1 Introduction

Intel® Advisor XE 2016 provides two tools to help ensure your Fortran and native/managed C++ applications take full performance advantage of today’s processors:

- **Vectorization Advisor** is a vectorization analysis tool that lets you identify loops that will benefit most from vectorization, identify what is blocking effective vectorization, explore the benefit of alternative data reorganizations, and increase the confidence that vectorization is safe.

- **Threading Advisor** is a threading design and prototyping tool that lets you analyze, design, tune, and check threading design options without disrupting your normal development.

This document provides system requirements, installation instructions, issues and limitations, and legal information.

To learn more about this product's:

- Documentation, help, and samples, click: **Start > All Programs > Intel Parallel Studio XE 2016 > Getting Started > Advisor XE**. You can access the product help in a web browser as well by opening the index.htm in the documentation help directory.

- Technical support, including answers to questions not addressed in the installed product, please visit: [http://software.intel.com/en-us/support/](http://software.intel.com/en-us/support/)
Please remember to register your product at https://registrationcenter.intel.com/ by providing your email address. This helps Intel recognize you as a valued customer in the support forum.

2 What’s New

Intel® Advisor XE 2016 Update 3

- Analysis of non-Executed code paths that allows exploring Instruction Set Architecture that is different from the host machine. E.g. you can analyze AVX-512 code paths when running on an older machine.

- New tab “Loop Analytics” in Survey view, combining several loop metrics in single place, including ISA, Traits and Instruction mix (percentage of Memory, Compute and other instructions).

- Ability to filter result data by thread in Survey view to narrow down performance metrics.

- New Recommendations tab in Memory Access Patterns analysis results with actionable hints.

- New AVX512-specific traits, e.g. Scatter, Compress/Expand, etc.

- Added new recommendations:
  - Indirect function calls, that can be replaced with direct ones to allow vectorization.
  - Better utilization of FMA instructions.
  - Updated recommendation for Fortran “contiguous” attribute.

- Extended CLI snapshot feature with caching of sources and binaries. So you can make self-contained packed result snapshot on a remote server or a cluster node, which then can be easily copied to your workstation for investigation.

Intel® Advisor XE 2016 Update 2

- Support variable names for object-oriented code in MAP/Dependencies analysis.

- Extended Survey grid by adding user functions and improved SIMD-enabled function representation.

- Ability to run Trip Counts and Survey analyses in any order. Trip Counts data is kept after recollecting Survey data.
• New recommendations for scalar math functions and OpenMP function calls.

• Introduced new issue “Vector register spilling” with appropriate recommendations. Number of actually used vector registers is reported in separate column.

• List of selected loops is stored in separate file. This allows to select loops in GUI and run analysis in CLI for the same project, without markup in CLI. Loop selection is editable from CLI and persistent, so no need to specify markup list for “-collect” command every time.

• Memory footprint metric estimate

• Bug fixes

Intel® Advisor XE 2016 Update 1

• Microsoft Windows® 10 OS support

• Microsoft Visual Studio® 2015 IDE integration

• Ability to filter in Refinement report

• Packed snapshot to transfer read-only result as a single file

• Significantly improved performance and responsiveness in Survey, Trip Counts, MAP and Correctness reports data loading and finalization

• Better GUI co-existence of Threading and Vectorization Advisor layouts

• Differentiated inlined functions in the Survey top-down grid

• Improved Summary report

• Added ability to sort by loop selection in Survey report

• Separate recommendations for Fortran and C++

• Improved data representation (parent-child relationship, filtering and highlight) in Survey.

• Added new MAP problem type: uniform stride (for stride = 0), improved variable resolution for MAP

• Exposed loops with estimated max trip count of loop = 1
Intel® Advisor XE 2016

- Extended Summary to support Vectorization.
- New Memory Access Pattern (MAP) recommendations to guide MAP analysis usage
- Improved quality and the types of data available in MAP and Correctness, including limited support for variable names-centric analysis.
- More information and better configuration in Source/Assembly views

Intel® Advisor XE 2016 Beta Update 3

- Added traits information in source and assembly views for selected loop.
- Highlighted some traits for loop:
  - instruction classes (masked stores, vgather (for AVX2), horizontal instructions (for AVX and SSE));
  - small trip counts for vectorized body;
  - 128 vector width for AVX/AVX2; 128/256 vector width for AVX2.
- Correctness analysis re-named to Dependencies.
- Added variable names to Dependencies view.
- Added assembly page in product options to change assembler code representation style.
- New CLI --help: better structure, new text, more examples.
- Enabled restoration of loops selection after results re-opening.

