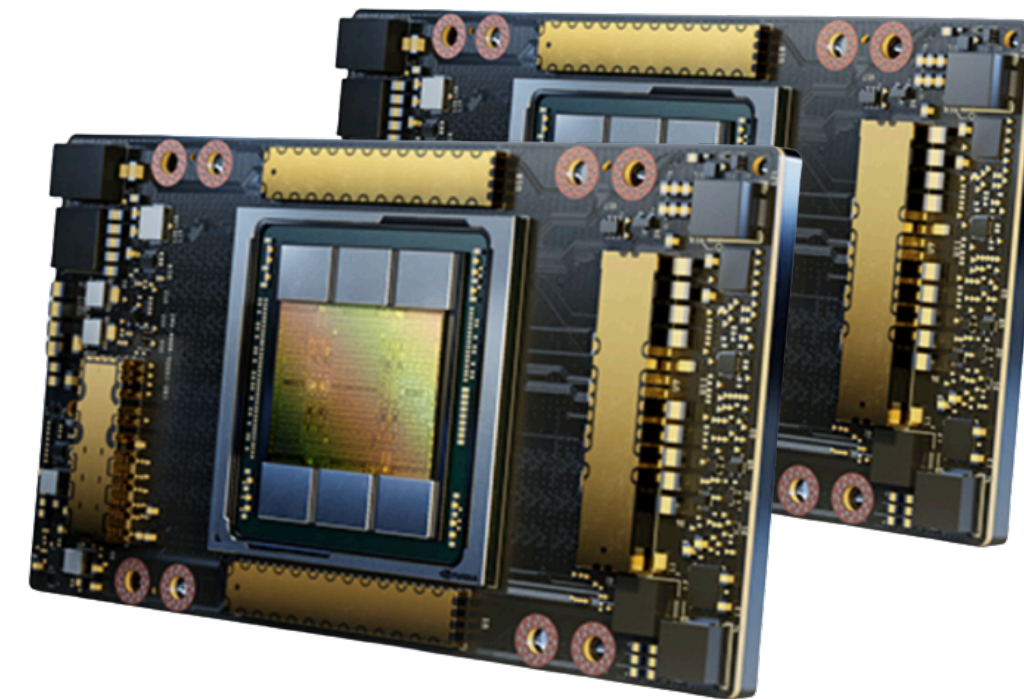


Kisski: Training Platform

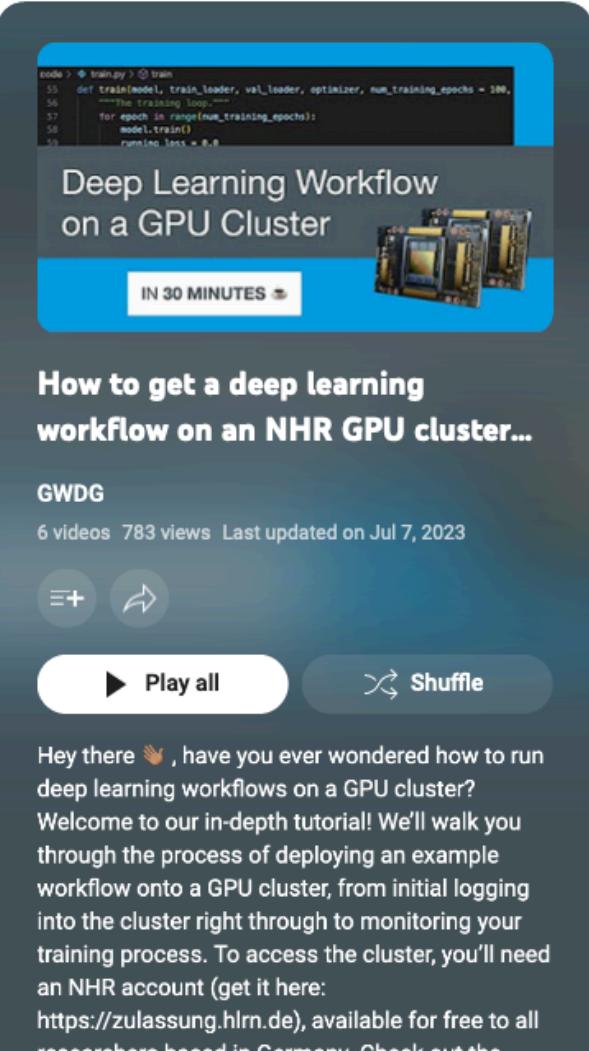
Introduction to Deep Learning Workflows on Kisski Infrastructure



Dorothea Sommer | GWDG | 20.12.2023

Look this up

1. 30 Minute Step-by-step Youtube Tutorial



Deep Learning Workflow on a GPU Cluster

IN 30 MINUTES

How to get a deep learning workflow on an NHR GPU cluster...

