

Intel® C++ Composer XE 2013 SP1 for Linux* Installation Guide and Release Notes

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1 Introduction

This document describes how to install the product, provides a summary of new and changed features and includes notes about features and problems not described in the product documentation.

Due to the nature of this comprehensive integrated software development tools solution, different Intel® C++ Composer XE components may be covered by different licenses. Please see the licenses included in the distribution as well as the [Disclaimer and Legal Information](#) section of these release notes for details.

1.1 Change History

This section highlights important from the previous product version and changes in product updates. For information on what is new in each component, please read the individual component release notes.

1.1.1 Changes in Update 5

- Intel® C++ Compiler XE 14.0.5
- Corrections to reported problems

1.1.2 Changes in Update 4

- Red Hat Enterprise Linux 7* now supported
- Intel® C++ Compiler XE 14.0.4
- [Intel® Math Kernel Library 11.1 update 4](#)
- Intel® Threading Building Blocks 4.2 update 5
- Corrections to reported problems

1.1.3 Changes in Update 3

- Intel® C++ Compiler XE 14.0.3
- [Intel® Math Kernel Library 11.1 update 3](#)
- Intel® Integrated Performance Primitives 8.1 update 1
- Intel® Threading Building Blocks 4.2 update 4
- Corrections to reported problems

1.1.4 Changes in Update 2

- Intel® C++ Compiler XE 14.0.2
- [Intel® Math Kernel Library 11.1 update 2](#)
- Intel® Integrated Performance Primitives 8.1
- Intel® Threading Building Blocks 4.2 update 3
- [New Intel® Cilk™ Plus STL vector reducer in Intel® C++ Composer XE 2013 SP1 update 2](#)
- [KMP_DYNAMIC_MODE Environment Variable Support for “asat” Deprecated](#)
- Corrections to reported problems

1.1.5 Changes in Update 1

- First 14.0 version with Japanese localization
- Intel® C++ Compiler XE 14.0.1
- [Intel® Math Kernel Library 11.1 update 1](#)
- Intel® Integrated Performance Primitives 8.0 update 1
- Intel® Threading Building Blocks 4.2 update 1
- [GNU* Project Debugger \(GDB\) provides register support for Intel® Memory Protection Extensions \(Intel® MPX\) and Intel® Advanced Vector Extensions 512 \(Intel® AVX-512\)](#)
- [New compiler option /Qopt-gather-scatter-unroll \(opt-gather-scatter-unroll\) for targeting Intel® MIC Architecture](#)
- [New compiler option /Q\[a\]xMIC-AVX512\(-\[a\]xMIC-AVX512\)](#)
- [New compiler option -f\[no-\]mpc_privatize to enable privatization of all static data for the MultiProcessor Communications environment \(MPC\) unified parallel runtime.](#)
- [New compiler option /Qcheck-pointers-mpx \(-check-pointers-mpx\) to support the Intel® Memory Protection Extensions \(Intel® MPX\)](#)
- [“uniform\(this\)” is now allowed in Intel® Cilk™ Plus SIMD enabled function \(e.g., declspec\(vector\(uniform\(this\)\)\)\)](#)
- [New intrinsic allow_cpu_features](#)
- [New Numeric String Conversion Library: libistrconv](#)
- Corrections to reported problems

1.1.6 Changes since Intel® Composer XE 2013

- [Online installation](#)
- [GUI installation](#)
- Intel® C++ Compiler XE 14.0.0
- [GNU* Project Debugger \(GDB*\)](#)
- Intel® Debugger support deprecated
- Fedora* 18 and 19 are now supported
- Ubuntu* 13.04 and Debian* 7.0 are now supported
- Support for the following versions of Linux distributions has been dropped:
 - Fedora* 17
 - Ubuntu* 11.10
 - Pardus* 2011.2

- [Features from C++11 \(-std=c++11\)](#)
- [Partial OpenMP* 4.0 support](#)
- [Intel® Cilk™ Plus changes](#)
- [DWARF V4 support](#)
- [__INTEL_COMPILER_UPDATE predefined macro](#)
- [Pointer type alignment qualifiers](#)
- [Variable definition attributes to avoid false sharing](#)
- [-mtune performance tuning option](#)
- [Using offload code in shared libraries requires main program to be linked with –offload=mandatory or –offload=optional option](#)
- [-openmp-offload/-openmp-simd options added for controlling the enabling/disabling of specific OpenMP* 4.0 features independently of other OpenMP features](#)
- [__GXX_EXPERIMENTAL_CXX0X Macro Not Supported](#)
- -xATOM_SSE4.2 option added to support Silvermont microarchitecture
- [Intel® Math Kernel Library 11.1](#)
- [Intel® Integrated Performance Primitives 8.0 update 1](#)
- [Intel® Threading Building Blocks 4.2](#)

1.2 Product Contents

*Intel® C++ Composer XE 2013 SP1 Update 5 for Linux** includes the following components:

- Intel® C++ Compiler XE 14.0.5 for building applications that run on IA-32, Intel® 64 architecture systems and Intel® Xeon Phi™ coprocessors running the Linux* operating system
- GNU* Project Debugger (GDB*) 7.5
- Intel® Debugger 13.0
- Intel® Integrated Performance Primitives 8.1 update 1
- Intel® Math Kernel Library 11.1 update 4
- Intel® Threading Building Blocks 4.2 update 5
- Integration into the Eclipse* development environment
- On-disk documentation

1.3 System Requirements

For an explanation of architecture names, see <http://intel.ly/q9JVjE>

- A PC based on an IA-32 or Intel® 64 architecture processor supporting the Intel® Streaming SIMD Extensions 2 (Intel® SSE2) instructions (Intel® Pentium® 4 processor or later, or compatible non-Intel processor)
 - Development of 64-bit applications or applications targeting Intel® MIC Architecture is supported on a 64-bit version of the OS only. Development of 32-bit applications is supported on either 32-bit or 64-bit versions of the OS. Development for a 32-bit 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.

- For Intel® MIC Architecture development/testing:
 - Intel® Xeon Phi™ coprocessor
 - [Intel® Manycore Platform Software Stack \(Intel® MPSS\)](#)
- For the best experience, a multi-core or multi-processor system is recommended
- 1GB of RAM (2GB recommended)
- 2.5GB free disk space for all features
- One of the following Linux distributions (this is the list of distributions tested by Intel; other distributions may or may not work and are not recommended - please refer to [Technical Support](#) if you have questions):
 - Fedora* 18,19
 - Red Hat Enterprise Linux* 5, 6, 7
 - SUSE LINUX Enterprise Server* 10, 11
 - Ubuntu* 12.04 LTS, 13.04
 - Debian* 6.0, 7.0
 - Intel® Cluster Ready
- Linux Developer tools component installed, including gcc, g++ and related tools
 - gcc versions 4.1-4.8 supported
 - binutils versions 2.17-2.23 supported
- Library libunwind.so is required in order to use the `-traceback` option. Some Linux distributions may require that it be obtained and installed separately.

Additional requirements to use GNU* GDB

- To use the provided GNU* GDB, Python* version 2.4, 2.6 or 2.7 is required.

Additional requirements to use the Graphical User Interface of the Intel® Debugger

- Java* Runtime Environment (JRE) 6.0 (also called 1.6†) – 5.0 or later recommended
 - A 32-bit JRE must be used on an IA-32 architecture system and a 64-bit JRE must be used on an Intel® 64 architecture system

Additional requirements to use the integration into the Eclipse* development environment

- Eclipse Platform version 4.2 with:
 - Eclipse C/C++ Development Tools (CDT) 8.1 or later
 - Java* Runtime Environment (JRE) 6.0 (also called 1.6†) or later
- Eclipse Platform version 3.8 with:
 - Eclipse C/C++ Development Tools (CDT) 8.1 or later
 - Java* Runtime Environment (JRE) 6.0 (also called 1.6†) or later
- Eclipse Platform version 3.7 with:
 - Eclipse C/C++ Development Tools (CDT) 8.0 or later
 - Java* Runtime Environment (JRE) 6.0 (also called 1.6†) or later

† There is a known issue with JRE 6.0 through update 10 that causes a crash on Intel® 64 architecture. It is recommended to use the latest update for your JRE. See http://www.eclipse.org/eclipse/development/readme_eclipse_3.7.html section 3.1.3 for details.

Notes

- The Intel compilers are tested with a number of different Linux distributions, with different versions of gcc. Some Linux distributions may contain header files different from those we have tested, which may cause problems. The version of glibc you use must be consistent with the version of gcc in use. For best results, use only the gcc versions as supplied with distributions listed above.
- The default for the Intel® compilers is to build IA-32 architecture applications that require a processor supporting the Intel® SSE2 instructions - for example, the Intel® Pentium® 4 processor. A compiler option is available to generate code that will run on any IA-32 architecture processor. However, if your application uses Intel® Integrated Performance Primitives or Intel® Threading Building Blocks, executing the application will require a processor supporting the Intel® SSE2 instructions.
- Compiling very large source files (several thousands of lines) using advanced optimizations such as -O3, -ipo and -openmp, may require substantially larger amounts of RAM.
- The above lists of processor model names are not exhaustive - other processor models correctly supporting the same instruction set as those listed are expected to work. Please refer to [Technical Support](#) if you have questions regarding a specific processor model
- Some optimization options have restrictions regarding the processor type on which the application is run. Please see the documentation of these options for more information.

1.3.1 Red Hat Enterprise Linux 5* and SuSE Enterprise Linux 10* are deprecated

Support for these operating system versions is deprecated, and support may be removed in a future release.

1.3.2 IA-64 Architecture (Intel® Itanium®) Development Not Supported

This product version does not support development on or for IA-64 architecture (Intel® Itanium®) systems. The version 11.1 compiler remains available for development of IA-64 architecture applications.

1.4 Documentation

Product documentation can be found in the `Documentation` folder as shown under [Installation Folders](#).

Optimization Notice

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 SSSE3 instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors. 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

1.5 Samples

Samples for each product component can be found in the `Samples` folder as shown under [Installation Folders](#).

1.6 Japanese Language Support

Intel compilers provide support for Japanese language users. Error messages, visual development environment dialogs and some documentation are provided in Japanese in addition to English. By default, the language of error messages and dialogs matches that of your operating system language selection. Japanese-language documentation can be found in the `ja_JP` subdirectory for documentation and samples.

Japanese language support will be available in an update on or after the release of Intel® C++ Composer XE 2013.

If you wish to use Japanese-language support on an English-language operating system, or English-language support on a Japanese-language operating system, you will find instructions at <http://intel.ly/qhINDv>

1.7 Technical Support

If you did not register your compiler during installation, please do so at the Intel® Software Development Products Registration Center at <http://registrationcenter.intel.com>. Registration entitles you to free technical support, product updates and upgrades for the duration of the support term.

For information about how to find Technical Support, Product Updates, User Forums, FAQs, tips and tricks, and other support information, please visit <http://www.intel.com/software/products/support/>

Note: If your distributor provides technical support for this product, please contact them for support rather than Intel.

2 Installation

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.

If you received your product on DVD, mount the DVD, change the directory (`cd`) to the top-level directory of the mounted DVD and begin the installation using the command:

```
./install.sh
```

If you received the product as a downloadable file, first unpack it into a writeable directory of your choice using the command:

```
tar -xzvf name-of-downloaded-file
```

Then change the directory (`cd`) to the directory containing the unpacked files and begin the installation using the command:

```
./install.sh
```

Follow the prompts to complete installation.

Note that there are several different downloadable files available, each providing different combinations of components. 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.

Please do not run the install script as a background process (i.e. running “`./install.sh &`”). This is not supported.

2.1 GUI installation now available in Intel® Composer XE 2013 SP1

If on a Linux* system with GUI support, the installation will now provide a GUI-based installation. If a GUI is not supported (for example if running from an ssh terminal), a command-line installation will be provided.

2.2 Online Installation now available in Intel® Composer XE 2013 SP1

The default electronic installation package for Intel® Composer XE 2013 SP1 now consists of 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.

2.2.1 `http_proxy` is set, but `sudo` installation still fails to connect

Most `sudo` profiles are set to not inherit certain settings like `http_proxy` from the original user. Make sure your `/etc/sudoers` file contains a line like the following to allow your proxy settings to propagate:

```
Defaults    env_keep += "http_proxy"
```

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.

You can also volunteer to provide Intel anonymous usage information about these products to help guide future product design. This option, the Intel® Software Improvement Program, is not enabled by default – you can opt-in during installation or at a later time, and may opt-out at any time. For more information please see <http://intel.ly/SoftwareImprovementProgram>.

2.4 Installation of Intel® Manycore Platform Software Stack (Intel® MPSS)

The Intel® Manycore Platform Software Stack (Intel® MPSS) may be installed before or after installing the Intel® Composer XE 2013 SP1 for Linux* including Intel® MIC Architecture product.

Using the latest version of Intel® MPSS available is recommended.

Refer to the Intel® MPSS documentation for the necessary steps to install the user space and kernel drivers.