Intel® Advisor XE 2016 Beta Update 2

- Fixed compatibility issue with Intel® Compilers 16.0 Beta Update 1

Intel® Advisor XE 2016 Beta Update 1

- Ability to set environment variables to manage collectors
- Added operand type and vector length information to the MAP Source view
- Stop/cancel for Trip Counts collection
- Improvements in command-line for MPI
- Slow scrolling in Survey fixed
• Search is now available in Source view and assembly view
• Survey finalization performance improvements
• Multiple stability and usability fixes

Intel® Advisor XE 2016 Beta

Intel Advisor XE 2016 Beta is a successor product to Intel® Advisor XE 2015. Intel Advisor XE 2016 Beta provides a set of tools that help you decide where to add threading and vectorization to your applications. The key features provided by this new major version since the Intel Advisor XE 2015 release include:

• Vectorization assistance in addition to the threading assistance available in the previous product
• Significant changes to the product workflow because of the addition of vectorization assistance

3 System Requirements

Supported Architectures and Terminology

Intel® Advisor XE supports the following architectures:

• **IA-32 Architecture** refers to systems based on 32-bit processors generally compatible with the Intel® Pentium® processors (for example, Intel® Pentium® 4 processor) or processors from other manufacturers supporting the same instruction set, running a 32-bit operating system.

• **Intel® 64 Architecture** refers to systems based on IA-32 architecture processors which have 64-bit architectural extensions, for example, Intel® Core™ processor family, running a 64-bit operating system such as Microsoft Windows XP* Professional x64 Edition or Microsoft Windows® 7 x64. If the system is running a 32-bit version of the Windows* operating system, then IA-32 architecture applies instead. Processors from other manufactures supporting the same instruction set running a 64-bit version of the Windows operating system are also supported.

Minimum System Requirements

• A system 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)
  - Since the Intel Advisor XE requires specific knowledge of assembly-level instructions, its analysis may not operate correctly if code contains non-Intel instructions. In this case, run the analysis with a target executable that contains
only Intel® instructions. After you finish using the Intel Advisor XE, you can use the assembler or optimizing compiler options that provide the non-Intel instructions.

- For the best experience, a multi-core or multi-processor system is recommended

• 2GB RAM
• 4GB free disk space for all product features and architectures

• Supported operating systems:
  - Microsoft Windows* 7 SP1
  - Microsoft Windows Server* 2008 SP2 and 2008 R2 SP1, 32-bit or “x64” editions - embedded editions are not supported
  - Microsoft Windows 8* and 8.1* operating system
  - Microsoft Windows Server* 2012

• Supported Microsoft Visual Studio (and Microsoft Visual C++* compiler) versions:
  - Microsoft Visual Studio* 2012
  - Microsoft Visual Studio* 2013

• Supported Intel compilers (optional):
  - Intel® C++ Compiler 15 or higher
  - Intel® Visual Fortran Compiler 15 or higher

• Native application coding requirements
  - Supported programming languages:
    - Fortran
    - C
    - C++
  - Supported threading methodologies:
    - Intel® Threading Building Blocks (Intel® TBB)
    - Intel® Cilk™ Plus
    - OpenMP
    - Windows* Threads (low-level)

• Managed application coding requirements
  - Supported programming languages:
    - C# (.NET* versions 3.0 to 4.0)
  - Supported threading methodologies
    - C# Thread Class
    - Microsoft* Task Parallel Library (TPL)

• To view PDF documents, you need a PDF reader, such as Adobe Reader* 6 or later

Floating licensing service requirements
Intel® Software License Manager version 2.3, available on the Intel® Registration Center (choose the right OS and platform; only users with floating license registrations have access to this link).

For more details please refer to the https://software.intel.com/en-us/articles/intel-software-license-manager-getting-started-tutorial

Notes:

1. Intel Advisor XE samples work with the Intel TBB by using the environment variable TBBROOT. Intel TBB is included with the Intel compiler and is available from http://software.intel.com/en-us/intel-tbb/. To build the Intel TBB projects, you will need to define the TBBROOT environment variable. To set the TBBROOT environment variable, see the Intel Advisor XE Help or Getting Started Tutorial.

4 Installation Notes

If you are installing the product for the first time, please be sure to have the product serial number available so you can type it in during installation. A valid license is required for installation and use.

To begin installation:

- Double-click on the executable file to begin installation. If several different downloadable files are available (such as for different components), please read the download web page carefully to determine which file is appropriate for you.

Intel® Advisor XE can be installed on the same system as the Intel® Parallel Advisor 2011.

Activation

You must activate the product to finish installation. Use one of these methods:

- Activation using serial number. Internet connection is required;
- Remote activation using serial number. Used when your computer is not connected to the internet. You can use another computer with internet access;
- Activation using license file;
- Activation using license server.

