Intel® C++ Composer XE 2011 for Windows* 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 product features and includes notes about features and problems not described in the product documentation.

Intel® C++ Composer XE 2011 is the next release of the product formerly called Intel® C++ Compiler Professional Edition.

1.1 Change History

This section highlights important changes in product updates.

Update 5 (2011.5)

- Intel® Math Kernel Library updated to 10.3 Update 5
- Intel® Threading Building Blocks 3.0 Update 8
- Corrections to reported problems

Update 4 (2011.4)

- Intel® Math Kernel Library updated to 10.3 Update 4
- Intel® Integrated Performance Primitives 7.0 Update 4
- Intel® Threading Building Blocks 3.0 Update 7
- Corrections to reported problems

Update 3 (2011.3)

- Intel® Math Kernel Library updated to 10.3 Update 3
- Intel® Integrated Performance Primitives 7.0 Update 3

- Intel® Threading Building Blocks 3.0 Update 6
- `/Qsox` option enhancement
- Corrections to reported problems

Update 2 (2011.2)

- Intel® Math Kernel Library updated to 10.3 Update 2
- Intel® Integrated Performance Primitives 7.0 Update 2
- Intel® Threading Building Blocks 3.0 Update 5
- 3 intrinsics changed in immintrin.h
- Utility "inspxe-runsc.exe" changed
- Corrections to reported problems

Update 1 (2011.1)

- Intel® Math Kernel Library updated to 10.3 Update 1
- Intel® Integrated Performance Primitives 7.0 Update 1
- Corrections to reported problems

Product Release (2011.0)

- Initial product release

1.2 Product Contents

*Intel® C++ Composer XE 2011 Update 5 for Windows** includes the following components:

- Intel® C++ Compiler XE 12.0 Update 5 for building applications that run on IA-32 or Intel® 64 architecture systems running the Windows* operating system
- Intel® Integrated Performance Primitives 7.0 Update 4
- Intel® Math Kernel Library 10.3 Update 5
- Intel® Threading Building Blocks 3.0 Update 8
- Intel® Parallel Debugger Extension
- Integration into Microsoft* development environments
- Sample programs
- On-disk documentation

1.3 System Requirements

For an explanation of architecture names, see http://software.intel.com/en-us/articles/intel-architecture-platform-terminology/

- 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
    - For the best experience, a multi-core or multi-processor system is recommended
- 1GB RAM (2GB recommended)
- 4GB free disk space for all product features and all architectures

- Microsoft Windows XP*, Microsoft Windows Vista*, Microsoft Windows 7*, Microsoft Windows Server 2003*, Microsoft Windows Server 2008* or Microsoft Windows HPC Server 2008* (embedded editions not supported)
    - Microsoft Windows Server 2008 or Windows HPC Server 2008 requires Microsoft Visual Studio 2008* SP1. Other versions of Visual Studio listed below are not supported on Windows Server 2008 or Windows HPC Server 2008.
- To use the Microsoft Visual Studio development environment or command-line tools to build IA-32 or Intel® 64 architecture applications, one of:
    - Microsoft Visual Studio 2010* with C++ and “X64 Compiler and Tools” components installed [1]
    - Microsoft Visual Studio 2008* Standard Edition (or higher edition) with C++ and “X64 Compiler and Tools” components installed [1]
    - Microsoft Visual Studio 2005* Standard Edition (or higher edition) with C++ and “X64 Compiler and Tools” components installed [1]
- To use command-line tools only to build IA-32 architecture applications, one of:
    - Microsoft Visual C++ 2010* Express Edition
    - Microsoft Visual C++ 2008* Express Edition
    - Microsoft Visual C++ 2005* Express Edition and Microsoft Windows SDK for Windows 2008 and .NET Framework 3.5*
- To use command-line tools only to build Intel® 64 architecture applications, one of:
    - Microsoft Windows Software Development Kit Update for Windows 7*
    - Microsoft Windows SDK for Windows 2008 and .NET Framework 3.5*
- To read the on-disk documentation, Adobe Reader* 7.0 or later

Notes:

1. Microsoft Visual Studio 2005 and 2008 Standard Edition installs the “x64 Compiler and Tools” component by default – the Professional and higher editions require a “Custom” install to select this. Microsoft Visual Studio 2010 includes x64 support by default.
2. 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.
3. Applications can be run on the same Windows versions as specified above for development. Applications may also run on non-embedded 32-bit versions of Microsoft Windows earlier than Windows XP, though Intel does not test these for compatibility. Your application may depend on a Win32 API routine not present in older versions of Windows. You are responsible for testing application compatibility. You may need to copy certain run-time DLLs onto the target system to run your application.

1.3.1 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 compilers, associated libraries and associated development tools may include or utilize options that optimize for instruction sets that are available in both Intel and non-Intel microprocessors (for example SIMD instruction sets), but do not optimize equally for non-Intel microprocessors. In addition, certain compiler options for Intel compilers, including some that are not specific to Intel micro-architecture, are reserved for Intel microprocessors. For a detailed description of Intel compiler options, including the instruction sets and specific microprocessors they implicate, please refer to the “Intel Compiler User and Reference Guides” under “Compiler Options." Many library routines that are part of Intel compiler products are more highly optimized for Intel microprocessors than for other microprocessors. While the compilers and libraries in Intel compiler products offer optimizations for both Intel and Intel-compatible microprocessors, depending on the options you select, your code and other factors, you likely will get extra performance on Intel microprocessors.

Intel compilers, associated libraries and associated development tools may or may not optimize to the same degree for non-Intel microprocessors for optimizations that are not unique to Intel microprocessors. These optimizations include Intel Streaming SIMD Extensions 2 (Intel SSE2), Intel Streaming SIMD Extensions 3 (Intel SSE3), and Supplemental Streaming SIMD Extensions 3 (Intel SSSE3) instruction sets and other optimizations. Intel does not guarantee the availability, functionality, or effectiveness of any optimization on microprocessors not manufactured by Intel. Microprocessor-dependent optimizations in this product are intended for use with Intel microprocessors.

While Intel believes our compilers and libraries are excellent choices to assist in obtaining the best performance on Intel and non-Intel microprocessors, Intel recommends that you evaluate other compilers and libraries to determine which best meet your requirements. We hope to win your business by striving to offer the best performance of any compiler or library; please let us know if you find we do not.

Notice revision #20110228

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.

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://software.intel.com/en-us/articles/changing-language-setting-to-see-english-on-a-japanese-os-environment-or-vice-versa-on-windows/

1.7 Technical Support

If you did not register your compiler during installation, please do so at the Intel® Software Development Products Registration Center. 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

2.1 Pre-installation Steps

2.1.1 Configure Visual Studio for 64-bit Applications

If you are using Microsoft Visual Studio 2005* or 2008 and will be developing 64-bit applications (for the Intel® 64 architecture) you may need to change the configuration of Visual Studio to add 64-bit support.

