RUC eScience

Introduction to Interactive and other types of HPC

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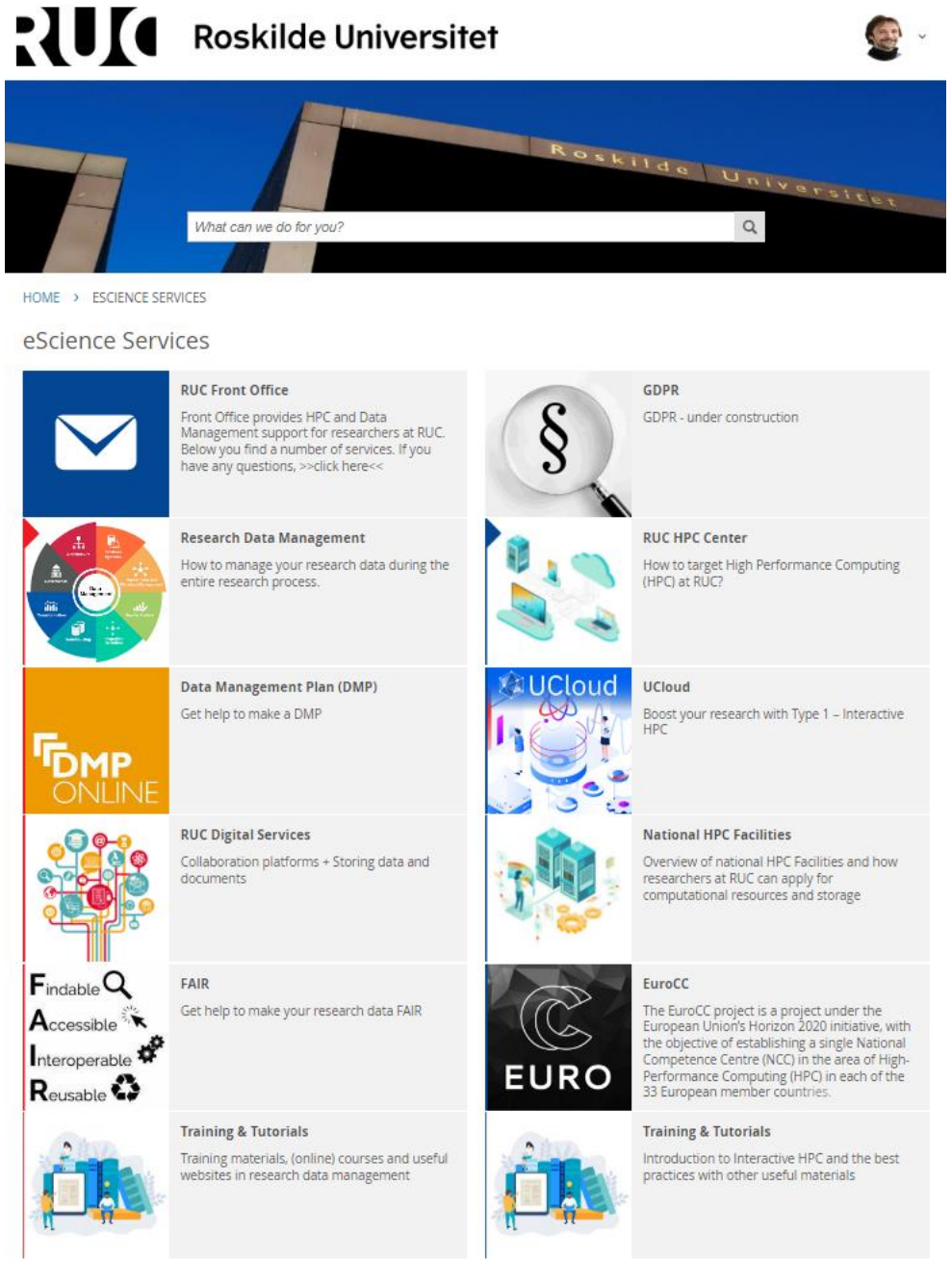
RUC eScience portal

- https://escience.ruc.dk
- eScience is a portal presenting access to services and resources:
  - Research Data Management
    - Data Management
    - Data Management Plan (DMP)
    - RUC Digital Services
    - FAIR
    - Training & Tutorials
  - HPC Center (DeiC Back Office)
    - RUC HPC Center
    - National HPC Systems
    - UCloud
    - EuroCC via DeiC
    - Training & Tutorials

