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Editors

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2020 20th IEEE/ACM International Symposium on Cluster, Cloud and Internet Computing (CCGRID) **CCGrid 2020**

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Message from the General Chair

I am delighted to chair and host the 20th IEEE/ACM International Symposium on Cluster, Cloud, and Internet Computing (CCGrid 2020) sponsored by the IEEE Computer Society, IEEE Technical Committee on Scalable Computing (TCSC), and the Association for Computing Machinery (ACM) in Melbourne, Australia.

Tremendous advances in network-driven computing, communication, storage, and systems/middleware technologies are leading to new paradigms and platforms, ranging from computing clusters to widely distributed Clouds and emerging Internet computing paradigms such as Fog/Edge Computing for the Internet of Things (IoT)/Big Data applications. CCGrid is a series of very successful conference with the overarching goal of bringing together international researchers, developers, and users and to provide an international forum to present leading research activities and results on a broad range of topics related to these platforms and paradigms and their applications. The conference features keynotes, technical presentations, posters, workshops, tutorials, as well as the SCALE challenge featuring live demonstrations and the IC FEC 2020 conference.

CCGrid is an important conference for the international community as it provides a forum for all cluster, cloud, and Internet computing researchers, developers, and users, and those who are just curious to see the project results and become aware of the progress made in these areas. The inaugural CCGrid conference was held in Brisbane, Australia in 2001. Since then, the conference has successfully been hosted around the world and has emerged as a truly global event. From 2002 to 2019, CCGrid annual events were held in Germany, Japan, the USA, UK, Singapore, Brazil, France, China, Australia, USA, Canada, Colombia, Spain, USA, and Cyprus. Returning to its originating country, we are honoured to host the 20th anniversary of the CCGrid conference in Melbourne, Australia.

CCGrid has been featuring original and outstanding research work in Cluster, Cloud, and Internet Computing. In fact, many emerging research trends and associated publications are featured “first” in CCGrid and their follow-up papers have appeared in other conferences later. This demonstrates the emergence of CCGrid as a “first” class venue for presenting original and ground-breaking works. For instance, CCGrid has been featuring various Internet computing paradigms actively during the last few years. At the same time, submissions for the Grid computing area have drastically declined. Hence, from 2020, we explicitly recognized this growing trend in CCGrid by including “Internet computing” in the conference title to embrace all emerging/new Internet-driven computing paradigms.

This 20th anniversary, CCGrid 2020 conference offers an outstanding technical program featuring keynote talks, tutorials, workshops, mini-symposiums, posters sessions, industry track, research exhibits and demos, and IEEE SCALE competition. CCGrid has been extremely fortunate to serve as a venue for presentation of prestigious “IEEE Medal/Award for Excellence in Scalable Computing” award offered annually by the IEEE Technical Committee on Scalable Computing. We are fortunate to host three keynote speakers drawn from Australia, USA, and Europe. Our Australian-originated keynote speaker, Professor John Grundy, is a Laureate Fellowship recipient from Australian Research Council.

The continued success and leadership of CCGrid requires dedicated and high-quality efforts from several international leaders and volunteers. As the Chair of CCGrid conference series and General Chair of this year’s event, I would like to express my sincere gratitude to the members of the Steering Committee and the Program Committee co-chaired by Professor Carlos A Varela and Laurent Lefevre. The Program Committee Co-Chairs and his Vice chairs

have coordinated peer-reviews of all submitted “full” papers and selected top-quality research papers for presentation at the conference. The CCGrid 2020 conference received 234 submissions (full papers) from 810 co-authors from 45 countries around the world: United States, China, Australia, France, India, Brazil, Spain, Canada, Germany, Japan, South Korea, Italy, United Kingdom, New Zealand, Israel, Poland, Sweden, Greece, Hungary, Norway, Portugal, Singapore, Hong Kong, Iran, Netherlands, Pakistan, Slovenia, Belgium, Finland, Indonesia, Austria, Saudi Arabia, Senegal, Taiwan, Denmark, Estonia, Switzerland, Thailand, Algeria, Ireland, North Korea, Mexico, Slovakia, Tunisia, and Vietnam. After peer-review of all submitted “full” papers, the Program Committee accepted 66 papers, resulting in an acceptance rate of 28%.

I thank George Pallis for coordinating the organisation of satellite workshops/mini-symposiums on hot topics such as Secure Mobile Cloud Computing, Network-Aware Big Data Computing (NEAC), and High-Performance Machine Learning. We appreciate the efforts of the chairs of various workshops and their PC members for attracting and selecting top-quality papers for presentation at the conference. I appreciate dedicated efforts of Doctoral Symposium Chairs (Anne-Cecile Orgerie and Ivan Rodero), Industry Chair (Rajeev Muralidhar), and Research/Product Demonstrations Chairs (Rodrigo Calheiros and Deepak Puthal).

