The EuroHPC flagship supercomputer

LUMI is an HPE Cray EX Supercomputer

LUMI

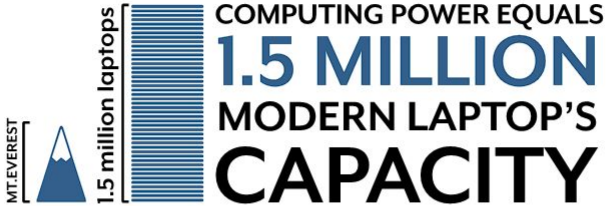
LUMI

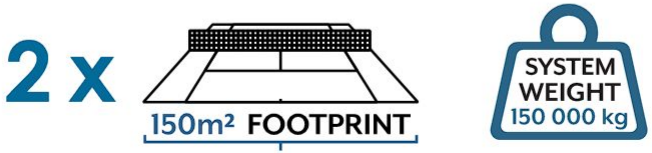
LUMI is 5th fastest supercomputer in the world

SUSTAINED PERFORMANCE

375 PETAFLOP/S

= performs 375 x 10^{15} calculations per second





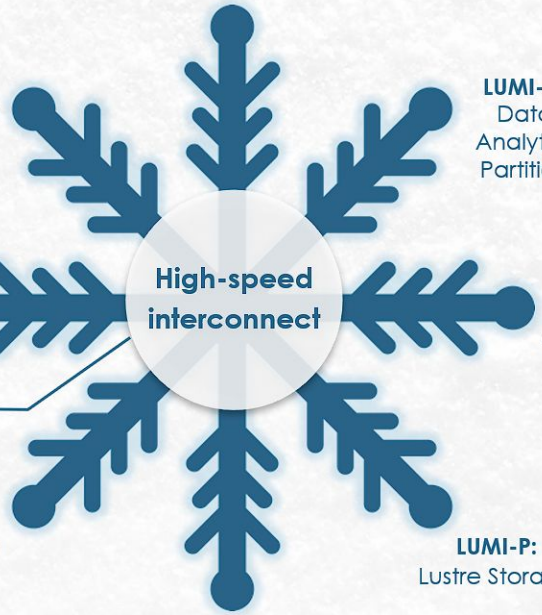
High-performance computing | AI | Data analytics

Rank	System	Cores	Rmax (PFlop/s)	Rpeak (PFlop/s)	Power (kW)
1	**Frontier** - HPE Cray EX235a, AMD Optimized 3rd Generation EPYC 64C 2GHz, AMD Instinct MI250X, Slingshot-11, HPE DOE/SC/Oak Ridge National Laboratory United States	8,699,904	1,194.00	1,679.82	22,703
2	**Aurora** - HPE Cray EX - Intel Exascale Compute Blade, Xeon CPU Max 9470 52C 2.4GHz, Intel Data Center GPU Max, Slingshot-11, Intel DOE/SC/Argonne National Laboratory United States	4,742,808	585.34	1,059.33	24,687
3	**Eagle** - Microsoft NDv5, Xeon Platinum 8480C 48C 2GHz, NVIDIA H100, NVIDIA Infiniband NDR, Microsoft Microsoft Azure United States	1,123,200	561.20	846.84	
4	**Supercomputer Fugaku** - Supercomputer Fugaku, A64FX 48C 2.2GHz, Tofu interconnect D, Fujitsu RIKEN Center for Computational Science Japan	7,630,848	442.01	537.21	29,899
5	**LUMI** - HPE Cray EX235a, AMD Optimized 3rd Generation EPYC 64C 2GHz, AMD Instinct MI250X, Slingshot-11, HPE EuroHPC/CSC Finland	2,752,704	379.70	531.51	7,107

LUMI

11/2023

Modern architecture



LUMI-G: GPU Partition

GPU partition: sustained performance **375 Pflop/s** powered by AMD Radeon Instinct™ MI250X GPUs

LUMI-C: x86 Partition

Supplementary CPU partition: **200,000** AMD EPYC CPU cores

LUMI-D: Data Analytics Partition

Interactive partition with **32 TB** of memory and graphics GPUs for data analytics and visualization.

LUMI-K: Container Cloud Service

Possibility for combining different resources within a single run. HPE Slingshot technology.

