



Deep Learning

Infrastructure du mésocentre de calcul GRICAD

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LABORATOIRE
JEAN KUNTZMANN
MATHÉMATIQUES APPLIQUÉES - INFORMATIQUE



UMS : Unité Mixte de Services ayant pour tutelle CNRS, UGA, GINP, INRIA

Missions principales :

- **Accompagnement et conseils** aux chercheurs sur leurs besoins liés au calcul et aux données
- **Mise à disposition** de l'ensemble des chercheurs et personnels en support de la recherche d'infrastructures avancées et mutualisées pour le calcul intensif et l'exploitation des données de la recherche

Contacts

Mail : gricad-contact@univ-grenoble-alpes.fr

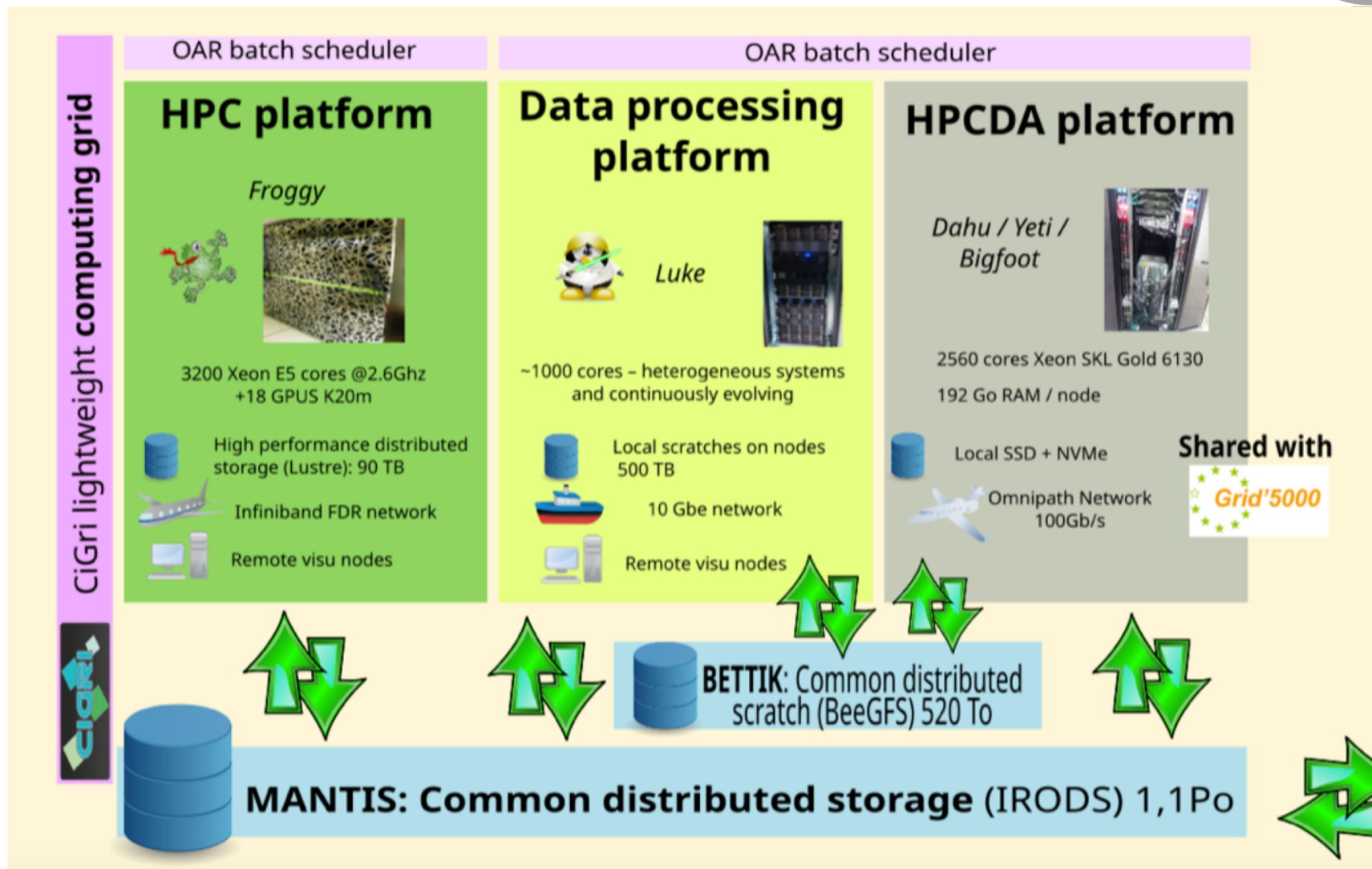
Site web : <https://gricad.univ-grenoble-alpes.fr/>



