

# CURRICULUM VITAE

Raju Rangaswami

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## RESEARCH EXPERTISE

Operating Systems, Storage Systems, Persistent Memory, Distributed Systems, Computer Security, and Real-time Systems for Web Services, Databases, Cloud Computing, and Mobile Computing

## EDUCATION

B.S.	<b>Indian Institute of Technology</b> , Kharagpur, India Computer Science and Engineering	1999
Ph.D.	<b>University of California, Santa Barbara</b> , USA Computer Science Thesis: “Real-time Storage Systems for Multimedia” Advisor: Edward Chang	2004

## FULL-TIME ACADEMIC EXPERIENCE

<b>Eminent Scholar Chaired Professor</b> School of Computing and Information Sciences, Florida International University.	08/19 - present
<b>Visiting Associate Professor</b> Department of Computer Science and Engineering, Indian Institute of Technology, Bombay.	08/15 - 12/16
<b>Associate Professor</b> School of Computing and Information Sciences, Florida International University.	08/09 - 08/19
<b>Assistant Professor</b> School of Computing and Information Sciences, Florida International University.	08/04 - 08/09

## AWARDS AND HONORS

Seagate Technology Research Gift	2022
IBM Distinguished Speaker	2021
ICAC'15 Best Paper Award	2015
NetApp Faculty Fellowship	2015, 2013, 2011
FIU SCIS Excellence in Student Mentoring	2013
Intel University Research Office Award	2013-2016
Charter Member, National Academy of Inventors	2012
FIU Faculty Award for Excellence in Research and Creative Activities	2011
IBM Faculty Award	2011
FIU Top Scholar	2010
NSF CAREER Award	2008-2013
FIU Top Scholar	2008
FIU SCIS Excellence in Research Award	2008
Department of Energy Early CAREER Principal Investigator (ECPI) Award	2006-2010
Dissertation Fellowship, University of California, Santa Barbara	2004
Dean's Fellowship, University of California, Santa Barbara	2004

## CONSULTING

- **Consulting Expert**, *Sterne, Kessler, Goldstein & Fox, LLP*, Veeam vs. Symantec, in the area of Computer Backup Software, 2013 (closed).
- **Research Consultant**, *Nutanix, Inc.*, Research for the Core Data Path team, 2016 (closed).

## CONFERENCE PUBLICATIONS

1. “Infusing Pub-Sub Storage with Transactions” Liana V. Rodriguez, John Bent, Tim Shaffer, and Raju Rangaswami. *Proceedings of the ACM Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2022.
2. “MULTI-CLOCK: Dynamic Tiering for Hybrid Memory Systems” Adnan Maruf, Ashikee Ghosh, Janki Bhimani, Daniel Campello, Andy Rudoff, and Raju Rangaswami *Proceedings of the IEEE International Symposium on High-Performance Computer Architecture*, 2022.
3. “Unifying the Data Center Caching Layer - Feasible? Profitable?” Liana V. Rodriguez, Alexis Gonzales, Pratik Poudel, Raju Rangaswami, and Jason Liu. *Proceedings of the ACM Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2021.
4. “Learning Cache Replacement with CACHEUS” Liana Valdes, Farzana Yusuf, Steven Lyons, Eysler Paz, Raju Rangaswami, Jason Liu, Ming Zhao, and Giri Narasimhan. *Proceedings of the USENIX Conference on File and Storage Technologies*, February 2021.
5. “Driving Cache Replacement with ML-based LeCaR” Giuseppe Vietri, Liana V. Rodriguez, Wendy A. Martinez, Steven Lyons, Jason Liu, and Raju Rangaswami, Ming Zhao, and Giri Narasimhan. *Proceedings of the USENIX Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2018.
6. “In Search of the Ideal Storage Configuration for Docker Containers” Vasily Tarasov, Lukas Rupprecht, Dimitris Skourtis, Amit Warke, Dean Hildebrand, Mohamed Mohamed, Nagapramod Mandagere, Wenji Li, Raju Rangaswami, and Ming Zhao *Proceedings of the Workshop on Autonomic Management of Large Scale Container-based Systems (AMLCs)*, 2017.
7. “Native OS Support for Persistent Memory with Regions” Mohammad Chowdhury and Raju Rangaswami. *Proceedings of the International Conference on Mass Storage Systems and Technology (MSST)*, 2017.
8. “ProvUSB: Block-level Provenance-Based Data Protection for USB Storage Devices” Dave (Jing) Tian, Adam Bates, Kevin Butler, and Raju Rangaswami. *Proceedings of the 23rd ACM Conference on Computer and Communications Security (CCS)*, October 2016.
9. “StepAhead: Rethinking File System Namespace Translations” Debadatta Mishra, Puru Kulkarni, and Raju Rangaswami *Proceedings of the Asia-Pacific Workshop on Systems (APSys)*, August 2016.
10. “A Fast and Slippery Slope for File Systems” Ricardo Santana, Vasily Tarasov, Raju Rangaswami, and Dean Hildebrand *Proceedings of the International Workshop on Interactions of NVM/Flash with Operating Systems and Workloads (INFLOW)*, co-located with *ACM SOSP*, October 2015.
11. “Centaur: Host-side SSD Caching for Storage Performance Control” Ricardo Koller, Ali Mashtizadeh, and Raju Rangaswami *Proceedings of the International Conference on Autonomic Computing*, July 2015.