If you are using Visual Studio 2005/2008 Standard Edition, or Visual Studio 2010 Professional Edition or higher, no configuration is needed to build Intel® 64 architecture applications. For other editions:

1. From Control Panel > Add or Remove Programs, select “Microsoft Visual Studio 2005” (or 2008) > Change/Remove. The Visual Studio Maintenance Mode window will appear. Click Next.
2. Click Add or Remove Features
3. Under “Select features to install”, expand Language Tools > Visual C++
4. If the box “X64 Compiler and Tools” is not checked, check it, then click Update. If the box is already checked, click Cancel.

Note that Visual C++ Express Edition does not support 64-bit development.

2.1.2 Installation on Microsoft Windows Vista* and Windows 7*

Microsoft Visual Studio 2005* users should install *Visual Studio 2005 Service Pack 1* (VS 2005 SP1) as well as the *Visual Studio 2005 Service Pack 1 Update for Windows Vista*, which is linked to from the VS 2005 SP1 page. After installing these updates, you must ensure that Visual Studio runs with Administrator permissions, otherwise you will be unable to use the Intel compiler. For more information, please see Microsoft's Visual Studio on Windows Vista page (http://msdn2.microsoft.com/en-us/vstudio/aa948853.aspx) and related documents.

2.2 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, insert the first product DVD in your computer's DVD drive; the installation should start automatically. If it does not, open the top-level folder of the DVD drive in Windows Explorer and double-click on setup.exe.

If you received your product as a downloadable file, double-click on the executable file (.EXE) to begin 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

2.2.1 Silent Install

For information on automated or "silent" install capability, please see http://software.intel.com/en-us/articles/intel-compilers-for-windows-silent-installation-guides/

2.2.2 Activation of Purchase after Evaluation Using the Intel Activation Tool

Note for evaluation customers a new tool Intel Activation Tool "ActivationTool.exe" is included in this product release and installed at "`[Common Files]\Intel\Parallel Studio XE 2011\Activation\`".

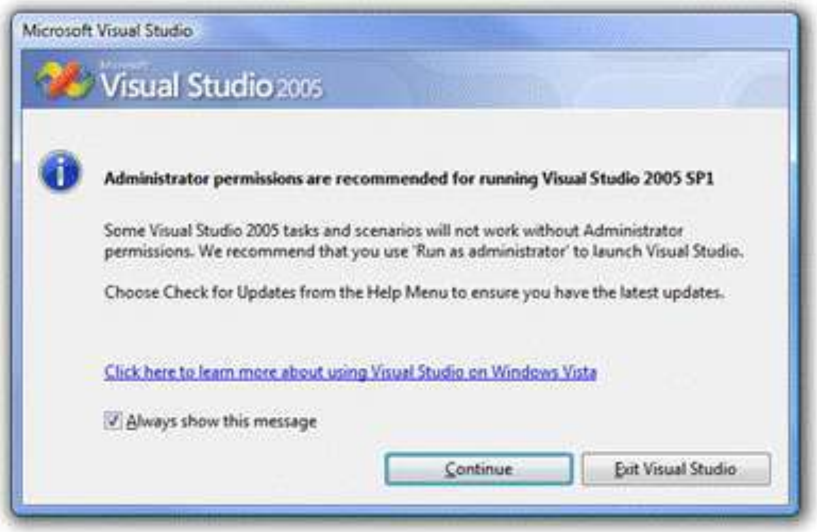
If you installed the product using an Evaluation license or SN, or using the "Evaluate this product (no serial number required)" option during installation, and then purchased the product, you can activate your purchase using the Intel Activation Tool at Start > All Programs > Intel Parallel Studio XE 2011 > Product Activation. It will convert your evaluation software to a fully licensed product.

2.2.3 Using a License Server

If you have purchased a "floating" license, see http://software.intel.com/en-us/articles/licensing-setting-up-the-client-floating-license/ 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.

2.2.4 Prompt for Administrator Permission with Microsoft Visual Studio 2005*

If you are installing on Microsoft Windows Vista* or later versions of Microsoft Windows and are using Microsoft Visual Studio 2005, Windows may display a dialog similar to the following:


Microsoft Visual Studio

Administrator permissions are recommended for running Visual Studio 2005 SP1

Some Visual Studio 2005 tasks and scenarios will not work without Administrator permissions. We recommend that you use 'Run as administrator' to launch Visual Studio.

Choose Check for Updates from the Help Menu to ensure you have the latest updates.

Click here to learn more about using Visual Studio on Windows Vista

☑ Always show this message

If this is displayed, it is important that you click the Continue button and leave the "Always show this message" box checked. If you select "Exit Visual Studio" instead, or do nothing (this message times out after two minutes), the compiler integration will not install completely.
For more information, see Installation on Microsoft Windows Vista*.

2.3 Changing, Updating and Removing the Product

Use the Windows Control Panel "Add or Remove Products" applet to change which product components are installed or to remove the product.

When installing an updated version of the product, you do not need to remove the older version first. You can have multiple versions of the compiler installed and select among them. If you remove a newer version of the product you may have to reinstall the integrations into Microsoft Visual Studio from the older version.

2.4 Installation Folders

The installation folder arrangement is shown in the diagram below. Not all folders will be present in a given installation.

- `C:\Program Files\Intel\ComposerXE-2011`
    - `bin`
        - `ia32`
        - `ia32_intel64`
        - `intel64`
    - `compiler`
        - `include`
            - `ia32`
            - `intel64`
        - `lib`
            - `ia32`
            - `intel64`

- `debugger`
- `Documentation`
- `Help`
- `ipp`
  - `bin`
  - `demo`
  - `include`
  - `interfaces`
  - `lib`
  - `tools`
- `mkl`
  - `benchmarks`
  - `bin`
  - `examples`
  - `include`
  - `interfaces`
  - `lib`
  - `tests`
  - `tools`
- `tbb`
  - `bin`
  - `examples`
  - `include`
  - `lib`
- `redist`
- `Samples`
- `VS Integration`

Where the folders under `bin, include` and `lib` are used as follows:

- `ia32`: Files used to build applications that run on IA-32
- `intel64`: Files used to build applications that run on Intel® 64
- `ia32_intel64`: Compilers that run on IA-32 to build applications that run on Intel®64

If you are installing on a system with a non-English language version of Windows, the name of the `Program Files` folder may be different. On Intel® 64 architecture systems, the folder name is `Program Files (X86)` or the equivalent.

By default, updates of a given version will replace the existing directory contents. When the first update is installed, the user is given the option of having the new update installed alongside the previous installation, keeping both on the system. If this is done, the top-level folder name for the older update is changed to `ComposerXE-2011.`*`nnn`* where *`nnn`* is the update number.

2.5 Installation Known Issues

2.5.1 Documentation Issue with Multiple Visual Studio Versions

If you have both Microsoft Visual Studio* 2005 and 2008 installed on your system and integrate Intel® C++ Composer XE 2011 into both versions, removing the integration from one of the versions will remove the integrated Intel® C++ Composer XE 2011 documentation from both.

