



FORTISSIMO

# HPC and Industry in Europe

## An EPCC perspective

Professor Mark Parsons

EPCC Director

30<sup>th</sup> September 2016

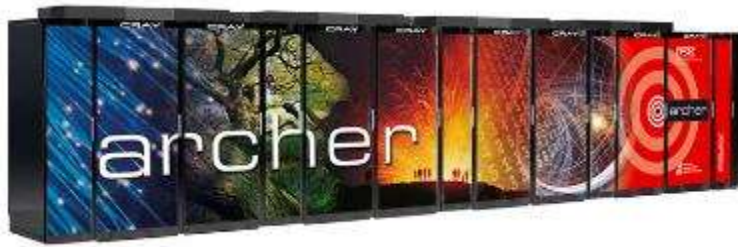


I4MS

| epcc |

# Outline of talk

- EPCC has work with industry for 25+ years
- One of our major current activities are the Fortissimo projects
- This talk will look at these projects and the general issue of HPC industry engagement in Europe



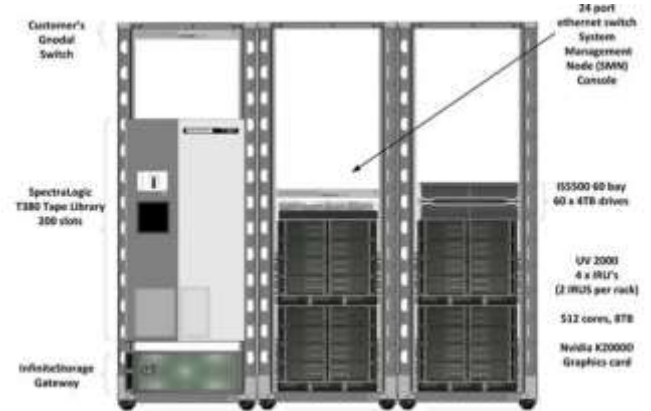
## National HPC and Big Data services

ARCHER and the RDF  
3,500 users (2,500 live)



### People

90 staff  
Majority software  
developers working  
with academia and  
industry



## Project specific services

SFC Innovation Centres  
Farr Institute  
Edinburgh Genomics  
EPCC INDY  
Fortissimo Marketplace

## Research systems

EDIM1 / 2  
Intel/Fujitsu 3D XPoint™  
system

**The next 5 years will see HPC and Data Analytics systems merging. Great opportunities for HPC in new sectors**



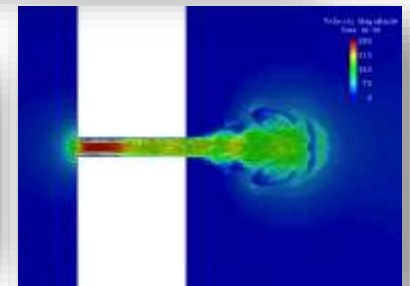
## Positioning Fortissimo within EC

- Fortissimo and Fortissimo 2 sit within the Factories of the Future PPP
- The FoF PPP is part of EC's response to 2008 financial crash
  - Quite distant from Research Infrastructures
- Managed by *Technologies and Systems for Digitising Industry* unit in DG CONNECT Dir. A
- Clustered by Innovation for Manufacturing SMEs (I4MS) CSAs
- Key part of European Commission's strategy

