

One of the world's mightiest supercomputers, LUMI, will lift European research and competitiveness to a new level

One of the most powerful supercomputers in the world, LUMI, will start to operate in CSC's data center in Kajaani, Finland, next year. The peak performance of LUMI is an astonishing 552 petaflop/s. To date, the world's fastest computer, Fugaku in Japan, reaches peak performance of 513 petaflop/s. When LUMI's operations start next year, it will be one of the world's fastest supercomputers.

LUMI is a unique European supercomputer endeavor, including ten European countries and the EuroHPC Joint Undertaking (EuroHPC JU) investing in one joint system. It is set to boost research, employment and competitiveness throughout Europe. The procurement process of LUMI is now complete, and the system supplier is Hewlett Packard Enterprise (HPE), providing a HPE Cray EX supercomputer with next generation AMD EPYC™ CPUs and AMD Instinct™ GPUs. In addition to the remarkable computing power, LUMI is also one of the world's most advanced platforms for artificial intelligence and it will be one of the world's best known scientific instruments throughout its lifetime.

- Today we mark an important step forward in the realisation of the European High-Performance Computing strategy. The pre-exascale supercomputer hosted by the LUMI consortium will be among the top 5 in the world. Together with the other EuroHPC pre-exascale and petascale supercomputers that will be deployed in 2021, LUMI supercomputer will help Europe's public and private users address many daunting research and innovation problems across different areas from weather and climate change through cybersecurity to drug discovery and personalised medicine. LUMI supercomputer aligns the Digital and Green Deal policies of the European Commission, using 100% renewable carbon neutral energy. Moreover, the heat generated will provide 20 percent of the district heat of the area, being one of the most efficient supercomputers in the world, says **Khalil Rouhana**, Deputy Director-General of the Directorate-General for Communications Networks, Content and Technology (DG Connect) of the European Commission.
- Once operational in mid-2021, the LUMI supercomputer will be one of the most competitive and green supercomputers in the world! Such leadership-class system will support European researchers, industry and public sector, in better understanding and responding to complex challenges and transforming them into innovation opportunities in sectors like health, weather forecasting or urban and rural planning, says EuroHPC Joint Undertaking's Executive Director **Anders Dam Jensen**.
- We are committed to supporting the European High Performance Computing Joint Undertaking (EuroHPC JU) to seize opportunities in next-generation supercomputing and bolster R&D in science, advance innovation and unlock economic growth. We are honored to continue collaborating with

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The acquisition and operation of the EuroHPC supercomputer is funded jointly by the EuroHPC Joint Undertaking, through the European Union's Connecting Europe Facility and the Horizon 2020 research and innovation programme, as well as the of Participating States FI, BE, CH, CZ, DK, EE, IS, NO, PL, SE.

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EuroHPC JU, and through our partnership with AMD, build one of the world's fastest pre-exascale supercomputers for Europe.", says **Peter Ungaro**, senior vice president and general manager, high-performance computing (HPC) and mission critical solutions (MCS), HPE.

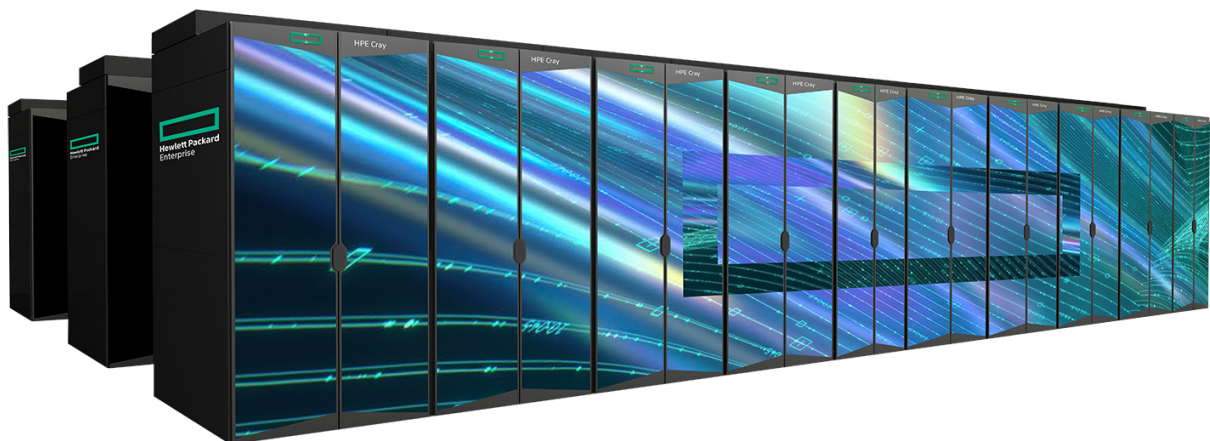
- The reliability of CSC and Finland made the European Commission and ten partner countries to invest in one pan-European high-performance computing and data management infrastructure in Finland. We have to keep up the excellent collaboration in order to maximize this investment to benefit society on a larger scale, says Permanent Secretary **Anita Lehikoinen** from Ministry of Education and Culture, Finland

LUMI is an investment of over 200 million euros, covering the whole lifecycle of the system. It will lift Europe to the forefront of high-performance computing (HPC) and research. Exploiting the potential of the data economy is a crucial factor for Europe's competitiveness. The investment will make CSC's data center one of the world's largest players in the field of HPC.

