EMINE UGUR KAYNAR

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OVERVIEW

Interests: Cloud Computing, Large Scale Distributed Systems, Cloud Storage Systems, Performance Evaluation
Skills: Ceph, OpenStack, Alluxio, Hadoop, Spark, C++, Python, Bash

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

- **Ph.D. dissertation - Caching for Object Stores:** I led efforts in our storage group for two projects that explore the integration of cooperative caching into today's immutable object-based data lakes. Both caches exploit data immutability, one of the key features of object storage to reduce the complexity of efficient caching. Both architectures distribute SSD-based caches across the data center to enable data sharing across analytic clusters (e.g., Spark) and dynamically adapt to changes in access patterns.
  - D3N: Datacenter-scale Data Delivery Network: is a clean and stateless multi-layer cooperative cache design for object stores.
    - *Open Source Software:* **D3N Data Cache For Ceph Object Storage**,
    Merged into Ceph by Red Hat, 2021. [Ceph Documentation]
  - D4N: Directory-Based D3N: is built on top of D3N. It maintains a distributed directory for a global state, supports writes, and provides application-specific specializations. A group of Red Hat Ceph developers is working with us to upstream D4N into Ceph. [Github]
- Kariz: Cache Prefetching and Management: I worked as part of the team working on the Kariz project that explores how to integrate rich information (e.g., DAGs) from data analytics platforms to maximize cache hit rate. Kariz is built on top of D3N and exploits DAG information from data-parallel frameworks to prefetch, pin/unpin, or evict data.
- Elastic Secure Infrastructure (ESI): I worked as a team member in the ESI project, which explores how to securely and rapidly multiplex physical servers between many different tenants while minimizing trust in the provider. Bare-Metal Imaging (BMI) prototype we developed enables 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. BMI is currently being integrated into Mass Open Cloud.

INDUSTRY RESEARCH EXPERIENCE

- **Red Hat**, Boston   May. 2017 - Jan. 2022

  Research Intern (Office of the CTO) | Mentors: Matt Benjamin
    - ○ Hybrid Cloud Cache Implemented the initial D4N prototype for the Ceph object store that focused on the hybrid cloud use case.
    - ○ Upstreaming D3N into Ceph: Worked with the Ceph RGW team on integrating the D3N cache prototype into Ceph to make it available to the broader community.

  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 the 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 the Ceph storage. Identified the overheads and pointed out possible improvements that may improve the performance of redundancy solutions.

- Mass Open Cloud (MOC) Alliance, Boston   2015 - Present

  Systems Researcher | Mentors: Ata Turk
    - ○ **Big Data Platform:** Worked with the big data team to implement big data services on top of elastic OpenStack deployment, and worked on applying the BMI provisioning solution for rapid deployment of bare-metal big-data platforms ondemand.
    - ○ **Monitoring Platform:** Worked with the monitoring team to deploy the monitoring infrastructure in the MOC data center 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, **ACM EUROSYS'22**.

- 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'21**.

- **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

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 "The 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 2003. Captain of Samsun Gazi Swimming Club from 2001 to 2004.

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 at 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.