

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



GUIDE FOR APPLICANTS

to

aerOS Open Call #2



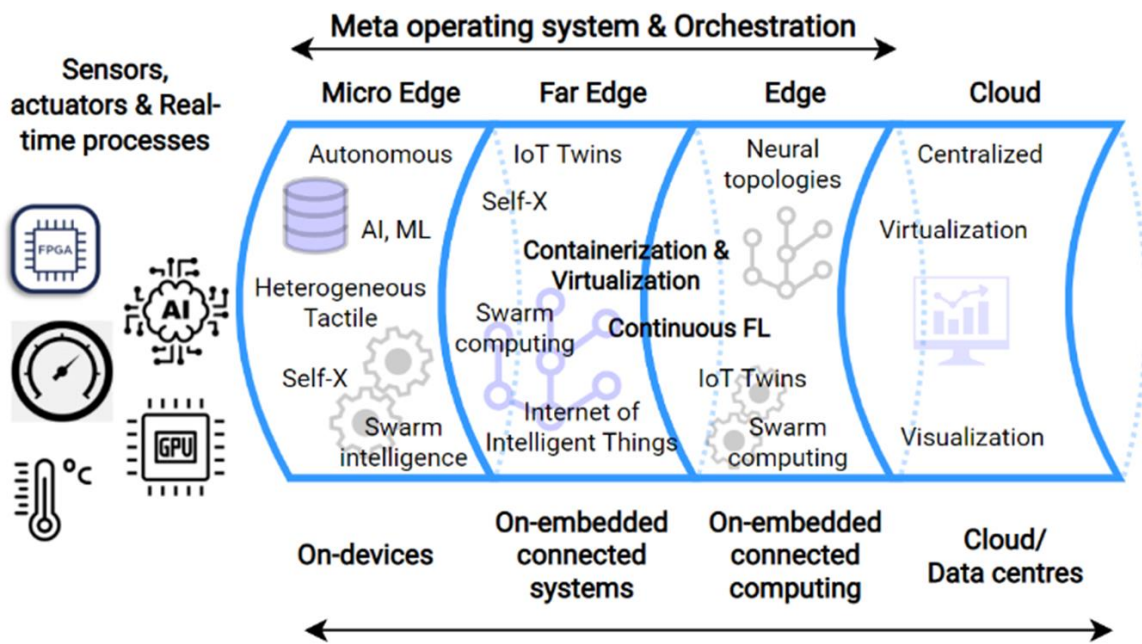
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1. Introduction

1.1. aerOS in a nutshell

Transition to software-driven components and systems requires efficient integration of a variety of new vertically agnostic technologies and services. It requires data strategy, trusted data exchange frameworks, frugal AI on the (far) edge, and containerisation and virtualisation across complex value chains. Besides, collective decentralised decision-making, and system / network federation must be exploited to govern data exchange within models, applications and services across the IoT edge-cloud continuum. Here, meta operating system has to (among others) provide flexible orchestration mechanisms for combining and efficiently utilising the heterogeneous Infrastructure Elements (IEs) comprising the IoT edge-cloud continuum. In particular, it should support exposed standardised services APIs, hardware abstraction, cross-domain resource orchestration, and explainable/decentralised frugal AI. Moreover, aerOS will allow for distributed data management to make user-side applications more intelligent and proactive, and to provide foundation for hyper-distributed applications and services, closer to data sources and event-generating processes without sacrificing aggregated data analysis and insights. Additionally, aerOS will leverage concept of services as a “unifying abstraction”, across resources (i.e., any physical or virtual IoT edge-cloud continuum resource, from device to far-edge, edge or cloud); across multiple infrastructure domains and service levels, supporting federation. Several aspects of aerOS will utilise the (semi)autonomous approaches, in particular these will include mechanisms for self-adaptation and self-healing of the Infrastructure Elements, based on self-observation.



aerOS is being carried out by a Consortium of 27 partners from 11 European countries, specialised in IoT, edge and cloud S/W and H/W technologies as well as in the verticals where the solution will be tested.

aerOS overarching goal is to design and build a virtualised, platform-agnostic meta operating system for the IoT edge-cloud continuum. As a solution, to be executed on any Infrastructure Element within the IoT edge-cloud continuum – hence, independent from underlying hardware and operating system(s) – aerOS will: (i) deliver common virtualised services to enable orchestration, virtual communication (network-related programmable functions), and efficient support for frugal, explainable AI and creation of distributed data-driven applications; (ii) expose an API to be available anywhere and anytime (location-time independent), flexible, resilient and platform-agnostic; and (iii) include a set of infrastructural services and features addressing cybersecurity, trustworthiness and manageability. aerOS will: (a) use context-awareness to distribute software task (application) execution requests; (b) support intelligence as close to the events as possible; (c) support

execution of services using “abstract resources” (e.g., virtual machines, containers) connected through a smart network infrastructure; (d) allocate and orchestrate abstract resources, responsible for executing service chain(s) and (e) support for scalable data autonomy.

To validate the architecture, supporting tools, and the methodology, aerOS will be instantiated in five real-world pilots with several scenarios to demonstrate feasibility of action results for future IoT: (i) manufacturing; (ii) computing near renewable energies, (iii) mobile agricultural machinery, (iv) smart maritime ports and (v) energy-efficient smart buildings.

More information can be found online at project’s website here: <https://aeros-project.eu/>

1.2. Technical objectives of the project

The objectives of the project are listed below:

- O1. Design, implementation and validation of aerOS for optimal orchestration.
- O2. Intelligent realisation of smart network functions for aerOS.
- O3. Definition and implementation of decentralised security, privacy and trust.
- O4. Definition and implementation of distributed AI components with explainability.
- O5. Specification and implementation of a Data Autonomy strategy for the IoT edge-cloud continuum.
- O6. Definition, deployment, and evaluation of real-life use cases.
- O7. Global ecosystem creation, maximisation of impact and Open Call conduction.

More information can be found online at project’s website here: <https://aeros-project.eu/objectives>

1.3. aerOS Open Calls

aerOS has reserved a total of 900.000 € for supporting third parties enhance the scope of the project by joining the project via Open Calls. aerOS will perform **two rounds of Open Calls** where research entities and SMEs around Europe are summoned to:

- Validate and improve technical components of the aerOS meta operating system;
- Bring external actors (developers, domain experts, entrepreneurs, etc.) to create new solutions leveraging aerOS;
- Promote the visibility of aerOS architecture and outcomes on the market;
- Gathering new inputs from IoT, edge, network and industrial experts
- Extend application base of aerOS to other verticals outside the ones included in the proposal (domain-agnostic).

