Message from the ISCA 2021 Program Chair

It is my great pleasure and honor to welcome you to the program of the 48th IEEE/ACM International Symposium on Computer Architecture (ISCA), the flagship conference of the computer architecture community. For the second year in a row, the conference is going to be virtual, but that has not lowered any excitement about submitting or attending. There is an excellent program that has been selected for the conference.

2021 is also the 50th Anniversary of the birth of the microprocessor. There will be some panels celebrating the microprocessor in the program.

Program Overview
We received 407 paper submissions out of which the program committee selected 76 papers for inclusion in the program – an acceptance rate of 18.6%. Seven papers were withdrawn at various stages during the review process. In addition to the 76 papers, the program also features three keynotes, an industry track, and various panels. The keynotes are delivered by Dr. Hillery Hunter (IBM), Prof. Monica Lam (Stanford University) and Dr. Pradeep Dubey (Intel). The industry track was a new initiative started in 2020. This year’s industry track was led by Dr. Hsien-Hsin Lee (Facebook). The industry track papers were selected through a separate review process which Hsien-Hsin Lee describes in his foreword.

Program Committee and External Review Committee
I had the privilege and honor to recruit and work with 101 Program Committee (PC) members who are experts on the broad range of topics within the field of computer architecture. Each PC member reviewed approximately 16 papers. I also recruited 142 External Review Committee (ERC) members who each reviewed about half a dozen papers. Finally, I also solicited additional reviews from 6 external reviewers who reviewed one or two papers. Their names are listed in the subsequent pages. When selecting the PC, ERC and the external reviewers, I paid special attention to balance the domain expertise, gender, employment (academia versus industry), seniority and geographical diversity. Industry members constituted 27% of the PC and female members constituted 18%. Only about 50% of the 2020 PC members were invited to serve on the 2021 PC, in an effort to have more inclusion. Members taking turns with the PC rather than staying on continuously every year makes the broader community to have more trust in the process. Effort was also made to include several members who were first time PC members.

Timeline: 14 weeks from Paper Submission to Author Notification
The timeline for ISCA 2021 was as follows. Abstracts were due on Thursday November 19, and full submissions were due on Tuesday November 24, 2020 – two days before the US Thanksgiving. Authors could not register a paper without having registered an abstract first. Abstract deadline was adjusted to be after the notification from ASPLOS conference. Reviewers were assigned by Friday December 11, 2020. The reviews were due on January 31, 2021. The authors were then given the opportunity to rebut the reviews and/or submit a revised manuscript between February 4 – 14. 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 on Zoom for 2 days to make the final paper acceptance decisions on February 25 – 26. The authors were notified with the paper decision outcomes on Wednesday March 4, 2021.

Single-Round Reviewing to Maximize Fairness and Balance Work/Life
The review process consisted of a single round. A total of more than 2,062 reviews were submitted – all papers received at least 5 reviews; 34 papers received 6 reviews. All reviewers (except for papers conflicted with me) were assigned manually by me – I read all paper abstracts to match papers with reviewer
expertise. Prof. Sandhya Dwarkadas (University of Rochester) assigned the papers I was conflicted with. Each paper got assigned three PC reviews and two (or three) ERC or external reviewers.

The reason for a single-round review cycle is twofold. First, it maximizes fairness among all submitted papers. Although a two-round or multi-round review period may reduce the overall review workload to some extent, it also adds noise to the review process which may bias paper outcomes: good papers may be rejected early in the process based on a few reviews, and papers that pass on to the next round may have an unfair bias when assigned to new reviewers who know that the paper has already passed one or more review rounds. Second, a single review deadline allows reviewers to budget their time and balance work and life. More specifically, organizing multiple review rounds for ISCA would imply a review deadline during or shortly after the Christmas and New Year’s break. Putting a review deadline at the end of January enabled the reviewers to commit to the ISCA review load while at the same time being able to enjoy family time over the holidays. I encouraged all reviewers to submit 50% of their reviews by January 15th to reduce the possibility of PC and ERC members keeping their workload to the deadline. While 50% was not done, more than 33% of the reviews were done by January 15th and most reviewers kept working on the reviews rather than waiting until the deadline.

Authors Were Given the Opportunity to Respond
Authors were able to see the reviews (and the review scores) between February 5 – 14 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 850-word rebuttal but no revision, or (iii) to submit a revised paper and an 850-word rebuttal. The revised paper had to comply with the original submission guidelines (no extra pages were allowed); authors could submit a diff to highlight changes between the original and the revised paper. 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.

