

INTRODUCTION TO HAICGU

Cluster Documentation

<https://haicgu.github.io>

Hardware:

- Compute and Development Nodes
 - 2 x Kunpeng 920 processor (ARMv8 AArch64; 64 cores; 2.6GHz; 180W)
 - 128GB main memory (16x 8GB, one DIMM per channel)
 - 1x 100Gbit/s EDR Infiniband HCA
- AI Training Node
 - 4 x Kunpeng 920 processor (ARMv8 AArch64; 64 cores; 2.6GHz; 180W)
 - 8 x Huawei Ascend 910 NPU (32GB HBM2)
 - 1024GB main memory (32x32GB, DDR4-2933)
- AI Inference Node
 - 2 x Kunpeng 920 processor (ARMv8 AArch64; 64 cores; 2.6GHz; 180W)
 - 5 x Huawei Atlas 300 AI Inference Card (32GB)
 - 512GB main memory (16x32GB, DDR4-2933)
- IO Nodes
 - Metadata: 2x960GB SSD SATA (RAID 1)
 - Object storage: 32x1.2TB HDD SAS (RAID 10)

Software

Operating System	Rocky Linux 8.7
Workload Manager	SLURM 21.08.4
Software Stack	EasyBuild-based, custom repository, system-specific optimizations
Libraries, Frameworks and Tools	BLIS, OpenBLAS, FFTW, GCC, ACfL, BiSheng, PyTorch, TensorFlow, MindSpore, ... (Tell us what you need)

Access

- Usually: Request via email to

`haicgu@fias.uni-frankfurt.de`

- Supply
 - Full Name
 - Email address
 - Public SSH key in OpenSSH format
- Today: Please fill spreadsheet

Access

Add the following to your ~/.ssh/config:

```
Host guoehi
  HostName 141.2.112.17
  User yourusername
  ServerAliveInterval 60
  IdentityFile /path/to/your/private/ssh/key
  IdentitiesOnly yes
Host guoehi-dev
  HostName dev
  user yourusername
  IdentityFile /path/to/your/private/ssh/key
  ProxyCommand ssh -q -W %h:%p guoehi
```

Log directly onto the development node:

```
~ ▶ ssh guoehi-dev  
Last login: Mon Jan 16 22:39:59 2023 from 192.168.23.1  
[snassyr@dev ~]$
```

Don't log onto the login node (guoehi), you won't be able to work there

- AI Hardware requires you to be in the hiai group
- If you haven't requested this so far, but need access, please

```
touch ~/hiai
```


Modules

The software stack is exposed to users as modules. List available packages with

```
module avail
```

```
----- Compilers in Stage 2022a -----
BiSheng-compiler/2.3.0  GCC/9.5.0  GCC/12.1.0 (D)  armlinux/22.0.1

----- Core modules in Stage 2022a -----
EasyBuild/4.5.5          alompi/22.0.1          gompi/2022a.9          help2man/1.49.2
Java/8.292.10             alplompi/22.0.1        gompi/2022a.12 (D)    tmux/3.3a
Java/11.0.15              (D) armlinux-install/22.0.1  goolf/2022a.9          zsh/5.8.1
Julia/1.8.2-linux-aarch64 flex/2.6.4              goolf/2022a.12 (D)

----- Architectures -----
Architecture/Kunpeng920 (S)  Architecture/somearch (S,D)

----- Custom modules -----
arm-optimized-routines/21.02 (L)
...
```

Most modules are only available after loading a compiler and OpenMPI

```
[snassyr@dev ~]$ module load GCC/9.5.0 OpenMPI
[snassyr@dev ~]$ module av
```

```
----- Modules built with GCC 9.5.0 and OpenMPI 4.1.3 -----
Arrow/7.0.0-Python-3.7.5          PyTorch-CANN/1.5.0-Python-3.7.5
Boost/1.79.0-Python-3.7.5         ScaLAPACK/2.2.0-OpenBLAS-0.3.20
CANN-Toolkit/5.0.4.alpha005-Python-3.7.5  SciPy-Stack/2022a-Python-3.7.5
CANN-tf2plugin/1.7.0-Python-3.7.5      SciPy-Stack/2022a-Python-3.10.4 (D)
CANN-tfplugin/1.9.0-Python-3.7.5      TensorFlow-CANN-Core/1.15.0-Python-3.7.5
FFTW/3.3.10                      TensorFlow-CANN-Core/2.4.1-Python-3.7.5 (D)
HDF5/1.10.9                      TensorFlow-CANN/1.15.0-Python-3.7.5
HDF5/1.12.2                      TensorFlow-CANN/2.4.1-Python-3.7.5 (D)
MindSpore-deps/1.8.1-Python-3.7.5      apex/0.1-Python-3.7.5
MindSpore/1.6.2-Python-3.7.5          h5py/3.6.0-Python-3.7.5
OpenCV/4.5.5-Python-3.7.5             mpi4py/3.1.3-Python-3.7.5
```

```
----- MPI runtimes available for GCC 9.5.0 -----
OpenMPI/4.1.3 (L)
```

```
----- Modules compiled with GCC 9.5.0 -----
Autotools/20220509                absl-py/1.0.0-Python-3.7.5
Bazel/0.26.1                      c-ares/1.18.1
Bazel/0.27.2                      cURL/7.82.0
```

