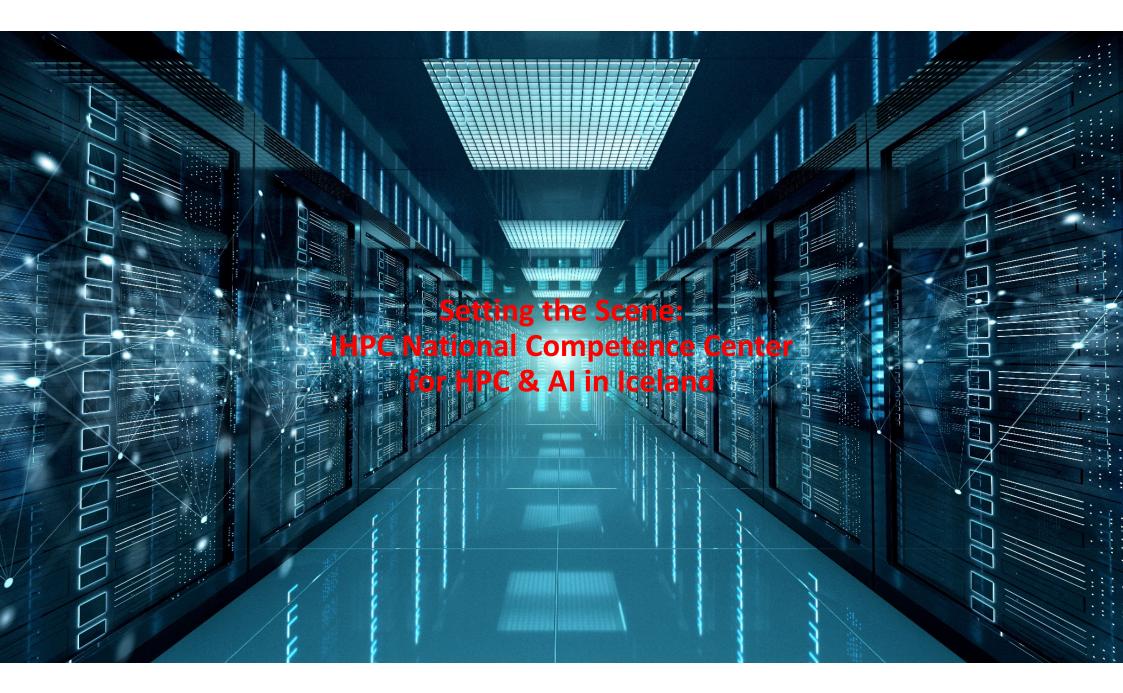


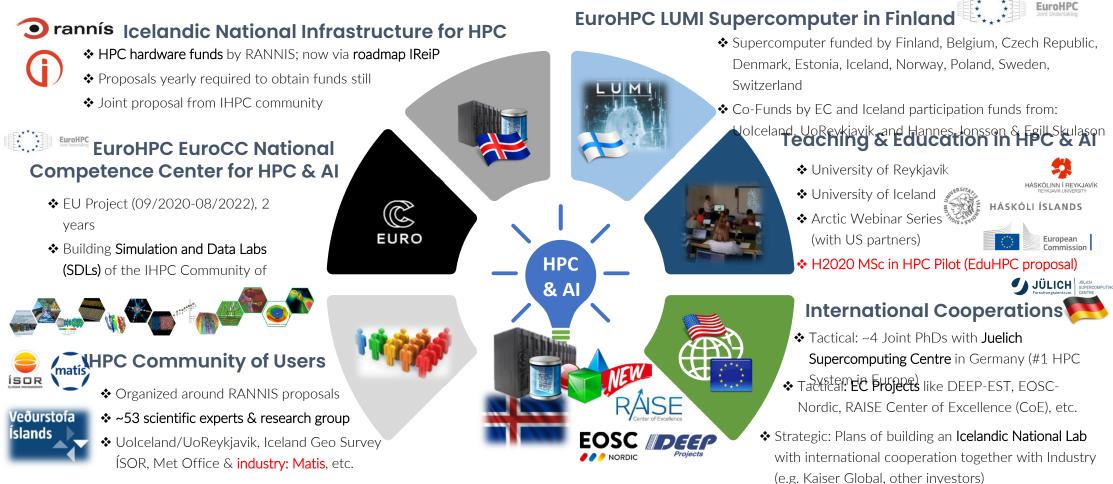
Icelandic HPC National Competence Center for HPC & AI – Welcome & Workshop Objectives

