

Intel® Inspector 2018 Release Notes for Linux* OS

Installation Guide and Release Notes

14 March 2017

Contents:

[Introduction](#)

[What's New](#)

[System Requirements](#)

[Installation Notes](#)

[Issues and Limitations](#)

[Attributions](#)

[Disclaimer and Legal Information](#)

1 Introduction

Intel® Inspector 2018 helps developers identify and resolve memory and threading correctness issues in their C, C++ and Fortran programs.

Intel Inspector is a static and dynamic error checking tool for developing multithreaded applications on Windows* or Linux* operating systems. Intel Inspector maximizes code quality and reliability by quickly detecting memory, threading, and source code security errors during the development cycle. You can also use the Intel Inspector to visualize and manage Static Analysis results created by Intel® compilers in various suite products. Intel Inspector is an easy, comprehensive solution that delivers rapid results in isolating memory and multithreading errors.

Intel Inspector has a standalone graphical user interface (GUI) as well as a command line interface (CLI).

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

Use the Getting Started tutorial and reference documentation to learn more about the Intel Inspector. For documentation, open the `documentation_inspector.htm` file in the following directory: `<install-dir>\documentation\<locale>\`. For example, if you choose the default installation path, you can find the `documentation_inspector.htm` file in the `/opt/intel/inspector_2018/documentation/en` directory.

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

For Technical Support, Product Updates, User Forums, FAQs, tips and tricks, and other support information, visit <http://www.intel.com/software/products/support/>. **Note:** If your distributor provides technical support for this product, contact them for support rather than Intel Corporation.

2 What's New

Intel® Inspector 2018 Beta

- Support for C++17 **std::shared_mutex** that enables threading error analysis for applications with read/write synchronization primitives.
- Support for [cross-OS analysis](#) to all license types. Download installation packages for additional operating systems from registrationcenter.intel.com.

3 System Requirements

Supported Architectures and Terminology

Intel® Inspector supports the following architectures:

- **IA-32 Architecture** refers to systems based on 32-bit processors generally compatible with the Intel® Pentium® processors (such as, 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 that have 64-bit architectural extensions (such as, Intel® Core™2 processor family), running a 64-bit operating system. If the system is running a 32-bit operating system, then IA-32 architecture applies instead. Processors from other manufacturers supporting the same instruction set and running a 64-bit 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)
 - Intel Inspector requires specific knowledge of assembly-level instructions. Its analysis may not operate correctly if a target executable contains instructions not supported by IA-32 or Intel 64 architectures. In this case, run the analysis with a target executable that contains only supported instructions. After you finish using

the Intel Inspector, you can revert to using unsupported instructions in the target executable.

- For the best experience, a multi-core or multiprocessor system is recommended.
- 4GB RAM
- 350M free disk space for all tool features and architectures
- Supported operating systems:
 - Red Hat* Enterprise Linux* 6 and 7
 - CentOS* versions equivalent to Red Hat* Enterprise Linux* versions listed above
 - Fedora* 23, 24 and 25 (`pangox-compat` package should be installed)
 - SUSE* Linux Enterprise Server* 11 and 12
 - Debian* 7 and 8
 - Ubuntu* 14.04, 16.04, 16.10

Note: Support for SUSE* Linux Enterprise Server* 10 and Red Hat* Linux* 5.10 is deprecated. Support may be removed in a future release of the Intel Inspector.
- Recommended compilers:
 - Intel® C/C++ Compiler XE 12.0 and higher
 - Intel® Fortran Compiler XE 12.0 and higher
 - GNU* C/C++ Compiler 3.4.6 and higher
- Supported debuggers:
 - Intel® Composer XE 2015 debugger or later
 - GNU gdb* debugger versions 6.3 or later with working remote debugging support (there are known issues with gdb-7.1-xx.fc13 versions)
- Application coding requirements:
 - Supported programming languages:
 - Fortran
 - C
 - C++
 - Supported threading methodologies:
 - Intel® Threading Building Blocks (Intel® TBB)
 - POSIX* Threads on Linux* OS
 - OpenMP* (see note below)
 - Intel® C++ Compiler parallel language extensions
- Sun* or Oracle* JRE 1.6 or higher is required to run Intel® Software Manager which enables automatic product updates and is one of the components of the Intel Inspector installation.
- PDF reader software such as Adobe* Reader* 7.0 or later is needed to read installed documentation

