LUMI supercomputer
for Industrial Use

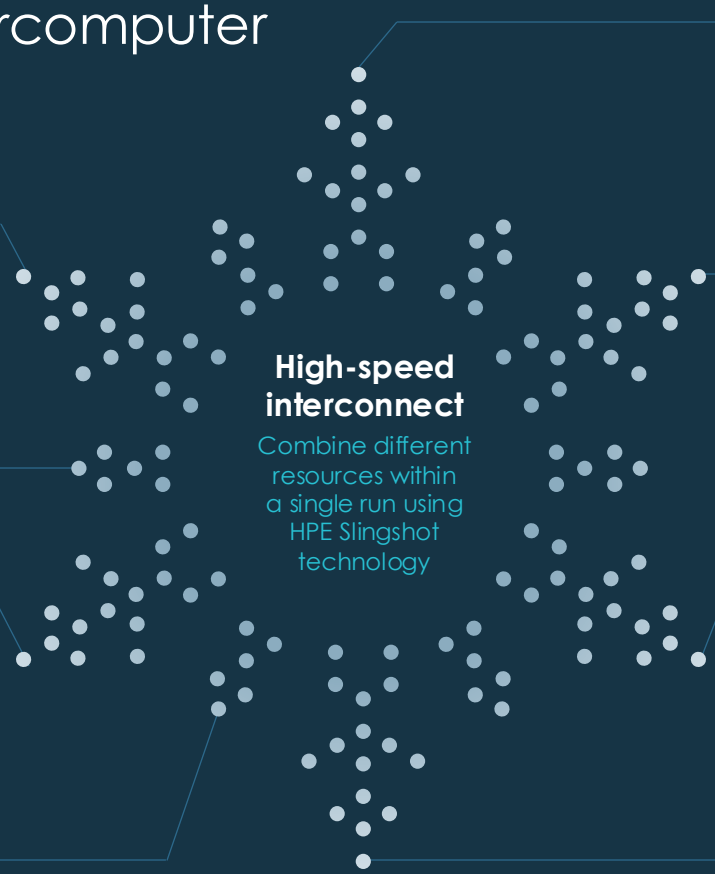
FIIF, 6.3.2025

Morthen Mathisen | CSC – IT Center for Science Ltd.

