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RESEARCH INTERESTS

Online software-upgrades, distributed systems, emergent behavior of software systems (with focus on fault-tolerance and reliability).

EDUCATION

Carnegie Mellon University, Pittsburgh, PA

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

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

DISSERTATION

Dissertation title: **Dependable, Online Upgrades in Distributed Systems**

Advisor: Prof. Priya Narasimhan

Software upgrades are unreliable, often causing downtime or data loss. My thesis addresses the leading causes of upgrade failure (broken dependencies) and of planned downtime (data migrations). I propose mechanisms that leverage existing cloud-computing infrastructures to simplify complex distributed-system upgrades and to improve their dependability. This approach allows upgrades to be performed as a service.

HONORS

- **John Vlissides Award**, ACM SIGPLAN 2009
- **1st Place, ACM Student Research Competition**, OOPSLA'09 2009
- **Research Grant**, Amazon Web Services 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 (3rd year) 1999

PUBLICATIONS

Book Chapters (refereed)

- [1] T. Dumitraș, D. Roșu, A. Dan and P. Narasimhan, 'Ecotopia: An Ecological Framework for Change Management in Distributed Systems.' In *Architecting Dependable Systems Vol. IV (ADS IV)*, edited by C. Gacek, A. Romanovsky and R. de Lemos, Springer-Verlag, 2007.

- [2] T. Dumitraş, D. Srivastava and P. Narasimhan. 'Architecting and Implementing Versatile Dependability.' In *Architecting Dependable Systems Vol. III (ADS III)*, edited by C. Gacek, A. Romanovsky and R. de Lemos, Springer-Verlag, 2005.

16 citations*

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

Journal Articles

- [4] P. Bogdan, T. Dumitraş, R. Mărculescu. 'Stochastic Communication: A New Paradigm for Fault-Tolerant Networks-on-Chip.' *VLSI Design*, vol. 2007, Special Issue on Networks-on-Chip, 2007.

8 citations

- [5] 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, 2005, pp. 1527-1545, Wiley and Sons.

44 citations

Conference and Workshop Papers

- [6] 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.

- [7] 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.

- [8] 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.

- [9] 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.

- [10] 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 *International Symposium on Wearable Computers (ISWC'06)*, Montreux, Switzerland, Oct 2006, pp. 145-146.

- [11] T. Dumitraş, D. Roşu, A. Dan and P. Narasimhan. 'Impact-Sensitive Framework for Dynamic Change-Management.' In *Workshop on Architecting Dependable Systems (WADS'06)*, Philadelphia, PA, Jun 2006.

- [12] 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.

7 citations

- [13] T. Dumitraş, P. Narasimhan. 'An Architecture for Versatile Dependability.' In *Workshop on Architecting Dependable Systems (WADS'05)*, Florence, Italy, Jun 2004.

6 citations

- [14] 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.

- [15] T. Dumitraş and R. Mărculescu. 'On-Chip Stochastic Communication.' In *Design, Automation and Test in Europe Conference (DATE'03)*, Munich, Germany, Mar 2003.

33 citations

* Citation counts retrieved on 30 October 2009 from Google Scholar.

- [16] 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
63 citations

Other Publications

- [17] 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.
- [18] 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.
- [19] 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.
- [20] 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.
- [21] T. Dumitraş. On-Chip Stochastic Communication. M.S. Thesis. Carnegie Mellon University, May 2003. Advised by Radu Mărculescu.

SYSTEMS RELEASED

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

MEAD (Middleware for Embedded Adaptive Dependability): Adding 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 – present
 Conducting research on improving the reliability of distributed-system upgrades. Contributions:

- Established upgrade-centric fault model with three non-overlapping classes of faults: (i) simple configuration errors (e.g., typos); (ii) semantic configuration errors (e.g., misunderstood effects of parameters); (iii) broken environmental dependencies; and (iv) data-access errors.
- Proposed novel mechanisms for dependable upgrades of distributed enterprise systems, in the presence of upgrade faults. These mechanisms include isolating the old and new versions of the system, to avoid shared dependencies, and initializing the persistent data of the new version, through an opportunistic data-transfer protocol, without disrupting the live workload.
- Conducting a realistic and reproducible case study: upgrading Wikipedia to an infrastructure centered on a different wiki engine. This case study simulates the practical scenario of switching software vendors and presents all the main challenges of online upgrades.