Second Round of Open Calls aims at funding **innovative proposals** that will **upscale and uptake aerOS’ technologies objectives framed** (mandatorily) within **application sectors different to those present in the pilots of the project**. In particular, Open Call proposals are expected to orbit around high TRLs, departing from already consolidated products, and **aiming at bringing aerOS to the next exploitation level**.

Consult [Error! No se encuentra el origen de la referencia.](#) to realise the different type of projects acceptable for Open Call #2.

2. aerOS Open call #2

2.1. Applicability and eligibility criteria

Only the following **type of entities** will be able to submit proposals:

- European SMEs
- Universities

- Research centres (RTOs)
- Individuals

Operational eligibility criteria for proposals will also be:

- Only one entity per proposal will be admitted, so activities in co-operation will not be considered eligible (no Consortia allowed).
- Proposals must contribute to the aerOS paradigm and stick to aerOS technological principles.
- (For Open Call #2) - The proposal must be contextualised **application sectors different to those present in the pilots of the project** (thus, the sectors that will not be acceptable are: manufacturing lines, physical containers close to renewable energy sources, agriculture machinery, maritime ports, smart buildings).
- (For Open Call #2) - The proposal must clearly depart from an existing product / project, thus guaranteeing a quick/prompt integration and exploitation capacity.
- (For Open Call #2) – TRL higher than 6 must be exposed.

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 space in the submission form (Previous IP background).
- 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.

2.2. Funding

For the **second round** of aerOS Open Calls, a **budget of 480k€ is available** considering the following:

- A total of **8 proposals** will be funded.
- A fix amount of **60.000€** will be provided **to every awarded proposal**.
- Fixed duration of projects is **8 months**.

The form of financial support to be used will be a **pre-defined lump sum**. Funds will be provided to the third parties following the accomplishment of different milestones verified on the basis on the presentation of technical and financial reports. Payments will be: (i) pre-financing, (ii) one interim payment according to the results of monitoring actions, (iii) final payment.

In the lump-sum to be requested, the costs will be **eligible** ('eligible costs'), if they correspond to the lump sum set out in Annex 2 and if the corresponding tasks have been properly implemented in accordance with the Proposal submitted. In addition, to be eligible the costs must meet the following criteria:

- i. they must be incurred in the period set out in Article 9.4 of the Collaboration Agreement (see Application Package), with the exception of costs relating to the submission of the technical report and financial statement (see Article 9 of the Collaboration Agreement);
- ii. they must be identifiable and verifiable, in particular recorded in the applicant's accounts in accordance with the accounting standards applicable in the country where the applicant is established and with applicant's usual cost accounting practices;
- iii. they must comply with the applicable national law on taxes, labour and social security, and
- iv. they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

In contrast, the following will be considered **ineligible costs**:

- i. costs that do not comply with the conditions set out above (see Article 7.1 of the Collaboration Agreement)
- ii. costs reimbursed under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the European Commission for the purpose of implementing the EU and Euratom budget).

A detail of the costs (and how to calculate them, regulation applicable, etc.) is given in the Collaboration Agreement template provided in the Applicants Package. Costs for the contribution (direct and indirect costs) are eligible ('eligible costs'),

2.3. Proposal preparation and submission

The submission of proposals will be managed through a dual-channel procedure after proper registry per applicant. The procedure is divided in three steps that are explained here below:

- (1) The applicant must **fulfil an online form** with data relative to the proposal. The URL for submitting the proposal is: <https://opencall.aeros-project.eu/author/submit.php>
The form includes several fields that will correspond to the information that needs to be analysed for eligibility and for evaluation of the proposal:
 - i. **Informative boxes** including: entity name, entity type, person registering the application, PIC of the entity, country and website.
 - ii. **Excellence boxes** (limited characters different in each box):
 - i. Innovative idea and relation with aerOS technology
 - ii. Expected results
 - iii. Previous background, IP and departing solution
 - iii. **Impact and sustainability boxes** (limited characters different in each box):
 - i. Uptake/upscale of aerOS technologies
 - ii. Scientific outreach and expected KPIs
 - iii. Exploitation and commercialization plan
 - iv. **Implementation boxes** (limited characters different in each box):
 - i. Workplan explanation: WPs, tasks and deliverables
 - ii. Technologies, methodologies, milestones and control of the advance
 - v. **Team boxes** (limited characters different in each box):
 - i. The Company
 - ii. The Team
 - vi. **Ethics and GDPR Compliance** (a check box): The form complies with all GDPR and ethical provisions as well as with aerOS procedures defined in deliverable D2.3 of the project. Informed consent and other legal details to ensure compliance with applicable regulations are included, designed in a secure way and including contact emails.
- (2) Employing the user and password data generated out of the form above (using the associated submission number), the applicant can Upload a Document via a specific endpoint. Here, **a PDF composed of only one page with maximum of 3 diagrams (including Gantt chart)** will be admitted.
The URL for uploading the PDF is: <https://opencall.aeros-project.eu/author/upload.php>.
In order for uploading the file, the submission number (previously obtained) must be used, together with the created password.

Please, find in Appendix C - the usage manual of the tool. The submission will be completed once:

- The applicant accesses the Make Submission form, fills all the information and clicks on the button "Submit".
- The applicant accesses the Upload File form, and, after inserting the proper data, attaches the correct file and clicks "Upload File".
The proposal can be updated an unlimited number of times before the submission deadline. Only the last submission will be considered.

The application will be open and available to receive proposals from **July 25th, 2024 to September 30th, 2024, 5 p.m. CEST**. Incomplete proposals will not be evaluated.

