

Message from the MICRO 2020 Program Co-Chairs

It is our great pleasure and honor to welcome you to the program of the 53rd IEEE/ACM International Symposium on Microarchitecture (MICRO).

Program Overview

We received a record number of 446 full-paper submissions (30% higher than MICRO 2019), out of which the program committee selected 82 papers for inclusion in the program – an acceptance rate of 18%. Twenty four papers were withdrawn at various stages during the review process (primarily during the rebuttal period). In addition to the 82 papers, the program also features three keynotes and a track highlighting the ACM Student Research Competition. The keynotes are delivered by Srilatha (Bobbie) Manne, Cristina Silvano, and Rich Wolsky.

Program Committee and External Review Committee

We had the honor to recruit and work with 102 Program Committee (PC) members who are experts on the broad range of topics within the field of computer architecture. Each PC member reviewed 13 or 14 papers. We also recruited 169 External Review Committee (ERC) members who each reviewed 4 - 6 papers. When composing the PC and ERC (and when assigning reviews), we paid special attention to balance domain expertise, gender, employment (academia versus industry), geography, and seniority. We had decided that the PC meeting would be virtual, which enabled us to target a larger committee and a somewhat lower review load per committee member. Finally, we also solicited additional reviews from 8 external reviewers who reviewed one or two papers. Committee membership was kept blind prior to the PC meeting as a means to minimize and avoid external influence on the review process.

Timeline: 11 weeks from Paper Submission to Author Notification

The timeline for MICRO 2020 was as follows. Abstracts were due on April 10 and full submissions were due on April 17, which was roughly two weeks later than initially planned to account for COVID-19 challenges. Authors could not submit a paper without having registered an abstract first. PC Reviewers were assigned by May 5 and ERC Reviewers by May 8. The reviews were due June 6, 2020. The authors were then given the opportunity to rebut the reviews and/or submit a revised manuscript between June 8 – 18. The PC, ERC, and the external reviewers started the online discussion right after the author response period, up until the PC meeting. The PC met virtually over Zoom for two days to make the final paper acceptance decisions on July 2 – 3. The authors were notified with the paper decision outcomes on July 7, 2020. Sixteen papers underwent a shepherding process that concluded on September 3, 2020.

Single-Round Reviewing to Maximize Fairness and Balance Work/Life

We adopted a single-round review process to maximize fairness among all submissions. This also allowed longer review duration and still left enough time for the authors to submit revised papers and enough time between MICRO decisions being announced and the submission deadline of the following architecture conference. The load for each reviewer in the single-round process was kept relatively low thanks to the large committee size. These decisions helped the reviewers dedicate sufficient time to each paper.

A total of 2,192 reviews were submitted. Of the submitted papers, 93% received 5 reviews, 4% received 6 reviews, and 3% received 4 reviews. All reviewers on papers with 4 reviews reached consensus that an additional review was not necessary, and the acceptance ratio for those papers was comparable to that of all papers at 20%. Each paper had at least 3 PC reviewers and 2 ERC or external reviewers.

Paper Assignment Process

We manually assigned reviewers to papers with input from three sets of scripts. First, we leveraged the scripts developed for ISCA 2018 by Babak Falsafi and his students to identify PC members whose papers are cited by each submission and assisted us in composing conflict-of-interest lists. Second, we also leveraged a new machine-learning tool that is being actively developed by Omer Anjum. Omer's tool, as

used for MICRO 2020, discovers hidden topics in the abstracts from PC/ERC publications crawled from online paper databases. The tool further explores how well the hidden topics of a reviewer can reproduce the abstract of a submission. The tool provided a ranked list of PC/ERC members who have authored similar papers. This assisted in quickly identifying PC/ERC members we might not have recognized as being especially well qualified to review a given paper or apparent from other metrics such as citations. We also used this tool to further expand and refine the conflict-of-interest lists. Third, we wrote new scripts that proposed review assignments based on the expertise suggested by the systems above and reviewer-interest/paper-topic matches. We manually verified all suggestions and made numerous modifications. We also used our scripts to ensure load balance among reviewers and to increase reviewer diversity for each paper. Specifically, we maximized expected expertise while minimizing the number of papers for which there were two reviewers from the same institution, more than two more-junior reviewers, more than two industry reviewers, or more than two reviewers from the same country (USA excluded).