GWDG

6 videos · 783 views · Last updated on Jul 7, 2023

Play all Shuffle

Hey there 🙋, have you ever wondered how to run deep learning workflows on a GPU cluster? Welcome to our in-depth tutorial! We'll walk you through the process of deploying an example workflow onto a GPU cluster, from initial logging into the cluster right through to monitoring your training process. To access the cluster, you'll need an NHR account (get it here: <https://zulassung.hlrn.de>), available for free to all researchers based in Germany. Check out the

1. Introduction + Resources [Deep Learning + GPU Tutorial]
GWDG · 439 views · 5 months ago
5:58
2. Cluster Setup [Deep Learning + GPU Tutorial]
GWDG · 604 views · 5 months ago
9:59
- 3.1 Slurm: Available GPU + sinfo [Deep Learning + GPU Tutorial]
GWDG · 235 views · 5 months ago
5:22
- 3.2 Slurm: Run code with srun [Deep Learning + GPU Tutorial]
GWDG · 297 views · 5 months ago
3:58
- 3.3 Slurm: Run code with sbatch [Deep Learning + GPU Tutorial]
GWDG · 496 views · 5 months ago
5:25
4. GPU Monitoring Basics [Deep Learning + GPU Tutorial]
GWDG · 272 views · 5 months ago
7:17

GWDG -> Playlist -> Deep learning workflow on a GPU cluster

<https://www.youtube.com/playlist?list=PLvcoSsXFNRbIM4AG5PZwY1AfYEW3EbD9O>

2. Example DL Code Repository

Dorothea Sommer > [deep-learning-with-gpu-cores](#)

Deep learning with GPU cores

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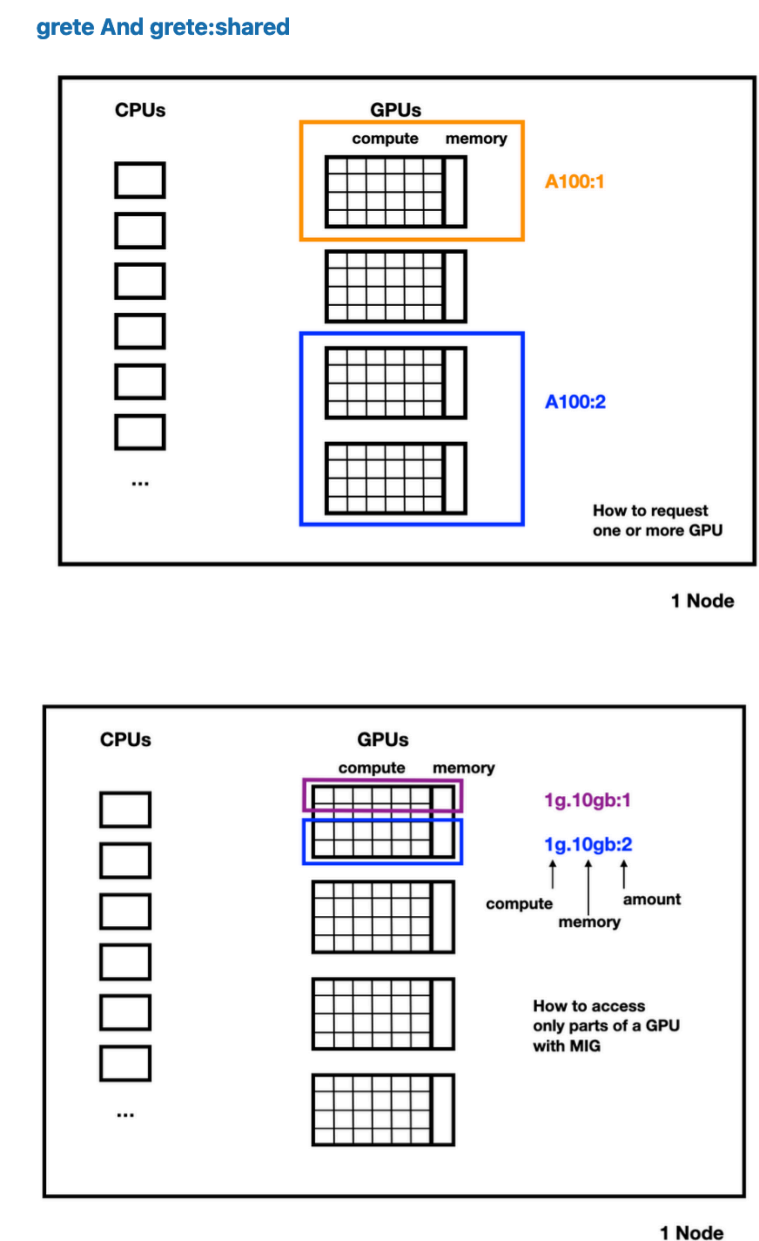
<https://gitlab-ce.gwdg.de/dmuelle3/deep-learning-with-gpu-cores>

4. Cluster concepts

“What scientist should know to efficiently use the Scientific Computing Cluster”

https://gitlab-ce.gwdg.de/hpc-team-public/science-domains-blog/-/blob/main/20230417_cluster-practical.md

3. GPU + Slurm Documentation



<https://www.hlrn.de/doc/display/PUB/GPU+Usage>

Helpful recipes for similar use cases!