12. “NVMKV: A Scalable, Lightweight, FTL-aware Key-Value Store”  
Leonardo Marmol, Swaminathan Sundararaman, Nisha Talagala, and Raju Rangaswami *Proceedings of the USENIX Annual Technical Conference*, July 2015.
13. “Revenue Driven Resource Allocation for Virtualized Data Centers”  
Sajib Kundu, Raju Rangaswami, Ming Zhao, Ajay Gulati, and Kaushik Dutta *Proceedings of the International Conference on Autonomic Computing*, July 2015.
14. “To ARC or Not to ARC” Ricardo Santana, Steven Lyons, Ricardo Koller, Raju Rangaswami, and Jason Liu *Proceedings of the USENIX Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2015.
15. “Non-blocking Writes to Files”  
Daniel Campello, Hector Lopez, Luis Useche, Ricardo Koller, and Raju Rangaswami *Proceedings of the USENIX Conference on File and Storage Technologies*, February 2015.
16. “NVMKV: A Scalable and Lightweight Flash Aware Key-Value Store”  
Leonardo Marmol, Swaminathan Sundararaman, Nisha Talagala, Raju Rangaswami, Sushma Devedrappa, Bharath Ramsundar, and Sriram Ganesan *Proceedings of the USENIX Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2014.
17. “Coriolis: Scalable VM Clustering in Clouds”  
Daniel Campello, Carlos Crespo, Akshat Verma, Raju Rangaswami, and Praveen Jayachandran *Proceedings of the International Conference on Autonomic Computing*, June 2013.
18. “Vector Repacking Algorithms for Power Aware Computing”  
Mario Consuegra, Giri Narasimhan, and Raju Rangaswami *Proceedings of the Workshop on Energy-Efficient Networks of Computers (E2NC): From the Chip to the Cloud*, June 2013.
19. “Write Policies for Host-side Flash Caches”  
Ricardo Koller, Leonardo Marmol, Raju Rangaswami, Swaminathan Sundararaman, Nisha Talagala, and Ming Zhao *Proceedings of the USENIX Conference on File and Storage Technologies*, February 2013.
20. “Software Persistent Memory”  
Jorge Guerra, Leonardo Marmol, Daniel Campello, Carlos Crespo, Raju Rangaswami, and Jinpeng Wei *Proceedings of the USENIX Annual Technical Conference*, June 2012.
21. “Modeling Virtualized Applications using Machine Learning Techniques”  
Sajib Kundu, Raju Rangaswami, Ajay Gulati, Kaushik Dutta, and Ming Zhao *Proceedings of the Annual International Conference on Virtual Execution Environments (VEE)*, March 2012.
22. “Estimating Application Cache Requirement for Provisioning Caches in Virtualized Systems”  
Ricardo Koller, Akshat Verma, and Raju Rangaswami *Proceedings of the IEEE International Symposium on Modeling, Analysis and Simulation of Computer and Telecommunication Systems (MASCOTS)*, July 2011.
23. “Truly Non-blocking Writes”  
Luis Useche, Ricardo Koller, Raju Rangaswami, and Akshat Verma. *Proceedings of the USENIX Workshop on Hot Topics in Storage Systems (HotStorage)*, June 2011.
24. “Cost Effective Storage using Extent Based Dynamic Tiering”  
Jorge Guerra, Himabindu Pucha, Joseph Glider, Wendy Belluomini, and Raju Rangaswami. *Proceedings of the USENIX Conference on File and Storage Technologies*, February 2011.

25. "Model Driven Network Emulation with Virtual Time Machine"  
Jason Liu, Raju Rangaswami, and Ming Zhao.  
*Proceedings of the Winter Simulation Conference*, December, 2010 (Invited paper).
26. "Generalized ERSS Tree Model: Revisiting Working Sets "  
Ricardo Koller, Akshat Verma, and Raju Rangaswami.  
*Proceedings of the IFIP International Symposium on Computer Performance, Modeling, Measurements and Evaluation*, , November, 2010.
27. "I/O Deduplication: Utilizing Content Similarity to Improve I/O Performance"  
Ricardo Koller and Raju Rangaswami.  
*Proceedings of the USENIX Conference on File and Storage Technologies*, February 2010.
28. "SRCMap: Energy Proportional Storage Using Dynamic Consolidation"  
Akshat Verma, Ricardo Koller, Luis Useche, and Raju Rangaswami.  
*Proceedings of the USENIX Conference on File and Storage Technologies*, February 2010.
29. "Application Performance Modeling in a Virtualized Environment"  
Sajib Kundu, Raju Rangaswami, Kaushik Dutta, and Ming Zhao.  
*Proceedings of the IEEE High-Performance Computer Architecture*, January 2010.
30. "BORG: Block-reORGanization for Self-Optimizing Storage Systems"  
Medha Bhadkamkar, Jorge Guerra, Luis Useche, Sam Burnett, Jason Liptak, Raju Rangaswami, and Vagelis Hristidis.  
*Proceedings of the File and Storage Technologies (FAST)*, February 2009.
31. "Anatomy of a Real-time Intrusion Prevention System"  
Ricardo Koller, Raju Rangaswami, Joseph Marrero, Igor Hernandez, Geoffrey Smith, Mandy Barsilai, Silviu Necula, S. Masoud Sadjadi, Tao Li, and Krista Merrill.  
*Proceedings of the IEEE International Conference on Autonomic Computing (ICAC)*, June 2008.
32. "Toward Scalable Routing Experiments with Real-Time Network Simulation"  
Yue Li, Jason Liu, and Raju Rangaswami.  
*Proceedings of the ACM/IEEE/SCS Workshop on Principles of Advanced and Distributed Simulation (PADS)*, June 2008.
33. "A Modeling Approach for Estimating Execution Time of Long-running Scientific Applications"  
S. Masoud Sadjadi, Shu Shimizu, Javier Figueroa, Raju Rangaswami, Javier Delgado, Hector Duran, and Xabriel Collazo.  
*Proceedings of High-Performance Grid Computing Workshop, held in conjunction with IEEE IPDPS*, April 2008.
34. "EXCES: EXternal Caching in Energy Saving Storage Systems"  
Luis Useche, Jorge Guerra, Medha Bhadkamkar, Mauricio Alarcon, and Raju Rangaswami.  
*Proceedings of IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, February, 2008.
35. "The Case for Active Block Layer Extensions"  
Jorge Guerra, Luis Useche, Medha Bhadkamkar, Ricardo Koller, and Raju Rangaswami.  
*Proceedings of the IEEE International Workshop on Storage and I/O Virtualization, Performance, Energy, Evaluation and Dependability (SPEED)*, held in conjunction with IEEE HPCA, February, 2008.
36. "Transparent Grid Enablement of Weather Research and Forecasting"  
S. Masoud Sadjadi, Liana Fong, Rosa M. Badia, Javier Figueroa, Javier Delgado, Xabriel J. Collazo-Mojica, Khalid Saleem, Raju Rangaswami, Shu Shimizu, Hector A. Duran Limon, Pat Welsh, Sandeep Pattnaik, Anthony Praino, David Villegas, Selim Kalayci, Gargi Dasgupta, Onyeka Ezenwoye, Juan

