

# Create Faster Code—Faster

## Intel® Parallel Studio XE 2017

### Intel Software Development Tools

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#### What it Does

- **Lets you develop faster code.** Boost application performance that scales on today's and next-generation processors.
- **Helps you code faster.** Use a toolset that simplifies creating fast, reliable parallel code.
- **Includes** industry-leading compiler(s), libraries, parallel models, high-performance Python\* packages powered by native Intel® Performance Libraries, vectorization and threading advisor, memory and threading debugger, performance profiler, and more.

#### What's New

- **Scale to next-generation platforms** including latest Intel® Xeon Phi™ processor. Optimizations for AVX-512, high bandwidth memory, and explicit vectorization for compiler and analysis tools.
- **Faster deep learning on Intel® architecture.** Optimize deep learning model training with Intel® Math Kernel Library neural network functions. Intel® Data Analytics Acceleration Library introduces new deep learning functionality, which is faster than popular open source alternatives.
- **Faster Python application performance.** Intel® Distribution for Python provides easy access to high-performance Python, powered by native Intel Performance Libraries, in an integrated distribution package. Identify the bottlenecks in Python and mixed native and Python code using Intel® VTune™ Amplifier XE.
- **Quick first look.** Snapshot features of Intel VTune Amplifier XE and Intel® Trace Analyzer and Collector help you quickly assess application performance.

#### Why Consider Intel Parallel Studio XE?

You're developing software that needs to run faster. Your software performs big data analytics, medical imaging, time-critical financial analysis, simulations (e.g., CFD or weather), machine/deep learning, or one of thousands of tasks that need to get done *now*. You're already using other development tools (e.g., GNU\*, XCode\*, or Visual Studio\*) on Linux\*, OS X\*, and Windows\*.

What you need is a toolset that's compatible with the way you already work—and that makes it easier to speed code execution. Intel® Parallel Studio XE is a performance tool suite that boosts application speed by taking advantage of the ever-increasing core count and vector registers width available in Intel® Xeon® processors and Intel Xeon Phi processors and coprocessors.

