Ministry of Economic Development

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HUNGARIAN HPC PROGRAM
PLANS FOR „LEVENTE"

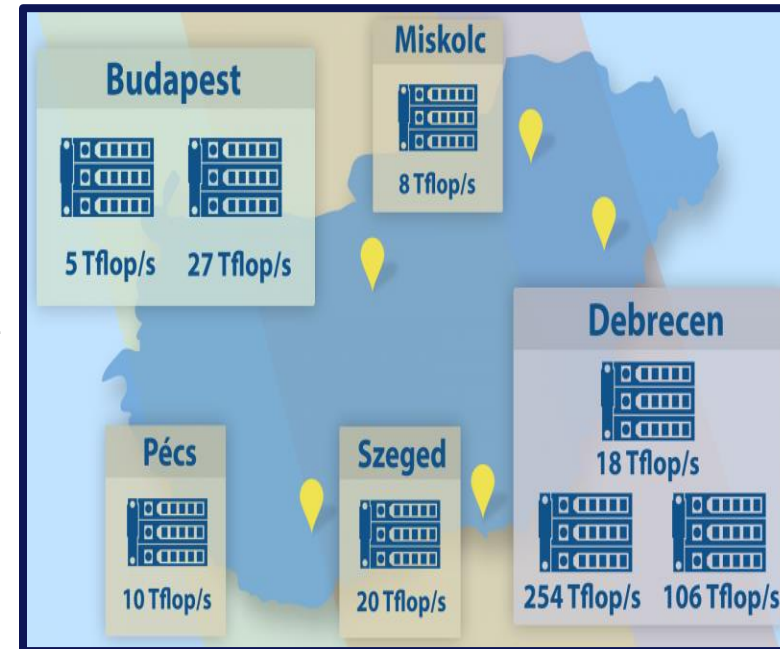**Meeting at Jülich Research Centre,** 6th December, 2023.

Major HPC-s in Hungary before 2020 (operated by KIFÜ)

Lack of capacity

- The total HPC capacity:
  0,45 PetaFlops

- More than 230 R&D teams, more capacity is needed

- Many Hungarian science and research teams as consortium memebers, use HPC-s outside Hungary

Outdated

- More than 5 years in operation

Budapest
5 Tflop/s   27 Tflop/s

Miskolc
8 Tflop/s

Debrecen
18 Tflop/s

Pécs
10 Tflop/s

Szeged
20 Tflop/s

254 Tflop/s   106 Tflop/s

Operated by KIFÜ

Governmental decision on the deleopment of HPC infrastructure and eco-system

Governmental decision of 1422/2020 (VII.23) Korm. hat. Defined a two-phase development of the Hungarian HPC infrastructure in order to contribute to the competitiveness of the Hungarian STI and economy
1st phase: Aim is a 5 PetaFlops system development on Hungarian financing (with structural funds) in I. half of 2023.
It has been implemented by the 6 Petaflops „Komondor" HPC.
2nd phase: further HPC capacity development – at least 20 PetaFlops, with joint Hungarian and EU (EuroHPC financing) by 2025/2026

- Successful submission of a proposal to the EuroHPC „mid-range" tender in Feb. 2022 to build the 20 PetaFlops „Levente" HPC with modular architecture
- The „hosting agreement" negotiations have already started
- A draft proposal – prepared by two ministries (Culture and Innovation and Economic Development)
- Governmental decision is expected

HPC developments and international cooperation activities

2014 ➡ 2021 ➡ 2022 Q1 ➡ 2025 ➡

KIFÜ

| 0,45 PetaFLOPS (0,28 PetaFLOPS - Leo) | Present: 6 PetaFLOPS Komondor | +20 PetaFLOPS modular architecture 2025/26 | Toward Quantum Comp. |

Joint project with EuroHPC

EuroHPC Joint Undertaking

- Hungary is a founder participating state in the EuroHPC JU
- Hungary is part of the Leonardo consortium

- Since Sept. 2020. we are part of the European HPC Competence Centres Network
- National Competence Centre operated by KIFÜ since 1st Aug. 2020

EuroHPC Joint Undertaking **KIFÜ**

Building a mid-range HPC of 20 PetaFlops – „Levente" negotiation on its implementation are going on with EuroHPC JU

