Marc Shapiro

Curriculum Vitæ

1 August 2010

Marc Shapiro   tel.: +33 1 4427 7093
Directeur de recherche INRIA   fax.: +33 1 4427 7495
Labo. d'Informatique de Paris 6   e-mail: mailto:marc.shapiro@acm.org
Bureau 26-00/211
4, place Jussieu   Web: http://lip6.fr/Marc.Shapiro/
75005 Paris, France

Languages: Trilingual in English, French and Italian; knowledge of Arabic, German and Russian.

Dual citizen, France and USA. Age: 57 years. Two children. Sports: rock climbing, swimming, running, hiking.

A brief two-page resume is available from my web site.

Research Keywords

Large Scale Distributed Systems, Cloud Computing, Replication and Consistency, Distributed Shared Data, Optimistic Replication, Partition-Tolerant Systems, Nomadic Computing, Garbage Collection, Concurrent Programming, Distributed Garbage Collection.

More information about my research can be found in the companion Research Statement.

Professional and Research Experience

2005–Today Principal INRIA Researcher in the Regal project-group (LIP6 & INRIA).

1998–2005 Senior Researcher at Microsoft Research Limited, Cambridge (United Kingdom).

1986–1999 Senior Researcher, then Principal Researcher at INRIA projet SOR (*Systèmes d'objets répartis*, Distributed Object Systems).

1997 Summer research with Jini Project, Sun Research Labs, Chelmsford MA (USA).

1993–1994 Visiting Professor, Cornell University, Ithaca (NY, USA) with Prof. Ken Birman.

1985 Research scientist at INRIA on ESPRIT Project SOMIW.

1984–1985 Research Software Engineer at GIPSI (INRIA-Bull-CNET), implementing networking on SM-90 workstation; on loan by CMIRH to INRIA.

1982–1985 Research Scientist at Centre Mondial Informatique et Ressource Humaine (CMIRH), Paris (France).

1982 Assistant Professor, Boston College, Boston MA (USA)

1980–1981 Visiting Scientist, Distributed Systems Group (Prof. Barbara Liskov), Laboratory for Computer Science, Massachusetts Institute of Technology, Cambridge MA (USA)

1978–1980 Graduate student researcher, Software and Communication group, Laboratoire d'Automatique et d'Analyse des Systèmes (LAAS-CNRS, Prof. Michel Diaz), Toulouse (France)

1975–1976 High school teacher, Besançon, France.

Degrees

2002 *Habilitation à diriger les recherches*. Title: "Object management in large-scale distributed systems." Université Paris Pierre-et-Marie-Curie.

1980 *Docteur-Ingénieur* (Ph.D.) at ENSEEIHT-INP. Thesis title: *Une méthode de conception progressive des systèmes parallèles, utilisant le langage CSP* ("A Stepwise Design Methodology for Parallel Systems, Using the Language CSP"). Research performed at LAAS-CNRS [9].

1978 *Diplôme d'Études Approfondies* (DEA, Masters), Université Paul Sabatier, Toulouse, France. Thesis title: "A Structured Subset of PL/1 for a Mini-Computer".

1978 Engineering degree in Computer Science at ENSEEIHT-INP, Toulouse, France.

1975 *Maîtrise* (Bachelors) in Physics, Université de Besançon, Besançon (France)

Main results

Concepts

- Commutative Replicated Data Types (CRDTs) for concurrent updates to replicated data without concurrency control [58].
- Design and implementation of the Treedoc CRDT for concurrent editing in large-scale distributed systems [58, 94].
- Telex optimistic replication middleware, enabling concurrent applications to operate on shared data in high-latency and disconnected scenarios [59, 93].

- Proof of correctness of a family of implementations of concurrent linked list algorithms [51, 125].

- A theory of consistency of replicated data, including asynchronous updates and partial replication [47–50, 119, 120].

- IceCube application-agnostic reconciliation algorithm [44–46, 116].

- Algorithms for collecting cyclic distributed garbage [6, 41, 85].

- Shared Persistent Distributed Memory concept forms the basis of the Esprit Long-Term Research project LTR PerDiS [82].

- A scalable garbage collection algorithm for the shared distributed persistent store Larchant [34, 35, 37, 40, 42, 84].

- A flexible binding protocol for assigning data and control to locations in a distibuted distributed object-oriented system [36].

- The SSP Chains mechanism for identification and location in a distributed system, supporting mobile objects and garbage collection [32, 33, 73, 109].

- A realistic, scalable, fault-tolerant algorithm for distributed garbage collection [107].

- The *proxy* concept, and the the Proxy Principle [13, 25] for structuring distributed systems as Fragmented Objects [3].

- Object-support operating system SOS [13]

Patent Applications

- 24 June 2003 "Reconcilable and Undoable File System."

- 5 Sept. 2003 "Probabilistic Scheduling."

- 25 Feb. 2004 "System-Wide Selective Action Management."

- 17 Sept. 2004 "Exploiting Dependency Relations in Distributed Decision Making."

Software Developments

- Design and implementation of Treedoc, a commutative replicated data type for concurrent editing [58, 94]. INRIA, 2008–Present.

- Design, implementation and deployment of Telex, an application-agnostic middleware platform, supporting concurrent updates to shared data in high-latency and disconnected-work environments [59, 93]. Design and implementation of consensus protocols for this environment [54, 55, 57, 132]. INRIA, 2006–Present.

- Joyce [52]. Application-agnostic systemes for cooperative work, based on the Action-Constraint Framework. Microsoft Research, 2005.

- Rufis [46]. Replicated file system supporting disconnected operation, reconciliation, and indefinite selective undo, based upon IceCube. Microsoft Research, 2003-2004.

3

- IceCube. A system for reconciling object replicas, of any type, using the Action-Constraint Framework [44, 44–46, 116, 117]. Microsoft Research Ltd., 2000–2003.

- The PerDiS sharing-oriented middleware platform http://www.perdis.esprit.ec.org/ [82, 84, 86, 114], 1996–2000.

- Design and implementation of Larchant [34, 35, 37, 40]. INRIA and Cornell, 1993–1996.

- Design and implementation of SSP Chains and SGP distributed garbage collection [32, 33, 73, 107, 109]. INRIA, 1990–1994.

- Designed *maillons*, a fast implementation of indirection [72]. INRIA, 1992.

- Principal investigator, object-support distributed operating system SOS [13]. INRIA, 1985–1990.

- "Plexes" (dynamically-sized arrays) proposed and implemented for the standard libg++ library. INRIA, 1987.

- BibTeX mode for GNU Emacs, INRIA 1987.

- Participated in design of the object-support distributed operating system COOL-1. INRIA, 1990–1991 (in collaboration with Chorus-systèmes).

- Participated in design of the Chorus virtual memory system [27]. INRIA, 1986–1988 (in collaboration with Chorus-systèmes).

- Port of BSD sockets to V7 Unix, on SM-90 workstation. INRIA, GIPSI SM-90, 1984.

- Design of REBUS [22] process control network. LAAS, 1976–1980.

Research Contracts

2010–2013, ANR Blanc ConcoRDanT Principal investigator, *ConcoRDanT: CRDTs for consistency without concurrency control in Cloud and Peer-to-Peer systems*, to develop a theory and practical libraries of CRDTs (Commutative Replicated Data Types).

