Ettore Speziale

Work experience

Oct 2012 – Current **Research internship**, *Barcelona Supercomputing Center*, Barcelona, Spain.

Optimized the Nanox task-based data-flow scheduler for OpenCL applications. The basic scheduler was developed during a previous internship in the same institution.

Jan 2012 – Jun 2012 **Code Optimization and Transformation teaching assistant**, *Politecnico di Milano*, Milano (MI), Italy.

Compiler middle-end analysis and optimizations. Introduction to LLVM compiler internals. Goal is to teach students how exploiting LLVM to implement some simple compiler analysis/optimizations.

Jan 2012 – Jun 2012 **Principi dei Linguaggi di Programmazione (Programming Languages Principles)**, *Politecnico di Milano*, Milano (MI), Italy.

Introduction to features implemented by mainstream languages, with focus on C++: inheritance, static/dynamic/type polymorphism, operator overloading, ... Introduction to basic memory management: free lists, pooled allocators, basic garbage collection algorithms. Introduction to parallel programming models: shared memory vs message passing paradigms.

Dec 2011 – Jan 2012 **Software Compilers teaching assistant**, *Univesità della Svizzera italiana*, Lugano, Switzerland.

Automatic compiler-building tools (flex and bison). Introducing compilers internal structure: teaching how a syntax-directed front-end for a C-like language works and how to add support for new language constructs.

Jun 2011 – Oct 2011 **Research internship**, *Barcelona Supercomputing Center*, Barcelona, Spain.

Extended the Nanox task-based data-flow scheduler in order to accept, schedule and execute OpenCL commands across a cluster. The whole cluster can be represented using a single OpenCL device, thus commands can be scheduled on the more suitable device in the cluster.

Sept 2010 – Jan 2011 **Linguaggi Formali e Compilatori (Formal Languages and Compilers) teaching assistant**, *Politecnico di Milano*, Milano (MI), Italy.

Automatic compiler-building tools (flex and bison). Introducing compilers internal structure: teaching how a syntax-directed front-end for a C-like language works and how to add support for new language constructs.

Sept 2010 – Jan 2011 **Fondamenti di Informatica (Foundations of Computer Science) teaching assistant**, *Politecnico di Milano*, Milano (MI), Italy.

Assist students during laboratory activities. Course goal is to learn writing simple programs using the C language.

Feb 2010 **Linguaggi Formali e Compilatori (Formal Languages and Compilers) teaching assistant**, *Politecnico di Milano*, Milano (MI), Italy.

Assist students during the preparation of the Linguaggi Formali e Compilatori (Formal Languages and Compilers) exam. Course goal is to introduce formal languages and basic compilation techniques, such as languages classification, parsing algorithms, and attribute grammars.

Jan 2010 – Current **Research collaborator in the 2PARMA European project**.

The PARallel PAradigms and Run-time MAnagement techniques for Many-core Architectures (`www.2parma.eu`) European project aims at overcoming the lack of parallel programming models and run-time resource management techniques to exploit the features of many-core processor architectures. Members of the Formal Languages and Compilers Group of Politecnico di Milano are involved in the project by providing compilers targeting many-core architectures.

Sept 2009 – Jan 2010 **Fondamenti di Informatica (Foundations of Computer Science) teaching assistant**, *Politecnico di Milano*, Milano (MI), Italy.

Assist students during laboratory activities. Course goal is to learn writing simple programs using the C language.

Sept 2009 – Dec 2009 **Research collaborator in the ILDJIT project**, *Politecnico di Milano*, Milano (MI), Italy.

The ILDJIT dynamic compiler, an open source implementation of the Common Language Infrastructure (ISO/IEC 23271) standard, is composed by two main components: a virtual machine and a class library. The virtual machine is mainly developed at Politecnico di Milano, while the class library is shared with the Portable .NET project. This work added to ILDJIT the capability of using as class library part of the Mono class library.

2002/2001 Summers **Computer technician**, *C.R.C. di De Bernardi C. & C. SAS*, Colico (LC), Italy.

Personal computer assembling and customer care. Wiring, installation and maintenance of networks for small and medium companies.

Education and training

Jul 2010 **ACACES summer school**, *HiPEAC*, Terrassa (Barcelona), Spain.

Advanced skills on computer architecture and compilation techniques for high performance and embedded systems. Focus on parallel programming model and parallel programs optimization. Courses attended:

- Multi-core Programming Models and their Compilation Challenges: compilation of explicitly parallel languages and related optimizations
- Compilation for Multi-core Processors: automatic parallelization of sequential programs, auto-vectorization and streaming languages
- System Virtualization: virtual machine technologies
- File Systems and Storage Technologies: physical and logical data organization, introduction to mainstream file system designs

Jan 2010 – Current **Ph.D. student in Computer Engineering**, *Politecnico di Milano*, Milano (MI), Italy.

Parallel architectures are known to be hardly programmable. This Ph.D. tries to address these problems by acting both at compile and at run time.

Automatic parallelization techniques cannot efficiently extract parallelism from a sequential application. For this reason, parallel languages are more attractive. They expose a simplified view of the parallel hardware, in order to ease the programmer writing explicitly parallel applications. Another interesting feature is the possibility to control data distribution in the parallel hardware, either explicitly (e.g. partitioned address space) or implicitly (e.g. exploiting programmer-provided hints to layout data). Moreover, these languages must handle many processing elements, leading to optimizing current synchronization primitives in order to reduce communication overhead.

Education and training

Sept 2006 – Jul 2009 **Master of Science Degree in Computer Engineering**, *Politecnico di Milano*, Milano (MI), Italy.

