INTEL® PARALLEL STUDIO XE 2019

11 September 2018

Contents

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_2019/en/ps2019` 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.

2 Product Contents

The following table shows which Intel® Software Development Tools are present in each edition of Intel® Parallel Studio XE 2019.

Tool	Composer Edition[1]	Professional Edition	Cluster Edition
Intel® C++ Compiler	X	X	X
Intel® Fortran Compiler / Intel® Visual Fortran	X	X	X
Intel® Distribution for Python*	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)[2]	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 **(for Windows* OS only)**	X	X	X
Intel® Advisor		X	X
Intel® Inspector		X	X
Intel® VTune™ Amplifier		X	X
Intel® Cluster Checker **(For Linux* OS only)**			X
Intel® MPI Benchmarks			X
Intel® MPI Library			X
Intel® Trace Analyzer and Collector			X

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[1] Intel® Parallel Studio XE is only available in Composer Edition for macOS*.

[2] 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 tools and related documentation.

Tool	Version	Documentation
Intel® Advisor	2019	get_started.htm
Intel® C++ Compiler	19.0	get_started_wc.htm for Windows* OS get_started_lc.htm for Linux* OS get_started_mc.htm for macOS*
Intel® Cluster Checker **(For Linux* OS only)**	2019	get_started.htm
Intel® Data Analytics Acceleration Library (Intel® DAAL)	2019	get_started.htm
Intel® Distribution for Python*	2019	
Intel® Fortran Compiler / Intel® Visual Fortran Compiler	19.0	get_started_wf.htm for Windows* OS get_started_lf.htm for Linux* OS get_started_mf.htm for macOS*
Intel® Inspector	2019	get_started.htm
Intel® Integrated Performance Primitives (Intel® IPP)	2019	get_started.htm
Intel® Math Kernel Library (Intel® MKL)	2019	get_started.htm
Intel® MPI Benchmarks	2019	ReadMe_IMB.txt IMB_Users_Guide.htm
Intel® MPI Library	2019	get_started.htm
Intel® Threading Building Blocks (Intel® TBB)	2019	get_started.htm
Intel® Trace Analyzer and Collector	2019	get_started.htm
Intel® VTune™ Amplifier	2019	get_started.htm
Intel-provided Debug Solutions		See below for additional information.
Microsoft Visual Studio Shell* for Intel® Visual Fortran **(For Windows* OS; installs only on the master node)**		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-2019-composer-edition-fortran-debug-solutions-release-notes and https://software.intel.com/en-us/articles/intel-parallel-studio-xe-2019-composer-edition-c-debug-solutions-release-notes for information specific to this tool.

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

On Windows* OS only, the installation 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.

3   What's New

This section highlights important changes from previous product versions. For more information on what is new in each tool, see the individual tool release notes. Documentation for all tools is online at https://software.intel.com/en-us/intel-software-technical-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 in Intel® Parallel Studio XE 2019:
- All tools updated to the latest version.
- Intel® Distribution for Python* integrated into Intel® Parallel Studio XE.
- Added support for Conda packaging.
- Installation statistics are GDPR compliant.
- Added native method to elevate privileges on Linux* and macOS*.
- Added support for tbb4py
- Improvements to integration with Microsoft Visual Studio* 2017.
- Added support for Xcode 9.4 on macOS*.
- Deprecated support for Microsoft Windows* 7.
- Deprecated support for Microsoft Visual Studio* 2013.
- Removed support for IA-32 targets in macOS*.
- Added required digital certificates on Microsoft Windows*.
- Updated Intel® Parallel Studio XE Getting Started documentation format and structure.
- Removed Intel® Xeon Phi™ related components.
- Removed support for Intel® Graphics Technology compiler.
- Removed Intel® Debugger for Heterogeneous Compute.
- Added support for GDB 8.0.1 in Intel® C/C++ Compiler and Intel® Fortran Compiler.
- Intel® Advisor:
  - Preview feature: Integrated Roofline showing which exact memory layer is the bottleneck for each loop.
  - Added Advisor macOS* interface to view and analyze data collected on Linux* or Microsoft Windows*.

