# Phase VIII Strategy

(2024-2026)

Accelerating Computing for Science

Editor: Maria Girone, CERN-IT, November 2024

## Introduction

CERN openlab stands as a testament to over two decades of pioneering history and expertise. Established in 2001, it remains a ground-breaking **public-private partnership**, forging collaborations between CERN and leading ICT companies as well as research centres worldwide, uniting them with the forefront of scientific innovation at CERN. These partnerships fuel CERN researchers with invaluable opportunities and resources to push the boundaries of computing, essential for tackling the unprecedented challenges presented by monumental projects like the High-Luminosity Large Hadron Collider (HL-LHC) or the Square Kilometre Array (SKA).

For more than twenty years, CERN openlab has been the bedrock of partnership, providing a structured and collaborative framework for industry and research organisations to engage with CERN researchers. Its framework not only fosters collaboration but also facilitates industry participation and investment.

Collaboration is the core of CERN openlab; industry and scientific researchers co-develop innovative solutions. Together, we pursue four primary missions: establishing strategic industry collaborations, fuelling technological innovation, exposing technology to researchers, and nurturing knowledge and growth in young STEM researchers.

Now embarking on its eighth phase and with 23 years of transformative history, CERN openlab embraces a new era of multidisciplinary collaboration, with fresh insights and activities. As the world evolves and new challenges emerge, our dedication to accelerate scientific computing, propelling technologies beyond HEP, and fostering positive societal impacts on a global scale remains unwavering.

## CERN openlab mission

Since its inception, CERN openlab has fostered the development of big data scientific research through **four primary missions**:

1. **Establishing strategic industry collaborations**

   CERN openlab projects provide an ideal incubator for collaborations to be formed and longer-term partnerships to be built. They act as the first step in the establishment of strategic collaborations between CERN and other organisations interested in investing in the future of science and technology.

2. **Fuelling technological innovation**

   CERN openlab serves as an **incubator for new technologies**. It forms a dynamic hub where CERN and its partners collaboratively push the boundaries of ICT technology. This synergy propels the co-development of new ideas and innovative solutions.

3. **Exposing technology to researchers**

   CERN openlab provides access to new technologies available on the market to its members and the HEP community, supporting the **critical tasks** of evaluation, adaptation, and benchmarking.

4. **Nurturing knowledge and growth in young STEM researchers**

   CERN openlab plays a crucial role in **training the experts of tomorrow**. The CERN openlab summer student programme, supported through industry contributions, trains students through real-world, concrete, multi-disciplinary projects. Through various programmes and workshops, it equips the next generation of researchers with essential skills required to navigate the complex landscape of modern computing technologies.

To address scientific challenges at the exascale level, CERN openlab has identified two main R&D directions: "**Sustainable Infrastructures**" and "**Emerging Technologies**". In sustainable infrastructures, it collaborates on energy-efficient computing platforms. In emerging technologies, it explores innovations like novel long-term digital storage materials, scientific digital twins, ML and AI methods, hybrid HPC systems, including quantum computing.

This document explains how CERN openlab has developed, how it intends to operate during Phase VIII, which communities are targeted, what objectives it sets for itself and its collaborations, and how it proposes to continue delivering **impactful results and sustainable collaborations** for the years to come.

## CERN openlab collaboration model

CERN openlab operates within structured **three-year phase cycles** designed to systematically assess technological evolution, delineate overarching thematic priorities, and anticipate future needs. This approach ensures the maintenance of a current and relevant research programme, thereby cultivating more effective collaborations and innovative advancements.

Upon joining CERN openlab, members gain access to a unique ecosystem characterised by **unparalleled computing challenges, ground-breaking scientific endeavours, and pioneering minds**. This environment serves as a crucible for the development and demonstration of emerging technologies, providing a platform for industry leaders to showcase their potential and validate solutions through realistic, demanding use cases. This process often leads to tangible enhancements in product features and capabilities.