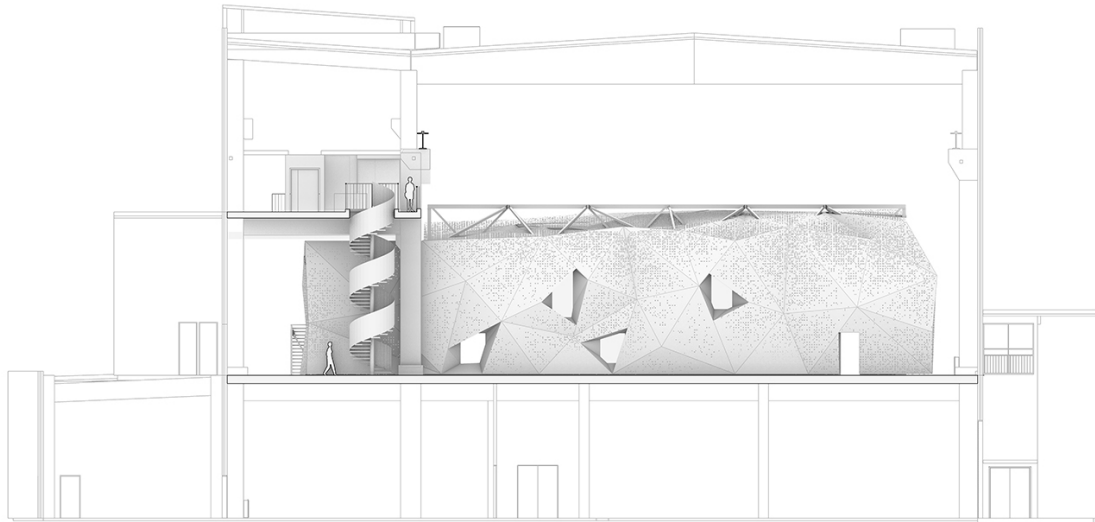
- The investment will make CSC data center one of the world's largest players in the field of HPC. The joint procurement process with the EuroHPC Joint Undertaking and ten European countries has proceeded on schedule despite the global pandemic, thanks to the vast know-how of the LUMI consortium and the excellent collaboration. LUMI's astonishing computing power combined with a very modern artificial intelligence platform and data management infrastructure will help European researchers tackle unforeseen research questions, says CSC's Managing Director **Kimmo Koski**.

The uptake of HPC will increase the competitiveness of small and medium-sized enterprises (SMEs) in Europe remarkably. Up to one-fifth of LUMI's resources will be available for industry and SMEs.

- The technology we are using is strongly based on mathematical modelling: analyses, artificial intelligence, simulations and optimization. Therefore, powerful computing capacity and data management infrastructure are of the utmost importance for us. The LUMI infrastructure will open up new possibilities for us, which we may exploit, says **Anna-Maria Henell**, CEO of Disior Ltd. Disior is a Finnish company developing software for analysing medical images in 3D.



Caption: A sketch image of LUMI, a HPC Cray EX supercomputer. Copyright: Hewlett Packard Enterprise



Caption: This is how the LUMI data center will look like. Copyright: Synopsis Architects Ltd. and Geometria Architecture Ltd.

Supercomputers fight against pandemics and resolve unforeseen research questions

LUMI's top-notch computing resources are needed in leading-edge research in a wide range of data- and computing-intensive fields. Examples include climate, pharmaceutical, and artificial intelligence.

LUMI will also have a channel for urgent computing for time- and mission-critical simulations. This kind of simulations might be, for example, related to a large epidemic or pandemic disease. The current COVID-19 pandemic has largely benefitted from supercomputers: supercomputers have been used for example to simulate studies related to vaccine research and defeat the spread of the virus. With its vast computing resources, LUMI can answer different research questions even faster than before. It will also enable totally new types of research questions combining multidisciplinary research and artificial intelligence.

- consortium countries' own quotes here (not in the main version)

CSC's data center in Kajaani is one of the world's most eco-efficient data centers: it uses 100% hydropower. LUMI's waste heat will be used in Kajaani's district heating network: 20% of the area's yearly district heating needs will be covered with LUMI's waste heat.