The list of HPC-s in Hungary

#	Name of the HPC	Operated by	HPC teraflops	AI teraflops	Users
1	Komondor GPU	KIFÜ	4.500	165.000	STI, universities, research institutions, groups, governments, industry
2	OTP Sambanova HPC	Monicomp	N/A	57.600	Exclusively for language modelling via deep learning, user is OTP (bank), later the governments
3	Komondor CPU	KIFÜ	900	36.000	STI, universities, research institutions, groups, governments, industry
4	ELKH Cloud GPU	ELKH	622	15.000	Primarily R&D institutes, academia and industry
5	Leo GPU	KIFÜ	254	1.000	STI, universities, research institutions, groups, governments, industry
6	DE IK GPU	DE IK	207	5.000	DE IK – University of Debrecen (DE), IT Faculty (IK)
7	OMSZ HPC	OMSZ	42	N/A	National Meteorology Services and its academic partners
8	ELTE HPC	ELTE IK	27	54	University of Eötvös Lóránd (ELTE) and its students

THE STRUCTURE OF THE KOMONDOR SUPERCOMPUTER

KIFÜ   HPC @hu
Competence Centre

CPU only partition
184 nodes, each contains 2 pcs of 64-core AMD EPYCTM 7763 (Milan) CPU and 256 GB RAM (all together 23552 core), 200 Gb/s Rpeak=0.9+ PF

Accelerated (GPU) partition
58 nodes, each contains 1 pc of 64-core AMD EPYCTM 7763 (Milan) CPU and 256 GB RAM and 4 pcs NVIDIA A100 GPU (all together 232 pieces GPU), 2 x 200Gb/s Slingshot interconnect Rpeak=4.6+ PF

Artificial Intelligence (AI) partition
4 nodes (HPE Apollo 6500 Gen10Plus), each contains 2 pcs of 64-core AMD EPYCTM 7763 (Milan) CPU and 512 GB RAM and 8 pcs NVIDIA A 100 GPU (all together 32pcs GPU), 2x200Gb/s Slingshot interconnect Rpeak=0.6+ PF

Big Date (Data Analytics) partition
1 node (SMP/NUMA), 16pcs 18-core Intel® Xeon® Gold 16 CPU (all together 288 core) and 12 TB RAM, 2 TB SSD, 2x200Gb/s Slingshot interconnect Rpeak=30 TF

User

Internet

Firewall

Login mode

Internal network

Ethernet network
100 Gbps external connection

200 Gbps Slingshot
internal networks

400 TB ultra fast storage unit
(300 Gbyte/s)

1,5 PB fast storage unit
(short-term storage)

10 PB long-term
archiving

HPC Komondor

- 80% of the capacity is provided by the GPU-accelerated partition,
- The system include a separate, purely CPU-based partition,
- Dedicated artificial intelligence (AI) and
- Big Data partitions.
- The system is equipped with a multi-level storage system of more than 10 petabytes.
- This supercomputer utilizes an advanced and energy-efficient technology, the power demand is less than 400 kW.
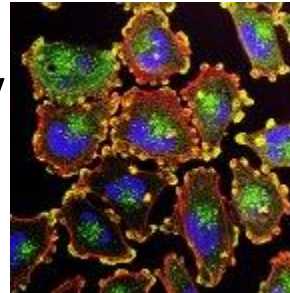
HPC Komomdor – major components

- **"CPU only" partition**
  - 184 nodes, each with a 2 x 64-core AMD EPYC™ 7763 (Milan) CPU and 256 GB RAM (a total of 17920 cores), 200Gb/s Slingshot interconnect
  - Performance: **0,9+ petaflops** (Rmax)
- **"Accelerated (GPU)" partition**
  - 58 nodes, each with a 1 x 64-core AMD EPYC™ 7763 (Milan) CPU and 256 GB RAM, and 4 x NVIDIA A100 GPUs (a total of 200 GPUs), 2x200Gb/s Slingshot interconnect
  - Performance: **4,6+ petaflops** (Rmax)
- **"Artificial Intelligence (AI)" partition**
  - 4 nodes (HPE Apollo 6500 Gen10 Plus), each with a 2 x 64-core AMD EPYC™ 7763 (Milan) CPU and 512 GB RAM and 8 NVIDIA A100 GPUs (a total of 16 GPUs), 2x200Gb/s Slingshot interconnect
  - Performance: **0,6+ petaflops** (Rmax)
- **"Big Data (Data Analytics)" partition**
  - 1 node (SMP/NUMA), 16 x 18-core Intel® Xeon® Gold 16 CPU (a total of 288 cores) and 12 TB RAM, 2 TB SSD, 2x200Gb/s Slingshot interconnect
  - Performance: **30 teraflops** (Rmax)
- **Storage**
  - **3-level** integrated data storage with a **400 TB ultrafast storage** unit for the workflow area (300 Gbyte/s), **1,5 PB fast** storage unit for short-term storage, and a **10 PB long-term archiving** system.

