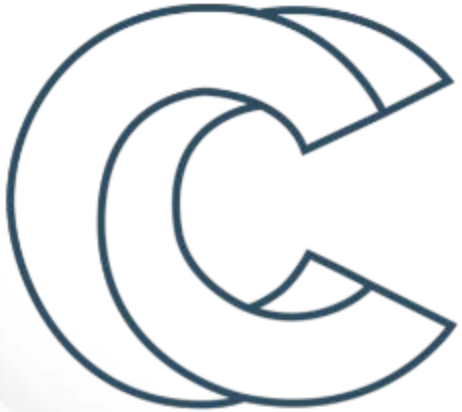
# Self assessment on HPC readiness for SMEs



EURO
Greece

**"Access to HPC resources by Greek SMEs" Info day**

*Eleni Kanellou*

kanellou@ics.forth.gr

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- ***What is HPC?*** ⟹ *Does this apply to my workflow?*
- ***Why is HPC important?*** ⟹ *Does this apply to my sector?*
- ***Why use HPC in Business?*** ⟹ *Does this apply to my business?*
- ***Adapting HPC for SMEs*** ⟹ *What are my HPC needs?*
- ***HPC services for SMEs*** ⟹ *Tools to cover my HPC needs.*

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# What is HPC?

# High-Performance Computing

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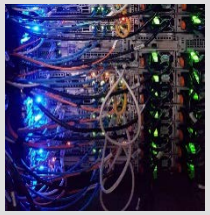
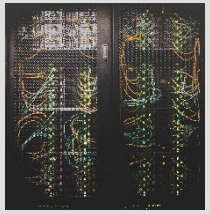


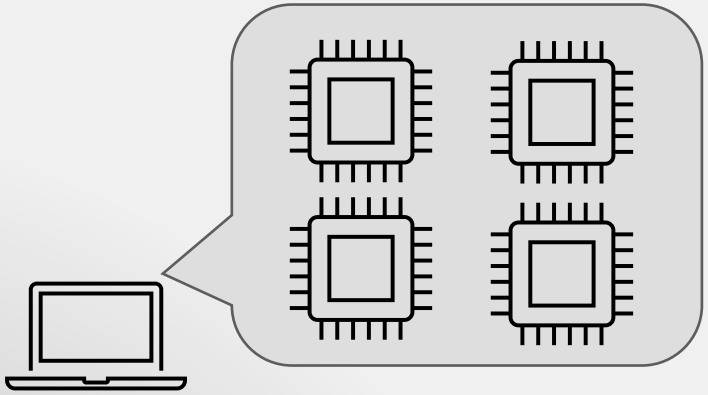
**What is HPC?**
Technology that takes advantage of the power of **supercomputers** or **computer clusters** to solve computational problems that are advanced or massive, be it in terms of data volume or complexity.

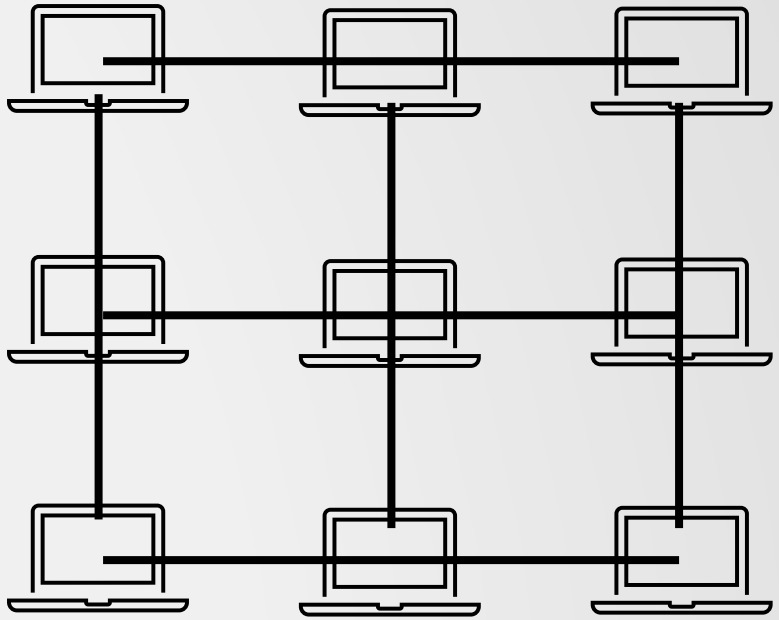
**Why is it useful?**
HPC can lead to major advancements in fields like scientific research or technological product development, because it make it possible to analyse *huge volumes of data,* or perform complex simulations, that would otherwise be impossible to do with standard computers.



**Where is it used?**
The adoption of HPC has been particularly robust in industries that need to *quickly analyze large data sets*, including genome sequencing, molecular dynamics, computational chemistry, etc. In the future, almost all industries will likely turn to HPC to tackle large volumes of data.

# How does it work?





# HPC in the broader sense

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**HPC**:
computing systems having extremely high computational capabilities. Today these systems are able to perform more than $10^{15}$ operations per second (petascale) and are expected in a few years to reach $10^{18}$ operations per second (exascale)

**HPDA = HPC + Big Data:**
Analyze extremely large datasets quickly and/or efficiently

**AI**:
Systems capable of learning and making decisions

**Cloud**:
On-demand access to computing resources such as servers, storage, databases, networking, software, analytics, and intelligence

**Quantum Computing**

# Self-assessment

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- *Are we moving towards compute-intensive workloads?*
- *Are we dealing with big data volumes?*
- *Are we relying on simulations?*
- *Are we using AI?*
- *Does our proprietary infrastructure seem overloaded?*
- *Have we seen improvement when using parallelism / GPUs / similar?*