2010–2013, ANR Arpège STREAMS *STREAMS: Solutions for peer-To-peer REAl-tiMe Social web*, a project to design peer-to-peer solutions supporting real-time social web applications.

2010–2013, Google Research Principal Investigator, *European Doctoral Fellowship in Distributed Computing* for Marek Zawirski.

2009–2012, ANR Verso Prose *PROSE: Content Shared Through P2P Recommendation & Opportunistic Social Environment*, a project aiming to design content sharing applications that take advantage of social networks in an opportunistic environment.

2009, Google Research Principal Investigator, Google Research Award on *CRDTs: Consistency without concurrency control.*

2006–2009, European Commission FP6 Grid4All STREP Project *Grid4All : Self-* ** Grid: Dynamic Virtual Organizations for schools, families, and all.* Aims to democratise access to computational grids and to provide collaborative tools, using replication and persistence over a peer-to-peer network. Chair of Scientific Committee.

2006–2009, ANR ARA Respire *Respire : Ressources et Services Pair-à-pair, Interrogation et Réplication.* Management of mutable data and distributed access to resources, in a peer-to-peer environnement, above JXTA.

2006–2007, INRIA ARC Recall *RECALL : Réplication optimiste pour l'Édition CoLLaborative massive sur réseau P2P.* Studies optimistic replication enabling large-scale collaborations.

1996–2000, European Commission Long-Term Research PerDiS Principal Investigator, Project *PerDiS: a Persistent Distributed Store for Cooperative Engineering.* Design and implementation of a distributed persistent store for sharing between cooperative CAD applications for the building industry.

1997–1999, Ministère des Affaires Étrangères *Franco-Israeli Cooperative Research on Information Highways.* Distributed garbage collection algorithms for shared memories.

1992–1999, European Commission Basic Research Broadcast *Broadcast* Esprit Project, followed by *Broadcast-WG* Working Group. Theory and practice of large scale distributed systems. Distributed Garbage Collection, distributed object management, replica consistency, application to nomadic computing.

1996–1999, Dyade *Large scale applications and active objects.*

1995–1998, World-Wide Web Consortium *Consistent and flexible cooperative caching for the World-Wide Web, applied to cooperative editing.*

1995–1998, Centre National d'Études des Télécommunications *Extension and industrialisation of Stub-Scion Pair Chains.*

1992–1995, Digital Equipment Corporation External Research Programme *Larchant persistent distributed shared memory.*

1993–1995, Novell Unix Systems Laboratory *Stub-Scion Pair Chains and Fragmented Objects; Hobbes binding protocol.*

1991–1993, Esprit R&D Harness *Project Harness*, a platform for programming distributed applications. Objects, fragmented objects, library of distributed abstractions.

1985–1988, Esprit R&D SOMIW *Project SOMIW* for a for multimedia office workstation. Our group developed the object-support operating system SOS.

Service

Throughout my career, I have been active in organising and defending the systems research community in Europe, by organising numerous meetings and

discussions at the French and European scale, and through ACM. Most recently, I helped create the ACM Europe Council, of which I am a member. I created and chaired the EuroSys scientific society and started the EuroSys conference, which has become the major systems conference in Europe. Before that, I was instrumental in bringing SOSP, the premier conference in systems worldwide, to Europe. I participated in several European projects and networks of excellence, and created the ERSADS series of winter schools in distributed systems.

Like any other member of the research community, I have my share of program committees (DISC, ICDCS, EuroSys, Euro-Par), reviewing for various journals, reviewing for funding agencies (European Commission, ANR, Swiss NSF, Swedish NSF), tenure reviewing for various universities, and membership of the Scientific Board of CITI.

Responsibilities

- Founding member of the ACM Europe Council, 2009–present.
- Member of ACM Distinguished Service Award Committee, 2009–2012. Chair, 2009.
- Founder and chair of EuroSys, the European professional society in Computer Systems (European Chapter of ACM Sigops), 2004–2008.
- Co-author of two white papers to the European Commission on systems research, education and industry in Europe [133, 134].
- Founder and Chair of Association ACM-SIGOPS de France (ASF), French chapter of ACM Sigops, 1996–2000.
- Co-founder of European Research Symposium on Advanced Distributed Systems (ERSADS), 1997.
- Vice-Chair, ACM Special Interest Group on Operating Systems (SIGOPS), 1995–1999.
- Co-founder and organiser of the I-WOOOS (Int. W. on Object-Orientation in Operating Systems) series of workshops, 1992.
- Co-founder of the *Journées d'Etudes sur les Langages Orientés Objet*, later to become ECOOP, 1983.

Organization of Scientific Meetings

- Program Committee co-Chair, Workshop on Large Distributed Systems and Middleware (LADIS), Zürich, Switzerland, July 2010.
- Program Commitee Chair, Workshop on Hot Topics in Operating Systems, Elmau/Oberbayern, Germany, May 2001.
- General Chair, SIGOPS European Workshop "Beyond the PC", Koldingsfjord, Kolding, Denmark, September 2000.
- Co-organiser, European Research Symposium on Advanced Distributed Systems (ERSADS), l'Alpe d'Huez (France), April 1995 and March 1997.

- Program Commitee chair, SIGOPS European Workshop, Dagstuhl Castle (Germany), September 1994 [99].

- Program Commitee Chair, I-WOOOS, Ottawa (Canada), 1990 and Palo Alto (CA USA), 1991.

- Organizational Chair, I-WOOOS, Dourdan (France), 1992.

- *Journée d'Études sur les Langages Orientés Objets*, Le Cap d'Agde, 1983.

Teaching

PhD Theses Advised

- Marek Zawirski. *Theory and practice of shared data types for cloud computing*. Université Pierre-et-Marie-Curie. Started 2010.

- Pierpaolo Cincilla. *Maintaining consistency in large-scale opportunistic networks*. Université Pierre-et-Marie-Curie. Started 2010.

- Lamia Benmouffok. *Consistency of replicated data in a peer-to-peer system*. Université Paris 6 Pierre-et-Marie-Curie. November 2010.

- Pierre Sutra. *A study and implementation of generic replication algorithms*. Université Paris 6 Pierre-et-Marie-Curie. November 2010.

- Nicolas Richer. *A Study of the Memory Behaviour of Persistent Cooperative Engineering Applications*. Université Paris 6 Pierre-et-Marie-Curie, May 2002.

- Fabrice le Fessant. *Conception et mise en œuvre d'un système à agents mobiles*. École Polytechique, December 2001.

- Xavier Blondel. *Gestion de la mémoire dans un environnement réparti persistant à grande échelle : l'exemple de PerDiS*. Conservatoire National des Arts et Métiers, Fall 2000.

- Aline Baggio. *Adaptable and Mobile-Aware Distributed Objects*. Université Paris 6 Pierre-et-Marie-Curie, June 1999.

- Georges Brun-Cottan. *Cohérence de données répliquées partagées par un groupe de processus coopérant à distance*. Université Paris 6 Pierre-et-Marie-Curie, September 1998.

- Julien Maisonneuve. *Hobbes: un modèle de liaison de références réparties*, Université Paris 6 Pierre-et-Marie-Curie, October 1996.