2.5 Cluster Installation

To install a product on multiple nodes of a cluster on Linux*, the following steps should be taken:

- 1) Run the installation on a system where Intel® Cluster Studio is installed. Also, passwordless `ssh` must be configured between machines in a cluster.
- 2) On step "4 Options" there will be a "Cluster installation" option. The default value is "Current node".
- 3) To install on a cluster, the user must select this option and then provide a `machines.LINUX` file with IP-addresses, hostnames, FQDNs, and other information for the cluster nodes (one node per line). The first line is expected to describe the current (master) node.
- 4) Once the `machines.LINUX` file is provided, additional options will appear: Number of parallel installations, Check for shared installation directory.
- 5) When all options are configured and installation has begun, the installation will check connectivity with all nodes (a prerequisite) and only then will it install the product on these nodes.

2.6 Silent Install

For information on automated or "silent" install capability, please see <http://intel.ly/ngVHY8>.

2.7 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.

2.8 Eclipse* Integration Installation

Please refer to the [section below on Eclipse Integration](#)

2.9 Security-Enhanced Linux* (SELinux*)

In previous Composer XE versions, installation required setting the `SELINUX` mode to `permissive`. Starting with Composer XE 2013, this is no longer required.

2.10 Known Installation Issues

- When uninstalling a more recent major version of Intel® Composer XE, the symbolic links will be removed even if other versions of Intel Composer XE exist on the system. For example, uninstalling Intel Composer XE 2011 will remove the symbolic links of Intel Composer XE 2013 SP1 at the same installed directory. As a workaround, refer to the other Composer XE's directories explicitly using `link_install.sh` (for example `/opt/intel/link_install.sh -i -p /opt/intel/composer_xe_2013_sp1.<n>.<pkg>`).

- On some versions of Linux, auto-mounted devices do not have the "exec" permission and therefore running the installation script directly from the DVD will result in an error such as:

```
bash: ./install.sh: /bin/bash: bad interpreter: Permission denied
```

If you see this error, remount the DVD with `exec` permission, for example:

```
mount /media/<dvd_label> -o remount,exec
```

and then try the installation again.

- The product is fully supported on Ubuntu* and Debian* Linux distributions for IA-32 and Intel® 64 architecture systems as noted above under System Requirements. Due to a restriction in the licensing software, however, it is not possible to use the Trial License feature when evaluating IA-32 components on an Intel® 64 architecture system under Ubuntu or Debian. This affects using a Trial License only. Use of serial numbers, license files, floating licenses or other license manager operations, and off-line activation (with serial numbers) is not affected. If you need to evaluate IA-32 components of the product on an Intel® 64 architecture system running Ubuntu or Debian, please visit the Intel® Software Evaluation Center (<http://intel.ly/nJS8y8>) to obtain an evaluation serial number.

2.11 Installation Folders

The compiler installs, by default, under `/opt/intel` – this is referenced as `<install-dir>` in the remainder of this document. You are able to specify a different location, and can also perform a “non-root” install in the location of your choice.

The directory organization has changed since the Intel® Compilers 11.1 release.

While the top-level installation directory has also changed between the original C++ Composer XE 2011 release and Composer XE 2013, the `composerxe` symbolic link can still be used to reference the latest product installation.

Under `<install-dir>` are the following directories:

- `bin` – contains symbolic links to executables for the latest installed version
- `lib` – symbolic link to the `lib` directory for the latest installed version
- `include` – symbolic link to the `include` directory for the latest installed version
- `man` – symbolic link to the directory containing man pages for the latest installed version
- `ipp` – symbolic link to the directory for the latest installed version of Intel® Integrated Performance Primitives
- `mkl` – symbolic link to the directory for the latest installed version of Intel® Math Kernel Library
- `tbb` – symbolic link to the directory for the latest installed version of Intel® Threading Building Blocks
- `ism` – contains files for Intel® Software Manager
- `composerxe` – symbolic link to the `composer_xe_2013` directory
- `composer_xe_2013_sp1` – directory containing symbolic links to subdirectories for the latest installed Intel® Composer XE 2013 SP1 compiler release
- `composer_xe_2013_sp1.<n>.<pkg>` - physical directory containing files for a specific compiler version. `<n>` is the update number, and `<pkg>` is a package build identifier.

Each `composer_xe_2013_sp1` directory contains the following directories that reference the latest installed Intel® Composer XE 2013 SP1 compiler:

- `bin` – directory containing scripts to establish the compiler environment and symbolic links to compiler executables for the host platform
- `pkg_bin` – symbolic link to the compiler `bin` directory
- `include` – symbolic link to the compiler `include` directory
- `lib` – symbolic link to the compiler `lib` directory
- `ipp` – symbolic link to the `ipp` directory
- `mkl` – symbolic link to the `mkl` directory
- `tbb` – symbolic link to the `tbb` directory
- `debugger` – symbolic link to the `debugger` directory

- `eclipse_support` – symbolic link to the `eclipse_support` directory
- `man` – symbolic link to the `man` directory
- `Documentation` – symbolic link to the `Documentation` directory
- `Samples` – symbolic link to the `Samples` directory

Each `composer_xe_2013_sp1.<n>.<pkg>` directory contains the following directories that reference a specific update of the Intel® Composer XE 2013 SP1 compiler:

- `bin` – all executables
- `pkg_bin` – symbolic link to `bin` directory
- `compiler` – shared libraries and header files
- `debugger` – debugger files
- `Documentation` – documentation files
- `man` – man pages
- `eclipse_support` – files to support Eclipse integration
- `ipp` – Intel® Integrated Performance Primitives libraries and header files
- `mkl` – Intel® Math Kernel Library libraries and header files
- `tbb` – Intel® Threading Building Blocks libraries and header files
- `Samples` – Product samples and tutorial files
- `Uninstall` – Files for uninstallation
- `.scripts` – scripts for installation

If you have both the Intel C++ and Intel Fortran compilers installed, they will share folders for a given version and update.

This directory layout allows you to choose whether you want the latest compiler, no matter which version, the latest update of the Intel® Composer XE 2013 compiler, or a specific update. Most users will reference `<install-dir>/bin` for the `compilervars.sh` [`.csh`] script, which will always get the latest compiler installed. This layout should remain stable for future releases.

2.12 Removal/Uninstall

Removing (uninstalling) the product should be done by the same user who installed it (root or a non-root user). If `sudo` was used to install, it must be used to uninstall as well. It is not possible to remove the compiler while leaving any of the performance library or Eclipse* integration components installed.

1. Open a terminal window and set default (`cd`) to any folder outside `<install-dir>`
2. Type the command: `<install-dir>/uninstall.sh`
3. Follow the prompts
4. Repeat steps 2 and 3 to remove additional platforms or versions

If you have the same-numbered version of Intel® Fortran Compiler installed, it may also be removed.

If you have added the Intel C++ Eclipse integration to an instance of Eclipse in your environment, you will need to update your Eclipse configuration by removing the Intel integration extension site from your Eclipse configuration. To do this, Go to Help > About Eclipse and click on "Installation Details". Select "Intel(R) C++ Compiler XE 14.0 for Linux* OS " under "Installed Software" and click on "Uninstall..." Click "Finish". When asked to restart Eclipse, select "Yes".

3 Intel® Many Integrated Core Architecture (Intel® MIC Architecture)

This section summarizes changes, new features and late-breaking news about the Intel Composer XE 2013 for Linux* including Intel® MIC Architecture.

3.1 About Intel® Composer XE 2013 for Linux* including Intel® MIC Architecture

The Intel® Composer XE 2013 for Linux* including Intel® MIC Architecture extends the feature set of the Intel® C++ Composer XE 2013 and the Intel® Fortran Composer XE 2013 products by enabling predefined sections of code to execute on an Intel® Xeon Phi™ coprocessor.

These sections of code run on the coprocessor if it is available. Otherwise, they run on the host CPU.

This document uses the terms *coprocessor* and *target* to refer to the target of an offload operation.

The current components of Intel® Composer XE 2013 that support Intel® MIC Architecture are the:

- Intel® C++ and Fortran Compilers
- Intel® Math Kernel Library (Intel® MKL)
- Intel® Threading Building Blocks (Intel® TBB)
- Eclipse* IDE Integration
- Debugger:
 - GNU* GDB
 - Intel® Debugger

3.2 Compatibility

This release supports the Intel® Xeon Phi™ coprocessor. Refer to the [Technical Support](#) section for additional information.

It's recommended to rebuild all code with Composer XE 2013 update 1 or later due to [this binary compatibility change in the offload libraries](#).

3.3 Getting Started

There is only one compiler that generates code both for Intel® 64 architecture and for Intel® MIC Architecture. Refer to the section on [Establishing the Compiler Environment](#) to get started, using intel64 as the architecture you setup for. Refer to the [Notes](#) section below for further changes.

3.4 Product Documentation

Documentation concerning the Intel® MIC Architecture for Composer XE 2013 SP1 can be found in the Composer XE Documentation directory.

3.5 Debugger

Documentation concerning the Intel® MIC Architecture for Composer XE 2013 SP1 can be found here:

```
<installdir>\Documentation\en_US\debugger\gdb\mic\ecmldb_config_guide.pdf
```

3.5.1 GNU* GDB

See the section [GNU* GDB Debugger](#).

3.5.2 Intel® Debugger

See the section [Intel® Debugger \(IDB\)](#).

3.6 Intel® Math Kernel Library (Intel® MKL)

For details on Intel® MIC Architecture support, see the section on [Intel MKL](#).

3.7 Notes

3.7.1 Intel C++ Compiler

3.7.1.1 *Using offload code in shared libraries requires main program to be linked with –offload=mandatory or –offload=optional option*

There is initialization required for offload that can only be done in the main program. For offload code in shared libraries, this means that the main program must also be linked for offload so that the initialization happens. This will happen automatically if the main code or code statically linked with the main program contains offload constructs. If that is not the case, you will need to link the main program with the `-offload=mandatory` or `-offload=optional` compiler options.

3.7.1.2 *New offload clauses in Intel® Composer XE 2013 SP1*

The three clauses “mandatory”, “optional”, and “status” have been added to the offload directives in Intel® Composer XE 2013 SP1.

- “mandatory”: Offloaded code aborts if card not available for offload, if “status” clause not added. If “status” clause added, user code directs action.
- “optional”: If card is not available for download, code runs on CPU.

These clauses in code override offload compiler option settings.

3.7.1.3 *–offload option changed in Intel® Composer XE 2013 SP1*

`-offload` now takes a keyword in Composer XE 2013 SP1

-offload=none: Any offload directives are ignored and cause warnings to be emitted at compile-time

-offload=mandatory (default): Any offload directives are processed. If card is not available for offload, program aborts.

-offload=optional: Any offload directives are processed. If card is not available, code runs on CPU.

These options are overridden by user-specified offload clauses.

3.7.1.4 New environment variables to control offload behavior in Intel® Composer XE 2013 SP1

Several new environment variables have been added:

- OFFLOAD_DEVICES: Restricts the process to use only the Intel® Xeon™ Phi coprocessor cards specified by the variable.
- OFFLOAD_INIT: Specifies a hint to the offload runtime when it should initialize Intel® Xeon™ Phi coprocessors.
- OFFLOAD_REPORT: Supports several levels of tracing and statistical information from offload.
- OFFLOAD_ACTIVE_WAIT: Controls keeping the CPU busy during DMA transfers.

3.7.1.5 Runtime errors or crashes when running an application built with the initial Intel® Composer XE 2013 product release with the offload libraries from 2013 update 1

There is a breaking binary compatibility change in the offload libraries for Intel® Composer XE 2013 update 1 that will cause runtime errors or crashes if you use the libraries from update 1 or later with a binary built with the initial release of the Intel Composer XE 2013 compiler.

Examples of the errors you may observe in this situation are:

Error 1:

```
***Warning: offload to device #0 : failed
```

Error 2:

```
Segmentation fault (core dumped)
```

Error 3:

```
terminate called after throwing an instance of 'COIRERESULT'  
terminate called recursively
```

Error 4:

```
CARD--ERROR:1 myoiPageFaultHandler: (nil) Out of Range!
```

```

CARD--ERROR:1 _myoiPageFaultHandler: (nil) switch to default signal
handle
CARD--ERROR:1 Segment Fault!
HOST--ERROR:myoiScifGetRecvId: Call recv() Header Failed ! errno = 104
^CHOST--ERROR:myoiScifSend: Call send() Failed! errno = 104
HOST--ERROR:myoiSend: Fail to send message!
HOST--ERROR:myoiBcastToOthers: Fail to send message to 1!
HOST--ERROR:myoiBcast: Fail to send message to others!

```

To resolve these issues, you should recompile your application fully with the Intel Composer XE 2013 update 1 or newer compiler in order to use the offload libraries included in the new package.

3.7.1.6 Default code generation no longer supports Intel® Xeon Phi™ coprocessor A0 stepping in Composer XE 2013 Update 1

Composer XE 2013 update 1 now generates new streaming store instructions that were introduced in the Intel® Xeon Phi™ coprocessor B0 stepping. These instructions are not supported on the A0 stepping, and will cause runtime errors. If you require your application to run on A0 steppings, use the option `-opt-streaming-stores never` to avoid generating these instructions. This may decrease performance on B0 or later steppings.

