



University of Turin

The [University of Turin \(UniTO\)](#), founded in 1404, is amongst the oldest and most prestigious Italian universities. UniTO has 27 departments and is among the top 3 Italian universities for its departments of excellence (10), over 2,000 professors, 80,000 students, 150 courses, 80 Masters and 38 PhD programs.

UniTO also has several multi-disciplinary centres and laboratories aimed at promoting research and the transfer of technology surrounding specific topics. Among these, the HPC4AI@UniTO open access lab, led by the IT department, is active in topics relating to the design of methods and tools for cloud and High-Performance Computing (HPC), with a particular focus on applications related to Artificial Intelligence (AI).

HPC4AI@UniTO

The [HPC4AI@UniTO](#) lab was established in 2018 as part of the HPC4AI project, a joint initiative between the two Turin universities in order to establish a federation of computing infrastructures for research purposes. The HPC4AI project, coordinated by UniTO, was financed with €4.5 million in 2018 thanks to the EU POR-FESR competitive call for large infrastructure 2014-2020 (ranking first) with co-funding from the two universities.

HPC4AI@UniTO is designed as a large, modern open access lab where researchers from various disciplines can experiment with the design and use of computing systems, cloud services and next-generation prototypic systems; where students can experience the complexity of large-scale systems and learn how to manage them, and where local businesses can co-design new applications alongside UniTO domain experts. The lab offers computing and design services that ensure its economic sustainability. In its first year, HPC4AI@UniTO participated in research projects funded for a total cost of over €150 million.



“Vertiv’s solution has enabled us to achieve a substantial reduction in cooling system complexity and countless benefits, such as: the absence of pipes and water within the data centre room resulting in increased safety, noise reduction, reduced implementation time, increased rack space (therefore much more space for the installation of servers dedicated to HPC, AI and BDA) within the data centre and increased IT infrastructure security.”

– Prof. Marco Aldinucci,
Dept. Computer Science,
University of Turin

The Challenge

In the age of managed ICT services, the biggest challenge for every university is to maintain, and possibly increase, the skills and design capabilities when implementing hardware and software systems. These skills are crucial to the value chain of many supply chains whose capacity for innovation is inextricably linked to the mastery of technological skills. This is why UniTO researchers, together with technology partners like Vertiv, designed the entire data centre technology infrastructure and systems. A design conducted as a research exercise based upon extremely challenging parameters in terms of performance, business continuity, reliability and energy efficiency. The challenge within the challenge lies in designing a data centre that is modular enough to sit within pre-existing spaces in the middle of the IT department, located inside the 'Piero della Francesca Centre' in Turin, and created as a design object: a quiet and metaphysical "electronic landscape"; a source of inspiration for students and researchers as imagined by Ettore Sottsass for the 'Olivetti Elea' calculator collection (Compasso D'Oro 1960).

The Needs of HPC4AI@UniTO

The IT department sought to build a TIER-III data centre (with N+1 redundancy) capable of supporting up to 250 kW of ICT equipment, comprising 16 cabinets of at least 20 kVA each, and also hosting high density servers (1.5 kW per unit). The data centre had to be built inside an armoured and soundproof glass room, clearly visible for students and researchers passing through the IT department. It also needed to achieve exceptional energy efficiency levels for data centres in this category (pPUE<1.06 for cooling).

Solution

Vertiv worked with the University of Turin technical staff and the engineering firm in charge of the final design, arriving at a solution that could both achieve modularity and save on costs and energy. In addition, Vertiv collaborated in the drafting of the final project and was responsible for its implementation. The University then identified a suitable room for the data centre on the top floor of the building, previously used for offices and located directly beneath a solar roof slab. This allowed Vertiv to implement an innovative, energy-efficient, air cooling system, and take advantage of the close proximity of the electrical cabin so as to install the uninterruptible power supply system.