Note:

Intel Inspector analysis is best done with applications built with the Intel Fortran Compiler XE version 12.0 or higher, the Intel C++ Compiler XE version 12.0 or higher, and the GNU

C/C++ Compiler 3.4.6 or later. Applications that use OpenMP technology and are built with the GNU* compiler must link to the OpenMP compatibility library as supplied by an Intel compiler.

4 Installation Notes

This product package can be used to install the software on both IA-32 systems and Intel® 64 systems. The installer determines the system architecture and installs the appropriate files. Both 32-bit and 64-bit versions of the software are automatically installed on an Intel 64 system.

The installation of the Intel® Inspector removes any earlier installed minor version of this product (with the same major version number). Different major versions can co-exist with each other.

If you are installing the product for the first time, you need the product serial number or a valid license file to activate the product.

To install, perform the following steps:

1. Uncompress the package: `gunzip <package-name>.tar.gz`
2. Extract the files: `tar xf <package-name>.tar`
3. Start the installation. (**Note:** For successful installation, you should have read and write permissions for the `/tmp` directory.)

- o To install on a local system enter the following:

```
cd <package-name>
```

- o `./install.sh`

Note: If you want to install the software for use by any user, you must do this as the root user. To install to a network-mounted drive or shared file system for multiple users, become the root user then enter:

```
cd <package-name>
```

```
./install.sh --SHARED_INSTALL
```

4. Follow the prompts to complete the installation and activation of the software.

Activation

You must activate the product to finish installation. There are several methods for product activation:

- Activate using a serial number. Internet connection is required.

- Activate remotely using a serial number. Use when your computer is not connected to the Internet. You can use another computer with Internet access.
- Activate using a license file.
- Activate using a 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 lets you:

- 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:

```
/opt/intel/inspector_2018
```

You can select a different top-level folder name as part of a custom installation.

Installing Collectors on Remote Systems

You can install just the data collection support features of the product on remote systems where run-time license checking is not feasible. The results of any data collection that is run on the

remote system must then be copied to the system where the regular install was done for analysis, viewing, and reporting.

To do this:

1. Copy the `CLI_install` folder (found at the top level in the untarred product install package) to the remote machine.
2. Execute the `./install.sh` script file (this file is located inside the `CLI_install` folder). Activation is not required.

Activating Your Evaluation Software After Purchase

If you installed an evaluation version of Intel Software Developer Products and then decided to purchase the product, you can use the Intel Software Manager to enter a valid product serial number to convert your evaluation license to fully licensed status.

Run the Intel Software Manager from `/opt/intel/ism/ism`. Click **Activate**, and supply a valid product serial number to convert your evaluation software to a fully licensed product.

Be sure to login or `su` to root to run if you want the product license to be available to all system users.

Removing the Product

To remove the product, execute the following commands:

Note: Replace `/opt/intel` with the chosen install folder name if the default folder was not used.

1. `cd /opt/intel/inspector_2018`
2. `uninstall.sh` (as a root user or the same user who performed the install)

Setting up the Intel Inspector Command Line Environment

To easily access the command line interface, set up the Intel Inspector XE environment settings in a terminal session using the following command from a bash shell:

```
source <install-dir>/inspxe-vars.sh
```

When using a C shell, source the `.csh` script instead.

5 Issues and Limitations

General Issues

- On some hardware, the Intel Inspector may report data race problems on simple operations (such as variable load or store operations) assumed to be atomic operations instead of explicit atomic instructions. In particular, the Intel Inspector reports false data

race issues on C++ 11, std::atomic class operations compiled with the GNU gcc* compiler. Intel and Microsoft* compilers use explicit atomic instructions; therefore, code generated with these compilers is not impacted.