LUMI-F: Accelerated Storage

8 PB Flash-based storage layer with extreme I/O bandwidth of 2 TB/s and IOPS capability.

LUMI-Q: Quantum Computing

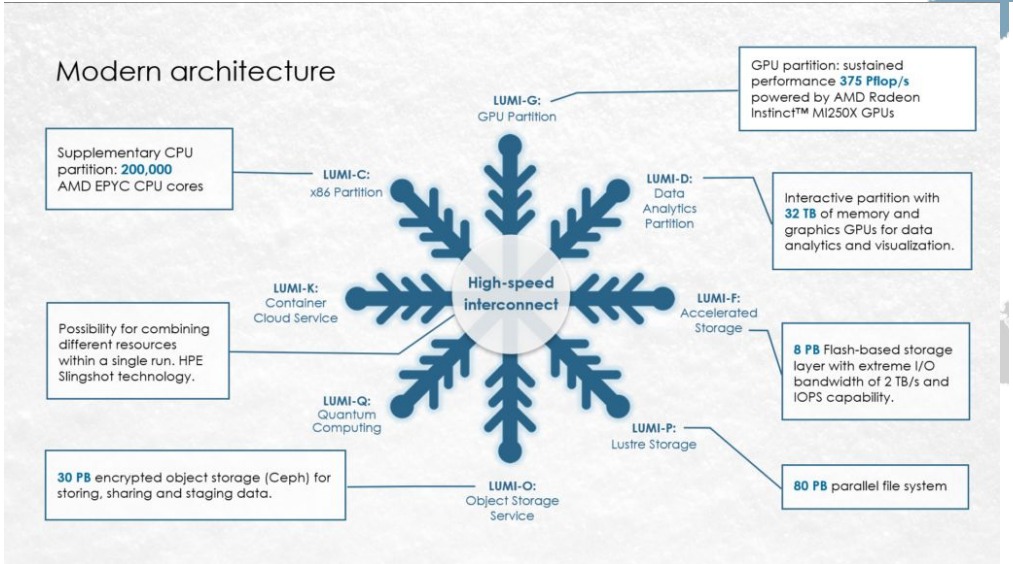
LUMI-P: Lustre Storage

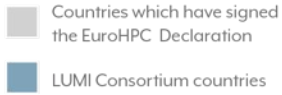
80 PB parallel file system

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

LUMI-O: Object Storage Service

LUMI – Hardware

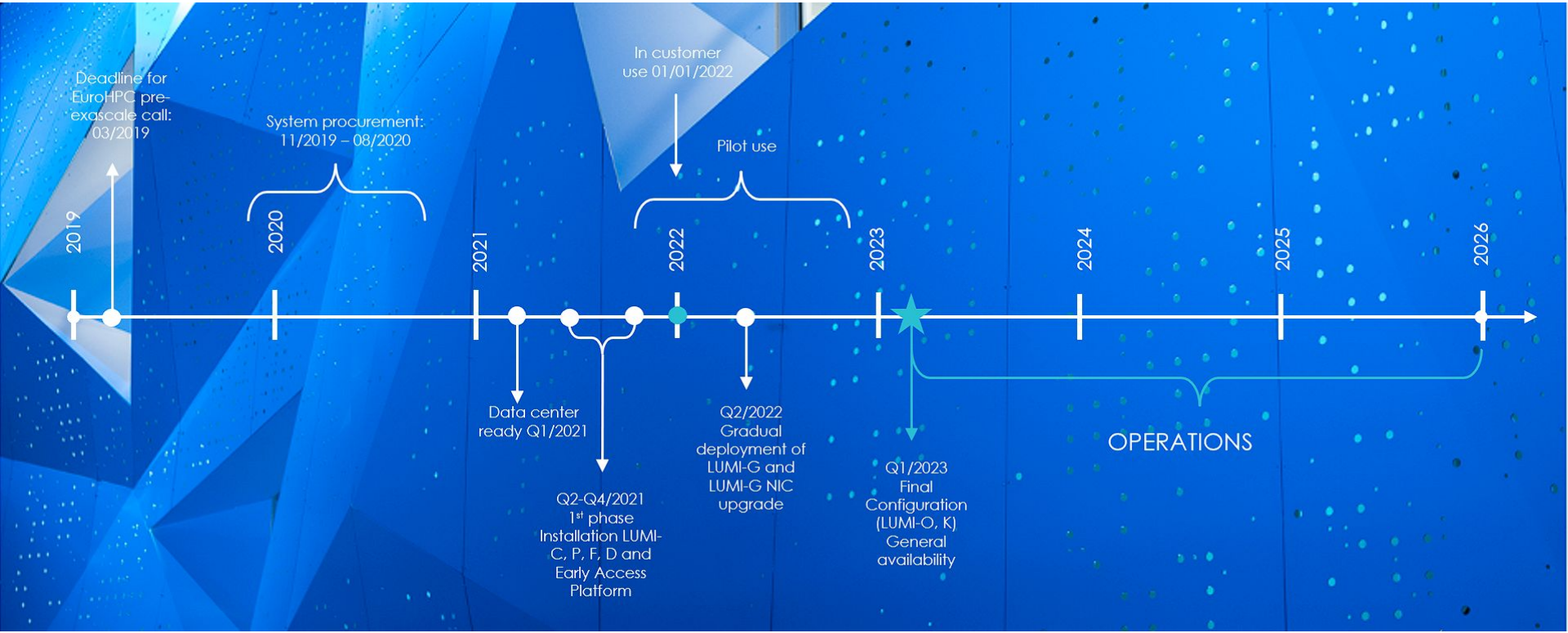




- The primary compute power is found in the LUMI-G hardware partition which consists of 2978 nodes with 4 AMD MI250x GPUs and a single 64 cores AMD EPYC "Trento" CPU.
- The LUMI-C hardware partition consists of 2048 CPU based compute nodes, each of them equipped with two AMD EPYC 7763 CPUs with 64 cores