

Shaleen Garg

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RESEARCH INTERESTS

Operating Systems, Machine Learning, Parallel & Distributed Systems, HPC.

EDUCATION

Ph.D. in Computer Science September 2019 - Ongoing
Rutgers University, GPA:3.8/4.0
Advisors: Prof. Sudarsun Kannan, Prof. Manish Parashar

Bachelors & Masters by Research in Computer Science August 2014 - May 2019
International Institute of Information Technology, Hyderabad
Advisors: Prof. Kishore Kothapalli, Prof. Suresh Purini

RESEARCH STATEMENT

Operating systems are designed, keeping in mind their omnipresence across different kinds of usage environments ranging from power-efficient IoTs, smartphones & personal computers to QoS aware data centers, cloud servers through performance hungry supercomputers.

In this tussle to cover all the dimensions of computing needs, today's OSs under-cater to most, if not all dimensions. My research goal is to design a better cache decision mechanism for the OSs in the context of the memory subsystem to be able to better serve all the other subsystems, keeping in mind the new heterogeneous hardware like NVMs and 3D stacked memory.

My research aims to provide better hardware efficiency and performance predictability while maintaining application performance.

PUBLICATIONS(* UNDER SUBMISSION)

The Need for Precise and Efficient Memory Capacity Budgeting
Shaleen Garg, Sudarsun Kannan, Manish Parashar
The 2020 International Conference on Memory Systems

Share-a-GPU: Providing Simple and Effective Time-Sharing on GPUs
Shaleen Garg, Kishore Kothapalli, Suresh Purini
25th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC) December 2018.

GPUScheduler: User Level Preemptive Scheduling for NVIDIA GPUs
Shaleen Garg, Kishore Kothapalli, Suresh Purini
24th IEEE International Conference on High Performance Computing, Data, and Analytics (HiPC-SRS10) December 2017.

RESEARCH PROJECTS (* CURRENT)

IntelliOS - The Modern Operating System* Oct'19 - Ongoing
Prof. Sudarsun Kannan, Prof. Manish Parashar

- Identifying requirements and assumptions friction between the OS and HPC applications
- Design better OS hardware management while preserving performance, efficiency and predictability
- Optimizing Performance keeping in mind decreasing per-core memory
- Designing reliable memory accounting mechanisms to inform the users of correct usage
- Design a lightweight agent which learns the application usage patterns to give OS hints

Reinforcement Learning for Financial Portfolio Management August'18 - January'19
Dr.Pawan Kumar

- Reducing the portfolio management problem to a typical game(MDP).
- Design the agent to predict the price of a commodity after some time using SARSA.
- Let the agent master the game on historical trading data by maximizing the portfolio value.
- Allow the agent to explore by changing the commodities in the portfolio.

Preemptive Scheduling on NVIDIA GPUs September'16 - July'18
Dr.Kishore Kothapalli(Associate Prof, IIIT-H) & Dr.Suresh Purini(Assistant Prof, IIIT-H)

- Developed a proof-of-concept scheduler using C and CUDA API which simulates preemptive scheduling and simulates time slicing for general purpose CUDA programs on NVIDIA GPUs.
- Used concepts gained in the above scheduler to provide a generic software-level preemptive scheduler for general purpose single-GPU applications.

- Provided a software memory manager for all the resident programs in order to provide GPU global memory guarantees.
- Load balancing for multi-GPU setting involving the above concepts.

