

# INTEL® PARALLEL STUDIO XE 2018 PRE-RELEASE (BETA)

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## 1 Introduction

Intel® Parallel Studio XE has three editions: Composer Edition, Professional Edition, and Cluster Edition.

Intel® Parallel Studio XE Composer Edition provides a software tools environment for developing Fortran, C, and/or C++ code using Intel® Compilers. Intel® Parallel Studio XE Composer Edition also includes Intel® Math Kernel Library, Intel® Integrated Performance Primitives, Intel® Threading Building Blocks, and Intel® Data Analytics Acceleration Library (Intel® DAAL).

Intel® Parallel Studio XE Professional Edition adds Intel® VTune™ Amplifier for performance analysis, Intel® Inspector for correctness analysis, and Intel® Advisor for parallelism discovery.

Intel® Parallel Studio XE Cluster Edition adds support for distributed memory computing via Intel® MPI Library, Intel® MPI Benchmarks, and Intel® Trace Analyzer and Collector. Intel® Cluster Checker provides cluster health monitoring tools.

On completing the Intel® Parallel Studio XE installation process, locate the `getstart*.htm` file in the `documentation_2018/en/ps2018` folder under the target installation path. This file is a documentation map to navigate to various information resources of Intel® Parallel Studio XE.

For licensing information, please refer to the Intel End User Licensing Agreement (EULA) available at <https://software.intel.com/en-us/articles/end-user-license-agreement>.

When you install Intel® Parallel Studio XE, we collect information that helps us understand your installation status and environment. Information collected is anonymous and is not shared outside of Intel. See <https://software.intel.com/en-us/articles/data-collection> for more information on what is collected and how to opt-out.

### 1.1 What Every User Should Know About This Release

This is the Beta Release of Intel® Parallel Studio XE 2018.

## 2 Product Contents

The following table shows which Intel® Software Development Tools are present in each edition of Intel® Parallel Studio XE 2018.

| Component  | Composer Edition <sup>1</sup> | Professional Edition | Cluster Edition |
|--|-------------------------------|----------------------|-----------------|
| Intel® C++ Compiler  | X                             | X                    | X               |
| Intel® Fortran Compiler / Intel® Visual Fortran  | X                             | X                    | X               |
| Intel® Integrated Performance Primitives (Intel® IPP)                                  | X                             | X                    | X               |
| Intel® Math Kernel Library (Intel® MKL)  | X                             | X                    | X               |
| Intel® Data Analytics Acceleration Library (Intel® DAAL) <sup>2</sup>                  | X                             | X                    | X               |
| Intel® Threading Building Blocks (Intel® TBB)  | X                             | X                    | X               |
| Intel-provided Debug Solutions   | X                             | X                    | X               |
| Microsoft Visual Studio Shell* for Intel® Visual Fortran <b>(for Windows* OS only)</b> | X                             | X                    | X               |
| Intel® Advisor   |                               | X                    | X               |
| Intel® Inspector   |                               | X                    | X               |
| Intel® VTune™ Amplifier  |                               | X                    | X               |
| Intel® Cluster Checker <b>(For Linux* OS only)</b>                                     |                               |                      | X               |
| Intel® MPI Benchmarks  |                               |                      | X               |
| Intel® MPI Library   |                               |                      | X               |
| Intel® Trace Analyzer and Collector  |                               |                      | X               |

<sup>1</sup> Intel® Parallel Studio XE is only available in Composer Edition for macOS\*.

<sup>2</sup> Intel® Integrated Performance Primitives, Intel® Data Analytics Acceleration Library, and Intel® Threading Building Blocks are not included in Fortran language only editions.

The table below lists the product components and related documentation.

