Peter Desnoyers

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Research Interests

Data storage, operating systems and cloud computing.

Education

- 1/2004–10/2007: PhD, Computer Science, University of Massachusetts at Amherst. Advisor: Prashant Shenoy.
- 9/1982-5/1988: BS, MS, Electrical Engineering and Computer Science, Massachusetts Institute of Technology.

Appointments

- 7/2014–present: Associate Professor, Northeastern University, Boston MA
- 9/2008–6/2014: Assistant Professor, Northeastern University, Boston MA
- 10/2007–7/2008: Member of Technical Staff, VMware, Cambridge MA

Publications

Refereed Journal Articles

- A. Aghayev, M. Shafaei, and P. Desnoyers, "Skylight—A Window on Shingled Disk Operation," ACM Transactions on Storage, vol. 11, no. 4, pp. 16:1–16:28, Oct. 2015.
- P. Desnoyers, "Analytic Models of SSD Write Performance," ACM Transactions on Storage, Volume 10 Issue 2, March 2014.

- F. Zhou, M. Goel, P. Desnoyers, and R. Sundaram, "Scheduler Vulnerabilities and Coordinated Attacks in Cloud Computing," Journal of Computer Security, Volume 21 Number 4, Sept. 2013.

- P. Desnoyers, T. Wood, P. Shenoy, R. Singh, S. Patil, and H. Vin, "Modellus: Automated Modeling of Complex Internet Data Center Applications," ACM Transactions on the Web, vol. 6, no. 2, pp. 8:1–8:29, Jun. 2012.

- G. Mathur, P. Desnoyers, P. Chukiu, D. Ganesan, and P. Shenoy, "Ultra-low power data storage for sensor networks," ACM Transactions on Sensor Networks, vol. 5, no. 4, pp. 1–34, 2009.

Refereed Conference Publications

- A. Mohan, S. Nadgowda, B. Pipaliya, S. Varma, S. Suneja, C. Isci, G. Cooperman., P. Desnoyers, O. Krieger, A. Turk. "Towards Non-Intrusive Software Introspection and Beyond". IEEE International Conference on Cloud Engineering (IC2E), 2020

- E. U. Kaynar, M. Abdi, M. H. Hajkazemi, A. Turk, R. R. Sambasivan, D. Cohen, L. Rudolph, P. Desnoyers, O. Krieger. "D3N: A multi-layer cache for the rest of us". IEEE International Conference on Big Data, 2019

- A. Mosayyebzadeh, A. Mohan, S. Tikale, M. Abdi, N. Schear, T. Hudson, C. Munson, L. Rudolph, G. Cooperman, P. Desnoyers, O. Krieger. "Supporting Security Sensitive Tenants in a Bare-Metal Cloud". USENIX Annual Technical Conference (ATC), 2019

- M. H. Hajkazemi, A. N. Kulkarni, P. Desnoyers, T. R. Feldman. "Track-based Translation Layers for Interlaced Magnetic Recording". USENIX Annual Technical Conference (ATC), 2019

- A. Mohan, A. Turk, R. Gudimetla, S. Tikale, J. Hennessey, U. Kaynar, G. Cooperman, P. Desnoyers, O. Krieger, "M2: Malleable Metal as a Service", IEEE International Conference on Cloud Engineering (IC2E), 2018

- M. H. Hajkazemi, M. Abdi, P. Desnoyers. "Minimizing Read Seeks for SMR Disk". IEEE International Symposium on Workload Characterization (IISWC), 2018

- M. H. Hajkazemi, M. Abdi, M. Shafaei, P. Desnoyers. "FSTL: A Framework to Design and Explore Shingled Magnetic Recording Translation Layers". IEEE International Symposium on Modeling, Analysis, and Simulation of Computer and Telecommunication Systems (MASCOTS), 2018.

- A. Aghayev, T. Ts'o, G. Gibson, P. Desnoyers, "Evolving Ext4 for Shingled Disks", 15th USENIX Conference on File and Storage Technologies (FAST '17), Santa Clara, Calif. February 2017.