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# *Why is HPC important?*

# Why is HPC important?

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| | |
|---|---|
| ***Reduced physical testing*** | By relying on HPC-powered simulations, physical tests can be eschewed. This can be very beneficial for industries where physical testing is costly and cumbersome, such as the automotive industry where crash tests can be replaced by simulations. |
| ***Fault tolerance*** | HPC clusters have more than one processing nodes, meaning that even if some of the nodes fail, the rest of the HPC system can continue its operation. Thus, even if overall processing is slowed down by the reduced computing power, there will be no problem of processing availability. |
| ***Higher Processing Speed*** | HPC clusters do not only exploit the availability of multiple nodes. They also contain highly performant processing and communication devices, such as the latest CPUs, graphics processing units (GPUs), and low-latency networking fabrics such as remote direct memory access (RDMA), coupled with all-flash local and block storage devices, HPC can perform massive calculations in minutes instead of weeks or months. |
| ***Lower Cost*** | The use of HPC shortens the time to complete production, given that it speeds up production processes. This translates to less wasted time and money. Furthermore, as remote HPC services become available, even small businesses and startups can afford to run HPC workloads, paying only for what they use and scaling up and down as needed (e.g. by relying on cloud-based HPC). |
| ***Improvement of existing processes*** | Faster processing time and quicker data analysis facilitates the automation and streamlining of workflows. |
| ***Innovation*** | Discoveries that are made possible for the first time through the use of HPC, make it a power that drives innovation across nearly every industry around the world. |

# Supercomputer vs. conventional computer


- Genetic Diagnostics: HPC speedup?
  - From few months down to weeks
  - From month down to few days
  - From year down to few months
- Early detection and treatment of diseases: HPC speedup?
  - From months down to month
  - Weeks down to days
  - From day down to hours
- 3D Brain Mapping: HPC simulation?
  - Can handle tenths of histological brain slice images
  - Can handle hundreds of histological brain slice images
  - Can handle many thousands of histological brain slice images

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**HPC Best Use Examples**

**Source**: https://digital-strategy.ec.europa.eu/en/library/high-performance-computing-best-use-examples

# Self-assessment

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- *Does my sector rely on scientific computations?*
- *Does my sector deal with simulations?*
- *Does my sector deal with ever-growing sets of data?*
- *Does my sector deal with data analytics?*

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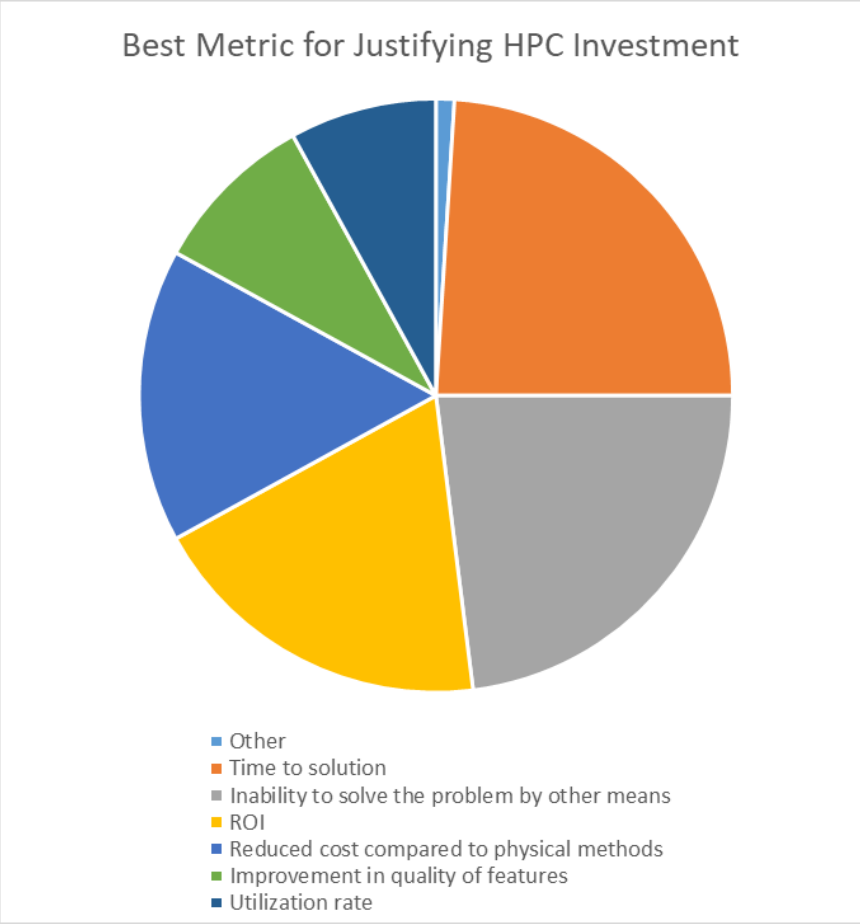
# *Why use HPC in Business?*

# Why use HPC in business




- HPC significantly reduce R&D costs and development cycles, producing higher quality products and services, reducing the time of product development cycles.
- **Example**: HPC has enabled automakers to reduce the time for developing new vehicle platforms from an average of 60 to 24 months, saving EUR 40 billion while improving crashworthiness, environmental friendliness, and passenger comfort
- High return on investment in HPC: each Euro invested in HPC on average returned EUR 867 in increased revenue and EUR 69 in profits.

**Sources**: https://digital-strategy.ec.europa.eu/en/library/high-performance-computing-factsheet
U.S. Council on Competitiveness report, "Solve. The Exascale Effect: The Benefits of Supercomputing Investment for U.S. Industry," Intersect360 Research, 2014

# Example: Drug Discovery and Pharmaceuticals

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| CHALLENGES… | …AND HOW TO FACE THEM |
| --- | --- |
| • Surfacing of new diseases<br>• Aging population means new patient profiles<br>• Medical data records growing exponentially<br>• Having to solve for enormous number of biological factors | • Make new discoveries faster than ever<br>• Work with larger data sets<br>• Collaborate more efficiently<br>• Scale up parallel simulations<br>• Exploit HPC-powered advances in genomics |