In addition to impactful technological progress, CERN openlab members have a valuable opportunity to boost their global reputation. Affiliation with a renowned institution like CERN elevates participants' visibility and stature within broader scientific and technological communities. CERN openlab represents the **convergence of cutting-edge science, collaborative exploration of disruptive technologies, and extensive visibility**, resulting in tangible strategic benefits for its members.

## Evolution of the collaboration model

### Inception (Phases I-IV)

CERN openlab was founded in 2001 at a time of great technological upheaval due to the transition from mainframe to commodity computing. Initially, large industrial partners were attracted to participate and invest in the design and construction of the computing infrastructures for the Large Hadron Collider (LHC). A number of top industry leaders joined CERN openlab, some of which are still actively involved. With the help of companies like Intel, IBM, and HP, CERN openlab navigated the challenges of transitioning the CERN IT data centre to modern x86 64-bit processors, multi-core devices, high-performance networking, and petascale storage. CERN openlab's collaboration with Oracle helped to establish high availability and redundancy for the critical online databases needed for detector operations. At the time, CERN was doing something nobody else was doing: defining the new **worldwide reference for big data scientific research**.

### Consolidation (Phases V-VII)

The second decade of CERN openlab coincided with LHC operation and a need for higher stability and reliability. At the same time, the technology market became more dynamic and fragmented, with a larger number of smaller companies and even start-ups showcasing innovative technologies. The CERN openlab operating model evolved to focus on shorter development/evaluation cycles and more targeted technology interests. We expanded the programme for the benefit of the accelerator and detector operations and defined a new model to collaborate with universities and research centres sharing challenges at the data and computer science level with a broader multi-disciplinary view. **The**

**number of partners increased and the work programme grew towards a broader portfolio of smaller, agile projects**.

**The next phases (Phase VIII and beyond)**

CERN, along with the High Energy Physics (HEP) community, is gearing up for the HL-LHC program and the future of particle physics. Building upon the achievements of the initial decade of LHC operations marked by swift advancements in computing architectures, infrastructures, algorithms, and disruptive technologies, CERN openlab is poised to harness these changes. With its extensive network spanning industry and academia, CERN openlab is uniquely positioned to validate and integrate emerging technology capabilities while facilitating access to novel infrastructures.

To address the impending challenges, **CERN openlab has reviewed its operational framework**, notably restructuring industry membership into two tiers: Associate and Partner (refer to membership levels and governance sections).

CERN openlab will build on its consolidated agile mechanism that facilitates the definition of practical projects, to remain an efficient vehicle for innovation. Projects typically span 1 to 3 years, an optimal duration to yield actionable outcomes aligned with the latest technological advancements. This framework represents an **ideal mechanism not only to nurture initial collaborations that can evolve into long-term programmes, but also to promote new partnerships and cultivate diverse networking avenues**.

In the coming years, CERN openlab will focus on facilitating sustained, long-term collaborations, serving as a platform not only for partnership preparation but also as a training ground for IT professionals seeking to expand their skill sets into project management and broader coordination roles.

## Motivations, objectives & expected impact for members

Throughout its history, CERN has been at the forefront of big data scientific research, with CERN openlab playing a pivotal role in tackling the associated computing challenges. By fostering collaborations with industry and research organisations, **CERN openlab empowers the HEP community in its research endeavours**. In response to the evolving landscape of scientific research, including the advent of exascale computing, CERN openlab spearheads efforts to enhance and scale up IT infrastructure to tackle the upcoming data challenges.

CERN openlab’s **objectives** are to pioneer sustainable and innovative computing solutions, harness AI and heterogeneous computing for environmental benefits, and foster collaboration and technology transfer between industry and the scientific community. Through collaboration with diverse stakeholders, including the HEP community, other scientific disciplines, and technology providers, CERN openlab fosters co-development of solutions and co-design of infrastructure. This collaborative approach drives innovation and advancement for all parties involved. Moreover, it enables partners to leverage solutions from HEP to address challenges in other fields, ensuring maximal relevance and **impact**. Projects within the CERN openlab framework are dedicated to accelerating computing for science, particularly under the **R&D directions of “Sustainable Infrastructures” and “Emerging Technologies”**.

