



# TRAINING SERVICES SURVEY ANALYSIS

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**Date:** 15/10/2024

Public report.

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# 1 Executive Summary

The National Competence Centre in HPC of the Czech Republic (NCC Czechia), which was established under the auspices of the EuroCC project, is the reference and single point of contact and coordination on a national level for high-performance computing (HPC), high-performance data analysis (HPDA), artificial intelligence (AI) and quantum computing (QC). In the Czech Republic, the National Competence Centre in HPC is represented by the IT4Innovations National Supercomputing Center at the VSB – Technical University of Ostrava. NCC Czechia offers a broad portfolio of services tailored to the industry, public administration, and academia.

Our focus on meeting our users' needs is evident in our continuous development of training services. Every two years, we conduct a Training Services Survey to analyse the knowledge of our stakeholders in the areas of High-Performance Computing (HPC), high-performance data Analytics (HPDA), Artificial Intelligence (AI), Visualization and Virtual Reality (VVR), and newly added Quantum Computing (QC). The insights from this survey guide us in tailoring our services to best serve our stakeholders.

The survey was developed and launched in mid-2021 to gather relevant feedback. The first results were obtained from July 2022 to December 2022, when 99 participants filled in the survey. The second and most recent study was performed from January 2024 to June 2024, and 105 responses were collected.

The survey is divided into three sections, each containing multiple questions focused on personal information, training needs, and preferred training formats. It is available online in both Czech and English. To ensure data comparability, the surveys are identical, except for an additional section on Quantum Computing. This new section was included in response to the growing interest in the field and the launch of the EuroHPC JU program aimed at procuring Quantum Computers for the European research community.

This document can also be a valuable resource for other training providers aiming to identify key areas and topics for developing effective training curricula.

## 2 Analysis of Results

### 2.1 Section 1 – About you

The first section aimed at gathering information about the respondents, such as contact details, scientific field, institution, and position within the institution, as well as data relevant to industrial and public sector respondents, like the size of the company they work for.

The community is categorised into three groups: academia, industry, and the public sector. Figure 1 illustrates the distribution of respondents across these groups for the two survey editions conducted in 2022 and 2024. In 2022, there were 81 responses from academia, 12 from industry, and 6 from the public sector. In 2024, the responses increased slightly, with 83 from academia, 12 from industry and the private sector, and 10 from the public sector. The increase in respondents is attributed to a higher engagement from the public administration sector.

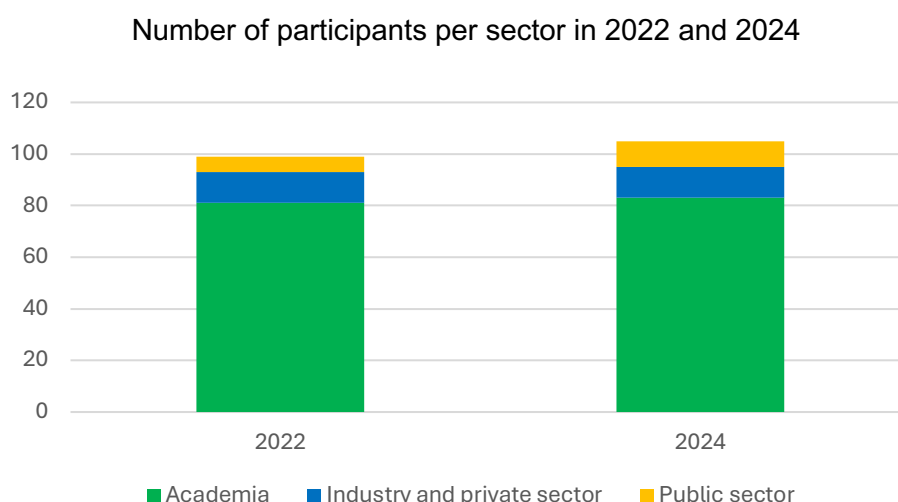


Figure 1 – Comparison of the number of respondents and their type of affiliation in 2022 and 2024

The academic respondents indicated that their positions were, in most cases, researcher (31%), academician (24%), and Ph.D. student (22%). Other positions mentioned were student, software developer and IT support.

