EMINE UGUR KAYNAR

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OVERVIEW

Interests: Computer System Design for Cloud Computing, Distributed Systems, Cloud Storage Systems, Performance Analysis and Tuning
Skills: Ceph, OpenStack, Alluxio, Hadoop, Spark, C++, Bash, Python

EDUCATION

Ph.D., Computer Science *May 2022*
Boston University
Dissertation Title: Cooperative Caching for Object Storage
Advisor: Prof. Orran Krieger

M.Sc., Computer Science *Aug. 2013*
State University of New York at Binghamton
Thesis title: Impact of Encryption on Live Virtual Machine Migration
Advisor: Assoc. Prof. Ping Yang

B.Sc., Information Systems Engineering *May 2011*
Bogazici University (Dual Diploma Program)
State University of New York at Binghamton

RESEARCH PROJECTS

- **Caching for Object Stores:** Lead two projects that explore the integration of distributed caching architectures into today's immutable object-based data lakes to enable data lakes to expand across the data center.
  - D3N: Datacenter-scale Data Delivery Network: a multi-layer cooperative cache for object stores, as a solution to network-constrained data centers. D3N enables data sharing across analytic clusters (e.g., Spark) in a data center, and dynamically adapts to changes in access patterns.

    ◇ *Open Source Software:* **D3N Data Cache For Ceph Object Storage**,
    Merged into Ceph by Red Hat, 2021. [Ceph Documentation]

  - D4N: Directory-Based D3N: a distributed cache framework, that is built on top of the existing SSD-based caching system D3N to support writes and to provide application-specific specializations to target wide range of applications. D4N provides a distributed directory for a global state and exploits data immutability, one of the key features of object storage to reduce the complexity of efficient caching. A group of Red Hat Ceph developers is working with us to upstream D4N into Ceph. [Github]
- Kariz: Cache Prefetching and Management: Involved a cache management project that explores how to integrate rich information from data analytics platforms to enable sophisticated cache management strategies. Kariz is a cache management and prefetching system for analytic frameworks that exploits the DAGs of inter-task dependencies used by data-parallel frameworks, historical run time information, and current cache state to drive caching and prefecting decisions.
- Elastic Secure Infrastructure (ESI): Involved ESI project which explores how to build a secure bare-metal elastic infrastructure for data centers and efficiently multiplexing bare-metal servers between different tenants. Bare-Metal Imaging (BMI) prototype that we developed for ESI project is a generic bare-metal provisioning solution for rapid deployment of bare-metal nodes on demand,

and brings attractive image management capabilities (e.g., fast snapshotting, cloning, rapid provisioning etc.) of virtualized solutions to bare-metal systems.

INDUSTRY RESEARCH EXPERIENCE

- Red Hat, Boston — May. 2017 - Jan. 2022
  Ph.D. Research Intern (Office of the CTO) | *Mentors: Matt Benjamin*
  - Hybrid Cloud Cache Implemented the initial D4N prototype for Ceph object store to support hybrid cloud use case.
  - Upstreaming D3N into Ceph: Worked with Ceph RGW team on integrating the D3N cache prototype into the open source Ceph to make it available to the broader community.

  Ph.D. Research Intern (Ceph Performance Engineering) | *Mentors: Rick Sussman, Ben England*
  - **Impact of Node Failure and Recovery:** Analyzed the performance implications associated with node failure and recovery on Ceph object store, conducted performance tuning, and provided detailed performance insights.
  - **Erasure Coding vs. Replication:** Analyzed the end-to-end performance and cost impact of *replication* and *erasure-coding* for Ceph storage. Identified the overheads and pointed out possible improvements that may improve redundancy solutions' performance.

- Mass Open Cloud (MOC) Alliance, Boston — 2015 - Present
  Systems Researcher | *Mentors: Ata Turk*
  - **MOC Big Data Platform:** Worked with big data team to implement big data services on top of elastic OpenStack deployment, and worked on applying BMI provisioning solution for rapid deployment of bare-metal big-data platforms ondemand.
  - **MOC Monitoring Platform:** Worked with monitoring team to deploy monitoring infrastructure in MOC data centers to collect metrics from virtual and physical servers.

- SUNY at Binghamton — Jul. 2012 - Aug. 2013
  Research Assistant | *Advisor: Assoc. Prof. Ping Yang*
  - **Impacts of encryption on VM migration:** Studied the impact of AES and 3DES encryption algorithms on two widely used live VM migration approaches (pre-copy and post-copy).