| Component  | Version   | Documentation  |
|--|-----------|--|
| Intel® Advisor   | 2018 Beta | get_started.htm  |
| Intel® C++ Compiler  | 18.0 Beta | get_started_wc.htm for Windows* OS<br>get_started_lc.htm for Linux* OS |
| Intel® Cluster Checker <b>(For Linux* OS only)</b>   | 2018 Beta | get_started.htm  |
| Intel® Data Analytics Acceleration Library (Intel® DAAL)   | 2018 Beta | get_started.htm  |
| Intel® Fortran Compiler / Intel® Visual Fortran Compiler   | 18.0 Beta | get_started_wf.htm for Windows* OS<br>get_started_lf.htm for Linux* OS |
| Intel® Inspector   | 2018 Beta | get_started.htm  |
| Intel® Integrated Performance Primitives (Intel® IPP)  | 2018 Beta | get_started.htm  |
| Intel® Math Kernel Library (Intel® MKL)  | 2018 Beta | get_started.htm  |
| Intel® MPI Benchmarks  | 2018 Beta | ReadMe_IMB.txt<br>IMB_Users_Guide.htm                                  |
| Intel® MPI Library   | 2018 Beta | get_started.htm  |
| Intel® Threading Building Blocks (Intel® TBB)  | 2018 Beta | get_started.htm  |
| Intel® Trace Analyzer and Collector  | 2018 Beta | get_started.htm  |
| Intel® VTune™ Amplifier  | 2018 Beta | get_started.htm  |
| Intel-provided Debug Solutions   |           | See below for additional information.                                  |
| Microsoft Visual Studio Shell* for Intel® Visual Fortran<br><b>(For Windows* OS; installs only on the master node)</b> |           | See below for additional information.                                  |

## 2.1 Additional Information for Intel-provided Debug Solutions

The Intel-provided Debug solutions are based on GNU\* GDB. Please see <https://software.intel.com/en-us/articles/intel-parallel-studio-xe-2018-composer-edition-fortran-debug-solutions-release-notes> and <https://software.intel.com/en-us/articles/intel-parallel-studio-xe-2018-composer-edition-c-debug-solutions-release-notes> for information specific to this component.

## 2.2 Additional Information for Microsoft Visual Studio Shell\* for Intel® Visual Fortran

A Fortran-only Integrated Development Environment (IDE) based on Microsoft Visual Studio Shell 2015\* is provided for systems that do not have a supported Microsoft Visual Studio installed. Installation of the Fortran IDE has the following additional requirements:

- Microsoft Windows 7 SP1\* or newer, or Microsoft Windows Server 2012\* or newer operating system
  - On Windows 8.1\* and Windows Server 2012 R2\*, KB2883200 is required
- Microsoft Windows 10 SDK\*

## 2.3 Intel® Software Manager

The installation now provides an Intel® Software Manager to provide a simplified delivery mechanism for product updates and provide current license status and news on all installed Intel® software products.

As part of the Beta program Intel will collect anonymous usage information about these products to help guide future product design. For more information please see <http://intel.ly/SoftwareImprovementProgram>.

## 3 What's New

This section highlights important changes from the previous product version. For more information on what is new in each component, please read the individual component release notes. The latest documentation for all components can be found at <https://software.intel.com/en-us/intel-parallel-studio-xe-support/documentation>. A current list of deprecated features can be found at <https://software.intel.com/en-us/articles/intel-parallel-studio-xe-deprecation-information>.

### Changes since Intel® Parallel Studio XE 2017 Update 2:

- All components updated to current versions.
- Release Notes merged into single document for all operating systems.
- Intel® Advisor:
  - Dynamic Instruction Mix metric in Code Analytics.
  - Improved data collection speed with filtering and refinement tracking.
  - Intel® Math Kernel Library recommendations added.
- Intel® C/C++ Compiler:
  - Optimizations for latest Intel® Xeon® and Intel® Xeon Phi™ Processors.
  - Initial support for OpenMP\* 5.0.
  - Implementation of Parallel STL\*.
- Intel® Cluster Checker:
  - Added validation of Intel® Scalable System Framework and Intel® HPC Orchestrator integration.
  - Simplified grouping of checks for extensibility.
  - Added support for multiple database sources for checks.