each running at 2.45 GHz for a total of 128 cores per node. The cores have support for 2-way simultaneous multithreading (SMT) allowing for up to 256 threads per node.
- The LUMI-D partition consists of 16 nodes with large memory capacity, of which 8 nodes also feature Nvidia visualization GPUs. LUMI-D is intended for interactive data analytics and visualization.
- Storage: LUMI-P (80PB Lustre parallel filesystem), LUMI-F (9PB accelerated flash-based storage layer) and LUMI-O (30PB encrypted object storage)
- More information: https://docs.lumi-supercomputer.eu/hardware/

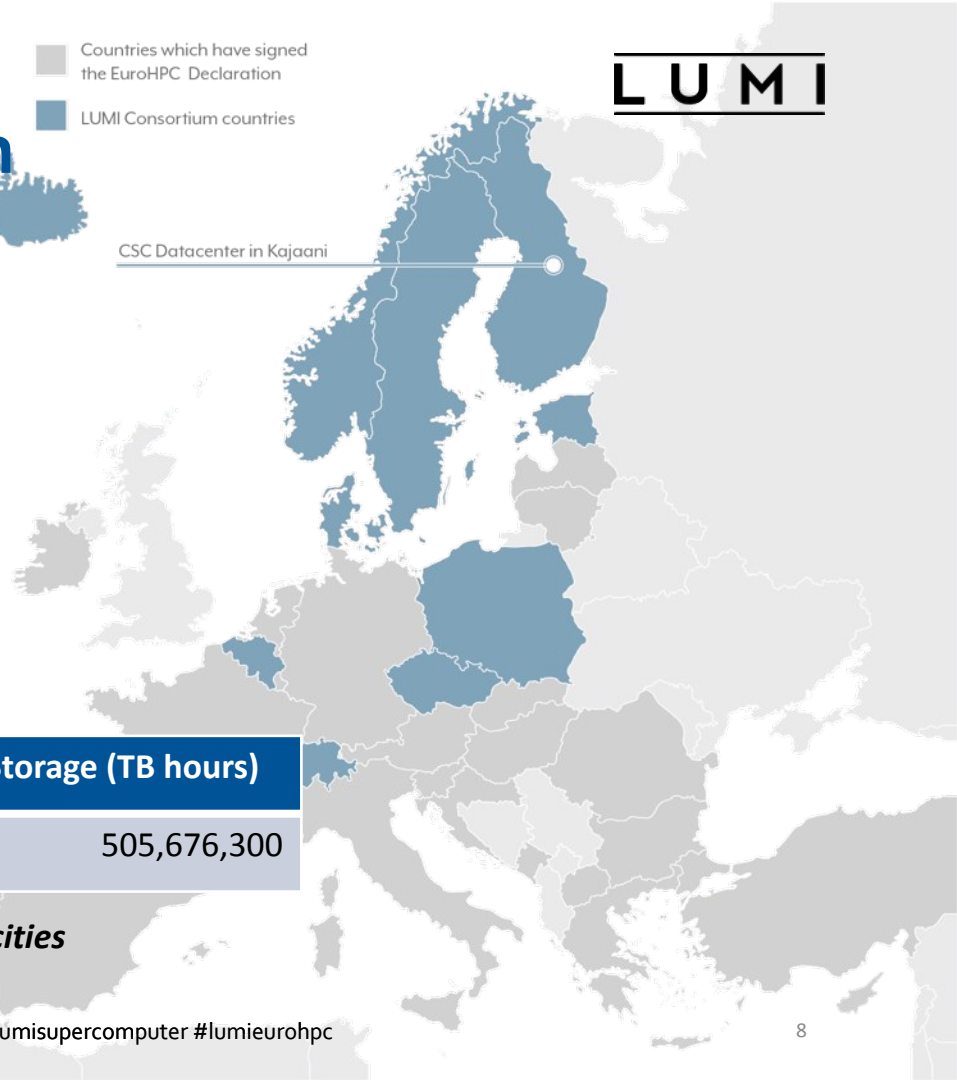
- **Job scheduling system**: Slurm based on a fair share policy configuration with a priority rate based on job age.

