Curriculum Vitae

Michele Loreti

http://www.micheleloreti.com/

July 2019

1 Education

May 1997 *Laurea in Scienze dell'Informazione*, *summa cum laude*, l'Università degli studi di Roma "La Sapienza", Italy. Title of the thesis: *Esecuzione ed Analisi di Algebre di Processo tramite Reti di Petri*.

January 2002 *PhD* in *Mathematical Logic and Theoretical Computer Science*, Dipartimento di Matematica of Università di Siena. Title of the thesis: *Languages and Logics for Network Aware Programming*.

2 Academic Positions

2001-2002 PostDoc (Assegno di Ricerca), Dipartimento di Sistemi e Informatica, Università di Firenze

2012-2016 Visiting Professor at *IMT Institute for Advanced Studies*, Lucca.

From 1 November 2002, to 31 October 2017 Researcher (INF/01), Università di Firenze.

From 1 November 2017 Associate Professor (INF/01), Scuola di Scienze e Tecnologie, Universtà di Camerino.

3 Research interests

Michele Loreti's research activity is focused on the study of formal tools for specifying and verifying qualitative and quantitative properties of concurrent and distributed systems.

Qualitative and quantitative semantics of process calculi

Michele Loreti contributed to the definition of process specification languages introduced for modelling specific class of systems like service-oriented architectures (with the calculi SCC and CasPiS) and, more recently, autonomous and adaptive systems (SCEL and CARMA). These calculi are equipped with the appropriate linguistic constructs that permits modelling the specific aspects of the systems of interest. Michele Loreti also contributed to the definition of a unifying framework to provide the semantics of process algebras, including their quantitative variants useful for modeling quantitative aspects of behaviours. This framework, that has been used to defined the stochastic semantics of the above mentioned languages, has been the starting point for the definition of tools for supporting the quantitative analysis of systems. Moreover, thanks to the use of this general framework, a new class of behavioural equivalences have been introduced to support comparison of different (possible alternative) models of the same system.

Logics, tools and methodologies for system verification

To specify properties of concurrent and distributed systems it is useful to use the appropriate operators that simply the description of some class of properties. Michele Loreti contributed to the definition of MoMo, a modal logic specifically designed for dealing with resource management and mobility aspects of concurrent behaviours, and MoSL+, its stochastic variant, together with the appropriate algorithms for their model-checking. Subsequently, these logics have been adapted in order to describe properties of service-oriented systems. Moreover, they have been also used to specify and verify properties of distributed and adaptive systems. However, these systems typically consists of a large number of agents that interact with each other. Classical model-checking techniques, due to state space explosion, can not always be applied to this class of systems. For this reason, Michele Loreti worked on new methodologies based on statistical model-checking, mean-field analysis and on-the-fly technique have been proposed to analyse systems with a large number of agents. Finally, to capture at the logical level the interplay between process behaviour and spatial aspects of computation, Michele Loreti contributed to the definition of the appropriate logic where modalities describe neighbourhood and surroundings.

Development of tools for system analysis and deployment

Michele Loreti contributed to development of many tools that can be used to support qualitative and quantitative analysis of systems modelled via one of the process calculi described above. Among these tools we mention here TAPAs, jSAM and the CARMA Eclipse Plug-In. TAPAs, and its Eclipse version eTAPAs, provides tools for supporting specification and analysis of concurrent systems via Process Algebras. In TAPAs properties can be verified by checking equivalences between concrete and abstract system descriptions, or by model checking temporal formulae over the obtained LTS. jSAM is an Eclipse plugin integrating a set of tools for stochastic analysis of concurrent and distributed systems specified using process algebras. jSAM integrates a statistical model-checker, an on-the-fly model-checker and mean-field techniques to handle large scaled systems. Finally, CARMA Eclipse Plug-In supports specification and analysis of Collective Adaptive Systems in CARMA. This plug-in is based on an high-level specification language that simplifies the task of modelling for users who are unfamiliar with process algebra and similar formal notations.

To support deployment of systems modelled via process specification languages, it is crucial to have runtime environments implementing the linguistic constructs used to model and to reason about specific classes of systems. In this context, Michele Loreti contributed to the definition of IMC, a Java framework for implementing distributed applications possibly with code mobility. This framework has bee used to develop runtime environments for many calculi. Here we mention in particular, JCaspis, a Java framework that can be used to develop application based on CaSPis in Java. More recently, Michele Loreti developed jRESP, a framework that support programming simulating autonomic and adaptive systems according to the SCEL paradigm. This framework provides a large set of API that permit to represent behaviors, knowledge and aggregations according to specific policies, and to support programming context-awareness, self-awareness and adaptation.

Research Projects

Michele Loreti has been the coordinator of the project *Strumenti formali ed automatici di supporto alla programmazione di codice mobile* Funded by Università degli Studi di Firenze within the Young Researchers Initiative 2000. Moreover, he has contributed to the following national and international research projects:

1999-2001 Teoria della Concorrenza, Linguaggi di Ordine Superiore e Strutture di Tipi (TOSCA) MURST programma di ricerca di interesse nazionale

1999-2001 Software Architectures and Languages to coordinate Distributed Mobile Components (SALADIN) MURST programma di ricerca di interesse nazionale

2000-2001 Sistemi di assegnazione di tipo per analisi e verifica di programmi, Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni (CNR)

2000-2001 Strumenti formali ed automatici di supporto alla programmazione di codice mobile, Young Researcher Initiative, Università degli Studi di Firenze

2001-2003 Sistemi di assegnazione di tipo per analisi e verifica di programmi, (continuazione progetto 2000), Gruppo Nazionale per le Strutture Algebriche, Geometriche e le loro Applicazioni (CNR)

2001-2003 Models, Calculi and Languages for Network Aware Programming (NAPOLI) MURST programma di ricerca di interesse nazionale

2001-2003 Network Aware Programming and Interoperability (NAPI), Microsoft Research

2002-2005 Mobile Calculi based on Domains (MIKADO) Funded by EU proactive initiative FET-Global Computing (Contract IST-2001-32222)

2002-2005 Architectures for Mobility (AGILE) Funded by EU proactive initiative FET-Global Computing (Contract IST-2001-32747)

2005-2007 Fondamenti Logici dei Sistemi Distribuiti e Codice Mobile, MIUR Programma di Ricerca di Interesse Nazionale.

2005-2009 Software Engineering for Service-Oriented Overlay Computers (SENSORIA) Funded by the European Union as an Integrated Project in the 6th framework program as part of the Global Computing Initiative (Contract IST-2005-16004).

