

Alessandro Pellegrini

Curriculum Vitæ

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Personal Information

first name Alessandro
last name Pellegrini
place/date of birth Roma (Italy), Wednesday 7th January, 1987
nationality Italian

Academic Positions

July 2016 **Research Fellowship**, *Sapienza, University of Rome*.
present Research targeting a performance and security assessment of the National Criminal Trial System of the Italian Ministry of Justice

2015 **Lecturer**, *Sapienza, University of Rome*.
present Lecturer for the “*Data Centers and High Performance Computing*” course, in the Master's Degree in Computer Science

2015 **Lecturer**, *Sapienza, University of Rome*.
present Assistant for the “*Computer Architectures*” course, in the Bachelor's Degree in Computer Science

September 2015 **Visiting Researcher**, *Barcelona Supercomputing Center (BSC)*.
October 2015 Visitor in the context of the “Severo Ochoa” Excellence Program

December 2014 **Research Fellow**, *Sapienza, University of Rome*.
December 2015 Research on the design and development of algorithms for high-performance computing on multicore environments

June 2014 **Researcher**, *IRIANC—International Research Institute for Autonomic Network Computing*.
May 2016 Researching on the EU FP7 Project–Panacea

April 2014 **Researcher**, *CINFAI—Consorzio Interuniversitario Nazionale per la Fisica delle Atmosfere e delle Idrosfere*.
February 2015 Researcher in the project SIGMA (Italian PON R&C), aimed at developing an integrated system for the cloud for the acquisition and management of data coming from heterogeneous sensor networks

October 2014 **Lecturer**, *CINI—Consorzio Interuniversitario Nazionale per l'Informatica*.
November 2014 Course on Distributed Simulation for the Private/Public COSMIC Laboratory

2011 **Lecturer**, *Sapienza, University of Rome*.
2015 Lecturer for the “*Concurrent and Parallel Programming*” course, in the Master's Degree “*Computer Architectures and Distributed Systems*”

2012 **Lecturer**, *Sapienza, University of Rome*.
2013 Assistant for the “*Computer Architectures*” course, in the Bachelor's Degree in Computer Science

- 2011 **Lecturer**, *Sapienza, University of Rome*.
2012 Assistant for the “*Operating Systems*” course, in the Bachelor’s Degree in Computer Science

Awards and Honors

- 2016 **Best Paper Award**, *20th International Symposium on Distributed Simulation and Real Time Applications (DS-RT)*.
Award for the paper “A Lock-Free O(1) Event Pool and its Application to Share-Everything PDES Platforms”
- 2015 **Best PhD Thesis of the year**, *Sapienza Università Editrice*.
- 2012 **Best Paper Award**, *5th International ICST Conference on Simulation Tools and Techniques (SIMUTools)*.
Award for the paper “Cache-Aware Memory Manager for Optimistic Simulations”

Work Experience

- June 2016 **Consultant**, *DGSIA—Direzione generale per i sistemi informativi automatizzati, Italian Ministry of Justice*.
present Assessment of the National Telematic Criminal Trial System
- February 2012 **Consultant**, *IES—Ingegneria Elettronica Sistemi s.r.l.*
- October 2012 Project of a redundancy system for the HElabor microcontroller, and reliability assessment
- July 2011 **Consultant**, *Poste Italiane S.p.A.*
- September 2011 Assessment and Capacity Analysis on the Business Main Core Infrastructure

