

Liana Valdes Rodriguez

KNIGHT FOUNDATION SCHOOL OF COMPUTING AND INFORMATION SCIENCE
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PROFESSIONAL INTERESTS

Storage, Distributed Systems, Caching Algorithms, ML for Systems, Systems for ML, OS, Relationship Management, Team Leadership, Innovation, Technology, Networking, Creativity, and Relationship Building.

SUMMARY

As a newly graduated Ph.D. student in Computer Science at the **Systems Research Laboratory (SyLab)** under the supervision of Prof. Raju Rangaswami, I have been exploring the fascinating realms of storage systems, distributed systems, operating systems, and the intersection between systems and machine learning. In my previous research projects, I successfully led a team focused on designing and implementing novel caching algorithms for storage caches, leading to a significant improvement in performance. I have also been actively involved in the development and enhancement of distributed systems solutions for today's cloud data centers. Prior to my Ph.D. program at FIU, I had the privilege of gaining valuable industry experience. I was a research intern at Microsoft Research Cambridge, UK, where I contributed to the Project Silica project. In 2021, I further honed my skills as a research intern at Seagate Technology. These experiences have not only enriched my understanding of the field but have also provided me with practical insights that I can apply to my current research. Before embarking on my Ph.D. journey, I completed my bachelor's degree in telecommunications and electronics engineering in Havana, Cuba.

EDUCATION

Florida International University <i>Master of Science in Computer Science</i> <i>Advisor: Eminent Scholar Chaired Professor Raju Rangaswami</i>	21 August 2017 - 17 December 2022 <i>Miami, FL</i>
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Florida International University <i>Doctor of Philosophy in Computer Science</i> <i>Advisor: Eminent Scholar Chaired Professor Raju Rangaswami</i>	21 August 2017 - 16 December 2023 <i>Miami, FL</i> GPA: 3.83/4.0
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Graduate Relevant Courses: Operating Systems, Analysis of Algorithms, Theory of Computation, Computer Communication and Networking Technologies, Introduction to Algorithms, Secure Application Programming, Principles of DBMS, Introduction to Machine Learning, Advanced Software Engineering, Data Visualization.

Technological University of Havana <i>Bachelor of Science in Electronic and Telecommunications Engineering</i> <i>Faculty of Telecommunications Engineering (FIT)</i>	1 September 2009 - 28 July 2015 <i>Havana, Cuba</i> GPA: 4.48/5
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Undergraduate Relevant Courses: Linear Algebra and Analytical Geometry, Mathematics I, Mathematics II, Molecular Physics and Mechanics, Computerized and Automated Office Systems, Programming I, Chemistry, Electric Circuits I, Electric Circuits II, Electromagnetism and Optics, Analog Electronics I, Communication Statistics, Probability and Statistics, Advanced Programming, Programming II, Differential Equations and Series. Electrical Circuits III, Digital Electronics I, Digital Electronics II, Analog Electronics I, Analog Electronics II, Principles of Communications I, Principles of Communications II, Virtual Instrumentation, Transmission Lines, Numerical Methods, Microprocessors I, Digital Signal Processing, Field Theory, and Business Management.

PUBLICATIONS

Project Silica: Towards Sustainable Cloud Archival Storage in Glass <i>Liana Valdes, in Acknowledgement,</i> <i>The 29th ACM Symposium on Operating Systems Principles, SOSP'23.</i>	October 2023
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Infusing Pub-Sub Storage with Transactions	July 2022
<i>Liana V. Rodriguez, John Bent, Tim Shaffer, and Raju Rangaswami, 14th ACM Workshop, HotStorage'22.</i>	
Unifying the Data Center Caching Layer - Feasible? Profitable?	July 2021
<i>Liana V. Rodriguez, Alexis Gonzalez, Pratik Poudel, Raju Rangaswami, and Jason Liu, 13th ACM Workshop, HotStorage'21.</i>	
Learning Cache Replacement with CACHEUS	February 2021
<i>Liana V. Rodriguez, Farzana Yusuf, Steven Lyons, Eysler Paz, Raju Rangaswami, Jason Liu, Ming Zhao, and Giri Narasimhan, 19th USENIX Conference, FAST'21.</i>	
To Cache or Not to Cache	
Steven Lyons, <i>Liana V. Rodriguez</i> , and Raju Rangaswami	
Driving Cache Replacement with ML-Based LeCaR	July 2018
<i>Giuseppe Vietri, Liana V. Rodriguez, Wendy A. Martinez, Steven Lyons, Jason Liu, Raju Rangaswami, Ming Zhao, and Giri Narasimhan, USENIX Workshop, HotStorage'18.</i>	

