

Building HPC Expertise: Training Initiatives of the Polish National Competence Centre

Joanna Jędraszczyk, Michał Hermanowicz ^{*}

Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw, Pawińskiego 5A, 02-106 Warsaw, Poland

*m.hermanowicz@icm.edu.pl

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Abstract

The EuroCC is a flagship project of the EuroHPC initiative intended to establish a network of National Competence Centers (NCCs) across participating member states. The Polish NCC has been dedicated to advancing skill sets and technical expertise in high-performance computing (HPC) among a broad user community. This work highlights NCC's main competence building efforts, their impact, and significance within the national HPC landscape.

Keywords:

High-performance computing, training, expertise, EuroCC, EuroHPC

1. Introduction

Advancing high-performance computing (HPC) and promoting its adoption across diverse domains of science, industry, in both public and commercial sectors, requires coordinated efforts in infrastructure development, funding, and dissemination. All of these pursuits, intended to support HPC uptake, must be carefully designed and structured into a coherent strategy at both the European and regional levels. Established in 2018, the European High Performance Computing Joint Undertaking (EuroHPC JU) [1] has been entrusted with the task of coordinating the endeavors of all its member states to contribute to consistent technological growth within European scientific, public, and commercial spaces. Broadening adoption of HPC infrastructure, however, is a task which requires a specialized set of skills and knowledge at the cross-section of computer science – operating systems, parallel programming, and networking – as well as domain-specific disciplines involving computational research, processing of large volumes of data and related efforts. These skills are often lacking within the general user community and bridging the competence gaps is a necessary step towards EuroHPC’s success. This is the main mission of the EuroCC project, [2] created within the EuroHPC framework. To this end, EuroCC formed a network of National Competence Centers (NCCs) to operate on a national/regional level.

The Polish NCC [3] brings together six national HPC centers: the Academic Computer Center Cyfronet AGH (ACC Cyfronet AGH, Kraków, the project leader), the Wrocław Centre for Networking and Supercomputing (WCSS, Wrocław), the Poznań Supercomputing and Networking Center (PCSS), the Centre of Informatics – Tricity Academic Supercomputer and Network (CI TASK, Gdańsk), the National Centre for Nuclear Research (NCBJ, Otwock-Świerk), and the Interdisciplinary Centre for Mathematical and Computational Modelling, University of Warsaw (ICM UW). These national HPC entities cooperate closely to implement a strategy for HPC competence development, thus advancing the project’s mission.

2. Competence development

2.1. Introduction to HPC

Training activities are offered by the NCC in various formats – as hands-on training sessions (both online and in-person events), bootcamps, hackathons, and summer schools – and across various time frames, ranging from short, intensive sessions to several full days of compre-

hensive courses. Some of the sessions are organized periodically throughout the year as part of onboarding for new users. These sessions mainly focus on the fundamentals of HPC and related topics, including the basics of the GNU/Linux system and its multi-user environment, the queuing system, and selected end-user applications. Such training is typically divided into two parts. The first takes the form of a lecture, providing an overview of the EuroHPC infrastructure, including the LUMI [4] supercomputer and the national HPC landscape, along with a brief introduction to access procedures. The second part is a hands-on session requiring access to an HPC system, for which participants are encouraged to apply in advance. Topics covered during the lecture are then demonstrated, elaborated on, and extended into exercises with detailed guidance from the instructor. Some of the exercises are solved in real-time by the instructor, and some are designed for self-paced work, allowing time to interact with the instructor, typically supported by user support staff answering questions within the text chat. The main point of the session covers basic HPC system usage, resource allocation, accessing compute nodes, and parallel execution of tasks. Following the session, participants gain both the theoretical background needed to understand the operation of HPC infrastructure and the practical skills to connect to an HPC system, set up an account, configure their terminal user environment, and run simple parallel tasks using fully functional software packages.

Originally offered mainly as a full-day in-person training, this introductory course has evolved to reflect users’ preferences and is now delivered primarily online, multiple times a year, while continuing to be refined after each iteration based on participants’ suggestions and feedback polls. Depending on the demand and group’s level of proficiency, the foundational HPC trainings are followed up with sessions covering more advanced system use, such as GNU Bash programming for task automation, data post-processing, and advanced Slurm [5] functionalities – taking the form of workshops or Q&A meetings held regularly.