National/International Projects

- November 2008 **ROOT-Sim**, *The ROME OpTimistic Simulator*, Open Source Software Project.
present The ROME OpTimistic Simulator is a multithread x86_64 Open Source, parallel/distributed simulation platform developed using C/POSIX technology, which is based on a simulation kernel layer that ultimately relies on MPI for data exchange. The platform transparently supports all the mechanisms associated with parallelization and optimistic synchronization.
- June 2014 **PANACEA**, *Proactive Autonomic Management of Cloud Resources*, EU FP7
May 2016 Project.
The main objective of the PANACEA project is to provide Proactive Autonomic Management of Cloud Resources, based on Machine Learning, as a remedy to the exponentially growing Cloud complexity. Main targets are: i) proactive autonomic management of Cloud resources, ii) proactive software migration within the Cloud(s), iii) efficient usage of Cloud resources, iv) monitoring, controlling, and proactively managing applications’ execution.
- April 2014 **SIGMA**, *Sistema Integrato di sensori in ambiente Cloud per la Gestione Multirischio*
February 2015 *Avanzata*, National Italian Project.
The Integrated Sensors System in Cloud Environments for Advanced Multirisk Management (SIGMA) is a multi-layered architecture for acquiring, integrating, and elaborating heterogeneous data coming from differentiated sensor networks. Its goal is to enhance (both environmental and factory) monitoring and control systems to provide data useful for the prevention of risk situations.

Peer-Review Activities and Service

Chairmanship

- 2018 **General Co-Chair**, *IEEE International Symposium on Network Computing and Applications (NCA)*.

- 2016 **Program Co-Chair**, *IEEE International Symposium on Network Computing and Applications (NCA)*.
- 2016 **Financial Chair**, *IEEE International Symposium on Network Computing and Applications (NCA)*.
- 2015 **Financial Chair**, *IEEE International Symposium on Network Computing and Applications (NCA)*.

Conference Program Committees

- 2017 **ACM SIGSIM PADS**, *PC Member of the ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*.
- 2015 **IEEE/ACM DS-RT**, *PC Member of the IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*.
- 2015 **IEEE NCA**, *PC Member of the IEEE International Symposium on Network Computing and Applications (NCA)*.
- 2015 **IEEE DPDNS**, *PC Member of the Workshop on Dependable Parallel, Distributed and Network-Centric Systems (DPDNS)*.
- 2014 **IEEE SIMULTECH**, *PC Member of the Workshop on Dependable Parallel, Distributed and Network-Centric Systems (DPDNS)*.

Education

- November 2010 **PhD Course**, *Sapienza, University of Rome*, Judgment: Outstanding.
- November 2013 Thesis Title: **Techniques for Transparent Parallelization of Discrete Event Simulation Models**
- December 2010 **Licence to Practice Computer Engineering**, *Sapienza, University of Rome*.
- November 2008 **Master's Degree in Computer Engineering**, *Sapienza, University of Rome*, Mark: 110/110.
- November 2010 Thesis Title: **Autonomic State Saving of Simulation Objects in Optimistic Simulation Systems**
- November 2005 **Bachelor's Degree in Computer Engineering**, *Sapienza, University of Rome*, Mark: 105/110.
- November 2008 Thesis Title: **Efficient and Transparent Tracking of Dynamic Memory Updates with Arbitrary Granularity in Optimistic Simulation Architectures**
- November 2000 **Classical Lyceum Diploma**, *Pontificio Istituto Apollinare, Rome, Italy*, Mark: 100/100.
- November 2005

Languages

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|----------|------------------|---|
| Italian | Mother Tongue | |
| English | Proficient (C2) | CAE – Cambridge University (2004). Mark: C
FCE – Cambridge University (2003). Mark: B
PET – Cambridge University (2002). Mark: Passed
KET – Cambridge University (2001). Mark: Passed with Merit |
| Spanish | Independent (B2) | Diploma Básico de Español – Cervantes (2002). Mark: 81/100 |
| French | Independent (B1) | DELFI – St. Louis de France (2002). Mark: 12,35/20 |
| Japanese | Entry level | |

Technical Skills

- Software Requirements: techniques and modeling
- Hardware Requirements: project and development
- Assessment of Large Scale Systems
- Development of non-critical embedded devices
- Development of dedicated management software

Computer Skills

Operating Systems Unix, Windows

Programming Languages C, Assembly, PHP, C++, Java, HTML5, CSS, SQL

Office Automation L^AT_EX, Microsoft Office

Graphics and Multimedia Adobe Photoshop, Adobe After Effects, Adobe Premiere, Adobe Audition, The Gimp

Artistic Skills

- Studied piano for 14 years
- Studied violin for 5 years
- Self-learning guitarist

Attachments

- 1 List of Publications
- 2 Summary of the Ph.D. Thesis

**Autorizzo il trattamento dei dati personali contenuti nel mio curriculum vitae
in base all'art. 13 del D. Lgs. 196/2003.**

Rome, Monday 18th September, 2017

Attachment 1: List of Publications

Books

- [1] Alessandro Pellegrini. *Parallelization of Discrete Event Simulation Models*. Studi e Ricerche. Sapienza Università Editrice, November 2015.

