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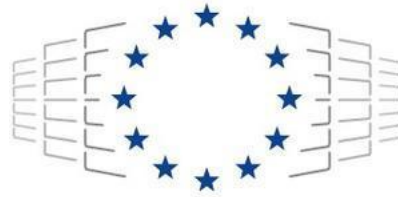


**Coordination & Support
for National Competence Centres and Centres of Excellence on a European Level
Phase 2**

Project Number: 101102047

D3.2

**Report on Training, Twinning, Mentoring
and Mobility Activities in the Second Year**



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Author(s):	Siegfried Höfinger	TUW
	Mary Kate Chessey	BSC
	Aline Melinette	BSC
	Tobias Haas	HLRS
	Maksym Deliyergiyev	HLRS
Approved by	PMT	2024-12-18
Reviewer 1	Andrea Ralamboson	TERATEC
Reviewer 2	Jisika Yono	HLRS
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List of abbreviations

<i>NCC</i>	<i>National Competence Centre</i>
<i>CoE</i>	<i>Centres of Excellence</i>
<i>HPC</i>	<i>High Performance Computing</i>
<i>HPDA</i>	<i>High Performance Data Analytics</i>
<i>AI</i>	<i>Artificial Intelligence</i>
<i>WP3</i>	<i>Work Package 3</i>
<i>EuroHPC</i>	<i>European HPC Joint Undertaking</i>
<i>C2ISS</i>	<i>CASTIEL 2 Information Sharing System</i>
<i>SME</i>	<i>Small and Medium Sized Enterprises</i>
<i>TB</i>	<i>Training Baseline</i>
<i>Academia++</i>	<i>TB target sector summarizing everything else than industry</i>
<i>EUMaster4HPC</i>	<i>European Master for HPC</i>
<i>ETP4HPC</i>	<i>European Technology Platform for HPC</i>
<i>EuroCC 2</i>	<i>2nd edition of the EU program NCC for HPC</i>
<i>GPU</i>	<i>Graphics Processing Unit</i>
<i>TCB</i>	<i>Training Coffee Break</i>
<i>BSCW</i>	<i>Shared Working Space for Collaborations (hosted at HLRS)</i>
<i>Research++/Academia</i>	<i>TB sector for profiles targeting careers at academic sites and research centres and the public sector</i>
<i>ISC</i>	<i>ISC High Performance – a yearly Supercomputing Conference</i>
<i>BoF</i>	<i>Birds of a Feather – special interactive discussion format at supercomputing conferences</i>
<i>PLUTO</i>	<i>Astrophysics code developed in the SPACE CoE</i>
<i>Quantum Espresso</i>	<i>Solid state electronic structure code developed in the MaX CoE</i>
<i>CHANGA</i>	<i>N-body SPMHD code developed in the SPACE CoE</i>
<i>SPMHD</i>	<i>Smoothed Particle Magnetohydrodynamics</i>

Executive Summary

This Deliverable 3.2 is an update of D3.1 [1] and describes the objectives and progress made in the second year (01/01/2024 to 31/12/2024) of the CASTIEL 2 project with the specific focus here on Work Package 3 (WP3), i.e. training, twinning and mentoring. Work Package 3 is divided into four tasks, which have seen the following advancement over the second year in the project:

- Task 3.1 --- Promote pan-European visibility for HPC training opportunities to NCCs, the industry, the public sector and academia, and integrate CoEs into these efforts.

This task has been further developed by the following three activities:

- a) The Training Baseline (TB) has been significantly revised, resulting in a more generalised structure that offers greater flexibility to the end users. Moreover, a novel metadata analysis was carried out taking into account all published courses from the HPC in Europe Portal [2].
 - b) More focused collaborations were also established through a dedicated initiative termed the “Training Sprint” [3].
 - c) Finally, financial guidelines were adopted including necessary clarifications for NCCs and CoEs.
- Task 3.2 --- Assist the evolution of NCCs and CoEs through the mentoring and twinning program.