LUMI is a HPE Cray EX Supercomputer

LUMI

LUMI is a GPU supercomputer



LUMI-G:
GPU Partition

380

Pflop/s performance powered by ~12,000 AMD Instinct MI250X GPUs

LUMI-C:
CPU Partition

~260,000

AMD EPYC "Milan" CPU cores

LUMI-D:
Data Analytics Partition

Interactive partition with

32 TB

memory and Nvidia GPUs for data analysis and visualization

LUMI-K:
Container Cloud Service

LUMI-F:
Accelerated Storage

10 PB

Flash-based storage layer with extreme I/O bandwidth and IOPS capability

LUMI-O:
Object Storage Service

30 PB

encrypted object storage (Ceph) for storing, sharing and staging data

LUMI-P:
Lustre Storage

80 PB

parallel file system

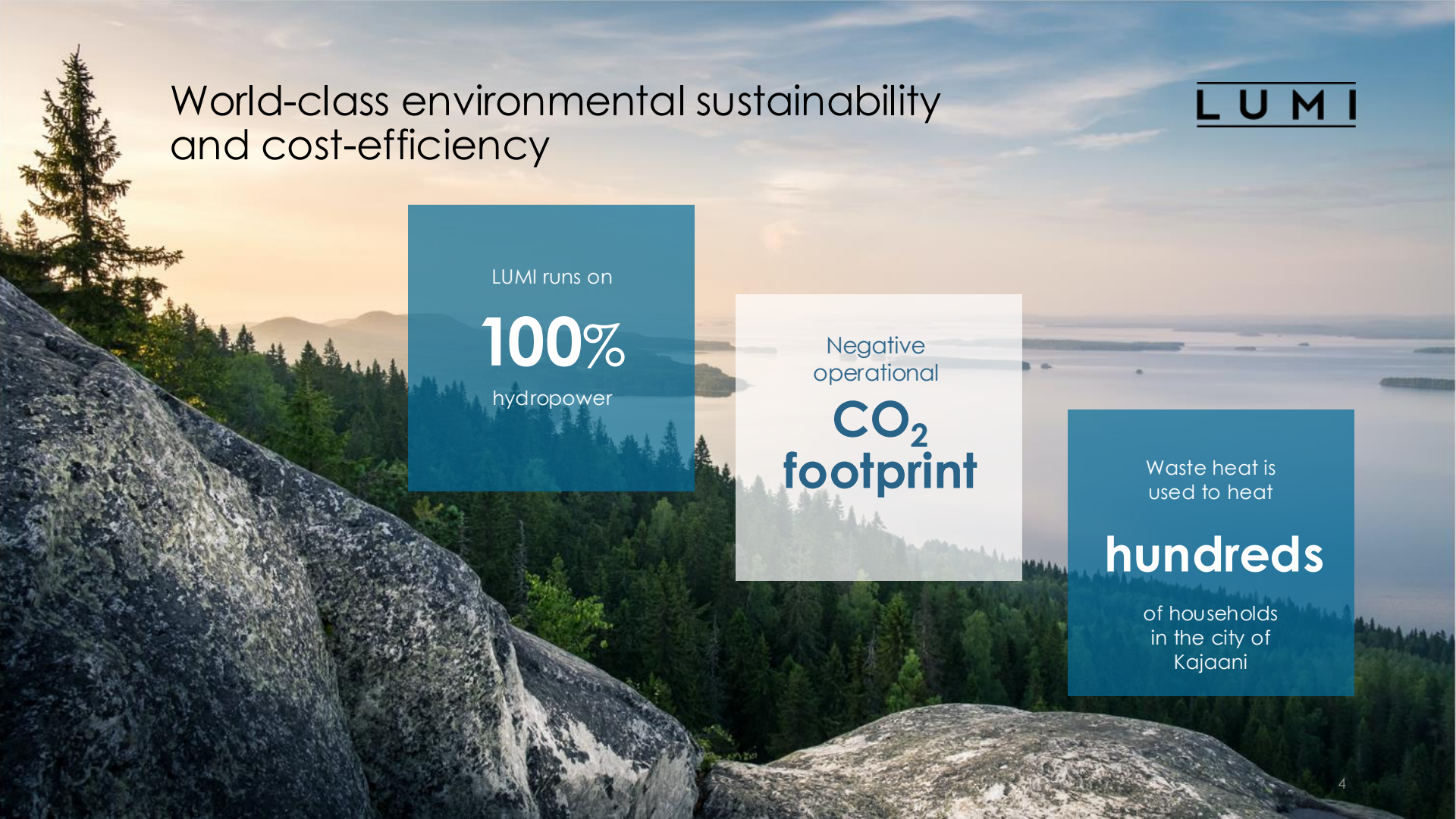
LUMI-Q:
Quantum Computing

High-speed interconnect

Combine different resources within a single run using HPE Slingshot technology

World-class environmental sustainability and cost-efficiency

LUMI



LUMI runs on

100%

hydropower

Negative operational

CO_2 footprint

Waste heat is used to heat

hundreds

of households in the city of Kajaani

EuroHPC
Joint Undertaking

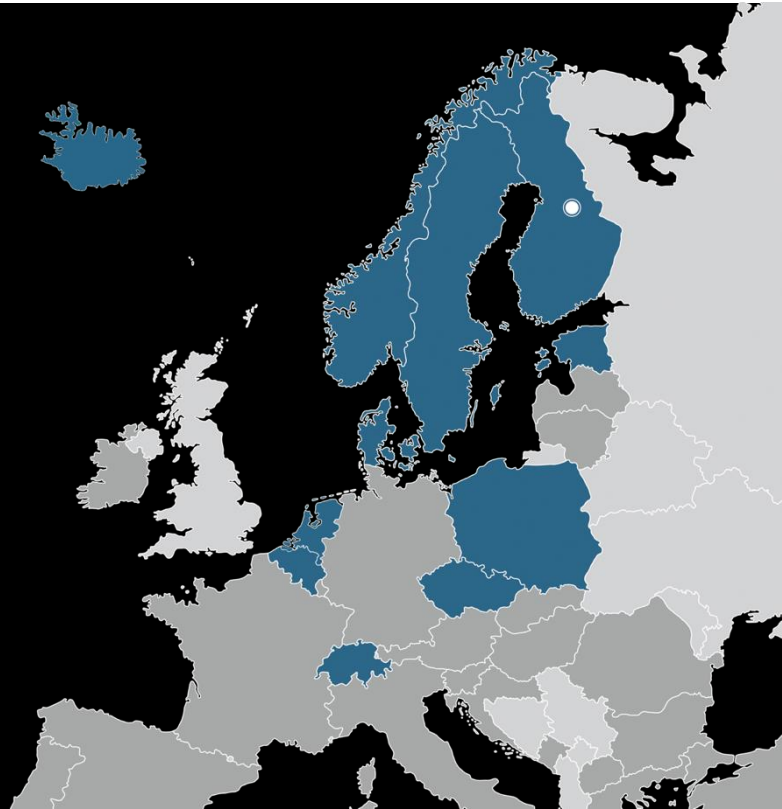
LUMI

LUMI Supercomputer is hosted by the LUMI consortium of eleven countries and the EU.

The resources of LUMI will be allocated per the investments. Finnish share is approximately 25 %.

The share of the EuroHPC JU (50%) will be allocated by a peer-review process.

LUMI Supercomputer is located in CSC's data center in Kajaani, Finland.



Up to 20% of LUMIs capacity is reserved for industry

LUMI

Massively parallel simulations

- **Material sciences and chemical processes**
  - Development of new materials
  - Development of new medicine
- **Climate & weather forecasting, numerical weather prediction**
- **Understanding different physical phenomena, e.g.**
  - Fluid dynamics
  - Structural mechanics
  - Electromagnetics
  - Heat transfer
  - Acoustics
  - Fire dynamics simulation

AI models with massive data sets

- **Large language models**
- **Generative AI, e.g. text-to-image, text-to-video**
- **Speech-to-text and text-to-speech**
- **Machine learning:**
  - Image Recognition, e.g. for defect detection
  - Autonomous vessels and cars

Collaboration models for Finnish companies

LUMI

Pay-per-use	Business Finland computing grant	EuroHPC JU Calls	RDI co-op with academic partner