What we'll cover

1 Setup

- Getting a user account
- Connecting to the cluster

2 Kisski Training Platform Setup

- Cluster Orientation + data perspective
- Loading DL environments

3 Running Code with Slurm

- Interactive working
- Scheduling longer jobs

4 Q&A

1. How to get access

1 Kisski website:

Service catalogue/
Leistungskatalog

Select:
Computing Resources/
Rechenressourcen

The screenshot shows the KISSKI website interface. At the top, the KISSKI logo is on the left, and navigation links 'Über uns', 'Zielgruppen', 'Leistungen', and 'Aktuelles' are on the right. Below the navigation, a large purple banner reads 'Alle Leistungen in der Ü'. To the right of the banner, a sidebar contains links for 'Leistungskatalog', 'Support', and 'FAQs'. Below the banner, a breadcrumb trail shows 'Home > Leistungen > Leistungskatalog'. The main heading is 'Infrastruktur'. A paragraph describes the services: 'Es werden Hardwareressourcen (Rechen- und Speicherressourcen), Softwareressourcen sowie allgemein verfügbare Modelle und Daten in Form von einfach zu beantragenden oder direkt buchbaren Services bereitgestellt. Diese können für Forschung, Entwicklung und Technik in den Bereichen Medizin und Energie genutzt werden. Die notwendige Datensicherheit bleibt dabei selbstverständlich gewährleistet.' Below this, two service cards are shown. The first card, 'Rechenressourcen', is highlighted with a red border and contains the text: 'GPU-basiertes HPC-System mit aktuellen NVIDIA A100 und H100 GPUs für Trainings- bzw. Inferenzaufgaben'. The second card, 'Sichere HPC Partition', contains the text: 'Isolierte Partition zur Verarbeitung besonders sensibler Daten (z.B. Gesundheitsdaten) auf all unseren Systemen, z.B. unsere GPU-basierten HPC-System mit aktuellen NVIDIA A100 und H100 GPUs.' To the right of the service cards, a navigation bar contains icons for 'FAQ', 'Support', and 'Book'. The 'Book' icon is highlighted with a red border. Below this bar, the 'Service type' is listed as 'Hardware', and the 'Contact person' is listed as 'Christian Boehme'.

KISSKI
KI-Servicezentrum für sensible
und kritische Infrastrukturen

Über uns Zielgruppen Leistungen Aktuelles DE EN

Leistungskatalog
Support
FAQs

Alle Leistungen in der Ü

Home > Leistungen > Leistungskatalog

Infrastruktur

Es werden Hardwareressourcen (Rechen- und Speicherressourcen), Softwareressourcen sowie allgemein verfügbare Modelle und Daten in Form von einfach zu beantragenden oder direkt buchbaren Services bereitgestellt. Diese können für Forschung, Entwicklung und Technik in den Bereichen Medizin und Energie genutzt werden. Die notwendige Datensicherheit bleibt dabei selbstverständlich gewährleistet.

Hardware

Rechenressourcen

GPU-basiertes HPC-System mit aktuellen NVIDIA A100 und H100 GPUs für Trainings- bzw. Inferenzaufgaben

Sichere HPC Partition

Isolierte Partition zur Verarbeitung besonders sensibler Daten (z.B. Gesundheitsdaten) auf all unseren Systemen, z.B. unsere GPU-basierten HPC-System mit aktuellen NVIDIA A100 und H100 GPUs.

