

TOOL SUITE FOR MPI DEVELOPERS ON HIGH-PERFORMANCE CLUSTERS

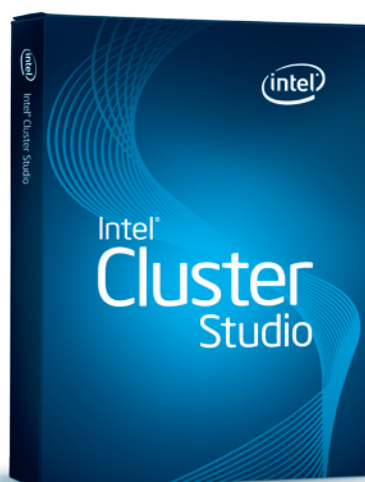
Intel® Cluster Studio 2011

For Linux* and Windows*

Product Brief

Intel® Cluster Studio 2011

For Linux* OS and Windows* OS



“We’re delighted by the efforts of the Intel cluster tools team in helping us scale our applications to 10s of thousands of cores with Intel® MPI Library 4.0. Intel is again raising the performance bar in providing us with the most scalable commercial MPI library for Intel architecture based processors.”

*Dr. Daniel Gruner
CTO- Software
SciNet High Performance
Computing Consortium, Canada*

Setting a new standard in performance and scalability for HPC cluster computing

Intel® Cluster Studio 2011 sets a new standard in distributed performance on Intel® Architecture (IA)-based clusters. This premier tool suite provides development flexibility for enabling MPI-based application performance for highly parallel shared-memory and cluster systems based on Intel® IA-32 and Intel® 64 architectures.

The newly re-architected Intel® MPI Library 4.0 Update 1 is key to achieving these advantages by providing new levels of cluster scalability, improved interconnect support across many fabrics, faster on-node messaging, support for hybrid parallelization, and an application tuning capability that adjusts to the cluster and application structure.

For the developer, Intel® Trace Analyzer and Collector 8.0 Upgrade 1 is enhanced with new features that accelerate the analysis and tuning cycle of MPI-based cluster applications. The suite is complemented with the latest Intel® C/C++ and Fortran Compiler XE 12.0 technology along with Intel® Math Kernel Library (Intel® MKL) 10.3, Intel® Integrated Performance Primitives (Intel® IPP) 7.0. New in this package is the availability of threading technologies in Intel® Parallel Building Blocks (Intel® PBB). This includes multiple threading mechanisms for task, data, and vector parallelism, Intel® Cilk Plus, Intel® Threading Building Blocks, and Intel® Array Building Blocks (in beta, available separately). This helps to further optimize and parallelize application execution on each computing node of a cluster. The Intel Fortran compiler introduces Co-arrays as part of supporting some key features of the Fortran 2008 standard. Co-Array Fortran (CAF) is supported on HPC clusters in this package. To exploit increasing vector support in IA processors with SSE and Intel® AVX, the compilers include array notation and SIMD pragmas to get higher vectorization efficiencies along with ease of use.

Intel® Parallel Building Blocks

Intel® Cilk Plus
Language extensions to simplify task, data and vector parallelism

Intel® Threading Building Blocks
Widely used C++ template library for data and task parallelism

Intel® Array Building Blocks
Sophisticated C++ library for data and vector parallelism

MIX AND MATCH TO OPTIMIZE YOUR APPLICATION'S PERFORMANCE

Compatible with Microsoft Visual Studio* and GCC*. Supports multiple operating systems and platforms.

Intel® Cluster Ready (Intel® ICR), is a program to define cluster architectures for increasing uptime, increasing productivity, and reducing total cost of ownership (TCO) for IA-based high-performance clusters. Intel has the complete set of tools for HPC cluster development to deployment. Intel Cluster Studio 2011 makes it easy to code, debug, and optimize to gain higher scalability for MPI-based cluster applications. It provides software tools for developing and tuning hybrid-parallel codes, which can mix MPI with multithreading paradigms like OpenMP* or parallel threading technologies in Intel® Parallel Building Blocks (Intel® PBB).

Intel Cluster Studio 2011 provides complete software package containing Intel® C/C++ compilers and Intel® Fortran compilers for Intel IA-32 and Intel® 64 architectures, and the Intel® cluster tools components of Intel Cluster Studio help develop, analyze, and optimize the performance of highly scalable applications on Linux* or Windows* OS. By combining all the compilers and tools into one license package, Intel provides single installation, interoperability, and support for the best-in-class cluster software tools at an incredibly low package price.

