CHRISTOPHER W. WAGNER

(480) 376-4303
wagne279@purdue.edu
azcwagner.github.io

RESEARCH INTERESTS

My goal is to use formal methods to create provably-correct, reliable software, protocols, and systems. My interests include program analysis, language design, computation theory, and information security.

My current research focuses primarily on building and verifying provably-correct distributed systems.

EDUCATION

Purdue University
PhD Student, Computer Science
August 2018 - Present

Utah State University
Bachelor of Computer Science
GPA: 4.0

HONORS AND AWARDS

Presidential Scholarship Utah State University
Eagle Scout Boy Scouts of America

PUBLICATIONS

Peer-Reviewed Conferences

· N. Jaber, S. Jacobs, C. Wagner, M. Kulkarni, and R. Samanta, Parameterized Verification of Systems with Global Synchronization and Guards. In *Computer Aided Verification (CAV)*, 2020.

Under Submission

· N. Jaber, C. Wagner, S. Jacobs, M. Kulkarni, and R. Samanta. Parameterized Reasoning for Distributed Systems with Consensus. January 2020. https://arxiv.org/abs/2004.04613

WORK EXPERIENCE

Purdue University - *Research Assistant, Teaching Assistant* Aug 2018 - Present

· Collaborating on the Discover[i] project for automated parameterized verification and synthesis of distributed systems.
· Contributed to the Purdue HACCLE project aiming to increase the usability and performance of secure multi-party computation.
· Led an Abstraction-Guided Program Repair project intending to increase the feasibility of formally-sound program repair for real-world programs.

Amazon Web Services - *Applied Scientist Intern* May 2020 - Aug 2020

· Enabled compositional reasoning in CBMC proofs by adding an 'assigns' clause, denoting function memory frames, to the CBMC code contracts functionality
· Proved functional correctness for portions of Amazon's FreeRTOS and s2n projects using CBMC
· Patched a bug in CBMC's file-local symbol mangling, which allows for multi-file compilation

Northrop Grumman - *Associate Software Engineer* Mar 2017 - Jul 2018

· Engineered RTOS error inducement techniques for PowerPC programs
· Updated software test scripts and documentation for USGS Landsat 9 satellite
· Detected and identified root cause of bugs in embedded flight software

Utah State University - *Computer Science Tutor* Aug 2014 - Dec 2016

· Guided CS students in understanding and debugging coding assignments
· Taught problem-solving and programming fundamentals

Micron Technology - *IT Software Engineer Intern* Summer 2016

· Supported a scrum agile team in stand-ups, sprint planning, and retrospectives
· Established automated build and testing assets using HP UFT and Jenkins

Hewlett Packard (Enterprise) - *Software Engineer Intern* Summer 2015

· Engineered dynamic web apps using ASP.NET Razor
· Patched internal web framework by processing Bugzilla tickets

PROJECTS

Discover[i]
This project abstracts distributed consensus as an atomic program-level construct and makes verification possible for a useful set of applications, parameterized on an arbitrary number of instances which may be running in the system. The nature of our approach also makes parameterized synthesis possible in many cases, yielding provably-correct system classes.

HACCLE
This IARPA-funded project aims to make secure multi-party computation (MPC) more powerful and accessible. We combine MPC techniques such as garbled circuits and FHE with programming languages concepts to allow programmers with minimal security background to write secure distributed programs. I have contributed to the development of our surface language and helped formalize a decomposition of functionality developed by our team which will reduce the need for expensive cryptographic operations.

Abstraction-Guided Program Repair
Our high-level goal with this project was to improve the scalability of fully-automated program repair. By generating abstract programs, and repairing them in their abstract form, we aimed to use details from the abstraction process to inform the construction and concretization of the repair.

SERVICE AND MENTORING

PurPL (Purdue PL Group)

· Coordinated attendance and presenters for weekly seminars during the 2018 academic year
· Presented a talk based on *SQLizer: Query Synthesis from Natural Language* by N. Yaghmazadeh et al.
· Presented a talk based on *Modular and Verified Automatic Program Repair* by F. Logozzo and T. Ball

Mentoring

· Mentored a visiting intern on the Abstraction-Guided Program Repair project by identifying strengths, building up technical background, and delegating tool development.

TECHNICAL SKILLS

Languages
Java, C, C++, C#, Python, Perl, PHP, MySQL, PostGreSQL, PowerPC Assembly
Coq, Scheme, PostScript, Prolog

Tools
CBMC, Z3, CPAchecker, Sketch, ANTLR, GNU Bison/Yacc
Git, Subversion, Bugzilla, Jenkins, HP Unified Functional Testing (UFT)
Amazon EC2, Wind River Simics