3.7.1.7 Missing symbols not detected at link time

In the offload compilation model, the binaries targeting the Intel® MIC Architecture are generated as dynamic libraries (.so). Dynamic libraries do not need all referenced variables or routines to be resolved during linking as these can be resolved during load time. This behavior could mask some missing variable or routine in the application resulting in a failure during load time. In order to identify and resolve all missing symbols at link time, use the following command line option to list the unresolved variables.

```
-offload-option,mic,compiler,"-z defs"
```

3.7.1.8 *MIC* tag added to compile-time diagnostics

The compiler diagnostics infrastructure is modified to add an additional offload *MIC* tag to the output message to allow differentiation from the Target (Intel® MIC Architecture) and the host CPU compilations. The additional tag appears only in the Target compilation diagnostics issued when compiling with offload extensions for Intel® MIC Architecture.

In the examples below the sample source programs trigger identical diagnostics during both the host CPU and Target Intel® MIC Architecture compilations; however, some programs will generate different diagnostics during these two compilations. The new tag permits easier association with either the CPU or Target compilation.

```

$ icc -c sample.c
sample.c(1): warning #1079: *MIC* return type of function "main" must
be "int"
    void main()
        ^

```

```
sample.c(5): warning #120: *MIC* return value type does not match the
function type
    return 0;
    ^
```

```
sample.c(1): warning #1079: return type of function "main" must be
"int"
    void main()
    ^
```

```
sample.c(5): warning #120: return value type does not match the
function type
    return 0;
```

3.7.1.9 Runtime Type Information (RTTI) not supported

Runtime Type Information (RTTI) is not supported under the Virtual-Shared memory programming method; specifically, use of `dynamic_cast<>` and `typeid()` is not supported.

3.7.1.10 Direct (native) mode requires transferring runtime libraries like `libiomp5.so` to coprocessor

The Intel® Manycore Platform Software Stack (Intel® MPSS) no longer includes Intel compiler libraries under `/lib`, for example the OpenMP* library, `libiomp5.so`.

When running OpenMP* applications in direct mode (i.e. on the coprocessor card), users must first upload (via scp) a copy of the Intel® MIC Architecture OpenMP* library (`<install_dir>/compiler/lib/mic/libiomp5.so`) to the card (device names will be of the format `micN`, where the first card will be named `mic0`, the second `mic1`, and so on) before running their application.

Failure to make this library available will result in a run-time failure like:

```
/libexec/ld-elf.so.1: Shared object "libiomp5.so" not found, required
by "sample"
```

This can also apply to other compiler runtimes like `libimf.so`. The required libraries will depend on the application and how it's built.

3.7.1.11 Calling `exit()` from an offload region

When calling `exit()` from within an offload region, the application terminates with an error diagnostic "offload error: process on the device 0 unexpectedly exited with code 0"

4 Intel® C++ Compiler

This section summarizes changes, new features and late-breaking news about the Intel C++ Compiler.

4.1 Compatibility

In version 11.0, the IA-32 architecture default for code generation changed to assume that Intel® Streaming SIMD Extensions 2 (Intel® SSE2) instructions are supported by the processor on which the application is run. [See below](#) for more information.

4.2 New and Changed Features

C++ Composer XE 2013 SP1 now contains Intel® C++ Compiler XE 14.0. The following features are new or significantly enhanced in this version. For more information on these features, please refer to the documentation.

- [New Intel® Cilk™ Plus STL vector reducer in Intel® C++ Composer XE 2013 SP1 update 2](#)
- [New intrinsic `allow_cpu` features in Intel® C++ Composer XE 2013 SP1 update 1](#)
- [The `this` pointer is now allowed in the Intel® Cilk™ Plus SIMD-enabled function `uniform` clause \(i.e. `__declspec\(vector\(uniform\(this\)\)\)`\) in Intel® C++ Composer XE 2013 SP1 update 1](#)
- [New Numeric String Conversion Library `libistrconv` in Intel® C++ Composer XE 2013 SP1 update 1](#)
- Features from C++11 (`-std=c++11`)
 - Complete (instead of partial) implementation of initializer lists. See N2672 and N3217.
 - Complete implementation of inline namespaces. See N2535.
 - Complete implementation of non-static data member initializers. See N2756.
 - Complete implementation of generalized constant expressions. See N2235.
 - Complete implementation of unrestricted unions. See N2544.
 - Delegating constructors. See N1986.
 - Rvalue references for `*this`. See N2439.
 - Raw string literals. See N2442.
 - Conversions of lambdas to function pointers.
 - Implicit move constructors and assignment operators. See N3053.
 - `__bases` and `__direct_bases` type traits.
 - The context-sensitive keyword "final" can now be used on a class definition, and "final" and "override" can be used on member function declarations. See N2928, N3206, and N3272.
 - Complete implementation of the "noexcept" specifier and operator. See N3050. Includes the late instantiation of noexcept per core issue 1330.
 - Note that language features available can depend on gcc* version installed. The version of gcc compiler, header files, and libraries that are provided as part of the Intel® Manycore Platform Software Stack distribution on Intel® Many Integrated Core Architecture is an experimental 4.7.0 version. This version lacks full support for some gcc features that are available in the final release of the 4.7.0 gcc compiler and libraries. In particular, this version of gcc lacks the support for `allocator_traits`.
- [Partial OpenMP* 4.0 RC1 and TR1 support](#)

- [Intel® Cilk™ Plus changes in Intel® C++ Composer XE 2013 SP1](#)
- DWARF V4 support
- `__INTEL_COMPILER_UPDATE` predefined macro
- [Pointer type alignment qualifiers](#)
- [Variable definition attributes to avoid false sharing](#)
- `-mtune` performance tuning option

4.2.1 New Intel® Cilk™ Plus STL vector reducer in Intel® C++ Composer XE 2013 SP1 update 2

In update 2, a `reducer_vector` class is now provided. The header file `"cilk/reducer_vector.h"` will need to be included. The reducer type is `cilk::reducer<cilk::op_vector<type> >`. See the header file comments for further specifics.

4.2.2 New intrinsic `_allow_cpu_features` in Intel® C++ Composer XE 2013 SP1 update 1

This new intrinsic `_allow_cpu_features([xxx][,xxx])` is added to `immintrin.h`. It tells the compiler that the code region following it may be targeted for processors with the specified feature(s) so some specific optimizations may be performances.

Note: support of this intrinsic is preliminary, not all of the compilers optimization phases can be taken place in the code region.

Please reference Compiler documentation for detailed information with code sample, and the article [New intrinsic `_allow_cpu_features` support](#) for additional information.

4.2.3 The `this` pointer is now allowed in the Intel® Cilk™ Plus SIMD-enabled function uniform clause (i.e. `__declspec(vector(uniform(this)))`) in Intel® C++ Composer XE 2013 SP1 update 1

When a uniform class object calls a SIMD-enabled class member function, explicitly specifying `"uniform(this)"` clause in the callee's SIMD declaration may improve performance (how much depends on how the `"this"` keyword is used inside the callee). The usage model is the same as the uniform clause applied to formal parameters.

Please reference Compiler documentation for detailed information.

4.2.4 New Numeric String Conversion Library `libistrconv` in Intel® C++ Composer XE 2013 SP1 update 1

This New Numeric String Conversion Library, `libistrconv`, provides a collection of routines for converting between ASCII strings and C data types, which are optimized for performance. The new APIs are declared in the header file `"istrconv.h"`.

Please reference Compiler documentation for detailed information.

4.2.5 Updated Support for Upcoming OpenMP* features added in Composer XE 2013 SP1

Composer XE 2013 SP1 adds partial support for OpenMP* 4.0 features. The features supported as defined in the OpenMP* 4.0 specifications available from <http://openmp.org> are:

- TEAMS pragmas, directives and clauses
- DISTRIBUTE pragmas, directive and clauses
- SIMD pragmas, directives, and clauses
- TARGET pragmas, directives and clauses for attached coprocessors (or devices)
- `#pragma omp taskgroup` construct
- Atomic clause `seq_cst`
- Six new forms of atomic capture and update:
 - Atomic swap: `{v = x; x = expr;}`
 - Atomic update: `x = expr binop x;`
 - Atomic capture 1: `v = x = x binop expr;`
 - Atomic capture 2: `v =x = expr binop x;`
 - Atomic capture 3: `{x = expr binop x; v = x;}`
 - Atomic capture 4: `{v = x; x = expr binop x;}`
- `proc_bind(<type>)` clause where `<type>` is “spread”, “close”, or “master”
- `OMP_PLACES` environment variable
- `OMP_PROC_BIND` environment variable
- `omp_get_proc_bind()` API

For more information, see <http://intel.ly/W7CHjb>.

4.2.6 Intel® Cilk™ Plus changes in Intel® C++ Composer XE 2013 SP1

Please note the following new features for Intel® Cilk™ Plus in Intel C++ Composer XE 2013 SP1:

- SIMD enabled function implementation has changed to be more compatible with other vector function implementations in gcc and OpenMP*. This breaks binary compatibility with previous Intel® C++ Compiler versions (13.1 and earlier). You should either rebuild all codes using SIMD enabled functions with the version 14.0 compiler, or use the `-vecabi=legacy` compiler option to use the previous implementation.
- New multiply reducer defined in `cilk/reducer_opmul.h`
- Three new array notation reduction intrinsics have been added to support bitwise reduction operations:
 - `__sec_reduce_and`
 - `__sec_reduce_or`
 - `__sec_reduce_xor`

4.2.7 New attribute for pointers and pointer types to specify assumed data alignment in Composer XE 2013 SP1

`__declspec(align_value(N))` and `__attribute__((align_value(N)))` have been added to indicate to the compiler it can assume the specified alignment “N” when using the attributed pointer type.

For example:


```
typedef float float_a16
__attribute__((align_value (16)));

void foo(float_a16 *restrict dest, float_a16 *restrict src){
```

Let's the compiler know that the src and dest arguments should be aligned by the user on 16-byte boundaries.

4.2.8 New attribute to variable declarations to avoid false sharing in Composer XE 2013 SP1

`__declspec(avoid_false_share)/__attribute__((avoid_false_share))` and `__declspec(avoid_false_share(identifier))/__attribute__((avoid_false_share(identifier)))` have been added to indicate to the compiler that the variable attributed should be suitably padded or aligned to avoid false sharing with any other variable. If an identifier is specified, then any variables attributed with that identifier will be padded or aligned to avoid false sharing with any other variables except those others with the same identifier. These attributes must be on variable definitions in function, global, or namespace scope. If in function scope, the scope of the identifier is the current function. If the variable definition is in global or namespace scope, the scope of the identifier is in the current compilation unit.

4.2.9 New `__INTEL_COMPILER_UPDATE` predefined macro in Composer XE 2013 SP1

A new `__INTEL_COMPILER_UPDATE` predefined macro can now be used to obtain the minor update number for the Intel® Compiler being used. For example, for a compiler version 14.0.2, the macro would preprocess to "2".

4.2.10 Static Analysis Feature (formerly "Static Security Analysis" or "Source Checker") Requires Intel® Inspector XE

The "Source Checker" feature, from compiler version 11.1, has been enhanced and renamed "Static Analysis". The compiler options to enable Static Analysis remain the same as in compiler version 11.1 (for example, `-diag-enable sc`), but the results are now written to a file that is interpreted by Intel® Inspector XE rather than being included in compiler diagnostics output.

4.3 New and Changed Compiler Options

For details on these and all compiler options, see the Compiler Options section of the on-disk documentation.

4.3.1 New compiler option `/Qcheck-pointers-mpx` (`-check-pointers-mpx`) to support the Intel® Memory Protection Extensions (Intel® MPX) (Update 1)

This option will cause the compiler to generate code which uses the Intel® Memory Protection Extensions (Intel® MPX) for performance acceleration of Pointer Checker. If the target platform does not support Intel® MPX, Pointer Checker features will operate as no-ops. See [the Introduction to Intel® Memory Protection Extensions](#) for some details about Intel® MPX.

Please see Compiler Options section of the documentation for detailed information about this new option.

4.3.2 New compiler option `-f[no-]mpc_privatize` to enable privatization of all static data for the MultiProcessor Communications environment (MPC) unified parallel runtime. (Update 1)

This option will cause calls to extended thread local storage resolution run-time routines that are not supported on standard Linux distributions. This option is only usable in conjunction with the MPC unified parallel runtime. The default is off (`-fno-mpc_privatize`).

This option is only available in the Intel C++ and Fortran Composer XE 2013 SP1 for Linux targeting Intel® 64 architecture and Intel® MIC Architecture.

Please see Compiler Options section of the documentation for detailed information.

4.3.3 New compiler option `/Q[a]xMIC-AVX512(-[a]xMIC-AVX512)` for Intel® Advanced Vector Extensions 512 (Intel® AVX-512) instructions support (Update 1)

This option may generate Intel(R) AVX-512 Foundation instructions, Intel(R) AVX-512 Conflict Detection instructions, Intel(R) AVX-512 Exponential and Reciprocal instructions, Intel(R) AVX-512 Prefetch instructions for Intel(R) processors and the instructions enabled with CORE-AVX2. It lets compiler to optimize for Intel(R) processors that support Intel(R) AVX-512 instructions.

