

TUDOR A. DUMITRAȘ

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RESEARCH INTERESTS

I am interested in fault-tolerant distributed systems. I equally enjoy building dependable systems firsthand and studying empirically the behavior of systems large and small.

EDUCATION

Carnegie Mellon University, Pittsburgh, PA

Ph.D. in Electrical and Computer Engineering (GPA: 4.0/4.0) December 2010

Advisor: Prof. Priya Narasimhan

M.S. in Electrical and Computer Engineering (GPA: 4.0/4.0) May 2003

Advisor: Prof. Radu Mărculescu

Ecole Polytechnique, Paris, France

Diplôme d'Ingénieur (Computer Science Major) July 2001

"Politehnica" University, Bucharest, Romania

B.S. in Computer Science July 2001

DOCTORAL DISSERTATION

Title: **Improving the Dependability of Distributed Systems through AIR Software Upgrades**

Advisor: Prof. Priya Narasimhan

Software upgrades are inevitable in distributed enterprise systems, and they often cause downtime, data loss or latent errors. My thesis identifies and addresses the leading causes of upgrade failure (broken dependencies) and of planned downtime (data migrations). I build on empirical insights and opportunities provided by emerging technologies to simplify large-scale upgrades and to improve their dependability.

PROFESSIONAL EXPERIENCE

Symantec Research Labs, Herndon, VA (senior research engineer) Nov 2010 – present

Working on defining a rigorous benchmark for computer security, using comprehensive field data. Responsible for Symantec's program for sharing data with the academia, the Worldwide Intelligence Network Environment (WINE).

Oracle Corporation, Redwood Shores, CA (intern, supervised by Alan Downing) May – Jul 2008

Conducted study on the data transformations required by enterprise-application upgrades.

VMware Inc., Palo Alto, CA (intern, supervised by Bich Le and Suresh Ravoore) May – Aug 2006

Developed prototype for applying software updates to offline virtual machines.

IBM Research, Hawthorne, NY (intern, supervised by Daniela Roșu and Asit Dan) May – Aug 2005

Developed upgrade-planning framework for minimizing service disruption.

Siemens Corporate Research, Princeton, NJ (intern) May – Sep 2004

Conducted analysis of the company practices for designing dependable systems.

IBM Corporation, Paris, France (intern) Apr – Jul 2001

Developed phone-based application for monitoring the supply chain of a transportation company.

HONORS

A.G. Jordan Award , Carnegie Mellon ECE Department (for outstanding Ph.D. thesis and service)	2011
Phi Kappa Phi Honor Society Membership	2010
John Vlissides Award , ACM SIGPLAN (for significant promise in applied software research)	2009
1st Place, ACM Student Research Competition , OOPSLA'09	2009
Research Grant , Amazon Web Services (for reducing upgrade failures via upgrades-as-a-service)	2009
Graduate Student Service Award , Carnegie Mellon University	2006
Best Paper Award , Asia and South Pacific Design Automation Conference	2003
Excellence scholarship , French government's EIFFEL program	1999–2001
Study-abroad scholarship , European Union's ERASMUS program	2000
First of class , "Politehnica" University (3 rd year)	1999

PUBLICATIONS

Conference Papers

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- [1] T. Dumitraş, E. Tilevich and P. Narasimhan. 'To Upgrade or Not To Upgrade: Impact of Online Upgrades Across Multiple Administrative Domains.' In *ACM Onward! Conference (Onward'10)*, Reno/Tahoe, NV, Oct 2010.
 - [2] T. Dumitraş and P. Narasimhan. 'Why Do Upgrades Fail And What Can We Do About It? Toward Dependable, Online Upgrades in Enterprise Systems.' In *ACM/IFIP/USENIX Conference on Middleware (Middleware'09)*, Urbana-Champaign, IL, Nov–Dec 2009.
 - [3] T. Dumitraş and P. Narasimhan. 'Got Predictability? Experiences with Fault-Tolerant Middleware.' In *ACM/IFIP/USENIX Conference on Middleware (Middleware'07)*, Newport Beach, CA, Nov 2007.
 - [4] T. Dumitraş and P. Narasimhan. 'Fault-Tolerant Middleware and the Magical 1%.' In *ACM/IFIP/USENIX Conference on Middleware (Middleware'05)*, Grenoble, France, Nov–Dec 2005.
12 citations*
 - [5] T. Dumitraş, S. Kerner and R. Mărculescu. 'Enabling On-Chip Diversity through Architectural Communication Design.' In *Asia and South Pacific Design Automation Conference (ASP-DAC'04)*, Yokohama, Japan, Jan 2004.
 - [6] T. Dumitraş and R. Mărculescu. 'On-Chip Stochastic Communication.' In *Design, Automation and Test in Europe Conference (DATE'03)*, Munich, Germany, Mar 2003.
70 citations
 - [7] T. Dumitraş, S. Kerner and R. Mărculescu. 'Towards on-chip fault-tolerant communication.' In *Asia and South Pacific Design Automation Conference (ASP-DAC'04)*, Kitakyushu, Japan, Jan 2003, pp. 225–232.
Best Paper Award
119 citations