- Intel® Data Analytics Acceleration Library:
  - New Classification and Regression Decision Tree and Forest.
  - Added API sample documentation.
  - New Neural Network optimizations and functionality.
- Intel® Distribution for Python\*:
  - Added support for OpenCV\*.
  - Updated to the latest Intel® Performance Libraries.
  - Improved NumPY\* and SciPy\* performance.
- Intel® Fortran Compiler:
  - Optimizations for latest Intel® Xeon® and Intel® Xeon Phi™ Processors.
  - Initial support for OpenMP\* 5.0.
  - Full Fortran 2008, initial Fortran 2015 support.
- Intel® Inspector:
  - Improved lock/unlock model to show unlocked, lock for read, and lock for write.
  - Added C++17 std::shared\_mutex.
  - Added Windows\* SRW Locks.
- Intel® Integrated Performance Primitives:
  - Adds support for latest Intel® Xeon Phi™ Processor (code named Knights Mill).
  - Cryptography library has removed dependence on main Intel® Integrated Performance Primitives package.
  - Improved compression performance.
- Intel® Math Kernel Library:
  - New integer multiplication routines in BLAS.
  - New vector math functionality.
  - New batched triangular solve matrix.
- Intel® MPI Library:
  - Improved MPI startup time.
  - Improved finalization time for OFI and TMI fabrics.
  - Added support for latest Intel® Xeon® Processors, Intel® Xeon Phi™ Processors and Coprocessors, and Intel® Omni-Path Architecture fabric.
- Intel® Threading Building Blocks:
  - Implementation of Parallel Standard Template Library.
  - Adds capability to parallelize and vectorize with compiler with minimal code change.
  - Adds ability to specify execution policies.
- Intel® Trace Analyzer and Collector:
  - Added OpenSHMEM\* support.
  - Added support for latest Intel® Xeon® Processors, Intel® Xeon Phi™ Processors and Coprocessors, and Intel® Omni-Path Architecture fabric.
- Intel® VTune™ Amplifier:
  - Adds support for latest Intel® Xeon Phi™ Processor (code named Knights Mill).
  - Adds support for profiling inside Docker\* and Mesos\* containers.
  - Improved Application Snapshot merges MPI Performance Snapshot with previous Application Performance Snapshot.

### Changes since Intel® Parallel Studio XE 2017 Update 1:

- All components updated to current versions.
- Migration to SHA-256 digital signatures on Linux\*.
- Intel® Advisor:
  - Roofline Analysis is released as a public feature.
  - Added call stacks for FLOPS and Trip Counts that enable total metrics.
  - Filter by module for Survey, FLOPS, and Trip Counts collections.
- Intel® Cluster Checker:
  - Added additional support for Intel® Xeon Phi™ Product Family x200 processors.
  - Added additional support for Intel® Omni-Path Architecture.
- Intel® Data Analytics Acceleration Library:
  - Added Deep Learning feature extensions.
  - Added API extensions for data parallelism scheme.
- Intel® Inspector:
  - Support for C++17 std::shared\_mutex.
- Intel® Integrated Performance Primitives:
  - Introduced support for Intel® Xeon Phi™ processor x200 leverage boot mode in examples.
  - Added new functions in ZLIB to support user-defined Huffman tables.
- Intel® Math Kernel Library:
  - Intel® AVX-512 code is dispatched by default on Intel® Xeon® processors.
  - Added support for Intel® Threading Building Blocks in various functions.
- Intel® MPI Library:
  - Added a new environment variable, I\_MPI\_MEMORY\_LOCK, to prevent memory swapping to the hard drive.
- Intel® Threading Building Blocks:
  - Added template class gfx\_factory to the flow graph API.
  - Fixed a possible deadlock caused by missed wakeup signals in task\_arena::execute().
- Intel® Trace Analyzer and Collector:
  - Improved the color changing scheme.
  - Added Pcontrol support in MPI Performance Snapshot.
  - Added idle time per function in MPI Performance Snapshot.
- Intel® VTune™ Amplifier:
  - Added support for mixed Python\* and native code in Locks and Waits analysis.
  - Added support for performance analysis of a guest Linux\* operating system via Kernel-based Virtual Machine (KVM) from a Linux\* host system with the KVM Guest OS option.
  - Enriched HPC Performance Characterization.

### Changes since Intel® Parallel Studio XE 2017:

- All components updated to current versions.
- Japanese localization added for most components.

