Project no. 288570

PARAPHRASE

Strategic Research Partnership (STREP)
PARALLEL PATTERNS FOR ADAPTIVE HETEROGENEOUS MULTICORE SYSTEMS

Report on first standalone user community workshop
D7.1

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Executive Summary

The objective of WP7 is to promote the use of ParaPhrase tools and technologies by establishing an active user community and by providing technical documentation as well as elaborated tutorials and training materials. This deliverable describes the first standalone User Workshop that was held by SCCH in Hagenberg, Austria, with roughly 50 participants including strong participation from local industry. In addition, the deliverable describes various tutorials, workshops, presentations and other related events that have been run by the Consortium in association with developer and other potential user conferences and other events in order to promote a general user community. Finally, it describes a range of technical documentation and training materials, including online videos, for the tools and software frameworks that have been developed in the remainder of the project. This material serves to support user community building activities, providing support for potential users of the various ParaPhrase technologies. Finally, this deliverable itemizes concrete plans for further community building activities to be implemented in the third year of the project.
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1. Introduction

The ParaPhrase project aims to disseminate results to two very different groups: the academic/scientific research community; and a broader user community comprising scientific/academic, industrial and independent developers. Intrinsic scientific results are disseminated in the various academic communities through WP8. In contrast, the objective of WP7 is to promote the use of ParaPhrase tools and technologies by establishing an active user community (T7.1), and by providing technical documentation as well as elaborated tutorials and training materials (T7.2). We envisage outreach to the developer and industry communities as well as to potential users from scientific and other academic backgrounds.

The first standalone user workshop was held slightly later than planned according in order to accommodate constraints regarding the availability of conference facilities; also we aimed to keep away from seasons that are usually very loaded with conferences and workshops in order to minimize potential conflicts with other activities and thus maximize the number of potential participants. The event was very successful, attracting a strong industry presence, with significant discussion during and after the event.

Other activities related to community building during the second year include the realization of tutorials, presentations and demos at major technical conferences, attending local user community events, and the organization of a first ParaPhrase user workshop. The second task of this work package produced a range of technical documentation and training material such as podcasts and online videos on tool usage. Also, some of the key technologies and tools have been made available to parts of the user community for evaluation.

This document firstly reports on the user community building activities that have been put into effect so far. Secondly, it details further plans for community building.
2. Community Building Activities

2.1 Standalone User Community Workshop

The first standalone user community workshop was organized by SCCH. The workshop entitled “Workshop on High Performance Computing for Industry” was held in Hagenberg, Austria, in July [1]. The workshop was well received with roughly 50 delegates from Austrian and European industry as well as academia participating.

The keynote presentations were given by representatives of ParaPhase members, USTAN and HLRS; in addition one of three technical contributions was given by SCCH personnel involved in ParaPhase. The workshop left ample room to allow for discussions amongst participants during lunch and coffee breaks.

Keynotes:

- Prof. K. Hammond presented the concepts behind the ParaPhase approach, i.e. high-level parallel programming patterns and their efficient usage through automatic lowering onto architecture specific low-level algorithmic skeletons.

- Prof. M. Resch, the director of HLRS, discussed the potential benefits of HPC usage in industrial applications and detailed services that HPC centres can provide to industrial customers.

Technical Contributions:

- Dr. Frank Graeber, MathWorks, show-cased the use of parallel computing for design optimization in manufacturing.

- Dr. Holger Schöner, SCCH, presented concrete results based on applying parallel programming patterns and refactoring to the ParaPhrase use-cases.

- A further show-case was presented by Volkmar Wieser, SCCH, on using auto-parallelization methods in the area of image processing and machine learning.

Discussions during the workshop clearly showed that efficient parallel programming is a challenge for industrial programmers particularly given the wide
range of parallel architectures, i.e. multi-cores, many-cores, GPGPU, and massive parallel clusters. Participants also acknowledged, that the abstraction of high-level patterns coupled with an optimized architecture specific runtime, as provided by ParaPhrase technology, is a promising approach to maintainability and performance portability. Follow-on activities are planned to build on this event.