2.3.1. Instructions for completing the boxes of the submission form

The applicants are provided with the following list of “check” items. It is strongly encouraged that all proposals will include enough clarification to the questions below. This list of questions will be the one used by the evaluators to analyse the quality of the submissions:

- **Excellence boxes**
 - Which is the main idea of the project and which sector it is expected to influence?
 - How does the project go beyond currently existing solutions?
 - Which is the product/technology underlying the project?
 - Is there any IPR background existing that should be noted?
 - Which is the illustrative process depicting the expected improvements/developments in the project?
 - How does the technology of the project interact with aerOS Meta-OS?
 - How does it validate and helps uptaking/upscaling aerOS technology?
 - Which are the expected outcomes and results of the project? Are those enough substantiated? Is the output TRL clear enough?
- **Impact and sustainability**
 - a. How will the project contribute to aerOS upscale and adoption
 - b. Which are the expected actions to foster the uptake of open source technologies?
 - c. Which is the expected impact of the solution during aerOS project?
 - d. Which are the mid- and long- term indicators that could be monitored to measure the impact of your solution? Attempt to quantify such estimated impact.
 - e. How will you ensure the sustainability of the work beyond the end of the funding? Please indicate any additional sources of funding/support you may need and how you plan to secure it
 - f. Explain every expected publication (scientific paper, congress article, etc.).
 - g. Standardisation and roll-out potential
- **Implementation**
 - a. Is the Gantt plan adjusted to 8 months and is the diagram properly included in the attached PDF?
 - b. Is the implementation feasible and doable in a short timespan?
 - c. Is there a structure of the control in the advances, and a solid timing for deliveries to accomplish the objectives? Is this well aligned with the timing of expected “technical checks to be performed by aerOS Coordination? (Month M1+, M6+ and M8+)?”
 - d. Is the work properly separated by knowledge domains and activities?
 - e. Is any additionally necessary means to realise the idea properly described (data, equipment, connectivity, access to infrastructure, systems, etc.).
- **Team**
 - a. Are all the relevant members of your team properly listed, indicating gender (voluntarily), their relevant skills and experience?
 - b. Is the rationale of the structure of the team and the roles and responsibilities that each member will be taking well described?
 - c. Which is the experience and specialization of your company Cite products, projects and previous research and transfer experiences.
 - d. Is the experience of the organisation (relevant previous projects, services, contracts, etc.) included?

2.4. Evaluation process

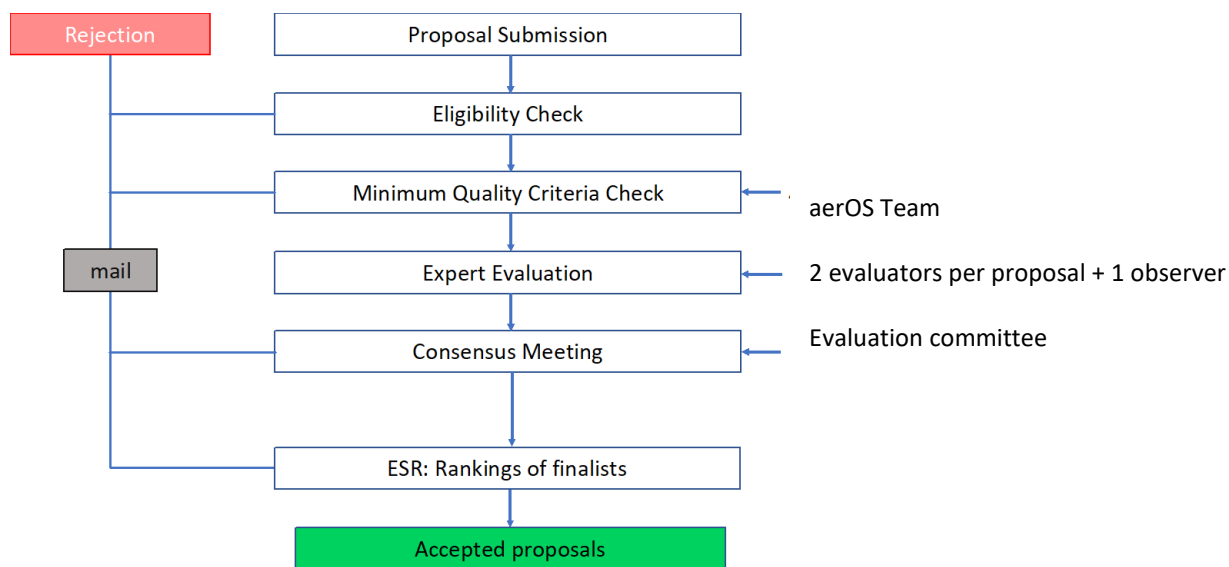
Received proposals will be evaluated and will be given a score upon which will be accepted or rejected to receive funding. The procedure will be crystal-clear, compliant with aerOS commitments to the European Commission. The process will be as follows:

- All proposals will be pre-screened by a selected group of aerOS members to check eligibility and minimum quality compliance based on the criteria exposed in 2.1.
- A selected Expert Evaluation team will be selected per each proposal. This team will be composed of two external experts (with experience in the related fields) and an observer to guarantee impartiality. The selected experts will sign a declaration of confidentiality concerning the evaluation process and the content of the proposals they evaluate. They will also declare their absence of any conflict of interest for the assigned tasks.
- Every expert (two per proposal) will give a score (using a specific form) to each of the evaluation criteria (see the image at the right). The evaluation will need to be based on: i) Relevance to aerOS (min. 3 out of 5); (ii) Impact and sustainability (min 4 out of 5); (iii) Technical excellence (min 4 out of 5); (iv) Quality of implementation (min4 out of 5) (v) Quality of the team (min. 4 out of 5), and 19 as a global threshold over 25.

The evaluation criteria will be:

- Relevance to aerOS (min. 3 out of 5)
- Impact and sustainability (min. 4 out of 5)
- Technical Excellence (min. 4 out of 5)
- Quality of implementation (min. 4 out of 5)
- Quality of the team (min. 4 out of 5)

- Afterwards, the two evaluators will meet (selected group of aerOS members will be present) and will reach a consensus evaluation on the quality of each proposal. The result of that agreement (comments and scores) will be reflected on the Evaluation Summary Report (ESR), which will be agreed by both.
- ESRs will be ranked and will go through a final evaluation by a committee formed by PCC (Project Coordination Committee) members of aerOS and two external observers to guarantee impartiality. Applying criteria here will be:
 - **(For the 2nd Open Call):** Priority to SMEs that can more easily transfer the technologies into the market. In case of ties, SMEs will be preferred.
 - **(For the 2nd Open Call):** Balance on sectors. Preference will be given for a more distributed selection of proposals. However, this criterion may be disregarded if the difference in quality of proposals is justified. The Committee to be established with aerOS picked partners and the external observers will agree on the final list of proposals to be funded.
 - Adequacy to aerOS goals and technology stack.
 - Ranking stands: In case of applications receiving an equal score the criteria will be marks in criteria 1, criteria 3, criteria 4, criteria 2 and criteria 5.
- Notifications on funding or rejections will be sent out to applicants, together with any feedback, by **November, 15th, 2024**. Slight delays might be experienced.
- Once the Open Call evaluation is finalised, representatives of the selected proposals will be invited to sign a Collaboration Agreement (final version included in the application package) with UPV to become third party. During the Collaboration Agreement signing process, the selected applicants will have to provide all relevant documentation concerning their legal and financial status (including providing PIC – Participant Identification Code), as well as any amendments in their technical proposals according to the comments received by the evaluators during the evaluation process, if applicable.