Three new mentoring groups have been set up, focusing on high-priority areas such as:

- a) Training on HPC for AI,
 - b) Training on Quantum Computing,
 - c) Training on HPC for SMEs.
- Task 3.3 --- Support the exchange of training best practices and training-related collaborations across NCCs and CoEs and identify potential ways of establishing certification within the EuroHPC framework.

Best practice guides were collected following key training events and shared on the common workspace BSCW accessible by NCCs and CoEs alike. Moreover, a new template for best practice guides was set up and advertised to the network. A significant number of Training Best Practices were presented to each other by training Champions during Training Coffee Breaks.

- Task 3.4 --- Provide training-related input to the design and implementation of the CASTIEL 2 Information Sharing System.

Ongoing support was provided in the form of conceptual discussions with key people involved in closely related projects (e.g. HPC Spectra [7]) to facilitate seamless initialisation once the CASTIEL 2 Information Sharing System (C2ISS) is available.

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1 Introduction

CASTIEL 2 was launched in January 2023 with the main objective of coordinating and supporting National Competence Centres (NCCs) and Centres of Excellence (CoEs) in implementing their goals for High Performance Computing (HPC), High Performance Data Analytics (HPDA) and Artificial Intelligence (AI).

Work Package 3 (WP3) focuses on training, twinning and mentoring.

Its tasks are briefly summarised as,

1. Promote pan-European visibility for HPC training opportunities to NCCs, the industry, the public sector and academia, and integrating CoEs into these efforts.
2. Assist the evolution of NCCs and CoEs through the mentoring and twinning program.
3. Support exchange of training best practices and training related collaborations across NCCs and CoEs and identify potential ways of establishing certification within the EuroHPC framework.
4. Provide training-related input to the design and implementation of the CASTIEL 2 Information Sharing System (C2ISS).

In the following, an update is provided on how the training, twinning and mentoring activities of WP3 have advanced throughout the second year of the project. This includes training activities (section 2), the evolution of the mentoring and twinning program (section 3), the exchange of best practice guides (section 4) and also new initiatives such as the “Training Sprint” (section 2.2) and the integration of feedback received from various stakeholders.

2 Training Activities

T3.1 Facilitate Access to Training Opportunities and Offers within the European HPC Ecosystem

The goal of this task is to facilitate access of interested NCCs, CoEs and other potential users (from industry, academia or the public sector) to training offered at the national and the European levels, through a centralised web-portal, i.e. HPC in Europe – The portal for European HPC services [2].

In the second year, WP3's efforts to expand access to training across the European HPC ecosystem evolved around three key activities: the refinement of the Training Baseline (TB), the development of more focused collaborations, including the launch of the “Training Sprint” [3], and the adaptation and clarification of adapted financial guidelines.

A common certification scheme and an HPC training baseline for industry, SMEs and academia/research/public sector are being addressed via respective task forces and cooperation with other European initiatives [7,9,10] in the area of HPC/HPDA/AI training.

2.1 Training Baseline

A major focus of WP3 during the second year was the refinement and further development of the TB, a framework designed to provide guidance for newcomers on basic HPC/HPDA/AI training to achieve a certain working level of knowledge. The approach involved selecting

training courses from various NCCs and other training providers, allowing candidates to follow a “career path” [8] to build user profiles tailored to the target sectors such as research/academia, SMEs and large industries. It follows that such an approach will be of European scope by design. This will further encourage cooperation between NCCs and CoEs. The first version of the TB was proposed in the spring of 2024, and feedback was gathered from stakeholders [7,9,10], including training champions and CoE representatives. This feedback highlighted the need for further refinements, such as using more generic unit names, clarifying the sectors and including more training providers.

Accordingly, a second version of the TB was set up in July 2024 (see Figure 1) incorporating the suggestions and aiming at greater flexibility in terms of course offers for both course providers and course end users (participants). A recurring subject was the need for an accompanying certification scheme which shall be addressed within a separate task force. The revised TB also aligns with other European HPC initiatives such as EUMaster4HPC [9] (curriculum based on learning outcomes), HPC Spectra [7] (certification forum) and ETP4HPC [10], ensuring coherence and collaboration across the broader European training landscape.

