OPENFOAM®'A GİRİŞ ÇALIŞTAYI

UHeM'de OpenFOAM Kullanımı

OpenFOAM®

ParaView

uhem

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https://valve.be.itu.edu.tr/

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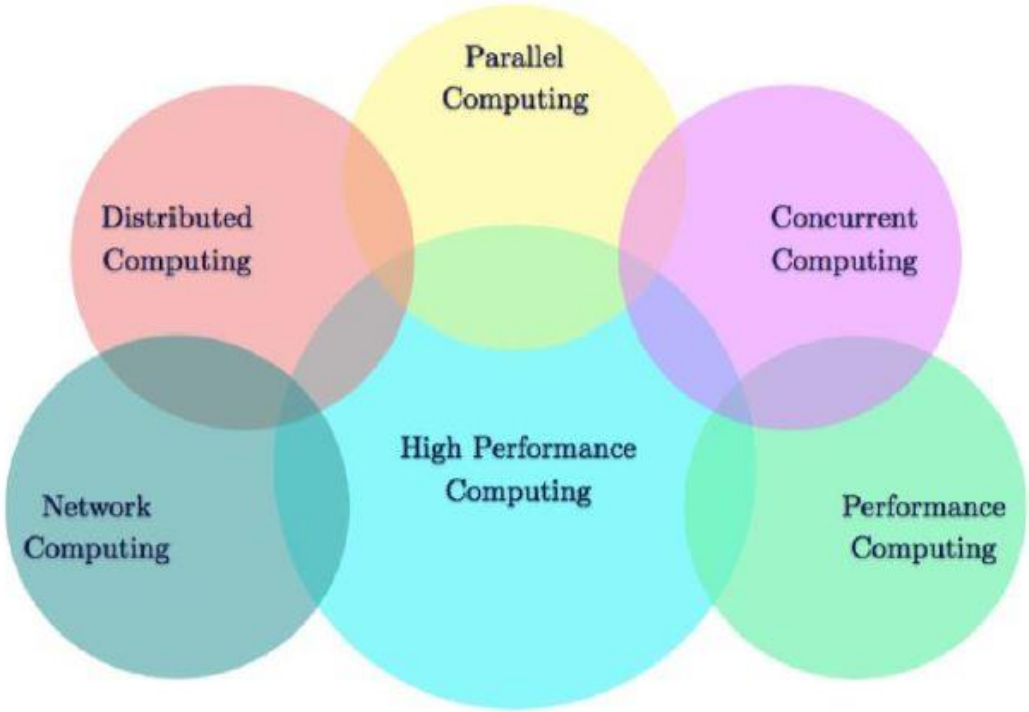
December 1, 2023

What is HPC?

“High-Performance Computing, or HPC, is the application of supercomputers to computational problems that are either too large for standard computers or would take too long.”

National Institute for Computational Sciences

- **HPC is everywhere!**
  - Medicine
  - Climatology
  - Economics
  - Materials
  - Cosmology
  - Entertainment
  - …



HPC in Türkiye

- **UHeM**

  https://www.uhem.itu.edu.tr/

- **TRUBA**

  https://www.truba.gov.tr/

HPC in Türkiye

- **UHeM**

  https://www.uhem.itu.edu.tr/

- 2004: Project approval by State Planning Organization (DPT)
- 2006: HPC services started. 353rd in TOP500 with the 1st phase server system of 3.28 Tflops.
- 2007: 240th in TOP500 with a system upgrade – 6.067 Tflops Rmax
- 2008: Participation to PRACE (Partnership for Advanced Computing in Europe)
- 2009: Service structuring and system upgrades
- 2010: PRACE First Implementation Phase
- Intel v3, v4 and v5 machines (2010 – 2020)
- AMD EPYC 2nd gen. machines (2021)

UHeM Hardware Infrastructure

Server name	SARIYER	
Processor	Intel® Xeon® Gold 6148	Intel® Xeon® E5-2680 v4
Number of compute nodes	36	93
Number of compute cores	40	28
Memory amount of compute node	192 GB	128 GB

Special nodes	• 1 Big-Mem GPGPU Node
	  • Accelerator: 4 x NVIDIA Tesla V100 SXM2 32GB (Volta)
	  • Memory: 384 GB
	  • Processor: Intel® Xeon® Gold 6248
		• 1 Big-Mem GPGPU Node
		  • Accelerator: 1 x NVIDIA Tesla K20m (Kepler)
		  • Memory: 512 GB
		• 3 GPGPU Nodes
		  • Accelerator: 1 x NVIDIA Tesla K20m (Kepler)
		• 10 Big-Mem Nodes
		  • Memory: 512 GB

High performance network	EDR InfiniBand (100 Gbps)	FDR InfiniBand (56 Gbps)
File system	Lustre, 360 TB	
Operating system	CentOS 7 x86_64	

