

COST

Domain Committee "Information and Communication Technologies
(ICT)"

COST Action IC0805

Start Date 07/05/2009

*Open European Network for High Performance
Computing on Complex Environments*

MONITORING PROGRESS REPORT

Reporting Period: from 07/05/2010 to 13/05/2011

This Report is presented to the relevant Domain Committee.
It contains three parts:

- I. Management Report** prepared by the COST Office/Grant Holder
- II. Scientific Report** prepared by the Chair of the Management Committee of the Action
- III. Previous versions of the Scientific Report;** i.e., part II of past reporting periods

The report is a "cumulative" report, i.e. it is updated annually and covers the entire period of the Action.

Confidentiality: the documents will be made available to the public via the COST Action web page except for chapter *II.D. Self-evaluation*.

Based on the monitoring results, the COST Office will decide on the following year's budget allocation.

Executive summary (max.250 words):

This report presents an outlook of results obtained during the second year of COST Action IC0805. The report shows that each Action Working Groups has been able to gather many researchers from more than 20 countries. Moreover, many STSMs were carried out by the Action and several led to interesting results that will be submitted to conferences or journals. Finally, IC0805 is working on an application catalogue that will help to test and evaluate solutions developed within the Action.

I. Management Report prepared by the COST Office/Grant Holder



I.A. COST Action Fact Sheet

- **COST Action IC0805:** *Open European Network for High Performance Computing on Complex Environments*

- **Domain** *Information and Communication Technologies (ICT)*

- **Action details:**

CSO Approval: 24/11/2008

End date: 06/05/2013

Entry into force: 08/01/2009

Extension: (day/month/year)

- **Objectives** *The main objective of the Action is to develop an integrated approach for tackling the challenges associated with heterogeneous and hierarchical systems for High Performance Computing.*

- **Parties:** *list of countries and date of acceptance*

Austria (date)	Greece 13/03/2009	Poland 28/01/2009
Belgium 27/01/2009	Hungary 30/03/2009	Portugal 26/01/2009
Bulgaria 08/01/2009	Iceland (date)	Romania 08/01/2009
Croatia (date)	Ireland 03/02/2009	Serbia (date)
Cyprus 25/03/2011	Israel 08/09/2009	Slovakia (date)
Czech Rep. (date)	Italy 08/01/2009	Slovenia 31/07/2009
Denmark 01/04/2009	Latvia (date)	Spain 08/01/2009
Estonia (date)	Lithuania 13/05/2009	Sweden 02/02/2011
Finland 16/04/2009	Luxembourg (date)	Switzerland 31/07/2009
FYR of Macedonia (date)	Malta (date)	Turkey 02/02/2011
France 08/01/2009	Netherlands 05/10/2009	United Kingdom 08/01/2009
Germany 08/01/2009	Norway 23/01/2009	

- **Intentions to accept:** -

- **Other participants:**

- Cadence Design Systems LLC, Moscow, Russia
- CHPC, South Africa

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<p>Prof. Pierre KUONEN</p> <p>MC Member</p> <p>pierre.kuonen@hefr.ch</p>	<p>Dr Bastien CHOPARD</p> <p>MC Member</p> <p>(not yet registered)</p> <p>Bastien.Chopard@cui.unige.ch</p> <p>PENDING</p>

Turkey	
<p>Dr Suleyman TOSUN</p> <p>MC Member</p> <p>Ankara University Ankara University, Computer Engineering Department, Besevler, NKARA 06500 ANKARA Turkey</p> <p>tosun@eng.ankara.edu.tr</p>	<p>Prof. Cevdet AYKANAT</p> <p>MC Member</p> <p>Bilkent University Computer Engineering Dept., Bilkent 06800 Ankara Turkey</p> <p>aykanat@cs.bilkent.edu.tr</p>
United Kingdom	
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Non-COST Participants	
Russian Federation	
<p>Dr Alexey KALINOV</p> <p>Cadence Design Systems LLC</p> <p>akalinov@gmail.com</p>	
South Africa	
<p>Dr Happy SITHOLE</p> <p>CHPC</p> <p>15 Lower Hope Road, Rosebank</p> <p>7700 Cape Town</p> <p>South Africa</p> <p>Tel. +27216582745</p> <p>Fax. +27216582744</p> <p>hsithole@csir.co.za</p>	