Journal Articles

- [8] T. Dumitraş, I. Neamtii and E. Tilevich. 'Report on the Second ACM Workshop on Hot Topics in Software Upgrades (HotSWUp'09).' *ACM SIGOPS Operating Systems Review*, vol. 44, no. 4, pp. 146-152, Dec 2010.
- [9] P. Bogdan, T. Dumitraş and R. Mărculescu. 'Stochastic Communication: A New Paradigm for Fault-Tolerant Networks-on-Chip.' *Hindawi VLSI Design*, vol. 2007, Special Issue on Networks-on-Chip, 2007
30 citations
- [10] P. Narasimhan, T. Dumitraş, A. M. Paulos, S. M. Pertet, C. F. Reverte, J. G. Slember and D. Srivastava. 'MEAD: Support for Real-Time, Fault-Tolerant CORBA.' *Concurrency and Computation: Practice and Experience*, vol. 17, no. 12, pp. 1527-1545, Oct 2005, Wiley and Sons.
66 citations

* Citation counts retrieved on 30 November 2011 from Google Scholar.

Book Chapters (refereed)

- [11] T. Dumitraş, D. Roşu, A. Dan and P. Narasimhan, 'Ecotopia: An Ecological Framework for Change Management in Distributed Systems.' In *Architecting Dependable Systems Vol. IV (ADS IV)*, C. Gacek, A. Romanovsky and R. de Lemos, eds., Springer-Verlag, 2007.
- [12] T. Dumitraş, D. Srivastava and P. Narasimhan. 'Architecting and Implementing Versatile Dependability.' In *Architecting Dependable Systems Vol. III (ADS III)*, C. Gacek, A. Romanovsky and R. de Lemos, eds., Springer-Verlag, 2005.

17 citations

- [13] T. Dumitraş and R. Mărculescu. 'On-Chip Stochastic Communication.' In *Embedded Software for SoC*, A. Jerraya, S. Yoo, D. Verkest and N. When, eds., Kluwer, 2003, pp. 373-386.

Workshop and Short Papers (refereed)

- [14] T. Dumitraş and I. Neamtiu. 'Cloud Software Upgrades: Challenges and Opportunities.' In *IEEE International Workshop on the Maintenance and Evolution of Service-Oriented and Cloud-Based Systems (MESOCA'11)*, Williamsburg, VA, Sep 2011.
- [15] T. Dumitraş and I. Neamtiu. 'Experimental Challenges in Cyber Security: A Story of Provenance and Lineage for Malware.' In *USENIX Workshop on Cyber Security Experimentation and Test (CSET'11)*, San Francisco, CA, Aug 2011.
- [16] T. Dumitraş and D. Shou. 'Toward a standard benchmark for computer security research: The Worldwide Intelligence Network Environment (WINE).' In *EuroSys Workshop on Building Analysis Datasets and Gathering Experience Returns for Security (BADGERS'11)*, Salzburg, Austria, Apr 2011.
- [17] T. Dumitraş and P. Narasimhan. 'Upgrades-as-a-Service in Distributed Systems.' In *Work-in-Progress Session at USENIX Conference on File and Storage Technologies (FAST'10)*, San Jose, CA, Jan 2010.
- [18] T. Dumitraş and P. Narasimhan. 'Toward Upgrades-as-a-Service in Distributed Systems.' In *Poster Session at ACM/IFIP/USENIX Conference on Middleware (Middleware'09)*, Urbana-Champaign, IL, Nov-Dec 2009.
- [19] T. Dumitraş. 'Dependable, Online Upgrades in Distributed Systems,' In *Doctoral Symposium at Object-Oriented Programming, Systems, Languages and Applications Conference (OOPSLA'09)*, Orlando, FL, Oct 2009.