## Sustainable Infrastructures

**Heterogeneous computing platforms and infrastructures**

CERN openlab contributes to this area of innovation via collaboration with resource providers for access to test resources on cloud and HPC infrastructures. The main focus is on understanding how to access and integrate external resources into the computing workflows employed by the CERN community (e.g., IT, experiments). This can be done via direct access to cloud environments or pilot collaborations with cloud providers and HPC sites. This activity includes optimisation of AI workflows on large-scale HPC systems. The expected impact is the **co-development of adapted access models to HPC and cloud infrastructures, integrated and optimised workflows, including AI, and cost models**.

**Computer architectures and software engineering**

CERN openlab contributes to this area of innovation via collaboration with resource providers for the provision of hardware and software components, dedicated specialised expertise from the technology partners, funds for engineers and developers, as well as training and education opportunities. The main focus is on assessment, benchmarking and validation of accelerated architectures (e.g. GPUs, FPGAs) and new processors (e.g. RISC V) following user requirements. The expected impact is to provide the HEP community with **innovative technology and key expertise on ongoing and future research programmes**.

**Storage and data management**

CERN openlab contributes to this area of innovation via collaborations with technology providers and system integrators. This includes, for example, the evaluation of new storage media, the co-development of specific functionality for multi-disciplinary applications, or the definition and implementation of data workflows for HEP in the context of the emerging data analysis facilities concept. The expected impact is to provide the HEP community with **storage and data management tools that can effectively support cutting-edge research programmes**.

### Artificial intelligence algorithms, platforms, and applications

CERN openlab contributes to this area of innovation by fostering collaboration with technology providers and research institutions developing state-of-the-art platforms, services, and methodologies. This includes access to software and expertise, as well as large-scale testbeds for co-creating new AI models and optimization workflows. The areas of work include distributed AI optimization, generative AI, foundation models for physics, as well as optimal deployment of AI-based algorithms on modern computing architectures, and benchmarking of these architectures on AI workloads. Work is also ongoing in the realm of real-time AI inference (on edge or accelerator devices) as part of the detector data acquisition, fast data selection, and accelerator control. The expected impact is to **enable the science community to access and leverage AI resources and skills**.

### Applications for society and environment

Energy-efficient computing and AI for society are of great interest to technology providers, data centres, and software developers. CERN openlab will contribute both in the establishment of dedicated investigations in green computing, life and environmental science, and in raising awareness through explicit requirements in the definition of development projects. CERN openlab will support the migration to **energy-efficient architectures** and develop Digital Twins for **sustainable data centres**. Furthermore, it will continue its work with other sciences and contribute to research with a societal impact.

## Emerging Technologies

**New solutions for long term digital storage**

On the time-scale of HL-LHC, it is expected that tape will remain the archive medium of choice for CERN experiments. However, other archival technologies are in the R&D stage and should be investigated for possible future exploitation. This topic evaluates the characteristics and likely evolution of **new materials** as archival storage mediums to inform CERN's long-term plans for data archival. CERN openlab will foster investigations of **innovative, long-term, and durable storage solutions** (DNA, ceramics, silicon).

**Digital twins**

Digital Twin technology is gaining traction across a diverse range of fields. It involves creating a dynamic digital counterpart of a physical entity, continuously updated to mirror real-world changes. CERN openlab focuses on Digital Twin use cases for scientific applications. Our involvement in the interTwin project, funded by the European Commission, focuses on developing a versatile digital twin engine prototype. This initiative spans physics, including particle physics, radio astronomy, and gravitational waves, as well as environmental modelling for early warnings using satellite imagery. Another direction of exploration includes CAD-based digital twins to enhance the operation of the LHC and experiments. This not only aids in maintenance but it would also allow to simulate detector assembly scenarios. The potential applications are vast, offering simulation of underground interventions in a virtual space, resulting in **cost savings, time efficiency, and reduced exposure to radiation**. CERN openlab will leverage the expertise developed in digital twin applications to offer **versatile solutions, from scientific applications to enhancing LHC**

**operations, enabling real-time modelling of real-world scenarios, predictions, and time-cost optimization**.

<u>**Quantum computing and networks**</u>

While quantum computing activities are managed within the **Quantum Technology Initiative (QTI)**, CERN openlab will be instrumental in establishing co-development projects with technology providers and application developers. It can also help with access since all quantum machines in Europe will be accessed via HPC centres, which is already one of the components of openlab. CERN openlab will provide expertise on tools and methods to access **federations of supercomputers** and **quantum computers**.