PROF. DR. – ING. MORRIS RIEDEL, UNIVERSITY OF ICELAND & JUELICH SUPERCOMPUTING CENTRE (GERMANY), EVENT CHAIR 31TH AUGUST, 6TH ICELANDIC HPC COMMUNITY WORKSHOP, UNIVERSITY OF ICELAND, GRÓSKA





Executive Summary – Major Icelandic HPC Activities



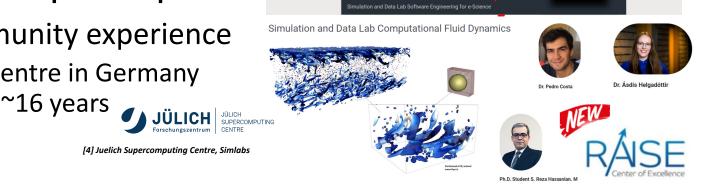
EuroCC Activities – Selected Benefits towards Bottom-Up Community Building





[1] Icelandic HPC Community Web page

- Simulation & Data Lab Communities
 - Experts w.r.t. HPC in domain-specific topics
- Based on extensive community experience
 - Juelich Supercomputing Centre in Germany works with the model for ~16 years



II Community Exper

Simulation and Data Lab Neuroscience

and Data Lab Re

and Data Lab Acoustic and Tactile Engi

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IHPC mailing list



The Simulation and Data Lab computational fluid dynamics (SimDataLab CFD) is leading parallel computing in Computing in Computing and the University of Iceland. The SimDataLab is Iceland's representative in the international projects in CFD and parallel computing. SimDataLab CFD aims to develop parallel code applications in CFD and support users who have already developed parallel application codes. SimDataLab CFD participates in the European project network in parallel computing and has an infrastructure and access to powerful parallel systems in-memory optimization, processing system architecture, high scalability, and have performance optimization computer nodes.

[2] IHPC SimDataLab CFD Web Page

nd Data Lab Electron, optical and transport properties of nanoscale systems – Computational Phys

Icelandic HPC National Competence Center for HPC & AI – Welcome & Workshop Objectives

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Ministry Report on HPC & Reykjavik Institute



Reykjavík Institute & High Performance Computing – Benefits for the Icelandic Science Community



Executive Summary

Computing in general and scientific computing, in particular, have outstanding track records of providing breakthrough research results, advancing society and providing a strong basis for commercialization and growth.¹ As a result, lcelandic researchers from various academic and industry organizations have formed the Icelandic High-Performance Computing (IHPC) National Competence Center². The conceptual idea of the Reykjavik Institute was co-designed by this IHPC community in close collaboration with Kaiser Global and William (Bill) Patrowicz. IHPC community members have formulated this report on the benefits of the Reykavik Institute for the Icelandic science community:

Benefit #1 Enable Access to Advanced Computing: The planned shared infrastructure usage with the Reykjavik Institute will provide an enormous improvement of Iceland's access to computational HPC resources and consequently increase the competitiveness of Iceland significantly. Hence, access to such a computing infrastructure is needed to reach Iceland's science, technology, and innovation goals.

Benefit #2 Empower Researchers via Joint Labs: The IHPC Simulation and Data Labs (SDLs) with experts in various science and engineering areas can increase and enlarge their international visibility and obtain additional grants. Dual affiliations of researchers enable very close cooperation.

Benefit #3 Expand Computing Skills & Capabilities: HPC is a research and engineering capability that delivers a clear impact. Joint university courses, hands-on training, and internships with the Reykjavik Institute increase lealandic researchers' and students HPC skills and scientific computing capabilities.

While this report primarily focuses on the scientific community benefits, we would like to use this opportunity to emphasize the enormous impact on the local industry and Icelandic economy shortly:

Establish a new knowledge-based industry built on local know-how, resources, and location: Unlike some existing resource-based industries, a compute based knowledge industry creates high-value modern jobs, both direct and derived. The Reykjavik Institute plans to build 150 expert-level jobs in lceland over the next five years, with an equal number of derived jobs, including digital-tech spin-offs.