Carlos Martinez, Ivan Rodero, Shuyi Chen, Javier Muoz, Diego Lopez, Julita Corbalan, Hugh Willoughby, Michael McFail, Christine Lisetti, and Malek Adjouadi.  
*Proceedings of the Workshop on Grid-Enabling Applications, held in conjunction with Mardi Gras Conference*, January, 2008.

37. "Beyond Lazy XML Parsing"  
Fernando Farfan, Vagelis Hristidis, and Raju Rangaswami.  
*Proceedings of International Conference on Database and Expert Systems Applications*, September 2007.
38. "STORM: An Approach to Database Storage Management in Clustered Storage Environments"  
Kaushik Dutta and Raju Rangaswami.  
*In Proceedings of IEEE International Symposium on Cluster Computing and the Grid*, May 2007.
39. "Automatic Generation of User-Centric Multimedia Communication Services"  
Raju Rangaswami, Masoud Sadjadi, Nagara jan Prabakar, and Yi Deng.  
*Proceedings of the IEEE International Performance Computing and Communications Conference*, April 2007.
40. "A User-Centric Network Communication Broker for Multimedia Collaborative Computing" Chi Zhang, S. Masoud Sadjadi, Weixiang Sun, Ra ju Rangaswami, and Yi Deng.  
*Proceedings of the International Conference on Collaborative Computing*, November 2006.
41. "A Communication Virtual Machine"  
Yi Deng, S. Masoud Sadjadi, Peter Clarke, Chi Zhang, Vagelis Hristidis, Raju Rangaswami, and Nagarajan Prabakar.  
*Proceedings of the International Computer Software and Applications Conference*, September 2006.
42. "Storing Trees on Disk Drives"  
Medha Bhadkamkar, Fernando Farfan, Vagelis Hristidis, and Raju Rangaswami.  
*Proceedings of the USENIX File and Storage Technologies - Work in Progress Session*, December 2005.
43. "Thwarting Virtual Bottlenecks in Multi-Bitrate Streaming Servers"  
Bin Liu, Raju Rangaswami, and Zoran Dimitrijevic.  
*Proceedings of the IEEE Real-Time Systems Symposium - Work in Progress Session*, December 2005.
44. "Architectural Support for Preemptive RAID Schedulers" Zoran Dimitrijevic, Raju Rangaswami, and Edward Chang *Proceedings of the USENIX File and Storage Technologies - Work in Progress Session*, March, 2004.
45. "The SfinX Video Surveillance System"  
Raju Rangaswami, Zoran Dimitrijevic, Kyle Kakligian, Edward Chang, and Yuan-Fang Wang.  
*Proceedings of the IEEE International Conference on Multimedia and Expo*, June 2004.
46. "Quality of Service Support for Real-time Storage Systems"  
Zoran Dimitrijevic and Raju Rangaswami.  
*Proceedings of International IPSI Conference, Sv. Stefan, Montenegro*, October 2003.
47. "Design and Implementation of Semi-preemptible IO"  
Zoran Dimitrijevic, Raju Rangaswami, and Edward Chang.  
*Proceedings of Usenix Conference on File and Storage Technologies (FAST)*, March 2003.
48. "MEMS-based disk buffer for streaming media servers"  
Raju Rangaswami, Zoran Dimitrijevic, Edward Chang, and Klaus E. Schauser.  
*Proceedings of IEEE International Conference on Data Engineering (ICDE)*, March 2003.
49. "Virtual IO: Preemptible Disk Access"  
Zoran Dimitrijevic, Raju Rangaswami, and Edward Chang.  
*Proceedings of the ACM Multimedia Conference (short paper)*, December 2002.

50. "The Xtream Multimedia System"  
Zoran Dimitrijevic, Raju Rangaswami, and Edward Chang.  
*Proceedings of the IEEE International Conference on Multimedia and Expo*, August 2002.
51. "Data Placement for Multiuser Interactive Digital VCR"  
Raju Rangaswami, Edward Chang, Chen Li, and Milton Chen.  
*Proceedings of the IEEE International Conference on Multimedia and Expo*, August 2001.
52. "Spoofers and Sniffers: Serious Security Threats"  
Raju Rangaswami, Himyanshu Anand, and Indranil Sengupta.  
*Proceedings of the National Communications Conference, India*, January 1999.