Les services mis à disposition des personnels de la recherche du site grenoblois :

- Plateformes de développement logiciel et de travail collaboratif (GitLab, JupyterHub)
- VM à la demande (plateforme OpenStack)
- Expertise Calcul scientifique et traitement massif de données
- Ingénierie de la donnée
- Exploitation du mésocentre de calcul grenoblois

Dans le cadre de nos activités, nous sommes quotidiennement amenés à expertiser, packager ou développer des codes logiciels pour la recherche





Quel cluster pour quel usage ?

- Le calcul massivement parallèle : Froggy et Dahu
- L'analyse ou le traitement de données (jobs séquentiels) : Luke ou la grille
- Calcul sur GPU : nœuds spécifiques

La grille (CiGri)

- Utilisation optimale des ressources (mode best effort)
- Intéressant pour un grand nombre de jobs utilisant peu de ressources (qqes coeurs max)
- Re-soumission automatique

Types de matériels disponibles



SPECIFICATIONS



**Tesla V100
PCIe**

**Tesla V100
SXM2**

	NVIDIA Volta	
GPU Architecture	NVIDIA Volta	
NVIDIA Tensor Cores	640	
NVIDIA CUDA® Cores	5,120	
Double-Precision Performance	7 TFLOPS	7.8 TFLOPS
Single-Precision Performance	14 TFLOPS	15.7 TFLOPS
Tensor Performance	112 TFLOPS	125 TFLOPS
GPU Memory	32GB /16GB HBM2	
Memory Bandwidth	900GB/sec	
ECC	Yes	
Interconnect Bandwidth	32GB/sec	300GB/sec
System Interface	PCIe Gen3	NVIDIA NVLink
Form Factor	PCIe Full Height/Length	SXM2
Max Power Consumption	250 W	300 W
Thermal Solution	Passive	
Compute APIs	CUDA, DirectCompute, OpenCL™, OpenACC	

TECHNICAL SPECIFICATIONS

	Tesla K40
Peak double-precision floating point performance (board)	1.43 Tflops
Peak single-precision floating point performance (board)	4.29 Tflops
GPU	1 x GK110B
CUDA cores	2,880
Memory size per board (GDDR5)	12 GB
Memory bandwidth for board (ECC off) ²	288 Gbytes/sec
Architecture features	SMX, Dynamic Par
System	Servers and workstations



Bigfoot : 3 serveurs comprenant 4 NVIDIA NV100 NVLINK Dediés **Multi-GPU** 300Gb/s vs 32Gb/s (PCI-e)

```
cougoulg@bigfoot2:~$ nvidia-smi
Wed Mar 27 14:22:21 2019

+-----+
| NVIDIA-SMI 410.48          Driver Version: 410.48          |
+-----+-----+-----+
| GPU Name      Persistence-M| Bus-Id        Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap|      Memory-Usage | GPU-Util  Compute M. |
+-----+-----+-----+-----+
| 0  Tesla V100-SXM2...  Off | 00000000:1A:00.0 Off |          0 |
| N/A   38C   P0   57W / 300W |  0MiB / 32480MiB |  0%      Default |
+-----+-----+-----+-----+
| 0  Tesla V100-SXM2...  Off | 00000000:1B:00.0 Off |          0 |
| N/A   38C   P0   57W / 300W |  0MiB / 32480MiB |  0%      Default |
+-----+-----+-----+-----+
| 1  Tesla V100-SXM2...  Off | 00000000:1C:00.0 Off |          0 |
| N/A   34C   P0   55W / 300W |  0MiB / 32480MiB |  0%      Default |
+-----+-----+-----+-----+
| 2  Tesla V100-SXM2...  Off | 00000000:1D:00.0 Off |          0 |
| N/A   34C   P0   56W / 300W |  0MiB / 32480MiB |  0%      Default |
+-----+-----+-----+-----+
```



Luke :

2 noeuds comprenant 2 NVIDIA K40m 16GB

1 noeud comprenant 2 NVIDIA K20m

Froggy :