• Company pays the market price according to price list	• 15.000 - 100.000 € computing grant for micro, small and medium sized companies • Can be applied together with R&D funding or later as a project change • 100% funding	• EuroHPC JU has several open calls for industry • Free of charge • E.g. EuroHPC JU Access Call for AI and Data-Intensive Applications	• Development project together with a Finnish higher-education institution or a state research organization • Free of charge, if results are at least partially open / published

Try & Buy test period

- A company can get familiar with and test the suitability of LUMI computing services by a "Try&Buy" test project
- After the testing period the company can continue LUMI usage by making a contract with CSC for the LUMI computing services
- Or, the company can decide not to continue using LUMI

How it works

- The company project is created with two user accounts and CPU-, GPU, and data storage resources for testing purposes.
  - 10.000 CPU hours
  - 1.000 GPU hours
  - 10.000 TiB units
- Expertise support will be available to get started with the LUMI usage.
- The testing project is available for a limited time.

A computational task does not have to be massive to use a supercomputer

LUMI

Perhaps you just have a large number of smaller experiments

- Run them all at the same time!
- Example of *trivial parallelism:* No limit for the scalability since individual experiments are independent

Other reasons why to use a supercomputer:

- ”Outsourcing” heavy/specialized computations to a remote server
- Prebuilt environment (software and libraries)
- Possibility to collaborate (public-private co-innovation)
- **CSC’s expert support**

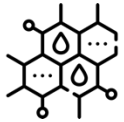
Examples of research areas and software* powered by supercomputers

LUMI

Artificial intelligence

PyTorch, TensorFlow

- Large language models
- Computer vision



Chemistry and materials science

CP2K, LAMMPS

- Catalysts for green hydrogen
- Solar cell and battery materials

Engineering

Elmer, OpenFOAM

- Computational fluid dynamics
- Structural mechanics

Life sciences

GROMACS, OpenMM

- Drug discovery
- Atomistic properties of biosystems

**All available for LUMI!*

Finnish LUMI references

LUMI

CAN · D · identity OUR

GOSTA Labs

ICEYE

Posiva

QMill

QUANSCIENT

RAMBØLL

RAUTE

/root signals

SILO AI

SUPERSIGHT

TOP data science
A MORPHO COMPANY

VEIL.AI
ENABLING USE OF SENSITIVE DATA

WÄRTSILÄ

Wärtsilä Finland: Superior capacity, cost efficiency, and sustainability with LUMI

Wärtsilä Finland is a global leader in innovative technologies and lifecycle solutions for the marine and energy markets. The company emphasise innovation in sustainable technology and services to help their customers continuously improve their environmental and economic performance.