## Intel Parallel Studio XE Editions

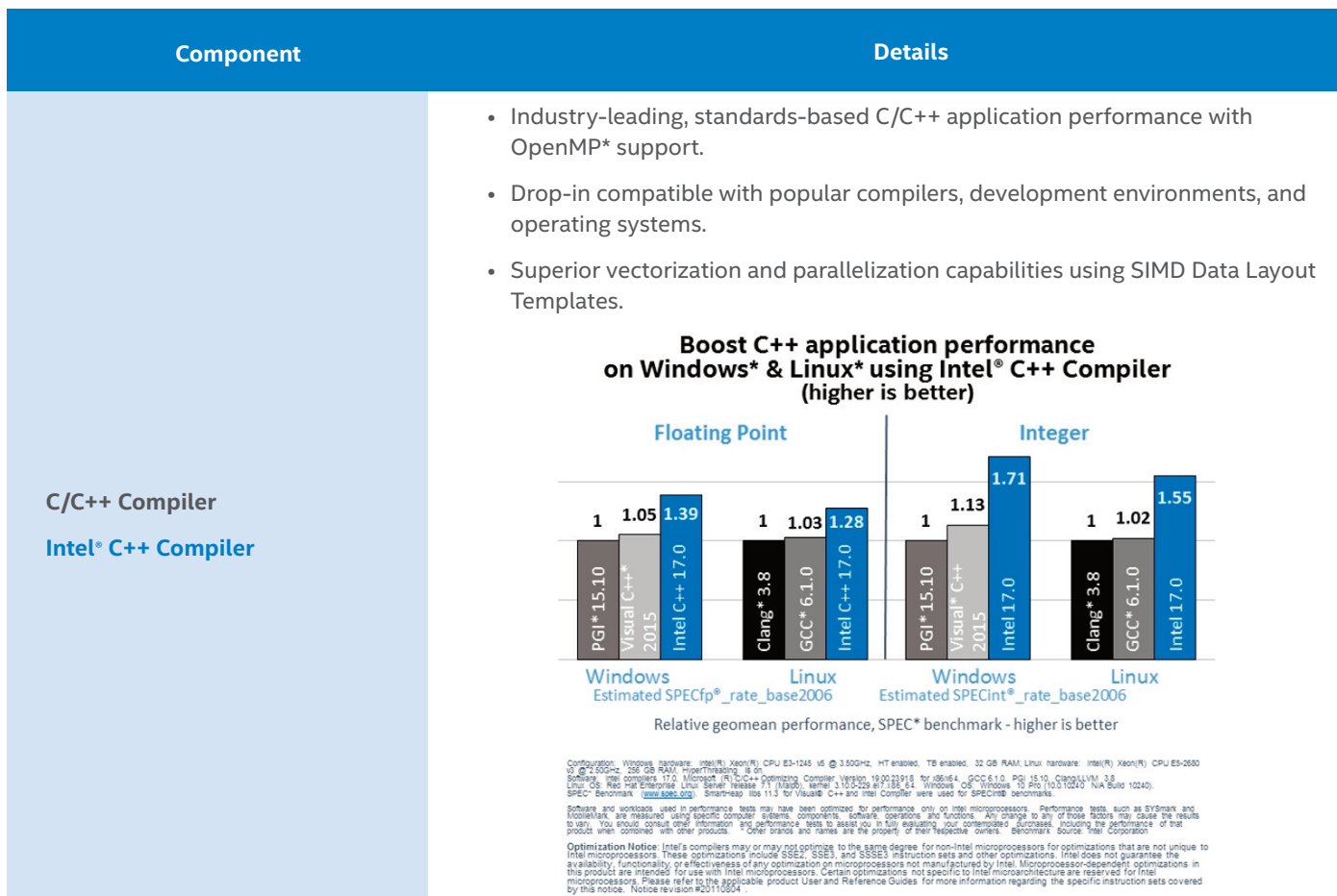
Edition	What it Does	What it Includes
<b>Composer Edition</b>	Build fast code using industry-leading compilers, performance libraries, and high-performance Python packages	C++ and/or Fortran* compilers, performance libraries, parallel models, and Python packages powered by native Intel Performance Libraries.
<b>Professional Edition</b>	Adds analysis tools	Composer Edition plus performance profiler, vectorization and threading advisor, and memory and thread debugger.
<b>Cluster Edition</b>	Adds MPI cluster tools	Professional Edition plus MPI cluster communications library, MPI error checking/tuning and a cluster diagnostic expert system.

## One Year of Product Support and Updates Included

Product purchase provides you access to and support for new updates and releases, as well as older versions. It also entitles you to private, direct, and responsive answers to product questions, along with access to decades of product experience from our user community through forums and a library of self-help documents.

## Composer Edition

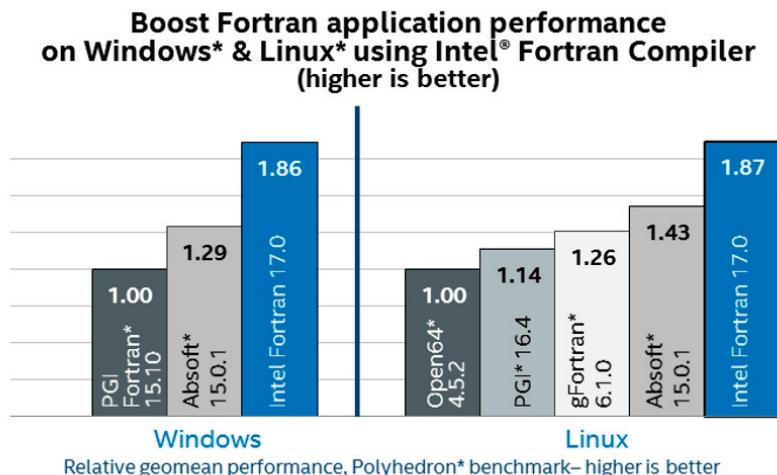
- **Get better performance** with a simple recompile using industry-leading and standards driven C++ and Fortran compilers.
- **Simplify adding parallelism** with built-in, intuitive, parallel models and vectorization support.
- **Drop advanced libraries**, optimized for the latest hardware, right into your code.
- **Get high-performance Python**, powered by native Intel Performance Libraries, in an integrated distribution package.