PUBLICATIONS

- **E. U. Kaynar**, A. Mosayyebzadeh, M. Abdi, M. Benjamin, L. Rudolph, P. Desnoyers, O. Krieger, *Universal Data Center Cache*, **(Submitted 2022)**.
- **E. U. Kaynar**, *Cooperative Caching for Object Storage*, **Ph.D. Dissertation, 2022**.
- M. H. Hajkazemi, V. Aschenbrenner, M. Abdi, **E. U. Kaynar**, A. Mosayyebzadeh, O. Krieger, P. Desnoyers, Beating the I/O bottleneck: A Case for Log-Structured Virtual Disks, **USENIX FAST'20**.
- M. Abdi, A. Mosayyebzadeh, M.H Hajkazemi, **E. U. Kaynar**, A. Turk, L. Rudolph, O. Krieger, P. Desnoyer, A Community Cache with Complete Information, **USENIX FAST'20**.
- **E. U. Kaynar**, M Abdi, M. H. Hajkazemi, A. Turk, R. R. Sambasivan, L. Rudolph, D. Cohen, P. Desnoyers, O. Krieger, D3N: A multi-layer cache for the rest of us, **IEEE Big Data'19**.
- A. Mohan, A. Turk, R. S. Gudimetla, S. Tikale, J. Hennesey, **E. U. Kaynar**, G. Cooperman, P. Desnoyers, O. Krieger, M2: Malleable Metal as a Service, **IEEE IC2E'18**.
- J. Hennessey, S. Tikale, A. Turk, **E. U. Kaynar**, C. Hill, P. Desnoyers, O. Krieger, HIL: Designing an Exokernel for the Data Center, **ACM SoCC'16**.

- A. Turk, R. S. Gudimetla, **E. U. Kaynar**, J. Hennessey, S. Tikale, P. Desnoyers, O. Krieger, An Experiment on Bare-Metal BigData Provisioning, **USENIX HotCloud'16**.
- Y. Hu, S. Panhale, T. Li, **E. U. Kaynar**, D. Chan, U. Deshpande, P. Yang, K. Gopalan, Performance Analysis of Encryption in Securing the Live Migration of Virtual Machines, **IEEE CLOUD'15**.
- **E. U. Kaynar**, *Impacts of Encryption on the Performance of Virtual Machine Migration*, **M.Sc. Thesis, 2013**.

SELECTED TALKS

- **Hybrid cloud storage**, Open Cloud Workshop 2020, Boston MA, [Video]
- **Hybrid cloud storage**, DevConf.US 2020, Boston MA, [Video]
- **D3N: A multi-layer cache for data centers**, DevConf.US 2019, Boston MA, [Video]
- **D3N: A multi-layer cache for improving big-data applications' performance**, Mass Open Cloud Workshop 2019, Boston MA, [Video]
- **The Massachusetts Open Cloud: an Open Cloud eXchange**, Red Hat Summit 2017, Boston MA
- **Big Data as a Service at Mass Open Cloud**, Open Stack Summit 2017, Boston MA, [Video]

TEACHING AND MENTORING EXPERIENCE

Mentoring

Project mentor to multiple projects in the Cloud Computing course jointly thought in Boston University and Northeastern University.

- Accelerating Ceph Cloud Storage with D4N, team of 4 graduate students
- Ceph RGW S3-Select Caching, team of 4 graduate students
- Ceph RGW Cache Prefetching, team of 3 graduate students
- Mass Open Cloud Monitoring Platform, team of 3 graduate students

Teaching Assistant

Department of Computer Science, Boston University

- Cloud Computing — Spring 2016
- Introduction to Application Programming — Spring & Fall 2014/2015
- Introduction to Computer Science — Summer 2015

Department of Computer Science, SUNY at Binghamton

- Introduction to Computer Security — Spring 2013
- Programming Languages — Fall 2012

ACTIVITIES

Filmmaking: Member of Bogazici Cinema Club. I am interested in films and film making. I made an amateur short film called "So-called Right" in 2013.

Sports: 3 times bronze medalist in 100m backstroke in *Women National Open Swimming Championship of Turkey* from 2000 to 2002. Many times gold medalist in 50m/100m/200m backstroke and freestyle in *Anatolia Region Swimming Championship of Turkey* from 1997 to 2009. Captain of Samsun Gazi Swimming Club from 2005 to 2009.

REFERENCES AVAILABLE TO CONTACT

Prof. Orran Krieger, Professor at Boston University Computer Science and Electrical and Computer Engineering

Prof. Larry Rudolph, Principal Research Scientist at MIT CSAIL, and Vice President and Senior Researcher Two Sigma Investments.

Prof. Peter Desnoyers, Associate Professor at Northeastern University Computer Science

Matt Benjamin, Architect and Senior Manager at Red Hat.

Dr. Ata Turk, Vice President of Cloud Architecture at State Street.