***Several years to decades to develop products*** → HPC → ***Personalized treatments in shorter time***

# High-Performance Computing Enhances Treatment Precision in Breast Cancer

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| Who? | The Problem | The Challenge |
|---|---|---|
| **United Kingdom**<br><br>End User:<br>**CHOSA Oncology Ltd**<br><br>Domain Expert:<br>**Hellenic Mediterranean University**<br><br>Technology Expert:<br>**JADBio** | • Many cancer patients fail to respond to their drug treatment, resulting in heavy human and economic loss<br>• Lack of efficacy is mainly attributed to host/tumour variations at the genetic and molecular level, which clinical practice still struggles to integrate<br>• New digital genomic technology delivers treatment regimens that assess and use the DNA, RNA, protein, and metabolites in the individual patient's tumour | • Current technologies focusing on just one or a few genetic biomarkers or using complex ex vivo laboratory tumour models are predictive of treatment outcomes only in highly selected cases and difficult to implement effectively<br>• Building an easy-to-use and intelligent platform to identify effective drugs in each individual requires the analysis of huge data sets. |

# High-Performance Computing Enhances Treatment Precision in Breast Cancer

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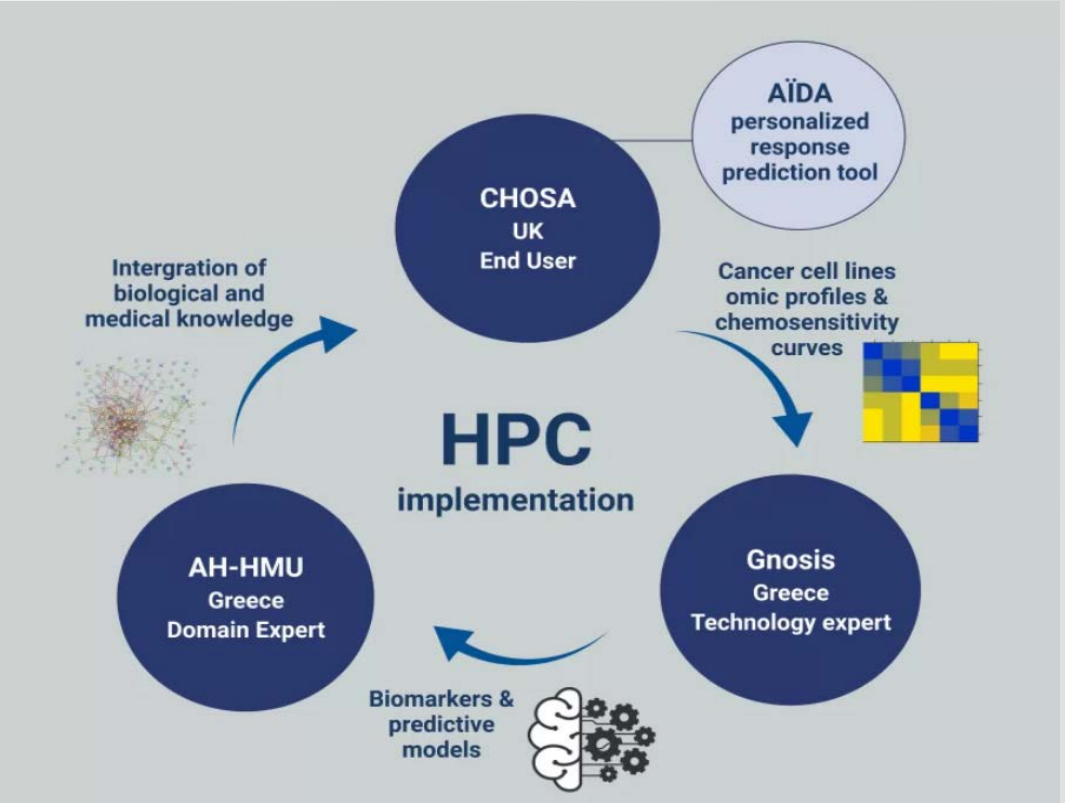
| The HPC Solution | The Business Benefit |
|---|---|
| • Extensive analyses of a huge volume of publicly available data (called NCI-60), which link different types of cancer to the anticancer activity of over 50,000 compounds<br>• Using the JADBio autoML platform and HPC resources, ML models for these selected compounds were built to estimate the models' performance in predicting treatment outcomes<br>• Analyses have required a prohibitive amount of time without the employment of HPC | • After further validation, the models will be used to set up a complete platform called 'Allied Intelligence for Drug Accuracy' (AÏDA) which predicts the efficacy of different cancer drugs for each individual patient<br>• No similar solutions exist at the moment<br>• With a focus on breast cancer, a business potential of up to €69m, based on an anticipated price of €3,000 per service. |



# Self-assessment

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- *Is time-to-market important for my business?*
- *Is my business operating in a competitive landscape?*
- *Are my competitors using HPC?*
- *Is the HPC ROI trend in my sector growing?*

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# *Adapting HPC for SMEs*

# HPC Needs by Stakeholder Type

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## Big Industry

- May have in-house HPC capabilities
- May have more liberal spending limits
- May have easier access to technology experts
- May be more time constraint-bound, in order to ensure competitiveness
- May have strict data or code confidentiality constraints.
- May have the capability of investing in research

## Academia

- May not have continuous flow of funding
- May have more freedom in accessing public HPC infrastructures
- May have HPC capabilities in-house
- May have to create novel/custom procedures or workflows
- May be allowed limited access to proprietary solutions, due to copyright issues etc

## Public Sector

- May rely on limited funding
- May face more regulations or restrictions on where and how to spend funding
- May be less deadline-bound
- May need robust HPC solutions, as decision-making may be slower

