TECHNISCHE UNIVERSITÄT DRESDEN

Fakultät für Elektro- und Informationstechnik, Professur für Grundlagen der Elektrotechnik und Elektronik

FliK Modul 2020

Deep Learning mit Keras

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Prof. Ronald Tetzlaff

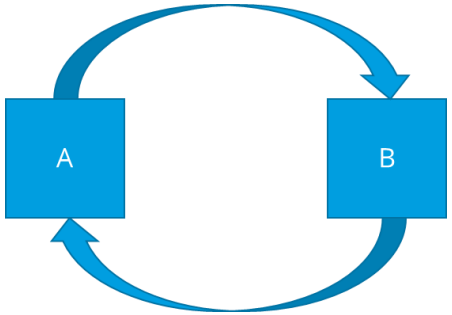
Dresden, 19-23.10.

Disclaimer

This course is for **you**. Don't hesitate to **ask** us!
Many of you will have questions and **we can't answer all** of them instantaneously, please respect that.

The scope of the course is to give you an **overview** to modern Machine Learning/Deep Learning and that you are able to build some of the most important architectures in your own. We will try to **skip heavy math/coding** but we can't really **leave out everything**. Some things will be **hard to explain** since you need some domain knowledge from Computer Science, but take your time and think about it!

Sometimes you require knowledge of A to understand B and vice versa! → Try keep going!



To help you to get over this obstacle, course will **consist of lectures and exercises** which will also serve as a kind of proof.

Schedule

Monday

Introduction
HPC and GIT
Jupyter Notebooks
Python Basics
Neural Networks with Keras
Keras Basics
MLP

Tuesday

Convolutional Neuronal Networks
BatchNorm
Activation Maps
CAM/GradCam

Wednesday

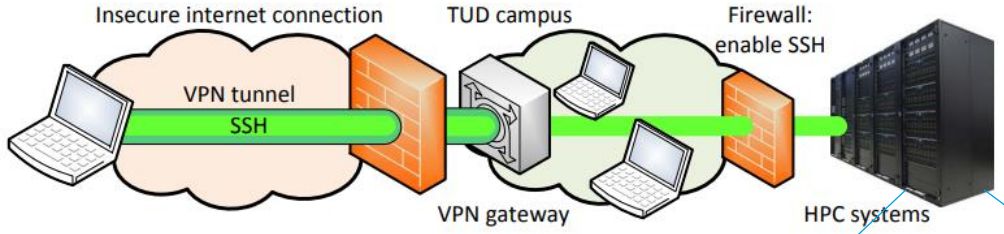
Recurrent Neural Networks
GAN
Autoencoder/VAE