Regarding the respondents' scientific domains, the question specific to academia yielded the following results: 32% work in informatics and computer science, 14% in applied mathematics, and another 14% in material science and chemistry. Additionally, 9% are involved in life sciences, 6% in artificial intelligence, and 5% in engineering. Other fields mentioned, such as astrophysics, earth sciences, and social sciences, were represented by only 1% of respondents.

Only 7 out of 12 industrial respondents have indicated the business sector in which their employers operate. The most mentioned is the IT sector, specifically mentioned is a data

centre, IT consulting, and Deeptech. Three were from a large company (>2000 employees), two from a medium-large company (250-2000 employees), and one from each a medium (51-250 employees) and a small company (10-50 employees).

## **2.2 Section 2 – Training needs**

In this survey, we mapped the participants' interest and level of expertise in the five following domains: High-Performance Computing (HPC), Artificial Intelligence/Machine Learning or Deep Learning (AI), High-Performance Data Analytics (HPDA), Visualization and Virtual reality (VVR), and Quantum Computing. The domains were described as follows.

HPC comprises large-scale, highly optimised computation and data processing that would not be possible with workstations or even public cloud services. One of the main advantages in comparison to the public cloud is high-speed interconnects between computation nodes (within computation clusters), an optimised storage hierarchy, and a physical locality of resources for the highest efficiency and scalability.

HPDA is supported by HPC to process large amounts of data (so-called Big Data) for analytical purposes to (pre) process, curate, optimise, or visualise. Its advantage is handling data that would not be possible on ordinary computation systems due to memory and storage limitations and a short latency to obtain the final data products (time-to-solution).

As AI, we hereafter consider Machine and Deep Learning using HPC. These fields of AI are currently sought after due to their high analytical power in combination with the latest hardware architectures. IT4Innovations offers dedicated systems optimised for this domain, like the latest NVIDIA GPUs, DGX-2 system and software stacks, using the full advantages of HPC, like large scalability and efficient storage technologies.

Visualisation and Virtual reality (VVR) offer solutions for visualising scientific results. These range from photorealistic rendering and real-time interactive visualisations to virtual reality simulations.

Quantum computing is a revolutionary paradigm of computation that uses the principles of quantum mechanics to perform certain types of calculations at speeds potentially far beyond the capabilities of classical computers. Unlike classical computers, which use bits to represent information as a 0 or a 1, quantum computers use quantum bits or qubits.

Figure 2 illustrates the community's interest across various domains. High-Performance Computing (HPC) is the most appealing, with 60% of respondents indicating it as extremely interesting and another 17% very interesting. The second most popular domain is Artificial Intelligence (AI), with 36% of respondents finding it extremely interesting and an additional 24% considering it very interesting. The remaining three domains received similar ratings, with approximately half of the respondents expressing interest and the other half showing little to no interest.

In 2022, the interest in HPC was also the highest, with 50% of the participants marking HPC as extremely interesting, followed by AI, with nearly 20% extremely interested.

How much are the domains of interest to you? Rank the following domains from 1 (not at all interesting) to 6 (extremely interesting):