Revision Letters for Review Continuity

The authors were given the opportunity to submit a revision letter explaining how a submission that had been previously rejected from a different venue was revised and improved. The intent of this revision letter is to provide some continuity in the review process and to also address cases in which comments regarding a lack of improvement are made during the review process. The deadline to submit this revision letter was one week after the paper submission deadline, which gave authors some time to construct a complete and concise revision letter. The authors had a choice about when and how to make the revision letter available to reviewers: (1) immediately available to all reviewers, (2) available upon explicit request (intended for past reviewers only), (3) available as part of the rebuttal, or (4) withheld from all reviewers. This process allowed authors to use their own judgment about whether and how to communicate to reviewers their effort in improving the paper, while keeping the reviewers unbiased with respect to the paper's submission history. The reviewers were instructed to use the revision letter strictly to understand how a submission had been improved over time. Roughly half of the submissions included a revision letter. Overall, feedback from reviewers indicates that the revision letters were useful and (positively) impactful for a small number of papers, yet unnecessary for the majority of papers. We believe that the positive impact, though limited to roughly 25% of the submissions, was worth the effort associated with preparing, managing, and perusing the revision letters.

Authors Were Given the Opportunity to Respond

Authors were able to see the reviews (and the review scores) on June 8-18, and were invited to submit a revised manuscript and/or a rebuttal. The authors were given three options: (i) to not submit a rebuttal nor a revision, (ii) to submit an 800-word rebuttal but no revision, or (iii) to submit a revised paper and a rebuttal. The revised paper had to comply with the original submission guidelines (no extra pages were allowed); authors were encouraged to highlight changes or submit a diff to clearly indicate differences between the original and the revised submissions. The goal of the revision option was to give the authors the opportunity to address (relatively) small issues that could be fixed within the response period, with the hope to accept as many excellent papers as possible. Our observations are that the revision process, as well as shepherding of some papers had a substantial positive impact.

A small number of papers received late reviews, including from additional/external reviews that had been requested to increase overall reviewer expertise. All late reviews were promptly forwarded to the authors, and the rebuttal deadline was relaxed in such cases. The online discussion took all available information into account in making a final decision.

Anonymous Post-rebuttal Discussion to Enable an Efficient Virtual Meeting

Papers were heavily discussed by the PC, ERC, and the external reviewers prior to the PC meeting using the HotCRP review site. The ERC and the external reviewers actively participated in the discussions. Each paper was assigned a PC Member as a discussion lead to initiate and monitor the discussion –

discussion leads were selected based on expertise and positivity, while balancing load across all PC members. We opted for an anonymous discussion process where reviewer names were hidden until a few days before the PC meeting. The purpose of keeping much of the discussion anonymous was twofold. First, discussion was less biased by seniority and reviewers were encouraged to make more complete discussion points. Second, less information could be leaked and reviewer identity was better protected. To hold the reviewers accountable for their discussion and to facilitate pre-meeting decisions, we revealed reviewer identities two days before the PC meeting. More than 3,500 comments were posted during the discussion process. On average, this is 8 comments per paper with reviewers exchanging more than 20 messages on some.

The discussion concluded with 275 papers being rejected by reviewer consensus and 45 papers being accepted by reviewer consensus prior to the PC meeting. The list of all papers accepted during the discussion period was reviewed by the entire PC prior to the PC meeting. The discussion lead of each paper was responsible for composing feedback to the authors summarizing the contributions, strengths, weaknesses, and discussion points that led to the outcome of a paper.

Virtual PC Meeting

The PC meeting was held online due to the pandemic. We used Zoom as our conferencing software due to its unique feature supporting breakout rooms. We deliberately formed an international PC committee and therefore organized a 2-day PC meeting into 5 sessions per day to accommodate 9 different time zones. Committee members were encouraged to attend all sessions that were reasonable in their own timezone. We ordered the paper discussion such that each paper was discussed at a time that was reasonable for that paper's PC reviewers. The attendance of the sessions was excellent overall at 75 - 100%. To handle conflicts of interest in a smooth manner that minimized downtime, all PC members with a conflict were automatically moved to a breakout room prior to each discussed paper and all other PC members automatically moved into a separate discussion breakout room to avoid the possibility of PC members joining the meeting in the middle of a discussion they were conflicted with.

The papers were ranked for discussion based on the post-response scores, using a customized metric that took into account each reviewer's expertise level, generosity of the reviewer, and review confidence. The papers were ordered into four groups in descending scores. The order in each group was randomized to limit the bias from discussion order. To also account for timezones, the papers were scheduled across five sessions each day with each session following its own group-rank order.

The process below was followed by all papers. The discussion lead introduced the paper and summarized the main points made by external reviewers during the discussion period. Then, other PC reviewers chimed in and provided their perspectives on the paper. The discussion then opened up to the entire PC for further comments and questions. Next, all PC reviewers voted on the paper. If there was no consensus, the PC reviewers were given another chance to summarize their opposing opinions. The paper's decision was then reached via an online whole-PC vote. Eighty four papers were discussed in the PC meeting. Thirty seven of these papers were accepted, 11 of which by PC-wide vote. The other 47 papers discussed during the PC meeting were rejected, 33 by PC-wide vote.

