Benjamin Michalowicz

PhD Student, The Ohio State University

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Columbus, Ohio, USA

Education

PhD, Computer Science and Engineering, The Ohio State University, Columbus, OH 08/21 - Present
Advisor: Dr. Dhabaleswar K. (DK) Panda
Research Interests: Network-based Computing for HPC, Parallel Programming Models, Parallel and Heterogeneous Architecture, Quantum Computing

MS, Computer Science (5-year BS/MS Program), Stony Brook University, Stony Brook, NY 08/19 - 05/21
Relevant Coursework: Principles of Programming Languages, System Security, Data Science Fundamentals, Analysis of Algorithms, Quantum Computing and Applications, Fundamentals of Computer Networks, Computational Geometry
Advisor: Dr. Barbara Chapman
Activities: SBUHacks Organizing Committee, Marching Band, Research

BS, Computer Science, Stony Brook University, Stony Brook, NY 08/16 - 05/20
Relevant Coursework: Principles of Programming Languages, Systems Fundamentals I/II, Operating Systems, Principles of Database Systems, Advanced Systems Programming in Unix/C, Algorithms, Calculus I-III, Linear Algebra, Theory of Computation

Activities: Marching Band, Research, SBCS, SBLive, TKD @ SBU

Experience

Research Assistant, The Ohio State University, 05/2021–
Columbus, OH Present
High-Performance Computing research in Dr. DK Panda's Network-Based Computing Laboratory. Focuses: Further understanding low-level transfer methods – the Open Fabrics Interface, IB-Verbs, and offloading communication to other hardware such as SmartNICs/DPUs

Research Intern, Los Alamos National Lab 05/2023–
Remote/Los Alamos, NM 08/2023
Research in Edge Devices and SmartNICs under the direction of Dr. Stephen Poole. Emphasis on optimizing both communication and computational offload to these devices for traditional HPC and ML/DL workloads.

Teaching Assistant, The Ohio State University, 08/2021–
Columbus, OH 12/2021
Grader for CSE 4471: Information Security.

Percussion Teacher/Drumline Instructor 05/2021–
Park Ridge, NJ 08/2021
Working with the Park Ridge Jr./Sr. High School Marching Band's drumline on their 2021-22 halftime show: wrote drumline parts, held weekly rehearsals, and taught marching fundamentals. Also taught drum lessons to beginner, intermediate, and advanced players, in rudiments and their applications to the drum set, drumming dexterity, and advanced techniques

Social Media Manager, SBUHacks Organizing Committee, 03/2020–
Stony Brook, NY 08/2021
Kept social media accounts up to date (Instagram, Twitter, Facebook, etc.) and otherwise helping organize the SBUHacks hackathon for the 2020 MLH season; helped successfully run Stony Brook's first-ever, student-run, virtual hackathon.

Research Assistant, Stony Brook University, 08/2020–
Stony Brook, NY 05/2021
High-Performance Computing research in Dr. Barbara Chapman's Exasca||ab, focusing on testing and benchmarking new HPC clusters and architecture. Ran acceptance tests and helped debug the configuration of the new Ookami cluster. Used code profilers to obtain exact behavior of performance across different HPC processor architectures. Studied/currently studying the effects of compiler toolchains and OpenMP on different applications on the A64FX processor

Teaching Assistant, Stony Brook University, 08/2020–
Stony Brook, NY 05/2021
Fall 2020: Held weekly office hours, led weekly recitations, and helped students understand material in Stony Brook University's CSE 216 course (Programming Abstractions). Designed recitation questions and collaborated with the course lecturer. Helped grade exams homework assignments, and led exam reviews outside of class. Kept in contact with students to answer conceptual and assignment questions.
Spring 2021: Held weekly office hours and collaborated on designing homework test cases and exam questions with the professor and fellow TAs for CSE 320: Systems Fundamentals II.