2008-2010 Performability-Aware Computing: Logiche, Modelli e Linguaggi (PaCo), MIUR Programma di Ricerca di Interesse Nazionale.

2010-2014 Autonomic Service-Component Ensembles (ASCENS), Funded by the European Union as an Integrated Project (IP) in 7th Framework Programme (FP7) and part of Future Emerging Technologies initiative (Contract 257414)

2013-2016 CINA: Composizionalità, Interazione, Negoziazione, Autonomicità per la società ICT futura. Programma di Ricerca di Interesse Nazionale, Funded by MIUR.

2013-2017 A Quantitative Approach to Management and Design of Collective and Adaptive Behaviours (QUANTICOL). Funded by European Union in FOCAS Initiative.

2019-2022 IT MATTERS: Methods and Tools for Trustworthy Smart Systems. Programma di Ricerca di Interesse Nazionale, Funded by MIUR (site leader).

4 Supervisions

From 2001 to 2017, Michele Loreti has been supervisor of more than 100 bachelor and master thesis (Computer Science degrees at University of Firenze: Laurea in Informatica, Laurea Magistrale in Informatica, Laurea Specialistica in Scienze e Tecnologia dell'Informazione, Laurea in Scienze dell'Informazione).

Michele Loreti supervised the following PhD students:

- Daniele Falassi (co-supervised with Rocco De Nicola)

- Francesco Calzolai
- Liliana D'Errico
- Yehia Abd Alrahman (co-supervised with Rocco De Nicola)

5 Teaching activities

List of taught courses in official courses of studies:

- Introduction to Computer Science (Master degrees at Università di Firenze, 1999-2003,2005-2006,2008-2011)
- Network Laboratory (Computer Science degrees at Università di Firenze, 2002-2005)
- Network Programming (Computer Science degrees at Università di Firenze, 2002-2008)
- Formal methods for Programming Languages (Computer Science degrees at Università di Firenze, , 2004-2009)
- Compilers (Computer Science degrees at Università di Firenze, 2009-2011)
- Ensemble-oriented programming of self-adaptive systems (PhD course at AWASS Summer School 2013, Lucca, Italy)
- Formal Methods (Computer Science degrees at Università di Firenze, 2012-2016)
- Networks (Computer Science degrees at Università di Firenze, 2012-2016)
- Introduction to Computer Programming and Programming Methodology (PhD course at IMT Lucca, 2012-2016)
- Principles of Model-checking (PhD course at Gran Sasso Science Institute, 2014-2016)
- Development of Distributed Applications with jRESP (*Bachelor Students* at DTU, 2016)

6 Other Activities

Michele loreti has been

- Member of *editorial board* of *The Journal of Logical and Algebraic Methods in Programming*, Elsevier
- Co-chair of *20th International Conference on Coordination Models and Languages* (COORDINATION 2018)
- Co-chair of *1st International Workshop on FORmal methods for the quantitative Evaluation* (FORECAST 2016)
- Co-chair of *15th Italian Conference on Theoretical Computer Science* (ICTCS 2015)
- Co-chair of *10th International Symposium on Trustworthy Global Computing* (TGC 2015)
- Co-Scientific director of Open Problems in Concurrency Theory (OPCT 2014)
- General Chair of 8th International Federated Conference on Distributed Computing Techniques (DisCoTec), Firenze from 3 to 6 of June 2013

- member of organizing committee of PLI (*Principles, Logics, and Implementations of high-level programming languages*), Firenze September 2001.
- member of program committees for:
  - *19th International Conference on Coordination Models and Languages* (COORDINATION 2017)
  - *14th International Workshop on Quantitative Aspects of Programming Languages and Systems* (QAPL 2016)
  - *26th Conference on Concurrency Theory* (CONCUR 2015)
  - *3nd IEEE International Workshop on Formal Methods Integration* (FMi 2015)
  - *8th International Conference on Performance Evaluation Methodologies and Tools* (ValueTools 2014)
  - *2nd IEEE International Workshop on Formal Methods Integration* (FMi 2014)
  - *16th International Conference on Coordination Models and Languages* (COORDINATION 2014)
  - *9th International Symposium on Trustworthy Global Computing* (TGC 2014)
  - *3rd Workshop On GRAPH Inspection and Traversal Engineering* (GRAPHITE 2014)
  - *7th International Conference on Performance Evaluation Methodologies and Tools* (ValueTools 2013)
  - *International Conference on Integrating Formal Methods* (2012, 2013)
  - *1st International Workshop on Formal Methods for Self-Adaptive Systems* (2012)
  - *7th European Performance Engineering Workshop* (2010)
  - *Workshop on Agent Based Computing* (2007, 2008, 2010,2011)
  - *Coordination Models, Languages and Architectures* of *Symposium on Applied Computing* (SAC'09 e SAC'10)
- reviewers of many international conferences and journals
- member of the following committee of Computer Science Program at Università di Firenze:
  - *Computer Laboratories*, devoted to the design, coordination and management of Computer Laboratories of the Computer Science Program;
  - *E-Learning and distance education*, devoted to the design of a distance degree program in Computer Science;
  - *Stages*, to coordinate relationships between students and business companies.
- member of the *Scientific Board* of PhD program in *Computer Science and Applications*, Dipartimento di Sistemi e Informatica, Università di Firenze,
- member of the *Board of Discipline* of Università di Firenze.

7 Publications

7.1 Journal Papers

2018 Nenzi, L., Bortolussi, L., Ciancia, V., Loreti, M., and Massink, M. Qualitative and quantitative monitoring of spatio-temporal properties with SSTL. *Logical Methods in Computer Science 14*, 4 (2018)

Ciancia, V., Gilmore, S., Grilletti, G., Latella, D., Loreti, M., and Massink, M. Spatio-temporal model checking of vehicular movement in public transport systems. *STTT 20*, 3 (2018), 289–311

Loreti, M. Replicated computations results (RCR) report for "mesoscopic modelling of pedestrian movement using carma and its tools". *ACM Trans. Model. Comput. Simul. 28*, 2 (2018), 12:1–12:3

2017 Lluch-Lafuente, A., Loreti, M., and Montanari, U. Asynchronous distributed execution of fixpoint-based computational fields. *Logical Methods in Computer Science 13*, 1 (2017)

2016 Ciancia, V., Latella, D., Loreti, M., and Massink, M. Model Checking Spatial Logics for Closure Spaces. *Logical Methods in Computer Science 12* (2016)

