October 27–30, 2019
Huntsville, ON, Canada

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SOSP '19

Proceedings of the Twenty-Seventh ACM
Symposium on Operating Systems Principles

Sponsored by:

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ISBN: 978-1-4503-6873-5

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Message from the General Chairs

Welcome to the 27th ACM Symposium on Operating Systems Principles (SOSP 2019)! SOSP is the flagship conference of ACM SIGOPS. Held every two years, it brings together the leading researchers and practitioners interested in the design, implementation, and evaluation of computer systems software. We are delighted to host SOSP in Canada for only the second time (Lake Louise 2001), and are glad that you could be a part of it.

The Program Chairs, Remzi Arpaci-Dusseau (University of Wisconsin, Madison) and YY Zhou (University of California, San Diego), have lined up an excellent technical program for you. We thank them and their Program Committee for all of their hard work. Volunteers have also put together four workshops and three tutorials taking place during the day preceding the conference. We hope that you partake in and enjoy all of the workshops, tutorials and conference talks and have many stimulating discussions with your colleagues during your time at SOSP.

Our many generous sponsors include Akamai, Alibaba, Amazon, ByteDance, Facebook, Huawei, Microsoft, NetApp, NSF, SIGOPS, Twitter, the Vector Institute, VMware, and the University of Waterloo. Their commitment to the SOSP conference is greatly appreciated, since they help keep registration fees low, and make it possible for many students to attend the conference.

Many people helped make this conference a success. We would like to thank the SIGOPS leadership (previously Robbert van Renesse, and currently Shan Lu) for talking us into taking on this role, and for handling our numerous questions along the way. We thank our Local Arrangements team (Bernard Wong, Ding Yuan, and their students), our Sponsorship team (Stefan Saroiu, Michael Stumm, and Hakim Weatherspoon), our Proceedings Chair (Ashvin Goel), our unerring Finance Chair (Martin Karsten), our Workshops/Tutorials Chair (Bianca Schroeder), our Web master (Ali Mashtizadeh), and our Publicity Chair (Samer Ali-Kiswany). In addition, Angela Demke Brown and Jeanna Matthews oversaw the Student Research Competition, Lin Tan coordinated the student travel support program, and Garth Gibson and his team from the Vector Institute (especially Maya Kwasnycia) coordinated the bus transportation program. We also thank Natacha Crooks and Malte Schwarzkopf who suggested and organized the excellent mentorship program. The assistance of our student volunteers on site is much appreciated, as are the many special touches provided by volunteer extraordinaire Sue Williamson.

Last but not least, the staff at ACM (Diana Brantuas, Irene Frawley, Adrienne Griscti, April Mosqus, John Otero, J.C. Peeples, Abigail Sumandal, and others), helped keep all the paperwork moving to ensure smooth conference operations, and our host team at Deerhurst Resort (Linda Chappell, Rory Golden, Deb Hill, Paul Mabee, Wendy Turner, and others) have been fabulous to work with from start to finish. Our gracious thanks to all of these people!

Thank you all for attending ACM SOSP 2019. We hope that you enjoy the conference, the hotel, the food, and the Muskoka region!

Tim Brecht and Carey Williamson
ACM SOSP 2019 General Chairs

Message from the SOSP '19 Program Co-Chairs

Dear Colleagues,

Welcome to the Symposium on Operating Systems Principles (SOSP '19), held in lovely Huntsville, Ontario! This year's SOSP includes 38 excellent papers, covering a wide range of exciting topics, including security and privacy, machine learning, bug detection, formal verification, high performance data processing, fault tolerance, networking, storage systems, persistent memory, and other fascinating topics.

Let's dive into the numbers. SOSP'19 received a total of 276 paper submissions, reviewed in multiple rounds by our program committee (PC) of 55 reviewers, with a mixture of academic and industrial research and practical experience from different continents and countries. The PC was divided into 27 "light" and 28 "heavy" members (including two PC chairs). All papers received three reviews in the first round. Based on first round reviews, 154 papers were selected to proceed to the second round, and each then received two to three additional reviews, mostly from heavy PC members. For a small number of papers that lacked expert reviewers, we solicited additional reviews as needed. In total, the PC and external reviewers wrote more than 1200 reviews, totaling over 1 million words of feedback. While reviewing can be imperfect, it surely isn't from a lack of effort.

This year's process included an author response period. A majority of papers submitted a response. PC members read author responses carefully and sometimes adjusted their reviews and ratings as a result. Responses also had an important impact on both our online and in-person discussions. Overall, we believe author responses helped reviewers make more informed decisions and improve the quality of the selected program.

After roughly one week of online discussion across the full PC, we picked 81 papers for the heavy PC members to discuss at a 1.5-day in-person PC meeting held at the University of California, San Diego. Almost all heavy PC members were able to attend in person, with four people calling in remotely. At the PC meeting, we grouped papers into high level categories so that similar topic papers could be discussed together. All discussed papers received a summary of the PC discussion written by one of the heavy PC reviewers. In the end, the PC selected 38 papers for presentation at the conference (a 14% acceptance rate). Each accepted paper was shepherded by a PC member to help the authors address the reviewers' comments in the camera-ready version.

After finalizing the program, we created a separate committee, composed of PC members with no conflicts with the papers under consideration, to determine the best paper awards. We selected six highly regarded papers as candidates for the award. After reading the nominated papers and considering reviews from the full PC, the awards committee agreed on two best paper awards.