Attract computing-based value-added industries, including space exploration and energy transition: A successful establishment of the Reykjavik Institute will attract enterprises and development groups benefitting from proximity to experts and computing resources. It constitutes a unique opportunity for Iceland to contribute meaningfully to the energy transition and decarbonization beyond our borders.

¹ PRACE – The Scientific Case for Computing in Europe 2018 – 2026, Online: <u>https://prace-ri.eu/wp-content/ubloads/2019/08/PRACEScientificCase.pdf</u> ² Icelandic HPC (IHPC) National Competence Center & Community, Online; <u>https://ihpc.is/community</u>. Reykjavík Institute & High Performance Computing - Benefits for the Icelandic Science Community

Benefit #1 Enable Access to Advanced Computing

[...] the competitiveness of European science & industry will be jeopardized if sufficiently capable computers are not made available, together with the associated infrastructure and skilled people necessary to maximize their exploitation.⁹

Scientific and engineering applications of HPC underpin all aspects of our lives. For example, HPC can quickly process scientific data and perform complex calculations at extremely high speeds. As a result, it has become an integral part of the scientific method for the physical sciences (e.g., see Figure 1 for avalanche simulations based on known physical laws).

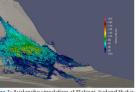


Figure 1: Avalanche simulation at Flateyri, Iceland that is only possible to compute using HPC; Image: Tómas Jóhannesson, Icelandic MetOffice, 3rd IHPC Workshop

The past decade showed a vast increase in HPC use across different scientific communities in Iceland. For example, the Principle Investigators (PIs) in Iceland that are part of RANNIS HPC proposals grew from roughly 17 to over 52 today. Many of those PIs are part of IHPC Simulation and Data Labs, and the number of PIs is expected to grow in the following years. That demonstrates the need for HPC resources in Iceland and benefits to cooperate closely with the Reykjavik Institute to co-design a computational infrastructure for energy, space, and the environment in Iceland.

The benefit includes usage access to that shared infrastructure in exchange for skills provided by lcelandic researchers to use and maintain scientific application codes on the Reykjavik Institute infrastructure used by a broader set of infrastructure users in the lcelandic private & public sector.

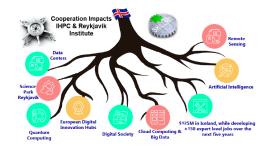


Figure 2: Selected impacts of the close cooperation between the Icelandic HPC (IHPC) community and the Reykjavík Institute, including building 150 expert-level jobs in Iceland over the next five years.

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³ PRACE – The Scientific Case for HPC in Europe 2012 – 2020, Online: <u>https://exdci.eu/sites/all/themes/exdci_theme/images/prace_the_scientific_case_full_text_-pdi</u> Reykjavík Institute & High Performance Computing – Benefits for the Icelan

Benefit #2 Empower Researchers via Joint Labs

[...] the European industry needs increased Icelandic researchers already have excellent support in application development: to develop effective HPC applications is intrinsically difficult (e.g., members of IHPC simulation and Data – and the adoption of such codes to new Labs) and forming joint laboratories with the hardware (for example, to accelerators such as PCUS) requires detailed expertise.⁴ factor for their research.

Compared to many other data centre strategies, the Reykjavik Institute plans to create 150 expertlevel jobs in Iceland over the next five years. Those job areas are in computer science and the realm of science and engineering applications that take advantage of HPC. Therefore, it makes sense to enable from the start close cooperation between the IHPC community and the Reykjavik Institute and its computational infrastructure activities. Furthermore, the dual affiliations of Icelandic researchers with the Reykjavik Institute make it possible not to lose identities with their Icelandic home organization (e.g., HI, HA, MetOffice, etc.). Figure 2 shows expected initial cooperation impacts, to list a few.

The benefit for Icelandic researchers in engaging in joint laboratories with the Reykjavík Institute is to strengthen the IHPC Simulation and Data Labs by gaining more international visibility, career path options for its younger scientists, and being in a better position to win additional research grants. Apart from having a more substantial footprint in Digital/Horizon Europe EU programs, researchers can also engage in US grants (e.g., National Science Foundation, Department of Energy, etc.).

