



LUMI

EuroHPC – Energy Efficient Supercomputing in Kajaani Data Center

Dec 10th, 2019
Kimmo Koski, CSC

Non-profit state
organization with
special tasks



Turn over
in 2019 (est.)
51,5 M€



Headquarters in
Espoo,
datacenter in
Kajaani



Owned by state **(70%)**
and all Finnish higher education
institutions **(30%)**



Circa
410
employees
now

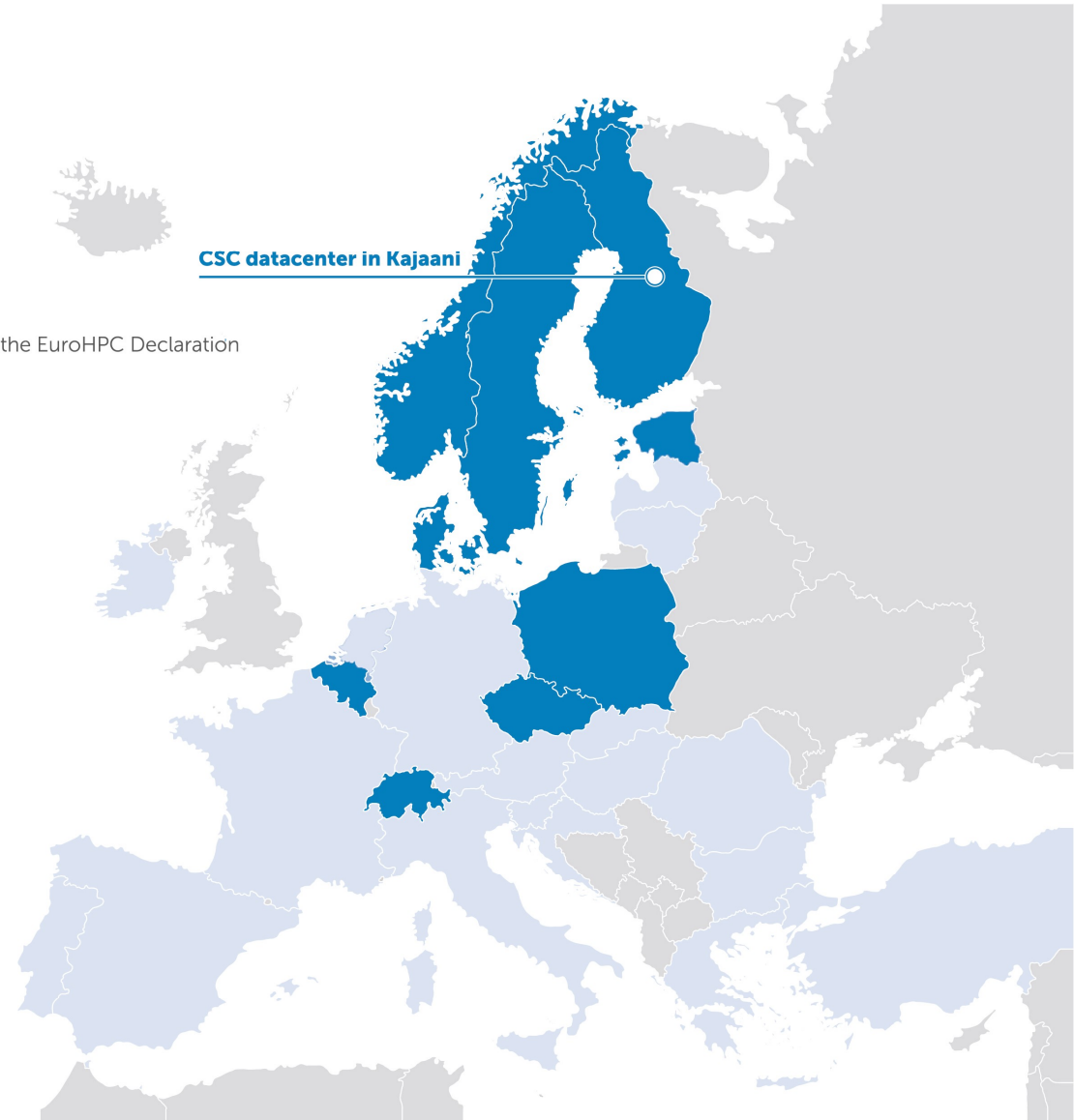
The EuroHPC initiative

- The **EuroHPC Joint Undertaking** will pool EU and national resources in high-performance computing (HPC)
 - **acquiring and providing a world-class supercomputing and data infrastructure** for Europe's scientific, industrial and public users
 - supporting an ambitious **research and innovation agenda**
- The EuroHPC declaration has been signed by **30 European countries**
- The first generation of EuroHPC systems announced in June
 - 3 pre-exascale systems (150+ Pflop/s Linpack) to Finland, Italy and Spain
 - 5 petascale systems (4+ Pflop/s Linpack) to Czech Republic, Bulgaria, Luxembourg, Portugal and Slovenia

LUMI budget

| | |
|----------------|----------|
| Finland | 50 M€ |
| Belgium | 15.5 M€ |
| Switzerland | 10 M€ |
| Sweden | 7 M€ |
| Denmark | 6 M€ |
| Czech Republic | 5 M€ |
| Poland | 5 M€ |
| Norway | 4 M€ |
| Estonia | 2 M€ |
| EU | 102,5 M€ |

- Countries which have signed the EuroHPC Declaration
- LUMI consortium countries



From Saw and Paper to Renforsin Ranta Business Park



1907
First Saw
Mill



1919
First
Paper Mill



2008
Renforsin
Ranta

2012
CSC
Datacenter

CSC World-class Data Center in Kajaani

- Annual PUE 1,03* (2018) bringing tangible energy cost savings to customers. (*free-air cooling)
- Cool climate: Kajaani has only a few days each year when the temperature is over +25°C (annual average temperature below +3°C). No compressor based cooling is required to maintain the required temperatures for the direct free air-cooled data centre (CSC has both direct free air and cool water-cooled data centres in Kajaani).
- High capacity green power is provided within the Renforsin Ranta Business Park with four links to the national grid. Green energy production in the region, three local hydroelectric power plants and a wood burning biomass power station. The region is also investing heavily to the Wind farms and Solar Energy.
