Turkish Academic Network and Information Center

# Turkish National Science e-Infrastructure (TRUBA)

Sevil Sarıkurt

*TÜBİTAK ULAKBİM, TRUBA*

*14 October 2023*

# Outline

- TRUBA HPC System
- HPC Architecture
- OpenVPN
- SSH connection
- Jupyter Notebook
- SLURM Files

https://github.com/TRUBA-HPC/MLforMultipleDomains

# TRUBA – Turkish National Science e-Infrastructure

- TRUBA: National center providing high performance computing and data storage for all research institutions and researchers in Türkiye.


**Supporting Organization:** Presidency of Strategy and Budget

**Resources**

- 80.000 CPUs (new resources)
- 216 GPUs (P100, V100, A100)+ 96 GPUs (H100)
- 14 PB data storage space

**Services**

- Research institutes, public organizations, and private sector
- > 190 National Scientific Research Project support
- > 6000 Registered researchers
- > 400 Researcher using the system at the same time
- > 180 Universities & Institutes &Research Centres

https://www.truba.gov.tr

TRUBA
Turkish Science e-Infrastructure

# Who Can Use TRUBA?

- Academic Researchers: Including faculty members, PhD candidates, postdoctoral researchers, and Master's students (with advisor approval).
- Researchers from Public Institutions: Government-affiliated researchers are eligible.
- Industry Researchers: Professionals from companies **established or located in Türkiye**

## How to Apply?

- Register: Visit http://portal.truba.gov.tr to begin the application process.
- Verification: The researcher's identity is verified through e-Government and YÖKSİS.
- Access Credentials: Upon approval, login credentials (username and password) are provided to the researcher through TRUBA portal.

grid-teknik@ulakbim.gov.tr

ardeb@ulakbim.gov.tr

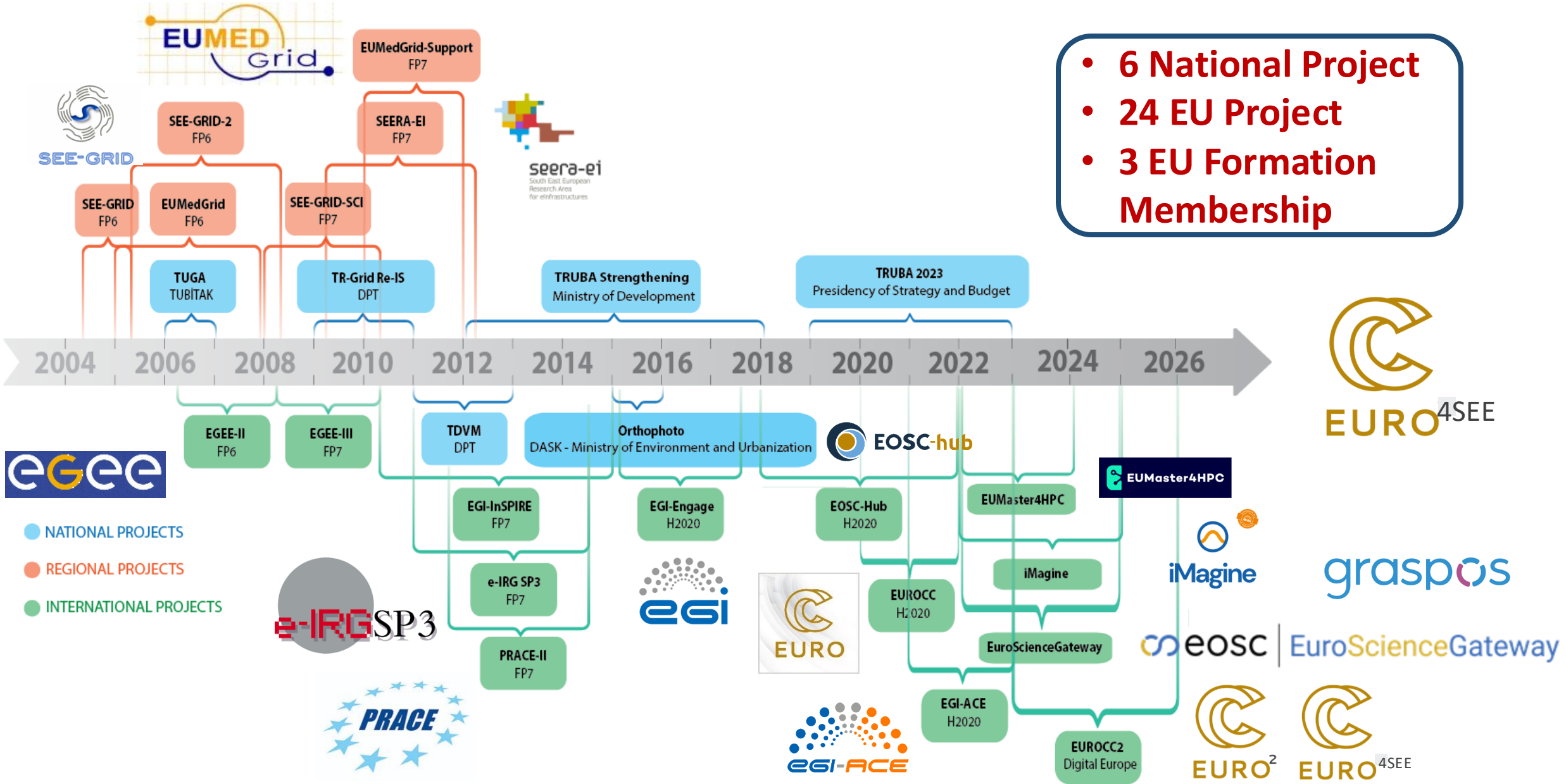
https://docs.truba.gov.tr/TRUBA/kullanici-el-kitabi/kullanicihesaplari.html