LUMI Timeline



A European collaboration

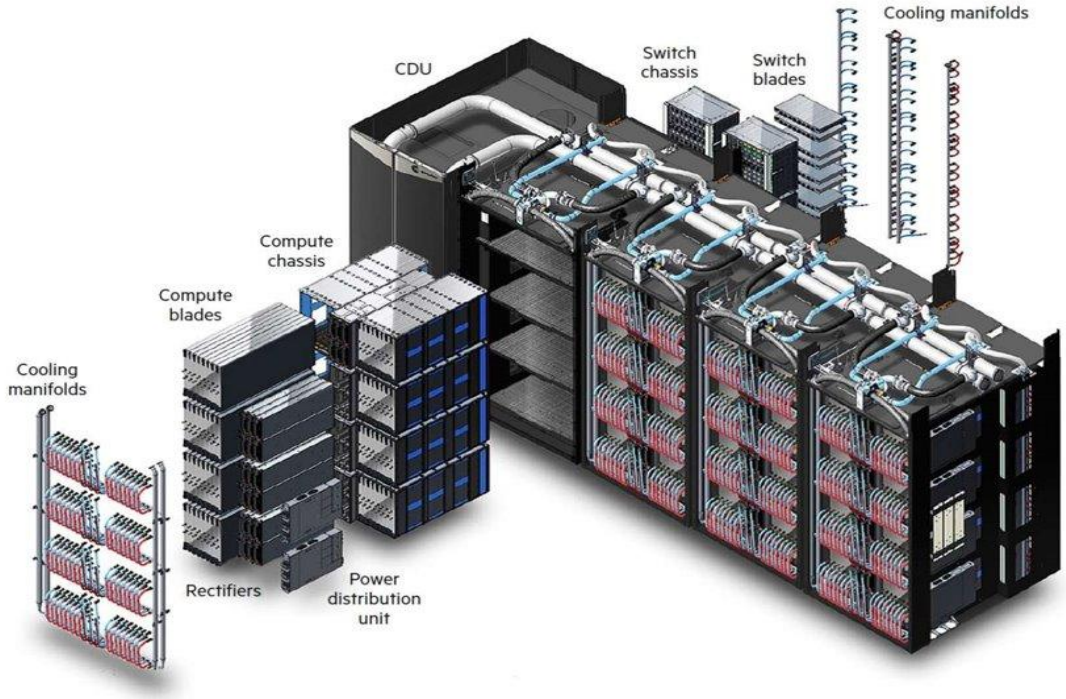
- A joint endeavour between EuroHPC JU and 11 consortium members: Belgium, Czech Republic, Denmark, Estonia, Finland, Iceland, Norway, Poland, Sweden, Switzerland and The Netherlands.
- The resources of LUMI are allocated per the investments. The share of the EuroHPC JU (50%) is allocated by a peer-review process:



CPU-core hours	GPU-node hours	Storage (TB hours)
1,460,417,900	95,720,200	505,676,300

