Finnish super power
CSC – IT Center for Science

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.

OWNED BY STATE 70% AND ALL FINNISH HIGHER EDUCATION INSTITUTIONS 30%.

NON-PROFIT STATE ORGANIZATION WITH SPECIAL TASKS.

HEADQUARTERS IN ESPOO, DATACENTER IN KAJAANI.

TURNOVER IN 2018 44.9 M€.

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.

TRANSFORMING YOUR DATA INTO A POWERFUL, COMPETITIVE EDGE

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.

DDN.COM

Snap video Cinemagraph 360° panorama Web 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
- World’s most accurate model on space weather, Vlasiator
- Gravitational waves from early universe

MID-SCALE SIMULATIONS
- Enabling workflows with large number of simulations
- Atmospheric feedback mechanisms (mid-scale simulations & data-intensive computing & data streams)

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 breast 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
  
Pekka Ruusuvuori, Tampere University

DEEP LANGUAGE MODEL OF FINNISH
- Modeling human language is leading into breakthroughs in machine translation, question answering, and natural language dialogue
- Web-scale Finnish language data together with very deep neural networks utilizing GPUs
- New model for Finnish that will be comparable in coverage and quality to the best language models available today for any language
- Results will be available under Open Data licensing
  
Filip Ginter, University of Turku

GRAVITATIONAL WAVES FROM EARLY UNIVERSE
- Computational modeling of sources of gravitational waves
- Phase transitions at Higgs boson “turning on” (10 picoseconds after Big Bang)
- Large simulations with over ten thousand CPU cores
  
David Weir, University of Helsinki

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 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)
- In use in Summer 2019

**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

Mahti supercomputer is the platform for the massive parallel jobs up to several tens of thousands of cores. Large scale simulations benefit from the efficient interconnect network and the homogeneous memory configuration.

- Atos BullSequana XH2000
- Liquid cooling
- AMD EPYC Rome CPUs
- 256 GB memory per node
- About 200,000 cores in total
- Infiniband HDR interconnect with Dragonfly+ topology
- Peak floating point performance is 6.5 Petaflops
- 8 Petabytes of work disk (DDN SFA18K)
- Available for customers in early 2020
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

Empowering Finnish research
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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.

- New storage service for all computing and cloud services
- 12 Petabytes available for data stored during project lifetime
- Object storage based on CEPH
- Supports initially S3 and Swift APIs but plans include value added services based on rich metadata management processes
- Publishing data to Internet possible (unlike most HPC environments)
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 or a researcher’s laptop.

**INFRASTRUCTURE CLOUD:**
- cPouta – general purpose IaaS cloud
- ePouta – an IaaS cloud for sensitive data processing
- Over 12000 cores spread over HTC, I/O, GPU and standard lightweight nodes container cloud
- 7000 cores, 14000 HT cores
- A modern platform for your container orchestration needs

**CONTAINER CLOUD**
- Rahti - ready to use Kubernetes for you
- A modern platform for your container orchestration needs

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

openstack

RED HAT OPENSHIFT
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
- Etc.

Software environment and databases

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

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.

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)
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

Support and training

In addition to the computing resources and software CSC provides science and HPC programming support and an extensive training portfolio to the customers.

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 5 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 of Kajaani Datacenter 1.04 (2017)

**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.