Book Chapters

- [2] Diego Rughetti, Pierangelo Di Sanzo, Alessandro Pellegrini, Bruno Ciciani, and Francesco Quaglia. Tuning the level of concurrency in software transactional memory: An overview of recent analytical, machine learning and mixed approaches. In Rachid Guerraoui and Paolo Romano, editors, *Transactional Memory. Foundations, Algorithms, Tools, and Applications*, volume 8913 of *Lecture Notes in Computer Science*, pages 395–417. Springer International Publishing, 2015.
- [3] Francesco Quaglia, Alessandro Pellegrini, and Roberto Vitali. Reshuffling PDES platforms for multi/many-core machines: a perspective with focus on load sharing. In Daniele Gianni, Andrea D'Ambrogio, and Andreas Tolk, editors, *Modeling and Simulation-based Systems Engineering Handbook*. Crc Pr I Llc, December 2014.

Journal Articles

- [4] Davide Cingolani, Alessandro Pellegrini, and Francesco Quaglia. Transparently mixing undo logs and software reversibility for state recovery in optimistic pdes. *ACM Transactions on Modeling and Computer Simulation*, 27(2), May 2017.
- [5] Alessandro Pellegrini and Francesco Quaglia. A fine-grain time-sharing time warp system. *ACM Transactions on Modeling and Computer Simulation*, 27(2), May 2017.
- [6] Alessandro Pellegrini, Sebastiano Peluso, Francesco Quaglia, and Roberto Vitali. Transparent speculative parallelization of discrete event simulation applications using global variables. *International Journal of Parallel Programming*, 44(6):1200–1247, December 2016.
- [7] Pierangelo Di Sanzo, Francesco Quaglia, Bruno Ciciani, Alessandro Pellegrini, Diego Didona, Paolo Romano, Roberto Palmieri, and Sebastiano Peluso. A flexible framework for accurate simulation of cloud in-memory data stores. *Simulation Modelling Practice and Theory*, 58(2):219–238, July 2015.
- [8] Alessandro Pellegrini, Roberto Vitali, and Francesco Quaglia. Autonomic state management for optimistic simulation platforms. *IEEE Transactions on Parallel and Distributed Systems*, 26(6):1560–1569, June 2015.
- [9] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. Load sharing for optimistic parallel simulations on multi core machines. *SIGMETRICS Performance Evaluation Review*, 40(3):2–11, August 2012.

Conference Articles

- [10] Tommaso Tocci, Alessandro Pellegrini, Francesco Quaglia, Josep Casanovas-García, and Toyotaro Suzumura. Orchestra: An asynchronous wait-free distributed gvt algorithm. In *Proceedings of the 21st IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*, DS-RT. IEEE Computer Society, October 2017. To appear.
- [11] Mauro Ianni, Romolo Marotta, Alessandro Pellegrini, and Francesco Quaglia. Towards a fully non-blocking share-everything pdes platform. In *Proceedings of the 21st IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*, DS-RT. IEEE Computer Society, October 2017. To appear.