- Paulo Ferreira. *Larchant: Garbage Collection in a Cached Distributed Shared Store with Persistence by Reachability*. Université Paris 6 Pierre-et-Marie-Curie, May 1996.

- Hervé Soulard. *Adaptation des systèmes de stockage aux besoins des utilisateurs : l'approche micro-systèmes de stockage et sa mise en œuvre dans BOSS*. Université Paris 6 Pierre-et-Marie-Curie, November 1995.

- David Plainfossé. *Distributed Garbage Collection and Reference Management in the Soul Object-Support System*. Université Paris 6 Pierre-et-Marie-Curie, June 1994.

- Daniel Edelson. *Type-specific storage management.* University of California at Santa Cruz, June 1993.

- Paulo Amaral. *PAS, a framework for studying the implementation of multiple uniform address spaces.* Université Paris 6 Pierre-et-Marie-Curie, May 1993.

- Michel Ruffin. *Kitlog: un service de journalisation générique.* Université Paris 6 Pierre-et-Marie-Curie, September 1992.

- Yvon Gourhant. *Outils pour la programmation d'objets fragmentés.* Université Paris 6 Pierre-et-Marie-Curie, June 1991.

- Sabine Habert. *Gestion d'objets et migration dans les systèmes répartis.* Université Paris-6 Pierre-et-Marie-Curie, December 1989.

- Mesaac Mounchili Makpangou. *Protocoles de communication et programmation par objets : l'exemple de SOS.* Université Paris 6 Pierre-et-Marie-Curie, February 1989.

Courses

OS Kernels, Multicore and Virtualisation, *(Noyaux, Multi-Cœurs et Virtualisation, NMV)*, 2nd year Computer Science Master's. Université Pierre-et-Marie-Curie, 2009–present. High-performance lock-free algorithms.

Advanced Distributed Systems, DEA (post-graduates), Systèmes Informatiques, Université Paris 6 Pierre et Marie Curie, 1985–1998; organization and teaching.

Distributed Computing Systems, Fundamentals of Informatics DEA (post-graduates), École Normale Supérieure de Lyon (ENS-Lyon), 1995; organization and teaching.

Distributed File Systems [1] and **Distributed Object Management** [2] course at École d'été INRIA-C[3] "Construction des systèmes d'exploitation répartis", St. Malo 1990 and 1991, Autrans 1993.

Objects and Distribution tutorial on distributed object management: TOOLS 92, Versailles (France); OOPSLA 93, Washington DC (USA).

Introduction to programming freshman course, Boston College, Boston, 1981.

Main publications

Here is a short list of my ten major publications. The numbering refers to the full list (in the next section). These papers total 1803 citations on Google Scholar (including all versions of each).

[58] Nuno Preguiça, Joan Manuel Marquès, Marc Shapiro, and Mihai Leția. A commutative replicated data type for cooperative editing. In *Int. Conf. on Distributed Comp. Sys. (ICDCS)*, Montréal, Canada, June 2009. Google Scholar citations: 22.

[51] Viktor Vafeiadis, Maurice Herlihy, Tony Hoare, and Marc Shapiro. Proving correctness of highly-concurrent linearisable objects. In *Principles and Practice of Parallel Programming (PPoPP)*, New York, USA, March 2006. ACM DL downloads: 370, citations: 8. Google Scholar citations: 44.

[14] Yasushi Saito and Marc Shapiro. Optimistic Replication. *Computing Surveys*, March 2005, vol. 37, no. 1, pp. 42–81. ACM DL downloads: 5236, citations: 41. Google Scholar citations: 414.

[45] Nuno Preguiça, Marc Shapiro, and Caroline Matheson. Semantics-based reconciliation for collaborative and mobile environments. Dans *Int. Conf. on Coop. Info. Sys. (CoopIS)*, Catania, Sicily, Italy, November 2003. Google Scholar citations: 60.

[43] Anne-Marie Kermarrec, Antony Rowstron, Marc Shapiro, and Peter Druschel. The IceCube approach to the reconciliation of divergent replicas. In *Symp. on Principles of Dist. Comp. (PODC)*, Newport RI, USA, August 2001. Google Scholar citations: 181. ACM DL downloads: 41 (last 12 months).

[41] Fabrice Le Fessant, Ian Piumarta, and Marc Shapiro. An implementation of complete, asynchronous, distributed garbage collection. In *Conf. on Prog. Lang. Design and Impl. (PLDI)*, Montreal (Canada), June 1998. ACM SIGPLAN. ACM DL downloads: 321, citations: 8. Google Scholar citations: 31.

[34] Paulo Ferreira and Marc Shapiro. Garbage collection and DSM consistency. In *Proc. Symp. on Operating Systems Design and Implementation (OSDI)*, pp. 229–241, Monterey CA (USA), November 1994. ACM. Google Scholar citations: 62.

[13] Marc Shapiro, Yvon Gourhant, Sabine Habert, Laurence Mosseri, Michel Ruffin et Céline Valot. SOS: An object-oriented operating system — assessment and perspectives. *Computing Systems*, 2(4):287–338, December 1989. Google Scholar citations: 164.

[27] V. Abrossimov, M. Rozier, and M. Shapiro. Generic virtual memory management for operating system kernels. *Symp. on Operating Systems Principles (SOSP)*, pp. 123–136, Litchfield Park AZ (USA), December 1989. ACM. ACM DL downloads: 112 (12 months), citations: 19. Google Scholar citations: 130.

[25] Marc Shapiro. Structure and encapsulation in distributed systems: the Proxy Principle. In *Int. Conf. on Dist. Computer Systems (ICDCS)*, pages 198–204, Cambridge, Mass. (USA), May 1986. IEEE. Google Scholar citations: 354.

Publications

Here follows the full list of publications, ordered by type, and chronologically within each type. Electronic copies are available through my publications page http://lip6.fr/Marc.Shapiro/pubs.html. See also my Author Page at ACM Digital Library and at DBLP.

Book Chapters

[1] Marc Shapiro. Gestion répartie de fichiers. In R. Balter, J.-P. Banâtre, and S. Krakowiak, editors, *Construction des Systèmes d'Exploitation Répartis*, *Collection Didactique*, no. 9 in Collection Didactique, chapter 6. INRIA, Rocquencourt (France), April 1991.

[2] Marc Shapiro. Gestion répartie d'objets. In R. Balter, J.-P. Banâtre, and S. Krakowiak, editors, *Construction des Systèmes d'Exploitation Répartis*, *Collection Didactique*, no. 9 in Collection Didactique, chapter 7. INRIA, Rocquencourt (France), April 1991.

[3] Mesaac Makpangou, Yvon Gourhant, Jean-Pierre Le Narzul, and Marc Shapiro. Fragmented objects for distributed abstractions. In T. L. Casavant and M. Singhal, editors, *Readings in Distributed Computing Systems*, pages 170–186. IEEE Computer Society Press, July 1994.

[4] Marc Shapiro. *Informatiques, enjeux tendances et évolutions*, volume 19 of *Techniques et Sciences Informatiques*, chapter Le partage d'informations dans les systèmes répartis grande échelle, pages 455–462. Hermès Science, Paris, January 2000.