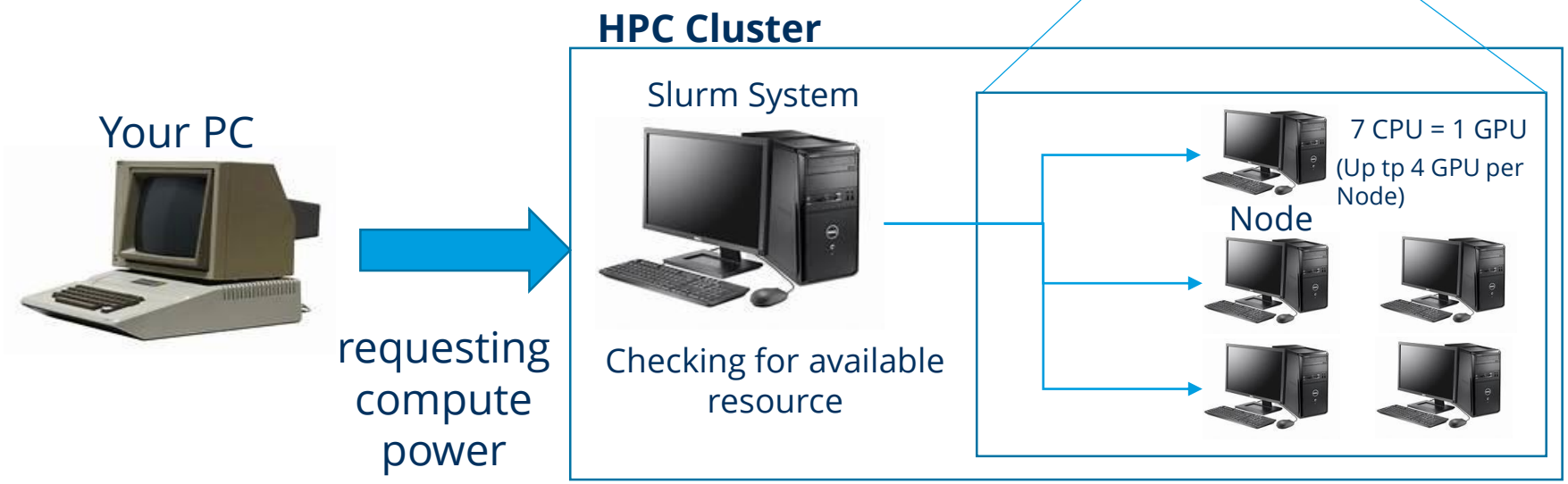
Thursday

Do it yourself! Hackday!

High Performance Computing

Through this course we will **need compute power** that could exceed the limitations of your PC/Laptop at home.
To run everything smoothly we are lucky to be supported by the TU Dresden Supercomputer **TAURUS**. This so called **H**ight **P**erformance **C**omputing (HPC) System is not accessible to public use and can only be used from the inside of TU Dresden Network





High Performance Computing

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To run eve moothly we n Supercomp **RUS**. This so called **H**ight
Performance ting (HPC) an only be u the inside of TU Dresden
Network

Slurm will allocate the resources requested by you without checking for sanity.

(If you need more request more. But **be humble**!)