- [12] Mauro Ianni, Romolo Marotta, Alessandro Pellegrini, and Francesco Quaglia. A non-blocking global virtual time algorithm with logarithmic number of memory operations. In *Proceedings of the 21st IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*, DS-RT. IEEE Computer Society, October 2017. To appear.
- [13] Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. A wait-free multi-word atomic $(1,n)$ register for large-scale data sharing on multi-core machines. In *Proceedings of the 2017 IEEE Cluster Conference*, CLUSTER. IEEE Computer Society, September 2017.
- [14] Davide Cingolani, Alessandro Pellegrini, Markus Schordan, Francesco Quaglia, and David R. Jefferson. Dealing with reversibility of shared libraries in pdes. In *Proceedings of the 2017 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS. ACM, May 2017.
- [15] Romolo Marotta, Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. A conflict-resilient lock-free calendar queue for scalable share-everything pdes platforms. In *Proceedings of the 2017 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS. ACM, May 2017.
- [16] Emiliano Silvestri, Simone Economo, Pierangelo Di Sanzo, Alessandro Pellegrini, and Francesco Quaglia. Preemptive software transactional memory. In *Proceedings of the 17th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing*, CCGrid. IEEE Computer Society, May 2017.
- [17] Alessandro Pellegrini and Pierangelo Di Sanzo. On the optimization of collaborative kerbside waste collection. In *Proceedings of the 14th International Conference on Energy, Environment, Ecosystems and Sustainable Development*, EEESD. WSEAS, January 2017.
- [18] Alessandro Pellegrini, Cristina Montañola-Sales, Francesco Quaglia, and Josep Casanovas-Garcia. Programming agent-based demographic models with cross-state and message-exchange dependencies: A study with speculative pdes and automatic load-sharing. In *Proceedings of the 2016 Winter Simulation Conference*, WSC. IEEE Computer Society, December 2016.
- [19] Romolo Marotta, Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. A lock-free $o(1)$ event pool and its application to share-everything pdes platforms. In *Proceedings of the 20th IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*, DS-RT. IEEE Computer Society, September 2016. Winner of the Best Paper Award.
- [20] Simone Economo, Davide Cingolani, Alessandro Pellegrini, and Francesco Quaglia. Configurable and efficient memory access tracing via selective expression-based x86 binary instrumentation. In *Proceedings of the 24th IEEE International Symposium on Modelling, Analysis and Simulation of Computer and Telecommunication Systems*, MASCTOS. IEEE Computer Society, September 2016.
- [21] Alessandro Pellegrini, Cristina Montañola-Sales, Francesco Quaglia, and Josep Casanovas-Garcia. Load-sharing policies in parallel simulation of agent-based demographic models. In *Proceedings of the 4th Workshop on Parallel and Distributed Agent-Based Simulations*, PADABS. LNCS, Springer-Verlag, August 2016.
- [22] Romolo Marotta, Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. A non-blocking priority queue for the pending event set. In *Proceedings of the 9th EAI International Conference on Simulation Tools and Techniques*, SIMUTools. ICST, August 2016.