Chiti, F., Fantacci, R., Loreti, M., and Pugliese, R. Context-aware wireless mobile autonomic computing and communications: research trends and emerging applications. *IEEE Wireless Commun. 23*, 2 (2016), 86–92

2015 Bernardo, M., De Nicola, R., and Loreti, M. Revisiting bisimilarity and its modal logic for nondeterministic and probabilistic processes. *Acta Inf. 52*, 1 (2015), 61–106

Boreale, M., Bruni, R., De Nicola, R., and Loreti, M. CaSPiS: a calculus of sessions, pipelines and services. *Mathematical Structures in Computer Science 25*, 3 (2015), 666–709

Latella, D., Loreti, M., and Massink, M. On-the-fly PCTL fast mean-field approximated model-checking for self-organising coordination. *Sci. Comput. Program. 110* (2015), 23–50

2014 Bernardo, M., De Nicola, R., and Loreti, M. Revisiting Trace and Testing Equivalences for Nondeterministic and Probabilistic Processes. *Logical Methods in Computer Science 10*, 1 (2014), 1–16

Bernardo, M., Gebler, D., and Loreti, M. Report on OPCT 2014. *Bulletin of the EATCS 114* (2014)

De Nicola, R., Loreti, M., Pugliese, R., and Tiezzi, F. A formal approach to autonomic systems programming: The SCEL Language . *ACM Transactions on Autonomous and Adaptive Systems 9*, 2 (2014), 7:1–7:29

Bernardo, M., De Nicola, R., and Loreti, M. Relating strong behavioral equivalences for processes with nondeterminism and probabilities. *Theoretical Computer Science 546* (2014), 63–92

2013 De Nicola, R., Latella, D., Loreti, M., and Massink, M. A uniform definition of stochastic process calculi. *ACM Comput. Surv. 46*, 1 (2013), 5:1–5:35

Bernardo, M., De Nicola, R., and Loreti, M. A uniform framework for modeling nondeterministic, probabilistic, stochastic, or mixed processes and their behavioral equivalences. *Inf. Comput. 225*, 1 (2013), 29–82

2008 De Nicola, R., and Loreti, M. Modelling global computations with Klaim. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences 366*, 1881 (2008), 3737–3745

De Nicola, R., and Loreti, M. Multiple-Labelled Transition Systems for nominal calculi and their logics. *Mathematical Structures in Computer Science 18*, 1 (2008), 107–143

Calzolai, F., De Nicola, R., Loreti, M., and Tiezzi, F. TAPAs: A Tool for the Analysis of Process Algebras. *T. Petri Nets and Other Models of Concurrency 1* (2008), 54–70

2007 De Nicola, R., Katoen, P., Latella, D., Loreti, M., and Massink, M. Model checking mobile stochastic logic. *Theor. Comput. Sci. 382*, 1 (2007), 42–70

2006 Bettini, L., De Nicola, R., and Loreti, M. Implementing Mobile and Distributed Applications in X-Klaim. *Scalable Computing: Practice and Experience 7*, 4 (2006)

2004 Bettini, L., De Nicola, R., and Loreti, M. Formulae Meet Programs Over the Net: A Framework for Correct Network Aware Programming. *Autom. Softw. Eng. 11*, 3 (2004), 245–288

De Nicola, R., and Loreti, M. A modal logic for mobile agents. *ACM Trans. Comput. Log. 5*, 1 (2004), 79–128

7.2 Proceedings of Refereed Conferences

2019 De Nicola, R., Duong, T., and Loreti, M. ABEL - A domain specific framework for programming with attribute-based communication. In *Coordination Models and Languages - 21st IFIP WG 6.1 International Conference, COORDINATION 2019, Held as Part of the 14th International Federated Conference on Distributed Computing Techniques, DisCoTec 2019, Kongens Lyngby, Denmark, June 17-21, 2019, Proceedings* (2019), H. R. Nielson and E. Tuosto, Eds., vol. 11533 of *Lecture Notes in Computer Science*, Springer, pp. 111–128

Bennaceur, A., Ghezzi, C., Tei, K., Kehrer, T., Weyns, D., Calinescu, R., Dustdar, S., Hu, Z., Honiden, S., Ishikawa, F., Jin, Z., Kramer, J., Litoiu, M., Loreti, M., Moreno, G. A., Müller, H. A., Nenzi, L., Nuseibeh, B., Pasquale, L., Reisig, W., Schmidt, H., Tsigkanos, C., and Zhao, H. Modelling and analysing resilient cyber-physical systems. In *Proceedings of the 14th International Symposium on Software Engineering for Adaptive and Self-Managing Systems, SEAMS@ICSE 2019, Montreal, QC, Canada, May 25-31, 2019* (2019), M. Litoiu, S. Clarke, and K. Tei, Eds., ACM, pp. 70–76

Tsigkanos, C., Nenzi, L., Loreti, M., Garriga, M., Dustdar, S., and Ghezzi, C. Inferring analyzable models from trajectories of spatially-distributed internet of things. In *Proceedings of the 14th International Symposium on Software Engineering for Adaptive and Self-Managing Systems, SEAMS@ICSE 2019, Montreal, QC, Canada, May 25-31, 2019* (2019), M. Litoiu, S. Clarke, and K. Tei, Eds., ACM, pp. 100–106

2018 Vashti Galpin, Anastasis Georgoulas, M. L. A. V. Statistical model checking of carma models using multivesta: an advanced tutorial. In *Proceedings of WSC 2018* (2018), B. Johansson and S. Jain, Eds., IEEE, pp. 395–409

Alrahman, Y. A., De Nicola, R., Garbi, G., and Loreti, M. A distributed coordination infrastructure for attribute-based interaction. In *Formal Techniques for Distributed Objects, Components, and Systems - 38th IFIP WG 6.1 International Conference, FORTE 2018, Held as Part of the 13th International Federated Conference on Distributed Computing Techniques, DisCoTec 2018, Madrid, Spain, June 18-21, 2018, Proceedings* (2018), C. Baier and L. Caires, Eds., vol. 10854 of *Lecture Notes in Computer Science*, Springer, pp. 1–20

2017 Latella, D., Loreti, M., and Massink, M. Flyfast: A scalable approach to probabilistic model-checking based on mean-field approximation. In *ModelEd, TestEd, TrustEd - Essays Dedicated to Ed Brinksma on the Occasion of His 60th Birthday* (2017), J. Katoen, R. Langerak, and A. Rensink, Eds., vol. 10500 of *Lecture Notes in Computer Science*, Springer, pp. 254–275