OTHER PROJECTS

Guaranteeing Mutual Exclusion in Transactional Systems(With Mr. Chakshu Tandon) *August'18 - March'19*
Dr.Santosh Nagarakatte(Associate Prof, Rutgers Uni & Dr. Sudarsun Kannan(Assistant Prof, Rutgers Uni))

- Developed a library using Intel's Memory Protection Keys to enable light-weight mutual exclusion
- It removes OS, page table entries and TLB invalidation overheads out of the critical path
- Memory Protection latency was dropped from 25 μ s to 15 ns
- Developed an LLVM IR pass to detect and pinpoint non-conforming transactional code

Optimizing Floating Point Numbers and their Arithmetic for FPGAs *August'18 - March'19*
Dr.Kishore Kothapalli(Associate Prof, IIIT-H) & Dr.Srikanth Sridharan(Senior Developer, HPC@Applied Materials)

- Exploring Unums/Posits for optimizing floating pointing representation
- Trying to come up with alternate ways for representing floating point numbers with efficient arithmetic logic
- Aiming to optimize bit representation, energy impact and implementation area for DSP applications on FPGAs

Performance Engineering of Wireless IoT Sensors *November'16 - December'16*

Course Project: Dr. Anil Gurijala

- Designed a low-cost Wireless IoT Boilerplate hardware platform using readily available 8-Bit micro-controller (arduino micro) and other hardware modules like ESP 8266.
- Tested the designed hardware platform to maximize both data transmission frequency and up-time (of the hardware), when connected to a finite remote power source like commodity "AA" batteries.
- Was successful in keeping the cost of the whole system as low as \$22.

Distributed Grep (Team-Mate Mr.Vinaya Khandelwal) *October'16 - November'16*

Course Project: Dr.Vivekananda Vellanki(Co-Founder - Stealth Mode Start Company)

- Implemented Hadoop Distributed File Systems in Java. Took care of underlying failures associated with this systems.
- Implemented generic Map-Reduce program over the HDFS and tested Distributed Grep on it.

Bflat Compiler *August'17 - November'17*

Course Project: Dr.Suresh Purini(Assistant Prof, IIIT-H)

- Implemented interpreter for Bflat(self-defined) language using C++.
- Implemented front-end compiler for LLVM Intermediate Representation generation.
- Used Flex(for tokens) and Bison(for grammar).

Distributed Graph Algorithms *May'16 - July'16*

Summer Project: Dr.Govindarajulu R(Emeritus Prof, IIIT-H)

- Implemented "Asynchronous concurrent-initiator depth first search spanning tree" and "Synchronous Breadth First Spanning Tree" in Erlang
- Tested the above algorithms on 5 nodes with graphs of size as large as 1 million vertices.

TEACHING EXPERIENCE

Teaching Assistant

Distributed Systems(CS417), Operating Systems(CS416)
Data Structures & Algorithms(CS512), Computer Arch(CS211)

Rutgers University

Teaching Assistant

Distributed Systems(CS431)

IIIT-H

SHORT TERM PROJECTS

Ultimate Tic-Tac-Toe Bot

Course Project: Dr.Praveen Paruchuri (Associate Prof, IIIT-H), Artificial Intelligence

February'16

- A python bot to play 9x9 ultimate tic-tac-toe. The bot uses 5 ply deep Alpha-Beta pruning to evaluate the next move based on self developed heuristics to win.

DonkeyKong

Course Project: Dr.Raghu Reddy(Associate Prof, IIIT-H), Structured Systems Analysis and Design (SSAD)

September'15

- An ASCII implementation of the classical Donkey Kong game
- It showcases and rigorously uses all the concepts of Object Oriented Programming in python

C-Shell

Course Project: Dr.Suresh Purini(Assistant Prof, IIIT-H), Operating Systems

October'15

- A C implementation of the shell using commands like execvp, fork, signal et cetera
- The shell has capabilities like piping, redirection and multiple commands

RELEVANT COURSES (* PURSUING IN FALL'20)

UNIVERSITY AND COMMUNITY SERVICE

Volunteer - Gave weekly science lessons to the local underprivileged children at Ashakiran	AY '16 - '17
Server Administrator - Maintained all the compute and storage nodes at CSTAR.	AY '17 - '19
Student's Parliament	AY '18 - '19
<ul style="list-style-type: none">• Elected Member of the student's parliament representing the Masters Students at IIIT Hyderabad.• Chief Election Commissioner for Student's Parliament Elections.• Student Member of the Disciplinary Sub-Committee(DISCO) at IIIT Hyderabad.	