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Xing Fan · Bronis R. de Supinski ·  
Oliver Sinnen · Nasser Giacaman (Eds.)

# OpenMP: Conquering the Full Hardware Spectrum

15th International Workshop on OpenMP, IWOMP 2019  
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Proceedings

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# Preface

OpenMP is a widely used application programming interface (API) for high-level shared-memory parallel programming in Fortran, C, and C++. Since its introduction in 1997, OpenMP has gained support from most high-performance compiler and hardware vendors. With the recent release of OpenMP specification version 5.0 by the OpenMP Architecture Review Board (ARB) in November 2018, OpenMP added several major new features that enhance portability of its applications and tools, and extend its support for heterogeneous systems and task-based parallelism. Major new features in OpenMP include: context selectors, the metadirectives, and the declare variant construct that use them; the requires directive; memory allocators and support for deep copy of pointer-based data structures; the descriptive loop construct; and first and third-party tools interfaces. OpenMP 5.0 also significantly enhances many existing features, such as by providing implicit declare target semantics and support for task reductions. As its additions (big and small) reflect the requests of the OpenMP user community, OpenMP 5.0 provides multi-language high-level parallelism that is performant, productive, and portable for the entire hardware spectrum from embedded and accelerator devices to multicore shared-memory systems.

OpenMP is important both as a stand-alone parallel programming model and as part of a hybrid programming model for massively parallel, distributed memory systems built from multicore, manycore, and heterogeneous node architectures. As most of the increased parallelism in the exascale systems is expected to be within a node, OpenMP will become even more widely used in these top end systems. Importantly, the features in OpenMP 5.0 support applications on such systems in addition to facilitating portable exploitation of specific system attributes.

The evolution of the specification would be impossible without active research in OpenMP compilers, runtime systems, tools, and environments. The many additions in OpenMP 5.0 reflect the vibrant research community that surrounds it. As we look towards the continued evolution of the language, that research community will continue to have a central role. The papers in this volume demonstrate that while OpenMP 5.0 will significantly enhance user experiences on a wide range of systems, the research community will offer ample potential directions for further improvements.

The community of OpenMP researchers and developers is united under the cOMPunity organization. This organization has held workshops on OpenMP around the world since 1999: the European Workshop on OpenMP (EWOMP), the North American Workshop on OpenMP Applications and Tools (WOMPAT), and the Asian Workshop on OpenMP Experiences and Implementation (WOMPEI) attracted annual audiences from academia and industry. The International Workshop on OpenMP (IWOMP) consolidated these three workshop series into a single annual international event that rotates across Europe, Asia-Pacific, and the Americas. The first IWOMP workshop was organized under the auspices of cOMPunity. Since that workshop, the IWOMP Steering Committee has organized these events and guided development

of the series. The first IWOMP meeting was held in 2005, in Eugene, Oregon, USA. Since then, meetings have been held each year, in Reims, France; Beijing, China; West Lafayette, USA; Dresden, Germany; Tsukuba, Japan; Chicago, USA; Rome, Italy; Canberra, Australia; Salvador, Brazil; Aachen, Germany; Nara, Japan; Stony Brook, USA; and Barcelona, Spain. Each workshop has drawn participants from research and industry throughout the world. IWOMP 2019 continues the series with technical papers and tutorials. The IWOMP meetings have been successful in large part due to generous support from numerous sponsors.

The IWOMP website ([www.iwomp.org](http://www.iwomp.org)) provides information on the latest event, as well as links to websites from previous years' events. This book contains proceedings of IWOMP 2019. The workshop program included 22 technical papers, 2 keynote talks, and a tutorial on OpenMP. The paper "OMPSan: Static Verification of OpenMP's Data Mapping Constructs," by Prithayan Barua, Jun Shirako, Whitney Tsang, Jeeva Paudel, Wang Chen, and Vivek Sarkar was selected for the Best Paper Award. All technical papers were peer reviewed by at least three different members of the Program Committee.

September 2019

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