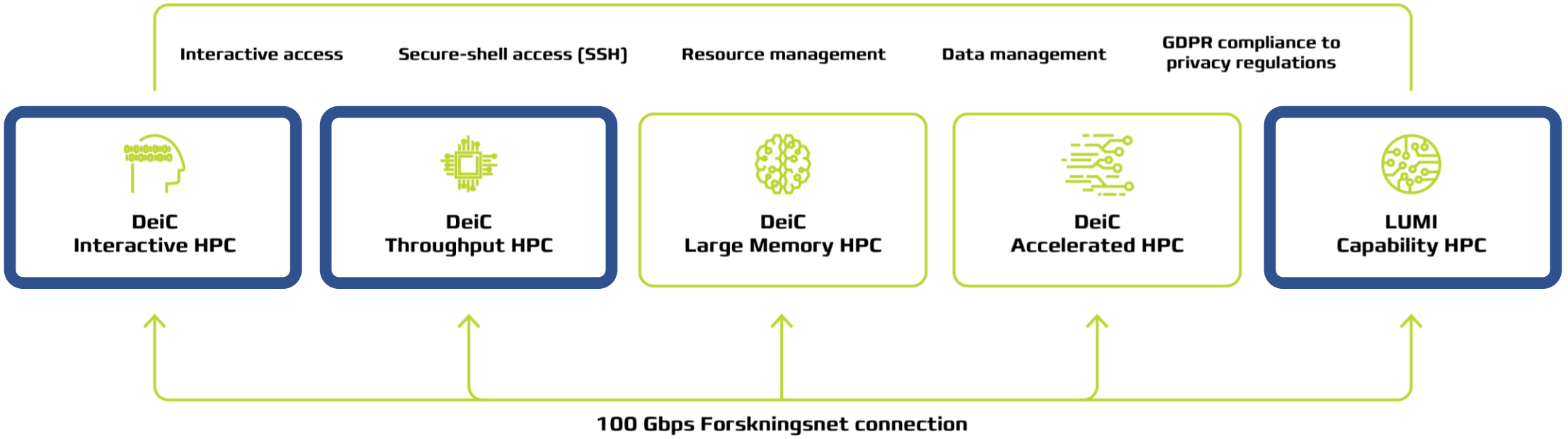


High Performance Computing (HPC)

- Sharing computational resources under different agreements to utilize maximum from HPC centers
- Danish National HPC facilities
  - The universities and DeiC are collaborating on the establishment and operation of a national HPC landscape, which will ensure the necessary and sufficient computing power for Danish research now and in the future. The universities handle operations and development, while DeiC has a coordinating role from year 2012.
  - https://www.deic.dk/en/supercomputing/national-hpc-facilities

Types of HPC provided by DeiC

- Overview of the DeiC infrastructure available to RUC marked as blue



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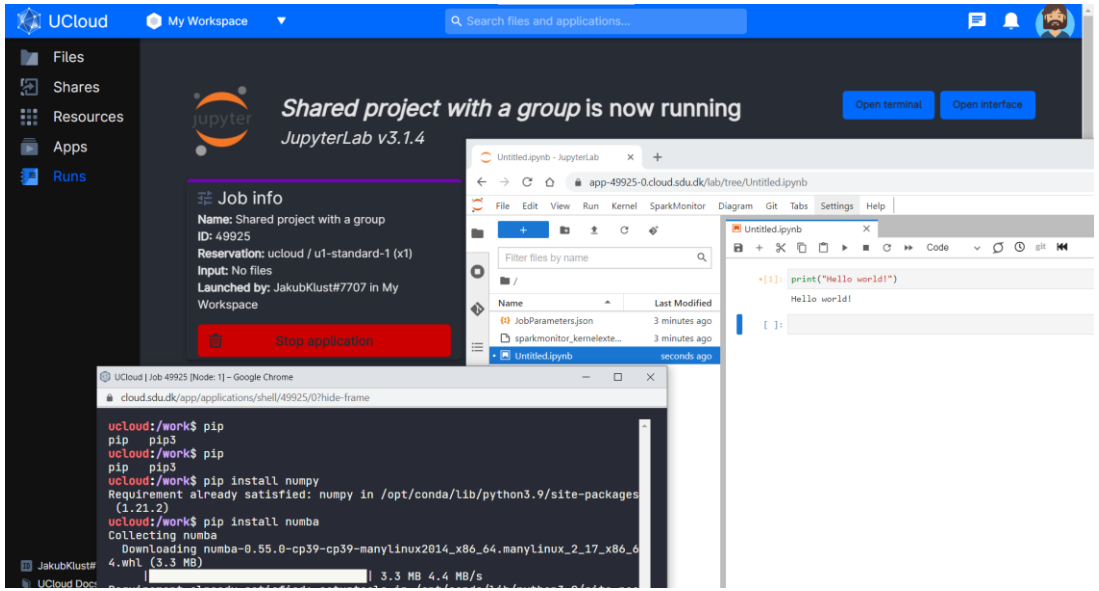
Type 1 (Interactive HPC)