- o Flow Graph Analyzer: New rapid visual prototyping environment to interactively build, validate, and visualize algorithms.
- Intel® C/C++ Compiler:
  - o The option openmp-simd is now set by default.
  - o Added support for exclusive scan SIMD and user-defined induction for OpenMP* parallel pragmas.
  - o Added support for more C++17 features.
- Intel® Cluster Checker:
  - o New output format with overall summary and extended output containing simplified scheme to assess issues.
  - o Simplified execution of Intel® Cluster Checker with a single command.
  - o Added auto-node discovery when using Slurm*.
- Intel® Data Analytics Acceleration Library:
  - o Enabled support for user-defined data modification procedure in CSV and ODBC data sources.
- Intel® Distribution for Python*:
  - o Intel® Distribution for Python* now integrated into Intel® Parallel Studio XE 2019 installer. Also available as an easy command line standalone install.
  - o Faster machine learning with Scikit-learn: Support Vector Machine (SVM) and K-means prediction accelerated with Intel® Data Analytics Acceleration Library.
  - o Introduced new XGBoost package with Python* interface to the library (available on Linux* only).
- Intel® Fortran Compiler:
  - o Added support for Microsoft Visual Studio* 2017 Build Tools.
  - o The option openmp-simd is now set by default.
  - o Added support for more Fortran 2018 features.
- Intel® Inspector:
  - o Introduced Intel® Inspector – Persistence Inspector feature.
  - o Added analysis of potential deadlocks on Read-Write locks.
  - o Deprecated support for Microsoft .NET* software.
- Intel® Integrated Performance Primitives:
  - o Extended optimization for CLX, CNL in some functions.
  - o Initial optimizations for ICX, ICL of Crypto functionality.
  - o Developed patch and required API to support ZFP Data Compression.
- Intel® Math Kernel Library:
  - o Aligned Intel® Math Kernel Library LAPACK functionality with Netlib* LAPACK 3.7.1 and 3.8.0.
  - o Significantly (up to 2.5x) reduced memory footprint of ScaLAPACK Eigensolvers P?[SY|HE]EV[D|X|R].
  - o Improved performance of multiple routines.
- Intel® MPI Library:
  - o Added Intel® Omni-Path Architecture PSM2 Multiple-Endpoints (Multi-EP) support.
  - o Consolidated all network interfaces into OFI.

- o Added new impi_info utility.
- Intel® Threading Building Blocks:
  - o More algorithms in Parallel STL support parallel and/or vector execution policies.
  - o Binaries for Universal Windows Driver (vc14_uwd) now link with static Microsoft* runtime libraries, and are only available in commercial releases.
  - o Fixed static_partitioner to assign tasks properly in case of nested parallelism.
- Intel® Trace Analyzer and Collector:
  - o Removed support of Intel® Trace Collector static libraries on Windows*.
  - o GDPR compliance bug fix in installer.
- Intel® VTune™ Amplifier:
  - o Introduced Intel® VTune™ Amplifier Platform Profiler tool for low overhead system-wide analysis and insights.
  - o Improved workflow for analysis types and configuration.
  - o Input and Output analysis on Linux* extended to profile DPDK and SPDK IO API.

