

# James C. Davis

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## RESEARCH INTERESTS

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My research improves computing systems, grounded in empirical measurements of how and why they are used. My projects have flavors of software engineering, cybersecurity, and systems.

## PROFESSIONAL EXPERIENCE

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| <b>Assistant Professor</b><br><i>Purdue University — Electrical and Computer Engineering</i>   | Fall 2020-present                   |
| <b>Intern, Microsoft Research (RiSE group: Cloud Security)</b><br><i>Microsoft Research, Redmond, WA — Mentored by Patrice Godefroid</i> | Summer 2019                         |
| <b>Intern, IBM Research (Storage)</b><br><i>IBM Research, Almaden, CA — Mentored by Deepavali Bhagwat</i>                                | Summer 2018                         |
| <b>Graduate Research Assistant</b><br><i>Virginia Tech — Advised by Dongyoon Lee</i>   | 2016-2020                           |
| <b>Software Engineer, IBM (GPFS)</b><br><i>IBM, Poughkeepsie, NY</i>   | 2012-2015, Summer 2016, Summer 2017 |

## EDUCATION

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|---|-----------|
| <b>Ph.D, Computer Science and Applications</b><br><i>Virginia Tech, Blacksburg, VA</i>      | 2015-2020 |
| <b>B.Sc. Computer Science, B.Sc. Mathematics</b><br><i>Clarkson University, Potsdam, NY</i> | 2008-2012 |

## RESEARCH GRANTS

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- [1] **Google, LLC**  
Principal Investigator (Co-PI: Yung-Hsiang Lu)  
*Unrestricted Gift*  
2020. \$80,000
- [2] **Google, LLC**  
Co-Principal Investigator (PI: Yung-Hsiang Lu)  
*Unrestricted Gift*  
2020. \$20,000
- [3] **Purdue University VEIL Program**  
Principal Investigator (Co-PI: Kirsten Davis)  
*Intercultural Engineering Education*  
2020. \$5,000

## REFEREED CONFERENCE PUBLICATIONS

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- [1] **Davis**, Servant, Lee. *Using Selective Memoization to Defeat Regular Expression Denial of Service (ReDoS)*. Proceedings of the 42nd IEEE Symposium on Security and Privacy (**IEEE S&P'21**).
- [2] Cha, Wittern, Baudart, **Davis**, Mandel, Laredo. *A Principled Approach to GraphQL Query Cost Analysis*. Proceedings of the 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (**ESEC/FSE'20**). *ACM Distinguished Paper Award*.
- [3] Rupperecht, **Davis**, Arnold, Gur, Bhagwat. *Improving Reproducibility of Data Science Pipelines through Transparent Provenance Capture*. Proceedings of the 46th International Conference on Very Large Data Bases (**VLDB'20 Industry track**).
- [4] **Davis**, Moyer, Kazerouni, and Lee. *Testing Regex Generalizability And Its Implications: A Large-Scale Many-Language Measurement Study*. Proceedings of the 34th IEEE/ACM International Conference on Automated Software Engineering (**ASE'19**).
- [5] Michael, Donohue, **Davis**, Lee, and Servant. *Regexes are Hard: Decision-making, Difficulties, and Risks in Programming Regular Expressions*. Proceedings of the 34th IEEE/ACM International Conference on Automated Software Engineering (**ASE'19**). *ACM Distinguished Paper Award*.
- [6] **Davis**, Michael, Coghlan, Servant, and Lee. *Are Regular Expressions a Lingua Franca? An Empirical Study on the Re-use and Portability of Regular Expressions*. Proceedings of the 27th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (**ESEC/FSE'19**).
- [7] Wittern, Cha, **Davis**, Baudart, Mandel. *An Empirical Study of GraphQL Schemas*. Proceedings of the 17th International Conference on Service-Oriented Computing (**ICSOC'19**).
- [8] Fu, Ghaffar, **Davis**, and Lee. *EdgeWise: A Better Stream Processing Engine for the Edge*. 2019 USENIX Annual Technical Conference (**USENIX ATC'19**).
- [9] **Davis**, Coghlan, Servant, and Lee. *The Impact of Regular Expression Denial of Service (REDOS) in Practice: an Empirical Study at the Ecosystem Scale*. Proceedings of the 26th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (**ESEC/FSE'18**). *ACM Distinguished Paper Award*.
- [10] **Davis**, Williamson, and Lee. *A Sense of Time for JavaScript and Node.js: First-Class Timeouts as a Cure for Event Handler Poisoning*. Proceedings of the 27th USENIX Security Symposium (**USENIX Security'18**).
- [11] **Davis**, Thekumparampil, and Lee. *Node.fz: Fuzzing the Server-Side Event-Driven Architecture*. Proceedings of the Twelfth European Conference on Computer Systems (**EuroSys'17**).