## Implementation Plan

The CERN openlab implementation model relies on two main approaches:

- Establishing a managed portfolio of small to medium-size, **focused, agile projects** with technology providers with clear impact on the CERN IT Technology Roadmap.
- Identifying a few collaborations, especially at the level of the computing infrastructures and as long-term partnership incubator, of high potential impact and acting as a **strategic partnership incubator**.

Leveraging these approaches, CERN openlab actively pursues collaborations with industry and academia, establishing a foundation of trust for enduring partnerships. This maximises the technical impact and fully harnesses the potential of innovative technologies, thereby amplifying our core strengths.

For its PHASE VIII, CERN openlab has identified the following short- and medium-term Focused Areas (FAs).

For each FA, we define three categories of partners. “Established partners” are industrial or research partners with whom collaboration agreements have been or are being finalised. “Prospective partners” are industry or research partners with whom possible projects are currently under discussion. Key players within the relevant areas of expertise with whom there has been no contact yet are grouped under “Other partners of interest”.

### Focused Areas (FAs)

| Focused Areas (FAs) | | Interest high/moderate/minimal | Coverage high/moderate/minimal/none |
|---|---|---|---|
| 01 | Heterogeneous Architectures | | |
| 02 | AI Training and Inference Optimization on HPC | | |
| 03 | Ultra low-latency AI inference | | |
| 04 | Real-Time Data Processing on CXL Architectures | | |
| 05 | Analysis on the cloud | | |
| 06 | New Materials/Technologies for Storage Solutions | | |
| 07 | Data Compression acceleration | | |
| 08 | Low-latency interconnects | | |
| 09 | Foundation Models | | |
| 10 | Hybrid and Multi Cloud | | |
| 11 | Digital Twins | | |
| 12 | Quantum Computing | | |

**FA01: Heterogeneous Architectures Testbed (x86, Arm, GPUs, FPGAs, etc.)**

- Established partners: E4, Intel, NVIDIA,
- Prospective partners: Altera, Xilinx, Cerebras
- Other partners of Interest: AMD,
- Synergies: IT-CD, IT-FA, IT-PW, EP R&D…
- Beneficiaries: CERN experiments and groups, RCS, ATS, NGT

**1.1** Provide a rich ecosystem to access and evaluate newest computer architectures, with on-prem and remote resources, via the openlab collaboration with E4. Access to industry evaluation resources through the openlab collaborations with Intel and NVIDIA.

**1.2** Collaborate with the HEP benchmarking team, in particular to the HEPScore benchmarks, for performance comparison across different architectures and HPC systems.

**1.3** Report and analyse test results with industry and research partners.

**1.4** Contribute to a unified platform for access to testbed resources for research teams.

**FA02: AI Training and Inference Optimization on HPC**

- Established partners: Simons Foundation, Oracle, E4
- Prospective partners: HPC centers, NVIDIA
- Other partners of Interest:
- Synergies: IT-PW, IT-FTI, EC-funded projects (CoE RAISE, SPECTRUM), EP R&D
- Beneficiaries: CERN experiments and groups, RCS, ATSt

**2.1** Implement HEP AI/ML workflows in HPC systems to demonstrate compatibility and scalability.

**2.2** Optimise HEP AI/ML algorithms and models through hyperparameter optimization employing parallel processing capabilities of HPC.

