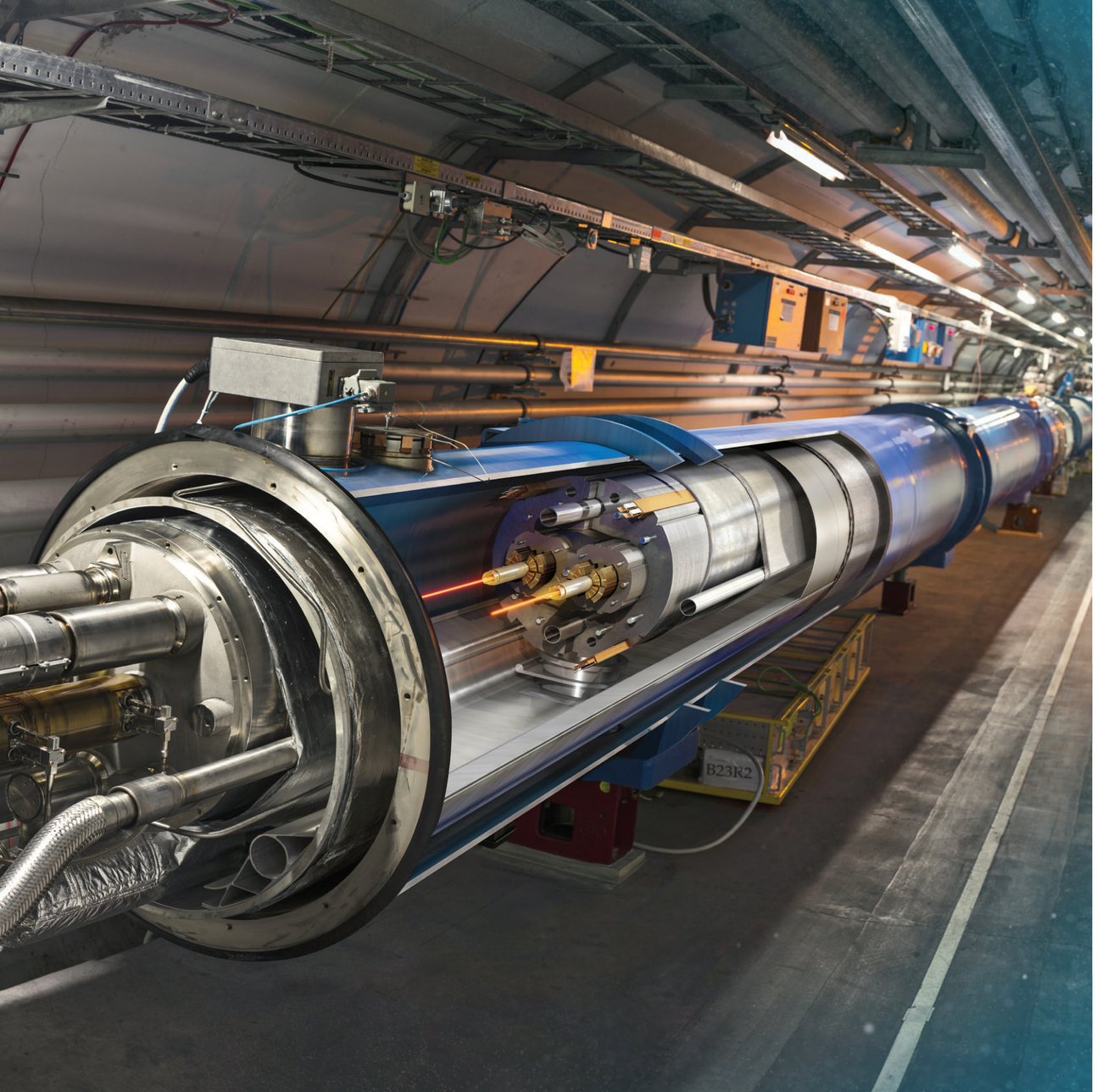
CERN openlab

A PUBLIC-PRIVATE PARTNERSHIP TO DRIVE ICT INNOVATION IN SCIENCE



CERN: A UNIQUE ENVIRONMENT

PUSHING TECHNOLOGIES TO THEIR LIMITS

At CERN, the European Organization for Nuclear Research, physicists and engineers are probing the fundamental structure of the universe. They use the world's largest and most complex scientific instruments to study the basic constituents of matter: the fundamental particles.