## Details

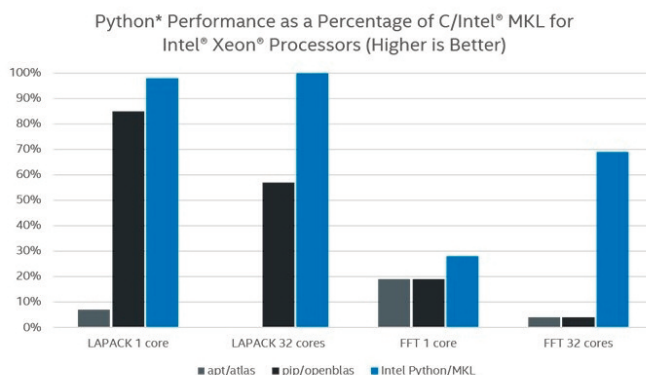
- Industry-leading Fortran application performance.
- Boost standards-based, coarray Fortran performance.
- Extensive support for Fortran standards, OpenMP, and more.
- Compatible with leading development environments and compilers

## Intel® Fortran Compiler

[illegible]

- Delivers faster Python application performance in an easy, integrated distribution for Windows, OS X, and Linux.
- Accelerates NumPy/SciPy/scikit-learn packages with native Intel Performance Libraries such as Intel Math Kernel Libraries for multithreaded performance benefits.

## Intel Distribution for Python



Configuration Info: apt/atlas: installed with apt-get, Ubuntu 16.10, python 3.5.2, numpy 1.11.0, scipy 0.17.0; pip/popenblas: installed with pip, Ubuntu 16.10, python 3.5.2, numpy 1.11.1, scipy 0.18.0; Intel Python: Intel Distribution for Python 2017.; Hardware: Intel Xeon CPU E5-2698 v3 @ 2.30 GHz (2 sockets, 16 cores each, HT-on), 64 GB of RAM, 8 DIMMS of 8GB@2133MHz; Xeon Phi: Intel Intel® Xeon Phi™ CPU 7210 1.30 GHz, 96 GB of RAM, 6 DIMMS of 16GB@1200MHz

(See additional configuration information on page 9.)

## Composer Edition (continued)

Component	Details
<p><b>Math Library</b></p> <p><b>Intel Math Kernel Library</b></p>	<ul style="list-style-type: none"> <li>Fastest and most-used math library for Intel® and compatible processors.</li> <li>Highly tuned for best performance on older, newer, and future processors before they are released.</li> <li>De facto standard APIs for simple code integration.</li> </ul> <p><b>DGEMM Performance</b> On Intel® Xeon® Processor E5-2699 v4</p>  <p>Configuration Info - Versions: Intel® Math Kernel Library (Intel® MKL) 2017; Hardware: Intel® Xeon® Processor E5-2699 v4, 2 Twenty-two-core CPU (55MB smart cache, 2.2GHz), 64GB of RAM; Operating System: RHEL 7.2 GA x86_64.</p> <p>Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. * Other brands and names are the property of their respective owners. Benchmark Source: Intel Corporation</p> <p><b>Optimization Notice:</b> Intel's compilers 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 SSE2, SSE3, and SSE4.2 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. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Notice revision #20110804.</p>
<p><b>Data Analytics and Machine Learning Library</b></p> <p><b>Intel® Data Analytics Acceleration Library (Intel® DAAL)</b></p>	<ul style="list-style-type: none"> <li>Helps applications make better predictions faster, and analyzes larger data sets with the same compute resources.</li> <li>Reduces application development time via a wide selection of preoptimized advanced analytics algorithms.</li> <li>Includes connectors to popular data sources and can be used with any data platform.</li> </ul> <p><b>Intel® DAAL vs. Spark® MLlib</b> K-means Performance Comparison on Eight-node Cluster</p>  <p>Configuration Info - Versions: Intel® Data Analytics Acceleration Library 2017; Spark CPUs (45MB LLC, 2.3GHz), 128GB of RAM per node; Operating System: CentOS 6.1</p> <p>Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. * Other brands and names are the property of their respective owners. Benchmark Source: Intel Corporation</p> <p><b>Optimization Notice:</b> Intel's compilers 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 SSE2, SSE3, and SSE4.2 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. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Notice revision #20110804.</p>