Turkish Science e-Infrastructure

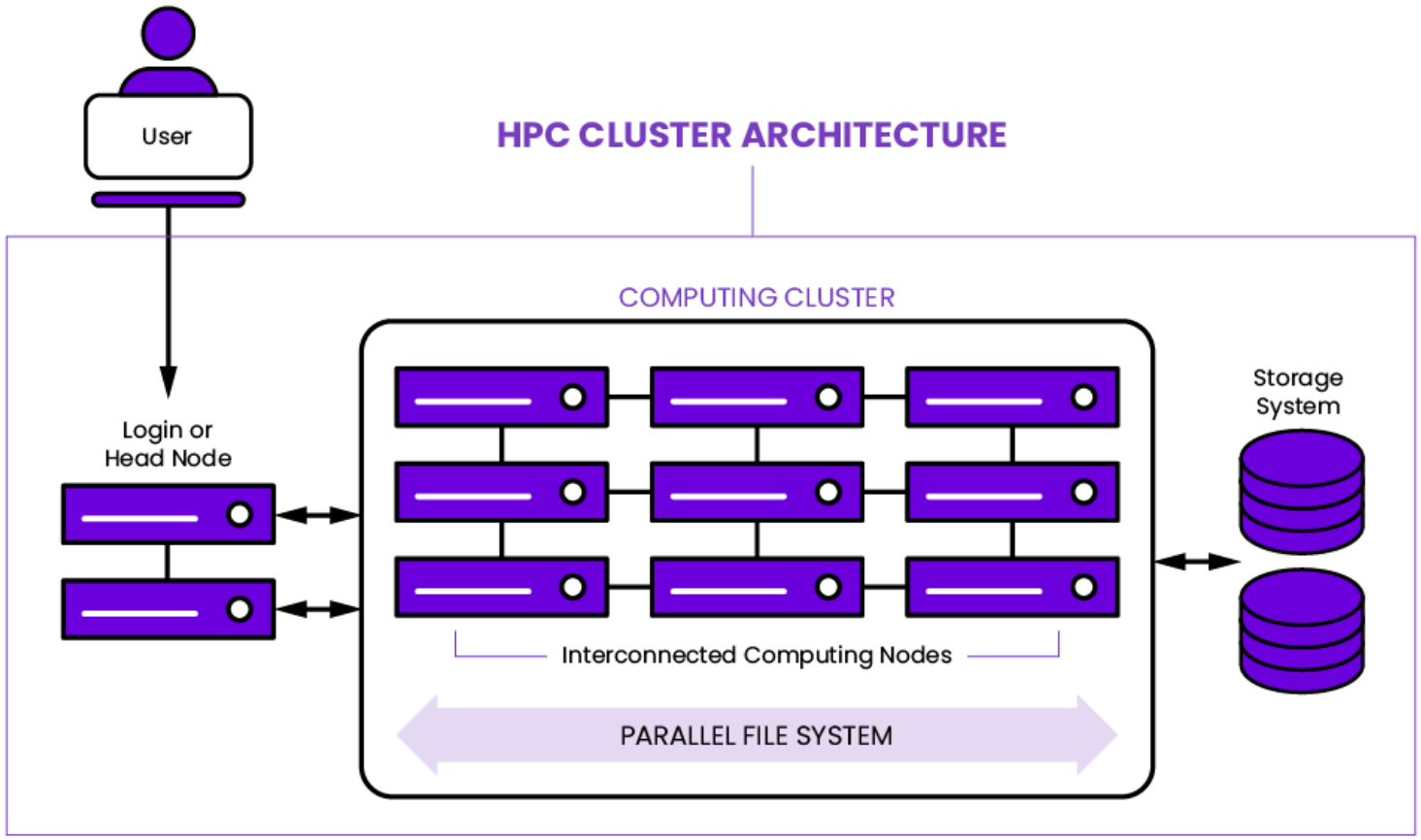
# TRUBA - Projects

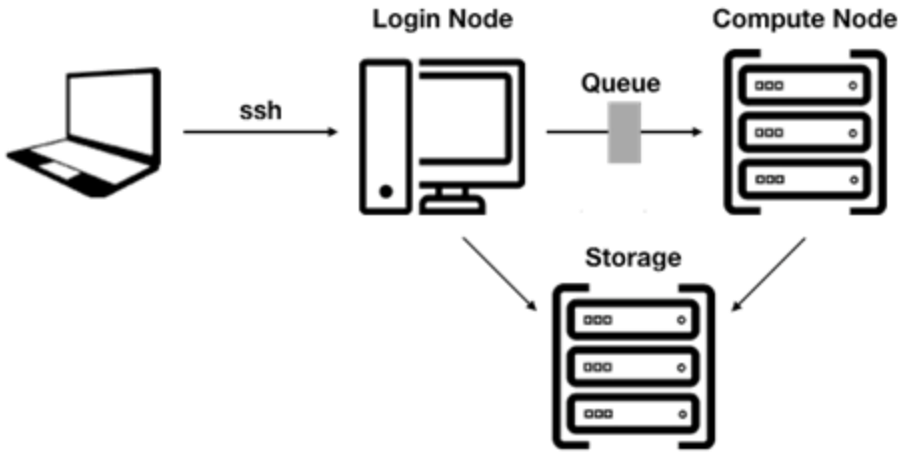
TRUBA
Turkish Science e-Infrastructure

- 6 National Project
- 24 EU Project
- 3 EU Formation Membership



# HPC Architecture



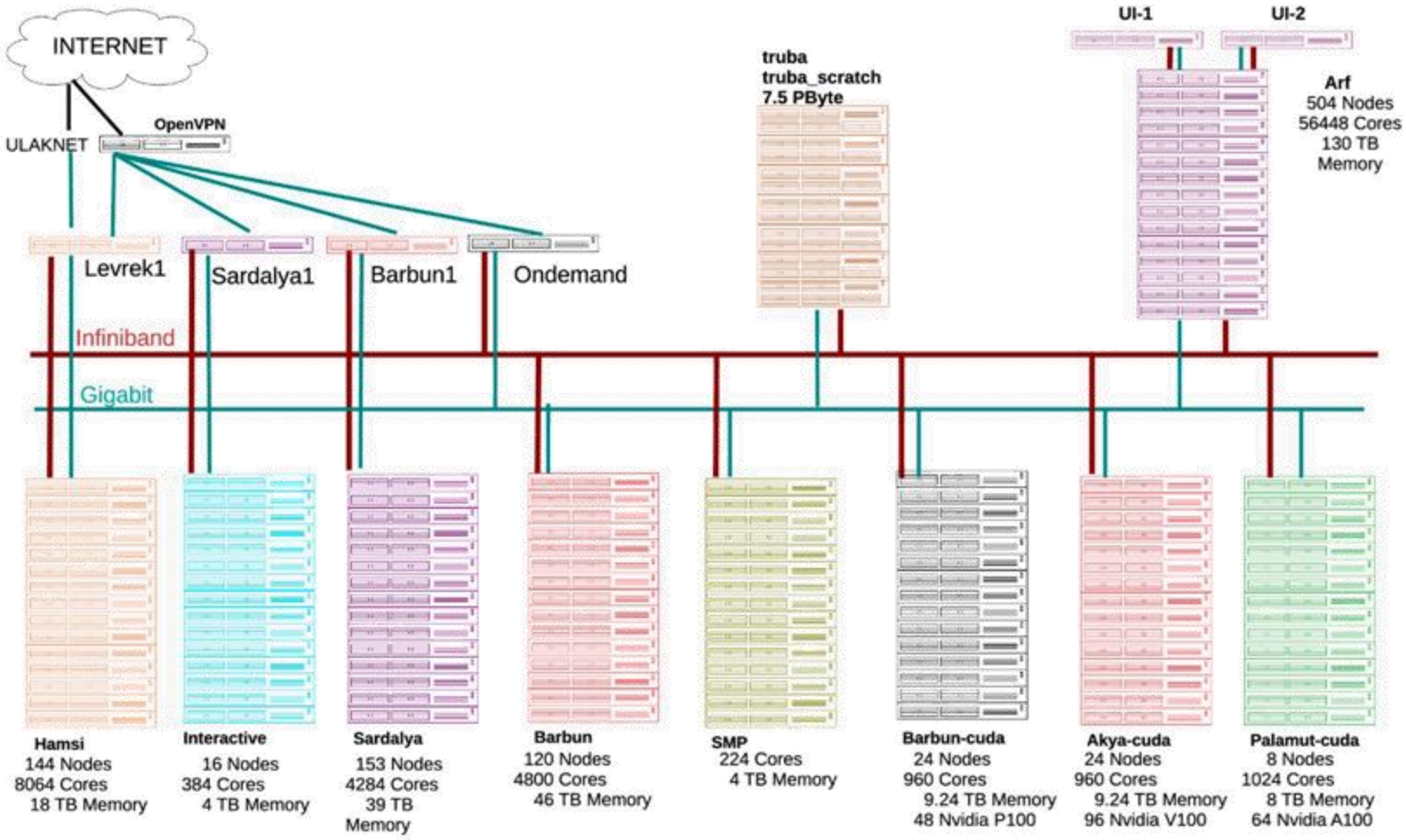




https://www.weka.io/learn/hpc/what-are-hpc-and-hpc-clusters/

http://tinyurl.com/HPC-arch

# TRUBA – Turkish Science e-Infrastructure

- TRUBA: National center providing high performance computing and data storage for all research institutions and researchers in Türkiye.




https://docs.truba.gov.tr/TRUBA/kullanici-el-kitabi/hesaplamakumeleri.html

# TRUBA-GPU Resources

| Calculation Nodes | Year | #Node | Architecture | Processor | Performance | RAM | #GPU |
|---|---|---|---|---|---|---|---|
| **Barbun-cuda** | 2018 | 24 | 20 cores x 2 CPU +2 x Nvidia P100 GPU | Xeon Scalable 6148 2.40GHz | 2048Gflops +9400Gflops | 384 GB + 2x16 GB HBM2 | 2 |
| **Akya-cuda** | 2018 | 24 | 20 cores x 2 CPU +4 x Nvidia V100 GPU | Xeon Scalable 6148 2.40GHz | 2048Gflops + 4x7800Gflops | 384 GB + 4x16 GB HBM | 4 |