- J. Hennessey, S. Tikale, A. Turk, E. Kaynar, C. Hill, P. Desnoyers, O. Krieger, "HIL: Designing an Exokernel for the Data Center", ACM Symposium on Cloud Computing, October 2016

- Y. Cheng, F. Douglis, P. Shilane, M. Trachtman, G. Wallace, P. Desnoyers, K. Li, "Erasing Belady's Limitations: In Search of Flash Cache Offline Optimality", USENIX Annual Technical Conference, June 2016.

- P Desnoyers, O Krieger, B Holden, J Hennessey, L Rudolph, A Young, "Using OpenStack for an Open Cloud eXchange (OCX)" IEEE International Conference on Cloud Engineering (IC2E '15), March 2015

- A Aghayev and P. Desnoyers, "Skylight—A Window on Shingled Disk Operation," USENIX Conf. on File and Storage Technologies (FAST), February 2015. **Best paper award**

- P. Desnoyers, O. Krieger, B. Holden, J. Hennessey, L. Rudolph, A. Young, "Using OpenStack for an Open Cloud eXchange (OCX)", IEEE Int'l Conf. on Cloud Engineering (IC2E), March 2015.

- D. Tiwari, S. Boboila, S. Vazhkudai, Y. Kim, X. Ma, P. Desnoyers and Y. Solihin, "Active Flash: Towards Energy-Efficient, In-Situ Data Analytics on Extreme-Scale Machines," in Proc. 11th USENIX Conference on File and Storage Technologies (FAST), San Jose, CA, 2013. (acceptance rate 19%)

- S. Boboila, Y. Kim, S. Vazhkudai, P. Desnoyers, and G. Shipman, "Active Flash: Out-of-core data analytics on flash storage," in IEEE Symposium on Mass Storage Systems and Technologies (MSST 2012), Monterey, CA, 2012. (acceptance rate 24%)

- P. Desnoyers, "Analytic modeling of SSD write performance," in 5th Annual International Systems and Storage Conference (SYSTOR), Haifa, Israel, 2012. (acceptance rate 28%) **Best paper award**

- F. Zhou, M. Goel, P. Desnoyers, and R. Sundaram, "Scheduler Vulnerabilities and Coordinated Attacks in Cloud Computing," in Proc. IEEE 10th Int'l Symposium on Network Computing and Applications (NCA), Washington, DC, 2011, pp. 123–130. (acceptance rate 28%)

- S. Boboila and P. Desnoyers, "Performance Models of Flash-based Solid-State Drives for Real Workloads," in IEEE Symposium on Mass Storage Systems and Technologies, Denver, CO, 2011. (short paper acceptance rate 44%)

- P. Desnoyers, "Teaching operating systems as how computers work," in Proc. 42nd ACM Technical Symposium on Computer Science Education (CSE), Dallas, TX, 2011, pp. 281–286. (acceptance rate 34%)

- S. Boboila and P. Desnoyers, "Write Endurance in Flash Drives: Measurements and Analysis," in USENIX Conference on File and Storage Technologies (FAST), San Jose, CA, 2010. (acceptance rate 20%)

- T. Wood, G. Tarasuk-Levin, P. Shenoy, P. Desnoyers, E. Cecchet, and M. D. Corner, "Memory buddies: exploiting page sharing for smart colocation in virtualized data centers," in ACM Int'l Conference on Virtual Execution Environments (VEE), Washington, DC, USA, 2009, pp. 31–40. (acceptance rate 35%)

- P. Desnoyers and P. Shenoy, "Hyperion: high volume stream archival for retrospective querying," in Proc. USENIX Annual Technical Conference (ATC), Santa Clara, CA, 2007. (acceptance rate 19%) **Best paper award**

- B. Bash and P. Desnoyers, "Exact distributed Voronoi cell computation in sensor networks," in Int'l Conference on Information Processing in Sensor Networks (IPSN), Cambridge, MA, 2007, pp. 236–243. (acceptance rate 20%)

