Swarmchestrat, ENACT, INTEND and EMPYREAN HEU projects, organised a panel session **“Cognitive Computing Continuum: Connecting 40 billion IoT devices with 200ZB of data (in the Cloud)”**, during which they discussed the latest advancements and challenges in dynamically connecting and orchestrating edge-cloud resources and the future of cognitive computing.

During the **IEEE 31st International Conference on Engineering, Technology and Innovation**, in June 2025, leading researchers and practitioners representing HYPER-AI, EMPYREAN, ENACT, MYRTUS, Swarmchestrat, and CoGNETs HEU projects, co-organised a special session under the name **“Cognitive Computing Continuum”**, which gave insights into dynamic connectivity and orchestration of edge-cloud resources, latest trends on AI-driven automation and adaptive resource management, strategies for security, privacy, and energy efficiency in distributed applications.

The Swarmchestrat project further aims to (co-)organise a scientific workshop during the second half of the project duration.

A 2-minute pitch video presentation of the Swarmchestrat project was part of the *“Launch Event: showcasing the future of innovation in AI, Data, and Robotics”*, an online webinar which took place in February 2024 and showcased the vision, objectives, and impact of 54 projects funded across diverse domain in a concise yet impactful manner.

The Swarmchestrat project actively participated in the joint webinar titled **“Get to know the research initiatives about Cognitive Computing Continuum: Intelligence and automation for more efficient data processing”** held in October 2024. This webinar showcased the innovative work of the seven cutting-edge projects: HYPER-AI, INTEND, EMPYREAN, ENACT, MYRTUS, Swarmchestrat, and CoGNETs. Each project presented their project concept and shared their future goals and expected contributions to advancing research in AI and the IoT-Edge-Cloud continuum, outlining the anticipated achievements within their respective domains. A comprehensive post-event report detailing the proceedings and outcomes was subsequently published on Zenodo [4].

According to the dissemination plan, one more webinar should be organised around M18, and two more webinars after releasing all platform components. At the moment of writing this deliverable, a joint standardisation webinar is being organised together with 6 projects of the CCC cluster. The aim is to discuss the standardisation potential of each project in a recorded, joint event that shall help disseminate the project results. There is also a plan to involve EU initiatives such as StandICT.eu, SNS CO-Op, HRBooster.eu.

The following five events qualify as **training and engagement sessions** with direct interaction with the general public (e.g., non-scientists, university students, secondary schools, etc.), during which, project partners inform their audience about the effect of the project’s results in their everyday life, creating awareness on facts regarding the societal benefits for empowering the fog and edge computing and IoT:

- **keynote speech** titled “*Towards fully decentralised orchestration in the cloud to edge continuum*”, during the 17th International Workshop on Science Gateways (IWSG 2025), hosted at the University of Westminster in London, in the UK;
- **keynote speech** titled “*The evolution of application orchestration in the Cloud-to-Edge continuum*”, including the presentation of the objectives and the architecture of the Swarmchestrat project, during the Eighth International Conference on Parallel, Distributed and Grid Computing (PDGC), hosted at the Jaypee University of Information Technology, in India;
- **speech** titled: “*The integration of Fog Computing, Blockchain, and Federated Learning for the management of IoT Applications*”, during the CERCIRAS closing conference, hosted at the University of Maribor, in Slovenia;
- **project overview** at the 5th edition of the RSLondonSouthEast workshop, hosted at Imperial College London, in the UK;
- **project overview** at the 16th International Workshop on Science Gateways (IWSG 2024), hosted at Toulouse, France.

3.4 Contributions to Standardisation and Open Source Communities

Use of and contribution to Topology and Orchestration Specification for Cloud Applications (TOSCA)

TOSCA is a widely used standard of OASIS that aims to provide a generic metalanguage for describing cloud applications and topologies. The Swarmchestrat project is showing active interest towards TOSCA, both in terms of furthering the specification and actually using it to describe applications in the cloud-to-edge continuum. UoW in particular has been a long-term contributor of the TOSCA community and Swarmchestrat is providing further opportunities for engagement.

When selecting the TOSCA version to be applied in the project, Swarmchestrat partners decided to go with TOSCA version 2.0. Lately, the OASIS Technical Committee officially approved and published TOSCA Version 2.0 as a Committee Specification 01 (CS01) on December 2024 [7]. Achieving Committee Specification status is a crucial milestone in the OASIS standardisation process. It signifies that the technical committee members have approved the specification as technically sound and stable, ready for implementation and testing. The next and final step typically involves processes like a call for consent within the committee and potentially a vote by the wider OASIS membership.