*No "one size fits all"!*

# The challenges in the case of the SME

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## COST

Prohibitive cost of in-house infrastructure

Limited budget for infrastructure hire

Limited budget for solution acquisition

## FLEXIBILITY

Computational requirements and needs may fluctuate during development

Workflows may need to be adapted to available infrastructure

## DATA

Data transfer time may be an issue

Data confidentiality may affect choice of infrastructure

Data storage needs may affect the cost

## EXPERTISE

Adapting workflows to HPC may require experts outside of the SME's field

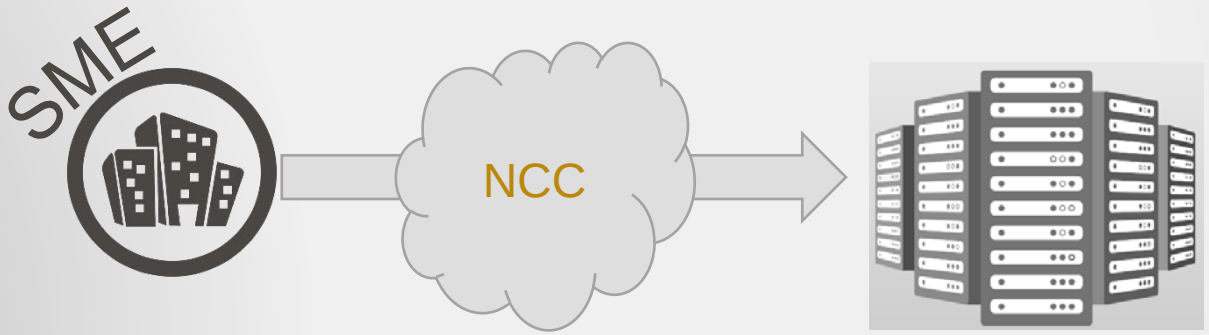
Experts should have a combination of backgrounds to better serve the SME's HPC need

## INVESTMENT

Competitive markets

Must carefully choose where to invest time and budget

Exploratory research may be prohibitive



# Access to infrastructure

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**HPC for hire**

+ Flexibility, more freedom of choice

- Extra cost that may be prohibitive

**Cloud Solutions**

+ Versatile

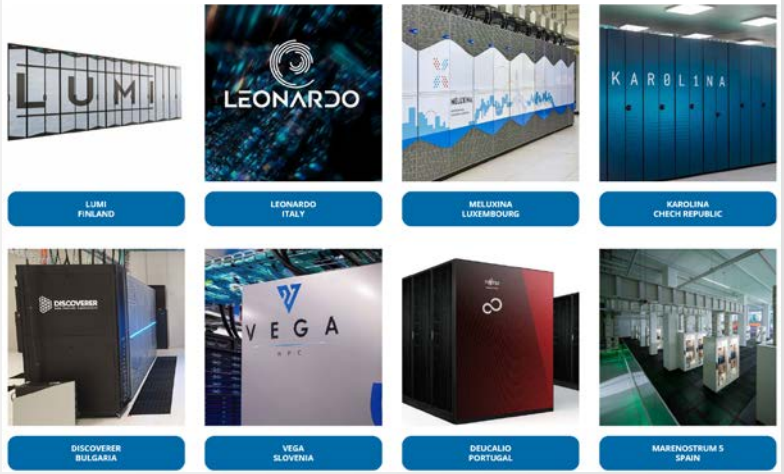
- Still incur cost, versatile under conditions

**National Infrastructures**

+ Lower cost

- Eligibility may be restricted

**EuroHPC JU Supercomputers**



# Access to infrastructure

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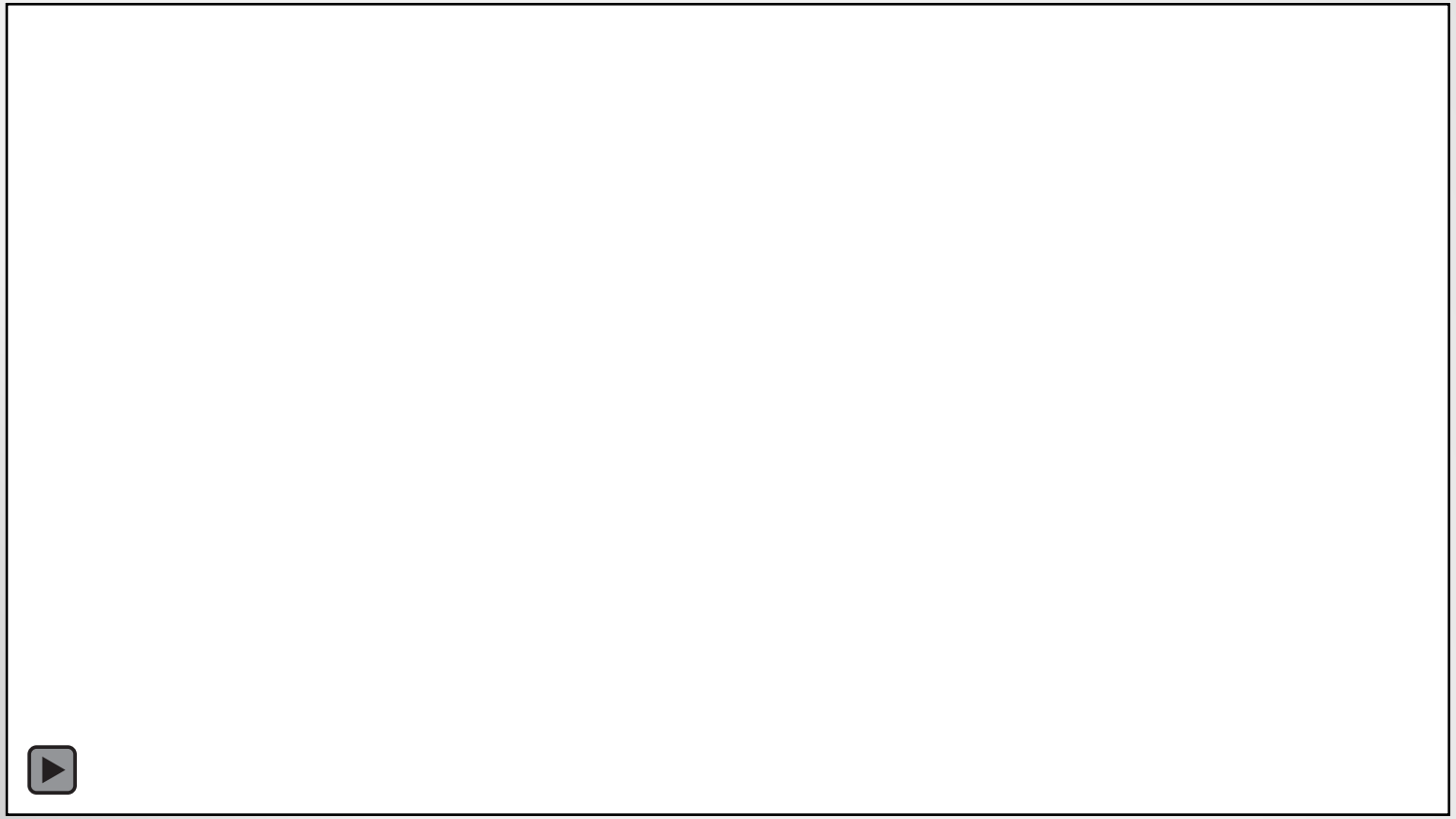