2.5. Joining the Consortium

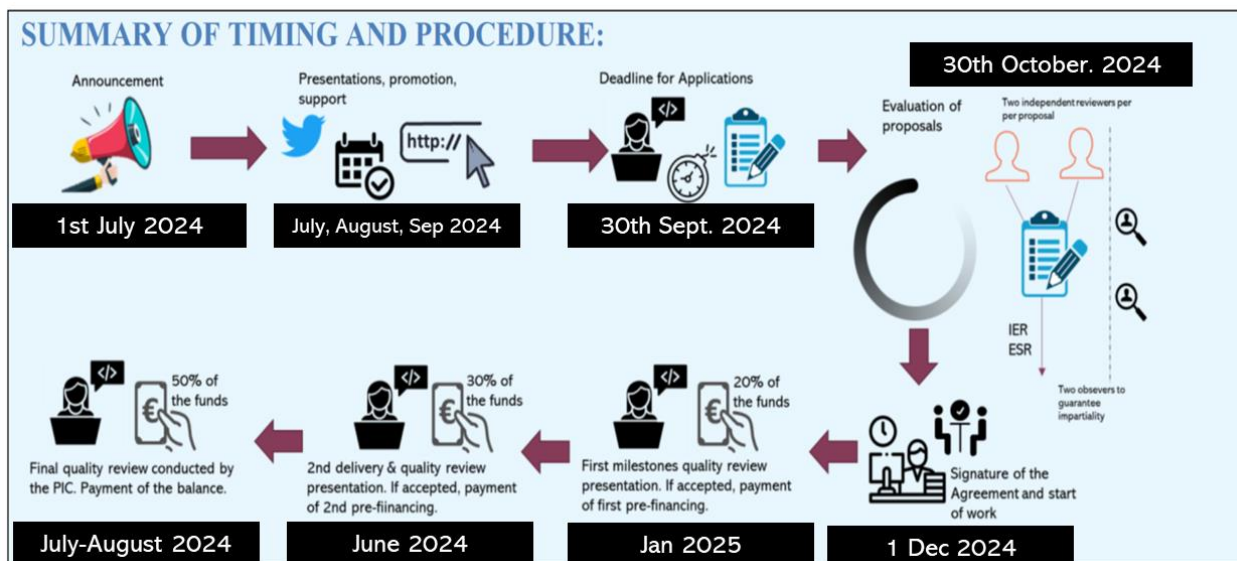
Successful applicants **will be required to sign a collaboration agreement*** with Universitat Politècnica de València (partner UPV), the Project Coordinator, on behalf of the aerOS Consortium in order to be able to receive the funds.

*Note: The Application Package currently published in aerOS’s website contains a **draft** Collaboration Agreement Model. This must be interpreted as a guiding template for the Collaboration Agreement that will need to be signed. aerOS Consortium **reserves the right to add minor modifications** during the period of final formalisation of the document to be signed.

Selected entities will therefore enter the Consortium of aerOS as **third parties of the Project Coordinator**. The draft collaboration agreement with the rights and obligations assumed by the third party is included in the Applicants Package. The applicant (if accepted to be funded) will be requested to fulfil the indicated fields. From then on, all managing aspects will be dealt with via communication with the Project Coordinator. Likewise, any question/issue related with technical/operational participation in the project will be conducted through the leader of task T1.4 of aerOS (Ignacio Lacalle – UPV – iglaub@upv.es).

2.6. Timeline summary

The following figure aims at illustrating the whole process, including timing and deadlines of the different steps. Applicants will be asked to stick to the indicated dates.



- Opening of Open Call application submission window: July 25th, 2024
- Closing of Open Call submission = Deadline for applications: September 30th, 2024
- Communication of the results: November 15th, 2024
- Expected start of action: 1st December 2024¹
- Expected end of action: 31st July 2024

2.7. FAQs

This section exposes the main FAQs that the members of the Consortium that have previously participated in Open Call tender procedures have experienced:

<p>FAQ#1: What is aerOS?</p> <p>aerOS is a project funded by HE programme aiming at designing and building a virtualized platform-agnostic meta operating system for the IoT-edge-cloud continuum. As a solution, to be executed on any Infrastructure Element of such continuum, aerOS will be independent from underlying hardware and operating system (s). More information can be found at: https://aeros-project.eu</p>
<p>FAQ#2: What is aerOS Open Call #2?</p> <p>aerOS has reserved a total of 900.000 € for financially supporting third parties enhance the scope of the project by joining the project via Open Calls. aerOS will perform two rounds of Open Calls where research entities and SMEs around Europe are summoned to present proposals fitting one of the project pilots, targeting specific challenges. aerOS Open Call #2 is the second (and last) of those two rounds.</p>
<p>FAQ#3: Could I apply to aerOS Open Calls?</p> <p>Only SMEs, Research entities (RTOs) and Universities can apply to aerOS Open Call. In addition, entities must also comply with specific legal requirements that can be found at the draft Collaboration Agreement.</p>
<p>FAQ#4: How could I apply to the funding?</p> <p>Via visiting the form https://opencall.aeros-project.eu/author/submit.php, fulfilling the mandatory fields following the instructions depicted in the Guidelines for Applicants. All of the previous must be done before September 30th, 2024, 5 p.m. CEST.</p>
<p>FAQ#5: Is there a checklist of steps to be conducted?</p> <p>Actions to be completed are:</p> <ul style="list-style-type: none"> ➤ Check articles in the Collaboration Agreement. ➤ Fulfil the form at https://opencall.aeros-project.eu/author/submit.php accept the Ethics and Legal terms.

¹ These dates may vary depending on the speed of reaction, signature process and associated paperwork.

