

Matteo Camilli

Ph.D., Computer Science

Current Occupation

2015–present **Postdoctoral research fellow**, *Department of Computer Science, Università degli Studi di Milano, Milan (Italy)*.

From September 2015, I'm a postdoc. researcher at the Computer Science department of the University of Milan. I'm focusing my research activity on methods and tools for specifying and verifying (self-adaptive) time-dependent systems.

Short Bio

I'm currently a postdoctoral fellow at the Computer Science Department of the University of Milan (Italy), where I teach software engineering, and I work in the "Software Engineering and Formal Methods" research group. I received my PhD degree in Computer Science from the University of Milan in 2014. My research activity has been focusing on Software Engineering, formal methods, formal Verification, self-adaptive systems, real-time systems, parallel and distributed Systems. I'm especially interested in methods and tools to improve dependability of adaptable and evolvable real-time applications.

Ongoing research

Runtime verification: I'm currently developing an event-based monitoring approach and its supporting software tool MAHARAJA for runtime verification of temporal properties of JAVA programs. The monitor continuously evaluates the conformance of the concrete implementation with respect to its formal specification given in terms of Time Basic Petri nets. The system under test is instrumented by using JAVA annotations on methods, to link the implementation to its formal model. The framework provides facilities to write test cases to stimulate and verify the correctness of different execution paths. The tool has been successfully used to monitor at runtime and test a number of real-time benchmarking case-studies. Preliminary experimental evaluation shows that our approach introduces bounded overhead and negligible auxiliary memory. <http://camilli.di.unimi.it/maharaja>.

Online model-based testing: I'm currently working on a novel online model-based testing technique for time-sensitive systems. The proposed technique makes use of Continuous Time Markov Chain (CTMC) specifications as a modeling formalism. I'm currently formalizing the conformance relation between the model and the system under test, and introducing different strategies to stochastically sample the state space at runtime rather than enumerate it. The technique explicitly takes into account the assumptions on time constraints and it verifies them at runtime through Continuous Stochastic Logic (CSL) properties. Moreover we exploit runtime information extracted from the test runs to refine the assumptions made upon the model at design-time.

Education

2012–2014 **Ph.D. in Computer Science**, *Department of Computer Science*, Università degli Studi di Milano, Milan (Italy).

Thesis title: *Coping with the State Explosion Problem in Formal Methods: Advanced Abstraction Techniques and Big Data Approaches.*

2009–2011 **Computer Science M.Sc.**, *Università degli Studi di Milano*, Milan (Italy), *Master of Science.*

I got my M.Sc. degree in Computer Science on July 12th, 2011 at the University of Milan, with a final grade of 110/110 cum laude. The thesis is entitled "Confronto tra architetture per la realizzazione distribuita di tecniche di analisi per reti di Petri." ("Parallel and distributed approaches to Real-Time system analysis.")

Achievement:

- Be able to understand and improve analysis methods, design methods and development methods of complex/innovative IT systems.
- Be able to take leadership roles in management/development of IT projects within companies or research institutes.
- Be able to understand and use mathematical and physical means to support IT applications.

2005–2008 **Computer Science B.Sc.**, *Università degli Studi di Milano*, Milan (Italy), *Bachelor of Science.*

I got my B.Sc. degree in Computer Science on December 16th, 2008 at the University of Milan, with a final grade of 110/110 cum laude. The thesis is entitled "Estensione, progettazione e realizzazione di una tecnica di analisi di sistemi Real-time." ("Design and implementation of a reachability analysis technique for Real-Time systems.")

Achievement:

- Fundamentals of different computer science fields.
- Design and development of IT systems.
- Networks management.
- Be able to understand and use mathematical means.

Phd thesis

title *Coping with the State Explosion Problem in Formal Methods: Advanced Abstraction Techniques and Big Data Approaches.*

supervisors Carlo Bellettini, Mattia Monga, Lorenzo Capra

description The thesis focuses on two complementary approaches to deal with the state explosion problem for dynamic, concurrent and real-time systems. On the one hand we explore advanced state space methods for real-time systems modeled with Time Basic Petri nets. On the other hand, we introduces distributed approaches which exploits techniques typically used by the big data community to enable verification of very complex systems using big data approaches and cloud computing facilities.