To re-install the documentation:

1. Use the Control Panel to select the product.
   - For Windows XP* users: Select **Control Panel > Add/Remove Programs.**
   - For Windows 7* users: Select **Control Panel > Programs and Features**.
   - For Windows Vista* users: Select **Control Panel > Programs**.
2. With the product selected, click the **Change/Remove** button and choose Modify mode.
3. In the **Select Components** dialog box, unselect "Integrated Documentation;" this will **remove** the documentation.
4. Repeat steps 1 and 2.
5. In the **Select Components** dialog box, select "Integrated Documentation" to **install** documentation again

3 Intel® C++ Compiler

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

3.1 Compatibility

In version 11, the IA-32 architecture default for code generation has 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.

3.2 New and Changed Features

The following features are new or significantly enhanced in Intel® C++ Compiler XE 12.0. For more information on these features, please refer to the documentation viewable from within Visual Studio.

- Intel® Cilk™ Plus language extensions for the Intel® C++ Compiler make it easy to add parallelism to both new and existing software.
- Guided Auto-Parallelism
- Features from C++0x
  - `rvalue` references
  - Standard atomics
  - Support of C99 hexadecimal floating point constants when in "Windows C++" mode
  - Right angle brackets
  - Extended friend declarations

    - Mixed string literal concatenations
    - Support for `long long`
    - Variadic macros
    - Static assertions
    - Auto-typed variables
    - Extern templates
    - `__func__` predefined identifier
    - Declared type of an expression (decltype)
    - Universal character name literals
    - Strongly-typed enums
    - Lambdas
- An option to use math library functions that are faster but return results with less precision or accuracy
- An option to use math library functions that return consistent results across different models and manufacturers of processors

3.2.1 Additional Keywords for `/Qsox` option, default changed in update 3

The `/Qsox` option, which adds information to the object file about compiler options used and procedure profiling information, has been enhanced to let the user request that the list of inlined functions be included and to let the user exclude information about procedure profiling.

The syntax for `/Qsox` is now:

```
/Qsox[-]
/Qsox=keyword[,keyword]
```

Where *`keyword`* is one of `inline` or `profile`. If `/Qsox` is specified with no keywords, only the command line options are included – this is a change from previous releases. To maintain the previous behavior, use `/Qsox=profile`. Multiple `/Qsox` options may be specified on the command line – if so, they are interpreted in left-to-right order.

The information is added to the object file as comment directives. These are ignored by Microsoft linkers beginning with Visual Studio 2005, therefore the information will not be present in the executable.

3.2.2 Three intrinsics changed in update 2

Three intrinsics (_rdrand16_step(), _rdrand32_step(), _rdrand64_step()) have been changed in update 2. The documentation has not been updated with these new changes. These intrinsic return a hardware-generated random value and are declared in the “immintrin.h” header file.

These three intrinsics are mapped to a single RDRAND instruction, generate random numbers of 16/32/64 bit wide random integers.

Syntax

1. extern int _rdrand16_step(unsigned short *random_val);

2. extern int _rdrand32_step(unsigned int *random_val);
3. extern int _rdrand64_step(unsigned __int64 *random_val);

Description

The intrinsics perform one attempt to generate a hardware generated random value using the instruction RDRAND. The generated random value is written to the given memory location and the success status is returned: 1 if the hardware returned a valid random value and 0 otherwise.

Return

A hardware-generated 16/32/64 random value.

Constraints

The _rdrand64_step() intrinsic can be used only on systems with the 64-bit registers support.

3.2.3 Static Security Analysis Feature (formerly Source Checker) Requires Intel® Inspector XE

The “Source Checker” feature, from compiler version 11.1, has been enhanced and renamed “Static Security Analysis”. The compiler options to enable Static Security Analysis remain the same as in compiler version 11.1 (for example, `/Qdiag-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.

3.2.3.1 The command line utility “inspxe-runsc.exe” changed since update 2

This utility is distributed with Intel® Composer XE 2011 and has been changed since update 2. This change only affects users who use Composer XE 2011 to perform Static Security Analysis (SSA). Those that do not use SSA and those that perform SSA without using this utility are unaffected. SSA is only available to users of Intel® Parallel Studio XE 2011 or Intel® C++ Studio XE 2011, so users who do not have those products are unaffected.

Inspxe-runsc executes a **build specification,** a description of how an application is built. Usually build specification files are generated by observing a build as it executes and recoding the compilations and links that are performed. Inspxe-runsc repeats these actions using the Intel compiler in SSA mode. SSA results are generated at the link step so a build specification that describes a build with more than one link step will generate more than one SSA result when inspxe-runsc is invoked.

The versions of inspxe-runsc included in Composer XE 2011 and Composer XE 2011 Update 1 generate all the SSA results in a single directory. In the multiple link case this violated the rule that all the SSA results for one and only one project must be created in the same directory. The updated version of inspxe-runsc respects this rule by generating results for each link step in a separate directory. The name of that directory is formed from the name of the file being linked. Thus if a build specification describes a project that builds two executables, file1.exe and file2.exe, then earlier versions of inspxe-runsc would create two results, one for file1 and one for file2, say r000sc and r001sc, in the same directory. The new version of inspxe-runsc will also create two results, but the one for file1 will be created in “My Inspector XE results – file1\r000sc” and the one for file2 will be created in “My Inspector XE results – file2\r000sc”. The directories containing the results are both created in the same parent directory.

Inspxe-runsc has a command line switch, -result-dir (-r), that specifies where results are to be created. The meaning of this switch has changed. Previous this would name the directory where the result itself, say r000sc, would be created. Now it names the parent directory where the “My Inspector XE Results - name” directory or directories will be created. So the directory named in the –r switch is effectively two levels up from the results themselves.

The change to inspxe-runsc effectively moves the result directory, and user action is required to adapt to this change. Those using scripts that invoke inspxe-runsc with the –r switch must update their scripts to reflect the new interpretation of the –r switch argument described earlier. Users must move their old result files into the new directory so that SSA results produced by earlier versions of inspxe-runsc share the same directory as results produced by the new version of inspxe-runsc. Users that had been using inspxe-runsc with a build specification with only one link step should move their old results into a directory of the form “My Inspector XE results – name”. If this is not done, then all the problems in the newly created result will appear to be “New”. Users that had been using inspxe-runsc with a build specification with multiple link steps have been having various issues with SSA that will be resolved by using the new utility. Such users are best advised to copy the most recent into their old results into each of the new “My Inspector XE results – name” directories. This offers the best chance that some old problem state information will be correctly applied to new results when they are created in the future.

