



Towards Simulation and Data Labs in the context of the LUMI Supercomputer

PROF. DR. – ING. MORRIS RIEDEL, UNIVERSITY OF ICELAND / JUELICH SUPERCOMPUTING CENTRE (JSC)

21TH APRIL, LUMI STEERING COMMITTEE, ONLINE



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@MorrisRiedel



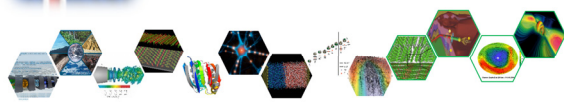
@MorrisRiedel



<https://www.youtube.com/channel/UCWC4VKHmL4NZgFfKoHtANKg>



IHPC National Competence Center
for HPC & AI in Iceland



EuroHPC
Joint Undertaking

EOSC
NORDIC

RAISE
Center of Excellence

ADMIRE



UNIVERSITY OF ICELAND
SCHOOL OF ENGINEERING AND NATURAL SCIENCES
FACULTY OF INDUSTRIAL ENGINEERING,
MECHANICAL ENGINEERING AND COMPUTER SCIENCE

HELMHOLTZAI | ARTIFICIAL INTELLIGENCE
COOPERATION UNIT

DEEP
Projects



JÜLICH
Forschungszentrum | JÜLICH
SUPERCOMPUTING
CENTRE

Executive Summary – Major Icelandic HPC Activities – LUMI & People!

rannís Icelandic National Infrastructure for HPC

- ❖ HPC hardware funds by RANNIS; now via roadmap IReiP
- ❖ Proposals yearly required to obtain funds still
- ❖ Joint proposal from IHPC community

EuroHPC EuroCC National Competence Center for HPC & AI

- ❖ EU Project (09/2019-08/2021), 2 years
- ❖ Building **Simulation and Data Labs (SDLs)** of the IHPC Community of Users
- ❖ Supports industry engagement in HPC

IHPC Community of Users

- ❖ Organized around RANNIS proposals
- ❖ ~53 scientific experts & research group
- ❖ UoIceland/UoReykjavik, Iceland Geo Survey ÍSOR, Met Office & industry: Matis, etc.

Towards Simulation and Data Labs in the context of the LUMI Supercomputer

EuroHPC LUMI Supercomputer in Finland

- ❖ Supercomputer funded by Finland, Belgium, Czech Republic, Denmark, Estonia, Iceland, Norway, Poland, Sweden, Switzerland
- ❖ Co-Funds by EC and Iceland participation funds from: UoIceland, UoReykjavik, and Hannes Jonsson & Egill Skulason

Teaching & Education in HPC & AI

- ❖ University of Reykjavik
- ❖ University of Iceland
- ❖ Arctic Webinar Series (with US partners)
- ❖ Digital/Horizon Europe MSc in HPC

International Cooperations

- ❖ Tactical: ~4 Joint PhDs with Juelich Supercomputing Centre in Germany (#1 HPC System in Europe)
- ❖ Tactical: **EC Projects** like DEEP-EST, EOSC-Nordic, RAISE Center of Excellence (CoE)
- ❖ Strategic: Building an **Icelandic National Lab** with international cooperation together with Industry (e.g. Kaiser Global, other investors)

NEW EuroCC EU Project: Building National Competence Centers for HPC & AI



- EuroHPC Joint Undertaking Project
- 33 Countries as Partners
- 50% funding only for University of Iceland (in-kind funding by person Prof. Dr. – Ing. Morris Riedel & Prof. Dr. Ebba Hvanberg)
- Goal: Establish National Competence Centers (NCCs) in the area of HPC & AI to bring national activities together

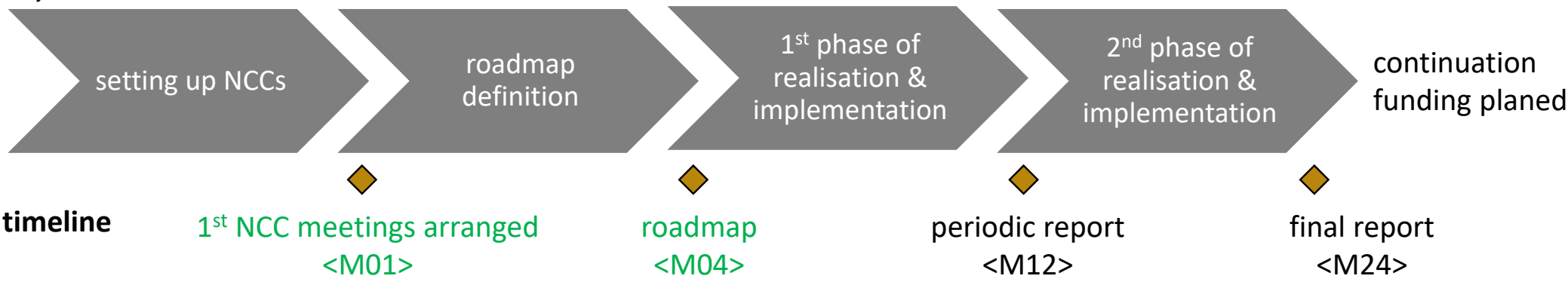


EuroCC funds two research activities for the University of Iceland in the area of neuroscience & computational fluid dynamics

The National Competence Center (NCC) for Iceland of the EuroCC project represents our already established IHPC & IRHPC activities is fully complementary to those activities



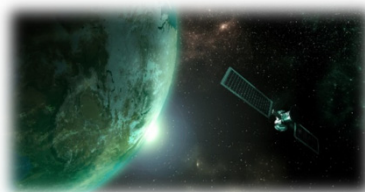
- Major activities: Community building (including industry)



International Collaboration Partners: Juelich Supercomputing Centre



DEEP Series of HPC Projects – Modular Supercomputing Architecture Research



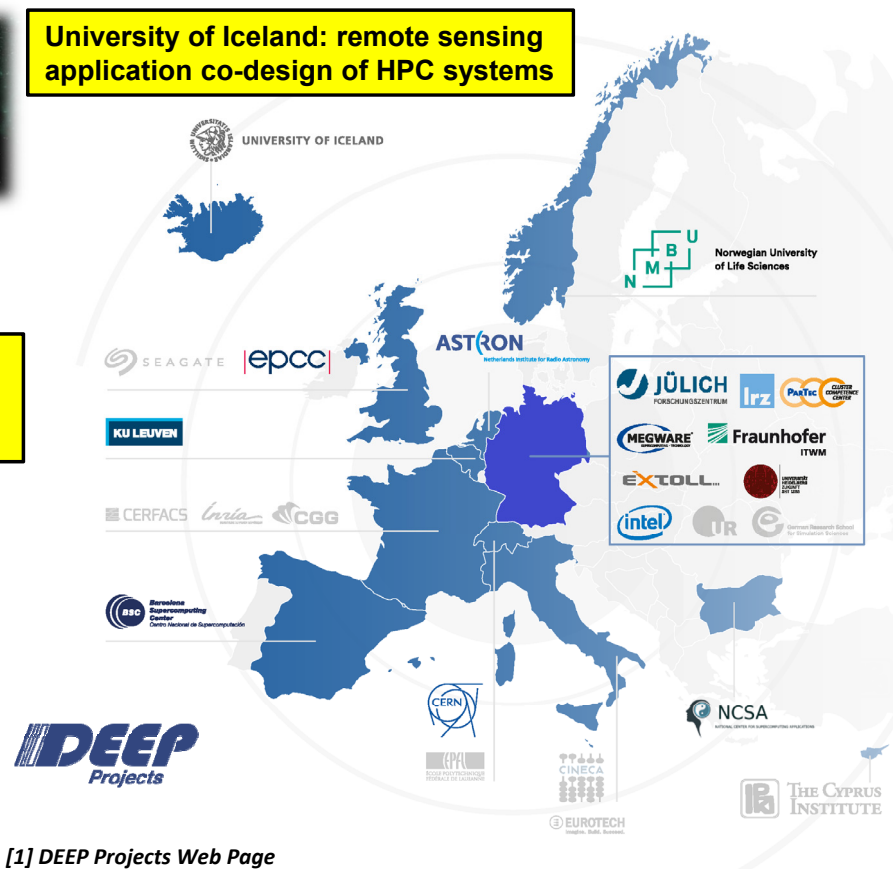
University of Iceland: remote sensing application co-design of HPC systems