Software Technical Intern, BAE Systems, 05/2019–
Totowa, NJ 08/2019
Worked with full-time employees to re-design a code generation tool from interface definition files with a backing symbol table in C#. Allowed for optimization and easier redesign for larger files. Created a Common Language Runtime Environment for generated objects to communicate via C# and C++. Worked with fellow interns to redesign the mentor/mentee program for incoming interns and YearOne employees.

Undergraduate Teaching Assistant, Stony Brook University, 01/2019–
Stony Brook, NY 12/2019
Held weekly office hours, led weekly recitations, and helped students understand material in Stony Brook University's CSE 216 course (Programming Abstractions).

Undergraduate Research Assistant, Stony Brook University, 05/2018–
Stony Brook, NY 05/2019
Worked with PhD students in the COMPAS lab on projects focusing on microarchitecture and cloud infrastructure. Specifically, I primarily used C and C++ for microarchitectural components (see Projects below), and JavaScript for verifying cloud benchmarks.

SOSB Summer Recruitment Staff, Stony Brook University, 04/2018–
Stony Brook, NY 08/2018
Aided in recruitment for the 2018-2019 Season. Assisted in planning for band camp, football games, and half-time shows for fall 2018. Helped organize funds, set up equipment to be ordered, cleaned instruments, and encouraged incoming undergraduate students to join The Spirit Of Stony Brook.

Master @ Master Yoo's Summit Martial Arts, 06/2012–
Park Ridge, NJ 08/2017
Led classes of all ranked levels, from beginner to 2nd degree black belt; taught sparring, blocking/striking techniques, self-defense, and weapon techniques while keeping a safe environment for students.

Projects

Offloading OneSided Communication 02/2023-
Columbus, OH Present
Developing an API to handle efficient offloading of one-sided communication to SmartNICs such as NVIDIA's BlueField DPUs. This can be placed both within MPI and PGAS libraries for seamless integration. See [1] for more details.

DPU-Bench 01/2023-
Columbus, OH Present
Developing and enhancing a microbenchmark suite to measure the offload efficiency of SmartNICs such as NVIDIA's BlueField DPUs. The goal is to enable this to work on any scale-up/out parallel programming model such as MPI and SHMEM. See [2] for more details.

Ookami/A64FX Research: Studying the FLASH code 03/2021–
Stony Brook, NY 07/2021
Collaborated with astrophysicists at the Institute for Advanced Computational Science studying FLASH: a multi-scale/multi-physics application written in Fortran. Analyzed memory constraints of FLASH through experiments revolving around 2D and 3D simulations.

Ookami/A64FX Research: Behavior analysis of the A64FX through OpenMP & MPI 08/2020–
Stony Brook, NY 05/2021
Tasked with helping run acceptance tests on the Ookami Cluster at Stony Brook University just after it had finished being installed, and repeated similar experiments on the Fugaku Supercomputer, analyzing OpenMP and MPI libraries and their behavior as well as examine several compiler toolchains and their abilities to optimize runtime, performance, and general efficiency of applications.

Chor-DNS: Implementation for Chord-based DNS Resolution | Data Management, Integration 10/2020–
Stony Brook, NY 12/2020
Course Project: Implemented the Chord Ring structure with Python/DistAlgo for DNS resolution and compared runtimes to queries made through Linux's `dig` and homemade DNS resolvers. Github link: https://github.com/BTMichalowicz/CSE534-ChorDNS

Topologic: Library to Simulate DFAs | Co-Developer 06/2020–
Park Ridge, NJ 08/2020
Simulates DFAs and Probabilistic NFAs using context switching. Programs can start at multiple vertices, which may be run in parallel using POSIX Threads and Mutexes in C. Github project: https://github.com/mstern98/Topologic

FeS2/SIMICS simulation research: COMPAS lab Research Project 05/2018–
Stony Brook, NY 12/2019
Studied the FeS2 simulator platform and the SIMICS x86 processor simulator to model its configuration to real processors. Using C/C++, I debugged the cycle-accurate platform to enable checkpoints of benchmark applications to run for durations over one billion clock cycles.