Versatile Dependability 2003 – 2006

Conducted research on quantifying and tuning 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. These mechanisms include switching between active and passive replication on the fly and configuring the system automatically, based on a high-level specification.

- Discovered the “magical 1%” phenomenon: the inherent unpredictability of fault-tolerant middleware is limited to at most 1% of the remote invocations. This phenomenon was verified experimentally for several fault-tolerant middleware systems.

On-Chip Stochastic Communication (M.S. Thesis) 2001 – 2003

Conducted research on fault-tolerant communication protocols for on-chip interconnection networks. Contributions:

- Proposed new communication paradigm for networks on chip, based on randomized gossip. This approach reduces design costs, by relaxing the requirement of 100% correctness for devices and interconnects, and provides tolerance to deep sub-micron faults (e.g., data upsets) at the system level.

TEACHING EXPERIENCE

15-213 – Introduction to Computer Systems (teaching assistant) Fall 2006

Held weekly recitation and office hours for 30 undergraduate students. Designed and graded homeworks and exams.

18-749 – Fault-Tolerant Distributed Systems (teaching assistant) Spring 2006

Gave guest lecture on the experimental evaluation of fault-tolerant middleware systems to a class of 30 graduate students. Designed experimental plan. Guided seven class projects.

18-849 – Dependable Embedded Systems (teaching assistant) Fall 2005

Selected discussion topics for a graduate-level class with 20 students. Led discussions on distributed time and on synchronous/asynchronous systems.

Electromagnétisme (teaching assistant) 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 EXPERIENCE

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

Conducted study on the data transformations required by enterprise-application upgrades. These transformations often conflict with the live workloads (e.g., by locking tables for writing or by imposing unacceptable overheads), and impose planned downtime.

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

Developed prototype for applying software updates to offline virtual machines. This prototype includes a sandbox for unmodified, third-party update managers (e.g., the Windows Update Agent) and transparently redirects the scanning and remediation operations to an offline virtual machine.

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

Developed upgrade-planning framework for minimizing service disruption and for optimizing business value. The optimization takes into account the service-level objectives of both the system under upgrade (e.g., response time, availability) and of the upgrade itself (e.g., the completion deadline).

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.

PROFESSIONAL SERVICE

- **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 International Journal of Computer Networks (COMNET); IEEE Transactions on Very Large Scale Integration Systems (TVLSI); Distributed Computing; Architecting Dependable Systems Vol. V (LNCS 5135); IEEE Pervasive Computing; International Conference on Computer-Aided Design (ICCAD) 2002; International Symposium on Low-Power Electronics and Design (ISLPED) 2002.

Other Activities

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

TALKS

'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	Jun 2009
'Toward Dependable, Online Upgrades in Enterprise Systems,' EPFL, Switzerland	May 2009
'Why Do Upgrades Fail and What Can We Do About It?,' Dagstuhl Seminar 09201	May 2009
'Imago: Dependency-Agnostic, Online Upgrades,' Annual Retreat of the Parallel Data Lab	Nov 2008
'Dependency-Agnostic Online Upgrades in Distributed Systems,' Vanderbilt University	Oct 2008
'Dependency-Agnostic Online Upgrades in Distributed Systems,' Oracle Corporation	Jun 2008
'Online Upgrades in Large-Scale Distributed Systems,' Annual Retreat of the Parallel Data Lab	Oct 2007
'Got Predictability? Experiences with Fault-Tolerant Middleware,' Middleware'07	Nov 2007
'Dependency-Agnostic Online Upgrades in Distributed Systems,' Cambridge University, UK	Jun 2007
'Dependency-Agnostic Online Upgrades in Distributed Systems,' Newcastle University, UK	Jun 2007
'Dependency-Agnostic Online Upgrades in Distributed Systems,' DSN'07 Student Forum	Jun 2007
'Impact-Sensitive Framework for Dynamic Change-Management,' WADS'06	Jun 2006
'Distributed, Impact-Sensitive Dynamic Change-Management,' CNRS-LAAS, France	Dec 2005
'Fault-Tolerant Middleware and the Magical 1%,' Middleware'05	Nov 2005
'Distributed, Impact-Sensitive Dynamic Change-Management,' IBM Research	Aug 2005
'An Architecture for Versatile Dependability,' 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

Student member of the Association for Computer Machinery (ACM) and the Institute of Electrical and Electronics Engineers (IEEE).

LANGUAGES

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

REFERENCES

Prof. Priya Narasimhan
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