

## Curriculum Vitæ

# Thomas Ropars

## PhD in Computer Science

Born: December 13th, 1982

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## Education

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2006-2009	<b>PhD thesis in Computer Science</b> at Université de Rennes 1, IRISA, Rennes, France. Advisor: Dr. Christine Morin. Defended on December 11, 2009.
2005-2006	<b>Master of Research in Computer Science</b> (Network and Distributed Systems), Université de Rennes 1, Rennes, France.
2000-2005	<b>Master of Engineering</b> , École Nationale d'Ingénieurs de Brest, Brest, France.

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## Research Activities

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**PhD Thesis** The Title of my PhD thesis is “Services and Protocols for the reliable execution of distributed applications in grid computing systems”. My work was supported by a grant from the French ministry of Research. My adviser was Christine Morin, senior researcher at INRIA Rennes-Bretagne Atlantique and INRIA PARIS project-team leader.

Computational grids aggregate computing resources belonging to various administrative domains to provide the amount of resource needed for High Performance Computing. Since a grid is a large scale distributed system, its Mean Time Between Failure is small. To be able to exploit grid resources, fault tolerance is essential.

Fault tolerance in computational grids raises several issues. From the applications point of view, mechanisms are needed to ensure their progress and termination despite failures. From the grid users point of view, grid services should remain available despite reconfigurations and failures occurring in the grid. I have addressed some of these issues, focusing mainly on the scalability, transparency and performance of the fault tolerance solutions

**O2P: A Rollback-Recovery Protocol for Large Scale Message Passing Applications** O2P is a rollback-recovery protocol targeting large scale message passing applications. It is able to handle multiple concurrent application processes failures. It is based on active optimistic message, i.e. the information needed to be able to replay messages are saved as soon as possible on stable storage. Thus O2P can reduce the risk of orphan process creation and reduce the amount of data to piggyback on application messages compared to existing optimistic message logging protocol. We also propose a distributed event logger for message logging. It makes use of the memory of the nodes hosting the application processes to implement message logging. This distributed event logger makes message logging protocols, including O2P, more scalable. Finally, for application executed on cluster federations, we propose O2P-CF, a protocol based on the combination of O2P with a pessimistic message logging protocol. O2P and the distributed event logger have been implemented in the Open MPI library and evaluated with the NAS benchmarks. The implementation of the O2P-CF protocol is in progress. This work has been published in several international conferences [BRB09, RM09, RM08a, Ro07].

**Semias: A Framework for Highly Available and Self-Healing Stateful Services** We propose a framework for highly available, self-healing and scalable grid services. Our solution is based on active replication of service entities on top of a structured peer-to-peer overlay. We have specified a reconfiguration protocol to deal with failures and new nodes arrival in the grid : we manage to minimize the number of service reconfigurations while ensuring the safety of the active replication protocol. We have implemented a prototype of our solution based on Pastry and Paxos, and applied it to make the application management service of the Vigne grid middleware highly available. It is to our knowledge the first implementation of active replication on top of a structured peer-to-peer overlay. Experiments show good performance and scalability, and also show the good self-healing properties of Semias even in highly dynamic environments [CRM09]. Additional information about Vigne are available here: <http://www.irisa.fr/paris/software/vigne/>.

**XtreemGCP: a Grid Fault Tolerance Service** In the context of the XtreemOS European project, we have contributed to the design of a grid fault tolerance service called XtreemGCP. XtreemGCP provides fault tolerance mechanisms for grid applications. It can deal with various rollback-recovery protocols. It is in charge of automatically restarting failed applications and handles the required interactions with other grid services like the resource management service. Additionally, it provides an optimized management of rollback-recovery data according to the selected rollback-recovery protocol. This work has been published in an international conference [MRSM09]. Additional information about XtreemOS are available here: <http://www.xtreemos.eu>.

**Master Thesis** My Master thesis work deal with application monitoring in computational grids. A distributed application running in a grid might be spread over distributed resources in various administrative domains. Monitoring grid applications is thus challenging.

We have designed a grid monitoring service called GAMoSe that provides grid users with reliable information about their applications. The service is scalable and can deal with node volatility. It provides information about applications state, failures and resource utilization. The mechanisms used to get those data are transparent to the applications. In order to provide accurate information, the service monitors every application process, including dynamically created processes.

GAMoSe has been implemented in the Vigne grid middleware. Experiments conducted on 400 nodes spread over 5 sites of the Grid'5000 testbed proved that GAMoSe is both scalable and efficient. This work has been published in an international conference [RJM07].

## Additional Activities

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Reviews	<b>Papers review for the following international conferences:</b> Cluster 2006, Cluster 2007, ICDCS 2007, Euro-Par 2007, e-Science 2007 et Euro-Par 2008.
International Conferences	<b>Voluntary student for Euro-Par 2007</b> held in Rennes, France. <b>Selected by ACM-SIGOPS France</b> for a grant to attend SOSP 2007.
Workshops	<b>Organization of a Workshop on Global Computing Systems</b> in the context of the Phenix associated team( <a href="http://www.irisa.fr/paris/web/at-phenix-2.html">http://www.irisa.fr/paris/web/at-phenix-2.html</a> ).