I thank Hari Subramoni and Joanna Kolodziej for organising and managing the poster session, Mohammad Goudarzi for the excellent management of the conference website, and publicity coordinators, Jithin Jose, Stefan Schulte, Bahman Javadi, Mohsen Amini, Ching-Hsien Hsu, Carlos Westphall, and Minxian Xu, for helping us reach a broader community. I thank SCALE Challenge chairs, Yogesh Simmhan and Daniel S. Katz, and all other chairs for their efforts in enhancing the conference program with interesting demos. I thank Adel Toosi and Lisa O’Conner for their support in ensuring the publication of the conference proceedings in record time. I thank Laurence Yang for managing TCSC sponsorship and the best paper awards.

I would like to offer my special appreciation to leading volunteers of the local organizing committee, led by Shashikant Ilager and Mohammad Goudarzi, for their dedicated services. I would like to thank Marie Trinh for managing registrations and Tricia Yamaguchi for her friendly services in finalising various contracts and budgets as an IEEE representative. Thanks are also due to our sponsors, namely, IEEE, ACM, and TCSC and organization supporters Melbourne’s CLOUDS Lab.

One of the key benefits of a conference is the networking opportunities provided especially for early-career community members: PhD students get to give a talk and be nominated to post-doctoral and faculty positions, junior tenure-track faculty get to meet senior faculty who can later write recommendation letters for tenure/promotion, PIs discuss future grants and collaboration, etc. Furthermore, sessions enable paper authors of similar directions to exchange ideas in ways that virtual meetings truly lack. Coffee breaks, meals, social events, elevator speeches, birds-of-a-feather sessions are where most interaction happens.

The safety and well-being of all conference participants is our priority. After evaluating the current COVID-19 situation, the conference leadership decided to postpone the physical meeting of CCGrid 2020 to 2021 (May). That is, all accepted papers and programs of CCGrid 2020 will be presented jointly with CCGrid 2021 program. However, this decision does not impact the publication of CCGrid 2020 accepted papers as we are publishing the Proceedings as per the original date. Thus, ensuring that innovative research contributions of CCGrid 2020 authors are disseminated in a timely manner in 2020 itself!

We (PC Chairs, Tricia Yamaguchi of IEEE Computer Society Event Sourcing & Contracting Specialist, and I on exploring various options) decided that given the uncertainties associated with the Covid-19 pandemic, it would be in the best interest of authors to postpone the conference but still hold it physically. In this way, social interaction is not undermined, particularly given the worldwide audience we have and the difficulty of even finding a time zone that would work for everyone or even the majority. While we initially postponed it to November 2020, it became clearer that it is not obvious whether we can still do it in that timeframe. So, we decided that we would merge presentations with 2021 which will be again hosted in Melbourne. Of course, we are taking risks: (1) will we be able to have the 2021 conference physically?, (2) is the work presented one year later going to be stale?, and (3) will there be people unwilling/unable to travel in 2021?

It was not an easy decision, but putting all the pros and cons, we decided it would be best to co-locate CCGrid 2020 and CCGrid 2021, and have one big celebration of the first two decades of the conference in Australia, its birthplace. The proceedings is published in May 2020 as per the original plan, and therefore, the accepted articles can still be timely read and referenced.

Ultimately, the success of the conference will be judged by how well the delegates have participated, learnt, interacted, and established contacts with other researchers in different fields. The Committees and the sponsors have provided the funding, the venue, and the environment to allow these objectives to be achieved. It is now up to all of us to ensure that the conference is an outstanding success. Finally, I wish everyone a successful, stimulating, and rewarding meeting and look forward to seeing you all CCGrid 2020 registered participants in Melbourne in May 2021 along with new delegates of CCGrid 2021. Please plan to join, enjoy your visit to multicultural Melbourne and beautiful Australia!

Thank you for your cooperation, understanding, and support.



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Message from the Program Chairs

The 20th IEEE/ACM International Symposium on Cluster, Cloud, and Internet Computing (CCGrid 2020) program contains 66 high-quality technical papers selected from 234 submissions from 48 different countries (28.2% acceptance rate). The great majority of papers received three or more reviews, and we ensured that all borderline papers received at least three reviews and were discussed electronically by the Program Committee before deciding on acceptance or rejection.

Peer review reports of program committee members and their quality rating on papers have guided in the selection of best quality papers. We had no target on acceptance rate for any of topics; and all accepted papers were based on their peer review quality report. We end up observing the following statistics of each topic:

Topic	Submitted	Accepted	PC Members
Sustainable and Green Computing	19	8	35
Storage and I/O Systems	21	9	58
Cyber-Security and Privacy	25	8	40
Programming Models and Runtime Systems	25	10	76
Architecture, Networking, Data Centers	41	8	60
Performance Modelling and Evaluation	45	14	67
Internet Computing Frontiers: Edge, Fog, Serverless, Lambda, Streaming, etc.	60	14	75
Applications: Data Science, Artificial Intelligence, Cyber-Physical Systems, etc.	66	13	67
Resource Management and Scheduling	87	22	101