Experience

- 2015–present **Postdoctoral research fellow**, *Università degli Studi di Milano*, Milano (Italy).
Formal methods in Software Engineering: Analysis and synthesis of (self-adaptive) real-time systems.
- 2014–2015 **Research grant holder**, *Università degli Studi di Bergamo*, Bergamo (Italy).
Software Engineering, formal methods, formal Verification, self-adaptive systems, real-time systems, parallel and distributed Systems.
Research and Development, *Bialetti Industrie S.p.A*, Brescia (Italy).
Research and development – Smart break project: <http://www.smartbreakproject.it>.
Requirements and use case analysis. Definition of the interactions between roles and components to achieve a goals.
- 2012–2014 **Phd student**, *Università degli Studi di Milano*, Milan (Italy).
My recent works were focused on the connection between formal methods in software engineering and big data approaches. Formal verification requires high performance data processing software for extracting knowledge from the unprecedented amount of data which come from analyzed systems. Since cloud based computing resources have become easily accessible, there is an opportunity for verification techniques and tools to undergo a deep technological transition to exploit the new available architectures.
- 2012–2013 **Research grant holder**, *Università degli Studi di Milano*, Milan (Italy).
Distributed analysis of internet traffic for protocol and structure independent botnet detection.
- 2011–2013 **Co-funder, technical director, developer**, *Failuresoftware*, Milan (Italy).
Failuresoftware is a team of creative and technology nerds building simple and sometimes useful mobile applications for the world.
Projects:
 - BikeMi:
 - BikeMi is Milan's new Bike Sharing easy, practical and ecological service. Available on the Google Playstore <https://play.google.com/store/apps/details?id=com.failuresoftware.bikemi&hl=it>
 - Photodump:
 - Photodump is a social app where users can collect and share bad photos.
- 2010–2011 **Research and development**, *Università degli Studi di Milano*, Milan (Italy).
Design, Development and Comparison between different parallel and distributed computational model for Real-time systems analysis techniques.
- 2008–2009 **Research and development**, *Università degli Studi di Milano*, Milan (Italy).
Design and Development of a Real-time systems analysis technique expressed by means of Time- Basic Petri nets.

Languages

Italian **Mother tongue**

English **Listening: B2***, **Reading C1***,
Spoken interaction: B2*, **Spoken production: B2***,
Writing: C1*

*<http://europass.cedefop.europa.eu/en/resources/european-language-levels-cefr>

Computer skills

Programming	Java, Java Reflection, RMI, AspectJ, C, C++, python, php, Smalltalk	Databases	SQL language, MySQL, PostgreSQL
Web	html, xml	VCS	Git
Cloud Computing	experience with the Amazon Elastic Compute Cloud infrastructure	Mobile	Google Android, Apple IOS

Teaching

- 2016-2017 **Teacher**, *Software Engineering (Ingegneria del software)*, Dipartimento di Scienze e Innovazione Tecnologica (DiSIT), Università degli Studi del Piemonte Orientale, Vercelli (Italy).
- 2015-2016 **Lab. teacher**, *Software Engineering (Ingegneria del software)*, Dipartimento di Informatica, Università degli Studi di Milano, Milan (Italy).
Lab. teacher, *Operating Systems (Sistemi Operativi)*, Dipartimento di Ingegneria gestionale, dell'informazione e della produzione (DIGIP), Università degli Studi di Bergamo, Bergamo (Italy).
- 2014-2015 **Lab. teacher**, *Software design (Progettazione del software)*, Dipartimento di Informatica, Università degli Studi di Milano, Milan (Italy).
- 2013-2014 **Lab. teacher**, *Software design (Progettazione del software)*, Dipartimento di Informatica, Università degli Studi di Milano, Milan (Italy).
- 2012-2013 **Lab. teacher**, *Software design (Progettazione del software)*, Dipartimento di Informatica, Università degli Studi di Milano, Milan (Italy).
- 2011-2012 **Teaching assistant**, *Software design course (Progettazione del software)*, Dipartimento di Informatica, Università degli Studi di Milano, Milan (Italy).