Service to Computer Science

SpecHPC Assistant Contributor to SPEChpc 2021 2020-2021
Aided in testing and verification during the development of SPEChpc2021, under the direction of Anthony Curtis (Stony Brook University). Mr. Curtis later received a contributor award in January 2022 from SPEC.

SC'2021: Virtual Student Volunteer 11/2021
Helping the virtual aspect of SuperComputing 2021 run smoothly in its attempt at a hybrid conference. Checked in with session chairs, helped fellow volunteers, and ensured that online sessions would start, run, and end smoothly. Recognized as one of the top Student Volunteers.

SCinet Volunteer, SC '22,'23,'24
Member of the Volunteer Services team. Aided in setting up and monitoring SC's massive infrastructure along with fellow students and professional staff from industry and academia. Specific Team(s): Edge/Wireless: 2022-24, Fiber: 2023-24

PC Member, Artifact Evaluation, Intl Conf. on Compiler Construction '23,'24
Member of the Artifact Evaluation Committee for the International Conference on Compiler Construction (CC) 2023-24. Reviewed artifacts submitted by authors on compiler optimizations and strategies for usability and reproducibility.

Technologies

MPI, OpenMP, Git, Slurm, Various Compiler Toolchains (Intel, LLVM, GNU, Cray, Fujitsu, ARM), TAU, NVIDIA Nsight

Programming Languages

C, C++, Java, Python, OCaml, C#, Fortran, MySQL, MIPS Assembly, LaTeX

Personal Interests

Drumming, Computer Science, Martial Arts, Languages (Programming and Natural), music of all types/theory/history

Non-technical skills

Drums and assorted percussion 2007-Present
- Formal training in jazz, rock, marching, and orchestral drumming. I am also a private teacher by request and have experience teaching drums to all ages and skill levels in the aforementioned styles.
- I was the snare-line section leader for the Spirit of Stony Brook Marching Band between 2017-2020 and played in several ensembles since 2011.

4th Degree Black Belt in TaeKwonDo
As of December 2015, I hold a 4th-degree black belt (and the rank of "Master") in Tae Kwon Do.

Awards

International Symposium on Computer Architecture 06/2019
Phoenix, AZ
A fully funded stipend to ISCA 2019 and its new undergraduate workshop in Computer Architecture (uArch).

John J. Leddy Director's Award, SOSB Marching Band 05/2020
Given for displaying Academic Excellence, Musical Leadership, Creativity, and Commanding Exceptional Attention in Rehearsal and Performance.

Shirley Strum Kenney Founder's Award, SOSB Marching Band 05/2018
Given for displaying the leadership and musical qualities and skills of some of the original founding members in SOSB #1 in 2006.

Student Volunteer Recognition, SC '21 Conference 11/2021
Recognized as one of the top Student Volunteers for keeping multiple lines of communication open and ensuring virtual sessions ran smoothly.

Publications

Journal Articles

[1] Accelerating Communication with Multi-HCA Aware Collectives in MPI
T. Tran, B. Ramesh, B. Michalowicz, M. Abduljabbar, H. Subramoni Aand D. Panda
Concurrency and Computation: Practice and Experience (CCPE) (July 2023)

[2] Understanding and Characterizing Communication Characteristics for Distributed Transformer Models
Quentin Anthony, Benjamin Michalowicz, Jacob Hatef, Lang Xu, Mustafa Abduljabbar, Aamir Shafi, Hari Subramoni, Dhabaleswar K. DK Panda
IEEE Micro 01 (Jan. 5555), pp. 1–7, IEEE Computer Society
DOI: 10.1109/MM.2025.3531323
URL: https://doi.ieeecomputersociety.org/10.1109/MM.2025.3531323

Conferences and Workshops

[1] Effective and Efficient Offloading Designs for One-Sided Communication to SmartNICs
B Michalowicz, K. Suresh, H. Subramoni, M. Abduljabbar, DK Panda, S. Poole
31st IEEE International Conference on High Performance Computing, Data, and Analytics, 2024