| **Palamut-cuda** | 2021 | 9 | 64 cores x 2 CPU + 8 x Nvidia A100 GPU | AMD EPYC 7742 2.24 GHz | 4600 Gflops + 8x9600Gflops | 192GB + 8x80GB HBM | 8 |
| **Kolyoz-cuda** | 2024 | 24 | 32 cores x 2 CPU & 4xNvidia H100 GPU | Intel(R) Xeon(R) GOLD 6548Y+ 2.5GHz | 5Tflops & 4x34Tflops | 1 TB & 4x80GB HBM | 4 |

# TRUBA – Pre-Requirements

## Basic Linux Knowledge

- Linux basic structure
- File, directory structure
- User permissions on files and directories
- Basic shell commands
- File operations, file editing (cp, mv, mkdir, cd, find, vi, etc.)
- Connection and file transfer (ssh, scp, sftp, etc.)
- X-forwarding

## Application Knowledge

- What/How does it calculate?
- How it works (serial, MPI, OpenMPI)
- Dependency on other applications and libraries
- Installation/Compilation processes
- Structuring according to the problem
- Input and output files
- Amount of resources needed

➢ **First Time Users**
https://docs.truba.gov.tr/tutorials/TRUBA-quick-start.html

➢ **Commonly Used Linux Commands**
https://docs.truba.gov.tr/tutorials/linux-intro.html

