Ludovic Henrio
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69364 Lyon
France

Born: 27/08/1976 in St Etienne (France)

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## Education and Experience

2018-now Cash team - joint project INRIA/CNRS/LIP/Univ. de Lyon

2016-now Leader of the SCALE Project. COMRED team – CNRS/I3S/Univ. of Nice Sophia Antipolis

2014–2015 Scientific leader of the SCALE Team
joint project INRIA/CNRS/I3S/Univ. of Nice Sophia Antipolis

2012 *Habilitation à diriger des recherches* (HDR). Defended the 19th of July 2012
subject: *Formal Models for Programming and Composing Correct Distributed Systems.*
jury members: Gordon Blair (reviewer), pascal Poizat (reviewer), Davide Sangiorgi (reviewer), Fabienne Boyer, Michel Riveill, Alan Schmitt.

2005-2013 OASIS Team - joint project INRIA/CNRS/I3S/Univ. of Nice Sophia Antipolis

since 2005 **Associate Scientist at CNRS** – CR1 since 2009 (now CRCN)

2004 - 05
1 year Research fellow at the **University of Westminster**:
Teaching at Harrow School of Computer Science
Research in the "Distributed and High Performance Computing" department.
Keywords: components, Grid, non-functional aspects, reconfiguration.

2003 - 04
1 year Temporary teaching and Research assistant:
**Univ. of Nice Sophia-Antipolis** at ESSI (engineer school). Research in the OASIS team (INRIA/CNRS/I3S/Univ. of Nice Sophia Antipolis)

2001 - 03
3 years *Ph.D in Computer Science*: University of Nice Sophia-Antipolis
defended the 28th of November 2003 in Sophia Antipolis
Subject: *Asynchronous Object Calculus: Confluence and Determinacy*

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|---|---|---|
| Advisor: | Denis Caromel | UNSA, IUF |
| Co-advisor: | Bernard Paul Serpette | INRIA Sophia Antipolis |
| Reviewer: | Luca Cardelli | Microsoft research, Cambridge |
| | Ugo Montanari | Universita di Pisa |
| | Elie Najm | ENST, Paris |
| Jury members: | Gérard Boudol (president) | INRIA Sophia Antipolis |
| | Gilles Kahn | INRIA |

Keywords: Parallelism, concurrency, object calculus, confluence, distribution.

2000
5 months Research internship at **INRIA Sophia Antipolis** - OASIS project
Static analysis of Java Card Object Sharing.
keywords: Security, Java Card, static analysis, typing.

1999 - 00 *Master Degree in Computer Science*: "DEA: *Programming* : semantics proofs and languages". University of Paris 7.

1999 Research internship at INRIA Sophia Antipolis - OASIS team
4 months Interactive testing of Java Card Applications.
keywords: static analysis, Java Card, tests.

1996 - 99 *Polytechnique School*

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## 10 Selected Publications

- Nicolas Chappe, Ludovic Henrio, Amaury Maillé, Matthieu Moy, Hadrien Renaud An Optimised Flow for Futures: From Theory to Practice The Art, Science, and Engineering of Programming, 2022, Vol. 6, Issue 1, Article 3. 2021
- Kiko Fernandez-Reyes, Dave Clarke, Ludovic Henrio, Einar Broch Johnsen, and Tobias Wrigstad. Godot: All the Benefits of Implicit and Explicit Futures. In Alastair F. Donaldson, editor, *33rd European Conference on Object-Oriented Programming (ECOOP 2019)*, *Leibniz International Proceedings in Informatics (LIPIcs)*. Distinguished artefact.
- Frank De Boer, Vlad Serbanescu, Reiner Hähnle, Ludovic Henrio, Justine Rochas, Crystal Chang Din, Einar Broch Johnsen, Marjan Sirjani, Ehsan Khamespanah, Kiko Fernandez-Reyes, and Albert Mingkun Yang. A survey of active object languages. *ACM Comput. Surv.*, 50(5):76:1–76:39, October 2017.
- Behavioural semantics for asynchronous components. R. Ameur-Boulifa, L. Henrio, O. Kulankhina, E. Madelaine, A. Savu Journal of Logical and Algebraic Methods in Programming, Volume 89, June 2017.
- Françoise Baude, Ludovic Henrio, and Cristian Ruz. Programming distributed and adaptable autonomous components - the GCM/ProActive framework. *Software, Practice and Experience*, 2014.
- Francesco Bongiovanni and Ludovic Henrio. A mechanized model for CAN protocols. In *16th International Conference on Fundamental Approaches to Software Engineering (FASE'13)*, LNCS. Springer, 2013
- Ludovic Henrio, Fabrice Huet, and Zsolt István. Multi-threaded active objects. In *COORDINATION 2013*, June 2013.
- Denis Caromel, Ludovic Henrio, and Bernard P. Serpette. Asynchronous sequential processes. *Information and Computation*, 207(4):459–495, 2009.
- Denis Caromel and Ludovic Henrio. *A Theory of Distributed Objects*. Springer-Verlag, 2005.
- Denis Caromel, Ludovic Henrio, and Bernard Paul Serpette. Asynchronous and deterministic objects. In *Proceedings of the 31st ACM SIGACT-SIGPLAN symposium on Principles of programming languages (POPL)*, pages 123–134. ACM Press, 2004.

# List of Publications

Most of my papers are available on HAL. Note that in most of my papers authors are ordered alphabetically.

### ▶ Book:


[1] Denis Caromel and Ludovic Henrio. *A Theory of Distributed Objects*. Springer-Verlag, 2005.


### ▶ Book Chapters:


[2] Francoise Baude, Denis Caromel, Ludovic Henrio, and Paul Naoumenko. A flexible model and implementation of component controllers. In *Making Grids Work – Post-Proceedings Selected Papers From The Coregrid Workshop On Grid Programming Model, Grid And P2p Systems Architecture, Grid Systems, Tools And Environments, June 2007*, pages 31–43. Springer US, 2008. 10.1007/978-0-387-78448-9_3.

[3] Antonio Cansado, Denis Caromel, Ludovic Henrio, Eric Madelaine, Marcela Rivera, and Emil Salageanu. *The Common Component Modeling Example: Comparing Software Component Models*, volume 5153 of *Lecture Notes in Computer Science*, chapter A Specification Language for Distributed Components implemented in GCM/ProActive. Springer, 2008. `http://agrausch.informatik.uni-kl.de/CoCoME`.

[4] Maciej Malawski, Tomasz Gubala, Marek Kasztelnik, Tomasz Bartynski, Marian Bubak, Francoise Baude, and Ludovic Henrio. High-level scripting approach for building component-based applications on the grid. In *Making Grids Work – Post-Proceedings Selected Papers From The Coregrid Workshop On Grid Programming Model, Grid And P2p Systems Architecture, Grid Systems, Tools And Environments, June 2007*, pages 309–321. Springer US, 2008. 10.1007/978-0-387-78448-9_25.