## Composer Edition (continued)

### Component

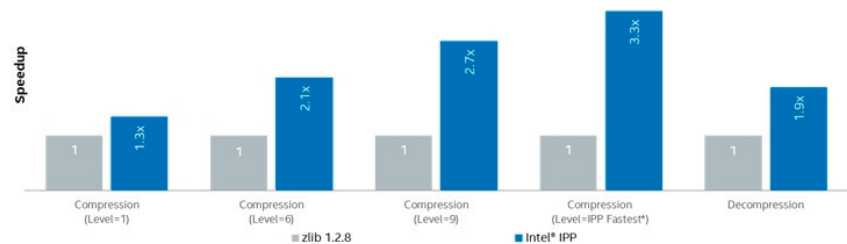
### Details

#### Optimized Building Blocks for Image, Signal, and Data Applications

#### Intel® Integrated Performance Primitives

- Highly optimized using Intel® Streaming SIMD Extensions (Intel® SSE) and Intel® Advanced Vector Extensions (Intel® AVX, Intel® AVX2) instruction sets so your application will perform faster on existing and future Intel® processors.
- Cross-OS support: Windows, OS X, and Linux libraries.
- Reduces costs and time associated with software development and maintenance.

#### Intel® IPP Data Compression and Decompression Performance Boost vs. ZLIB Library



Configuration Info - SW Versions: Intel® Integrated Performance Primitives (Intel® IPP) 2017, Intel C++ Compiler 16.0. Hardware: Intel® Core™ Processor i7-6700K, 8 MB cache, 4.2 GHz, 16 GB RAM, Windows Server® 2012 R2. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. \* Other brands and names are the property of their respective owners. Benchmark Source: Intel Corporation

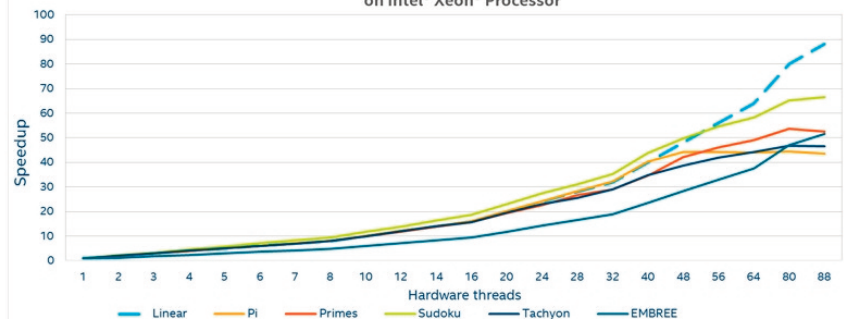
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#### Threading Library

#### Intel® Threading Building Blocks

- Widely used C++ template library for task parallelism.
- Maps your logical tasks onto threads with full support for nested parallelism.
- Uses proven, efficient parallel patterns and work-stealing to support the load balance of unknown task execution time.
- Compatible with multiple compilers and Intel® compatible processors.
- Flow graph feature allows developers to easily express dependency and data flow graphs.

#### Excellent Performance Scalability with Intel® Threading Building Blocks 2017 on Intel® Xeon® Processor



Configuration Info: Software Versions: Intel® C++ Intel® 64 Compiler, Version 17.0, Intel® Threading Building Blocks (Intel® TBB) 2017; Hardware: Intel® Xeon® CPU E5-2699 v4 @ 2.20GHz 44/88T, 128GB Main Memory; Operating System: Red Hat Enterprise Linux Server release 7.2 (Maipo), kernel 3.10.0-327.4.5.el7.x86\_64; Benchmark Source: Intel Corp. Note: sudoku, primes, and tachyon are included with Intel TBB. Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, refer to [www.intel.com/performance/resources/benchmark\\_limitations.htm](http://www.intel.com/performance/resources/benchmark_limitations.htm).