- G. Mathur, P. Chukiu, P. Desnoyers, D. Ganesan, and P. Shenoy, "A storage-centric camera sensor network," in ACM Int'l Conference on Embedded Networked Sensor Systems (SenSys), Boulder, CO, 2006, pp. 337–338. (acceptance rate 25%)

- G. Mathur, P. Desnoyers, D. Ganesan, and P. Shenoy, "Capsule: an energy-optimized object storage system for memory-constrained sensor devices," in ACM Int'l Conference on Embedded Networked Sensor Systems (SenSys), Boulder, CO, 2006, pp. 195–208. (acceptance rate 25%)

- P. Desnoyers, D. Ganesan, and P. Shenoy, "Tsar: A two tier sensor storage architecture using interval skip graphs," In ACM Int'l Conference on Embedded Networked Sensor Systems (SenSys), San Diego, CA, 2005, pp. 39–50. (acceptance rate 18%)

- P. Desnoyers, D. Ganesan, H. Li, M. Li, and P. Shenoy, "PRESTO: a predictive storage architecture for sensor networks," in Proc. 10th Conference on Hot Topics in Operating Systems (HotOS X), Santa Fe, NM, 2005, pp. 23–23. (acceptance rate 20%)

Refereed Workshop Publications

- M. Abdi, A. Mosayyebzadeh, M. H. Hajkazemi, A. Turk, O. Krieger, P. Desnoyers. "Caching in the Multiverse". USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage), 2019.

- A. Mosayyebzadeh, G. Ravago, A. Mohan, A. Raza, S. Tikale, N. Schear, T. Hudson, J. Hennessey, N. Ansari, K. Hogan, C. Munson, L. Rudolph, G. Cooperman, P. Desnoyers, O. Krieger. "A Secure Cloud with Minimal Provider Trust". USENIX Workshop on Hot Topics in Cloud Computing (HotCloud), 2018.

- M. Shafaei, P. Desnoyers, "Virtual Guard: A Track-Based Translation Layer for Shingled Disks", 9th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage 17), June 2017

- A. Turk, R. Gudimetla, E. Kaynar, J. Hennessey, S. Tikale, P. Desnoyers, O. Krieger, "An Experiment on Bare-Metal BigData Provisioning", 8th USENIX Workshop on Hot Topics in Cloud Computing, 2016

- M. Shafaei, P. Desnoyers, J. Fitzpatrick, "Write Amplification Reduction in Flash-Based SSDs Through Extent-Based Temperature Identification", 8th USENIX Workshop on Hot Topics in Storage and File Systems, 2016

- A. Aghayev, P. Desnoyers, "Log-Structured Cache: Trading Hit-Rate for Storage Performance (and winning) in Mobile Devices," in First Workshop on Interactions of NVM/Flash with Operating-Systems and Workloads (INFLOW '13), Nemacolin Woodlands, Penn. November 2013.

- P. Desnoyers, "What Systems Researchers Need to Know about NAND Flash," in Proc. Workshop on Hot Topics in Storage and File Systems (HotStorage), San Jose, CA, 2013. (acceptance rate 28%)

- P. Desnoyers, "Analysis of Flash Cleaning," in UCSD Annual Non-Volatile Memory Workshop (NVMW), San Diego, CA, 2013. (abstract and talk only)

- D. Tiwari, S. Vazhkudai, Y. Kim, X. Ma, S. Boboila, and P. Desnoyers, "Reducing Data Movement Costs Using Energy-Efficient, Active Computation on SSD," in Proc. 2012 Workshop on Power Aware Computing and Systems (HotPower 2012), Hollywood, CA, 2012. (acceptance rate 25%)

- P. Desnoyers, "Empirical evaluation of NAND flash memory performance," in Proc. Workshop on Hot Topics in Storage and File Systems (HotStorage), Big Sky, Montana, 2009, vol. 44, pp. 50–54. (acceptance rate 20%)

Presentations

- 1/6/2016: "Storage Research at Northeastern", invited talk, Samsung America Research, Santa Clara, CA.