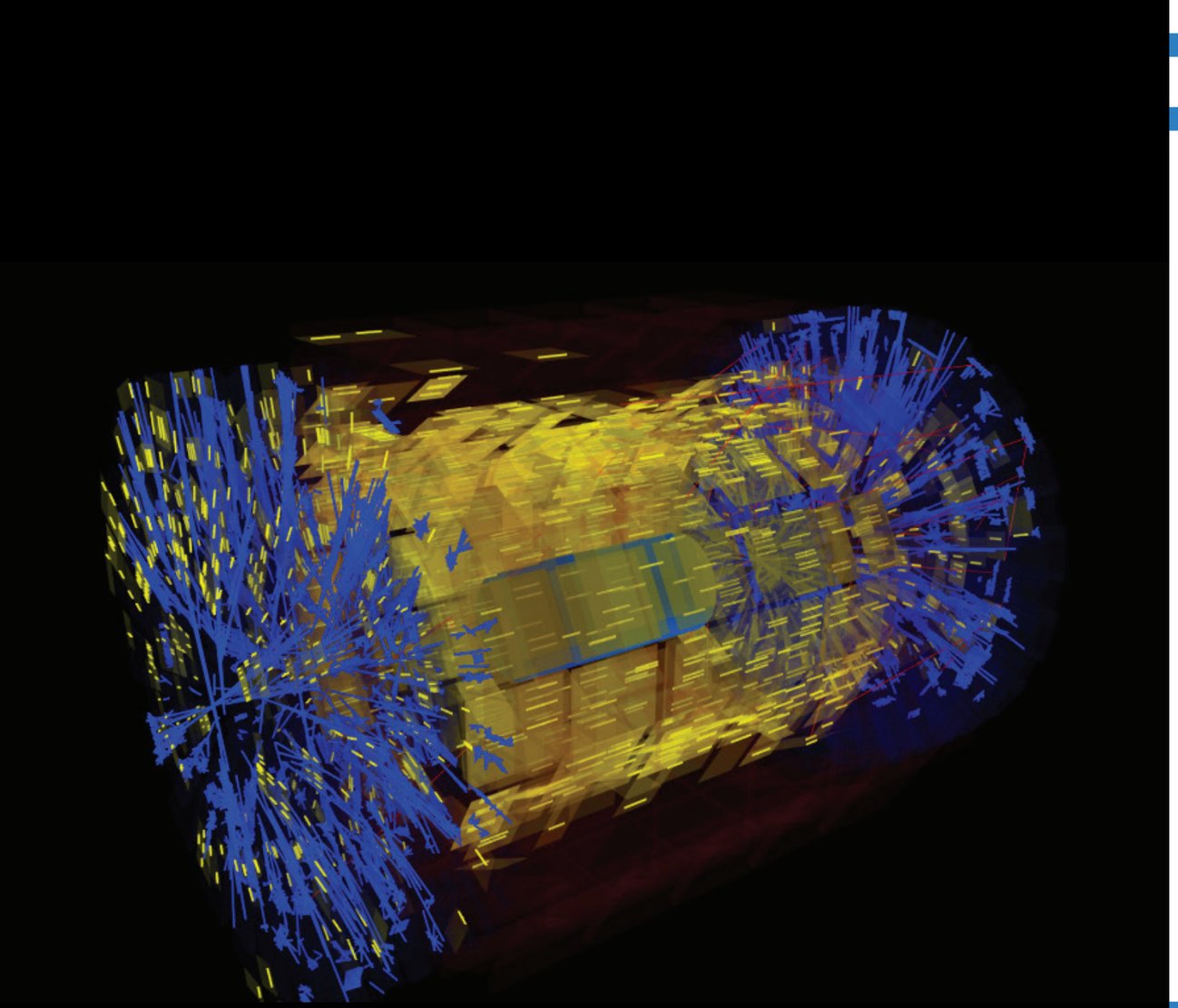
The instruments used at CERN are purpose-built particle accelerators and detectors. Accelerators boost beams of particles to close to the speed of light, before the beams are made to collide. Detectors observe and record the results of these collisions, producing enormous amounts of highly complex data. This process gives the physicists clues about how the particles interact, and provides insights into the fundamental laws of nature.