## JOURNAL ARTICLES

1. "Evaluating Docker Storage Performance: from Workloads to Graph Drivers"  
Vasily Tarasov, Lukas Rupperecht, Dimitris Skourtis, Wenji Li, Raju Rangaswami, and Ming Zhao.  
*Springer Journal of Cluster Computing*, January 2019.
2. "LibPM: Simplifying Application Usage of Persistent Memory"  
Leonardo Marmol, Mohammad Chowdhury, and Raju Rangaswami.  
*ACM Transactions on Storage*, 14(4), December 2018.
3. "Synergy: A Hypervisor Managed Holistic Caching System"  
Debadatta Mishra, Puru Kulkarni, and Raju Rangaswami.  
*IEEE Transactions on Cloud Computing*, 49, February 2017.
4. "A Fast and Slippery Slope for File Systems"  
Ricardo Santana, Raju Rangaswami, Vasily Tarasov, and Dean Hildebrand.  
*ACM Operating Systems Review*, 49(2), December 2015.
5. "I/O Deduplication: Utilizing Content Similarity to Improve I/O Performance "  
Ricardo Koller and Raju Rangaswami.  
*ACM Transactions on Storage*, 6(3), September 2010.
6. "Platform-independent modeling and prediction of application resource usage characteristics"  
Shuichi Shimizu, Raju Rangaswami, Hector A. Duran-Limon, and Manuel Corona-Perez.  
*Elsevier Journal of Systems and Software*, 82(12), December 2009.
7. "A User-Centric Network Communication Broker for Multimedia Collaborative Computing"  
Chi Zhang, S. Masoud Sadjadi, Weixiang Sun, Raju Rangaswami, and Yi Deng.  
*Multimedia Tools and Applications (Springer/ACM SIGMM)*, 50(2):335-357, 2010.
8. "Storing Semi-structured data on disk drives"  
Medha Bhadkamkar, Fernando Farfan, Vagelis Hristidis, and Raju Rangaswami.  
*ACM Transactions on Storage*, 5(2), May, 2009 .
9. "Real-time Network Simulation Support for Scalable Routing Experiments"  
Yue Li, Jason Liu, and Raju Rangaswami, *International Journal of Simulation and Process Modelling*, Inderscience Publishers, (in press), 2009.
10. "2LP - A Double Lazy XML Parser"  
Fernando Farfan, Vagelis Hristidis, and Raju Rangaswami.  
*Elsevier Information Systems Journal* 34:145-163, 2009.
11. "The Case for Active Block Layer Extensions"  
Jorge Guerra, Luis Useche, Medha Bhadkamkar, Ricardo Koller, and Raju Rangaswami.  
*ACM Operating Systems Review*, 42(6), October, 2008.

12. “Workload-based Generation of Admin Hints for Optimizing Database Storage Utilization”  
Kaushik Dutta, Raju Rangaswami, and Sajib Kundu.  
*ACM Transactions on Storage*, 3(4), February, 2008.
13. “CVM - A Communication Virtual Machine”  
Yi Deng, S. Masoud Sadjadi, Peter J. Clarke, Vagelis Hristidis, Raju Rangaswami, and Yingbo Wang.  
*The Elsevier Special Issue of the Journal of Systems and Software* 81:1640-1662, 2008.
14. “Building MEMS-Based Storage Systems for Streaming Media”  
Raju Rangaswami, Zoran Dimitrijevic, Edward Chang, and Klaus E. Schauser.  
*ACM Transactions on Storage*, vol. 2, no. 2, June 2007.
15. “Stream Combination: Adaptive IO Scheduling for Streaming Servers”  
Bin Liu, Raju Rangaswami, and Zoran Dimitrijevic.  
*ACM SigBED Review*, vol. 3, no. 1, January 2006.
16. “Systems Support for Preemptive Disk Scheduling”  
Zoran Dimitrijevic, Raju Rangaswami, and Edward Chang.  
*IEEE Transactions on Computers*, vol 54, no. 10, pp. 1314-1326, October 2005.
17. “Fine-grained device management in an interactive media server”  
Raju Rangaswami, Zoran Dimitrijevic, Edward Chang, and S.-H. Gary Chan.  
*IEEE Transactions on Multimedia*, Volume(5), No.(4), pages 558–569, December 2003.

## PATENTS

1. “Machine learning based tiered memory systems and methods” Adnan Maruf, Janki Bhimani, Ashikee Ghosh, and Raju Rangaswami. Assignee: The FIU Board of Trustees, *Patent number: 11307986*, April 2022.
2. “Non-blocking writes to file data” Raju Rangaswami, Daniel Campello, Luis Useche, Hector Lopez, and Ricardo Koller. Assignee: The FIU Board of Trustees, *Patent number: 10073721*, September 2018.
3. “Techniques and systems for local independent failure domains” Raju Rangaswami, Saman Biook Aghazadeh, and Steven Lyons. Assignee: The FIU Board of Trustees, *Patent number: 9652345*, May 2017.
4. “Communication virtual machine” Yi Deng, S. Masoud Sadjadi, Steve Luis, Peter Clarke, Chi Zhang, Evangelos Christidis, and Raju Rangaswami. Assignee: The FIU Board of Trustees, *Patent number: 9146710*, September 2015.

## TALKS

- *ML for Systems and Systems for ML*, International Conference on High Performance Big Data and Intelligent Systems (HPBD&IS) 2021, December 2021 - *Plenary Speaker*
- *Caching Cloud Storage*, IBM Distinguished Speaker Series on Systems and Cloud, October 2021 - *Distinguished Lecture*
- *Programming Abstractions for Persistent Memory*, Intel Corporation, Hillsboro, OR, May 2015. - *Invited Talk*
- *Writes: The Next Performance Barrier*, Nutanix, Inc. San Jose, CA, February 2015. - *Invited Talk*
- *Non-blocking Writes to Files*, NetApp, Inc., August 2014. - *Invited Talk*
- *Programming Abstractions for Persistent Memory*, Intel Corporation, Santa Clara, CA, February 2014. - *Invited Talk*

