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MobiCom'19

Proceedings of the 25th Annual International Conference on
Mobile Computing and Networking

Sponsored by:

ACM SIGMobile



Association for
Computing Machinery

Advancing Computing as a Science & Profession

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Message from ACM MobiCom 2019 General Co-Chairs and Vice General Chair

It is our great pleasure to welcome you to the proceedings of *ACM MobiCom 2019, the International Conference on Mobile Computing and Networking*, the twenty-fifth edition in a series of annual conferences sponsored by ACM SIGMOBILE. The conference is being held in Los Cabos, Mexico, from October 21 to October 25, 2019. This is the first time that this highly selective and premier conference, or any ACM SIGMOBILE conference or workshop, has been held in Mexico. This is also the first time that it has been held in an all-inclusive resort. Being the silver jubilee anniversary of the conference, we wanted to hold it in a special venue where attendees could celebrate and form deeper connections with each other and the work that they do.

ACM MobiCom 2019 includes two keynote talks, a Test of Time Award talk, regular paper sessions with 55 paper talks, which is more than ever before, seven workshops, four tutorials on current and exciting topics by field experts, and a poster and demo session that includes the ACM Student Research Competition.

The ACM MobiCom 2019 program keynotes are given by world experts working in very impactful fields that have not been core to MobiCom, but we predict will have great influence on our work in the future. The ACM MobiCom 2019 organizing committee thanks the Keynote speakers – Professors Maja Mataric (University of Southern California) and Carlos Guestrin (University of Washington and Apple).

The ACM MobiCom 2019 organizing committee is composed of a strong mix of 28 industry and academic researchers with diverse backgrounds. Through their efforts, a stellar technical program has been put together for this year’s conference. We are thankful to the TPC co-chairs, Professors Shyam Gollakota (University of Washington) and Xinyu Zhang (University of California, San Diego). Thanks to their efforts, the ACM MobiCom 2019 technical program includes 55 regular papers – the most ever – on diverse and exciting topics in mobile communications.

We express our sincere appreciation to the workshops co-chairs, Professors Rajesh Balan (Singapore Management University) and Yingying (Jennifer) Chen (Rutgers University) for selecting a fantastic lineup of seven workshops and four tutorials.

We thank the posters co-chairs, Shubham Jain (Old Dominion University) and Morgan Vigil-Hayes (Northern Arizona University) and our demo co-chairs, Tarun Bansal (Google) and Xia Zhou (Dartmouth College) for selecting 29 posters and 19 demos, respectively. Out of them, 22 posters and 9 demos have qualified for the next round in the Student Research Competition (SRC). We thank the SRC chair Vaishnavi Ranganathan (Microsoft) for chairing the important event.

Our thanks to the finance chair, Eric Rozner (University of Colorado Boulder), who spent a lot of time developing the conference budget, publicity co-chairs Robert LiKamWa (Arizona State University), Youngki Lee (Seoul National University), Ella Peltonen (University of Oulu), and David Ramirez (Princeton University).

Our sincere thanks to the celebrations chair, Giovanni Pau (Sorbonne Université - LIP6), for planning a variety of activities for the twenty-fifth anniversary of the conference, to the sponsorship chair, Eduardo Cuervo (Oculus), for fundraising, to our video co-chairs, Kenny Choo (Singapore Management University) and Yunxin Liu (Microsoft), to our student travel grant co-chairs, Aarathi Prasad (Skidmore College) and Bhuvana Krishnaswamy (University of Wisconsin-Madison), to our MobiJob event chair, Aaron Schulman (University of California, San Diego), and to our N2Women chair, Mariya Zheleva (University of Albany – SUNY).

We would also like to thank our publications chair, Ali Razeen (University of British Columbia), formerly the local arrangements chair, who took on this role when we opted to hold the conference in Mexico instead of Vancouver. He worked closely with several organizing committee members, ACM and Sheridan Printing Services to provide high-quality ACM MobiCom 2019 proceedings. And we would like to thank our registration chair, Yuanchao Shu (Microsoft), who greatly facilitated coordinating registrations and the conference hotel's all-inclusive room reservations.

We would like to thank our web chair, Justin Chan (University of Washington), who completely redesigned the MobiCom website to be much more visually appealing and to support browsing on mobile devices. Finally, we would like to thank Shubham Jain (Old Dominion University) and Mariya Zheleva (University of Albany – SUNY) for piloting the Mentorship Program with the goal of enabling SIGMOBILE student members to interact more with senior researchers.

The conference is extremely grateful to the industrial and nonprofit sponsors. Our thanks go to SIGMOBILE and NSF for providing generous financial support, including travel grants for students attending the conference. We give special thanks to this year's Gold Sponsor (Microsoft), Silver Sponsor (Google), Bronze Sponsors (Facebook, HP, Intel) and Sponsor (NEC Labs). We also thank Facebook for sponsoring the N2Women event at ACM MobiCom 2019, and to Microsoft for sponsoring the ACM Student Research Competition.