9 noeuds comprenant 2 Nvidia K20m

```
| 0 Tesla K20m      Off | 00000000:02:00.0 Off |      0 |
| N/A 36C  P0  50W / 225W |  0MiB / 4742MiB |    0% | Default |
+-----+-----+-----+
| 1 Tesla K20m      Off | 00000000:84:00.0 Off |      0 |
| N/A 37C  P0  51W / 225W |  0MiB / 4742MiB |   81% | Default |
+-----+-----+-----+
```




Formations CED-Maimosine-GRICAD

<https://pole-calcul-formation.gricad-pages.univ-grenoble-alpes.fr/ced/>

Les bases du système Linux pour le calcul scientifique

Outils pour le développement et l'utilisation de logiciels de calcul scientifique

Introduction au calcul parallèle

Utilisateurs Windows : client ssh

Putty ou Ubuntu Windows 10 etc...

```
cougoulg — -bash — 80x24
Last login: Sun Jun 2 10:52:39 on ttys000
(base) okami:~ cougoulg$
```

Avoir un compte et un projet : Perseus



<https://perseus.ujf-grenoble.fr>

perseus.ujf-grenoble.fr

Login New Account

CIMENT

PERSEUS: PERSONal Space for cimEnt USERS

FROGGY

LIFE

[What is perseus?](#)

login:

password:

No account yet? You can [get a new account](#).

[\[Lost your password ?\]](#)


[Get CIMENT certificate](#)

Documentations



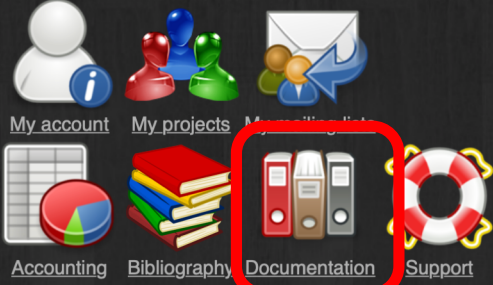
perseus.ujf-grenoble.fr

Log Out (cougoulg) Home Projects



PERSEUS: PERsonal Space for cimEnt USERS

Home of Glenn Cougoulat (cougoulg)
Your account is currently: Active
[CIMENT charter](#) (accepted on 2017-06-12)



My account My projects My messages
Accounting Bibliography **Documentation** Support

Clefs SSH / comment se connecter / usages etc...

Ressources disponibles : status des serveurs



<https://ciment-grid.univ-grenoble-alpes.fr>

```
cougoulg@f-dahu:~$ chandler
bigfoot1: [Free]
bigfoot3: [Besteffort]
dahu33: [Free]
dahu35: [Free]
dahu37: [Besteffort]
dahu39: [Besteffort]
dahu41: [Besteffort]
dahu43: [Besteffort]
dahu45: [Besteffort]
dahu47: [Besteffort]
dahu49: [Besteffort]
dahu51: [Besteffort]
dahu53: [Besteffort]
dahu55: [Besteffort]
dahu57: [Besteffort]
dahu59: [Besteffort]
dahu61: [Besteffort]
dahu63: [Free]
dahu65: [Free]
dahu67: [Free]
dahu69: [Free]
dahu71: [Free]
bigfoot2: [Free]
dahu34: [Free]
dahu36: [Besteffort]
dahu38: [Besteffort]
dahu40: [Besteffort]
dahu42: [Besteffort]
dahu44: [Besteffort]
dahu46: [Besteffort]
dahu48: [Besteffort]
dahu50: [Besteffort]
dahu52: [Besteffort]
dahu54: [Besteffort]
dahu56: [Besteffort]
dahu58: [Besteffort]
dahu60: [Standby]
dahu62: [Job]
dahu64: [Standby]
dahu66: [Standby]
dahu68: [Standby]
dahu70: [Standby]
dahu72: [Free]
```

[Free] [Besteffort] [Standby] [Job] [Suspected] [Absent] [Dead]

153 jobs, 1376 resources, 0 down, 851 used

User	Jobs running	Jobs waiting	Resources	Nodes
jbeaumet	2	0	16	2
chevremw	4	0	16	3
kimang18	1	0	1	1
juanpelvis	1	48	18	1
tintest	96	0	768	25
lguensar	1	0	32	1

```
cougoulg@f-dahu:~$
```

CIMET Grid Server

Welcome!