**2.3** Develop and document best practices for scaling AI models on HPC infrastructures.

**2.4** Anomaly Detection for Physics discovery

**FA03: Ultra low-latency AI inference**

- Established partners: Micron
- Prospective partners: AMD (Xilinx/Mipsology), Intel (Altera),
- Other partners of Interest: GROQ
- Synergies: EP R&D, NGT, EP-CMD, EP-CMG
- Beneficiaries: CERN experiments, NGT

**3.1** Deploy AI models on edge devices in ultra low-latency environments for event selection and triggering.

**3.2** Assess feasibility of the prototype for deployment at the HL-LHC through performance and capabilities measurements.

**FA04: Real-Time Data Processing on CXL Architectures**

- Established partners: Micron,
- Prospective partners: Intel
- Other partners of Interest:
- Synergies with other initiatives/groups/services: EP-CMD
- Beneficiaries: CERN experiments (CMS, LHCb), RCS, ATS, NGT

**4.1** Identify HEP use cases that would benefit from CXL architectures and develop a plan for CXL integration.

**4.2** Establish a CXL testbed using on-prem or remote resources.

**4.3** Demonstrate and document the performance and operations improvements due to CXL functionality.

**FA05: Analysis on the cloud**

- Established partners:
- Prospective partners: Google
- Other partners of Interest:Microsoft
- Synergies: EP-SFT, IT-CD, IT-DA, LHC experiments

- Beneficiaries: CERN experiments

**5.1** Port two experiment analyses to ROOT's modern analysis interfaces.

**5.2** Benchmark cloud vs CERN HTC performance in terms of latency, time-to-result, throughput; costing model in terms of CHF and CO2.

**5.3** Determine performance benefits / penalties given different data storage models (S3 ingestion, remote xrootd, "local"); use of accelerators of different generations.

**5.4** Optimization of implementation, performance and publication of study.

**FA06: New Materials/Technologies for Storage Solutions**

- Established partners: Cerabyte, PureStorage
- Prospective partners:Microsoft,
- Other partners of Interest: Nimbus Data, Hammerspace,
- Synergies with other initiatives/groups/services: IT-SD
- Beneficiaries: CERN experiments and groups

**6.1** Develop the requirements for cost, performance, efficiency and durability of new long-term storage solutions and compare to existing solutions

**6.2** Establish a long term storage testbed to evaluate performance and operations of the current prototypes

**FA07: Data Compression acceleration**

- Established partners: Intel
- Prospective partners: Nvidia
- Other partners of Interest: AMD, Ampere
- Synergies with other initiatives/groups/services: IT-SD, EP-SFT
- Beneficiaries: CERN experiments and groups

**7.1** Identify accelerators for writing compressed data sets, investigating both performance aspects (throughput, compression ratio) as well as software engineering aspects (integration in ROOT).

**7.2** Improve performance on checksumming, compression & encryption technologies.

**FA08: Low-latency interconnects**

- Established partners:
- Prospective partners: NVIDIA, Cornelis Networks, Intel
- Other partners of Interest:
- Synergies with other initiatives/groups/services: ATLAS, CMS, LHCb, EP-DT
- Beneficiaries: CERN experiments and groups

**8.1** Assess off-the-shelf low-latency interconnect technologies for physics data acquisition at CERN.

**FA09: Foundation Models**

- Established partners: Simons Foundation
- Prospective partner:
- Other partners of Interest: IBM, Meta, Oracle
- Synergies with other initiatives/groups/services: IT-FTI, ATS, NGT
- Beneficiaries: CERN experiments and groups, NGT, RCS, ATS

**9.1** Catalogue which HEP AI/ML applications might benefit from a common foundation model (pre-trained NN models that can be used as a base to more rapidly/easily/cheaply develop more specialised models).

**9.2** Train a common foundation model for their potential applications at CERN.

**9.3** Demonstrate the performance and cost savings associated with building on a foundation model and tuning for specific applications.