Challenges and Solutions:
Wärtsilä Finland tested LUMI Supercomputer for their Computation Fluid dynamics simulation. They have complex and computationally demanding problems including mesh motion chemical reactions, moving particles and multi-phase flows.

Wärtsilä strives for improvements in cost effectiveness and efficiency in demanding simulations. The scope and complexity of the simulations must fit within the required timeframes.

Impact:
Wärtsilä was impressed with the benefits they recognised while using LUMI: Improved efficiency, accelerated R&D processes, reduced energy consumption and reduced costs.

"We were really positively surprised by the results. The improved efficiency was clearly visible in our test runs. We were able to run our simulations much faster, meeting tight project deadlines and accelerating our R&D processes."

Bulut Tekgül, Combustion & CFD Expert, Wärtsilä

READ ARTICLE:

LUMI supercomputer impressed Wärtsilä Finland: Superior capacity, cost efficiency, and sustainability

Ramboll Finland – Fire Safety Simulations

Ramboll is global engineering, architecture and consultancy company with a leading edge in creating sustainable cities and societies. The company employs 17 500 experts worldwide, 2 500 across Finland.

Challenge

- Ramboll Finland provides fire technical simulations of buildings, e.g, to authorities. **Time is usually the most important resource for customers**, simulation results are needed in hours/a day rather than earlier typical several days/a week.

Solution and Impact

Ramboll used EuroHPC LUMI resources from Finnish industrial quota and HPC software expert support to install, adapt and test the simulation software and compiler tools in the LUMI environment.

- The typical fire technical simulation process was executed more flexibly and finalised in hours compared to days earlier.
- Time was significantly shortened for fire safety approvals from the authorities.

READ ARTICLE:

Major time savings with high-performance computing in fire engineering

Sweco – computational fluid dynamics for industrial applications

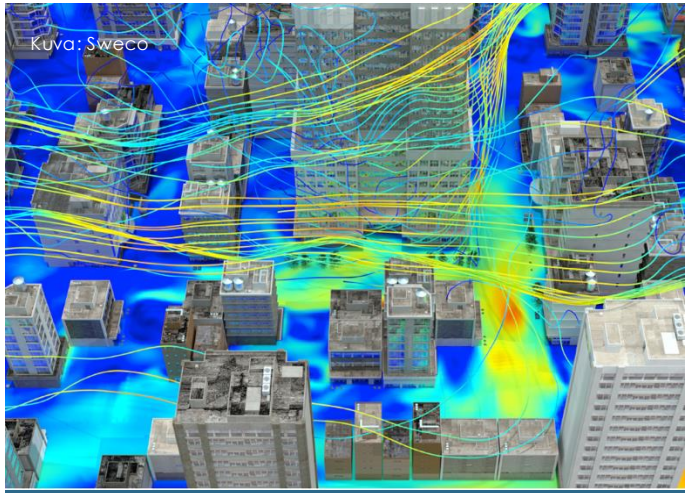
Sweco Finland is a leading consultancy and design company for the built environment and industry. Sweco uses computational fluid dynamics and simulations to develop the built environment and industrial processes. For this, they need advanced technologies, e.g. high-performance computing (HPC).

Challenge

- The use of HPC for modeling and simulations requires a lot of computing capacity.
- Building and maintaining own computing cluster is challenging.
- The use of public computing environments, cloud services, is not without problems – the available runtimes may be too short for the needs of modeling and/or the use may become expensive.

Solution and impact

Sweco uses EuroHPC LUMI supercomputer to solve the demanding computational fluid dynamic problems of its customers. LUMI offers Sweco's customers a cost-effective, flexible and data-secure computing environment that utilizes opensource codes.



READ ARTICLE:

Sweco Finland uses the LUMI supercomputer for demanding built-environment simulations

ICEYE – AI-based Data Analysis of Satellite Images

ICEYE is a Finnish space technology company whose microsatellites deliver real-time radar (SAR) images from anywhere, at any time of the day and under any weather conditions.

ICEYE makes the radar signal computationally visible and produces analytics of what the image shows. The company has imaged and investigated, among other things, floods and wildfires.