2024 EuroHPC JU allocation capacities

HPE Cray EX system



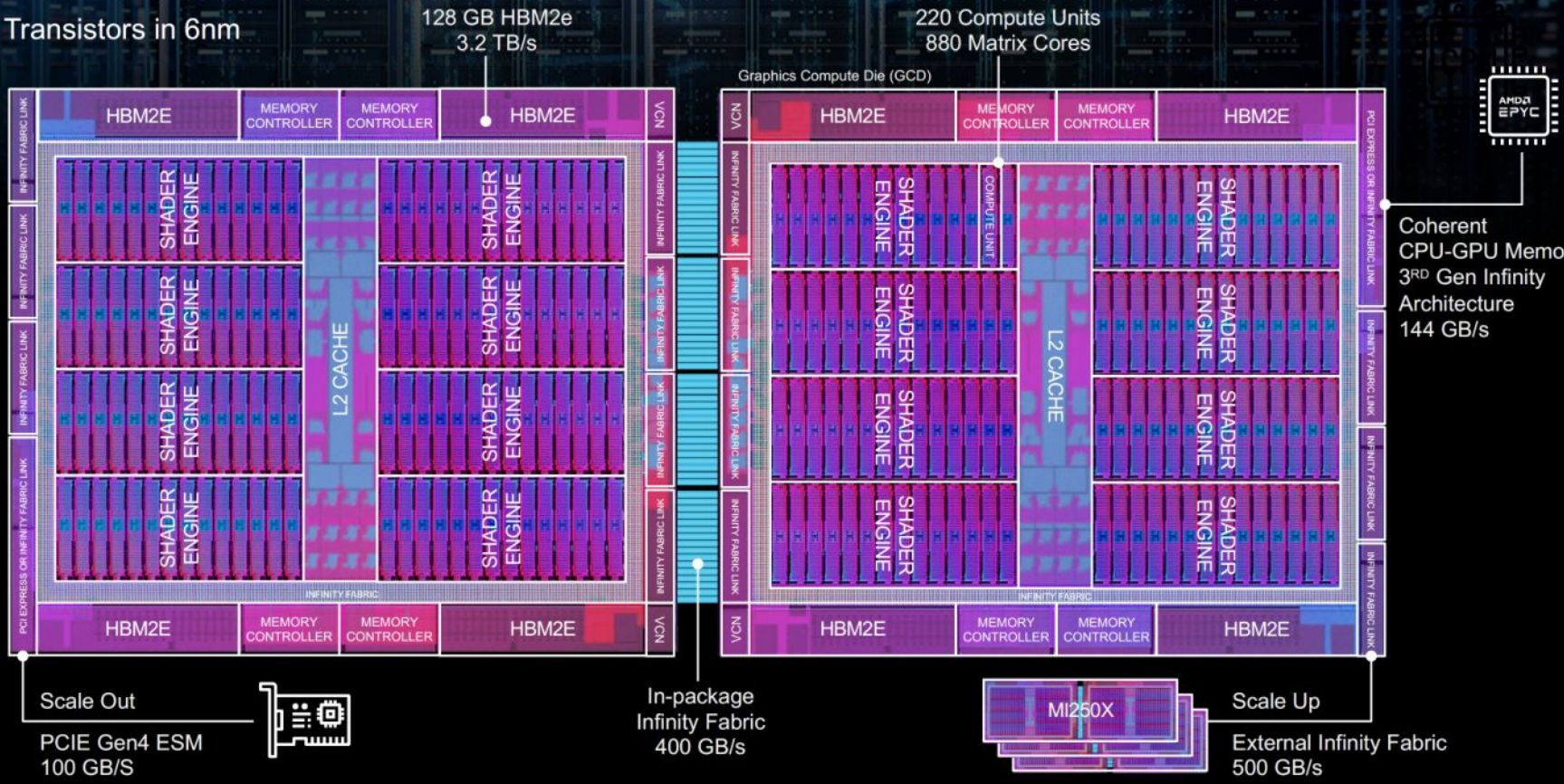
- LUMI-C
  - 1 network port/node
  - 4 nodes/compute blade
  - 2 switch blades/chassis
  - 4 nodes on a blade distributed over 2 switches!
- LUMI-G
  - 4 network ports/node
  - 2 nodes/compute blade
  - 4 switch blades/chassis
  - 2 nodes on blade on other switch pair!

LUMI Spec

- LUMI-G: 2978 nodes with 1 AMD EPYC 7A53 CPU and 4 AMD MI250x accelerators (512 GB + 4x128 GB RAM)
- LUMI-C: 2048 nodes with 2 64-core AMD EPYC 7763 CPUs (1888x 256GB, 128x 512 GB and 32x 1TB)
- Nodes for interactive data analytics: 8 4TB CPU nodes and 8 nodes with 8 GPUs each for visualisation
- LUMI-F: 8 PB Lustre flash-based file storage (> 2 TB/s)
- LUMI-P: 4 20 PB hard disk based Lustre file systems (4x 240 GB/s)
- Object based file system
- 4 user access nodes with two AMD Rome CPUs each for ssh access and some for web access via Open OnDemand
- All linked together with a HPE Cray Slingshot 11 interconnect

