Exascale in France, EU and the world: Where are we?

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Exascale ?

An exascale computer
is expected to achieve at least
10^{18} or **1 exa** or **1 E** or **1 quintillion Flop/s**

1 quintillion

=

the width of the milky way galaxy in km

Today Largest Supercomputers

TOP 500 The List.

0.5 EFlop/s

29 MW

Rank	System	Cores	Rmax (TFlop/s)	Rpeak (TFlop/s)	Power (kW)
1	**Supercomputer Fugaku** - Supercomputer Fugaku, A64FX 48C 2.2GHz, Tofu interconnect D, Fujitsu RIKEN Center for Computational Science Japan	7,630,848	442,010.0	537,212.0	29,899
2	**Summit** - IBM Power System AC922, IBM POWER9 22C 3.07GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband, IBM DOE/SC/Oak Ridge National Laboratory United States	2,414,592	148,600.0	200,794.9	10,096
3	**Sierra** - IBM Power System AC922, IBM POWER9 22C 3.1GHz, NVIDIA Volta GV100, Dual-rail Mellanox EDR Infiniband, IBM / NVIDIA / Mellanox DOE/NNSA/LLNL United States	1,572,480	94,640.0	125,712.0	7,438
4	**Sunway TaihuLight** - Sunway MPP, Sunway SW26010 260C 1.45GHz, Sunway, NRCPC National Supercomputing Center in Wuxi China	10,649,600	93,014.6	125,435.9	15,371
5	**Selene** - NVIDIA DGX A100, AMD EPYC 7742 64C 2.25GHz, NVIDIA A100, Mellanox HDR Infiniband, Nvidia NVIDIA Corporation United States	555,520	63,460.0	79,215.0	2,646

Nov 2020 ranking

First Exascale Machine ?

- Aurora (US) was expected in 2021, delayed *indefinitely* due to ongoing Intel manufacturing issues with 7nm chips.

- Frontier (US) should be first in 2021:
  - 1.5 EFlop/s
  - $600 millions
  - AMD Epyc CPUs and Radeon Instinct GPUs
  - 30 MW

EuroHPC machines
(50% EU, 50% Countries)

Exascale machines (call open)

- France ?
- Germany (may be 2 machines) ?

Pre-exascale machines:

- LUMI, CsC, Finland
- LEONARDO, CINECA, Italy
- MareNostrum-5, Barcelona Supercomputing Centre, Spain

Petascale machines:

- LuxProvide, Luxembourg
- IZUM, Slovenia
- IT4Innovations National Supercomputing Centre, Czech Republic
- Sofiatech, Bulgaria
- Minho Advanced Computing Centre (MACC), Portugal,

LUMI, Finland

The LUMI system will be a Cray EX supercomputer supplied by Hewlett Packard Enterprise (HPE) and located in Finland.

Sustained performance:	375 petaflops	
Peak performance:	552 petaflops	0.5 EFlop/s
Compute partitions:	GPU partition (LUMI-G), x86 CPU-partition (LUMI-C), data analytics partition (LUMI-D), container cloud partition (LUMI-K)	
Central Processing Unit (CPU):	The LUMI-C partition will feature 64-core next-generation AMD EPYC™ CPUs	
Graphics Processing Unit (GPU):	LUMI-G based on the future generation AMD Instinct™ GPU	

LUMI, Finland

- LUMI will use 100% renewable carbon neutral energy (hydropower).

- The heat generated will provide 20 percent of the district heat of the area

- « One of the most energy efficient supercomputers in the world »

EU Exascale Machines

- Likely with many accelerators (only way to keep energy budget around 20MW)
- One at least with a « european processor » (from EPI initiative ?)
- Delivered in 2023
- France: Bruyères-le-Châtel
- Main challenge for applications: accelerator support