Finnish super power
CSC – IT Center for Science is a Finnish center of expertise in information technology owned by the Finnish state and higher education institutions. We provide internationally high-quality ICT expert services for higher education institutions, research institutes, culture, public administration and enterprises to help them thrive and benefit society at large.

CSC received 33 M€ funding 2018 - 2021 to develop data management and computing environment and 4 M€ funding for increased AI capacity. In addition, 2 M€ was granted for competence development and new services & support for novel use cases and emerging user groups. CSC’s next supercomputing environment and Fairdata services are freely available for academic research in universities and state research institutes. CSC resources can also be used for teaching and education.

The GoZee app makes the brochure come alive

GoZee: Get started in 30 seconds

1. Go to App Store or Google Play, enter “GoZee” in the search field and download the app to your smartphone or tablet.
2. Open the app and use it on pages with the GoZee icon.
The new Finnish research infrastructure for data management and computing

BALANCED HPC ECOSYSTEM FOR SUPPORTING THE SIX DRIVERS

Community IaaS Cloud

Private IaaS cloud

MAHTI

PUHTI

PUHTI-AI (GPU)

FAST PARALLEL STORAGE

FAST PARALLEL STORAGE

ALLAS

OBJECT STORAGE AREA

Container cloud
Scientific drivers

DATA-INTENSIVE COMPUTING
- The Sequencing Initiative Suomi (data-intensive computing with sensitive data)
- Whole-genome analysis of cancers and patients (data streams & data-intensive computing with sensitive data)

DATA-INTENSIVE COMPUTING FOR SENSITIVE DATA

LARGE SCALE SIMULATIONS
- Challenging scientific questions are studied by enabling larger, longer, higher fidelity models
- Climate change, space weather, fusion reaction, astrophysics and particle physics

MID-SCALE SIMULATIONS
- Enabling workflows with large number of simulations
- Material science, energy technology, molecular simulations (e.g. functioning of cells)
- Geosciences

ARTIFICIAL INTELLIGENCE
- Analysis and categorization of data and learning from it at massive scale
- Integral part of future simulations and computational workflows
- Prediction of molecular phenotypes for cancer diagnosis
  - Deep language model of Finnish

INTERNET OF THINGS (IOT) AND DATA STREAMS
Pilot cases

ARTIFICIAL INTELLIGENCE BASED PREDICTION OF MOLECULAR PHENOTYPES FOR CANCER DIAGNOSIS
- Molecular phenotyping can make diagnosis of prostate cancer more precise and comprehensive
- Deep neural networks are utilized for classification of histopathology image data
- Large data volumes and optimized computational pipeline using both CPU and GPU computation
- Published in The Lancet Oncology, Jan. 8, 2020

Pekka Ruusuvuori, Tampere University

MACHINE LEARNING FORCE FIELD SIMULATION OF CARBON NANOTUBE GROWTH
- Carbon nanotubes have emerged as versatile materials
- The lack of fundamental understanding of the growth mechanisms prevents further optimization of nanotube synthesis and wider adoption of nanotube-based technologies
- The researchers will train an accurate machine-learning force field from highly accurate quantum-mechanical reference data that will allow to model the formation of carbon nanotubes with unprecedented level of realism

Miguel Caro, Aalto University

ANTARCTIC ICE AND SOUTHERN OCEAN SIMULATIONS
- The Antarctic Ice Sheet is losing mass. Warmer waters penetrate under the ice shelves, causing melting and thinning.
- The researchers will develop and apply state-of-the-art modelling tools to investigate ice sheet – subglacial hydrology – ocean cavity interactions and patterns of change in both landward and seaward directions
- This is motivated by understanding Antarctic Ice Sheet stability and its contribution to sea level rise.