MI250X MCM

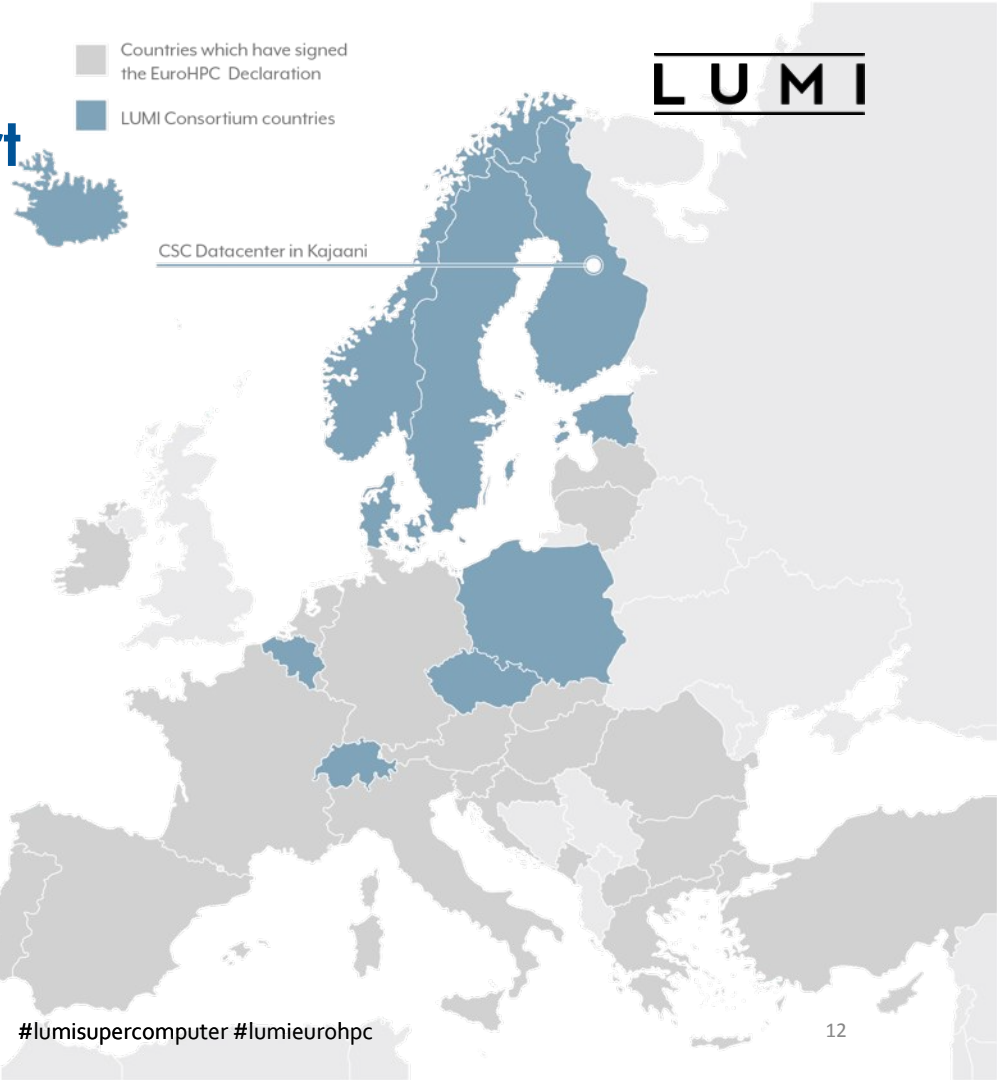
58B Transistors in 6nm



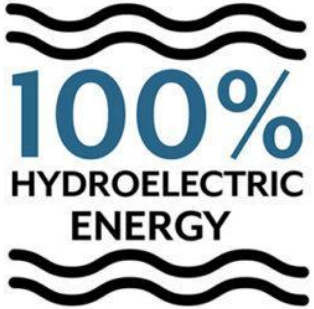
AMD

LUST – a unique user support team in high-performance computing

- Centralized virtual help desk run by the distributed LUMI User Support Team
- The model is based on a network of dedicated HPC experts
- Each partner provides 1 FTE/year
- Level-3 support via local centers, EuroHPC Competence Centers, HPE and AMD
- National support for issues with accounts and allocations



LUMI – Energy



LUMI is using 100% hydro-powered energy. LUMI's waste heat is used to heat hundreds of households in the city of Kajaani.