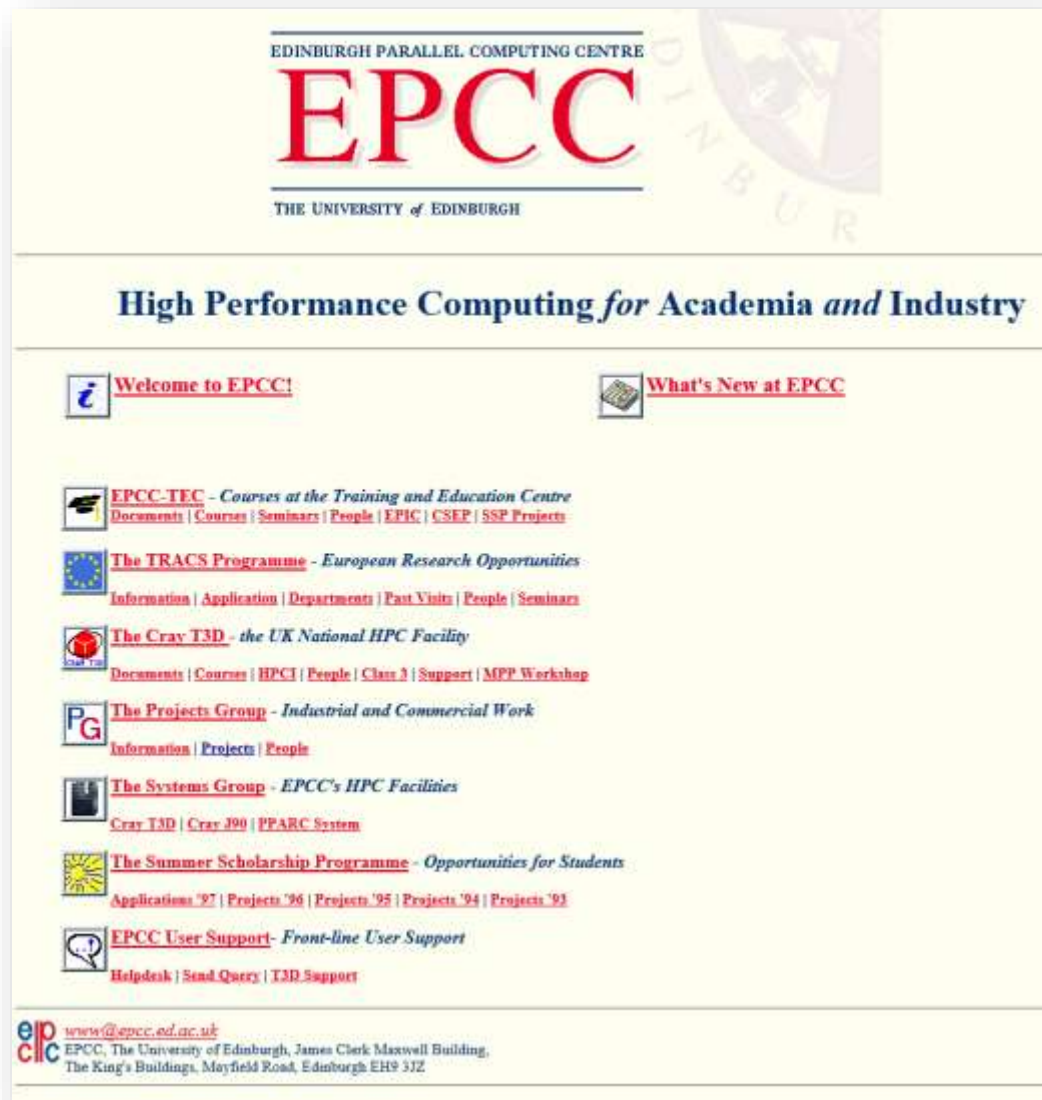
# Fortissimo's Goal & Ambition

- **Goal:** provide easy and cost-effective access to **Cloud infrastructure**, **software**, **services** through a **single point of access** of **HPC resources**, **expertise**, and **tools**
  - **Fortissimo 2 also focusses on coupled simulations**
- **Ambition:** become **THE** portal of choice for **HPC and HPDA** expertise and service provision, delivered by Europe's major HPC technology providers

Fortissimo 2 also focusses on coupled simulations



# A long history ...




The screenshot shows the EPCC website homepage. At the top, it reads "EDINBURGH PARALLEL COMPUTING CENTRE" above the large red "EPCC" logo, with "THE UNIVERSITY of EDINBURGH" below it. A navigation bar contains the text "High Performance Computing for Academia and Industry". Below this are two main sections: "Welcome to EPCC!" with an information icon and "What's New at EPCC" with a document icon. A list of links follows, each with a small icon: "EPCC-TEC - Courses at the Training and Education Centre" (document icon), "The TRACS Programme - European Research Opportunities" (European Union flag icon), "The Cray T3D - the UK National HPC Facility" (Cray logo icon), "The Projects Group - Industrial and Commercial Work" (PG icon), "The Systems Group - EPCC's HPC Facilities" (server rack icon), "The Summer Scholarship Programme - Opportunities for Students" (sun icon), and "EPCC User Support - Front-line User Support" (headset icon). The footer includes the email "www@epcc.ed.ac.uk", the EPCC logo, and the address: "EPCC, The University of Edinburgh, James Clerk Maxwell Building, The King's Buildings, Mayfield Road, Edinburgh EH9 3JZ".