You can also evaluate the product for 31 days.

Floating licensing service requirements
Intel® Software License Manager version 2.3, available on the Intel® Registration Center (choose the right OS and platform; only users with floating license registrations have access to this link).

For more details please refer to the https://software.intel.com/en-us/articles/intel-software-license-manager-getting-started-tutorial

Intel® Software Manager

Intel® Software Manager is a utility that allows users to:

- Download and install updates for your Intel® Software Development Products.
- Manage subscription status of installed software.
- Activate serial numbers.
- Find out about the latest news for Intel Software Development Products.
- Intel Software Manager requires an Internet connection to connect to a remote server for information and updates.

Intel Software Manager installs with Intel Software Development Products on Windows*, Linux*, and Mac OS* X operating systems.

To obtain more information about the Intel Software Manager, please refer to the https://registrationcenter-ssl.intel.com/Docs/ism.htm web-page.

Default Installation Folders

The default top-level installation folder for this product is:

- C:\Program Files (x86)\Intel_sw_development_tools\Advisor XE 2016

If you are installing on a system with a non-English language version of Windows OS, the name of the Program Files (x86) folder may be different. On IA-32 architecture systems, the folder name is Program Files.

This product installs into an arrangement of folders shown in the diagram below. Not all folders will be present in a given installation.

- C:\Program Files (x86)\Intel_sw_development_tools\Advisor XE 2016
  - bin32
  - bin64
  - config
  - documentation
Changing, Repairing and Removing the Product

If you want to modify, repair, or remove the Intel Advisor XE components, open the Control Panel and select the Add or Remove Programs applet (or Programs and Features in the Microsoft Windows 7 OS), select Intel Advisor XE 2016 and click Change/Remove (or Uninstall/Change in the Microsoft Windows 7 OS). Follow the installation instructions. You may need the original installation files to complete this process. If you do not have the extracted files, you can use the original installer executable to complete this process as well.

Silent Installation

To learn details of silent non-interactive installation on Windows* systems, refer to the following link: http://software.intel.com/en-us/windows_silent_installation_guide.

Known Installation and Configuration Issues

- Please close Visual Studio sessions before installing, modifying, or removing the Intel Advisor XE from a non-administrator account. Not doing so will affect Visual Studio integration and may result in obscure error messages.

  If you encounter problems viewing the Intel Parallel Studio XE (local) help: click Help > Manage Help Settings > Settings, and check I want to use local help. These set-up steps are needed only once.

- By default, Microsoft Visual Studio 2012 software sets the Launch in Browser option to display documentation for integrated products. To view the Intel Advisor XE local help documentation: Choose Help > Intel Advisor XE 2016 Help or use context-sensitive help. If you still encounter problems viewing the help, Choose Help > Set Help Preferences > Launch in Help Viewer.

- If you have multiple versions of Microsoft Visual Studio software installed on your system and integrate the Intel Advisor XE into each IDE, removing the integration from one of the IDEs will remove the integrated Intel Advisor XE documentation from both.
  There are two options to restore the documentation:
  First option:
  1. Open the Intel Parallel Studio XE command prompt: Start > All Programs > Intel Parallel Studio XE 2016 > Analyzers > Command prompt. You can choose any shortcut here, for example, “IA-32 Visual Studio 2012 mode”).
  2. Remove the integration for the Visual Studio version that is missing integrated help. For example, to remove the Intel Advisor XE integration:
3. Restore the integration. For example, to restore the Intel Advisor XE integration:

<table>
<thead>
<tr>
<th>With:</th>
<th>Type:</th>
</tr>
</thead>
</table>

Second option:
- Uninstall the product.
- Install it again with the desired Visual Studio integration selected.

5  Issues and Limitations

Known Issues and Limitations

- For the most complete vectorization analysis results using an Intel compiler (Version 15.0 or higher), set the /qopt-report compiler option to 5. (Alternatively, you can set the /qopt-report-phase Intel compiler option to vec.)

- Intel® Advisor XE may display a message that the “Project is out of date” before running the data collectors. You do not need to rebuild the project prior to running the collector if you know that the project is up-to-date.

- The Suitability tool cannot accurately measure and analyze the behavior of loops with very small task times (on the order of sub-microseconds) if those tasks are annotated with the TASK_BEGIN/TASK_END annotations. If possible, use the ITERATION_TASK annotation instead.

- The Suitability Report combines all lock data into a single lock and may not have source line information for LOCK_ACQUIRE and LOCK_RELEASE annotations.