A major difference between TOSCA v2.0 and earlier versions has been the introduction of *profiles*. Previously, *normative TOSCA types* proposed a set of component definitions that were to be used by those writing TOSCA. In TOSCA v2.0, TOSCA authors are empowered to write their own component definitions into a TOSCA profile that is representative of their domain, which can be shared with others engaging with similar use cases. **This puts the Swarmchestrat project in a unique position to define the first *swarm computing* TOSCA profile, which can be used by other TOSCA adopters in the swarm computing space.**

With TOSCA profiles, it is accepted that some domains will share similarities and therefore could share a set of common component definitions as a profile. Since late 2024, UoW has been collaborating with a subset of the OASIS TOSCA Technical Committee to determine and define this common componentry. Inputs from the Swarmchestrate project will feed directly into a set of common definitions that could be used by any TOSCA adopters, regardless of domain.

Additionally, UoW has been evaluating various software tools in the TOSCA ecosystem, which are used for validating, parsing, and orchestrating TOSCA templates. This evaluation process gives to the Swarmchestrate project the opportunity to provide feedback and influence the development of TOSCA tooling, ensuring that it can support the needs of swarm computing as it grows.

Within Swarmchestrate, TOSCA is used in multiple roles to describe applications, resources (capacities) and monitoring requirements. The detailed technical work on TOSCA is described in the deliverable D2.1 (deliverable D2.1 is being prepared in parallel with the deliverable at hand).

One of the key features of the proposed Swarmchestrate decentralised framework is the **TOSCA-based application and resource description template**. Application requirements, including application topology, resource requirements and quality of service parameters (e.g., response time, security requirements, energy consumption), and also resource characteristics and capabilities, are described in standardised TOSCA-based documents.

In the context of the Monitoring System of Swarmchestrate, TOSCA is used to define the Metric Model of each application running on Swarmchestrate, which is a set of QoS requirements needed to be fulfilled. It consists of the monitoring metrics that need to be captured and the requirements in the form of metric constraints needed to be obeyed. In order to represent fully the above notions, we created the necessary node types, data types and capabilities for the different kinds of metrics and the constraints needed. In order for the monitoring system to be able to handle the TOSCA description, a translation plugin was also developed to allow the Event Monitoring System to properly interpret TOSCA.

Compliance with W3C standards for Decentralised Identifiers (DID) and Verifiable Credentials (VCs)

Swarmchestrate's Knowledge Management layer components (i.e., identity and role management system, trust management system) comply with the W3C standards for Decentralised Identifiers (DID) and Verifiable Credentials (VCs). The W3C DID standard defines the URI syntax, a rich DID Document data model, and a set of verification relationships, which bind public-key material to concrete uses. It also details method-independent resolution, security and privacy requirements, and a conformance test-suite. Moreover, it contains 103 experimental DID-method drafts and 46 conformant implementations, demonstrating healthy interoperability.

The W3C VCs data model standardises an extensible JSON-LD/CBOR schema for verifiable credentials and presentations, formalises the three-party issuer–holder–verifier ecosystem,

and makes Data Integrity 1.0 and JOSE/COSE proof formats normative. The specification introduces canonical features such as credentialStatus, credentialSchema, status-list registries, and the updated validFrom/validUntil timespan properties, all underscored by comprehensive security and privacy guidance. By anchoring role assignments, permissions, and trust assertions in these tamper-evident, selectively disclosable credentials —and resolving their subjects by DID, Swarmchestrate enables secure identity, role, and trust management while remaining interoperable with any other conformant tooling.



4. Exploitation Considerations

4.1 Updated Individual Exploitation Planning

This section lays down the updated individual exploitation plans of the different Swarmchestrate partners, at M18 of the project. In their individual exploitation planning, each consortium member described how the results of their work within the Swarmchestrate project will enable them to enrich their own offering(s), advance their research, enhance the status and position of their organisation, etc., always keeping in mind the nature of each partner, e.g., university, research center, SME, etc.