- 9/24/2015: "Skylight – A Window on Shingled Disk Operation", invited talk, SNIA Storage Development Conference, Santa Clara, CA.

- 4/5/2015: "Skylight – A Window on Shingled Disk Operation", invited talk, EMC, Hopkinton MA.

- 11/13/2014: "Building a 'Multi-Landlord' Public Cloud, invited talk, USENIX Large Installation System Administration (LISA) Conference, Seattle.

- 10/5/2014: "Flash Math—FTL Algorithms and Performance," keynote talk, 2nd Workshop on Interactions of NVM/Flash with Operating Systems and Workloads (INFLOW '14), Broomfield CO. 5/15/2014: J M Holzer, B Holden, J Hennessey, P Desnoyers, "Implementation and Lessons Learned from Building a Large ScaleCloud", OpenStack Summit, Atlanta.
- 4/12/2013: "Flash Cleaning for Semi-Realistic Workloads," Harvard Systems Research Group, Cambridge MA.
- 1/12/2012: "Flash Memory and Future Computers," NU@Noon Alumni talk, Northeastern University, Burlington MA
- 3/19/2012: "Mathematical Models of Write Amplification in FTLs," NetApp Advanced Technology Group, Waltham MA
- 11/8/2011: "Mathematical Models of Write Amplifications in FTLs," NVRAMOS: Operating System Support for Next Generation Large Scale NVRAM, Jeju, Korea. Invited talk, **travel expenses paid** by organizers.
- 8/5/2010: "Behavior of next-generation storage devices," IBM Almaden Research Center, San Jose CA
- 5/14/2010: "Solid-State Storage," IBM T. J. Watson Research Center, Yorktown NY
- 3/24/2010: "Flash memory: New directions in storage or incremental change?," Microsoft Research, Redmond CA
- 7/22/2009: "Using Flash to Bridge the Compute/Storage Gap," Verivue Corp., Westford MA.

External Funding Awarded

- "CNS Core: Small: Byte-Addressable I/O Everywhere," NSF, 2019. Principle investigator, 3 years, $500,000.
- " CCRI: Grand: Developing a Testbed for the Research Community Exploring Next-Generation Cloud Platforms", NSF, co-Principle Investigator (collaborative grant, UMass lead). $1,320,000 (total grant $5,000,000)
- "Analytic and Numerical Modeling of SMR Disk Performance Characteristics," NetApp Faculty Fellowship, 2013, 2014, 2016, 2019. $160,000.
- "The Massachusetts Open Cloud," Massachusetts Technology Council, 2014. Co-Principal Investigator (with Orran Krieger, BU, and others). 3 years. Total project funding $3,000,000 from state, over $15,000,000 in industry contibutions.
- "Investigation of SMR Disk Performance," EMC gift, 2014, 2016, 2018. $75,000

- "Designing Cloud and Big Data Platforms for Data-intensive Scientific Applications," MGH-PCC Seed Fund, 2012. Co-Principal Investigator (with Orran Krieger, BU, and Prashant Shenoy, UMass Amherst) 1 year, 1 graduate student, $36,000. Semi-internal—funding contributed by PI institutions.
- "CAREER: Algorithms and Implementations for New Storage Technologies," NSF, 2011. Principal investigator. 5 years, 1 graduate student (x 5 years), $450,000
- "Solid State Drive Analysis, Modeling, and Measurement," IBM Faculty Award, 2010. $20,000

Teaching Experience

- CS 7600: Intensive Computer Systems (PhD core): Fall '16, '15, '14, Spring & Fall '13, Fall '12, '11, Spring '10, '09.
- CS 5600: Computer Systems (MS core): Fall '16, '15, '14, '13, Spring '12, Fall '12, '11, '10, '09, '08.
- CS 7680, Special Topics: OS Design & Implemenation, Spring '14.
- CS 3600, Systems and Networks, Undergraduate course, Fall '10.