[5] Maciej Malawski, Marian Bubak, Françoise Baude, Denis Caromel, Ludovic Henrio, and Matthieu Morel. Interoperability of grid component models: GCM and CCA case study. In Thierry Priol and Marco Vanneschi, editors, *Towards Next Generation Grids: Proceedings of the CoreGrid Symposium*, pages 95–105. Springer US, 2007. 10.1007/978-0-387-72498-0_9.


### ▶ Journals:


[6] Nicolas Chappe, Ludovic Henrio, Amaury Maillé, Matthieu Moy, and Hadrien Renaud. An Optimised Flow for Futures: From Theory to Practice. *The Art, Science, and Engineering of Programming*, 6(1):1–41, July 2021.

[7] Ludovic Henrio, Christoph Kessler, and Lu Li. Leveraging access mode declarations in a model for memory consistency in heterogeneous systems. *Journal of Logical and Algebraic Methods in Programming*, 110:100498, 2020.

[8] Ludovic Henrio and Justine Rochas. Multiactive objects and their applications. *Logical Methods in Computer Science*, Volume 13, Issue 4, November 2017.

[9] Frank De Boer, Vlad Serbanescu, Reiner Hähnle, Ludovic Henrio, Justine Rochas, Crystal Chang Din, Einar Broch Johnsen, Marjan Sirjani, Ehsan Khamespanah, Kiko Fernandez-Reyes, and Albert Mingkun Yang. A survey of active object languages. *ACM Comput. Surv.*, 50(5):76:1–76:39, October 2017.

[10] Frédéric Lemoine, Tatiana Aubonnet, Ludovic Henrio, Soumia Kessal, Eric Madelaine, and Noëmie Simoni. Monitoring as-a-service to drive more efficient future system design. *EAI Endorsed Transactions on Cloud Systems*, 3(9):1 – 15, June 2017.

[11] R. Ameur-Boulifa, L. Henrio, O. Kulankhina, E. Madelaine, and A. Savu. Behavioural semantics for asynchronous components. *Journal of Logical and Algebraic Methods in Programming*, 89:1 – 40, 2017.
[12] Matías Ibañez, Cristian Ruz, Ludovic Henrio, and Javier Bustos-Jiménez. Reconfigurable applications using gcmscript. *IEEE Cloud computing. Special issue: Autonomic clouds*, 2016.
[13] Tatiana Aubonnet, Ludovic Henrio, Soumia Kessal, Oleksandra Kulankhina, Frédéric Lemoine, Eric Madelaine, Cristian Ruz, and Noëmie Simoni. Management of service composition based on self-controlled components. *Journal of Internet Services and Applications*, 6(15):17, 2015.
[14] Françoise Baude, Ludovic Henrio, and Cristian Ruz. Programming distributed and adaptable autonomous components - the GCM/ProActive framework. *Software, Practice and Experience*, 2014.
[15] Ludovic Henrio, Florian Kammüller, and Bianca Lutz. ASPfun : A typed functional active object calculus. *Science of Computer Programming*, 77(7-8):823–847, July 2012.
[16] Françoise Baude, Virginie Legrand, Ludovic Henrio, Paul Naoumenko, Heiko Pfeffer, Louay Bassbouss, and David Linner. Mixing Workflows and Components to Support Evolving Services. *International Journal of Adaptive, Resilient and Autonomic Systems (IJARAS)*, 1(4):60–84, 2010.
[17] Tomás Barros, Rabéa Ameur-Boulifa, Antonio Cansado, Ludovic Henrio, and Eric Madelaine. Behavioural models for distributed fractal components. *Annales des Télécommunications*, 64(1-2):25–43, 2009.
[18] Françoise Baude, Denis Caromel, Cédric Dalmasso, Marco Danelutto, Vladimir Getov, Ludovic Henrio, and Christian Pérez. GCM: a grid extension to fractal for autonomous distributed components. *Annales des Télécommunications*, 64(1-2):5–24, 2009.
[19] Denis Caromel, Ludovic Henrio, and Bernard P. Serpette. Asynchronous sequential processes. *Inf. Comput.*, 207(4):459–495, 2009.
[20] Françoise Baude, Denis Caromel, Christian Delbé, and Ludovic Henrio. Un protocole de tolérance aux pannes pour objets actifs non préemptifs. *Technique et Science Informatiques*, 2006.
[21] Isabelle Attali, Denis Caromel, Carine Courbis, Ludovic Henrio, and Henrik Nilsson. An integrated development environment for Java Card. *Computer Networks*, 2001.

### ▶ Conferences and Workshops:

[22] Cinzia Giusto, Loïc Guizouarn, Ludovic Henrio, and Etienne Lozes. Formalising Futures and Promises in Viper. In Chantal Keller and Timothy Bourke, editors, *JFLA 2022 - 33èmes Journées Francophones des Langages Applicatifs*, pages 165–183, Saint-Médard-d'Excideuil, France, June 2022.
[23] Julien Emmanuel, Matthieu Moy, Ludovic Henrio, and Gregoire Pichon. S4BXI: the MPI-ready Portals 4 Simulator. In *MASCOTS 2021 - 29th IEEE International Symposium on the Modeling, Analysis, and Simulation of Computer and Telecommunication Systems*, pages 1–8, Houston, United States, November 2021. IEEE.
[24] Amaury Maillé, Ludovic Henrio, and Matthieu Moy. Promise Plus: Flexible Synchronization for Parallel Computations on Arrays. In *FSEN 2021 - 9th IPM International Conference on Fundamentals of Software Engineering*, pages 1–7, Tehran, Iran, May 2021.
[25] Julien Emmanuel, Matthieu Moy, Ludovic Henrio, and Gregoire Pichon. Simulation of the Portals 4 protocol, and case study on the BXI interconnect. In *HPCS 2020 - International Conference on High Performance Computing & Simulation*, pages 1–8, Barcelona, Spain, December 2020.
[26] Ludovic Henrio, Einar Broch Johnsen, and Violet Ka I. Pun. Active Objects with Deterministic Behaviour. In *Integrated Formal Methods. IFM 2020*, pages 181–198, Lugano, Switzerland, November 2020.
[27] Pierre Leca, Ludovic Henrio, Françoise Baude, and Wijnand Suijlen. Distributed futures for efficient data transfer between parallel processes. In *The 35th ACM/SIGAPP Symposium On Applied Computing*, Brno, Czech Republic, March 2020.

[28] Wolfgang Ahrendt, Ludovic Henrio, and Wytse Oortwijn. Who is to blame? runtime verification of distributed objects with active monitors. *Electronic Proceedings in Theoretical Computer Science*, 302:32?46, Aug 2019. Post-proceedings of VORTEX 2018.

[29] Simon Bliudze, Ludovic Henrio, and Eric Madelaine. Verification of concurrent design patterns with data. In Hanne Riis Nielson and Emilio Tuosto, editors, *COORDINATION 2019 - 21st International Conference on Coordination Models and Languages*, volume 11533 of *Lecture Notes in Computer Science*, pages 161–181, Copenhagen, Denmark, June 2019. Springer.