3.2.4 Microsoft* Visual Studio 2010* Support

This release supports Microsoft Visual Studio 2010. The Intel® C++ integration of Visual Studio 2010 is very different in comparison to the integration of Visual Studio 2005 or 2008. Please see this article for some details: http://software.intel.com/en-us/articles/what-are-the-differences-in-ide-integration-of-visual-studio-2010-and-visual-studio-2005-2008/

3.2.5 Intel® C++ Project File Compatibility

The Intel C++ project file (`.icproj`) format changed in version 12.0. If you open a project created with an earlier version of Intel C++, you will get a message indicating that the project needs to be converted. A version 12 project cannot be used by an earlier version of the Intel C++ integration but you can use older versions of the compiler that you have installed through `Tools > Options > Intel C++ > Compilers`.

3.3 New and Changed Compiler Options

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

- /Qansi-alias-check
- /Qcilk-serialize

- /Qdiag-sc-dir
- /Qfp-trap
- /Qfp-trap-all
- /Qguide
- /Qguide-data-trans
- /Qguide-file
- /Qguide-file-append
- /Qguide-opts
- /Qguide-par
- /Qguide-vec
- /Qimf-absolute-error
- /Qimf-accuracy-bits
- /Qimf-arch-consistency
- /Qimf-max-error
- /Qimf-precision
- /Qintel-extensions
- /Qopt-args-in-regs
- /Qopt-matmul
- /Qpatchable-addresses
- /Qprof-value-profiling
- /Qprofile-functions
- /Qprofile-loops
- /Qprofile-loops-report
- /Qpar-runtime-control[n]
- /Qpar-runtime-control-
- /Qregcall
- /Qsimd[-]
- /Qzero-initialized-in-bss

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

3.3.1 Deprecated Options

Use following method to find all the deprecated compiler options:

1) Open a command prompt from Start menu: Start > All Programs > Intel Parallel Studio XE 2011 > Command Prompt > Parallel Studio XE with Intel Compiler XE 2011 v12.0 [Update xx] > IA-32 Visual Studio xxx mode
2) Run command:

```
>> icl /? deprecate
```

3.4 Other Changes

3.4.1 Build Environment Command Script Change

The command window script used to establish the build environment allows the optional specification of the version of Microsoft Visual Studio to use. If you are not using the predefined Start menu shortcut to open a build environment window, use the following command to establish the proper environment:

```
"<install-dir>\bin\compilervars.bat" arch [vs]
```

Where `arch` is one of followings as appropriate for the target architecture you want to build for:

- `ia32`
- `ia32_intel64`
- `intel64`

`vs` is optional and can be one of followings. If `vs` is not specified, the version of Visual Studio specified at installation time for command-line integration is used by default.

- `vs2010`
- `vs2008`
- `vs2005`

If you also have Intel® Visual Fortran Composer XE 2011 installed, this command will also establish the environment for using that compiler.

The script file names iclvars.bat and ifortvars.bat have been retained for compatibility with previous releases.

3.4.2 OpenMP* Legacy Libraries Removed

The OpenMP "legacy" libraries have been removed in this release. Only the "compatibility" libraries are provided.

3.4.3 OpenMP* Libraries Default to Dynamic Linking

As of version 11.0, OpenMP applications link to the dynamic OpenMP libraries by default. To specify static linking of the OpenMP libraries, specify `/Qopenmp-link:static` . The static libraries are deprecated and may be removed in a future major release.

3.4.4 Using Intel C++ Projects with a Source Control System

If your project is managed under a source control system, for example, Microsoft Visual Source Safe* or Microsoft Visual Studio Team Foundation Server*, there are additional steps you must follow in order to use the Intel C++ project system with your project. A detailed article on this topic is available at http://software.intel.com/en-us/articles/tips-on-using-the-intel-c-compiler-with-source-code-control-software/

3.5 Known Issues

3.5.1 Compiler Known Issues

3.5.1.1 Command-Line Diagnostic Issue for Filenames with Japanese Characters

The filename in compiler diagnostics for filenames containing Japanese characters may be displayed incorrectly when compiled within a Windows command shell using the native Intel® 64 architecture compiler. It is not a problem when using Visual Studio or when using the Intel® 64 architecture cross-compiler or IA-32 architecture compiler

3.5.2 Visual Studio Known Issues

3.5.2.1 Visual Studio 2010 sets default of `/fp:precise`

A project created in or converted to Visual Studio 2010 will have the command line option `/fp:precise` set by default. This option sets the "floating point model" to improve consistency for floating point operations by disabling certain optimizations, reducing performance. To set the option back to the Intel default of `/fp:fast`, change the project property C++ > Optimization > Floating Point Model to Fast.

*3.5.2.2 Custom Build Rules in Microsoft Visual Studio 2005**

The Intel® C++ integration into Microsoft Visual Studio 2005* includes support for the Visual C++ Custom Build Rule functionality with some limitations. Custom Build Rules allow you to add custom tool invocations to your build process. See the Visual C++ documentation for a detailed explanation of Custom Build Rules.

You must create your custom build rules before converting your Visual C++ project to the Intel project system. If you need to modify your custom build rules after converting your project to the Intel project system, you must convert your project to the Visual C++ project system, make your custom build rule changes, and then convert the project back to the Intel project system.

The Macro lists that are available when you change the string properties defined for a Custom Build Rule don't contain Intel-specific macros (such as `$(icInstallDir); $(icIDEInstallDir); $(icProjectExt); $(icProjectFileName)`). However, you can use the Intel-specific macros in Custom Build Rule property values and they will be expanded correctly.

The Intel® C++ integration into Visual Studio 2005 does not currently support the Visual C++ Tool Build Order functionality which is available from the Visual C++ Tool Build Order dialog box. That is, you cannot change the order in which the build steps are run.

3.5.2.3 Language packs of Visual Studio 2010

If you install a new language pack of Visual Studio 2010 after installing the Intel C++ Composer XE 2011, you may not see the Intel C++ Compiler specific options in the Project Property dialog. Please try the following to fix the issue:

1) if directory "`<program files>\MSBuild\Microsoft.Cpp\v4.0\Platforms\[Win32|x64]\PlatformToolset`

`s\Intel C++ Compiler XE 12.0\1033`" exists, copy all files to “`<program files>\MSBuild\Microsoft.Cpp\v4.0\Platforms\[Win32|x64]\PlatformToolsets\Intel C++ Compiler XE 12.0\<locale-ID>`”.

2) if directory "`<program files>\MSBuild\Microsoft.Cpp\v4.0\Platforms\[Win32|x64]\PlatformToolsets\v100\1033\`" exists, copy all files to “`<program files>\MSBuild\Microsoft.Cpp\v4.0\Platforms\[Win32|x64]\PlatformToolsets\v100\<locale-ID>`”.

* The `<locale-ID>` is the language pack.

Another method is to uninstall the Intel C++ Composer XE 2011 and reinstall the Intel C++ Composer XE 2011.