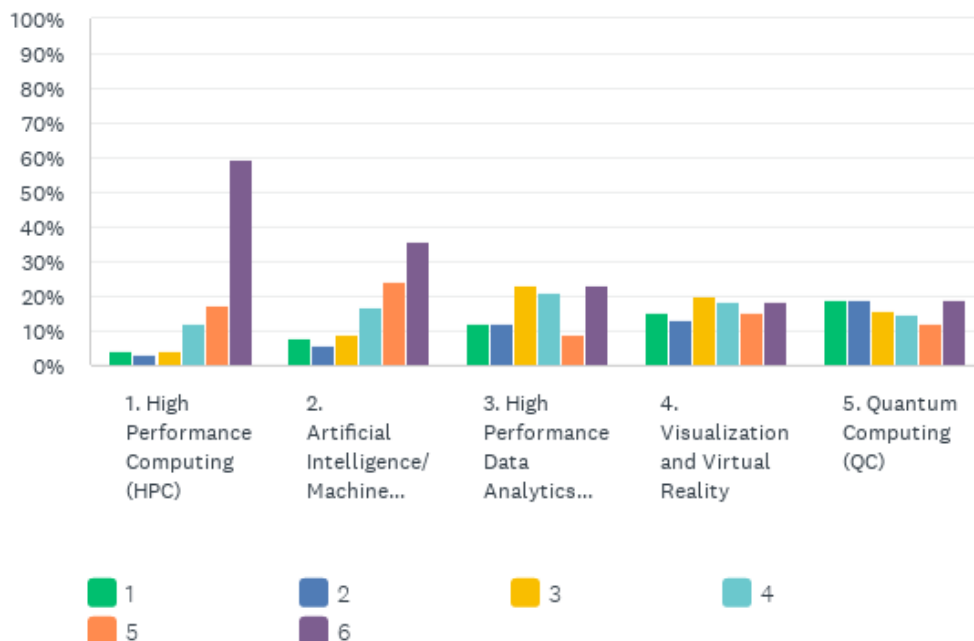


Figure 2 – Indication of interest in the five domains.

Finding out about the participants' proficiency in all areas is crucial in tailoring the upcoming courses. Comparing data also indicates how the training offers from the previous term influenced the participants' self-assessment and whether the participants' proficiency was developing.

Respondents in 2022 claimed to have mostly none or beginner expertise in HPDA and Visualisation and Virtual Reality, which did not change over time. Similar results were obtained in 2024. In 2022, over 50% of the respondents considered themselves beginners in AI, whereas in 2024, the beginner level was chosen by 43% of respondents. There was no shift for the Intermediate level; in both years, 27% of respondents claimed to be intermediate. There was a slight increase in the number of advanced users, from 5,5 % in 2022 to 9% in 2024. In HPC, around 30% were beginners and intermediate-level practitioners, and nearly 20% considered themselves advanced users in 2022. The number of participants who consider themselves advanced doubled between the years 2022 and 2024. The intermediate level remained at 34%. In 2024, Quantum computing was surveyed for the first time, and the results were expected, as 68% of the respondents had zero experience, 26% considered themselves beginner and only 5% advanced. These results are shown in Figure 3 for 2022 and Figure 4 for 2024.

What is your level of expertise in the following domains?

