

COMPUTING INFRASTRUCTURE



EMPOWERING INNOVATIONS WITH AI, KAROLINA AND BARBORA SUPERCOMPUTERS AND THE VLQ QUANTUM COMPUTER

IT4Innovations National Supercomputing Center at VSB – Technical University of Ostrava is a leading research, development and innovation centre active in the fields of High-Performance Computing (**HPC**), High-Performance Data Analysis (**HPDA**), Quantum Computing (**QC**), and Artificial Intelligence (**AI**), and their applications across scientific fields, industry and society.

Together with CESNET and CERIT-SC, IT4Innovations constitutes **e-INFRA CZ**, a strategic research infrastructure of the Czech Republic. IT4Innovations currently operates three supercomputers – **Karolina**, **Barbora** and **Barbora NG**, as well as smaller **complementary systems** that provide users with access to emerging, non-traditional or highly specialised hardware architectures.

In 2025, IT4Innovations installed the Czech Republic's first **quantum computer**, **VLQ**, acquired by the LUMI-Q consortium. VLQ is based on 24 superconducting qubits connected to a central resonator in a star-shaped topology.

Czech research communities also have access to the **LUMI** supercomputer, one of Europe's most powerful supercomputers. IT4Innovations is a member of the LUMI consortium and also contributes to its operation.

IT4Innovations is actively involved in the European network of AI Factories. It is a member of the **LUMI AI Factory** and coordinates the **Czech AI Factory**. The main aim of the AI Factories is to support the development of AI-focused start-ups and the deployment of AI across industry, public administration and society as a whole.

TECHNICAL SPECIFICATIONS OF SUPERCOMPUTERS

Specifications	KAROLINA	LUMI	BARBORA NG
Put into operation	Summer 2021	Winter 2023	Summer 2026
Theoretical peak performance	15.7 PFlop/s	531.5 PFlop/s	1,858 TFlop/s
Operating system	Rocky Linux 8.x	HPE Cray OS	RHEL 9
Compute nodes	831	5,042	144
Types of compute nodes	756 CPU nodes 2x AMD EPYC 7h12 64-core, 2.6 GHz, 256 GB RAM	2,048 CPU nodes 2x AMD EPYC 7763 64-core, 2.45 GHz, 256–1,024 GB RAM	144 CPU nodes 2x Intel Xeon 6952P 96-core, 2.1 GHz, 768 GB RAM
	72 GPU nodes 2x AMD EPYC 7763 64-core, 2.45 GHz 1 TB RAM 8x NVIDIA A100 40 GB HBM2	2,978 GPU nodes 1x AMD EPYC 7A53 64-core, 2.45 GHz, 512 GB RAM 4x AMD Instinct MI250X 128 GB HBM2e	
	1 data analytics node 32x Intel Xeon-SC 8628 24-core, 2.9 GHz, 24 TB RAM	8 data analytics nodes 2x AMD EPYC 7742 64-core, 2.25 GHz, 4 TB RAM	
	2 visualisation nodes 2x AMD EPYC 7452 32-core, 2.35 GHz 256 GB RAM 1x NVIDIA RTX 6000	8 visualisation nodes 2x AMD EPYC 7742 64-core, 2.25 GHz, 2 TB RAM 8x NVIDIA A40 GPU	
Accelerators in total	576x NVIDIA A100 2x NVIDIA RTX 6000	11,912x AMD Instinct MI250X 8x NVIDIA A40	
CPU cores in total	106,880	454,784	27,648
Storage	30 TB / home 1,275 TB / scratch (NVMe, 730 GB/s sequential write performance; 1,198 GB/s sequential read performance)	81 PB / (home + project + scratch) (240 GB/s)	25 TB / home 500 TB / scratch (NVMe, 187 GB/s sequential write performance, 384 GB/s sequential read performance)
Interconnection	Infiniband HDR 200 Gb/s	Slingshot-11,200 Gb/s	Infiniband NDR 400 Gb/s

Computational Resources Allocation

IT4Innovations provides access to computational resources for research, development, education and commercial use. The way computing time is allocated depends on the type of project and the applicant.

Open access – computational resources for the research community in the Czech Republic. The largest share of the computational resources is distributed within the framework of Open Access Grant Competitions.

Access for thematic HPC resource utilisation – allocations for socially important tasks, teaching and educational activities, commercial activities (contract research), and in-house infrastructure research. Submissions at any time.

Transnational access – access to the LUMI supercomputer and other European systems through European calls announced by the EuroHPC JU. The calls cover access modes for application development and testing, large-scale scientific and commercial projects, as well as projects focused on AI and industrial innovation.

Companies can make use of:

- rental of computing capacity at IT4Innovations – from standard allocations to tailored solutions, contract research
- commercial use of IT4Innovations' computational resources as part of contract research,
- AI Factory calls by the EuroHPC JU.

VLQ QUANTUM COMPUTER



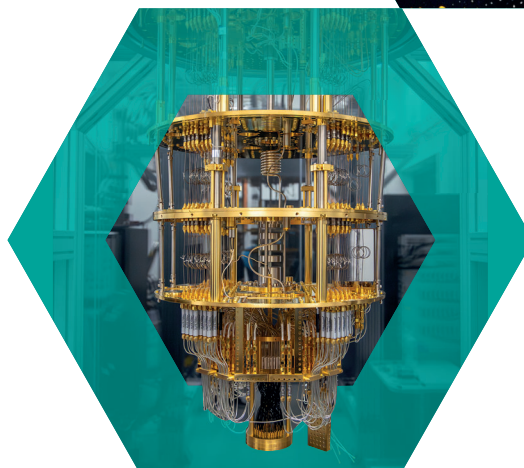
The VLQ quantum computer of the LUMI-Q consortium provides a European quantum computing environment integrated into the infrastructure of the EuroHPC JU. The system is integrated with the Karolina supercomputer in Czechia and LUMI in Finland and is accessible to a wide range of users – academic institutions, industry and the public sector. Its computing capabilities primarily support research and innovation across Europe.

VLQ supports the development of applications with industrial, scientific and societal benefits and expands the capabilities of European supercomputing infrastructure.

Research organisations from the Czech Republic can apply for access to VLQ through IT4Innovations' Open Access Grant Competitions. Users from the partner countries of the LUMI-Q consortium can apply through calls organised by individual partners, while applicants from other European countries can apply through EuroHPC JU calls.

Architecture:

- 24 physical qubits connected to a central resonator
- superconducting qubits in a star topology
- integrated with the EuroHPC JU supercomputers: KAROLINA in the Czech Republic and LUMI in Finland

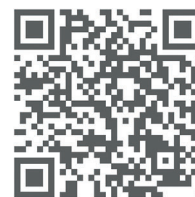


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IT4Innovations National Supercomputing Center
VSB – Technical University of Ostrava
Studentská 6231/1B
708 00 Ostrava
Czech Republic
E-mail: info@it4i.cz

www.it4i.eu



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