[30] Zeinab Ganjei, Ahmed Rezine, Ludovic Henrio, Petru Eles, and Zebo Peng, editors. *Tools and Algorithms for the Construction and Analysis of Systems - 24th International Conference, TACAS 2019, Prague, Czech Republic*, Lecture Notes in Computer Science. Springer, 2019.

[31] Kiko Fernandez-Reyes, Dave Clarke, Ludovic Henrio, Einar Broch Johnsen, and Tobias Wrigstad. Godot: All the Benefits of Implicit and Explicit Futures. In Alastair F. Donaldson, editor, *33rd European Conference on Object-Oriented Programming (ECOOP 2019)*, volume 134 of *Leibniz International Proceedings in Informatics (LIPIcs)*, pages 2:1–2:28, Dagstuhl, Germany, 2019. Schloss Dagstuhl–Leibniz-Zentrum fuer Informatik. Distinguished artefact.

[32] Ludovic Henrio, Christoph Kessler, and Lu Li. Ensuring memory consistency in heterogeneous systems based on access mode declarations. In Frédéric Loulergue and Jean-Michel Couvreur, editors, *5th International Symposium on Formal Approaches to Parallel and Distributed Systems, as part of The 16th International Conference on High Performance Computing & Simulation (HPCS 2018)*. IEEE, July 2018.

[33] Gaétan Hains, Ludovic Henrio, Pierre Leca, and Wijnand Suijlen. Active objects for coordinating BSP computations (short paper). In Giovanna Di Marzo Serugendo and Michele Loreti, editors, *20th IFIP WG 6.1 International Conference, COORDINATION 2018, Held as Part of the 13th International Federated Conference on Distributed Computing Techniques, DisCoTec 2018*, LNCS. IFIP International Federation for Information Processing, Springer, June 2018.

[34] Fabien Hermenier and Ludovic Henrio. Trustable Virtual Machine Scheduling in a Cloud. In *Proceedings of the 2017 Symposium on Cloud Computing. SoCC '17.*, page 12, Santa Clara, United States, September 2017.

[35] Ludovic Henrio, Cosimo Laneve, and Vincenzo Mastandrea. Analysis of synchronisations in stateful active objects. In Nadia Polikarpova and Steve Schneider, editors, *Integrated Formal Methods: 13th International Conference, IFM 2017, Turin, Italy, September 20-22, 2017, Proceedings*, pages 195–210, Cham, 2017. Springer International Publishing.

[36] Elena Giachino, Ludovic Henrio, Cosimo Laneve, and Vincenzo Mastandrea. Actors may synchronize, safely! In *PPDP 2016 18th International Symposium on Principles and Practice of Declarative Programming*, Edinburgh, United Kingdom, September 2016.

[37] Ludovic Henrio, Eric Madelaine, and Min Zhang. A theory for the composition of concurrent processes. In Elvira Albert and Ivan Lanese, editors, *FORTE 2016*, LNCS. IFIP International Federation for Information Processing, Springer, June 2016. 11th International Federated Conference on Distributed Computing Techniques, Heraklion, Greece. Extended version available at: `https://hal.archives-ouvertes.fr/hal-01299562`.

[38] Ludovic Henrio and Justine Rochas. From modelling to systematic deployment of distributed active objects. In Alberto Lluch Lafuente and José Proença, editors, *COORDINATION 2016*, LNCS. IFIP International Federation for Information Processing, Springer, June 2016. 11th International Federated Conference on Distributed Computing Techniques, Heraklion, Greece. Extended version available at: `https://hal.archives-ouvertes.fr/hal-01299817`.

[39] Ludovic Henrio, Oleksandra Kulankhina, and Eric Madelaine. Integrated environment for verifying and running distributed components. In *Proc. International Conference on Fundamental Approaches to Software Engineering (FASE 2016)*, LNCS. Springer, 2016. Extended version available at: `https://hal.archives-ouvertes.fr/hal-01252323`.

[40] Nuno Gaspar, Ludovic Henrio, and Eric Madelaine. Painless support for static and runtime verification of component-based applications. In *Fundamentals of Software Engineering (FSEN'2015)*, page 15, Teheran, Iran, April 2015.

[41] Ludovic Henrio, Eric Madelaine, and Min Zhang. pNets: an Expressive Model for Parameterised Networks of Processes. In *Formal Approaches to Parallel and Distributed Systems (4PAD)-Special Session of Parallel, Distributed and network-based Processing (PDP)*, Turku, Finland, 2015. Extended version available at: `https://hal.inria.fr/hal-01055091v2`.

[42] Ludovic Henrio, Oleksandra Kulankhina, Dongqian Liu, and Eric Madelaine. Verifying the correct composition of distributed components: Formalisation and Tool. In *International Workshop on the Foundations of Coordination Languages and Software Architecture*, Rome, September 2014.

[43] Ludovic Henrio and Justine Rochas. Declarative scheduling for active objects. In Sung Y. Shin, editor, *SAC 2014 - 29th Symposium On Applied Computing*, Gyeongju, March 2014. ACM Special Interest Group on Applied Computing, ACM.

[44] Gustavo Pabón and Ludovic Henrio. Self-configuration and self-optimization autonomic skeletons using events. In Pavan Balaji, Minyi Guo, and Zhiyi Huang, editors, *Proceedings of the 2014 PPOPP International Workshop on Programming Models and Applications for Multicores and Manycores, PMAM 2014, Orlando, Florida, USA, February 15, 2014*. ACM, 2014.

[45] Ludovic Henrio, Fabrice Huet, and Justine Rochas. An optimal broadcast algorithm for content-addressable networks. In *Principles of Distributed Systems, 17th International Conference, OPODIS 2013, Nice, France*, LNCS. Springer, December 2013.

[46] Nuno Gaspar, Ludovic Henrio, and Eric Madelaine. Formally Reasoning on a Reconfigurable Component-Based System — A Case Study for the Industrial World. In *The 10th International Symposium on Formal Aspects of Component Software*, Nanchang, China, October 2013.

[47] Nuno Gaspar, Ludovic Henrio, and Eric Madelaine. Bringing coq into the world of gcm distributed applications. In *International Symposium on High-level Parallel Programming and Applications, HLPP*, Paris, France, July 2013.

[48] Ludovic Henrio, Fabrice Huet, and Zsolt István. Multi-threaded active objects. In Christine Julien and Rocco De Nicola, editors, *COORDINATION 2013*, LNCS. IFIP International Federation for Information Processing, Springer, June 2013. 15th International Conference on Coordination Models and Languages, Florence, Italy.

[49] Francesco Bongiovanni and Ludovic Henrio. A mechanized model for can protocols. In *16th International Conference on Fundamental Approaches to Software Engineering (FASE'13)*, LNCS. Springer, 2013.

[50] Rabéa Ameur Boulifa, Raluca Halalai, Ludovic Henrio, and Eric Madelaine. Verifying safety of fault-tolerant distributed components. In *International Symposium on Formal Aspects of Component Software (FACS 2011)*, Lecture Notes in Computer Science, Oslo, Sept 2011. Springer.

[51] Ludovic Henrio, Fabrice Huet, Zsolt István, and Gheorghen Sebestyén. Adapting active objects to multicore architectures. In *ISPDC*. IEEE Computer Society, 2011.