I.C. Overview activities and expenditure

2009-2010 Budget

Total Action Budget: 82600

Remaining Action Commitment: 8000

Meetings

MC	10/05/2011	Amsterdam							15000	Total
										15000

STSM

Beneficiary	Date	Place							Cost	Total
Dr John O'Donnell, University of Glasgow, United Kingdom	2010-12-15 to 2010-12-23	Thomas Rauber, University of Bayreuth, Germany							1200	
Mr Sergio Sanchez, University of Extremadura, Spain	2011-04-01 to 2011-04-30	Leonel Sousa (INESC-ID), Portugal							3000	
Mr Aleksandr Igumenov, Vilnius University, Lithuania	2011-01-23 to 2011-02-05	Krzysztof Kurowski, Poznan Supercomputing and Networking Center, Poland							1200	
Mr Milosz Ciznicki, Poznan Supercomputing and Networking Center, Poland	2011-01-10 to 2011-01-16	Dr Antonio Plaza, Escuela Politecnica de Caceres, University of Extremadura, Spain							1500	
Dr Krzysztof Kurowski, Poznan Supercomputing and Networking Center, Poland	2011-03-01 to 2011-03-10	Dr Antonio Plaza, Escuela Politecnica de Caceres, University of Extremadura, Spain							1900	
Mr Martin Tillenius, Uppsala University, Uppsala	2011-03-28 to 2011-04-11	Simon Peyton-Jones, Microsoft Research, Cambridge, UK							1400	
										10200

Workshops

Title	Date	Place							Cost	Total
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	From	To								
Workshop on High Performance Computing on Complex Environments (HPCCE)	20/09/2011	20/09/2011	Heraklion, Crete, Greece						0	0

General Support Grants

										Total
										0

Schools

Title	Date	Place							Cost	Total
2011 complexHPC spring school	09-13/05/2011	Amsterdam							38000	38626

Dissemination

Title	Date	Place							Cost	Total
										0

Others

Action Total : 66100

II. Scientific Report

II.A. Innovative networking

- *Innovative knowledge resulting from COST networking through the Action.*

The main outcome of this year Action is the Spring School that was held in Amsterdam from May 9 to May 13 2011 (<http://www.cs.vu.nl/complexhpc2011/>). It gathered 46 young researchers from 11 countries and 21 different institutes during one week. The main theme of this year was High-Performance Distributed Computing, Middleware, Environments, and Tools. It featured several invited speakers, among them Rosa Badia from Barcelona, Spain and Satoshi Matsuoka from Tokyo, Japan. There have been also several *hands-on* sessions that gave the opportunity for the participants to use state-of-the-art tools and environments for performing High-Performance Distributed Computing. We believe that this was the opportunity for many young researchers to have deep contact with the best research teams in Europe and also to better know each other.

- *Significant scientific breakthroughs as part of the COST Action.*

Among the different STSMs that have been carried out during this year several have led to interesting results:

- **Using GPU for compression.** Researchers of University of Extremadura and Poznan supercomputing centre have proposed an implementation of JPEG2000 for GPUs and conclude that: “[b]ased on our computational experiments and benchmarks, our new GPU- based implementation of JPEG2000 proved to be a cheaper alternative in comparison to hardware solutions or less efficient CPU-based implementations.”
 - **Using functional languages for parallel computation.** A first collaboration between *Microsoft Research* in Cambridge and University of Uppsala, on using functional languages (Haskell) for data parallel computation was initiated. A second collaboration started between Univ. Glasgow and Bayreuth for using Haskell to support task parallelism instead of only data-parallelism
 - **The use of a mix of XMPP and MPI for High-performance distributed computing** (branch and bound algorithm) .
- *Tangible medium term socio-economic impacts achieved or expected.*

We continue to strongly believe that GPU programming is an ongoing major revolution in scientific computing. This is why a full hands-on session was dedicated to this aspect during the Spring school. Another major issue for high-performance computing is the energy consumption. This is in direct relationship with COST Action IC0804.

- *Spin off of new EC RTD Framework Programme proposals/projects.*

Dana Petcu, our representative of Romania, successfully submitted a FP7-REGPOT project proposal named HOST: High Performance Computing Service Centre. It was a very competitive call as only 20 projects were selected among 300 in all fields of science. Many member of the COST Action are also member of this project, such as: Krzysztof Kurowsky (Poland), Antonio Plaza (Spain) or Emmanuel Jeannot (France).