[5] Paulo Ferreira, Marc Shapiro, Xavier Blondel, Olivier Fambon, João Garcia, Sytse Kloosterman, Nicolas Richer, Marcus Roberts, Fadi Sandakly, George Coulouris, Jean Dollimore, Paulo Guedes, Daniel Hagimont, and Sacha Krakowiak. PerDiS: design, implementation, and use of a PERsistent DIstributed Store. In S. Krakowiak and S. K. Shrivastava, editors, *Recent Advances in Distributed Systems*, volume 1752 of *Lecture Notes in Comp. Sc.*, chapter 18, pages 427–452. Springer-Verlag, February 2000. http://www-sor.inria.fr/publi/PDIUPDS_lncs1752.html.

[6] Marc Shapiro, Fabrice Le Fessant, and Paulo Ferreira. Recent advances in distributed garbage collection. In S. Krakowiak and S. K. Shrivastava, editors, *Recent Advances in Distributed Systems*, volume 1752 of *Lecture Notes in Comp. Sc.*, chapter 5, pages 104–126. Springer-Verlag, February 2000. http://www-sor.inria.fr/publi/RAIDGC_lncs1752.html.

[7] Marc Shapiro. Optimistic replication and resolution. In M. Tamer Özsu and Ling Liu, editors, *Encyclopedia of Database Systems (online and print)*. Springer-Verlag GmbH, October 2009.

[8] Marc Shapiro and Bettina Kemme. Eventual consistency. In M. Tamer Özsu and Ling Liu, editors, *Encyclopedia of Database Systems (online and print)*. Springer-Verlag GmbH, October 2009.

Theses

[9] Marc Shapiro. *Une méthode de conception progressive des systèmes parallèles utilisant le langage C.S.P.* Thèse de docteur-ingénieur, Institut National Polytechnique de Toulouse, E.N.S.E.E.I.H.T., Toulouse, France, September 1980.

[10] Marc Shapiro. *La gestion des objets dans les systèmes répartis de grande échelle*. Habilitation à diriger les recherches, Université Paris VI — Pierre et Marie Curie, Paris, France, November 2002. http://www-sor.inria.fr/~shapiro/habilitation/.

Refereed Journal Articles

[11] Marc Shapiro. Le service d'appel de procédure distante Girolle. *Technique et Science Informatiques*, 3(6):435–442, December 1984.

[12] Marc Shapiro, Vadim Abrossimov, Philippe Gautron, Sabine Habert, and Mesaac Mounchili Makpangou. SOS : un système d'exploitation réparti basé sur les objets. *Technique et Science Informatiques*, 6(2):166–169, 1987.

[13] Marc Shapiro, Yvon Gourhant, Sabine Habert, Laurence Mosseri, Michel Ruffin, and Céline Valot. SOS: An object-oriented operating system — assessment and perspectives. *Computing Systems*, 2(4):287–338, December 1989.

[14] Yasushi Saito and Marc Shapiro. Optimistic replication. *Computing Surveys*, 37(1):42–81, March 2005. http://doi.acm.org/10.1145/1057977.1057980.

[15] Youssef Hamadi and Marc Shapiro. Pushing log-based reconciliation. *Int. J. on Artif. Intelligence Tools (IJAIT)*, 14(3–4):445–458, jun 2005. http://www.research.microsoft.com/~youssefh/Papers/ijait05Log.pdf.

[16] Marc Shapiro. What's wrong with us? *Distributed Systems Online*, 7(5), May 2006. Art. no. 0506-o5003.

Proceedings Editor

[17] Luis-Felipe Cabrera, Vince Russo, and Marc Shapiro, editors. *1991 International Workshop on Object Orientation in Operating Systems*, Palo Alto CA (USA), October 1991. IEEE, IEEE Computer Society Press. IEEE Computer Society Press Order Number 2265.

[18] Isabelle Demeure and Marc Shapiro. Numéro spécial sur la mémoire partagée répartie. *Techniques et Sciences Informatiques*, December 1997.

Invited Talks

[19] Marc Shapiro. Réplication : les approches optimistes (conf. invitée). In Philippe Pucheral, editor, *Journées Bases de Données Avancées (BDA)*, Évry, France, October 2002.

[20] Marc Shapiro. Practical proofs of concurrent programs. In *Int. Conf. on Functional Programming (ICFP)*, pages 123–123, Portland, Oregon, USA, September 2006. ACM Sigplan, Assoc. for Comp. Machinery.

Refereed Conference Articles

[21] J. M. Ayache, B. Carrichon, M. Devy, M. Diaz, B. Potin, and M. Shapiro. A distributed control system for industrial plants. In *Euromicro 80 Conference*, London, United Kingdom, September 1980.

[22] J.M. Ayache, B. Carrichon, J.P. Courtiat, M. Diaz, B. Potin, and M. Shapiro. Fault tolerance in Rebus, a distributed system for industrial real time control. In *Symp. on Fault-Tolerant Computing (FTCS-11)*, Portland, Maine, USA, June 1981.

[23] Marc Shapiro. An experiment in distributed program design, using control enrichment. In *Int. Conf. on Dist. Computing Syst. (ICDCS)*, Miami-Ft. Lauderdale FL (USA), October 1982.

[24] Guy Bernard, Pierre Bouchet, Thierry Fleury, Marc Shapiro, and Yves de Talhouet. Microrézo : le projet réseau local du Centre Mondial. In *1983 World Conference on Systems*, Caracas, Venezuela, 1983.

[25] Marc Shapiro. Structure and encapsulation in distributed systems: the Proxy Principle. In *6th Int. Conf. on Distributed Comp. Sys. (ICDCS)*, pages 198–204, Cambridge, MA, USA, May 1986. IEEE. http://www-sor.inria.fr/publi/summaries/1986/SEDSPP_icdcs86.html.

[26] Mesaac Makpangou and Marc Shapiro. The SOS object-oriented communication service. In *Proc. 9th Int. Conf. on Computer Communication*, Tel Aviv (Israel), October–November 1988.

[27] V. Abrossimov, M. Rozier, and M. Shapiro. Generic virtual memory management for operating system kernels. In *Proceedings of the 12th ACM Symposium on Operating Systems Principles*, pages 123–136, Litchfield Park AZ (USA), December 1989. ACM.

[28] Marc Shapiro. Prototyping a distributed object-oriented OS on Unix. In Eugene Spafford, editor, *W. on Experiences with Building Distributed and Multiprocessor Systems*, Ft. Lauderdale FL (USA), October 1989. USENIX. Also available as Rapport de Recherche INRIA no. 1082.

[29] Marc Shapiro, Philippe Gautron, and Laurence Mosseri. Persistence and migration for C++ objects. In Stephen Cook, editor, *ECOOP'89, Proc. of the Third European Conf. on Object-Oriented Programming*, *British Computer Society Workshop Series*, British Computer Society Workshop Series, pages 191–204, Nottingham (GB), July 1989. The British Computer Society, Cambridge University Society.

[30] Yvon Gourhant and Marc Shapiro. FOG/C++: a fragmented-object generator. In *C++ Conference*, pages 63–74, San Francisco, CA (USA), April 1990. Usenix.

[31] Marc Shapiro. A fault-tolerant, scalable, low-overhead distributed garbage detection protocol. In *Tenth Symp. on Reliable Distributed Sytems*, Pisa (Italy), October 1991.