TÜBİTAK ULAKBİM

https://docs.truba.gov.tr/

TRUBA Türk Ulusal Bilim e-Altyapısı

# OpenVPN

- Linux: installation through command line
  - sudo apt-get install openvpn

OpenVPN config file:

https://tinyurl.com/TRUBA-openvpn

```
sevil@pop-os:~/VPN$ sudo openvpn TRUBA-genel.ovpn
2023-09-10 22:20:22 Note: Treating option '--ncp-ciphers' as  '--data-ciphers' (renamed in OpenVPN 2.5).
2023-09-10 22:20:22 DEPRECATED OPTION: --cipher set to 'AES-256-CBC' but missi
). Future OpenVPN version will ignore --cipher for cipher negotiations. Add 'A
her 'AES-256-CBC' to --data-ciphers-fallback 'AES-256-CBC' to silence this war
2023-09-10 22:20:22 OpenVPN 2.5.5 x86_64-pc-linux-gnu [SSL (OpenSSL)] [LZO] [L
t on Jul 14 2022
2023-09-10 22:20:22 library versions: OpenSSL 3.0.2 15 Mar 2022, LZO 2.10
Enter Auth Username: sevil
Enter Auth Password: ********
2023-09-10 22:20:29 TCP/UDP: Preserving recently used remote address: [AF_INET
2023-09-10 22:20:29 UDP link local (bound): [AF_INET][undef]:1194
2023-09-10 22:20:29 UDP link remote: [AF_INET]193.140.99.241:1195
2023-09-10 22:20:29 [midye.truba.gov.tr] Peer Connection Initiated with [AF_IN
2023-09-10 22:20:40 Options error: Unrecognized option or missing or extra par
2.5.5)
2023-09-10 22:20:40 TUN/TAP device tun0 opened
2023-09-10 22:20:40 net_iface_mtu_set: mtu 1500 for tun0
2023-09-10 22:20:40 net_iface_up: set tun0 up
2023-09-10 22:20:40 net_addr_v4_add: 10.3.9.106/22 dev tun0
2023-09-10 22:20:40 WARNING: this configuration may cache passwords in memory
s
2023-09-10 22:20:40 Initialization Sequence Completed
```

```
sevil@pop-os:~$ ssh sevil@172.16.7.1
sevil@172.16.7.1's password:
```

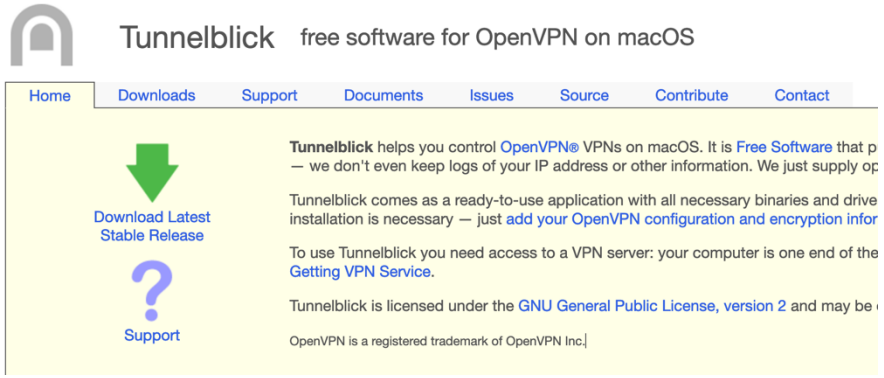
**ssh username@172.16.11.1**

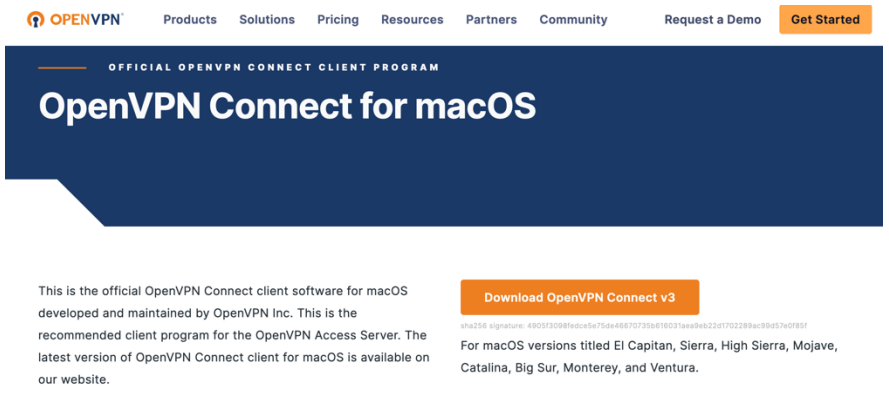
https://docs.truba.gov.tr/TRUBA/kullanici-el-kitabi/open-vpn/index.html

Türk Ulusal Bilim e-Altyapısı

# OpenVPN

- MacOS:
  - https://tunnelblick.net/index.html
  - https://openvpn.net/client-connect-vpn-for-mac-os/
- Windows: https://openvpn.net/community-downloads/


OpenVPN config file:

https://tinyurl.com/TRUBA-openvpn

Turkish Science e-Infrastructure

# SSH Connection

Windows:

https://www.putty.org/

https://mobaxterm.mobatek.net/


**Package files**

You probably want one of these. They include versions of all the PuTTY utilities (

(Not sure whether you want the 32-bit or the 64-bit version? Read the FAQ entry.)