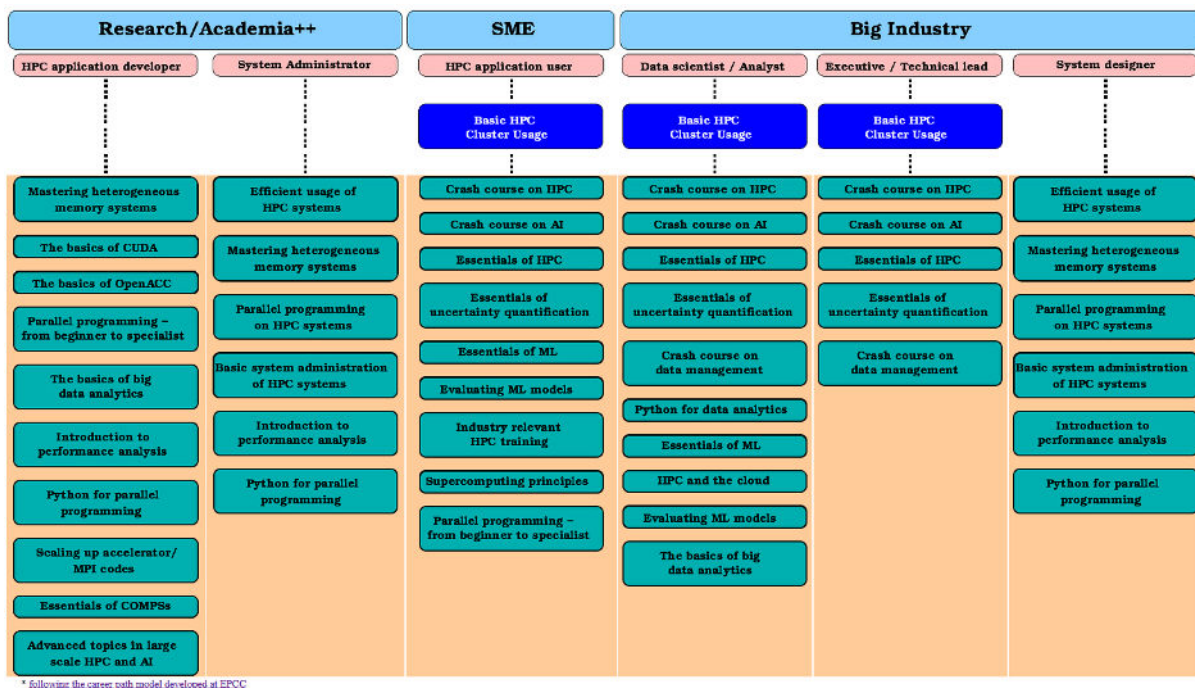


Figure 1: Training Baseline (version 2)

2.1.1 Metadata Analysis

During the second year, a new quantitative analysis of the growing body of metadata on HPC training events and short courses as retrievable from the HPC in Europe Portal [2] was conceptualised and carried out. The analysis validated the efforts of the TB and provided an overview of the training activities of the EuroCC2 network. Preliminary results of this analysis were presented at the Training Coffee Break (TCB) on November 7, 2024.

HPC in Europe Portal metadata categories include:

- Level of instruction
 - Beginner

- Intermediate
- Advanced
- Other (informational for potential users or the general public...)
- HPC Profile of Target Audience
 - Application Users
 - Application Developers
 - Data Scientists
 - System Administrators
- Sector of Target Audience
 - Research and Academia
 - Industry
 - Public sector
 - Other (general public...)
- Technical Domain
 - 18 different options including accelerators, HPC application usage, performance engineering, quantum computing, visualisation, and more.

The HPC in Europe Portal metadata analysis consisted of basic summary statistics of (1) the usage of different metadata categories such as level of instruction and sector of target audience, (2) the coincidence of two or more metadata categories, such as the number of courses targeting each combination of HPC Profiles of Target Audience, and the number of beginner courses for each HPC Profile of Target Audience, and (3) the ratio of beginner to advanced courses for a specific HPC Profile for all different Technical Domains.