[32] David Plainfossé and Marc Shapiro. Experience with a fault-tolerant garbage collector in a distributed Lisp system. In *Proc. 1992 International Workshop on Memory Management*, pages 116–133, Saint-Malo (France), September 1992.

[33] Marc Shapiro, Peter Dickman, and David Plainfossé. Robust, distributed references and acyclic garbage collection. In *Symp. on Principles of Distributed Computing*, pages 135–146, Vancouver (Canada), August 1992. ACM.

[34] Paulo Ferreira and Marc Shapiro. Garbage collection and DSM consistency. In *Proc. of the First Symposium on Operating Systems Design and Implementation (OSDI)*, pages 229–241, Monterey CA (USA), November 1994. ACM.

[35] Paulo Ferreira and Marc Shapiro. Garbage collection of persistent objects in distributed shared memory. In *Proc. of the 6th Int. Workshop on Persistent Object Systems*, pages 176–191, Tarascon (France), September 1994. Springer-Verlag.

[36] Marc Shapiro. A binding protocol for distributed shared objects. In *Proc. Int. Conf. on Distributed Computing Systems*, Poznan (Poland), June 1994.

[37] Paulo Ferreira and Marc Shapiro. Garbage collection in the Larchant persistent distributed store. In *Proc. of the 5th Workshop on Future Trends in Distributed Computing Systems (FTDC'95)*, Cheju Island (Republic of Korea), August 1995.

[38] Paulo Ferreira and Marc Shapiro. Larchant: Persistence by reachability in distributed shared memory through garbage collection. In *Proc. 16th Int. Conf. on Dist. Comp. Syst. (ICDCS)*, Hong Kong, May 1996. http://www-sor.inria.fr/publi/LPRDSMGC:icdcs96.html.

[39] David Plainfossé and Marc Shapiro. Un algorithme conservatif de détection des miettes en milieu réparti. In *Convention Unix 91*, pages 61–74, Paris, March 1991.

[40] Marc Shapiro and Paulo Ferreira. Larchant-RDOSS: a distributed shared persistent memory and its garbage collector. In J.-M. Hélary and M. Raynal, editors, *WDAG, Workshop on Distributed Algorithms*, number 972 in Springer-Verlag LNCS, pages 198–214, Le Mont Saint-Michel (France), September 1995.

[41] Fabrice le Fessant, Ian Piumarta, and Marc Shapiro. An implementation of complete, asynchronous, distributed garbage collection. In *Conf. on Prog. Lang. Design and Impl. (PLDI)*, Montreal (Canada), June 1998. ACM SIGPLAN. http://www-sor.inria.fr/publi/ICADGC_pldi98.html.

[42] Paulo Ferreira and Marc Shapiro. Modelling a distributed cached store for garbage collection. In *12th Euro. Conf. on Object-Oriented Prog. (ECOOP)*, Brussels (Belgium), July 1998. http://www-sor.inria.fr/publi/MDCSGC_ecoop98.html.

[43] Anne-Marie Kermarrec, Antony Rowstron, Marc Shapiro, and Peter Druschel. The IceCube approach to the reconciliation of divergent replicas. In *20th Symp. on Principles of Dist. Comp. (PODC)*, Newport RI, USA, August 2001. ACM SIGACT-SIGOPS. http://research.microsoft.com/research/camdis/Publis/podc2001.pdf.

[44] Nuno Preguiça, Marc Shapiro, and J. Legatheaux Martins. Automating semantics-based reconciliation for mobile transactions. In *CFSE'3: conférence française sur les systèmes d'exploitation*, pages 515–524, La-Colle-sur-Loup, France, October 2003.

[45] Nuno Preguiça, Marc Shapiro, and Caroline Matheson. Semantics-based reconciliation for collaborative and mobile environments. In *Proc. Tenth Int. Conf. on Coop. Info. Sys. (CoopIS)*, volume 2888 of *Lecture Notes in Comp. Sc.*, pages 38–55, Catania, Sicily, Italy, November 2003. Springer-Verlag. http://www-sor.inria.fr/~shapiro/papers/coopis-2003.pdf.

[46] Marc Shapiro, Nuno Preguiça, and James O'Brien. Rufis: mobile data sharing using a generic constraint-oriented reconciler. In *Conf. on Mobile Data Management*, Berkeley, CA, USA, January 2004. http://www-sor.inria.fr/~shapiro/papers/mdm-2004-final.ps.gz.

[47] Marc Shapiro, Karthik Bhargavan, Yek Chong, and Youssef Hamadi. Brief announcement: A formalism for consistency and partial replication. In Rachid Guerraoui, editor, *Conference on Distributed Computing (DISC)*, volume 3274/2004 of *Lecture Nodes in Computer Science*, Trippenhuis, Amsterdam, the Netherlands, October 2004.

[48] Marc Shapiro, Karthikeyan Bhargavan, and Nishith Krishna. A constraint-based formalism for consistency in replicated systems. In *Proc. 8th Int. Conf. on Principles of Dist. Sys. (OPODIS)*, number 3544 in Springer-Verlag, pages 331–345, Grenoble, France, December 2004. http://www-sor.inria.fr/~shapiro/papers/opodis2004-final-2004-10-30.pdf.

[49] Nishith Krishna, Marc Shapiro, and Karthikeyan Bhargavan. Brief announcement: Exploring the consistency problem space. In *Symp. on Prin. of Dist. Computing (PODC)*, Las Vegas, Nevada, USA, July 2005. ACM SIGACT-SIGOPS.

[50] Marc Shapiro and Nishith Krishna. The three dimensions of data consistency. In *Journées Francophones sur la Cohérence des Données en Univers Réparti (CDUR)*, CNAM, Paris, France, November 2005. http://www-sor.inria.fr/~shapiro/papers/cdur2005.pdf.

[51] Viktor Vafeiadis, Maurice Herlihy, Tony Hoare, and Marc Shapiro. Proving correctness of highly-concurrent linearisable objects. In *Principles and Practice of Parallel Programming (PPoPP)*, pages 129–136, New York, USA, March 2006.

[52] James O'Brien and Marc Shapiro. An application framework for collaborative, nomadic applications. In *Int. Conf. on Dist. App. and Interop. Sys. (DAIS)*, Bologna, Italy, June 2006. IFIP WG 6.1. http://www-sor.inria.fr/~shapiro/papers/Joyce_DAIS-2006.pdf.

[53] João Barreto, Paulo Ferreira, and Marc Shapiro. Exploiting our computational surroundings for better mobile collaboration. In *Int. Conf. on Mobile Data Management (MDM)*, pages 110–117, Mannheim, Germany, May 2007.

[54] Pierre Sutra and Marc Shapiro. Comparing optimistic database replication techniques. In *Bases de Données Avancées (BDA)*, Marseille, France, October 2007.

[55] Pierre Sutra, João Barreto, and Marc Shapiro. Decentralised commitment for optimistic semantic replication. In *Int. Conf. on Coop. Info. Sys. (CoopIS)*, Vilamoura, Algarve, Portugal, November 2007.