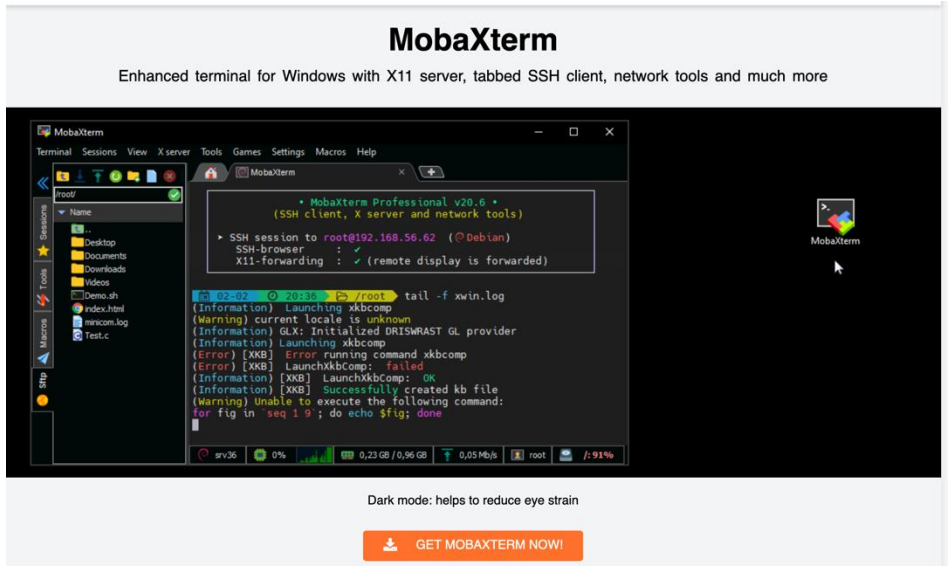
We also publish the latest PuTTY installers for all Windows architectures as a free

**MSI ('Windows Installer')**

| | | |
|---|---|---|
| 64-bit x86: | putty-64bit-0.79-installer.msi | (signature) |
| 64-bit Arm: | putty-arm64-0.79-installer.msi | (signature) |
| 32-bit x86: | putty-0.79-installer.msi | (signature) |

**Unix source archive**

| | | |
|---|---|---|
| .tar.gz: | putty-0.79.tar.gz | (signature) |




ssh username@172.16.11.1

Turkish Science e-Infrastructure

# UI & Open OnDemand Connection

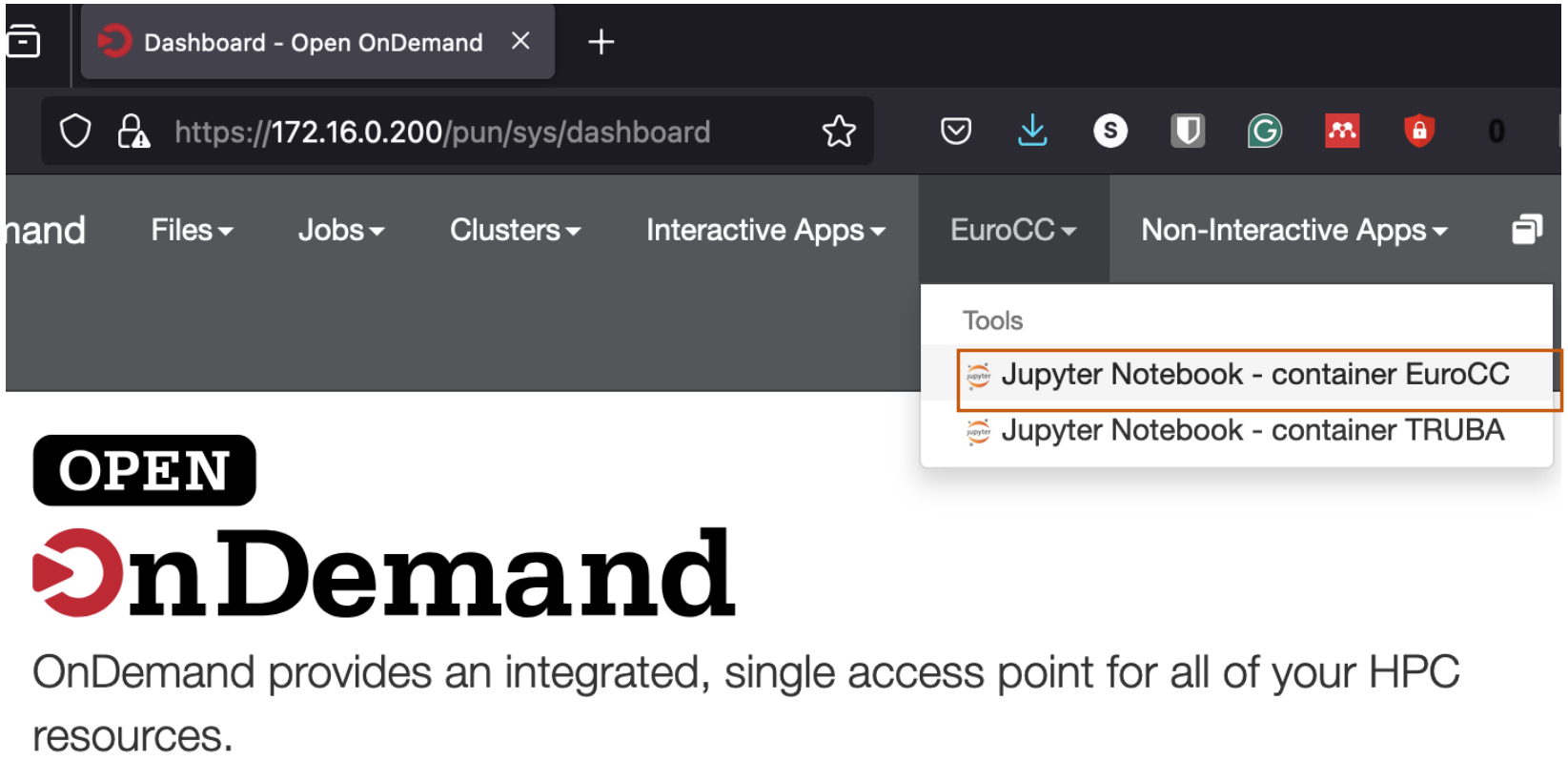
| User Interface | Address |
|---|---|
| barbun1 | 172.16.11.1 |
| Open OnDemand | http://172.16.0.200 |
| Grafana | http://grafana.yonetim:3000 |

| |
|---|
| ssh user_name@172.16.11.1 |
| ssh –l user_name 172.16.11.1 (-l lower case ‘L’) |