Several papers each received an additional review after the rebuttal period started. There were two major reasons for soliciting additional reviews. Firstly, if a paper had less than five reviews before the rebuttal/revision phase – adding a fifth review provided fairness for all papers. Secondly, for papers with high variance in the reviews, or where multiple reviewers marked low expertise, an additional review was obtained. Adding an additional expert review increased the overall level of expertise to make a comprehensive decision during the online discussion and/or at the PC meeting.

Anonymous On-line Discussions
Papers were heavily discussed online by the PC, ERC and the external reviewers. The ERC and the external reviewers actively participated in the discussions.

I opted for an anonymous discussion process where reviewer names were hidden until the PC meeting. The purpose of keeping much of the discussion anonymous was twofold. First, discussion was less biased by seniority or other factors. Reviewers were encouraged to make more complete discussion points in an objective manner. Reviewer personalities could not influence the discussions because of anonymity. Second, less information could be leaked and reviewer identity was better protected. However, to hold the reviewers accountable for their discussion and to facilitate pre-meeting decisions, reviewer identities were revealed before the PC meeting. Many reviewers were surprised to see who they were arguing with during the anonymous arguments. Such frank and unbiased discussions will not happen when reviewer identities are known.

Each paper was assigned a discussion lead to initiate and monitor the discussion – discussion leads were selected based on expertise (primarily) and positivity and balance (secondarily). More than 4,485
comments were posted on the HotCRP paper submission site during the review process – on average, this is more than 11 comments per paper.
At the beginning of the rebuttal process, papers were tagged according to the pre-rebuttal overall merit scores weighted with expertise. The papers were categorized into four tiers, where tier#1, tier#2, tier#3 and tier#4 represented the top 20%, next 15%, next 15%, and the bottom 50% of all submissions respectively. This relative ranking gave the reviewers and discussion leads a good perspective on where the papers stood with respect to the entire pool of papers.

The discussion lead was asked to write a summary covering both the positive and negative aspects of the paper to initiate the online discussion. Summarizing the reviews at the beginning of the online discussion was essential to avoid discarding papers without adequate attention.

Rebuttals were submitted for 350 out of the 407 papers. Once the rebuttals were submitted, reviewers were asked to provide a post-response overall merit score after having read the rebuttal, the revised submission (if available), and the other reviews. After the online discussion, discussion leads were asked to tag the papers into multiple categories such as #online-accept, #discuss, #online-reject and #discuss-if-time-allows.

At the end of the online discussion, the discussion lead prepared a succinct paper summary, including the contributions, strengths, weaknesses and discussion points, for the PC meeting. This enabled efficient and effective discussions at the PC meeting.

**Virtual PC Meeting**
The PC meeting was held online due to the pandemic. Zoom was used as the conferencing software due to its unique feature supporting breakout rooms. The PC was composed of members from 4 continents covering virtually every time zone on the planet and scheduling the paper discussion order in a manner convenient to all was challenging. Opportunity was provided to PC members to mark their convenience, and then paper discussion was ordered to be at a time-slot that was reasonable for that paper’s PC reviewers. Committee members were encouraged to attend all sessions that were reasonable in their own time zone. Most PC members from Asia, Europe and Australia took the pain to attend almost the entire 2-day PC meeting even when the hours were inconvenient to them. The attendance of the sessions was excellent overall at 75 - 90%. 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.

It is extremely important that our paper selection system is fair and just to all authors. We have many submission rules and guidelines, that most authors follow seriously. There are many complaints from reviewers on papers squeezing too much stuff and figures, tables and text being unreadable. There were 30+ papers that looked to have shrunk spacing or used small fonts. Some of them are flagged to authors during submission process (i.e. they got a message from the PDF checker). Some of them are not flagged by the PDF checker. The pdf checker had many false positives and false negatives. There were also a few violations related to double-blinding. Shared governance is good in these kinds of things; so I asked the PC to vote on this matter. A policy voting was done at the beginning of the PC meeting using Zoom polls. The PC members in attendance voted to decide on policies on format violations, and a few such procedural matters. In general, the PC vote outcome was to go on a case by case basis.

Before the beginning of the meeting, the PC was reminded that there is no target acceptance rate and that we can accept all papers that the PC decides is above the bar and PC believes our community will find interesting/useful. The papers were ranked for discussion based on the post-rebuttal scores, using a customized metric that took into account each reviewer’s expertise level and the overall review score. The
final discussion order was based on the time-zones and availability of the reviewers. Since the discussion order was not in descending order of merit, there was no bias from discussion order.