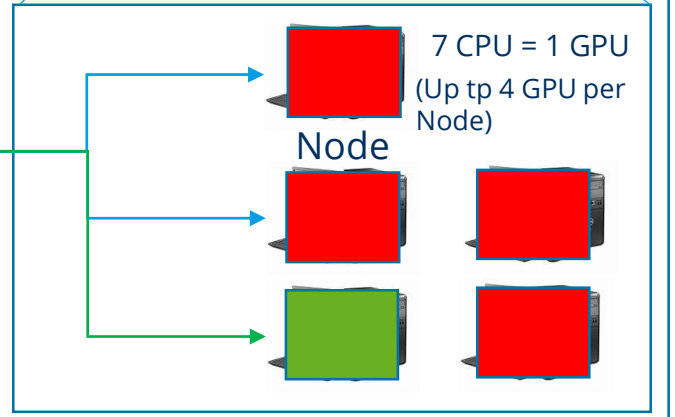
Your PC

requesting compute power

HPC Cluster

Slurm System

Checking for available resource

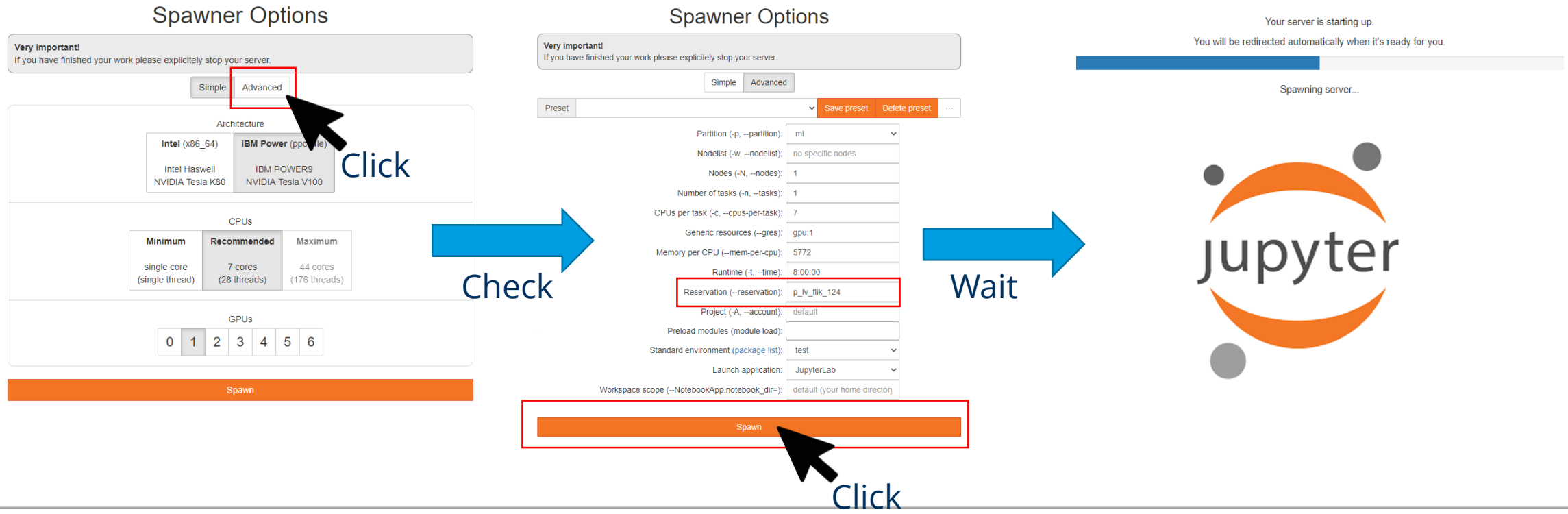


Free Occupied

How to connect to HPC through the course

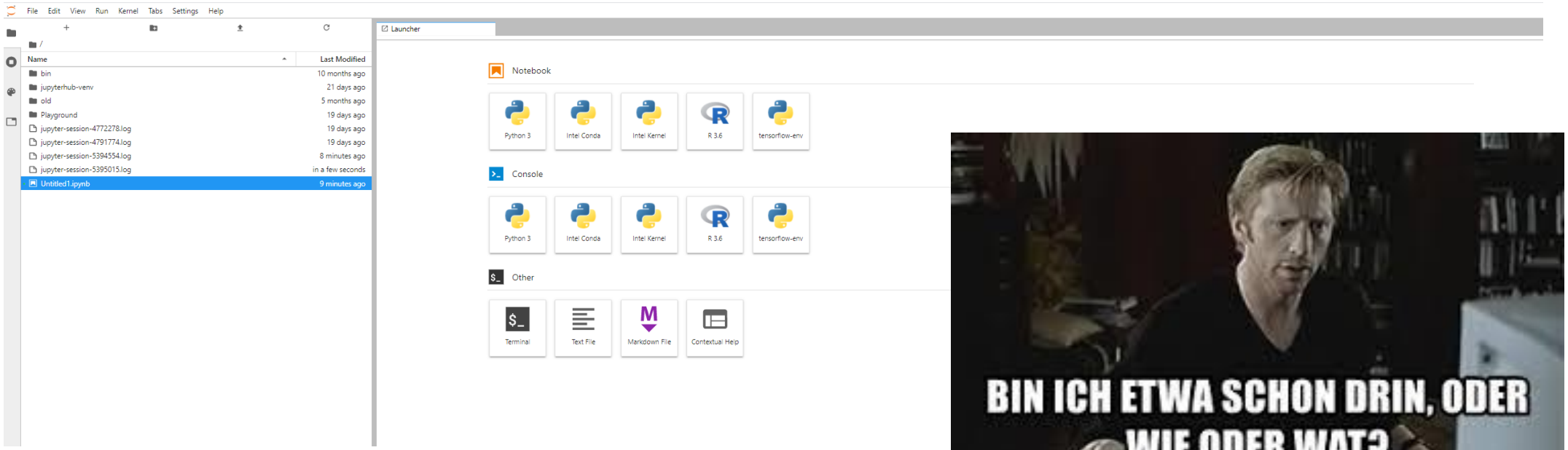
Make your you are connecting from the secure network **within** TU Dresden!
Go to your browser and visit: https://taurus.hrsk.tu-dresden.de/jupyter

If you are within the TU network you can click on the button Start My Server to enter this screen