Table 4 Updated Individual Exploitation Plans of the Swarmchestrate partners

Partner Name	Individual Exploitation Plan
SZTAKI	SZTAKI, as an academic organisation, will not directly pursue the commercialisation of its research findings. All intellectual properties developed by SZTAKI will be open access to ensure that these results are freely available to the public.
TUB	<p>TU Berlin (TUB), as an academic institution, does not pursue direct commercial exploitation of its research outcomes. Instead, the intellectual property generated in the context of distributed resource allocation for cloud-edge workloads — particularly in the areas of logical proximity modelling, matchmaking algorithms, and orchestration strategies — will be made openly available. This includes dissemination through open-access scientific publications, presentations at international conferences, and contributions to open-source software repositories.</p> <p>TUB is committed to ensuring that the knowledge produced within the project promotes further academic research, fosters collaborations with other universities and research centers, and informs the broader scientific community. Additionally, TUB intends to engage with industrial stakeholders and SMEs through workshops, seminars, and collaborative discussions, offering insights into the innovative solutions developed and their potential applications. Where appropriate, TUB may also explore opportunities for joint research projects or consultancy activities in tandem with external partners interested in applying these technologies in practical settings.</p>
ICCS	ICCS is a non-profit, private law body associated with the School of Electrical and Computer Engineering of the National Technical University of Athens. ICCS was established in 1989 by the Ministry of Education of Greece in order to promote research and development activity in all diverse aspects of computer and telecommunications systems and their applications. The Information Management Unit of ICCS participates in Swarmchestr ate . As an academic institution, ICCS it is not going to pursue the financial exploitation of the research findings. Its research outcome and the intellectual property produced in this project will be available to public through open-access publications and open source code repositories in order to promote knowledge dissemination and the advancement of

Partner Name	Individual Exploitation Plan
	science and research. ICCS intends to exploit academic publication opportunities to disseminate its core work in terms of the Swarmchestrat project. Furthermore, ICCS intends to provide insights of the Swarmchestrat innovations to enterprises and SMEs while participating in training activities regarding the project. ICCS can organise seminars and workshops in organisations which will aim at educating them on how to take advantage of the innovative technologies to enhance modern organisations with valuable application deployments over the computing continuum.
TAU	As an academic institution, TAU will not pursue direct commercialisation of research results. Outputs will be released as open source under the least restrictive licenses. Research outcomes in the field of security will be disseminated through peer-reviewed publications and lectures. TAU will maximise the impact of its work by targeting top conferences in applied cryptography, security, and privacy. In parallel, it will engage with industry partners and the university's startup ecosystem to share project results. We will also involve master's students, who will contribute to the project through their theses and gain experience in EU research.
IRI UL	<p>IRI UL (Institute for Innovation and Development of University of Ljubljana) was established jointly by the University of Ljubljana and several technologically advanced Slovenian companies as the intermediary organisation, operating as a service for knowledge and technology transfer of Slovenia's most prominent University. It is a non-profit research institute that actively co-designs, creates and disseminates technological and societal solutions tailored to people and the environment. In partnership with UL, the IRI UL is dedicated to nurturing an open source ecosystem for its research and development results. Furthermore, IRI UL will offer technical support for the upkeep and progress of products via commercial consulting and contractual research services.</p> <p>IRI UL will retain intellectual property for the trust-management component of the Swarmchestrat solution (primarily co-owned with UL) and will seek to commercialise this asset independently, as well as integrated into the full Swarmchestrat Platform.</p>
UL	<p>The University of Ljubljana is committed to fostering an open source environment for its academic outputs. In pursuit of this, the university will proactively engage with commercial entities, seeking partnerships beyond the consortium to aid in the commercialisation process. Furthermore, the University of Ljubljana will provide technical assistance for product maintenance and advancement through commercial consultancy and contract research arrangements. This approach ensures that the university's innovations are both accessible and supported by robust commercial strategies.</p> <p>UL will proactively pursue commercial partnerships, both within and beyond the consortium, to bring project outcomes to market. Through tailored consultancy and contract-research agreements, UL will also supply ongoing</p>