Changes in Intel® Parallel Studio XE 2018 Update 3:
- All components updated to current versions.
- Intel® Advisor
  - o Enhanced roofline analysis usability.
  - o Added ability to stop MAP analysis by condition to reduce collection overhead.
  - o Added ability to specify a number of top hot innermost loops in batch mode.
- Intel® C/C++ Compiler:
  - o Added support for parallel and/or vector execution policies in more algorithms.
  - o Added specialization of parallel_transform_scan pattern for better performance with floating point types.
- Intel® Math Kernel Library:
  - o Improved performance for small problem sizes in certain routines.
  - o Improved performance of LAPACK inverse routines.
  - o Added optimizations in certain routines for Intel® Advanced Vector Extensions 2 and 512 (Intel® AVX2 and Intel® AVX-512).
- Intel® Threading Building Blocks:
  - o Improved support for Flow Graph Analyzer and Intel® VTune™ Amplifier in the task scheduler and generic parallel algorithms.
  - o Default device set for opencl_node now includes all the devices from the first available OpenCL* platform.
  - o Added template class blocked_rangeNd for a generic multi-dimensional range (requires C++11).
- Intel® VTune™ Amplifier:
  - o Input and Output analysis on Linux* extended to profile DPDK and SPDK IO API.
  - o Added support for SUSE* Linux* Enterprise Server 12 SP3, Red Hat Enterprise Linux* 7 Update 5, Ubuntu* 18.04, and Microsoft Windows* 10 RS4 (user-mode sampling and tracing collection only).

Changes in Intel® Parallel Studio XE 2018 Update 2:
- All components updated to current versions.
- Added support for Xcode 9.2.
- Intel® Advisor:
    - Improved recommendations: new navigation, parameters for peel/remainder recommendations, and more.
    - Roofline chart improvements: benchmarks on 1 MPI rank per node, guidance on chart, recalculation of roofs for number of threads.
    - Refinement analysis improvements: analyze limited amount of loop iterations to reduce overhead, new footprint metric with precise analytics for loop's first iteration
- Intel® Data Analytics Acceleration Library:
    - Host application interface has been added to DAAL. Example code is provided.
    - Published experimental DAAL and DAAL extension library technical preview.
    - Gradient boosted trees training algorithm has been extended with inexact splits calculation mode.
- Intel® Integrated Performance Primitives:
    - Extended optimization for Intel® AVX-512 and for Intel® SSE4.2 instruction set.
    - Fixed a problem with incorrect code dispatching for some systems.
- Intel® Inspector:
    - Added support for Ubuntu 17.10 and Windows 10 RS3.
- Intel® Math Kernel Library:
    - Improved performance of BLAS level 3 functions and SGEMM/DGEMM on certain instruction sets.
    - Introduced Intel® TBB support of triangular solvers and converters routines.
    - Introduced new capabilities in Intel® Pardiso functionality.
- Intel® MPI Library:
    - Improved shm performance with collective operations.
    - I_MPI_SCHED_YIELD and I_MPI_SCHED_YIELD_MT_OPTIMIZATION are replaced by I_MPI_THREAD_YIELD. See Intel® MPI Library documentation for values.
    - Intel® MPI Library is available to install now in YUM and APT repositories.
- Intel® Threading Building Blocks:
    - Binaries for Universal Windows Driver (vc14_uwd) now link with static Microsoft* runtime libraries, and are only available in commercial releases.
    - Extended flow graph documentation with more code samples.
- Intel® Trace Analyzer and Collector:
    - User interface improvements.
    - Deprecated ITC static libraries on Windows.
- Intel® VTune™ Amplifier:
    - Preview of CPU/FPGA Interaction analysis for systems with a discrete Intel® Arria® 10 FPGA.
    - HPC workload profiling improvements.
    - Managed runtime analysis improvements.