Advanced skills on some aspects of computer science. Focus on design and implementation of compilers, marks 108/110. Main courses includes:

- Linguaggi Formali e Compilatori (Formal Languages and Compilers): languages classification, parsing algorithms, and attribute grammars
- Ingegneria del Software 2 (Software Engineering 2): development models
- Laboratorio Software (Laboratory of Operating Systems and Software Design): Unix system programming
- Analisi e Progetto di Sistemi Critici (Analysis and Design of Critical Systems): Petri nets, and first order temporal logic
- Sistemi Distribuiti (Distributed Systems): Lamport's clocks, inter-node communication, distributed agreement, and distributed data storage
- Trasformazione ed Ottimizzazione del Codice (Program Transformation and Optimization): intermediate representation, optimizations, code generation, and memory management
- Architettura dei Calcolatori (Computer Architectures): scalar and super-scalar machines, and pipeline model
- Design and Analysis of Algorithms: computational classes, and asymptotic complexity

Education and training

Sept 2003 – Mar 2007 **Bachelor of Science Degree in Computer Engineering**, *Politecnico di Milano*, Milano (MI), Italy.

Basic skills of engineering and computer science subjects, marks 93/110. Computer science related courses includes:

- Informatica {1, 2} (Computer Science {1, 2}): procedural and system programming
- Ingegneria del Software (Software Engineering): OO programming model and unit testing
- Informatica 3 (Computer Science 3): algorithms and their computational complexity
- Informatica Teorica (Theoretical Computer Science): computational models

Sept 1998 – Jul 2003 **Secondary school-leaving certificate of Computer Science Technicians**, *Istituto Tecnico Industriale Enea Mattei*, Sondrio (SO), Italy.

Design and development of small software systems, marks 82/100.

Master thesis

Title Multithreading support in ILDJIT dynamic compiler

Supervisors Professor Stefano Crespi Reghizzi and Simone Campanoni

Description The ILDJIT virtual machine is an open source implementation of the Common Language Infrastructure (ISO/IEC 23271) standard, developed at Politecnico di Milano. Thesis main contribution was augmenting ILDJIT in order to execute multi-threaded programs. Multi-threading allows to split an application into threads, that can be run in parallel on architectures that expose some kind of hardware parallelism, such as multi-processor or multi-core machines.

The main problem involved into multi-threading support are mapping user-defined threads into operating system provided threads and implementing an efficient communication mechanism between threads.

Inside the ILDJIT virtual machine the first problem is addressed by linking each user defined thread to an operating system thread, while the latter is resolved through the implementation of an optimized locking algorithm.

Bachelor thesis

Title NLFS: progetto di un filesystem basato sui metadati

Supervisors Professor Pietro Braione and Marco Plebani

Description File systems usually organize data in a tree structure, in order to both provide a clear environment to the users and to efficiently support data access. However, this kind of organization does not allow classifying data in multiple classes, due to the hierarchical structure of the tree.

NLFS is a filesystem that stores data in an unordered set. Each file can be marked with one or more labels. Such labels are organized in indexes, allowing searching files by expressing a query above the labels. With this organization, a file can be classified into multiple topics.

Awards

Oct 2012 – Current Internship at Barcelona Supercomputing Center supported by an HiPEAC grant.

Jun 2011 – Oct 2011 Internship at Barcelona Supercomputing Center supported by an HiPEAC grant.

Jan 2010 – Current Ph.D. is financed by an ST Microelectronics scholarship.

Computer skills

Operating systems	Good skills with “Unix-like” operating systems. Skills ranging from system administration to low-level programming.
Software development methodologies	Knowledge and application of agile software development models. Good knowledge of tools for project automation, in particular the GNU tool chain.
Programming languages	Excellent knowledge of OpenCL. Good skills on C, C++, C# and Java languages. Knowledge of Ruby and Python scripting languages.
Compiler internals	Knowledge of GCC C and Fortran front-ends. Ability to write simple GCC analysis/transformation passes over GIMPLE tuples. Basic knowledge of both LLVM and CLANG internals.
Compiler construction tools	Knowledge of flex, bison, and gperf tools.
Others	Knowledge of LaTeX language for scientific paper writing.
Open source	Collaboration to ILDJIT virtual machine development, in garbage collector and multi-threading areas

Languages

Italian	**Native**
English	**Working knowledge**

References

Ph.D. advisor	Professor Stefano Crespi Reghizzi Politecnico di Milano, Dipartimento di Elettronica ed Informazione, via Ponzio 34/5, 20133, Milano (MI), Italy Email: crespi@elet.polimi.it
HiPEAC host	Professor Eduard Ayguadé Barcelona Supercomputing Center, calle Jordi Girona 31, 08034, Barcelona, Spain Email: eduard.ayguade@bsc.es

Publications

Andrea di Biagio, Ettore Speziale, and Giovanni Agosta. Exploiting thread-data affinity in OpenMP with data access pattern. In *Euro-Par*, 2011.

Speziale Ettore and Michele Tartara. A lightweight approach to compiling and scheduling highly dynamic parallel programs. In *HotPar'12 (Poster)*, 2012.

Paolo Roberto Grassi, Mariagiovanna Sami, Ettore Speziale, and Michele Tartara. Analyzing the sensitivity to faults of synchronization primitives. In *DFT*, 2011.

Ettore Speziale, Andrea di Biagio, and Giovanni Agosta. An optimized reduction design to minimize atomic operations in shared memory multiprocessors. In *HIPS*, 2011.