University of Basel

Department of
Mathematics and Computer Science

University of Basel, Department of Mathematics and Computer Science (DMI),
Spiegelgasse 1, 4051 Basel, Switzerland

Open PhD position in Parallel Computing at the University of Basel, Switzerland

Topic area

Modeling Parallel Computing Systems Behavior

PhD advisor

Prof. Florina Ciorba

Scientific context of the PhD topic

Each of the four pillars (experiments, theory, simulation, and data) of the scientific method produce and consume large amounts of data. Breakthrough science will occur at the interface between empirical, analytical, computational and data-based observation. Parallel computing systems are the workhorse of the third pillar. These systems constitute a highly complex ecosystem, with multiple layers, ranging from hardware to the application layer. Monitoring solutions exist at every single layer of these systems[1]. Understanding the interaction between the software running on parallel computers and the underlying hardware is a notorious challenge, especially given the fact that the hardware models and designs change very often. This is due to the rapid advances in computing technologies. Studying the interaction between hardware and software in this context will require integration of monitoring solutions from the different system layers.

The aim of this thesis is to develop a (set of) model(s) that captures the behavior of parallel computing systems to facilitate a holistic view and understanding of their behavior. Such a model will allow the systematic investigation of the interaction between hardware, software and operating conditions in parallel computers. This will enable the study of the behavior, efficiency, and resiliency of parallel computing systems on the operational, application, cost, and performance levels. In addition, a holistic system model will provide a more comprehensive view into other practical metrics, such as broader application and project performance, job cost, and historical trends. The model needs to be generic enough to be useful for new hardware releases.

The benefits of **modeling system behavior** include: improved performance, efficiency, resiliency, and system operation, decreased costs, as well as offering guidelines for future system co-design and procurement.

[1] Nicole Hemsoth, Modernizing HPC Cluster Monitoring, September 2014, http://www.hpcwire.com/2014/09/18/modernizing-hpc-cluster-monitoring/

Required qualifications

The **High Performance Computing (HPC)** group (hpc.dmi.unibas.ch) at the Department of Mathematics and Computer Science is looking for candidates who are highly motivated to pursue a doctoral degree in Computer Science, with a focus on Parallel Computing. The candidates should have a drive to conduct high quality research and publish in top venues.

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Applicants must have:

- A Master's degree (or equivalent) in Computer Science, Computer Engineering, Computational Science or Mathematics;
- Good mathematical, statistical, and analytical skills;
- Very good programming skills (C, C++, Java, Python, R, Spark, etc.);
- Very good knowledge of operating systems, in particular Linux;
- Fluency in English (verbally and in writing), while knowledge of German, although not required, can be a plus;
- Strong team-working abilities;
- Ease of interaction in a multicultural environment; and
- What it takes to do a PhD in our HPC group at University of Basel is accurately described here: http://sape.inf.usi.ch/to-get-a-phd

Experience in carrying out research projects and writing scientific articles will be considered a plus. Experience with *parallel performance models* and familiarity with *monitoring tools* are also a plus.

Application procedure

Applications should be submitted *by email* in a single PDF file to Yvonne Wegmüller (yvonne.wegmueller@unibas.ch) and include "*PhD Position in Parallel Computing – MLS Comm*" in the subject line. If you have any question about the position (before applying) please contact Prof. Florina Ciorba (florina.ciorba@unibas.ch) with the same subject line.

Applications must include in a **single PDF** file:

- A 300-word personal statement explaining your interest and motivation in the topic of *modeling system behavior*, as well as descriptions of how you fulfill the above requirements.
- Full curriculum vitae.
- List and contact information of 2-3 reference persons that are willing to provide detailed recommendations of the candidate. **Do not** send existing recommendation letters as they *will be discarded* from your application.
- Transcripts of undergraduate and graduate studies (translated into English if not originally issued in English).
- Links to/attachments of master and internship thesis/reports, and publications, if applicable.
- Links to/attachments of examples of personal contributions to software (github, bitbucket, etc.)

Selection procedure

Application submission deadline: **February 28, 2017**
Interviews: **April, 2017**

Contact

For informal enquiries about the position (before applying) please contact Prof. Florina Ciorba (florina.ciorba@unibas.ch) with "*PhD Position in Parallel Computing – SysMod*" in the subject line.