[52] Ludovic Henrio, Muhammad Uzair Khan, Nadia Ranaldo, and Eugenio Zimeo. First class futures: Specification and implementation of update strategies. In *Post-Proceedings Selected Papers From The Coregrid Workshop On Grids, Clouds and P2P Computing August 31, 2010*, August 2010.

[53] Rabéa Ameur Boulifa, Ludovic Henrio, and Eric Madelaine. Behavioural models for group communications. In *WCSI-10: International Workshop on Component and Service Interoperability*, 2010.

[54] Ludovic Henrio, Florian Kammüller, and Muhammad Uzair Khan. A framework for reasoning on component composition. In *FMCO 2009*, Lecture Notes in Computer Science. Springer, 2010.

[55] Ludovic Henrio and Muhammad Uzair Khan. Asynchronous components with futures: Semantics and proofs in isabelle/hol. In *Proceedings of the Seventh International Workshop, FESCA 2010*. ENTCS, 2010.

[56] Mario Leyton, Ludovic Henrio, and José M. Piquer. Exceptions for algorithmic skeletons. In *16th Int. European Conference on Parallel and Distributed Computing (Euro-Par 2010)*, 2010.

[57] Boutheina Bannour, Ludovic Henrio, and Marcela Rivera. A reconfiguration framework for distributed components. In *SINTER Workshop Software Integration and Evolution @ Runtime*. ACM, 2009.

[58] Françoise Baude, Ludovic Henrio, and Paul Naoumenko. Structural reconfiguration: An autonomic strategy for gcm components. In *International Conference on Autonomic and Autonomous Systems*, pages 123–128, Los Alamitos, CA, USA, 2009. IEEE Computer Society.

[59] Ludovic Henrio and Florian Kammüller. Functional active objects: Typing and formalisation. In *Proceedings of the International Workshop on the Foundations of Coordination Languages and Software Architecture (FOCLASA)*. Elsevier, 2009.

[60] Ludovic Henrio, Florian Kammüller, and Marcela Rivera. An asynchronous distributed component model and its semantics. In Frank S. de Boer, Marcello M. Bonsangue, and Eric Madelaine, editors, *Formal Methods for Components and Objects, 7th International Symposium, FMCO 2008, Sophia Antipolis, France, October 21-23, 2008, Revised Lectures*, volume 5751 of *Lecture Notes in Computer Science*, pages 159–179. Springer, 2009.

[61] Antonio Cansado, Ludovic Henrio, and Eric Madelaine. Transparent first-class futures and distributed component. In *International Workshop on Formal Aspects of Component Software (FACS'08)*, Malaga, Sept 2008. Electronic Notes in Theoretical Computer Science (ENTCS).

[62] Antonio Cansado, Ludovic Henrio, and Eric Madelaine. Unifying architectural and behavioural specifications of distributed components. In *International Workshop on Formal Aspects of Component Software (FACS'08)*, Malaga, Sept 2008. Electronic Notes in Theoretical Computer Science (ENTCS).

[63] Denis Caromel, Ludovic Henrio, and Mario Leyton. Type safe algorithmic skeletons. In *Proceedings of the 16th Euromicro International Conference on Parallel, Distributed and network-based Processing*, Toulouse, France, February 2008.

[64] Denis Caromel, Ludovic Henrio, and Eric Madelaine. Active objects and distributed components: Theory and implementation. In Frank de Boer and Marcello Bonsangue, editors, *FMCO 2007*, number 5382 in LNCS, pages 179–199, Berlin Heidelberg, 2008. Springer-Verlag.

[65] Ludovic Henrio and Marcela Rivera. Stopping safely hierarchical distributed components: application to gcm. In *CBHPC '08: Proceedings of the 2008 compFrame/HPC-GECO workshop on Component based high performance*, pages 1–11, New York, NY, USA, 2008. ACM.

[66] Denis Caromel, Guillaume Chazarain, and Ludovic Henrio. Garbage collecting the grid: a complete dgc for activities. In *Proceedings of the 8th ACM/IFIP/USENIX International Middleware Conference*, Newport Beach, CA, November 2007.

[67] Françoise Baude, Ludovic Henrio, and Paul Naoumenko. A Component Platform for Experimenting with Autonomic Composition. In *First International Conference on Autonomic Computing and Communication Systems (Autonomics 2007). Invited Paper*. ACM Digital Library, Oct 2007.

[68] Ludovic Henrio and Florian Kammüller. A mechanized model of the theory of objects. In *9th IFIP International Conference on Formal Methods for Open Object-Based Distributed Systems (FMOODS)*, LNCS. Springer, June 2007.

[69] Françoise Baude, Denis Caromel, Ludovic Henrio, and Matthieu Morel. Collective interfaces for distributed components. In *CCGrid 2007: IEEE International Symposium on Cluster Computing and the Grid*, May 2007.

[70] Françoise Baude, Denis Caromel, Christian Delbé, and Ludovic Henrio. Promised messages: Recovering from inconsistent global states. In *ACM SIGOPS conference Principles and Practice of Parallel Programming (PPoPP). Poster*, 2007.

[71] Sébastien Bezinne, Virginie Galtier, Stéphane Vialle, Françoise Baude, Mireille Bossy, Viet-Dung Doan, and Ludovic Henrio. A fault tolerant and multi-paradigm grid architecture for time constrained problems. application to financial option pricing. In *2nd IEEE International Conference on e-Science and Grid Computing*. IEEE, December 2006.

[72] Denis Caromel and Ludovic Henrio. Asynchonous distributed components: Concurrency and determinacy. In *Proceedings of the IFIP International Conference on Theoretical Computer Science 2006 (IFIP TCS'06)*, Santiago, Chile,, August 2006. Springer Science. 19th IFIP World Computer Congress.

[73] Antonio Cansado, Ludovic Henrio, and Eric Madelaine. Towards real case component model-checking. In *5th Fractal Workshop*, Nantes, France, July 2006.

[74] Jeyarajan Thiyagalingam, Nikos Parlavantzas, Stavros Isaiadis, Ludovic Henrio, Denis Caromel, and Vladimir Getov. Proposal for a lightweight generic grid platform architecture. In *Proceedings of CompFrame 2006, Component and Framework Technology in High-Performance and Scientific Computing*, Paris, France, June 2006. IEEE.

[75] Alessandro Basso, Alexander Bolotov, Artie Basukoski, Vladimir Getov, Ludovic Henrio, and Mariusz Urbanski. Specification and verification of reconfiguration protocols in grid component systems. In *Proceedings of the 3rd IEEE Conference On Intelligent Systems IS-2006*. IEEE Computer Society, 2006. long version published as a CoreGRID Technical Report, TR-0042.

[76] Tomás Barros, Ludovic Henrio, and Eric Madelaine. Verification of distributed hierarchical components. In *International Workshop on Formal Aspects of Component Software (FACS'05)*, Macao, October 2005. Electronic Notes in Theoretical Computer Science (ENTCS).