Students Advised

PhD Students Advised

- Mohammad Hajkazemi (since Fall 2015)
- Mania Abdi (since Spring 2016)
- Mansour Shafaei (dissertation defense scheduled 2/18)
- Simona Boboila (PhD 12/2012, first employment EMC), dissertation: Analysis, Modeling and Design of Flash-based Solid-State Drives
- Abutalib Aghayev (MS 2015), currently at CMU.
- Jed Davis (since 2009), graduated with MS degree in 2010, employed by VMware.
- Yiyun Ma (MS degree 2014).

Member of Dissertation Committee

- Yue Yang, PhD U. Toronto, 2017
- Thomas McCormick, PhD, 2016
- Xavier Jiminez, PhD EPFL, 2014
- Jianzhe Tai, PhD 2014
- Damien Hogan, PhD University of Limerick, 2013
- Hooman Javaheri, PhD, 2012
- Fangfei Zhou, PhD, 2012
- Ana-Maria Visan, PhD, 2012
- Emmanuel Arzuaga, PhD (ECE), 2011
- Xin Dong, PhD, 2011
- Steven Chen (ECE), MS thesis, 2008

MS Students Advised on Research Projects

- Shyam Shankar (Fall 2009), "Live Migration Support for the Palacios Virtual Machine Monitor."
- Praveen Solanki (Spring 2010), "Linux I/O Scheduler for SSDs."
- Chandresh Kapadia (Fall 2009, Spring 2010), "Java support for Hadoop on TRITON embedded processor."
- Xinghan Cui (Spring 2010), "Memory access monitoring in the Xen Virtual Machine."
- Raghuram Krishnamachari (Spring 2010), "Memory access monitoring in the Linux kernel."
- Gen Wang (Spring 2010), "Linux kernel project: enhancements to software RAID."
- Harsh Kumar (Fall 2010), "Conversion of file system traces to block traces for storage system research."
- Sudeep Ghiya (Spring 2013), "SSD-optimized Linux Kernel File System."

Undergraduate Students Advised on Research Projects

- Greg Kerr (Spring 2009, Fall 2009), Linux kernel driver development.

Honors and Awards

- 1/2015: Best Paper at the 13th USENIX Conference on File and Storage Technologies (FAST '15)
- 6/2012: Best Paper at the 5th Annual International Systems and Storage Conference (SYSTOR '12)
- 10/2008: Outstanding Doctoral Dissertation Award, Computer Science Department, University of Massachusetts at Amherst
- 6/2007: Best Paper at the 2007 USENIX Annual Technical Conference (ATC)
- 6/2007: Travel grant to attend USENIX Annual Technical Conference, 2007
- 11/2005: Travel grant to attend ACM Int'l Conference on Embedded Networked Sensor Systems (SenSys)
- 11/2004: Travel grant to attend ACM Int'l Conference on Embedded Networked Sensor Systems (SenSys)
- 4/2004: NSF Graduate Research Fellowship Honorable Mention

Patents

- US Patent 6,791,948, "Distributed switch and connection control arrangement and method for digital communications network," Peter Desnoyers, Shawn Clayton, and Nitin Godiwala. 1999.
- European patent WO9514971, "Method and system for synchronizing encoders and decoders in communication networks when errors are detected," Peter Desnoyers and Shahid Qureshi. 1994.

Service

Institutional

College of Computer and Information Science

- Fall 2008 - Spring 2009: PhD Committee.
- Fall 2009 - Spring 2015: MS Committee.
- Fall 2015 - Spring 2016: Chair, PhD admissions committee.

Northeastern University

- Fall 2012 - Spring 2016: Research Computing Advisory Committee.

Professional

Program Committee Chair

- 10th ACM International Systems and Storage Conference (SYSTOR 2017)
- ACM Symposium on Operating Systems Principles (SOSP 2015), workshops chair
- IEEE International Conference on Massive Storage Systems and Technology (MSST 2015), program committee chair.
- 3rd Workshop on Interactions of NVM/Flash with Operating Systems and Workloads (INFLOW 2015), program committee chair.