- If your sources include huge source files that contain annotations, be aware that only the first 8 MB of each file will be parsed for annotations. If not all of your annotations are being parsed in such huge source files, consider breaking that source file into several source files each less than 8MB.

- When opening the Intel Advisor XE samples, Visual Studio software will display a warning message related to Intel Cilk Plus projects or list them as unsupported when the Intel C++ Compiler is not installed. This message may be ignored. However, Intel Cilk Plus projects will not compile without an Intel C++ Compiler with Intel Cilk Plus support, such as the Intel Parallel Studio XE (or similar Intel software suite).

- In the Correctness Report, the following sequence of actions may cause the Intel Advisor XE and Visual Studio software to crash: select the “Not fixed” State filter
category in the Filter pane, mark the last remaining “Not fixed” problem as fixed in the Observation pane, and then remove the “Not fixed” filter by clicking the All button in the **State** filter or clicking the **Deselect all search criteria** button. To workaround this issue do one of the following:

1. Avoid marking the last remaining problem as “Fixed” in the Observation pane while the “Not fixed” filter is applied.
2. Avoid removing the “Not fixed” filter if all of the problems have been marked as “Fixed”.

- Navigating or interacting with the Intel Advisor XE Correctness Report while Correctness analysis is still running may cause the GUI to freeze or display empty Correctness results.

- The Survey Report may incorrectly report loops if a function contains calls to a non-returning function such as the exit() function.

- Loops within a function that does not contain debug information may not be reported as a loop in the Survey Report. For the suggested build settings, see the help topics under Choosing and Building a Target > Build Settings. After you fix the build settings to specify debug information, rebuild the target and run Survey analysis again.

- After analyzing the specified target executable, the Survey tool may report that no significant hotspot areas were detected. In this case, view the collected result using the Survey Report window. The suggested build settings are described in the help topics under Choosing and Building a Target > Build Settings.

- If debug information correlating an instruction to source code is not available to an Intel Advisor XE tool, the tool cannot correlate collected data with source code. In this case it will show an empty field, question mark, or broken icon. Source correlation may not be available for many different reasons, including:
  1. Omitting debug information options when building the target executable – see the help topics under Choosing and Building a Target > Build Settings.
  2. A compiler error.
  3. The compiler not generating debug information for this specific source line.
  4. The compiler not generating debug information for this specific source file.
  5. The linker not copying the debug information into the debug information database.
  6. The debug information database not being found by the finalization step in the Intel Advisor XE, because it was not moved along with the executable to the location where the Intel Advisor XE is being run.
  7. When using the Intel Advisor XE GUI, insufficient project properties were specified for the Binary/Symbol Search tab. In this case, see the help topic Specifying Project Properties Using the Intel Advisor XE GUI.
• Do not close the Intel Advisor XE GUI or Visual Studio software while expanding the Survey tree. Doing so may cause the product to crash or hang.

• Intel Advisor XE may present incorrect or incomplete information if local character sets are used. For general character set support, use Unicode.

• To build the Intel TBB versions of the samples using Visual Studio 2012, make sure the Intel TBB version installed is 4.1 or higher.

• On Windows Server 2012 systems, if you have problems viewing Microsoft Visual Studio 2012 help pages, check the settings for Internet Explorer in Tools > Internet Options > Security. To allow correct display of help, in the Internet zone enable MIME Sniffing and Active scripting.

• On Windows Server 2012 systems, if you find that you cannot display Getting Started Tutorials from within Internet Explorer 10, correcting a security setting for Microsoft Internet Explorer usually corrects the problem. From Tools > Internet Options > Security, add “about:internet” to the list of trusted sites. Optionally, you can remove “about:internet” from the list of trusted sites after you are finished viewing the documentation.

6 Attributions

Boost Software License - Version 1.0 - August 17th, 2003

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the "Software") to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.
Copyright (c) 2002 Hewlett-Packard Co.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except where otherwise noted in the source code (e.g. the files hash.c, list.c and the trio files, which are covered by a similar licence but with different Copyright notices) all the files are:

Copyright (C) 1998-2003 Daniel Veillard. All Rights Reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE DANIEL VEILLARD BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of Daniel Veillard shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization from him.

wxWidgets Library
This product includes wxWindows software which can be downloaded from www.wxwidgets.org/downloads.

wxWindows Library Licence, Version 3.1
======================================

Copyright (C) 1998-2005 Julian Smart, Robert Roebling et al

Everyone is permitted to copy and distribute verbatim copies of this licence document, but changing it is not allowed.

WXWINDOWS LIBRARY LICENCE
TERMS AND CONDITIONS FOR COPYING, DISTRIBUTION AND MODIFICATION

This library is free software; you can redistribute it and/or modify it under the terms of the GNU Library General Public Licence as published by the Free Software Foundation; either version 2 of the Licence, or (at your option) any later version.