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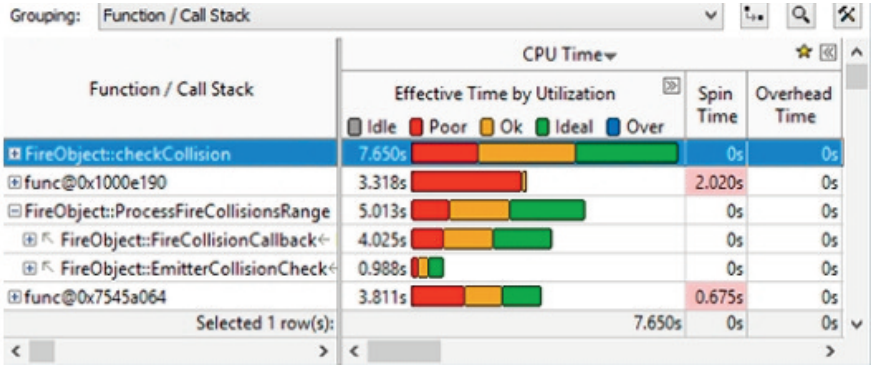
## Composer Edition (continued)

Component	Details
<b>Standards-based Parallel Model</b> <b>OpenMP*</b>	<ul style="list-style-type: none"> <li>Performance-oriented implementation of OpenMP 4.0 and initial support for 4.5.</li> <li>Support for Intel® SSE and the latest AVX* instruction sets.</li> </ul>
<b>Fortran Numerical Analysis</b> <b>Rogue Wave IMSL* Library</b>	<ul style="list-style-type: none"> <li>Numerical analysis functions for Fortran applications with a comprehensive set of 1,000+ mathematics and statistics algorithms.</li> <li>Available as an add-on for any Intel Parallel Studio XE suite (included in Intel Parallel Studio XE Composer Edition for Fortran with Rogue Wave* IMSL*).</li> </ul>

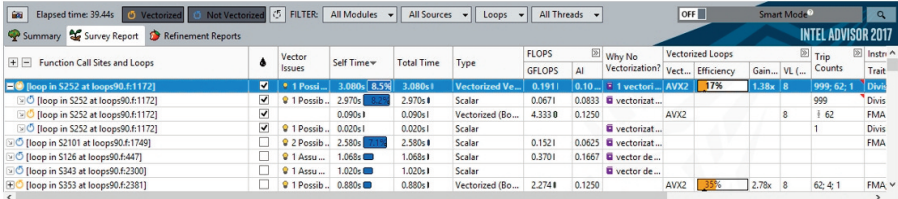
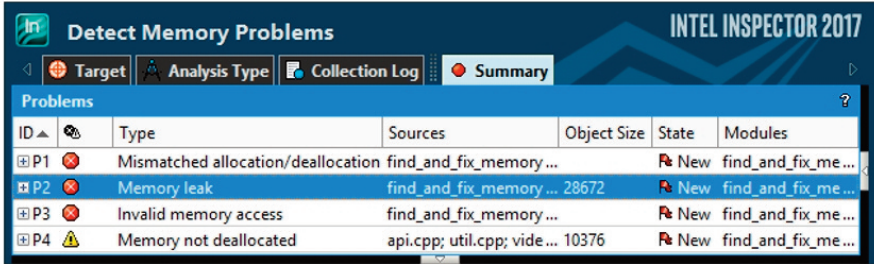
## Professional Edition

Includes everything in Composer Edition plus:

- Advanced performance profiler** to tune application performance, scalability and memory access
- Vectorization and threading advisor** to optimize vectorization and quickly prototype threading designs
- Memory and thread debugger** to efficiently find memory errors and intermittent threading errors

Component	Details
<b>Performance Profiler</b> <b>Intel VTune Amplifier XE</b>	<ul style="list-style-type: none"> <li>Accurately profile C, C++, Fortran, Python, Go*, Java*, or a mix of coding languages</li> <li>Diverse data for CPU, GPU, threading, memory, cache, and storage.</li> <li>Fast answers: rich analysis turns data into insight.</li> </ul> 

## Professional Edition (continued)

Component	Details
<b>Vectorization and Threading Advisor</b> <b>Intel® Advisor</b>	<ul style="list-style-type: none"> <li>Vectorize and thread your code- or performance dies on modern processors.</li> <li>Get trip counts, data dependencies, memory access patterns, and more.</li> <li>Follow an easy optimization workflow with tips for faster code.</li> </ul> 
<b>Memory and Thread Debugger</b> <b>Intel® Inspector</b>	<ul style="list-style-type: none"> <li>Find root-cause memory and threading errors early, before you release.</li> <li>Quickly debug intermittent races and deadlocks.</li> </ul> 

## Cluster Edition

Includes everything in the Professional Edition plus tools to:

- Accelerate applications' performance** on Intel architecture-based clusters with multiple fabric flexibility.
- Profile MPI applications** to quickly finding bottlenecks, achieving high performance for parallel cluster applications.
- Verify** that cluster components continue working together throughout the cluster life cycle.