We appreciate the support received from the management and staff of the Paradisus Hotel, Los Cabos, for providing top-notch facilities for the ACM MobiCom 2019 conference; from Paty Mata and her colleagues at Tropical Incentives for their help setting up activities and transportation; from John Otero at the ACM for helping us to obtain bids from hotels and to finalize a hotel contract; and from Lisa M. Tolles and her colleagues at Sheridan Communications, USA, for their efforts to assemble and deliver our ACM MobiCom 2019 proceedings.

No conference can be successful without the energy and enthusiasm of the volunteers. We are thankful to the volunteers of ACM MobiCom 2019 who signed up to support us for the five-day conference.

We are pleased to present you with the very special twenty-fifth anniversary publication of ACM MobiCom.

Sharad Agarwal

MobiCom'19 General Co-Chair
Microsoft

Ben Greenstein

MobiCom'19 General Co-Chair
Google

Aruna Balasubramanian

MobiCom'19 Vice General Chair
Stonybrook University

Technical Program Committee Chairs' Welcome

Welcome to ACM MobiCom '19, the 25th Annual International Conference on Mobile Computing and Networking. MobiCom is the premier forum for cutting-edge research in mobile systems and wireless networks. The technical program this year features 55 papers covering a wide range of topics, including automotive and robotic systems, mobile deep learning, mobile interaction, low power wireless design, wireless sensing, wireless multimedia, mobile security and privacy as well as new topics for MobiCom such as computational health.

This year, for the first time, MobiCom adopted a two-deadline model and added a one-shot revision process to enhance the timeliness and quality of the scientific results from the research community. We solicited two rounds of submissions, with deadlines on Aug. 7, 2018, and Mar. 18, 2019, respectively. Each paper went through the same rigorous reviewing process as in previous MobiCom conferences. But apart from accept/reject, a small number of papers were given the one-shot-revision option. Such papers were allowed to be resubmitted for the next deadline, while addressing specific reviewer comments. We are pleased to report evidence that the two-deadline model is effective for the healthy growth of our research community: In total, MobiCom'19 attracted 290 papers across the two rounds of submissions, approximately 50% more than MobiCom'17 and MobiCom'18. Given the larger pool of submitted papers to choose from, we believe we have also raised the bar of selectivity and quality for accepted papers. Papers accepted in each round were posted immediately on the MobiCom'19 website, effectively shortening the publication cycle to half a year.

Each paper was reviewed by 3 to 4 TPC members, and the top papers advanced to the second phase. Review scores, in addition to reviewer confidence and normalization with respect to other papers by the same reviewer, were considered in the selection process. In the second phase, each paper was reviewed by 2 to 4 additional reviewers. Afterwards, the reviewers participated in an online discussion phase to come to an agreement on whether to promote the paper to discussion at the in-person PC meeting. We held two PC meetings corresponding to the two rounds of submissions: a one-day meeting held on the University of California San Diego campus on Oct. 12, 2018, and a two-day meeting on the University of Washington campus on May 16-17, 2019. Each PC meeting decided on the top papers to be conditionally accepted. Each of such papers was assigned a shepherd---a PC member who served as a reviewer and participated in the in-person PC meeting. The shepherds supervised the authors to address the review comments and they approved the final versions for publication. The shepherding process remained double blind in the winter round. 25 of the 104 submissions in the summer round were accepted. 32 of the 186 submissions in the winter round made it to the shepherding phase; of these 30 eventually were accepted after shepherding. After the papers were accepted, a best paper award committee was set up and independently run by Suman Banerjee, without the TPC chairs' involvement in the selection of the committee members.

The MobiCom'19 TPC consists of 70 members with diverse backgrounds. Besides research expertise, the TPC selection also took into account gender, seniority, institution, country, expertise, and academic or industrial background. The TPC include researchers from 11 countries: Canada, China, Finland, India, Italy, Singapore, South Korea, Spain, Switzerland, UK, and US. Around 21% of the TPC were female. The TPC also had broad industry participation, with members from Alibaba, Apple, Cisco, Google, Microsoft, and NEC.

The establishment of the MobiCom'19 technical program involves substantial team effort. As TPC co-chairs, we would like to express our sincere gratitude to everyone who made it possible. We

thank all the authors who submitted their great research work to MobiCom'19. We are extremely grateful to all the TPC members, who dedicated their time and efforts in ensuring fair and quality reviews, within a shorter review cycle and under a heavier workload than previous years. We thank Suman Banerjee for running the best paper award committee. We also want to thank the entire MobiCom'19 organizing committee, especially our General Co-Chairs, Sharad Agarwal and Ben Greenstein, for their support and effort behind the scenes. Last but not least, we extend our thanks to the MobiCom Steering Committee. We appreciate their guidance and wisdom, and their support for us to experiment with the new two-deadline model.

We hope that the program can provide you exciting and thought-provoking research ideas, and that it will inspire you to break new grounds in the area of mobile computing and networking!

Shyam Gollakota

MobiCom'19 TPC Co-Chair

University of Washington, USA

Xinyu Zhang

MobiCom'19 TPC Co-Chair

University of California San Diego, USA

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