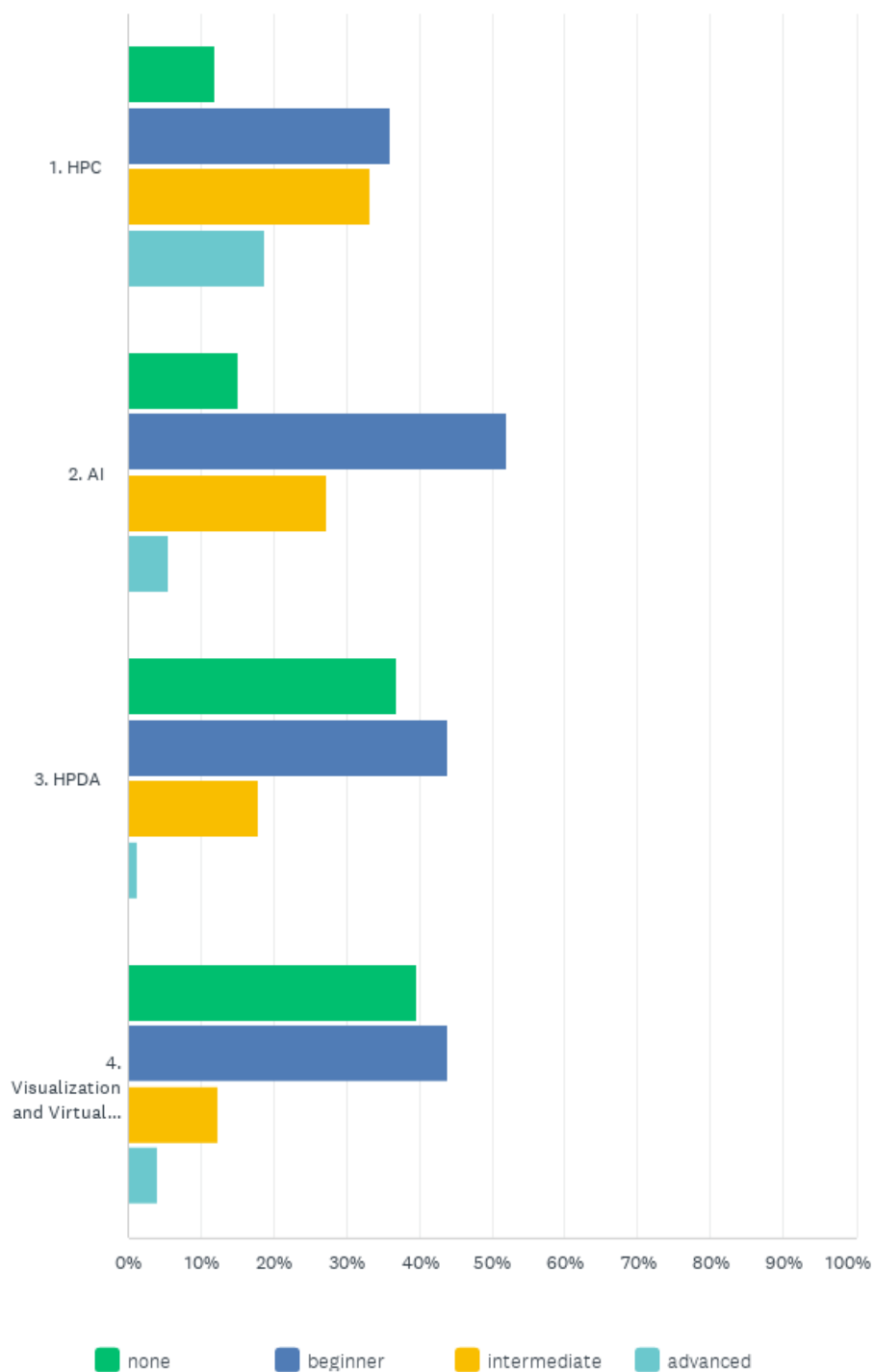


Figure 3 – Indicated level of expertise per domain in 2022

What is your level of expertise in the following domains?

