Transforming Modelling and Simulation for European Growth

Dr Mark Parsons

The University of Edinburgh

Dr Mark Parsons
Commercial Director, EPCC
m.parsons@epcc.ed.ac.uk
+44 131 650 5022

A key challenge for Europe

- Modelling and simulation is now recognised as the third pillar of scientific method – complementing theory and experiment
- Scientific grand challenges drive supercomputer design and evolution
  - From the Petascale to the Exascale
  - From 100,000+ cores today to 10,000,000+ cores tomorrow
- An enormous disconnect is opening up between software and hardware
  - Nowhere is this clearer than in the engineering sector
  - Codes scale to a few 10s of cores and get little benefit from today's or tomorrow's supercomputers – scaling is the challenge
- This has a direct impact on European economic growth
  - Modelling and simulation is a key enabler of economic growth worldwide
- Solving the challenge will require key scientific advances in
  - Basic and applied sciences which make use of modelling
  - Computational science, informatics and mathematics

Our ambition

- Innovation in products & services drives European economy
- Modelling and simulation is needed throughout our economy
  - E.g. In manufacturing, energy, climate change, biology, health ...
- The global economies that invest in modelling and simulation are those that will, over time, gain the greatest competitive advantage and reap the largest economic benefits.

Our ambition is to build the next generation of simulation applications to drive European economic growth over the next 20 years

Impact

- Solving this challenge will have a broad, sustained and measurable impact across European science and industry
- Tangible nature of scientific outputs means impact can be directly quantified (by measuring GVA)
  - Jobs will be sustained and created across European industry through creation of new or enhanced products and services
  - New consultancies will be formed to create models, simulate the products and processes and analyse the results
- Indirect impacts include
  - New mathematical methods; new models and simulations; new users; previously infeasible simulations will become possible
- Substantial, sustainable progress with long term impact

Integration

- To succeed we must bring together experts from industry, mathematical and physical sciences, informatics and computational science
- Key challenges include
  - Independent Software Vendors (ISVs)
    - Many are small and lack skills, openness and financial clout
    - Small users bases and limited revenue is leading to limited innovation and lack of new simulation approaches
  - Disconnect between mathematics and modelling communities
    - Need to reconnect communities of knowledge
    - We must recreate the link between modelling and mathematics
- Idea has synergy with similar ideas e.g. Mateo Valero and specific scientific proposals – Virtual Physiological Human

Plausibility of an FET-F Pilot Project

- Many modelling and simulations challenges exist
  - For example in CFD, FEA, MM, EM, etc etc
- A pilot will allow a specific challenge to be tackled
  - Necessary communities brought together to tackle a specific problem
  - Focussed pilot will demonstrate potential of approach
- Tackling one area will act as a proof of concept that a large-scale FET Flagship will work
- Challenge can be clearly defined
- Economic and scientific impact can be estimated and initial results measured

Support for the idea

- In Europe today there is
  - A large supercomputing community
    - Providing access to a wide variety of very large modern supercomputer systems
  - A large mathematics community
  - Some of the world's leading informatics and computational science organisations
  - A strong industrial base with much existing expertise in ISVs
- Strong support has been expressed for solving these issues
  - For example at ISC 2010 in Hamburg last week large-scale simulation and modelling was identified as a key challenge linking supercomputing with economic growth
  - Strong links into some of the ESFRI Research Infrastructures particularly PRACE
- Through collaboration we will deliver transformation