- *Spin off of new National Programme proposals/projects.*
None so far.

II.B. Inter-disciplinary networking

- *Additional knowledge obtained from working with other disciplines within the COST framework.*

This Action is not focussed on interdisciplinary networking (there is no mention of interdisciplinary work in the MoU). The main reason is that we target development of computer-science tools and methodologies.

- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts.*

Inter-disciplinarity is absent at the moment: there is therefore room for improvement in this respect. However, all participants already have good connections with application-dependent areas and we are well aware of the needs of other disciplines.

- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide socio-economic impacts.*

As there had not been any inter-disciplinarity in this Action last year, we have invited Simon Portegies Zwart (full professor at Leiden University, Netherlands) for a keynote during the Amsterdam Spring School. He is a computational astrophysicist and talked about the need of complex computing environments for his field.

II.C. New networking

- *Additional new members joining the Action during its life.*

Since the beginning of the Action, in May 2009, the following members have joined this Action: Israel, The Netherlands (2009), Switzerland (2010), Cyprus (2011), Sweden (2011), Turkey (2011). In November 2010, South Africa officially joined our Action as an external member.

- *Total number of individual participants involved in the Action work.*

46 persons participated in the Spring School. They were all Early Stage Researchers, and around 20% were female.

- *Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools. In addition, justification should be provided if less than 4 STSMs were carried out during the year.*

Among the 6 STSMs that have been carried out this year, 5 were done by an ESR. We plan to have more STSMs by the end of the grant period.

- *Involvement of researchers from outside of COST Countries.*

We have two participants from non-COST countries, with Dr Alexey Kalinov from Russia (Cadence Systems) and Dr Happy Sithole from CHPC, Cape Town, South Africa. We are very happy that South Africa joined the Action. They are currently building up several computing centres in this country. We plan to contribute to this by sharing our experience in this domain. There is a possibility that some of the Action members are invited onto the steering committees of these facilities.

- *Advancement and promotion of scientific knowledge through publications and other outreach activities.*

10 articles have been published thanks to our action in the Workshop on High Performance

Computing on Complex Environments (HPCCE) held in Heraklion, Crete, Greece in September 2010 (<http://www.cluster2010.org/program.html>)

- *Activities and projects with COST network colleagues.*

We have informal contacts with COST Action IC0804: Energy Efficiency in Large Scale Distributed Systems. Contrary to what was expected, we have not formalized this collaboration this year.

- *The capacity of the Action members to raise research funds.*

We have been successful in a highly competitive call (FP7-REGPOT).

II.D. Self-evaluation

We think that the greatest success of this year is the Spring School. We have been able to attract and train young researchers from many different places. The number of participants (46) largely exceeded our expectation and plan which has forced us to revise the global budget allocation.

On the other hand, the number of STSMs (6) is much lower than the number budgeted. We can honestly say that this is not satisfactory even though there might be a few more STSMs before the end of the grant period.

We also have issues with the website, which is not at the level of quality we wanted. One of the main reasons is that the person responsible of the website is seriously sick and could not undertake this duty in a professional manner. During the last MC meeting we have decided to change the site that will host the website. We hope that this will lead to an improvement of its quality.

III. Previous scientific report(s)

2009-2010

III.A. Innovative networking

- *Innovative knowledge resulting from COST networking through the Action. (Specific examples of Results vs. Objectives)*

Action participants had an opportunity to meet and present their work at the first Action meeting, which took place in Lisbon at the end of October. A total of 50 talks were given during this meeting. They are available at:

<http://complexhpc.org/events/lisbon/presentations.php>. Each Working Group chair also gave a presentation. This helped to foster synergies between different teams within the Action. To enable cooperation among these teams, a call for STSMs was opened in 2009. 18 applications were received for STSMs between many different groups. At the time of this report some have already ended and led to interesting results (see next paragraph). The call for STSMs will be open until the end of the grant period.