Rupert Gladstone, University of Lapland

FLUXIONALITY OF SUPPORTED PLATINUM AND RHODIUM CLUSTERS
- Small supported metal clusters can have multiple low-energy structural isomers
- The researchers will carry out ab initio molecular dynamics simulations to explore the structural dynamics of zirconia-supported platinum and rhodium clusters in order to understand their fluxionality
- The obtained results will be used to derive theoretical concepts to rationalize the catalytic behavior of the studied systems

Karoliina Honkala, University of Jyväskylä

Where innovation and business come together
VTT is a visionary research, development and innovation partner. We drive sustainable growth, tackle the biggest global challenges of our time and turn them into growth opportunities. We go beyond the obvious to help the society and companies to grow through technological innovations. www.vttresearch.com
PUHTI

Puhti is a general purpose computing cluster that is intended to cover a broad range of use cases and workflows. Simulations and data intensive computations benefit from the 682 node CPU partition that has 192 GB to 1.5 TB per node, and fast NVMe drives in a subset of the nodes. AI and HPC workloads benefit from the large GPU partition with in total 320 latest generation Nvidia volta GPUs, as well as the new VNNI instructions for AI inference.

PUHTI - COMPUTING CLUSTER
- CPU partition peak performance is 1.8 Petaflops with in total 171 TB of main memory
- 682 nodes with latest generation Intel Xeon Scalable processors (Cascade lake)
- Intel Xeon Gold 6230 with 20 cores running at 2.1 GHz
- Infiniband HDR interconnect between nodes
- 4+ Petabytes work disk (DDN SFA18K)

PUHTI-AI
- GPU partition peak performance is 2.7 Petaflops with in total 30 TB of main memory and 10 TB of GPU memory
- 80 nodes with equipped with 4 NVIDIA V100 (32 GB) GPUs and 3.2 TB local NVME
- 2 x 100 Gbps links to each node providing extreme network performance
- CPU architecture provides VNNI instructions for AI inference
- Designed to enable massive multinode training workloads
Mahti is a supercomputer designed for massively parallel jobs that require large floating point performance and a capable interconnect. Mahti is in particular geared towards medium to large scale simulations. Also smaller parallel workloads that are able to use full nodes efficiently can utilize Mahti.

- Atos BullSequana XH2000 supercomputer
- 1404 nodes with a peak performance of 7.5 Pflops with in total 359 TB of main memory
- Each node has two 64 core AMD EPYC 7H12 (Rome) processors running at 2.6 GHz
- 8.7 PB Lustre parallel storage system (DDN SFA18K)
- Interconnect network HDR InfiniBand by Mellanox
- Full 200 Gbps HDR connection to each node
- Dragonfly+ interconnect
The most powerful supercomputer in the Nordics

#SupercomputingForFinland

Big data, machine learning and artificial intelligence are changing our society at a fast pace, and supercomputers enable major advancements in these fields. As the leading European high performance computing provider, Atos leveraging its partnership with AMD for its BullSequana supercomputer solutions contributes to the international competitiveness of Finland by supporting top-class Finnish research and providing the Finnish academic community with new innovative possibilities.

The new powerful BullSequana XH2000 supercomputer at CSC features high performance next generation AMD EPYC™ processors to enable world leading performance enhancements for HPC workloads. The CSC supercomputer will boost data-intensive computing, a prerequisite for advanced research in areas such as artificial intelligence, development of new pharmaceuticals and nanomaterials, as well as for climate change prediction model developments.

CSC and its technological partnership with Atos will play a key role in advanced scientific research in Finland, which underlines the value of CSC’s supercomputing capacity for the entire Finnish and European research community.

atos.net/nordics

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atos.net/nordics
True cross-platform service for storing and sharing data. Supports data transfers within the CSC systems, large uploads from organisations and individual data management cases. Data can be shared for customised groups or published publicly on the Internet.
CSC’s cloud services - modern research infrastructures for modern research.

Sometimes research needs something different than standard HPC systems - or a researcher’s laptop. For these situations we have the CSC cloud services. From solving small problems to hosting large infrastructures the CSC cloud services put the control in your hands.

THE CSC CLOUD SERVICES ARE BUILT WITH OPEN SOURCE TOOLS USING OPEN SOURCE SOFTWARE

INFRASCTURE CLOUD:
- cPouta - general purpose IaaS cloud
- ePouta - an IaaS cloud for sensitive data processing
- Over 20000 cores spread over HTC, I/O, GPU and general purpose nodes
- Virtual machines, storage, networks at a click of a mouse, or over an API

CONTAINER CLOUD
- Rahti - ready to use Kubernetes for you
- A modern platform for your container orchestration needs
- Deploy and develop container based applications quickly and easily
Software environment and databases

CSC provides researchers the largest collection of scientific software and databases in Finland.