The process below was followed by all papers. The discussion lead introduced the paper and summarized the paper and the main points made by external reviewers. Then, other PC reviewers chimed in and provided their perspectives on the paper. If all reviewers agreed on a decision, the paper was accepted without going to PC wide vote. Shepherding was provided as an option to reach consensus – shepherding was allowed to fix writing and clarification issues, not to provide new experiments and results. ERC member scores were considered equivalent to a vote (note that ERC members were not present at the PC meeting) and was counted towards the reviewer vote count. If score was 3 or 4, it was counted as ACCEPT and if the score was 1 or 2, it was counted as REJECT. If post-rebuttal score was not marked, pre-rebuttal merit score was used. The result of the vote was considered final if the difference is at least 2 votes (e.g., 4-0, 5-0, 4-1, 4-2). If the vote was a tie or a difference of one vote (e.g., 2-2, 3-2, 3-3), the paper went to whole PC vote. The paper’s decision was then reached via an online whole-PC vote. In order to be accepted, a paper needed a 55% majority during a PC-wide vote. But I can also tell that all papers that received simple majority also received the 55% majority. Voting was done electronically using HotCRP and was anonymous. The reason for keeping the voting anonymous was to not create a side-channel through which to leak results.

There were 36 papers that were marked with a tag #online-accept and 9 papers that were marked with #online-accept-with-shepherding tag. These 9 papers contained minor modifications requested by a PC/ERC member who was still recommending accept but with the suggested modification. All of the online accepts were examined by the PC, and 12 of the online accepts were discussed at the PC to get a good calibration of the reviews. Nine of the online accept papers were accepted with shepherding. The PC was invited to examine all of the online accepts until the end of the PC meeting, and voice concerns to the PC Chair. Towards the end of the PC meeting, floor was opened to make sure that there were no concerns on the online accepts.

Eighty seven papers were discussed at PC meeting. Out of the 87 papers discussed at the PC meeting, 32 were accepted without going to PC-wide vote, 11 were accepted after going to PC-wide vote, 4 were rejected without going to PC-wide vote and 40 were rejected after going to PC-wide vote.

At the end of the review process and the PC meeting, 76 papers were accepted, out of which 22 were with shepherding. The shepherded papers went through further iterations of improvement until the reviewer objections were adequately handled. The discussion leads provided a discussion summary for all the papers that had submitted a rebuttal and/or revision, and were discussed online or at the PC meeting.

PC members were able to view all submitted papers, reviews and comments during the PC meeting, until the author notifications were sent out. Shepherding was coordinated using HotCRP as well. The PC members could no longer see the list of the submitted papers, reviews and comments once the authors were notified – this is to close another potential side-channel about the review process. ERC members and external reviewers were able to see only the papers, reviews and comments for which they were a reviewer, i.e., ERC members and external reviewers could not see the list of submitted papers, reviews and comments. Author names of rejected papers were never revealed throughout the review process. Author names of accepted papers were revealed only after the final decision was reached.

**Author and Reviewer Ethics**

Maximum care was taken to ensure the integrity of the review process. All authors agreed to an ethics form at the time of submission which stated:
1. 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.

2. I have not and will not make any attempt to influence any reviewer opinion or decision about the submitted paper, nor will I ask any other person to do so. I will not reveal the paper number or title or contents to anyone who does not have a need to know. Any research discussions will be held with maximum effort to maintain anonymity of the ISCA submission.

Prior overlapping submissions or submissions on arXiv were disclosed to the PC Chair on the submission form.

All reviewers were asked to abide to and agree with the following review ethics upon entering a review into the HotCRP paper submission system:

- Reviewers must treat all submissions as strictly confidential and destroy all papers once the technical program has been finalized.
- Reviewers must review their paper assignments themselves and provide unbiased reviews.
- Reviewers must contact the PC chair 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 must not actively look for author identities. Reviewers should judge a paper solely on its merits.
- If you know the authors, do not publicize the authors. If you would like to recuse yourself from the review task, contact the PC Chair.
- Reviewers should review the current submission. If you have reviewed a previous submission, make sure your review is based on the current submission.
- Reviewers must not share the papers with students/colleagues.
- Reviewers must compose the reviews themselves and provide unbiased reviews.
- Reviewers must not solicit external reviews without prior approval of the PC Chair. If PC/ERC members regularly involve your students in the review process as part of their Ph.D. training or feel they must seek a third-party review, they may avail this on one of their assignments. PC/ERC member is still responsible for the reviews. The student member also must sign an agreement with the PC Chair to abide by these ethics guidelines.
- Reviewers must keep review discussions (including paper numbers) confidential.
- Reviewers should not discuss the content of a submitted paper/reviews with anyone other than officially on HotCRP during the online discussion period or the PC meeting (from now until paper publication in any venue).
- Reviewers must not reveal the name of paper authors in case reviewers happen to be aware of the author's identity. (Author names of accepted papers will be revealed after the PC meeting; author names of rejected papers will never be revealed.)
- Reviewers must not disclose the outcome of a paper until its authors are notified of its acceptance or rejection.
- Reviewers must not download or acquire material from the review site that you do not need access to.
- Reviewers must not disclose the content of reviews, including the reviewers' identities, or discussions about papers.
- Violation of the review guidelines can result in serious consequences including/but not limited to getting banned from submitting/reviewing in future years.