Server name	ALTAY		
Processor	AMD EPYC™ 7742	Intel XEON 8362	AMD EPYC 7543
Number of compute nodes	88	30	10
Number of compute cores	128	64	
Memory amount of compute node	256 GB	512 GB	1024 GB
Special nodes	-	• NVIDIA A100 80 GB PCIe • 8.8 TB scratch disc	• 4 x NVIDIA A100 80 GB NVLink • 12 TB scratch disc
High performance network	HDR InfiniBand (200 Gbps)		HDR InfiniBand (100 Gbps)
File system	BeeGFS, 1.6 PB		
Operating system	Red Hat Enterprise Linux 8.5		

How to Install VPN

- On Ubuntu and Debian based operating systems (e.g., Mint, Pop!_OS, Mx)

  sudo apt install openvpn

- On Arch based operating systems (e.g., Manjaro)

  sudo pacman -S openvpn

- On Rhel based operating systems (e.g., Fedora, Centos)

  sudo yum install openvpn

→ **sudo openvpn *openvpn-uhem-config-linux.ovpn* *(while in same directory with the config file)***

- On Windows

  Download OpenVPN from https://openvpn.net/community-downloads/

  Import the file "*openvpn-uhem-config.ovpn*"

- On Mac OSX

  Download Tunnelblick from https://tunnelblick.net/downloads.html

  Import the file "*openvpn-uhem-config.ovpn*"

How to Connect to UHeM

- **ssh –l your_username altay.uhem.itu.edu.tr**

  or

- **ssh your_username@10.128.2.40**

```
[du040@altay:~ ]$ bosmakinalar
     QUEUE STA   FREE  TOTAL RESORC  OTHER   FREE  TOTAL ||   MIN   MAX DEFMEM MAXMEM    MAXIMUM  CORES   NODE
 PARTITION TUS  CORES  CORES PENDNG PENDNG  NODES  NODES || NODES NODES G/NODE G/NODE   JOB-TIME  /NODE MEM-GB
      defq   *   6656  11264      0      0     52     88 ||     0     4    250    250   10 days    128    250
     longq        640   4096      0      0      5     32 ||     0     4    250    250   21 days    128    250
   bigjobq       6528  11136      0      0     51     87 ||     4     -    250    250    3 days    128    250
     a100q       1600   1920      0      0     25     30 ||     0    10    500    500   10 days     64    500
   a100x4q        512    640      0      0      8     10 ||     0     4   1000   1000   10 days     64   1000
 workshopq   g   4736   9216      0      0     37     72 ||     0     4    250    250   12 hour    128    250

                YOUR PEND PEND YOUR
                 RUN  RES OTHR TOTL
   COMMON VALUES:    0    0    0    0

   ================================================================================================================
    komutlar komutu ile hizlica komut ozetlerine ulasabilirsiniz.
    Use komutlar command for a list of frequently used commands.
   ================================================================================================================

[du040@altay:~ ]$
```

- Please protect your runspace folder with **chmod 700** command.

```
[hbm51301@sariyer ~ ]$ pwd
/okyanus/users/hbm51301
[hbm51301@sariyer ~ ]$ cd ..
[hbm51301@sariyer users ]$ chmod -R 700 hbm51301
```

- If you want to disconnect from UHeM, first **logout**, then close your vpn connection on the connection terminal with CTRL + C.

Slurm

- SLURM is an open-source, modular, extensible, scalable resource manager and workload scheduling software for clusters and supercomputers running Linux or other Unix-compatible OS.
- SLURM runs on UHeM – Altay cluster and will help on allocate the computing nodes and queue the job submitted with a specific script.
- Command list for UHeM

komutlar	command list
bosmakinalar	show the usable nodes list
squeue -u username	monitor your jobs
module avail	shows the current installed programs

- The current latest version on Altay cluster is OpenFOAMv2206.
- In order to use OpenFOAM commands, we need to load its module and source the corresponding bashrc.

```
$ module load OpenFOAM/OpenFoam.com-v2206
$ source /okyanus/progs/OpenFOAM.com-v2206/OpenFOAM-v2206/etc/bashrc
```

Run an OpenFOAM Simulation

- In order to submit a job, we need to use the `sbatch` command.
- We need a batch script first!

```
#!/bin/bash
#SBATCH -A username              #account name (use your own)
#SBATCH -p workshopq             #queue name (do not change)
#SBATCH -o slurm.%j.out
#SBATCH -e slurm.%j.err
#SBATCH -n 128                   #number of cores

module load OpenFOAM/OpenFoam.com-v2206
source /okyanus/progs/OpenFOAM.com-v2206/OpenFOAM-v2206/etc/bashrc

mpirun icoFoam -parallel > log.icofoam
```

- To submit your job: `sbatch your_script.sh`

File Transfer with “scp”

- To copy a file from your pc to UHeM:

```
$ scp filename username@altay.uhem.itu.edu.tr:~/
```

- To copy a file from UHeM to your own pc:

```
$ scp username@altay.uhem.itu.edu.tr:~/filename ./
```

- To copy a file a folder:

```
$ scp –r directoryname username@altay.uhem.itu.edu.tr:~/
```

Thank you ☺

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