Strong collaboration with our industry partners Intel, Extoll & Megware

Strong collaboration with industry partners Intel, Extoll & Megware

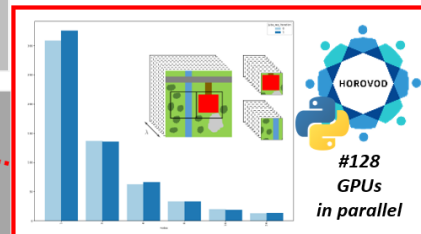
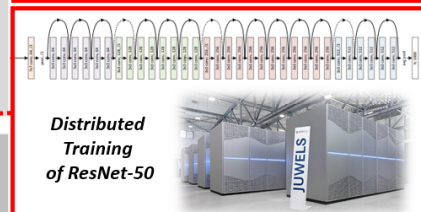
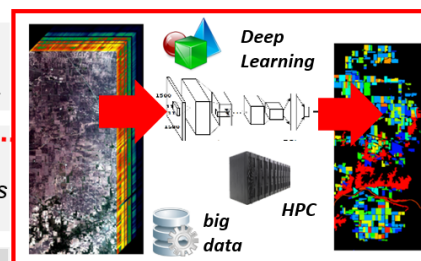
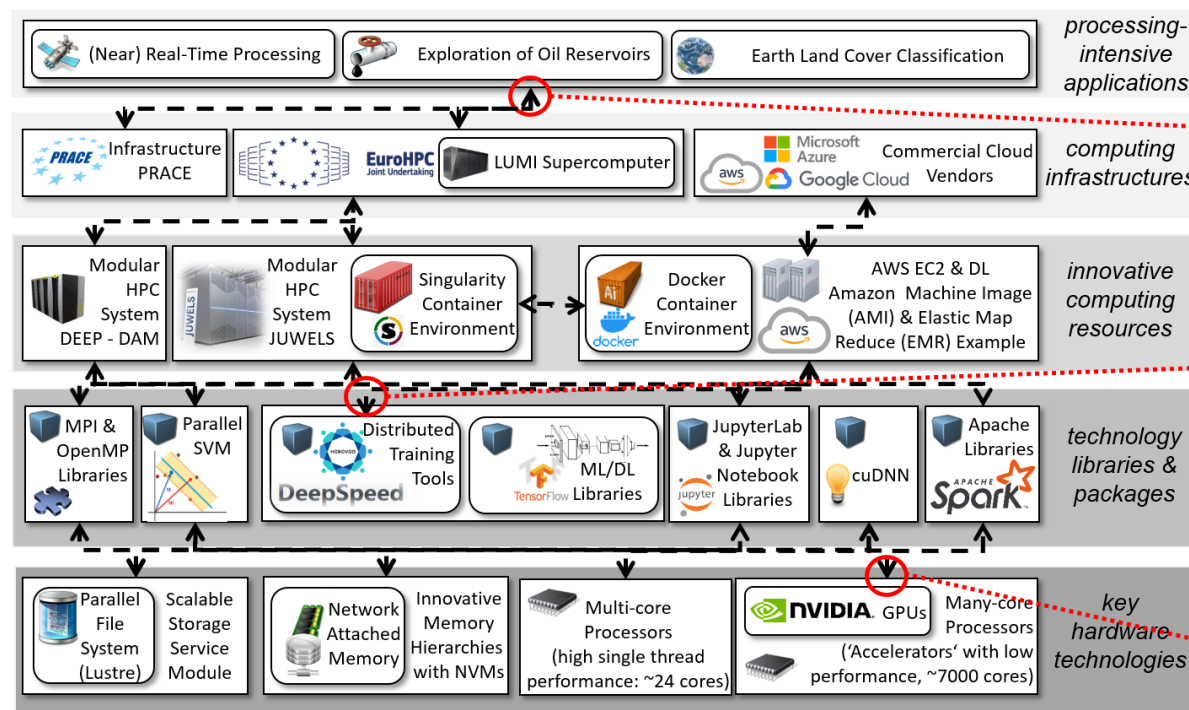
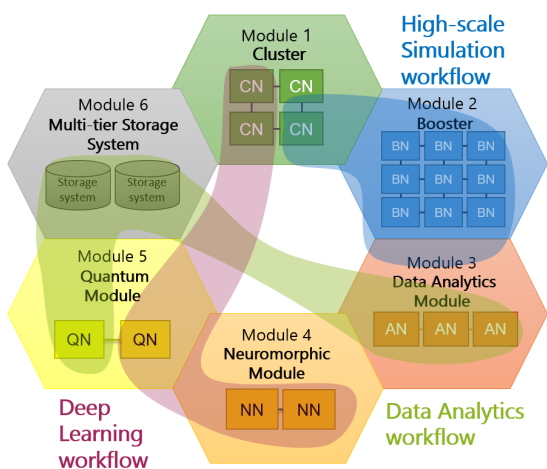
Juelich Supercomputing Centre implements the DEEP projects designs in its HPC infrastructure

- 3 EU Exascale projects
DEEP, DEEP-ER, DEEP-EST
- 27 partners
Coordinated by JSC
- EU-funding: 30 M€
JSC-part > 5,3 M€
- Nov 2011 – Mar 2021



[1] DEEP Projects Web Page

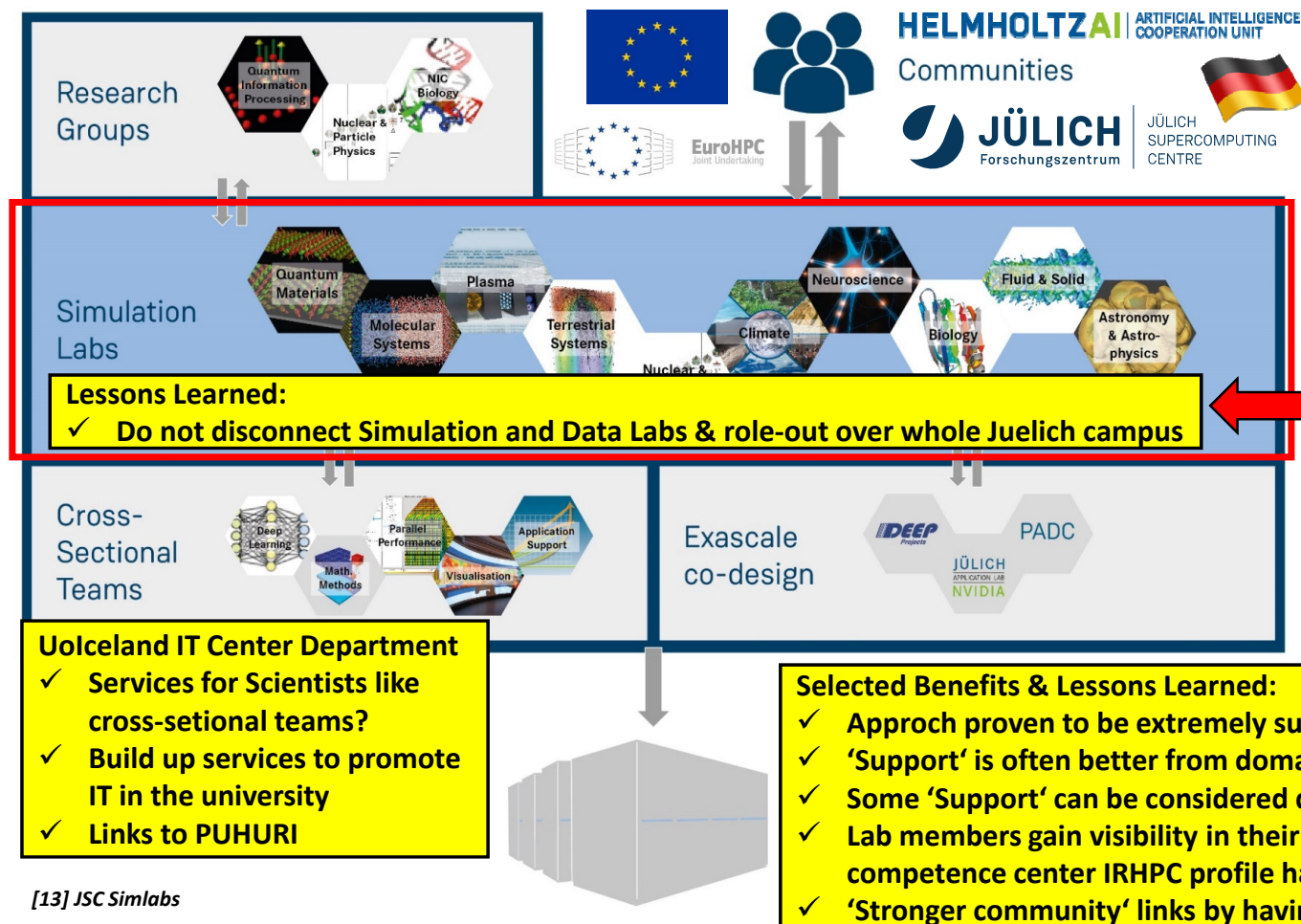
DEEP Series of Projects – Research Examples & Need for Academic HPC Centres



The modular supercomputing architecture (MSA) enables a flexible HPC system design co-designed by the need of diverse research application workloads

Commercial cloud computing is no option to be used here instead (e.g., Amazon Web Services charge 24\$/hour GPU)

Community-building with Simulation & Data Labs (SDLs) – Lessons Learned



'For some years now there has been a growing realisation that application software is lagging behind HPC hardware developments. While several Petaflop-scale supercomputers are now available worldwide, it is becoming increasingly difficult to exploit these machines with single applications. Substantial efforts are needed in order to enable computational science communities to solve problems with high scientific impact through efficient use of high-end supercomputing resources. To help meet this challenge the Juelich Supercomputing Centre (JSC) has proposed a new type of domain-specific research and support structure: the Simulation Laboratory.'

Lessons Learned:

- ✓ The heart of an academic HPC Centre are the people doing the research that is a key differentiator to cloud computing companies (e.g., Amazon Web Services, MS Azure, or Google Platform/Colab) & ensure funding

[13] JSC Simlabs

The diagram illustrates the selection of research projects for the SimDataLabs project in Iceland. It is organized into three main horizontal sections: 'Selected Research @ University of Reykjavik', 'Selected Research @ The Icelandic Innovation Center', and 'Selected Research @ Icelandic Met Office'. A central yellow box labeled 'PIs of 'Old HPC Rannis' proposal as candidates for SimDataLabs in Iceland' is positioned between the top and bottom sections. The bottom section features a blue background with a row of research projects, another central yellow box with the same text, and a bottom row of technical operations and facilities.

