Rajath Shashidhara

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Education

The University of Texas at Austin Aug 2019 - Present

M.S. Computer Science GPA: 4.0/4.0

Courses: Advanced Operating Systems, Datacenters, Virtualization, Distributed Computing, Graduate Algorithms

Teaching Experience: Cloud Computing (Spring 2020)

Thesis: Offloading datacenter TCP stack to SmartNICs advised by Prof. Simon Peter

Birla Institute of Technology & Science (BITS), Pilani, India Aug 2012 – June 2017

M.Sc. (Hons.) Physics GPA: 9.01/10

B.E. (Hons.) Computer Science Distinction Class

Courses: Parallel Computing, Operating Systems, Computer Networks, Data Mining, Information Retrieval

Thesis: Driven Aubry-Andre-Harper Models advised by Prof. Tapomoy Guha Sarkar

Adjudged **Best Student of Batch 2017** by Department of Physics for outstanding academic and research track record

Work Experience

Confluent, Mountain View, CA May 2020 – Aug 2020

Software Engineering Intern, Cluster Management Team

- Development of Kubernetes Operator for automating deployment life cycle of stateful Kafka clusters
- Designed *safe and seamless live migration* of Kafka clusters between different operators with no service disruption or data loss

Samsung Research, Bangalore, India July 2017 – Aug 2019

Senior Software Engineer (Research), Communication R&D Division

- Developed the fast data plane radio access network stack (PDCP, RLC, MAC) for the world's first Pre-5G mobile user equipment. Technical support for the 5G demo at *PyeongChang Winter Olympics* (Korea, 2018)
- Research on *parallelization, memory management & flow control* to improve throughput and reduce memory footprint of datapath of 5G NR Distributed Unit (deployed in USA & Korea) on Marvell (Cavium) Multi-core SoCs and S/W accelerated stacks such as DPDK/ODP
- Developed *Reinforcement Learning based Radio-Resource Scheduling* – multi-objective optimization in stochastic input-driven environments [GLOBECOM 2020]
- Presented with *Samsung Technical Excellence Award* for no critical S/W bugs in bare-metal real-time code

Symantec, Bangalore, India Jan 2017 – June 2017

Software Engineering Intern, Website Security Development Team

- Designed a proof-of-concept microservices based cloud-ready web application to automate the purchase, delivery & installation of SSL certificates for webservices hosted on Amazon AWS

Microsoft, Hyderabad, India May 2016 – July 2016

Software Engineering Intern

- Integrated Azure AD cloud authentication/authorization service into ASP.NET Core based web applications

Google Summer of Code June 2013 – Sept 2013

Open-source Software Development Intern, Apache Software Foundation (OpenOffice)

- Developed an in-app document version control toolbar which connects to cloud content repository

Research Experience

Accelerating datacenter TCP stacks using programmable SmartNICs Jan 2020 - Present
Advisors: Prof. Simon Peter, UT Austin

- Full offload of TCP packet processing to SmartNIC – frees up CPU cores from TCP overhead
- Low latency high-throughput networking better/comparable to RDMA NICs
- Data transfer directly from application memory to wire and vice vera, eliminating OS & context switch overheads
- Unlike RDMA, no modifications required to application and network configuration

Distributed key-value store with co-located Serverless compute Jan 2020 – Present
Advisor: Prof. Simon Peter & Vijay Chidambaram, UT Austin [Paper]

- Aggregate compute & storage to exploit data locality
- Improves execution time of serverless compilation workloads by 1.6x and 5x reduction in data movement against conventional disaggregated deployments

SRoCE: Software RDMA over Commodity Ethernet Aug 2019 – Dec 2019
Advisors: Prof. Simon Peter & Prof. Chris Rossbach, UT Austin [Code] [Paper]

- Software-based flexible RDMA verbs implementation using high performance user-space TCP stack
- Achieved 3x single-connection throughput for 1000 bytes RDMA ops as compared to H/W RDMA NICs

Improving connection scalability in TAS: datacenter TCP stack Aug 2019 – Dec 2019
Advisors: Prof. Simon Peter, UT Austin [Code] [Paper]

- Designed and conducted experiments to identify bottlenecks in TAS: TCP acceleration for datacenters
- Increased throughput by 10% at 100k connections by improving TCP shaping and congestion control module

Studying Quantum Chaos in Aubry-André-Harper electron systems Aug 2015 – Dec 2016
Advisor: Prof. Tapomoy Guha Sarkar, BITS Pilani [Code] [Paper] [Thesis]