Please see Compiler Options section of the documentation for detailed information, and see [AVX-512 instructions article](#) for more about the new instructions.

4.3.4 `/Qopt-gather-scatter-unroll(-opt-gather-scatter-unroll)` for targeting Intel® MIC Architecture (Update 1)

This option lets you specify an alternative loop unroll sequence for gather and scatter loops on Intel® MIC Architecture. It is only available on Intel® 64 architecture targeting Intel® MIC Architecture.

Please see Compiler Options section of the documentation for detailed information.

4.3.5 New and Changed in Composer XE 2013 SP1

- `-[no-]openmp-offload`
- `-[no-]openmp-simd`
- `-xATOM_SSE4.2`
- `-xATOM_SSSE3`
- `-vecabi=<arg>`
- `-gdwarf-4`
- `-standalone`
- `-offload=<arg>`
- `-mtune=<arch>`
- `-mlong-double-64`
- `-mlong-double-80`

For a list of deprecated compiler options, see the Compiler Options section of the documentation.

4.3.6 `–[no-]openmp-offload` and `–[no-]openmp-simd` added to Composer XE 2013 SP1

These two options allow you to enable/disable the TARGET and SIMD features of OpenMP* 4.0 independently of support of the rest of OpenMP* (enabled with `–openmp`). When `–openmp` is specified, `–openmp-offload` and `–openmp-simd` are set as well, allowing the use of these features.

4.3.7 `–mtune` added to Composer XE 2013 SP1

`–mtune=<arch>` can now be used to specify the compiler “tuning” for a specific architecture, similar to how the equivalent `gcc*` option behaves.

4.3.8 `–gdwarf-4` added to Composer XE 2013 SP1

Support for generating DWARF V4 debug information is now available via the `–gdwarf-4` option.

4.3.9 `–vec-report7` added to Composer XE 2013 Update 2

A new vectorizer reporting level has been added to update 2 to provide more detailed and advanced information on loop vectorization. See the article at <http://intel.ly/XeSkW6> for more information.

4.3.10 `–gcc-version` is deprecated in Composer XE 2013 Update 2

`–gcc-version` functionality has been superseded by `–gcc-name`. `–gcc-version` has therefore been deprecated and may be removed from a future release.

4.4 Other Changes

4.4.1 `KMP_DYNAMIC_MODE` Environment Variable Support for “`asat`” Deprecated

Support for “`asat`” (automatic self-allocating threads) by the environment variable `KMP_DYNAMIC_MODE` is now deprecated, and will be removed in a future release.

4.4.2 `__attribute__((always_inline))` now requires `inline` keyword to enable inlining with Composer XE 2013 SP1

In previous Intel compiler versions, a routine declared with the “`always_inline`” attribute would always be inlined. In Composer XE 2013 SP1, the compiler now requires that the routine also be `inline` (either explicitly declared that way using the “`inline`” keyword or implicitly `inline` because it is a member function whose definition appears inside the class) in order for the routine to be inlined. The compiler will now match `gcc` behavior and also give a warning for this, i.e.:

```
// t.cpp
__attribute__((always_inline)) int foo2(int x) // need to add
"inline" keyword also
{
    return x;
}
```

```
icpc -c t.cpp
t.cpp(2): warning #3414: the "always_inline" attribute is ignored on
non-inline functions
    __attribute__((always_inline)) int foo2(int x)
        ^
```

4.4.3 Establishing the Compiler Environment

The `compilervars.sh` script is used to establish the compiler environment. `compilervars.csh` is also provided.

The command takes the form:

```
source <install-dir>/bin/compilervars.sh argument
```

Where *argument* is either `ia32` or `intel64` as appropriate for the architecture you are building for. Establishing the compiler environment also establishes the environment for the Intel® Debugger, provided GNU* GDB (`gdb-ia`), Intel® Performance Libraries and, if present, Intel® Fortran Compiler.

4.4.4 Instruction Set Default Changed to Require Intel® Streaming SIMD Extensions 2 (Intel® SSE2)

When compiling for the IA-32 architecture, `-msse2` (formerly `-xW`) is the default. Programs built with `-msse2` in effect require that they be run on a processor that supports the Intel® Streaming SIMD Extensions 2 (Intel® SSE2), such as the Intel® Pentium® 4 processor and some non-Intel processors. No run-time check is made to ensure compatibility – if the program is run on an unsupported processor, an invalid instruction fault may occur. Note that this may change floating point results since the Intel® SSE instructions will be used instead of the x87 instructions and therefore computations will be done in the declared precision rather than sometimes a higher precision.

All Intel® 64 architecture processors support Intel® SSE2.

To specify the older default of generic IA-32, specify `-mia32`

4.5 Known Issues

4.5.1 Pointer Checker requires a dynamic runtime library

When using the `-check-pointers` option, the runtime library `libchkp.so` must be linked in. When using options like `-static` or `-static-intel` with `-check-pointers`, be aware that this dynamic library will be linked in regardless of your settings. See the article at <http://intel.ly/1jV0eWD> for more information.

4.5.2 `__GXX_EXPERIMENTAL_CXX0X__` Macro Not Supported

In the Gnu* version 4.8 or later environments, using the `-std=c++11` or `-std=gnu++0x` options may lead to a diagnostic of the form:

This file requires compiler and library support for the upcoming ISO C++ standard, C++0x. This support is currently experimental, and must be enabled with the `-std=c++0x` or `-std=gnu++0x` compiler options.

The Intel compiler does not currently define the `__GXX_EXPERIMENTAL_CXX0X__` macro in gcc 4.8 mode, since it does not yet support some C++11 features enabled by the macro in the C++ standard library headers. This may lead to incompatibilities with g++ when using the C++ standard library in the `-std=c++11` or `-std=gnu++0x` modes.

4.5.3 Missing documentation for functions to check decimal floating-point status

To detect exceptions occurring during decimal floating-point arithmetic, use the following floating-point exception functions:

Function	Brief Description
<code>fe_dec_feclearexcept</code>	Clears the supported floating-point exceptions
<code>fe_dec_fegetexceptflag</code>	Stores an implementation-defined representation of the states of the floating-point status flags
<code>fe_dec_feraiseexcept</code>	Raises the supported floating-point exceptions
<code>fe_dec_fesetexceptflag</code>	Sets the floating-point status flags
<code>fe_dec_fetestexcept</code>	Determines which of a specified subset of the floating point exception flags are currently set

The decimal floating-point exception functions are defined in the `fenv.h` header file.

Similar binary floating-point exception functions are described in ISO C99.

To compile the source using DFP, use the preprocessor macro `__STDC_WANT_DEC_FP__`.

4.5.4 Intel® Cilk™ Plus Known Issues

- Static linkage of the runtime is not supported

Static versions of the Intel® Cilk™ Plus library are not provided by design. Using `-static-intel` to link static libraries will generate an expected warning that the dynamic version of the of Intel® Cilk™ Plus library, `libcilkrts.so`, is linked.

```
$ icc -static-intel sample.c
```

```
icc: warning #10237: -lcilkrts linked in dynamically, static library not available
```

Alternatively, you can build the open source version of Intel Cilk Plus with a static runtime. See <http://cilk.com> for information on this implementation of Intel Cilk Plus. Using static versions of the Intel® Cilk™ Plus library is not supported. Any issues must be reported using the dynamic version of the Intel® Cilk™ Plus library.

4.5.5 Guided Auto-Parallel Known Issues

Guided Auto Parallel (GAP) analysis for single file, function name or specific range of source code does not work when Whole Program Interprocedural Optimization (-ipo) is enabled

4.5.6 Static Analysis Known Issues

4.5.6.1 Excessive false messages on C++ classes with virtual functions

Note that use of the Static Analysis feature also requires the use of Intel® Inspector XE.

Static analysis reports a very large number of incorrect diagnostics when processing any program that contains a C++ class with virtual functions. In some cases the number of spurious diagnostics is so large that the result file becomes unusable.

If your application contains this common C++ source construct, add the following command line switch to suppress the undesired messages: `/Qdiag-disable:12020,12040` (Windows) or `-diag-disable 12020,12040` (Linux). **This switch must be added at the link step because that is when static analysis results are created.** Adding the switch at the compile step alone is not sufficient.

If you are using a build specification to perform static analysis, add the `-disable-id 12020,12040` switch to the invocation of the `inspxe-runsc`, for example,
`inspxe-runsc -spec-file mybuildspec.spec -disable-id 12020,12040`

If you have already created a static analysis result that was affected by this issue and you are able to open that result in the Intel® Inspector XE GUI, then you can hide the undesired messages as follows:

- The messages you will want to suppress are “Arg count mismatch” and “Arg type mismatch”. For each problem type, do the following:
- Click on the undesired problem type in the Problem filter. This hides all other problem types.
- Click on any problem in the table of problem sets
- Type control-A to select all the problems
- Right click and select *Change State -> Not a problem* from the pop-up menu to set the state of all the undesired problems
- Reset the filter on problem type to All
- Repeat for the other unwanted problem type
- Set the Investigated/Not investigated filter to *Not investigated*. You may have to scroll down in the filter pane to see it as it is near the bottom. This hides all the undesired messages because the “Not a problem” state is considered a “not investigated” state.

5 GNU* GDB Debugger

This section summarizes the changes, new features, customizations and known issues related to the GNU* GDB provided with Intel® Composer XE 2013 SP1.

5.1 Features

GNU* GDB provided with Intel® Composer XE 2013 SP1 is based on GDB 7.5 with enhancements provided by Intel. This debugger is planned to [replace the Intel® Debugger in a future release](#). In addition to features found in GDB 7.5, there are several other new features:

- Support for Intel® Many Integrated Core Architecture (Intel® MIC Architecture)
- Support for Intel® Transactional Synchronization Extensions (Intel® TSX)
- Register support for Intel® Memory Protection Extensions (Intel® MPX) and Intel® Advanced Vector Extensions 512 (Intel® AVX-512)
- Data Race Detection (*pdbx*):
Detect and locate data races for applications threaded using POSIX* thread (pthread) or OpenMP* models
- Branch Trace Store (*btrace*):
Record branches taken in the execution flow to backtrack easily after events like crashes, signals, exceptions, etc.
- Pointer Checker:
Assist in finding pointer issues if compiled with Intel® C++ Compiler and having Pointer Checker feature enabled (see Intel® C++ Compiler documentation for more information)

5.2 Pre-requisites

In order to use the provided GNU* GDB Python* version 2.4, 2.6 or 2.7 is required.

5.3 Using GNU* GDB

GNU* GDB provided with Intel® Composer XE 2013 SP1 comes in different versions:

- IA-32/Intel® 64 debugger:
Debug applications natively on IA-32 or Intel® 64 systems.
- Intel® Xeon Phi™ coprocessor debugger:
Debug applications remotely on Intel® Xeon Phi™ coprocessor systems. The debugger will run on a host system and a debug agent (`gdbserver`) on the coprocessor.
There are two options:
 - Use the command line version of the debugger. This only works for native Intel® Xeon Phi coprocessor applications.
 - Use the Eclipse* IDE plugin. This works only for offload enabled Intel® Xeon Phi coprocessor applications. Native applications need to be debugged with the command line version.

To use any of the above versions of GNU* GDB source the following script:

```
source <install-dir>/bin/debuggervars.[sh|csh]
```

Please make sure to source the above script always before using the debugger.

5.3.1 IA-32/Intel® 64 Debugger

To start GNU* GDB provided with Intel® Composer XE use the following command:

```
$ gdb-ia
```

This debugger is designed to debug IA-32 or Intel® 64 applications natively. Its use is no different than with traditional GNU* GDB debuggers. There are some extensions, though, which can be found in the [documentation](#).


5.3.2 Intel® Xeon Phi™ Coprocessor Debugger

Debugging applications for the Intel® Xeon Phi™ coprocessor is different to debugging local applications because of the difference of host and target. The host is running the debugger GNU* GDB. This system can be the host containing the coprocessor cards or any other development host. The target, here the coprocessor itself, executes a debug agent (`gdbserver`) to which the host connects to.

