Future of OpenMP API
Technical and Organizational Update

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The webinar will start shortly after the top of the hour. Stay tuned!
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OpenMP Architecture Review Board

The mission of the OpenMP ARB (Architecture Review Board) is to standardize directive-based multi-language high-level parallelism that is performant, productive and portable.

The OpenMP API moves common (domain) approaches into an industry standard.
OpenMP has a well-defined roadmap:

- 5-year cadence for major releases
- One minor release in between
- OpenMP 5.2 was added as a second minor release before OpenMP version 6.0
- (At least) one Technical Report (TR) with feature previews in every year

* Numbers assigned to TRs may change if additional TRs are released.
Development Process of the Specification

- Modifications to the OpenMP specification follow a (strict) process:

  - Proposal
  - Impl. in LaTeX
  - 1st vote
  - 2nd vote
  - Verification
  - Merge to "mainline"

- Release process for specifications:

  - Draft
  - Editing
  - Comment Draft
  - Quality Control
  - Final Draft
  - ARB Approval
OpenMP Version 5.0

- New powerful features to improve programmability

- Task Reductions
- Memory Allocators
- Detachable Tasks
- C++14 and C++17 support
- Dependence Objects
- Tools APIs
- Fortran 2008 support
- Unified Shared Memory
- Improved affinity support
- Collapse non-rect. Loops
- Loop Construct
- Data Serialization for Offload
- Multi-level Parallelism
- “Reverse Offloading”
- Task-to-data Affinity
- Function Variants
- Parallel Scan
- Meta-directives
- Improved Task Dependences
OpenMP Version 5.1

- Even more new powerful features to improve programmability

- C++ attribute specifiers
- Detachable Tasks
- C++14 and C++17 support
- Dependence Objects
- C++20 support
- Tools APIs
- Improved affinity support
- Unified Shared Memory
- interop Directive
- Fortran 2008 support
- Task Reductions
- Assume Directive
- Loop Construct
- Collapsing non-rect. Loops
- multi-level Parallelism
- “Reverse Offloading”
- Task-to-data Affinity
- Meta-directives
- Data Serialization for Offload
- Loop-Transformation Directives
- Improved Task Dependences
- dispatch Directive
- Managed Task Groups
- Masked Directive
OpenMP Version 5.2 is Coming Soon

- Will be released in November 2021, comment draft much sooner
- Will improve specification of OpenMP syntax
  - Ensuring syntax of directives and clauses is well-specified and consistent
  - Ensuring restrictions are consistent and not just implied by syntax
  - Deprecating one-off syntax choices and other inconsistencies
  - Makes C++ attribute syntax a first-class citizen
- Automating generation of large portions of specification
  - Section headers and directive and clause formats
  - Cross references and more?
- Many other many minor improvements
- Regularization of format specifications will eventually support generation of grammar and quick reference guides directly from specification
OpenMP Version 6.0 and Beyond

- Removal of features that were deprecated in 5.0, 5.1 or 5.2
- Continued improvements to device support
  - True support for using multiple devices
  - Extensions of deep copy support (serialize/deserialize functions)
- More support for memory affinity and complex hierarchies
- Task-only or free-agent threads
- Spawning tasks for other teams (event-driven parallelism and more)
- Deeper support for descriptive and prescriptive control
- Support for pipelining, other computation/data associations; data-flow?
OpenMP API Specification

- PDF and HTML available at https://www.openmp.org/specifications/

- You can also save your printer ink and get the full specification as a paperback book!
  - Always have the spec in easy reach.
  - Includes the entire specification with the same pagination and line numbers as the PDF.
  - Available at a near-wholesale price.
  - Get yours at Amazon at https://link.openmp.org/book51
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## Membership Structure

<table>
<thead>
<tr>
<th>Role</th>
<th>Privileges</th>
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| ARB Member                    | - Highest membership category  
|                               |   - Participation in technical discussions and organizational decisions  
|                               |   - Voting rights: organizational topics  
|                               |   - Voting rights: technical topics (tickets, TRs, specs)  |
| ARB Advisor & ARB Contributor | - Contribute to technical discussions  
|                               | - Voting rights: technical topics (tickets, TRs, specs)  |

Your organization can join and influence the direction of OpenMP. Interested? Contact me at ceo@openmp.org.
Community Interaction

Check out www.openmp.org/news/events-calendar/
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Summary

- The OpenMP API versions 5.0 and 5.1 were a major leap forward
- The OpenMP API version 5.2 will improve quality of specification
- The OpenMP API versions 6.0 and later will add significant features
- OpenMP is a modern directive-based programming model
  - Multi-level parallelism supported (coprocessors, threads, SIMD)
  - Task-based programming model is the modern approach to parallelism
  - Powerful language features for complex algorithms
  - High-level access to parallelism; path forward to highly efficient programming
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