[77] Isabelle Attali, Denis Caromel, Ludovic Henrio, and Felipe Luna Del Aguila. Secured information flow for asynchronous sequential processes. In *3rd International Workshop on Security Issues in Concurrency (SecCo'05)*, Electronic Notes in Theoretical Computer Science, San Francisco, USA, August 2005. Elsevier.

[78] Laurent Baduel, Françoise Baude, Denis Caromel, Ludovic Henrio, Fabrice Huet, Stéphane Lanteri, and Matthieu Morel. Grid components techniques: Composing, gathering, and scattering. In *Coupled Problems 2005, Computational Methods for Coupled Problems in Science and Engineering, an ECCOMAS Thematic Conference*, Santorini, Greece, may 2005.

[79] Tomás Barros, Ludovic Henrio, and Eric Madelaine. Behavioural models for hierarchical components. In *Proceedings of SPIN'05*. Spinger Verlag, 2005.

[80] Françoise Baude, Denis Caromel, Christian Delbé, and Ludovic Henrio. A Hybrid Message Logging-CIC Protocol for Constrained Checkpointability. In *Proc. of the 11th International Euro-Par Conference*, volume 3648 of *LNCS*. Springer-Verlag, 2005.

[81] Ludovic Henrio, Bernard Paul Serpette, and Szabolcs Szentes. Algorithmes et complexités de la réduction statique minimale. In *Actes des journées JFLA*, Sainte-Marie-de-Ré, France, January 2004.

[82] Denis Caromel, Ludovic Henrio, and Bernard Paul Serpette. Asynchronous and deterministic objects. In *Proceedings of the 31st ACM SIGACT-SIGPLAN symposium on Principles of programming languages (POPL)*, pages 123–134. ACM Press, 2004.

[83] Ludovic Henrio and Bernard Paul Serpette. A parameterized polyvariant Byte-Code verifier. In *Actes des journées JFLA*, Chamrousse, France, January 2003.

[84] Denis Caromel, Ludovic Henrio, and Bernard Serpette. Context inference for static analysis of java card object sharing. In *Proceedings e-Smart 2001*. Springer-Verlag, 2001.

[85] Isabelle Attali, Denis Caromel, Carine Courbis, Ludovic Henrio, and Henrik Nilsson. Smart Tools for Java Cards. In Josep Domingo-Ferrer, David Chan, and Anthony Watson, editors, *Smart Card Research and Advanced Applications*. Kluwer Academic Publishers, September 2000. Proceedings of the IFIP Fourth Working Conference on Smart Card Research and Advanced Applications (CARDIS 2000), HP Labs, Bristol, UK.

### ▶ Thesis and Habilitation thesis:

[86] Ludovic Henrio. *Formal Models for Programming and Composing Correct Distributed Systems*. PhD thesis, Université de Nice Sophia-Antipolis, July 2012. HDR Thesis.

[87] Ludovic Henrio. *Calcul d'Objets Asynchrones : Confluence et Déterminisme*. PhD thesis, Université de Nice Sophia-Antipolis, 2003. `http://www-sop.inria.fr/oasis/Ludovic.Henrio/these`.

### ▶ Research Reports:

[88] Rabea Ameur-Boulifa, Ludovic Henrio, and Eric Madelaine. Compositional equivalences based on open pNets. working paper or preprint, January 2021.

[89] Ludovic Henrio. Pourquoi créer des nouveaux langages de programmation ? *Interstices*, January 2019.

[90] Ludovic Henrio. Data-flow Explicit Futures. Research report, I3S, Université Côte d'Azur, April 2018.
[91] Ludovic Henrio and Justine Rochas. Multi-active Objects and their Applications (extended version). Research report, I3S, November 2017.
[92] Justine Rochas and Ludovic Henrio. A ProActive Backend for ABS: from Modelling to Deployment. Research Report RR-8596, INRIA, September 2014.
[93] Ludovic Henrio and Eric Madelaine. Behavioural verification of distributed components. preproceedings of ICE 2013, 2013.
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## Students and Teaching

### ▶ Advised PhD Students

- **Nicolas Chappe**: *"Toward a verified compilation infrastructure for concurrent programs: Non-sequential paradigms in Vellvm."* (From Sept 2021)
  **Scientific advisors:** Yannick Zakowski, Ludovic Henrio,
  **Summary:** This PhD thesis takes place in the context of a long term, ambitious research goal: developing at scale techniques and tools for the verified compilation of concurrent languages. We anchor in particular this objective around LLVM IR and the Vellvm project. The objective of this PhD thesis is geared toward laying the necessary foundations for this endeavor, and exploring some of its ramifications.
- **Julien Emmanuel**: *"Multi-precision modeling and simulation of supercomputer interconnection network."* (From Jan 2020)
  **Scientific advisors:** Matthieu Moy, Grégoire Pichon, Ludovic Henrio,
  **Summary:** This PhD thesis is a "Cifre" thesis in collaboration with Atos. The goal of this thesis is to improve communications in high-performance computing applications. This will be achieved through modeling the applications with the underlying NIC architecture, given a network topology, to detect hotspots and improve resource allocation and usage at the NIC level.
- **Amaury Maillé**: *"Programming model to assemble compute kernels safely and efficiently: Future-based synchronization for arrays and matrices"* (From Oct 2019)
  **Scientific advisors:** Ludovic Henrio, Matthieu Moy
  **Summary:** The objective of this PhD thesis is to design new coordination patterns between processes that allow the efficient execution of applications made of the assembly of several kernels with well defined data dependencies. The principle of the approach is to design new interaction patterns adapted to the transmission of big quantities of data typically stored in matrices.
- **Pierre Leca**: *"Distributed BSP: Active Objects for BSPlib programs"* (From Aug 2017)
  **PhD advisors:** Ludovic Henrio and Gaétan Hains
  **Scientific advisor:** Gaétan Hains, Ludovic Henrio, and Wijnand Suijlen
  **Summary:** This PhD thesis is a "Cifre" thesis in collaboration with Huawei technologies, Distributed and Parallel Computing Team. The goal of this PhD thesis is to bring some of the asynchronous features of actor programming into the BSP model to increase its efficiency in a distrubted setting while retaining most of the nice properties of the BSP model.
- **Vincenzo Mastandrea**: *"Deadlock analysis for concurrent and distributed programming"* (Oct 2014 – Dec 2017).
  **PhD advisors:** Ludovic Henrio and Cosimo Laneve
  **Scientific advisor:** Elena Giachino, Ludovic Henrio, and Cosimo Laneve
  **Summary:** This thesis contribute to the formal model of multi-active objects and to their practical implementation. In particular, we will provide tools for the static analysis of deadlocks.While several works already focus on the safe design of distributed applications, those works are not massively adopted in practice. The main originality of our approach is twofold. First we rely on a programming model that enforces a strong separation between remote entities. This helps us for automatically inferring behavioral types for those entities and makes our analysis more

compositional, more scalable, and thus better adapted to real applications. Second, the design of our language is mainly driven by the efficiency of program execution, by the expressiveness of the model, and by the easiness of writing distributed applications.

