

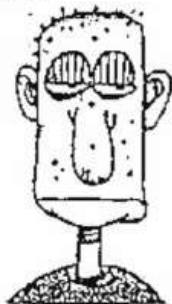


Goals for Pan-European supercomputer by LUMI Consortium

Kimmo Koski, CSCS October 7th 2019



TALKS ABOUT THE FINNS' EMOTIONAL COLDNESS
ARE NONSENSE. HERE ARE EXAMPLES OF PASSIONATE
FEELINGS.



1. FURIOUS DELIGHT



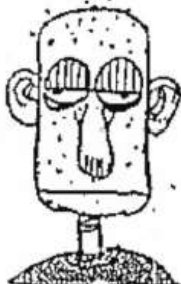
2. ENDLESS LAUGH



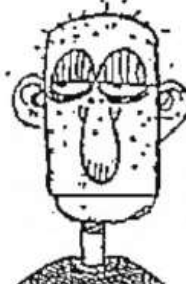
3. ENORMOUS JOY



4. SMARTING FRUSTRATION



5. DEEP SORROW



6. BITTER ANGER

Non-profit state
organization with
special tasks



Turn over
in 2018
44,9 M€



Headquarters in
Espoo,
datacenter in
Kajaani



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



Circa
410
employees
now

Data management and computing development project - DL2021

Funding for Systems and Service / Competence Development

- 33 M€ funding 2018-2021 to develop data management and computing environment
- 4 M€ additional funding for increased AI capacity (2018)