[56] Claudia-Lavinia Ignat, Gérald Oster, Pascal Molli, Michèle Cart, Jean Ferrié, Anne-Marie Kermarrec, Pierre Sutra, Marc Shapiro, Lamia Benmouffok, Jean-Michel Busca, and Rachid Guerraoui. A comparison of optimistic approaches to collaborative editing of Wiki pages. In *Int. Conf. on Coll. Computing: Networking, Apps. and Worksharing (CollaborateCom)*, number 3, White Plains, NY, USA, November 2007.

[57] Pierre Sutra and Marc Shapiro. Fault-tolerant partial replication in large-scale database systems. In *Euro. Conf. on Parallel and Dist. Comp. (Euro-Par)*, pages 404–413, Las Palmas de Gran Canaria, Spain, August 2008.

[58] Nuno Preguiça, Joan Manuel Marquès, Marc Shapiro, and Mihai Leția. A commutative replicated data type for cooperative editing. In *Int. Conf. on Distributed Comp. Sys. (ICDCS)*, pages 395–403, Montréal, Canada, June 2009.

[59] Lamia Benmouffok, Jean-Michel Busca, Joan Manuel Marquès, Marc Shapiro, Pierre Sutra, and Georgios Tsoukalas. Telex: A semantic platform for cooperative application development. In *Conf. Française sur les Systèmes d'Exploitation (CFSE)*, Toulouse, France, September 2009.

Refereed Workshops

[60] Marc Shapiro. The contributions of an object-oriented approach to the programming of distributed applications. In Jean Bézivin and Pierre Cointe, editors, *Journée d'Étude sur les Langages Orientés Objet*, number 37 in BIGRE, pages 149–159, Le Cap d'Agde, France, October 1983. AFCET-Informatique.

[61] Marc Shapiro. Une proposition pour Microrézo : Girolle, un protocole d'appel de procédure distante. In *"Génie Logiciel : le second souffle ?", Journées Bigre 1983*, Le Cap d'Agde, France, October 1983.

[62] Marc Shapiro. SOS: a distributed object-oriented operating system. In *2nd ACM SIGOPS European Workshop, on "Making Distributed Systems Work"*, Amsterdam (the Netherlands), September 1986. ACM Sigops.

[63] Philippe Gautron and Marc Shapiro. Two extensions to C++: A dynamic link editor and inner data. In *Proceeding and additional papers, C++ Workshop*, Berkeley, CA (USA), November 1987. USENIX.

[64] Marc Shapiro. The design of a distributed object-oriented operating system for office applications. In *Proc. Esprit Technical Week 1988*, Brussels (Belgium), November 1988.

[65] Marc Shapiro. Domains and dynamic loading: reconciling autonomy and integration. In *SIGOPS European Workshop on "Autonomy or interdependence in distributed systems?"*. ACM SIGOPS, September 1988. http://doi.acm.org/10.1145/504092.504127.

[66] Marc Shapiro and Nuno Guimarães. Software integration in SOMIW: Goals, accomplishments, and problems. In Commission of the European Communities, editor, *Esprit'89, Proceedings of the 6th Annual Esprit Conference*. North-Holland, November 1989.

[67] Marc Shapiro and Laurence Mosseri. A simple object storage system. In J. Rosenberg, editor, *Proc. Workshop on persistent object systems*, pages 320–327, Newcastle NSW (Australia), January 1989.

[68] Mesaac Makpangou, Yvon Gourhant, and Marc Shapiro. BOAR: A library of fragmented object types for distributed abstractions. In *Proc. of the International Workshop on Object-Orientation in Operating Systems*, Palo Alto, CA (USA), October 1991.

[69] David Plainfossé and Marc Shapiro. Distributed garbage collection in the system is good. In Cabrera et al. [17], pages 94–99. IEEE Computer Society Press Order Number 2265.

[70] Marc Shapiro. Soul: An object-oriented OS framework for object support. In *Workshop on Operating Systems for the Nineties and Beyond*, pages 251–255, Dagstuhl Castle, Germany, July 1991. Springer-Verlag.

[71] Peter Dickman, Mesaac Makpangou, and Marc Shapiro. Contrasting fragmented objects with uniform transparent object references for distributed programming. In *5th European SIGOPS Workshop, on "Models and Paradigms for Distributed Systems Structuring"*, Mont Saint-Michel (France), September 1992. ACM SIGOPS, IRISA, INRIA-Rennes.

[72] Julien Maisonneuve, Marc Shapiro, and Pierre Collet. Implementing references as chains of links. In *1992 Int. Workshop on Object Orientation and Operating Systems*, pages 236–243, Dourdan (France), October 1992. IEEE Comp. Society, IEEE Comp. Society Press.

[73] David Plainfossé and Marc Shapiro. A distributed GC in an object-support operating system. In *1992 Int. Workshop on Object Orientation and Operating Systems*, pages 221–229, Dourdan (France), October 1992. IEEE Comp. Society, IEEE Comp. Society Press.

[74] Marc Shapiro. Operating system support for distributed and persistent objects. In *Proc. Int. Workshop on Distributed Object Management*, pages 202–205, Edmonton (Canada), August 1992.

[75] Paulo Ferreira and Marc Shapiro. Distribution and persistence in multiple and heterogeneous address spaces. In *Broadcast 1st Open Workshop*, pages 83–94, Newcastle (UK), October 1993.

[76] Julien Maisonneuve and Marc Shapiro. Implementing efficient indirections. In *Broadcast 1st Open Workshop*, Newcastle England, October 1993.

[77] Marc Shapiro. Binding should be flexible in a distributed system. In *Int. W. on Object Orientation and Op. Sys.*, pages 216–217, Asheville, NC, USA, December 1993. IEEE Comp. Soc.

[78] Paulo Ferreira and Marc Shapiro. Distribution and persistence in multiple and heterogeneous address spaces. In *Proc. Int. Workshop on Object-Orientation in Operating Systems*, Asheville NC (USA), December 1993.

[79] Marc Shapiro, David Plainfossé, Paulo Ferreira, and Laurent Amsaleg. Some key issues in the design of distributed garbage collection and references. In *Unifying Theory and Practice in Distributed Systems*, Dagstuhl (Germany), September 1994.

[80] David Plainfossé and Marc Shapiro. A survey of distributed garbage collection techniques. In Henry G. Baker, editor, *Proc. Int. Workshop on Memory Management (IWMM)*, volume 986 of *Lecture Notes in Comp. Sc.*, pages 211–249, Kinross, Scotland, UK, September 1995. Springer-Verlag. http://www-sor.inria.fr/publi/SDGC_iwmm95.html.

[81] Laurent Amsaleg, Paulo Ferreira, Michael Franklin, and Marc Shapiro. Evaluating garbage collectors for large persistence stores. In *Conf. on Object-Oriented Programming Systems, Languages, and Applications*, Austin TX, USA, October 1995.

[82] Marc Shapiro, Sytse Kloosterman, and Fabio Riccardi. PerDiS — a persistent distributed store for cooperative applications. In *Proc. 3rd Cabernet Plenary W.*, Rennes (France), April 1997. http://www-sor.inria.fr/publi/PPDSCA_cabernet97.html.

[83] Aline Baggio et Marc Shapiro. Reconciling transparency with resource awareness in nomadic computing. In *Proc. 4th Cabernet Radicals W.*, Rethimnon, Crete (Greece), 1997. Cabernet Working Group. http://www-sor.inria.fr/publi/RTRANC_radical97.html.