Bartocci, E., Bortolussi, L., Loreti, M., and Nenzi, L. Monitoring mobile and spatially distributed cyber-physical systems. In *Proceedings of the 15th ACM-IEEE International Conference on Formal Methods and Models for System Design, MEMOCODE 2017, Vienna, Austria, September 29 - October 02, 2017* (2017), J. Talpin, P. Derler, and K. Schneider, Eds., ACM, pp. 146–155

Vissat, L. L., Loreti, M., Nenzi, L., Hillston, J., and Marion, G. Three-valued spatio-temporal logic: A further analysis on spatio-temporal properties of stochastic systems. In *Quantitative Evaluation of Systems - 14th International Conference, QEST 2017, Berlin, Germany, September 5-7, 2017, Proceedings* (2017), N. Bertrand and L. Bortolussi, Eds., vol. 10503 of *Lecture Notes in Computer Science*, Springer, pp. 317–332

Latella, D., Loreti, M., and Massink, M. Flyfast: A mean field model checker. In *Tools and Algorithms for the Construction and Analysis of Systems - 23rd International Conference, TACAS 2017, Held as Part of the European Joint Conferences on Theory and Practice of Software, ETAPS 2017, Uppsala, Sweden, April 22-29, 2017, Proceedings, Part II* (2017), A. Legay and T. Margaria, Eds., vol. 10206 of *Lecture Notes in Computer Science*, pp. 303–309

2016 Alrahman, Y. A., De Nicola, R., and Loreti, M. Programming of CAS Systems by Relying on Attribute-Based Communication. In *Leveraging Applications of Formal Methods, Verification and Validation: Foundational Techniques - 7th International Symposium, ISoLA 2016, Imperial, C* (2016), T. Margaria and B. Steffen, Eds., vol. 9952 of *Lecture Notes in Computer Science*, pp. 539–553

Alrahman, Y. A., De Nicola, R., and Loreti, M. On the Power of Attribute-Based Communication. In *Formal Techniques for Distributed Objects, Components, and Systems - 36th IFIP WG 6.1 International Conference, FORTE 2016* (2016), E. Albert and I. Lanese, Eds., vol. 9688 of *Lecture Notes in Computer Science*, Springer, pp. 1–18

Hillston, J., and Loreti, M. CARMA Eclipse Plug-in: A Tool Supporting Design and Analysis of Collective Adaptive Systems. In *Quantitative Evaluation of Systems - 13th International Conference, QEST 2016, Quebec City, QC, Canada, August 23-25, 2016, Proceedings* (2016), G. Agha and B. V. Houdt, Eds., vol. 9826 of *Lecture Notes in Computer Science*, Springer, pp. 167–171

Loreti, M., and Hillston, J. Modelling and Analysis of Collective Adaptive Systems with CARMA and its Tools. In *Formal Methods for the Quantitative Evaluation of Collective Adaptive Systems - 16th International School on Formal Methods for the Design of Computer* (2016), M. Bernardo, R. D. Nicola, and J. Hillston, Eds., vol. 9700 of *Lecture Notes in Computer Science*, Springer, pp. 83–119

Ciancia, V., Latella, D., Loreti, M., and Massink, M. Spatial Logic and Spatial Model Checking for Closure Spaces. In *Formal Methods for the Quantitative Evaluation of Collective Adaptive Systems - 16th International School on Formal Methods for the Design of Computer* (2016), M. Bernardo, R. D. Nicola, and J. Hillston, Eds., vol. 9700 of *Lecture Notes in Computer Science*, Springer, pp. 156–201

2015 Latella, D., Loreti, M., Massink, M., and Senni, V. On StocS: A Stochastic Extension of SCEL. In *Software, Services, and Systems - Essays Dedicated to Martin Wirsing on the Occasion of His Retirement from the Chair of Programming and Software Engi* (2015), R. D. Nicola and R. Hennicker, Eds., vol. 8950 of *Lecture Notes in Computer Science*, Springer, pp. 619–640

Latella, D., Loreti, M., and Massink, M. Investigating Fluid-Flow Semantics of Asynchronous Tuple-Based Process Languages for Collective Adaptive Systems. In *Coordination Models and Languages - 17th IFIP WG 6.1 International Conference, COORDINATION 2015, Held as Part of the 10th International Federated Con* (2015), T. Holvoet and M. Viroli, Eds., vol. 9037 of *Lecture Notes in Computer Science*, Springer, pp. 19–34

Lluch-Lafuente, A., Loreti, M., and Montanari, U. A Fixpoint-Based Calculus for Graph-Shaped Computational Fields. In *Coordination Models and Languages - 17th IFIP WG 6.1 International Conference, COORDINATION 2015, Held as Part of the 10th International Federated Con* (2015), T. Holvoet and M. Viroli, Eds., vol. 9037 of *Lecture Notes in Computer Science*, Springer, pp. 101–116
(**Best paper at DisCoTec 2015**)

Latella, D., Loreti, M., and Massink, M. On-the-fly Fluid Model Checking via Discrete Time Population Models. In *Computer Performance Engineering - 12th European Workshop, EPEW 2015, Madrid, Spain, August 31 - September 1, 2015, Proceedings* (2015), M. Beltrán, W. J. Knottenbelt, and J. T. Bradley, Eds., vol. 9272 of *Lecture Notes in Computer Science*, Springer, pp. 193–207

Nenzi, L., Bortolussi, L., Ciancia, V., Loreti, M., and Massink, M. Qualitative and Quantitative Monitoring of Spatio-Temporal Properties. In *Runtime Verification - 6th International Conference, RV 2015 Vienna, Austria, September 22-25, 2015. Proceedings* (2015), E. Bartocci and R. Majumdar, Eds., vol. 9333 of *Lecture Notes in Computer Science*, Springer, pp. 21–37

Alrahman, Y. A., De Nicola, R., Loreti, M., Tiezzi, F., and Vigo, R. A calculus for attribute-based communication. In *Proceedings of the 30th Annual ACM Symposium on Applied Computing, Salamanca, Spain, April 13-17, 2015* (2015), R. L. Wainwright, J. M. Corchado, A. Bechini, and J. Hong, Eds., ACM, pp. 1840–1845

Abeywickrama, D. B., Serbedzija, N. B., and Loreti, M. Monitoring and visualizing adaptation of autonomic systems at runtime. In *Proceedings of the 30th Annual ACM Symposium on Applied Computing, Salamanca, Spain, April 13-17, 2015* (2015), R. L. Wainwright, J. M. Corchado, A. Bechini, and J. Hong, Eds., ACM, pp. 1857–1860