John Vlissides Award

- [20] T. Dumitraş. 'Dependable, Online Upgrades in Distributed Systems,' In *ACM Student Research Competition at Object-Oriented Programming, Systems, Languages and Applications Conference (OOPSLA'09)*, Orlando, FL, Oct 2009.

First Place

- [21] T. Dumitraş, J. Tan, Z. Gho and P. Narasimhan, 'No More *HotDependencies*: Toward Dependency-Agnostic Upgrades in Distributed Systems.' In *Workshop on Hot Topics in System Dependability (HotDep'07)*, Edinburgh, Scotland, Jun 2007.

11 citations

- [22] T. Dumitraş. 'Dependency-Agnostic Online Upgrades in Distributed Systems,' In *Student Forum at IEEE Conference on Dependable Systems and Networks (DSN'07)*, Edinburgh, Scotland, Jun 2007.
- [23] T. Dumitraş, M. Lee, P. Quinones, A. Smailagic, D. Siewiorek and P. Narasimhan. 'Eye of the Beholder: Phone-Based Text-Recognition for the Visually-Impaired.' In *Poster Session at International Symposium on Wearable Computers (ISWC'06)*, Montreux, Switzerland, Oct 2006, pp. 145-146.
- [24] T. Dumitraş, D. Roşu, A. Dan and P. Narasimhan. 'Impact-Sensitive Framework for Dynamic Change-Management.' In *DSN Workshop on Architecting Dependable Systems (WADS'06)*, Philadelphia, PA, Jun 2006.
- [25] T. Dumitraş, P. Narasimhan. 'An Architecture for Versatile Dependability.' In *DSN Workshop on Architecting Dependable Systems (WADS'05)*, Florence, Italy, Jun 2004.

Other Publications

- [26] T. Dumitraş. ‘Improving the Dependability of Distributed Systems through AIR Software Upgrades.’ *Ph.D. Thesis*, Carnegie Mellon University, Dec 2010.
Committee: P. Narasimhan (chair), G. Ganger, B. Maggs, A. Dan.
- [27] T. Dumitraş, I. Neamtiu and E. Tilevich, co-editors. ‘Proceedings of the 2nd ACM Workshop on Hot Topics in Software Upgrades (**HotSWUp’09**)’ Orlando, FL, Oct 2009.
- [28] T. Dumitraş, F. Eliassen, K. Geihs, H. Muccini, A. Polini and T. Ungerer. ‘Testing Run-time Evolving Systems’ In *Self-Healing and Self-Adaptive Systems, Dagstuhl Seminar Proceedings*, no. 09201 (**Dagstuhl Seminar 09201**), Dagstuhl, Germany, May 2009.
- [29] T. Dumitraş, D. Dig and I. Neamtiu, co-editors. ‘Proceedings of the 1st ACM Workshop on Hot Topics in Software Upgrades (**HotSWUp’08**)’ Nashville, TN, Oct 2008.
- [30] T. Dumitraş, A. Hanemann, B. Kratz and J. Pathak, co-editors. Proceedings of the IBM Ph.D. Student Symposium at ICSOC 2007, Vienna, Austria, Sep 2007.
- [31] A. Hanemann, B. Kratz, T. Dumitraş, and N. Mukhi, co-editors. Proceedings of the IBM Ph.D. Student Symposium at ICSOC 2007, Chicago, IL, Dec 2006.
- [32] T. Dumitraş. ‘On-Chip Stochastic Communication.’ *M.S. Thesis*. Carnegie Mellon University, May 2003.
Committee: R. Mărculescu (advisor), P. Narasimhan.

SYSTEMS RELEASED

Imago: System for dependable, online upgrades-as-a-service in three-tier, enterprise systems.

MEAD (Middleware for Embedded Adaptive Dependability): Adds transparent fault-tolerance and resource-aware adaptation to legacy applications based on the Common Object Request Broker Architecture (CORBA). Main fault-tolerance platform for the DARPA-ARMS II and DARPA-PCES II programs.
<http://www.ece.cmu.edu/~mead>

Eye of the Beholder: Phone-based text-recognition system for the visually impaired. The user takes pictures of written text from our environment (e.g., restaurant menus, street signs, product expiration dates), and the system uses text recognition and speech synthesis to communicate this information.