PRESENTATIONS

CORTX and FDMI CORTX Meet the Architect Series	November 2022
<i>Liana V. Rodriguez and John Bent</i>	
Infusing Pub-Sub Storage with Transactions HotStorage'22 Presentation	Jul. 2022
<i>Liana V. Rodriguez, John Bent, Tim Shaffer, and Raju Rangaswami</i>	
Unifying the Data Center Caching Layer - Feasible? Profitable? HotStorage'21 Presentation	Jul. 2021
<i>Liana V. Rodriguez, Alexis Gonzalez, Pratik Paudel, Raju Rangaswami and Jason Liu</i>	
Learning Cache Replacement with CACHEUS Poster Annual FIU SCIS Research Day	October 2019
<i>Liana V. Rodriguez, Farzana Yusuf, Steven Lyons, Eysler Paz, Raju Rangaswami, Jason Liu, Ming Zhao, and Giri Narasimhan.</i>	
ANX: Caching with Anxiety Poster Annual FIU SCIS Research Day	October 2019
<i>Steven Lyons, Liana V. Rodriguez, and Raju Rangaswami</i>	
Driving Cache Replacement with ML-Based LeCaR HotStorage'18 Poster session	July 2018
<i>Giuseppe Vietri, Liana V. Rodriguez, Wendy A. Martinez, Steven Lyons, Jason Liu, Raju Rangaswami, Ming Zhao, and Giri Narasimhan.</i>	

EXPERIENCE

Graduate Research Assistant (GRA) SyLab, Florida, US	August 2017 - April 2023
Florida International University	
<ul style="list-style-type: none"> Developed novel caching algorithms for storage caches using ML techniques to improve performance. Analyzed real-world production storage workloads to identify application I/O patterns that can be exploited in the design of novel caching algorithms customized to specific applications which improves performance. Research in distributed systems that addresses distributed storage challenges such as data consistency, high scalability, high availability, failover, disaster recovery, and fault tolerance. 	
Research Intern Microsoft Research, Cambridge, UK	January 2020 - March 2020
<ul style="list-style-type: none"> I worked on Microsoft's Project Silica as part of the optics for the Cloud Systems Futures cloud initiative, where I developed a storage software stack for storage systems based on quartz glass technology. Develop ML techniques in the software pipeline that improve data recovery and error analysis in the storage system (Python, PyTorch, Scikit-learn, Isolation Forest, Encoders). Project Silica aims to develop the first Azure Archival Storage based on solid-silica glass and laser-induced femtosecond pulse technology for Azure Cloud archival workloads. The archival storage system developed in Project Silica co-designs hardware and software focusing on sustainability and vulnerability. 	
Intern Seagate Technology, Remote, US	August 2021 - December 2021
<ul style="list-style-type: none"> Seagate's object storage solution, CORTX testing integration, and software stack deployment. CORTX Storage Extensible Interface research (C, Python, Distributed Consensus Transactions). 	

- I worked on planning the Seagate Global Hackathon event in 2021, where I worked on the challenge requirements, steps to follow, and possible solutions.
- Performance study of Motr, an object storage system deployed at the Jülich Supercomputing Center (JSC) in Germany (**C, Go, fio, SelfNet Lustre**).

Network Engineer | Telecommunications Company (ETECSA) September 2015 - June 2016

- Monitor the core infrastructure of the ATM, DSL, PSTN, and public and private VoIP telephone systems to ensure high telephone network reliability and availability.
- Performed network assessment to deploy OTN devices for the EPON/GPON fiber-to-home project in Old Havana.

Intern | Radiocommunications Company (RadioCuba) March 2012 - July 2015

- Changed the board layout to modify UHF/VHF modules from PAL to NTSC television standards, improving the frequency of the television signal.
- Designed RF matching networks with passive components for maximum power transfer to 50-ohm load or real-world load (TV antenna) and model results with MATLAB simulations using E-field sensors and spectrum/network analyzers. (MATLAB, Network Analyzers).

RESEARCH PROJECTS

Caching Algorithms for Storage Caches | SyLab, BioRG (FIU) & VISA (ASU) August 2017

- Characterize production storage workloads from different cloud service providers.
- Design and develop new cache replacement algorithms to improve the hit rate performance of caches that store data for cloud application workloads. We developed multiple algorithms; in particular, two algorithms, LeCaR and CACHEUS, outperform classical cache replacement algorithms. LeCaR inspired CACHEUS but overcomes an critical flaw by being completely adaptive, eliminating statically chosen hyperparameters, thus guaranteeing high flexibility.
- Identify cache-relevant characteristics that are reported by workload primitive types. We identify four primitive workloads: LRU-friendly, LFU-friendly, scan, and churn. Workload primitive types vary between workloads, within a single workload over time, and as cache size changes.
- Reduce the cost of accessing SSD-based caches by reducing the total of application writes sent to storage devices (SATA SSD and NVMe SSD).