CATALYSING COLLABORATION

TACKLING TOMORROW'S ICT CHALLENGES TODAY

CERN openlab is a unique public-private partnership that works to accelerate the development of cutting-edge solutions for the worldwide LHC community and wider scientific research. Through CERN openlab, CERN collaborates with leading ICT companies and research institutes.

Within this framework, CERN provides access to its complex ICT infrastructure and its engineering experience — in some cases even extended to collaborating institutes worldwide. Testing in CERN's demanding environment provides the ICT industry collaborators with valuable feedback on their products, while enabling CERN to assess the merits of new technologies in their early stages of development for possible future use. This framework also offers a neutral ground for carrying out advanced research-and-development activities with more than one company.



CREATING KNOWLEDGE

EDUCATION AND DISSEMINATION

CERN openlab is a structure designed to create knowledge through research, development, and evaluation of technologies. This knowledge is disseminated through a wide range of channels, from the publication of reports and articles, to the organisation of workshops and seminars at CERN. CERN openlab's dedicated communications office also supports our collaborators' outreach activities.

Each summer, CERN openlab runs a nine-week programme for bachelor's and master's students specialising in subjects related to computer science. These students come to CERN to work on cutting-edge projects with our collaborators, gaining hands-on experience with the latest ICT solutions. This highly competitive programme typically receives around 1500 applications for just 40 places.

COLLABORATING WITH NEW COMMUNITIES

SHARING OUR KNOWLEDGE

CERN openlab's mission rests on three pillars: technological investigation, education, and dissemination. Our collaboration with research communities and laboratories outside the high-energy physics community brings together all these aspects. CERN openlab works closely with the CERN Knowledge Transfer Group on a number of initiatives aimed at transferring tools, skills, and knowledge from the high-energy physics community to other research fields.