- Studied phase transitions in Hofstadter's butterfly under time-varying magnetic field and the relationship between *topological invariants and Hall conductivity*
- Simulated and computationally evaluated solutions to Schrodinger's equation for special quantum systems using perturbation methods and computational physics algorithms

Fast semantic matching of strings generated by Context Free Grammar Jan 2016 – May 2016
Advisor: Prof. Sundar Balasubramaniam, BITS Pilani [Code] [Report]

- Designed a language for domain experts to express *semantic equivalence based on parse tree* structure
- Autogenerated *hash function* to hash parse trees for fast matching
- Proof-of-concept implementation on XML DBs

Distributed Combinatorial Optimization on a Cluster Mar 2016 – May 2016
Advisor: Prof. Sundar Balasubramaniam, BITS Pilani [Code] [Report]

- Designed a distributed algorithm to efficiently perform *Branch & Bound search* on a commodity cluster
- Developed a load balancing technique based on *peer-to-peer diffusion* between nodes on toroid communication topology and *leftist-heap based work-stealing queues* between threads

Gravitational lensing in Elliptical Galaxies May 2015 – July 2015
Advisor: Prof. Ko Chung-Ming, National Central University, Taiwan [Code] [Report]

- Analytically derived the gravitational lensing equation for elliptical galaxies
- Developed a *distributed recursive sub-gridding* algorithm to find the solution on a cluster and simulate the lensing

Satellite Image Stitching using Feature Recognition May 2014 – July 2014
Bhaskaracharya Institute of Space Applications & Geoinformatics, Gandhinagar, India [Code] [Report]

- Surveyed existing literature on algorithms to *stitch large satellite images* into a mosaic.
- Evaluated performance of OpenCV implementations of SIFT & SURF algorithms on large datasets of satellite images

Projects

Nested Paravirtualization of JOS on x86 architecture
Aug 2019 – Dec 2019

- Implemented a basic paravirtual hypervisor using x86 hardware virtualization features to host JOS-on-JOS

Persistent storage with C++ STL abstraction
Oct 2015 – Mar 2016

- Implemented *templatized out-of-core (secondary storage) data structures* (B+ Trees, Vectors) with STL interface. User-space applications simply need to relink with library for persistent structures [Code]
- Customized *buffer caches* bypassing the kernel, *async I/O* for high efficiency
- Built a proof-of-concept TF-IDF based Search Engine using this library that scales beyond primary memory limits (> 100GB) [Code]

IoT enabled Laboratory Environment: Project SmartLAB
Aug 2012 – Dec 2013

- Proactive lab monitoring and activity tracking using *sensor networks, speech and gesture recognition* [Code]
- Awarded *Prof. I J Nagrath Student Project Fund* by Dept. of Electrical Engineering, BITS Pilani [Link]
- Won 2nd place in *Siemens Home Automation* challenge

Publications

A Reinforcement Learning Framework for QoS-Driven Radio Resource Scheduler
Jitender Singh Shekhawat, Rishabh Agarwal, K Gautam Shenoy, Rajath Shashidhara, **Samsung Research**
To appear in IEEE Globecom 2020

Phase transition in an Aubry-André system with a rapidly oscillating magnetic field
Tridev Mishra, Rajath Shashidhara, Tapomoy Guha Sarkar, and Jayendra N. Bandyopadhyay
Phys. Rev. A 94, 053612 – Published 14 November 2016

Driven Aubry-André-Harper models
Master's thesis, Birla Institute of Technology and Science, Pilani – Published May 9, 2017

Honors & Achievements

- **Best Outgoing Student of Batch 2017 Award** – adjudged by Department of Physics, BITS Pilani for outstanding academic and research track record
- **Prof. I J Nagrath Student Project Fund** for Project SmartLAB – awarded by BITSAA and adjudged by Department of Electrical and Electronics Engineering, BITS Pilani
- **BITS Pilani MCN Scholarship Award** – 80% tuition fee waiver for all semesters for consistent academic performance (top 5% in a batch of 800 students)
- **Samsung Professional Software Competency Certification** – held by < 10% employees globally
- **Samsung Annual Excellence Awards** – Outstanding Project of the Year 2018-19
- **Samsung Citizen Awards** – organization-wide award for technological excellence and quality of code

Skills

- **Languages:** C, C++, Java, Python (+numpy/scipy/matplotlib/PyTorch), Julia, LaTeX, JavaScript
- **Frameworks:** Linux, MPI, OpenMP, Pthreads, ODP, DPDK, ns-3, NodeJS, AWS, Azure
- **Tools:** git, gdb, make, valgrind, strace, qemu, kvm