RESEARCH EXPERIENCE

Dependable, Online Upgrades in Distributed Systems (Ph.D. Dissertation) 2007 – 2010
Conducted research on improving the reliability of distributed-system upgrades. Contributions:

- Identified leading causes of both unplanned failures (breaking hidden dependencies) and planned downtime (migrating persistent data) during upgrades of large-scale distributed systems.
- Proposed original solution for end-to-end upgrades in distributed systems with minimal downtime. Defined method for benchmarking the dependability of upgrading approaches.

Transparent Adaptation in Fault-Tolerant Middleware 2003 – 2006
Conducted research on adapting the trade-offs between the fault-tolerance and the performance of distributed enterprise-systems. Contributions:

- Developed mechanisms for resource-aware adaptation to crash, communication and timing faults (e.g., switching between active and passive replication on-the-fly, automatic configuration knobs).
- Characterized the inherent unpredictability of fault-tolerant middleware performance in 16 different systems, running on various operating systems and middleware platforms.

On-Chip Stochastic Communication (M.S. Thesis) 2001 – 2003
Conducted research on fault-tolerant communication protocols for networks-on-chip. Contributions:

- Proposed new communication paradigm for networks on chip, based on randomized gossip. This approach marks a clear departure from traditional chip design, which focuses on the correctness of devices and interconnects, by tolerating network-on-chip faults at the system level.

STUDENTS MENTORED

- **Jiyong Jang**, internship, Symantec Research Labs
- **Leyla Bilge**, internship, Symantec Research Labs
- **Jiaqi Tan**, undergraduate research, CMU (contributed to his first publication, in HotDep'07)
- **Zhengheng Gho**, undergraduate research, CMU (contributed to his first publication, in HotDep'07)
- **Sreevishnu Byrakur**, M.S. Thesis in the Information Networking Institute, CMU
- **Ruchi Lohani**, M.S. Thesis in the Information Networking Institute, CMU

TEACHING EXPERIENCE

Introduction to Computer Systems (teaching assistant for Profs. R. Bryant and D. O'Hallaron) Fall 2006
Held weekly recitation and office hours for a sophomore-level class of 150 students. Designed and graded homeworks and exams. TA Course Evaluation: 3.93/4.00.

Fault-Tolerant Distributed Systems (teaching assistant for Prof. P. Narasimhan) Spring 2006
Gave guest lecture on the experimental evaluation of fault-tolerant middleware systems in a graduate-level class of 30 students. Designed experimental plan. Guided seven class projects.

Dependable Embedded Systems (teaching assistant for Prof. P. Koopman) Fall 2005
Selected discussion topics for a graduate-level class with 20 students. Led discussions on distributed timekeeping and on synchrony models for distributed systems.

Electromagnétisme (teaching assistant for Prof. C. Florea) Spring 2001
Guided lab work for a section of 20 students from an introductory course in electromagnetism at the *Ecole Supérieure d'Ingénieurs en Electronique et Electrotechnique* (ESIEE), Paris, France.

PROFESSIONAL SERVICE

- **PC Member**, Fast Abstracts, International Symposium on Software Reliability Engineering (ISSRE), 2010
- **Founder and Chair**, ACM Workshop on Hot Topics in Software Upgrades (HotSWUp), 2008–2009
- **Local Arrangements Chair**, Conference on Dependable Systems and Networks (DSN), 2008
- **Chair**, IBM Ph.D. Symposium, International Conference on Service-Oriented Computing, 2006–2007
- **Publicity Chair**, Software Technologies for Future Embedded and Ubiquitous Systems, 2005
- **Reviewer** for IEEE Transactions on Dependable and Secure Computing (TDSC); IEEE Transactions on Computers (TC); ACM Object-Oriented Programming, Systems, Languages and Applications Conference (OOPSLA) 2010; International Journal of Computer Networks (COMNET); Distributed Computing; IBM Journal of Research and Development; ACM Transactions on the Web (TWEB); Service-Oriented Computing and Applications; IEEE Transactions on Very Large Scale Integration Systems (TVLSI); Architecting Dependable Systems Vol. V; IEEE Pervasive Computing.

