

OpenMP 4.0 and Beyond

Tuesday, November 19, 2013

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LLNL-PRES-645964

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OpenMP 4.0 ratified July 2013

- End of a long road? A brief stop along the way...
- Addresses several major open issues for OpenMP
- Did not break existing code (unnecessarily?)
- Includes 106 passed tickets
 - Focused on major tickets initially
 - Builds on two comment drafts (“RC1” and “RC2”)
 - Many small tickets after RC2, a few large ones
- Already starting work on OpenMP 4.1 and 5.0

Overview of major 4.0 additions

- Device constructs
- SIMD constructs
- Cancellation
- Task dependences and task groups
- Thread affinity control
- User-defined reductions
- Initial support for Fortran 2003
- Support for array sections (including in C and C++)
- Sequentially consistent atomics
- Display of initial OpenMP internal control variables

Plan for OpenMP specifications

- OpenMP Examples: A separate document
- OpenMP 4.1
 - Clarifications and errata to existing specification
 - Refinements and minor extensions
 - Do not break existing code
 - Minimal implementation burden beyond 4.0
 - Time frame is TBD but targeting \leq two years
- OpenMP 5.0
 - Address several major open issues for OpenMP
 - Expect less significant advance than 4.0 from 3.1/3.0
 - Do not break existing code unnecessarily
 - Time frame is TBD

OpenMP 4.1 will include many refinements to recent additions

- Many clarifications and minor enhancements
 - SIMD extensions
 - Reductions for C/C++ arrays and templates
 - Runtime routines to support cancelation
- Initial support for memory affinity
- Interoperability with Pthreads
- Tasking and stand-alone reductions
- Some new features are also being considered
 - Support for DOACROSS loops
 - Unroll, block and tile

Refinements to device constructs are the most significant 4.1 plans

- Refinements of combined clauses
 - Addition of even more combined constructs
 - Specifying overlapping clauses on combined constructs
- Asynchronous work queues
- Unstructured data movement
- Link clause/linkable support
- Multiple device types
- Deep copy/map/serialization for map
- Update for map even if present
- Providing device-specific environment variables

OpenMP 4.0 includes initial support for Fortran 2003

- Added to list of base language versions
- Have a list of unsupported Fortran 2003 features
 - List initially included 24 items (some big, some small)
 - List has been reduced to 14 items
 - List in specification reflects approximate OpenMP 4.1 priority
 - Priorities determined by importance and difficulty
- Plan: Reduce list to provide full support in 4.1
 - Many small changes throughout; Support:
 - Procedure pointers
 - Renaming operators on the `USE` statement
 - `ASSOCIATE` construct
 - `VOLATILE` attribute
 - Structure constructors
 - Will support Fortran 2003 object-oriented features next
 - The biggest issue
 - Considering concurrent reexamination of C++ support

More significant topics are being considered for OpenMP 5.0

- More tasking advances (support for event loops)
- General error model
- Continued improvements to device support
- Performance and debugging tools support
- Interoperability and composability
- Locality and affinity
- Transactional memory
- Additional looping constructs and refinements
- Help us shape the future of OpenMP
 - Attend IWOMP, become a cOMPunity member
 - Lobby your institution to join the OpenMP ARB