There are two options to start a debug session on the host:

1. Command line version of the debugger:

The debug agent needs to be transferred to the Intel® Xeon Phi™ coprocessor first:

```
$ scp <install-dir>/debugger/gdb/target/mic/bin/gdbserver 
mic0:/tmp
```

Start GNU* GDB and connect to the coprocessor, e.g.:

```
$ gdb-mic
(gdb) target extended-remote | ssh mic0 /tmp/gdbserver --multi -
```

To load and execute an application on the coprocessor issue the following commands:

```
(gdb) file <path_on_host>/application
(gdb) set remote exec-file <path_on_target>/application
```

To attach to a process already running on the coprocessor with PID `<pid>` issue the following commands:

```
(gdb) file <path_on_host>/application
(gdb) attach <pid>
```

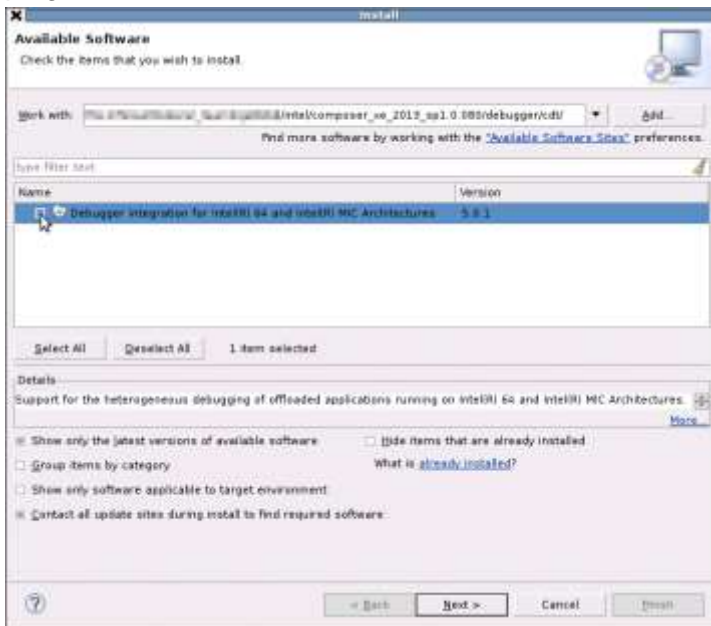
2. Eclipse* IDE:

Make sure that `debuggervars.[sh|csh]` is sourced in the same environment as Eclipse* IDE is being started (see above).

Before starting Eclipse IDE, additional environment variables need to be set in order to debug offload enabled Intel® Xeon Phi™ applications. Depending on the version of the Intel® Manycore Platform Software Stack (Intel® MPSS) set the following variables:

- Intel® MPSS 3.1:
AMPLXE_COI_DEBUG_SUPPORT=TRUE
MYO_WATCHDOG_MONITOR=-1
- Intel® MPSS 2.1:
COI_SEP_DISABLE=FALSE
MYO_WATCHDOG_MONITOR=-1

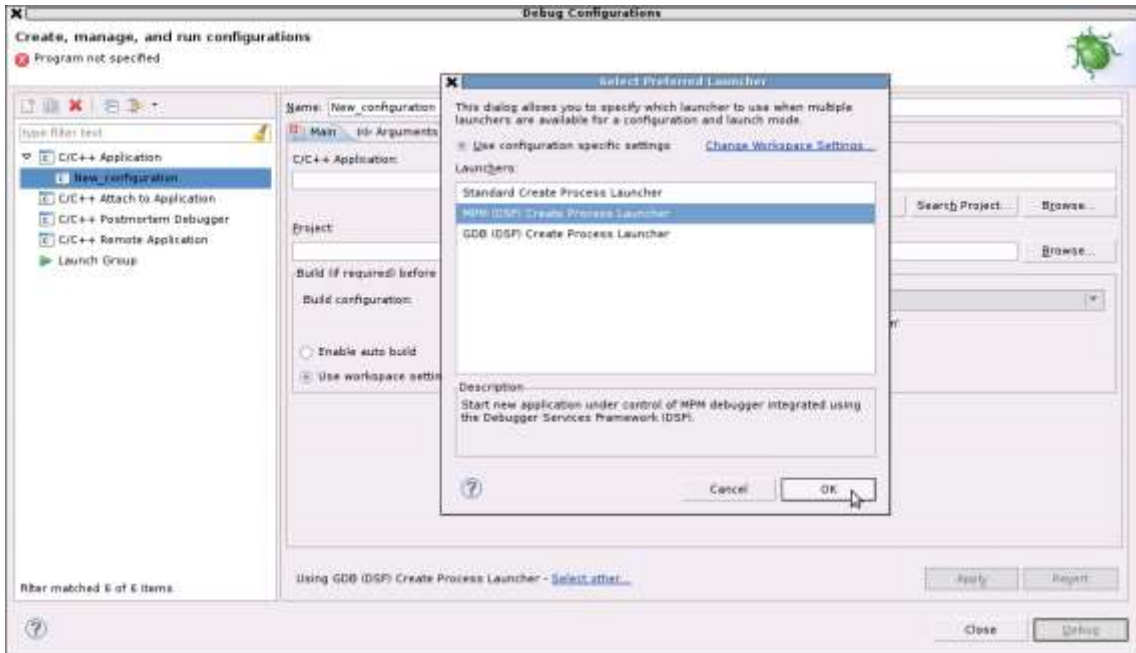
To use the new GNU* GDB back-end for debugging Intel® Xeon Phi™ applications a plugin needs to be installed. It can be found under <install-dir>/debugger/cdt/:



Ensure that “Group items by category” is not checked. There might be a warning regarding unsigned content. This can be ignored.

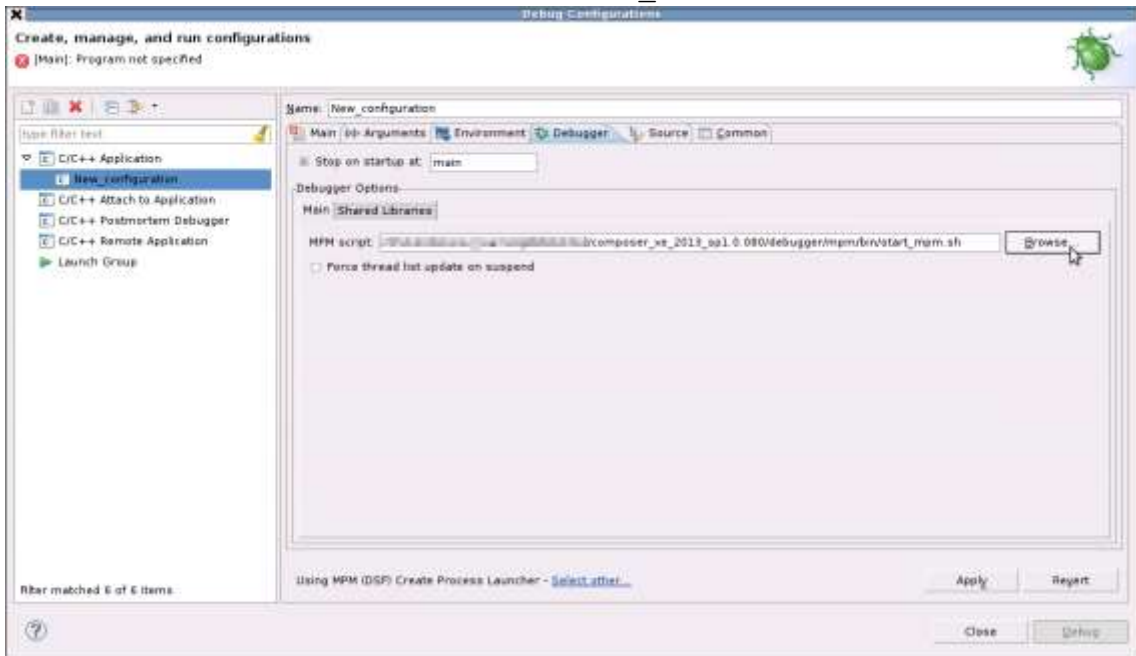
After installation and restart, create a new debug configuration for “C/C++ Application”,

click on “Select other...” and select “MPM (DSF) Create Process Launcher”:



Switch to tab “Debugger” and select the following script:

```
<install-dir>/debugger/mpm/bin/start_mpm.sh
```



Note:

Currently only offload enabled Intel® Xeon Phi™ applications can be debugged.

5.4 Documentation

The documentation for the provided GNU* GDB can be found here:

```
<install-dir>/Documentation/[en_US|ja_JP]/debugger/gdb/gdb.pdf  
<install-
```

dir>/Documentation/[en_US|ja_JP]/debugger/gdb/mic/eclmigdb_config_guide.pdf

5.5 Known Issues and Changes

5.5.1 Intel® Manycore Platform Software Stack (Intel® MPSS) 3.2 and 3.2.1 do not support offload debugging with Intel® Composer XE 2013 SP1

Offload debugging with the Eclipse* plug-in from Intel® Composer XE 2013 SP1 does not work with Intel MPSS 3.2 and 3.2.1. A configuration file required for operation by the Intel Composer XE 2013 SP1 package was removed from Intel MPSS 3.2 and 3.2.1. Intel MPSS 3.2.3 resolves this problem. Previous Intel MPSS versions are not affected.

5.5.2 MYO debug libraries are no longer installed with Intel® Manycore Platform Software Stack (Intel® MPSS) 3.2

MYO debug libraries are no longer installed with Intel MPSS 3.2 by default. This is a change from earlier Intel MPSS versions. Users must install the MYO debug libraries manually in order to debug MYO enabled applications using the Eclipse plug-in for offload debugging. For Intel MPSS 3.2 (and later) the MYO debug libraries can be found in the package mpss-myo-dbg-* which is included in the mpss-*.tar file.

5.5.3 Safely ending offload debug sessions

To avoid issues like orphan processes or stale debugger windows when ending offload applications, manually end the debugging session before the application is reaching its exit code. The following procedure is recommended for terminating a debug session.

- Manually stop a debug session before the application reaches the exit-code.
- When stopped, press the red stop button in the toolbar in the Intel® MIC Architecture-side debugger first. This will end the offloaded part of the application.
- Next, do the same in the CPU-side debugger.
- The link between the two debuggers will be kept alive. The Intel® MIC Architecture-side debugger will stay connected to the debug agent and the application will remain loaded in the CPU-side debugger, including all breakpoints that have been set.
- At this point, both debugger windows can safely be closed.

5.5.4 Intel® MIC Architecture-side debugger asserts on setting source directories

Setting source directories in the GNU* GDB might lead to an assertion.

Resolution:

The assertion should not affect debugger operation. To avoid the assertion anyway, don't use source directory settings. The debugger will prompt you to browse for files it cannot locate automatically.

5.5.5 Accessing `_Cilk_shared` variables in the debugger

Writing to a shared variable in an offloaded section from within the CPU-side debugger **before** the CPU-side debuggee has accessed that variable may result in loss of the written value/might display a wrong value or cause the application to crash.

Consider the following code snippet:

```
_Cilk_shared bool is_active;
_Cilk_shared my_target_func() {
//Accessing "is_active" from the debugger *could* lead to unexpected
//results e.g. a lost write or outdated data is read.
is_active = true;
//Accessing "is_active" (read or write) from the debugger at this
//point is considered safe e.g. correct value is displayed.
}
```

6 Intel® Debugger (IDB)

Intel® Debugger (IDB) is available as host debugger for IA-32 and Intel® 64 applications, as well as for the Intel® Xeon Phi™ coprocessor.

6.1 Support Deprecated for Intel® Debugger

In a future major release of the product, the Intel® Debugger may be removed. This impacts all components and features described in this section.

New users should use the [GNU* GDB debugger components](#) instead.

6.2 Using Intel® Debugger

Intel® Debugger provided with Intel® Composer XE 2013 SP1 comes in different versions:

- IA-32/Intel® 64 debugger:
Debug applications natively on IA-32 or Intel® 64 systems.
- Intel® Xeon Phi™ coprocessor debugger:
Debug applications remotely on Intel® Xeon Phi™ coprocessor systems. The debugger will run on a host system and a debug agent (`idbserver_mic`) on the coprocessor.
There are two options:
 - Use the command line version of the debugger. This only works for native Intel® Xeon Phi coprocessor applications.
 - Use the Eclipse* IDE plugin. This works for both native and offload enabled Intel® Xeon Phi coprocessor applications.

To use any of the above versions of Intel® Debugger source the following script:

```
source <install-dir>/bin/idbvars.[sh|csh] [ia32|intel64]
```

Depending on the desired architecture either choose `ia32` (for IA-32) or `intel64` (for Intel® 64). Please make sure to source the above script always before using the debugger.

6.2.1 IA-32/Intel® 64 Debugger

To start Intel® Debugger provided with Intel® Composer XE use the following command:

```
$ idb (stand-alone GUI version)
```

or

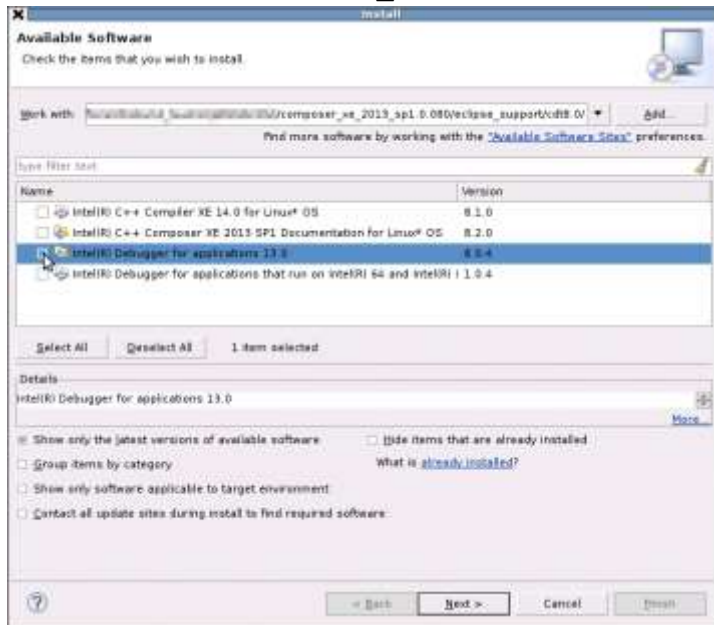
```
$ idbc (command line version)
```

This debugger is designed to debug IA-32 or Intel® 64 applications natively. Additional documentation can be found at [Documentation](#) section.