This library is distributed in the hope that it will be useful, but WITHOUT ANY WARRANTY; without even the implied warranty of MERCHANTABILITY or FITNESS FOR A PARTICULAR PURPOSE. See the GNU Library General Public Licence for more details.

You should have received a copy of the GNU Library General Public Licence along with this software, usually in a file named COPYING.LIB. If not, write to the Free Software Foundation, Inc., 59 Temple Place, Suite 330, Boston, MA 02111-1307 USA.

EXCEPTION NOTICE

1. As a special exception, the copyright holders of this library give permission for additional uses of the text contained in this release of the library as licenced under the wxWindows Library Licence, applying either version 3.1 of the Licence, or (at your option) any later version of the Licence as published by the copyright holders of version 3.1 of the Licence document.

2. The exception is that you may use, copy, link, modify and distribute under your own terms, binary object code versions of works based on the Library.

3. If you copy code from files distributed under the terms of the GNU General Public Licence or the GNU Library General Public Licence into a copy of this library, as this licence permits, the exception does not apply to the code that you add in this way. To avoid misleading anyone as to the status of such modified files, you must delete this exception notice from such code and/or adjust the licensing conditions notice accordingly.

4. If you write modifications of your own for this library, it is your choice whether to permit this exception to apply to your modifications. If you do not wish that, you must delete the exception notice from such code and/or adjust the licensing conditions notice accordingly.
/* zlib.h -- interface of the 'zlib' general purpose compression library
version 1.2.3, July 18th, 2005

Copyright (C) 1995-2005 Jean-loup Gailly and Mark Adler

This software is provided 'as-is', without any express or implied
warranty. In no event will the authors be held liable for any damages
arising from the use of this software.

Permission is granted to anyone to use this software for any purpose,
including commercial applications, and to alter it and redistribute it
freely, subject to the following restrictions:

1. The origin of this software must not be misrepresented; you must not
claim that you wrote the original software. If you use this software
in a product, an acknowledgment in the product documentation would be
appreciated but is not required.
2. Altered source versions must be plainly marked as such, and must not be
 misrepresented as being the original software.
3. This notice may not be removed or altered from any source distribution.

Jean-loup Gailly jloup@gzip.org
Mark Adler madler@alumni.caltech.edu

*/

Limxml2

Except where otherwise noted in the source code (e.g. the files hash.c,list.c
and the trio files, which are covered by a similar license but with different
Copyright notices) all the files are:

Copyright (C) 1998-2003 Daniel Veillard. All Rights Reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy
of this software and associated documentation files (the "Software"), to deal
in the Software without restriction, including without limitation the rights
to use, copy, modify, merge, publish, distribute, sublicense, and/or sell
copies of the Software, and to permit persons to whom the Software is
furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in
all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR
IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY,
FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE
DANIEL VEILLARD BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY,
WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR
IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.
Apache License
Version 2.0, January 2004
http://www.apache.org/licenses/

TERMS AND CONDITIONS FOR USE, REPRODUCTION, AND DISTRIBUTION

1. Definitions.

"License" shall mean the terms and conditions for use, reproduction, and distribution as defined by Sections 1 through 9 of this document.

"Licensor" shall mean the copyright owner or entity authorized by the copyright owner that is granting the License.

"Legal Entity" shall mean the union of the acting entity and all other entities that control, are controlled by, or are under common control with that entity. For the purposes of this definition, "control" means (i) the power, direct or indirect, to cause the direction or management of such entity, whether by contract or otherwise, or (ii) ownership of fifty percent (50%) or more of the outstanding shares, or (iii) beneficial ownership of such entity.

"You" (or "Your") shall mean an individual or Legal Entity exercising permissions granted by this License.

"Source" form shall mean the preferred form for making modifications, including but not limited to software source code, documentation source, and configuration files.

"Object" form shall mean any form resulting from mechanical transformation or translation of a Source form, including but not limited to compiled object code, generated documentation, and conversions to other media types.

"Work" shall mean the work of authorship, whether in Source or Object form, made available under the License, as indicated by a copyright notice that is included in or attached to the work (an example is provided in the Appendix below).

"Derivative Works" shall mean any work, whether in Source or Object form, that is based on (or derived from) the Work and for which the editorial revisions, annotations, elaborations, or other modifications represent, as a whole, an original work of authorship. For the purposes of this License, Derivative Works shall not include works that remain separable from, or merely link (or bind by name) to the interfaces of, the Work and Derivative Works thereof.