**FA10: Hybrid and Multi Cloud**

- Established partners: Oracle;
- Prospective partners:
- Other partners of Interest: Microsoft, Google, AWS
- Synergies with other initiatives/groups/services: IT-PW, IT-DA
- Beneficiaries: CERN experiments and groups

**10.1** Security for hybrid/multi-cloud – also, "open source vault" / secret management

**10.2** Seamless private-public cloud allocation/migration of workloads and BC/DR

**10.3** Multi-cloud Kubernetes clusters deployment

**10.4** Better cost modelling and accounting for cloud resources – FinOps

#### FA11: Quantum Computing

- Established partners: PASQAL
- Prospective partners: Oracle
- Other partners of Interest:
- Synergies with other initiatives/groups/services: IT-FTI, QTI
- Beneficiaries: QTI

**11.1** Precise time signal distribution. The synchronisation of very large-scale and fast real-time databases might require precise time signals and it might be interesting to explore relations with the quantum networks projects and White Rabbit (effort to renovate the current CERN control and timing system) More info at official page.

## Incubators (ICs)

The first strategic Incubator Projects (IPs) are focused on long-term, disruptive new techniques in AI with Digital Twins and Generative AI, and in disruptive technologies through integration of hybrid HPC and quantum computing.

#### IC01: Digital Twins of Accelerators and Detectors

- Prospective partners: NVIDIA
- Other partners of Interest:
- Synergies with other initiatives/groups/services: EC-funded projects (interTwin), ATS, EP, IT-FTI
- Beneficiaries: CERN experiments and groups

**1.1** Continue the development of a digital twin prototype for the accelerator complex and detector systems.

**1.2** Validate the digital twin with real-world operational data.

**1.3** Explore and document the use of digital twins for predictive maintenance and operational optimization.

**IC02: Hybrid HPC and Quantum Computing System (QCS) Integration**

- Prospective partners: IQM
- Other partners of Interest:
- Synergies with other initiatives/groups/services: QTI, IT-FTI
- Beneficiaries: QTI

**2.1** Identify quantum-ready applications and algorithms.

**2.2** Pilot a hybrid HPC-QCS with a focus on specific computational tasks.

**2.3** Create a white paper on the lessons learned and the potential of hybrid HPC-QCS systems.

**IC03: Generative AI**

- Prospective partners: NVIDIA
- Other partners of Interest: Google, Microsoft, Amazon, OpenAI, UntetherAI
- Synergies with other initiatives/groups/services: ATS, IT-CD

**3.1** Generative AI for simulation: demonstrate the feasibility of generative AI for detector simulation

**3.2** Construct generative AI models for scientific software creation

**3.3** Generalizable generative AI: Study the effectiveness of common scientific generative AI models across several scientific use-cases

## Stakeholders

Having HEP work together with other science communities and technology providers enhances co-development of common solutions of general validity and impact on science and society. Collaboration and engagement with both scientific communities and ICT industrial partners will therefore not only **drive innovation and advancements in science and technology**, but also lead to a better understanding of future requirements.

CERN openlab's primary role is to **act as conduit and facilitator for collaboration in computing science and technology between two categories of stakeholders**: the science communities (CERN departments and groups; R&D teams at CERN; research centres) on one side and technology providers (industry) on the other side. Once established, **the engagement is kept alive and current via periodic check-point meetings and formal governance mechanisms** (more information in the governance section).

## Membership levels

For CERN openlab Phase VIII (2024-2026), a **simplified membership structure has been implemented** with two levels: strategic members (Partners) and associate members (Associates).

<u>Partners</u>

In-kind contributions and annual funded effort of ≥300,000CHF, annual membership of 30,000CHF and with a scope of collaboration of long-term co-development programmes.

Associates

In-kind contributions and annual funded effort of <300,000CHF, annual membership of 30,000CHF and with a scope of collaboration of shorter tactical projects.

Projects are required to **include overhead costs for activities such as system administration, dedicated communication, and support activities**. The appropriate level of overhead to be charged depends on the type of project and will be explicitly negotiated, typically around 10% of the total project cost.

Although the main distinction between Partners and Associates is in the scope of the collaboration, Partners have more benefits than Associates. **Participation in the CERN openlab Collaboration Board is reserved to Partners**.

**Research centres with complementary expertise, aligned scientific goals, and innovation objectives may become research members of CERN openlab** with or without direct financial contributions.