Benefit #3 Expand Computing Skills & Capabilities

HPC is a research and engineering capability built using technology, people, and processes to deliver clear business value and scientific impact. It is not just supercomputing. Al, and Quantum, and therefore it is instrumental for Iceland to enlarge its number of experts having those capabilities in the future. They enable a deeper scientific understanding and breakthroughs in nearly every scientific field.

The benefit of cooperation between the Reykjavík Institute and the IHPC community will enable a broader range of education options through new joint university courses, student education, internships, and hands-on training to massively increase the HPC research and engineering capability of Icelandic researchers.

Garðarsson)

University of Iceland (Prof. Morris Riedel, Prof. Jón Atli Benediktsson, Prof. Sigurður Magnús

The Icelandic HPC Competence Center has received

funding from the European Union's Horizon 2020

research and innovation programme under grant

University of Revkiavík (Prof. Gísli Hiálmtýsson)



Figure 3: William (Bill) Patrowicz (CEO, Kaiser Global) agreement No 763558 (DEFP_EST EU Project) and discusses the Reykjavik institute with members of the grants agreement No 951740 (EuroCC EU Project) HPC community at the first HPC workshop in 2021. & \$951733 (RAISE EU Project).

⁴ European Technology Platform for High Peformance Computing (ETP4HPC) Strategic Research Agenda: <u>https://www.etp4hpc.eu/sra.html</u>

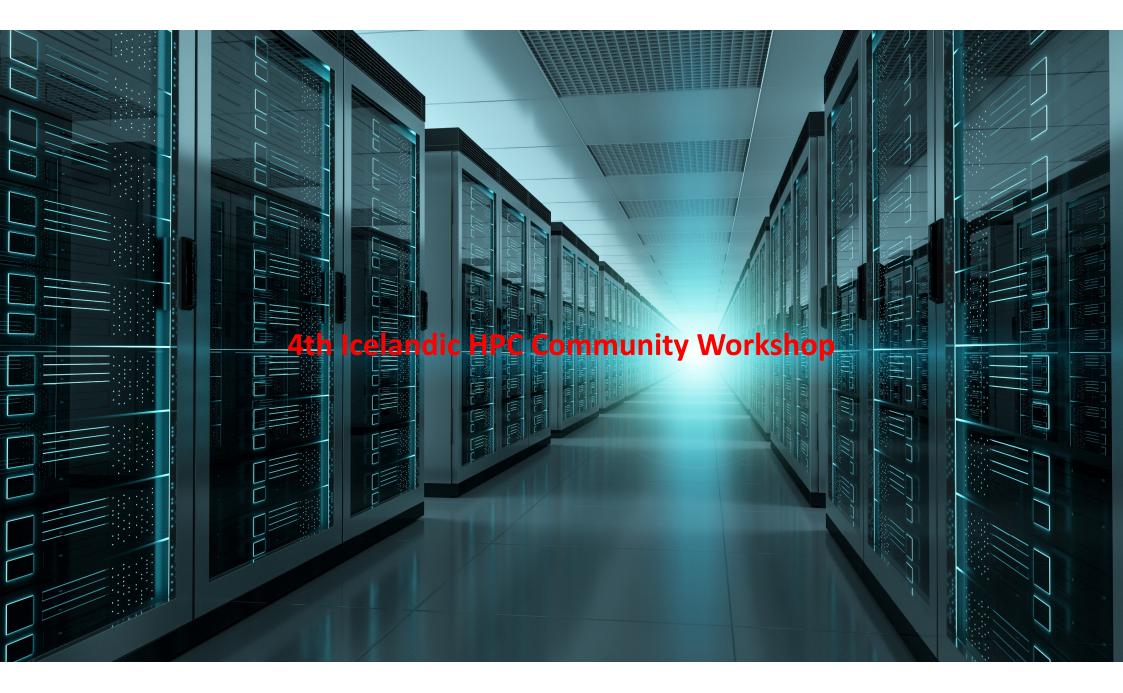
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Áslaug Arna Sigurbjörnsdóttir

Embætti: Hásköla, iðnaðar og nýsköpunarráðherra Ráðuneyti: Hásköla, iðnaðar og nýsköpunarráðuneyt Kjördæmi: Reykjavíkurkjördæmi suður Þingflökkur: Sjálfsastofnökkur Ø aslaurs@althingf.is Ø aslaurarna.is

Råðuneyti: Kjördæmi: Þingflokkur: @ aslaugs@alth

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Workshop Objectives

F2F WORKSHOP

Bring together a diverse group of Icelandic and international stakeholders to discuss the role of HPC and related areas within Iceland without losing sight of its international links.