Partner Name	Individual Exploitation Plan
	technical support for product maintenance and further development. UL will retain intellectual property for the trust-management component of the Swarmchestrat solution (primarily co-owned with UL IRI) and will seek to commercialise this asset independently as well as integrated into the full Swarmchestrat Platform.
FUELICS	Fuelics is a deep tech, edge computing battery operated devices manufacturing company that offers end-2-end IoT platform solution in vertical markets ranging from oil&gas to Smart Cities. The Swarmchestrat decentralised orchestrator will allow Fuelics to automate the configuration management of the deployed sensors. Fuelics is willing to incorporate the Swarmchestrat orchestrator in its commercial offering and/or collaborate with other partners on a shared or licenced IP.
SUITE5	Suite5 Data Intelligence Solutions (S5) expects to acquire further technological and innovation know-how related to smart IoT services and the orchestration of decentralised applications, to further expand its unique solution portfolio on analytics and smart scheduling solutions. S5 aims to experiment on and implement distributed intelligence techniques for (a) matchmaking between applications and resources, and (b) self-organised Swarms, which in turn shall further expand the capabilities of the S5 Enterprise Analytics software. The exploitation of the results and of the work performed inside the Swarmchestrat project shall help gain insights into novel business models including IoT services in the domains of smart manufacturing, utilities, and energy sectors, where S5 is active and aspires to upgrade its services portfolio.
FEA	FEA will continue to develop and support the DISSECT-CF-Fog simulation tool. The simulator will be available as open-source for research and academic purposes, with paid consultancy services offered to assist commercial entities in adapting it for specific Cloud-to-Edge applications. Additionally, the tool will support the creation of digital twin models for Cloud-to-Edge environments, increasing its usability in real-world scenarios. These enhancements make the simulator a valuable resource for ongoing research activities beyond the project's scope and generate opportunities for further collaboration both with domestic and international partners.

Partner Name	Individual Exploitation Plan
FBK	<p>Being a research center, FBK will exploit the results, as well as knowledge matured in Swarmchestrat as an opportunity for scientific dissemination through international journals, transactions and conferences and preprints in online repositories (e.g., arXiv, Zenodo), for production of academic material (PhD program courses, courses thought by FBK personnel involved in the project), seminars and tutorials, but also thesis assignments and internships, for technology transfer to industrial third parties. In particular, FBK is associated with HIT (Trentino Innovation Hub), whose mission is to connect research and market innovation demand. TrentinoSviluppo is also a partner of HIT (Trentino Innovation Hub), thus directly connecting FBK with local companies, in particular SMEs and start-ups. FBK also pays particular attention to its stakeholders – public administration, private companies and European agencies – by coordinating its global strategy in strong synergy between the two pillars on which the Foundation is based: scientific excellence and impact on the market and society.</p> <p>With this in mind, FBK implements two main actions aimed at directing and coordinating research, development and innovation activities:</p> <ol style="list-style-type: none"> (1) a marketing strategy whose objective is to identify the “reference market”, i.e., what meets the needs and interests of FBK’s stakeholders, and FBK’s “market products”, i.e., the solutions, products, and services that arise from the needs of stakeholders. (2) business development, whose goal is to define, suggest, and implement a planning strategy, projects and activities that seize the opportunities of the reference market identified by strategic marketing, considering the resources, the skills present (but also those that can be created) at FBK.
UST	<p>UST will commercialise its skills and services as implementers of IoT technology in challenging environments such as those exposed to the weather. The technology developed in Swarmchestrat will allow more efficient and robust implementations and will provide a flagship reference. Additionally, the ability to simulate the site based on sustainability-related data will allow additional services and offerings in rehabilitation of natural spaces.</p>
SNU	<p>SNU is an academic organisation, which does not seek direct commercial exploitation of their research results. Any intellectual properties created in the area of optimisation will be shared through publications and lectures. This approach allows for fast knowledge dissemination, fosters further innovations, and enhances collaboration with other creative entities. With respect to publications, SNU seeks to publish in computer science journals and business management journals, to allow for long-term knowledge dissemination of knowledge gained through the participation in the Swarmchestrat project.</p>
ENU	<p>As an academic institution, ENU will not directly seek the commercialisation of the research results. All outputs developed by ENU will be open source on the less restrictive license possible. Furthermore, research results created in the area of orchestration will be shared through publications and</p>

Partner Name	Individual Exploitation Plan
	lectures. ENU will actively search for commercial partners, both inside and outside the consortium, to support the commercialisation of the outputs. ENU will offer technical support for the maintenance and further development of the products based on commercial consultancy/contract research agreements. Regarding exploitable results, ENU will co-own the IP behind the orchestrator component of the Swarmchestrat solution (primarily with SZTAKI and UoW), and will focus on the exploitation of this component individually, as well as part of the Swarmchestrat Platform.
UoW	As an academic institution, UoW will not directly pursue the commercialisation of the results. All outputs developed by UoW will be open sourced on the less restrictive license possible (currently all UoW outputs are licensed under Apache 2.0). UoW will actively search for commercial partners, both inside and outside the consortium, to support the commercialisation of the outputs. UoW will offer technical support for the maintenance and further development of the products based on commercial consultancy/ contract research agreements. Regarding exploitable results, UoW will co-own the IP behind the orchestrator component of the Swarmchestrat solution (primarily with SZTAKI and ENU), and will focus on the exploitation of this component individually, as well as part of the Swarmchestrat Platform.
INNORENEW	InnoRenew CoE will exploit the results of its demonstrator both academically and commercially. All core outputs will be released as open-source code and shared through scientific publications to ensure broad accessibility and foster innovation. At the same time, InnoRenew will explore commercial opportunities through service-oriented deployments and follow-up collaborations. The key exploitable result is the edge-based noise classification system, which will be directly used by the Municipality of Koper to monitor urban noise sources. This will support better planning and event management in line with citizens' well-being. The demonstrator serves as a showcase of responsible, privacy-preserving smart city solutions that can be adapted and replicated in similar urban contexts.