Keeping reviewer names anonymous during the online discussion period also helped to have unbiased discussions and less leaking of information.
Challenges
The increasing number of submissions poses a number of challenges for our conference review model. A few of them are:

- **Identifying conflicts is a tedious process.** I spent more than a full week double-checking conflicts. The submission site (HotCRP.com) provides suggestions for possibly missed conflicts – I got in touch with the authors to verify those. Furthermore, I used scripts provided by Babak Falsafi and Emery Berger and modified them to find all conflicts from DBLP. All co-authors within the last five years were flagged as conflicts. DBLP based conflicts were uploaded to each PC/ERC member’s HotCRP profile. This was a very time-consuming process. A conflict database that keeps track of conflicts would facilitate the process for both the authors and the program chair.

- **Many authors and PC members often do not remember all collaborators from large groups they have interacted with.** This leads to unintentional omissions of names from the conflict list. Automatic checking against a conflict database will be helpful for authors and reviewers alike.

- **Manually assigning reviewers to papers is a tedious and time-consuming process, especially with 407 submissions and a PC plus ERC of approximately 250 members.** Automatically assigning reviewers to papers based on topic keywords provided by the authors and the reviewer expertise by the reviewers does not work too well because of the disparity in how authors chose topic keywords for their submissions – many provided only a single keyword whereas others provide half a dozen keywords. Reviewers are busy and do not often update their topics of interest/expertise. I spent more than 10 days to do the manual review assignments. I gave the highest importance to expertise matching and only the second priority to load balancing. This led to some load imbalance, however, I am proud that I made the highest effort to match expertise.

- **Managing a Zoom PC meeting with 100+ experts is challenging.** Scheduling papers in a virtual PC meeting considering reviewer geography and availability needs extra planning. In an in-person PC meeting, reviewers are available all the time, but not in a virtual meeting. However, in another way, the virtual PC meeting enabled to have a larger PC, about 50% larger than the previous year. This allowed to keep the reviewer load around 15 (instead of around 20). If conferences go back to physical PC meetings, hotel conference rooms may not hold 100+ members. Reviewer load will be 20 papers or more if PCs are in the 60-70 member size. PC meetings are invaluable to ‘set the bar’, to find consensus if possible, and, if there is no consensus, to clearly spell out disagreements among the reviewers before making an informed decision. Virtual PC meetings reduce carbon footprint of our conferences, and is more inclusive to members with travel challenges. Whether PCs should be virtual or in-person will be an item to discuss in the future.

- **Eliminating noise from the decision process is challenging.** A lot of effort was made to improve the fairness in the review and decision process. Extreme care was taken to get adequate number of expert reviewers, to keep online discussions anonymous, fair and balanced, etc. however, there is still some noise in the decisions. Typically we do not revisit decisions during a PC meeting and at times the decisions are not calibrated against each other especially during a long 2-day PC meeting. For instance, a committee can be very harsh in the beginning and more lenient later on in the process. I welcomed suggestions on revisiting some of the close decisions from the first day. At least two papers were revisited towards the end of the PC meeting, but in both cases, the PC decided to stay with the earlier decision. Whether a methodology other than a single-pass process can be devised is up to the architecture community to think about.
Acknowledgement

Finally, I am grateful to a large group of people without whom it would not have been possible to come up with the exciting program for ISCA 2021. A big thank you to:

• all the authors for having submitted their best work to ISCA 2021;
• the 101 PC members who each reviewed ~16 papers, and who attended the long Zoom PC meeting (many at odd hours, losing sleep);
• the 142 ERC members who reviewed half a dozen papers;
• the 6 external reviewers;
• Sandhya Dwarkadas for handling my conflict papers;
• the “shepherds” who worked with the authors of conditionally accepted papers to improve the papers to satisfaction;
• the three keynote speakers, Hillery Hunter (IBM), Monica Lam (Stanford), and Pradeep Dubey (Intel);
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I hope you will enjoy ISCA 2021’s technical program!

Yours sincerely,

Lizy Kurian John, The University of Texas at Austin
ISCA 2021 Program Chair