CiGri

- [Grid docs](#)

Clusters status

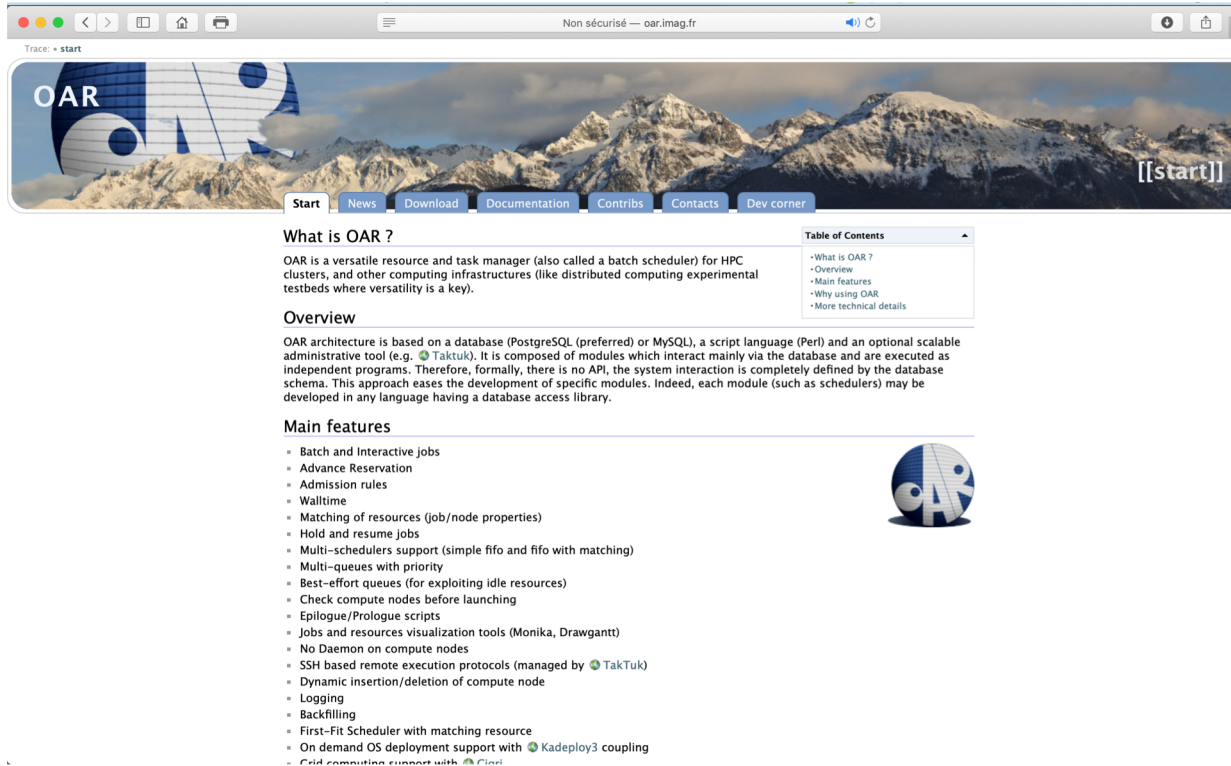
- Froggy: [Monika](#), [Drawgantt](#), [Colmet](#)
- Luke: [Monika](#), [Drawgantt](#), [Luke home disk usage](#)
- Dahu: [Monika](#), [Drawgantt](#), [Colmet](#)
- Gofree: [Monika](#), [Drawgantt](#), [Ganglia](#), [Temperatures](#), [Power](#)

Bettik BeeGFS Storage

- [Bettik disk usage](#)
- [Bettik data age](#)
- [Bettik performance](#)
 - from luke open the <http://bettik-meta1.u-ga.fr:8000> link
 - then open the downloaded file with : `java -jar "file"`
 - login:information/passwd:bettik

Mantis iRODS Storage

- [iRODS Browser](#)
- [Mantis resource usage](#)



The screenshot shows the OAR website interface. At the top, there's a navigation bar with links: Start, News, Download, Documentation, Contribs, Contacts, and Dev corner. Below the navigation bar, there's a section titled "What is OAR ?" with a "Table of Contents" dropdown menu. The "Table of Contents" menu is open, showing options: "What is OAR ?", "Overview", "Main features", "Why using OAR", and "More technical details". The "Overview" section is selected, and its content is displayed below. The "Main features" section is also visible, listing various capabilities of OAR.