Examples of the preliminary results are included in Appendix 1.

2.2 Training Sprint Initiative

In response to the need for better collaboration and communication around training activities, WP3 launched the Training Sprint initiative [3]. This initiative was designed to streamline the organisation of training sessions delivered by CoEs, particularly around specific codes used in HPC environments. The Training Sprint facilitated joint efforts between NCCs and CoEs, simplifying logistical challenges and fostering an efficient, collaborative environment for training delivery.



Figure 2: Training Sprint Landing Page

Throughout the year, the initiative successfully organised several training sessions, including HPC code optimisation, use of profiling tools, and GPU programming. These sessions not only addressed key training needs but also strengthened connections between participating NCCs and CoEs. In 2024, a total of 16 training events were conducted across various European CoEs and NCCs. These activities focused on advancing HPC knowledge and applications in fields such as astrophysics, materials science, climate modelling, and natural hazard mitigation. Collaboration between CoEs and NCCs played a central role in promoting synergy and resource sharing. These events provided hands-on training on scientific codes (e.g., PLUTO [4], Quantum ESPRESSO [5], ChanGa [6]). Given the frequency and breadth of this type of events in 2024, we can anticipate similar or increased activity in 2025.

2.3 New financial guidelines and adaptation

WP3 noted the significant impact of the changes in funding conditions introduced in the second year of the project. Indeed, up to April 2024, no funding was accessible for training activities. The updated financial guidelines were presented and made available, including new restrictions on eligibility of activities. Under these guidelines, travel expenses and events involving only two NCCs or CoEs (i.e. all in-person twinning activities) became ineligible for CASTIEL2 funding. In addition, the application and review process were revised, so that potential applicants for financial support had to learn the new procedure. Due to the restrictions, many prior successful training, twinning and mentoring activities between NCCs and CoEs were discontinued, and new formats for interactions were explored.

Since April 2024, the CASTIEL 2 Project Management Team, the Financial Officer and WP3 have received new funding requests to support collaboratively organised and highly valuable training sessions. However, the number of applications has been much lower than estimated at the start of the project. WP3 is therefore actively exploring alternative ways to allocate the available funds effectively.

3 Mentoring and Twinning Activities

T3.2 Assist the Evolution of NCCs and CoEs through the Mentoring and Twinning Programme

The aim of this task is to assist the development of training by NCCs and CoEs through an effective mentoring and twinning programme with suitable instruments that serve their needs.

Mentoring events, such as workshops, hackathons and advanced trainings with a focus on collaboration and coordination aspects across NCCs or CoEs, are co-organised.

The focus in the second year regarding the mentoring and twinning programme was to overcome organisational constraints (mainly due to the financial guidelines) and to initiate new collaborations for NCCs and CoEs. However, the progress was hampered by delays in reallocating funds for these activities and the revision of the financial guidelines.

Despite these challenges, WP3 successfully launched three mentoring groups focused on high-priority areas such as

- Training on HPC for AI,

- Training on Quantum Computing,
- Training on HPC for SMEs.

These groups brought together representatives from 14 different NCCs, enabling them to share expertise and best practices in these emerging fields. Additionally, WP3 facilitated discussions around the "train-the-trainer" model with a particular focus on course development targeting multi-GPU AI. A corresponding joint workshop together with WP2 entitled "Multi GPUs Train the Trainers Course development" was organised.

By the end of the second year, mentoring and twinning activities had regained momentum, although some delays persisted due to the earlier reallocation of funds. For example, continuation of prior (CASTIEL 1) successful twinning and mentoring activities such as site visits became impossible, demanding the adaptation of NCC and CoE staff to online communication through virtual meetings and email communication.

3.1 Exchange on Training-Related Topics among NCCs, CoEs and Stakeholders

In the second year, WP3 continued to periodically organise Training Coffee Breaks (TCBs) that allowed NCCs and CoEs to share insights on their training activities, exchange best practices, and explore potential collaborations. These informal meetings fostered greater cooperation across the HPC training community and provided a platform for participants to raise concerns, bring up challenges and seek advice on training delivery.