PERFORM COMMUNITY BUILDING

Perform community building in developing new successful joint activities between academia and industry, potentially creating new joint Simulation and Data Labs or collaborations.



Icelandic HPC National Competence Center for HPC & AI – Welcome & Workshop Objectives

DOCUMENT COMPETENCIES

Document competencies, achievements, activities, and lessons learnt from participating stakeholders of Icelandic HPC efforts and associated international activities.

RECOMMENDATIONS

Identify best practices and core principles with a set of recommendations for developing the future Icelandic HPC ecosystem, including necessary skills, funding opportunities, applications, Centre of Excellences, community events, and sustainable infrastructure developments.

Supercomputing 2021 Conference St. Louis – "Data Centers by Iceland"



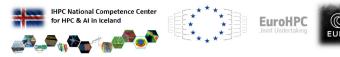
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Selected Results – 1st Workshop

Facts

- Active on Social Media
- Visibility in EuroCC Project Review
- ~25 participants
- Report per Workshop
 - Will be available soon
 - Updates also on IHPC Web page

| 5:00 - 5:15 | Informal Welcome – Participant Introduction & Discussions | All |
|-------------|--|--------------------------------|
| | (Coffee/Tea/Refreshments, Snacks, and Sandwiches available) | |
| 5:15 - 5:25 | Opening remarks & Workshop objectives & Introduction | Prof. Dr. – Ing. Morris Riedel |
| | EuroCC IHPC National Competence Center for HPC & AI | (University of Iceland) |
| 5:25 - 5:30 | Q&A | All |
| 5:30 - 5:40 | Infrastructure, Services, and HPCFlow from atNorth | Rui Gomes |
| | | (atNorth) |
| 5:40 - 5:45 | Q&A | All |
| 5:45 - 5:55 | Simulation and Data Lab Computational Fluid Dynamics | Seyedreza Hassanianmoaref |
| | | (University of Iceland) |
| 5:55 - 6:00 | Q&A | All |
| 6:00 - 6:10 | An Overview of the Reykjavik Institute and its Strategic | Bill Patrowicz |
| | Planning for Icelandic Stakeholders | (Kaiser Global) |
| 6:10-6:15 | Q&A | All |
| 6:15 - 6:25 | From Management Games to the idea of "Dig In" and its future | Baldvin Albertsson & |
| | | Björn H. Helgason (Vitargames) |
| 6:25 - 6:30 | Q&A | All |
| 6:30 - 6:40 | Accurate Virtual Acoustics Enabled by High-Performance | Finnur Pind |
| | Computing | (Treble) |
| 6:40 - 6:45 | Q&A | All |
| 6:45 - 7:00 | Workshop Closing – Concluding remarks with next steps | All |
| | (Coffee/Tea/Refreshments, Snacks, and Sandwiches available) | |
| | | |



1st Icelandic HPC Community Workshop Endurmenntun HI, Dunhaga 7, 107 Reykjavik – Room Náma 11th August 2021 – 5:00 – 7:00 p.m. GMT

Background

The Icelandic High-Performance Computing (IHPC) activities are increasing in academia and industry that also includes related areas such as Artificial Intelligence (AI), Machine Learning (ML), Data Analytics, and Data Sciences. As a result, the IHPC community members created Icelandic Simulation and Data Labs (SDLs)¹, including academic and industrial partners. They form together in a bottom-up fashion the IHPC National Competence Center for HPC & AI in Iceland partly funded by the EuroHPC Joint Undertaking EuroCC project. The IHPC community seeks more collaborations and new members.

Objectives

This workshop aims to bring together a diverse group of Icelandic and international stakeholders to discuss the role of HPC and related areas within Iceland without losing sight of its international links. The specific objectives of the workshop are to:

- Document competencies, achievements, activities, and lessons learnt from participating stakeholders of Icelandic HPC efforts and associated international activities.
- **Perform community building** in developing new successful joint activities between academia and industry, potentially creating new joint Simulation and Data Labs or collaborations.
- Identify best practices and core principles with a set of recommendations for developing the future Icelandic HPC ecosystem, including necessary skills, funding opportunities, applications, Centre of Excellences, community events, and sustainable infrastructure developments.

