

# Mohammad Alian

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## Overview

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- **Areas of interest:** Computer Architecture and Systems
- **Vision:** The computation in future datacenters will be distributed over a heterogenous array of processing elements, packaged modularly within a server's boundaries. The inter- and intra-server data movement will bottleneck such a computing landscape. The vision of my research is to seamlessly integrate processor, memory, and network architecture through a co-design with operating systems, network software stack, and software libraries to minimize the data movement in future datacenters.

## Education

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- **University of Illinois Urbana Champaign** Urbana, IL  
*PhD. in Electrical and Computer Engineering* Sep. 2015 – Jul. 2020  
*Thesis: Network-centric architectural design for next-generation datacenters*  
*Advisor: Nam Sung Kim*
- **University of Wisconsin Madison** Madison, WI  
*M.S. in Electrical and Computer Engineering* Jan. 2014 – Aug. 2015  
*Thesis: Simulation infrastructure for parallel/distributed computer systems*
- **University of Tehran** Tehran, IRAN  
*B.S. in Electrical and Computer Engineering* Sep. 2009 – Jul. 2013

## Experience

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- **EPFL** Lausanne, Switzerland  
*Visiting Assistant Professor, School of Computer and Communication Sciences* Jan. 2023 – Aug. 2023
- **University of Kansas** Lawrence, KS  
*Assistant Professor, Electrical Engineering and Computer Science Department* Aug. 2020 – present
- **University of Illinois** Urbana, IL  
*Research Assistant, Coordinated Science Lab* Aug. 2015 – Jul. 2020
- **University of Wisconsin-Madison** Madison, WI  
*Research Assistant, Electrical and Computer Engineering Department* Jan. 2014 – Aug. 2015

## Honors and Awards

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- NSF CAREER Award 2023
- Runner up award in [Samsung Open Innovation Contest](#)
- Selected as one of the 7 Rising Stars in Computer Architecture in 2019, hosted by Georgia Tech
- Best paper finalist in IEEE International Symposium on Workload Characterization (IISWC) 2018
- Best paper finalist in IEEE/ACM International Symposium on Microarchitecture (MICRO) 2018
- Honorable mention in IEEE MICRO Top Picks 2017
- Best paper finalist in IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS) 2017
- Best paper finalist in IEEE International Symposium on High-Performance Computer Architecture (HPCA) 2017

## Teaching

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<b>University of Kansas</b>	Lawrence, KS
EECS700 - Modern Computer Organization	Fall 2022
EECS388 - Embedded Systems	Fall-2022
• EECS645 - Computer Architecture	Spring-2022
EECS388 - Embedded Systems	Fall-2021
EECS700 - Modern Computer Organization	Spring 2021
EECS388 - Embedded Systems	Fall-2020

## Professional Activities

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### Conference and Tutorial Organizing and Committee Memberships

IEEE Symp. on Performance Analysis of Systems and Software (ISPASS), Travel Grant Chair	2023
International Symposium on Computer Architecture (ISCA), PC member	2023
International Conference on Parallel Processing (ICPP), PC member	2023
• IEEE Symp. on Performance Analysis of Systems and Software (ISPASS), PC member	2022/23
• IEEE Parallel and Distributed Processing Symposium (IPDPS), PC member	2022/23
The Young Architect Workshop (YArch'21 w/ ASPLOS), PC member	2021/22
Tutorial on dist-gem5 (w/ ISPASS), Organizer/Presenter	2018
Tutorial on dist-gem5 (w/ ISCA), Organizer/Presenter	2017
Tutorial on dist-gem5 (w/ MICRO), Organizer/Presenter	2015

### University Committee Memberships

• School of Engineering DEIB Committee (Previously Diversity Task Force), member	2020/21/22/23
• EECS Department Ph.D. Qualifying Exam, member	2022/21/22/23
EECS Department Scholarships, member	2020/21/22/23