Trace: ▶ start

Non sécurisé — oarimag.fr

OAR

[[start]]

Start News Download Documentation Contribs Contacts Dev corner

What is OAR ?

OAR is a versatile resource and task manager (also called a batch scheduler) for HPC clusters, and other computing infrastructures (like distributed computing experimental testbeds where versatility is a key).

Overview

OAR architecture is based on a database (PostgreSQL (preferred) or MySQL), a script language (Perl) and an optional scalable administrative tool (e.g. [Taktuk](#)). It is composed of modules which interact mainly via the database and are executed as independent programs. Therefore, formally, there is no API, the system interaction is completely defined by the database schema. This approach eases the development of specific modules. Indeed, each module (such as schedulers) may be developed in any language having a database access library.

Main features

- Batch and Interactive jobs
- Advance Reservation
- Admission rules
- Walltime
- Matching of resources (job/node properties)
- Hold and resume jobs
- Multi-schedulers support (simple fifo and fifo with matching)
- Multi-queues with priority
- Best-effort queues (for exploiting idle resources)
- Check compute nodes before launching
- Epilogue/Prologue scripts
- Jobs and resources visualization tools (Monika, Drawgantt)
- No Daemon on compute nodes
- SSH based remote execution protocols (managed by [TakTuk](#))
- Dynamic insertion/deletion of compute node
- Logging
- Backfilling
- First-Fit Scheduler with matching resource
- On demand OS deployment support with [Kadeploy3](#) coupling
- Grid computing support with [Gis](#)

Table of Contents

- What is OAR ?
- Overview
- Main features
- Why using OAR
- More technical details

Cas particulier de la demande d'un nœud GPU en interactif

```
oarsub -I --project mon_projet -t gpu -l /nodes=1
```

Charger l'environnement CUDA et Conda



```
source /applis/environments/cuda_env.sh cluster_name cuda_toolkit
```

Ex : Dahu toolkit Cuda 10
source /applis/environments/cuda_env.sh dahu 10.0

```
source /applis/environments/conda.sh
```

Ex d'utilisation : conda activate GPU



Environnement de développement python3 avec les librairies usuelles
Pytorch, Keras, Tensorflow, scikit-learn etc...

Possibilité de créer son environnement personnel cf. conda cheat sheet
Ex : conda list pour la liste des paquets

Pas d'utilisation de NIX gestionnaire recommandé

Problèmes ? Questions ? Gestionnaire de ticket



<https://sos-gricad.univ-grenoble-alpes.fr/>

Accueil | Rechercher | Reports | Outils | Connecté en tant que cougoulg

RT pour sos-gricad

Créer un ticket dans Calcul Q-Recherche

RT en un coup d'œil

Mes 10 tickets de plus haute priorité

Les 10 derniers tickets sans intervenant

Tickets favoris

Création rapide de ticket

Sujet:

File: Calcul Intervenant: Moi

Demandeurs: Glenn.COUGOULAT@univ-grenoble-alpes.fr

Contenu:

Ajouter

Mes rappels

Liste de files

File	nouveau	ouvert	stagnant
Calcul	2	15	-
Spam	-	-	-
SuiviAdmin	-	1	-

Tableaux de bord

Actualiser

Ne pas actualiser cette page.

Go !