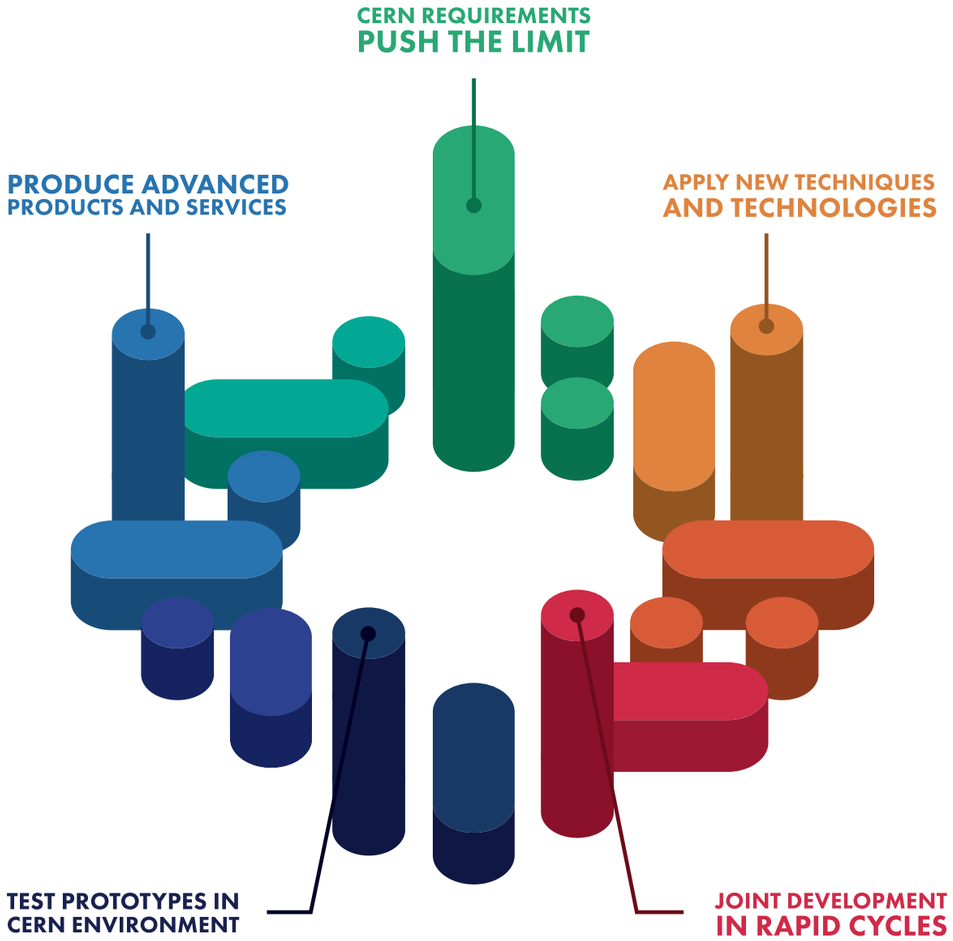
Examples of ongoing knowledge-sharing projects include GeneROOT, which is working to adapt a data-processing framework used in the high-energy physics community to analyse large genomics datasets, and BioDynaMo, which is developing a scalable, flexible cloud-based computing platform for rapid simulation of biological tissue development.

DELIVERING RESULTS

GOVERNANCE

Each project team within CERN openlab is supervised by a member of CERN staff. These project coordinators also act as a liaison between CERN and the company collaborating in the project. At monthly review meetings, the project coordinators update the CERN management team on the progress of projects, thus ensuring timely follow-up of any issues that may arise.

At CERN openlab's annual technical workshop, the representatives of the collaborating companies meet with the project teams, who provide in-depth updates on technical status. Collaborators are also invited to elect a representative for the annual 'collaboration board' meeting, which is an opportunity to discuss the progress made by the CERN openlab teams and exchange views on the collaboration's plans. The third major event organised by the CERN openlab management team is the annual 'open day', which is used to communicate the collaboration's work to new audiences.



A VIRTUOUS CIRCLE

ADDING VALUE

RETURN ON INVESTMENT

Collaborating through CERN openlab represents a significant investment for all parties. Such investments are only made when the expected returns are clear and have been carefully assessed.

Since its establishment in 2001, CERN openlab has demonstrated a clear track record of producing significant returns for all stakeholders. These returns may relate to technological developments, refinement of products, communication, knowledge shared, and access to talent.

BECOMING A MEMBER OF CERN OPENLAB

A whole new set of technology paradigms is emerging, from pervasive ultra-fast networks of smart sensors in 'the internet of things', to machine learning and 'the optimisation of everything'. These technologies have the power to revolutionise the way big science is done, particularly in terms of data analysis and the control of engineering processes. They have enormous potential, not just for research, but also for wider society. The knowledge and expertise at CERN can play a key role in ensuring this potential is realised, with these technologies being put to use for the benefit of both science and society.

CERN openlab — with its research members across a range of scientific fields and its unique collaboration with several of the world's leading ICT companies — is ideally positioned to help make this a reality. Together, we can share a vision for the future of scientific computing.

Company membership of CERN openlab can be as a partner, contributor, or associate. Each status represents a different level of investment.