- **Interactive HPC** platform managed by University of Southern Denmark (SDU) utilizing HPC centers from Århus University (AU) and Ålborg University (AAU)
  - **UCloud** applications are optimized during compilation for the hardware architecture
- **Hardware configuration** (expands based on external cooperation between DeiC partners)
  - https://escience.sdu.dk/index.php/ucloud-yougene-cluster/
- **Web based interface** to control everything
  - https://cloud.sdu.dk (login to the platform with Roskilde University and Single Sign-On)
  - The main page serves an overview of resources, previous runs, files uploaded to UCloud (or data generated by applications)
  - By default, all students get credit of 1000DKK and extension can be negotiated based on approval from supervisor (more resources can be requested by application from UCloud main page)
- **Documentation** about the platform and individual applications
  - https://docs.cloud.sdu.dk/

UCloud accessible through a browser

- Secure Platform
  - ISO/IEC27001:2013 certified since February 2020
- Interactive HPC
  - terminal on demand
- Data Analytics
  - pre-installed and optimized applications: JupyterLab, RStudio, MATLAB, Spark, TensorFlow, PyTorch, Dash, Streamlit, Voilà
- Private Cloud
  - infrastructure natively supports multitenancy, with a separation between data and computing resources
- Share and Collaborate
  - designed for large research datasheets with focus on sensitive data
- Workspaces
  - virtual workspaces dedicated to your projects, to share resources and work together with your collaborators



Other types of HPC

- Type 2 (Throughput HPC)
  - large number of cores that can run many simultaneous calculations in a job and which is intended for handling large amounts of data
  - managed by Aarhus University, the Technical University of Denmark and the University of Copenhagen
- Type 3 (Large Memory HPC)
  - relatively few CPU cores and large amounts of memory that can be accessed from all cores
  - operated by the University of Southern Denmark
- Type 4 (Accelerated HPC & Capability HPC)
  - primary computing capacity comes from accelerators of various kinds (HPC laboratory)
  - operated by KU supported by collaboration between ITU, RUC and KU
- Type 5 (LUMI Capability HPC)
  - LUMI is an abbreviation for "Large Unified Modern Infrastructure", and will be located in CSC's data center in Kajaani, Finland
  - LUMI is one of three pre-exascale supercomputers to be build as part of the European EuroHPC project

Application for additional HPC resources

- RUC has a pool of resource (CPU and GPU) that can be distributed to research projects and supporting teaching activities
  - Write an email to escience@ruc.dk or apply for more resources directly from UCloud main page
- As a researcher at a Danish university, you have various options for gaining access to computing power at both Danish (national) and international HPC facilities.
  - https://www.deic.dk/en/supercomputing/Apply-for-HPC-resources

Inspiration from research using HPC

- The research results from the national supercomputers in this publication list:
  - https://deic-hpc.github.io/EuroCC-knowledgepool/use_cases/
  - https://escience.sdu.dk/index.php/all-projects/
  - https://deic.dk/en/Supercomputing/HPC-Publications
- Read more (analysis from recent years is going to be provided as well)
  - Analysis of a total of 835 publications from 2015-2019
  - Analysis of a total of 576 publications from 2015-2018
  - Analysis of a total of 290 publications from 2015-2017
  - Registration of Scientific Publications
  - Remember to acknowledge the use of national HPC
  - Guide to the online search function

Questions

Additional materials

- DeiC Interactive HPC - general information: https://interactivehpc.dk
- RUC HPC Centre: https://hpc.ruc.dk
- Link to this presentation (may be updated in future)
  - http://dirac.ruc.dk/~jklust/HPC/RUC_eScience_HPC_UCloud.pdf
- Single page guide (login to the UCloud and interaction with job):
  - http://dirac.ruc.dk/~jklust/HPC/UCloud%20-%20HPC%20Type%201%20-%201%20page%20quick%20guide_A3.pdf
- Detailed guide how to interact with the UCloud created by AU:
  - http://dirac.ruc.dk/~jklust/HPC/UCloud%20-%20HPC%20Type%201%20-%20detailed%20guide_Arhus.pdf
- Example of scripts that automate interaction with UCloud: http://dirac.ruc.dk/~jklust/HPC/scripts/
- List of available resources on Type 1 HPC (not all accessible to RUC):
  - https://cloud.sdu.dk/app/skus
- Interactive SLURMlearning tutorial: http://slurmlearning.deic.dk