- Default installation includes components for 32-bit targets on Linux\*.
- Intel® Advisor:
  - Extended recommendations for virtual methods in vectorized loops.
- Intel® C/C++ Compiler:
  - Bug fixes.
- Intel® Cluster Checker:
  - Added Intel® Scalable System Framework support.
  - Added additional support for Intel® Xeon Phi™ Product Family x200 processors.
  - Removed heartbeat functionality.
- Intel® Data Analytics Acceleration Library:
  - Added distributed neural network training.
  - Added KNN algorithm for batch computing mode.
  - Added min-max normalization.
- Intel® Integrated Performance Primitives:
  - Added functions for the finite field GF(p) arithmetic, and the elliptic curves over the finite field GF(p)
  - Added `ippECCPBindGxyTblStd` functions that allow to control memory size for the elliptic curves over GF(p).
- Intel® Math Kernel Library:
  - Added support of non-square cores of convolution.
  - Improved performance of `?GETRF`, `?GETRS` and `?GETRI` for very small matrices via `MKL_DIRECT_CALL`.
  - Improved single thread SGEMM/DGEMM performance on Intel® Advanced Vector Extensions 2 (Intel® AVX2), Intel® Advanced Vector Extensions 512 (Intel® AVX-512), and Intel® Xeon® for Intel® Many Integrated Core Architecture.
- Intel® MPI Library:
  - PMI-2 support for SLURM\*.
  - Deprecating support for cross-OS launches.
  - Deprecating support for DAPL, TMI, and OFA fabrics.
- Intel® Threading Building Blocks:
  - Bug fixes.
- Intel® Trace Analyzer and Collector:
  - Introduced mouse wheel zooming support for timelines.
  - MPI Performance Snapshot adds a new diagram Node-to-Node Data Transfers.
  - MPI Performance Snapshot adds support for non-MPI applications.
- Intel® VTune™ Amplifier:
  - Support for locator hardware event metrics for the General Exploration analysis results in the Source/Assembly view that enable you to filter the data by a metric of interest and identify performance-critical code lines/instructions.
  - Summary view of the General Exploration analysis extended to explicitly display measure for the hardware metrics: Clockticks vs. Pipeline Slots.
  - Command line summary report for the HPC Performance Characterization analysis extended to show metrics for CPU, Memory, and FPU performance



aspects including issue descriptions for metrics that exceed the predefined threshold.

## 4 System Requirements

### 4.1 Processor Requirements

**Systems based on Intel® 64 architecture:**

- Intel® Core™ processor family or higher
- Intel® Xeon® E5 v5 processor families recommended
- Intel® Xeon® E7 v5 processor families recommended

**NOTE:** It is assumed that the processors listed above are configured into homogeneous clusters. For Windows\* OS, only processors based on the Intel® 64 architecture are supported.

### 4.2 Disk Space Requirements

12 GB of disk space (minimum) on a standard installation. Cluster installations require an additional 4 GB of disk space.

**NOTE:** During the installation process, the installer may need up to 12 GB of additional temporary disk storage to manage the intermediate installation files.

### 4.3 Operating System Requirements

The operating systems listed below are supported by all components on Intel® 64 Architecture. Individual components may support additional operating systems and architecture configurations. See the individual component release notes for full details.

- Debian\* 8, 9
- Fedora\* 25
- Red Hat Enterprise Linux\* 6, 7 (equivalent CentOS versions supported, but not separately tested)
- SUSE Linux Enterprise Server\* 11, 12
- Ubuntu\* 14.04, 16.04
- Microsoft\* Windows\* 7, 8.x, 10
- Microsoft\* Windows\* Server 2012, 2012 R2, 2016
- macOS\* 10.12

The Intel® MPI Library and Intel® Trace Analyzer and Collector are supported on Intel® Cluster Ready systems and HPC versions of the listed versions of Microsoft\* Windows\* Server. These components are not supported on Ubuntu non-LTS systems.

Installation on IA-32 hosts is no longer supported by any components.

## 4.4 Memory Requirements

2 GB RAM (minimum)

## 4.5 Additional Software Requirements

Development for a 32-bit target on a 64-bit host may require optional library components (ia32-libs, lib32gcc1, lib32stdc++6, libc6-dev-i386, gcc-multilib, g++-multilib) to be installed from your Linux distribution.

On Microsoft Windows\* OS, the Intel® C/C++ Compiler and Intel® Visual Fortran Compiler require a version of Microsoft Visual Studio\* to be installed. The following versions are currently supported:

- Microsoft Visual Studio\* 2013, 2015, 2017
- Microsoft Visual Studio Express\* (only for command line compilation)

On macOS\*, the Intel® C/C++ Compiler and Intel® Fortran Compiler require a version of Xcode\* to be installed. The following versions are currently supported:

- Xcode\* 8

## 5 Installation Notes

For instructions on installing and uninstalling the Intel® Parallel Studio XE Cluster Edition on Linux\* OS and Windows\* OS, see the Installation Guide (Install\_Guide.pdf).

The installation of the product requires a valid license file or serial number. If you are evaluating the product, you can also choose the “Evaluate this product (no serial number required)” option during installation.

### 5.1 License Changes

The ‘named-user’ license provisions in the Intel software EULA (available as ‘EULA.rtf’ or ‘EULA.txt’ in the same product directory as this release note) changed to only allow the software to be installed on up to three systems, tracked by the system host ID. In order to install on another system after you have reached this limit, you will need to release an old system host ID from the registration system.