At the end of the review process, 82 papers were accepted, out of which 16 with shepherding.

Author and Reviewer Ethics

We employed measures to strengthen the ethics for both authors and reviewers. First, we kept PC and ERC membership hidden throughout the review process to minimize the possibility of external influences. Second, all authors were required to sign an ethics declaration acknowledging adhering to the ethics guidelines below. Scanned signatures from all authors were required within one week of the submission deadline. Ethics guidelines:

- I have, to the best of my knowledge, identified all potential reviewers with a conflict of interest and have included them in the conflicts-of-interest list on the submission form. Conflict of interest definitions are provided in EXHIBIT A.
- I have not and will not make any explicit attempt to influence any reviewer opinion or decision about the submitted paper, nor will I ask any other person to do so. A technical discussion of the submitted paper content, or any other sharing of content from the paper is not a violation of this declaration, unless done with the implication that review-related action is expected.

Third, all reviewers were asked to acknowledge abiding with the following review process before accepting the invitation to join the PC or ERC. Reviewers were also asked to click-through an acknowledgement of these guidelines before preparing reviews. The ethics guidelines were derived from ASPLOS 2020 and ISCA 2020:

- Reviewers must treat all submissions as strictly confidential and destroy all papers once the technical program has been finalized.
- Reviewers must compose the reviews themselves and provide unbiased reviews.
- Reviewers must contact the PC co-chairs if they feel there is an ethical violation of any sort (e.g., authors seeking support for a paper, authors seeking to identify who the reviewers are).
- Reviewers should review the current submission. Authors may make revision information available, which reviewers should then take into account as well.

PC/ERC members and other reviewers are not allowed to:

- Actively look for author identities. Reviewers should judge a paper solely on its merits.
- Solicit external reviews without consulting the PC chairs. Reviewers who have any reason to request a third-party review should contact the PC chairs.
- Discuss the content of a submitted paper with anyone other than unconflicted reviewers of the paper, PC/ERC members, and the PC chairs during the review period (from now until paper publication in any venue).
- Discuss the content of reviews, including the reviewers' identities, with anyone other than unconflicted reviewers of the paper, PC/ERC members, and PC chairs during the review period (from now until paper publication in any venue).
- Reveal the name of paper authors in case reviewers happen to be aware of author identity. (Author names of accepted papers will be revealed after the PC meeting; author names of rejected papers will never be revealed.)
- Disclose the outcome of a paper until its authors are notified of its acceptance or rejection.
- Disclose the content of a paper until its publication.
- Disclose the content of reviews, including the reviewers' identities, or discussions about a paper until its publication. After publication, reviewers, PC/ERC members, and the PC chairs are allowed to discuss their own opinions of a paper, but not the content of others' reviews or any PC/ERC discussion about the papers.

Challenges and Future Opportunities

The increasing number of submissions raises a number of challenges for our conference review model. MICRO 2020 was particularly challenging due to the pandemic that started about a month and half before the original planned deadline. This caused unprecedented disturbance to authors worldwide. For that reason, we postponed the submission deadline by two weeks to reduce the stress on authors and help them better adjust to a new normal. Similarly, we considered the stress of reviewing placed on PC members and decided to substantially increase the PC size to reduce the burden on individual reviewers. This was possible because MICRO 2020 was among the first conferences in our community to hold a virtual PC

meeting. However, managing the large number of submissions and the large number of PC members across numerous timezones was a challenge, as was keeping PC members engaged in the meeting and discussions.

Another growing challenge that also scales poorly with the number of submissions is accurately identifying conflicts of interest. This was a somewhat greater challenge for us because authors were not able to select PC conflicts as PC membership was hidden. We used a combination of scripts, including those developed for ISCA 2018 by Prof. Babak Falsafi and his students and those developed by Omer Anjum, a postdoc from Prof. Wen-Mei Hwu's group. However, the scripts required pre-processing and were unable to identify numerous conflicts that were suggested by the internal conflict-identification system of HotCRP. Even then, some conflicts were simply unmarked and required our own knowledge of the community. We also verified unclear conflicts with authors in some cases.

Assigning reviewers is also an effort-intensive task. Both manual and scripted assignments were generated initially. We used scripts because they help us track how diverse and balanced the assignments are. Dealing with continuously-discovered conflicts of interest while maintaining a high-quality assignment was particularly challenging.

A few ideas that could be considered for future conferences are: (1) to add explicit tracks to the submission and review process to partition some of the effort; (2) to provide tools that facilitate online video discussions between small groups of reviewers; and (3) to use two rounds of reviewing, where the first round reviews are used primarily to improve the topic-list of papers and identify higher-expertise reviewers for the second round. Another suggestion that could be implemented with a slightly expanded review time is to include a short pre-rebuttal discussion period to allow reviewers to prioritize requests for the rebuttal and revision.

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