This high-quality program has been possible due to the hard work of 249 Program Committee members and Program Vice-Chairs of the various topics noted below:

- Internet Computing Frontiers: Edge, Fog, Serverless, Lambda, Streaming: **Stacy Patterson** (RPI, USA) and **Satish Srirama** (University of Tartu, Estonia)
- Architecture, Networking, Data Centers: **Shadi Ibrahim** (INRIA, France) and **Nageswara Rao** (Oak Ridge National Lab, USA)
- Storage, and I/O Systems: **Suren Byna** (Lawrence Berkeley National Lab, USA) and **Gregory Chockler** (U London, UK)
- Programming Models and Runtime Systems: **Gul Agha** (UIUC, USA) and **Hélène Coullon** (IMT&Inria, France)
- Scheduling and Resource Management: **Ivona Brandić** (Vienna U of Technology, Austria), **Shikharesh Majumdar** (Carleton University, Canada) and **Rizos Sakellariou** (U Manchester, UK)
- Performance Modeling and Evaluation: **Pavan Balaji** (Argonne Nat Lab, USA) and **Marco Netto** (IBM Research, Brazil)
- Cyber-Security and Privacy: **Richard Sinnott** (U. Melbourne, Australia)
- Sustainable and Green Computing: **Wu Feng** (Virginia Tech, USA) and **Young Choon Lee** (Macquarie U., Australia)
- Applications: Data Science, Artificial Intelligence, Cyber-Physical Systems: **Travis Desell** (Rochester Inst of Tech, USA), **Rajiv Ranjan** (University of Newcastle, UK) and **Lizhe Wang** (Chinese Academy of Sciences, China)

We also are indebted to the additional reviewers who volunteered their time and effort to make this the best possible CCGrid technical program. We also want to especially thank Rajkumar Buyya, the CCGrid 2020 General Chair for his never-ending guidance. Last but not least, we want to thank the technical paper authors for submitting their research results and presenting them to the CCGrid community. Without their work, this conference would not have been possible.

We have selected three papers receiving the highest quality ratings for their contributions and recommendations of program committee and vice chairs for the **best papers awards** as follows:

- First prize: "NFV Placement in Resource-Scarce Edge Nodes", Yaron Fairstein, Dor Harris, Joseph Naor and Danny Raz (Technion - Israel Institute of Technology, Israel)
- Second prize: "A Data-Driven Frequency Scaling Approach for Deadline-Aware Energy Efficient Scheduling on Graphics Processing Units (GPUs)", Shashikant Ilager, Rajeev Muralidhar, Kotagiri Rammohanrao and Rajkumar Buyya (The University of Melbourne, Australia)
- Third prize: "A Pattern-Based API for Mapping Applications to a Hierarchy of Multi-core Devices", Jia Guo, Radu Teodorescu (The Ohio State University, USA), and Gagan Agrawal (The Augusta University, USA)

Due to the pandemic situation imposed by the Coronavirus, we had to postpone the CCGrid 2020 conference. But this will not stop the CCGrid dynamism and we will lively celebrate later the 20th CCGrid conference. And now, it is your time to enjoy the CCGrid 2020 accepted publications!



Laurent Lefevre
Inria, ENS Lyon, France



Carlos A. Varela
Rensselaer Polytechnic Institute, USA

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CCGrid 2020 Workshops and Organising Chairs

1. The First International Workshop on Secure Mobile Cloud Computing (IWSeMC-20)

- Joanna Kolodziej, *NASK/ Cracow University of Technology, Warsaw, Poland*
- Martin Gilje Jaatun, *SINTEF Digital / University of Stavanger, Trondheim, Norway*

2. The 3rd High Performance Machine Learning Workshop (HPML 2020)

- Eduardo Rocha Rodrigues, *IBM Research*
- Jairo Panetta, *Instituto Tecnológico de Aeronautica, ITA, Brazil*
- Bruno Raffin, *INRIA, France*
- Abhishek Gupta, *Schlumberger, USA*
- Leonardo Bautista Gomez, *Barcelona Supercomputing Center, Spain*
- Marco Netto, *IBM Research, Brazil*

3. The 1st Workshop on Secure IoT, Edge and Cloud systems (SIoTEC) 2020

- Massimo Villari, *University of Messina, Italy*
- Javid Taheri, *Karlstad University, Sweden*
- Maria Fazio, *University of Messina, Italy*
- Giuseppe Di Modica, *University of Bologna, Bologna*
- Antonino Galletta, *University of Messina, Italy*

4. The 5th International Workshop on Emerging Computing Paradigms and Context in Business Process Management (CCBPM 2020)

- Yun Yang, *Swinburne University of Technology*
- Xuejun Li, *Anhui University*
- Dong Yuan, *University of Sydney*

5. The 2nd IEEE/ACM International Workshop on Network-Aware Big Data Computing (NEAC'20)

- Long Cheng, *Dublin City University, Ireland*
- John Murphy, *University College Dublin, Ireland*
- Zhiming Zhao, *University of Amsterdam, Netherlands*