- **Justine Rochas**: *"Execution Support for Multi-threaded Active Objects: Design and Implementation"* (2013 – 2016).
  **PhD advisors:** Ludovic Henrio
  **Scientific advisor:** Ludovic Henrio
  **Summary:** To tackle the development of concurrent and distributed systems, the active object programming model promotes execution safety and portability of the applications that are developed with it. Active objects allow the programmer to focus on the business of concurrent entities, and let the programming model handle asynchronous interactions. In this thesis, we focus on the challenges of having multiple threads inside an active object, and how to safely schedule them for executing the tasks of an active object. We enhance the model with programming language constructs for coordination, that allow us to simulate various active object languages and frameworks. Overall, we design a flexible programming model and framework for the development of distributed and highly concurrent applications, and we provide it with a thorough support for distributed execution. We reinforce our programming model by formalising our work, thus exposing the execution guarantees that it provides. Finally, we develop a peer-to-peer application that shows multi-threaded active objects and their features in action.

- **Oleksandra Kulankhina**: *"A framework for rigorous development of distributed components: formalisation and tool"* (2013 – 2016).
  **PhD advisors:** Eric Madelaine
  **Scientific advisor:** Eric Madelaine and Ludovic Henrio
  **Summary:** We introduce an approach for rigorous design and development of distributed hierarchical component-based systems. The core objectuve is to ensure the functional properties of a distributed system and to detect errors at the design stage. First, we introduce a UML-based graphical formalism for modeling architecture and behavior of hierarchical components. Second, we formally specify a set of constraints that ensure the correct components composition with a focus on separation between the functional and non-functional aspects. Third, we show how the graphical models can be automatically translated into an input for a model-checker. We rely on a formally specified intermediate structure encoding the semantics of components behavior as a network of synchronised parametrised label transition systems. We focus here on encoding the advanced features of distributed components such as one-to-many communications, reconfiguration and asynchronous communications based on request-reply. Finally, we implement the approach in an integrated model-driven environment which comprises a set of graphical editors, an architecture static correctness validation module, a module translating the conceptual model into an input for a verification toolsuite CADP and a generator of the implementation code.

- **Nuno Gaspar**: *"Integrated, Autonomic, and Reliable Deployment and Management for SaaS composite applications"'* (from Oct 2011).
  **PhD advisors:** Eric Madelaine
  **Scientific advisor:** Eric Madelaine and Ludovic Henrio
  **Summary:** The objective of this thesis is to contribute to the safety of distributed component systems. The approach proposed is to join efforts for the specifications of correct component architectures, done in the Coq theorem prover, and contribution on the behavioural specifications, done in the Vercors environment and verified by model-checking techniques.

- **Marcela Rivera**: *"Reconfiguration and Life-cycle of Distributed Components : Asynchrony, Coherence and Verification"* (Dec 2006 - Dec 2011).
  **PhD advisors:** Denis Caromel and Ludovic Henrio
  **Scientific advisor:** Ludovic Henrio
  **Summary:** For component programming, but even more specifically in distributed environments, components need to be adaptative. Mostly, adaptativeness relies on dynamic reconfiguration of component systems. We introduce a new approach for reconfiguring distributed components that facilitates the reconfiguration process and ensures the consistency and coherence of the system. First, before executing a reconfiguration the components must be in a coherent and quiescent state. To achieve this, we design an algorithm for stopping a component in a safe manner. This was realized by implementing a tagging and interception mechanism that adds informations to the requests, manipulates their flow, and decides which of them must be served before stopping the component. Additionally, for triggering the reconfiguration tasks, we extended the FScript language to give it the capability of executing distributed reconfiguration scripts. To achieve this objective, we defined an additional controller inside the management part of the components. We tested our implementation over two GCM/ProActive based applications: the CoCoME example and the TurnTable example.

- **Paul Naoumenko**: *"Designing non-functional aspects with components"* (Oct 2006 - Jul 2010)
  **PhD advisors:** Françoise Baude and Ludovic Henrio
  **Scientific advisors:** Françoise Baude and Ludovic Henrio
  **Summary:** We focus on the adaptation of deployed application to dynamically changing environments. To maintain their function with minimal involvement of humans, applications must provide self-adaptive capabilities. We rely on autonomic elements, software entities exposing two parts: a business part, and a management part, with managers in charge of supervising the business part by reacting to environmental changes. Managers can implement complex management strategies: additionnaly to the supervision of the business part, they can contact managers from other autonomic elements involved in the application, and collaborate with them to elaborate adequate reactions. Strategies of managers can be dynamically updated. We use GCM components that are distributed by essence and feature separation of concerns (GCM components have a business part and a management part), hierarchical structure, and dynamic reconfiguration. We extend the management part of GCM components to include managers that correspond to the vision of autonomic computing. We modify the Architecture Description Language to statically describe GCM component assemblies. We included these extensions in the reference implementation of GCM.

- **Muhammad-Uzair Khan**: *"A Study of First Class Futures: Specification, Formalisation, and Mechanised Proofs"* (Oct 2007 - Feb 2011)
  **PhD advisors:** Denis Caromel and Ludovic Henrio
  **Scientific advisor:** Ludovic Henrio
  **Summary:** A future is a placeholder for result of concurrent execution. Futures can be "first class objects"; first class futures may be safely transmitted between the communicating processes. Consequently, futures spread everywhere. When the result of a concurrent execution is available, it is communicated to all processes which received the future. In this thesis, we study the mechanisms for transmitting the results of first class futures; the 'future update strategies'. We provide a detailed semi-formal specification of three main future update strategies adapted from ASP-

Calculus ; we then use this specification for a real implementation in a distributed programming library. We study the efficiency of the three update strategies through experiments. To show that our specification is correct, we formalise it together with a component model. Components abstract away the program structure and the details of the business logic, facilitating the reasoning on the protocol. We formalise in Isabelle/HOL, a component model comprising notions of hierarchical components, asynchronous communications, and futures. We present the basic constructs and corresponding lemmas related to structure of components. We present a formal operational semantics of our components in presence of a future update strategy and proofs showing the correctness of our future update strategy. Our work can be considered as a formalisation of ProActive/GCM and shows the correctness of the middleware implementation.

- **Alessandro Basso**: *"Integrating formal reasoning into a component-based approach to reconfigurable distributed systems"*. Univ. of Westminster. (Feb 2006 - Mar 2010)
  **PhD advisors:** Alexander Bolotov, Vladimir Getov and Ludovic Henrio
  **Scientific advisors:** Alexander Bolotov
  **Summary:** The difficulty of Grid systems to deal with unforeseen and unexpected circumstances resulting from dynamic reconfiguration is related to the fact that Grid applications are large, distributed and prone to resource failures. This research has produced a methodology for the solution of this problem by analysing the structure of distributed systems and their reliance on the environment which they sit upon. It is concluded that the way that Grid applications interact with the infrastructure is not sufficiently addressed and a novel approach is developed in which formal verification methods are integrated with distributed applications development and deployment in a way that includes the environment. This approach allows for reconfiguration scenarios in distributed applications to proceed in a safe and controlled way, as demonstrated by the development of a prototype application.

