HPC FOR INDUSTRY

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3rd HPC Enabling of OpenFOAM for CFD applications, 26th March 2015

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CINECA IN FIGURES

- Founded in 1969
- 72 Universities + 4 Public institutions
- 3 sites
- 2 controlled companies (Kion, SCS)
- > 900 employees

CINECA - SCAI

- 1 Tier 0 system(Fermi) e 3 Tier 1 (Galileo, Eurora, Pico)
- Best placement in Top500: #7 (Fermi)
- Best placement in GreenTop500: #1 (Eurora)
- Total storage capacity: >15PB
- HPC services to support public research
 - International: PRACE
 - Italian: ISCRA
- Technological transfer towards industry

SCS SUPERCOMPUTING SOLUTIONS

- Funded in 2003
- HPC services marketing and sales
- Consultancy services (CAE, HPDA)
- Development of integrated solutions (HPC+CAE+HPDA)

HIGH PERFORMANCE COMPUTING

"Centralize a computing capacity in a single system to provide much higher performance than those of a workstation or a desktop computer. This capability is used to solve problems in chemistry, physics, engineering or finance." (source: HPC Inside)

nion

EVOLUTION



APPLICATIONS



THE HPC IN THE PRODUCT CYCLE

SRC: IDC Report on HPC

97% of the companies that invested in HPC is increasing their spending (IDC 2013)

Prototying

W/O

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Concept Development Virtual prototyping

TIME

Engineering

Final preparation

EU PRIORITIES

EC increased its HPC investment to 1.2B€ To reach 1ExaFlops within 2020 Make more relevant the EU HPC ecosystem Make more fair the HPC market for EU operators

THE EU CHALLENGE



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EC ACTIONS

- Strengthen e-infrastructure programs (PRACE)
- Creating PPP to promote the adoption of HPC technologies (ETP4HPC, FoF)
- To develop centre of excellence for application domains
- To promote specific actions to improve applications scalability to exascale class.
- To promote specific actions in order to improve productive technologies (aka power consumption, e.g. DEEP
 - To promote actions to standardize the access services (Cloud, PaaS, IaaS, HPCaaS -> Fortissimo).

THE HPC MARKET

- HPC market is foreseen in constant growth for the next three years (ave. 7,6%, IDC data)
- China, US, Korea, Russia leaders claimed that HPC is the key to competitiveness of their industry.
- Among segments, storage will grow the most.
- Big data, particularly HPDA will be trending.

THE CHALLENGES-1

To keep low operational costs (that can reach 20% of the total cost of a HPC system, $20M \in /y$)

Cooling

- Partnership CINECA-Eurotech
- Sustainable, eco-friendly datacentre

THE CHALLENGES-2

HPC as a commodity? WTH?

- laas vs PaaS
- Security models
- SLA e QoS

(Train)



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THE CHALLENGES-3

To train people in HPC adequately is a priority for

EC.

Summer of HPC Program

CINECA Schools

(SISSA+ICTP)

International master in HPC





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CINECA FOR INDUSTRIES

- On demand technical computing service on a cluster HPC
 - FAST
 - SECURE
 - COMPLETE
 - EASY
- Technical support (CFD, Visualization, DA)
- International network on HPC

HPC IN SIX STEPS



Get your account on our user portal.



Upload your data on our servers.



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Set your job.



Run the analyses.

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Focus on your work, we notify when results are ready. 06



Start analyzing your results interactively.

DATA SECURITY

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System access (ISO 27001) Cyphered connection S. Access policy on local file system Differentiated access policies for industry users Access policy on scheduler Data Backup Disaster recovery



HPC Services	Home	My Sessions	My Data	My Jobs	File Manager	Help Desk			
CFD	Remote User								
E <u>Remote User</u>	Welcome to the Fluent page for Remote test! You must use this page if your input files are on your remote cluster Please insert:								
	Journal File A file with the command lines for your Fluent test. Input Files Input Files: *cas and/or *.dat and all the additional files you need Version You must select one of these versions: 2d, 3d, 2ddp, 3ddp Number of CPUs How many CPUs do you want to use ? Other Parameters If you are an expert user, you should use some usefull other parameters. Please type "-help" in the box in order to get some information. Queue								
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HPC INFRASTRUCTURE







Top500 ranked HPC infrastructure

Fermi is ranked #7 on June 2012 op500 list

Galileo is the cluster targeting CAE simulations.

>1000 Intel Haswel CPUs (8000 cores) Green500 ranked HPC infrastructure

Eurora is ranked #1 on the June 2013 green500 list Dedicated HW for pre/post processing CAE activity

Dedicated 'Fat' nodes enables the management of up to 1TB of shared RAM

OF & HPC: TECHNOLOGICAL CONVERGENCES

HPC Infrastructures

- Moore's Law has being reached
- Multi-cores and many-cores architectures are pushing scalability efficiency

Open-Source Codes and Languages

- Reliable & robust CFD libraries are now free from license limitations
- Ease of use scripting languages for gluing computational workflows into automated computational experiments

Web Interfaces and Cloud Computing

• Web-based services for automated workflow and collaborative experience

THE 3rd CFD REVOLUTION

For the first time CFD applications can be designed without any limitations concerning ISV licensing costs that in the last decades represented a well known bottle-neck.

Open-source CFD libraries are mature, robust and reliable tools that can today compete with ISV softwares in problem solving for a wide range of filed of applications in engineering and physics.

 The ideal workflow able to exploit the technological convergences of open-source technologies and HPC platforms into automated and productive workflows must be redesigned.

AUTOMATIC & ROBUST CFD TOOLS +...



Shape optimization Shape design optimization based on CFD data

Parallel CFD

High parallel CFD computations for internal flows and external aerodynamics problems

3D complex geometries meshing

Highly automated meshing process of 3D complex shapes; fullystructured, hybrid or unstructured

CFD analysis State of the art

computational study of fluid dynamics and thermo-fluid dynamics problems

...HPC = HIGHLY PRODUCTIVE COMPUTING





Mesh automation

Highly automated

performed using

scripting

techniques applied

to open-source

software





Web-based

interfaces

Overall workflow, is available on

flexible web-

based

technologies for a

remote high

productive

experience

Automatic postprocessing and reporting

Post-processing, visualization and quantification are standardized into automated workflows

Tailored Scalability

Performance indices, including rating, speed-up and efficiency are evaluated for specific cases and settings

SCALING-UP

Our working methodology



ARE YOU READY FOR HPC*?

- CAE and particularly CFD are a key factor to improve competitiveness of a manufacturing company.
- HPC is an enabling technology part of innovation strategy for EU G20 countries.
- OpenFOAM on HPC might boost your productivity.
- We are ready to speed up your innovation.

THANK YOU



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