- Additional efforts (2 M€) for competence development and new services & support for novel use cases and emerging user groups



Outline

- EuroHPC Joint Undertaking, LUMI consortium
- Lumi, vision of the pre-exascale system
- Lumi DC & connectivity
- User support model & EuroHPC competence centers
- What do we expect to achieve?
- Summary and conclusions
- Q&A

The EuroHPC initiative

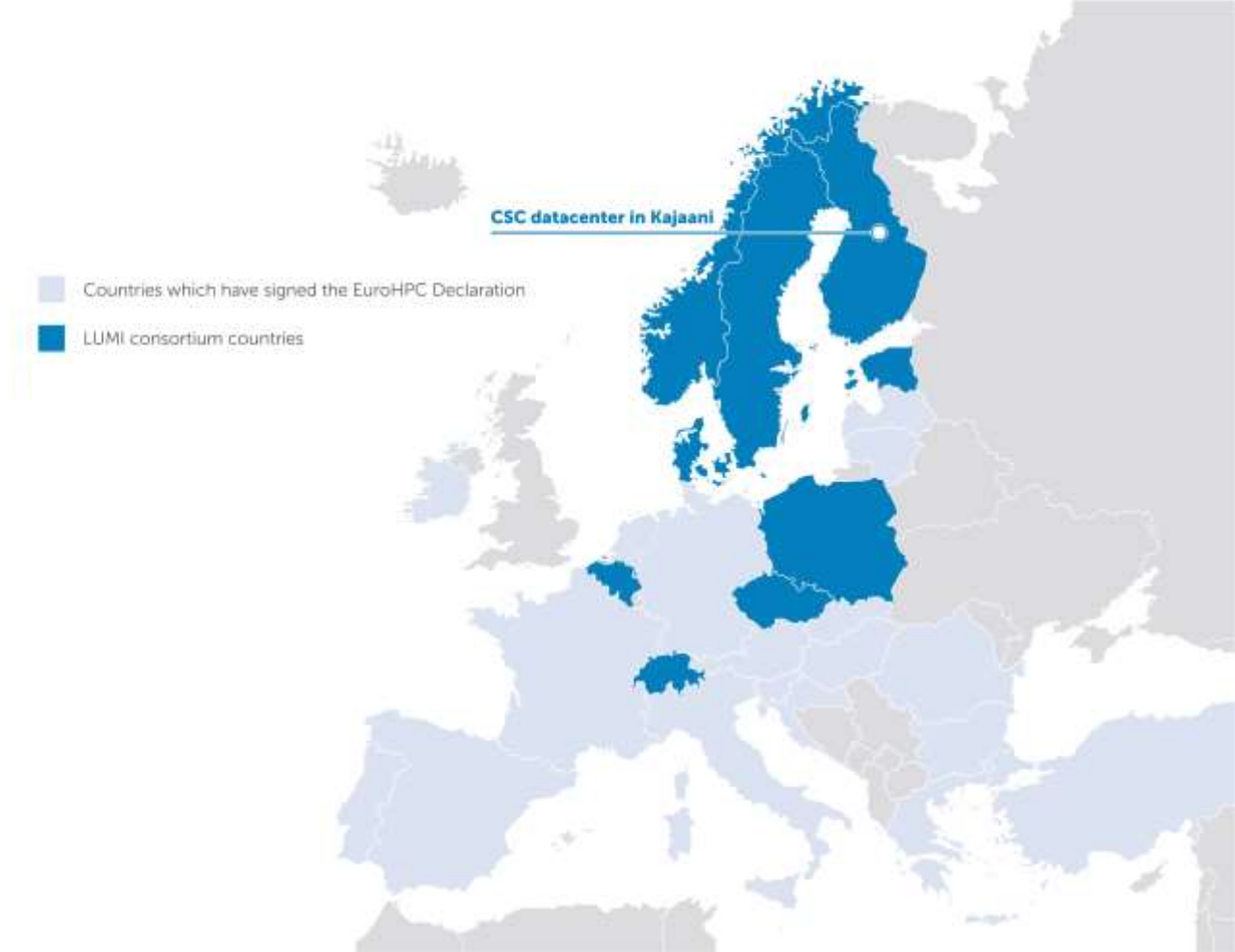
- The **EuroHPC Joint Undertaking** will pool EU and national resources in high-performance computing (HPC)
 - **acquiring and providing a world-class supercomputing and data infrastructure** for Europe's scientific, industrial and public users
 - supporting an ambitious **research and innovation agenda**
- The EuroHPC declaration has been signed by **29 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 – Large Unified Modern Infrastructure



