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SME/HPC

HPC for SMEs - Training Programme

Region specific - Slovenia

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

Slovenia

Programme description: The aim of the HPC for SME Programme is to inform SMEs on the possibilities of using HPC technologies, their benefits & expected business impacts and to inform them about its technical aspects such as HPC infrastructure and programming.

The region-specific training outline will address also existing gaps in relation to HPC expertise and utilisation in pilot regions of Slovenia, Romania and Ireland.

Audience – SME managing staff: Mangers and technical managers

Objectives

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

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

o   understand the purpose and use of HPC (introduction to need of HPC, good practice of HPC…)
o   be able to understand HPC usage opportunities for SMEs
o   be able to identify SMEs' opportunities for HPC usage
o   be able to create service agreement between SMEs and HPC providers, and to adapt it to specific end-user needs if necessary
o   get hands on experience by remote work on HPC infrastructures, get examples of problem solving...advanced exercises will provide more complex solutions to practical problems of HPC usage (parallel programming, OpenMP, MPI, use of some programming frames...)

List of topics
o   Understanding High Performance Computing (HPC)
o   Understanding HPC usage and identify opportunities for SMEs working with HPC
o   SME/HPC provider relationship management.
o   Exercises and solutions to practical problems by using HPC
o   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 centre

I Basic	**Understand HPC usage and identify opportunities for SMEs working with HPC**	**Duration**: 5x1 hour block **Learning Method**: Lecture, group exercises

	Description – participants will learn about HPC & HPC processes, infrastructure and usage opportunities. The goal is to teach SMEs staff to identify HPC opportunities for SMEs and why HPC is good for them. They will see some examples of SMEs success stories, for better understanding of good practice of HPC usage.
	
	Objective
	
	   - To train SME staff to understand what HPC is (who operates it, what, why, how)
	   - To provide SME staff knowledge to identify HPC opportunities and usability
	
	Learning outcomes – at the end of this topic participants will:
	
	   - gain the understanding of HPC usability for SMEs
	   - see some of good practices of HPC usage
	   - gain the basic knowledge to identify opportunities for SMEs
	
	Resources: PC with projector, theatre room, personal laptops/computer lab, access to HPC
	Course material (essential reading, video clips,…)	

Delivery method: online, face-2-face

Outcome: HPC Training for enterprises

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?	
	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	

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	Biomedicine	
	Manufacturing and Materials	
	Virtual Prototyping	
	Agriculture	
Topic 4	Success stories	
	HPC based high-resolution modelling of magnets	
	Cloud-based-HPC optimisation of manufacturing processes	
	HPC-Cloud-based simulation of light-aircraft aerodynamics	
	HPC-Cloud-based simulation of coupled electromagnetic and structural-acoustics in in-wheel electric motors	
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 HPC Centres and private HPCs of Slovenia	

II Basic	**SME/HPC provider relationship management**	**Duration**: 2x 2-hour block **Learning Method**: Lecture, group exercises
	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.). **Objective** - To train SME staff to understand the operational aspects of engaging with HPC providers **Learning outcomes –** at the end of this topic participants will: - understand the administrative process of SME engagement with HPC providers - be able to formalise engagement with HPC providers **Resources:** PC with projector, theatre room, personal laptops/computer lab **Course material** (essential reading, video clips,…)	

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	
	SLA/SLIs templates	
	Reference SLA/SLIs for SMEs	
	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

	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…
	
	 Objective
	
	    - To provide SME staff experience with real HPC problems and remote hands on work on HPC
	
	 Learning outcomes – at the end of this topic participants will:
	
	    - gain the understanding of HPC infrastructure
	    - get hands on experience by remotely working on the HPC
	    - see specific use cases for domain environment
	
	 Resources: PC with projector, theatre room, personal laptops/computer lab
	
	 Course material (essential reading, video clips,…)		

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	Exercises and solutions for practical problems, using HPC	
Topic 1	HPC Terms and technologies	
	Clusters	
	Supercomputers	
	Shared memory	
	Distributed memory	
	Hybrid Systems	
	Parallel Programming	
	Usage example	
Topic 2	HPC intro – Exercises	
	Basic Linux commands	
	Connecting to the HPC system	
	Arctur-2 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
	Description – The advance courses will provide more complex (advanced) exercises and solutions to practical problems by using HPC **Objective**	

	- To train HEI staff to understand the operational aspects of engaging with SMEs **Learning outcomes –** at the end of this topic participants will: - get experience with parallel programming, OpenMP, MPI, use of some programming frames - be able to see some advanced data management and data formats used on HPC - get basic knowledge of GPU programming with CUDA - be able to identify opportunities for SMEs **Resources:** PC with projector, theatre room, personal laptops/computer lab **Course material** (essential reading, video clips,…)

Complex exercise and solution to practical problems by using HPC		
Topic 1	Introduction to complex exercises	
	Basics	
	Serial and parallel applications	
	Types of parallelism	
	Message passing interface	
	CUDA	