Participation as speaker

- 2015 **ISSRE 2015**, *26th IEEE International Symposium on Software Reliability Engineering (ISSRE)*, Formal methods track.
- 2014 **SYNASC 2014**, *16th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, Distributed computing track.
- 2014 **ICSE 2014**, *36th International Conference on Software Engineering (ICSE)*, Doctoral symposium.
- 2013 **RP 2013**, *7th International workshop on Reachability Problems (RP)*.
- 2012 **ICSE 2012**, *34th International Conference on Software Engineering (ICSE)*, ACM Student research competition.

- 2012 **SYNASC 2012**, *14th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC)*, Distributed computing track.

Honours and Awards

- 2014 **ICSE 2014 Doctoral Symposium**, *selected to participate at the Doctoral Symposium of ICSE 2014 conference with the research paper: Formal verification problems in a big data world: Towards a mighty synergy.*
- 2012 **ACM Student Research Competition at ICSE 2012**, *selected to participate at the main competition at the ICSE conference with the research abstract: Petri Nets State Space Analysis in the Cloud.*

Publications

Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Distributed ctl model checking in the cloud. *CoRR*, abs/1310.6670, 2013.

Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Mardigras: Simplified building of reachability graphs on large clusters. In ParoshAziz Abdulla and Igor Potapov, editors, *Reachability Problems*, volume 8169 of *Lecture Notes in Computer Science*, pages 83–95. Springer Berlin Heidelberg, 2013.

Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Distributed ctl model checking using mapreduce: theory and practice. *Concurrency and Computation: Practice and Experience*, 2015.

Carlo Bellettini, Matteo Camilli, Lorenzo Capra, and Mattia Monga. Distributed ctl model checking using mapreduce: theory and practice. *Concurrency and Computation: Practice and Experience*, 28(11):3025–3041, 2016. cpe.3652.

Carlo Bellettini, Matteo Camilli, Mattia Monga, and Lorenzo Capra. Symbolic state space exploration of rt systems in the cloud. In *Proceedings of the 2012 14th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing*, SYNASC '12, 2012.

M. Camilli. Constructing Coverability Graphs for Time Basic Petri Nets. *ArXiv e-prints*, September 2014.

M. Camilli. Verification of Reachability Problems for Time Basic Petri Nets. *ArXiv e-prints*, September 2014.

Matteo Camilli. Petri nets state space analysis in the cloud. In *Software Engineering (ICSE), 2012 34th International Conference on*, pages 1638–1640, june 2012.

Matteo Camilli. Preserving co-location privacy in geo-social networks. *CoRR*, abs/1203.3946, 2012.

Matteo Camilli. Formal verification problems in a big data world: Towards a mighty synergy. In *Companion Proceedings of the 36th International Conference on Software Engineering*, ICSE Companion 2014, pages 638–641, New York, NY, USA, 2014. ACM.

Matteo Camilli, Carlo Bellettini, Lorenzo Capra, and Mattia Monga. Coverability analysis of time basic petri nets with non-urgent behavior. In *Symbolic and Numeric Algorithms for Scientific Computing*, SYNASC 2016, Los Alamitos, CA, USA, 2014. IEEE CS Press. To appear.

Matteo Camilli, Carlo Bellettini, Lorenzo Capra, and Mattia Monga. CTL model checking in the cloud using mapreduce. In *Symbolic and Numeric Algorithms for Scientific Computing*, SYNASC 2014, Los Alamitos, CA, USA, 2014. IEEE CS Press.

Matteo Camilli, Angelo Gargantini, and Patrizia Scandurra. Specifying and verifying real-time self-adaptive systems. In *Software Reliability Engineering (ISSRE), 2015 IEEE 26th International Symposium on*, pages 303–313, Nov 2015.