4.2 Identification of Key Exploitable Results

This section lays down the Key Exploitable Results, as identified by the Swarmchestrat partners at M18 of the project. In line with the exploitation strategy described in the DoA and the comments received during the project’s technical check, an effort has been made to describe each KER, define an exploitation strategy for it, identify an as least restrictive as possible license, and assign more than one partners who wish to jointly exploit each KER.

4.2.1 Integrated Swarmchestrat Platform

Table 5 Swarmchestrat Solution KER

KER Name	Swarmchestrat Solution
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Description of Exploitable Result	<p>This is the main exploitable result of the Swarmchestrat project.</p> <p>It represents the entire Swarmchestrat platform, including all integrated components (decentralised orchestration, swarm management, AI-based optimisation, event monitoring system, knowledge management system, and further supporting components, e.g., authentication mechanism).</p>
Main Partner	UoW
Contributing Partner(s)	ENU, SZTAKI, TUB, ICCS, TAU, UL, FEA, FBK, SNU
Exploitation Strategy	<p>As this KER depends on the output of a large number of partners, the exploitation requires further intensive discussions. It needs to be understood whether the Swarmchestrat Solution as a whole can be efficiently exploited, or whether it is better to focus on the individual components (as presented in the upcoming sub-sections). It also needs to be explored, whether all components are essential or whether there is a minimum viable product with less components and partners, which could be exploited separately and more easily. As most of the owners of this KER are academic and research institutions, the plan is to base the exploitation on an open source model where the main income will come from offering paid consultancy services directed to commercial entities, who would like to tailor the solution to their needs. This could be accomplished by designating a small team (2-3 persons) of Swarmchestrat members to act as the first line of response to business inquiries. Academic and research partners also plan to utilise the Swarmchestrat solution as a basis for PhDs and for further funded research projects. Besides academic partners, we are also looking for collaboration with commercial entities, either the demonstrator partners within the project or companies outside the project, that are willing to explore how the Swarmchestrat Solution can become a commercial offer. This could happen through a licensing model where the client deploys the solution and pays the appropriate license fees, or via a service provider model</p>

	where a pay as you go service is operated by a commercial entity.
Licensing Intentions	Ideally, all components will be available on an open source license. However, this requires further discussion between all involved parties until the end of the project duration.

4.2.2 Particular Components & Knowledge Assets

Table 6 Decentralised Orchestrator KER

KER Name	Decentralised Orchestrator
Description of Exploitable Result	This is the orchestrator component of Swarmchestrat, which is responsible for the deployment and run-time management of applications. The orchestrator is responsible for deploying the applications' microservices in the cloud-to-edge continuum based on the input TOSCA description, and then dynamically managing application behaviour (e.g. scaling up or down at both virtual machine and container levels, migrating microservices between hosts, etc.).
Main Partner	UoW
Contributing Partner(s)	ENU, SZTAKI
Exploitation Strategy	<p>Release the source code as open-source to online repositories.</p> <p>Advertise and offer paid consultancy services directed to commercial entities, who would like to tailor the solution to the needs of the commercial entity.</p> <p>Use the decentralised orchestrator as basis for PhDs /for further research.</p> <p>Keep alive the decentralised orchestrator for at least five years after the end of the project, by offering support to interested parties who access and wish to use the source code.</p>
Licensing Intentions	Apache 2.0

Table 7 Extended DISSECT-CF-Fog KER

KER Name	Extended DISSECT-CF-Fog
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Description of Exploitable Result	The simulator is designed as a modular service and is ready to be used as a practical tool for testing orchestration scenarios, resource placement, and application deployment strategies for Cloud-to-Edge environments.
Main Partner	FEA
Contributing Partner(s)	SZTAKI, FBK, TUB, UOW, ENU
Exploitation Strategy	<p>The enhanced DISSECT-CF-Fog simulator, with its novel capabilities for modelling the Cloud-to-Edge Continuum, is published as an open-source tool.</p> <p>In addition, paid consultancy services are offered to commercial entities, providing support in utilising the simulator and adapting it to their specific needs.</p>
Licensing Intentions	GPL v3.0