- [23] Alessandro Pellegrini. Optimizing memory management for optimistic simulation with reinforcement learning. In *Proceedings of the 2016 International Conference on High Performance Computing & Simulation Workshops*, HPCS, pages 26–33. IEEE Computer Society, July 2016.
- [24] Davide Cingolani, Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. Mixing hardware and software reversibility for speculative parallel discrete event simulation. In *Proceedings of the 8th Conference on Reversible Computation*, RC, pages 137–152. Springer-Verlag, July 2016.
- [25] Andrea La Rizza, Giuseppe Casarano, Gilberto Castellani, Bruno Ciciani, Luca Pas-salacqua, and Alessandro Pellegrini. Machine learning-based elastic cloud resource provisioning in the solvency ii framework. In *Proceedings of the 2016 IEEE 36th International Conference on Distributed Computing Systems Workshops*, ICDCS, pages 44–48. IEEE Computer Society, June 2016.
- [26] Alessandro Pellegrini, Pierangelo Di Sanzo, and Dimiter R. Avresky. Proactive cloud management for highly heterogeneous multi-cloud infrastructures. In *Proceedings of the 21st IEEE Workshop on Dependable Parallel, Distributed and Network-Centric Systems*, DPDNS. IEEE Computer Society, May 2016.
- [27] Nazzareno Marziale, Francesco Nobilia, Alessandro Pellegrini, and Francesco Quaglia. Granular time warp objects. In *Proceedings of the 2016 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 57–68. ACM, May 2016.
- [28] Ilaria Di Gennaro, Alessandro Pellegrini, and Francesco Quaglia. Os-based numa optimization: Tackling the case of truly multi-thread applications with non-partitioned virtual page accesses. In *Proceedings of the 16th IEEE/ACM International Symposium on Cluster, Cloud and Grid Computing*, CCGrid, pages 292–300. IEEE Computer Society, May 2016.
- [29] Vanessa Büsing-Menses, Cristina Montañola-Sales, Josep Casanovas-Garcia, and Alessandro Pellegrini. Analysis and optimization of a demographic simulator for parallel environments (poster paper). In *Proceedings of the 2015 Winter Simulation Conference*, WSC. IEEE Computer Society, December 2015.
- [30] Emanuele Santini, Mauro Ianni, Alessandro Pellegrini, and Francesco Quaglia. Htm based speculative parallel discrete event simulation of very fine grain models. In *Proceedings of the 22nd International Conference on High Performance Computing*, HiPC. IEEE Computer Society, December 2015.
- [31] Dimiter R. Avresky, Pierangelo Di Sanzo, Alessandro Pellegrini, Bruno Ciciani, and Luca Forte. Proactive scalability and management of resources in hybrid clouds via machine learning (short paper). In *Proceedings of the 14th IEEE International Symposium on Network Computing and Applications*, NCA, pages 114–119. IEEE Computer Society, September 2015.
- [32] Davide Cingolani, Alessandro Pellegrini, and Francesco Quaglia. RAMSES: Reversibility-based agent modeling and simulation environment with speculation support. In *Proceedings of the 3rd Workshop on Parallel and Distributed Agent-Based Simulations*, PADABS, pages 466–478. LNCS, Springer-Verlag, August 2015.
- [33] Pierangelo Di Sanzo, Alessandro Pellegrini, and Dimiter R. Avresky. Machine learning for achieving self-* properties and seamless execution of applications in the cloud. In *Proceedings of the Fourth IEEE Symposium on Network Cloud Computing and Applications*, NCCA, pages 51–58. IEEE Computer Society, June 2015.

- [34] Davide Cingolani, Alessandro Pellegrini, and Francesco Quaglia. Transparently mixing undo logs and software reversibility for state recovery in optimistic pdes. In *Proceedings of the 2015 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 211–222. ACM, June 2015.
- [35] Alessandro Pellegrini and Francesco Quaglia. Numa time warp. In *Proceedings of the 2015 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 59–70. ACM, June 2015.
- [36] Alessandro Pellegrini and Francesco Quaglia. Time-sharing time warp via lightweight operating system support. In *Proceedings of the 2015 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 47–58. ACM, June 2015.
- [37] Alessandro Pellegrini, Pierangelo Di Sanzo, and Dimiter R. Avresky. A machine learning-based framework for building application failure prediction models. In *Proceedings of the 20th IEEE Workshop on Dependable Parallel, Distributed and Network-Centric Systems*, DPDNS, pages 1072–1081. IEEE Computer Society, May 2015.
- [38] Alessandro Pellegrini and Francesco Quaglia. Wait-free Global Virtual Time computation in shared memory Time-Warp systems. In *Proceedings of the 26th International Conference on Computer Architecture and High Performance Computing*, SBAC-PAD. IEEE Computer Society, October 2014.
- [39] Alessandro Pellegrini and Francesco Quaglia. Programmability and performance of parallel ECS-based simulation of multi-agent exploration models. In *Proceedings of the 2nd Workshop on Parallel and Distributed Agent-Based Simulations*, PADABS. LNCS, Springer-Verlag, August 2014.
- [40] Alessandro Pellegrini and Francesco Quaglia. Transparent multi-core speculative parallelization of DES models with event and cross-state dependencies. In *Proceedings of the 2014 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 105–116. ACM, May 2014.
- [41] Diego Rughetti, Pierangelo Di Sanzo, and Alessandro Pellegrini. Adaptive transactional memories: Performance and energy consumption tradeoffs. In *Proceedings of the Third IEEE Symposium on Network Cloud Computing and Applications*, NCCA. IEEE Computer Society, February 2014.
- [42] Alessandro Pellegrini and Francesco Quaglia. The ROme OpTimistic Simulator: A tutorial (invited tutorial). In *Proceedings of the 1st Workshop on Parallel and Distributed Agent-Based Simulations*, PADABS. LNCS, Springer-Verlag, August 2013.
- [43] Alessandro Pellegrini and Francesco Quaglia. A study on the parallelization of terrain-covering ant robots simulations. In *Proceedings of the 1st Workshop on Parallel and Distributed Agent-Based Simulations*, PADABS. LNCS, Springer-Verlag, August 2013.
- [44] Alice Porfirio, Alessandro Pellegrini, Pierangelo Di Sanzo, and Francesco Quaglia. Transparent support for partial rollback in software transactional memories. In *Proceedings of the International Euro-Par 2013 Conference*, Euro-Par. LNCS, Springer-Verlag, August 2013.
- [45] Alessandro Pellegrini. Hijacker: Efficient static software instrumentation with applications in high performance computing (poster paper). In *Proceedings of the 2013 International Conference on High Performance Computing & Simulation*, HPCS,