How to connect to HPC through the course

This is your „home“ screen for Jupyter on the HPC

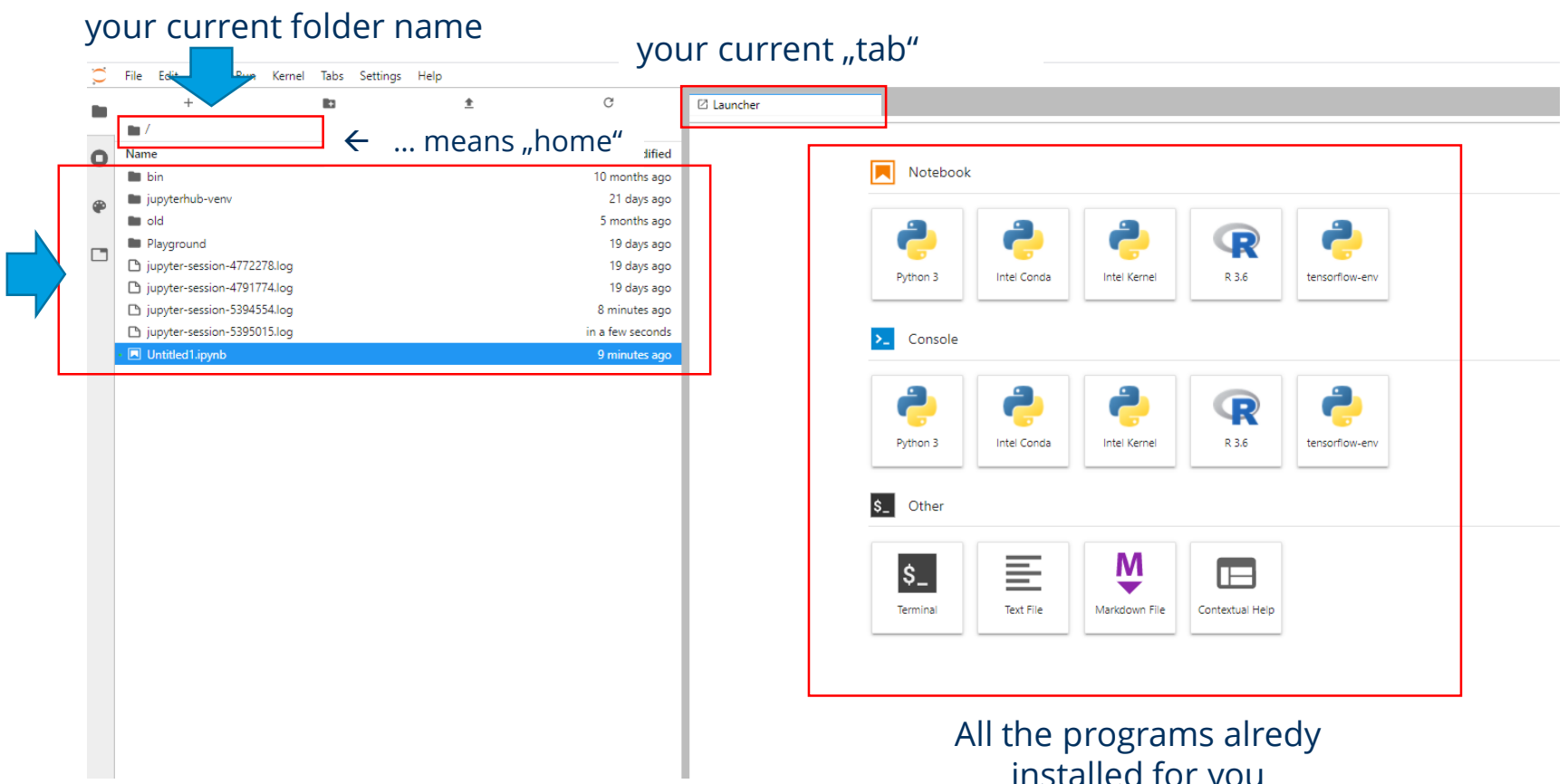


Your screen will look a little different but don‘t worry!

Yep! ☺

Jupyter Hub

All your folders
(this will probably be empty)



All the programs alredy
installed for you

The Jupyter Hub is **GUI** on top of the Linux running on the HPC, which is accessible by the comand line. (don‘t worry we will only touch this in a single case)

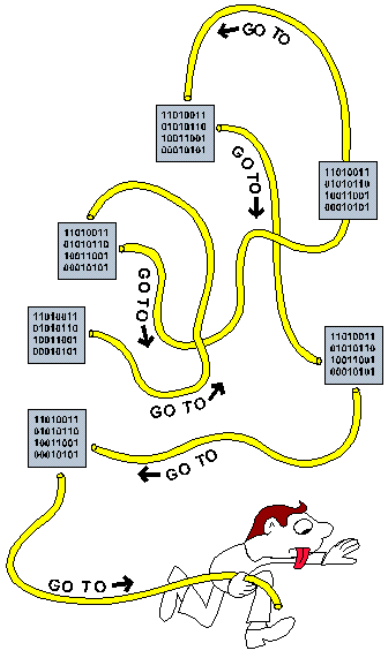
GitHub

We did prepare your materials to be downloaded via **GitHub** (Microsoft)

Github is an online code shareing platform which is very pupular in Computer Science (especially in ML)
Using a „Git“ is a **very helpful tool** in programing alone and with colaborateurs because of his version controll. (Coding a giant project with many collegues can end in a **codemess**)