Selected Research @ University of Reykjavik:

- Permutation patterns & algorithms to automate the discovery and verification of results in discrete mathematics (Henning Ulfarsson)
- Nanophysics & Properties of small, vacuum electronic systems (Andrei Manolescu)
- Natural Language Technology (Hrafn Loftsson, Jón Guðnason)

Selected Research @ The Icelandic Innovation Center:

- Computer Aided Engineering & Flow & Material Simulations
- Simulation of multiphased viscoplastic flow (Jón Elvar Wallevik)

Selected Research @ Icelandic Met Office:

- Weather & Volcanic Studies
- Hydrological modeling** (highlighted in yellow)

PIs of 'Old HPC Rannis' proposal as candidates for SimDataLabs in Iceland

Selected Research @ University of Iceland:

- Investigation & Design of New Catalytic Processes (Egill Skúlason)
- Parallel & Scalable Machine Learning of Remote Sensing Datasets (Morris Riedel)
- Natural Language Technology (Anton Karl Ingason)
- Novel Electrocatalysts & Multi-Scale Modelling of Reactive Materials and Processes (Hannes Jónsson)
- New dark matter physics (Jesús Zavala Franco)
- Time-dependent electron transport through a strong cavity photon field (Viðar Guðmundsson)
- Electron heating in electronegative capacitively coupled discharge of complex Chemistry (Jón Tómas Guðmundsson)
- Automated assessment of cerebral autoregulation & coupled dynamics using NIRS & EEG scoring (Tómas Philip Rúnarsson)
- Image processing for evaluation of the ventricular system in health and disease (Lotta M. Ellingsen)

PIs of 'Old HPC Rannis' proposal as candidates for SimDataLabs in Iceland

Technical Ops UTS Team & PUHURI

LUMI HPC Pre-Exascale Research Facility in Finland

New IRHPC Cluster

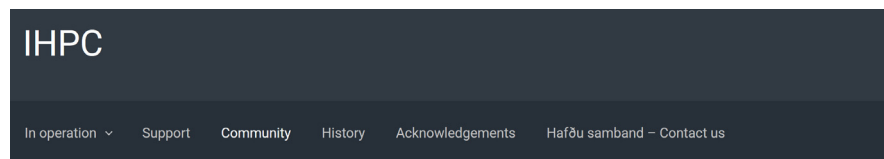
GARPUR HPC Tool Research Facility in Iceland

EURO

New Communities & Organizations

EUROHPC Joint Undertaking

SimDataLabs in Iceland – Confirmed Participation (Work-in-Progress)

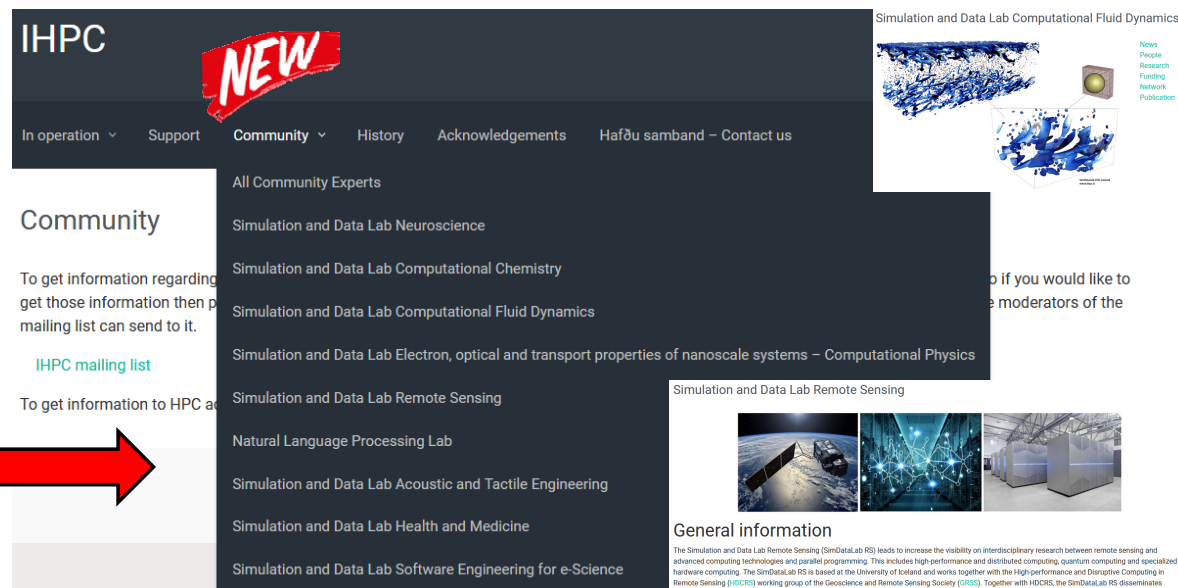


Community

To get information regarding upgrades, downtime or some other important issues then we will send those information to users with email. If you get those information then please sign up. This is not used very regularly so don't worry about getting spammed through this list and our mailing list can send to it.

[IHPC mailing list](#)

To get information to HPC admins, then please send an email to help@hi.is and include HPC in the subject.



[14] IHPC Community

Jointly engage in future funding together, e.g. EuroHPC Master of Science in HPC program and many other activities planned in Horizon Europe

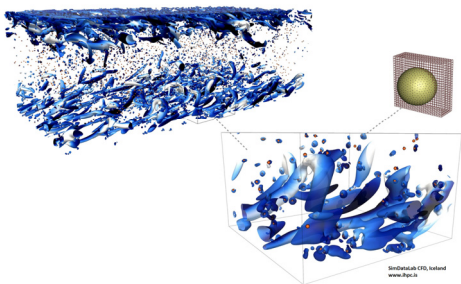


Selected Discussion Topics:

- ✓ **Governance of Labs: Bottom-Up by PI, but optional Executive Advisory Board (EAB) members could be used to guide & 'review' labs on a yearly basis (could be useful): labs of Juelich are 'friendly' reviewed on a 1-2 years basis as part of funding program**
- ✓ **Engagement with Industry: ISOR, MATIS, MAREL, DECODE (work-in-progress), etc.**
- ✓ **Including Start-Ups: Nordverse (medical NLP, done), Treble (Acoustic, done), others?**
- ✓ **Teaching better topics of relevance in HPC Course for Iceland, other activities?**

Simulation and Data Labs – Iceland NCC – Examples

Simulation and Data Lab Computational Fluid Dynamics



Simulation and Data Lab Remote Sensing



General information

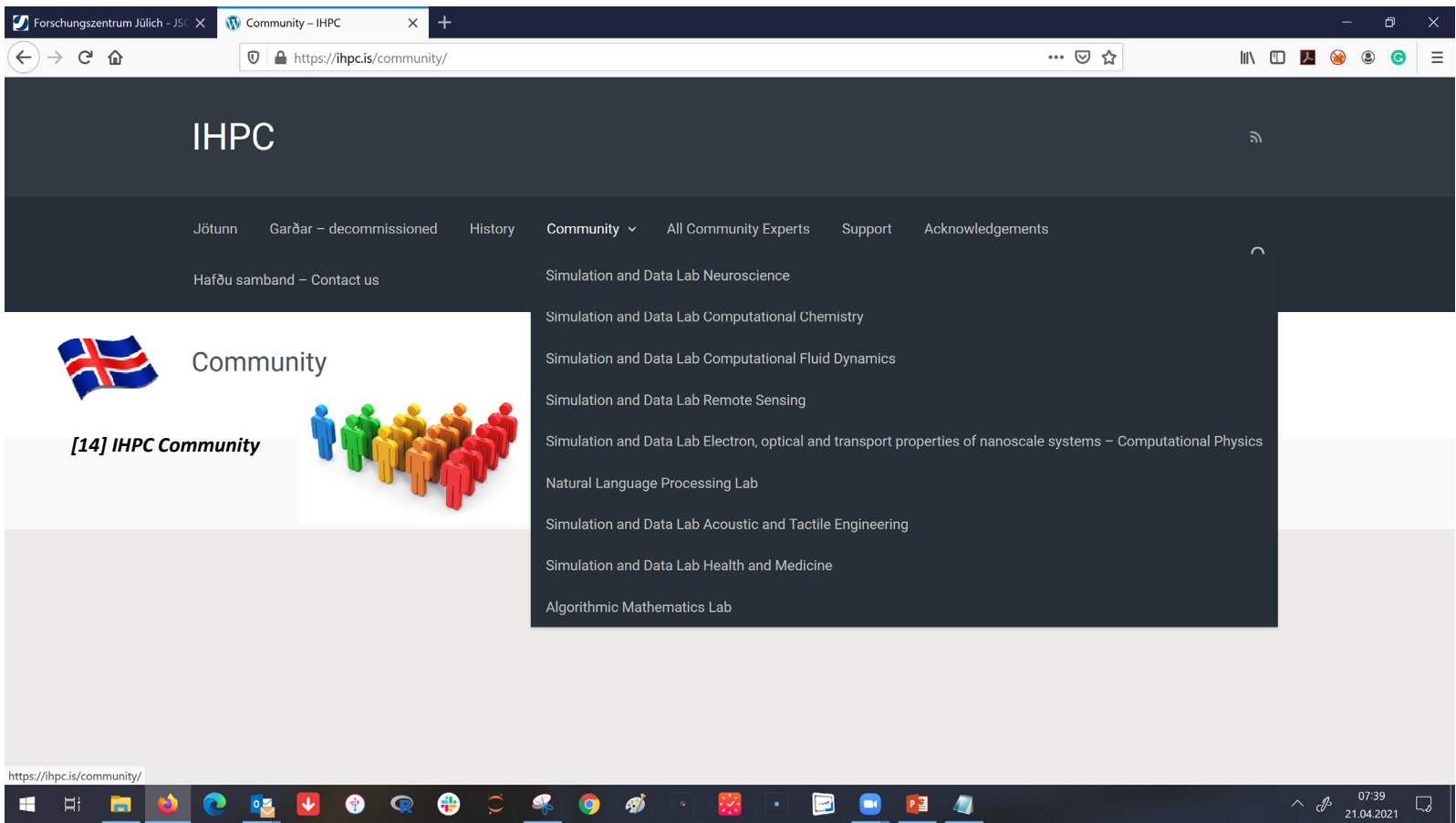
The Simulation and Data Lab Remote Sensing (SimDataLab RS) is a research group that focuses on remote sensing and advanced computing technologies and parallel programming. We include high performance and disruptive computing, quantum computing and specialized hardware computing. The SimDataLab RS is based at the University of Iceland and works together with the High-performance and Disruptive Computing in Remote Sensing (HDCRS) working group of the Geoscience and Remote Sensing Society (GRSS). Together with HDCRS, the SimDataLab RS disseminates information and knowledge through educational events, special sessions and tutorials at conferences and publication activities.

Simulation and Data Lab Health and Medicine



General information

The Simulation and Data Lab Health and Medicine (SimDataLab HM) aims to shed light on novel data analysis approaches in the medical domain on the application of High Performance Computing (HPC) architectures in the processing of patient medical data, as well as diagnosis. The SimDataLab HM works in cooperation with the Juelich Supercomputing Centre (JSC) of Forschungszentrum Juelich (FZJ) – Juelich SMITH consortium's Algorithmic Surveillance of ICU Patients (ASIC) use case.