### ▶ Internship Students

Most of the following internships have been co-advised with one or two colleagues:

- Master 2: Paul Naoumenko : "A component-oriented approach for adaptive and autonomic computing: application to situated autonomic communications" (2006)
- Master 2: Muhammad Uzair Khan: "A Fault-tolerance Mechanism for Future Updates" (2007)
- Master 2 + Enseirb: Boutheina Bannour: "Langage de Reconfiguration pour Composants Distribués" (2008)
- Master 1: Sona Djohou: "Outils pour la preuve formelle de propriétés ASP" (2008)
- Master 2: Justine Rochas: "Request Scheduling for Multiactive Objects" (2013)
- Engineer (Chili): Matias Ibañez: "distributed execution of algorithmic skeletons" (2013), "Support for distributed autonomic components" (2014).
- Pavlo Khvorostov (Master 2 Ubinet - 2015) co-advised with Justine Rochas.
- Amaury Maillé (Master 2 SRIV - 2019) co-advised with Matthieu Moy.
- Master 2 ENS Lyon: Nicolas Chappe "Dataflow explicit futures: Formalisation and experimentation" (2020) co-advised with Matthieu Moy and Amaury Maillé.
- Polytechnique: Hadrien Renaud "Dataflow explicit futures and comparison with traditional futures" (2020) co-advised with Matthieu Moy and Amaury Maillé.
- Master 2: Ambre Suhamy "Formalisation en Coq de sémantiques de calculs de processus" (2021) co-advised with Yannick Zakowski.

- Master 2 ENS Lyon: Alban Reynaud "A parameterized bisimulation for interaction trees" (2021) co-advised with Yannick Zakowski.
- Master 2 ENS: Quentin Corradi ""Designing a refinement relation for open automata" (2021) co-advised with Rabéa Boulifa and Eric Madelaine.
- Master 2 ENS Lyon: Nicolas Chappe "Compositional code generators for verified LLVM IR" (2021) co-advised with Yannick Zakowski.
- Master 2 ENS Lyon: Lev Pikman "Formal Algebraic Proofs of Optimizations" (2022) co-advised with Yannick Zakowski.
- master 1 ENS Rennes: Martin Andrieux "Safe concurrent abstractions for multicore OCaml" (2022) co-advised with Gabriel Radanne.

### ▶ PhD Committees

- Keyvan Azadbakht – Universiteit Leiden – reading committee "Asynchronous Programming in the Abstract Behavioural Specification Language" (2019)
- Johan Östlund – Uppsala university – Opponent: "Language Constructs for Safe Parallel Programming on Multi-Cores" (2016)
- Sylvain Daillé – Univ. d'Orléans – Reviewer: "Compilation certifiée paramétrée pour la programmation parallèle" (2015)
- Thomas Pinsard – Univ. d'Orléans – Reviewer: "Sections atomiques emboîtées avec échappement de processus légers : sémantiques et compilation" (2014)
- Karl Palmskog – KTH – jury member: "Towards Correct and Efficient Program Execution in Decentralized Networks: Programming Languages, Semantics, and Resource Management" (2014)
- Yann Hodique – Univ. des Sciences et Technologies de Lille – jury member: "Sûreté et optimisation par les systèmes de types en contexte ouvert et contraint" (2007).

### ▶ Teaching

- Java Card Programming (48h - Master 2 – 2001-2002),
- Java Card Security (8h - Master 2 – 2002-2003),
- System programming (54h - ESSI 2$^{nd}$ year– 2003-2004),
- C language (42h - ESSI 3$^{rd}$ year – 2003-2004)
- Introduction to Programming – C++ (66h - Univ. of Westminster - 1$^{st}$ year– 2004-2005)
- Object Oriented Software Development – Java (44h - Univ. of Westminster - 1$^{st}$ year – 2004-2005)
- Semantics of Distributed and Embedded Systems (approx. 20h, Master 1 – 2009-2011)
- Distributed Systems: an algorithmic approach (between 1 and 3 sessions of 3.5hours per year,) Master 2, Univ Côte d'Azur – 2009-2022.
- Compilation and program analysis (10h course, 6h TP in 2019 only). Master 1, ENS Lyon – 2019–2022.

## Contracts and Collaborations

I have been significantly involved and took responsibilities in the following projects:

### ▶ NoE CoreGrid (European Network of excellence FP6)

**Title:** The European Research Network of Excellence on Foundations, Software Infrastructures and Applications for large scale distributed, GRID and Peer-to-Peer Technologies
**Dates:** 2005-2009
**Personal responsibility:** Coordination of deliverables, local responsible for a work-package (programming models)
**Partners:** ERCIM (France). CETIC (Belgium), IPP-BAS (Bulgaria), CNR-ISTI (Italy), CNRS (France), TUD (The Netherlands), EPFL (Switzerland), FhG (Germany), FZJ (Germany), USTUTT (Germany), ICS-FORTH (Greece), INFN (Italy), INRIA (France), KTH (Sweden), MU (Czech R.), PSNC (Poland), STFC (UK), SICS (Sweden), SZTAKI (Hungary), QUB (UK), WWU Muenster (Germany), UNICAL (Italy), UWC (UK), UCHILE (Chili), UCO (Portugal), UCY (Cyprus), Univ. Dortmund (Germany), UCL (Belgium), Univ. of Manchester (UK), UNCL (UK), Univ. Passau (Germany), Univ. Pisa(Italy), HES-SO (Switzerland), Univ. of Westminster (UK), UPC (Spain), VUA (The Netherland), ZIB (Germany), CYFRONET (Poland), Univ. of Innsbruck (Austria)
**Summary:** The CoreGRID Network of Excellence (NoE) aims at strengthening and advancing scientific and technological excellence in the area of Grid and Peer-to-Peer technologies. To achieve this objective, the Network brings together a critical mass of well-established researchers (161 permanent researchers and 164 PhD students) from forty-one institutions who have constructed an ambitious joint programme of activities. This joint programme of activity is structured around six complementary research areas that have been selected on the basis of their strategic importance, their research challenges and the recognised European expertise to develop next generation Grid middleware, namely: knowledge and data management; programming models; architectural issues: scalability, dependability, adaptability; Grid information, resource and workflow monitoring services; resource management and scheduling; Grid systems, tools and environments.