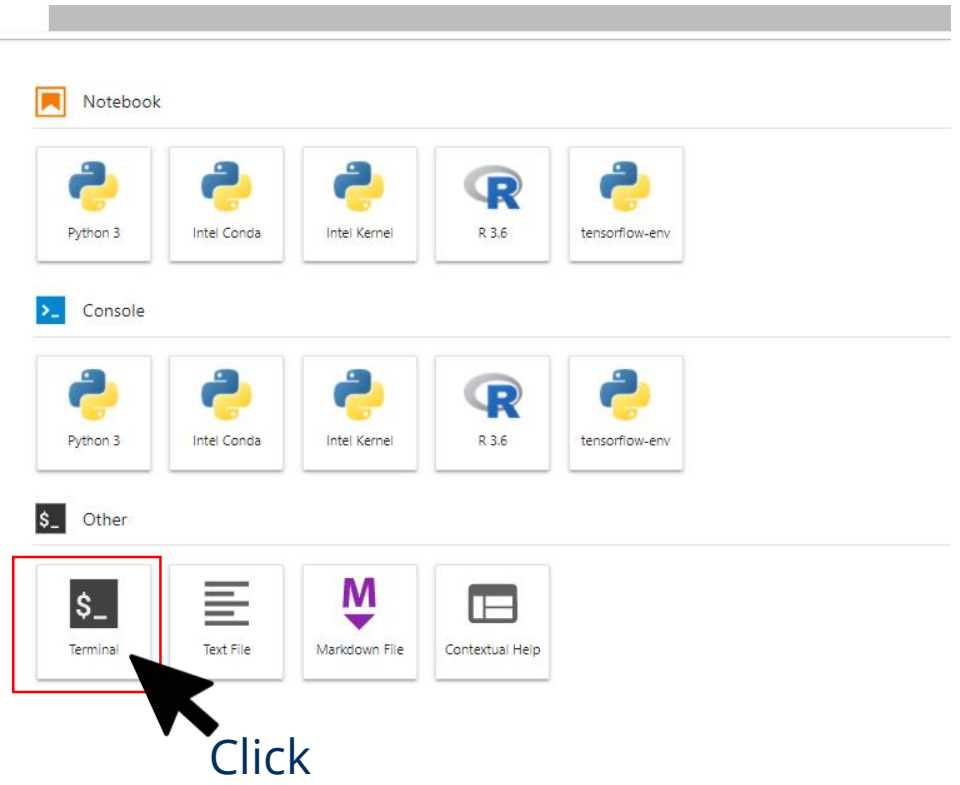
Unfortunatly we dont have the time to introduce you to git in this course.
But **we encurage you to learn using it** from one of the many very good resources already out in the internet.

For the sake of simplicity we just show you how to download an existing project (our material) from the github server to your HPC local folder.



Git is **already installed** for you in the Taurus! ☺

How to material with Git?



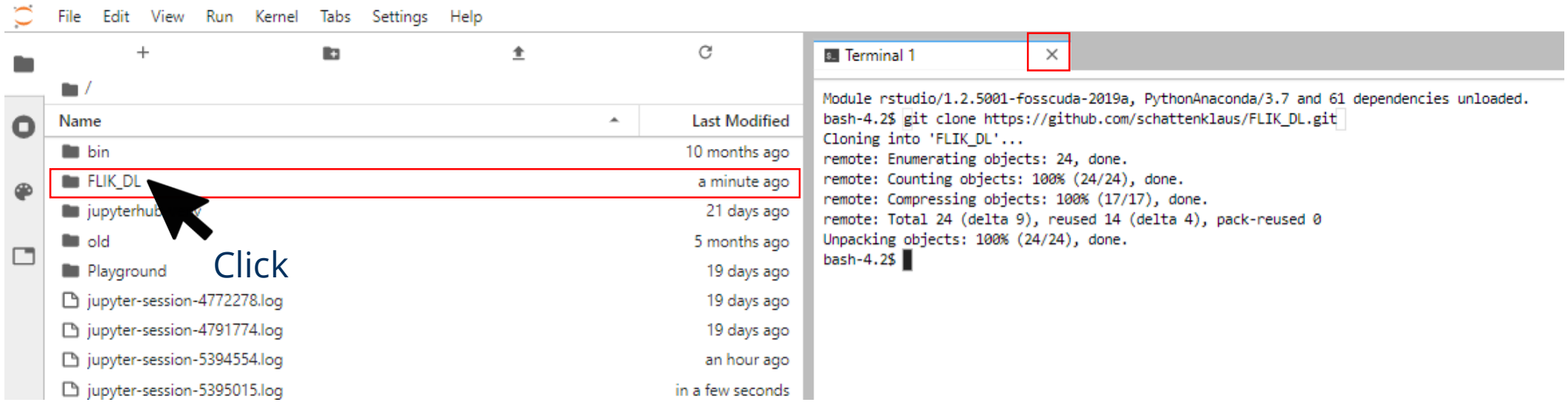
In the new terminal window write:

```
$ git clone https://github.com/schattenklaus/FLIK_DL.git
```

Press Enter

How to the course material with Git?