- *Write Policies for Host-side Flash Caches*, VMware Inc., Palo Alto, CA, June 2013. - *Invited Talk*
- *Write Policies for Host-side Flash Caches*, Symantec Research Lab, San Jose, CA, June 2013. - *Invited Talk*
- *Trade-offs in Managing Host-side Flash Caches*, NetApp, Inc., Waltham, MA, July 2012. - *Invited Talk*
- *Non-blocking Writes*, Indian Institute of Technology - Bombay, India, May 2012. - *Invited Talk*
- *Systems Research at FIU's SyLab*, Fusion-io, April 2012. - *Invited Talk*
- *Partitioned SSD Caching of Virtual Disks*, NetApp, April 2012. - *Invited Talk*
- *Trade-offs in Server-side SSD Caches*, NetApp Inc., (teleconference), March 2012. - *Invited Talk*
- *Software Persistent Memory*, Indian Institute of Technology - Bombay, India, May 2011. - *Invited Talk*
- *Addressing Software Challenges for Smart Infrastructures using Software Persistent Memory*, IFIP 10.4 WG Meeting, Snowmass, CO, January 13<sup>th</sup>, 2011.
- *Building Reliable Systems with Software Persistent Memory*, Indian Institute of Technology, Bombay, India, January 2011. - *Invited Talk*
- *Building Reliable Systems with Software Persistent Memory*, IBM Research - India, December 2010. - *Invited Talk*
- *Software Persistent Memory*, Sandia National Laboratories, Albuquerque, NM, May 2010. - *Invited Talk*
- *Streamlining High-End Computing with Software Persistent Memory*, National Science Foundation High-End Computing File Systems and I/O Workshop, August 2009. - *Invited Talk*
- *Software Persistent Memory and Its Applications*, Argonne National Laboratory, July 2009. - *Invited Talk*
- *Software Persistent Memory and Its Applications*, Indian Institute of Science, May 2009. - *Invited Talk*
- *New Directions in Self-Managing Storage Systems*, IBM India Research Laboratory, New Delhi, India, May 2008. - *Invited Talk*
- *Active Block Layer Extensions*, VMWare Inc., February 2008. - *Invited Talk*
- *Storage Systems for Semi-structured Data*, University of California, Santa Cruz, October 2006. - *Invited Talk*
- *Storage Systems for Semi-structured Data*, University of California, Riverside, October 2006. - *Invited Talk*
- *Operating System Security: Host-based Intrusion Detection*, University of Miami, April 2006. - *Invited Talk*
- *Storing Trees on Disk Drives*, USENIX File and Storage Technologies Conference, San Francisco, December 2005. - *Refereed Conference Publication Presentation*
- *Thwarting Virtual Bottlenecks in Multi-Bitrate Streaming Servers*, IEEE Real-time Systems Symposium, Miami, December 2005. - *Refereed Conference Publication Presentation*
- *Computer Science Research at F.I.U.*, ACM-FIU High-school Teacher's Visit, F.I.U., February 2005. - *Invited Talk*
- *Leaping the Storage Hurdle*, Faculty Research Colloquium, F.I.U., October 2004. - *Invited Talk*



- *MEMS-based Disk Buffer for Streaming Media Servers*, NEC Research Laboratory, May 2004. - *Invited Talk*
- *High-performance Preemptible and MEMS-based IOs*, IBM Almaden Research Center, November 2003. - *Invited Talk*
- *MEMS-based Disk Buffer for Streaming Media Servers*, IEEE International Conference on Data Engineering, Bangalore, India, March 2003. - *Refereed Conference Publication Presentation*
- *Data Placement for Multiuser Interactive Digital VCR*, IEEE International Conference on Multimedia and Expo, Tokyo, Japan, August 2001. - *Refereed Conference Publication Presentation*

## RESEARCH GRANTS AND CONTRACTS

### 1. *Scalable Storage Systems.*

*Role:* **PI**

*Award:* Seagate Technology Research Gift

*Agency:* Seagate Technology

*Amount:* \$30,000

*Period:* 2022

### 2. *Collaborative Research: CNS Core: Medium: Generalized Caching-as-a-Service.*

*Role:* **PI**

*Co-investigators:* Ming Zhao (PI @ ASU), Jason Liu (FIU Co-PI) and Giri Narasimhan (FIU Co-PI)

*Agency:* National Science Foundation

*Amount:* \$1M

*Period:* 2020-23

### 3. *Vertically Integrated Persistence.*

*Role:* **PI**

*Co-investigators:* None

*Agency:* National Science Foundation

*Number:* CCF-1718335

*Amount:* \$458,000

*Period:* 2017-2020

### 4. *CSR: Medium: Collaborative Research: NVM-enabled Host-side Caches.*

*Role:* **Lead PI**

*Co-investigators:* Ming Zhao (PI @ ASU), Jason Liu (FIU Co-PI) and Giri Narasimhan (FIU Co-PI)

*Agency:* National Science Foundation

*Number:* CNS-1563883

*Amount:* \$1.1M

*Period:* 2016-2019

### 5. *Securing Storage for Insider Threat Mitigation.*

*Role:* **PI**

*Co-investigators:* Kevin Butler (PI), University of Florida, Gainesville

*Agency:* Florida Center for Cybersecurity

*Amount:* \$25,000

*Period:* 2015-16

6. ***Programming Abstractions for Persistent Memory.***

*Role:* **PI**

*Award:* Intel URO Award

*Agency:* Intel Corporation

*Amount:* \$300,000

*Period:* Unrestricted (started 2013)

7. ***Non-blocking Writes.***

*Role:* **PI**

*Co-investigators:* None

*Agency:* National Science Foundation

*Number:* CNS-1320426

*Amount:* \$497,367

*Period:* 2013-2016

8. ***Non-blocking Writes to File Data.***

*Role:* **PI**

*Award:* NetApp Faculty Fellowship

*Agency:* NetApp, Inc.

