



HPC for SMEs - Training Programme

Region specific - Ireland

Developed by SME HPC consortium within Erasmus+ strategic project

smehpc.eu

Short description: region-specific training programme was developed with the aim of enhancing innovativeness in less developed regions by co-designing the High-Performance Computing Training Programme.



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Enabling SMEs to gain competitive advantage from the use of HPC (SME/HPC)

HPC for SMEs – Training Programme

Ireland

Programme description: The aim of the HPC for SME Programme is to support SMEs to become more knowledgeable on HPC technologies, expected business impacts and technical aspects such as HPC infrastructure and programming.

Audience – SME managers and technical staff

Objectives

- To show and train SME staff about HPC advantages and usability

Learning outcomes - at the end of this programme the participant will:

- Become familiar with HPC and related concepts
- Be able to understand HPC usage opportunities for SME
- be able to identify SMEs opportunities for HPC usage
- Be able to understand the dynamics between SMEs and HPC providers
- Learn the HPC landscape from Ireland
- Learn use cases from Pharmaceutical, Agriculture and IT services industries

List of topics

- Understanding High Performance Computing (HPC)
- Understanding HPC usage and identify opportunities for SMEs working with HPC
- SME/HPC provider relationship management.
- Exercises and solutions to practical problems by using HPC
- Advanced exercises and solutions to practical problems by using HPC

Prerequisites: none

Programme Duration – 2x8-hour blocks

Programme leader: self-study with optional mentoring & supervision of experts from HPC centres

Delivery method: online and face-to-face

Outcome: HPC Training for SMEs



I Basic	Understanding HPC usage and identify opportunities for SMEs working with HPC	Duration: 5x 1-hour block Learning Method: Lecture, group exercises
	<p>Description – participants will learn about HPC & HPC processes, infrastructure and usage opportunities. The goal is to teach SMEs staff to identify HPC opportunities for their companies. They will see examples of SMEs success stories, for better understanding of good practice of HPC usage.</p> <p>Objective</p> <ul style="list-style-type: none"> - To train SME staff to understand the HPC environment and usage - To provide SME staff knowledge to identify HPC opportunities <p>Learning outcomes – at the end of this topic participants will:</p> <ul style="list-style-type: none"> - Gain the understanding of HPC usability for SMEs - Learn about good practices of HPC usage - Gain the basic knowledge to identify opportunities for SMEs <p>Resources: PC with projector, theatre room, personal laptops/computer lab, access to HPC</p> <p>Course material: PPT presentations and videos</p>	

Understand HPC, HPC usage and identify opportunities for SMEs working with HPC		
Topic 1	Introduction to High Performance Computing (HPC)	
	What is High Performance Computing (HPC)?	
	How is HPC different from regular desktop computing?	
	Why is HPC important?	
	History of High-Performance Computing and potential future	
Topic 2	Aspects and benefits of using HPC technology	
	Economic reasons	
	Innovative reasons	
	Marketing reasons	
	Competitive advantage reasons	
Topic 3	Use cases	
	Pharmaceutical	

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	Agriculture	
	IT services	
Topic 4	Success stories	
	Cloud-based optimisation of water turbines for power generation	
	HPC Cloud-based simulation of flange tightening	
	Cloud-based HPC optimisation of manufacturing processes	
	Cloud-based optimisation of a multi-body wave energy device	
Topic 5	Roadmap for improving SME uptake of HPC	
	Introduction	
	Are SMEs ready to use HPC services?	
	Are HPC Centres ready for SMEs?	
	Examples of National (Ireland) HPC Centres and their expertise	

II Basic	SME/HPC provider relationship management	Duration: 2x2-hour block Learning Method: Lecture, group exercises
	<p>Description – this topic focuses on understanding the legal and operative engagement process between SMEs and HPC providers, including service quality, legal documentation (service level agreements, contracts, NDA, etc.) and additional value add services (knowledge of further educational environment, etc.).</p> <p>Objective</p> <ul style="list-style-type: none"> - To train SME staff to understand the operational aspects of engaging with HPC providers <p>Learning outcomes – at the end of this topic participants will:</p> <ul style="list-style-type: none"> - understand the administrative process of SME engagement with HPC providers - be able to formalise engagement with HPC providers <p>Resources: PC with projector, theatre room, personal laptops/computer lab Course material essential reading and videos</p>	



SME/HPC provider relationship management	
Topic 1	HPC Global Market Landscape
	HPC Market Segments
	What Services HPC is Providing
	How could HPC solutions benefit SMEs?
Topic 2	Initiatives on HPC Adoption by SMEs: Regional and International Perspectives
	HPC Adoption Initiatives for SMEs: EU Countries
	Adoption Initiatives for SMEs: USA
Topic 3	Implementation of new types of SLAs
	Are SMEs ready to use HPC?
	SLA/SLIs templates
	Contracting with HPC Providers and other legal framework (e.g. data protection)

III Intermediate	Exercises and solutions for practical problems, using HPC	Duration: 4-hour block Learning Method: Lecture, group exercises
	<p>Description – this topic all participants will be provided hands on experience by working remotely on the HPCs infrastructures: examples on problem solving, tutorials for domain specific use cases, HPC and software...</p> <p>Objective</p> <ul style="list-style-type: none"> - To provide SME staff experience with real HPC problems and remote hands on work on HPC <p>Learning outcomes – at the end of this topic participants will:</p> <ul style="list-style-type: none"> - gain the understanding of HPC infrastructure - get hands on experience by remotely working on the HPC - see specific use cases for domain environment <p>Resources: PC with projector, theatre room, personal laptops/computer lab Course material: essential reading and videos</p>	

Exercises and solutions for practical problems, using HPC

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Topic 1	HPC Terms and technologies
	Clusters
	Supercomputers
	Shared memory
	Distributed memory
	Hybrid Systems
	Parallel Programming
	Introduction to open source
	Usage example
Topic 2	HPC intro – Exercises
	Basic Linux commands
	Connecting to the HPC system
	KAY's system overview
	SLURM Basics
	Job management
	Transferring files
	Accessing software
	Using resources effectively
	Using shared resources responsibly



IV Advanced	Complex (advanced) exercises and solutions to practical problems by using HPC	Duration: 5-hour block Learning Method: Lecture, group exercises
	<p>Description – The advance courses will provide more complex (advanced) exercises and solutions to practical problems by using HPC</p> <p>Objective</p> <ul style="list-style-type: none"> - To train HEI staff to understand the operational aspects of engaging with SMEs <p>Learning outcomes – at the end of this topic participants will:</p> <ul style="list-style-type: none"> - obtain experience with parallel programming, OpenMP, MPI, use of some programming frames - be able to understand advanced data management and data formats used on HPC - get basic knowledge on GPU programming with CUDA - be able to identify opportunities for SMEs <p>Resources: PC with projector, theatre room, personal laptops/computer lab Course material (essential reading, video clips,...)</p>	

Complex exercise and solution to practical problems by using HPC advanced knowledge; target: IT		
Topic 1	Introduction to complex exercises	
	Basics (difference between GPUs and CPUs)	
	Serial and parallel applications	
	Types of parallelism (basic examples of what can be parallelised; overview of best practices)	
	Message passing interface	
	CUDA	