Make sure you're using correct tools

```
[snassyr@dev ~]$ gcc --version
gcc (GCC) 8.5.0 20210514 (Red Hat 8.5.0-15)
Copyright (C) 2018 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

[snassyr@dev ~]$ module load GCC/9.5.0
[snassyr@dev ~]$ gcc --version
gcc (GCC) 9.5.0
Copyright (C) 2019 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

[snassyr@dev ~]$ module swap GCC/9.5.0 GCC/12.1.0

Due to MODULEPATH changes, the following have been reloaded:
  1) binutils/.2.38

The following have been reloaded with a version change:
  1) GCC/9.5.0 => GCC/12.1.0      2) GCCcore/.9.5.0 => GCCcore/.12.1.0

[snassyr@dev ~]$ gcc --version
gcc (GCC) 12.1.0
Copyright (C) 2022 Free Software Foundation, Inc.
This is free software; see the source for copying conditions.  There is NO
warranty; not even for MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE.

[snassyr@dev ~]$ █
```

Path to module root

```
[snassy@dev ~]$ module load GCC/9.5.0 OpenMPI
[snassy@dev ~]$ echo $EBROOTOPENMPI
/software/kp920-RL8/Stages/2022a/software/OpenMPI/4.1.3-GCC-9.5.0
[snassy@dev ~]$ ls $EBROOTOPENMPI/
bin  easybuild  etc  include  lib  lib64  share
[snassy@dev ~]$
```

For AI Frameworks/Toolkits, load GCC/9.5.0 and
OpenMPI first

```
[snassyr@dev ~]$ module load GCC/9.5.0 OpenMPI
[snassyr@dev ~]$ module load TensorFlow-CANN
[snassyr@dev ~]$ srun -p a800-9000 python -c "import tensorflow as tf; print(tf.version.VERSION)"
2.4.1
[snassyr@dev ~]$
```

- Modules are preferred to containers/external binaries/self-built libraries/tools
- If something is not available, ask us first

Working with SLURM

- Partitions:
 - arm-kunpeng920: compute
 - a800-9000: training
 - a800-3000: inference
- Submit job to appropriate partitions
- Accelerated PyTorch/MindSpore/TensorFlow only on a800-* partitions

Node state:

```
[snassyr@dev ~]$ sinfo
PARTITION      AVAIL  TIMELIMIT  NODES  STATE NODELIST
arm-kunpeng920* up      infinite    2    down* cn[01-02]
arm-kunpeng920* up      infinite   25    idle  cn[03-07,09-28]
arm-kunpeng920* up      infinite    1    down  cn08
a800-9000       up      infinite    1    idle  ml01
a800-3000       up      infinite    1    idle  ml02
[snassyr@dev ~]$
```


Submit simple jobs

```
[snassyr@dev ~]$ srun -p arm-kunpeng920 uname -m  
aarch64  
[snassyr@dev ~]$ █
```

Submit batch jobs

```
[snassyr@dev test]$ pygmentize -g batchscript.sh
#!/bin/bash
#SBATCH --partition=a800-9000
#SBATCH --time=00:01:00
#SBATCH --ntasks=1
#SBATCH --nodes=1

module load GCC/9.5.0 OpenMPI PyTorch-CANN

srun python -c "import torch; print(torch.__version__)"
[snassyr@dev test]$ sbatch batchscript.sh
Submitted batch job 3024
[snassyr@dev test]$ cat slurm-3024.out
1.5.0
[snassyr@dev test]$
```

View job queue

```
[snassyr@dev test]$ squeue
      JOBID PARTITION     NAME     USER ST       TIME  NODES NODELIST(REASON)
      3025  a800-9000 batchscr  snassyr  R        0:02      1 ml01
[snassyr@dev test]$
```

Questions?