- Running the Intel Inspector on a Fedora* 22 operating system may generate the following error: *Error: This operating system is not supported. Suggestion: Check the Release Notes for a list of supported operating systems.*
Recommendation: Do one of the following to resolve:
 - Set the following environment variable: INSPXE_PIN_OPTIONS='-ifeellucky'
 - If you are running a bash shell, use the following command:
export INSPXE_PIN_OPTIONS='-ifeellucky'
- Intel® Inspector 2017 does not support processing of results generated by the legacy Intel® Thread Checker product. However, such Intel Thread Checker generated results can still be processed and converted by Intel® Inspector XE 2011 product.
- When using Intel Inspector with Linux desktop window managers on Linux OS like TWM and Ubuntu/Unity* window managers, there are known Linux window manager issues which may cause unexpected behavior (like disappearance of controls or even the whole GUI) or even spontaneous crashes of Intel Inspector.
Recommendation: Switch to another window manager.
- In the Intel Inspector, the Code complexity metrics feature isn't available for Fortran code.
- Intel does not guarantee this software tool will detect or report every memory and threading error in an application.
 - Not all logic errors are detectable.
 - Heuristics used to eliminate false positives may hide real issues.
 - Highly correlated events are grouped into a single problem.
- You can use the Intel Inspector to analyze applications in debug and release modes. To learn more about options necessary to produce the most accurate, complete results, refer to the following related resources:
 - Memory error analysis: <http://software.intel.com/en-us/articles/compiler-settings-for-memory-error-analysis-in-intel-inspector-xe/>
 - Threading error analysis: <http://software.intel.com/en-us/articles/compiler-settings-for-threading-error-analysis-in-intel-inspector-xe/>
- If no symbols are found for a module in which a problem is detected, the Intel Inspector displays the call stack and observation source code of the first location where it can find symbols. If it cannot find any location in the call stack with symbols, it displays the module name and relative virtual address (RVA) for the location.
- Applications that crash when run outside the Intel Inspector may crash or hang the Intel Inspector runtime analysis engine. For example, a corrupt return address on an application call stack crashes the runtime analysis engine. If a crash occurs, problems detected prior to that time can be viewed, but memory leaks will not be reported.
Recommendation: Review the reported problems – it is likely one of them caused the crash.
- Intel Inspector uses a socket to communicate between the graphical user interface and the runtime analysis engine. Preventing an application from opening a socket prevents an analysis of the application from being started by the graphical user interface. The command-line interface can be used to run an analysis in this case and the results can subsequently be viewed using the graphical interface.

- Intel Inspector may report an incorrect call stack following an interruption of normal call flow, such as when an exception is thrown and caught. While the Intel Inspector recognizes and attempts to correct result data when this situation occurs, it is possible for a threading or memory problem to be reported before the call stack is fully corrected.
- If the Intel Inspector reports insufficient memory errors while analyzing OpenMP* applications, try setting `OMP_NUM_THREADS` to limit the number of OpenMP threads. In most cases, `OMP_NUM_THREADS=2` is sufficient.
- If the Intel Inspector reports insufficient memory errors during analysis, try analyzing your application in sections by running several analyses and excluding a different set of modules for each run.
Note: The Intel Inspector does not detect or report issues in excluded modules.
- On Ubuntu* 10.04 systems with Ambience and Radiance themes, the error message “CRITICAL **: murrine_style_draw_box: assertion ‘width >= -1’ failed” is printed in console for `inspxe-gui`. [200159955]
Recommendation: Change to another theme. See <https://bugs.launchpad.net/ubuntu/+source/light-themes/+bug/538499/> for more information.
- Intel Inspector does not currently support Security-enhanced Linux* settings (SELinux); it supports only Permissive mode.
Recommendation: Either disable SELinux (set the line “SELINUX=disabled” in your `/etc/sysconfig/selinux` file or add the “selinux=0” kernel argument in `lilo.conf` or `grub.conf` files) or make a SELinux mode adjustment (set the line “SELINUX=permissive” in your `/etc/sysconfig/selinux` file or ask your system administrator to make a SELinux mode adjustment). You may need to reboot your system after changing the system parameters. See <http://www.nsa.gov/selinux/> for more information about SELinux.[200155374]
- If a child application is selected for analysis, the Intel Inspector analyzes only the first instance of that application, even if multiple instances of that application occur.
- Intel Inspector cannot launch a debugger when the terminal type `konsole` is used on KDE* versions older than 4.6.
Recommendation: Use a terminal such as `xterm` on older KDE versions when using the analysis with debug feature. [200223810]
- When running a multi-threaded application, use of `Enable debugger when problem detected (-appdebug=on-error)` can result in multiple debugger sessions being opened. Only the first occurrence will be connected and able to debug the application under analysis. The workaround is to use `Select analysis start location with debugger (-appdebug=on-start)` so that only one debug session will be started and then turn on analysis by entering the extended debugger command `monitor begin-analysis` then continue to resume execution until it encounters a problem.
- If you try to store results on a Parallel Virtual File System 2 (pvfs2), Intel Inspector analysis fails with the following error: “Error: Failed to create a database. Cannot continue.”
Recommendation: Specify a result directory location that is not on a pvfs2 file system. [200213391]
- If you encounter problems searching Intel inspector help using a certain web browser, consider using a newer version of that browser or use a different web browser as your default browser.