2.2 Other Activities

Events

Further activities related to community building during the second year include the organization of tutorials, demos, and workshops at major technical conferences, as well as the contribution to a summer school. In particular:

USTAN presented ParaPhrase technology to 50 participants at the GOTO Zurich developer conference in Zurich in April 2013[2].

USTAN held a tutorial on the use of skeletons in Erlang at the Erlang User Conference in Stockholm [3]. At the same conference, ESL gave a demo of the usage of ParaPhrase technologies in a heterogeneous environment by coupling together several Raspberry Pis, equipped with cameras that offloaded the actual image processing to a Parallella board running OpenCL, under Erlang [4]. Furthermore, ESL gave a presentation at the London Erlang User Group Meeting on Erlang in multicore and cloud environments [5], and USTAN gave a presentation at the London Erlang User Group on ParaPhrase refactoring technologies.

USTAN and UNIPI contributed to the summer school “Domain Specific Languages – DSL 2013” in July 2013 held in Cluj-Napoca, Romania, with lectures on structured parallel programming with FastFlow, and use of ParaPhrase refactoring techniques for parallel programming [6]. There were approximately 100 attendees, who engaged with extensive lectures and lab sessions using ParaPhrase technologies.

Material Production

The second task produced technical documentation and training material on tool usage. Also some online material as videos and podcast have been produced (USTAN) [7, 8]. Further, some of the technologies developed by ParaPhrase have been made available to the user community for evaluation. This includes the Erlang Skel package (ESL, USTAN) [9], and the refactoring tool for Erlang and C++ (USTAN) [10]. The Performance Enhancement Infrastructure (PEI)(RGU) [11] is currently being integrated into the main FastFlow repository. We intend to release these technologies to the wider user community early in the third year.

As a mature and well tested product, the FastFlow C++ library and training material (UNITO, UNIPI) [12], are, therefore, continuously released to the public and announced to the user community. The FastFlow library has been downloaded
more 8000 times so far indicating that significant numbers of developers are using it.

Please consult the project web page\(^1\) and the FastFlow web page\(^2\) for details.

### 2.3 Activity Details

[1] High-Performance-Computing (HPC) for Industry, July 4, Hagenberg, Austria
http://www.scch.at/de/service/news-events/10784

Keynote: *High Performance Computing and Advances in Parallel Computing - General Trends & Techniques.* Kevin Hammond, University of St. Andrews

Keynote: *Einsatz von HPC im Umfeld eines Rechenzentrums.* Michael Resch, HLRS, University Stuttgart

Contributed talk: *Parallel Design Patterns, Software Refactoring und Anwendungen im Bereich des HPC.* Holger Schöner, SCCH

Contributed talk: *Accelerating Design Optimization with Parallel computing.* Frank Graeber, MathWorks GmbH

Contributed talk: *Auto-Parallelisierung von Methoden aus dem Bereich der Bildverarbeitung und des maschinellen Lernens.* Volkmar Wieser, SCCH

[2] GOTO Zurich International Software Development Conference, April 10-11, Zurich, Switzerland
http://gotooncon.com/zurich-2013

Lecture: *Thinking Parallel: Parallel Refactoring using ParaPhrase Technologies* Kevin Hammond, University of St. Andrews


Tutorial: *Putting the Skeletons back in the Closet: Effective Parallel Programming in Erlang.* Chris Brown & Kevin Hammond, University of St. Andrews
http://www.erlang-factory.com/conference/ErlangUserConference2013/speakers/KevinHammond


Demo: *Offloading OpenCL kernels from Erlang.* Edward Tate, Erlang Solutions


Talk: *Erlang in multi-core and cloud environments.* Torben Hoffmann, Er-

\(^1\)http://paraphrase-ict.eu

\(^2\)http://calvados.di.unipi.it/dokuwiki/doku.php?id=ffnamespace:about
lang Solutions
https://www.erlang-solutions.com/event/london-erlang-user-group-meeting-2