"Contribution" shall mean any work of authorship, including the original version of the Work and any modifications or additions to that Work or Derivative Works thereof, that is intentionally
submitted to Licensor for inclusion in the Work by the copyright owner or by an individual or Legal Entity authorized to submit on behalf of the copyright owner. For the purposes of this definition, "submitted" means any form of electronic, verbal, or written communication sent to the Licensor or its representatives, including but not limited to communication on electronic mailing lists, source code control systems, and issue tracking systems that are managed by, or on behalf of, the Licensor for the purpose of discussing and improving the Work, but excluding communication that is conspicuously marked or otherwise designated in writing by the copyright owner as "Not a Contribution."

"Contributor" shall mean Licensor and any individual or Legal Entity on behalf of whom a Contribution has been received by Licensor and subsequently incorporated within the Work.

2. Grant of Copyright License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable copyright license to reproduce, prepare Derivative Works of, publicly display, publicly perform, sublicense, and distribute the Work and such Derivative Works in Source or Object form.

3. Grant of Patent License. Subject to the terms and conditions of this License, each Contributor hereby grants to You a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable (except as stated in this section) patent license to make, have made, use, offer to sell, sell, import, and otherwise transfer the Work, where such license applies only to those patent claims licensable by such Contributor that are necessarily infringed by their Contribution(s) alone or by combination of their Contribution(s) with the Work to which such Contribution(s) was submitted. If You institute patent litigation against any entity (including a cross-claim or counterclaim in a lawsuit) alleging that the Work or a Contribution incorporated within the Work constitutes direct or contributory patent infringement, then any patent licenses granted to You under this License for that Work shall terminate as of the date such litigation is filed.

4. Redistribution. You may reproduce and distribute copies of the Work or Derivative Works thereof in any medium, with or without modifications, and in Source or Object form, provided that You meet the following conditions:

(a) You must give any other recipients of the Work or Derivative Works a copy of this License; and

(b) You must cause any modified files to carry prominent notices stating that You changed the files; and

(c) You must retain, in the Source form of any Derivative Works that You distribute, all copyright, patent, trademark, and attribution notices from the Source form of the Work, excluding those notices that do not pertain to any part of the Derivative Works; and
(d) If the Work includes a "NOTICE" text file as part of its distribution, then any Derivative Works that You distribute must include a readable copy of the attribution notices contained within such NOTICE file, excluding those notices that do not pertain to any part of the Derivative Works, in at least one of the following places: within a NOTICE text file distributed as part of the Derivative Works; within the Source form or documentation, if provided along with the Derivative Works; or, within a display generated by the Derivative Works, if and wherever such third-party notices normally appear. The contents of the NOTICE file are for informational purposes only and do not modify the License. You may add Your own attribution notices within Derivative Works that You distribute, alongside or as an addendum to the NOTICE text from the Work, provided that such additional attribution notices cannot be construed as modifying the License.

You may add Your own copyright statement to Your modifications and may provide additional or different license terms and conditions for use, reproduction, or distribution of Your modifications, or for any such Derivative Works as a whole, provided Your use, reproduction, and distribution of the Work otherwise complies with the conditions stated in this License.

5. Submission of Contributions. Unless You explicitly state otherwise, any Contribution intentionally submitted for inclusion in the Work by You to the Licensor shall be under the terms and conditions of this License, without any additional terms or conditions. Notwithstanding the above, nothing herein shall supersede or modify the terms of any separate license agreement you may have executed with Licensor regarding such Contributions.

6. Trademarks. This License does not grant permission to use the trade names, trademarks, service marks, or product names of the Licensor, except as required for reasonable and customary use in describing the origin of the Work and reproducing the content of the NOTICE file.

7. Disclaimer of Warranty. Unless required by applicable law or agreed to in writing, Licensor provides the Work (and each Contributor provides its Contributions) on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied, including, without limitation, any warranties or conditions of TITLE, NON-INFRINGEMENT, MERCHANTABILITY, or FITNESS FOR A PARTICULAR PURPOSE. You are solely responsible for determining the appropriateness of using or redistributing the Work and assume any risks associated with Your exercise of permissions under this License.

8. Limitation of Liability. In no event and under no legal theory, whether in tort (including negligence), contract, or otherwise, unless required by applicable law (such as deliberate and grossly negligent acts) or agreed to in writing, shall any Contributor be liable to You for damages, including any direct, indirect, special, incidental, or consequential damages of any character arising as a result of this License or out of the use or inability to use the Work (including but not limited to damages for loss of goodwill,
work stoppage, computer failure or malfunction, or any and all other commercial damages or losses), even if such Contributor has been advised of the possibility of such damages.