3.5.3 Intel® Cilk™ Plus Known Issues

- Microsoft C++ Structured Exception Handling (SEH) will fail if an SEH exception is thrown after a steal occurs and before the corresponding `_Cilk_sync`.
- The Cilk™ Plus Language Specification (hereafter referred to as “the specification”) is available for download from http://cilk.com. Below are differences between the posted specification and the implementation of Cilk Plus in the 12.0 compiler.
  - The specification defines rules for determining the rank of an expression that contains a reference to an array section. The Intel® C++ Compiler 12.0 diverges from the specification in certain fairly rare cases involving the use of a section as a simple subscript (these operations are commonly termed "scatter" and "gather" operations).

    According to the specification:

    The rank of a subscript expression, having the form: X[Y], is the sum of the ranks of X and Y. Semantically speaking, subscripting of built-in arrays involves the use of pointer addition: when X is an array or pointer, X[Y] is the same as *(X+(Y)). However, the rank of X+(Y) is the common rank of X and Y (i.e. the rank of X and Y must match, unless one of them has rank zero). So the ranks of X[Y] and *(X+(Y)) can be different if the rank of Y is nonzero.

    The Intel® C++ Compiler 12.0 determines the rank of a subscript or pointer addition expression as follows: If the expression with pointer type started out having array type, and became a pointer through the array-to-pointer conversion, then the rank is the sum of the ranks of the operands (i.e. the "subscript rule" is used). But if the expression with pointer type started out with pointer type, then the rank is the common rank of the operands.

    For example:

    ```
    int a[10][10];
    int i[10];

    a[:][ i[:] ]       // rank 2
    *(a[:] + i[:])     // rank should be 1 per specification
    ```

```
                    // compiler uses rank 2 because a[:] has array
                    type

int **p;

p[0:10][ i[:] ]   // rank should be 2 per specification
                    // compiler uses rank 1 because p[0:10] has
                    pointer type
*(p[0:10] + i[:]) // rank 1
```

Rank can be thought of as the number of array dimensions to which sections are applied. It affects the shape of the array data that is read or written. Rank must match on the left and right sides of an assignment expression, except for when the right side has rank 0.

In the first example, 100 elements of “a” are accessed (which may or may not be distinct, given the values of i[:]).
In the second example, only 10 values are referenced, pointed to by *(p[m] + i[m]) for values of m between 0 and 9, inclusive.

- An error will be printed if the stride field of an array section is determined to be constant 0 at compile time, as the 12.0 compiler treats stride 0 to be illegal or undefined behavior. This differs from the description in the specification, which defines the use of stride 0 to replicate data into a multi-dimensional array.

  An example of what the specification specifies:

  ```
  a[0:N][0:M] = b[0:N][0:M];
  ```

  All rows of b are copied to a.

  ```
  a[0:N][0:M] = b[0:N:0][0:M];
  ```

  The first row of b is replicated for each row of a. Note the rank and shape still match.
- The __sec_reduce[..]() family of intrinsics has the following restrictions in the Intel® C++ Compiler 12.0:
  - The element type of the array passed to the reduction intrinsic must not require construction, destruction, or assignment operators. It must be POD (plain old data, not an object of class type.)
  - The built-in operator reductions (e.g. __sec_reduce_add(), __sec_reduce_mul()) will not call C++ overloaded operator functions to perform the addition, multiplication, etc.
  - The __sec_reduce() intrinsic for user-defined reductions will not accept a function that is either: overloaded, a user-defined operator, a template function, a function that accepts reference parameters, a lambda, or a C++0x functor.
- The specification specifies a new __sec_reduce with a different argument order. For the Intel® C++ Compiler 12.0, users must continue to use the specification in the 12.0 Compiler User’s Guide, copied as follows:

  Example:

  ```
  type fn(type in1, type in2);  // declaration of scalar reduction
  ```

```
                                    // function
type in[N], out;             // array input and scalar output
result

// accumulate successive elements in in with a user function fn,
// resulting in a single value out
out = __sec_reduce(fn, identity_value, in[x:y:z]);
```

- Scalar code (code that does not contain an array section) used in an if-then-else body that is controlled by an array section may be executed multiple times. Example:

  ```
  if (A[:] > 0) {
  foo();
  }
  ```

  In the above example, the function call foo() will be called multiple times, for each element of A[] that is > 0.
- If an array-section-mapped function call is used in a chained assignment, the number of times it is called is dependent on the number of assignments performed. Example:

  ```
  A[0:10] = B[0:10] = foo(C[0:10]);
  ```

  The function foo() may be called 10 times to assign to B[] and 10 times to assign to A.
- If a call to a function that contains array section code is used in the body of an if-then-else that is also controlled by an array section, the function must be declared as __forceinline if the user wants the controlling conditional array section to apply to the code in the function.

  Example:

  ```
  int A[20],B[20];
  __forceinline void assign(int x[20], y[20]) {
        x[:] = y[:];
  }

  void bar(void) {
        if (C[:]) {
        foo(A,B);
        }
  }
  ```

  In this example, the assignment “x[:] = y[:]” is intended to be applied conditionally, controlled by the array section C[:]. Without the __forceinline keyword, it will be executed independently of the conditional expression, and it will apply to all elements of x and y.
- As described in the User’s Guide, if a Cilk Plus array section is copied to another array section, and the compiler determines that the array sections may overlap, the compiler will copy the source array section to a temporary array, and use the temporary array as the source of the operation. This behavior differs from the specification which describes the result as undefined. Also, in C++ Composer XE 2011 update 5, the compiler will relax the rule, and not create temporary arrays, when one of more of the array section bases are parameter variables. Instead, a warning will be printed so that the user knows that the result will be undefined if the arrays overlap. This prevents excessive memory

usage and performance loss in the very common case where the array parameters do not overlap. This is only true for array bases that are function parameters. The compiler will still create temporary arrays by default in all other situations.

- When declaring an elemental vector function, parameter types that are scalar can be denoted with either the keyword uniform or the keyword scalar.

3.5.4 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 (`/Qipo`) is enabled. The workaround is to disable `/Qipo` – in Visual Studio, this is `Project > [projectname] Properties > C++ > Optimization > Interprocedural Optimization > No`.

3.5.5 Static Security Analysis Known Issues

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

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

Static security 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 <u>link</u> step because that is when static security analysis results are created.** Adding the switch at the compile step alone is not sufficient. In Microsoft Visual Studio, add this to the property page Linker > Command Line.

If you are using a build specification to perform static security 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 security analysis result that was affected by this issue and you are able to open that result in the Intel® Parallel 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.

4 Intel® Integrated Performance Primitives

This section summarizes changes, new features and late-breaking news about this version of Intel® Integrated Performance Primitives (Intel® IPP). 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://www.intel.com/software/products/ipp; and the Intel IPP Release Notes at http://software.intel.com/en-us/articles/intel-ipp-70-library-release-notes/.

- **Documentation, help, and samples**: see the documentation links on the IPP product page at: http://www.intel.com/software/products/ipp.