## JOURNAL ARTICLES

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- [1] Kazerouni, **Davis**, Basak, Shaffer, Servant, Edwards. *Fast and Accurate Incremental Feedback for Students' Software Tests Using Selective Mutation Analysis*. Journal of Systems and Software (**JSS'21**).
- [2] Ozkan, Davis, **Davis**, James, Murzi, Knight. *Expectations and Experiences of Short-Term Study Abroad Leadership Teams*. Journal of International Engineering Education (**JIEE'20**).

## SHORT PAPERS

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- [1] **Davis**. *On the Impact and Defeat of Regex DoS*. **ACM SRC – Grand Finals. Second place, graduate student division.**
- [2] **Davis**. *Rethinking Regex Engines to Address ReDoS*. **ACM SRC – ESEC/FSE’19. First place, graduate student division.**
- [3] Rupperecht, **Davis**, Arnold, Lubbock, Tyson, and Bhagwat. *Ursprung: Provenance for Large-Scale Analytics Environments*. Proceedings of the 2019 International Conference on Management of Data (**SIGMOD’19 Demo**).
- [4] **Davis**, Kildow, and Lee. *The Case of the Poisoned Event Handler: Weaknesses in the Node.js Event-Driven Architecture*. Proceedings of the 10th European Workshop on Systems Security (**EuroSec’17**).

## POSTERS

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- [1] Vivek, Chinnakotla, Banna, Vegesana, Yan, **Davis**, Lu, Thiruvathukal. *Exemplars for Machine Learning: Towards Software Engineering & Reproducibility*. SIAM Conference on Computational Science and Engineering (**CSE’20**).

## PATENTS

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- [1] Davis, **Davis**. *Injection of Simulated Hardware Failure(s) in a File System for Establishing File System Tolerance-to-Storage-Failure(s)*. IBM, U.S. patent application 20200264961. U.S. patent pending.
- [2] Davis, **Davis**. *Verification of the integrity of data files stored in copy-on-write (CoW) based file system snapshots*. IBM, U.S. patent application 20200242075. U.S. patent pending.
- [3] **Davis**, Davis. *File metadata verification in a distributed file system*. IBM, U.S. patent 10,678,755B2, granted Jun. 9, 2020..
- [4] Davis, **Davis**. *Testing of lock managers in computing environments*. IBM, U.S. patent 10,061,777 B1, granted Aug. 28, 2018.
- [5] **Davis**, Davis, Knop. *Detection of file corruption in a distributed file system*. IBM, U.S. patent 10,025,788, granted Jul. 17, 2018.

## COURSES DESIGNED

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|  |             |
|--|-------------|
| <b>ECE 595 — Advanced Software Engineering</b><br><i>Purdue University</i> | Spring 2021 |
| <b>ECE 30861 — Software Engineering</b><br><i>Purdue University</i>        | Spring 2021 |

## COURSES TAUGHT

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|  |             |
|--|-------------|
| <b>ECE 30861 — Software Engineering</b><br><i>Purdue University</i>        | Fall 2021   |
| <b>ECE 595 — Advanced Software Engineering</b><br><i>Purdue University</i> | Spring 2021 |
| <b>ECE 368 — Data Structures</b>   | Fall 2020   |