In addition, WP3 organised a joint workshop together with WP4 on training for industry and SMEs (September 30, 2024, title: "Training the Industry/SMEs Stakeholders: Listen to the Champions' Insights", number of participants: 73), which provided valuable insights into the onboarding process and training needs of industrial stakeholders.

Finally, a Birds of a Feather session (BoF) on "Current topics in EuroHPC training" was organised at the ISC24 in Hamburg from 12 to 16 May, 2024. This allowed to gain additional insight into non-EuroCC2/CoE training programs and corresponding viewpoints by their providers. Thus, the feedback received there was very helpful in further developing the TB and other WP3 activities.

4 Exchange of Best Practices

T3.3 Support Exchange of Training Best Practices and Training-Related Collaborations across NCCs and CoEs

This task supports the exchange of training-related best practices, available resources, knowledge and information within and between NCCs and CoEs, and those resulting from the activities in Task 3.1 and Task 3.2. This task also supports training-related collaborations of NCCs and CoEs by encouraging joint activities.

Furthermore, this task is connecting NCCs and CoEs to the network of different hardware and software suppliers based in Europe (NVIDIA, AMD, WEKA) in order to enable information exchange also in this regard.

One of WP3's responsibilities is to facilitate the exchange of best practice guides across NCCs and CoEs. In the second year, this involved collecting and disseminating best practices guides following key training events, such as a hackathon organised in collaboration with NVIDIA. These best practice guides were shared via the NCC-CoE workspace on BSCW ensuring that all training champions had access to the latest versions of these guidelines.

Moreover, a new template for a best practice guide was set up and incorporated by WP3 when revising the financial guidelines.

Implicitly, best practice guidelines were also the subject of many discussions during TCBs. A specific example was given on the October 2024 TCB where one NCC training champion took the opportunity to advertise internally the availability of an online HPC training resource in moodle, which they had developed and translated from their local language to English.

5 Training-Related Input to C2ISS

T3.4 Provide training-related input to the design and implementation of the CASTIEL 2 Information Sharing System

Conceptual discussions were continued with key people involved in closely related projects (e.g. HPC Spectra [7]) to facilitate seamless initialisation once the CASTIEL 2 Information Sharing System has become available.

6 Major Achievements

A key achievement was the integration of CoEs both for the provision of new specialised training as well as the dissemination of their courses via the central portal (currently: hpc-portal.eu [2], in future: C2ISS).

WP3 has also seen an increase in collaboration with industry partners with new training events hosted in partnership with suppliers such as NVIDIA, which contributed significantly to the new "Training Sprint" initiative [3].

Financial Guidelines have been significantly reworked to address the change in funding conditions introduced early on in 2024.

Despite challenging general regulations, three new mentoring groups could be established in high-priority areas, Quantum Computing, AI and HPC for SMEs.

The training baseline had undergone significant re-structuring, increasing the course offer for participants and training providers.

A new quantitative analysis examining metadata of published training events and short courses was carried out for the first time in WP3. It will be further developed in the upcoming year according to the response of the European HPC community. This continued development may include the refinement of reporting and presentation of results, the addition of new queries based on NCC and CoE interest, and meta-analysis of results for possible suggestions of improvements to the training activity and short course metadata within the upcoming new portal(s).

7 Concluding Remarks

In the upcoming year, the development and publication of new online tools for facilitating access to training offers, such as C2ISS, are expected. As training providers begin publishing their training offerings on the new portal(s), CASTIEL 2 will support their efforts. The exact form of support will vary based on needs, but may include creating a How-To guide for publishing courses on the new portal(s), presenting information about the new portal(s) during monthly Training Coffee Breaks, and channelling user feedback to portal developers to suggest improvements as practical.