# Proving the model ...

HPCN TTN

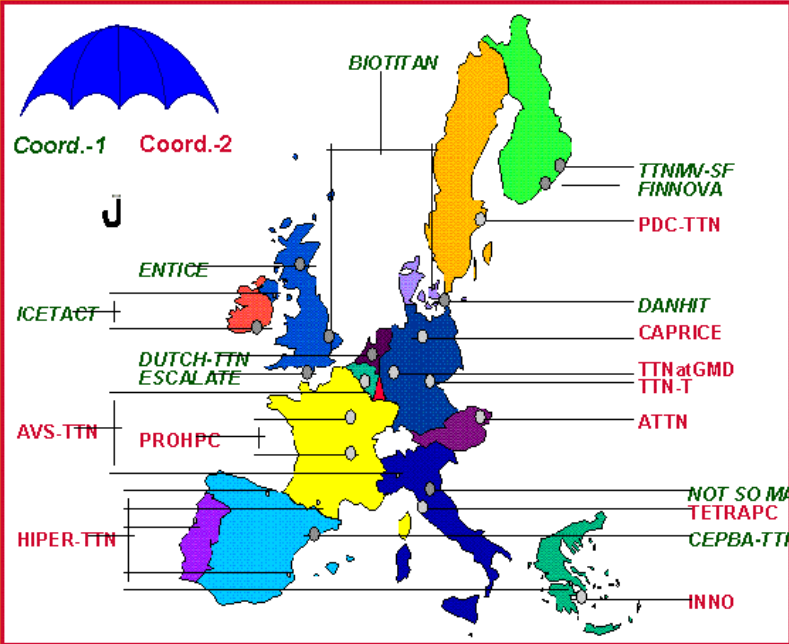
network



## HPCN TTN Network

**Industrial Groups:**

- Automotive
- Aerospace
- Medical
- Pharmaceutical/Chemical
- Machinery
- Food/Agriculture
- Environment/Transport
- Construction
- Forging/Casting
- Moulding
- Quality Control
- Finance/Retail/Insurance
- Video/Film/Entertainment



**Statistics**

20 TTNs  
1 Associated  
2 Coordinators

169 Activities  
619 Partners  
273 SMEs

**Funding:**  
40 MECU

1997 - 2000

European Commission
DG III: Industry
RTD: Information technologies

# Testing the waters

## **Pilot Programme (completed April 2010)**

### **3 projects funded by De Minimis aid from Scottish Enterprise**

Could we identify the right type of company?

Could we convince them that HPC could deliver for their business?

Could we convince them to partner with a university?

### **Most important of all:**

Could we deliver business benefit?

(new product/process, lower costs, faster development cycle)

Could we deliver a viable business case for the proposal?

Could we deliver (and measure) impact (or anticipated impact)?

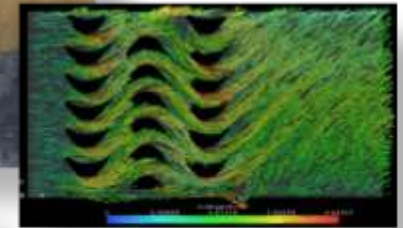
### **High Impact - key selection criterion**



# Pilot projects

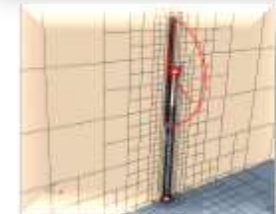
- Deep Casing Tools Ltd

- Oil & gas sector
- Mud-powered reaming device



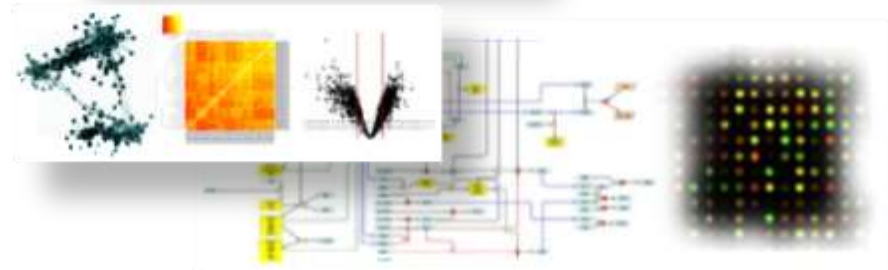
- Prospect FS Ltd

- Renewable energy sector
- Shallow water wind turbine



- Fios Genomics Ltd

- Bio-science sector
- Genomics services



## Positive Evaluation

*“The return over the 3 years to 2013 would appear to be good generating approx. £10 net GVA for every pound of public spend with a five year projection of £25 ... Clear benefits have been derived by the firms in the pilot.”*