As an additional consequence to this change as well as some changes to the license design, you will need an updated license to use the production version of Intel® Parallel Studio XE 2016 or later versions. Additional information is provided [here](#). If you have further questions or concerns, please contact [Technical Support](#).

### 5.2 Online Installation

The electronic installation package for Intel® Parallel Studio XE now offers as an alternative a smaller installation package that dynamically downloads and then installs packages selected to be installed. This requires a working internet connection and potentially a proxy setting if

you are behind an internet proxy. Full packages are provided alongside where you download this online install package if a working internet connection is not available. The online installer may be downloaded and saved as an executable file which can then be launched from the command line.

## 5.3 Silent Install

For information on automated or “silent” install capability, please see <http://intel.ly/nKrzhy>.

### 5.3.1 Support of Non-Interactive Custom Installation

Intel® Parallel Studio XE supports the saving of user install choices during an ‘interactive’ install in a configuration file that can then be used for silent installs. This configuration file is created when the following option is used from the command line install:

- `--duplicate=config_file_name`: it specifies the configuration file name. If full path file name is specified, the “`--download-dir`” is ignored and the installable package will be created under the directory where configuration file is.
- `--download-dir=dir_name`: optional, it specifies where the configuration file will be created. If this option is omitted, the installation package and the configuration file will be created under the default download directory:

```
Windows: %Program Files%\Intel\Download\<>package_id>  
Linux: /tmp/<UID>/<package_id>
```

For example: `parallel_studio_xe <version>_setup.exe --duplicate=ic16_install_config.ini --download-dir="C:\temp\custom_pkg_ic16"`

The configuration file and installable package will be created under “C:\temp\custom\_pkg\_ic16”.

## 5.4 Using a License Server

If you have purchased a “floating” license, see <http://intel.ly/pjGfwC> for information on how to install using a license file or license server. This article also provides a source for the Intel® License Server that can be installed on any of a wide variety of systems.

## 6 Documentation

The documentation index file `getstart*.htm` provides more information about Intel® Parallel Studio XE.

Note: Some hyperlinks in HTML documents may not work when you use Internet Explorer\*. Try using another browser, such as Chrome\* or Firefox\*, or right-click the link, select **Copy shortcut**, and paste the link into a new Internet Explorer\* window.

## 7 Issues and Limitations

1. Cluster installation for Intel® Parallel Studio XE 2018 Beta on Windows\* Server 2016 with HPC Pack 2016 will fail. Installation will complete on the head node, but will hang during installation on compute nodes. After approximately 1 hour, the installer says that the installation completed successfully. However, nothing will have been installed on the compute nodes.
2. In certain cases, Microsoft Visual Studio\* 2017 is known to not install completely. This can lead to an incomplete install of Intel® Parallel Studio XE 2018 Beta. We are aware of this issue and at this time, we do not have a known workaround. Re-installing Visual Studio may correct the situation. Please contact customer support for additional information if you encounter difficulties installing with Visual Studio 2017.
3. There have been situations where during the installation process, `/tmp` has been filled up. We recommend that you have **at least 12 GB of free space** in `/tmp` when installing the Intel® Parallel Studio XE. Also, the installer script `install.sh` has the command-line options:

```
-t [FOLDER]
```

or

```
--tmp-dir [FOLDER]
```

where `[FOLDER]` is a directory path, which can direct the use of intermediate storage to another disk partition referenced by `[FOLDER]`. `[FOLDER]` should be a non-shared storage location on each node of the cluster. Note that `[FOLDER]` should also contain **at least 12 GB of free space**.

4. On Linux\* OS, if any software component of the Intel® Parallel Studio XE is detected as pre-installed on the head node, that software component will not be processed by the installer. There is a similar problem on Windows\* OS in the 'Modify' mode. For Windows\* OS, if some software component of the Intel® Parallel Studio XE is pre-installed on the head node using the installer, that software component will not be installed on the compute nodes of the cluster. For either Linux\* OS or Windows\* OS, if you already installed some of the software components only on the head node, and you want to install them on the other nodes using the installer, you need to uninstall such components from the head node manually before starting the installer.
5. Intel® Parallel Studio XE for Windows\* OS requires **the creation and use of symbolic links for installation of the Intel® software product components**. If you have a File Allocation Table (FAT32) file system deployed on your Windows\* OS platform, these

symbolic links cannot be created and the integrity of the Intel® Parallel Studio XE installation is compromised.