9. Accepting Warranty or Additional Liability. While redistributing the Work or Derivative Works thereof, You may choose to offer, and charge a fee for, acceptance of support, warranty, indemnity, or other liability obligations and/or rights consistent with this License. However, in accepting such obligations, You may act only on Your own behalf and on Your sole responsibility, not on behalf of any other Contributor, and only if You agree to indemnify, defend, and hold each Contributor harmless for any liability incurred by, or claims asserted against, such Contributor by reason of your accepting any such warranty or additional liability.

END OF TERMS AND CONDITIONS

libpng

This copy of the libpng notices is provided for your convenience. In case of any discrepancy between this copy and the notices in the file png.h that is included in the libpng distribution, the latter shall prevail.

COPYRIGHT NOTICE, DISCLAIMER, and LICENSE:

If you modify libpng you may insert additional notices immediately following this sentence.

This code is released under the libpng license.

libpng versions 1.2.6, August 15, 2004, through 1.5.11, June 14, 2012, are Copyright (c) 2004, 2006-2012 Glenn Randers-Pehrson, and are distributed according to the same disclaimer and license as libpng-1.2.5 with the following individual added to the list of Contributing Authors

Cosmin Truta

libpng versions 1.0.7, July 1, 2000, through 1.2.5 - October 3, 2002, are Copyright (c) 2000-2002 Glenn Randers-Pehrson, and are distributed according to the same disclaimer and license as libpng-1.0.6 with the following individuals added to the list of Contributing Authors

Simon-Pierre Cadieux
Eric S. Raymond
Gilles Vollant

and with the following additions to the disclaimer:

There is no warranty against interference with your enjoyment of the library or against infringement. There is no warranty that our efforts or the library will fulfill any of your particular purposes or needs. This library is provided with all faults, and the entire risk of satisfactory quality, performance, accuracy, and effort is with the user.
libpng versions 0.97, January 1998, through 1.0.6, March 20, 2000, are
Copyright (c) 1998, 1999 Glenn Randers-Pehrson, and are
distributed according to the same disclaimer and license as libpng-0.96,
with the following individuals added to the list of Contributing Authors:

   Tom Lane
   Glenn Randers-Pehrson
   Willem van Schaik

libpng versions 0.89, June 1996, through 0.96, May 1997, are
Copyright (c) 1996, 1997 Andreas Dilger
Distributed according to the same disclaimer and license as libpng-0.88,
with the following individuals added to the list of Contributing Authors:

   John Bowler
   Kevin Bracey
   Sam Bushell
   Magnus Holmgren
   Greg Roelofs
   Tom Tanner

libpng versions 0.5, May 1995, through 0.88, January 1996, are
Copyright (c) 1995, 1996 Guy Eric Schalnat, Group 42, Inc.

For the purposes of this copyright and license, "Contributing Authors"
is defined as the following set of individuals:

   Andreas Dilger
   Dave Martindale
   Guy Eric Schalnat
   Paul Schmidt
   Tim Wegner

The PNG Reference Library is supplied "AS IS".  The Contributing Authors
and Group 42, Inc. disclaim all warranties, expressed or implied,
including, without limitation, the warranties of merchantability and of
fitness for any purpose.  The Contributing Authors and Group 42, Inc.
assume no liability for direct, indirect, incidental, special, exemplary,
or consequential damages, which may result from the use of the PNG
Reference Library, even if advised of the possibility of such damage.

Permission is hereby granted to use, copy, modify, and distribute this
source code, or portions hereof, for any purpose, without fee, subject
to the following restrictions:

1. The origin of this source code must not be misrepresented.

2. Altered versions must be plainly marked as such and must not
   be misrepresented as being the original source.

3. This Copyright notice may not be removed or altered from any
   source or altered source distribution.

The Contributing Authors and Group 42, Inc. specifically permit, without
fee, and encourage the use of this source code as a component to
supporting the PNG file format in commercial products. If you use this source code in a product, acknowledgment is not required but would be appreciated.

A "png_get_copyright" function is available, for convenient use in "about" boxes and the like:

    printf("%s",png_get_copyright(NULL));

Also, the PNG logo (in PNG format, of course) is supplied in the files "pngbar.png" and "pngbar.jpg" (88x31) and "pngnow.png" (98x31). Libpng is OSI Certified Open Source Software. OSI Certified Open Source is a certification mark of the Open Source Initiative.

Glenn Randers-Pehrson
glennrp at users.sourceforge.net
June 14, 2012

libtiff

Copyright (c) 1988-1997 Sam Leffler
Copyright (c) 1991-1997 Silicon Graphics, Inc.