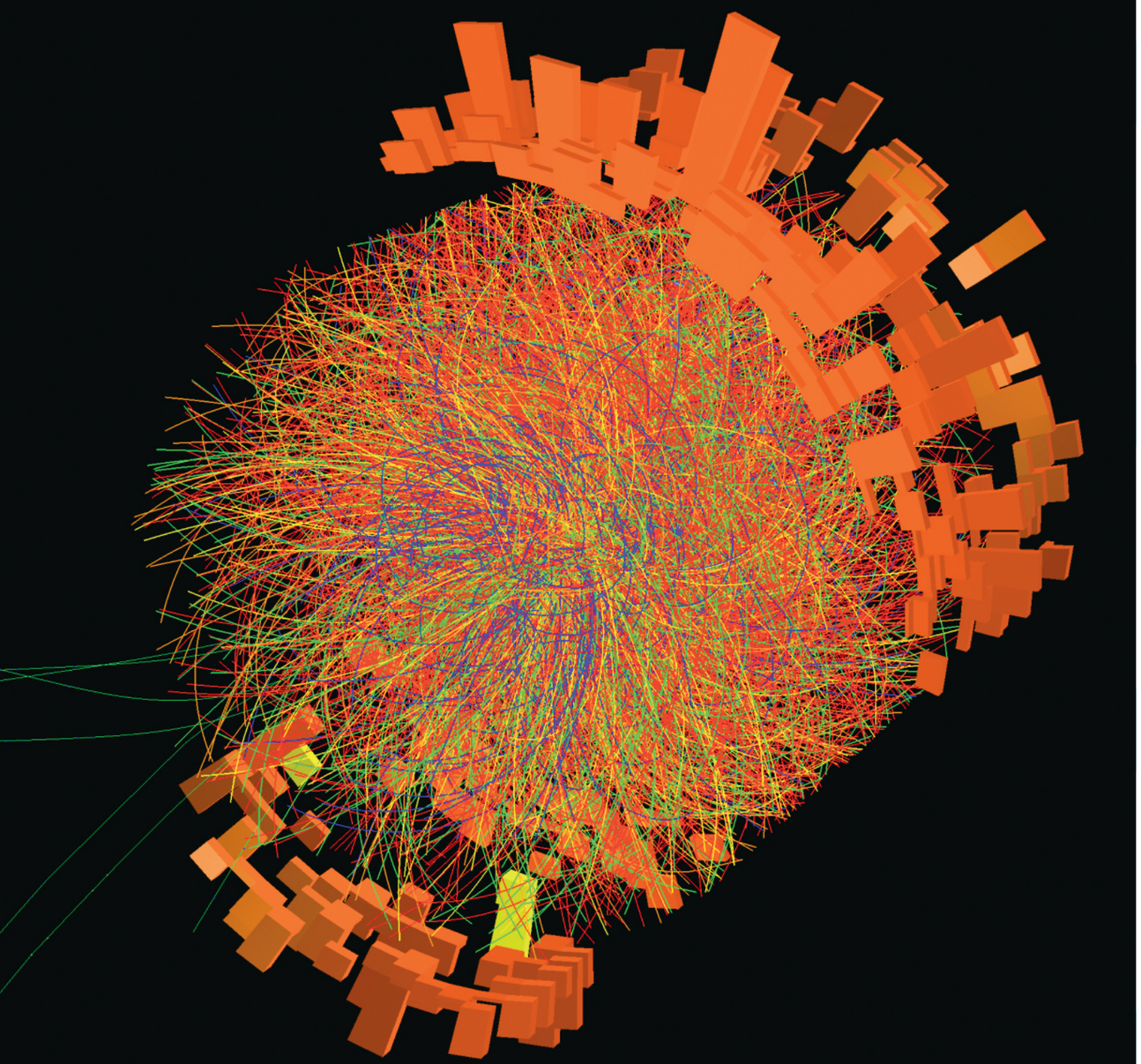
BECOMING A PARTNER

CERN openlab partners typically commit to a three-year programme of work. They provide three kinds of resources: funds to hire young researchers, access to products and services, and engineering capacity. The partners receive the full range of benefits of membership in CERN openlab, including extensive support for communications activities and access to dedicated events.

BECOMING A CONTRIBUTOR

The contributor status formalises a collaboration between CERN and the company that typically lasts between one and three years. This is a broad-scope collaboration, usually based on one or more tactical projects. The contributor status includes a contribution to hire a young ICT specialist — supervised by CERN staff — to work on the common project.