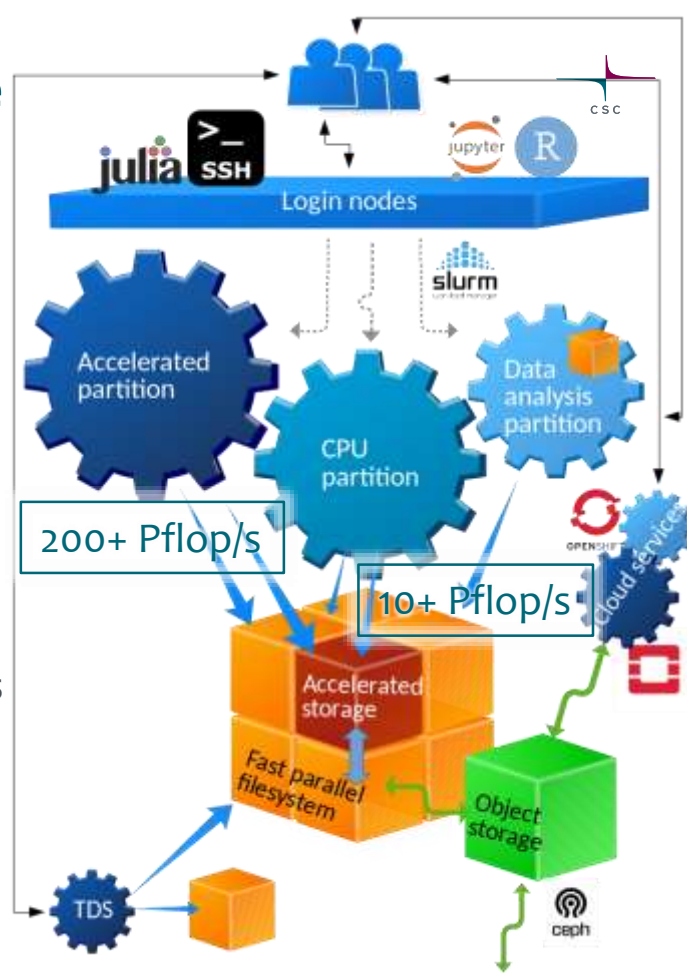
LUMI budget

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€



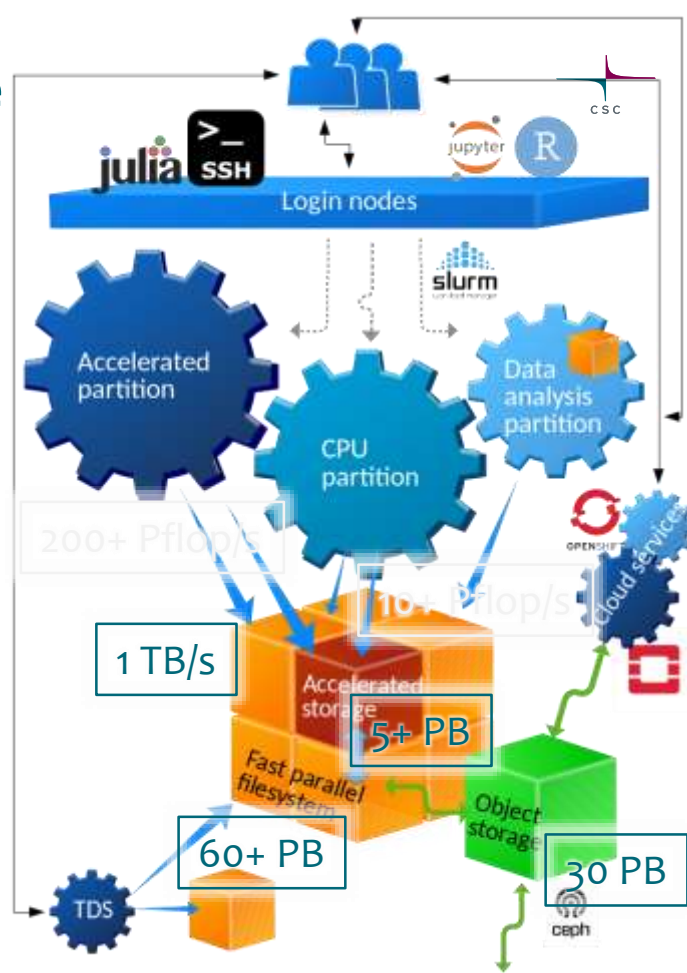
Lumi: Our vision of the EuroHPC pre-exascale system

- A pre-exascale **GPU-accelerated supercomputer**, which enables the convergence of **high-performance computing**, **artificial intelligence**, and **high-performance data analytics**.
 - Likely 1-2 CPU + 4 (AMD, Intel, or Nvidia) GPUs per node
 - Best of breed interconnect
- The system will be supplemented by a **number of supporting compute and storage resources**, maximizing its overall value.
 - "Tier-1" x86 supercomputer (Intel or AMD)
 - M, L, XL memory nodes
 - Kubernetes/OpenShift and OpenStack IaaS cloud computing resources



Lumi: Our vision of the EuroHPC pre-exascale system

- A highly capable parallel filesystem
- An accelerated I/O (flash) layer, providing the same namespace and tiering capability to/from the parallel filesystem
 - An extreme sustained bandwidth as well as IOPS capability
- **Object storage** service for project-time storage, and for convenient data management
 - Possibly accelerated with flash as well



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 €/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

