# Tapan Srivastava

tapansriv@uchicago.edu · tapansrivastava.com

## EDUCATION

**Ph.D., Computer Science** — 2020 – Present
*University of Chicago*
Advised by Prof. Raul Castro Fernandez

**M.S., Computer Science** — 2020 – 2023
*University of Chicago*
Advised by Prof. Raul Castro Fernandez
Master's Paper: *Saving Money For Analytical Workloads in the Cloud*

**B.S. Honors, Computer Science** — 2016 – 2020
*University of Chicago* — GPA: 3.90/4.0
Bachelor's Thesis Advised by Prof. Hank Hoffmann

**B.S., Mathematics** — 2016 – 2020
*University of Chicago* — GPA: 3.88/4.0

## SELECTED PROJECTS

**Saving Money for Analytical Workloads in the Cloud**
*University of Chicago*
As users migrate their analytical workloads to cloud databases, it is becoming just as important to reduce monetary cost as it is to improve query performance. In the cloud, users choose to pay based on either the compute time or the amount of data a query reads. We observe that analytical queries are compute- or IO-intensive and each query type executes cheaper in a different pricing model. We exploit this opportunity and propose methods to build cheaper execution plans across pricing models. We implement these methods, observe how SQL text and query optimizers impact cost, and consider a transparent deployment of DuckDB on infrastructure-as-a-service to avoid the cost premiums of platform-as-a-service without placing the burden of deployment or maintenance on users. We reduce workload costs by as much as 80% and produce execution plans spanning multiple pricing models that save as much as 47%. We also reduce individual query costs by as much as 90%. We simulate the effect of different cloud prices on real query performance and observe that there are still significant multi-cloud opportunities if cloud vendors change their prices. These results indicate the massive opportunity to save money by building execution plans across multiple pricing models.

**Penelope: Peer-to-peer Power Management**
*University of Chicago*
Large scale distributed computing setups rely on power management systems to enforce tight power budgets. Existing systems use a central authority that redistributes excess power to power-hungry nodes. This central authority, however, is both a single point of failure and a critical bottleneck—especially at large scale. To address these limitations we propose *Penelope*, a distributed power management system which shifts power through peer-to-peer transactions, ensuring that it remains robust in faulty environments and at large scale. We implement *Penelope* and compare its achieved performance to *SLURM*, a centralized power manager, under a variety of power budgets. We find that under normal conditions *SLURM* and *Penelope* achieve almost equivalent performance; however in faulty environments, *Penelope* achieves 8–15% mean application performance gains over *SLURM*. At large scale and with increasing frequency of messages, *Penelope* maintains its performance in contrast to centralized approaches which degrade and become unusable. This work was published at ICPP'22.

## PUBLICATIONS

**Penelope: Peer-to-peer Power Management**
*ICPP '22: Proceedings of the 51st International Conference on Parallel Processing*

Tapan Srivastava, Huazhe Zhang, Henry Hoffmann
10.1145/3545008.3545047

POSTERS

**Saving Money For Analytical Workloads in the Cloud**
*GCASR: Greater Chicago Area Systems Research Workshop*
Tapan Srivastava, Raul Castro Fernandez
Illinois Institute of Technology, April 2023

**Saving Money For Analytical Workloads in the Cloud**
*CERES Summit*
Tapan Srivastava, Raul Castro Fernandez
University of Chicago, May 2023

PROFESSIONAL EXPERIENCE

**Software Engineering Intern**
*Pittsburgh, PA*
Uber ATG
• Built backend services to create a debugging tool for the tablets onboard the self-driving vehicle.
• Utilized gRPC servers and protobuf to effectively log data for playback during debugging.

**Software Engineering Intern**
*Pittsburgh, PA*
Uber ATG
• Migrated an existing service running onboard the self-driving car from using an HTTP server to using a gRPC server.
• Designed, implemented, and deployed a new backend service for a feature on the self-driving car.
• Implemented new service in Go and Thrift, logged via Kafka streams, and utilized a distributed task orchestrator to manage workflows in a distributed production environment.
• Deployed the service into production.

HONORS AND AWARDS

**University of Chicago Dean's List** 2017-2020
**University of Chicago Presidential Scholarship** 2016
**University of Chicago University Scholarship** 2016

RELEVANT COURSES

**Computer Science:** • Databases • Operating Systems • Complexity Theory • Computer Architecture • Advanced Distributed Systems

**Mathematics:** • Analysis • Abstract Algebra • Linear Algebra
• Discrete Mathematics • Statistical Models and Methods

TECHNICAL SKILLS

**Languages:** C/C++, Java, Python, Bash, LaTeX
**General:** Data Structures, Algorithms, Object Oriented Programming

ADDITIONAL ACTIVITIES

• Created iPhone app to analyze Jazz chord changes
• First Chair Alto Sax, Overlake High School Jazz Band
• Intramural Spades Finalist 2019