Program Committee Membership

- ACM Sigmetrics 2015
- ACM/USENIX Conference on File and Storage Technologies (FAST 2017, 2015, 2012)
- IEEE Technical Symposium on Mass Storage Systems and Technologies (MSST 2016, 2014, 2011)
- USENIX Annual Technical Conference (ATC 2018)
- IEEE 25th International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (MASCOTS 2017)
- 15th USENIX Conference on File and Storage Technologies (FAST '17)
- 8th USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage '16)
- The 18th CSI International Symposium on Computer Architecture and Digital Systems (CADS 2015)
- ACM SIGPLAN/SIGBED Conference on Languages, Compilers, Tools and Theory for Embedded Systems
- ACM SIGMETRICS 2015: International Conference on Measurement and Modeling of Computer Systems
- ACM/USENIX Conference on File and Storage Technologies (FAST 2015)

- IEEE Technical Symposium on Mass Storage Systems and Technologies (MSST 2014)
- 7th Annual International Systems and Storage Conference (SYSTOR 2014)
- IEEE International Conference on Parallel and Distributed Systems (ICPADS) 2013
- First Workshop on Interactions of NVM/Flash with Operating-Systems and Workloads (INFLOW '13), a new SOSP workshop.
- USENIX Workshop on Hot Topics in Storage (HotStorage 2013). Program committee meeting, attended via teleconference.
- Annual UCSD Non-Volatile Memories Workshop (NVMW 2012)
- Annual International Systems and Storage Conference (SYSTOR 2012) (also poster chair)
- USENIX Workshop on Hot Topics in Storage (HotStorage 2011).

External Reviewer

- ACM/USENIX Conference on File and Storage Technologies (FAST) 2013.
- ACM International Conference on Supercomputing 2010
- IEEE/ACM Workshop on Micro Architectural Support for Virtualization 2011
- IEEE INFOCOM
- ACM Conference on Embedded Networked Sensor Systems (SenSys)

Refereeing

- Associate Editor, IEEE Transactions on Computers
- ACM Transactions on Storage
- Computer Communications Journal
- IEEE Transactions on Knowledge and Data Engineering
- Multimedia Systems Journal (Springer / ACM)
- ACM Transactions on Computer Systems
- ACM Transactions on Embedded Computing Systems
- IEEE Transactions on Sensor Networks
- IEEE/ACM Journal on Selected Areas in Communications

Other Professional Activities

- Member of ACM, IEEE, USENIX, ACM SIGOPS
- Member of Industrial Advisory Board, UMass Boston Computer Science Department

Prior Industrial Experience

- 4/2002-1/2004–Incipient, Inc., Waltham, MA . Principal engineer, designed and developed switch-resident block device virtualization for fibre channel storage area networks.
- 7/2001-3/2002–Chinook Communications (ceased operations 3/02), Lexington MA . Principal engineer, designed and developed digital video software and drivers for linux-based set-top device.
- 1999-2001–InfoLibria, Inc., Waltham, MA. Principal engineer, designed and developed management and control systems for web cache / streaming media distribution system.
- 1997-1999–Giganet (acquired by Emulex), Concord MA. Principal engineer, designed and developed distributed ATM switch control system, patent awarded; designed and developed NIC driver and library, database and MPI library support.
- 1994-1997–Midnight Networks (acquired by Teradyne Inc.), Waltham, MA. Principal Engineer, designed and developed network and routing protocol test suites and test automation systems.
- 1990-1994–Motorola Codex, Canton MA. Principal Engineer, Research & Advanced Development Group - responsible for software performance modeling and measurement. Patent awarded for data compression improvement.
- 1988-1990–Apple Computer, Cupertino CA. Research Engineer, Advanced Technology Group - designed, prototyped emerging networking technologies.