Certification remains a major topic for the European HPC community. Authority (to issue certificates) and assessment (of certified knowledge and skills) require substantial development and agreement that are beyond the scope of the CASTIEL 2 action. These major requirements for a trustworthy and broadly accepted HPC certification system will be advanced by future projects, such as the EuroHPC Virtual Training Academy [11]. Even so, from its conception, CASTIEL 2 sought to lay the groundwork for certification by assessing the landscape. As the recently advanced Training Baseline and certification are closely linked topics, CASTIEL 2 will now be able to turn its attention to the building blocks of future certification throughout the upcoming year. For example, WP3 aims to introduce a new standardised certificate of participation (in training activities for learners) in collaboration with all NCCs and CoEs. The collaborative approach will open the community discussion and facilitate the identification of key challenges that will likely impact future certification efforts.

8 References and Applicable Documents

- [1] D3.1 Report on Training, Twinning, Mentoring and Mobility Activities in the First Year (2023)
- [2] HPC Portal, <https://hpc-portal.eu>.
- [3] EuroCC2 project – Training Sprint, <https://www.eurocc-access.eu/training-sprint>
- [4] Space CoE, <https://www.space-coe.eu/training/training-20240528.php>
- [5] MaX CoE, <https://www.max-centre.eu/codes-max/quantum-espresso>
- [6] Space CoE, <https://www.space-coe.eu/codes/changa.php>
- [7] HPC Spectra project, <https://www.hpc-spectra.eu/>
- [8] *Personalized Learning Pathways for upskilling RSEs*, by Weronika Filinger (University of Edinburgh), SC24, <https://us-rse.org/rse-hpc-2024/agenda>
- [9] European Master for High Performance Computing, <https://eumaster4hpc.uni.lu/>
- [10] European Technology Platform for High Performance Computing, <https://etp4hpc.eu/>
- [11] EuroHPC Virtual Training Academy, https://eurohpc-ju.europa.eu/eurohpc-virtual-training-academy_en

Appendix 1 – Examples from preliminary results of the HPC in Europe Portal metadata analysis