<ul style="list-style-type: none"> ➤ Upload a PDF including a maximum of 3 diagrams/pictures (including Gantt chart) through this link: https://opencall.aeros-project.eu/author/upload.php, using the submission number provided by the system, and the password created by you. ➤ Receiving an automated acknowledge receipt from the System.
FAQ#6: Which activities qualify for financial support?
The second round of aerOS Open Calls aims at funding innovative proposals that will be easily transferred into the market fostering the uptaking/upscaling of aerOS technologies, departing from already established solutions and focused in application sectors different to those present in the pilots of the project. Check Guide for Applicants for further information.
FAQ#7: How many applications could I submit?
Only one proposal per applicant will be considered for evaluation. Multiple submissions of the same proposal can be made: the last one received through the system (with corresponding acknowledge of receipt) will be considered.
FAQ#8: Which are the evaluation criteria that will be applied?
The evaluation will be based on: i) Relevance to aerOS (min. 3 out of 5); (ii) Impact and sustainability (min 4 out of 5); (iii) Technical excellence (min 4 out of 5); (iv) Quality of implementation (min 4 out of 5) (v) Quality of the team (min. 4 out of 5), and 19 as a global threshold over 25.
FAQ#9: How would I be joining the project?
Selected entities will enter the Consortium of aerOS as third parties of the Project Coordinator after the signature of a Collaboration Agreement based on the template provided in the Application Package.
FAQ#10: How amount of funding can be requested and which are the eligible costs?
A fixed requested amount of 60.000€ per proposal might be accepted. The form of financial support to be used will be a pre-defined lump sum.
FAQ#11: Which should be the duration of the project?
All proposals must have a fix duration of 8 months.
FAQ#12: When will I find out whether the proposal has been accepted?
Notifications on funding or rejections will be sent out to applicants, together with any feedback, by November, 15th, 2024 . Slight delays might be experienced.
FAQ#13: Could I be eligible for the 2nd round of Open Calls if I have already received funding in the first round of Open Calls?
If you have been granted funding in the 1 st round, you are not eligible. Otherwise, all entities are eligible in so far as they meet the global eligibility criteria.
FAQ#14: Which will be the differences between Open Call #1 and Open Call #2?
First, more budget is reserved for round #2. Second, it will focus on applying aerOS to verticals outside of these considered in the project rather than to expanding aerOS' original pilots. Also, additional challenges have been implemented, that can be consulted in detail in the Guidelines for Applicants .
FAQ#15: Who can I contact to get more information about the Open Call?
You can contact the following addresses: opencall-aeros-project@aeros-project.eu , iglaub@upv.es , info@aeros-project.eu

For what regards aerOS particularities, the Consortium will maintain a frequently asked questions (FAQ) section available in <https://aeros-project.eu/open-call-faqs> . This page will be continuously updated according to the feedback and questions received from applicants. Follow the website and also social networks accounts of the project to get more information about the open call.

Appendix A - Accepted project types/ideas

In general, all projects that will meet with the next premises could be eligible:

- Are contextualised to the innovation on CEI (CloudEdgeIoT) technologies and deployments.
- Depart from solid technologies and are able to reach high TRLs.
- Validate and make use of aerOS results, fostering their upscale/uptake.
- Have a clear exploitation roadmap.
- Are focused on application domains / sectors different to those existing in aerOS pilots (manufacturing lines, physical containerised data centers, agriculture machinery, maritime ports and smart buildings).

Relevant examples of technical propositions that could qualify for potentially eligible proposals are:

- AI/ML libraries and tools to be integrated in aerOS, that complement and expand the existing artifacts provided by the project and/or AI/ML services working over aerOS core and supporting features to enhance the scope of one project use-case. Here, contributions related to distributed frugal AI with explainability (close to the edge) will be particularly thought.
- Smart networking components, which can be incorporated into the virtualised smart networking topology of aerOS. Networking layer components should be based on different standards higher-level communication standards (e.g. OPC UA, TSN, 5G etc.) or proprietary networking solutions.
- Value-adding application service components. Application service layer components should exploit major standards and be integrated with aerOS API. Advanced virtualisation mechanism for smart objects, including context-aware mechanisms
- New smart data and semantics components related to trust, aggregation, security or any sovereignty realm feature that might enhance the application of aerOS in a use-case.
- External Validation of the overall aerOS solution (architecture, deployment and modules) in an IoT-edge-cloud validation environment.
- Extension, advanced application, innovative proposal over DevPrivSecOps methodology for aerOS deployment in projects' use-cases.
- External owned products/systems that can be integrated with aerOS features to deliver relevant applications/services to an aerOS use-case.
- Own-developed Infrastructure Elements (hardware and software) compliant with aerOS architecture to be tested and deployed on-premises in an aerOS use-case scenario.
- Innovative usage of aerOS orchestrator to demonstrate further efficiency, network throughput, analytics capabilities or other relevant improvements.
- Application of advanced multi-scale and multi-plane analytics using aerOS software (and own if required) using use-cases datasets and infrastructure.
- Smart Device layer components to complement project's use-cases based on different low-level communication standards (e.g., Zigbee, 6LowPan, WIFI, Bluetooth, IEEE 802.15.4, NFC, etc) or on ad-hoc proprietary device solutions.
- Developing and using aerOS self-* functions including self-adaptation and self-healing of the Infrastructure Elements, based on self-observation in the addressed verticals.
- Practical application of semantic technologies supported by aerOS available functions and/or extending aerOS capabilities by application of semantic technologies.
- Development of Digital Twin solution profiting aerOS deployment in the IoT-edge-cloud continuum, addressing the different verticals and providing benefits in terms of execution, traffic reduction and real-time analytics latency reduction.

Appendix B - aerOS Technological Principles

B.1 - Relevant resources

Based on the descriptions above, the applicants to the Open Call might bear in mind the technologies and the provisions available from aerOS: Although some of the components of the Meta-OS are still being finalised/integrated/refined at the moment, the following resources should allow to build a more comprehensive technological approach of the submitted proposals.

Applicants must bear in mind that upscaling/uptaking aerOS technologies is a paramount factor that will be studied by external reviewers. It is worth noting that aerOS has a clear commitment towards open source. Thus, the usage of OSS technologies will also be positively appreciated for applications.