Outreach Activities

- **President**, ECE Graduate Student Organization, Carnegie Mellon University
- **Founder and president**, Romanian Students Association, Carnegie Mellon University

TALKS

- 'Benchmarking Computer Security through WINE,' **ACM CCS'11** (tutorial) Oct 2011
- 'The Worldwide Intelligence Network Environment (WINE)'
▪ **University of Maryland** (host: Michael Hicks) Nov 2011

- **UC Riverside** (host: Iulian Neamtii) Apr 2011
- **ASPLOS EXERT'11** (invited talk) Mar 2011
- 'Improving the end-to-end dependability of distributed systems'
- **USC** (host: Ramesh Govindan) Jan 2011
- **Purdue** (host: Cristina Niţă-Rotaru) Jul 2010
- **UIUC** (host: Indranil Gupta) Jun 2010
- **VMware** (host: Orran Krieger) Jun 2010
- **Stevens Institute of Technology** (host: Hong Man) Apr 2010
- **Caltech** (host: Adam Wierman) Apr 2010
- **UCLA** (host: Carlo Zaniolo) Apr 2010
- **IBM Research, Almaden** (host: Joseph Slember) Mar 2010
- **Microsoft Research, Silicon Valley** (host: Mihai Budiu) Feb 2010
- **HP Labs** (host: Lucy Cherkasova) Feb 2010
- **IBM Research, T.J. Watson** (host: Peter Sweeney) Jan 2010
- **AT&T Labs** (hosts: Matti Hiltunen and Rick Schlichting) Jan 2010
- 'Why Do Upgrades Fail and What Can We Do About It?,' **Middleware'09** Dec 2009
- Talks on distributed-system upgrades at the **Annual Retreat of the Parallel Data Lab** 2007 – 2009
- 'Dependable, Online Upgrades in Enterprise Systems,' **ACM Student Research Competition** Oct 2009
- 'Dependable, Online Upgrades in Enterprise Systems,' **OOPSLA'09 Doctoral Symposium** Oct 2009
- 'Toward Dependable, Online Upgrades in Enterprise Systems'
- **Software Engineering Institute**, Carnegie Mellon University (host: Charles Weinstock) Jun 2009
- **EPFL**, Switzerland (host: Willy Zwaenepoel) May 2009
- 'Why Do Upgrades Fail and What Can We Do About It?,' **Dagstuhl Seminar 09201** (invited talk) May 2009
- 'Dependency-Agnostic Online Upgrades in Distributed Systems'
- **Vanderbilt University** (host: Aniruddhā Gokhālé) Oct 2008
- **Oracle Corporation** (host: Alan Downing) Jun 2008
- 'Got Predictability? Experiences with Fault-Tolerant Middleware,' **Middleware'07** Nov 2007
- 'Dependency-Agnostic Online Upgrades in Distributed Systems'
- **Cambridge University**, UK (host: Jon Crowcroft) Jun 2007
- **Newcastle University**, UK (host: Graham Morgan) Jun 2007
- **DSN'07 Student Forum** Jun 2007
- 'Impact-Sensitive Framework for Dynamic Change-Management,' **DSN WADS'06** Jun 2006
- 'Patch Management Sandboxing,' **VMware Inc.** (host: Suresh Ravoor) Jul 2006
- 'Distributed, Impact-Sensitive Dynamic Change-Management,'
- **CNRS-LAAS**, France (host: Jean-Charles Fabre) Dec 2005
- **IBM Research** (host: Asit Dan) Aug 2005
- 'Fault-Tolerant Middleware and the Magical 1%,' **Middleware'05** Nov 2005
- 'An Architecture for Versatile Dependability,' **DSN WADS'04** Jun 2004
- 'On-Chip Stochastic Communication,' **DATE'03** Mar 2003
- 'Towards On-Chip Fault-Tolerant Communication,' **ASP-DAC'03** Jan 2003

PROFESSIONAL AFFILIATIONS

The Honor Society of Phi Kappa Phi ($\Phi\kappa\Phi$), Association for Computer Machinery (ACM), Institute of Electrical and Electronics Engineers (IEEE), USENIX Association.

LANGUAGES

Fluent in English, French and Romanian. Reading and basic conversation skills in Italian.