LUMI system architecture explained:

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- The LUMI system will be supplied by Hewlett Packard Enterprise (HPE), based on an HPE Cray EX supercomputer.
- The peak performance of LUMI is an astonishing 552 petaflop/s meaning $552 * 10^{15}$ floating point operations per second. This figure makes LUMI one of the world's fastest supercomputers. For comparison, the world's fastest computer today (Fugaku in Japan) reaches 513 petaflop/s and the second fastest (Summit in the US) 200 petaflop/s (more information: www.top500.org). If LUMI's computing power was compared to normal laptops, it would require 1.5 million laptops together to reach the performance of LUMI. If these laptops were piled up, they would form a tower of over 23 kilometers high!
- LUMI will also be one of the most advanced platforms in the world for artificial intelligence (AI). With LUMI, it will be possible to combine AI, especially deep learning, and traditional large scale simulations combined with massive scale data analytics in solving one research problem.
- The number crunching capability of LUMI is accelerated by the GPU (Graphics Processing Unit) partition. It is based on the future generation AMD Instinct™ GPU.
- LUMI will be complemented by a CPU (Central Processing Unit) partition, featuring 64-core next-generation AMD EPYC™ CPUs.
- LUMI's data analytics partition has 32 an aggregated terabytes of memory and 64 visualization GPUs. This partition is used e.g. for visualization, heavy data analysis, meshing and pre/post-processing.
- LUMI's storage system will consist of three components. First, there will be a 7-petabyte partition of ultra-fast flash storage, combined with a more traditional 80-petabyte capacity storage, both based on the Lustre parallel filesystem, as well as a data management service, based on Ceph and being 30 petabytes in volume.
- In total, LUMI will have an astounding storage of 117 petabytes and an impressive aggregated I/O bandwidth of 2 terabytes per second
- LUMI will also have an OpenShift/Kubernetes container cloud platform for running microservices.
- All the different compute and storage partitions are connected to the very fast Cray Slingshot interconnect of 200 Gbit/s. The global bandwidth of the LUMI-GPU partition is 160 TB/s. The global Internet traffic would fit therein, in fact two times!
- LUMI takes over 150m² of space, which is about the size of a tennis court. The weight of the system is nearly 150 000 kilograms (150 metric tons).

More information:

Images and videos for media: www.lumi-supercomputer.eu/media

More information at CSC: CSC's Managing Director **Kimmo Koski** tel. +358 50 381 9777 email: kimmo.koski@csc.fi and Director, LUMI Leadership Computing Facility **Pekka Manninen** tel. +358 50 381 2831, email: pekka.manninen@csc.fi

Ministry of Education and Culture, Finland: Director, Division for Science Policy, Minister of Education and Culture **Erja Heikkinen** tel. +358 295 330 101 email: erja.heikkinen@minedu.fi

EuroHPC JU's announcement about LUMI: <https://eurohpc-ju.europa.eu/news/lumi-new-eurohpc-world-class-supercomputer-finland>

LUMI – One of the world's most powerful supercomputers

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The European High-Performance Computing Joint Undertaking (EuroHPC JU) is pooling European resources to develop top-of-the-range exascale supercomputers for processing big data, based on competitive European technology.

One of the pan-European pre-exascale supercomputers, LUMI, will be located in CSC's data center in Kajaani, Finland.

The supercomputer will be hosted by the LUMI consortium. The LUMI (Large Unified Modern Infrastructure) consortium countries are Finland, Belgium, Czech Republic, Denmark, Estonia, Iceland, Norway, Poland, Sweden, and Switzerland.

LUMI will be one of the world's best known scientific instruments for the lifespan of 2021–2026.

Follow LUMI on social media: Twitter: @LUMIhpc, Youtube: LUMI supercomputer, LinkedIn: LUMI supercomputer
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EuroHPC JU:

The EuroHPC JU was established by [Council Regulation \(EU\) 2018/1488](#) in 2018. 32 European countries are currently taking part in the initiative and pooling their resources with the EU and private partners to enable the EU to become a world leader in supercomputing.

The mission of the EuroHPC JU is to develop, deploy, extend and maintain an integrated world-class supercomputing and data infrastructure in the EU and to develop and support a highly competitive and innovative HPC ecosystem.

The EuroHPC JU aims at equipping the EU in 2021 with an infrastructure of petascale (capable of at least 10^{15} calculations per second) and precursor to exascale supercomputers (capable of at least 10^{17} calculations per second), and developing the necessary technologies and applications for reaching full exascale capabilities around 2022 / 2023.

More information can be found on the [EuroHPC JU's website: https://eurohpc-ju.europa.eu/](https://eurohpc-ju.europa.eu/)

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