## Publications

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### Conferences

14. Mohammad Alian, Siddharth Agarwal, Jongmin Shin, Neel Patel, Yifan Yuan, Daehoon Kim, Ren Wang, Nam Sung Kim, "*IDIO: Network-driven, Inbound Network Data Orchestration on Server Processors*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2022
13. Ki-Dong Kang, Gyeongseo Park, Hyosang Kim, Mohammad Alian, Nam Sung Kim, Daehoon Kim, "*NMAP: Power Management Based on Network Packet Processing Mode Transition for Latency-Critical Workloads*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2021
12. Yifan Yuan, Mohammad Alian, Yipeng Wang, Ilia Kurakin, Ren Wang, Charlie Tai, Nam Sung Kim, "*Don't Forget the I/O When Allocating Your LLC*," ACM International Symposium on Computer Architecture (ISCA), 2021 [[Commercial System Demonstration](#)][[Technology Adapted by Intel](#)]
11. Soroush Ghodrati, Byung Hoon Ahn, Joon Kyung Kim, Sean Kinzer, Brahmendra Yatham, Navateja Alla, Hardik Sharma, Mohammad Alian, Eiman Ebrahimi, Nam Sung Kim, Cliff Young, Hadi Esmailzadeh, "*Planaria: Dynamic architecture Fission for Spatial Multi-Tenant Acceleration of Deep Neural Networks*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2020
10. Mohammad Alian, Yifan Yuan, Jie Zhang, Ren Wang, Myoungsoo Jung, Nam Sung Kim, "*Data Direct I/O Characterization for Future I/O System Exploration*," IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), 2020

9. Mohammad Alian, Nam Sung Kim, "*NetDIMM: Low-Latency, Near-Memory Network Interface Architecture*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2019
8. Ki-dong Kang, Mohammad Alian, Daehoon Kim, Jaehyuk Huh, Nam Sung Kim, "*VIP: Virtual performance-state for efficient power management of virtual machines*," ACM Symposium on Cloud Computing (SoCC), 2018 [[Commercial System Demonstration](#)]
7. Mohammad Alian, Krishna Parasuram Srinivasan, Nam Sung Kim, "*Simulating PCI-Express Interconnect for Future System Exploration*," IEEE International Symposium on Workload Characterization (IISWC), 2018, [[Best Paper Finalist](#)]
6. Jie Zhang, Miryeong, Kwon, Donghyun Gouk, Changlim Lee, Mohammad Alian, Myoungjun Chun, Mahmut Kandemir, Nam Sung Kim, Jihong Kim, Myoungsoo Jung, "*FlashShare: Punching Through Server Storage Stack from Kernel to Firmware for Ultra-Low Latency SSDs*," USENIX Symposium on Operating Systems Design and Implementation (OSDI), 2018
5. Mohammad Alian, Seung Won Min, Hadi Asgharimoghaddam, Ashutosh Dhar, Dong Kai Wang, Thomas Roewer, Adam McPadden, Oliver OHalloran, Deming Chen, Jinjun Xiong, Daehoon Kim, Wen-mei Hwu, Nam Sung Kim, "*Application-Transparent Near-Memory Processing Architecture with Memory Channel Network*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2018, [[Best Paper Finalist](#)] [[Commercial System Demonstration](#)] [[Industry Product](#)]
4. Youjie Li, Jongsea Park, Mohammad Alian, Yifan Yuan, Hardik Sharma, Qu Zheng, Petian Pan, Alexander Gerhard Schwing, Hadi Esmailzadeh, Nam Sung Kim, "*INCEPTIONN: A Network-Centric Algorithm/Hardware Co-Design to Accelerate Distributed Training of DNNs*," IEEE/ACM International Symposium on Microarchitecture (MICRO), 2018 [[Commercial System Demonstration](#)]
3. Seokhan Lee, Kiwon Lee, Minchul Sung, Mohammad Alian, Chankyung Kim, Wooyeong Cho, Reum Oh, Seongil O, Jung Ho Ahn, Nam Sung Kim, "*3D-XPath: High-Density Managed DRAM Architecture with Cost-effective Alternative Paths for Memory Transactions*," Parallel Architectures and Compilation Techniques (PACT), 2018
2. Mohammad Alian, Umur Darbaz, Gabor Dozsa, Stephan Diestelhorst, Daehoon Kim, Nam Sung Kim, "*dist-gem5: Distributed Simulation of Computer Clusters*," IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), 2017, [[Best Paper Finalist](#)] [[Open Source Release](#)]
1. Mohammad Alian, Ahmed Abulila, Lokesh Jindal, Daehoon Kim, Nam Sung Kim, "*NCAP: Network Driven, Packet Context-Aware Power Management for Client-Server Architecture*," IEEE International Symposium on High-Performance Computer Architecture(HPCA), 2017, [[Best Paper Finalist](#)] [[IEEE Micro Honorable Mention](#)]