- CSC uses 100% certificated hydroelectric power (CUE close to zero) in all its data centre production and office environments.



Green Power

- **High capacity green power** is provided within the Renforsin Ranta Business Park with **four links to the national grid**. Green energy production in the region, three local hydro power plants and a wood burning biomass power station. The region is also investing heavily to wind farms and solar energy.
- Redundant **green power scalability** up to hundreds of MWs, based on customer need.
- **95% of Data Center energy consumption can be re-used** (energy re-use factor, ERF) with these heat pumps by utilizing local district heating system. The Data Center operation costs goes down because local energy company buys the waste heat.
- **CSC uses 100% certificated hydroelectric power** (with a Carbon Usage Effectiveness of close to zero) in all its data center production and office environments.

Regional Strengths

- **A previous paper mill site** (brownfield solution), with heavy-duty **power infrastructure already** in place, extremely high **reliability**
- CSC's datacenter space 3 000 m² (option to 4 000 m² additional datacenter space) – **scalability** in space and power.
- Total business park area is **120 + 200 hectare**, land and premises owned by UPM
- Finland and Kajaani are **low-risk areas** in terms of geographical, weather, political and man-made risks.
- No risk of seismic / volcanic activities, hurricane/tidal or other form of severe weather
- **Strong local datacenter ecosystem:** local authorities, university, funding organisations, industry – all onboard.



LUMI Datacenter

2200 m² white space, expandable up to 4600 m²

100% hydroelectric energy up to 200 MW

Very reliable power grid: Only one 2 min outage in 36 years

100% free cooling, PUE 1.03

Waste heat reuse in the district heating system of Kajaani city

effective energy price 35-40 €/MWh

negative CO₂ footprint: 13500 tons reduced every year

Extreme connectivity: Kajaani DC is a direct part of the Nordic Internet backbone.