Note:

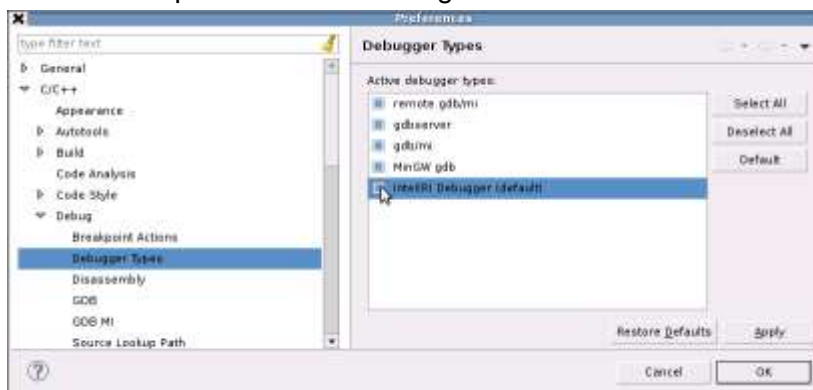
Any version requires `idbvars.[sh|csh]` to be sourced in the same environment as started.

The stand-alone GUI above does not require an existing Eclipse* IDE. However, there is a dedicated plug-in for Eclipse* IDE available as well. It can be found under `<install-dir>/eclipse_support/cdt8.0/:`

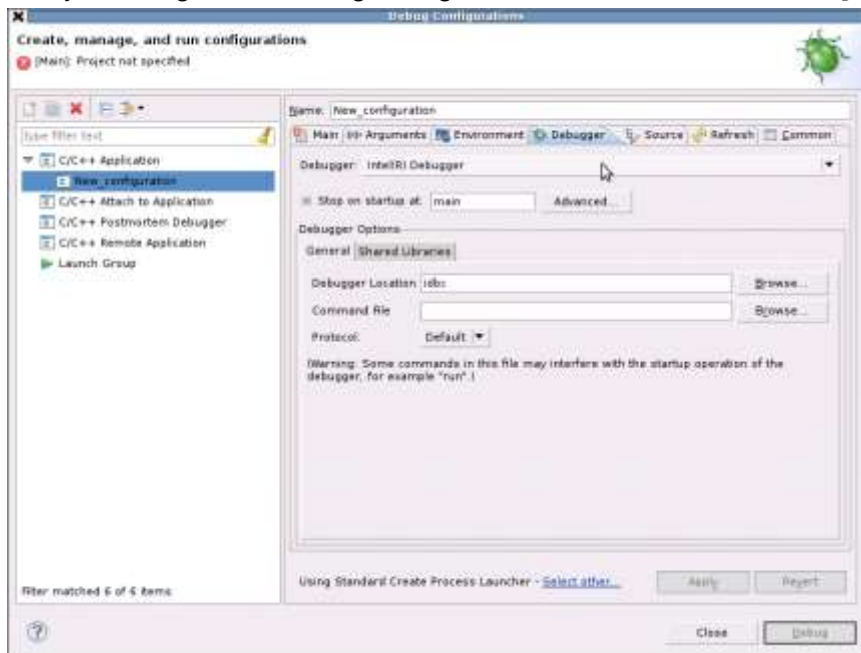


Ensure that “Group items by category” is not checked. There might be a warning regarding unsigned content. This can be ignored.

This allows you to replace the default debugger back-end by the Intel® Debugger, depending on the used Eclipse* IDE version. E.g. via menu Window->Preferences :



Or by creating a new debug configuration via menu Run->Debug Configurations...:



The debugger back-end can only be changed if the “Standard Create Process Launcher” or “Standard Attach to Process Launcher” is selected.

6.2.2 Intel® Xeon Phi™ Coprocessor Debugger

Debugging applications for the Intel® Xeon Phi™ coprocessor is different to debugging local applications because of the difference of host and target. The host is running the Intel® Debugger. This system can be the host containing the coprocessor cards or any other development host. The target, here the coprocessor itself, executes a debug agent (`idbserver_mic`) to which the host connects to.

Before proceeding, source the `idbvars.[sh|csh]` script in the same environment as you are using the debugger.

There are two options to start a debug session on the host:

1. Command line version of the debugger:
Start Intel® Debugger and connect to the coprocessor, e.g.:

```
$ idbc_mic
```

To load and execute an application on the coprocessor issue the following commands:

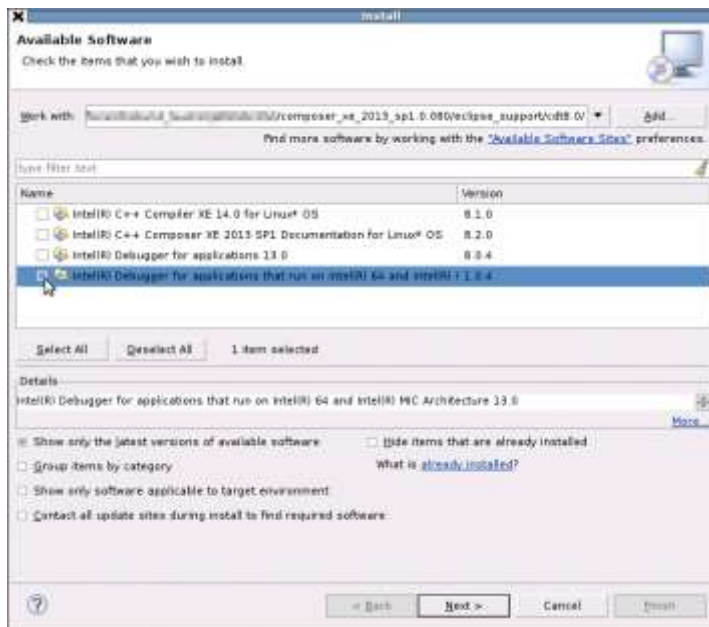
```
(idb) idb file-remote <path_on_target>/application  
(idb) file <path_on_host>/application
```

To attach to a process already running on the coprocessor with PID `<pid>` issue the following commands:

```
(idb) attach <pid> <path_on_host>/application
```

2. Eclipse* IDE:

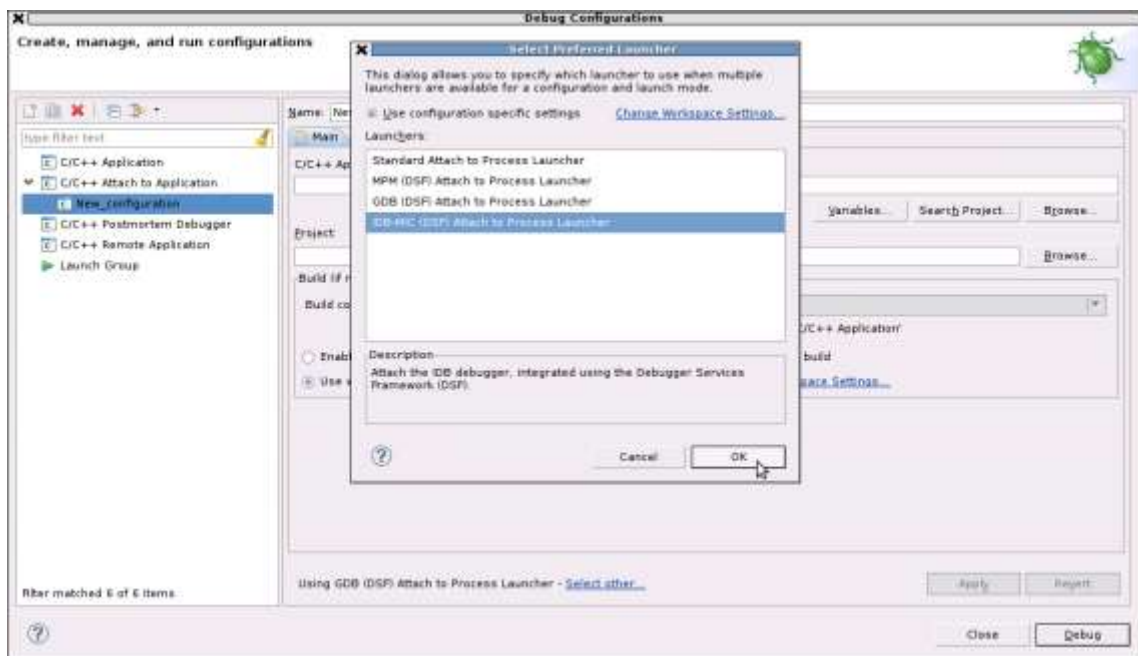
To use the IDB back-end for debugging Intel® Xeon Phi™ applications a plugin needs to be installed. It can be found under <install-dir>/eclipse_support/cdt8.0/:



Install the package “Intel® Debugger for applications that run on Intel® 64 and Intel® MIC Architecture”.

Ensure that “Group items by category” is not checked. There might be a warning regarding unsigned content. This can be ignored.

After installation and restart, create a new debug configuration for “C/C++ Application” or “C/C++ Application, click on “Select other...” and select “MPM (DSF) Create Process Launcher”:



In case of attaching to an Intel® Xeon Phi™ application the card needs to be selected under the “Debugger” tab under “MIC options”.

6.3 Setting up the Java* Runtime Environment

The stand-alone GUI of the Intel® IDB Debugger (`idb`) requires a Java Runtime Environment (JRE) to execute. The debugger will run with a 6.0 (also called 1.6) JRE. Install the JRE according to the JRE provider's instructions. Finally, ensure that `java` can be found via `$PATH`.

Note:

Make sure that the JRE is for the same architecture as you sourced the `idbvars.[sh|csh]` script. IDB won't start if the architectures do not match (e.g. IDB for 32 bit won't start with a JRE for 64 bit).

6.4 Documentation

Documentation for the Intel® Debugger can be found here:

```
<install-dir>/Documentation/[en_US|ja_JP]/debugger/
```

Online help titled *Intel® Compilers / Intel® Debugger Online Help* is accessible from the debugger graphical user interface as `Help > Help Contents`.

Context-sensitive help is also available in several debugger dialogs where a `Help` button is displayed.

6.5 Debugger Features

6.5.1 Main Features of IDB

The stand-alone GUI version of the debugger supports all features of the command line version. Debugger functions can be called from within the debugger GUI or the GUI-command line. Please refer to the Known Limitations when using the graphical environment.

6.5.2 Inspector XE 2011 Update 6 Supports “break into debug” with IDB

Inspector XE 2011 Update 6 now supports “break into debug” mode with the Composer XE 2011 Update 6 and later versions of IDB. Refer to the Inspector XE 2011 Release Notes for more information.

6.6 Known Issues and Changes

6.6.1 Using the Intel® Debugger with Intel® MPSS

When using the Intel® Debugger for Intel® Many Integrated Core Architecture the following limitations apply:

- When debugging native coprocessor applications on the command line, the remote debug agent `idbserver_mic` is uploaded and started using `scp/ssh`. This implies that the user id used to start `idbc_mic` must also exist on the coprocessor. Unless

passwordless authentication has been configured for this user id, scp and ssh will require a password being typed.

- When debugging heterogeneous applications on the command line, the offload process is started as root. Using `idbc_mic` with a different user id than root will cause the offload process to not be visible by the remote debug server `idbserver_mic`. The workaround is to launch the command line debugger `idbc_mic` as root. Alternatively the options `-mpm-launch=1 -mpm-cardid=<card-id>` can be added to the default launch options: `idbc_mic -mpm-launch=1 -mpm-cardid=<card-id> -tco -rconnect=tcpip:<cardip>:<port>`

6.6.2 IDB might fail to setup command line argument for debuggee under Eclipse* IDE

The debugger might not set the command line argument for the debuggee correctly under Eclipse* IDE when loading an application using the `'file'` command in GDB mode. The debuggee may abort with the message:

```
*** abort -internal failure : get_command_argument failed
```

In this case, add the executable to the command line argument of IDB.

6.6.2.1 Eclipse* IDE fails to display local variables

Local variables cannot be seen under the Eclipse* IDE environment while debugging an application.

Workaround:

Enter the local variable into the “Expressions” window to get its value.

6.6.3 Thread Data Sharing Filters may not work correctly

Setting Thread Data Sharing Filters may lead to unexpected behavior of the debugger. It may happen that threads will not continue after a data sharing detection and the debugger may exit with a SIG SEGV.

If you encounter issues related to Data Sharing Detection with filters enabled, disable all filters in the ‘Thread Data Sharing Filters’ window context menu.

6.6.4 Core File Debugging

To be able to debug core files you need to start the debugger (command line debugger `idbc` or GUI debugger `idb`) with command-line options as follows:

```
idb|idbc <executable> <corefile>
```

<or>

```
idb|idbc <executable> -core <corefile>
```

Once started with a core file, the debugger is not able to debug a live process e.g. attaching or creating a new process. Also, when debugging a live process a core file cannot be debugged.