## Teaching Activities

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### INSA de Rennes 2008-2009

3rd Year (CS): Lab classes in C language (24h).  
2nd Year (Main Track): Lectures classes in object oriented programming in Java (14h).  
2nd Year (Main Track): Lab classes in object oriented programming in Java (14h).

### Université de Rennes 1 2008-2009

Master 1 (CS): Lab classes in operating system (24h).

## Student Advising

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R. K. Nath	M.Sc. in Computer Science, University of Tennessee. 3 months in 2008 at IRISA, in collaboration with Christine Morin. Subject: <i>Active Replication of Vigne Application Managers</i> .
S. Costache	M.Sc. in Computer Science, Politehnica University of Bucarest. 6 months in 2009 at IRISA, in collaboration with Christine Morin. Subject: <i>High Availability of Grid Services through Active Replication</i> .
S. Gillot	M.Sc. in Computer Science, Université de Rennes 1. 3 months in 2009 at IRISA, in collaboration with Christine Morin. Subject: <i>Evaluation of an Atomic Broadcast System Built on top of a DHT</i> .
C. Leordeanu	PhD. in Computer Science, Politehnica University of Bucarest. 3 months in 2009 at IRISA, in collaboration with Christine Morin. Subject: <i>A Failure Detection Service for the Grid</i> .

## Professional Experiences

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2006	Master thesis under the supervision of Christine Morin at IRISA, Rennes, France: <i>Monitoring Grid Applications</i> .
2004	5-month training under the supervision of Pierre Chevailler at the European Center for Virtual Reality in Brest, France: <i>Contribution to behaviorRis implementation, a multi-agent animals' behavior simulator</i> .
2003	5-month training at EADS, Munich, Germany: <i>Implementation of an Ethernet communications test software</i> .

## Languages

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French	Native.
English	Good skills, both written and oral.
German	Basic knowledge.

## Miscellaneous

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Sport	Football player during 15 years at E.S. Lampaul. In charge during 3 years of the players between 16 and 18 years old at E.S. Lampaul. Tennis player during 10 years at T.C. Lampaul.
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# List of Publications

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## International Conferences

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- [BRB09] Aurelien Bouteiller, Thomas Ropars, George Bosilca, Christine Morin and Jack Dongarra. Reasons for a Pessimistic or Optimistic Message Logging Protocol in MPI Uncoordinated Failure Recovery . In *IEEE International Conference on Cluster Computing (Cluster 2009)*. New Orleans, USA, September 2009.
- [RM09] Thomas Ropars and Christine Morin. Active Optimistic Message Logging for Reliable Execution of MPI Applications. In *15th International Euro-Par Conference*, pages 615-626. Delft, The Netherlands, August 2009.
- [MRSM09] John Mehnert-Spahn, Thomas Ropars, Michael Schoettner and Christine Morin. The Architecture of the XtreamOS Grid Checkpointing Service .In *15th International Euro-Par Conference*, pages 429-441. Delft, The Netherlands, August 2009.
- [RM08a] Thomas Ropars and Christine Morin. Fault Tolerance in Cluster Federations with O2P-CF. In *Resilience 2008, Workshop on Resiliency in High Performance Computing*, pages 807-812, Held in conjunction with CCGrid 2008. Lyon, France, May 2008.
- [RJM07] Thomas Ropars, Emmanuel Jeanvoine and Christine Morin. GAMoSe: An Accurate Monitoring Service for Grid Applications. In *6th International Symposium on Parallel and Distributed Computing (ISPDC 2007)*, pages 295-302. Hagenberg, Austria, July 2007.
- [Ro07] Thomas Ropars. Combining Optimism and Pessimism in a Grid Message Logging Protocol. In *Student Forum of the International Conference on Dependable Systems and Networks (DSN 2007) (Supplemental Volume)*. Edinburgh, UK, June 2007.

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## National Conferences

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- [RM08b] Thomas Ropars and Christine Morin. O2P : un protocole à enregistrement de messages extrêmement optimiste. In *Rencontres Francophones du Parallélisme (RenPar18)*. Fribourg, Switzerland, 2008.

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## Research Reports

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- [CRM09] Stefania Costache, Thomas Ropars and Christine Morin. Semias: A Framework for Highly Available and Self-Healing Services in Large Scale Dynamic Distributed Systems. *Technical report, RR-7083, INRIA, France, November 2009.*
- [MRSM08] John Mehnert-Spahn, Thomas Ropars, Michael Schoettner and Christine Morin. The Architecture of the XtreamOS Grid Checkpointing Service. *Technical report, RR-6772, INRIA, France, December 2008.*
- [RM08c] Thomas Ropars and Christine Morin. O2P: An Extremely Optimistic Message Logging Protocol. *Technical report, RR-6357, INRIA, France, November 2007.*
- [RJM06] Thomas Ropars, Emmanuel Jeanvoine and Christine Morin. Providing QoS in a Grid Application Monitoring Service. *Technical report, RR-6070, INRIA, France, December 2006.*
- [Ro06] Thomas Ropars. Supervision d'applications sur grille de calcul. Master Thesis. Université de Rennes 1, June 2006.