Changes in Intel® Parallel Studio XE 2018 Update 1:
- All components updated to current versions.
- Added installer support for Xcode* 9.1.
- Added Japanese content for compilers and libraries.
- Improved integration with Microsoft Visual Studio* 2017.
- Online documentation moved to https://software.intel.com/en-us/intel-software-technical-documentation.
- Intel® Advisor:
    - Added selective profiling for Roofline, FLOPS and Trip Counts collections.
    - Added capability to run Roofline in command line with single command.
    - Added ITT "pause/resume" API calls to mark regions of interest in source code.
- Intel® Cluster Checker:
    - Enabled provider configuration as part of Framework Definitions.
    - Enabled latest Intel® Xeon® processors.
    - Added support for the SGEMM benchmark.
- Intel® Data Analytics Acceleration Library:
    - Added Gradient Boosting algorithm.
    - Added normalization in PCA algorithm.
    - Includes tech preview of High Level API for Python and R.
- Intel® Inspector:
    - Fixed incompatibility with some antiviruses.
- Intel® Integrated Performance Primitives:
    - Support of new modes CS1, CS2, and CS3 for AES and SMS4 functionality has been enabled in Crypto domain.
    - Added new Platform Aware functionality ipprFilterBorder and ipprCopyBorder.
- Intel® Math Kernel Library:
    - Improved performance with and without scaling factor across all of FFT domains.
    - Introduced LAPACKE_set_nancheck routine for disabling/enabling nan checks in LAPACKE functions.
    - Introduced TBB-threading layer in MKL Data Fitting and Vector Statistics components.
- Intel® MPI Library:
    - The Intel® MPI Library 2019 Technical Preview for Linux* OS is available under Intel® MPI Library 2018 Update 1 installation. It is installed in <install_path>/compilers_and_libraries_2018.1.<pkg>/linux/mpi_2019. The usage terms and conditions are provided in <install_path>/compilers_and_libraries_2018.1.<pkg>/licensing/mpi_2019/.
    - Improved MPI_Init scalability, see the I_MPI_STARTUP_MODE environment variable description for details.
    - Fixed multiple functionality and performance regressions from 2017 Update 4.
- Intel® Threading Building Blocks:
    - Added lambda-friendly overloads for parallel_scan.

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- o Added preview of reservation support in overwrite_node and write_once_node
- o Bugs fixed: fixed a potential deadlock scenario in the flow graph that affected Intel® TBB 2018.
- Intel® Trace Analyzer and Collector:
  - o Fixed --summary option in ITAC command line interface.
  - o Performance improvements in Imbalance Diagram building process.
- Intel® VTune™ Amplifier:
  - o Application Performance Snapshot can now use Intel® VTune™ Amplifier Sampling driver or perf system wide profiling capability.
  - o GPU Hotspots analysis extended to analyze FPU bound OpenCL™ applications and identify a cause of low occupancy problems.
  - o New amplxe-self-checker.sh script introduced to validate VTune Amplifier deployment on Linux*.

Changes in Intel® Parallel Studio XE 2018:
- Licensing system has been updated. Floating license servers must be updated to support this change. The current license manager software can be downloaded at https://registrationcenter.intel.com.
- Added support for new processors including Intel® Xeon Phi™ processors (code named Knights Landing and Knights Mill) and the Intel® Xeon® Processor Scalable family.
- Support for the Intel® Xeon Phi™ x100 product family coprocessor (formerly code name Knights Corner) is removed in this release. See section 3.1 for more information.
- All components updated to current versions.
- Release Notes merged into a single document for all operating systems.
- Added support for cluster installation on Windows Server* 2016 with HPC Pack 2016.
- Added cross-OS analysis to all license types. This enables data collection on one operating system family with analysis on a different operating system family under one license. To download installation packages for additional operating systems, visit https://registrationcenter.intel.com.
- Component documentation has been moved online and is available at https://software.intel.com/en-us/parallel-studio-xe/documentation/view-all.
- Intel® Software Manager can now be removed in Windows* via the Add/Remove Programs utility. See https://registrationcenter-ssl.intel.com/Docs/ism_v2.htm for more information.
- The Intel® Integrated Performance Primitives (Intel® IPP) Cryptography Library is now a standalone library and no longer depends on Intel® IPP. See https://software.intel.com/en-us/get-ipp-cryptography-libraries for information on how to obtain this library.
- Intel® Advisor:
  - o Introduced general availability of the Cache-aware Roofline performance characterization model.
  - o Added an experimental feature Hierarchical Roofline which is enabled by setting the environment variable ADVIXE_EXPERIMENTAL=roofline_ex before launching Intel® Advisor.