6.6.5 Debugger crash if \$HOME not set on calling shell

The debugger will end with a “Segmentation fault” if no \$HOME environment variable is set on the shell the debugger is started from.

6.6.6 Command line parameter `-idb` and `-dbx` not supported

The debugger command line parameters `-idb` and `-dbx` are not supported in conjunction with the debugger GUI.

6.6.7 Watchpoints limitations

For IA-32 and Intel® 64 architecture systems there are the following limitations (if possible IDB will raise appropriate error messages to assist the user):

- Possible sizes of the watched memory areas are only 1, 2, 4 or 8 (Intel® 64 architecture only) bytes.
- The start address of the watched memory area has to be aligned with its size. For example it is not possible to watch 2 bytes starting with an odd address.
- There is only support for a maximum of 4 active/enabled watchpoints. Unused ones can be disabled to free resources and to enable/create other ones.
- Only the following access modes are supported:
 - Write: trigger on write accesses
 - Any: trigger on either write or read accesses
 - Changed: trigger on write accesses that actually changed the value
- Watched memory areas must not overlap each other.
- Watchpoints are not scope related but tied to a process. As long as a process exists the watchpoints are active/enabled. Only if the process is terminated (e.g. rerun) will the watchpoints will be disabled. They can be enabled again if the user wishes to do so.
- Using the debugger to access the watched memory area (e.g. assign a different value to a variable) bypasses the hardware detection. Hence watchpoints only trigger if the debuggee itself accessed the watched memory area.
- If the debuggee is running on a guest OS inside a virtual machine, stepping over an instruction or code line might continue the process without stopping. Watchpoints are only guaranteed to work when the debuggee runs on real hardware.

6.6.8 Position Independent Executable (PIE) Debugging not Supported

On some systems the compiler is tuned to produce Position Independent Executable (PIE) code. In those cases the flag `-fno-pie` has to be used both for compilation and linking, otherwise the application cannot be debugged.

6.6.9 Command line parameter `-parallel` not supported

The debugger command line parameter `-parallel` is not supported on the shell command prompt or on the Console Window of the Debugger GUI.

6.6.10 Signals Dialog Not Working

The Signals dialog accessible via the GUI dialog Debug / Signal Handling or the shortcut Ctrl+S is not working correctly. Please refer to the Intel® Debugger (IDB) Manual for use of the signals command line commands instead.

6.6.11 Resizing GUI

If the debugger GUI window is reduced in size, some windows may fully disappear. Enlarge the window and the hidden windows will appear again.

6.6.12 `$cdir`, `$cwd` Directories

`$cdir` is the compilation directory (if recorded). This is supported in that the directory is set; but `$cdir` is not itself supported as a symbol.

`$cwd` is the current working directory. Neither the semantics nor the symbol is supported.

The difference between `$cwd` and `'.'` is that `$cwd` tracks the current working directory as it changes during a debug session. `'.'` is immediately expanded to the current directory at the time an entry to the source path is added.

6.6.13 `info stack` Usage

The GDB mode debugger command `info stack` does not currently support negative frame counts the way GDB does, for the following command:

```
info stack [num]
```

A positive value of `num` prints the innermost `num` frames, a zero value prints all frames and a negative one prints the innermost `-num` frames in reverse order.

6.6.14 `$stepg0` Default Value Changed

The debugger variable `$stepg0` changed default to a value of 0. With the value "0" the debugger will step over code without debug information if you do a "step" command. Set the debugger variable to 1 to be compatible with previous debugger versions as follows:

```
(idb) set $stepg0 = 1
```

6.6.15 SIGTRAP error on some Linux* Systems

On some Linux distributions (e.g. Red Hat Enterprise Linux Server release 5.1 (Tikanga)) a SIGTRAP error may occur when the debugger stops at a breakpoint and you continue debugging. As a workaround you may define the SIGTRAP signal as follows on command line:

```
(idb) handle SIGTRAP nopass noprint nostop
SIGTRAP is used by the debugger.
SIGTRAP      No      No      No      Trace/breakpoint trap
(idb)
```

Caveat: With this workaround all SIGTRAP signals to the debuggee are blocked.

6.6.16 `idb` GUI cannot be used to debug MPI processes

The `idb` GUI cannot be used to debug MPI processes. The command line interface (`idbc`) can be used for this purpose.

6.6.17 Thread Syncpoint Creation in GUI

While for plain code and data breakpoints the field “Location” is mandatory, thread syncpoints require both “Location” and “Thread Filter” to be specified. The latter specifies the threads to synchronize. Please note that for the other breakpoint types this field restricts the breakpoints created to the threads listed.

6.6.18 Data Breakpoint Dialog

The fields “Within Function” and “Length” are not used. The location to watch provides the watched length implicitly (the type of the effective expression is used). Also “Read” access is not working.

6.6.19 Stack Alignment for IA-32 Architecture

Due to changes in the default stack alignment for the IA-32 architecture, the usage of inferior calls (i.e. evaluation of expressions that cause execution of debuggee code) might fail. This can cause as well crashes of the debuggee and therefore a restart of the debug session. If you need to use this feature, make sure to compile your code with 4 byte stack alignment by proper usage of the `-falign-stack=<mode>` option.

6.6.20 GNOME Environment Issues

With GNOME 2.28, debugger menu icons may not being displayed by default. To get the menu icons back, you need to go to the “System->Preferences->Appearance, Interface” tab and enable, “Show icons in menus”. If there is not “Interface” tab available, you can change this with the corresponding GConf keys in console as follows:

```
gconftool-2 --type boolean --set
/desktop/gnome/interface/buttons_have_icons true
gconftool-2 --type boolean --set
/desktop/gnome/interface/menus_have_icons true
```

6.6.21 Accessing Online-Help

On systems where the Online-Help is not accessible from the IDB Debugger GUI Help menu, you can access the web-based debugger documentation from <http://intel.ly/o5DMp9>

7 Eclipse Integration

The Intel C++ Compiler installs an Eclipse feature and associated plugins (the Intel C++ Eclipse Product Extension) which provide support for the Intel C++ compiler when added as an Eclipse product extension site to an existing instance of the Eclipse* Integrated Development Environment (IDE). With this feature, you will be able to use the Intel C++ compiler from within the Eclipse integrated development environment to develop your applications.

7.1 Supplied Integrations

The Intel feature provided in the following directory:

```
<install-dir>/eclipse_support/cdt8.0/eclipse
```

supports and requires Eclipse Platform versions 4.2, 3.8, and 3.7; Eclipse C/C++ Development Tools (CDT) version 8.0 or later; and a functional Java Runtime Environment (JRE) version 6.0 (also called 1.6) update 11 or later.

7.1.1 Integration notes

If you already have the proper versions of Eclipse, CDT and a functional JRE installed and configured in your environment, then you can add the Intel C++ Eclipse Product Extension to your Eclipse Platform, as described in the section, below, entitled [How to Install the Intel C++ Eclipse Product Extension in Your Eclipse Platform](#). Otherwise, you will first need to obtain and install Eclipse, CDT and a JRE, as described in the section, below, entitled [How to Obtain and Install Eclipse, CDT and a JRE](#) and then install the Intel C++ Eclipse Product Extension.

If your installation of Eclipse already has an earlier Intel® C++ Composer XE integration installed, installing the updated integration will not work. You will need to install a fresh version of Eclipse into which you can install the latest Composer XE integration. For this same reason, using the Eclipse update mechanism to install a newer Composer XE integration will not work.

7.2 How to Install the Intel C++ Eclipse Product Extension in Your Eclipse Platform

To add the Intel C++ product extension to your existing Eclipse configuration, follow these steps, from within Eclipse.

Open the "Available Software" page by selecting: `Help > Install New Software...`
Click on the "Add..." button. Select "Local...". A directory browser will open. Browse to select the `eclipse` directory in your Intel C++ compiler installation. For example, if you installed the compiler as root to the default directory, you would browse to `/opt/intel/composer_xe_2013.<n>.<xxx>/eclipse_support/cdt8.0/eclipse`. Select "OK" to close the directory browser. Then select "OK" to close the "Add Site" dialog. Select the two boxes for the Intel C++ integration: there will be one box for "Intel® C++ Compiler Documentation" and a second box for "Intel® C++ Compiler XE 14.0 for Linux* OS". Note: The Intel features will not be visible if you have Group items by category set – unset this option to view the Intel features.

Click the "Next" button. An "Install" dialog will open which gives you a chance to review and confirm you want to install the checked items. Click "Next". You will now be asked to accept the license agreement. Accept the license agreement and click "Finish". Select "OK" on the "Security Warning" dialog that says you are installing software that contains unsigned content. The installation of the Intel support will proceed.

When asked to restart Eclipse, select "Yes". When Eclipse restarts, you will be able to create and work with CDT projects that use the Intel C++ compiler. See the Intel C++ Compiler documentation for more information. You can find the Intel C++ documentation under `Help > Help Contents > Intel(R) C++ Compiler XE 14.0 User and Reference Guides`.

7.2.1 Integrating the GNU* Project Debugger into Eclipse

See the section [GNU* GDB Debugger](#).

7.2.2 Integrating the Intel® Debugger into Eclipse

See the section [Intel® Debugger \(IDB\)](#).

7.3 How to Obtain and Install Eclipse, CDT and a JRE

Eclipse is a Java application and therefore requires a Java Runtime Environment (JRE) to execute. The choice of a JRE is dependent on your operating environment (machine architecture, operating system, etc.) and there are many JRE's available to choose from.

A package containing both Eclipse 4.2 and CDT 8.1 is available from:

<http://www.eclipse.org/downloads/>

Scroll down to find “Eclipse IDE for C/C++ Developers”. Choose either the Linux 32-bit or Linux 64-bit download as desired.

7.3.1 Installing JRE, Eclipse and CDT

Once you have downloaded the appropriate files for Eclipse, CDT, and a JRE, you can install them as follows:

1. Install your chosen JRE according to the JRE provider's instructions.
2. Create a directory where you would like to install Eclipse and `cd` to this directory. This directory will be referred to as `<eclipse-install-dir>`
3. Copy the Eclipse package binary `.tgz` file to the `<eclipse-install-dir>` directory.
4. Expand the `.tgz` file.
5. Start `eclipse`

You are now ready to add the Intel C++ product extension to your Eclipse configuration as described in the section, *How to Install the Intel C++ Eclipse Product Extension in Your Eclipse Platform*. If you need help with launching Eclipse for the first time, please read the next section.

7.4 Launching Eclipse for Development with the Intel C++ Compiler

If you have not already set your `LANG` environment variable, you will need to do so. For example,

```
setenv LANG en_US
```

Setup Intel C++ compiler related environment variables by executing the `compilervars.csh` (or `.sh`) script prior to starting Eclipse:

```
source <install-dir>/bin/compilervars.csh arch_arg (where "arch_arg" is one of "ia32" or "intel64").
```

Since Eclipse requires a JRE to execute, you must ensure that an appropriate JRE is available to Eclipse prior to its invocation. You can set the `PATH` environment variable to the full path of

the folder of the `java` file from the JRE installed on your system or reference the full path of the `java` executable from the JRE installed on your system in the `-vm` parameter of the Eclipse command, e.g.:

```
eclipse -vm /JRE folder/bin/java
```

Invoke the Eclipse executable directly from the directory where it has been installed. For example:

```
<eclipse-install-dir>/eclipse/eclipse
```

7.5 Installing on Fedora* Systems

If the Intel C++ Compiler for Linux is installed on an IA-32 or Intel® 64 architecture Fedora* system as a "local" installation, i.e. not installed as root, the installation may fail to properly execute the Eclipse graphical user interfaces to the compiler or debugger. The failure mechanism will typically be displayed as a `JVM Terminated` error. The error condition can also occur if the software is installed from the root account at the system level, but executed by less privileged user accounts.

The cause for this failure is that a more granular level of security has been implemented on Fedora, but this new security capability can adversely affect access to system resources, such as dynamic libraries. This new *SELinux* security capability may require adjustment by your system administrator in order for the compiler installation to work for regular users.

7.6 Selecting Compiler Versions

For Eclipse projects you can select among the installed versions of the Intel C++ Compiler. On IA-32 architecture systems, the supported Intel compiler versions are 9.1, 10.0, 10.1, 11.0, 11.1, 12.0, 12.1, 13.0, and 14.0. On Intel® 64 architecture systems, only compiler versions 11.0, 11.1, 12.0, 12.1, 13.0, and 14.0 are supported.

8 Intel® Integrated Performance Primitives

This section summarizes changes, new features and late-breaking news about this version of Intel® Integrated Performance Primitives (Intel® IPP).

The latest information on Intel® IPP 8.1 can be found in the product release notes under

```
<install
dir>/composer_xe_2013_sp1.x.xxx/Documentation/<locale>/ipp/ReleaseNotes.htm.
```

For detailed information about IPP see the following links:

- **New features:** see the information below and visit the main Intel IPP product page on the Intel web site at: <http://intel.ly/OG5IF7>; and the Intel IPP Release Notes at <http://intel.ly/OmWI4d>.

- **Documentation, help, and samples:** see the documentation links on the IPP product page at: <http://intel.ly/OG5IF7>.