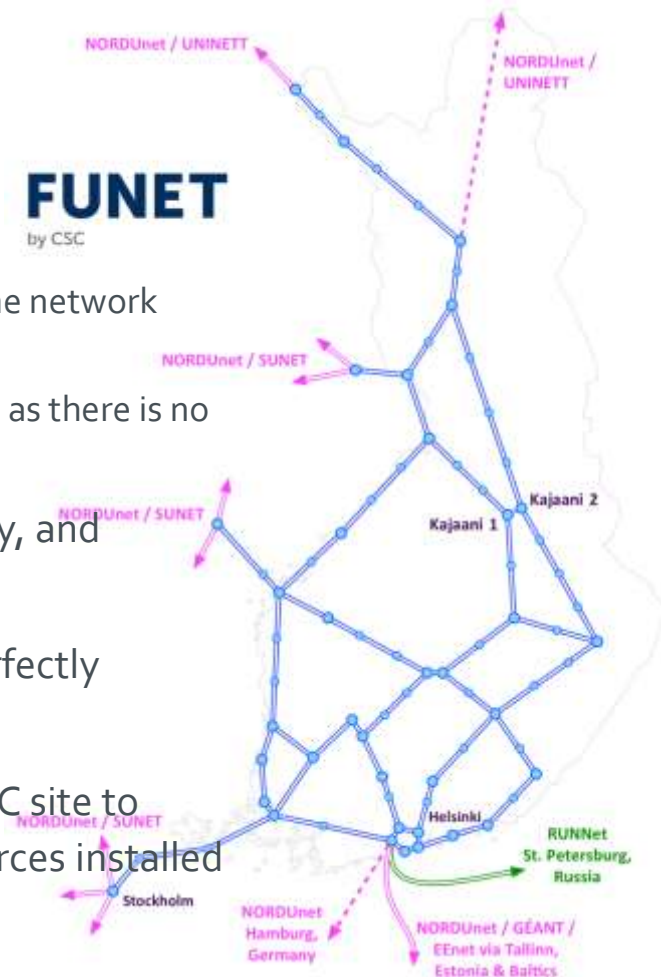
Elevated security standards guaranteed by ISO27001 compliancy



Data transfer capabilities of the 2020's

- LUMI DC is a **direct part of the Nordic backbone**
 - Perfect integration of the HPC hosting site and the national backbone network
 - CSC also operates the network infrastructure inside the data centre
 - **The hosting site can leverage the full backbone network capacity**, as there is no last mile as a bottleneck (i.e. direct cross-connect inside the DC)
- **Scalability for multi-terabit transmission needs** already today, and readiness for future transmission technologies
- The Funet 2020 network supports the EuroHPC installation perfectly without needs for additional investments
- The next-generation NORDUnet connects the Kajaani EuroHPC site to GÉANT, ensuring European-wide availability of any HPC resources installed in Kajaani

FUNET
by CSC

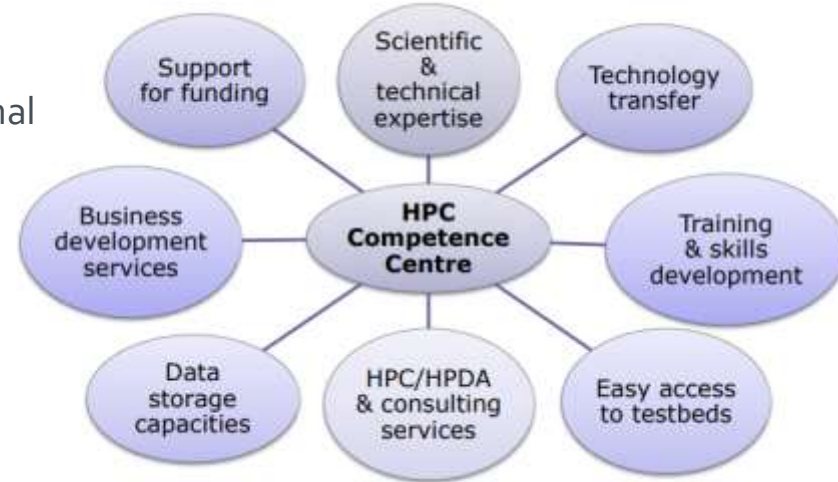


Enhanced user experience

- In addition to traditional CLI, we aim at supporting high-level interfaces on Lumi
 - Seamlessly integrate Jupyter Notebooks, Rstudio, Matlab and such to back-end to LUMI bare-metal resources
 - Ultimately the LUMI resources being an extension to scientist's laptop
- A rich stack of pre-installed software, both community and commercial
- Datasets as a Service
- Capabilities for interactively steering batch job simulations