- o Added experimental support for accessing Intel® Advisor data via a Python* API. Examples are provided in the {install_dir}/pythonapi/examples directory.
- Intel® C/C++ Compiler:
  - o Starting with Intel® C++ Compiler 18.0 Gold Release, Intel® Cilk™ Plus will be marked as deprecated and eventually removed in a future release. To learn how to migrate to OpenMP* or Intel® Threading Building Blocks, see this article.
  - o Optimizations for latest Intel® Xeon® and Intel® Xeon Phi™ Processors.
  - o Initial support for OpenMP* 5.0.
  - o Implementation of Parallel STL*.
- Intel® Cluster Checker:
  - o Added support for Intel® Xeon® Scalable Processors.
  - o Added Framework Definition feature to allow for customization of analysis.
  - o Enhanced Intel® Omni-Path Architecture validation.
- Intel® Data Analytics Acceleration Library:
  - o New Classification and Regression Decision Tree and Forest.
  - o Introduced API modifications to streamline library usage and enable consistency across functionality.
  - o New Neural Network optimizations and functionality.
- Intel® Distribution for Python*:
  - o Added support for OpenCV*.
  - o Updated to the latest Intel® Performance Libraries.
  - o Improved NumPY* and SciPy* performance.
- Intel® Fortran Compiler:
  - o Optimizations for latest Intel® Xeon® and Intel® Xeon Phi™ Processors.
  - o Initial support for OpenMP* 5.0.
  - o Full Fortran 2008, initial Fortran 2015 support.
- Intel® Inspector:
  - o Added support for C++17 std::shared_mutex and Windows* SRW Locks.
  - o Added support for cross-OS analysis to all license types. Installation packages can be downloaded from registrationcenter.intel.com.
  - o Added integration and support for Microsoft Visual Studio* 2017.
- Intel® Integrated Performance Primitives:
  - o Introduced patch files for the GraphicsMagick* source to provide drop-in optimization with Intel® IPP functions.
  - o Cryptography library has removed dependence on main Intel® Integrated Performance Primitives package.
  - o Improved compression performance.
- Intel® Math Kernel Library:
  - o Introduced compact GEMM and TRSM functions and optimized specific GEMM functions to work with quantized matrices.
  - o Introduced optimizations for tall-and-skinny/short-and-wide matrices for certain matrix functions.
  - o Introduced Verbose support for FFT domain.
- Intel® MPI Library:

- o Improved finalization time for OFI and TMI fabrics.
  - o Added support for latest Intel® Xeon® Processors, Intel® Xeon Phi™ Processors and Coprocessors, and Intel® Omni-Path Architecture fabric.
- Intel® Threading Building Blocks:
  - o Implementation of Parallel Standard Template Library.
  - o Adds capability to parallelize and vectorize with compiler with minimal code change.
  - o Adds ability to specify execution policies.
- Intel® Trace Analyzer and Collector:
  - o Added OpenSHMEM* support.
  - o Added support for latest Intel® Xeon® Processors, Intel® Xeon Phi™ Processors and Coprocessors, and Intel® Omni-Path Architecture fabric.
- Intel® VTune™ Amplifier:
  - o Python* profiling enhanced with Locks and Waits and Memory Consumption analysis to enable tuning threaded performance of mixed Python* and native code.
  - o Adds support for profiling inside Docker* and Mesos* containers.
  - o Improved Application Snapshot merges MPI Performance Snapshot with previous Application Performance Snapshot.