Challenge

- ICEYE's datasets with size of terabytes are typically a challenge considering the **data transfer, storage and the memory capacity** need with computing.
- Training the advanced machine learning (ML) algorithms is computing-intensive, thus **speed and cost of computation** are essential criteria in the development job.

Solution and impact

- LUMI offers large amount of GPU nodes with fast memory for computing.
- LUMI's cost-efficient computing and data storage and the great computing speed enabled ambitious experimenting even with the most demanding AI-models to get the best automated image interpretation of the satellite images.

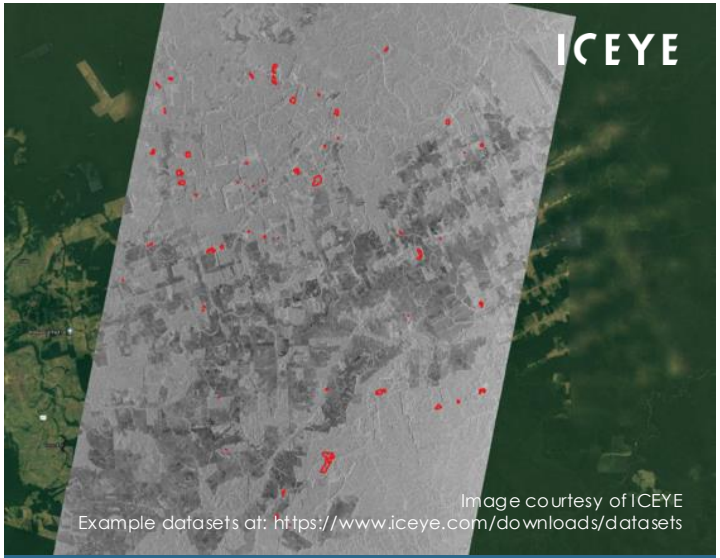


Image courtesy of ICEYE
Example datasets at: https://www.iceye.com/downloads/datasets

READ ARTICLE:

Space Technology Company ICEYE praises LUMI user support: "A CSC expert guided us step by step."

University of Turku & Silo.AI - Large Language Models

Collaboration for LLM development

- Finnish research team on Natural Language Processing, TurkuNLP at **University of Turku** has created a Generative Pre-trained Transformer 3 **"FinGPT"** language model (open access)
    - Trained with 13 billion parameters based entirely on Finnish language.
- University of Turku has been collaborating with the **Silo AI** (Europe's largest private AI lab) that deliver AI-driven solutions and products.
- November 2023: First version of **"PORO"** launched, a family of multilingual open source LLMs for all official European languages and code
    - Trained with 34 billion parameters and a trillion of tokens.

Solution and Impact with LUMI

- **LUMI computing power is essential to accelerate the creation of open large language models** with millions of GPU-hours granted.
- Massive language models lay the foundation for next generation AI applications.
- It is vital to enable the development of open language models also for smaller languages to **democratize access to LLMs.**

EU promotes HPC capacity for AI innovation

- European Commission launched the AI Innovation Package in January 2024 to support European startups, and SMEs in the development of trustworthy AI
- EuroHPC JU has launched a series of competitive calls for **AI Factory** proposals – first seven announced in December 2024
- AI Factory = **compute** + **data** + **talent**
- AI Factories focus on certain **AI ecosystems and communities in** alignment with **national AI strategies**

The EuroHPC AI Factories initiative *- designed to create a robust and interconnected network of AI hubs.*

One-stop shop to offer AI startups, SMEs, and researchers comprehensive support, including access to AI-optimised high-performance computing (HPC) resources, training, and technical expertise.

