Industries as users of HPC - what are the challenges?

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Workshop - From Edge computing to HPC: EuroCC and CASTIEL meet ETP4HPC

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My Introduction

Dr. Sai Narasimhamurthy is Engineering Director, Seagate Systems, working on Research and Development for next generation storage systems and responsible for EU R&D for the Seagate Systems business.

Sai currently also holds the position of vice-chair of industry/Steering Board member of the ETP4HPC organization and co-leads the storage and I/O working group for developing ETP4HPC's Strategic Research Agenda (SRA). He has also actively led and contributed to many European R&D consortia (SAGE, Sage2, Maestro, IO-SEA etc) in the area of HPC focused on I/O and storage.

Previously (2005 - 2009) , Sai was CTO and Co-founder at 4Blox, inc in the area of Storage Area Networks.

During the course of his doctoral dissertation at Arizona State University (2001 – 2005) Sai has worked on Storage Area Networking protocols focusing on solutions for bulk data transfer over IP networks.

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IUWG: Introduction & Motivation

- Industrial use of HPC a major Pillar of European HPC Strategy

- ETP4HPC Industrial User Working Group (IUWG) setup
  - Goal: Deeper understanding of the needs of Industrial Users
  - ETP4HPC as a strong conduit to liaison b/w industrial users & EuroHPC
    - In line with the feedbacks and recommendations from the Commission
  - Address Industrial User inputs into R&I agendas

- What we have done?
  - Look at the overall problem of HPC provision for industry (as part of IUWG setup)
  - Looking at specific usage examples within the industry
  - SMEs, Specific verticals (eg: Oil & Gas), Large Companies, HPC centres perspectives, etc
  - Try & understand the pain points that are prevalent

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Industrial HPC Usage: A Background

- HPC typically/traditionally forte of Scientific communities

  – Simulation driven science

- Many Major technological and societal advances are driven by the industry with HPC use
  – Oil & Gas exploration
  – Health
    • Bio-informatics/genomics,
  – Engineering
    • automotive design, semiconductor design
  – Media & entertainment
    • Rendering/animation
  – Finance & fintech
    • Stock markets, financial modelling
  – Era of Digital Twins (Digital Replica of Physical Entities)
    • Manufacturing, retail, supply chain, driverless cars
  – Etc

> • Building Better Products/Services
> • Optimization of their business ops

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Observations & Major Challenges (Europe)

- In Europe , Industrials are fairly limited users of HPC

- However there is an **Increasing need & desire** among industrials to exploit HPC & increasingly large number of players wanting to do that

- Will benefit from the availability of public HPC machines
  - EuroHPC pre-Exscale, Exascale incl.

- Also SMEs need an understanding & knowledge of the usage of HPC as a tool
  - Very limited SME usage of HPC through programs such as Fortissimo
    - https://www.fortissimo-project.eu/

- HPC industrials lack strong connecting links with EuroHPC
  - Inclusion in **R&I Roadmapping**
  - Getting better **understanding on the usage of machines**

Foster & promote multiple connecting links between the industrials and public HPC bodies/EuroHPC

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Industrial Enablement - ETP4HPC Perspective

- Participate very actively in the EuroHPC decision-making processes and help to co-develop the European short and medium-term HPC strategy in line with Industrial User Requirements.

- Engage in co-design for the technology developments in all relevant communities including Big Data, IoT and AI.

- Communicate their requirements for EuroHPC Infrastructures.

> https://www.etp4hpc.eu/pujades/files/ETP4HPC_IUWG-Position-paper_20200325.pdf

- Get support in accessing top level EuroHPC Infrastructure for industrial applications.

  - Shorten their industrial innovation cycles and time-to-market.

> **Multiple conversations with Industrial Users since then (IUWG driven Webinars)**

- Benefit from enhanced collaboration and interaction with other players or indeed the management and governing entities for EuroHPC.

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ETP4HPC Conversations

ETP4HPC Conversations (SMEs)

- Needs better emphasis on **commercialization of technologies** coming out of R&D
  - Through more funding avenues, etc

- European Exascale will require **world class customer engagement model** – not just provision of the machines

- Building a **Sustainable HPC industry in Europe more important than building Exascale Machines**

- Some differences between Exascale class machines and "Real world" HPC

Exascale	**Real World**
Software: open and free	Software: commercial or open
Most Important: transparency, no lockin	Most Important: liability, 24-7 technical support
Commercial value: to HW vendors	Commercial value: to software companies
Almost entirely on-prem	Mainly on the cloud

- Large companies taking all the "value" created (eg: through Cloudification) . An Army of SMEs can create more value

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ETP4HPC Conversations (SMEs)

- Very high barrier to entry
  - Currently HPC is mostly the prerogative of large firms and government national research facilities

- Wider adoption is limited by:
  - Accessibility & availability challenges
  - Affordability
  - Administrative opaque procedures & lack of visibility
  - Lack of skills and awareness
  - Absence of Flexibility
  - Security, privacy, confidentiality concerns
  - Silos – seen as a domain of experts
    - Shouldn't need a PhD in computing when you have a PhD in chemistry!