Table 8 Algorithms for logical proximity, swarm formation & swarm management KER

KER Name	Algorithms for logical proximity, swarm formation & swarm management
Description of Exploitable Result	Centralised and decentralised algorithms for selecting the resources that form swarms at application launch and modify swarms during application runtime.
Main Partner	FBK
Contributing Partner(s)	TUB
Exploitation Strategy	<p>Release the source code as open-source to online repositories.</p> <p>Offer on-demand, paid consultancy services to project partners for customisation for specific customer needs.</p> <p>Use the decentralised algorithms as a basis for PhDs and for further research.</p>
Licensing Intentions	MIT

Table 9 Decentralised Event Management System KER

KER Name	Decentralised Event Management System
Description of Exploitable Result	This refers to the adaptive, context-aware decentralised monitoring mechanism that will

	enable self-adaptive adaptations in swarm-based deployments.
Main Partner	ICCS
Contributing Partner(s)	SZTAKI, TUB, SNU, ENU, UoW
Exploitation Strategy	As an academic institution, ICCS it is not going to pursue the financial exploitation of the research findings. Its research outcome and the intellectual property produced in this project will be available to public through publications and open-access repositories in order to promote knowledge dissemination and the advancement of science and research.
Licensing Intentions	MPL 2.0

Table 10 Identity & Role Management System KER

KER Name	Identity & Role Management System
Description of Exploitable Result	It will leverage Decentralised Identifiers (DIDs) to implement a robust identification and authentication mechanism for software agents and resources in the cloud computing continuum. These agents and resources, once registered using Smart Contracts, are considered trusted within the system. DIDs will facilitate the creation and association of identities with various functionalities, ensuring that resources operate only under the conditions where they have the appropriate rights and permissions.
Main Partner	ICCS
Contributing Partner(s)	TAU, UL, IRI UL
Exploitation Strategy	As an academic institution, ICCS it is not going to pursue the financial exploitation of the research findings. Its research outcome and the intellectual property produced in this project will be available to public through publications and open-access repositories in order to promote knowledge dissemination and the advancement of science and research.
Licensing Intentions	MIT

Table 11 Decentralised Knowledge Base KER

KER Name	Decentralised Knowledge Base
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Description of Exploitable Result	A dedicated mechanism that will support the decentralised management of data processing across the cloud computing continuum. This mechanism will materialise a decentralised knowledge base that will enable effective decision-making for resource allocation and application reconfiguration across the cloud continuum.
Main Partner	ICCS
Contributing Partner(s)	UL, IRI UL, FEA, UST
Exploitation Strategy	As an academic institution, ICCS it is not going to pursue the financial exploitation of the research findings. Its research outcome and the intellectual property produced in this project will be available to public through publications and open-access repositories in order to promote knowledge dissemination and the advancement of science and research.
Licensing Intentions	Apache 2.0

Table 12 Trust Management System KER

KER Name	Trust Management System
Description of Exploitable Result	A dedicated mechanism that delivers decentralised trust management, integrating data aggregation components, evidence-based policies, deterministic and stochastic algorithms, and blockchain technologies (DID and VCs) to ensure transparent and traceable establishment of trust among all the participants in the system.
Main Partner	UL
Contributing Partner(s)	UL IRI, ICCS, TAU
Exploitation Strategy	Release the source code as open-source. Offer on-demand, paid consultancy services to project partners for customisation for specific customer needs. Use the algorithms as a basis for PhDs and for further research.
Licensing Intentions	Apache 2.0

Table 13 Privacy-Preserving Analytics KER

KER Name	Privacy-Preserving Analytics
Description of Exploitable Result	A cryptographic framework combining Publicly Verifiable Functional Encryption (PV-FE) and Hybrid Homomorphic Encryption (HHE) to enable privacy-preserving analysis of encrypted data within the Swarmchestrat system. This technology allows legitimate entities to perform verifiable computations and predictions over sensitive data without revealing the underlying inputs or model parameters. The solution supports leakage-resistance and fairness, ensuring secure and accountable decentralised analytics.
Main Partner	TAU
Contributing Partner(s)	UoW
Exploitation Strategy	<p>Release the developed source code as open-source through well-known online repositories.</p> <p>Offer on-demand, paid consultancy services to project partners for customisation for specific customer needs.</p> <p>Leverage the decentralised privacy-preserving algorithms as a foundation for PhD research, academic publications, and future collaborative research projects to expand their applicability and technological maturity.</p>
Licensing Intentions	Apache 2.0