- *Significant scientific breakthroughs as part of the COST Action. (Specific examples)*

Some of the STSMs have led to interesting results such as:

- Study, analysis and understanding of the programming issues with EXTOLL, a high performance low-latency interconnection architecture. These network interface cards (NIC) use Hyper Transport eXpansion (HTX) instead of PCI-Express to be able to communicate directly with the host CPU (See annexed report: STSM_JavaEXTOLL_report.pdf).
- Implementation and improvement of scalable of linear algebra kernels working on accelerators (modern GPU connected with infiniband) (see annexed report: GPU_MM_LU.pdf)
- Parallelization of the EULAG (Eulerian/semi-Lagrangian fluid solver) code using a hybrid model: using MPI across nodes and OpenMP within nodes. This solution allows for good usage of both shared and distributed-memory system

resource (memory, latency, and bandwidth). Also, the hybrid model allows for the efficient adaptation of the EULAG code to other hierarchical architectures such as clusters of multi-core processors (see annexed report: EULAG_Hybrid.pdf)

- *Tangible medium term socio-economic impacts achieved or expected. (Specific examples)*
Many works carried out within the Action concern the use of GPUs (Graphic Processing Units), to perform scientific computation. It is expected that GPUs, and accelerators will be of major importance in the next years for high-performance scientific computing. Hence works carried out in this Action will ease the development of applications using this new hardware environment.
- *Spin off of new EC RTD Framework Programme proposals/projects. (List)*
None so far.
- *Spin off of new National Programme proposals/projects. (List)*
None so far.

III.B. Inter-disciplinary networking

- *Additional knowledge obtained from working with other disciplines within the COST framework. (Specific examples)*
This Action is not focussed on interdisciplinary networking (there is no mention of interdisciplinary work in the MoU). The main reason is that we target development of computer-science tools and methodologies. However, within working group 4, we are working on the definition of a catalogue of applications for which we could test and evaluate the solutions provided within this action (see joint document COST_ApplicationsCatalogDefinition.pdf).
- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide scientific impacts. (Specific examples)*
Inter-disciplinarity is absent at the moment: there is therefore room for improvement on this respect. However, all participants already have good connection with application-dependent area and we are well aware of the needs of other disciplines.
- *Evaluation of whether the level of inter-disciplinarity is sufficient to potentially provide socio-economic impacts. (Specific examples)*
Inter-disciplinarity is absent at the moment: there is therefore room for improvement on this respect. We plan to invite researchers from different fields to the Training School we will organize next year.

III.C. New networking

- *Additional new members joining the Action during its life.*
Since the beginning of the action in May 2009, the following members have joined this Action: Israel, The Netherlands, Switzerland, Cyprus, Sweden, Turkey.
- *Total number of individual participants involved in the Action work. (Number of participants. Give % of female and of Early Stage Researcher participants).*
The Lisbon Working Groups meeting gathered 65 participants (10% female, 37% ESR).
- *Involvement of Early Stage Researchers in the Action, in particular with respect to STSMs, networking activities, and Training Schools. In addition, justification should be provided if less than 4 STSMs were carried out during the year.*
We have funded 18 STSM between January and June 2010. 16 of these STSMs (89%) involved ESR.
- *Involvement of researchers from outside of COST Countries. (Number of participants from non-COST Countries approved by the CSO. Give % of such participants from countries with reciprocal agreements. Specify their contribution)*
We have one participant from non-COST countries: Dr. Alexey Kalinov from Russia (Cadence Systems). We are planning to involve researchers from South Africa (Super-computing centre of Cape Town).
- *Advancement and promotion of scientific knowledge through publications and other outreach activities. (Number of publications and other outreach activities that resulted from COST networking through the Action. Complete list should be given in an annex)*

- No papers have been published yet within this Action.
- *Activities and projects with COST network colleagues.*
We have informal contacts with COST Action IC0804: Energy Efficiency in Large Scale Distributed Systems. We plan to formalize collaboration next year.
 - *The capacity of the Action members to raise research funds.*
There is a current discussion for applying to the FP7 call: **Objective ICT-2011.9.13 Exa-scale computing, software and simulation.**

III.D. Self-evaluation

We believe that the main success of this year was the Working Group meeting that took place in Lisbon. It gathered more than 60 researchers from almost all participating countries and enabled fruitful discussions within participants. This led to many interesting STSMs that already took place or will be carried out before the end of the current Grant period.

We have found it difficult to precisely forecast meetings costs. This will lead to some under-spending that it is difficult to evaluate at this time.

The transition to the e-COST system is also problematic. Some features were missing (such as changing the status of an MC member invited/not invited).

However, the main problem comes from the Grant Holder. Processing reimbursements and reports is done very slowly by the Grant Holder. For instance, now, more than 6 months after the Lisbon meeting, some participants have not yet been reimbursed!