Turkish Science e-Infrastructure

# Open OnDemand

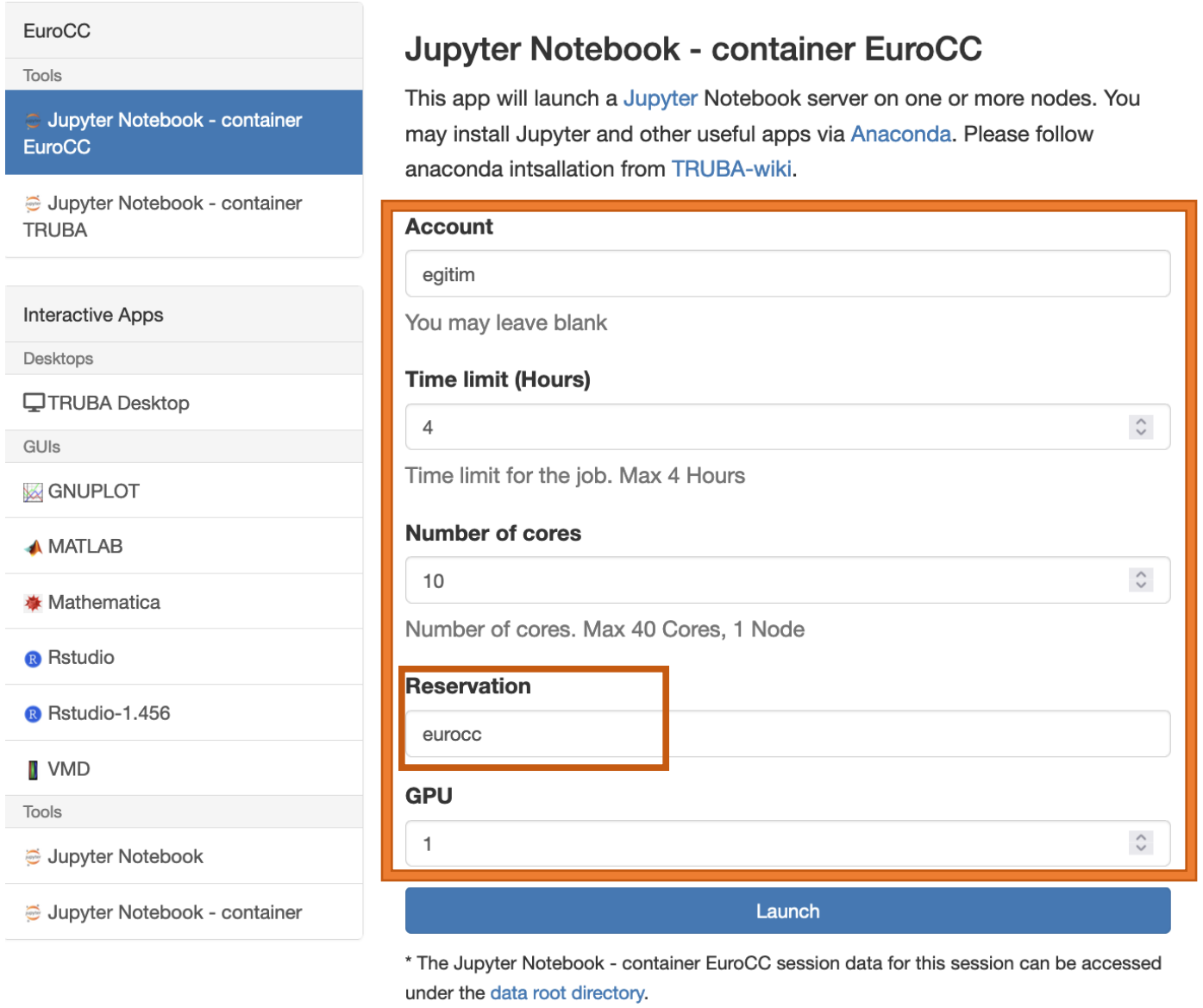
- Open OnDemand Interface
  - can be accessed at https://172.16.0.200
  - Only CPU and akya-cuda partitions can be requested.




https://github.com/TRUBA-HPC/MLforMultipleDomains

# Jupyter Notebook: Open OnDemand

- Open OnDemand Interface: https://172.16.0.200



# Jupyter Notebook: Open OnDemand

Session was successfully created. ×

Home / My Interactive Sessions

EuroCC

Tools

Jupyter Notebook - container EuroCC

Jupyter Notebook - container TRUBA

Interactive Apps

Desktops

**Jupyter Notebook - container EuroCC (1706595)** Queued

**Created at:** 2024-10-14 01:16:03 +03

**Time Requested:** 4 hours

**Session ID:** febb8f9a-1b01-4377-addd-1ac1ff4e6ceb

Delete

Please be patient as your job currently sits in queue. The wait time depends on the number of cores as well as time requested.