As PC co-chairs, we have many people to thank for all of their hard work in helping to make SOSP '19 a success; it takes a village to run a conference, it seems. We thank all of the authors who submitted their papers; we know how much work it is to create a worthy submission, and we thank you for that work and for your trust that our review process would benefit your paper. Thank you also to the PC and external reviewers, who wrote excellent and (for the most part) on-time reviews, often with an astonishing level of detail and care. Thank you also to those who served as paper shepherds, and who will serve as session chairs during the conference itself. We extend a deep thank you to Tim Brecht and Carey Williamson, our General Co-Chairs, for the huge amount of work they've done to ensure the conference is a success. We also thank Ali Mashtizadeh (the web chair), Samer Al-Kiswany (the publicity chair), and Ashvin Goel (publications chair) for all of their work in helping make sure many important details worked out as needed. We thank Vijay Chidambaram, Baris Kasikci, and Supreeth Shastri, and all of the others who helped perform an Artifact Evaluation for some of the papers. We also thank YY's students Chengcheng Xiang and Yudong Wu who helped during the running of the PC meeting. Finally, thanks to the OSDI '18 chairs for writing an excellent "Message from the Program Chairs", from which we copied liberally. Plagiarism, when properly applied, can be your ally.

We hope you enjoy SOSP '19!

Remzi Arpaci-Dusseau, *University of Wisconsin-Madison*
Yuanyuan Zhou, *University of California, San Diego*
SOSP '19 Program Co-Chairs

Message from the Artifact Evaluation Co-Chairs

Dear systems community:

In systems research, artifacts play an important role since the results are often tied to the produced artifact. This not only includes software systems but also datasets, benchmarks, models and test suites. In many cases, it is impossible to reproduce the results without the artifact. Yet, as a community, we offered no formal means to submit and evaluate anything but the paper. This year, we took a small step in this direction. In this letter, we share our experiences of organizing the first artifact evaluation (AE) process at SOSP 2019.

As this was the inaugural year, artifact evaluation was limited only to accepted papers. We were encouraged to see that 23 of the 38 accpeted papers (i.e., 61%) applied to participate. We reached out to broader systems community via Twitter and Slack (systems-research.slack.com) to put together an artifact evaluation committee (AEC). This helped us bring together a team of 42 researchers, postdocs, and graduate students hailing from 11 different countries, who volunteered to read papers and evaluate the systems. We decided on three badges that made sense for systems research (from out of the six that ACM has proposed): *Artifact Available*, when the artifact is made available for retrieval, publicly and permanently; *Artifact Functional*, when the artifact has gone through an independent audit, and it functions as described; *Results Replicated*, when the main results of the paper are obtained independently using the supplied artifacts.

We designed the evaluation process to be single-blind (i.e., evaluator identities were not revealed to the authors). Every artifact was evaluated by at least two members of the AEC. We advised the AEC members to work with the authors to help them achieve the badges they sought. This required a significant amount of communication between evaluators and authors as well as accepting several revisions of artifacts and instructions. Due to the single-blind nature of the process, communications were via HotCRP comments. Average length of communications including reviews, comments, and troubleshooting help was 3456 words per paper. The whole process starting from authors registering their artifacts, to evaluators familiarizing themselves with the underlying research papers, to verifying the artifact functionality, to reproducing the results, to writing the reviews, and to awarding the badges was completed in the span of 28 days.

We aimed to recognize authors who had gone the extra mile and put in work to produce artifacts that were of high quality. We formed an independent committee consisting of two reviewers from the AEC. The committee focused on papers which obtained the Results Reproduced Badge and made their artifact publicly available. We believe this extra recognition will motivate authors to produce high-quality artifacts.

Here are the key results from the artifact evaluation process.

- Of the 23 submissions, 21 got *Artifact Available*, 19 got *Artifact Functional*, and 12 got *Results Replicated* badges.
- 96% (22/23) of the submissions earned at least one badge, and 48% (11/23) earned all three badges.
- We saw a strong preference for open-sourcing. In fact, all of the papers that have industry affiliations or industry-based collaborators sought *Artifact Available* badge.
- Despite having to meet rigorous standards in a short evaluation timeframe, 82% artifacts earned the *Artifact Functional* badge, and 52% earned the *Results Replicated* badge.

Given this is our first time, we would be remiss to not share our key takeaways: (i) *AE increased the paper quality.* For instance, when AEC members identified a performance mismatch, the authors worked with them to root cause it to usage of older versions of external dependencies (TensorFlow, in this case). In response, the authors revised the numbers in their camera ready paper. Also, for the first time, a large number of SOSP papers will release artifacts that have been externally validated. (ii) *Specialized hardware is not a hindrance for AE.* Our effort dispels the conventional wisdom that projects involving custom hardware or expansive clusters cannot be evaluated. We observed that in such cases, the authors allowed AEC members to access their resources (via ssh) to perform evaluations. This was the case for 6 (out of 23) evaluations. (iii) *Interest in AE is not limited to academic projects.* Nearly 40% of the submitted artifacts either originated from industry, or had industrial collaborators. Half the industry papers got all three badges. Even when business concerns did not allow open-sourcing the artifacts, the authors were happy to let AEC members access artifacts privately.

We sincerely thank the conference chairs for trusting us with this effort, and hope that these results serve as a catalyst in making artifact evaluation more common at future systems conferences.

Thank you,
Baris Kasikci, Supreeth Shastri, and Vijay Chidambaram.
https://sysartifacts.github.io/

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