# Self-assessment

- *Do I need / where can I secure additional funding?*
- *What is my access profile (e.g. for JU supercomputers)?*
- *What type of data am I processing and what are the confidentiality levels?*

# HPC4SME Automated Assessment Tool

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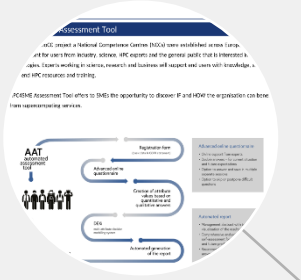
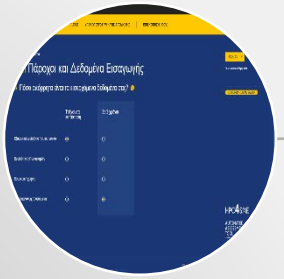
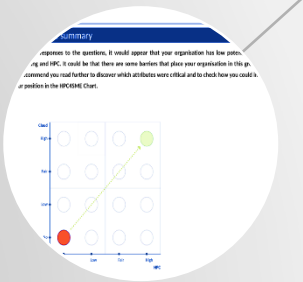
- 35 assessment questions
- Updated by Task Force



- Available in English
- Currently being translated **in 10 languages:** Greek, Montenegrin, Dutch, Macedonian, Swedish, Romanian, Estonian, Turkish, Latvian



- Provides personalized assessment report
- Provides recommendations based on the assessment



HPC4SME
AUTOMATED ASSESSMENT TOOL

**HPC4SME AAT EuroCC2 Task Force**

Update AAT Questions

Translate to other European languages

Lead beta testing with SMEs

Continuous support for users after release

Led by Arctur (Slovenia), developers of the AAT

14 NCCs currently participating

# HPC4SME Automated Assessment Tool

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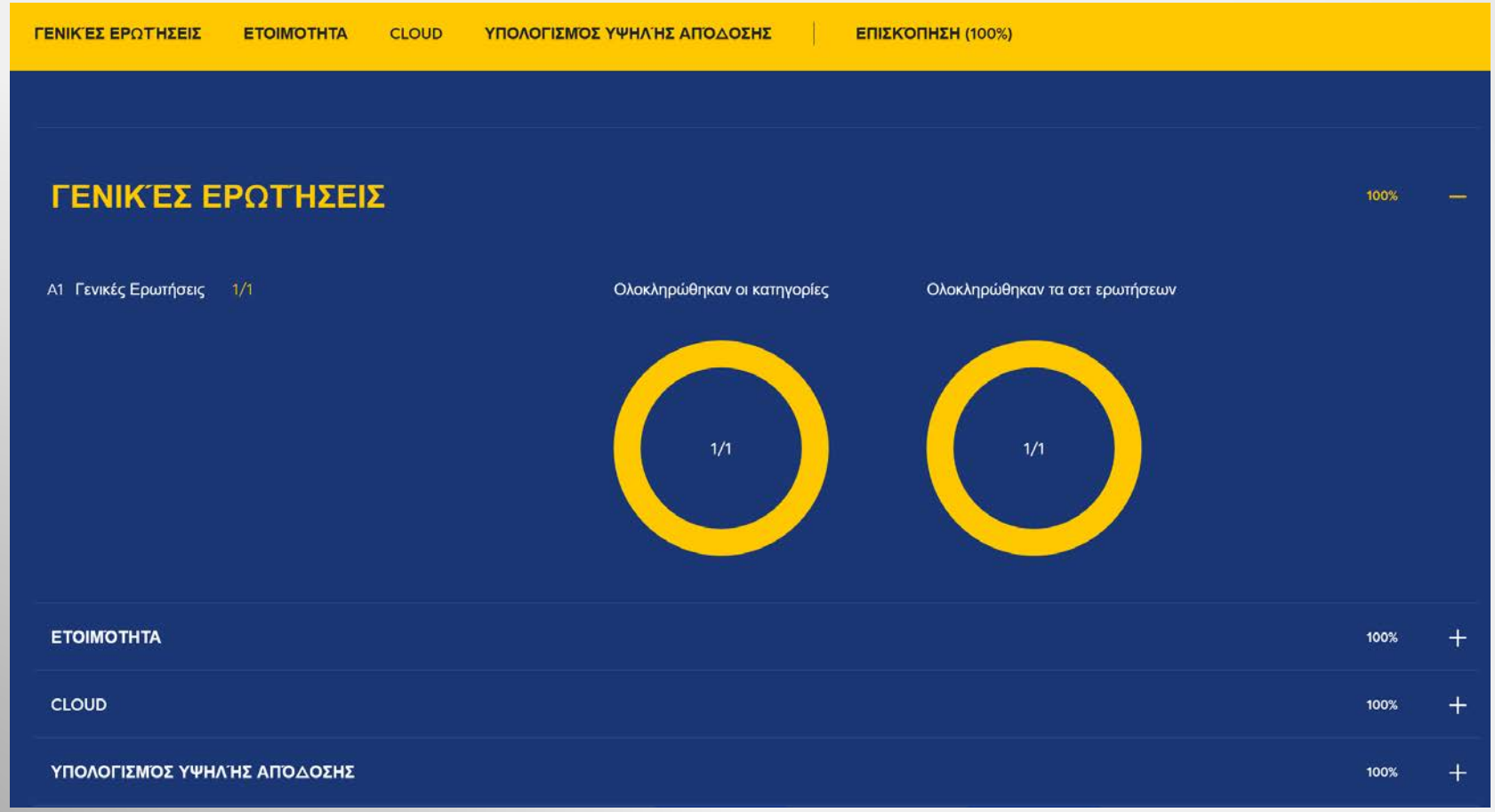