Documentation of aerOS software results

<https://docs.aeros-project.eu>

Data Model of a CEI Continuum

<https://wp4.pages.aeros-project.eu/t4.1/aeros-continuum/>

aerOS Installation Guide

<https://gitlab.aeros-project.eu/aeros-public/installation-guide>

aerOS Public packages and registries

<https://gitlab.aeros-project.eu/aeros-public/>

Relevant deliverables to analyse

Deliverable D2.6 – aerOS Architecture Definition

[Deliverable D3.2 – Intermediate distributed compute infrastructure implementation](#)

[Deliverable D4.2 - Software for delivering intelligence at the edge intermediate release](#)

[Deliverable D2.5 – DevPrivSecOps methodology](#)

B.2 - Architecture design and diagram

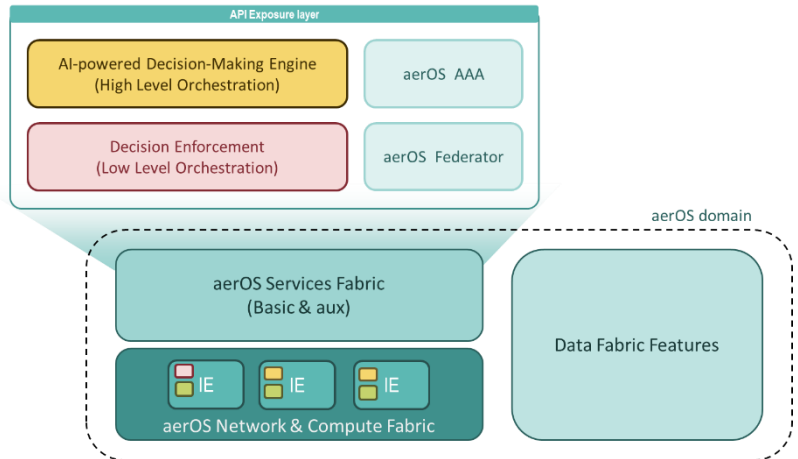
In the ongoing quest to develop a comprehensive Meta-OS for the continuum, the landscape is marked by existing concepts and frameworks aimed at unifying edge, cloud, and IoT resources. aerOS, however, stands out by leveraging these existing concepts to significantly extend the current state-of-the-art architecture. By introducing advanced mechanisms and enhancements, aerOS addresses the complex demands of this diverse ecosystem. Consequently, it advances orchestration and management capabilities beyond what is currently available, offering a more robust, scalable, and efficient solution for the modern Cloud-Edge-IoT landscape.

To efficiently formulate such an ecosystem, all geographically and administratively dispersed and heterogeneous networking and computing resources should be unified under a common allocation framework. This requires abstracting the diversity of these resources and offering them as a pooled set ready to execute workloads on demand. Beyond building this continuum for workload deployment, a Meta-OS must have comprehensive information about these resources' capabilities and current availability. This knowledge enables Meta-OS to make the most efficient decisions for workload placement and support efficient migrations to mitigate failures.

While the decentralization of services and segmentation of monolithic applications and services have been progressing as design concepts, aerOS moves a step further by integrating the architectural concept of managing resources and orchestrating services over a federated ecosystem. aerOS develops a set of core services that address the need to abstract individual resources and homogenize access to their capabilities, while also

collectively sharing and managing these capabilities for the most efficient allocation of resources and IoT service placement according to their constraints.

The underlying computing resources are enrolled in the continuum as aerOS **Infrastructure Elements (IEs)**, offering a common runtime abstraction. A set of one or more IEs, functionally connected and sharing a common instance of aerOS basic services, forms the aerOS domain, which acts as the minimum administrative unit. The networking and interaction of services of all aerOS domains across the continuum build the aerOS fabrics (network & compute, service, and data fabric) and provide the foundation for the prevailing Federated Orchestration concept.



This design establishes an egalitarian framework in which all aerOS domains across the continuum operate as peers, each with equal access to resource knowledge and decision-making capabilities. Such an approach not only enhances autonomy but also promotes a more granular level of control over distributed resources, fundamentally altering the ecosystem for orchestration and resource utilization.

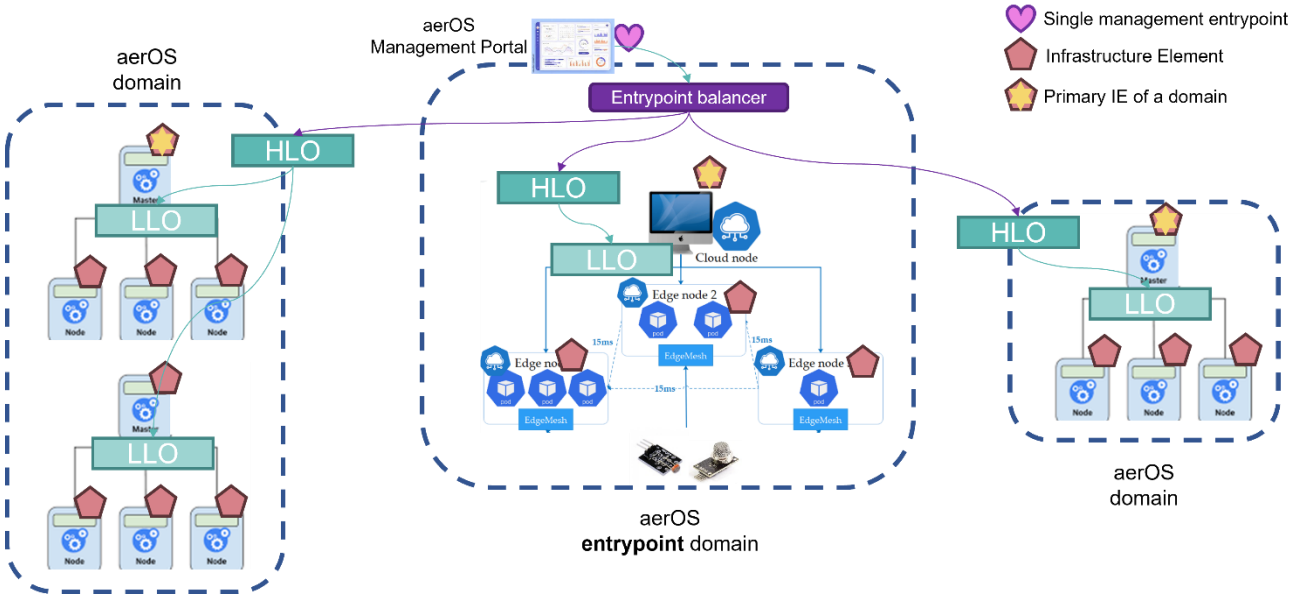
On one hand, it provides the **Federation** across the continuum, enabling the capability to request and receive at any time and any place the total capabilities and resources' availability of all aerOS domains. This is primarily built on aerOS Data Fabric provisions. This provides the ability to publish and share, under a common and interpretable schema, all information regarding the capabilities and status of each domain's elements. This transparency empowers components to make informed decisions regarding resource engagement, even beyond their respective domains. By breaking down silos and enabling cross-domain communication, the federation promotes efficient resource utilization and collaboration, ultimately enhancing the overall functionality and performance of a Cloud-Edge-IoT ecosystem. This capability is built on the **NGSI-LD ETSI** standard and its intrinsic mechanisms to facilitate the exchange and sharing of context information.