In some cases, becoming a contributor may also be considered a stepping-stone towards full partner status in CERN openlab. This enables both CERN and the company to evaluate the benefits of collaborating before committing to long-term projects.



BECOMING AN ASSOCIATE

The associate status formalises a one- to three-year collaboration between CERN and the company. It is a focused collaboration based on a specific, targeted project. This status is suitable for activities that do not require a presence on CERN site.

BECOMING A RESEARCH MEMBER

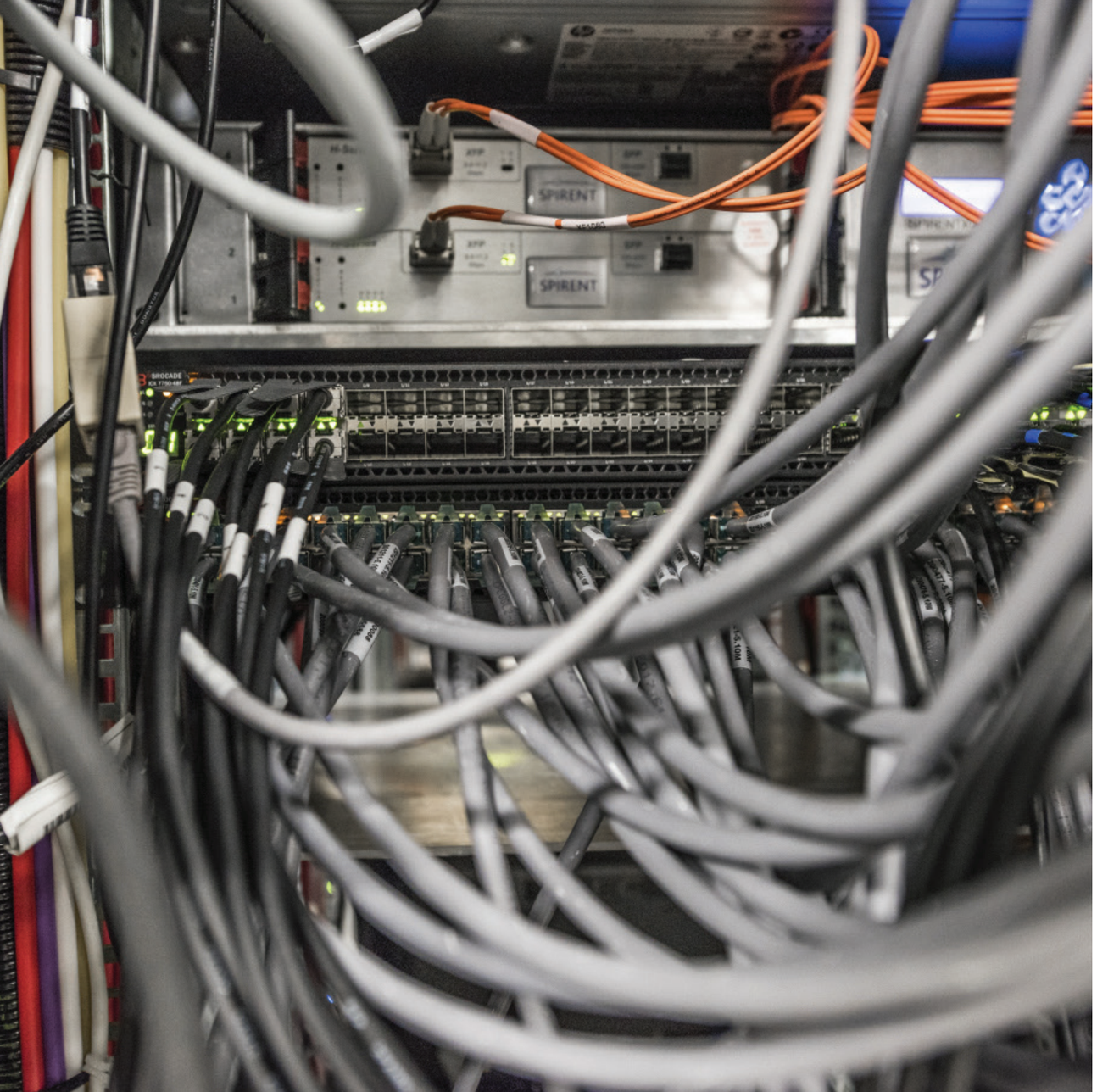
Since its establishment in 2001, CERN openlab has demonstrated a proven track record of working together with industry leaders to accelerate the development of ICT solutions in support of research. By collaborating with scientific institutions on ICT challenges common across large research infrastructures, CERN openlab is able to ensure maximum relevance of its work.