Démonstration



```
PROBLEMES SORTIE CONSOLE DE DEBLOGAGE TERMINAL
```

```
Step: 161ms | 1 [ 0.7% ] 9 [ 1.3% ] 17 [ 3.3% ] 25 [ 2.6% ]
Step: 1499ms | 2 [ 3.3% ] 10 [ 0.0% ] 18 [ 2.6% ] 26 [ 0.0% ]
Step: 1540ms | 3 [ 0.0% ] 11 [ 5.9% ] 19 [ 0.0% ] 27 [ 1.3% ]
Step: 155ms | 4 [ 2.6% ] 12 [ 0.0% ] 20 [ 0.0% ] 28 [ 4.0% ]
Step: 151ms | 5 [ 2.7% ] 13 [ 6.0% ] 21 [ 0.0% ] 29 [ 2.0% ]
Step: 163ms | 6 [ 0.0% ] 14 [ 0.0% ] 22 [ 2.0% ] 30 [ 0.0% ]
Step: 997ms | 7 [ 0.0% ] 15 [ 0.7% ] 23 [ 0.7% ] 31 [ 0.0% ]
Step: 165ms | 8 [ 0.0% ] 16 [ 9.9% ] 24 [ 2.6% ] 32 [ 2.7% ]
Step: 972ms | Mem [ 10.776280GiB ] Tasks: 33 96 1ms 1 run/mem
Step: 1510ms | Load Average: 0.34 0.24 0.10
Step: 165ms | Uptime: 1 day, 21:51:59
```

```
Step: 998ms | PID USER PRI NI VIRT RES SHR S CPU MEM% TIME+ Command
Step: 161ms | 28919 root 20 0 23.00 24950 1100 S 0.6 1.3 0:17.36 python main.py
Step: 188ms | 28918 root 20 0 23.00 25431 1100 S 0.6 1.3 0:17.84 python main.py
Step: 25727ms | 28941 root 20 0 36.30 9.76 7290 S 5.2 5.2 0:06.65 python main.py
Step: 161ms | 28942 root 20 0 36.30 9.76 7290 S 3.3 5.2 0:04.60 python main.py
Step: 1520ms | 28943 root 20 0 36.30 9.76 7290 S 3.3 5.2 0:04.20 python main.py
Step: 189ms | 28944 root 20 0 36.30 9.76 7290 S 2.6 5.2 0:04.15 python main.py
Step: 24628ms | 28783 root 20 0 13180 3620 2536 R 1.3 0.0 0:01.71 htopin main.py
Step: 163ms | 28925 root 20 0 36.30 9.76 7290 S 0.7 5.2 0:00.07 python main.py
Step: 25723ms | 28916 root 20 0 36.30 9.76 7290 S 0.7 5.2 0:00.07 python main.py
Step: 188ms | 28926 root 20 0 23.00 24950 1100 S 0.6 1.3 0:00.04 python main.py
Step: 1593ms | 28923 root 20 0 23.00 25035 1100 S 0.0 1.3 0:00.04 python main.py
Step: 161ms | 28928 root 20 0 36.30 9.76 7290 S 0.0 5.2 0:00.06 python main.py
Step: 1516ms | 25335 root 20 0 1190 8628 7356 S 0.0 0.0 0:00.11 sshd: root@pts/2
Step: 983ms | 1261 root 20 0 35160 3476 2868 S 0.0 0.0 0:30.71 /usr/sbin/irqbalance -
Step: 161ms | 28916 root 20 0 36.30 9.76 7290 S 0.0 5.2 0:00.00 python main.py
Step: 829ms | 28926 root 20 0 23.00 24950 1100 S 0.0 1.3 0:00.03 python main.py
Step: 164ms | 25341 root 20 0 11290 4392 2540 S 0.0 0.0 0:00.12 -bash
Step: 728ms | 28978 root 20 0 36.30 9.76 7290 S 0.0 5.2 0:00.04 python main.py
Step: 163ms | 25335 root 20 0 1190 8618 7356 S 0.0 0.0 0:00.09 sshd: root@pts/2
Step: 778ms | 1269 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.00 /usr/sbin/mcscd
Step: 162ms | 1270 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.00 /usr/sbin/mcscd
Step: 832ms | 1271 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.04 /usr/sbin/mcscd
Step: 189ms | 1272 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.04 /usr/sbin/mcscd
Step: 885ms | 1273 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.05 /usr/sbin/mcscd
Step: 178ms | 1274 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.04 /usr/sbin/mcscd
Step: 878ms | 1275 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.05 /usr/sbin/mcscd
Step: 189ms | 1263 root 20 0 3000 6284 4860 S 0.0 0.0 0:00.00 /usr/sbin/mcscd
Step: 963ms | 1277 root 20 0 2300 3128 2396 S 0.0 0.0 0:00.12 /usr/sbin/rysdlog -n
Step: 159ms | 1278 root 20 0 2300 3128 2396 S 0.0 0.0 0:00.00 /usr/sbin/rysdlog -n
Step: 892ms | 1279 root 20 0 2300 3128 2396 S 0.0 0.0 0:00.13 /usr/sbin/rysdlog -n
Step: 189ms | 1264 root 20 0 2300 3128 2396 S 0.0 0.0 0:00.22 /usr/sbin/rysdlog -n
Step: 914ms | 1301 root 20 0 64072 6228 5400 S 0.0 0.0 0:00.02 /usr/sbin/sshd -D
Step: 167ms | 1319 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.71 /opt/beegfs/sbin/beegf