Simulation and Data Labs – Juelich Supercomputing Centre – Examples

Simulation Laboratory Neuroscience



The SimLab Neuroscience is an interdisciplinary team of scientists and engineers with complementary backgrounds and skills, dedicated to supporting neuroscientists in using high-performance computing and data resources for their research. Expertise in both neuroscience and HPC is based on in-house research and development, as well as collaborative joint projects with the Institute of Neuroscience and Medicine (INM), Forschungszentrum Jülich, and other national and international partners.

[13] JSC Simlabs



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Simulation and Data Laboratories

For some years now there has been a growing realisation that application software is lagging behind HPC hardware developments. While several Petaflop-scale supercomputers are now available worldwide, it is becoming increasingly difficult to exploit these machines with single applications. Substantial efforts are needed in order to enable computational science communities to solve problems with high scientific impact through efficient use of high-end supercomputing resources.

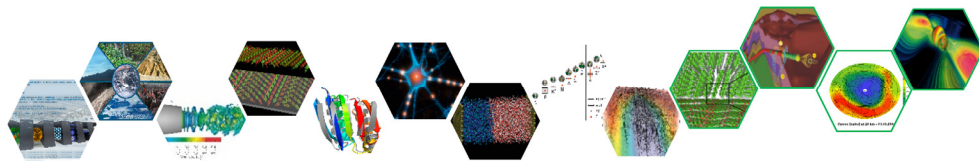
To help meet this challenge the Jülich Supercomputing Centre (JSC) has proposed a new type of domain-specific research and support structure: the Simulation and Data Laboratory. Four such units have now been established at JSC in the fields of Computational Biology, Molecular Systems, Plasma Physics, and Climate Modelling, which have already been actively engaged with user groups from their respective communities over the past year. In October 2012 the SimLab Terrestrial Systems was started. Another SimLab in Neuroscience came on stream early 2013.

In collaboration with JARA-HPC at RWTH Aachen, the JARA Simulation and Data Laboratories "Highly Scalable Fluids and Solids Engineering" and "Ab-Initio Methods in Chemistry and Physics" have been established.



Supercomputers
JUNIQ
User Support
Simulation and Data Laboratories
SDL Biology
SDL Plasma Physics
SDL Molecular Systems
SDL Climate Science
SDL Fluid & Solid Engineering
SDL Quantum Materials
SDL Terrestrial Systems
SDL Numerical Quantum Field Theory
SL Neuroscience
SDL Astrophysics
Test projects on JSC Resources
Data Management
Scientific Cloud Services
Services

EuroHPC – LUMI – What Strategy for People(!) in Research & Support?



EuroHPC
Joint Undertaking

LUMI

Going beyond simple LUMI User Groups?

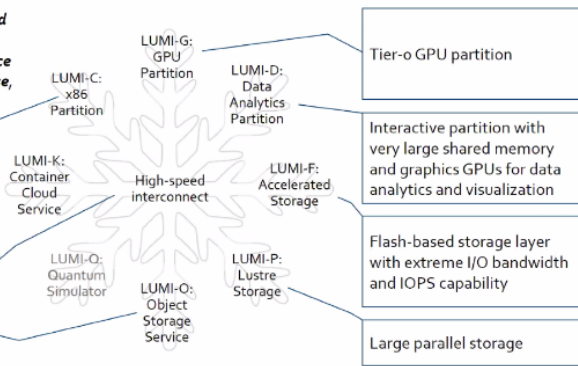
LUMI system architecture

LUMI is a Tier-0 GPU-accelerated supercomputer that enables the convergence of high-performance computing, artificial intelligence, and high-performance data analytics.

- Supplementary "Tier-1" CPU partition
- M, L and XL memory nodes

Possibility for combining different resources within a single run

Encrypted object storage (Ceph) for storing, sharing and staging data



1 SYSTEM
550+ Pflop/s
PEAK PERFORMANCE

LUMI's computing power will be over 550 petaflops.

COMPUTING POWER EQUALS
1.5 MILLION
MODERN LAPTOP'S
CAPACITY

LUMI's computing power is equivalent to the combined performance of 1.5 million of the latest laptop computers. These would form over 23-kilometer high tower.

117 PB
STORAGE

In total, LUMI will have astounding storage of 117 petabytes and an impressive aggregated I/O bandwidth of 2 terabytes per second.

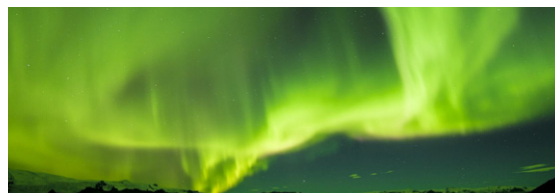
100%
HYDROPOWERED
ENERGY UP TO
200MW

LUMI is using 100% hydropowered energy. Up to 200MWs are available. The waste heat of LUMI will produce 20 percent of the district heat of the area.

- The strategy of people around LUMI will be key to success of the LUMI consortium, not simple hardware
- Possibilities. Jointly engage in CoE or other Calls for creating Simulation and Data Labs around LUMI over time, e.g. also Digital Twins might contribute Digital/Horizon Europe, etc. – Bottom-up; E.g. approach like EOSC-Nordic was one idea
- Some approach also for cross-sectional teams that could be the SIGs in a way, but will they provide support & answers?

[6] LUMI Supercomputer

Simulation and Data Labs – Recruiting links to Teaching & Education in HPC & AI



Masterworks Webinar Series

Advanced Computing driven research in Health Sciences, Energy, and the Environment

Arctic Master Works Webinar and Panel Session 2 | Master Works Webinar and Panel Session 1

As part of an effort to promote and foster new scientific collaboration among Arctic nations, we are initiating a Master Works webinar series to highlight the impact of advanced computing in health sciences, energy, and environmental research. This webinar series brings together scientists from the U.S., Iceland and the Nordic countries to discuss compelling scientific challenges of common interest being addressed through advanced computing and to explore opportunities for collaboration. These Master Works events will feature two 30 minute presentations followed by a 30 minute panel session, total 90 min.

- Date: Wednesday December 9, 2020
- Time: 4pm GMT 10am CDT 9am MDT
- Zoom Link: [MasterWorks webinar link](#)

Presenter

Henrik Madsen - Professor, Head of Section, Dept. of Applied Mathematics and Computer Science (DTU COMPUTE), Technical University of Denmark.

Title: Digitalization for the future weather-driven low-carbon energy system

Abstract: Today energy systems are operated and planned such that the production follows the demand. However, a future low-carbon society calls for systems where demand follows the weather-driven energy production. This highlights a need for a disruption of the whole spectrum of methods ranging energy systems operation to planning. Most importantly we need methods for enabling energy flexibility at all levels of the society; examples being buildings, supermarkets, wastewater treatment plants, districts and cities. We describe a framework called the Smart-Energy Operating-System (SE-OS) for controlling the electricity load in integrated energy systems using big data analytics, AI, edge-to-cloud computing and IoT solutions. The framework can also provide ancillary services (like congestion management, voltage and frequency control) for systems with a large penetration of wind and solar power.

Ben Kroposki - Director of the Power Systems Engineering Center at the National Renewable Energy Laboratory and IEEE Fellow, where he leads strategic research in the design, planning and operations of electrical power systems.

Title: Understanding the Challenges with Integrating Very High Levels of Wind and Solar in Electric Power Systems

Webinar Series Organizing Committee

- Morris Riedel, Associate Professor, University of Iceland
- David Martin, Industry Partnerships and Outreach Manager, Argonne National Laboratory
- Henning Úlfarsson, Assistant Professor, Reykjavik University
- Steve Hammond, Senior Research Advisor, National Renewable Energy Laboratory



Teaching HPC & AI university courses at two universities



HÁSKÓLI ÍSLANDS



HÁSKÓLINN Í REYKJAVÍK
REYKJAVÍK UNIVERSITY



EuroHPC
Joint Undertaking

emerging education activities



long-term center of excellence in HPC, e.g. RAISE

European Commission | Funding & tender opportunities
Single Electronic Data Interchange Area (SEIDIA)

SEARCH FUNDING & TENDERS | HOW TO PARTICIPATE | PROJECTS & RESULTS | WORK AS AN EXPERT | SUPPORT

Training and Education on High Performance Computing

TOPIC ID: EuroHPC-2020-03

[Grant](#)

General information	General information
Topic description	Programme
Conditions and documents	Horizon 2020 Framework Programme
Partner search	Call
Submission service	Training and Education on High Performance Computing (H2020-JTI-EuroHPC-2020-03)
Topic related FAQ	Type of action
Get support	EuroHPC-CSA EuroHPC-CSA
Call updates	Deadline model
	single-stage
	Opening date
	17 March 2021
	Deadline date
	01 July 2021 17:00:00 Brussels time

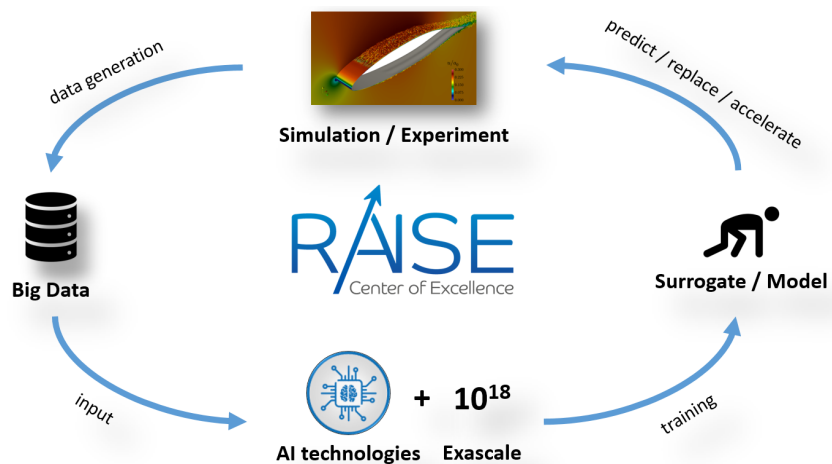
INDICATIVE Pillar 5: Investment Plan for 2021-27 Digital Europe Programme Funding

PILLAR	ACTION	Total EU (21 - 27)
Usage & Skills	Supporting Networking National Centres of Competence (CoC) on HPC (Actions to strengthen the wide application of HPC and increasing the innovation potential of SMEs using advanced HPC services)	€100M
Usage & Skills	Education (Curricula development) - Short Term trainings/Traineeships	€30M
Usage & Skills	M.Sc. HPC	€20M