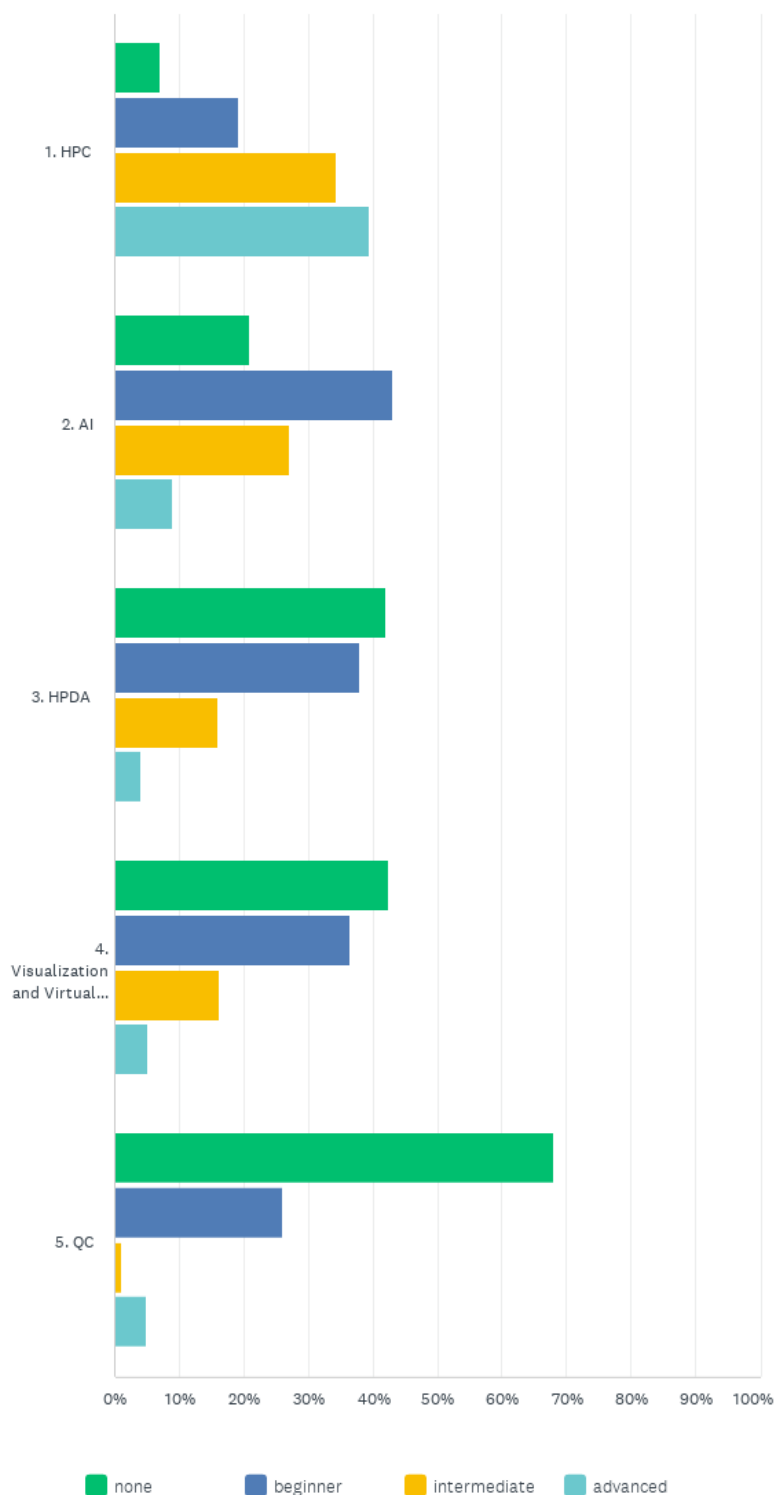


Figure 4 – Indicated level of expertise per domain in 2024



We identified several sub-domains within each domain and surveyed participants to gauge interest in more specific topics for future training events. In the HPC domain, the most highly rated subtopics were Access to HPC resources, Parallel Programming (MPI, OpenMP, vectorisation), and GPU-accelerated computing, with around 40% of participants marking these as extremely interesting. The level of interest remained consistent between 2022 and 2024.

In the AI domain, the most interesting topics for the participants were (Deep) Neural Network Architectures and the Selection of Machine Learning algorithms. However, there was notably less interest in HPDA, and Visualization and Virtual Reality. This trend was also observed in 2022.

The participants were uninterested in the subdomains related to quantum computing. Only 20% of participants considered the most engaging subdomain, Introduction to Gate-Based Quantum Computing, extremely interesting. None of the other subdomains surpassed this, and nearly 30% of participants rated all the subdomains as not interesting at all.

We asked the participants to select three subdomain priorities in the following question. These subdomains represent the most frequently mentioned and relevant areas across HPC, AI, Quantum Computing, HPDA, and Visualization and Virtual reality:

1. Access to HPC Resources
2. Parallel Programming (MPI, OpenMP, vectorisation)
3. GPU-Accelerated Computing
4. (Deep) Neural Network Architectures
5. Selection of Machine Learning Algorithms
6. Optimisation of Computation
7. Data Mining
8. Introduction to Gate-Based Quantum Computing
9. Variational Quantum Algorithms (VQAs)
10. Processing Pipelines/Workflows

In the following question, participants were asked to name three applications, frameworks, or programming languages they currently use or plan to use in the future. TensorFlow, PyTorch, Blender, GROMACS, and ParaView were the most frequently mentioned tools, while R and Python topped the list of programming languages. Compared to 2022, GROMACS entered the top five, but the overall selection of applications and languages remained the same.