4.2.3 Demonstrator Results

Table 14 Decentralised Device Management KER

KER Name	Decentralised Device Management <i>as implemented in Demos “flood prevention” & “parking space management”</i>
Description of Exploitable Result	Decentralised, automated device reconfiguration using external events and data sources coupled with predefined operational profiles. This mechanism will allow the dynamic adaptation of the deployment to optimise its operation both in terms of responsiveness as well as its cost.
Main Partner	FUELICS

Contributing Partner(s)	FBK, SZTAKI
Exploitation Strategy	The transition from centralised to decentralised, automated sensor configuration management will constitute a new feature in FUELICS IoT platform. Swarmchestrat will allow FUELICS operations team to scale up the number of actively managed devices without increasing its headcount. In addition, data from external sources can be used to alter a deployments' configuration dynamically enabling the creation of new solutions and commercial offerings which are currently not possible.
Licensing Intentions	Commercial

Table 15 Natural Environment Digital Twin KER

KER Name	Natural Environment Digital Twin
Description of Exploitable Result	User Centric Digital Twin of the natural environment populated with information extracted from several edge devices (IoT) that capture different environmental attributes such as weather related (humidity, temperature, wind direction and component...) and others more specific and relevant for environmental research, like some water characteristics from a wetland close by (ph. and electroconductivity). The solution has been designed sticking to very specific constraints established for the adequate restoration of the environment under study, hence usual technical elements that are generally considered a commodity (such as sustained electric current of sufficient broadband connectivity) are not regularly available at the site and the architecture has been planned for use with devices that have the smallest environmental footprint possible.
Main Partner	UST
Contributing Partner(s)	
Exploitation Strategy	UST is expecting to gain expertise in deploying edge devices in challenging environments as exemplified by the La Chanta site, and to extrapolate the learnings to other sites with similar complexity including both natural environments and industrial sites.

Licensing Intentions	Commercial
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Table 16 Noise Source Classification at the Edge KER

KER Name	Noise Source Classification at the Edge
Description of Exploitable Result	The system for noise source classification which enables real-time, privacy-preserving identification of environmental noise sources using edge devices. This system enhances urban sound monitoring while ensuring data protection through local processing and intelligent orchestration via Swarmchestr ate . Additionally, a custom data logger board has been developed to interface with acoustic sensors and support reliable, efficient data acquisition.
Main Partner	INNORENEW
Contributing Partner(s)	
Exploitation Strategy	The edge-based noise classification system, enabled by Swarmchestr ate 's decentralised orchestration, will be offered in a service-oriented manner to municipalities and other stakeholders as a deployable, privacy-preserving monitoring solution. All software components and the custom data logger board will be released under the MIT license, supporting reuse, adaptation, and further development in future sensor-based projects. This open approach encourages collaboration while allowing InnoRenew to monetise through paid services for deployment, maintenance, and data access.
Licensing Intentions	MIT

5. Conclusions & Next Steps

The first half of the Swarmchestrat project has been marked by substantial achievements across its communication, dissemination, and exploitation activities, laying a robust foundation for future success.

The project has successfully established a comprehensive and multi-faceted **communication infrastructure**. The project website effectively serves as a central repository for project goals and demonstrator descriptions, complemented by dynamic social media engagement, a periodic newsletter for sustained outreach, and professionally produced promotional videos and printed materials. Furthermore, the strategic cultivation of liaisons with other pertinent HEU projects has resulted in fruitful co-organisation of sessions, thereby enhancing visibility and fostering collaborative synergies.

Regarding **dissemination**, Swarmchestrat has made significant inroads in sharing its research findings and advancements with both specialised and broader audiences. A set of scientific publications has effectively communicated the project's innovations to the research community in an open manner. Active participation in key events, alongside the successful organisation of workshops, webinars, and training sessions, has ensured the project's visibility extended to the general public, including non-scientific communities and university students. A noteworthy accomplishment is the project's impactful engagement with the TOSCA standard, both in terms of furthering its specification and its practical application in describing cloud-to-edge continuum applications.