Ciancia, V., Grilletti, G., Latella, D., Loreti, M., and Massink, M. An Experimental Spatio-Temporal Model Checker. In *Software Engineering and Formal Methods - SEFM 2015 Collocated Workshops: ATSE, HOFM, MoKMaSD, and VERY*SCART, York, UK, September 7-8, 2015, Revised* (2015), D. Bianculli, R. Calinescu, and B. Rumpe, Eds., vol. 9509 of *Lecture Notes in Computer Science*, Springer, pp. 297–311

Bortolussi, L., De Nicola, R., Galpin, V., Gilmore, S., Hillston, J., Latella, D., Loreti, M., and Massink, M. CARMA: Collective Adaptive Resource-sharing Markovian Agents. In *Proceedings Thirteenth Workshop on Quantitative Aspects of Programming Languages and Systems, QAPL 2015, London, UK, 11th-12th April 2015.* (2015), N. Bertrand and M. Tribastone, Eds., vol. 194 of *EPTCS*, pp. 16–31

2014 Hillston, J., and Loreti, M. Specification and Analysis of Open-Ended Systems with CARMA. In *Agent Environments for Multi-Agent Systems IV - 4th International Workshop, E4MAS 2014 - 10 Years Later, Paris, France, May 6, 2014, Revised Selected* (2014), D. Weyns and F. Michel, Eds., vol. 9068 of *Lecture Notes in Computer Science*, Springer, pp. 95–116

De Nicola, R., Loreti, M., Morichetta, A., Pugliese, R., Senni, V., Tiezzi, F., and Alberto, L.-L. Programming and Verifying Component Ensembles. In *From Programs to Systems. The Systems perspective in Computing - ETAPS Workshop, FPS 2014, in Honor of Joseph Sifakis.* (2014), S. Bensalem, Y. Lakhnech, and A. Legay, Eds., vol. 8415 of *Lecture Notes in Computer Science*, Springer, pp. 69–83

Latella, D., Loreti, M., Massink, M., and Ciancia, V. Specifying and Verifying Properties of Space. In *Theoretical Computer Science - 8th IFIP TC 1/WG 2.2 International Conference, TCS 2014, Rome, Italy, September 1-3, 2014. Proceed* (2014), J. Díaz, I. Lanese, and D. Sangiorgi, Eds., vol. 8705 of *Lecture Notes in Computer Science*, Springer, pp. 222–235

Loreti, M., Margheri, A., Pugliese, R., and Tiezzi, F. On Programming and Policing Autonomic Computing Systems. In *Leveraging Applications of Formal Methods, Verification and Validation. Technologies for Mastering Change - 6th International Symposium, ISoLA 2014, P* (2014), T. Margaria and B. Steffen, Eds., vol. 8802 of *Lecture Notes in Computer Science*, Springer, pp. 164–183

Ciancia, V., Gilmore, S., Latella, D., Loreti, M., and Massink, M. Data Verification for Collective Adaptive Systems: Spatial Model-Checking of Vehicle Location Data. In *Eighth IEEE International Conference on Self-Adaptive and Self-Organizing Systems Workshops, SASOW 2014, London, United Kingdom, September 8-12, 2014* (2014), IEEE Computer Society, pp. 32–37

Latella, D., Loreti, M., Massink, M., and Senni, V. Stochastically timed predicate-based communication primitives for autonomic computing. In *Proceedings of 12th Quantitative Aspects of Programming Languages and Systems (QAPL)* (2014), N. Bertrand and L. Bortolussi, Eds., vol. 154 of *Electronic Proceedings in Theoretical Computer Science*, Open Publishing Association, pp. 1–16

Latella, D., Loreti, M., and Massink, M. On-the-fly Probabilistic Model Checking. In *Proc. of 7th Interaction and Concurrency Experience* (2014), I. Lanese, A. L. Lafuente, A. Sokolova, and H. Vieira, Eds., Electronic Proceedings in Theoretical Computer Science, p. To appear

Latella, D., Loreti, M., and Massink, M. On-the-fly Fast Mean-Field Model-Checking. In *Trustworthy Global Computing*, M. Abadi and A. L. Lafuente, Eds., Lecture Notes in Computer Science. Springer International Publishing, 2014, pp. 297–314

Bernardo, M., De Nicola, R., and Loreti, M. Group-by-Group Probabilistic Bisimilarities and Their Logical Characterizations. In *Trustworthy Global Computing*, M. Abadi and A. L. Lafuente, Eds., Lecture Notes in Computer Science. Springer International Publishing, 2014, pp. 315–330

2013 Bernardo, M., De Nicola, R., and Loreti, M. The Spectrum of Strong Behavioral Equivalences for Nondeterministic and Probabilistic Processes. In *Proceedings 11th International Workshop on Quantitative Aspects of Programming Languages and Systems, QAPL 2013* (2013), L. Bortolussi and H. Wiklicky, Eds., vol. 117 of *Electronic Proceedings in Theoretical Computer Science*, pp. 81–96

De Nicola, R., Ferrari, G. L., Loreti, M., and Pugliese, R. A Language-Based Approach to Autonomic Computing. In *Formal Methods for Components and Objects, 10th International Symposium, FMCO 2011* (2013), B. Beckert, F. Damiani, F. S. de Boer, and M. M. Bonsangue, Eds., vol. 7542 of *Lecture Notes in Computer Science*, Springer, pp. 25–48

2012 Bernardo, M., De Nicola, R., and Loreti, M. Revisiting Trace and Testing Equivalences for Nondeterministic and Probabilistic Processes. In *Foundations of Software Science and Computational Structures - 15th International Conference, FOSSACS 2012* (2012), L. Birkedal, Ed., vol. 7213 of *Lecture Notes in Computer Science*, Springer, pp. 195–209

Gjondrekaj, E., Loreti, M., Pugliese, R., Tiezzi, F., Pinciroli, C., Brambilla, M., Birattari, M., and Dorigo, M. Towards a Formal Verification Methodology for Collective Robotic Systems. In *Formal Methods and Software Engineering - 14th International Conference on Formal Engineering Methods, ICFEM 2012* (2012), T. Aoki and K. Taguchi, Eds., vol. 7635 of *Lecture Notes in Computer Science*, Springer, pp. 54–70

Gjondrekaj, E., Loreti, M., Pugliese, R., and Tiezzi, F. Modeling adaptation with a tuple-based coordination language. In *Proceedings of the ACM Symposium on Applied Computing, SAC 2012* (2012), S. Ossowski and P. Lecca, Eds., ACM, pp. 1522–1527