[84] Xavier Blondel, Paulo Ferreira, and Marc Shapiro. PerDiS PPF case study: Fitting a distributed garbage collection algorithm to a persistent distributed store architecture. In *OOPSLA'97 W. on Garbage Collection and Memory Management*, Atlanta GA (USA), October 1997. http://www-sor.inria.fr/publi/PPCS_oopsla97.html.

[85] Fabrice le Fessant, Ian Piumarta, and Marc Shapiro. A detection algorithm for distributed cycles of garbage. In *OOPSLA W. on Garbage Collection and Memory Management*, Atlanta, GA, USA, October 1997. http://www-sor.inria.fr/publi/DADCG_gcmm97.html.

[86] Xavier Blondel, Paulo Ferreira, and Marc Shapiro. Implementing garbage collection in the PerDiS system. In *Proc. 8th Int. W. on Persistent Object Systems*, Tiburon CA (USA), August 1998. http://www-sor.inria.fr/publi/IGCPS_pos8.html.

[87] Marc Shapiro, Paulo Ferreira, and Nicolas Richer. Experience with the PerDiS large-scale data-sharing middleware. In D.I.K. SjǍžberg G.N.C. Kirby, A. Dearle, editor, *Int. W. on Persistent Obj. Sys.*, volume 2135 of *Lecture Notes in Comp. Sc.*, pages 57–71, Lillehammer, Norway, September 2000. Springer-Verlag. http://www-sor.inria.fr/publi/EwPLSDSM_pos2000.html.

[88] Marc Shapiro and Nicolas Richer. The memory behavior of the WWW, or: The WWW considered as a persistent store. In G.N.C. Kirby, A. Dearle, and D.I.K. SjǍžberg, editors, *Int. W. on Persistent Obj. Sys.*, volume 2135 of *Lecture Notes in Comp. Sc.*, pages 169–184, Lillehammer, Norway, September 2000. Springer-Verlag. http://www-sor.inria.fr/publi/TMBotWoTWCaaPS_pos2000.html.

[89] Marc Shapiro, Antony Rowstron, and Anne-Marie Kermarrec. Application-independent reconciliation for nomadic applications. In *Proc. SIGOPS European Workshop: "Beyond the PC: New Challenges for the Operating System"*, Kolding (Denmark), September 2000. ACM SIGOPS. http://www-sor.inria.fr/~shapiro/papers/sigops-ew-2000-logmerge.html.

[90] Marc Shapiro and Yasushi Saito. Scaling optimistic replication. In A. Schiper, A. A. Shvartsman, H. Weatherspoon, and B. Y. Zhao, editors, *W. on Future Directions in Distributed Computing (FuDiCo 2002): Research and Position Papers*, volume 2584 of *Lecture Notes in Comp. Sc.*, pages 164–168, Bertinoro, Forlì, Italy, June 2002. Springer-Verlag. http://www.springerlink.com/openurl.asp?genre=article&issn=0302-9743&volume=2584&spage=164.

[91] James O'Brien and Marc Shapiro. Undo for anyone, anywhere, anytime. In *SIGOPS European Workshop*, Leuven, Belgium, September 2004. ACM Special Interest Group on Operating Systems.

[92] Nuno Pregui ca, Carlos Baquero, J. Legatheaux Martins, Marc Shapiro, Paulo Sérgio Almeida, Henrique Domingos, Victor Fonte, and Sérgio Duarte. FEW: File management for portable devices. In *Proc. Int. W. on Software Support for Portable Storage*, San Francisco, CA, USA, March 2005. http://asc.di.fct.unl.pt/few/papers/few-iwssps2005.pdf.

[93] Lamia Benmouffok, Jean-Michel Busca, and Marc Shapiro. Semantic middleware for designing collaborative applications in mobile environment. In *Middleware*

for Network Eccentric and Mobile Apps. W. (MiNEMA), pages 58–61, Magdeburg, Germany, September 2007.

[94] Mihai Leția, Nuno Preguiça, and Marc Shapiro. CRDTs: Consistency without concurrency control. In *SOSP W. on Large Scale Distributed Systems and Middleware (LADIS)*, volume 44 of *Operating Systems Review*, pages 29–34, Big Sky, MT, USA, October 2009. ACM SIG on Operating Systems (SIGOPS), Assoc. for Comp. Machinery.

Audio-visual

[95] Marc Shapiro. *Gestion Répartie d'Objets*. Imasoft, producer. 75 minutes. 1992.

Unrefereed Articles

[96] Marc Shapiro. Object-support operating systems. *Newsletter of the IEEE Computer Society Technical Committee on Operating Systems and Application Environments*, 5(1):39–42, 1991.

[97] Marc Shapiro. Systèmes d'objets répartis. *Newsletter of the IEEE Computer Society Technical Committee on Operating Systems and Application Environments*, 5(2):12–14, 1991.

[98] Marc Shapiro, Yvon Gourhant, Sabine Habert, Jean-Pierre Le Narzul, Laurence Mosseri, Michel Ruffin, and Céline Valot. Un bilan du système réparti à objets SOS. *AFCET Interfaces*, (103/104):46–53, May 1991.

[99] Marc Shapiro. Summary of the 6th SIGOPS European Workshop on "Matching Operating Systems to Application Needs". *Operating Systems Review*, 29(1):47–51, January 1995.

Unrefereed Conferences and Workshops

[100] Jean-Pierre Le Narzul and Marc Shapiro. Un service de nommage pour un système à objets répartis. In *Actes Convention Unix 89*, pages 73–82, Paris, March 1989. AFUU.

[101] Jean-Pierre Le Narzul and Marc Shapiro. Un service de nommage pour un système réparti à objets. In *Séminaire Franco-Brésilien sur les Systèmes Informatiques Répartis*, pages 127–133, Florianopolis (Brazil), September 1989. LAAS and UFSC.

[102] Marc Shapiro. Distributed object-support operating systems and garbage collection. In *Workshop on Garbage Collection at ECOOP/OOPSLA 1990*, Ottawa (Canada), October 1990.

[103] Marc Shapiro. Object-support operating systems. In *Workshop on Operating Systems and Object Orientation at ECOOP/OOPSLA 1990*, Ottawa (Canada), October 1990.

[104] David Plainfossé and Marc Shapiro. A survey of distributed garbage collection techniques. In *Second Closed BROADCAST Workshop*, Bruxelles (Belgique), November 1994. Broadcast Basic Research Action.

Technical Reports

[105] Mesaac Makpangou and Marc Shapiro. The SOS object-oriented communication service. Rapport de Recherche 801, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), March 1988.

[106] Marc Shapiro, Yvon Gourhant, Sabine Habert, Jean-Pierre Le Narzul, Laurence Mosseri, Michel Ruffin, and Céline Valot. Un bilan du système réparti à objets SOS. Rapport de Recherche 1242, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), May 1990.

[107] Marc Shapiro, Olivier Gruber, and David Plainfossé. A garbage detection protocol for a realistic distributed object-support system. Rapport de Recherche 1320, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), November 1990.