pages 650–655. IEEE Computer Society, July 2013. Candidate for (but not winner of) the Outstanding Poster Paper Award.

- [46] Francesco Antonacci, Alessandro Pellegrini, and Francesco Quaglia. Consistent and efficient output-stream management in optimistic simulation platform. In *Proceedings of the 2013 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation*, PADS, pages 315–326. ACM, May 2013.
- [47] Alessandro Pellegrini and Giuseppe Piro. Multi-threaded simulation of 4G cellular systems within the LTE-Sim framework. In *Proceedings of the 8th IEEE International Workshop on the Performance Analysis and Enhancement of Wireless Networks*, PAEWN. IEEE Computer Society, March 2013.
- [48] Pierangelo Di Sanzo, Francesco Antonacci, Bruno Ciciani, Roberto Palmieri, Alessandro Pellegrini, Sebastiano Peluso, Francesco Quaglia, Diego Rughetti, and Roberto Vitali. A framework for high performance simulation of transactional data grid platforms. In *Proceedings of the 6th ICST Conference of Simulation Tools and Techniques*, SIMUTools. ICST, March 2013.
- [49] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. A load sharing architecture for optimistic simulations on multi-core machines. In *Proceedings of the 19th International Conference on High Performance Computing*, HiPC. IEEE Computer Society, December 2012.
- [50] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. Assessing load sharing within optimistic simulation platforms (invited paper). In *Proceedings of the 2012 Winter Simulation Conference*, WSC. Society for Computer Simulation, December 2012.
- [51] Alessandro Pellegrini, Roberto Vitali, Sebastiano Peluso, and Francesco Quaglia. Transparent and efficient shared-state management for optimistic simulations on multi-core machines. In *Proceedings 20th International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems*, MASCOTS, pages 134–141. IEEE Computer Society, August 2012.
- [52] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. Towards symmetric multi-threaded optimistic simulation kernels. In *Proceedings of the 26th International Workshop on Principles of Advanced and Distributed Simulation*, PADS, pages 211–220. IEEE Computer Society, August 2012.
- [53] Roberto Vitali, Alessandro Pellegrini, and Gionata Cerasuolo. Cache-aware memory manager for optimistic simulations. In *Proceedings of the 5th ICST Conference of Simulation Tools and Techniques*, SIMUTools. ICST, March 2012. Winner of the Best Paper Award.
- [54] Alessandro Pellegrini, Roberto Vitali, and Francesco Quaglia. The ROme OpTimistic Simulator: Core internals and programming model. In *Proceedings of the 4th International ICST Conference on Simulation Tools and Techniques*, SIMUTools. ICST, 2011.
- [55] Alessandro Pellegrini, Roberto Vitali, and Francesco Quaglia. An evolutionary algorithm to optimize log/restore operations within optimistic simulation platforms. In *Proceedings of the 4th International ICST Conference on Simulation Tools and Techniques*, SIMUTools. SIGSIM, 2011.
- [56] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. Autonomic log/restore for advanced optimistic simulation systems. In *Proceedings of the Symposium on*

Modeling, Analysis, and Simulation of Computer and Telecommunication Systems, MASCOTS, pages 319–327. IEEE Computer Society, 2010.