## Training and education

Education is vital for maintaining and advancing CERN's and CERN's IT capabilities, fostering innovation, and ensuring that the organisation remains a global leader in scientific research.

When preparing the future of scientific computing, it is vital to **ensure that the computing specialists of the future have the right skills to enable them to fully capitalise on new, innovative technologies**.

As a part of the education and training programme, CERN openlab **runs various initiatives that support participation of scientists and other research organisations**.

For example, the CERN openlab summer student programme provides undergraduate and master's level students with an opportunity to work on one of the R&D projects for nine weeks under experts' supervision.

Apart from that, the public has open access to regular CERN openlab **lectures and technical training that cover a wide range of computing topics, from AI to exascale computing and quantum technologies**.

Technical training is offered through projects, lectures, technology roadmaps, hands-on workshops, BoFs, and hackathons, making sure that computer scientists are being equipped with indispensable knowledge that inspires scientific advancement and fuels innovation.

CERN openlab training and education efforts aim to foster collaboration among researchers and industry experts, creating a robust network of professionals who can work together to tackle computing challenges.

## Our team and governance

CERN openlab operates as a dynamic bridge between innovation and practical application, functioning both as a broker and an incubator. Its ongoing success and sustainability are underpinned by contributions from its member organisation, including significant direct support from CERN, particularly in areas of openlab management and coordination efforts. CERN openlab is part of the Collaborations and Partnerships (CAP) section, in the Frontier Technologies and

Initiatives (FTI) group. The CERN openlab Governance relies on a **small central coordination team and support from specific IT functions**. The coordination team works in close collaboration with CERN groups and IT teams, the Project Management Office, Engagement, Technical Delivery, and Communication. Regular meetings occur between the Head of CERN openlab, the CTO office, administrative, communication, finance support, and the projects' coordinators. Highlighting our commitment to collaboration and transparency, we hold an annual Collaboration Board meeting. This event brings together industry representatives at the Partner level and coincides with the CERN openlab Technical Workshop. It serves as a platform to review and celebrate the progress and achievements of our projects, fostering a shared sense of accomplishment and direction among all stakeholders.

### Head of CERN openlab (Maria Girone)

Coordinates the overall programme and manages the negotiation of contracts between CERN and members with the assistance of the CERN Legal Services.

### CTO office (Technical contacts: Thomas Owen James; Antonio Nappi; Luca Mascetti; Luca Atzori; Eric Wulff. Project support: Killian Verder)

The CTO team consists of experts from different CERN IT technical groups, each with different fields of expertise. It functions as a central hub for assessment of technologies, project proposals, and project coordination all the while maintaining close contact with broader CERN technical groups and departments. AI, low-latency computing and AI, cloud computing, storage, and HPC are the domains of expertise of Eric Wulff, Thomas James, Antonio Nappi, Luca Mascetti, and Luca Atzori respectively. This thoroughly covers CERN openlab's breadth of activities, with additional experts being involved where it is deemed of benefit to the project.

## Communication office (Mariana Velho)

Manages CERN openlab's communication needs, especially agreements with industrial partners about communication. This office works extensively to promote and communicate CERN openlab partnerships and the work emerging from its R&D projects. CERN openlab is present across various social media channels (Facebook, X, LinkedIn Group) and it is highlighted on CERN social media accounts, as well as in partner and other important industry channels. Disseminating its research to the public is an important mission for CERN openlab, demonstrating the importance of the R&D work being developed, not only to the ICT community, but to society in general.

This office has an impact on the department mission, by communicating about CERN openlab we are showcasing the work developed in the CERN IT department, where CERN openlab is based. Communicating our activities and research can help reinforce the role of CERN IT as a trusted and efficient service provider and technology partner, generating awareness of not only our department's innovative work but also its societal impact. Within the IT department, CERN openlab Communication, Education & Outreach efforts help promote the role of the CERN IT department in creating disruptive technologies through a designated section aiming to accelerate the development of these technologies.

Financial and Administrative support (Valentina Clavel, Kristina Gunne, Killian Verder)

Handle finances and administrative tasks, including the organisation of the summer student programme.


## With thanks to:

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