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NEW

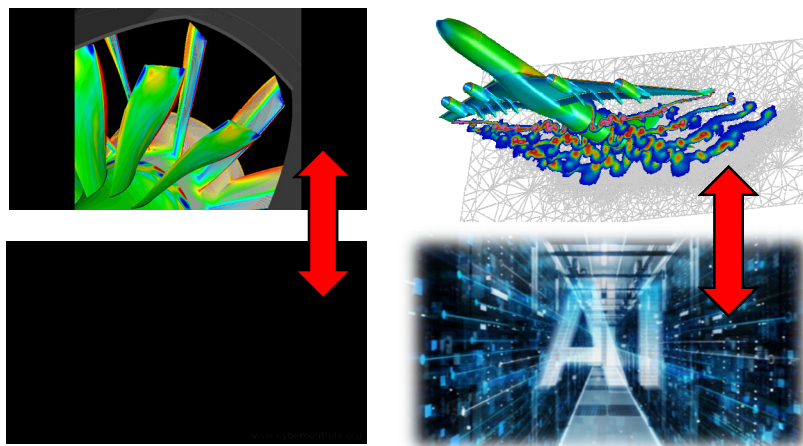
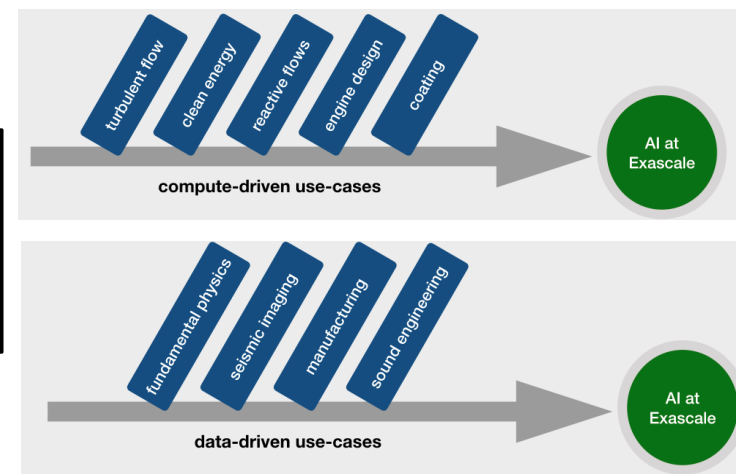
RAISE Center of Excellence (CoE) EU Project – CFD SDLs Join Forces



[4] CoE RAISE Web Page

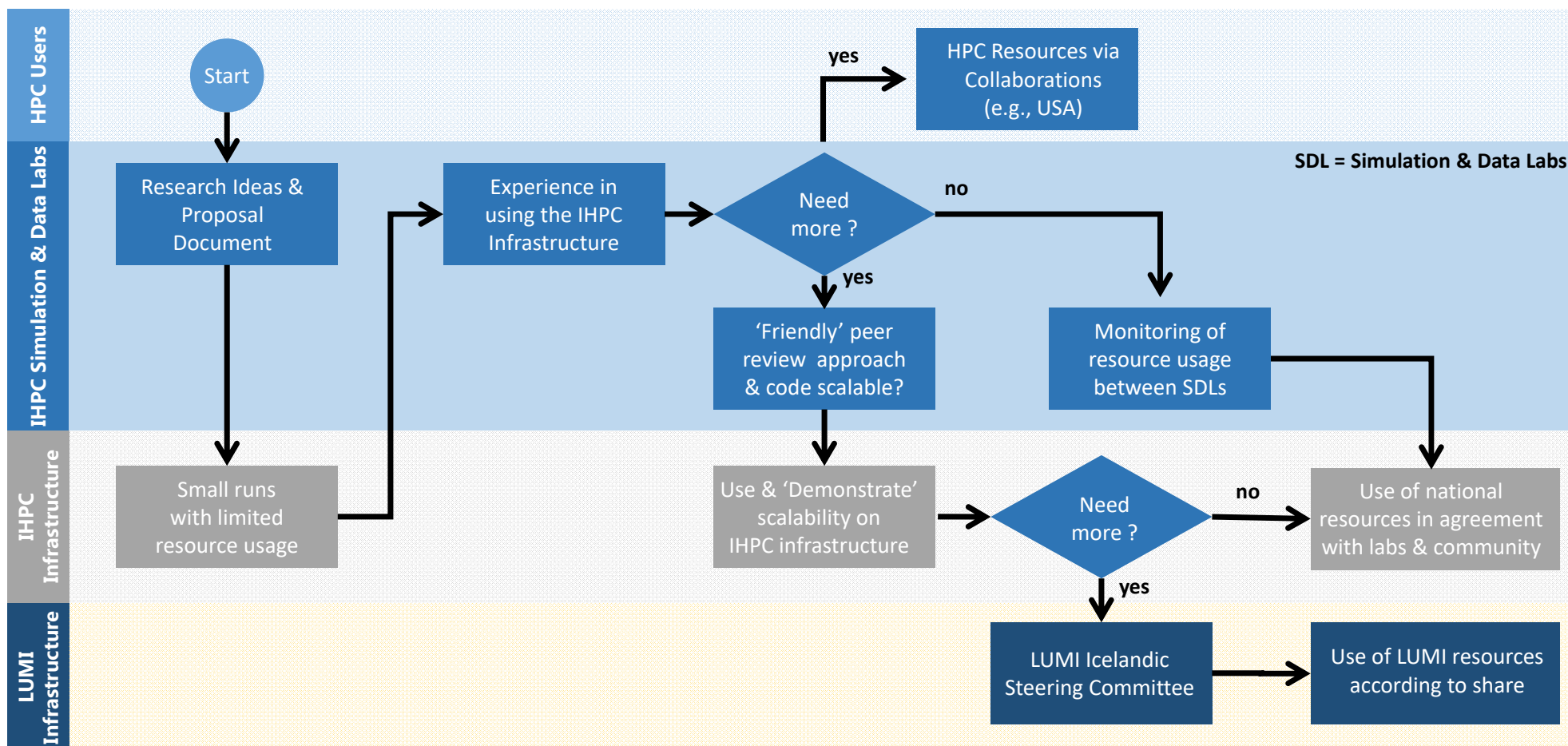
[3] Simulation Figure

RAISE funds three use cases for the University of Iceland in the area of AI-enabled remote sensing, sound engineering, and links with our computational fluid dynamics activities

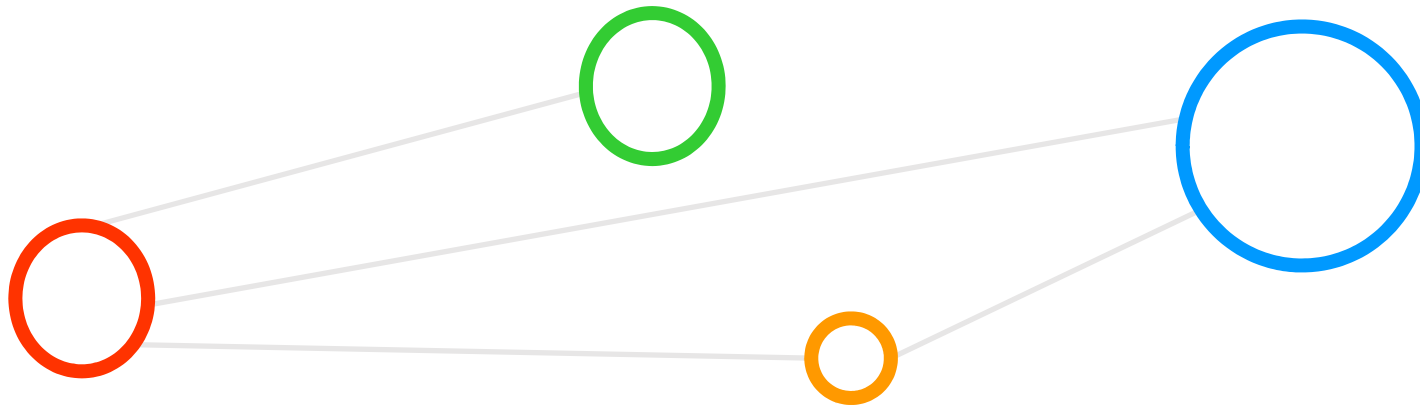


Towards Simulation and Data Labs in the context of the LUMI Supercomputer

Icelandic National Resource Allocation Principle & LUMI – Work-in-Progress



Lecture Bibliography



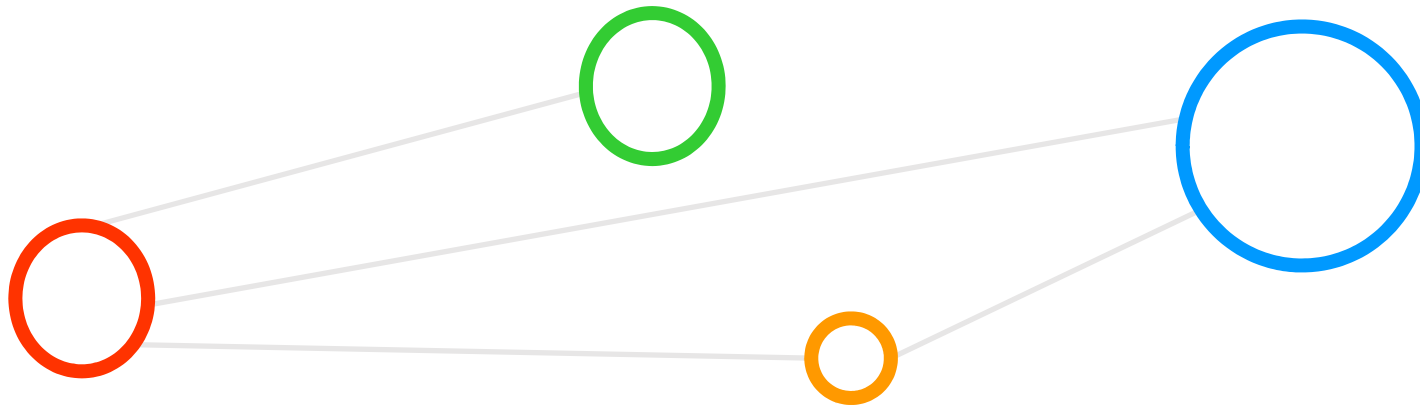
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<http://www.deep-projects.eu/>
- [2] YouTube Video, 'flexible and energy-efficient supercomputer: JUWELS is faster than 300 000 modern PCs' Online:
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<https://www.aia.rwth-aachen.de>
- [4] CoE RAISE Web page, Online:
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- [12] EuroCC Project, Online:
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- [14] Icelandic HPC Community Page, Online:
<https://ihpc.is/>

