A Cambridge Contribution to a Centre of Excellence

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Higgs Centre Workshop, 15 April 2014

Outline

- About LFT and HPC in Cambridge
- Opportunity
- Benefits to members of CoE
- Outputs (deliverables)
- Benefits to proposal

About us

- Speaking from a lattice field theory perspective
- Strong Cambridge interest in HPC for cosmology and astrophysics (see next talk, for example)
- HPC resources in Cambridge: High Performance Computing Service (HPCS) and Cosmos supercomputer

Lattice field theory @ Cambridge

- Academic Staff
  - RR Horgan
  - MB Wingate
  - CE Thomas (new)
- Postdoc
  - R Dowdall
- Up to 5 PhD students
- Visitors
  - G P Lepage (6 months, 2014)
  - J Shigemitsu (3 months, 2015)
- International Collaborations
  - HPQCD (UK, USA, Spain) - quark flavour physics, etc.
  - HSC (UK, USA, Ireland) - hadron spectrum, etc.

Cambridge HPCS

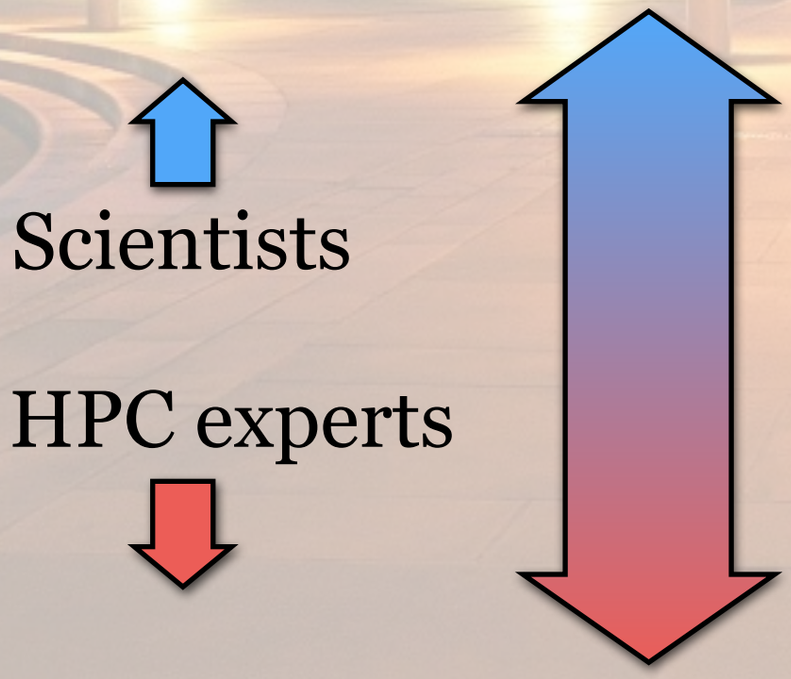
- High Performance Computing Service www.hpc.cam.ac.uk
- Darwin cluster (DiRAC):
  - 9600 2.60GHz Intel Sandy Bridge cores (600 nodes, 64GB of RAM per node, connected by Mellanox FDR Infiniband)
  - Sustained Linpack performance of 183.379 TFlops
  - Also coupled to 1536 legacy Westmere cores
- Wilkes cluster (Square Km Array):
  - 128 Dell T620 servers and 256 NVIDIA K20 GPUs interconnected by 256 Mellanox Connect IB cards
  - Top500 position of 166 in the November 2013 list
  - Efficient air cooling: 2nd in Green500 ranking with performance/power of 3631 MFlop/Watt.

Large data

- Projects of interest to both HPQCD and HSC require computation and storage of many quark propagators (need many input parameters, high statistics)
- HPCS has been very responsive in finding solutions to storage and I/O bottlenecks

Opportunity

- Opportunity to obtain funding for postdoctoral research associates & programmers across spectrum of expertise
- Complements STFC support in the UK for hardware DiRAC: Distributed Research utilising Advanced Computing (www.dirac.ac.uk)



Data analysis

Data production and storage

Efficient algorithms, storage, I/O

Links with industry, “big data”

Benefits to CoE members

- Cambridge-HPCS is one of the DiRAC-2 sites (with Cambridge-Cosmos, Edinburgh, Leicester, Durham) and proposed site for DiRAC-3 distributed data analytics service (HPCS+Cosmos+Leicester)

Dirac in Cambridge

- CoE support for these systems would be of obvious benefit to those awarded time on these resources
- CoE support would establish links with European users of similar systems, perhaps facing similar problems

Deliverables

- Improved HPC algorithms/methods for scientific computing, especially related to generating, storing, analysing large data sets
- Establishing stronger links between academical and industrial HPC
- Basic scientific results, publications

Benefits to proposal

- Participation by DiRAC sites in CoE proposal represents strong UK commitment to European CoE
- Establish links between UK-funded sites and European partners
- DiRAC sites already engaged in industrial outreach (HPCS has industrial users)

Summary

- Lattice field theory and HPC experience
- (not to mention computational cosmology and astrophysics)
- European support for software development nicely complements UK support for hardware
- Goal: to tackle problems under “big data” umbrella
  (and, as a consequence, to get some world-leading science done)
- Synergy between Cambridge-HPCS and its LFT users could provide good model for component of a successful Centre of Excellence