aerOS addresses IEs, Domains, and IoT services as NGSI-LD entities and has modelled them as part of a continuum knowledge graph that provides the status of all resources from Edge to Cloud. The **aerOS knowledge graph** is built on NGSI-LD modeling principles and specifications, and the REST API counterpart is employed to query and share this information. A robust AAA framework provides granular control over both exposed APIs and data. It is important to note that aerOS offers to the SDO, as it is developing and providing to the community by extending NGSI-LD features needed to promote federation behavior. Thus, within the aerOS project, we implement capabilities related to the propagation of requests across connected domains.

aerOS **Orchestration** design extends the existing landscape by introducing a dual-layered Orchestration pattern. It follows a separation of concerns design, keeping distinct components for the decision engine and the enforcement layer. aerOS Orchestration acts as the complementary part of Federation, which provides a continuum underlay, enabling aerOS to offer advanced Meta-OS operations over this continuum. Like all core aerOS services, each aerOS domain runs its own instance of the orchestrator. Despite execution locality decisions take into consideration all other domains and may produce deployment decisions for them.

The **High-Level-Orchestrator (HLO)** provides the NB exposing API and implements the decision engine. It builds upon the foundations provided by Federation to gain a holistic view of resources' availability and capabilities across the entire continuum in real-time. This extensive information equips HLO with a multitude of options for workload placement decisions. Having received the deployment request constraints and retrieved candidate IEs across the continuum, it executes a double optimization algorithm considering energy efficiency parameters to provide the most efficient placement decision.

The **Low-Level-Orchestrator (LLO)** is the enforcement layer responsible for conveying the decision blueprint as an LCM message to the actual underlying resources. LLO is implemented as a flexible layer that can easily be extended to support the integration of more types of actual underlying computing resources, either physical or virtual. When it comes to integrating new types of resources only this part of the orchestration should be extended and only to the concerned domain. It does not affect HLO counterpart nor other domains functionality.



All the above architectural decisions under aerOS design provide several enhancements regarding performance and efficiency. The Federated approach, where each domain operates as a peer with equal capabilities and access to information, enhances robustness and resilience, avoiding the pitfalls of centralized control. All domains are equipped with the same capabilities to share and retrieve resources, maintaining their autonomy while enforcing the desired level of access control and limits.

The use of the aerOS knowledge graph for the continuum, a linked data graph dynamically updated and shared across the continuum, ensures real-time access to the state and relationships of resources. This facilitates informed decision-making and efficient resource management. By integrating and extending NGS-LD, aerOS builds robust data fabric core storage engines and federation mechanisms. This adoption of open standards facilitates interoperability and community support.

Double-Layer Orchestration improves orchestration in terms of flexibility and scalability. The modular approach allows for easy expansion and integration of various types of computing resources and custom AI implementations. The integration of all resources under an IE abstraction, serving as a fundamental execution unit, provides two basic advantages. First, it offers a common execution environment, enabling the capability to run and migrate all applications on every hosting IE (regardless of underlying architectures) within all domains across the continuum. Second, it provides the possibility to easily extend resources, with LLO responsible for all IEs abstracting a specific kind of resource.

Beyond architectural design enhancements, aerOS has developed a **DevPrivSecOps** methodology that extends the traditional DevOps cycle by integrating security and privacy considerations from the design phase. While the integration of security aspects has been researched, the incorporation of privacy goes beyond the current state of the art. aerOS has created a fully specified methodology that targets the entire software development landscape and provides guidance for its implementation. This methodology includes a thoroughly defined sequence of steps that integrates both local and hosted tools and services, detailing how it should be implemented from design through development to deployment and monitoring. The result is a robust environment for the full life cycle of software components, enhancing their robustness and minimizing security and privacy risks associated with their static or dynamic functionalities

Appendix C - Submission tool manual

Please, find below an example of usage of the tool in: <https://opencall.aeros-project.eu/author/submit.php>

- i. **Informative boxes** This information is mandatory.

aerOS OpenConf

OpenConf Peer Review and Submission Management System

[OpenConf Home](#) | [Privacy Policy](#) | [Email Chair](#)

Submission

General Information

Acronym:

Title of the project:

Company Information

Add information about the submitting company and about the contact person (name and email)

Author 1

Company name:

Company Type:

Country:

PIC (optional):

Website:

First Name:

Last Name:

Email:

In the next box, the “Author 1” option of the dropdown list must be selected. This is a mandatory step.

Contact Person

Contact Person:

Person who will serve as the point of contact for correspondence about the submission.

Alternate Contact:

Alternate contact information, such as personal email address or telephone number; used only if unable to contact using above email address.

In the next box, the applicant must introduce a password for their submission (free selection). This is a mandatory step. It is important to note it down, as it will be required later to upload the PDF file with the images.

Password

Please enter a password you will remember. The submission ID, which you will receive via email upon submission of this form, along with this password will allow you to upload the PDF associated to this submission.