- When using interactive debugging with gdb on Fortran programs on Linux, the ‘next’ and ‘step’ commands in the debugger can take a very long time to execute.
Recommendation: use the Intel debugger with Fortran programs. The launched debugger can be changed in the GUI from the File->Options menu. It can be set for the CLI using the `INSPXE_DEBUGGER` environment variable or the `-debug-using` command line option.
- Memory and threading analysis require ptrace to be enabled on Linux platforms. Some newer Linux distributions, including Ubuntu* 12 disable it by default. Message reads, “Error: Failed to start the analysis because the scope of ptrace() system call application is limited.”
Recommendation: Enable ptrace by setting `/proc/sys/kernel/yama/ptrace_scope` to 1. [200317488]
- When taking advantage of the Intel Inspector XE custom filter by source, be aware that this filter does not persist when reloading results.
- There is an issue on RHEL 5.10 when installing the Intel® Parallel Studio XE 2015 or the Intel Parallel Studio XE 2015 bundles (with an old version of the Intel Inspector XE inside) over the current product releases before Intel® Parallel Studio XE 2013 SP1. This issue breaks product functionality and makes it impossible to uninstall the product using the uninstaller.
 - If the bundle has not been installed:
 1. Uninstall the current Intel® Inspector XE
 2. Install the Intel Parallel Studio XE 2015 bundle
 3. Install the current Intel Inspector XE release over the bundle release.
 - If the bundle has already been installed:
 1. Locate the distribution package (webimage) of the current product release and copy the file `pset/mediaconfig.xml` from it into the `uninstall` directory under the Intel Inspector XE installation directory (e.g. `/opt/intel/inspector_xe_2013/uninstall/`)
 2. Uninstall the Intel Inspector XE (e.g. `/opt/intel/inspector_xe_2013/uninstall_GUI.sh`)
 3. Run the Intel Parallel Studio XE installer, select **Modify** mode, deselect the Intel Inspector and proceed to modification
 4. Install the current Intel Inspector release one more time
- The message “detected an attempt to suspend an internal thread...” happens when the target application attempts to suspend all threads, causing the Intel Inspector XE thread suspension as well. To avoid this error:
 - Disable the **Enable collection progress information** checkbox in the **Target** tab of the **Project Properties** dialog box.
 - Disable the **Enable interactive memory growth detection** checkbox in the **Analysis Type** pane.
 - Rerun the analysis.

Also avoid running an interactive debugging session during analysis [200238394]

Memory Error Analysis Issues

- An Intel® Cilk™ Plus program that does not run to completion when serialized will not run successfully under memory analysis. Intel Inspector memory analysis works with Intel Cilk Plus programs that have well-defined semantics with respect to program

serialization (see the following resource for more details:

http://software.intel.com/sites/products/documentation/hpc/composerxe/en-us/cpp/mac/cref_cls/common/cilk_serial.htm). [200174735]

