

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. Dhableswar K. (DK) Panda

Research Interests: High-Performance Computing, Parallel Programming Models, Computer Architecture, Parallel Architectures, Virtualization, Heterogeneous HPC Environments

Relevant Coursework: Advanced Operating Systems, Introduction to High-Performance Deep Learning, Network-based HPC, Algorithms, Computability and Complexity, Intro to Parallel Programming, Advanced Computer Architecture, Intro to Data Mining, Compiler Design and Implementation

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, Columbus, OH 05/2021–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 Remote/Los Alamos, NM 05/2023–08/2023

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, Columbus, OH 08/2021–12/2021

Grader for CSE 4471: Information Security.

Percussion Teacher/Drumline Instructor, Park Ridge, NJ 05/2021–08/2021

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, Stony Brook, NY 03/2020–08/2021

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, Stony Brook, NY 08/2020–05/2021

High-Performance Computing research in Dr. Barbara Chapman's [Exascalelab](#), 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

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 [\[1\]](#) 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

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: 2022-23, Fiber: 2023

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)

Conferences and Workshops

- [1] Ookami: An A64FX Computing Resource
A. C. Calder
15th International Conference on Numerical Modeling of Space Plasma Flows, 2023
- [2] 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
- [3] 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](https://doi.org/10.1109/HOTI59126.2023.00020)
- [4] 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](https://doi.org/10.1145/3569951.3593595)
URL: <https://doi.org/10.1145/3569951.3593595>
- [5] 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](https://doi.org/10.1145/3577193.3593720)
- [6] 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
- [7] 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
- [8] 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
- [9] Designing Hierarchical Multi-HCA Aware Allgather in MPI
A. Tran, B. Michalowicz, B. Ramesh, H. Subramoni, A. Shafi, DK Panda

- [10] 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)
- [11] 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
- [12] 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)
- [13] 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) 2023 Conference* "DPUBench: A New Microbenchmark Suite to Measure the Offload Efficiency of SmartNICs (Lightning Talk, presentation of [1])
August 21, 2023
- [2] Benjamin Michalowicz *OpenSNAPI Consortium*. "DPUBench: A New Microbenchmark Suite to Measure Offload Efficiency of SmartNICs" (presentation of [1])
June 12, 2023
- [3] Benjamin Michalowicz, Yan Kang. *IACS Student Seminar*. "Studying OpenMP Behavior on the A64FX Processor"
Apr. 1, 2021
- [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

Posters

- [1] 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
- [2] 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