### **2.3 Section 3 – Training Format**

To effectively tailor training services to the community's needs, the third section of the survey examined key factors such as preferred training format, delivery methods, and duration. The results revealed that the most favoured approach is a combination of lectures offering broad topic coverage, along with practical, hands-on sessions. This format was identified as the most preferred for acquiring knowledge. However, it was closely followed by self-paced online courses, a new option introduced in the 2024 survey in response to the growing popularity of this learning style. The survey results confirmed the increasing demand for this

flexible learning format, as 30% of the respondents chose it as very convenient. The results are shown in Figure 5.

Which format(s) would you prefer? Rank the following domains from 1 (not convenient at all) to 6 (very convenient):

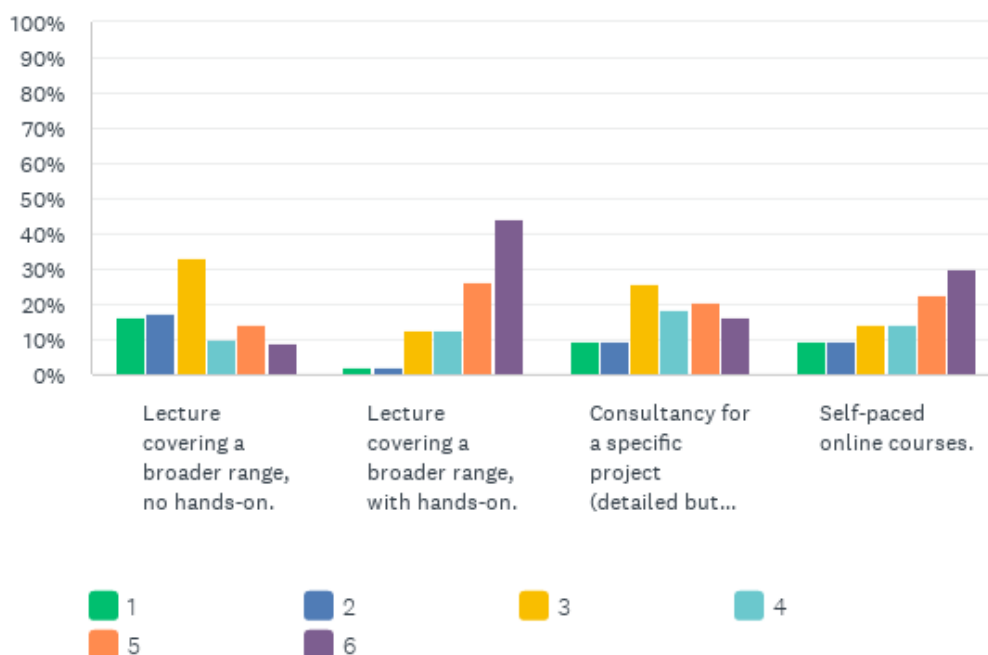


Figure 5 – Preferred formats of training.

Until 2019, all training events provided by IT4I were conducted in person. However, with the onset of the pandemic, the centre began offering online training, and in 2022, it introduced a hybrid format. According to survey responses, there is a clear preference for continuing with online training, though the difference between online and onsite options was minimal. By 2024, online courses have emerged as the most convenient format by a significant margin. In contrast to 2022, there is no strong preference between attending onsite courses at IT4I or the respondents' institutions, though there is a slight preference for the latter. This suggests that travelling for training is becoming increasingly less convenient for participants, which corresponds to the results of the previous question. Results are shown in Figure 6.

How would you like us to deliver the training service? Rank the following domains from 1 (not convenient at all) to 6 (very convenient):