- [57] Roberto Vitali, Alessandro Pellegrini, and Francesco Quaglia. Benchmarking memory management capabilities within root-sim. In *Proceedings of the 13th IEEE/ACM International Symposium on Distributed Simulation and Real Time Applications*, DS-RT. IEEE Computer Society, 2009.
- [58] Alessandro Pellegrini, Roberto Vitali, and Francesco Quaglia. Di-DyMeLoR: Logging only dirty chunks for efficient management of dynamic memory based optimistic simulation objects. In *Proceedings of the 2009 ACM/IEEE/SCS 23rd Workshop on Principles of Advanced and Distributed Simulation*, PADS, pages 45–53. IEEE Computer Society, 2009. Candidate for (but not winner of) the Best Paper Award.
[Talks Given \(without Proceedings\)](#)
- [59] Alessandro Pellegrini and Francesco Quaglia. On the relevance of wait-free coordination algorithms in shared-memory hpc: The global virtual time case. Workshop di Informatica Quantitativa, October 2014.
- [60] Alessandro Pellegrini. Adaptive transactional memories: Performance and energy consumption tradeoffs (poster + talk). Euro-TM Workshop on Transactional Memory, April 2014.
- [61] Alessandro Pellegrini. A symmetric multi-threaded architecture for load-sharing in multi-core optimistic simulations. Workshop di Informatica Quantitativa, July 2012.

Simulation is a powerful technique to represent the evolution of real-world phenomena or systems over time. It has been extensively used in different research fields (from medicine to biology, to economy, and to disaster rescue) to study the behaviour of complex systems during their evolution (*symbiotic simulation*) or before their actual realization (*what-if analysis*).

A traditional way to achieve high performance simulations is the employment of Parallel Discrete Event Simulation (PDES) techniques, which are based on the partitioning of the simulation model into Logical Processes (LPs) that can execute events in parallel on different CPUs and/or different CPU cores, and rely on synchronization mechanisms to achieve causally consistent execution of simulation events. As it is well recognized, the optimistic synchronization approach, namely the Time Warp protocol, which is based on rollback for recovering possible timestamp-order violations due to the absence of block-until-safe policies for event processing, is likely to favour speedup in general application/architectural contexts.

However, the optimistic PDES paradigm implicitly relies on a programming model that shifts from traditional sequential-style programming, given that there is no notion of global address space (fully accessible while processing events at any LP). Furthermore, there is the underlying assumption that the code associated with event handlers cannot execute unrecoverable operations given their speculative processing nature. Nevertheless, even though no unrecoverable action is ever executed by event handlers, a means to actually undo the action if requested needs to be devised and implemented within the software stack.

On the other hand, sequential-style programming is an easy paradigm for the development of simulation code, given that it does not require the programmer to reason about memory partitioning (and therefore message passing) and speculative (concurrent) processing of the application.

My PhD Thesis presents methodological and technical innovations which will show how it is possible, by developing innovative runtime mechanisms, to allow a programmer to implement its simulation model in a fully sequential way, and have the underlying simulation framework to execute it in parallel according to speculative processing techniques. Some of the approaches we provide show applicability in either shared- or distributed-memory systems, while others will be specifically tailored to multi/many-core architectures.

I show, during the development of these supports, what is the effect on performance of these solutions, which will nevertheless be negligible, allowing a fruitful exploitation of the available computing power. In the end, I highlight which are the clear benefits on the programming model that the model developer will experience by relying on these innovative solutions.