Specifically, the technological solution relating to the electrical infrastructure created by the Euroimpianti installer includes: the setup of structured wiring for technological utilities; installation of the standard lighting and safety system; the arrangement of power sockets and RJ45 data sockets; installation of the system for protection against indirect contact; installation of the fire detection and signalling system for technical premises

and fire extinguishing system; and the installation of the access control system with different types of tokens (smartcards, QR code, pins). In addition, the supply and installation of lighting fixtures for standard and safety lighting, as well as the supply and installation of safety release buttons, were also provided.

As for thermal management, the data centre has been equipped with an innovative, highly-efficient external cooling solution which uses indirect freecooling, evaporative cooling integration, and a direct expansion system. A water treatment system has also been installed for the reintegration of the evaporative cooling system implemented by the installer. Finally, the data centre is equipped with exhaust networks for the new units and a cooling system for the UPS room with a direct expansion perimeter unit and a rooftop external condenser.

The fire suppression system for the data centre is based on Novec technology, which allows for the safeguarding of IT material and the increased safety of personnel. An automatic inert gas system was installed inside the data centre, which, in the event of a fire, will pour gas into the IT room, lowering the oxygen concentration and thus extinguishing any flames. The installation has been coupled with a system of fans and dampers, which can be operated manually when a fire has been extinguished in order to allow the room to be cleaned. In spaces where electronic equipment is provided, at least two CO2 fire extinguishers have been installed.

Vertiv solutions provided:

- 2 x **Vertiv™ Liebert® APM** 150 kW UPS scalable up to 250 kW;
- 1 x **Vertiv™ Liebert® GXT5** UPS serving the electrical cabinet;
- 1 x 415 kVA diesel soundproof generator set;
- 16 x **Vertiv™ DCM** racks per data centre;
- 1 x **Vertiv™ Knürr Miracel® 2** rack for the technical room;
- 28 x **Vertiv™ Liebert® Geist™ PDUs** (GS30019L) 22.2 kVA;
- 4 x **Vertiv™ Liebert® Geist™ PDUs** (GS30015L) 7.3 kVA;
- 1 (+1 prearrangement) x **Vertiv™ Liebert® EFC 220** direct expansion, high efficiency indirect freecooling with evaporative cooling;
- **Vertiv™ Life™ Services** preventative monitoring and remote diagnostics services;

Results

- Energy-efficient and effective air conditioning by combining three cooling modes
- Immediate exchange between mains power and generator set ensuring continuous data centre operation
- Powering of the entire data centre electrical load for 12 hours which protects the computing infrastructure against significant power supply interruptions from grid outages.
- Modularity implemented through UPS expansion of up to 250 kW
- Achievement of N+1 redundancy by installing a second UPS in parallel with the same characteristics as the first
- 24/7 preventive remote monitoring and 4-hour on-site support when needed



“The new data centre had to be designed according to the most innovative systems, both for cooling and continuous power,” said Prof. Marco Aldinucci, Dept. of IT, University of Turin, “and to respond to the most stringent parameters in terms of energy consumption and environmental impact. The criteria we focused on were: to have a TIER III system with a reduced structural impact within the data centre; to ensure the reduction of energy consumption of the cooling and uninterruptible power supply infrastructure; to have a smart and scalable infrastructure; and to ensure a pPUE value below 1.1 for data centre cooling. Vertiv’s solutions and services have perfectly met every requirement.”

“One of the distinguishing elements that has been recognised in the proposed solution is the utmost silence within the adjacent rooms: the transparent glass walls maintain an extremely low level of sound impact and, at the same time, delimit the data centre while allowing teachers and students to see it”, emphasised Stefano Mozzato, Country Manager for Vertiv Italy.

“There is also a very low sound impact on the roof. As the building is located in a crowded area of Turin, the University found it essential to choose an innovative solution like the Vertiv™ Liebert® EFC so as not to add to the noise pollution. So, a data centre with low environmental impact without reducing project needs: HPC4AI and silence are straight parallels that we have brought together.”



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