User groups of the Hungarian HPC infrastructure

- 70+ disciplines
- 400 projects
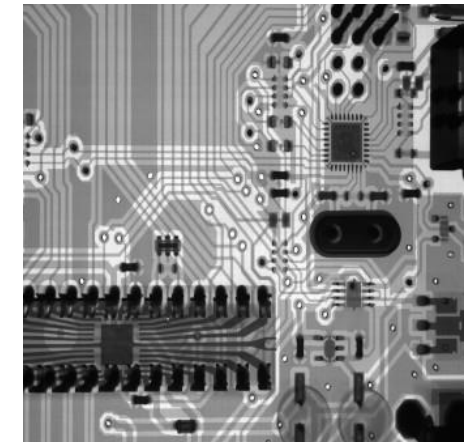- 26 institutions
- 3740000 job run in 2020
- 900 users

Komondor users' and projects' number is rapidly growing

Biology

Chemistry

Physics

Engineering

Second phase: „Levente" development

- Joint project – KIFÜ and EuroHPC JU partnership

- Mid-range HPC of 20 PetaFlops capacity and modular architecture

- Hungarian contribution is provided in frames of cooperation of the Ministry of Culture and Innovatiuon (MCI) and the Ministry of Economic Development (MED)

- „Hosting agreement" negotiations have recently started

- Procurement planned in 2024, delivery and operation launch in 2025

- Usage primarily for science: R&D (MCI), but also for innovation, knowledge. and technology transfer, high tech. development (MED)

„Levente" HPC - new perspectives and opportunities

- More and new HPC services for the Hungarian users (the recently launched „Komondor" services are close to fully booked state)
- The HPC existence is stimulating new more complex multidisciplinary STI projects, new modelling, simulating models, new Big Data and AI applications → new perspectives to scientists, researchers
- Wider international cooperation
- An example: tighter cooperation agreement with German partners: Jülich and Par-Tec (we would welcome its extension)
- Steps towards new breakthrough STI results – primarily in Quantum Technologies (hence the modular architecture of „Levente")

„Levente" HPC - new perspectives in tighter R&D and business links

- Two ministries – MCI – responsible for R&D and – MED – responsible for business developments act together

- Aim: right infrastructure and eco-system for intensive, competitive S&T, R&D&I activities followed by business technology implementations

- Widening the scope of the multidisciplinary scientific projects that use HPC-s

- In this regard we encourage tightening international cooperation – an example: with the Fraunhofer Gesellschaft

An important remark

- Just on this year's result: praising the success of Hungarian – German cooperation – two Nobel Prizes
- Ms Katalin Karikó – Hungarian scientist working together with German company BionTech (Mainz) and
- Mr Fernec Krausz – director of the Max Planck Institute of Quantum Optics and teaching at the Ludwig Maximilian University (Münich) with also a German institute
- The Hungarian Government is planning to support the extablishment of multidisciplinary (medical and physics) research team/institute for medical testing (e.g. human cells with attosecond laser pulses)

Surely: These two stories prove the success and underline the importance of our cooperation

Dear Ladies and Gentlemen, dear hosts of this meeting

- First: let me express our great thanks for organising and hosting this meeting and letting us to discuss on our development plans in the very exciting field of supercomputing

- Secondly: I would express my firm hope and vision that this meeting is a starting point of a prosperous and fruitful cooperation between the best experts of our countries.

Ministry of Economic Development

Thank you very much!