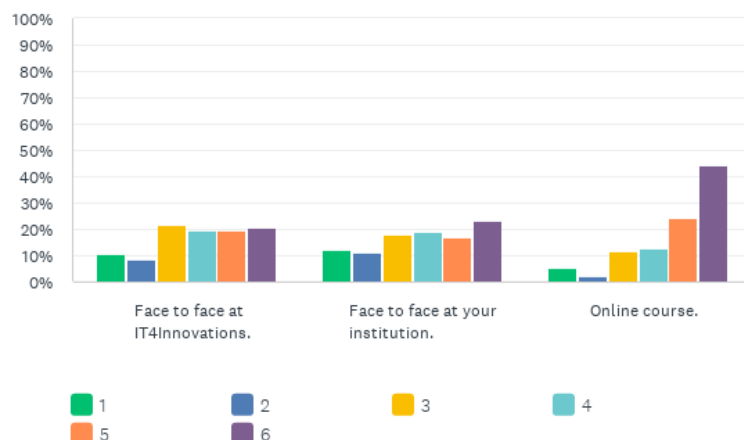


Figure 6 – Preferred ways of delivery of training.

The survey results regarding the preferred length of training are minimally different between 2022 and 2024. The most convenient duration is one day or less, with two-day sessions being viewed as slightly more favourable than multi-day events, such as seasonal schools, as depicted in Figure 7.

How long should the training take? Rank the following domains from 1 (not convenient at all) to 6 (very convenient):

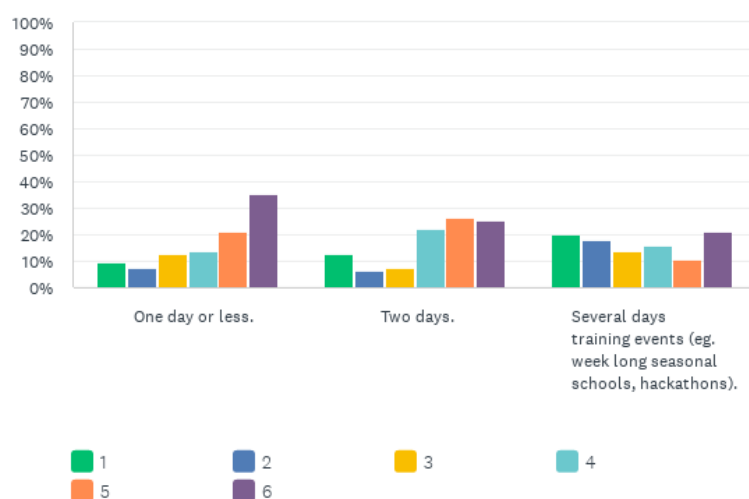


Figure 7 – Preferred length of training events.

### 3 Conclusions

The results of the 2024 survey provide valuable insights into the evolving training needs and preferences of the community. A key takeaway is the increasing preference for flexible training formats, particularly online and self-paced courses. While in-person training remains relevant, the convenience of online learning has grown significantly in recent years, likely due to the shift initiated during the pandemic. This trend is expected to continue as respondents favour the flexibility and accessibility of online options.

Furthermore, the preference for shorter training sessions—one day or less—indicates that participants prioritise efficiency and concise learning opportunities. Two-day events are still considered effective, but multi-day formats, such as seasonal schools, are seen as less convenient. This highlights the need to adapt training offerings to accommodate the time constraints of busy professionals.

In terms of content, the results show a consistent interest in High-Performance Computing (HPC) and Artificial Intelligence (AI). Respondents indicated a desire for more specialised training in subdomains such as Parallel Programming, GPU-Accelerated Computing, and Neural Network Architectures. While there is still significant interest in these domains, the survey also revealed that Quantum Computing, though emerging, remains an area where many participants have limited experience and knowledge. This points to an opportunity for future training programs to focus on foundational courses in Quantum Computing, helping to build expertise in this growing field.

## 4 Outlook

Looking ahead, NCC Czechia will continue to refine its training services to align with the preferences and needs highlighted in this survey. In particular, the focus will be on expanding online and hybrid offerings, emphasising shorter, high-impact training sessions. Additionally, as interest in Quantum Computing grows, developing beginner-friendly courses will be a strategic priority to help bridge the knowledge gap in this area.

The ongoing monitoring of training needs through biennial surveys will remain crucial in guiding the adaptation of services. As the community continues to evolve, the NCC Czechia will strive to stay at the forefront of these changes, ensuring that its offerings remain relevant, accessible, and effective in supporting the professional development of its stakeholders.