## Journals

4. Mohammad Alian, Jongmin Shin, Ki-Dong Kang, Ren Wang, Alexandros Daglis, Daehoon Kim, Nam Sung Kim, "*IDIO: Orchestrating Inbound Network Data on Server Processors*," IEEE Computer Architecture Letters (CAL), 2020
3. Jason Lowe-Power, Abdul Mutaal Ahmad, Ayaz Akram, Mohammad Alian, et al., "*The gem5 Simulator: Version 20.0+: A New Era for the Open-Source Computer Architecture Simulator*," ArXivorg, 2020
2. Seung Won Min, Mohammad Alian, Wen-Mei Hwu, Nam Sung Kim, "*Semi-Coherent DMA: An Alternative I/O Coherency Management for Embedded Systems*," IEEE Computer Architecture Letters (CAL), 2018

1. Mohammad Alian, Daehoon Kim, Nam Sung Kim, "*pd-gem5: Simulation Infrastructure for Parallel/Distributed Computer Systems*," IEEE Computer Architecture Letters (CAL), 2016

## Others

5. Nedasadat Taheri, Alex Manley, Ahmni-Pang Johnson, Mohammad Alian, "*Profiling an Architectural Simulator*," Poster Session at (ISPASS), 2022
4. Mohammad Alian, "*A Cross-Stack, Network-Centric Architectural Design for Next-Generation Datacenters*," Ph.D. Dissertation, 2020
3. Jason Lowe-Power, Abdul Mutaal Ahmad, Ayaz Akram, Mohammad Alian, et al., "*The gem5 simulator: Version 20.0+*," arXiv:2007.03152, 2020
2. Yifan Yuan, Mohammad Alian, Yipeng Wang, Iliia Kurakin, Ren Wang, Charlie Tai, Nam Sung Kim, "*IOCA: High-Speed I/O-Aware LLC Management for Network-Centric Multi-Tenant Platform*," arXiv:2007.04552, 2020
1. Daehoon Kim, Mohammad Alian, Jaehyuk Huh, Nam Sung Kim, "*Janus: Supporting Heterogeneous Power Management in Virtualized Environments*," Poster Session at ACM Symposium on Cloud Computing (SoCC), 2017

## Patents

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2. Nam Sung Kim, Mohammad Alian, "*Application-Transparent Near-Memory Processing Architecture with Memory Channel Network*," [US20210209047A1](#)
1. Nam Sung Kim, Mohammad Alian, "*NCAP: Network Driven, Packet Context-Aware Power Management for Client-Server Architecture*," [US20190004594A1](#)

## Students

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### Current Students

- Amin Mamandipoor, Ph.D., Expected 2026
- Johnson Chinedu, Ph.D., Expected 2027
- Ramesh Ganapam, Ph.D., Expected 2028
- Derrick Quinn, Ph.D., Expected 2028
- Siddharth Agarwal, MS./Ph.D., co-advised w/ Prof. Nam Sung Kim at UIUC
- Neel Maulik Pattel, MS., [KU SFS Fellow](#), Expected 2024
- Alex Manely, MS., Expected 2025
- Minwoo Lee, Undergrad
- Luke Staudacher, Undergrad

### Students Supervised

- Mac Hayes, Undergrad at KU, first employment: Stocker ALDI USA
- Ahmni R. Pang-Johnson, Undergrad at KU, [Emerging Undergrad Scholar](#)
- Nedasadat Taheri, MS. at KU, first employment: Ph.D. student at University of Nebraska Lincoln
- Umur Darbaz, MS. at UIUC, first employment: NVIDIA
- Seung Won Min, MS. at UIUC, first employment: Ph.D. student at UIUC
- Yeongil Ko, Undergrad Visiting Scholar at UIUC, first employment: MS. at Harvard
- Petian Pan, Undergrad Visiting Scholar at UIUC
- Yifan Yuan, Ph.D. at UIUC, first employment: Intel Labs
- Qu Zheng, Undergraduate Visiting Scholar at UIUC, first employment: Ph.D. student at UCSB
- Jongmin Shin, Ph.D. at DGIST