Over 100 scientific software packages are available in:
- Biosciences
- Chemistry
- Computational engineering (computational fluid dynamics and structural analysis)
- Geosciences
- Language research
- Mathematics and statistics
- Physics
- Visualization

Open source software development at CSC

CSC develops software products that support key areas of Finnish research and are integrated to CSC’s services. Most of the developed software is distributed under an open source license model.

- Chipster - Open source platform for data analysis (https://chipster.csc.fi/)
- Elmer - Open source finite element software for multiphysical problems (https://research.csc.fi/web/elmer/elmer)

Research groups and public sector organisations are keenly interested in benefiting from advanced AI solutions. CSC has developed the expertise to support users on their path, starting from the very first steps when they are familiarising themselves with data driven ways of working. We run workshops and mentoring, supported by our analytics maturity model and AI project canvas.
Support and training

CSC offers highest level of support in various fields of science:
- Chemistry
- Computational engineering (computational fluid dynamics and structural analysis)
- Geosciences
- Language research
- Mathematics and statistics
- Physics
- Visualization
- For HPC programming support is available in:
  - Code porting
  - Parallelization
  - Performance analysis and optimization

CSC offers Finnish universities, research institutes and government organisations versatile and high-quality training in scientific computing, data management and information networks, from bleeding-edge technologies to widely used methods and useful and practical IT skills. Information and registration for upcoming trainings and learning materials can be found in www.csc.fi/web/training.

CSC organizes annually over 70 training events: courses, workshops, seminars etc. comprising in total over 100 training days a year. Our lecturers and trainers are leading experts of scientific computing, data networks, and data management – from CSC or external organisations.

CSC is active in European training collaborations and networks as one of the ten PRACE Training Centres, bringing world-class training in scientific computing to Finland.

CSC SUMMER SCHOOL IN HIGH-PERFORMANCE COMPUTING

Since 2010 CSC has organized summer school bringing together undergraduate and graduate students and postdoctoral researchers in different disciplines of scientific computing from all over the world. The contents consist of lectures and hands-on training on parallel programming, code optimization and other necessary skills in development of scientific software.

HDR 200G InfiniBand

With In-Network Computing Acceleration Engines

Highest Performance & Scalability for CSC Supercomputers
CSC Datacenter in Kajaani
– World-class HPC excellence and Eco-efficiency

COST AND ENERGY-EFFICIENCY
- Free air cooling can be utilized – no additional compressors required to maintain the target temperatures
- CSC uses 100% certificated hydro power in all data center production and office environments
- High capacity green power provided with multiple links to the national grid – no major power failures since 1980’s
- Options for wind and solar energy are possible
- Modern reuse of waste heat is available, excess heat can be sold to municipal district heating network
- Annual PUE for datacenter hosting Puhti and Mahti is approximately 1.04

EXCELLENCE IN HPC
- CSC has knowledge and expertise of covering the entire lifecycle of an HPC center – from planning and construction to maintenance and usage
- Since the first datacenter, established in 1980s, CSC has gained experience in planning and implementing fully equipped, functional data centers of the latest technology
- CSC is a trusted European actor and partner to continuously improve service quality in line with changing customer needs.

FUNET CONNECTIONS
- Funet, the Finnish University and Research Network, provides excellent network connections to the rest of the world
- Reliable, congestion-free connectivity through 100 Gbit/s national IP/MPLS backbone
- Dedicated connections available through Funet Light path service and National and international MPLS services.
MODULARITY AND SCALABILITY
- CSC datacenter perfectly suited for modular expansion. The existing infrastructure already built for heavy industry use, and it can be re-built.
- Finland’s geographical and political stability ideal for secure and long-standing operations. Local service providers and partner networks, e.g. university, funding organisations, authorities, industry – ensure rapid scalability.
- According to Invest in Finland operating a 10 MW datacenter in Finland would save €13 million over 3 years and a staggering €42 million in 10 years as opposed to the EU average.
CSC – IT CENTER FOR SCIENCE LTD.
P.O. Box 405
FI-02101 Espoo, Finland

Visiting address:
Life Science Center Kellaniemi
Keilaranta 14, Espoo

Datacenter CSC Kajaani:
Tehdaskatu 15 P21
87100 Kajaani

phone +3589 457 2821
servicedesk@csc.fi

www.csc.fi