2011 D'Errico, L., and Loreti, M. Context Aware Specification and Verification of Distributed Systems. In *Trustworthy Global Computing - 6th International Symposium, TGC 2011* (2011), R. Bruni and V. Sassone, Eds., vol. 7173 of *Lecture Notes in Computer Science*, Springer, pp. 142–159

Bernardo, M., De Nicola, R., and Loreti, M. Uniform Labeled Transition Systems for Nondeterministic, Probabilistic, and Stochastic Process Calculi. In *Proceedings First International Workshop on Process Algebra and Coordination, PACO 2011* (2011), L. Aceto and M. R. Mousavi, Eds., vol. 60 of *Electronic Proceedings in Theoretical Computer Science*, pp. 66–75

2010 Calzolai, F., and Loreti, M. Simulation and Analysis of Distributed Systems in Klaim. In *Coordination Models and Languages, 12th International Conference, COORDINATION 2010* (2010), D. Clarke and G. A. Agha, Eds., vol. 6116 of *Lecture Notes in Computer Science*, Springer, pp. 122–136

Bernardo, M., De Nicola, R., and Loreti, M. Uniform Labeled Transition Systems for Nondeterministic, Probabilistic, and Stochastic Processes. In *Trustworthly Global Computing - 5th International Symposium, TGC 2010* (2010), M. Wirsing, M. Hofmann, and A. Rauschmayer, Eds., vol. 6084 of *Lecture Notes in Computer Science*, Springer, pp. 35–56

D'Errico, L., and Loreti, M. Property-Preserving Refinement of Concurrent Systems. In *Trustworthly Global Computing - 5th International Symposium, TGC 2010* (2010), M. Wirsing, M. Hofmann, and A. Rauschmayer, Eds., vol. 6084 of *Lecture Notes in Computer Science*, Springer, pp. 222–236

2009 D'Errico, L., and Loreti, M. Assume-Guarantee Verification of Concurrent Systems. In *Coordination Models and Languages, 11th International Conference, COORDINATION 2009* (2009), J. Field and V. T. Vasconcelos, Eds., vol. 5521 of *Lecture Notes in Computer Science*, Springer, pp. 288–305

D'Errico, L., and Loreti, M. A process Algebra Approach to Fuzzy Reasoning. In *Proceedings of the Joint 2009 International Fuzzy Systems Association World Congress and 2009 European Society of Fuzzy Logic and Technology Conferenc* (2009), J. ao Paulo Carvalho, D. Dubois, U. Kaymak, and J. ao Miguel da Costa Sousa, Eds., pp. 1136–1141

De Nicola, R., Latella, D., Loreti, M., and Massink, M. On a Uniform Framework for the Definition of Stochastic Process Languages. In *Formal Methods for Industrial Critical Systems, 14th International Workshop, FMICS 2009* (2009), M. Alpuente, B. Cook, and C. Joubert, Eds., vol. 5825 of *Lecture Notes in Computer Science*, Springer, pp. 9–25

De Nicola, R., Latella, D., Loreti, M., and Massink, M. Rate-Based Transition Systems for Stochastic Process Calculi. In *ICALP (2)* (2009), S. Albers, A. Marchetti-Spaccamela, Y. Matias, S. E. Nikoletseas, and W. Thomas, Eds., vol. 5556 of *Lecture Notes in Computer Science*, Springer, pp. 435–446

2008 Bettini, L., De Nicola, R., and Loreti, M. Implementing Session Centered Calculi. In *Coordination Models and Languages, 10th International Conference, COORDINATION 2008* (2008), D. Lea and G. Zavattaro, Eds., vol. 5052 of *Lecture Notes in Computer Science*, Springer, pp. 17–32

Boreale, M., Bruni, R., De Nicola, R., and Loreti, M. Sessions and Pipelines for Structured Service Programming. In *Formal Methods for Open Object-Based Distributed Systems, 10th IFIP WG 6.1 International Conference, FMOODS 2008* (2008), G. Barthe and F. S. de Boer, Eds., vol. 5051 of *Lecture Notes in Computer Science*, Springer, pp. 19–38

Massink, M., Latella, D., Beek, M. H. t., Harrison, M. D., and Loreti, M. A Fluid Flow Approach to Usability Analysis of Multi-user Systems. In *Engineering Interactive Systems, Second Conference on Human-Centered Software Engineering, HCSE 2008, and 7th International Workshop on Task Models an* (2008), P. Forbrig and F. Paternò, Eds., vol. 5247 of *Lecture Notes in Computer Science*, Springer, pp. 166–180

Bravetti, M., Latella, D., Loreti, M., Massink, M., and Zavattaro, G. Combining Timed Coordination Primitives and Probabilistic Tuple Spaces. In *TGC* (2008), C. Kaklamanis and F. Nielson, Eds., vol. 5474 of *Lecture Notes in Computer Science*, Springer, pp. 52–68

Bruni, R., De Nicola, R., Loreti, M., and Mezzina, L. G. Provably Correct Implementations of Services. In *Trustworthy Global Computing, 4th International Symposium, TGC 2008* (2008), C. Kaklamanis and F. Nielson, Eds., vol. 5474 of *Lecture Notes in Computer Science*, Springer, pp. 69–86

2007 D'Errico, L., and Loreti, M. Modeling Fuzzy Behaviours in Concurrent Systems. In *Theoretical Computer Science, 10th Italian Conference, ICTCS 2007* (2007), G. F. Italiano, E. Moggi, and L. Laura, Eds., World Scientific, pp. 94–105

Manganaro, A., Koblensky, M., and Loreti, M. Design of a Password-based Authentication Method for Wireless Networks. In *WINSYS 2007 - Proceedings of the International Conference on Wireless Information Networks and Systems* (2007), M. S. Obaidat, V. P. Lecha, and R. F. S. Caldeirinha, Eds., INSTICC Press, pp. 9–16

2006 Crescenzi, P., Loreti, M., and Pugliese, R. Assessing CS1 java skills: a three-year experience. In *Proceedings of the 11th Annual SIGCSE Conference on Innovation and Technology in Computer Science Education, ITiCSE 2006* (2006), R. Davoli, M. Goldweber, and P. Salomoni, Eds., ACM Press, p. 348

Boreale, M., Bruni, R., Caires, L., De Nicola, R., Lanese, I., Loreti, M., Martins, F., Montanari, U., Ravara, A., Sangiorgi, D., Vasconcelos, V. T., and Zavattaro, G. SCC: A Service Centered Calculus. In *Web Services and Formal Methods, Third International Workshop WS-FM 2006* (2006), M. Bravetti, M. N. nez, and G. Zavattaro, Eds., vol. 4184 of *Lecture Notes in Computer Science*, Springer, pp. 38–57