Research members are expected to provide expertise in their scientific field and to take part in CERN openlab's education and outreach activities.

DRIVING ICT INNOVATION IN SCIENCE

CERN openlab is tackling ambitious challenges covering the most critical needs of ICT infrastructures, in domains such as data acquisition, computing platforms, data storage architectures, compute provisioning and management, networks and communication, and data analytics.

Over the following pages, learn more about our projects with each of our partners.



CASE STUDY

HUAWEI

We're working with Huawei to enhance OpenStack, a popular open-source software package used for managing private and public clouds. CERN's private cloud — among the world's largest private OpenStack installations — consists of around 200,000 compute cores running across the data centres in Meyrin, Switzerland, and Budapest, Hungary.

Based on CERN's experience running scientific workloads on the CERN private cloud and Huawei's experience delivering the technological base of Deutsche Telekom's Open Telekom Cloud, we're collaborating together to enrich OpenStack's capacity to deliver services at large scale. We're focusing on areas such as resource control, quotas, 'bare-metal' management, and scaling.

Intel has been a partner in CERN openlab since our foundation in 2001. During this time, we have collaborated on a wide range of projects related to various technological domains. Code modernisation is a current topic of focus, so as to ensure that maximum performance is gained from the cutting-edge hardware available. As well as technical research, our joint work in this area has seen a number of training and educational activities take place, including a global competition launched for students.

The High-Throughput Computing Collaboration is another major joint endeavour: this investigates the potential use of upcoming Intel technologies in the data-filtering and acquisition systems of the LHC experiments. We have also launched a new joint project on data analytics and machine learning, which addresses use cases related to data-reduction, control, and analysis for the LHC. In addition, we are collaborating with Intel in the area of innovation management and entrepreneurship.