Home / My Interactive Sessions

EuroCC

Tools

Jupyter Notebook - container EuroCC

Jupyter Notebook - container TRUBA

Interactive Apps

Desktops

**Jupyter Notebook - container EuroCC (1706595)** 1 node | 10 cores | Starting

**Created at:** 2024-10-14 01:16:03 +03

**Time Remaining:** 3 hours and 59 minutes

**Session ID:** febb8f9a-1b01-4377-addd-1ac1ff4e6ceb

Delete

Your session is currently starting... Please be patient as this process can take a few minutes.

https://github.com/TRUBA-HPC/MLforMultipleDomains

# Jupyter Notebook: Open OnDemand

Home / My Interactive Sessions

EuroCC

Tools

Jupyter Notebook - container EuroCC

Jupyter Notebook - container TRUBA

Interactive Apps

Desktops

**Jupyter Notebook - container EuroCC (1706595)** 1 node | 10 cores | Running

**Host:** >_akya13.yonetim

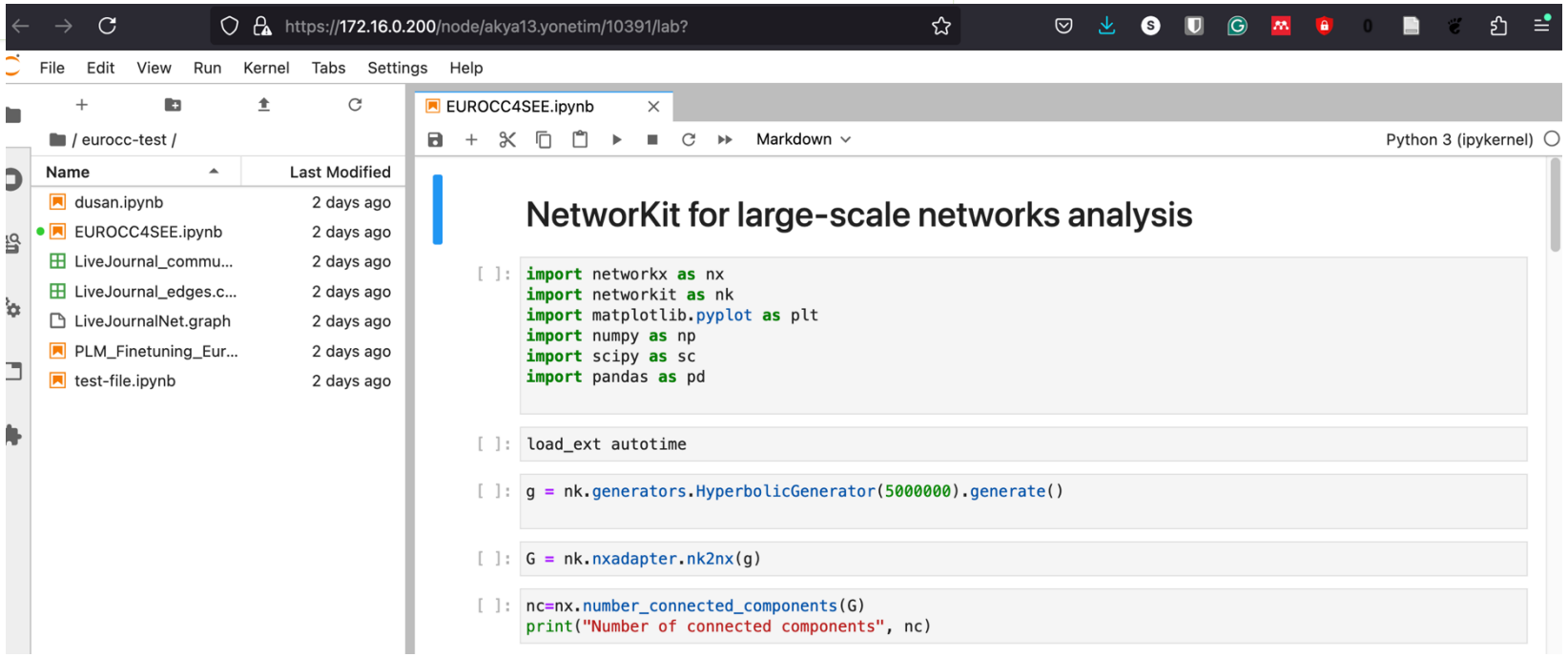
Delete

**Created at:** 2024-10-14 01:16:03 +03

**Time Remaining:** 3 hours and 59 minutes

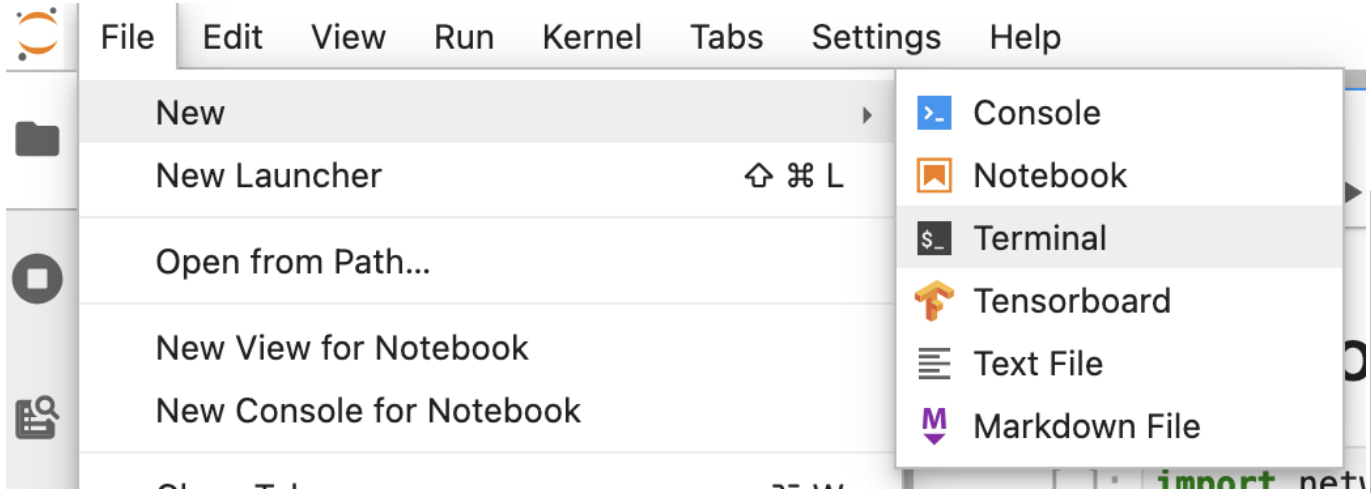
**Session ID:** febb8f9a-1b01-4377-addd-1ac1ff4e6ceb

