Third EAGE Workshop on High Performance Computing for Upstream

1-4 October 2017
Athens, Greece

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Workshop Overview

The energy market is experiencing historic changes in the price of oil that have prodded the industry to seek higher productivity, lower costs and increased efficiencies. HPC modelling and simulation is a leading technology in this effort. Faster algorithms and hardware lead to improved visibility of the subsurface and the systematic investigation of more drilling and production scenarios. The larger the memories available, the higher the resolution of those simulations. Better mathematics and algorithms produce more accurate solutions using fewer calculations. Co-design of algorithms to computer architectures can yield reductions in total cost of ownership. This technical evolution in HPC helps make the industry Faster, Better, and Cheaper, which is the underlying theme of this third instalment of the EAGE workshop for HPC in Upstream.

Upstream simulation and modelling is our principal mechanism for the accurate location of hydrocarbons and their optimal production. The reliance on data for making better business decisions at a lower cost is becoming critical. Seismic data are explored using traditional imaging algorithms such as Reverse Time Migration (RTM), Full Waveform Inversion (FWI) and Electromagnetic Modeling (EM) to illuminate the hidden subsurface of the earth and reservoir simulation is used to optimally produce fields and predict the time evolution of assets. Both are highly compute-intensive activities, which push the leading edge of HPC storage, interconnect and calculation. The industry is evolving on several fronts. Changes in the underlying hardware with the advent of co-processing technologies and many-core CPUs are challenging practitioners to develop new algorithms and port old ones to reap the most performance from modern hardware. The explosion of data and the recent rapid development in machine learning (ML) are leading to non-traditional ways of interpreting seismic and reservoir data. The emergence of significantly faster reservoir simulation technology is breathing new life into multi-resolution and uncertainty quantification workflows.

The ability to create and mine these data relies on the optimal utilisation of supercomputers. This is the result of various synergies between industries, companies, departments and, most importantly, people. HPC IT departments (or even HPC cloud solution providers) are focused on minimising turnaround times for various workloads, but also deploy the various compute architectures in a cost competitive fashion while adapting to the fast-paced innovation in the semiconductor industry. Research groups and software application teams in both academia and industry develop new algorithms and keep abreast with the latest while adapting to the fast-paced innovation in the latest parallel programming model, language and architecture.

The workshop brings together experts in order to understand state-of-the-art key applications employed in the upstream industry and anticipate what ambitions are enabled by increased computational power.

Social Programme

Icebreaker Reception - Sunday 1 October
18:00 Icebreaker Reception

Technical Programme

Oral & Poster Presentations - Monday 2 October

Meeting Room

08:30 Opening Remarks - HSE
08:35 Welcome & Aims - Introduction to Day 1
08:45 KN01 - Keynote Presentation

SESSION: SCALING

09:30 HPC01 - Scale Out vs. Scale Up for Ultra-scale Reservoir Simulation - K. Mukundakrishnan* (Stone Ridge Technology), R. Gandham (Stone Ridge Technology), K.P. Eater (Stone Ridge Technology), D. Dembeck (Stone Ridge Technology), J. Shumway (Stone Ridge Technology) & V. Natoli (Stone Ridge Technology)
10:00 HPC02 - Selecting a CPU for Reservoir Simulation Optimized for Cost, Energy and Performance - O. Al-Saadoon* (Saudi Aramco), M. Baddourah (Saudi Aramco), A. Alturki (Saudi Aramco) & M. Al-Hagri (Saudi Aramco)

Foyer Area

10:30 Introduction Poster Presentations
P001 - On a Robust Data Modelling Approach for Managing the Fractured Reservoirs in an Onshore Colombian Oil & Gas Field - S.L. Nimmagadda* (Curtin University), L. Chavez (Ecopetrol), J. Castaneda (Ecopetrol) & A. Lobo (Ecopetrol)
P002 - Consensus K-means Clustering With Spark - H. Huwaidi* (Saudi Aramco)
10:35 Coffee Break

Meeting Room

SESSION: SYMBOLIC COMPUTATION

11:00 HPC03 - Rapid Development of Seismic Imaging Applications Using Symbolic Math - N. Kukreja* (Imperial College, London), M. Louboutin (The University of British Columbia), M. Lange (Imperial College, London), F. Luporini (Imperial College, London) & G. Gorman (Imperial College, London)
11:30 HPC04 - Achieving Computationally Scalable Parallelism in a Geostatistical Inversion Algorithm - A. Ephanov* (CGG GeoSoftware), R. Bornard (CGG GeoSoftware) & H. Debeye (CGG GeoSoftware)
12:00 HPC05 - A Generic Multi-parameters FWI Framework Based on Symbolic Expressions - E. Bergounioux* (TOTAL SA), C. Rivera (TOTAL SA), B. Duquet (TOTAL SA) & M. Doliázal (TOTAL E&P USA)
12:30 Lunch Break