- Intel Inspector may report false positives when the analyzed application uses custom memory allocators. Use of `_itt_notify` to annotate your source code can reduce these false positives.
- If the semantics of standard C runtime allocators are changed, the behavior of the Intel Inspector is unknown and could lead to abnormal analysis termination. For instance, if the application is using non-standard versions of these allocators where the memory returned by the allocator is initialized when it would normally be uninitialized.
- The memory error analysis type with the narrowest scope may be slow for binaries that do not contain a binary search table in the `.eh_frame_hdr` section. [200154305]
- Memory error analysis of applications that use Qt* APIs may report false positives.
- Intel Inspector memory analysis may miss memory releases in `atexit()` registered functions with analysis type `mi2` and above and therefore report leaks of the memory released in these functions. [200233761]
- On-demand leak detection will not report memory leaks until the end of the basic block in which they occur, as there is still an internal reference in the program to that memory. If the baseline for leak detection is not reset, these leaks will be reported at the next request [200348282]

Threading Error Analysis Issues

- Intel Inspector does not capture the main thread creation site if the binary is built without debug symbol information.
- Intel Inspector does not detect deadlocks or potential deadlocks created with:
 - Some types of locks via Intel® C/C++ parallel extension (`__critical`) provided by the Intel® Compiler Professional Edition 11.0.
 - Some types of locks in Intel® Threading Building Blocks (Intel® TBB) (`spin_mutex`, `spin_rw_mutex`)
 - Non-exclusive ownership synchronization objects involved, for example, condition variables, semaphores and events and reader/writer locks.
- Intel Inspector does not detect inter-process data races or deadlocks.
- Intel Inspector may report false positives for analyzed applications using customized synchronization primitives. Use of `_itt_notify` to annotate your source code can reduce these false positives.
- Intel Inspector is not a replacement for a traditional debugger, such as the Microsoft Visual Studio* debugger on Windows* operating systems or GNU `gdb`* debugger on Linux* operating systems. If an application crashes inside/outside the Intel Inspector, try running the application inside the debugger to reproduce and fix the crash.
- Intel Inspector may report false positives if you have `libc` or `libpthread` statically linked in the application.
Recommendation: Build your application with `libc` and `libpthread` dynamically linked in.
- To enable correct analysis of Intel TBB applications, set the following required macros before compiling:
 - **TBB_USE_DEBUG** (which sets **TBB_USE_THREADING_TOOLS**) if you use Intel TBB debug libraries

- **TBB_USE_THREADING_TOOLS** if you use Intel TBB release libraries

6 Attributions

The following are licenses for third party software that was used to develop the Intel Inspector. These licenses are listed due to attribution requirements in these license agreements. For the avoidance of doubt, the Intel Inspector is solely governed by the terms and conditions of the End User License Agreement for Intel® Software Development Product that accompanies the Intel Inspector.

ICU License - ICU 1.8.1 and later

COPYRIGHT AND PERMISSION NOTICE

Copyright (c) 1995-2009 International Business Machines Corporation and others

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, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, provided that the above copyright notice(s) and this permission notice appear in all copies of the Software and that both the above copyright notice(s) and this permission notice appear in supporting documentation.

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 OF THIRD PARTY RIGHTS. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR HOLDERS INCLUDED IN THIS NOTICE BE LIABLE FOR ANY CLAIM, OR ANY SPECIAL INDIRECT OR CONSEQUENTIAL DAMAGES, OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER IN AN ACTION OF CONTRACT, NEGLIGENCE OR OTHER TORTIOUS ACTION, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

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

wxWindows Library

This tool includes wxWindows software which can be downloaded from
<http://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 license 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

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.

Libxml2

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 NON-INFRINGEMENT. IN NO EVENT SHALL THE DANIEL VEILLARD BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHERIN 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.

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

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."

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.

Apache

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

All trademarks and registered trademarks mentioned herein are the property of their respective owners.

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.

Copies of documents which have an order number and are referenced in this document may be obtained by calling 1-800-548-4725 or by visiting www.intel.com/design/literature.htm.

Intel, the Intel logo, Cilk, Intel Xeon Phi, VTune, and Xeon are trademarks of Intel Corporation in the U.S. and/or other countries.

* Other names and brands may be claimed as the property of others.

© 2016 Intel Corporation.