Step: 666ms | 1320 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 162ms | 1321 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 657ms | 1322 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 164ms | 1323 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 15293ms | 1325 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 161ms | 1326 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 954ms | 1327 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 162ms | 1328 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 1596ms | 1329 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 161ms | 1330 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 1313ms | 1331 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 189ms | 1333 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 3574ms | 1334 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
Step: 1315ms | 1335 root 20 0 49050 2472 1876 S 0.0 0.0 0:00.00 /opt/beegfs/sbin/beegf
```

```
root@bigfoot1-4:~# nvidia-smi
Fri Dec 21 15:00:08 2018

+-----+
| NVIDIA-SMI 384.145                | Driver Version: 384.145 |
+-----+-----+-----+-----+-----+
| GPU Name      Persistence-M | Bus-Id  Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap |  Memory-Usage | GPU-Util  Compute M. |
+-----+-----+-----+-----+-----+
| 0  Tesla V100-SM2...  Off  | 00000000:1A:00:0  Off  |
| N/A   30C    P0   50W / 300W | 1729MiB / 3250MiB |      0%      Default  |
+-----+-----+-----+-----+-----+
| 1  Tesla V100-SM2...  Off  | 00000000:1C:00:0  Off  |
| N/A   34C    P0   50W / 300W | 1640MiB / 3250MiB |      0%      Default  |
+-----+-----+-----+-----+-----+
| 2  Tesla V100-SM2...  Off  | 00000000:1D:00:0  Off  |
| N/A   36C    P0   50W / 300W | 1640MiB / 3250MiB |      0%      Default  |
+-----+-----+-----+-----+-----+
| 3  Tesla V100-SM2...  Off  | 00000000:1E:00:0  Off  |
| N/A   39C    P0   50W / 300W | 1648MiB / 3250MiB |      0%      Default  |
+-----+-----+-----+-----+-----+

Processes:                               GPU Memory
GPU   PID  Type  Process name                               Usage
+-----+-----+-----+-----+-----+
| 0   28825  C    python                                     1719MiB |
| 1   28825  C    python                                     1630MiB |
| 2   28825  C    python                                     1630MiB |
| 3   28825  C    python                                     1639MiB |
+-----+-----+-----+-----+-----+

root@bigfoot1-4:~# nvidia-smi
Fri Dec 21 15:00:08 2018

+-----+
| NVIDIA-SMI 384.145                | Driver Version: 384.145 |
+-----+-----+-----+-----+-----+
| GPU Name      Persistence-M | Bus-Id  Disp.A | Volatile Uncorr. ECC |
| Fan  Temp  Perf  Pwr:Usage/Cap |  Memory-Usage | GPU-Util  Compute M. |
+-----+-----+-----+-----+-----+
| 0  Tesla V100-SM2...  Off  | 00000000:1A:00:0  Off  |
| N/A   30C    P0   50W / 300W | 1728MiB / 3250MiB |     15%      Default  |
+-----+-----+-----+-----+-----+
| 1  Tesla V100-SM2...  Off  | 00000000:1C:00:0  Off  |
| N/A   34C    P0   50W / 300W | 1640MiB / 3250MiB |     13%      Default  |
+-----+-----+-----+-----+-----+
| 2  Tesla V100-SM2...  Off  | 00000000:1D:00:0  Off  |
| N/A   36C    P0   50W / 300W | 1640MiB / 3250MiB |     14%      Default  |
+-----+-----+-----+-----+-----+
| 3  Tesla V100-SM2...  Off  | 00000000:1E:00:0  Off  |
| N/A   39C    P0   50W / 300W | 1648MiB / 3250MiB |     13%      Default  |
+-----+-----+-----+-----+-----+

Processes:                               GPU Memory
GPU   PID  Type  Process name                               Usage
+-----+-----+-----+-----+-----+
| 0   28825  C    python                                     1719MiB |
| 1   28825  C    python                                     1630MiB |
| 2   28825  C    python                                     1630MiB |
| 3   28825  C    python                                     1639MiB |
+-----+-----+-----+-----+-----+
```

```
root@bigfoot1-4:~#
```

```
1: ssh, ssh, ssh
```

```
169/908 s | Loss: 0.128 | Acc: 96.800% (5329/5488)
```

```
Map F_Setup Search F_Allip F_Line F_Gortrip Wics #P0icc F_V11 F1001
```