## Open Source Tools

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### **dist-gem5**

- Full-system, cycle level tool for distributed simulation of computer clusters  
Part of the gem5's official release: <https://github.com/gem5/gem5>

### **Planaria**

- Spatially multi-tenant DNN accelerator hardware simulator and task scheduler  
<https://github.com/he-actlab/planaria.code>

### **Dynamic management of DDIO ways in LLC**

- Artifacts of our ISCA 2021 paper  
Part of Intel RDT software package: <https://github.com/intel/intel-cmt-cat/releases/tag/v4.4.0>

### **DDIO and DPDK modeling in gem5**

- Artifacts of our ISPASS 2020 and MICRO 2022 papers  
<https://github.com/agsiddharth/CAL-DPDK-GEM5>

## Grants

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### **Funded**

- Sponsor: NSF, CAREER: Title: “*CAREER: Near-Memory Datacenter Network*”; Personnel: Mohammad Alian (PI, KU); \$533,095 + \$17,424 (Cloud Computing Resources); Period: 05/01/2023 - 04/30/2028
- Sponsor: SRC, JUMP 2.0 Center Proposal; Title: “*ACE: Evolvable Computing for Next Generation Distributed Computer Systems*”; Lead Institution: UIUC, Personnel: Mohammad Alian (co-PI, KU) and 20 others; My share: \$1,500,000; Period: 01/01/2023 - 01/01/2028
- Sponsor: NSF, CCRI: Planning-C; Title: “*Accelerated Infrastructure for Simulating Future Systems*”; Personnel: Mohammad Alian (PI, KU); \$50,000; Period: 08/15/2022 - 08/14/2023
- Sponsor: Samsung Electronics; Title: “*Near-Memory Acceleration of Layer-5 Network Protocols*”; Personnel: Mohammad Alian (PI, KU); \$40,000; Period: 01/1/2022 - 09/1/2023
- Sponsor: Samsung Electronics; Title: “*Development of PIM and AXDIMM Eco-System*”; Personnel: Mohammad Alian (PI, KU); \$54,687; Period: 07/01/2021 - 06/30/2022
- Sponsor: NVIDIA, Hardware Grant Program; Title: “*Collaborative in-memory/in-network acceleration of layer 5 networking protocols*”; Personnel: Mohammad Alian (PI, KU); 2 NVIDIA/Mellanox DPUs

### **Pending**

- Sponsor: NSF, CSSI: Title: “*Collaborative Research: Frameworks: Advancing Computer Hardware and Systems’ Research Capability, Reproducibility, and Sustainability with the gem5 Simulator Ecosystem*”; Personnel: Jason Lowe-Power (PI, UC-Davis), Houman Homayoun, (Co-PI, UC-Davis), John Shalf, Georgios Michelogiannakis (Co-PI, LBNL), Christopher Batten (Co-PI, Cornell), Matt Sinclair (Co-PI, UW Madison), Tushar Krishna (Co-PI, GTech), Elba Garza (Co-PI, UW), Mohammad Alian (Co-PI, KU); Total/my share: \$5,000,000/\$300,000; Period: 08/15/2023 - 08/14/2028
- Sponsor: NSF, RETTL: Title: “*RETTL: EDU: AI-Assisted Just-in-Time Scaffolding Framework for Exploring Modern Computer Design*”; Personnel: Mohammad Alian (PI, KU), Pavlo Antonenko (Co-PI, University of Florida), Tamzidul Hoque (Co-PI, KU), Md Tauhidur Rahman (Co-PI, Florida International University); Total/my share: \$850,000/\$250,000; Period: 08/15/2023 - 08/14/2026
- Sponsor: Google, Research Scholar Program; Title: “*Near-Memory Acceleration of Far Memory*”; Personnel: Mohammad Alian (PI, KU); up to \$60,000; Period: 07/1/2023 - 06/31/2024