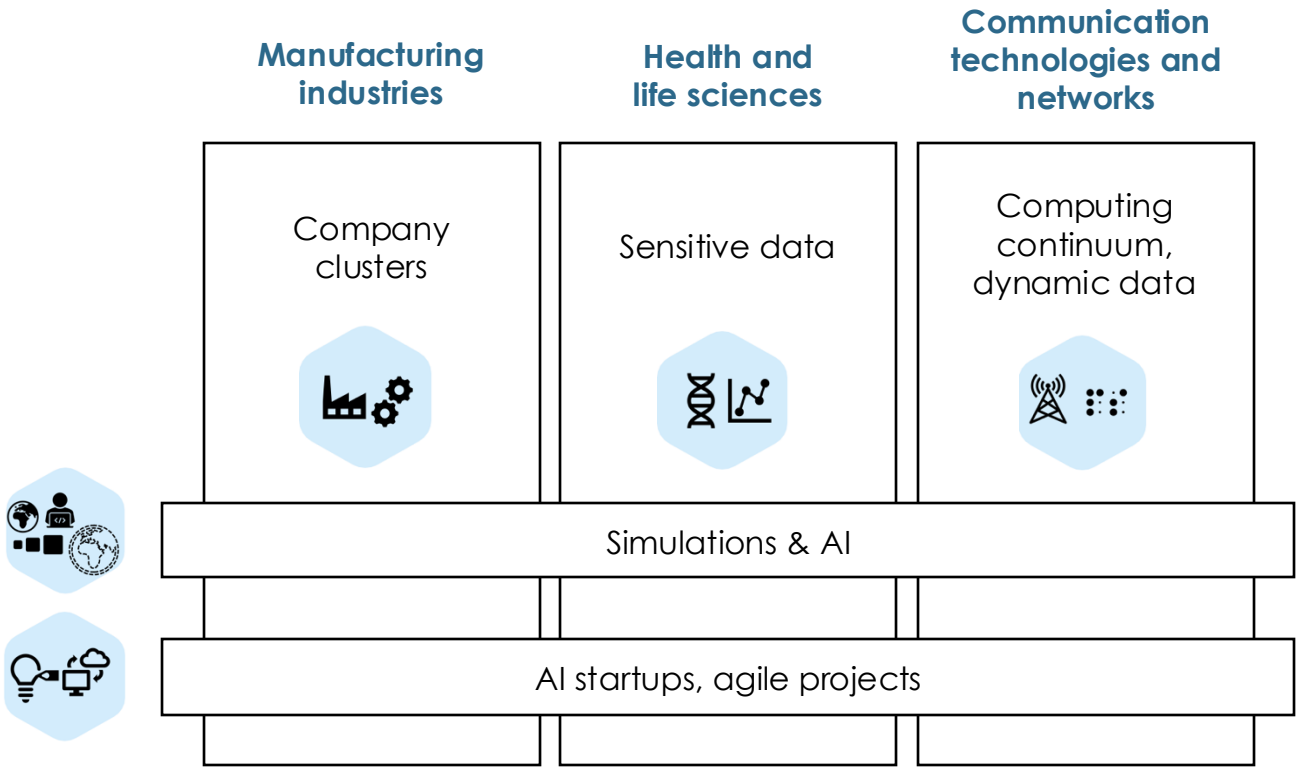
https://eurohpc-ju.europa.eu/selection-first-seven-ai-factories-drive-europes-leadership-ai-2024-12-10_en

LUMI AI Factory

LUMI

- **LUMI AI Factory – one of the most performant combined HPC + AI+ QC platform in the world**
  - AI-optimised supercomputer **LUMI-AI**
  - AI Factory **Service Center**
  - Experimental QC-AI platform **LUMI-IQ**
- CSC (Finland) coordinated consortium with participation from **Czechia, Denmark, Estonia, Norway and Poland** - with **Finnish partners FCAI** (Aalto University, University of Helsinki) and **AI Finland** (Technology industries)
- Total budget over 600 million euros – largest public computing ecosystem investment in Finland, among the largest in Europe – largest AI Factory investment
- Significant investment in **talent and competence development**
- **Services (computing, consultation)** free of charge for startups, SME's, research and public sector. **Unlocking data to empower users.**
- Big step from serving Research to **Research, Development and Innovation (RDI)**