Permission to use, copy, modify, distribute, and sell this software and its documentation for any purpose is hereby granted without fee, provided that (i) the above copyright notices and this permission notice appear in all copies of the software and related documentation, and (ii) the names of Sam Leffler and Silicon Graphics may not be used in any advertising or publicity relating to the software without the specific, prior written permission of Sam Leffler and Silicon Graphics.

THE SOFTWARE IS PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EXPRESS, IMPLIED OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL SAM LEFFLER OR SILICON GRAPHICS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER OR NOT ADVISED OF THE POSSIBILITY OF DAMAGE, AND ON ANY THEORY OF LIABILITY, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

libjpeg

We welcome the use of this software as a component of commercial products. No royalty is required, but we do ask for an acknowledgement in product documentation, as described under LEGAL ISSUES.

LEGAL ISSUES

==========
In plain English:

1. We don't promise that this software works. (But if you find any bugs, please let us know!)
2. You can use this software for whatever you want. You don't have to pay us.
3. You may not pretend that you wrote this software. If you use it in a program, you must acknowledge somewhere in your documentation that you've used the IJG code.

In legalese:

The authors make NO WARRANTY or representation, either express or implied, with respect to this software, its quality, accuracy, merchantability, or fitness for a particular purpose. This software is provided "AS IS", and you, its user, assume the entire risk as to its quality and accuracy.

This software is copyright (C) 1991-1998, Thomas G. Lane. All Rights Reserved except as specified below.

Permission is hereby granted to use, copy, modify, and distribute this software (or portions thereof) for any purpose, without fee, subject to these conditions:
(1) If any part of the source code for this software is distributed, then this README file must be included, with this copyright and no-warranty notice unaltered; and any additions, deletions, or changes to the original files must be clearly indicated in accompanying documentation.
(2) If only executable code is distributed, then the accompanying documentation must state that "this software is based in part on the work of the Independent JPEG Group".
(3) Permission for use of this software is granted only if the user accepts full responsibility for any undesirable consequences; the authors accept NO LIABILITY for damages of any kind.

These conditions apply to any software derived from or based on the IJG code, not just to the unmodified library. If you use our work, you ought to acknowledge us.

Permission is NOT granted for the use of any IJG author's name or company name in advertising or publicity relating to this software or products derived from it. This software may be referred to only as "the Independent JPEG Group's software".

We specifically permit and encourage the use of this software as the basis of commercial products, provided that all warranty or liability claims are assumed by the product vendor.

ansi2knr.c is included in this distribution by permission of L. Peter Deutsch,
sole proprietor of its copyright holder, Aladdin Enterprises of Menlo Park, CA. 
ansi2knr.c is NOT covered by the above copyright and conditions, but instead by the usual distribution terms of the Free Software Foundation; principally, that you must include source code if you redistribute it. (See the file ansi2knr.c for full details.) However, since ansi2knr.c is not needed as part of any program generated from the IJG code, this does not limit you more than the foregoing paragraphs do.

The Unix configuration script "configure" was produced with GNU Autoconf. It is copyright by the Free Software Foundation but is freely distributable. The same holds for its supporting scripts (config.guess, config.sub, ltconfig, ltmain.sh). Another support script, install-sh, is copyright by M.I.T. but is also freely distributable.

It appears that the arithmetic coding option of the JPEG spec is covered by patents owned by IBM, AT&T, and Mitsubishi. Hence arithmetic coding cannot legally be used without obtaining one or more licenses. For this reason, support for arithmetic coding has been removed from the free JPEG software. (Since arithmetic coding provides only a marginal gain over the unpatented Huffman mode, it is unlikely that very many implementations will support it.) So far as we are aware, there are no patent restrictions on the remaining code.

The IJG distribution formerly included code to read and write GIF files. To avoid entanglement with the Unisys LZW patent, GIF reading support has been removed altogether, and the GIF writer has been simplified to produce "uncompressed GIFs". This technique does not use the LZW algorithm; the resulting GIF files are larger than usual, but are readable by all standard GIF decoders.

We are required to state that
"The Graphics Interchange Format(c) is the Copyright property of CompuServe Incorporated. GIF(sm) is a Service Mark property of CompuServe Incorporated."

7 Disclaimer and Legal Information
No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document.

Intel disclaims all express and implied warranties, including without limitation, the implied warranties of merchantability, fitness for a particular purpose, and non-infringement, as well as any warranty arising from course of performance, course of dealing, or usage in trade.

This document contains information on products, services and/or processes in development. All information provided here is subject to change without notice. Contact your Intel representative to obtain the latest forecast, schedule, specifications and roadmaps.

The products and services described may contain defects or errors known as errata which may cause deviations from published specifications. Current characterized errata are available on request.