[2] Using BlueField-3 SmartNICs to Offload Vector Operations in Krylov Subspace Methods
K. Suresh, B. Michalowicz, N. Contini, B. Ramesh, M. Abduljabbar, A. Shafi, H. Subramoni, DK Panda
31st IEEE International Conference on High Performance Computing, Data, and Analytics, 2024

[3] Demystifying the Communication Characteristics for Distributed Transformer Models
Q. Anthony, B. Michalowicz, J. Hatef, L. Xu, M. Abduljabbar, A. Shafi, H. Subramoni, D. Panda
IEEE Hot Interconnects Symposium 2024, 2024

[4] Ookami: An A64FX Computing Resource
A C Calder, E Siegmann, C Feldman, S Chheda, D C Smolarski, F D Swesty, A Curtis, J Dey, D Carlson, B Michalowicz, R J Harrison
Journal of Physics: Conference Series 2742.1 (Apr. 2024), p. 012019, IOP Publishing
DOI: 10.1088/1742-6596/2742/1/012019
URL: https://dx.doi.org/10.1088/1742-6596/2742/1/012019

[5] PML-MPI: A Pre-Trained ML Framework for Efficient Collective Algorithm Selection in MPI
M. Han, G. Kuncham, B. Michalowicz, R. Vaidya, M. Abduljabbar, A. Shafi, H. Subramoni, DK Panda
The Nineteenth International Workshop on Automatic Performance Tuning (Held in Conjunction with IPDPS '24'), 2024

[6] Battle of the BlueFields: An In-Depth Comparison of the BlueField-2 and BlueField-3 SmartNICs
Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, Dhabaleswar K. DK Panda, Steve Poole
2023 IEEE Symposium on High-Performance Interconnects (HOTI), 2023
DOI: 10.1109/HOTI59126.2023.00020

[7] DPU-Bench: A Micro-Benchmark Suite to Measure Offload Efficiency Of SmartNICs
Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, Dhabaleswar Panda, Steve Poole
Practice and Experience in Advanced Research Computing, 2023, Association for Computing Machinery
DOI: 10.1145/3569951.3593595
URL: https://doi.org/10.1145/3569951.3593595

[8] Enabling Reconfigurable HPC through MPI-Based Inter-FPGA Communication

Nicholas Contini, Bharath Ramesh, Kaushik Kandadi Suresh, Tu Tran, Ben Michalowicz, Mustafa Abduljabbar, Hari Subramoni, Dhabaleswar Panda
Proceedings of the 37th International Conference on Supercomputing, 2023, Association for Computing Machinery
DOI: 10.1145/3577193.3593720

[9] In-Depth Evaluation of a Lower-Level Direct-Verbs API on InfiniBand-based Clusters: Early Experiences
B. Michalowicz, K. Suresh, B. Ramesh, A. Shafi, H. Subramoni, M. Abduljabbar, DK Panda
The 25th Workshop on Advances in Parallel and Distributed Computational Models (Held in Conjunction With the IPDPS '23), 2023

[10] A Novel Framework for Efficient Offloading of Communication Operations to Bluefield SmartNICs
K. Suresh, B. Michalowicz, B. Ramesh, N. Contini, J. Yao, S. Xu, A. Shafi, D. Panda
The 37th IEEE International Parallel & Distributed Processing Symposium (IPDPS '23), 2023

[11] Efficient Personalized and Non-Personalized Alltoall Communication for Modern Multi-HCA GPU-Based Clusters
K. Suresh, A. Paniraja Guptha, B. Michalowicz, B. Ramesh, M. Abduljabbar, A. Shafi, DK Panda
29th IEEE International Conference on High Performance Computing, Data, and Analytics, 2022

[12] Designing Hierarchical Multi-HCA Aware Allgather in MPI
A. Tran, B. Michalowicz, B. Ramesh, H. Subramoni, A. Shafi, DK Panda
Fifteenth International Workshop on Parallel Programming Models and Systems Software for High-End Computing (P2S2), In Conjunction With ICPP 2022: The 51st International Conference on Parallel Processing, 2022