HPC4SME AAT

# HPC4SME Automated Assessment Tool

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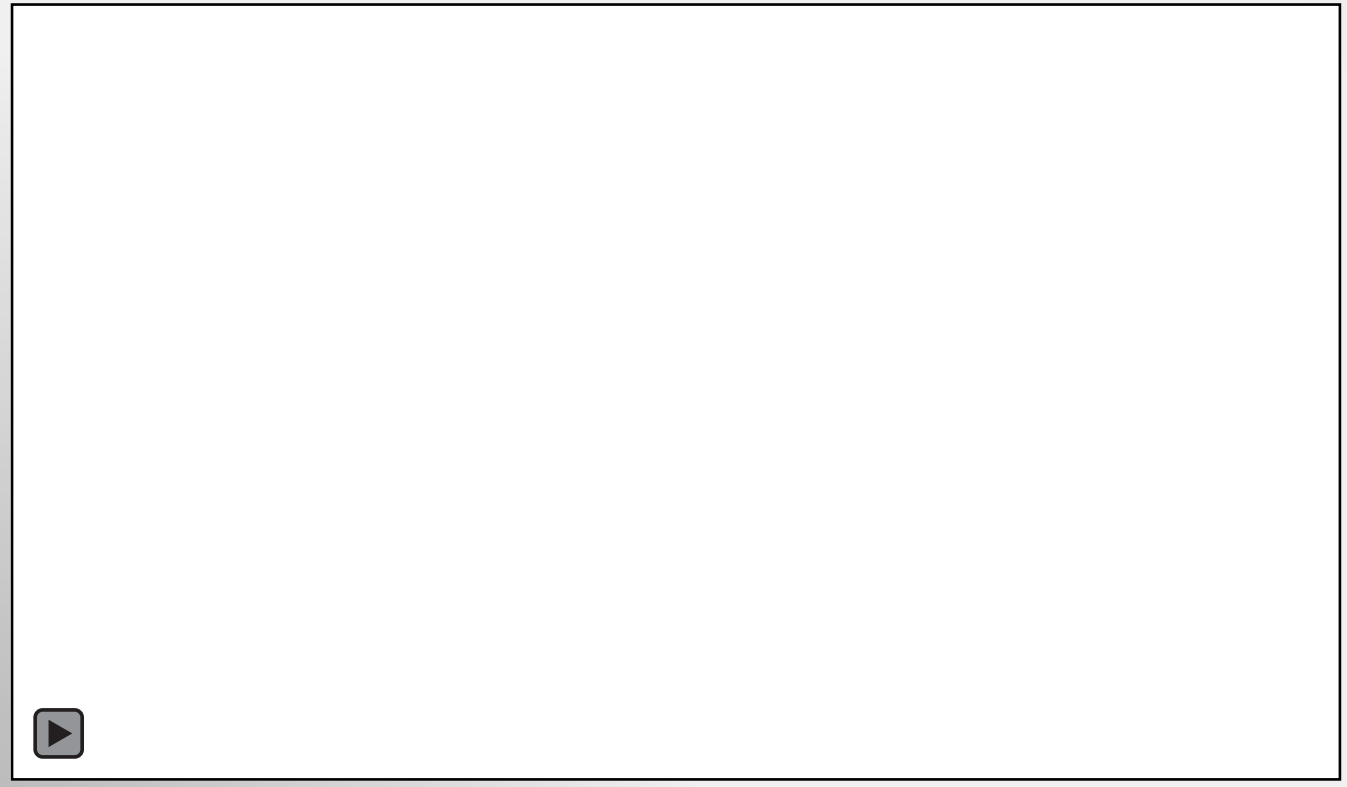

HPC4SME AAT

# HPC4SME Automated Assessment Tool

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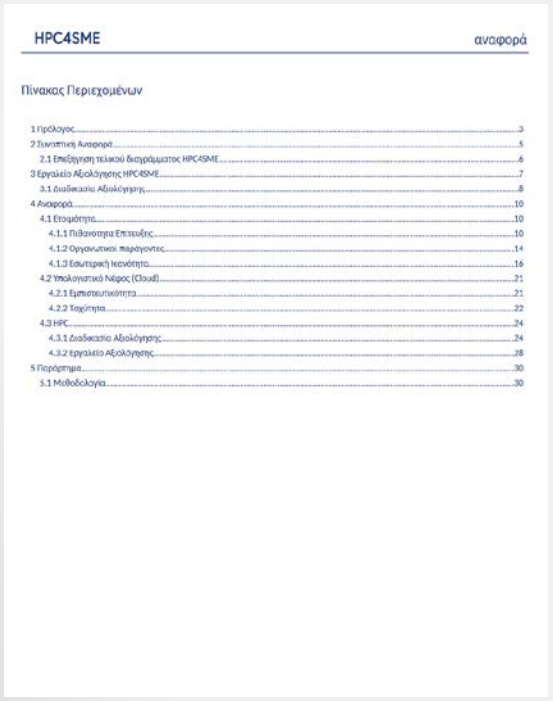
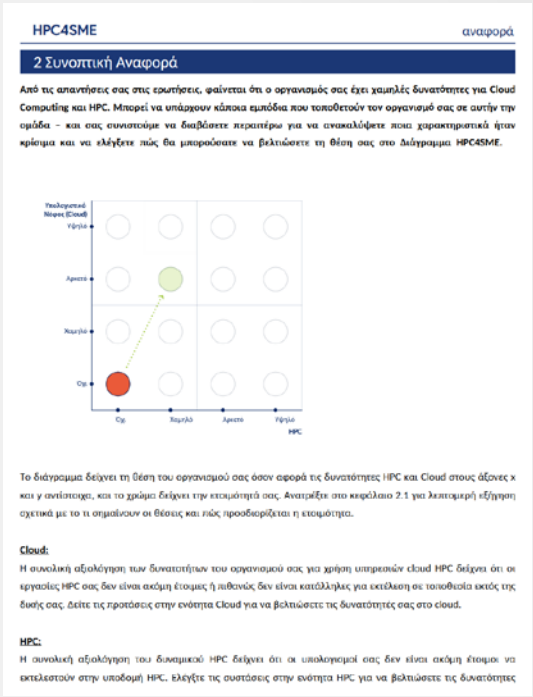