FAQ Support Book

Service type
Hardware

Contact person
Christian Boehme

2 Click: Book, you will be asked to login with Academic ID

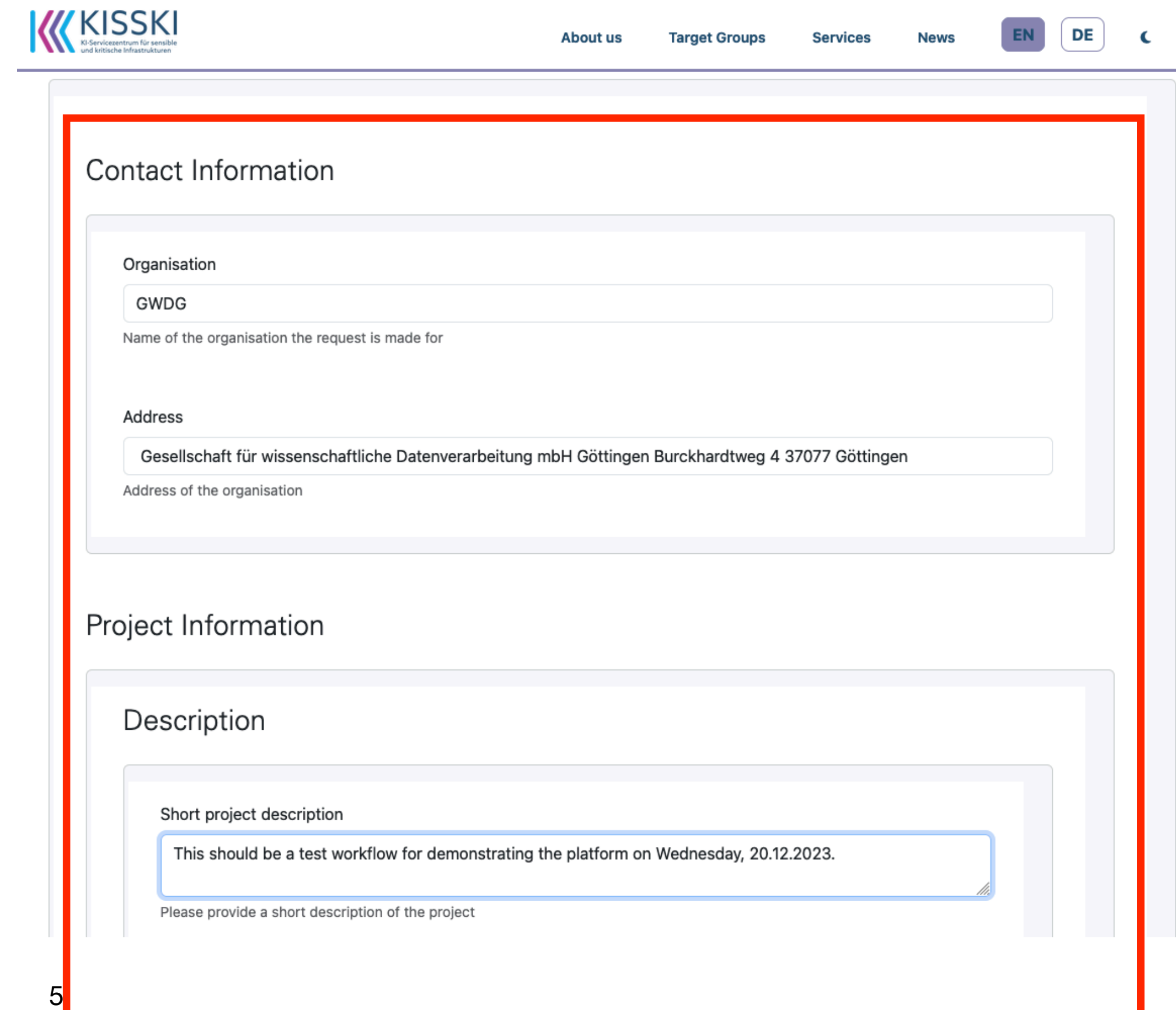
1. How to get access

3 Make an IDM account if needed (follow the steps) at <https://idm.gwdg.de>

4 Fill out:

**Project Information
+ which resources you need**

5 Wait... ☕
until you have been
granted resources



The screenshot shows the KISSKI website header with navigation links: About us, Target Groups, Services, News, and language buttons for EN and DE. The main content area is titled 'Contact Information' and contains two sections: 'Organisation' and 'Address'. The 'Organisation' section has a text input field with 'GWDG' and a label 'Name of the organisation the request is made for'. The 'Address' section has a text input field with 'Gesellschaft für wissenschaftliche Datenverarbeitung mbH Göttingen Burckhardtweg 4 37077 Göttingen' and a label 'Address of the organisation'. Below this is the 'Project Information' section, which includes a 'Description' subsection. The 'Description' section has a text input field with 'This should be a test workflow for demonstrating the platform on Wednesday, 20.12.2023.' and a label 'Short project description'. The entire form is enclosed in a red border.

KISSKI
KI-Servicezentrum für sensible
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About us Target Groups Services News EN DE

Contact Information

Organisation
GWDG
Name of the organisation the request is made for

Address
Gesellschaft für wissenschaftliche Datenverarbeitung mbH Göttingen Burckhardtweg 4 37077 Göttingen
Address of the organisation

Project Information

Description

Short project description
This should be a test workflow for demonstrating the platform on Wednesday, 20.12.2023.
Please provide a short description of the project

1. How to get access

 **hpc-project-service@gwdg.de** Inbox - Exchange 8. December 2023, 10:52
Einladung zum HPC Projekt KISSKI Project 4567 / invitation for HPC project KISSKI Project 4567 🚩
To: Dorothea Müller

Please find the English version below.

Hallo dmuelle3,

dies ist eine automatisierte Benachrichtigung vom HPC-Projektmanagementsystem der GWDG.