Features

Extensive Tool Suite

The Intel Cluster Studio 2011 license provides access and support for the following tools on either Windows or Linux:

- Intel® G++ Composer XE 12.0
- Intel® Fortran Composer XE 12.0
- Intel® MPI Library 4.0 Update 1
- Intel® Trace Analyzer and Collector 8.0 Update 1
- Intel® Math Kernel Library 10.3
- Intel® Integrated Performance Primitives 7.0 Update 1
- Intel® Threading Building Blocks 3.0 Update 3
- Intel® MPI Benchmarks 3.2.2
- Intel® Debugger 12.0 (except with Intel® MPI Library for Windows applications)

Easy Installation and Updates

With a valid product serial number for Intel Cluster Studio 2011, you can register and/or login to the Intel® Software Development Products Registration Center (<https://registrationcenter.intel.com/>) and download the package and updates for one year from the date of purchase.

Featured Products

All the software tools included with Intel Cluster Studio 2011 have undergone a revision to give you the best parallel development and performance analysis tools for cluster software development with MPI. The following list contains just a few of the many new features included in this latest version:

Intel® Composer XE 2011

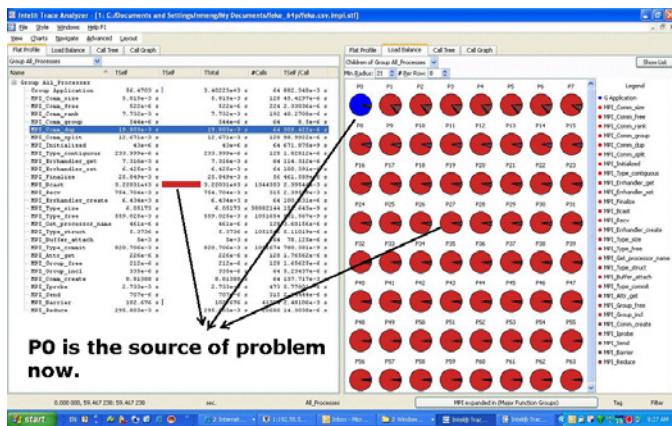
Multicore Optimizations – Intel® compilers have built-in optimization technologies and multithreading support that help create code that runs best on the latest Intel® multicore processors. Intel® Fortran Compiler XE 12.0 provides support for CAF on clusters as part of its support of key features of Fortran 2008 standard.

Optimize Applications – Intel compilers offer the breadth of advanced optimization, multithreading, and processor support that includes automatic processor dispatch, vectorization, auto-parallelization, data prefetching, and loop unrolling. It is possible to take advantage of hybrid models of parallelism, mixing process, task, data, and vector parallelism with MPI and threading models like OpenMP, Intel Cilk Plus, and Intel TBB methods to boost application performance on clusters made up of two-, four-, and eight-socket multicore nodes, each node being an SMP.

New Features – Additional information on the new features for each of the Intel compilers can be found at: <http://software.intel.com/en-us/intel-compilers/>.

Intel MPI Library 4.0 Update 1

Intel® MPI Library 4.0 update 1 provides new levels of performance and flexibility for applications that execute on clusters of Intel® platforms. The library achieves these advantages by improved interconnect support, faster on-node messaging, and an application-tuning capability that adjusts to the cluster architecture and application structure. This library features multirail InfiniBand* (IB) support, and enhancements to the native IB layer for lower communication latencies. In addition, the library maintains compatibility with previous Intel MPI 3.x versions while providing an enhanced library architecture that will enable interconnect vendors and Intel processors to better expose their future maximum performance and functionality.



Intel Trace Analyzer and Collector 8.0 Update 1

Intel Trace Analyzer and Collector 8.0 Update 1 is enhanced with new features that accelerate the analysis and tuning cycle of MPI-based cluster applications and enables programmers to analyze the effect of advanced interconnects on application performance. The Intel Trace