HPC4SME αναφορά

Πίνακας Περιεχομένων





HPC4SME αναφορά

## 2 Συνοπτική Αναφορά

**Από τις απαντήσεις σας στις ερωτήσεις, φαίνεται ότι ο οργανισμός σας έχει χαμηλές δυνατότητες για Cloud Computing και HPC. Μπορεί να υπάρχουν κάποια εμπόδια που τοποθετούν τον οργανισμό σας σε αυτήν την ομάδα – και σας συνιστούμε να διαβάσετε περαιτέρω για να ανακαλύψετε ποια χαρακτηριστικά ήταν κρίσιμα και να ελέγξετε πώς θα μπορούσατε να βελτιώσετε τη θέση σας στο Διάγραμμα HPC4SME.**




Το διάγραμμα δείχνει τη θέση του οργανισμού σας όσον αφορά τις δυνατότητες HPC και Cloud στους άξονες x και y αντίστοιχα, και το χρώμα δείχνει την ετοιμότητά σας. Ανατρέξτε στο κεφάλαιο 2.1 για λεπτομερή εξήγηση σχετικά με το τι σημαίνουν οι θέσεις και πώς προσδιορίζεται η ετοιμότητα.

**Cloud:**

Η συνολική αξιολόγηση των δυνατοτήτων του οργανισμού σας για χρήση υπηρεσιών cloud HPC δείχνει ότι οι εργασίες HPC σας δεν είναι ακόμη έτοιμες ή πιθανώς δεν είναι κατάλληλες για εκτέλεση σε τοποθεσία εκτός της δικής σας. Δείτε τις προτάσεις στην ενότητα Cloud για να βελτιώσετε τις δυνατότητές σας στο cloud.

**HPC:**

Η συνολική αξιολόγηση του δυναμικού HPC δείχνει ότι οι υπολογισμοί σας δεν είναι ακόμη έτοιμοι να εκτελεστούν στην υποδομή HPC. Ελέγξτε τις συστάσεις στην ενότητα HPC για να βελτιώσετε τις δυνατότητες

**HPC4SME AAT**

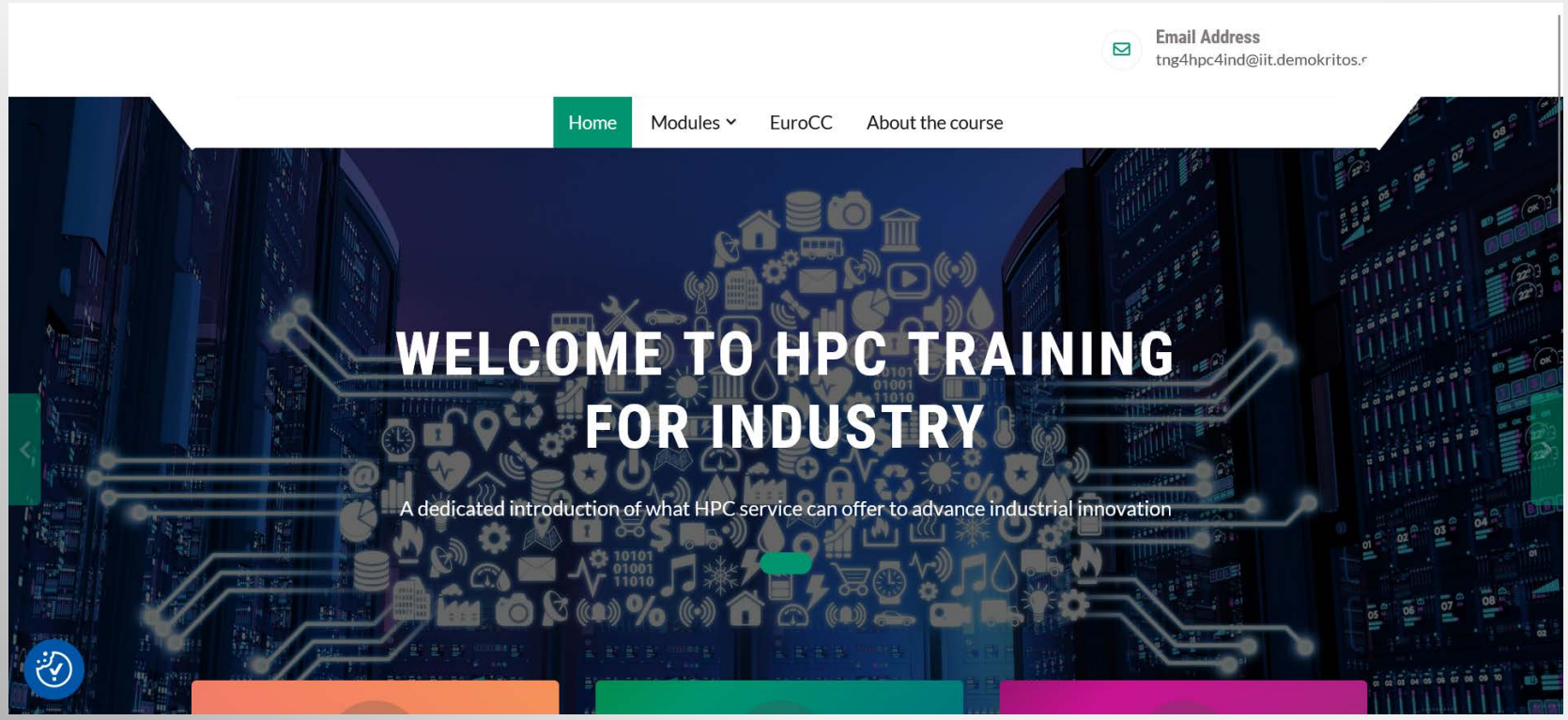
# *Available resources and how to use them*