### *Caveats:*

*Small sample size – only 3 projects*

*Small investment – can lead to high impact ratios*

*Selected for demonstrator effect*

*GVA – Gross Value Added = Turnover – cost of inputs*

# Industry HPC across Europe

- Although most HPC centres in Europe *talk* about working with industry only a subset *actively target* industry
- Key requirement to be a Core Partner in Fortissimo is to actively work with industry
- Fortissimo has both publicly funded HPC service providers and commercial HPC service providers

# Fortissimo projects in numbers

- Fortissimo - €22m FP7 project – ends 12/2016
  - 122 partners
  - 53 ‘experiments’ in three tranches **delivering real impact**
  - Focus on **HPC enabled modelling and simulation for manufacturing SMEs and Mid Caps**
- Fortissimo 2 - €11m H2020 project – ends 10/2018
  - 63 partners (probably 90 by end)
  - 24 ‘experiments’ currently running (39 by end)
  - Now integrating 15 new ‘experiments’ from Open Call 2
  - Fortissimo focus plus **High Performance Data Analytics**
- Lots of effort to help SMEs take part

## Similar model for both projects

- Small set of core partners
  - Almost identical for both projects
- Initial set of ‘experiments’
- Two Open Calls for experiments
  - At Month 6 and Month 12
- Experiments last 18 months and involve 3-5 partners and funding up to €250,000

# Fortissimo Open Calls – lots of demand

- Three Open Calls to date
- Fortissimo
  - Call 1: 65 proposals – funded 22 new experiments
  - Call 2: 82 proposals – funded 11 new experiments
- Fortissimo 2
  - Call 1: 73 proposals – funded 10 new experiments
    - 107 SMEs involved in bids
  - Call 2: 102 proposals – funded 15 new experiments
- All run as per EC best practice

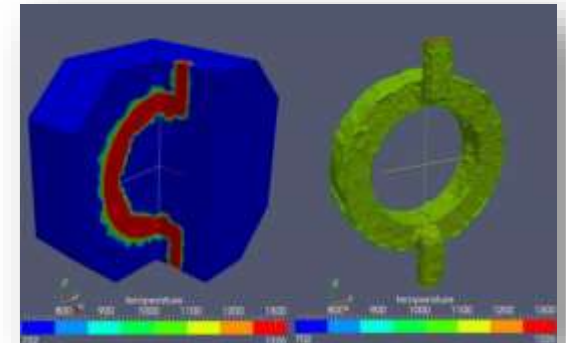
# Cloud-based simulation of continuous casting

- CFD modelling liquid steel pouring from ladle to tundish
- Aim to minimise slag transfer
- Fast return on investment
- Medium sized steel plant produces 1m tons steel per year
- Operating costs of €300 million
- Estimated €3 million annual saving
- Now being exploited by Ergolines



# Cloud-based simulation for low-pressure die-casting of copper alloys

- Focus on optimisation of copper alloy moulds
- Costs of testing a new mould are high - €40K per mould
- Simulation saves around €6K per mould – fewer failures
- Annual savings of around €50K already accruing to IMR