ACKNOWLEDGEMENTS



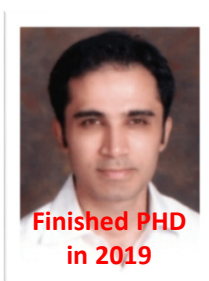
Acknowledgements – High Productivity Data Processing Research Group



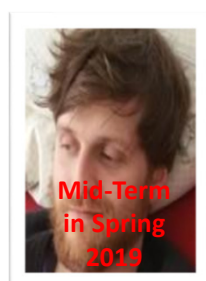
PD Dr.
G. Cavallaro



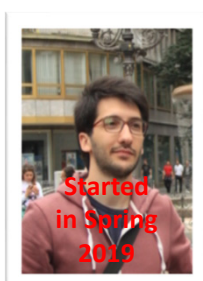
Senior PhD
Student
A.S. Memon



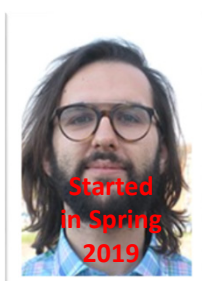
PD Dr.
M.S. Memon



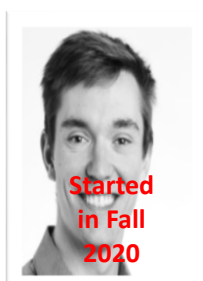
PhD Student
E. Erlingsson



PhD Student
S. Bakarar



PhD Student
R. Sedona



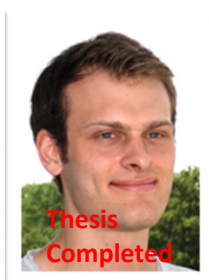
PhD Student
P. H. Einarsson



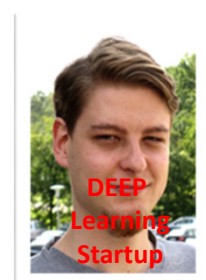
Dr. M. Goetz
(now KIT)



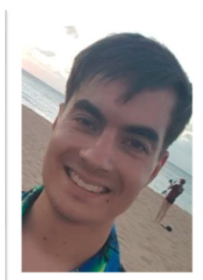
MSc M.
Richerzhagen
(now other division)



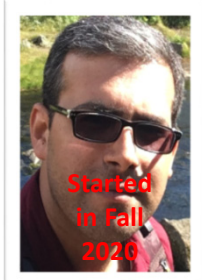
MSc
P. Glock
(now INM-1)



MSc
C. Bodenstein
(now Soccerwatch.tv)



MSc G.S.
Guðmundsson
(Landsverkjun)



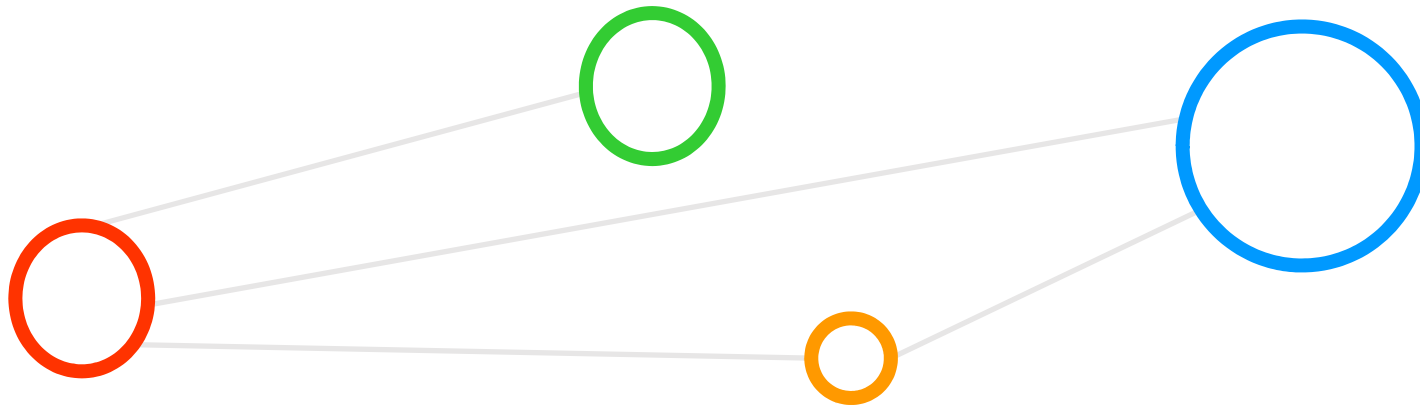
PhD Student
Reza



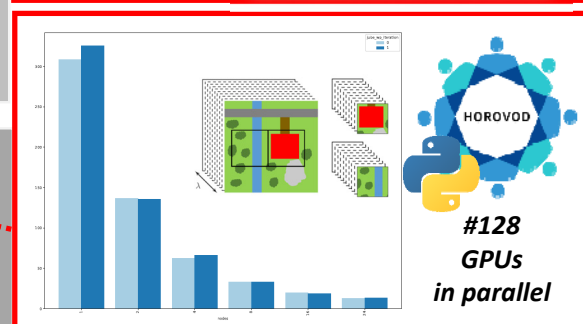
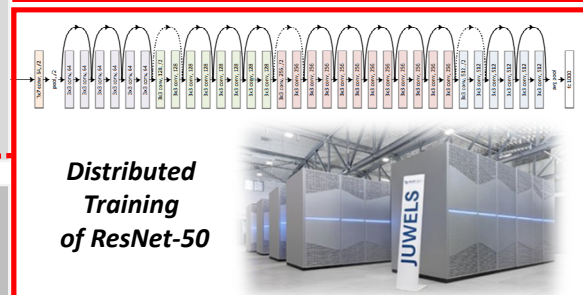
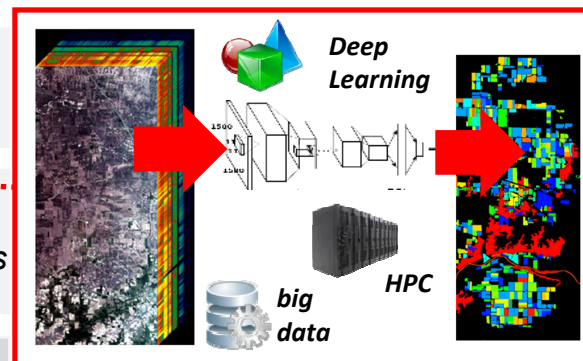
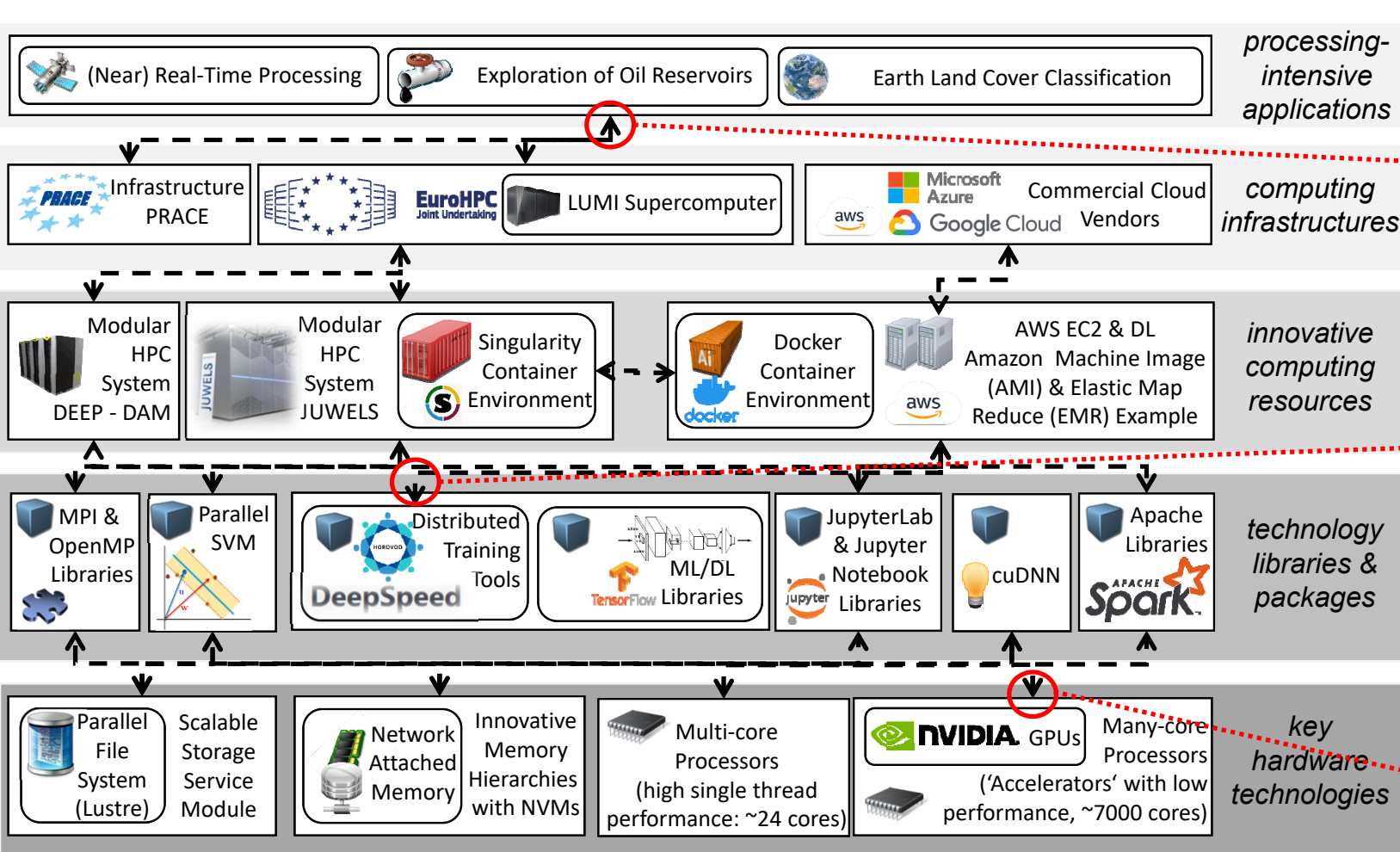
This research group has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 763558 (DEEP-EST EU Project) and grant agreement No 951740 (EuroCC EU Project) & 951733 (RAISE EU Project)