# EuroCC@Greece Website


**EuroCC@Greece Website**

https://eurocc-greece.gr /

# Industrial Training Course




Industrial Training Course

https://mssg.ipta.demokritos.gr/tng4hpc4ind/

# HPC Marketplace

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**HPC Marketplace**

https://hub.eurocc-greece.gr/

# HPC Tools Directory

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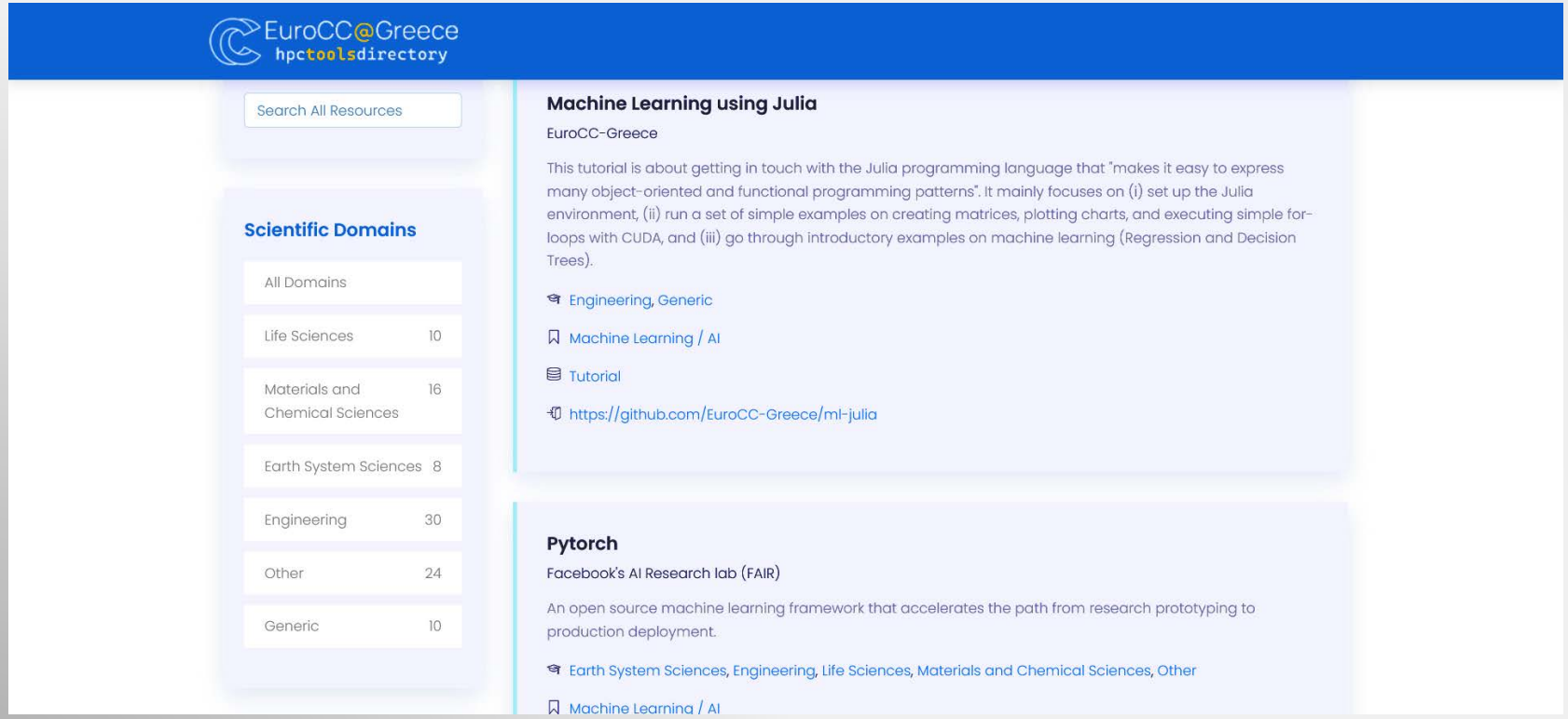


https://hpctools.chemeng.ntua.gr/

# Call for expression of interest

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- Are you an industry or government stakeholder looking for access to HPC resources?

➢ Apply to our program and secure assistance in your project projects by members of the High-Level Support Team of EuroCC@Greece.

- Fill out the form or e-mail
- **contact@eurocc-greece.gr**

**Express Your Interest in HPC!**

# Get in touch and stay connected!

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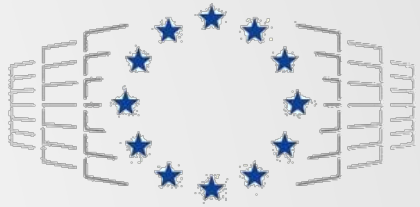
contact@eurocc-greece.gr

Newsletter

Contact Us!

# Thanks!

EuroHPC
Joint Undertaking

Funded by the European Union. This work has received funding from the European High Performance Computing Joint Undertaking (JU) and Germany, Bulgaria, Austria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Ireland, Italy, Lithuania, Latvia, Poland, Portugal, Romania, Slovenia, Spain, Sweden, France, Netherlands, Belgium, Luxembourg, Slovakia, Norway, Türkiye, Republic of North Macedonia, Iceland, Montenegro, Serbia under grant agreement No 101101903.

# Q & A

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**Contact Us!**