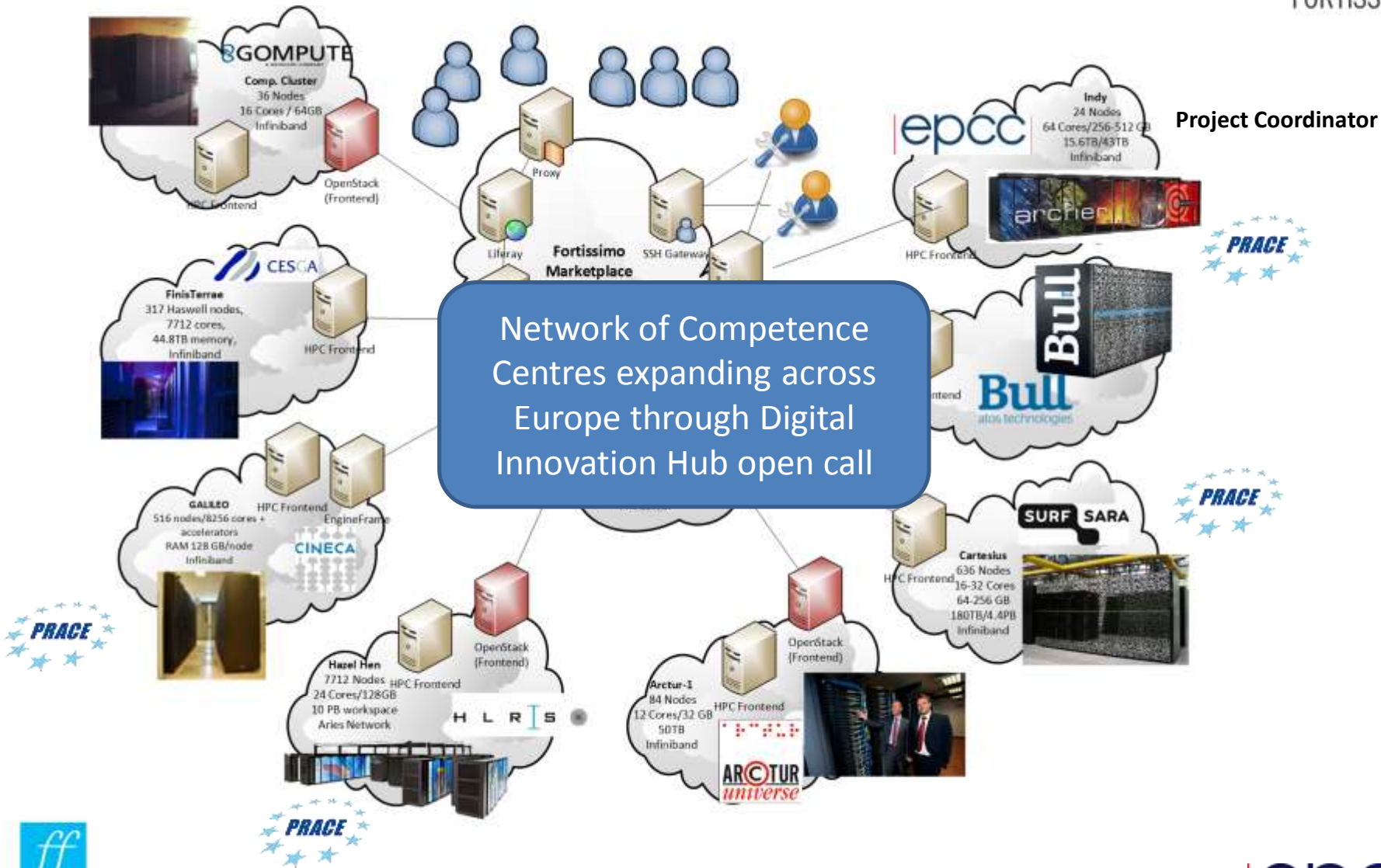


# Cloud-based CFD simulation for hypercars

- Koenigsegg are EU Hypercar manufacturer ... and an SME
- In-house CFD too expensive
  - Cloud is compelling option
- Impressive results
  - 250% increase in downforce with only 15% increase in drag at 250kph
- 30% saving in design costs plus 50% reduction in wind tunnel and physical testing
- Development savings of €90K per year PLUS 30% decrease in time to market
- €4m benefit to company over 5 years



# Fortissimo HPC Cloud resources



## Fortissimo – supporting SMEs

- All Experiments exist in their own “IPR bubble”  
– gives SMEs confidence in such large projects
- We try and keep financial and reporting processes simple and quick
  - We have helped with SME cash-flow issues on case-by-case basis
- Quid pro quo is that each experiment must have a clear Success Story and
- Fortissimo 2 is using new H2020 rules to simplify Open Calls ...

# Building Fortissimo to help the masses

Source: EC  
Report on SMEs  
2014

- Fortissimo and Fortissimo 2 are running 92 'experiments'
- Clear economic benefits to the companies and to Europe in terms of jobs and growth
- But ... there are 21.6 million SMEs in the EU representing 99% of all businesses
- In manufacturing sector there are **2.08 million SMEs**, employing 17.87 million and **contributing €750 billion** to EU economy

## So what's the problem?

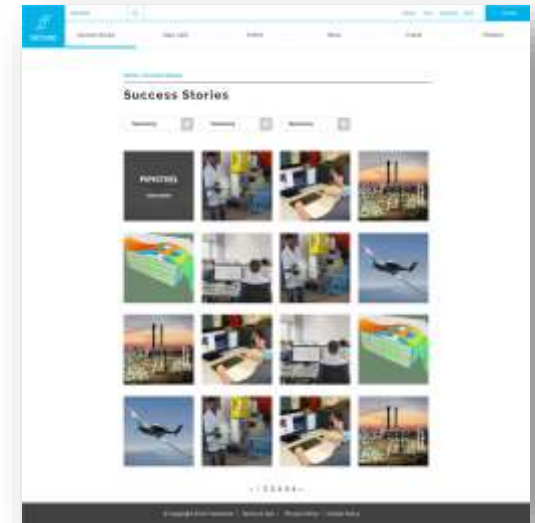
- Many new users of HPC and HPDA are put off due to the initial cost
- A first project can easily cost €60K-100K
  - Particularly if they have never used HPC before
  - This is a lot of money for an SME
- A key objective for Fortissimo is to challenge this state of affairs
  - Solving real business challenges and developing a set of business-focussed case studies
  - Overall goal is to convince others to adopt