[13] Experiences with Porting the FLASH Code to Ookami, an HPE Apollo 80 A64FX Platform
C Feldman, B Michalowicz, E Siegmann, A Curtis, A Calder, R Harrison
International Workshop on Arm-based HPC: Practice and Experience (2022)

[14] Comparing OpenMP Implementations with Applications across A64FX Processor Platforms
Benjamin Michalowicz, Eric Raut, Yan Kang, Tony Curtis, Dossay Oryspayev, Barbara Chapman
17th International Workshop on OpenMP, 2021

[15] Comparing the behavior of OpenMP Implementations with Various Applications on two Different Fujitsu A64FX Platforms
Benjamin Michalowicz, Eric Raut, Yan Kang, Tony Curtis, Dossay Oryspayev, Barbara Chapman
Practice and Experience in Advanced Research Computing (PEARC) (2021)

[16] Ookami: Deployment and Initial Experiences
Andrew Burford, Alan Calder, David Carlson, Barbara Chapman, Firat Coskun, Tony Curtis, Catherine Feldman, Robert Harrison, Yan Kang, Benjamin Michalowicz, Eric Raut, Eva Siegmann, Daniel Wood, Robert DeLeon, Mathew Jones, Nikolay Simakov, Joseph White, Dossay Oryspayev
Practice and Experience in Advanced Research Computing (PEARC) (2021)

Invited Talks

[1] Benjamin Michalowicz, ***MVAPICH User Group (MUG) 2024 Conference*** "Demystifying the Communication Characteristics for Distributed Transformer Models (Lightning Talk)
August 19, 2024

[2] Benjamin Michalowicz, ***MVAPICH User Group (MUG) 2023 Conference*** "DPUBench: A New Microbnenchmark Suite to Measure the Offload Efficiency of SmartNICs (Lightning Talk)
August 21, 2023

[3] Benjamin Michalowicz ***OpenSNAPI Consortium***. "DPUBench: A New Microbenchmark Suite to Measure Offload Efficiency of SmartNICs"
June 12, 2023

[4] Catherine Feldman, Benjamin Michalowicz, Alan Calder. ***ACM Frontiers in Computing***. "Lessons Learned: An In-Depth Look at Running FLASH on Ookami"
May 11-13, 2021

[5] Benjamin Michalowicz, Yan Kang. ***IACS Student Seminar***. "Studying OpenMP Behavior on the A64FX Processor"
Apr. 1, 2021

Posters

[1] Benjamin Michalowicz, Michael Beebe, Steve Poole, Wendy Poole; ***Chesapeake Large Scale Analytics Con-***

ference. "Offloading 'Everything' to DPUs: Why, How, and Potential Benefits?"
November 4 - 8, 2024

[2] Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, DK Panda, and Stephen Poole; ***MUG 2024***. "DPU-Bench: A New Microbenchmark Suite to Measure the Offload Efficiency of SmartNICs"
August 19-21, 2024

[3] Benjamin Michalowicz, Kaushik Kandadi Suresh, Hari Subramoni, DK Panda, and Stephen Poole; ***NVIDIA GTC***. "DPU-Bench: A New Microbenchmark Suite to Measure the Offload Efficiency of SmartNICs"
March 17-21, 2024

[4] Benjamin Michalowicz, Andrew McNamara, Daniel Y. Hwang, and Jose Ortiz; ***Chesapeake Large Scale Analytics Conference***. "Fully Homomorphic Schemes For Real-World Usage"
October 30 - Nov 2, 2023

Tutorials Presented

[1] Dhabaleswar K. Panda, Hari Subramoni, Benjamin Michalowicz; ***The International Conference for High-Performance Computing, Networking, Storage, and Analysis (SC'24) in Atlanta, GA***. "High-Performance and Smart Networking Technologies for HPC and AI"
November 18, 2024