*Amount:* \$45,000

*Period:* Unrestricted (started 2013)

9. ***Dynamic Resource Management in Virtualized Cloud Data Centers.***

*Role:* **PI**

*Award:* IBM Faculty Award

*Agency:* IBM Corporation

*Amount:* \$10,000

*Period:* Unrestricted (started 2011)

10. ***Trade-offs in SSD Caching vs. Tiering.***

*Role:* **PI**

*Award:* NetApp Faculty Fellowship

*Agency:* NetApp, Inc.

*Amount:* \$40,000

*Period:* Unrestricted (started 2011)

11. ***Energy Proportional Storage Systems.***

*Role:* **PI**

*Co-investigators:* Giri Narasimhan

*Agency:* National Science Foundation

*Number:* CNS-1018262

*Amount:* \$520,163

*Period:* 2010-2013

12. ***Streamlining High-end Computing with Software Persistent Memory.***

*Role:* **PI**

*Co-investigators:* Jason Liu and Ming Zhao

*Agency:* National Science Foundation

*Number:* CCF-0937964

*Amount:* \$759,999

*Period:* 2010-2013

13. ***Active Block Layer Extensions: A Foundation for Building Self-Managing Storage Systems.***

*Role:* **PI**

*Co-investigators:* None

*Agency:* National Science Foundation

*Award:* CAREER Award

*Number:* CNS-0747038

*Amount:* \$476,000

*Period:* 2008-2013

14. ***QoS-Enabled, High-Performance Storage Systems for Data-Intensive Scientific Computing.***

*Role:* **PI**

*Co-investigators:* None

*Agency:* Department of Energy

*Award:* Early CAREER Principal Investigator Award

*Number:* DE-FG01-05ER05-25

*Amount:* \$300,000

*Period:* 2006-2010

15. ***Building Efficient, Native Storage Systems for Semi-structured Data.***

*Role:* **PI**

*Co-investigators:* Dr. Vagelis Hristidis (Co-PI)

*Agency:* National Science Foundation

*Number:* IIS-0534530

*Amount:* \$408,000

*Period:* 2006-2009

16. ***MRI: Development of a High-performance Database Appliance for Geospatial Applications.***

*Role:* **Co-PI**

*Co-investigators:* Dr. Naphtali Rishe (PI), Drs. Vagelis Hristidis and Tao Li (Co-PI).

*Agency:* National Science Foundation

*Number:* CNS-0021345

*Amount:* \$1,000,000

*Period:* 2008-2013

17. ***Investigation of Geospatial Data Management on MapReduce Platform.***

*Role:* **Co-PI**

*Co-investigators:* Dr. Naphtali Rishe (PI), Dr. Vagelis Hristidis (Co-PI).

*Agency:* National Science Foundation  
*Number:* IIS-0837716  
*Amount:* \$150,000  
*Period:* 2008-2009

18. ***Partnerships for International Research and Education: A Global Living Laboratory for Cyberinfrastructure Application Enablement.***

*Role:* **Senior Investigator**

*Co-investigators:* Dr. Yi Deng (PI), Drs. Shu-ching Chen, Burko Fuhrt, Masoud Sadjadi (Co-PI), Dr. Tao Li (Senior Investigator)

*Agency:* National Science Foundation

*Number:* OISE-0730065

*Amount:* \$2,300,000

*Period:* 2007-2012

19. ***Research Experience for Undergraduates: Autonomic Computing Research at FIU.***

*Role:* **Senior Investigator**

*Co-investigators:* Dr. Masoud Milani (PI), Dr. Tao Li (Co-PI), Drs. Peter Clarke, Masoud Sadjadi, Chi Zhang (Senior Investigators)

*Agency:* National Science Foundation

*Number:* IIS-0550555

*Amount:* \$300,000

*Period:* 2006-2009

## PHD STUDENTS

Student	Degree	Period	Status / Employment
Medha Bhadkamkar	Ph. D.	Spring 2005 - Summer 2009	<i>Spin Research Labs</i>
Daniel Campello	Ph. D.	Fall 2010 - 2016	<i>Google</i>
Mohammad Chowdhury	Ph. D.	Spring 2013 - 2019	<i>Intel Research</i>
Ashikee Ghosh	Ph. D.	Spring 2020 - present	<i>post-candidacy</i>
Alexis Gonzales	Ph. D.	Fall 2020 - present	<i>pre-candidacy</i>
Jorge Guerra	Ph. D.	Spring 2007 - Summer 2012	<i>Facebook</i>
Ricardo Koller	Ph. D.	Spring 2007 - Summer 2012	<i>Google</i>
Sajib Kundu.	Ph. D.	Spring 2007 - present	<i>OfferUp</i>
Steven Lyons	Ph. D.	Fall 2016 - Fall 2021	<i>Google</i>
Leonardo Marmol	Ph. D.	Fall 2012 - Fall 2019	<i>Google</i>
Adnan Maruf	Ph. D.	Fall 2018 - present	<i>post-candidacy (co-advisor)</i>
Luis Useche	Ph. D.	Fall 2006 - Summer 2012	<i>Google</i>
Liana Valdes	Ph. D.	Spring 2019 - present	<i>post-candidacy</i>

## MASTERS RESEARCH ADVISEES

Student	Degree	Period	Employment
Ricardo Santana	M.S.	Spring 2013 - Spring 2015	<i>Google</i>
Muminul Islam	M.S.	Spring 2013 - Spring 2014	<i>Oracle</i>
David Delgado	M. S.	Spring 2005 - Fall 2006	<i>Miami-Dade College</i>
Robert Fortunato Jr.	M. S.	Spring 2010 - Fall 2010	<i>Assurant</i>
Eric Sanchez	M. S.	Fall 2005 - Spring 2006	<i>Square</i>
Silviu Necula	M. S.	Fall 2006 - Fall 2007	<i>SP Richards</i>
Haroldo Level	M. S.	Fall 2006 - Fall 2007	<i>Google</i>
Hector Lopez	M. S.	Spring 2014 - present	<i>Ramsey Solutions</i>
Bin Liu	M. S.	Fall 2006 - Fall 2007	<i>graduated, Fall 2007</i>
Eduardo Monteiro	M. S.	Fall 2006 - Fall 2007	<i>Florida International University</i>