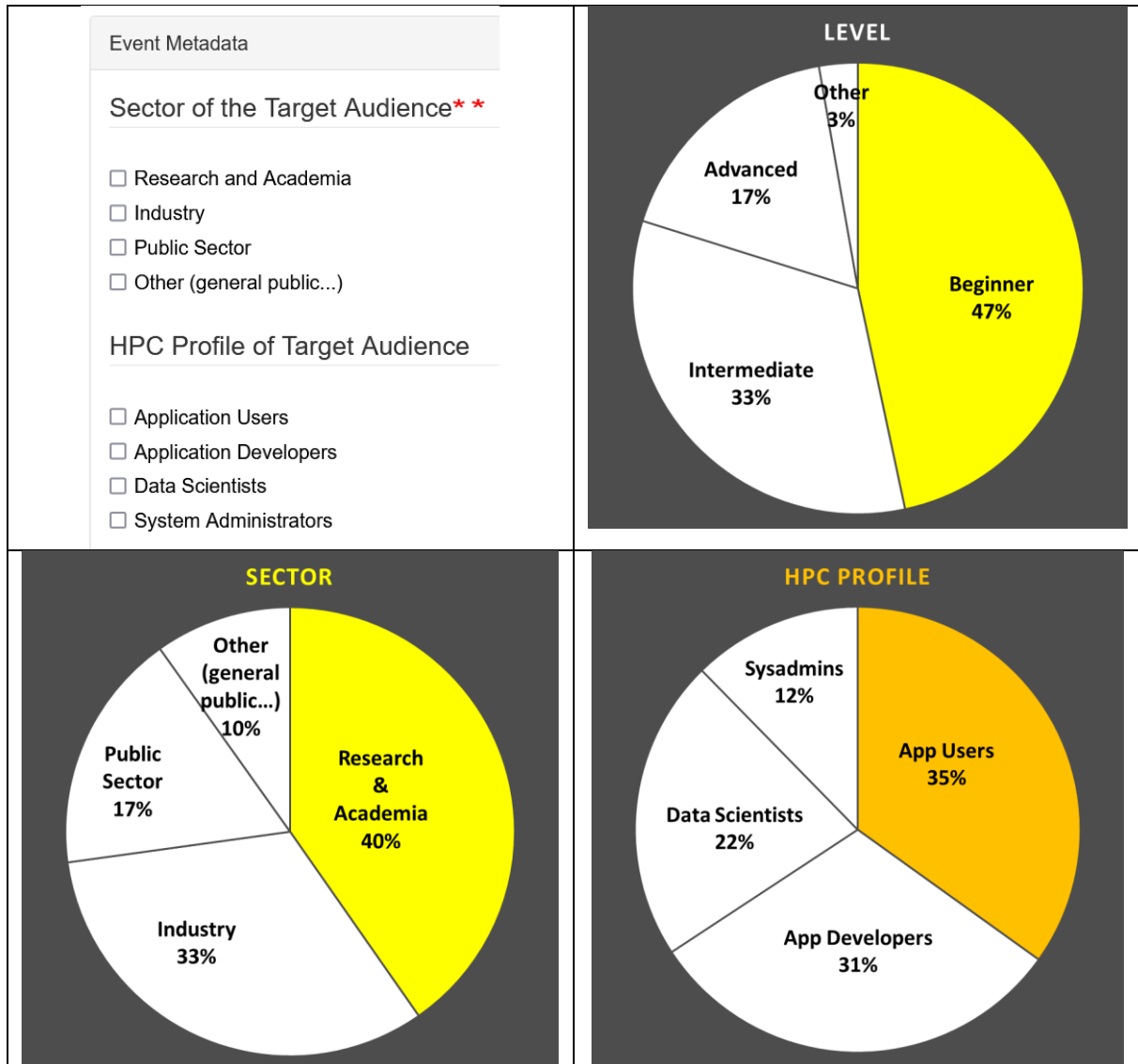


Figure A1. Percentages of all published short courses on the HPC in Europe Portal before 2022 at each level of instruction, sector of target audience, and HPC profile of target audience.

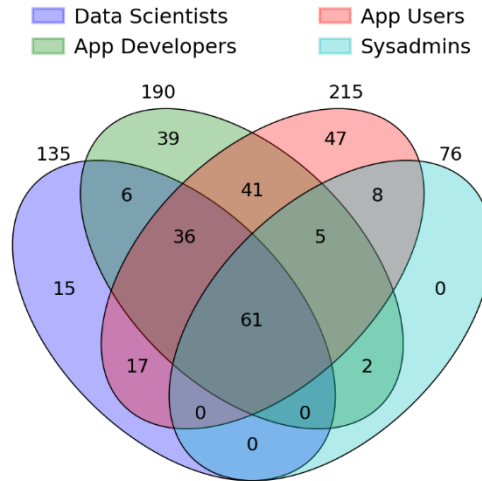


Figure A2. The numbers of published short courses on the HPC in Europe Portal before 2022 for each HPC profile of target audience and each combination.

HPC Profile	App Users	App Developers	Data Scientists	Sysadmins
Top 5 technical domains of courses targeting each HPC Profile	<ul style="list-style-type: none"> • HPC application usage (57) • General HPC systems and architectures (52) • Scientific programming (43) • Parallel programming (37) • Data science and high performance data analytics (HPDA) (31) 	<ul style="list-style-type: none"> • Parallel programming (59) • Scientific programming (38) • General HPC systems and architectures (33) • HPC application usage (32) • Not technical domain specific (26) 	<ul style="list-style-type: none"> • Scientific programming (36) • Artificial intelligence (AI), machine and deep learning (36) • Data science and high performance data analytics (HPDA) (35) • Parallel programming (29) • General HPC systems and architectures (26) 	<ul style="list-style-type: none"> • General HPC systems and architectures (24) • Scientific programming (23) • Parallel programming (20) • HPC application usage (16) • Not technical domain specific (14)

Table A1. The top five most common technical domains applied to short courses published in the HPC in Europe Portal before 2022 for each targeted HPC profile of target audience. Numbers in parentheses indicate the number of courses.