6. For Intel® MIC Architecture, Intel® MPI Library supports only Intel® Xeon Phi™ Coprocessor.

This release of the Intel® MPI Library for Linux\* OS does not support the MPD process manager for Intel® Xeon Phi™ Coprocessor.

Intel® MPI Library for Linux\* OS supports multiple DAPL\* providers for communication between the host and the Intel® Xeon Phi™ Coprocessor and between several Intel® Xeon Phi™ Coprocessors inside one node.

Currently supported providers are DAPL over InfiniBand\* Architecture and DAPL over Intel® Symmetric Communication Interface (Intel® SCI). This feature requires using symbolic names in the host file.

7. Intel® Software Manager will always install to either `/opt` or `$HOME` on Linux\* OS even if a custom installation path is chosen. This can slow installation when the destination folder is a slow NFS shared folder, even if locally hosted.
8. In some situations, if a Windows OS computer has been updated but not restarted and the Visual Studio Shell is to be installed, Intel® Parallel Studio XE installation will fail with the error message “Intel(R) Parallel Studio XE 2018 Cluster Edition for Windows\* Setup Wizard ended prematurely because of an error(s).” The failing module is `vs_isoshell.exe`. To work around this issue, restart your computer and repeat the installation process.

## 8 Technical Support

Your feedback is very important to us. To receive technical support for the tools provided in this product and technical information including FAQ's and product updates, you are encouraged to register your product at the Intel® Software Development Products Registration Center.

**NOTE:** Registering for support varies for release product or pre-release products (alpha, beta, etc.) – only released software products have support web pages at

<http://software.intel.com/sites/support/>.

To register for an account, please visit the Intel® Software Development Products Registration Center website at <http://www.intel.com/software/products/registrationcenter/index.htm>. If you have forgotten your password, please follow the instructions on the login page for forgotten password.

Product support requests can be submitted via the Online Service Center at <http://www.intel.com/supporttickets>. Visit our Frequently Asked Questions page for Online Service Center assistance at <https://software.intel.com/en-us/faq/online-service-center>. When submitting a support request, please select the appropriate component tool unless your request is related to the entire suite.

## 9 Attributions for Intel® Math Kernel Library

As referenced in the End User License Agreement, attribution requires, at a minimum, prominently displaying the full Intel product name (e.g. "Intel® Math Kernel Library") and providing a link/URL to the Intel® MKL homepage (<http://www.intel.com/software/products/mkl>) in both the product documentation and website.

The original versions of the BLAS from which that part of Intel® MKL was derived can be obtained from <http://www.netlib.org/blas/index.html>.

The original versions of LAPACK from which that part of Intel® MKL was derived can be obtained from <http://www.netlib.org/lapack/index.html>. The authors of LAPACK are E. Anderson, Z. Bai, C. Bischof, S. Blackford, J. Demmel, J. Dongarra, J. Du Croz, A. Greenbaum, S. Hammarling, A. McKenney, and D. Sorensen. Our FORTRAN 90/95 interfaces to LAPACK are similar to those in the LAPACK95 package at <http://www.netlib.org/lapack95/index.html>. All interfaces are provided for pure procedures.

The original versions of ScaLAPACK from which that part of Intel® MKL was derived can be obtained from <http://www.netlib.org/scalapack/index.html>. The authors of ScaLAPACK are L. S. Blackford, J. Choi, A. Cleary, E. D'Azevedo, J. Demmel, I. Dhillon, J. Dongarra, S. Hammarling, G. Henry, A. Petitet, K. Stanley, D. Walker, and R. C. Whaley.

The Intel® MKL Extended Eigensolver functionality is based on the Feast Eigenvalue Solver 2.0 <http://www.ecs.umass.edu/~polizzi/feast/>.

PARDISO in Intel® MKL is compliant with the 3.2 release of PARDISO that is freely distributed by the University of Basel. It can be obtained at <http://www.pardiso-project.org>.

Some FFT functions in this release of Intel® MKL have been generated by the SPIRAL software generation system (<http://www.spiral.net/>) under license from Carnegie Mellon University. The Authors of SPIRAL are Markus Puschel, Jose Moura, Jeremy Johnson, David Padua, Manuela Veloso, Bryan Singer, Jianxin Xiong, Franz Franchetti, Aca Gacic, Yevgen Voronenko, Kang Chen, Robert W. Johnson, and Nick Rizzolo.

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