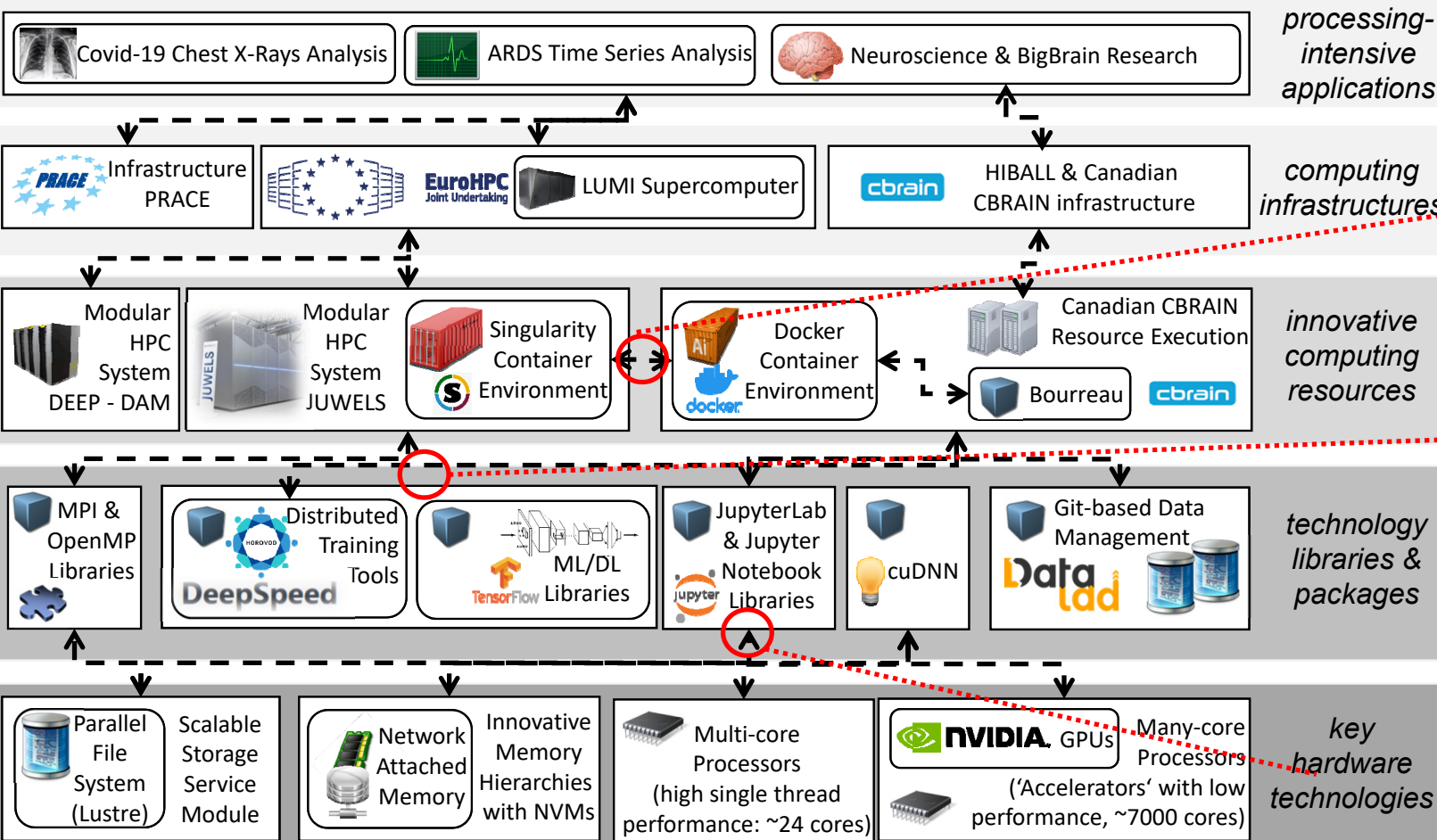
Appendix



Research Examples – Remote Sensing AI & HPC Applications



Research Examples – Health & Medical AI & HPC Applications



Some preparation

```
$ mkdir winterschool_winterschool_cache winterschool_tmp
$ chmod +w winterschool_cache
$ export SINGULARITY_CACHEDIR=$(mktemp -d -p "$(pwd)/winterschool_cache")
$ export SINGULARITY_TMPDIR=$(mktemp -d -p "$(pwd)/winterschool_tmp")
```

Pull the docker image:

```
$ cd winterschool
$ singularity pull hws.sif docker://glatard/hws
```

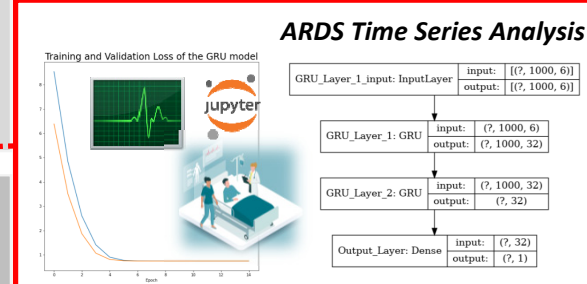
Step into the container

```
$ singularity shell ./hws.sif
(the prompt changes to `Singularity`)
```

download a dataset:

```
$ git config --global user.name "Your name"
$ git config --global user.email "peturhelgi@gmail.com"
```

Singularity> datalad install https://github.com/CONP-PCNO/conp-dataset.git



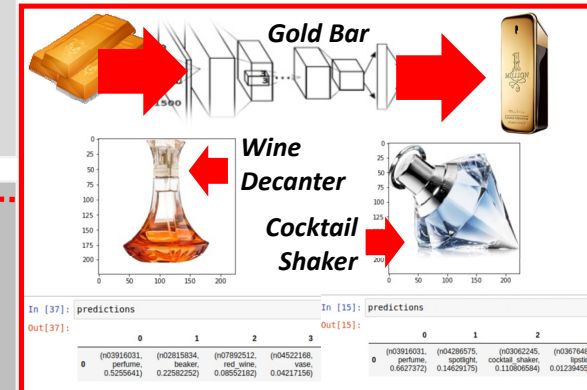
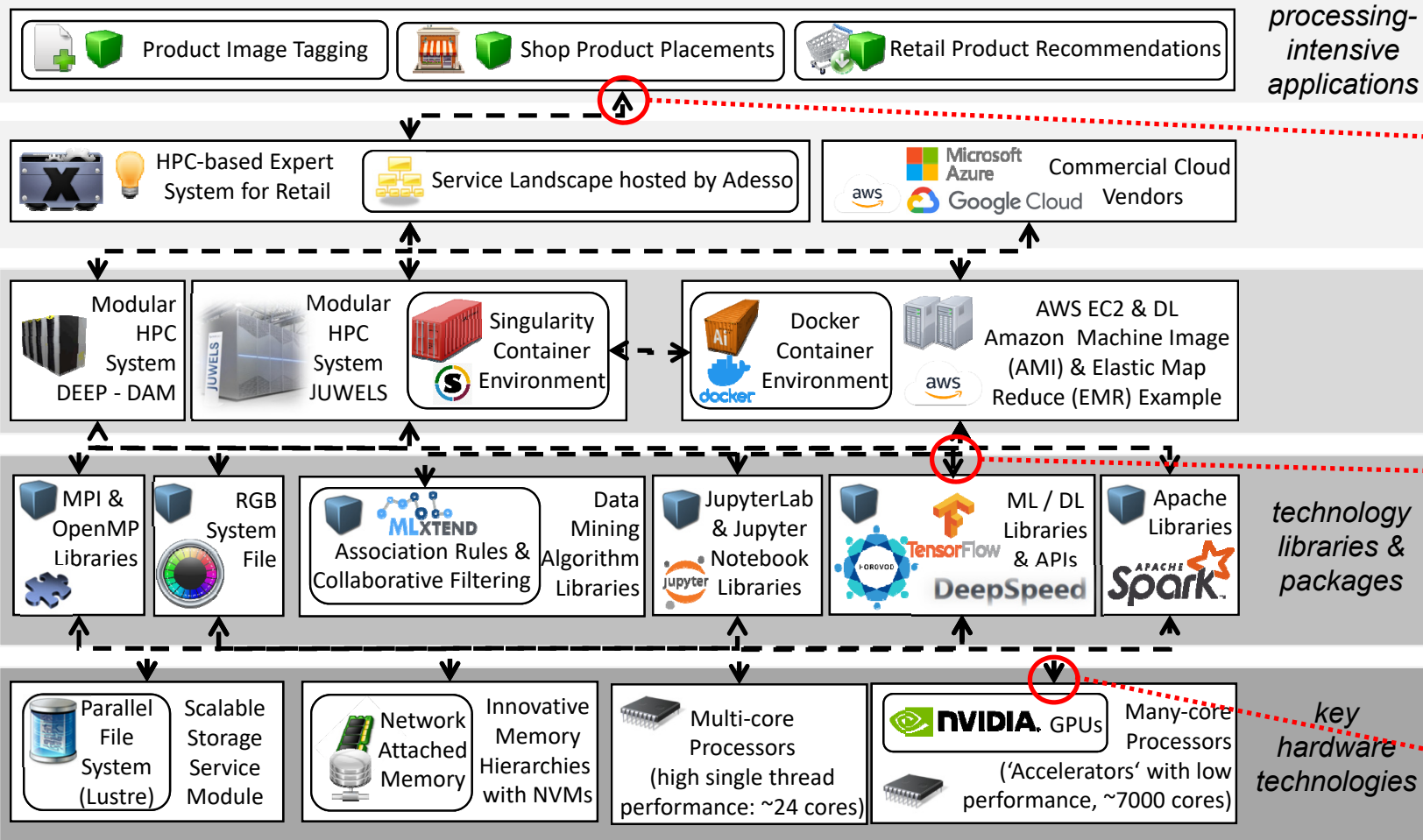
Covid-19 Chest X-Ray Analysis

