# Aruba partners with University of Pisa: machine learning and AI for the optimisation of cloud resources

*Through this joint venture in experimental projects, these organisations have teamed up to harness the power of cloud computing to develop innovative prediction algorithms that enhance performance and optimise energy use.*

**London, 17ᵗʰ January 2024** – [Aruba S.p.A](), the main Italian provider of cloud services and the leader in Italy for data centre services, cloud, hosting, trust services, e-mail, PEC (certified emails), domain registration and digital signature, announces a new collaboration with the **Department of Information Engineering of the University of Pisa.**

With mounting economic and environmental pressures, and regulations like the European Commission's Energy Efficiency Directive (EED) setting the bar, energy efficiency is rapidly becoming a cornerstone of effective service design.

It is with these priorities in mind that Aruba and the Department of Information Engineering of the University of Pisa reached this two-year framework agreement, in which an experimental project of machine learning and AI applied to cloud computing was developed. The project aims to develop an integrated solution for load management on cloud platforms, based on the prediction of the resources used by virtual machines (VMs). Predictions will be based on the analysis of historical data relating to VMs and, through the development of specific algorithms, will aim to optimise the energy consumption of hardware, while guaranteeing the requirements of VM users.

Since cloud environments are generally used dynamically and flexibly, their cost is influenced by energy consumption. Being able to optimise the use of these resources - for example, by predictively modulating the amount of hardware as per the specific needs of customers - can reduce consumption when not needed and as a result, offer the service at a better cost.

Two different algorithms will be developed through the joint project:

- A dynamic VM profiling algorithm to outline certain profiles based on the resources used historically.

- An algorithm for managing VMs that exploits profiles to manage their execution on the different hardware that make up the cloud platform, in order to optimise energy consumption, while guaranteeing performance.

The project, therefore, will make it possible to develop an integrated solution for virtual machine management on a cloud platform based on load prediction, and to implement a proof-of-concept based on OpenStack for field experimentation through application cases. In detail, the main benefits of the project include:

- The possibility of being able to move the load between OpenStack nodes on a predictive and historical basis to optimise the use of resources on the nodes.
- The possibility of guaranteeing adequate resources for client requests, optimising the use of servers dedicated to the service, without creating artificial limitations.
- The possibility of having stand-by computation nodes in OpenStack clusters to be activated according to load distribution needs.

*"We are proud to announce our new collaboration with a prestigious institute such as the University of Pisa, a significant step towards innovation in the practical application of machine learning within the cloud ecosystem,"* commented Daniele Migliorini, Head of Engineering at Aruba. *"This partnership reflects our ongoing commitment to technology collaboration with Italian academic institutions of excellence, in order to offer cutting-edge solutions and meet the rapidly evolving needs of the market. We are confident that the synergy between our experience in the sector and the expertise of the University of Pisa will result in solutions that will shape the future of the cloud and encourage benefits that can be derived from artificial intelligence, optimising the use of energy in the data centre sector with a view to long-term sustainability."*

"*Our department has a long tradition of dialogue and work alongside companies,*" comments the Director of the Department of Information Engineering Andrea Caiti. "*We have several active laboratories dedicated to the research of 4.0 and 5.0, which have now acquired not only local, but also national and international relevance. We receive numerous requests for collaboration from businesses for training courses, co-design of solutions, use of the cutting-edge tools in our laboratories for product studies, and to set up joint research laboratories. This openness to collaboration has enabled us to contribute to effectively bridging the gap that has always existed between research and enterprise, literally bringing two worlds that usually don't speak to each other to the same table.*"

"*The opportunity to collaborate with a large company like Aruba,*" adds the scientific head of the collaboration, Carlo Vallati, "*allows our department to work on frontier topics in the area of cloud computing technologies. This gives us the opportunity to work on innovative solutions, with a potentially significant impact on areas such as energy efficiency and environmental sustainability, which are crucial in the development of the cloud of the future.*"

## Aruba S.p.A.

Aruba S.p.A., founded in 1994, is the main Italian provider of cloud services and the leader in Italy for data centre services, cloud, hosting, trust services, e-mail, PEC (certified emails), domain registration and digital signature. The company, with wholly Italian capital, caters for private individuals, professionals, businesses and Public Administration.