## UNDERGRADUATE RESEARCH ADVISEES

Student	Degree	Period	Status
Alexis Gonzales	B. S.	Fall 2019 - Spring 2020	<i>PhD student @ FIU</i>
Stephen Ballesteros	B. S.	Fall 2019 - Spring 2020	<i>alumnus</i>
Darya Chepurna	B. S.	Fall 2019 - Spring 2020	<i>alumnus</i>
Ricarfens Augustin	B. S.	Fall 2009 - Spring 2010	<i>alumnus</i>
Mandy Barsilai	B. S.	Spring 2006	<i>alumnus</i>
Aldo Barreras	B. S.	Spring 2013	<i>alumnus</i>
Sam Burnett	B. S.	Spring 2013	<i>alumnus</i>
Daniel Costa Esa	B. S.	Spring 2014 - present	<i>alumnus</i>
Ruben Duque	B. S.	Spring 2006	<i>alumnus</i>
Daniel Galano	B. S.	Fall 2009 - Fall 2010	<i>alumnus</i>
Andres Gonzalez	B. S.	Spring 2013	<i>alumnus</i>
Igor Hernandez	B. S.	Fall 2005 - Summer 2006	<i>alumnus</i>
Christopher Kerrutt	B. S.	Fall 2013 - present	<i>alumnus</i>
Jason Liptak	B. S.	Summer 2006	<i>visiting REU student</i>
Steven Lyons	B. S.	Fall 2013 - present	<i>Google</i>
Joseph Marrero	B. S.	Spring 2005 - Summer 2006	<i>alumnus</i>
Leonardo Marmol	B. S.	Fall 2009 - Summer 2011	<i>Google</i>
Krista Merrill	B. S.	Summer 2006	<i>alumnus</i>
Joseph Marrero	B. S.	Spring 2005 - Summer 2006	<i>alumnus</i>
Joseph Naps	B. S.	Summer 2007	<i>visiting REU student</i>
Andy Norcisa	B. S.	Summer 2013 - present	<i>junior year</i>
Robert Parks	B. S.	Summer 2008	<i>visiting REU student</i>
Jesus Ramos	B. S.	Spring 2011 - Fall 2012	<i>NVIDIA</i>
Salma Rodriguez	B. S.	Fall 2011 - Spring 2012	<i>alumnus</i>
David Saba	B. S.	Summer 2007	<i>alumnus</i>
Eric Sanchez	B. S.	Summer 2007	<i>alumnus</i>
Jaime Soto	B. S.	Fall 2010 - Spring 2011	<i>alumnus</i>
Mike Torchio	B. S.	Summer 2008	<i>visiting REU student</i>
Ellen Wagner	B. S.	Summer 2008	<i>visiting REU student</i>

## Ph.D. COMMITTEES

Student	Advisor
Adnan Maruf	Prof. Janki Bhimani, FIU
Manoj Pravakar Saha	Prof. Janki Bhimani, FIU
Pedro Espina	Prof. Jason Liu, FIU
Pedro Soto	Prof. Jun Li, FIU
Raja Appuswamy	Prof. Andrew Tanenbaum, Vrije University
Ariel Cary	Prof. Naphtali Rishe, FIU
Vivek Chaturvedi	Prof. Gang Quan, FIU
Ian De Felipe	Prof. Naphtali Rishe, FIU
Onyeka Ezenwoye	Prof. Masoud Sadjadi
Fernando Farfan	Prof. Vagelis Hristidis
Juan-Carlos Martinez	Prof. Masoud Sadjadi
Ziyuan Meng	Prof. Geoffrey Smith, FIU
Francisco Ortega	Prof. Naphtali Rishe, FIU
Zhengguo Sun	Prof. Naphtali Rishe, FIU
Pollawat Thanarungroj	Prof. Chen Liu, FIU
Ramakrishna Varadarajan	Prof. Vagelis Hristidis
Nathaneal Van Vorst	Prof. Jason Liu, FIU
Lichen Wang	Prof. Chen Liu, FIU
Lixi Wang	Prof. Ming Zhao, FIU

## TEACHING

- COP4610, Operating Systems, Spring 2022
- COP4610, Operating Systems, Fall 2021
- COP4610, Operating Systems, Spring 2021
- COP4610, Operating Systems, Fall 2020
- COP4610, Operating Systems, Spring 2020
- COP4610, Operating Systems, Fall 2019
- COP4610, Operating Systems, Spring 2019
- COP4610, Operating Systems, Fall 2018
- COP5614, Operating Systems, Spring 2018
- COP4610, Operating Systems, Spring 2018
- COP5614, Operating Systems, Spring 2017
- CS 695 Topics in Virtualization and Cloud Computing, Autumn 2015 (IIT Bombay)
- COP 5614 Operating Systems, Spring 2014
- COP 4338 Programming III, Spring 2014
- COP 6611 Advanced Operating Systems, Fall 2013.
- COP 5614 Operating Systems, Fall 2013
- COP 5614 Operating Systems, Spring 2013