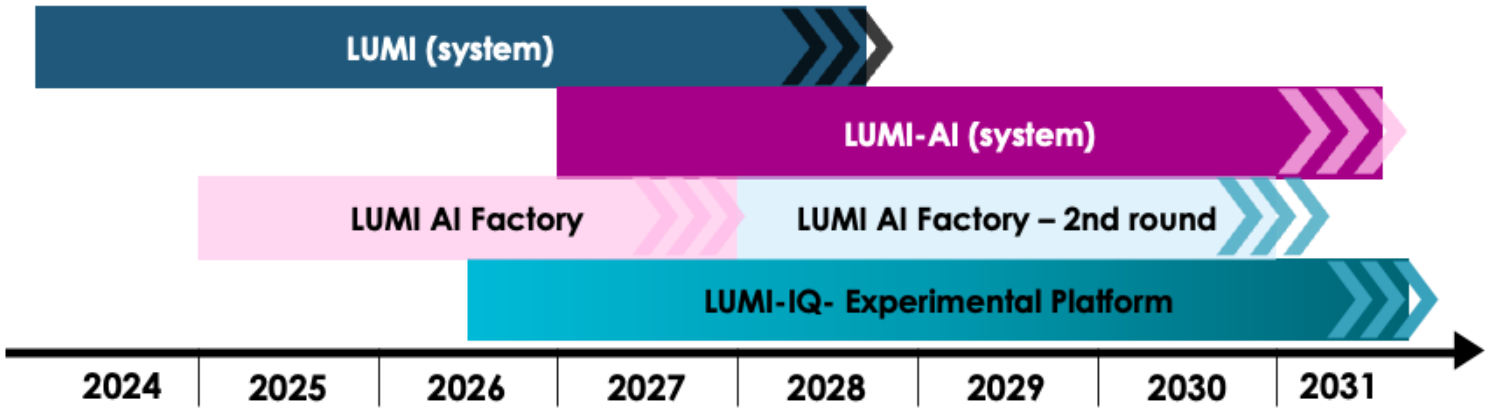
LUMI AI Factory key industrial sectors and focus areas



Digital twins and "AI for science"

Ease of use and streamlined access

Timeline for the LUMI AI Factory ecosystem



Supercomputing expert support is funded by

EuroCC project builds a European network of 34 national supercomputing competence centers that promotes and facilitates supercomputing.
https://www.eurocc-access.eu/

The Finnish AI Region offers businesses low-threshold expertise in artificial intelligence, augmented reality, high-performance computing, and cyber security.
https://www.fairedih.fi/en/

AIKA ecosystem offers companies at Kainuu region support for the digital business transition and the development of new innovative solutions
https://aikaecosystem.com/

The Location Innovation Hub (LIH) is a centre of excellence in location information, serving companies and public sector that want to solve the challenges of digitalisation and strengthen their competitiveness.
https://locationinnovationhub.eu/

Contact

LUMI

Areas of interest in LUMI applications:

- Fluid dynamics (CFD)
- Structural mechanigs (FEM)
- Machine Learning (ML/AI) in industrial processes

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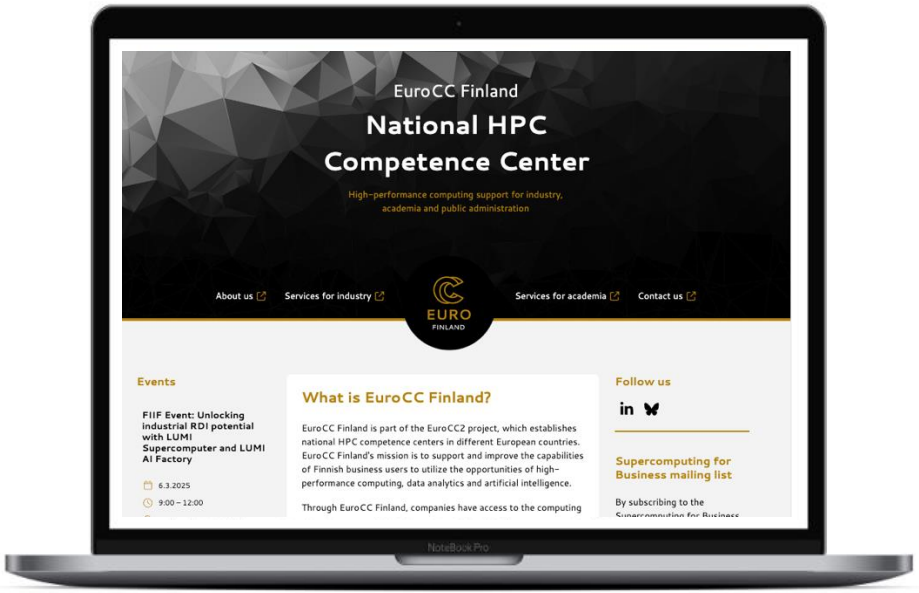
More about Supercomputing for Business

CSC / Industry web pages

- https://csc.fi/en/about-us/customers/high-performance-computing-for-companies/

EuroCC Finland

- **Web pages** (events, training, success stories): https://www.eurocc-finland.fi/
- **Follow us on LinkedIN:** www.linkedin.com/company/eurocc-finland/



If interested in using LUMI, contact us!

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