Sie wurden zum HPC-Projekt "KISSKI Project 4567" hinzugefügt, bitte folgen Sie dem Link, um weitere Informationen über Ihr Projekt zu erhalten:

[HPC-Projektmanagementsystem](#)

Sie können sich mit dem Anmeldenamen

u10792

auf den Loginknoten des HPC Systems anmelden.

Mit freundlichen Grüßen

GWDG

Wir freuen uns auf Ihren Besuch!

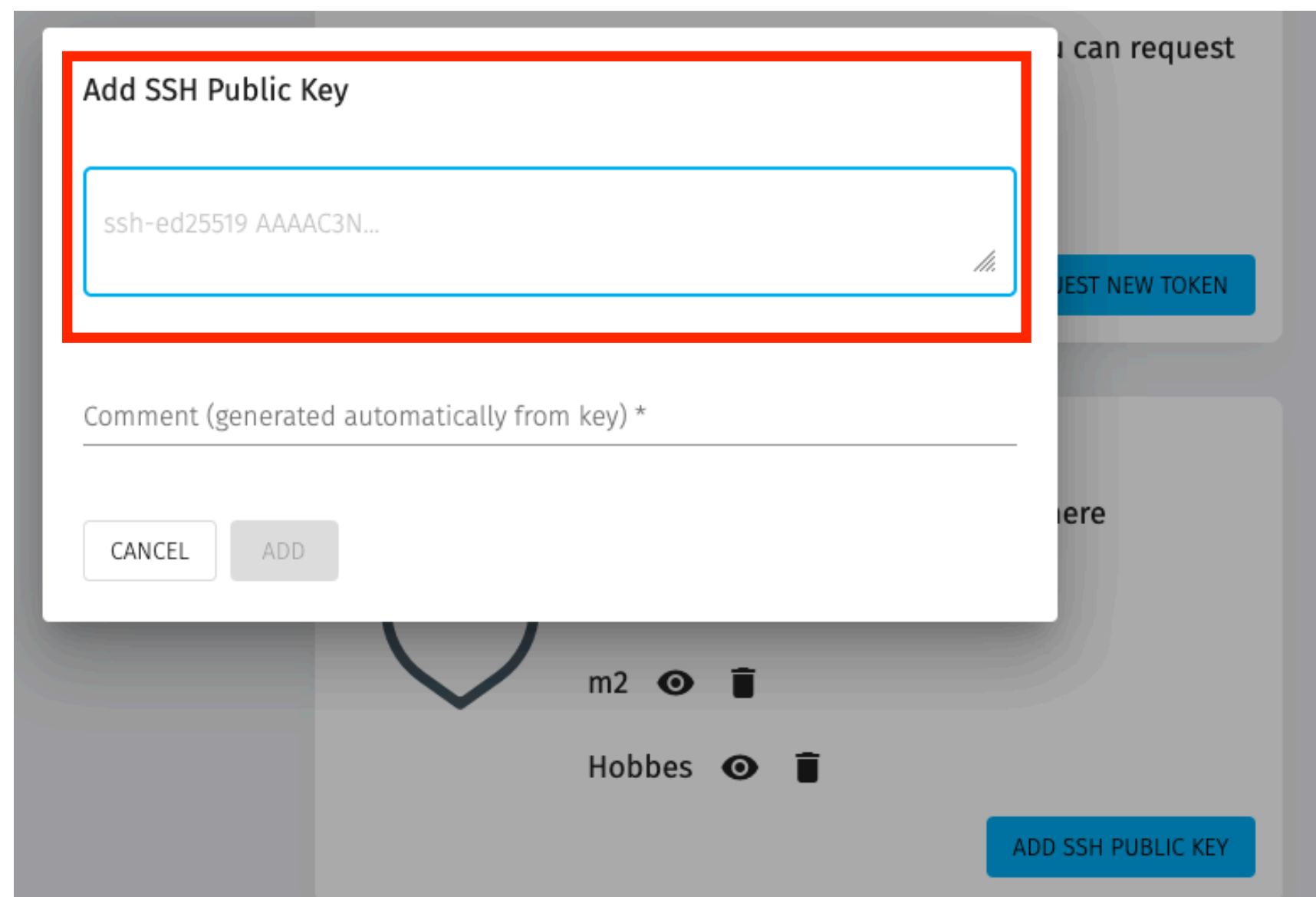
6

Save your credentials from the mail you get

- the project
- your user name

1. How to get access

- 7 Make an ssh key. Upload under <https://id.academiccloud.de> under “Security” (left bar), scroll down:



- 8 Log in!