Participants

Approximately 20-25 participants from Iceland, Germany, and the USA. Participants will include:

- Selected Icelandic companies and SMEs from different sectors with interest in HPC & AI
- Academic representatives from the University of Iceland and Simulation and Data Labs
- The Icelandic Centre for Research (Rannís), Startup Iceland, and Icelandic Technology Clusters
- US company that forms government, industry, and academic cooperative research coalitions

Output

The following outputs are expected:

- A short synthesis paper that documents Icelandic competencies, field experiences and achievements in using and/or offerings HPC & AI solutions and consideration of 'best practices'
- A short strategy paper responding to HPC & Al issues and challenges identified during the workshop, including potential options for jointly engaging in EuroHPC funding opportunities
- Strengthened informal networks and transfer of experiences and lessons learnt



Reza Hassanian • 1st earcher PHD Student at University of Iceland - Háskóli Íslands, Computati. mo · 🕥 1st HPC Community Workshop Simulation and Data Lab communities Simulation and Data Lab Computational Fluid Dynamics University of Iceland Morris Riedel Reza Hassanian Pedro Simões Costa Háskóli Íslands EuroCC CoE RAISE Kaiser Global atNorth Rannís - Icelandic Centre for Research

#ai #hpc #deeplearning #machinelearning #artificialintelligence #datascience

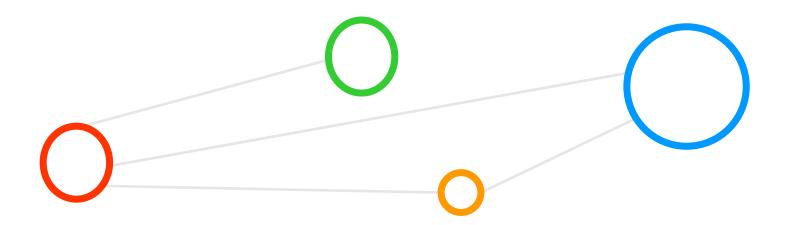


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Treble Technologies EuroHPC Joint Undertaking

#cfd #neuralnetworks

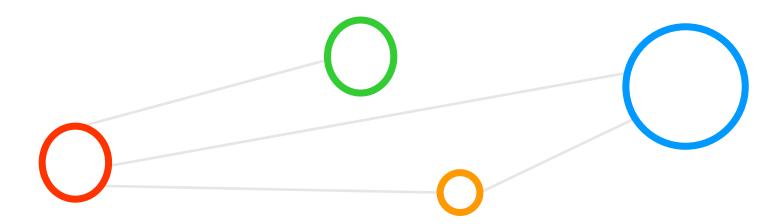
Selected References



Selected References

- [1] Icelandic HPC Community Web Page, Online: <u>ihpc.is/community</u>
- [2] Icelandic HPC Simulation and Data Lab Computational Fluid Dynamics (CFD), Online: <u>https://ihpc.is/simulation-and-data-lab-computational-fluid-dynamics/</u>
- [3] Icelandic HPC Simulation and Data Lab Computational Chemistry, Online: <u>https://ihpc.is/simulation-and-data-lab-computational-chemistry/</u>
- [4] Juelich Supercomputing Centre (JSC) Simulation and Data Labs, Online: https://www.fz-juelich.de/ias/jsc/EN/Expertise/SimLab/simlab_node.html

ACKNOWLEDGEMENTS



Acknowledgements – High Productivity Data Processing Research Group



PD Dr. G. Cavallaro



Senior PhD Student N

A.S. Memon



PD Dr. M.S. Memon



PhD Student E. Erlingsson



PhD Student

S. Bakarat



PhD Student R. Sedona

Started in Fall 2020

PhD Student P. H. Einarsson

Morris Riedel @MorrisRiedel - Feb 10 Fojoying our yearly research group dinner 'Iceland Section' to celebrate our productive collaboration of @wnij celand @uisens @Haskoli (sland: & @ft; jsc @ft; jueich: & E.Erlingsson @ennire passed mid-term in modular supercomputing driven hv @DESPEndencire - morrifieled direvench



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Dr. M. Goetz (now KIT)



MSc M. MSc Richerzhagen P. Glock (now other division) (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)