4.1 Intel® Integrated Performance Primitives 7.0

4.1.1 New and Changed Features

- Additional optimizations for the 256-bit AVX SIMD instruction set (available on Intel® processors code named "Sandy Bridge") have been incorporated.
- Further AES-NI optimizations have been applied to the cryptography domain (separate download, see below) and data compression (CRC32 for ipp_bzip2), substantially improving performance on those processors that support the AES-NI instructions.
- Microsoft* Visual Studio 2010 is now supported by the Windows edition of the IPP library; meaning, IPP help files and project files are compatible with the Visual Studio 2010 IDE. The Visual Studio 2005 and 2008 IDEs are also supported.
- Support for the JPEG-XR (HD Photo) forward and inverse transforms for 16s, 32s and 32f data types and variable length code (VLC) encode and decode functions for 32s data types has been added.
- A JPEG-XR (HD Photo) codec is now included in the IPP UIC sample framework for grayscale, RGB and RGBA images with 8, 16, and 32-bit integer and 16 and 32-bit floating point pixel depths.
- The DMIP sample now includes a Microsoft DSL (Domain Specific Language) add-on for use with Visual Studio 2008.
- A new *interfaces* directory has been added that contains high-level application code, in the form of source and pre-built binaries. Several popular data compression libraries (e.g., bzip2, zlib and gzip) have been modified for use with the IPP library and can be found in the *interfaces* directory for immediate use.
- There is a new ipp_lzopack (data compression) library, located in the *interfaces* directory mentioned above, as part of this release.
- Multi-threading is now part of the ipp_zlib library (by use of the OpenMP multi-threading library).

- A new directory hierarchy has been established to simplify integration of the Intel IPP library with the Intel Compiler products. This change may require that you update your build scripts, makefiles and/or Visual Studio project files.
- Directories formerly designated as "em64t" are now designated by the "intel64" tag. This change may require that you update your build scripts, makefiles and/or Visual Studio project files.
- Library filenames have been normalized to be consistent between 32-bit and 64-bit architectures (i.e., the "em64t" tag has been removed from all 64-bit library file names). This change may require that you update your build scripts, makefiles and/or Visual Studio project files.
- The domain-specific "emerged" and "merged" static library files have been combined for simpler reference (e.g., ippsemerged.lib + ippsmerged_t.lib ⇒ ipps_t.lib) and the single-threaded static libraries are now designated by a "_l" suffix (multi-threaded static libraries continue to be designated with a "_t" suffix). This change may require that you update your build scripts, makefiles and/or Visual Studio project files.
- The speech recognition functions (ippSR domain) are not part of this release; this domain will continue to be supported in the IPP 6.1 product.
- Intel® Itanium® architecture (IA-64) support is not included in this release. Intel® IPP 6.1 is the latest release for the IA-64 architecture.
- The SPIRAL generated functions (ippGEN domain) are now distributed as a separate download. See instructions below for more information.

4.1.2 Directory Structure Changed

A new directory hierarchy has been established to simplify integration with the Intel® compiler products. This may require action on your part in order to be able to continue building applications that use Intel® Integrated Performance Primitives.

- If you used the “Select Build Components” dialog for the Intel® performance libraries with earlier versions of Intel® Parallel Composer or Intel® C++ Compiler, right click on your C++ project in Microsoft Visual Studio, select Intel Parallel Composer > Select Build Components, then click OK to update the paths.
- If you use the Tools > Options > Intel Parallel Composer > Compilers dialog to change the version of compiler you are using, you must also update the Build Components paths as above.

4.2 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://software.intel.com/en-us/articles/download-ipp-cryptography-libraries/

4.3 SPIRAL Generated Functions are Available as a Separate Download

The *SPIRAL generated functions*, a special subset of the Signal Processing domain of the Intel IPP library that was added in version 6.0 of the library, have been moved to a separately installed add-on library. This change was made to reduce the overall download size of the IPP library. The functions contained within the ippGEN domain all begin with the ippg prefix and are listed below using an abbreviated naming format.

- ippgenGetLibVersion
- ippgDCT4_[32f|64f]
- ippgDCT4Init_[32f|64f]
- ippgDCT4InitAlloc_[32f|64f]
- ippgDCT4Free_[32f|64f]
- ippgDCT4GetSize_[32f|64f]

- ippgDFTFwd_CToC_[32fc|64fc]
- ippgDFTFwd_CToC_*_[32fc|64fc]
- ippgDFTInv_CToC_[32fc|64fc]
- ippgDFTInv_CToC_*_[32fc|64fc]

- ippgHartley_[32f|64f]
- ippgHartley_*_[32f|64f]

You will find the download for the SPIRAL generated functions alongside the compiler download at the Intel® Software Development Products Registration Center.

4.4 Intel® IPP Code Samples

The Intel® IPP code samples are organized into downloadable packages at http://www.intel.com/software/products/ipp

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.

5 Intel® Math Kernel Library

This section summarizes changes, new features and late-breaking news about this version of the Intel® Math Kernel Library. All the bug fixes can be found here: http://software.intel.com/en-us/articles/intel-mkl-103-bug-fixes/

5.1 Changes in This Version

5.1.1 Changes in Initial Release

1) BLAS

- New functions for computing 2 matrix-vector products at once: [D/S]GEM2VU, [Z/C]GEM2VC
- New functions for computing mixed precision general matrix-vector products: [DZ/SC]GEMV
- New function for computing the sum of two scaled vectors: *AXPBY

- Intel® AVX optimizations in key functions: SMP LINPACK, level 3 BLAS, DDOT, DAXPY

2) LAPACK
   - New C interfaces for LAPACK supporting row-major ordering
   - Integrated Netlib LAPACK 3.2.2 including one new computational routine (*GEQRFP) and two new auxiliary routines (*GEQR2P and *LARFGP) and the earlier LAPACK 3.2.1 update
   - Intel® AVX optimizations in key functions: DGETRF, DPOTRF, DGEQRF
3) PARDISO
   - Improved performance of factor and solve steps in multi-core environments
   - Introduced the ability to solve for sparse right-hand sides and perform partial solves—produces partial solution vector
   - Improved performance of the out-of-core (OOC) factorization step
   - Support for zero-based (C-style) array indexing
   - Zeros on the diagonal of the matrix are no longer required in sparse data structures for symmetric matrices
   - New ILP64 PARDISO interface allows the use of both LP64 and ILP64 versions when linked to the LP64 libraries
   - The memory required for storing files on the disk in OOC mode can now be estimated just after reordering
4) Sparse BLAS
   - Format conversion functions now support all data types (single and double precision for real and complex data) and can return sorted or unsorted arrays
5) FFTs
   - New MPI FFTW 3.3alpha1 wrappers cover new cluster functionality
   - Improved load-balancing of cluster FFTs provides improved performance
   - Intel AVX optimizations in all 1D/2D/3D FFTs
   - Improved performance of 2D and 3D mixed-radix FFTs for single and double precision data for all systems supporting the SSE4.2 instruction set
   - Support for split-complex data represented as two real arrays introduced for 2D/3D FFTs
   - Support for 1D complex-to-complex transforms of large prime lengths
   - Introduced Hybrid parallelism (MPI + OpenMP*) on cluster 1D complex transforms and increased performance on vector lengths which are a multiple of the number of MPI processes
6) VML
   - A new function for computing (ax+b)/(cy+d) where a, b, c, and d are scalars, and x and y are real vectors: v[s/d]LinearFrac()
   - Intel AVX optimizations for real functions
   - A new mode for setting denormals to zero, overflow support for complex vectors, and for every VML function a new function with an additional parameter for setting the accuracy mode
7) VSL
   - A set of new Summary Statistics functions was added covering basic statistics, covariance and correlation, pooled, group, partial, and robust covariance/correlation,