Changes in Intel® Parallel Studio XE 2017 Update 3:
- All components updated to current versions.
- Added support for Microsoft Visual Studio 2017*.
- Added support for installing some libraries from yum, apt, or conda. See https://software.intel.com/en-us/articles/installing-intel-free-libs-and-python-yum-repo, https://software.intel.com/en-us/articles/installing-intel-free-libs-and-python-apt-repo, and https://software.intel.com/en-us/articles/using-intel-distribution-for-python-with-anaconda for more information.
- Added support for cluster installation on Microsoft Windows Server 2016*.
- Intel® Math Kernel Library (Intel® MKL), Intel® Integrated Performance Primitives (Intel® IPP) are distributed under Intel Simplified Software License. Intel® Threading Building Blocks (Intel® TBB) for Linux*, and macOS*, Intel® Data Analytics Acceleration Library (Intel® DAAL) for Linux*, and macOS* are distributed under Apache License, Version 2.0. See compilers_and_libraries_2017/licensing/ folder under the target installation path for reference.
- Intel® Advisor:
  - o Added recommendation to force scalar remainder for loops with low mask utilization on Intel® AVX-512.
  - o Extended "Gather recommendation" with "Constant (non-unit)" pattern.
- Intel® Data Analytics Acceleration Library:
  - o License switched to Apache License 2.0*.
- Intel® MPI Library:
  - o Improved MPI startup up to 8.5x on large HPC systems.

- o Intel® Omni-Path Architecture is used by default on systems with multiple fabrics.
- Intel® Threading Building Blocks:
  - o Adds a graph/matmult example to demonstrate support for compute offload to Intel® Graphics Technology in the flow graph API.
  - o The "compiler" build option now allows the user to specify a full path to the compiler.
- Intel® VTune™ Amplifier XE:
  - o Added support for Intel® Xeon Phi™ coprocessor code named Knights Landing from Windows* host.
  - o Enhanced support for applications using Intel® Threading Building Blocks that helps identify code inefficiencies causing high Overhead and Spin time.
  - o Automated installation of collectors on a remote Linux* target system.

Changes in Intel® Parallel Studio XE 2017 Update 2:
- All components updated to current versions.
- Migration to SHA-256 digital signatures on Linux*.
- Intel® Advisor:
  - o Roofline Analysis is released as a public feature.
  - o Added call stacks for FLOPS and Trip Counts that enable total metrics.
  - o Filter by module for Survey, FLOPS, and Trip Counts collections.
- Intel® Cluster Checker:
  - o Added additional support for Intel® Xeon Phi™ Product Family x200 processors.
  - o Added additional support for Intel® Omni-Path Architecture.
- Intel® Data Analytics Acceleration Library:
  - o Added Deep Learning feature extensions.
  - o Added API extensions for data parallelism scheme.
- Intel® Inspector:
  - o Support for C++17 std::shared_mutex.
- Intel® Integrated Performance Primitives:
  - o Introduced support for Intel® Xeon Phi™ processor x200 leverage boot mode in examples.
  - o Added new functions in ZLIB to support user-defined Huffman tables.
- Intel® Math Kernel Library:
  - o Intel® AVX-512 code is dispatched by default on Intel® Xeon® processors.
  - o Added support for Intel® Threading Building Blocks in various functions.
- Intel® MPI Library:
  - o Added a new environment variable, I_MPI_MEMORY_LOCK, to prevent memory swapping to the hard drive.
- Intel® Threading Building Blocks:
  - o Added template class gfx_factory to the flow graph API.
  - o 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.

3.1 Intel® Xeon Phi™ Product Family Updates

3.1.1 Intel® Xeon Phi™ 7200 Coprocessor (codenamed Knights Landing coprocessor)

Intel continually evaluates the markets for our products in order to provide the best possible solutions to our customer's challenges. As part of this on-going evaluation process Intel has decided to not offer Intel® Xeon Phi™ 7200 Coprocessor (codenamed Knights Landing Coprocessor) products to the market.

- Given the rapid adoption of Intel® Xeon Phi™ 7200 processors, Intel has decided to not deploy the Knights Landing Coprocessor to the general market.
- Intel® Xeon Phi™ Processors remain a key element of our solution portfolio for providing customers the most compelling and competitive solutions possible.