2.2. Beyond the fundamentals

Following the introductory HPC sessions, users are provided with advanced courses designed to raise their skills. Parallel programming is one of the topics continuously attracting a large number of participants. It typically covers two programming models based on memory architecture: shared- and distributed-memory systems, focusing on OpenMP and the Message Passing Interface (MPI). These sessions, usually organized separately, introduce users to the general concepts of parallel programming, ranging from writing simple

beginner-friendly access methods alongside the standard terminal-based interaction.

Among the practices developed by the NCC are procedures related to hosting training events which aim to enhance community engagement. These include integrating the community through in-person events, open Q&A sessions, guided tours of HPC facilities, and active participation in domain-specific conferences via booths and presentations. The NCC also actively engages with the community through social media channels, where training opportunities are presented to a broad audience, and provides detailed information on its official website [3].

Diversifying training offerings in various formats has increased user involvement and established a feedback loop, enhanced by polls and suggestion forms. While the NCC does not conduct formal assessments of participants' progress, the effectiveness of training is evaluated indirectly through feedback collected after sessions, including participants' satisfaction and suggestions for future topics. For those participants who continue to use HPC systems after training, their engagement provides a practical indication that the sessions equip users with the necessary skills. This feedback-driven approach allows the NCC to iteratively refine its training offerings and adapt content to participants' needs. Efforts are also made to organize events according to participants' preferred language, addressing both Polish- and English-speaking audiences. These practices, together with proactive outreach, allow the continuous refinement of the NCC's competence-building activities.

3. Summary

Since 2023, NCC Poland has organized a total of 74 training sessions (as of August 2025), 44 of them online and 30 in-person, hosted at four locations across the country: Warsaw, Kraków, Poznań, and Zakopane. The number of events has been steadily increasing year by year and is expected to exceed 30 in 2025 alone. Table 1 summarizes the training topics by broad subject areas, along with the number of corresponding events, as briefly outlined in Section 2.

The majority of participants in the NCC training programme can be grouped into three main categories: students in disciplines that can directly benefit from HPC infrastructure (including physics, chemistry, mathematics, biology, biotechnology, geography, and economics); researchers affiliated with academic and research institutions in Poland (and, in the case of international collaborations, in partner countries); and representatives of commercial entities, primarily small and medium-sized enterprises. Within this majority, students and researchers together constitute the largest share of participants.

Table 1: Number of training events grouped by broad subject areas

Thematic category	Events
Fundamentals of HPC & advanced topics, tools and utilities, operating systems, access methods, queuing systems, user environment, virtualization	38
AI, large language models, machine learning	11
Accelerated computing (GPU, VE)	9
Parallel programming (OpenMP, MPI, CUDA)	5
Domain-specific applications	4
LUMI supercomputer environment	3
Big data, storage solutions in HPC	3
Quantum computing	1

The diverse training offer – tailored to the needs of the community – is at the core of EuroCC's mission and helps drive the EuroHPC JU toward its objectives. Building on the expertise of the user support staff at NCC Poland, skill development at both national and international levels is being advanced in a coherent manner, contributing to the European HPC landscape and supporting its technological sovereignty.

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References

- [1] The European High Performance Computing Joint Undertaking (EuroHPC JU); <https://www.eurohpc-ju.europa.eu>. [Online; accessed 2025-08-20].
- [2] EuroCC: National Competence Centres in HPC; https://www.eurohpc-ju.europa.eu/research-innovation/our-projects/eurocc_en. [Online; accessed 2025-08-20].
- [3] The Polish National Competence Center in HPC; <https://cc.eurohpc.pl/>. [Online; accessed 2025-08-20].
- [4] LUMI supercomputer; <https://lumi-supercomputer.eu>. [Online; accessed 2025-08-22].
- [5] Slurm Workload Manager; <https://slurm.schedmd.com>. [Online; accessed 2025-08-20].
- [6] NEC SX-Aurora TSUBASA; <https://www.nec.com/en/global/solutions/hpc/sx>. [Online; accessed 2025-08-22].

- [7] Indico; <https://getindico.io>. [Online; accessed 2025-08-20].
- [8] Zammad; <https://zammad.com>. [Online; accessed 2025-08-20].
- [9] Open OnDemand; <https://openondemand.org>. [Online; accessed 2025-08-20].