# How many can realistically benefit?

- In 2009, around 1,400 companies in Scotland with 300 employees or more
- Scaling up 92 experiments = 30,000 likely companies
- 142,000 companies are likely to be helped
- Why the 0.3% helped in total
  - Many are low tech e.g. bakers

# How does the Marketplace help?

- There are many barriers to uptake:
  1. First use may be expensive
  2. Target is normally a company cost centre
    - E.g. R&D department
  3. Access to computing and software resources
  4. Access to expert help
  5. Lack of success stories from other companies
- Fortissimo Marketplace targets (3), (4) and (5) to help (2) make the case for (1) ...

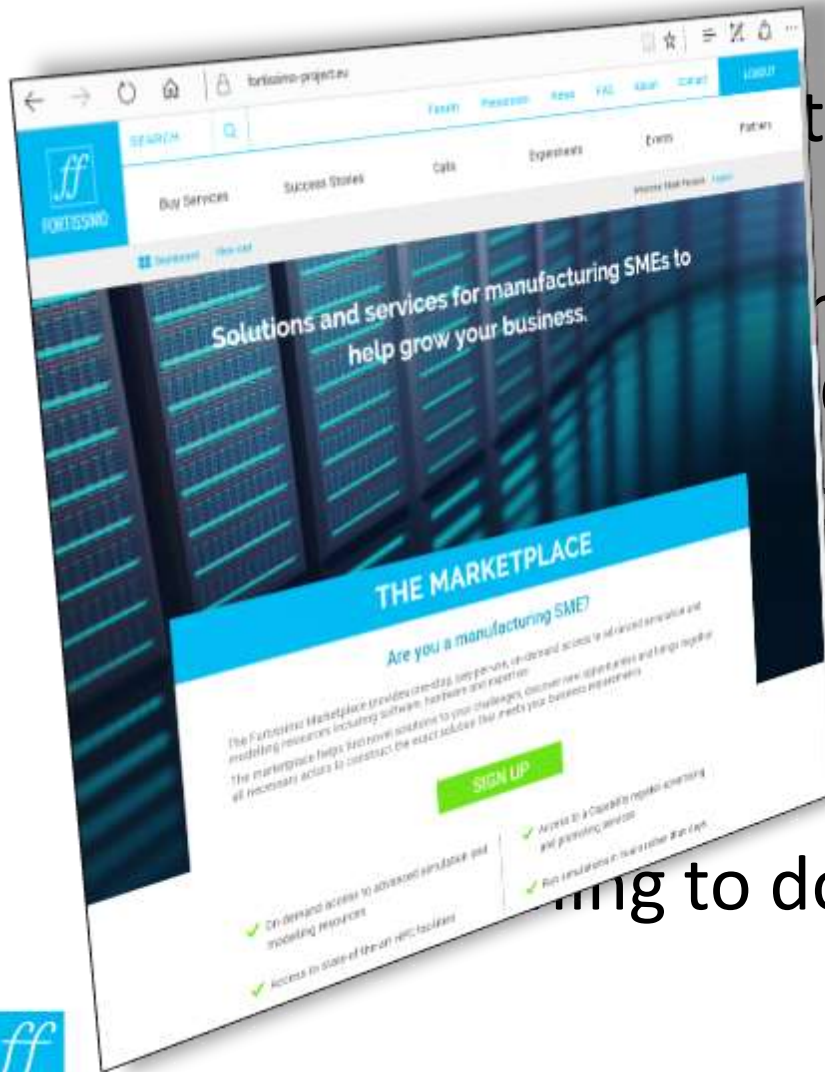


## Fortissimo marketplace





# Fortissimo Marketplace Ltd



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# Conclusion

- Strong demand for Fortissimo model is evident
- Many SMEs are new to HPC and HPDA
  - Seeing direct benefits
- Direct impact on
  - Manufacturing costs
  - Product quality and innovation
- Fortissimo's key focus is jobs and growth for Europe