You should see the **new „FLIK_DL“ folder** in your directory → Click on it to excess all the course materials (our slides and notebooks on a daily basis)

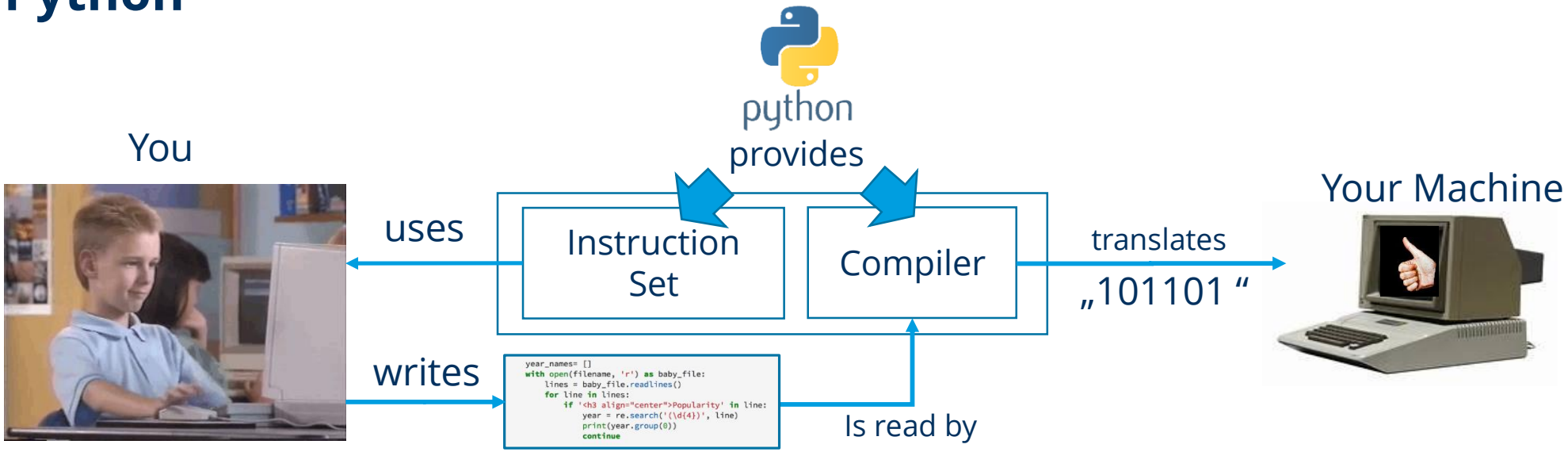


This is a **local copy** of our materials on your Taurus. If you unintentionally deleted something **just redo** the whole cloning process. You can now close the terminal window.

1. Exercise

Setup your HPC resources and download the course material to your home folder via GIT!