Furthermore, considerable progress has been achieved in defining clear pathways for the **exploitation** of project results. All consortium members have diligently updated their individual exploitation plans, providing clear roadmaps for how Swarmchestrat's outcomes will enrich their specific offerings, advance their research capabilities, and elevate their organisational standing, appropriately reflecting the distinct nature of each partner. Crucially, Key Exploitable Results (KERs) have been formally identified and aligned with the exploitation strategy outlined in the DoA and refined based on feedback from the project's technical check.

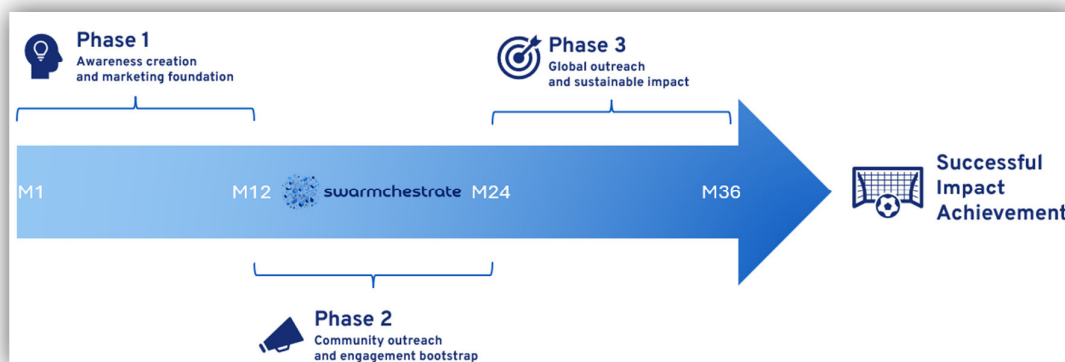


Figure 12 Swarmchestrat D&C Phases [2]

Looking ahead, the project will continue with the implementation of Phase 2 and shall eventually transition into Phase 3 of its D&C strategy. Phase 2 concentrates on actively engaging key target stakeholders to cultivate interest in Swarmchestr^{ate}'s on-going activities and initial outcomes, while solidifying plans for impactful dissemination events such as webinars and workshops. Following this, Phase 3 shall intensify efforts to support industry, SMEs, and other stakeholders in the adoption and deployment of Swarmchestr^{ate}'s concepts, technologies, and tools. This will be achieved through a comprehensive suite of promotional activities, including further scientific publications, targeted material distribution, active participation in and organisation of demonstration events, workshops, and training sessions, and continued liaisons. Standardisation efforts are also anticipated to escalate as the project's technologies mature, complemented by the co-organisation of further collaborative events with CCC cluster projects.



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Annex – D&C Activities Monitoring Table

KPIs as per the DoA		Target by M36	Timeframe	M18
Scientific publications/papers and presentations in conferences	Nr of scientific publications submitted	>30	Throughout the project duration +1 year after project's end	8
Scientific workshops at large conferences	Nr of workshops	2	Throughout the project duration +1 year after project's end	1
	Nr of attendees	>100		~50
Short webinars	Nr of webinars	>4	1 by M12 on concept, 1 by M18, 2 after releasing all components	1
Appearances in general media (News sites, TV, Newspapers)	Nr of appearances	>15	Close to M18 on the overall concept and close to M36 on the outcome presentation	0
Contributions to SDOs and open-source communities	Nr of contributions submitted	>2	After M18 and more active towards end of the project	0
Liaisons with other projects	Nr of synergies/liaisons	>3	Planning M06; Connection before M12; Actions throughout Y2 and Y3	6
Co-organised workshops with other projects	Nr of workshops	2	Planning M06; Connection before M12; Actions throughout Y2 and Y3	2
Co-organised webinars with other projects on common areas	Nr of webinars	4	Planning M06; Connection before M12; Actions throughout Y2 and Y3	2
Social media followers	Nr of cumulative Twitter & BlueSky followers	>500	By end of project	47
	Nr of LinkedIn followers	>500		178
Press releases distributed to media	Nr of press releases	9	press releases after kick-off meeting, by M06, by M24 and by M36	2
Public appearances	Nr of public appearances	>6	To pursue this goal	0
Videos available in YouTube and LinkedIn	Nr of videos	5 (1 on the concept, 1 on final outcomes and 3 related to use cases outcomes)	Throughout project duration	1
Technical brochures/flyers	Nr of brochures/flyers	4	Throughout project duration	1
Newletters	Nr of newsletters issued	15 (1st version in M06 and new issues every 3 months to the end of the project)	Throughout project duration	3
Public events at universities/ colleges and events organised by public authorities	Nr of public events	>8	Project Y2 & Y3	5
	Nr of attendees	>100		~110