Covid-Net

```
#!/bin/bash
# Load required modules
module purge
module use $OTHERSTAGES
module load Stages/2020
module load GCCcore/9.3.0
module load Python/3.8.5
module load TensorFlow/2.3.1-Python-3.8.5
module load OpenCV/4.5.0-Python-3.8.5
# Activate Python virtual environment
source /p/project/training2104/ingolfsson1/jupyter/kernels/ingolfsson1_kernel/bin/activate
# Ensure python packages installed in the virtual environment are always preferred
export PYTHONPATH=/p/project/training2104/ingolfsson1/jupyter/kernels/ingolfsson1_kernel/lib
exec python -m ipynbkernel $@
```

Covid-X Dataset

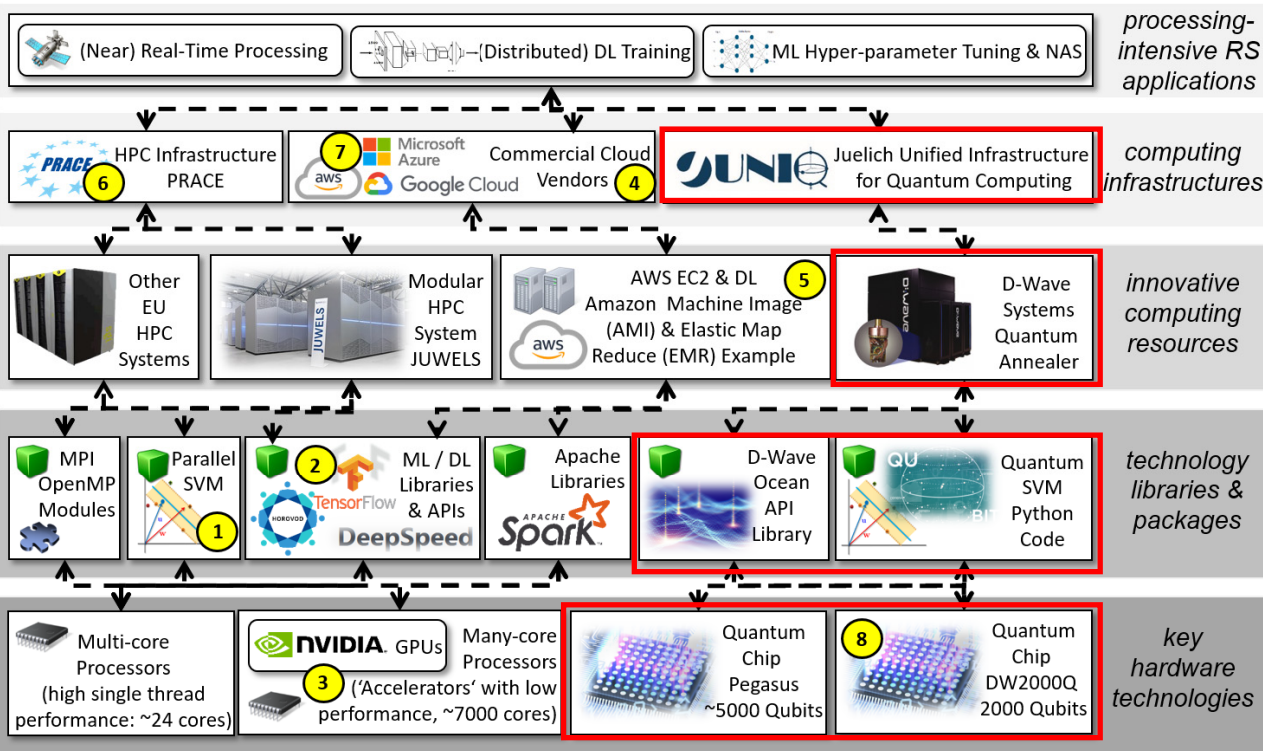
Research Examples – Retail AI & HPC Applications



#GPUs	images/s	speedup	Performance per GPU [images/s]
1	55	1.0	55
4	178	3.2	44.5
8	357	6.5	44.63
16	689	12.5	43.06
32	1230	22.4	38.44
64	2276	41.4	35.56
128	5562	101.1	43.45

#128 GPUs in parallel

Research Examples – Quantum Module with D-Wave Systems Quantum Annealer



- 1 Parallel ML implementations still rare (MPI/OpenMP)
- 2 Open source tools good, but all need to fit in versions
- 3 Using very many GPUs beyond NVlink could be tricky
- 4 Look & feel of CC vendor ML services differ significantly
- 5 Costs of GPUs of CC vendors (e.g., EC2) tough, 24\$/hour
- 6 GPU hours are free, but requires time grant proposal
- 7 Free GPUs in Google Colab vary in the available types
- 8 Works not yet with multi-class problems & large data

Legend:
N Highlighted Challenges & Experiences

```
In [ ]: from quantum_SVM import *
import numpy as np
from utils import *
from sklearn.model_selection import KFold
from sklearn import preprocessing

# Write the data
experimental =
slices = # Number of samples to use for the training
fold = int(len(X_train)/40)

print(fold)

for i in range(0, experiment):
    cv = KFold(n_splits=fold, random_state=i, shuffle=True)
    count = 0
    for test_index, train_index in cv.split(X_train):
        #print("Train index: ", len(train_index), "\n")
        X_train_slice = X_train[train_index], Y_train[train_index]
        X_train_slice = preprocessing.scale(X_train_slice)

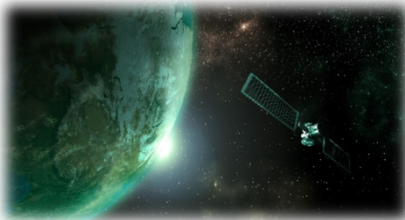
        X_test_slice = X_train[test_index], Y_train[test_index]
        X_test_slice = preprocessing.scale(X_test_slice)
```

[9] Approaching Remote Sensing Image Classification with Ensembles of SVMs on the D-Wave Quantum Annealer, G. Cavallaro & M. Riedel et al.

Morris Riedel
Juelich Supercomputing Centre
Demystifying Quantum Computing

[8] Quantum SVM, D. Willsch et al. [7] M. Riedel, UTMessan 2020 YouTube Video

Open PhD Position Available in EU Project RAISE @ Iceland



Information

The PhD position is funded by the EU project Center of Excellence "Research on AI- and Simulation-Based Engineering at Exascale" (CoE RAISE). This project will be the excellent enabler for the advancement of European multi-physics and/or multi-scale applications on industrial and academic level and a driver for novel intertwined AI and HPC technologies.

👤 **Supervisor:** Prof. Morris Riedel (University of Iceland)

👥 **Co-Supervisors:** Dr. Gabriele Cavallaro (Jülich Supercomputing Centre) and Prof. Magnús Örn Úlfarsson (University of Iceland)

📅 **Starting date:** January 2021

⚠️ (Due to the current corona pandemic, the first work period can be conducted remotely)

📍 **Location:** Reykjavík (Iceland). You will be employed at the University of Iceland. A research stay at the Jülich Supercomputing Centre (Forschungszentrum Jülich, Germany) is envisaged for a minimum period of time of 6 months. To obtain your PhD degree at the University of Iceland you will have to acquire 30 ECTS from courses and seminars. Your working hours will be not monitored and working from home will be largely permitted.

🎯 **Goal:** pioneer the research of advanced deep transfer learning methods in the context of complex learning scenarios in applications from remote sensing. The priority will be put on the investigation of the transferability capacity of Deep Learning (DL) models with meta-learning and Neural Architecture Search methods.

🧑‍🔬 **Research Group:** be part of our joint research group "High Productivity Data Processing" at University of Iceland and Jülich Supercomputing Centre. The group is highly active in developing parallel and scalable machine (deep) learning algorithms for remote sensing data processing and many other types of applications (i.e., medical research and retail sectors).

⚙️ **Working Environment:** Direct access to high performance multi-GPU systems equipped with the state-of-the-art of DL frameworks (TensorFlow, pyTorch, Chainer, Horovod, DeepSpeed). There is also the possibility to access innovative quantum computing systems.

📖 **Other information:** You will have the possibility to participate in international top conferences in the field of machine learning, HPC and remote sensing. You will be put in contact with several international partners for initiating research collaborations that match the topic of the PhD.

🎓 **Background education:** MSc degree in computer science or computer engineering. Level of English >= B2.

🧠 **Required knowledge and experience:** deep learning (Convolutional Neural Networks and/or Transformers) and Python programming (TensorFlow and/or pyTorch). Experience with parallel programming (OpenMP and MPI), High Performance Computing (HPC) and remote sensing data processing are a substantial plus.

✉️ **Apply:** Send your CV, a cover letter and the transcripts of records of your bachelor and master to Gabriele Cavallaro: g.cavallaro@fz-juelich.de.

[Apply now](#)

A screenshot of a Facebook post. At the top, it shows the profile of Morris Riedel, Professor & Head of Research Group High Productivity Data Processing Juelich. Below that, it shows a post by Dr. -Ing. Gabriele Cavallaro, 1st Machine Learning | HPC | Remote Sensing, Deputy Head of a research group @ Jülich. The post text says: "Fully-funded PhD position in our 'High Productivity Data Processing' research group at the University of Iceland - Háskóli Íslands". Below the text is a large image of a landscape in Iceland, featuring a prominent, layered mountain peak (Hvannadalshnúkur) and a waterfall. At the bottom of the image, the text "PHD POSITION IN ICELAND" is written in large, bold, white letters.

[10] Open PhD Position, RAISE EC Project @ Iceland