4x100 Gbit/s to GEANT in place, can be easily scaled up to multi-Tbit/s level

Elevated security standards guaranteed by ISO27001 compliancy



SITE AVAILABILITY FROM 2 MW UP TO 200 MW IT LOAD

- 110 kV transformers ready up to 50 MW
- Formar paper mill buildings ready up to 100 MW
- 110 kV main switchgears can support dc up to 200 MW
- Green field availability if required

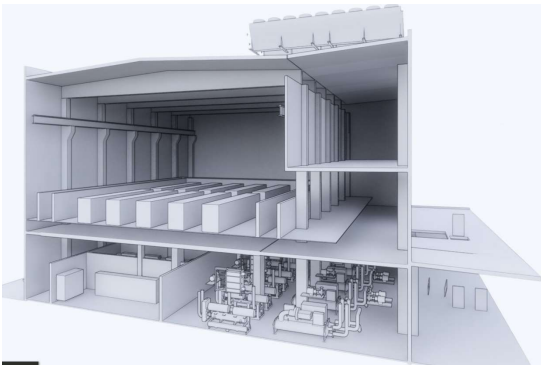


MODULAR AND EXPANDABLE FROM 16 MW UP TO 100 MW IT LOAD DCs

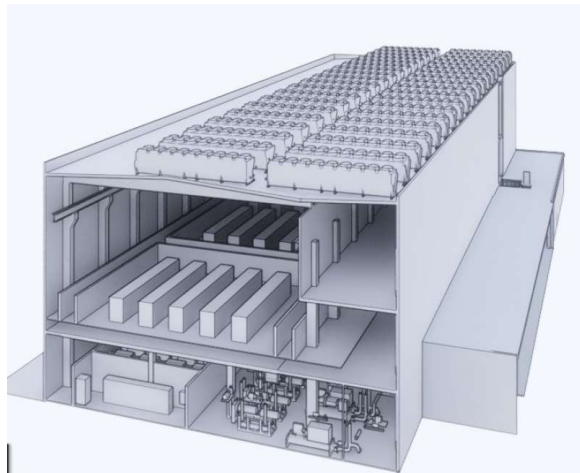


- 110 kV transformers ready up to 100 MW
- Former paper mill buildings ready up to 100 MW
- Electrical 110 kV main switchgears can support dc up to 200 MW
- All technical spaces can be located close from the loads > economical design

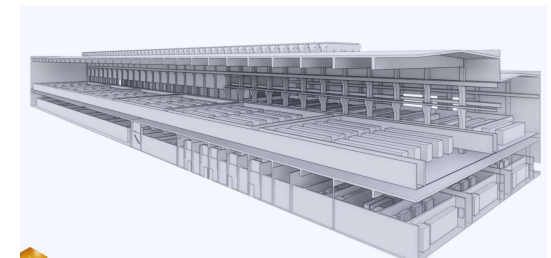
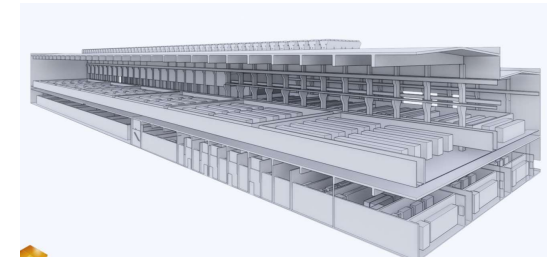
16 MW (IT)



50 MW (IT)



100 MW (IT)



Numbers of LUMI

Cost-efficiency

204 M€
total budget

149 M€
system acquisition
budget

6
years
of operation

Sustainability

100%
carbon-neutral electricity

100%
free cooling

-13 500 tons
CO₂ emissions each year

Collaboration

9
country
consortium

19
Top-50
entries

user base of
20 000
users

Leadership-class system

220
Pflop/s

1+
TB/s I/O

1
system



CSC – IT Center for Science Ltd.

P.O.Box 405, FI-02101 Espoo
phone +358 9 457 2001
servicedesk@csc.fi

www.csc.fi

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