Feature	Benefit
Support for both Linux* OS and Windows* OS platforms	Development capability with the same set of tools on both Windows* OS and Linux* OS platforms—enhanced performance, productivity, and programmability
C/C++ compilers with Intel® Parallel Building Blocks	Breakthrough in providing choice of parallelism—process, task, data, and vector—for applications, with mix-and-match flexibility for optimizing application performance on clusters of SMP nodes. C/C++ standards support.
Fortran compilers with limited Fortran 2008 standards support, including Co-Array Fortran (CAF) on clusters	Advances in the industry-leading Fortran compilers with new support for scalable parallelism on nodes and clusters. Fortran standards support key features in Fortran 2008, more complete Fortran 2003 standard support.
Analysis tools for MPI developers—load imbalance diagram, ideal interconnect simulator	Enhanced developer productivity and efficiencies by simplifying and speeding the detection of errors and offering performance profiling of MPI messages
Updated performance libraries—Intel® MKL and Intel® IPP	Multicore performance for common math and data processing tasks, including a simple linking with these auto-matically parallel libraries
Scalable Intel® MPI Library with multirail InfiniBand* (IB) support and application tuner	Scale to tens of thousands of cores with one of the most scalable and robust commercial MPI libraries in the industry. Ease-of-use with dynamic and configurable support across multiple cluster fabrics and multirail InfiniBand* (IB) support.

Analyzer and Collector 8.0 Update 1 load imbalance diagram and the ideal interconnect simulator help MPI programmers identify further optimization opportunities.

Intel Math Kernel Library 10.3

Intel Math Kernel Library 10.3 (Intel® MKL 10.3) is a library of highly optimized, extensively threaded math routines for science, engineering, and financial applications that require maximum performance. Core math functions include BLAS, LAPACK, ScaLAPACK, Sparse Solvers, Fast Fourier Transforms, Cluster FFTs, Vector Math, and more. Intel MKL version 10.3 is a revision and offers support for Intel® Advanced Vector Extensions (Intel® AVX), C extensions for LAPACK and PARDISO, Summary Statistics Library, and enhancements to several routines like DGEMM, FFTS, and RNGs. .

Intel MPI Benchmarks 3.2.2

Intel MPI Benchmarks 3.2.2. provides the following:

- Support of large message buffers greater than 2 gigabytes for some MPI collective benchmarks (e.g., Allgather, Alltoall, Gather, and Scatter) so as to support large core counts
- New Intel® MPI Benchmark executable command-line options “-include/-exclude” to better control execution of the benchmarks list. Use these options to include or exclude benchmarks from the default execution list.
- New benchmarks PingPongSpecificSource and PingPingSpecificSource. The exact destination rank is used for these tests instead of MPI_ANY_SOURCE as in the PingPong and PingPing tests. These two tests are not executed by default. Use the “-include” option to enable execution of the new benchmarks.

Support

Every purchase of an Intel® Software Development Product includes one year of support services, which provide access to Intel® Premier Support and all product updates during that time. Intel Premier Support gives you online access to technical notes, application notes, and documentation.

Intel Software Development Products

Intel Software Development Products help you create the fastest software possible by offering a full suite of software tools:

- Intel® Parallel Studio XE 2011—Optimizing C/C++ and Fortran compilers, performance libraries, correctness analyzer, security checking, performance profiler, all in one package

Visit our website at www.intel.com/software/products for details about our entire line of software products.

Try and Buy Intel® Cluster Studio 2011 Today.

<http://software.intel.com/en-us/intel-cluster-studio>

Optimization Notice

Intel® Compiler includes compiler options that optimize for instruction sets that are available in both Intel® and non-Intel microprocessors (for example SIMD instruction sets), but do not optimize equally for non-Intel microprocessors. In addition, certain compiler options for Intel® Compiler are reserved for Intel microprocessors. For a detailed description of these compiler options, including the instruction sets they implicate, please refer to "Intel® Compiler User and Reference Guides > Compiler Options." Many library routines that are part of Intel® Compiler are more highly optimized for Intel microprocessors than for other microprocessors. While the compilers and libraries in Intel® Compiler offer optimizations for both Intel and Intel-compatible microprocessors, depending on the options you select, your code and other factors, you likely will get extra performance on Intel microprocessors.

While the paragraph above describes the basic optimization approach for Intel® Compiler, with respect to Intel's compilers and associated libraries as a whole, Intel® Compiler may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include Intel® Streaming SIMD Extensions 2 (Intel® SSE2), Intel® Streaming SIMD Extensions 3 (Intel® SSE3), and Supplemental Streaming SIMD Extensions 3 (Intel® SSSE3) instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors.

Intel recommends that you evaluate other compilers to determine which best meet your requirements.