Example: In `.ssh/config`

```
Host kisski
  HostName glogin9.hlrn.de
  User u10792
  IdentityFile ~/.ssh/scc
```

\$ssh kisski

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2. Setup

Login

Compute Nodes

Storage

User Side

frontend

switches

2 Put data here.



ssh

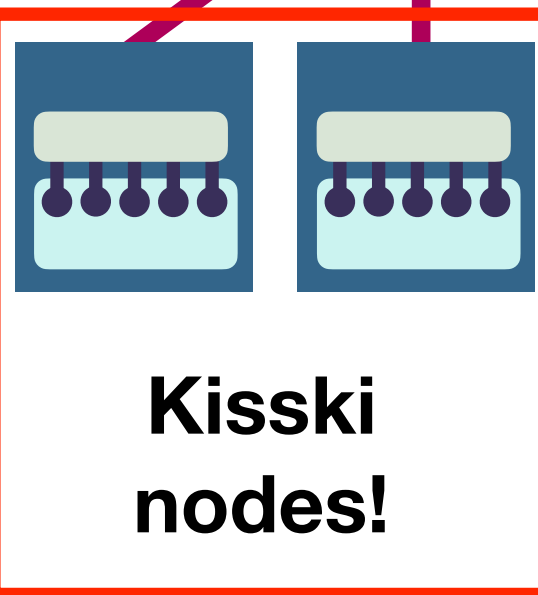


user

glogin9

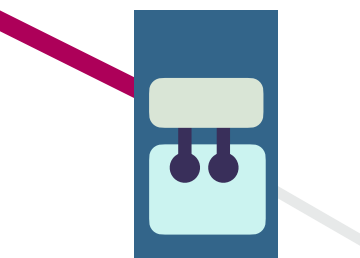
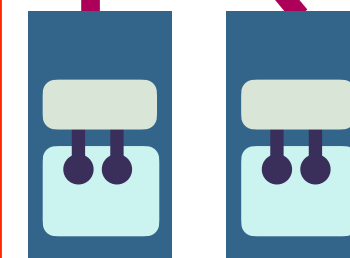
1 We are here.

compute nodes



Kisski nodes!

3 Run your programme here.



gateway nodes

\$PROJECT

All members!

\$HOME

You only!

S3 buckets

(fast) Omni-Path

(slow) Ethernet

2. Setup

Our Use Case

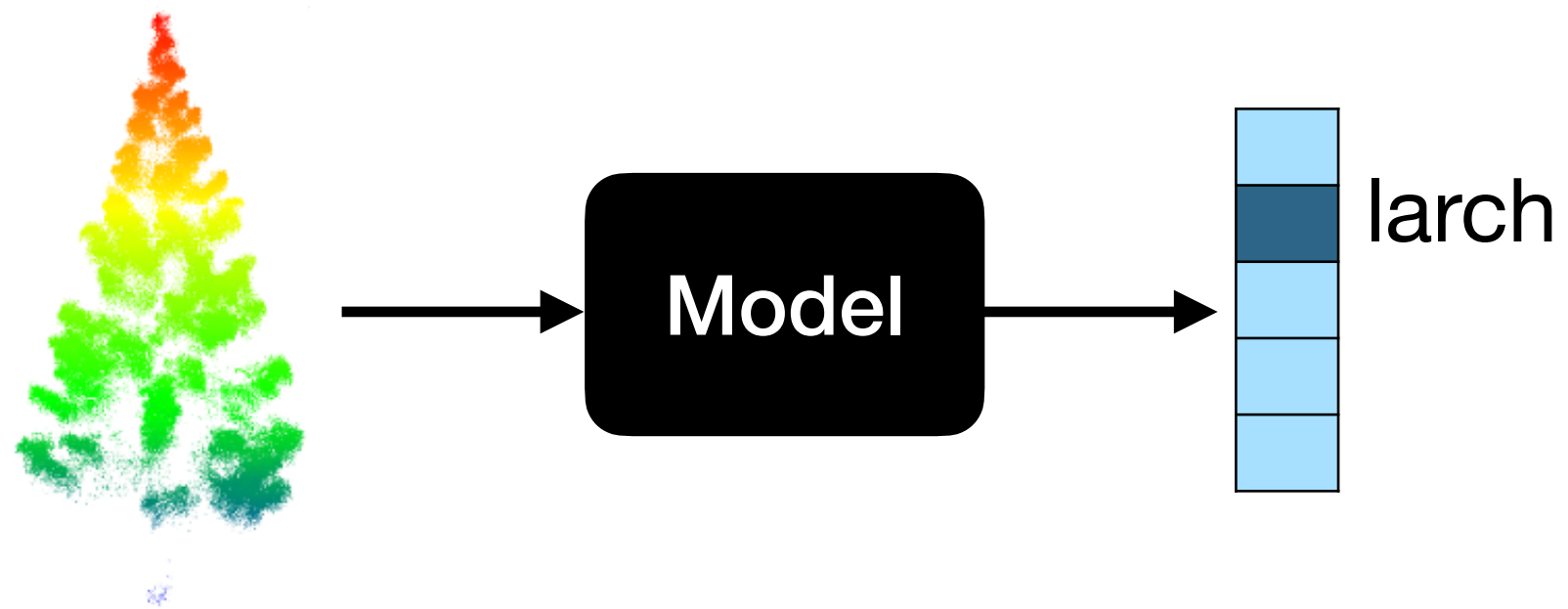
tree species classification

Data

x_i tree photo

y_i corresponding tree species

Aim



classification

predict tree species
given LiDAR scan of
the tree

Example DL Code Repository

Dorothea Sommer > deep-learning-with-gpu-cores

Deep learning with GPU cores

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[https://gitlab-ce.gwdg.de/dmuelle3/
deep-learning-with-gpu-cores](https://gitlab-ce.gwdg.de/dmuelle3/deep-learning-with-gpu-cores)