Component	Details
<b>Message Passing Interface Library</b> <b>Intel® MPI Library</b>	<ul style="list-style-type: none"> <li>A performance-optimized MPI library supporting the MPI 3.1 standard</li> <li>Makes applications perform better on Intel architecture-based clusters with multiple fabric flexibility.</li> <li>Sustained scalability—low latencies, higher bandwidth and increased processes.</li> <li>Full hybrid support for multi-core and many-core systems.</li> </ul>

## Cluster Edition (continued)

Component	Details																
<div>Message Passing Interface Library</div> <div>Intel® MPI Library</div> <div>(Continued)</div>	<div><div>Superior Performance with Intel® MPI Library</div><div>1152 Processes, 32 Xeon nodes (Omni-Path), Linux® 64</div><div>Relative (Geomean) MPI Latency Benchmarks</div><div>(Higher is Better)</div><div><div>Up to 2.35X faster on 32 nodes</div><table><thead><tr><th>Message Size</th><th>IntelMPI 2017</th><th>OpenMPI-1.10.0</th><th>MVAPICH2-2.2RC1</th></tr></thead><tbody><tr><td>8 bytes</td><td>1.34</td><td>1.00</td><td>0.91</td></tr><tr><td>16 Kbytes</td><td>2.35</td><td>1.00</td><td>2.27</td></tr><tr><td>4 Mbytes</td><td>2.08</td><td>1.00</td><td>1.86</td></tr></tbody></table></div><div><div>Configuration Info:</div><div>Hardware: CPU: Intel® Xeon E5-2697 v4 @ 2.30GHz, 128 GB RAM, Interconnect: Intel® Corporation Omni-Path® Silicon 100 Series (discrete) (rev. 11)</div><div>Software: Build: 6.7.105.10.1.10.0, Libraries: 3.0, Intel® MPI Library 2017: Intel® MPI Benchmarks 4.1.1 (Built with Intel® C++ Compiler XE 17.0.0 Beta for Linux®).</div><div>Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. * Other brands and names are the property of their respective owners. Benchmark Source: Intel Corporation.</div><div>Optimization Notice: Intel compilers 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 SSE2, SSE3, and SSE4.2 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. Certain optimizations not specific to Intel microarchitecture are reserved for Intel microprocessors. Please refer to the applicable product User and Reference Guides for more information regarding the specific instruction sets covered by this notice. Notice revision #20170804</div></div></div> <div><ul style="list-style-type: none"><li>Boost big data analytics and machine learning performance with easy-to-use library</li></ul></div>	Message Size	IntelMPI 2017	OpenMPI-1.10.0	MVAPICH2-2.2RC1	8 bytes	1.34	1.00	0.91	16 Kbytes	2.35	1.00	2.27	4 Mbytes	2.08	1.00	1.86
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8 bytes	1.34	1.00	0.91														
16 Kbytes	2.35	1.00	2.27														
4 Mbytes	2.08	1.00	1.86														
<div>MPI Tuning and Analysis</div> <div>Intel® Trace Analyzer and Collector</div>	<div><ul style="list-style-type: none"><li>Profile MPI application to quickly find bottlenecks and achieve high performance for parallel cluster applications.</li><li>Scalable, with low overhead and effective visualization.</li><li>Flexible-to-fit workflow—compile, link, or run.</li></ul></div>																
<div>Cluster Diagnostic Expert System in a Tool</div> <div>Intel® Cluster Checker</div>	<div><ul style="list-style-type: none"><li>Simplified diagnosis of issues to improve cluster functionality and performance.</li><li>API to integrate into other software.</li><li>Comprehensive cluster environment checking, extensible with custom tests.</li></ul></div>																

