Rahulkumar Gayatri
Technical Specialist – High Performance Computing
Wipro Infotech.

Summary:

- Working in the area of High Performance Computing since 2008.
- Experience in sequential and parallel algorithm development.
  - Parallelized Breadth First Search (BFS) on IBM's Cell B./E. processor.
  - Parallelized Graph500 benchmarks on an SMP machine using the StarSs programming model.
  - Experience in design and parallel implementations of Nqueens, Matrix Multiplication, Specfem, and Linear Algebra iterative solvers.
- Experience in compiler and runtime development of parallel programming models.
- Worked with OpenMP, MPI and OMPSs programming models.
- Worked on speculative synchronization techniques to handle multiple threads in StarSs, a task-based programming model.
- Knowledge on the Transactional Memory framework.
  - Worked extensively with the TinySTM (a Software Transactional Memory (STM)) library.
- Published conference, workshop and journal papers in international formats.
- Familiarity with tools like valgrind profiler, gdb, Intel Compilers.
- Currently working on :
  - MOOSE : a multi-scale simulation model of neuron connections in human brain.

Academic Qualification:

Degree	University	Year
Doctor of Philosophy (Ph.D)	Barcelona Supercomputig Center	2015
M.Tech (CS)	Sri Sathya Sai Institute of Higher Learning (SSSU)	2009
MSc (Maths with Specialization in CS)	SSSU	2007
BSc (Maths)	SSSU	2005

Honors

- Was awarded the FI AGAUR grant by the Catalan government. This grant is given to select few researchers by the government of Catalunya , Spain, in order to promote, encourage and help the research candidate.

Areas of proficiency:

- **Programming Languages**   C/C++, python (basic)
- **Parallel Programming Libraries**   OpenMP. OMPSs, StarSs, Transactional Memory (TM), MPI, , Cell SDK, PThreads.
- **Scripting Languages**   Shell, Latex, Sed, Awk, gnuplot
- **Profiling Tools**   valgrind, gprof, google-performance tools

- **Debugging Tools**   gdb, valgrind
- **Operating Systems**   Linux, Microst Windows

Current Employer – Wipro Infotech

Ongoing Projects –
- **Moose:** Parallelizing the application on a shared memory system using OpenMP threading. Currently profiling the application to find performance bottlenecks and then optimize the parallelization for higher speedups.

Projects
Doctoral Thesis

- Research the idea of integrating Transactional Memory into a Task based Programming Model for synchronization of multiple threads.
- This optimistic approach has been adopted to improve the performance and efficiency of parallel applications.
- To test our idea we parallelized benchmarks such as Specfem, Graph500 and iterative solvers such as Jacobi and Gauss-Seidel. We observed a performance improvement of 20% on an already parallelized code.
- We also used TM as a synchronization mechanism to update shared memory locations in StarSs. We observed that TM-based synchronization performed better compared to lock-based synchronization when the ratio of shared memory update to conflicts is low. The benchmarking was done on applications such as NQueens and GMeans.

StarSs

- A task-based programming model to make parallel programming easier.
- Implementations for widely used multicore architectures such as SMPs, clusters, GPUs.
- The programming model generates a task-dependency graph at runtime based on data-flow principles.
- My contribution was to handle the synchronization of multiple threads.

Teraflux

- Teraflux project proposes a set of programming model, compiler analysis and a scalable, reliable architecture that will be able to harness such large scale parallelism in an efficient way.
- My contribution to this project was to introduce STM-based concurrency to handle simultaneous access to shared memory.

GRAPH500
- It is a list of application benchmarks to evaluate the performance of supercomputing systems for data intensive applications.
- The aim of Graph500 is to develop comprehensive benchmarks to address three application kernels: concurrent search, optimization and edge oriented.
- I parallelized the benchmarks on a 24 core SMP machine using the OMPSs programming model.
- A dynamic work distribution mechanism was used to maintain load balancing on the machine.

Mtech

- An efficient Breadth First Search (BFS) implementation that exploits memory locality on IBM's Cell BroadBand Engine Architecture.
- The challenge in the project was to efficiently use the 256KB local storage that was given to each of the Synergetic Processing Unit (SPE).

Last employment:

Barcelona Supercomputing Center
Location – Barcelona, Spain
Duration – Sept 2009 – March 2015
Position: Doctoral Research Candidate
Responsibilities

- Development and maintaining the SMPSs programming model. It is the StarSs implementation for Symmetric MultiProcessors (SMPs)
- Contributed to the development of OMPss programming model.
- Parallelized applications and benchmarks using StarSs for the research center's application repositories.

Publications:

- Rahulkumar Gayatri, Rosa M.Badia, Eduard Ayguade, et.al. "Loop level speculation in a task based programming model." HighPerformanceComputing(HiPC), 2013 20th International Conference on. IEEE, 2013.

- Rahulkumar Gayatri, Rosa M.Badia and Eduard Ayguade. "Transactional access to shared memory in StarSs, a task based programming model." Euro-Par 2012 Parallel Processing. Springer Berlin Heidelberg.

- Rahulkumar Gayatri, Rosa M.Badia and Eduard Ayguade "Analysis of the overheads incurred due to speculation in a task based programming model." Programmability Issues for Heterogeneous Multicores (MULTIPROG-2015).

- Giorgi, Roberto, et al. "TERAFLUX: Harnessing dataflow in next generation teradevices." Microprocessors and Microsystems 38.8 (2014): 976-990.

- Rahulkumar Gayatri, Pallav Baurah "Parallelizing Breadth First Search Using Cell BE." HiPC, Student Symposium 2008.

- Presented a Poster on the benefits of using CellSs (a programming model for Cell Processor) in the ACACES 2010 summer school of HiPEAC.