Try this out at home :-)

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3. Running Code

Login

Compute Nodes

Storage

User Side

frontend

switches

2 Put data here.



ssh

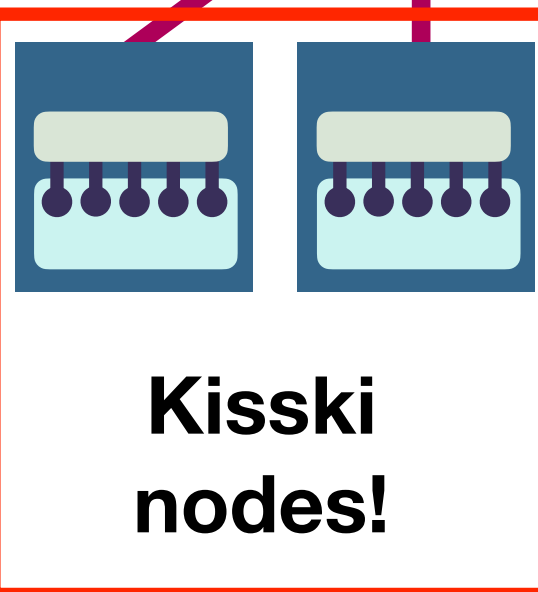


user

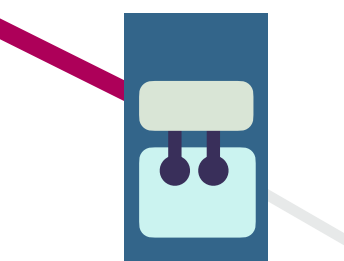
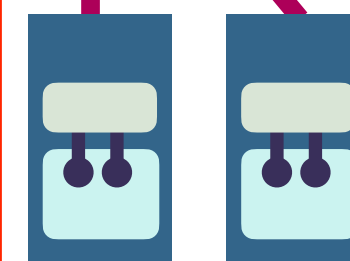
glogin9

1 We are here.

compute nodes



Kisski nodes!



gateway nodes

\$PROJECT

All members!

\$HOME

You only!

S3 buckets

3 Run your programme here.

Use Slurm



Scheduler (playing Tetris what gets run where & when)

sinfo | srun | sbatch

(fast) Omni-Path

(slow) Ethernet

3. Example Script

```
code > $ submit_train.sh
1  #!/bin/bash
2  #SBATCH --job-name=train-nn-gpu
3  #SBATCH -t 05:00:00           # estimated time # TODO: adapt to your needs
4  #SBATCH -p kisski           # the partition you are training on (i.e., which nodes)
5  #SBATCH -G 1
6  #SBATCH --nodes=1           # total number of nodes
7  #SBATCH --ntasks=1          # total number of tasks
8  #SBATCH --mail-type=all      # send mail when job begins and ends
9  #SBATCH --mail-user=dorothea.sommer@gwdg.de # TODO: change this to your mailaddress!
10 #SBATCH --output=./slurm_files/slurm-%x-%j.out # where to write output, %x give job name
11 #SBATCH --error=./slurm_files/slurm-%x-%j.err # where to write slurm error
12
13 export TMPDIR=$LOCAL_TMPDIR # Temporarily needed.
14
15 module load anaconda3
16 source activate dl-gpu-home # Or whatever you called your environment.
17 python -u train.py
```