Courtesy of CGG.
Oral Presentations & Panel Session - Tuesday 3 October

Meeting Room

08:30 Introduction to Day 2
08:45 KN02 - Keynote Presentation

SESSION: WAVE MODELS

09:30 HPC09 - Performances Analysis of a Hybridizable Discontinuous Galerkin Solver for the 3D Helmholtz Equations in Geophysical Context - M. Bonnasse-Gahot (Equipe-projet INRIA MAGIQUE 3D), H. Calandra (Total), J. Diaz (Equipe-projet INRIA MAGIQUE 3D) & S. Lanteri (Equipe-projet INRIA NACHOS)

10:00 HPC10 - Better Productivity and Portable Finite Difference Wave Equation Propagators Using Directive Based - G. Hugues* (Total E&P Research & Technology) & H. Calandra (Total)

10:30 Coffee Break
10:50 Panel Session

PAN01 - IBM Data Cognitive Systems Strategy and Directions – Innovations for HPC, HPDA and Deep Learning Merging in Oil and Gas - P. Vezolles* (IBM)

PAN02 - Machine Learning Ecosystem for the O&G Industry - Patrick Demichel* (Hewlett-Packard Enterprise)

PAN03 - A. Jones* (NAG Ltd)

PAN04 - Big Data Role in the Upstream Business Research - S.L. Nimmagadda* (Curtin University) & A. Aseev (Schlumberger)

12:30 Lunch Break

SESSION: PERFORMANCE

14:00 HPC11 - From CPU to GPU in Two Days: 3D Elastic Orthorhombic Modelling with Open Acc. - C. Tzivanakis* (King Abdullah University of Science & Technology), V. Kazei (King Abdullah University of Science & Technology), N. Masmoudi (King Abdullah University of Science & Technology), J-W. Oh (King Abdullah University of Science & Technology) & T. Alkhalifah (King Abdullah University of Science & Technology)

14:30 HPC12 - High Performance Seismic Modelling with Finite-difference Using Spatial and Temporal Cache Blocking - V. Etienne* (Saudi Aramco), T. Tonellot (Saudi Aramco), T. Malas (Lawrence Berkeley National Laboratory), H. Ltaief (King Abdullah University of Science and Technology), S. Kortas (King Abdullah University of Science and Technology), P. Thierry (Intel) & D. Keyes (King Abdullah University of Science and Technology)

15:00 Coffee Break

15:30 HPC13 - Optimizing Performance of a TTI RTM Finite Difference Kernel for x86 Instruction Set Architectures - G. Skinner* (Intel Corporation), A. St-Cyr (Shell International Exploration and Production, Inc.), M. Bosmans (VRtech) & D. van Eijkeren (VRtech)

16:00 HPC14 - Overlapping Communication with Computation in an In-house Parallel Reservoir Simulator - N. Kayum* (Saudi Aramco) & A. Baddourah (Saudi Aramco)

16:30 Discussion/Break-out Session
17:00 Day 2 Close
19:00 Workshop Dinner
Registration

<table>
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<th>Registration</th>
<th>Workshop</th>
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<th>02/08/2017 – On-site</th>
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Please note: to qualify for the member registration fee, your EAGE membership dues for 2017 must have been paid and confirmed. The processing time for the membership applications or renewals is 10 working days.
1. The non-member fee includes EAGE membership for 2018.
2. To qualify for the reduced student registration fee:
   - Students must be enrolled in a full-time study programme at a recognized university or institute.
   - The registration must be accompanied by a copy of a student ID card and/or official proof of enrolment.
   - Please note: student non-members cannot be older than 34 years of age (when registering).
3. Please note that EAGE reserves the right to cancel the workshop due to low participation. In this case, payment will be refunded in full.

How to register

We recommend that you register via the online registration form on the EAGE event website (www.eage.org/event/hpc-2017). However, a downloadable registration form, which should be completed and returned to the EAGE Head Office, is also available on the event page.

Visa Requirements

You can apply for the Greek Schengen Visa since Greece is a Member of the European Union and a member state of the Schengen Area. Please visit www.schengenvisainfo.com/greece-visa/ for further information.

It is the participant’s responsibility to enquire about the latest visa requirements that apply to his/her nationality.

Venue

The workshop will be held in the fascinating Radisson Blu Park Hotel in Athens, Greece (www.rbathenspark.com). EAGE has negotiated set rates for your accommodation, please visit www.eage.org to know more.

Radisson Blu Park Hotel, Athens
10, Alexandras Av.
10682 Athens, Greece
Tel: 0030 210 8894500
Email: info@rbathenspark.com

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Contact

For more information or to enquire about this workshop, please visit the event website (www.eage.org/event/hpc-2017) or contact the Middle East office via middle_east@eage.org or +971 4 369 3897.

We look forward to seeing you in Athens!