CASE STUDY

INTEL

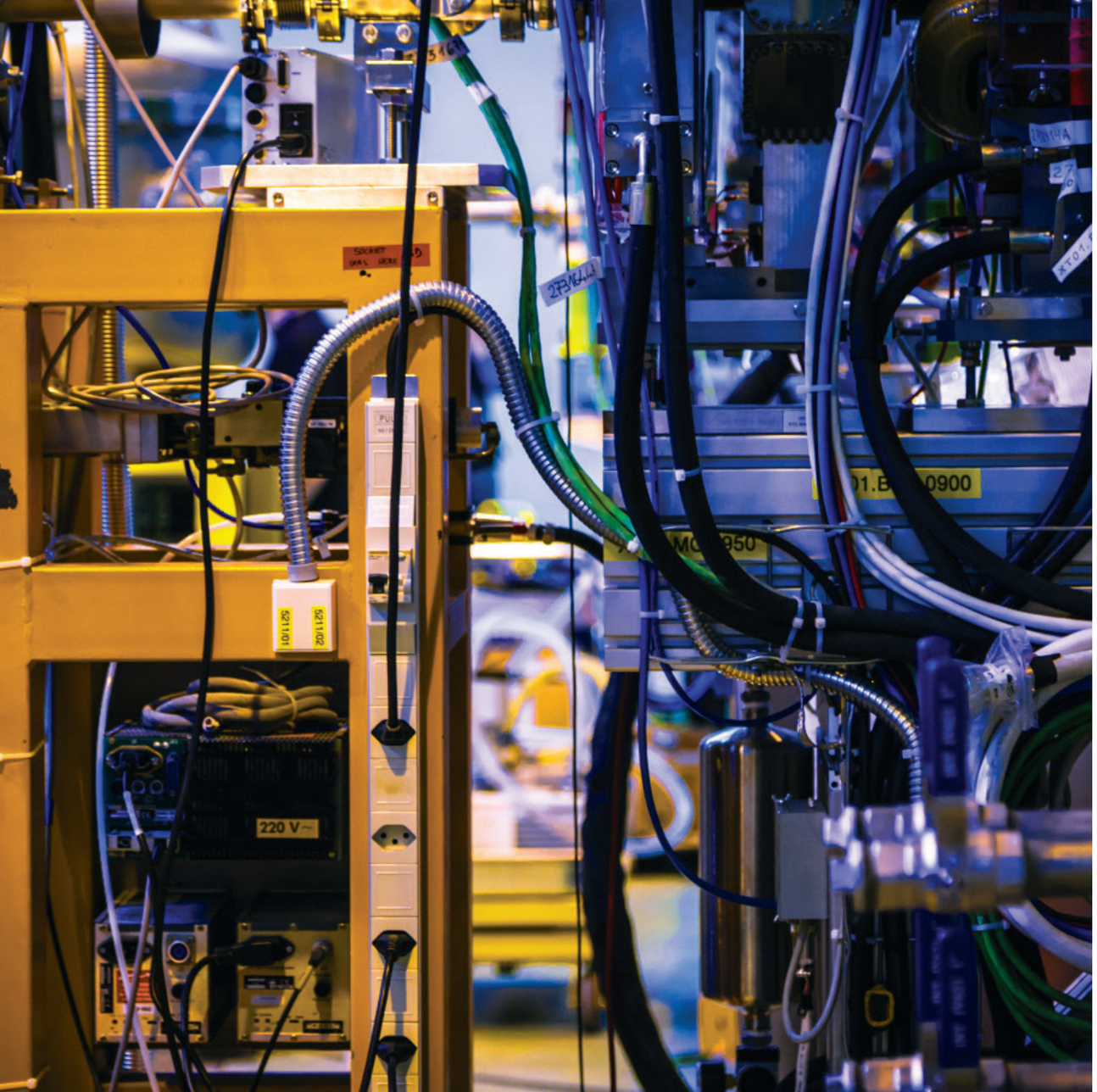
CASE STUDY

Oracle has been a partner in CERN openlab since 2003, working with us on a wide range of projects. We currently have four ongoing projects with Oracle.

Through the 'analytics-as-a-service' project, we are working with several Oracle analytics technologies in CERN's challenging environment. This work benefits the control processes of the LHC, aids our reliability-assessment studies for a potential successor accelerator, and has implications for 'internet-of-things' technologies.

One project is evaluating the use of Oracle Cloud for scientific computation, and for running services at large organisations like CERN. Another focuses on testing Oracle WebLogic in cloud infrastructures. The remaining joint project explores evolution in Oracle's database technologies, such as those related to columnar in-memory.

ORACLE



CASE STUDY

SIEMENS

The CERN accelerators, experiments, and other technical infrastructures rely on a multitude of complex industrial control systems for proper functioning. These control systems produce enormous amounts of data. Together with Siemens, we are applying big-data analytics techniques to some of these datasets, in order to increase efficiency and develop new control models that improve reliability.

Current areas of work include improving detection of faulty sensor measurements for cryogenics systems; detection of alarm flooding and identification of responsible control devices; and development of a recommendation system for users. Methods developed through this collaborative project have already been integrated into operational tools used in various control rooms at CERN.

CONTACT US

Alberto Di Meglio
Head of CERN openlab
alberto.di.meglio@cern.ch

Maria Girone
Chief Technology Officer
maria.girone@cern.ch

Fons Rademakers
Chief Research Officer
fons.rademakers@cern.ch

Andrew Purcell
Communications officer
andrew.purcell@cern.ch

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