Aruba manages a vast infrastructure that includes 2.6 million registered domains, 9.4 million e-mail accounts, 9 million PEC accounts and 130,000 managed servers, offering services to a total of 16 million users. Aruba PEC and Actalis are Aruba's two Certification Authorities, both accredited with AgID (Agency for Digital Italy), and provide qualified services in the field of IT security, including digital signatures. In March 2021, Aruba expanded its offer by entering the telecommunications market with ultra-broadband connectivity services throughout the country. These services are based on Open Fiber's fully fibre-optic network (FTTH - Fiber To The Home).

In 30 years of activity, Aruba has developed extensive experience in the design and management of high-tech data centres, owned and distributed throughout Italy. The largest one is located in Ponte San Pietro, in the province of Bergamo (near Milan), and is characterised by "green by design" infrastructures and facilities that comply with the highest security standards in the industry (Rating 4 ANSI/TIA-942 and ISO 22237), as well as being designed to minimise environmental impact. It also produces clean energy through photovoltaic systems, groundwater cooling systems and hydroelectric power plants. Aruba is also committed to implementing energy-efficient solutions in its data centres, demonstrating its commitment to sustainability. The infrastructure network also extends across Europe, with a proprietary data centre in the Czech Republic and partner facilities located in France, Germany, Poland and the UK. This international presence allows Aruba to offer integrated services and solutions at a European level.

Aruba is actively involved in the community, supporting social projects and cultural initiatives. The company promotes digital inclusion, technology training and support for innovation through programmes and partnerships with entities, institutions and third sector organisations. Furthermore, Aruba has established strategic partnerships with important technological and institutional companies that allow it to offer integrated and high-quality solutions to customers, guaranteeing complete and reliable services in the field of digital technology. With a strong presence on the Italian market and a growing relevance at international level, Aruba stands out for its leadership in the sector of cloud services, data centres and connectivity solutions. Aruba is committed to technological innovation, sustainability and the development of cutting-edge solutions. The company continues to invest in research and development in order to offer its customers advanced services and products and to meet the increasingly complex and diverse needs of customers, adapting to the constantly evolving digital market.

For further information on the Aruba Group, please visit: https://www.aruba.it/

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## University of Pisa – Department of Information Engineering

The Department of Information Engineering (DII) of the University of Pisa is an Excellence Center for Research and Higher Education in the field of Information and Communication Technology (ICT), Robotics and Bioengineering. 120 professors and 100 post-docs are members of the Department. The main research fields include Electronics, Applied Electromagnetism, Communication Systems, Information Engineering, Automation and Robotics and Biomedical Engineering.

DII has promoted 14 spin-off projects, and it cooperates with private and public institutions to provide innovative solutions to key issues in different ICT sectors, and to bridge the gap between academic and industrial research. The Department is involved in about 20 European projects, 3 ERC, 23 Regional and National Projects and almost 700 projects and collaborations with enterprises and industries.

It runs an intense activity in Higher Education for about 4000 students and 200 PhD students, it organizes the Master in Cyber-security and the Summer Schools "Open medical device design", "Enabling Technologies for the Internet of Things", "Microwaves and mm-waves for the Design of Advanced Wireless Links: Communication, Sensing and Power Transfer", "5G: Enabling Technologies, Opportunities and Research Challenges Ahead".

In 2018 DII was selected by the Italian Minister of Education as "Department of Excellence" with the project CrossLab, aiming to support the revolution of Industry 4.0 in Italy by creating interdisciplinary research labs open to big, medium and small-sized enterprises. In 2023 the Department was included again among the "Departments of Excellence" with ForeLab (Future-oriented Research Lab) project, focused on frontier research for Industry 5.0.

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