[6] Summer School Domain Specific Languages, July 8-20, Cluj-Napoca, Romania
Lecture: *Structured parallel programming in FastFlow*. Marco Danelutto, University of Pisa

Lecture: *Forming Parallel Programs using Novel Refactoring Techniques*, Kevin Hammond, University of St. Andrews

[7] Video: Erlang Refactoring Tool
http://chrisb.host.cs.st-andrews.ac.uk/SkelRefactoring.mov

[8] Podcast on concepts as patterns and skeletons as used in ParaPhrase
http://mostlyerlang.com/2013/09/04/014-mega-core-with-kevin-hammond/

[9] Erlang Skel website, including download, documentation, tutorial and short videos
http://chrisb.host.cs.st-andrews.ac.uk/skel.html

[10] Erlang/C++ Refactoring Tool website
http://chrisb.host.cs.st-andrews.ac.uk/refactoring.html

http://www.paraphrase-ict.eu/Deliverables/deliverable-3.2/deliverable-3.2-prototype/view

[12] FastFlow website
http://calvados.di.unipi.it/dokuwiki/doku.php?id=ffnamespace:about
3. Future Community Building Activities

We aim to engage with scientific/academic, industrial and independent developers, companies and institutions who are considering developing new parallel applications, as well as ones with existing applications.

One important target group is individuals and institutions that have already identified performance as an issue with their own application. This group is most likely actively seeking alternatives to their current development approaches and technologies. Given convincing arguments regarding the suitability of ParaPhrase technology for their particular application type, this group is willing to invest effort in switching to another programming model, provided that adequate training is made available to them. The best way to convince this target group to use ParaPhrase technologies is to show-case the benefits of ParaPhrase technology by means of real applications as produced in WP6, for example. In most cases, users will be looking not only for raw execution performance, but also to usability of the technology, and the portability of performance to new architectures. Our WP6 use-cases, which stem from a wide range of different areas, will play the role of convincing show-cases to attract potentially interested parties, while the availability of the various refactoring tools caters for the usability requirements. Evaluation results will provide convincing evidence of the advantages of our approach. Lastly, performance portability is addressed by the combination of high-level parallel design patterns and their low-level architecture specific implementation.

The second requirement, namely adequate training, will be addressed by conducting tutorials and training courses for all components of the ParaPhrase technology. These might be organized as standalone activities or be co-located with major conferences, workshops, or other events that attract users interested in novel developments in parallel programming. Also, we will consolidate and gather all available training material in a single website giving our users a single point-of-entry. We have specifically planned the following community building activities.

Planned Events

- Kevin Hammond will present ParaPhrase technologies at the Build Stuff Developer conference in Vilnius in December 2013.
• We will engage with the High-Performance Advisory Council to run tutorials at future HPC-AC events in 2014

• We plan to submit proposals to run tutorials at the following conferences: HiPEAC (January 2014, Vienna), ACM ICS (June 2014, Munich), ISC (June 2014, Leipzig), EuroPar (August 2014, Porto), Erlang User Conference (March 2014, San Francisco).

• We will run the second standalone user community workshop in early summer; possibly in collaboration with other EU FP7 projects; possibly back-to-back with the International Parallel Tools Workshop organized by HLRS.

• We plan to organise a summer school on ParaPhrase technologies at NCI (Ireland) in June 2014, including industrial sessions

• We will present ParaPhrase technologies at an event "HPC Industrial Services" (November 2014, Stuttgart).

Planned Materials production

• We will consolidate available materials and offer them on the project website.

• We will implement a quality control system for materials in order to assure correctness and comprehensibility.

• We will finalize new FastFlow and Erlang/Skel tutorials highlighting recent developments.

• We will produce videos advertising the different features of the FastFlow framework.

• We will provide training material for the Refactoring tools and the Performance Enhancement Infrastructure.

• We will provide a virtual machine image pre-installed with all ParaPhase components and documentation