quantiles and streaming quantiles, outliers detection algorithm, and missing values support
    - Performance optimized algorithms: MI algorithm for support of missing values, TBS algorithm for computation of robust covariance, BACON algorithm for detection of outliers, ZW algorithm for computation of quantiles (streaming data case), and 1PASS algorithm for computation of pooled covariance
- Improved performance of SFMT19937 Basic Random Number Generator (BRNG)
- Intel® AVX optimizations: MT19937 and MT2203 BRNGs

8) Documentation: Product documentation is available in the Microsoft Help Viewer* 1.x format that integrates with Microsoft Visual Studio* 2010
9) Added runtime dispatching dynamic libraries allowing link to a single interface library which loads dependent libraries dynamically at runtime depending on runtime CPU detection and/or library function calls
10) A new directory structure has been established to simplify integration of Intel MKL with the Intel® Parallel Studio XE family of products and directories formerly designated as "em64t" are now designated by the "intel64" tag
11) Intel® Itanium® architecture (IA-64) support is not included in this release. Intel® MKL 10.2 is the latest release for IA-64
12) The sparse solver functionality has been fully integrated into the core Intel MKL libraries and the libraries with "solver" in the filename have been removed from the product

5.1.2 Changes in Update 1

1) PARDISO/DSS: Added true F90 overloaded API (see the Intel MKL reference manual for more information)
2) PARDISO: Improved the statistical reporting to be more reader friendly
3) Sparse BLAS: Improved performance of ?BSRMM functions on the latest Intel& processors
4) FFTs: Support for negative strides
5) FFT examples: Added examples for split-complex FFTs in C and Fortran using both the DFTI and FFTW3 interfaces
6) VML: Improved performance of real in-place Add/Sub/Mul/Sqr functions on systems supporting SSE2 and SSE3
7) Poisson Library: Changed the default behavior of the Poisson library functions from sequential to threaded operation
8) Bug fixes: http://software.intel.com/en-us/articles/intel-mkl-103-bug-fixes/

5.1.3 Changes in Update 2

1) BLAS: Improved performance of transposition functions on the Intel® Xeon® processor 5600 series
2) BLAS: Added examples for transposition routines
3) FFT: Added Fortran examples showing how to reduce application footprint by linking only functions with the desired precision
4) FFT: Added check for stride consistency on in-place real transforms with CCE storage
5) FFT: Expanded threading to new cases for multi-dimensional transforms
6) VSL: Improved performance of Multivariate Gaussian random number generator for single- and double-precision on 4-core Intel® Xeon® processors 5500 series

7) VML: Improved performance of in-place operation of Add, Mul, and Sub functions on the Intel® Xeon® processor 5500 series
8) Bug fixes: http://software.intel.com/en-us/articles/intel-mkl-103-bug-fixes/

5.1.4 Changes in Update 3

1) BLAS: Improved multi-threaded performance of DSYRK, DTRSM, and DGEMM on Intel® Xeon® processor 5400 series running 32-bit Windows*
2) LAPACK: Implemented LAPACK 3.3 from netlib including Cosine-Sine decomposition, improved linear equations solvers for symmetric and Hermitian matrices and auxiliary functions
3) PARDISO: 0-based permutation vectors are now allowed at input
4) PARDISO: Documentation for the pardisoinit() routine
5) PARDISO: Improved performance of serial PARDISO with multiple right-hand sides (RHS)
6) PARDISO: Independent control for parallelism in the solve step for improved performance on small matrices—see description of iparm(25)
7) PARDISO: Reduced backward substitution—allows partial solution computation for a full RHS—see description of iparm(31)
8) FFT: Implemented Real FFT transforms for up to 3 to 7 dimensions
9) FFT: Parallelized multi-dimensional complex transforms using split-complex data represented as two real arrays
10) Cluster FFTs: Extended FORTRAN 90 interface to real-to-complex transforms and included new examples
11) VML: Added new complex Pack/Unpack functions and real Gamma/LGamma functions
12) VML: Improved performance on Intel® Xeon® processor 5600 series and processors supporting Intel® Advanced Vector Extensions (Intel® AVX) for the following: all functions when operating on short vectors (<100), all functions when operating on unaligned input vectors, the sPow2o3 function, and the enhanced performance (EP) version of complex Add and Sub.
13) VSL: Functions for saving/restoring random number generator (RNG) streams to/from memory
14) VSL: Added new UniformBits32 and UniformBits64 functions
15) VSL: Extended the number of unique streams supported by MT2203 BRNG from 1024 to 6024
16) Bug fixes: http://software.intel.com/en-us/articles/intel-mkl-103-bug-fixes/

5.1.5 Changes in Update 4

1) BLAS: Improved DTRMM performance on Intel® Xeon® processors 5400 and later
2) BLAS: Improved DTRSM performance on all 64-bit enabled processors, especially processors with Intel® Advanced Vector Extensions (Intel® AVX)
3) LAPACK: Incorporated bug fixes from the LAPACK 3.3.1 release
4) OOC PARDISO: Improved the estimate of the amount of memory needed in out-of-core operation
5) FFT: Improved 1D real FFT scaling through improved threading
6) FFT: Updated C and Fortran FFT examples to use the new single dynamic library linking model

7) VML: Improved performance of the single precision Enhanced Performance version of the real Hypot and complex Abs functions and of the complex Arg, Div, Mul, MulByConj functions for all accuracy modes on Intel® Xeon® processors 5600 and 7500 series, and the Intel® Core™ i7-2600 processor
8) Service functions: Improvements and additions to the Intel MKL service functions (see the online release notes at http://software.intel.com/en-us/articles/intel-mkl-103-release-notes/ for more information)
9) Bug fixes: http://software.intel.com/en-us/articles/intel-mkl-103-bug-fixes/

Deprecation Notice

1) The GMP Arithmetic Functions in Intel MKL will be removed in a future version of Intel MKL.
2) The timing function mkl_set_cpu_frequency() is deprecated.