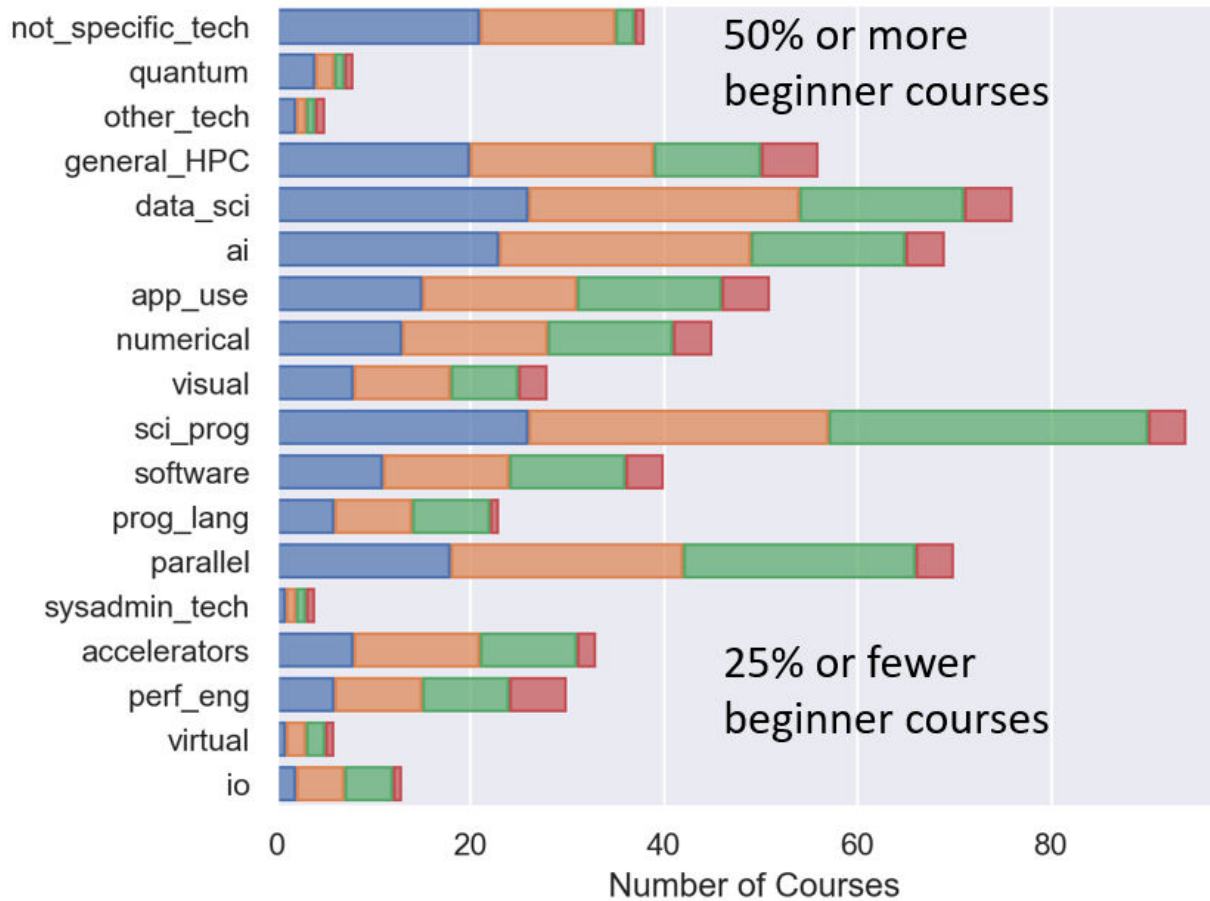


Figure A3. Among short courses published in the HPC in Europe Portal before 2022 that target the HPC profile of data scientists, information is displayed about the technical domains and the level of instruction. Each technical domain appears along the y-axis. Each level of instruction appears in the bar, with blue for beginner, orange for intermediate, green for advanced, and red for others. The length of each section of each bar illustrates the number of courses for data scientists that match the indicated technical domain and level of instruction. In order from top to bottom, the highest percentage of courses for beginners (Not specific to a technical domain, quantum computing, etc.) down to the lowest percentage of courses for beginners (IO, virtualisation, etc.)