3.1.2 Support for the Intel® Xeon Phi™ x100 product family coprocessor (formerly code name Knights Corner) is removed in this release

The Intel® Xeon Phi™ x100 product family coprocessor (former code name Knights Corner) was officially announced end of life in January 2017. As part of the end of life process, the support for this family will only be available in the Intel® Parallel Studio XE 2017 version. Intel® Parallel Studio XE 2017 will be supported for a period of 3 years ending in January 2020 for the Intel® Xeon Phi™ x100 product family. Support will be provided for those customers with active support.

4   System Requirements

4.1   Processor Requirements

Systems based on IA-32 architecture are supported as target platforms on Windows* and Linux*. Systems based on Intel® 64 architectures below are supported both as host and target platforms.

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.

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 tools on Intel® 64 Architecture. Individual tools may support additional operating systems and architecture configurations. See the individual tool release notes for full details.

- Debian* 8, 9
- Fedora* 27, 28
- Red Hat Enterprise Linux* 6, 7 (equivalent CentOS versions supported, but not separately tested)
- SUSE Linux Enterprise Server* 12, 15
- Ubuntu* 16.04, 18.04
- Microsoft* Windows* 7 (deprecated), 10
- Microsoft* Windows* Server 2012, 2012 R2, 2016
- macOS* 10.13

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 tools are not supported on Ubuntu non-LTS systems.

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

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 (deprecated), 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* 9

5   Installation Notes

For instructions on installing and uninstalling the Intel® Parallel Studio XE see the Installation Guide for your operating system. These are available from the Intel® Software Development Products Registration Center page for Intel® Parallel Studio XE for your operating system. The installation of the product requires a valid license file or serial number.

5.1   Installation on macOS*

If you will be using Xcode*, please make sure that a supported version of Xcode is installed. If you install a new version of Xcode in the future, you must reinstall Intel® Parallel Studio XE afterwards.

The `Command Line Tools` component, required for command-line development, is not installed by default. It can be installed using the Components tab of the Downloads preferences panel.

You will need to have administrative or "sudo" privileges to install, change or uninstall the product.

Follow the prompts to complete installation.

Note that there are several different downloadable files available, each providing different combinations of tools. Please read the download web page carefully to determine which file is appropriate for you.

You do not need to uninstall previous versions or updates before installing a newer version – the new version will coexist with the older versions.

5.2   Some Features Require Installing as Root

Most of Intel® VTune™ Amplifier profiling features work with a non-root install. Many work on either a genuine Intel processor or a compatible processor.

Some advanced features that use event-based sampling require the latest OS kernel or sampling driver to be installed. Intel® Atom™ processors also require this driver for analysis.

To install the driver on a system with a genuine Intel processor, launch the installer as root or ask your system administrator to install the driver later. For information on building and setting up the drivers, see https://software.intel.com/en-us/sep_driver.

5.3 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.

5.4 Silent Install

For information on automated or "silent" install capability, please see http://intel.ly/nKrzhv.

5.4.1 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>
  macOS:
  /Volumes/<package_id>/<package_id>.app/Contents/MacOS/
  ```

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`".

5.5 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.

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7 Issues and Limitations

1. Multiple problems have been encountered regarding integration with Microsoft Visual Studio* 2017. Please see https://software.intel.com/en-us/articles/intel-software-development-tools-integration-to-vs2017-issue for a current list of related issues along with known resolutions and workarounds.

2. 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**.

3. On Linux* OS, if any software tool of the Intel® Parallel Studio XE is detected as pre-installed on the head node, that software tool 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 tool of the Intel® Parallel Studio XE is pre-installed on the head node using the installer, that software tool 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 tools only on the head node, and you want to install them on the other nodes using the installer, you need to uninstall such tools from the head node manually before starting the installer.

4. Intel® Parallel Studio XE for Windows* OS requires **the creation and use of symbolic links for installation of the Intel® software product tools**. 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.

5. 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 2019 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.

Each purchase of Intel® Parallel Studio XE includes a year of support services, which includes priority support at Online Service Center. For more information on Online Service Center please see http://software.intel.com/en-us/support/online-service-center. When submitting a support request, please select the appropriate 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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