- COP 4338 Programming III, Spring 2013
- CIS 5346 Storage Systems, Fall 2012.
- COP 4338 Programming III, Spring 2012
- COP 4338 Programming III, Spring 2011
- COP 5614 Operating Systems, Spring 2011
- COP 6611 Advanced Operating Systems, Fall 2010.
- CIS 5346 Storage Systems, Spring 2010.
- COP 4610 Operating Systems Principles, Fall 2009
- COP 4610 Operating Systems Principles, Spring 2009
- COP 5614 Operating Systems, Spring 2009
- COP 4610 Operating Systems Principles, Fall 2008.
- COP 5614 Operating Systems, Spring 2008.
- COP 4343 UNIX System Administration, Fall 2007.
- COP 6611 Advanced Operating Systems, Fall 2007.
- CIS 5346 Storage Systems, Spring 2007.
- COP 4610 Operating Systems Principles, Fall 2006.
- COP 6611 Advanced Operating Systems, Fall 2006.
- COP 4610 Operating Systems Principles, Spring 2006.
- CIS 5346 Storage Systems, Spring 2006.
- COP 4610 Operating Systems Principles, Fall 2005.
- CIS 5346 Storage Systems, Spring 2005. - New course I introduced.
- COP 4610 Operating Systems Principles, Spring 2005.
- COP 4610 Operating Systems Principles, Fall 2004.
- Computer Programming Summer 2000 (UC, Santa Barbara).

## PROFESSIONAL SERVICE

- Steering Committee Member, USENIX File and Storage Technologies Conference, since 2018.
- Program Chair, USENIX File and Storage Technologies Conference, 2018
- *Steering Committee Member*, USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage), 2012-2019.
- *Program Chair*, USENIX Workshop on Hot Topics in Storage and File Systems (HotStorage), 2012
- *Editorial Board*, Springer Journal of Distributed and Parallel Databases, 2014-2018.
- *Panelist*, National Science Foundation - since 2006.

- *Program Committee Member*, For multiple years at USENIX FAST, USENIX ATC, USENIX HotStorage, IEEE MSST, ACM SYSTOR, IEEE NAS, and more.

## UNIVERSITY SERVICE

<i>Chair</i> , Human Resources Committee, SCIS	2021-2022
<i>Member</i> , Faculty Search and Screen Committee, SCIS	2021-2022
<i>Chair</i> , Human Resources Committee, SCIS	2020-2021
<i>Member</i> , Faculty Search and Screen Committee, SCIS	2020-2021
<i>Member</i> , Human Resources Committee, SCIS	2019-2020
<i>Chair</i> , Faculty Search and Screen Committee, SCIS	2019-2020
<i>Member</i> , Infrastructure Committee, SCIS	2017-2018
<i>Member</i> , Infrastructure Committee, SCIS	2016-2017
<i>Chair</i> , Graduate Committee, SCIS	2014-2015
<i>Chair</i> , Faculty Search and Screen Committee, SCIS	2013-2014
<i>Chair</i> , Faculty Search and Screen Committee, SCIS	2012-2013
<i>Member and Secretary</i> , College Faculty Council on Governance, CEC	2009-10, 2010-11
<i>Member</i> , College T&P Committee, CEC	2010-11
<i>Member</i> , Faculty Search and Screen Committee, SCIS	2008-2009
<i>Member</i> , Faculty Search and Screen Committee, SCIS	2007-2008
<i>Member</i> , Graduate Committee, SCIS	2008-2009
<i>Co-ordinator</i> , Research Colloquiums, SCIS	2007-2008
<i>Member</i> , Faculty Search and Screen Committee, SCIS	2006-2007
<i>Co-ordinator</i> , Research Colloquiums, SCIS	2005-2006
<i>Member</i> , Graduate Committee, SCIS	2004-2005
<i>Member of 5 Non-Major-Advisor Ph. D. Dissertation Committees</i> , SCIS	2004-current
<i>Member of 10 Ph. D. Candidacy Exam Committees</i> , SCIS	2004-current
<i>Member Screening Committee</i> , Information Technology Awards, ACM-FIU	2004
<i>Judge</i> , ACM-FIU High-school Programming Competition	2004
<i>Invited Speaker</i> , ACM-FIU High-school Teacher's visit	2004
<i>Honors Research Affiliate</i> , Honors College	2005-2006
<i>Invited Speaker</i> , ACM-FIU High-school Teacher's visit	2004

## COLLABORATORS

- Anurag Acharya, Principal Engineer, Google.
- Himyanshu Anand, Freescale Semiconductor, Inc.
- John Bent, Seagate.
- Wendy Belluomini, IBM Research - Almaden.
- John Bent, Seagate.
- Kevin Butler, Professor, University of Florida, Gainesville.
- Gary Chan, Associate Professor, Hong Kong University of Science and Technology.
- Edward Chang, Founder/CTO, Ailly Corp.
- Milton Chen, VSee Lab.
- Yi Deng, Dean and Professor, Drexel Univeristy.
- Zoran Dimitrijević, Google.
- Hector A. Duran-Limon, Research Professor, University of Guadalajara, Mexico.
- Kaushik Dutta, National University of Singapore.
- Joseph Glider, IBM Research - Almaden.



- Dean Hildebrand, Google.
- Ajay Gulati, VMware.
- Vagelis Hristidis, Professor, UC Riverside.
- Kyle Kakligian, Google.
- Himabindu Pucha, IBM Research - Almaden.
- Lukas Rupperecht, Google.
- Klaus Schauer, Founder, AppFolio.
- Indranil Sengupta, Professor, Indian Institute of Technology, Kharagpur, India.
- Tim Shaffer, Seagate.
- Shuichi Shimizu, IBM Tokyo Research Laboratory, Tokyo, Japan
- Swaminathan Sundararaman, IBM Research - Almaden
- Nisha Talagala, Pyxeda.AI
- Dave (Jing) Tian, Assistant Professor, Purdue University.
- Akshat Verma, IBM Research, India
- Yuan-Fang Wang, Professor, University of California, Santa Barbara.
- David Watson, Google.
- Ming Zhao, Associate Professor, Arizona State University.