## Specifications At a Glance

<b>Processors</b>	Supports multiple generations of Intel and compatible processors including, but not limited to, Intel® Core™ processors, Intel Xeon processors, and Intel Xeon Phi processors and coprocessors.
<b>Languages</b>	<ul style="list-style-type: none"> <li>Compatible with compilers from Microsoft, GCC, Intel, and others that follow standards.</li> <li>C, C++, Fortran, Python, Java<sup>*1</sup>, Go<sup>*1</sup></li> </ul>
<b>Operating Systems</b>	Windows, Linux, and OS X <sup>2</sup>
<b>Development Environment</b>	<ul style="list-style-type: none"> <li>Microsoft Visual Studio (Windows), Eclipse (Linux), XCode (OS X).</li> <li>Compatible with GNU tools (Linux).</li> </ul>
<b>Additional Details</b>	See <a href="http://www.intel.com/software/products/systemrequirements/">www.intel.com/software/products/systemrequirements/</a>

<sup>1</sup> Intel VTune Amplifier only.<sup>2</sup> OS X developers can choose between the C++ or Fortran versions of the Composer Edition.



## What's Included in Intel Parallel Studio XE

	Composer Edition <sup>1</sup>	Professional Edition <sup>1</sup>	Cluster Edition
Intel C++ Compiler	✓	✓	✓
Intel® Fortran Compiler	✓	✓	✓
Intel Distribution for Python <sup>2</sup>	✓	✓	✓
Intel Math Kernel Library	✓	✓	✓
Intel Data Analytics Acceleration Library	✓ (C++ Only)	✓	✓
Intel® Threading Building Blocks (C++ only)	✓ (C++ Only)	✓	✓
Intel® Integrated Performance Primitives	✓ (C++ Only)	✓	✓
OpenMP	✓	✓	✓
Intel VTune Amplifier XE <sup>3</sup>		✓	✓
Intel® Advisor		✓	✓
Intel® Inspector		✓	✓
Intel® MPI Library <sup>3</sup>			✓
Intel Trace Analyzer and Collector			✓
Intel® Cluster Checker			✓
Rogue Wave IMSL* Library <sup>4</sup>	Bundled and Add-On	Add-On	Add-On
Operating System (Development Environment)	<ul style="list-style-type: none"> <li>Windows (Visual Studio)</li> <li>Linux (GNU)</li> <li>OS X<sup>5</sup> (XCode)</li> </ul>	<ul style="list-style-type: none"> <li>Windows (Visual Studio)</li> <li>Linux (GNU)</li> </ul>	<ul style="list-style-type: none"> <li>Windows (Visual Studio)</li> <li>Linux (GNU)</li> </ul>

<sup>1</sup> Available with a single language (C++ or Fortran) or both languages.

<sup>2</sup> Available on Windows, Linux, and OS X.

<sup>3</sup> Available bundled in a suite or standalone.

<sup>4</sup> Available as an add-on to any Windows Fortran suite or bundled with a version of the Composer Edition.

<sup>5</sup> Available as single language suites on OS X.

Hardware/Problem Size	dot	lu	det	inv	cholesky	fft
Intel® Xeon® processor (32 core) and Intel® Xeon Phi™ processor (64 core)	(20k, 10k) and (10k, 20k)	(35k, 35k)	(15k, 15k)	(25k, 25k)	(40k, 40k)	
Intel Xeon processor (1 core)	(20k, 5k) and (5, 20k)	(20k, 20k)		(10k, 10k)		520k
Intel Xeon Phi processor (1 core)	(20k, 300) and (300, 20k)	(6k, 6k)	(4k, 4k)	(2k, 2k)	(10k, 10k)	

**Configuration Info:** apt/atlas: installed with apt-get, Ubuntu® 16.10, Python® 3.5.2, numpy® 1.11.0, scipy® 0.17.0; pip/openblas\*: installed with pip, Ubuntu 16.10, python 3.5.2, numpy 1.11.1, scipy 0.18.0; Intel Python: Intel® Distribution for Python 2017; Hardware: Intel Xeon processor: Intel Xeon processor E5-2698 v3 @ 2.30 GHz (2 sockets, 16 cores each, HT=off), 64 GB of RAM, 8 DIMMS of 8GB@2133MHz; Intel Xeon Phi processor: Intel Xeon Phi™ processor 7210 1.30 GHz 96 GB of RAM, 6 DIMMS of 16GB@1200MHz

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Learn more about  
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