2005 Bettini, L., De Nicola, R., Falassi, D., Lacoste, M., and Loreti, M. A Flexible and Modular Framework for Implementing Infrastructures for Global Computing. In *Distributed Applications and Interoperable Systems, 5th IFIP WG 6.1 International Conference, DAIS 2005* (2005), L. Kutvonen and N. Alonistioti, Eds., vol. 3543 of *Lecture Notes in Computer Science*, Springer, pp. 181–193

De Nicola, R., and Loreti, M. MoMo: A Modal Logic for Reasoning About Mobility. In *Formal Methods for Components and Objects, Third International Symposium, FMCO 2004* (2004), F. S. de Boer, M. M. Bonsangue, S. Graf, and W. P. de Roever, Eds., vol. 3657 of *Lecture Notes in Computer Science*, Springer, pp. 95–119

2004 Bettini, L., Crescenzi, P., Innocenti, G., Loreti, M., and Cecchi, L. An Environment for Self-Assessing Java Programming Skills in Undergraduate First Programming Courses. In *Proceedings of the IEEE International Conference on Advanced Learning Technologies, ICALT 2004* (2004), Kinshuk, K. Looi, E. Sutinen, D. G. Sampson, I. Aedo, L. Uden, and E. Kähkönen, Eds., IEEE Computer Society

Bettini, L., Bono, V., De Nicola, R., Ferrari, G. L., Gorla, D., Loreti, M., Moggi, E., Pugliese, R., Tuosto, E., and Venneri, B. The Klaim Project: Theory and Practice. In *Global Computing. Programming Environments, Languages, Security, and Analysis of Systems, IST/FET International Workshop, GC 2003* (2003), C. Priami, Ed., vol. 2874, Springer, pp. 88–150

2003 Bettini, L., De Nicola, R., and Loreti, M. Formalizing Properties of Mobile Agent Systems. In *COORDINATION* (2002), F. Arbab and C. L. Talcott, Eds., vol. 2315 of *Lecture Notes in Computer Science*, Springer, pp. 72–87

2002 Bettini, L., De Nicola, R., and Loreti, M. Software update via mobile agent based programming. In *Proceedings of the 2002 ACM Symposium on Applied Computing (SAC)* (2002), ACM Press, pp. 32–36

Bettini, L., Loreti, M., and Pugliese, R. An infrastructure language for open nets. In *Proceedings of the 2002 ACM Symposium on Applied Computing (SAC)* (2002), ACM Press, pp. 373–377

Andrade, L. F., Baldan, P., Baumeister, H., Bruni, R., Corradini, A., De Nicola, R., Fiadeiro, J. L., Gadducci, F., Gnesi, S., Hoffman, P., Koch, N., Kosiuczenko, P., Lapadula, A., Latella, D., Lopes, A., Loreti, M., Massink, M., Mazzanti, F., Montanari, U., Oliveira, C. a., Pugliese, R., Tarlecki, A., Wermelinger, M., Wirsing, M., and Zawlocki, A. AGILE: Software Architecture for Mobility. In *Recent Trends in Algebraic Development Techniques, 16th International Workshop, WADT 2002* (2002), M. Wirsing, D. Pattinson, and R. Hennicker, Eds., vol. 2755, pp. 1–33

2000 De Nicola, R., and Loreti, M. A Modal Logic for KLAIM. In *Algebraic Methodology and Software Technology. 8th International Conference, AMAST 2000* (2000), T. Rus, Ed., vol. 1816 of *Lecture Notes in Computer Science*, Springer, pp. 339–354

Bettini, L., Loreti, M., and Pugliese, R. Structured Nets in KLAIM. In *Applied Computing 2000, Proceedings of the 2000 ACM Symposium on Applied Computing* (2000), vol. 1, ACM Press, pp. 174–180

7.3 Proceedings on Electronic Journals

2009 De Nicola, R., Latella, D., Loreti, M., and Massink, M. MarCaSPiS: a Markovian Extension of a Calculus for Services. *Electr. Notes Theor. Comput. Sci. 229*, 4 (2009), 11–26

2007 Bettini, L., De Nicola, R., Falassi, D., and Loreti, M. Implementing a Distributed Mobile Calculus Using the IMC Framework. *Electr. Notes Theor. Comput. Sci. 181* (2007), 63–79

De Nicola, R., and Loreti, M. Multi Labelled Transition Systems: A Semantic Framework for Nominal Calculi. *Electr. Notes Theor. Comput. Sci. 169* (2007), 133–146

2001 Capitani, B., Loreti, M., and Venneri, B. Hyperformulae, Parallel Deductions and Intersection Types. *Electr. Notes Theor. Comput. Sci. 50*, 2 (2001), 178–195

Bettini, L., Loreti, M., and Pugliese, R. Modelling Node Connectivity in Dynamically Evolving Networks. *Electr. Notes Theor. Comput. Sci. 54* (2001), 81–91

7.4 Book Chapters

2015 De Nicola, R., Latella, D., Lluch-Lafuente, A., Loreti, M., Margheri, A., Massink, M., Morichetta, A., Pugliese, R., Tiezzi, F., and Vandin, A. The SCEL Language: Design, Implementation, Verification. In *Software Engineering for Collective Autonomic Systems - The ASCENS Approach*, M. Wirsing, M. M. Hölzl, N. Koch, and P. Mayer, Eds., vol. 8998 of *Lecture Notes in Computer Science*. Springer, 2015, pp. 3–71

Abeywickrama, D. B., Combaz, J., Horký, V., Keznikl, J., Kofron, J., Lluch-Lafuente, A., Loreti, M., Margheri, A., Mayer, P., Monreale, G. V., Montanari, U., Pinciroli, C., Tuma, P., Vandin, A., and Vassev, E. Tools for Ensemble Design and Runtime. In *Software Engineering for Collective Autonomic Systems - The ASCENS Approach*, M. Wirsing, M. M. Hölzl, N. Koch, and P. Mayer, Eds., vol. 8998 of *Lecture Notes in Computer Science*. Springer, 2015, pp. 429–448

De Nicola, R., Latella, D., Loreti, M., and Massink, M. *Quantitative Analysis of Distributed Systems in Stoklaim: A Tutorial*. John Wiley & Sons, 2015, pp. 27–55