*Purdue University*

**VIP: Open-Source TensorFlow Software**

Fall 2020, Spring 2021

*Purdue University*

**VIP: SafeRegex**

Fall 2020, Spring 2021

*Purdue University*

**CS 3114 — Data Structures and Algorithms**

Fall 2019

*Virginia Tech*

**CS 1064 — Introduction to Programming in Python**

Spring 2019

*Virginia Tech*

**Rising Sophomore Abroad Program (Track Leader)**

Spring 2018, Spring 2019

*Virginia Tech*

## MASTER'S AND PHD THESIS STUDENTS CURRENTLY SUPERVISED

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Wenxin Jiang

PhD

Spring 2021-present

## INVITED TALKS

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**Regexes Awry: Characterizing and Defeating Regex-based Denial of Service**

2020

*Clemson University CS department colloquium*

**Regex-based Denial of Service**

2020

*Clarkson University CS department colloquium*

**Regexes are Hard: Qualitative and Quantitative Perspectives**

2019

*NC State CS department colloquium*

**The Dangers of Copy/Pasting Code**

2019

*Episode of the Podcast "The Secure Developer": <https://tinyurl.com/DavisResearchPodcast>*

**Regexes in the Wild**

2019

*Virginia Tech department seminar*

**Academic Perspectives on Node.js**

2018

*Node.js Collaborator Summit, Vancouver*

**International Engineering**

Annual, 2015-2019

*Rising Sophomore Abroad Program, Virginia Tech*

## AWARDS AND RECOGNITION

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|  |           |
|--|-----------|
| ACM Distinguished Paper Award, ESEC/FSE 2020                                 | 2020      |
| Outstanding Graduate Student Service Award, CS@VT                            | 2020      |
| Second place, Grand Finals of the ACM Graduate Student Research Competition  | 2020      |
| First place, Graduate Student Research Competition, ESEC/FSE 2019            | 2019      |
| ACM Distinguished Paper Award, ASE 2019                                      | 2019      |
| ACM Distinguished Paper Award, ESEC/FSE 2018                                 | 2018      |
| Microsoft Security Researcher Acknowledgments (Regex DoS)                    | 2018      |
| Pratt Fellowship, Virginia Tech College of Engineering                       | 2017-2019 |
| Davenport Fellowship, Virginia Tech College of Engineering                   | 2019      |
| Graduate Fellow, VT Academy for Global Engineering                           | 2019-2020 |
| IBM Significant Contributor Award (Node.js)                                  | 2018      |
| IBM Poughkeepsie's New hire of the month                                     | 2014      |
| Frederica Clarkson Award   | 2012      |
| Clarkson University's Outstanding Senior (x2): Mathematics, Computer science | 2012      |
| Clarkson University Phalanx Commendable Leadership                           | 2011      |

## ACTIVITIES AS A REFEREE

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|  |              |
|--|--------------|
| Member, ASE Program Committee                            | 2021         |
| Member, ICSE Demonstrations Track                        | ICSE 2021    |
| Member, ESEC/FSE Artifact Evaluation Committee           | 2020, 2021   |
| Reviewer, ACM Transactions on Software Engineering (TSE) | 2020-present |
| Reviewer, Springer Empirical Software Engineering (EMSE) | 2020-present |
| Member, CGO Artifact Evaluation Committee                | CGO 2019     |

## DEPARTMENTAL SERVICE

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|---|--------------|
| Committee member, Purdue ECE Undergraduate Curriculum Committee | 2020-present |
| President, Virginia Tech CS Graduate Student Council            | 2018-2019    |
| Organizer, Virginia Tech Systems Reading Group                  | 2017-2020    |

## SHORT COURSES AND WORKSHOPS ATTENDED

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| Effective College Teaching (Brent & Felder)                  | 2020 |
| Intercultural Pedagogy Grant Training Program, Purdue CILMAR | 2020 |

## PROFESSIONAL MEMBERSHIPS

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| Member, Association for Computing Machinery |
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