### ▶ European project BIONETS (IP FP6)

**Title:** Bio-inspired Networks and Services.
**Personal responsibility:** Coordination of deliverables, local responsible for a workpackage
**Dates:** 2006-2011
**Partners:** CREATE-NET (Italy), University of Basel (Switzerland), TUB (Germany), University of Passau (Germany), Budapest University of Thechnologie and Economics (Hungary), Nokia Corporation, VTT (Finland), INRIA (France), National and Kapodistrian University of Athens (Greese), Telecom Italia. London School of Economics and Political Science (UK). Sun Microsystems Spain.
**Summary:** The motivation for BIONETS comes from emerging trends towards pervasive computing and communication environments. Traditional communication approaches are ineffective in this context, since they fail to address several new features: a huge number of nodes, a wide heterogeneity in

node capabilities, high node mobility, the management complexity, the possibility of exploiting spare node resources. Nature and society exhibit many instances of systems in which large populations are able to reach efficient equilibrium states and to develop effective collaboration and survival strategies, able to work in the absence of central control and to exploit local interactions. We seek inspiration from these systems to provide a fully integrated network and service environment that scales to large amounts of heterogeneous devices, and that is able to adapt and evolve in an autonomic way. BIONETS overcomes device heterogeneity and achieves scalability via an autonomic and localised peer-to-peer communication paradigm. Services in BIONETS are also autonomic, and evolve to adapt to the surrounding environment, like living organisms evolve by natural selection. Biologically-inspired concepts permeate the network and its services, blending them together, so that the network moulds itself to the services it runs, and services, in turn, become a mirror image of the social networks of users they serve. This new paradigm breaks the barrier between service providers and users, and sets up the opportunity for "mushrooming" of spontaneous services, therefore paving the way to a service-centric ICT revolution.

### ▶ Programme d'Investissements d'Avenir – FUI OpenCloudWare

`http://www.opencloudware.org/`
**Dates:** 2012-2014
**Personal responsibility:** Task coordinator
**Partners:** France Télécom, ActiveEon, Armines, Bull, eNovance, eXoINPT/IRIT, INRIA, OW2, peergreen, PetalsLink, Télécom Paris Tech, Télécom Saint Etienne, Thalès Communication, Thalès Services, Univ. Joseph Fourier/LIG, Univ. de Savoie/LISTIC, UShareSoft.
**Summary:** The OpenCloudware project aims at building an open software engineering platform for the collaborative development of distributed applications to be deployed on multiple Cloud infrastructures. The results of OpenCloudware will contain a set of software components to manage the lifecycle of such applications, from modelling (Think), developing and building images (Build), to a multi-IaaS compliant PaaS platform (Run) for their deployment, orchestration, performance testing, self-management (elasticity, green IT optimisation), and provisioning. Applications will be deployed potentially on multi IaaS (supporting either one IaaS at a time, or hybrid scenarios).The results of the project will be made available as open source components through the OW2 Open Source Cloudware initiative.

### ▶ Oseo-Isis Spinnaker

`http://www.spinnaker-rfid.com`
**Dates:** 2011-2015
**Personal responsibility:** Participant
**Partners:** SMEs: Inside-Secure, STIC, Legrand; Academic: IPG, ENS des Mines de St Etienne, Un. du Maine, Un, F. Rabelais Tours, AETS ESEO Angers, Un. Marne la Vallée, Un. Paris 6, Un. Rennes 1, INRIA.
**Summary:** The objective of Spinnaker is to really allow RFID technology to be widely and easily deployed. The role of the OASIS (now SCALE) team in this project is to allow the wide scale deployment and management of the specific RFID application servers in the cloud, so to build an end-to-end robust and flexible solution using GCM technology.

### ▶ INRIA Associate Team SCADA

`http://team.inria.fr/SCADA`
**Dates:** 2012-2014
**Personal responsibility:** Project coordinator
**Partners:** OASIS/SCALE, NIC-Labs (Chile).
**Summary:** Besides a formal collaboration between NIC Labs and OASIS team (and now the SCALE team), the aim of the project is to contribute to programming models and languages for programming, running and debugging parallel and distributed applications. For this we will contribute both from at theoretical and practical perspectives to the design of languages, and their implementation and formalisation. In this project we will focus on composition models allowing to put together individual sequential code into complex applications featuring parallelism and distribution. More precisely we focus on two such composition models: algorithmic skeletons and software components.

### ▶ INRIA Associate Team DAESD

`http://team.inria.fr/DAESD`
**Dates:** 2012-2014
**Personal responsibility:** Participant
**Partners:** OASIS/SCALE and AOSTE team from INRIA/CNRS/Univ. Nice Sophia Antipolis, East China Normal University (ECNU) Shanghai.
**Summary:** The aim of the DAESD associate team is to build models, methods, and prototype tools inheriting from synchronous and asynchronous models. We plan to address modelling formalisms and tools, for this combined model; to establish a method to analyze temporal and spatial consistency of embedded distributed real-time systems; to develop scheduling strategies for multiple tasks in embedded and distributed systems with mixed constraints.

### ▶ INRIA Associate Team FM4CPS

`https://project.inria.fr/fm4cps/`
**Dates:** 2015-2018
**Personal responsibility:** Participant
**Partners:** SCALE and AOSTE team from INRIA/CNRS/Univ. Nice Sophia Antipolis, East China Normal University (ECNU) Shanghai.
**Summary:** FM4CPS addresses several facets of Formal Model-Driven Engineering for Cyber-Physical Systems. The design of such large heterogeneous systems calls for hybrid modeling, combining formal Models of Computation, drawn from Concurrency Theory for the ?cyber? discrete processors, timed extension and continuous behaviors for physical environments, requirement models and user constraints extended to non-functional aspects, new challenges for designing and analyzing large and highly dynamic communicating software entities.

### ▶ BQR (Bonus Quality Research) LIP

**Date:** 2019
This is a grant attributed by LIP for new members.

### ▶ Projet Emergent ENS "DataFut"

**Date:** 2020-2022
The objective of the project is to provide theoretical and practical tools to develop high-performance application relying on parallelism. The project is focused on the "Future" language construct that makes parallel programming safe and efficient.

### ▶ HPC Aurora SLAS

**Type** PHC Aurora 2020
**Title:** Synchronous languages meet asynchronous semantics
**Date:** 2020
**Personal responsibility:** French coordinator
**Partners:** university of Bergen and university of Oslo
This project combines competencies in the formal specification of futures and actors, and recent advances in the domain of dataflow and control flow futures to study dataflow aspects in programming languages and the unification of *futures*, asynchronous *actors*, and *synchronous* languages.

I also participated to the following projects: GCPMF (ANR - 2006-2008), GridCOMP (EU FP6-Strep - 2006-2009), Reseco (Stic-Amsud - 2006-2009), MCorePHP (ANR blanc international - 2010-2012).

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## Other activities

• Program committee: *FACS* 2022 *ICE* 2020–2022, *HLPP* 2021, *FM* 2021, *Coordination* 2019 and 2020, *Agere* 2019, *FASE* 2019, *ACSD* 2019, *HLPP* 2019, *iFM* 2019, *PDP/4PAD* 2016, 2017 and 2018, *TASE* 2017, *AGERE* 2015, *ICE* workshop 2013 to 2015, *FOCLASA* 2009 to 2013, *FESCA* 2009 to 2013, *FMOODS/DAIS 2003 Student Workshop*.

• Program committee chair of *ICE* workshop 2016, 2017, 2018, and 2019.

• Reviews for many other conferences, and many journal reviews, including the following journals: IJPP, SCP, TCS, MSCS, TOPLAS, ComSIS, DIST, STVR, SPE, LMCS.

• Member of the Scientific Advisory board of the Envisage European project (FP7)
2013 – 2016.