Python

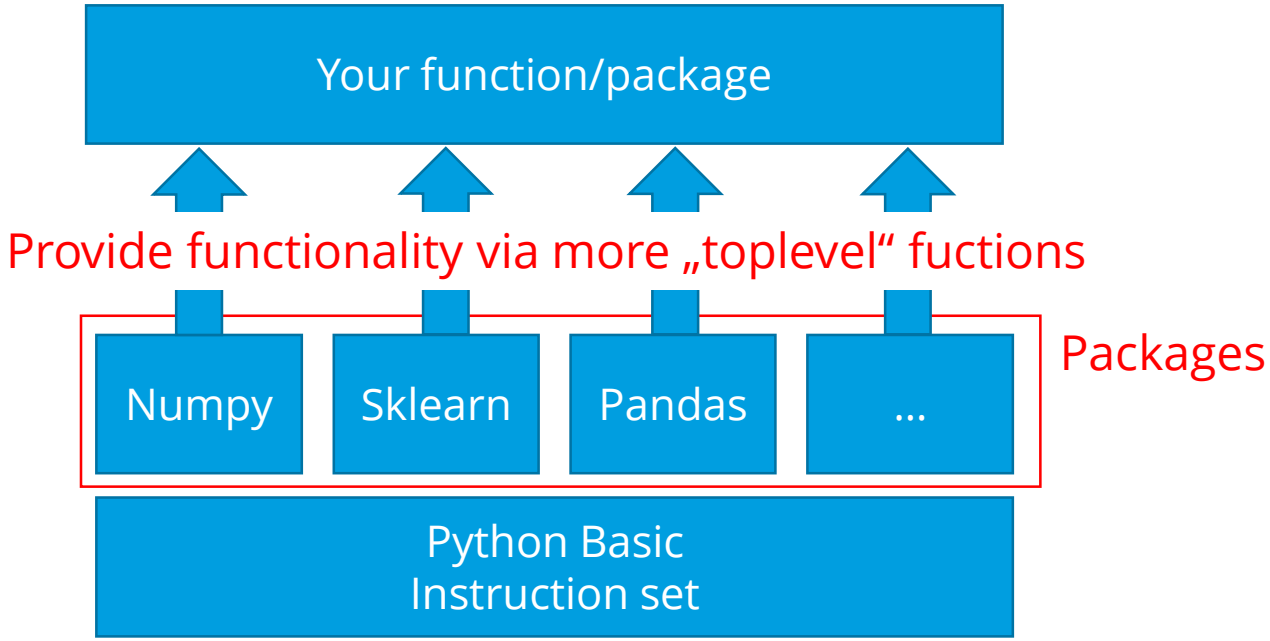


Very popular programming language in the scientific comunity!

Reason: **easy** understandeble code, **free** of charge and **modular**

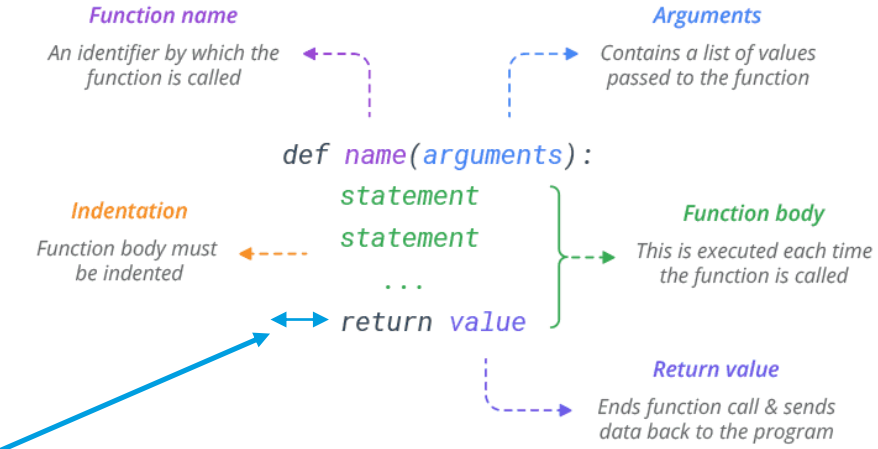
Python Modules

Packages/Modules are nothing else then **classes** with **functions** written by other users free of charge!



Python Code Explained

classes and functions



Python **groups code** blocks by looking at the **intent**.

```
# Create an object from the 'Car' class by passing style and color
class Car:

    # class attribute
    wheels = 4

    # initializer with instance attributes
    def __init__(self, color, style):
        self.color = color
        self.style = style

c = Car('Sedan', 'Black')
```

```
# Pass two arguments
def func(name, job):
    print(name, 'is a', job)

func('Bob', 'developer')
# Prints Bob is a developer
```

The **def** statement only creates a **function** but does not call it. After the def has run, you can can call (run) the function by adding parentheses after the function's name.

Slicing

```
L[start:stop:step]
```

Start position *End position* *The increment*

To access a **range** of items in a list or array, you need to **slice** a list. One way to do this is to use the simple slicing operator "**:**"

```
L = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i']
print(L[2:7])
# Prints ['c', 'd', 'e', 'f', 'g']
```

Reverse a list

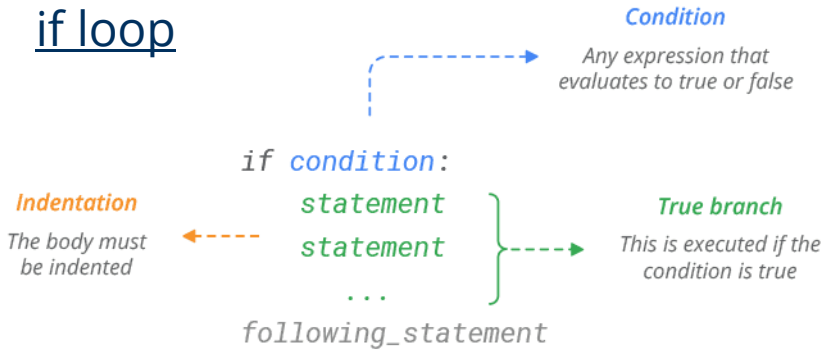
```
L = ['a', 'b', 'c', 'd', 'e']
print(L[::-1])
# Prints ['e', 'd', 'c', 'b', 'a']
```