Connect to Jupyter




https://github.com/TRUBA-HPC/MLforMultipleDomains

# Jupyter Notebook: Open OnDemand




EUROCC4SEE.ipynb | Terminal 1

```
Apptainer> nvidia-smi
Mon Oct 14 01:20:24 2024
+-----------------------------------------------------------------------------------------+
| NVIDIA-SMI 550.90.07              Driver Version: 550.90.07      CUDA Version: 12.4     |
|-----------------------------------------+------------------------+----------------------+
| GPU  Name                 Persistence-M | Bus-Id          Disp.A | Volatile Uncorr. ECC |
| Fan  Temp   Perf          Pwr:Usage/Cap |           Memory-Usage | GPU-Util  Compute M. |
|                                         |                        |               MIG M. |
|=========================================+========================+======================|
|   0  Tesla V100-SXM2-16GB           Off |   00000000:61:00.0 Off |                    0 |
| N/A   33C    P0             54W /  300W |       1MiB /  16384MiB |      0%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+
|   1  Tesla V100-SXM2-16GB           Off |   00000000:62:00.0 Off |                    0 |
| N/A   33C    P0             54W /  300W |       1MiB /  16384MiB |      0%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+
|   2  Tesla V100-SXM2-16GB           Off |   00000000:89:00.0 Off |                    0 |
| N/A   34C    P0             54W /  300W |       1MiB /  16384MiB |      1%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+
|   3  Tesla V100-SXM2-16GB           Off |   00000000:8A:00.0 Off |                    0 |
| N/A   35C    P0             53W /  300W |       1MiB /  16384MiB |      0%      Default |
|                                         |                        |                  N/A |
+-----------------------------------------+------------------------+----------------------+

+-----------------------------------------------------------------------------------------+
| Processes:                                                                              |
|  GPU   GI   CI        PID   Type   Process name                              GPU Memory |
|        ID   ID                                                               Usage      |
|=========================================================================================|
|  No running processes found                                                             |
+-----------------------------------------------------------------------------------------+
Apptainer>
```

https://github.com/TRUBA-HPC/MLforMultipleDomains

# Jupyter Notebook: SLURM

Sample SLURM file to run Python code on akya-cuda:

- The limitations on GPU nodes
  - 10*[GPU_NUMBER] for akya-cuda cluster
    (4xV100s on one node)

- Submit the slurm file to the system to run your code
  $> sbatch slurmname.sh

```
#!/bin/bash
#SBATCH -A egitim
#SBATCH -J MLtest
#SBATCH --partition=akya-cuda
#SBATCH --gres=gpu:1
#SBATCH -N 1
#SBATCH -n 10
#SBATCH --cpus-per-task=1
#SBATCH --reservation=eurocc
#SBATCH --time=2:00:00
#SBATCH --output=%A.out
#SBATCH --error=%A.err

eval "$(/truba/home/egitim/miniconda3/bin/conda shell.bash hook)"
conda activate envname

python youcode.py

exit
```

https://slurm.schedmd.com/sbatch.html

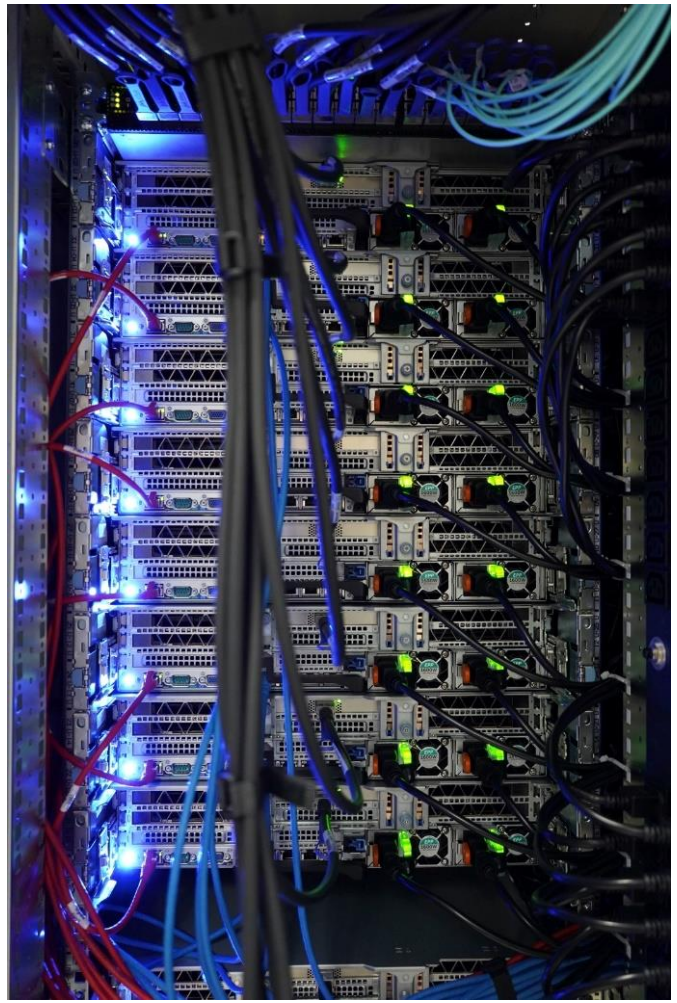
# Machine Learning for Multiple Domains: From Concepts to Implementation

***Interactive Session: HPC Technical Support for Hands-on***
***15 October 2024,  13:30 – 14:00 GMT+3 (12:30-13:00 CET)***

TRUBA
Turkish Science e-Infrastructure

TÜBİTAK ULAKBİM

# Thank You!



**User Support**

grid-teknik@ulakbim.gov.tr

**TRUBA HPC Center**

http://www.truba.gov.tr

http://docs.truba.gov.tr

http://portal.truba.gov.tr

https://twitter.com/TrubaUlakbim

https://www.linkedin.com/company/truba

EURO²