Other EuroHPC activities: competence centers

- EuroHPC competence centers - the concept
 - One center per member state, associated with national supercomputing centers
 - On demand services and tools to users
 - Access to the HPC innovation ecosystem, and to the supercomputers
 - Access to skilled technical experts
 - Training and outreach activities
 - Networking and coordination with other competence centers
- Volume 1 M€/year per country, starting 2020



Goals

1. Building a world-class HPC Ecosystem
 - Major capacity for HPC, data-computing and AI
 - Competence development
 - Impact for research and innovation
2. New era of collaboration: 9 countries invest together
 - New ways for joining the resources
 - Additional initiatives through the consortium
3. Prepare for the future
 - Platform for the future
 - What should we do next?

Sustainability

Numbers of LUMI

Cost-efficiency

207 M€
total budget

149 M€
system acquisition
budget

6
years
of operation

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

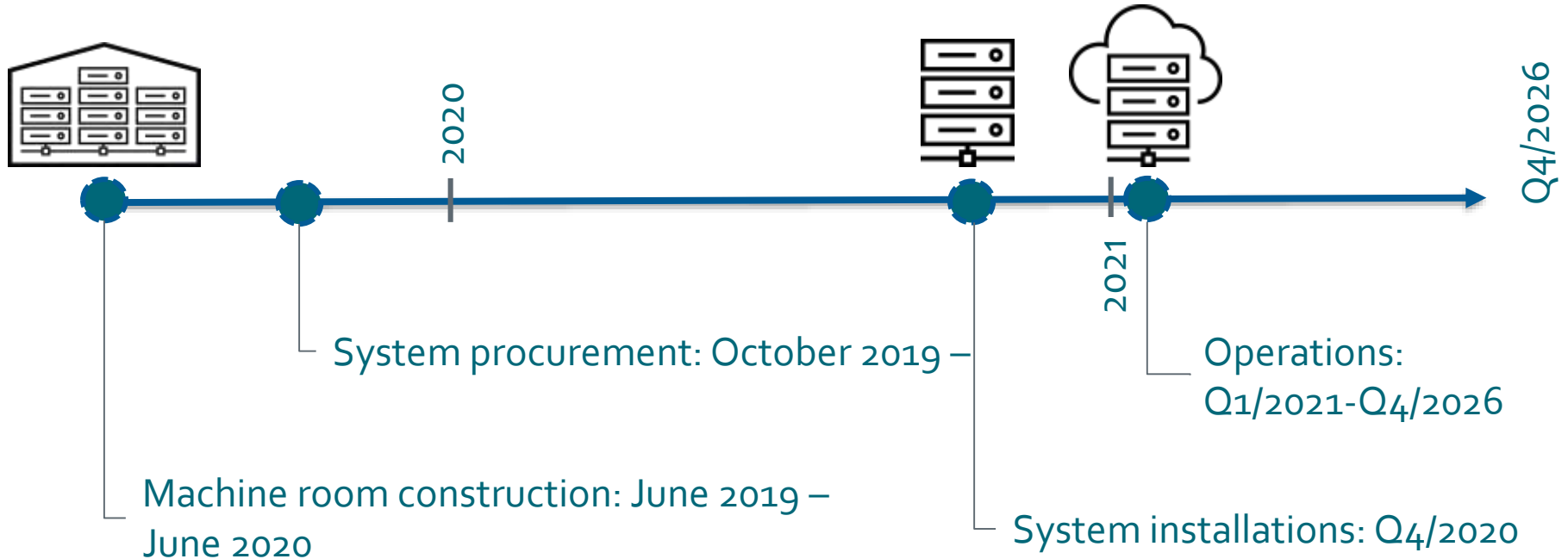
Leadership-class system

220
Pflop/s

1+
TB/s I/O

1
system

LUMI: Timeline



Winter is coming

L U M I





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