2011 De Nicola, R., Latella, D., Loreti, M., and Massink, M. SoSL: A Service-Oriented Stochastic Logic. In *Results of the SENSORIA Project*, M. Wirsing and M. M. Hölzl, Eds., vol. 6582 of *Lecture Notes in Computer Science*. Springer, 2011, pp. 447–466

Cappello, I., Clark, A., Gilmore, S., Latella, D., Loreti, M., Quaglia, P., and Schivo, S. Quantitative Analysis of Services. In *Results of the SENSORIA Project*, M. Wirsing and M. M. Hölzl, Eds., vol. 6582 of *Lecture Notes in Computer Science*. Springer, 2011, pp. 522–540

Beek, M. H. t., Lapadula, A., Loreti, M., and Palasciano, C. Analysing Robot Movement Using the Sensoria Methods. In *Results of the SENSORIA Project*, M. Wirsing and M. M. Hölzl, Eds., vol. 6582 of *Lecture Notes in Computer Science*. Springer, 2011, pp. 678–697

7.5 Editor of Special Issues, Volumes and Proceedings

2019 Boreale, M., Corradini, F., Loreti, M., and Pugliese, R., Eds. *Models, Languages, and Tools for Concurrent and Distributed Programming - Essays Dedicated to Rocco De Nicola on the Occasion of His 65th Birthday* (2019), vol. 11665 of *Lecture Notes in Computer Science*, Springer

2018 ter Beek, M. H., and Loreti, M. Guest editorial for the special issue on formal methods for the quantitative evaluation of collective adaptive systems (FORECAST). *ACM Trans. Model. Comput. Simul. 28*, 2 (2018), 8:1–8:4

Serugendo, G. D. M., and Loreti, M., Eds. *Coordination Models and Languages - 20th IFIP WG 6.1 International Conference, COORDINATION 2018, Held as Part of the 13th International Federated Conference on Distributed Computing Techniques, DisCoTec 2018, Madrid, Spain, June 18-21, 2018. Proceedings* (2018), vol. 10852 of *Lecture Notes in Computer Science*, Springer

2016 ter Beek, M. H., and Loreti, M., Eds. *Proceedings of the Workshop on FORmal methods for the quantitative Evaluation of Collective Adaptive SysTems, FORECAST@STAF 2016, Vienna, Austria, 8 July 2016* (2016), vol. 217 of *EPTCS*

Crescenzi, P., and Loreti, M. Preface of Proceedings of ICTCS 2015. *Electr. Notes Theor. Comput. Sci. 322* (2016), 1–2

2015 Bernardo, M., Gebler, D., and Loreti, M. Editorial for the Special Issue on Open Problems in Concurrency Theory. *J. Log. Algebr. Meth. Program. 84*, 6 (2015), 731

Ganty, P., and Loreti, M., Eds. *Trustworthy Global Computing - 10th International Symposium, TGC 2015, Madrid, Spain, August 31 - September 1, 2015 Revised Selected Papers* (2016), vol. 9533 of *Lecture Notes in Computer Science*, Springer

8 Tools and Software

SAM: Stochastic Analyser for Mobility SAM is a command-line tool, developed in OCaML, that supports the stochastic analysis of mobile and distributed systems specified in StoKlaim. SAM can be used for: executing interactively specifications; simulating stochastic behaviours; model checking formulae of MoSL, a stochastic logic for mobility.

MarCaSPiS: Markovian CaSPiS SoSL-MC permits verifying whether a given MarCaSPiS specification satisfies or not a SoSL formula. The idea is to use an existing state-based stochastic model-checkers, the Markov Reward Model Checker (MRMC), and wrapping them in the SoSL model-checking algorithm. SoSL-MC, which is implemented in OCaML, permits analysing the execution of MarCaSPiS programs and generating their reachability graphs. Moreover, after loading a MarCaSPiS specification and a formula, it verifies, by means of one or more calls to MRMC, the satisfaction of the formula by the specification.

TAPAs: Tool for Process Algebra TAPAs is a tool that can be used to support the use of process algebrae to specify and analyze concurrent systems. Systems are described as process algebras terms that are then mapped to Labelled Transition Systems (LTSs). Properties can be verified by checking equivalences between concrete and abstract system descriptions, or by model checking temporal formulae over the obtained LTS. A key feature of TAPAs, that makes it particularly suited for teaching, is that it maintains a consistent double representation as term and as graph of each system. After a change in the graphic notation the updating is automatic, but when a modification concern of the textual notation the updating is on request.

JavaMM JavaMM is a tool that can be effectively used to support students in their first approach to the Java language, according to the philosophy of "structured programming before object oriented programming". Indeed, this environment allows the student to learn the basics of the Java language without necessarily knowing the object-oriented features of the language itself, and the teacher to propose new tests by making use of a graphical test editor.

IMC and JDpi IMC is a Java software framework for building infrastructures to support the development of applications for systems where mobility and network awareness are key issues. The framework is particularly useful to develop run-time support for languages oriented towards global computing. It enables platform designers to customize communication protocols and network architectures and guarantees transparency of name management and code mobility in distributed environments. IMC has been employed for developing a Java prototype implementation of a run-time system for the distributed Pi calculus, JDpi. JDpi is a Java framework that can be used to develop distributed applications following the paradigm introduced by the distributed π-calculus (Dπ in short). The framework provides Java classes to develop processes that can migrate between nodes and communicate over channel, with a semantics derived from Dπ.

jRESP jRESP is a runtime environment, developed in Java, that aims at providing programmers with a framework that permits developing autonomic and adaptive systems programmed in SCEL. SCEL is a process algebraic language that provides abstractions explicitly supporting autonomic computing systems in terms of *Behaviors*, *Knowledge* and *Aggregations*, according to specific *Policies*. jRESP provides a set of API that permits using the SCEL paradigm in Java programs. This allows programmers to experiment with SCEL primitives that are integrated in a standard and well known programming language.

Eclipse CARMA plug-in This is an Eclipse plug-in developed for supporting specification and analysis of CAS in CARMA. In this plug-in, CARMA systems are specified by using an appropriate high-level language for designers of CAS, named the CARMA Specification Language. This is mapped to the process algebra, and hence will enable qualitative and quantitive analysis of CAS during system development by enabling a design workflow and analysis pathway. The intention of this high-level language is not to add to the expressiveness of CARMA, which we believe to be well-suited to capturing the behaviour of CAS, but rather to ease the task of modelling for users who are unfamiliar with process algebra and similar formal notations.

jSSTL jSSTL is a Java tool for the specification and verification of SSTL. This tool, developed in Java, consists of a Java library (jSSTL API) and a front-end, integrated in ECLIPSE.