Password:

Re-enter Password:

ii. **Excellence boxes** (limited characters different in each box):

Excellence

Innovative idea and relation with aerOS technology:
*Which is the main idea of the project and which sector it is expected to influence?
 How does the project go beyond currently existing solutions?
 How does the technology of the project interact with aerOS Meta-OS?
 How does it validate and helps uptaking/upscaling aerOS technology?*

Expected results:

*Which are the expected outcomes and results of the project?
 Are those enough substantiated? Is the output TRL clear enough?
 Which is the illustrative process depicting the expected improvements/developments in the project?*

Previous background, IP and departing solution:

*Which is the product/technology underlying the project?
 Is there any IPR background existing that should be noted?*

iii. **Impact and sustainability boxes** (limited characters different in each box):

Impact and Sustainability

Increase of uptake/upscale of aerOS:
*How will the project contribute to aerOS upscale and adoption?
 Which are the expected actions to foster the uptake of open source technologies?*

Scientific outreach and KPIs:

*Which is the expected impact of the solution during aerOS project?
 Explain every expected publication (scientific paper, congress article, etc.).
 Which are the mid- and long- term indicators that could be monitored to measure the impact of your solution? Attempt to quantify such estimated impact*

Previous background, IP and departing solution:

*How will you ensure the sustainability of the work beyond the end of the funding? Please indicate any additional sources of funding/support you may need and how you plan to secure it.
 Which is the exploitation and commercialization strategy behind the product?
 Standardisation and roll-out potential*

iv. **Implementation boxes** (limited characters different in each box):

Implementation workplan

Workplan explanation: (Max. 5000 chars)
 WPs, tasks and deliverables: (Max. 10000 chars)
 Technologies, methodologies, milestones and control of the advance: (Max. 10000 chars)

*Is the Gantt plan adjusted to 8 months and is the diagram properly included in the attached PDF?
 Is the implementation feasible and doable in a short timespan?
 Is the work properly separated by knowledge domains and activities?*

*Is there a structure of the control in the advances, and a solid timing for deliveries to accomplish the objectives? Is this well aligned with the timing of expected technical checks to be performed by aerOS Coordination? (Month M1+, M6+ and M8+)?
 Is any additionally necessary means to realise the idea properly described (data, equipment, connectivity, access to infrastructure, systems, etc.)?*

v. **Team boxes** (limited characters different in each box):

Team and Company

The Company: (Max. 2500 chars)
*Is the experience of the organisation (relevant previous projects, services, contracts, etc.) included?
 Which is the experience and specialization of your company Cite products, projects and previous research and transfer experiences.*

The Team: (Max. 2500 chars)

*Are all the relevant members of your team properly listed, indicating gender (voluntarily), their relevant skills and experience?
 Is the rationale of the structure of the team and the roles and responsibilities that each member will be taking well described?*

IMPORTANT!! It is mandatory to accept (consent) the Ethics and GDPR clauses that are exposed at the end of the webpage.

Consent

Consent: I consent to the ethics and GDPR disclosure included at the end of this page

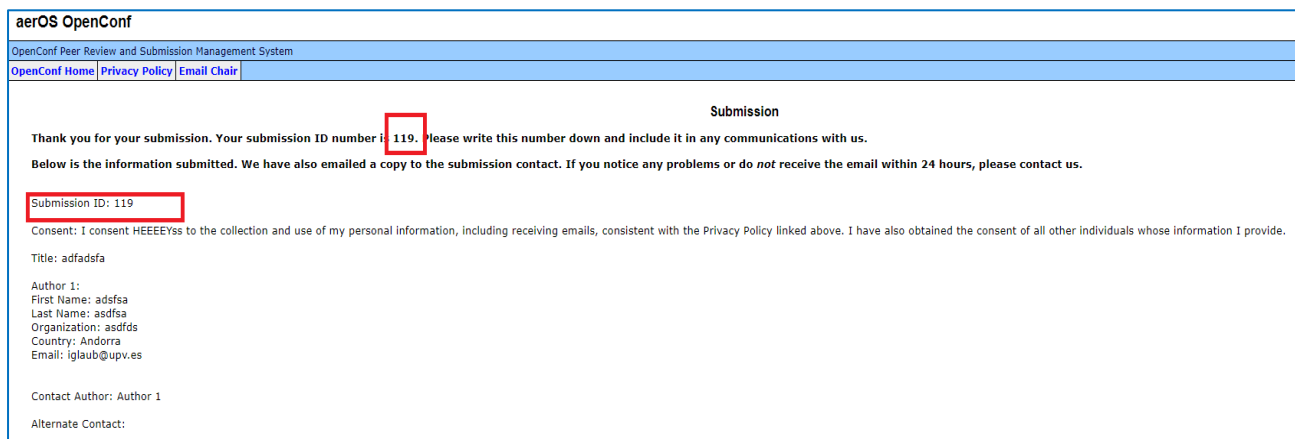
To finalize the submission, press: “Make Submission” button:

Please check over your entries, making sure everything is filled out. When ready, click on the Make Submission button below once.

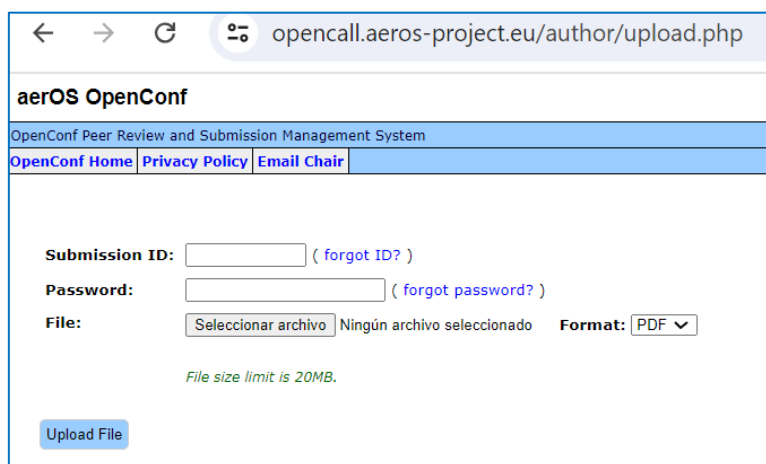
Make Submission

Ethics guidelines
 The aerOS is to comply with the ethical standards in its operation. The project’s ethics manual guides the actions to accommodate participants a
 The ethical issues are vital to be followed by all the participants in the project throughout its whole lifecycle- before, during, but also after the pi

After generating a successful submission, a message will be prompted to the applicant providing the following information:



In order to finalise the submission, another functionality of the tool must be used. As indicated in the guidelines for applicants, the Submission Form must be accompanied with a **PDF composed of only one page with maximum of 3 diagrams (including Gantt chart)** to aid proposal reviewers in their evaluations. Please, find below an example of usage of the tool in: <https://opencall.aeros-project.eu/author/upload.php>



- Submission ID: The number obtained in the output provided as a result of successful completion of previous step.
- Password: The password introduced by the applicant in the corresponding cell of Submission Form.
- File: PDF file of 1 page, with max. of 3 diagrams.