Only every 2nd value

```
# Return every 2nd item between position 2 to 7
L = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i']
print(L[2:7:2])
# Prints ['c', 'e', 'g']
```

Python Code Explained

if loop



Operator	Meaning	Example
==	Equals	if x == y
!=	Not equals	if x != y
>	Greater than	if x > y
>=	Greater than or equal to	if x >= y
<	Less than	if x < y
<=	Less than or equal to	if x <= y

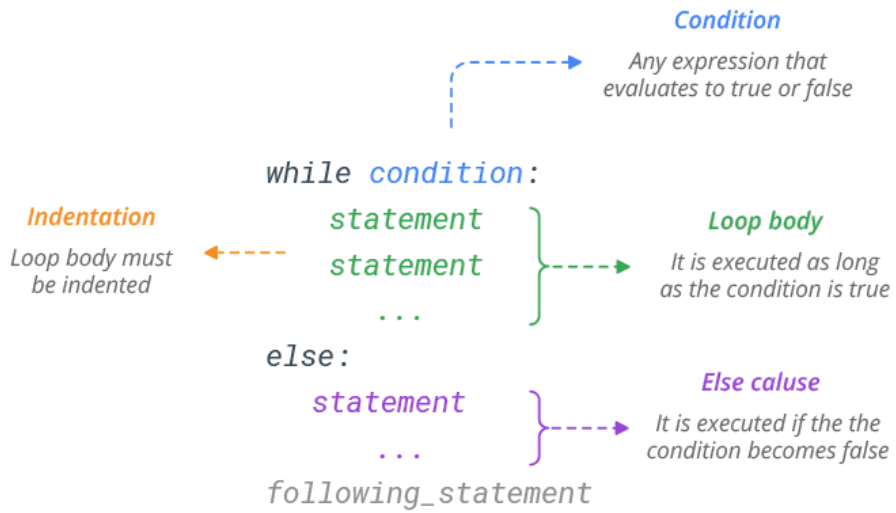
```
x, y = 7, 5
if x > y:
    print('x is greater')

# Prints x is greater
```

Python Code Explained

while loop

Any **non-zero** value or **nonempty** container is considered **TRUE**; whereas Zero, None, and empty container is considered **FALSE**.



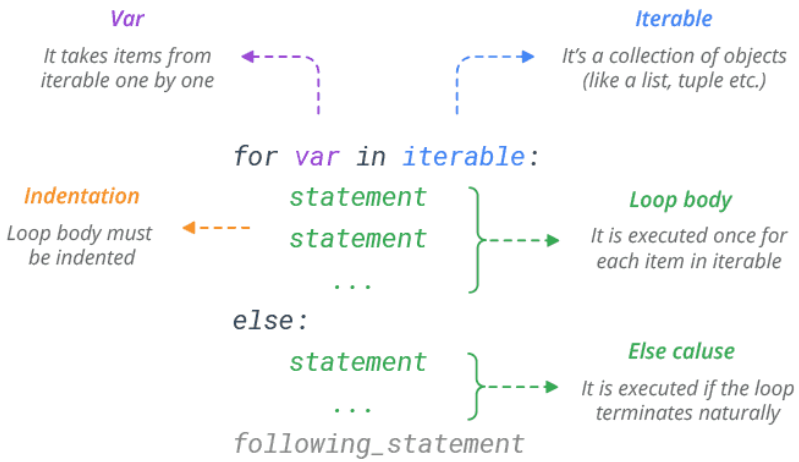

```
# Iterate until x becomes 0
x = 6
while x:
    print(x)
    x -= 1
# Prints 6 5 4 3 2 1
```

```
# Iterate until list is empty
L = ['red', 'green', 'blue']
while L:
    print(L.pop())
# Prints blue green red
```

```
# Iterate until string is empty
x = 'blue'
while x:
    print(x)
    x = x[1:]
# Prints blue
# Prints lue
# Prints ue
# Prints e
```

Python Code Explained

for loop




```python
# Print 'Hello!' three times
for x in range(3):
    print('Hello!')
# Prints Hello!
# Prints Hello!
# Prints Hello!
```

2. Exercise

Open the notebook „Python_Intro“ and follow the instructions