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ETP4HPC Conversations (Large Companies)

- **Education and Training in some key areas**

  - Algorithms, systems, architectures, etc (all are needed) – hard to get all the expertise in all of them from new graduates
  - Companies don't have people readily available to work with parallel algorithms
  - Continuously updating/upgrading knowledge is also an issue – so companies need good "venues"

- **Convincing end users to adopt HPC**

- **Potential of Quantum Computing**
  - There are unsolvable problems (Multidimensional optimization, Fault tree analysis) in the industry
  - This is an opportunity

- **Edge & digital continuum**
  - Guaranteeing answers in short time needed (Urgent computing) - eg: Aircrafts inspite of edge systems being very small
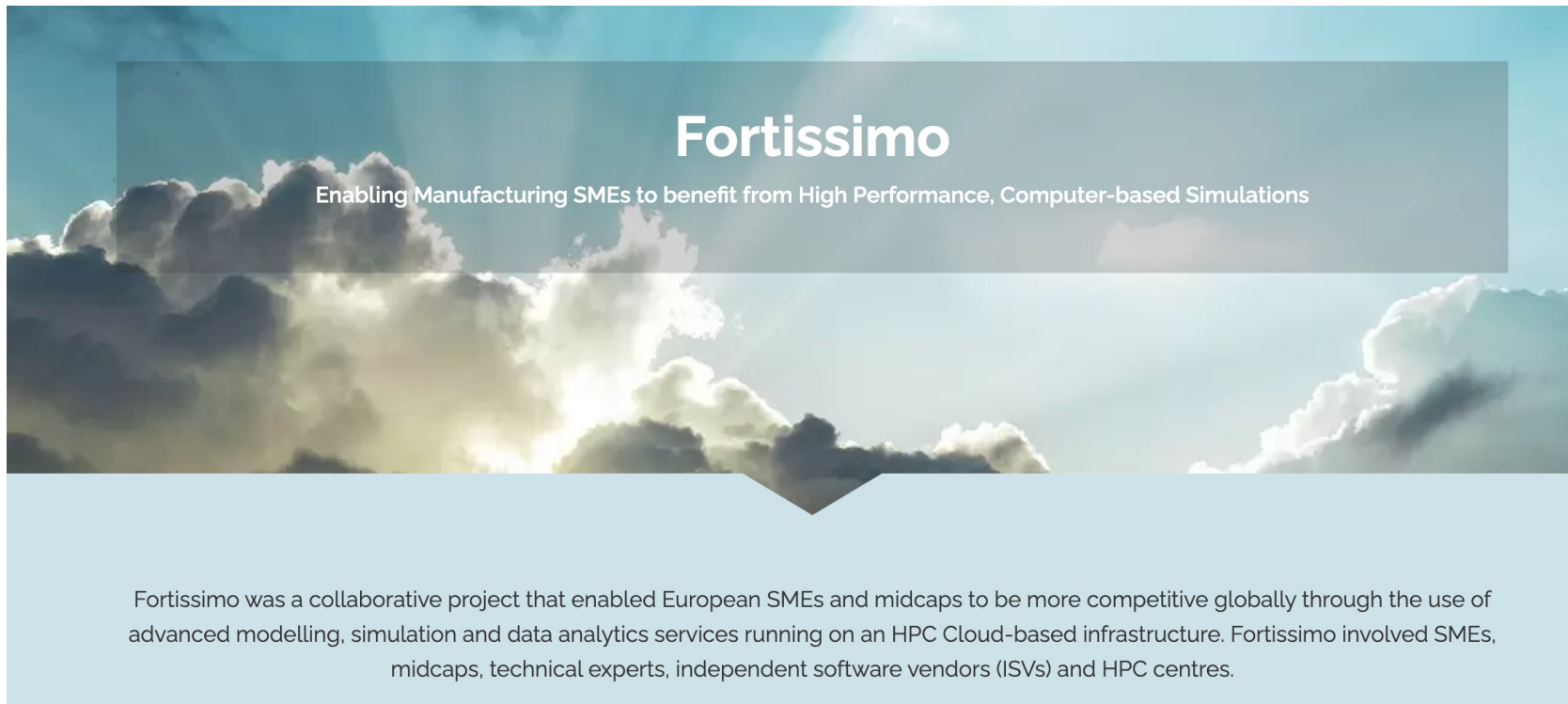 - Critical Importance of 5G & beyond

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ETP4HPC Conversations (Large Companies)

- Heavy focus on ease of use stressed

- Smart integration of Cloud+HPC
  - Large companies typically have operations in multiple countries
  - Cant have HPC facilities everywhere!
  - Data transfer still a major issue
  - Lowering the cost of adoption of Cloud
    - Cost highly prohibitive

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ETP4HPC Conversations (Computing Centers)

- Sustainability very critical for industrials rather than bleeding edge technology upgrades

- Industrial users needs clearer elaboration on the potentials of using HPC/HPDA & AI techs

- Security & clear access policies need stronger focus

- Needs sharing of expertise & best practices with industry – not just provision of cycle time

ETP4HPC Webinar #5

Note on Fortissomo (With thanks to Hans-Christian Hoppe!)

Fortissimo

Enabling Manufacturing SMEs to benefit from High Performance, Computer-based Simulations

Fortissimo was a collaborative project that enabled European SMEs and midcaps to be more competitive globally through the use of advanced modelling, simulation and data analytics services running on an HPC Cloud-based infrastructure. Fortissimo involved SMEs, midcaps, technical experts, independent software vendors (ISVs) and HPC centres.

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Some conclusions

- More continued conversations & notes sharing with Castiel, EuroCC, ETP4HPC

  - Need to continue to **speak with industrials, gather requirements and share notes**
    - More joint workshops will be very good
  - Better disseminate HPC technology to upstart industrials within each country
  - How to better provide their feed back to public funding bodies?

- More conversations with associated communities such as DAIRO, AIOTI, GAIA-X, Quantum Computing communities, AI communities etc

  - What are the industrial computing needs and how can HPC support it?

- HPC **SME's** need to be bolstered in Europe. What can be done to enable them further? How can be better share information with them (on conversations with funding entities & R&I priorities) How can be provide them more access to funding bodies (incl. Private)?

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