5.1.6 Changes in Update 5

1) BLAS: Improved performance: {S,C,Z}TRSM for processors with Intel® Advanced Vector Extensions (Intel® AVX); {S,D}GEM2VU for processors with Intel AVX as well as the Intel® Core™ i7 processor and the Intel® Xeon® processor 5500 series
2) BLAS: Improved scaling: ?TRMV for large matrices on all architectures; DGEMM for odd numbers of threads on Intel® Xeon® processor 5400 series
3) LAPACK: Included LAPACK 3.3.1 extensions and the respective LAPACKE interfaces
4) LAPACK: Improved the performance of ?SYGST and ?HEGST used in generalized eigenvalue problems
5) LAPACK: Improved the performance of the inverse of an LU factored matrix (?GETRI)
6) PARDISO: Added transpose and conjugate transpose solve capability (ATx=b and AHx=b); facilitates compressed sparse column (CSC) format support
7) PARDISO: Improve out-of-core PARDISO performance when the memory requirements slightly exceed available memory using MKL_PARDISO_OOC_MAX_SWAP_SIZE environment variable and in-core PARDISO
8) Optimization Solvers: Added Inf and NaN checks in the RCI Trust-Region solvers
9) FFTs: Improved the performance of 3D FFTs on small cubes from 2x2x2 to 10x10x10 for all supported precisions and types on all Intel® processors supporting Intel® SSE3 and later
10) FFT examples: Re-designed example programs to cover common use cases for Intel MKL DFTI and FFTW
11) VSL: Improved the performance of the single precision MT19937 and MT2203 basic random number generators on the Intel® Core™ i7-2600 processor on 64-bit operating systems
12) VSL: Improved the performance of the integer version of the SOBOL quasi-random number

5.2 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.

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.

6 Intel® Threading Building Blocks

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

6.1 Known Issues

Please note the following with respect to this particular release of Intel Threading Building Blocks.

6.1.1 Library Issues

- To allow more accurate results to be obtained with Intel® Thread Checker or Intel® Thread Profiler, download the latest update releases of these products before using them with Intel Threading Building Blocks.
- If you are using Intel Threading Building Blocks and OpenMP* constructs mixed together in rapid succession in the same program, and you are using Intel compilers for your OpenMP* code, set KMP_BLOCKTIME to a small value (e.g., 20 milliseconds) to improve performance. This setting can also be made within your OpenMP* code via the kmp_set_blocktime() library call. See the Intel compiler OpenMP* documentation for more details on KMP_BLOCKTIME and kmp_set_blocktime().
- In general, non-debug ("release") builds of applications or examples should link against the non-debug versions of the Intel Threading Building Blocks libraries, and debug builds should link against the debug versions of these libraries. On Windows systems, compile with /MD and use Intel Threading Building Blocks release libraries,

or compile with /MDd and use debug libraries; not doing so may cause run-time failures. See the Tutorial in the product "Documentation" sub-directory for more details on debug vs. release libraries.

7 Intel® Parallel Debugger Extension

This section summarizes changes, new features and late-breaking news about this version of the Intel® Parallel Debugger Extension.

7.1 New Features

- Intel® Cilk™ Plus support
    - Serialized execution of an Intel® Cilk™ Plus program at debug-time, without re-compilation.
    - Intel® Cilk™ Plus worker threads are clearly marked in the Visual Studio Debugger
    - Display of stealing points and current Cilk Plus workers on Cilk Plus Thread stack window
- Threads Window
    - Improved Data Sharing Detection
    - Support for OpenMP* 3.0
    - Support for Windows OS synchronization functions
    - Improved data sharing detection analysis performance

7.2 Known Issues

- The Parallel Debugger Extension issues an incorrect warning

  ```
  OMP: Warning #90: ittnotify: Lookup of "__itt_<function>"
  function in <installdir><redistlibpath>\pdbx.dll library failed.
  ```

  when OpenMP* executables built with the compiler option /debug:parallel are being debugged. You can safely ignore these warnings.
- If you are using Microsoft Visual Studio 2005, there are six Intel-specific exceptions that must be enabled manually. Select `Debug` > `Exceptions`, expand the `Win32 Exceptions` tree, and enable items:

  ```
      a1a01db0 Intel Parallel Debugger Extension Exception 0
      a1a01db1 Intel Parallel Debugger Extension Exception 1
      a1a01db2 Intel Parallel Debugger Extension Exception 2
      a1a01db3 Intel Parallel Debugger Extension Exception 3
      a1a01db4 Intel Parallel Debugger Extension Exception 4
      a1a01db5 Intel Parallel Debugger Extension Exception 5
  ```

  This needs to be done once per project.

- Disabling the Intel Debugging exceptions during a debug session may cause Visual Studio (up to Visual Studio 2008, SP1) to hang.

- Use of the Intel Parallel Debugger Extension requires that the OpenMP library be linked dynamically, which is the default. If you wish to use the Parallel Debugger Extension, do not use `/Qopenmp-link:static` to specify static linking of the OpenMP Library.

- Be sure to enable the parallel debug instrumentation (switch /debug:parallel) before you start parallel debugging: Project > [project name] `Properties` > `Configuration Properties` > `C/C++` > `Debug` > `Enable Parallel Debug Checks: Yes (/debug:parallel)`. Otherwise, the debugger will not detect data sharing events nor break on re-entrant calls.

- Microsoft Visual Studio 2010 users: If you have specified that the project be built with Microsoft Visual C++, and then change the project to use the Intel C++ compiler, you must close and re-open the solution for the Parallel Debug Environment property setting "Auto" to be recognized.

- If you are using Microsoft Visual Studio 2008 and debugging 64-bit applications, you must have Visual Studio 2008 Service Pack 1 installed.

    - You can debug 64-bit applications under Visual Studio 2005 and 2008 without Service Packs only if they are linked to the low memory area. If not linked to the low memory area, you will not see any events until the debuggee terminates. After termination, all events are displayed in the event window. In order to debug 64-bit applications properly, set the base address to `0x10000` in `Project` > `Properties` > `Linker` > `Advanced`.

- Function local or heap variables are displayed as "???" in the data sharing event window.

- The SSE Registers window does not work for 64-bit applications - the window shows "`???`"

- Filters on static local variables are not set correctly via context menu.

- Reentrant call detection stops in Disassembly view. It does not work correctly for static functions. When used in design mode, the function should be preceded by a suitable context operator, for example, `{,,myapp.exe} my_extern_function`

- The debugger extension windows remain empty when their placement is changed from "docked" to "floating". The workaround is to either keep them docked or to restart the debug session after the placement was changed.

- The debugger extension requires the application to be started from Visual Studio. It does not work when attaching to an existing process.

- Windows settings are restored to default (Hexadecimal) when the window is hidden or closed and reopened again.

7.3 Documentation

Intel Parallel Debugger Extension Documentation can be accessed via the Help menu of Microsoft Visual Studio or by pressing the function key F1 after activation of a Parallel Debugger Extension window. Help is also available by clicking the link “HTML version” inside `debugger-documentation.htm`.

8 Disclaimer and Legal Information