\$sbatch submit_train.sh

What we have covered



1 Setup

- Getting a user account
- Connecting to the cluster

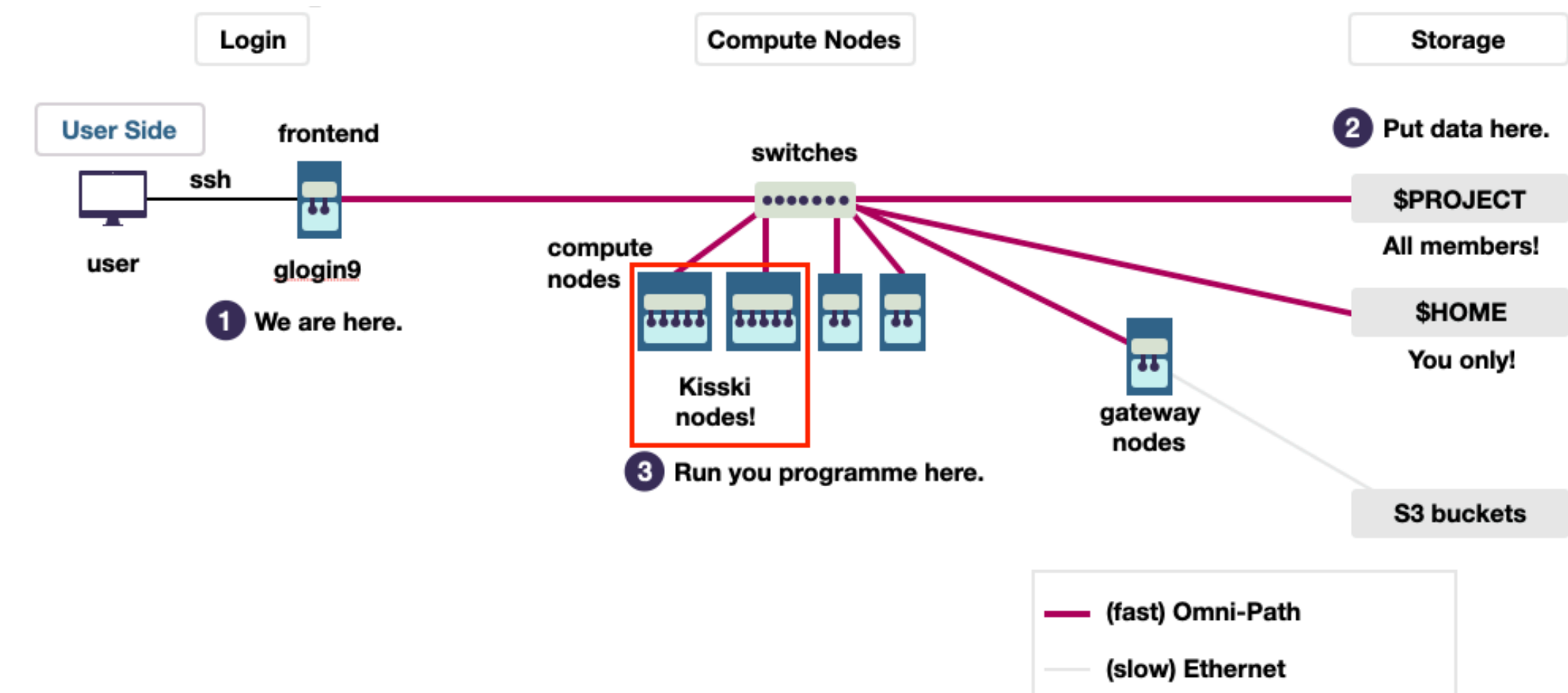
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4 #SBATCH -p kisski # the partition you are training on
5 #SBATCH -G 1
6 #SBATCH --nodes=1 # total number of nodes
7 #SBATCH --ntasks=1 # total number of tasks
8 #SBATCH --mail-type=all # send mail when job completes
9 #SBATCH --mail-user=dorothea.sommer@gwdg.de # TODO: change to your email
10 #SBATCH --output=./slurm_files/slurm-%x-%j.out # where to put stdout
11 #SBATCH --error=./slurm_files/slurm-%x-%j.err # where to put stderr
12
13 export TMPDIR=$LOCAL_TMPDIR # Temporarily needed.
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17 python -u train.py
```

Monitoring

Basic GPU ideas: What to monitor?

- 1 Start the program.
Define the network.



“**Host**” = primary processor
that manages the copying
and controls the GPU

- 2 Copy model.



- 3 Copy data.



- 5 Copy result back.



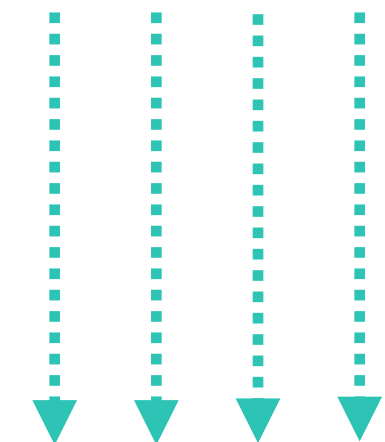
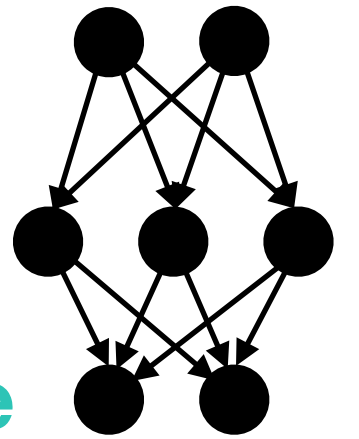
=> **Bandwidth matters!**

=> **Make sure to compute a lot,
not only copy a lot!**

=> **Size (GB) matters!**



- 4 Compute
in threads.



Computation is done
in a **kernel function** that is
executed in **parallel**
simultaneously among
many threads.