8.1 Intel® IPP Cryptography Libraries are Available as a Separate Download

The Intel® IPP cryptography libraries are available as a separate download. For download and installation instructions, please read <http://intel.ly/ndrGnR>

8.2 Intel® IPP Code Samples

The Intel® IPP code samples are organized into downloadable packages at <http://intel.ly/pnsHxc>

The samples include source code for audio/video codecs, image processing and media player applications, and for calling functions from C++, C# and Java*. Instructions on how to build the sample are described in a readme file that comes with the installation package for each sample.

9 Intel® Math Kernel Library

This section summarizes changes, new features and late-breaking news about this version of the Intel® Math Kernel Library (Intel MKL). All the bug fixes can be found here: <http://intel.ly/OeHQqf>

9.1 Notices

Please refer to the [Knowledge Base article on Deprecations](#) for more information on the following notices

- Intel® MKL now provides a choice of components to install. Components necessary for PGI* compiler, Compaq Visual Fortran* Compiler, SP2DP interface, BLAS95 and LAPACK95 interfaces, Cluster support (ScaLAPACK and Cluster DFT) and Intel® Many Integrated Core Architecture (Intel® MIC Architecture) support are not installed unless explicitly selected during installation
- Unaligned Conditional Numerical Reproducibility (CNR) is not available for Intel MKL Cluster components (ScaLAPACK and Cluster DFT)
- Examples for using Intel MKL with Boost* uBLAS and Java* have been removed from product distribution and placed in the following articles:
 - [How to use Intel MKL with Java*](#)
 - [How to use Boost* uBLAS with Intel MKL](#)

9.2 Changes in This Version

9.2.1 What's New in Intel MKL 11.1 Update 4

- Added a customizable error handler; see the Intel Math Kernel Library Reference Manual description of `mkl_set_exit_handler()` for further details
- Extended the Intel® Xeon Phi™ coprocessor Automatic Offload feature with a resource sharing mechanism; see the Intel Math Kernel Library Reference Manual description of

`mkl_mic_set_resource_limit()` function and the `MKL_MIC_RESOURCE_LIMIT` environment variable for further details

- **BLAS:**
 - Improved performance of ?TRSM and ?SYMM in Automatic Offload mode on Intel® Many Integrated Core Architecture (Intel® MIC Architecture)
 - Improved threaded performance of ?GEMM for all 64-bit architectures supporting Intel® Advanced Vector Extensions 2 (Intel® AVX2)
 - Optimized DGEMV on Intel® Advanced Vector Extensions 512 (Intel® AVX-512) instruction set
 - Improved threaded performance of ?AXPBY for all Intel processors
 - Optimized ?COPY on Intel AVX2 and Intel AVX512 instruction sets
 - Improved performance of SSYR2K for 64-bit processors supporting Intel® Advanced Vector Extensions (Intel® AVX) and Intel AVX2
 - Optimized ZDOTC on Intel AVX-512 instruction set
 - Reduced stack usage for CHEMM, CHERK, CHER2K, {D,C}SYRK, and {D,C}SYR2K
- **LAPACK:**
 - Improved performance of (S/D/C/Z)GE(SVD/SDD) when $M \geq N$ and singular vectors are not needed
 - Improved performance of ?GELSX, ?GGSVP
 - Improved performance of ?POTRF UPLO=U in Automatic Offload mode on Intel MIC Architecture
- **Intel MKL PARDISO:**
 - Added the ability to store the Intel MKL PARDISO handle to the disk for future use at any solver stage
 - Added capability to free memory taken by original matrix after factorization stage if iterative refinement is disabled
 - Added example demonstrating use of Intel MKL PARDISO as an iterative solver for non-linear systems
 - Improved message output from Intel MKL PARDISO
 - Added support of zero pivot during factorization for structurally symmetric cases
- **VSL RNG:**
 - Improved performance of the Wichmann-Hill basic random number generator on CPUs supporting Intel AVX and Intel AVX2 instruction sets
 - Improved performance of the MRG32K3A basic random number generator on Intel® 64 architecture CPUs supporting Intel AVX instruction set

9.2.2 What's New in Intel MKL 11.1 Update 3

- **BLAS:**
 - Improved performance of Level 3 BLAS functions for 64-bit processors supporting Intel® Advanced Vector Extensions 2 (Intel® AVX2)
 - Improved performance of matrix generation in the heterogeneous Intel® Optimized MP LINPACK Benchmark for Clusters
 - Optimized ?GEMM, ?TRSM, DTRMM for the Intel® Advanced Vector Extensions 512 (Intel® AVX-512) instruction set

- LAPACK:
 - Improved performance of ?(SY/HE)RDB
 - Improved performance of ?(SY/HE)(EV/EVR/EVD) when eigenvectors are not needed
 - Improved performance of ?SY(EV/EVD) when eigenvectors are needed
 - Improved performance of NaN checkers in LAPACKE interfaces
 - Improved performance of DGETRF for processors supporting Intel AVX2
 - Added Automatic Offload for ?SYRDB on Intel® Many Integrated Core Architecture (Intel® MIC Architecture), which speeds up DSY(EV/EVD) when eigenvectors are not needed
- Sparse BLAS:
 - Added example for diagonal format matrix
- Intel MKL PARDISO:
 - Improved memory estimation of out-of-core (OOC) portion size for reordering algorithm leading to improved factorization-solving step performance in OOC mode
 - Added pivot control support for nonsymmetric matrices and OOC mode
 - Added diagonal extraction support for nonsymmetric matrices and OOC mode
- Extended Eigensolver:
 - Improved output message
 - Improved examples
 - Added input and output iparm parameters in predefined interfaces for solving sparse problems
- FFT:
 - Optimized the whole range of FFTs for Intel® Advanced Vector Extensions 512 (Intel® AVX-512) instruction set
 - Improved performance of FFT for lengths which are not powers of two on Intel MIC Architecture

9.2.3 What's New in Intel MKL 11.1 update 2

- Introduced support for Intel® Atom™ processors
- BLAS:
 - Improved performance of ?GEMM for m==1 or n==1 on all Intel architectures
 - Improved MP LINPACK performance for systems using Intel® Many Integrated Core Architecture (Intel® MIC Architecture)
 - Improved performance of ?GEMM for outer product [large M, large N, small K] and tall skinny matrices [large M, medium N, small K] on Intel MIC Architecture
 - Improved performance of ?SYMM on Intel MIC Architecture
 - Improved {S/D}GEMM single thread performance on small matrices for 64-bit processors supporting Intel® Advanced Vector Extensions (Intel® AVX) and Intel® Advanced Vector Extensions 2 (Intel® AVX2)
 - Improved DGEMV performance for 64-bit processors supporting Intel AVX2
 - Improved threaded performance of {S,D,C,Z}GEMV for notrans:n>>m and trans:m>>n on all Intel architectures
 - Improved DSYR2K performance for 64-bit processors supporting Intel AVX and Intel AVX2
 - Improved DTRMM performance on small matrices (A matrix size <= 10) for 64-bit processors supporting Intel AVX and Intel AVX2

- Reduced stack usage for ZHEMM and ZSYRK
- Added more detailed error messages for running Offload MP LINPACK scripts with unsupported configurations
- LAPACK:
 - Improved performance of (S/D)SYRDB and (D/S)SYEV for large dimensions and UPLO=L when eigenvectors are needed
 - Improved performance of ?GELQF, ?GELS and ?GELSS for underdetermined case (M)
 - Improved performance of ?GEHRD, ?GEEV and ?GEES
 - Added Automatic Offload to Intel® Xeon Phi™ coprocessor for DSYRDB UPLO=L
- Sparse BLAS:
 - Optimized SpMV kernels for Intel® Advanced Vector Extensions 512 (Intel® AVX-512) instruction set
 - Improved Sparse BLAS level 2 and 3 performance for systems supporting Intel® Streaming SIMD Extensions 4.2 (Intel® SSE4.2), Intel AVX, and Intel AVX2 instruction sets
- PARDISO:
 - Improved memory estimation of out-of-core portion size for reordering algorithm leading to improved factorization-solving step performance in OOC mode
- VML:
 - Added v[d|s]Frac function computing fractional part for each vector element
- VSL RNG:
 - Improved performance of MRG32K3A, and MT2203 BRNGs on Intel Xeon Phi coprocessors
 - Improved performance of MT2203 BRNG on CPUs supporting Intel AVX and Intel AVX2 instruction sets
- VSL Summary Statistics:
 - Added support for computation of group/pooled (VSL_SS_GROUP_MEAN/VSL_SS_POOLED_MEAN) mean estimates

9.2.4 What's New in Intel MKL 11.1 update 1

- Introduced support for Intel® AVX-512 instructions set with limited set of optimizations
- BLAS:
 - Improved performance of DSDOT, and added support for multiple threads, on all 64-bit Intel processors supporting Intel® Advanced Vector Extensions (Intel® AVX) and Intel® Advanced Vector Extensions 2 (Intel® AVX2)
 - Improved handling of denormals on the diagonal in *TRSM
 - Improved SGEMM performance for small N and large M and K on Intel® Many Integrated Core Architecture (Intel® MIC Architecture)
 - Improved parallel performance of *HEMM on all Intel processors supporting Intel® SSE4.2 and later
 - Improved parallel performance of 64-bit *SYRK/*HERK on all Intel processors supporting Intel® SSSE3 and later

- Improved serial performance of 64-bit {D,S}SYRK on all Intel processors supporting Intel® SSE4.2 and later
- Improved performance of DTRSM on Intel® MIC Architecture
- Enhanced Intel® Optimized HPL Benchmark runmultiscript capabilities for Intel processors supporting Intel® AVX
- Improved Intel® Optimized HPL Benchmark performance on Intel® MIC Architecture
- LAPACK
 - Decreased memory utilization for parallel LAPACK functions (OR/UN)M(QR/RQ/QL/LQ)
 - Decreased stack memory utilization in LAPACK functions
 - Improved performance of (S/D)SYRDB and (S/D)SYEV for large dimensions when eigenvalues are only needed
- ScaLAPACK
 - Updated PBLAS headers to mix default NETLIB and MKL complex datatypes
- DFT: Optimized complex-to-complex and real-to-complex transforms
- Transposition: Improved performance of mkl_?omatcopy routines on tall and skinny matrices
- DFTI interface and FFTW wrappers are now thread safe. setting NUMBER_OF_USER_THREADS parameter when using MKL DFT from parallel regions became optional.

9.2.5 What's New in Intel MKL 11.1

- Conditional Numerical Reproducibility : Introduced support for Conditional Numerical Reproducibility (CNR) mode on unaligned data
- Introduced MP LINPACK support for heterogeneous clusters - clusters whose nodes differ from each other, either by processor type or by having varying number of attached Intel® Xeon Phi™ coprocessors
- Improved performance of CNR=AUTO mode on recent AMD* systems
- BLAS:
 - Improved performance of [S/D]GEMV on all Intel processors supporting Intel® SSE4.2 and later
 - Optimized [D/Z]GEMM and double-precision Level 3 BLAS functions on Intel® Advanced Vector Extensions 2 (Intel® AVX2)
 - Optimized [Z/C]AXPY and [Z/C]DOT[U/C] on Intel® Advanced Vector Extensions (Intel® AVX) and Intel AVX2
 - Optimized sequential version of DTRMM on Intel MIC Architecture
 - Tuned DAXPY on Intel AVX2
- LAPACK:
 - Improved performance of (S/D)SYRDB and (S/D)SYEV for large dimensions when only eigenvalues are needed
 - Improved performance of xGESVD for small sizes like M,N<10
- VSL:
 - Added support and examples for mean absolute deviation
 - Improved performance of Weibull Random Number Generator (RNG) for alpha=1
 - Added support of raw and central statistical sums up to the 4th order, matrix of cross-products and median absolute deviation

- Added a VSL example designed by S. Joe and F. Y. Kuo illustrating usage of Sobol QRNG with direction numbers which supports dimensions up to 21,201
- Improved performance of SFMT19937 Basic Random Number Generator (BRNG) on Intel MIC Architecture
- DFT:
 - Improved performance of double precision complex-to-complex transforms on Intel MIC Architecture
 - Optimized complex-to-complex DFT on Intel AVX2
 - Optimized complex-to-complex 2D DFT on Intel® Xeon processor E5 v2 series
 - Improved performance for workloads specific to GENE application on Intel Xeon E5-series (Intel AVX) and on Intel AVX2
 - Improved documentation data layout for DFTI compute functions
 - Introduced scaling in large real-to-complex FFTs
- Data Fitting:
 - Improved performance of `df?Interpolate1D` and `df?SearchCells1D` functions on Intel Xeon processors and Intel MIC Architecture
 - Improved performance of `df?construct1d` function for linear and Hermite/Bessel/Akima cubic types of splines on Intel MIC Architecture, Intel® Xeon® processor X5570 and Intel® Xeon® processor E5-2690
- Transposition
 - Improved performance of in-place transposition for square matrices
- Examples and tests for using Intel MKL are now packaged as an archive to shorten the installation time

9.3 Attributions

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.

10 Intel® Threading Building Blocks

For information on changes to Intel® Threading Building Blocks, please read the file `CHANGES` in the TBB documentation directory.

11 Disclaimer and Legal Information

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