[108] Mesaac Makpangou, Yvon Gourhant, Jean-Pierre Le Narzul, and Marc Shapiro. Structuring distributed applications as fragmented objects. Rapport de recherche 1404, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), January 1991.

[109] Marc Shapiro, Peter Dickman, and David Plainfossé. SSP chains: Robust, distributed references supporting acyclic garbage collection. Rapport de Recherche 1799, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), nov 1992. Also available as Broadcast Technical Report #1.

[110] Paulo Ferreira and Marc Shapiro. Distribution and persistence in multiple and heterogeneous address spaces. Rapport de Recherche 2016, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), September 1993.

[111] Marc Shapiro. Flexible bindings for fine-grain, distributed objects. Rapport de Recherche 2007, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), August 1993.

[112] Marc Shapiro and Paulo Ferreira. Larchant-RDOSS: a distributed shared persistent memory and its garbage collector. Rapport de Recherche 2399, Institut National de la Recherche en Informatique et Automatique, Rocquencourt (France), November 1994.

[113] Marc Shapiro and Paulo Ferreira. Larchant-RDOSS: a distributed shared persistent memory and its garbage collector. Technical Report TR94-1466, Dept. of Comp. Sc., Cornell University, Ithaca NY (USA), November 1994.

[114] Paulo Ferreira, Marc Shapiro, Xavier Blondel, Olivier Fambon, Joâo Garcia, Sytse Kloosterman, Nicolas Richer, Marcus Roberts, Fadi Sandakly, George Coulouris, Jean Dollimore, Paulo Guedes, Daniel Hagimont, and Sacha Krakowiak. PerDiS: design, implementation, and use of a PERsistent DIstributed Store. Technical Report QMW TR 752, CSTB ILC/98-1392, INRIA RR 3525, INESC RT/5/98, QMW, CSTB, INRIA and INESC, October 1998. http://www-sor.inria.fr/publi/PDIUPDS_rr3525.html.

[115] Yasushi Saito and Marc Shapiro. Replication: Optimistic approaches. Technical Report HPL-2002-33, Hewlett-Packard Laboratories, March 2002. http://www.hpl.hp.com/techreports/2002/HPL-2002-33.html.

[116] Nuno Preguiça, Marc Shapiro, and Caroline Matheson. Efficient semantics-aware reconciliation for optimistic write sharing. Technical Report MSR-TR-2002-52, Microsoft Research, Cambridge, UK, May 2002. http://research.microsoft.com/scripts/pubs/view.asp?TR_ID=MSR-TR-2002-52.

[117] Nuno Preguiça, Marc Shapiro, and J. Legatheaux Martins. SqlIceCube: Automatic semantics-based reconciliation for mobile databases. Technical Report TR-02-2003 DI-FCT-UNL, Universidade Nova de Lisboa, Dep. Informática, FCT, 2003. http://asc.di.fct.unl.pt/~nmp/papers/sqlice3-rep.pdf.

[118] Yasushi Saito and Marc Shapiro. Optimistic replication. Technical Report MSR-TR-2003-60, Microsoft Research, October 2003. ftp://ftp.research.microsoft.com/pub/tr/tr-2003-60.pdf.

[119] Marc Shapiro and Karthik Bhargavan. The Actions-Constraints approach to replication: Definitions and proofs. Technical Report MSR-TR-2004-14, Microsoft Research, March 2004. ftp://ftp.research.microsoft.com/pub/tr/TR-2004-14.pdf.

[120] Marc Shapiro, Karthik Bhargavan, Yek Chong, and Youssef Hamadi. A formalism for consistency and partial replication. Technical Report MSR-TR-2004-58, Microsoft Research, Cambridge, UK, June 2004. ftp://ftp.research.microsoft.com/pub/tr/TR-2004-58.pdf.

[121] James O'Brien and Marc Shapiro. An application agnostic replication system for ubiquitous computing. Technical Report MSR-TR-2004-64, Microsoft Research Cambridge, July 2004. ftp://ftp.research.microsoft.com/pub/tr/TR-2004-64.pdf.

[122] Viktor Vafeiadis, Maurice Herlihy, Tony Hoare, and Marc Shapiro. Proving correctness of highly-concurrent linearisable objects. Rapport de recherche RR-5716, Institut National de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, October 2005. http://www.inria.fr/rrrt/rr-5716.html.

[123] James O'Brien and Marc Shapiro. An application framework for collaborative, nomadic applications. Rapport de recherche RR-5745, Institut National de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, November 2005. http://www.inria.fr/rrrt/rr-5745.html.

[124] Pierre Sutra, João Barreto, and Marc Shapiro. An asynchronous, decentralised commitment protocol for semantic optimistic replication. Rapport de recherche 6069, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, December 2006.

[125] Viktor Vafeiadis, Maurice Herlihy, Tony Hoare, and Marc Shapiro. A safety proof of a lazy concurrent list-based set implementation. Technical Report UCAM-CL-TR-659, U. of Cambridge Computer Lab., Cambridge, UK, January 2006. http://www.cl.cam.ac.uk/TechReports/UCAM-CL-TR-659.html.

[126] Claudia Ignat, Gérald Oster, Pascal Molli, Michèle Cart, Jean Ferrié, Anne-Marie Kermarrec, Pierre Sutra, Marc Shapiro, Lamia Benmouffok, Jean-Michel Busca, and Rachid Guerraoui. A comparison of optimistic approaches to collaborative editing of Wiki pages. Research Report RR-6278, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), September 2007.

[127] Marc Shapiro and Nuno Preguiça. Designing a commutative replicated data type. Rapport de recherche RR-6320, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, October 2007.

[128] Pierre Sutra and Marc Shapiro. Fault-tolerant partial replication in large-scale database systems. Rapport de recherche 6440, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, February 2008.

[129] Lamia Benmouffok, Jean-Michel Busca, Joan Manuel Marquès, Marc Shapiro, Pierre Sutra, and Georgios Tsoukalas. Telex: Principled system support for write-sharing in collaborative applications. Rapport de recherche 6546, INRIA, Rocquencourt, France, May 2008.

[130] Nuno Preguiça, Marc Shapiro, and J. Legatheaux Martins. Designing a commutative replicated data type for cooperative editing systems. Technical Report TR-02-2008 DI-FCT-UNL, Universidade Nova de Lisboa, Dep. Informática, FCT, 2008.

[131] Mihai Leția, Nuno Preguiça, and Marc Shapiro. CRDTs: Consistency without concurrency control. Rapport de recherche RR-6956, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, June 2009.

[132] Pierre Sutra and Marc Shapiro. Fast Genuine Generalized Consensus. Rapport de recherche ???, Institut Nat. de la Recherche en Informatique et Automatique (INRIA), Rocquencourt, France, May 2010.

Miscellaneous

[133] Marc Shapiro, Yolande Berbers, Willy Zwaenepoel, and Tim Harris. Systems research, education and industry in Europe. Text submitted to the European Commission, June 2005. http://www-sor.inria.fr/~shapiro/papers/Systems_research,_education_and_industry_in_Europe.pdf.

[134] Peter Druschel, Rebecca Isaacs, Thomas Gross, and Marc Shapiro. Fostering Systems research in Europe. White paper, EuroSys, the European Professional Society in Systems, April 2006. http://www.eurosys.org/whitepaper-2006/.