Distributed Caches in Data Centers | SyLab, ModLab, DAMRL (FIU) & HASLab (UMinho) May 2020

- Design and develop Caching-as-a-Service (CaaS), a distributed and generalized caching service that addresses the requirements of different types of cloud storage production workloads. First and foremost, CaaS is designed as a general cache utility for various store types, including block storage, object storage, file systems, and key-value stores. CaaS integrates into the storage I/O software stack in cloud infrastructure services and is entirely transparent to applications.
- Design and develop CaaS as a writable cache. To achieve durability, fault tolerance, and scalability, CaaS stores data in a set of nodes, each implemented as a fault-tolerant cluster managed by Raft, a distributed consensus protocol.
- Improve cache read and write latency and performance relative to back-end storage. CaaS performs write-back calls eagerly to improve performance. It also proactively schedules asynchronous eviction calls to deliver faster cache access time to the application and increase available cache space, which is then used to cache new writes.
- Implement a simulation framework to simulate the different components of a consistent and writable caching system. The CaaS simulator is a complete system simulator that implements the operation of multiple types of components, including clients, servers, the coordinator, and network communication between them.

Extensible Distributed Storage Systems | Seagate Technology & SyLab (FIU) August 2021

- Design TxFuse based on the FDMI architecture from Seagate's storage system, a novel architecture that allows development of different storage features as plugins to improve the CORTX distributed storage system. TxFuse enables the development and deployment of features independently of the storage system layer.
- Define a taxonomy of plugins that uses transactional coupling and a reliable notification mechanism. We identify three classes of plugins, class A, class B, and class C, which differ in how they interact with the storage system. Plugins execute code in response to client-initiated operations on the storage system.
- Simplify integration and deployment among distributed nodes using docker containers.
- Evaluate different plugin prototypes based on performance and development complexity. We count lines of code (LOC) and calculate cyclomatic complexity (CC) per feature in plugins and MinIO's native features.

AWARDS

CMD-IT/ACM Richard Tapia Celebration of Diversity in Computing Conference Scholarship in **2022**.
Grace Hooper Celebration of Women in Computing FIU Scholarship in **GHC'19 & GHC'22**.
GAANN Fellowship from U.S. Department of Education in **2022** and **2023**.
USENIX Student Travel Award in **FAST'23 & FAST'19 & FAST'18**.

TEACHING ASSISTANT

Operating Systems (Graduate)	August 2018 & January 2019
Florida International University	Miami, FL
Transmission Systems II	2011 - 2012
Technological University of Havana "José Antonio Echeverría", CUJAE	Havana, Cuba
Analog Electronics I	2010 - 2011
Technological University of Havana "José Antonio Echeverría", CUJAE	Havana, Cuba

SOCIETIES & ACTIVITIES

- I was a planner, presenter, and team leader at FIU on three research projects in **2018, 2019, 2020, 2021, 2022,** and **2023**. These projects included collaborations with globally distributed members of the technology industry and universities.
- Planner of the Seagate Global CORTX Hackathon Event in **2021**.
- Reviewer for the ACM Transactions on Storage (TOS) Journal in **2021**.
- Presenter for the Women in Computer Science, WiCS meeting in **2019**.
- Participated in Upsilon Pi Epsilon, UPE activities on campus in **2019, 2021, and 2022**.
- Volunteered for the Google CS First program in **2019** as a coding instructor for kids under 8, teaching general computer science concepts and critical thinking problems using Scratch.

TECHNICAL SKILLS

Languages: Python, C#, C, C++, Go, R, R++, TeX, Visual Basic, High Level Assembly (HLA)
Tools: GitLab, Docker, VirtualBox, VMware Workstation, VsCode, Tableau, MATLAB, LabVIEW, LaTeX

CERTIFICATIONS

CompTIA A+ 220-801 Certification Exam.
CompTIA A+ 220-802 Certification Exam.

LANGUAGE

Spanish: Native
English: Fluent and Full Professional Proficiency

HOBBIES

Music: Traditional Cuban Music, Country Music, Pop Music, Blues, Jazz.
Poetry: Cuban Poetry, Latinoamerican Poetry, Spanish Poetry, American Poetry.
Chess: Chess Play Online Application with Time Control, Tournaments and Matches, Titles and Rankings.
Fitness: Physical Fitness.
Animation: Computer Animation, Disney Animation, Japanese Animation.

SKILLS

Relationship building, Emotional intelligence, Forward-thinking, Empowerment, Adaptability, Motivation, Innovation, Inspiration, Active listening, Empathy, Presentation skills, Authenticity and honesty, Creativity, Innovation and Relationship management.