



Intel® SDK for OpenCL™ Applications 2020 Update 3

Release Notes

27 October 2020

Version History/Revision History

These are the major releases of Intel® SDK for OpenCL™ Applications (also known as Intel® System Studio: OpenCL™ Tools component):

Date	Revision	Description
October 2020	2020 U3	No functional changes.
July 2020	2020 U2	FPGA support was deprecated and removed. Bug fixes.
March 2020	2020 U1	OpenCL™ API Headers and OpenCL™ ICD Loader were updated. Intel® Debugger for Heterogeneous Compute was removed. Functionality of assembly code generation was removed.
December 2019	2020	Visual Studio 2019 support. CentOS* 8 support. Support of generation optimized ELF IR binaries from SPIR-V file. Visual Studio 2015 support was removed.
September 2019	2019 U5	Qt* was updated to 5.13.0 version. Includes security updates. Visual Studio 2015 support is deprecated.
May 2019	2019 U4	Added support of DCH Intel® Graphics Driver for Windows* 10. Feature enhancement for Kernel Development Framework. Assembly generation for 8th Generation Intel® Core™ Processors was fixed in Intel® SDK for OpenCL™ - offline compiler. Qt* was updated to 5.12.2 version.
March 2019	2019 U3	Includes security updates.
February 2019	2019 U2	Added support of Eclipse* 2018-12 R. Support of Eclipse* Oxygen and Visual Studio 2013 were deprecated and removed. Qt* was updated to 5.12 version. Protobuf* was updated to 3.6.1 version.
November 2018	2019 U1	Experimental version of the CPU Runtime supporting OpenCL™ 2.1 has been deprecated and removed. Added support for Intel® VTune™ Amplifier, added support for Ubuntu* 18.04.
August 2018	2019	Coffee Lake support, support of Intel® CPU Runtime for OpenCL™ Applications 18.1.
December 2017	2017 U2	Eclipse Oxygen (4.7) support, bug fixes, and improvements.
July 2017	2017 U1	Visual Studio 2017 support, new OSes and platforms support.
October 2016	2016 U3	7 th Generation Intel® Core™ Processor support, Windows* 10 Anniversary Update, OpenCL 2.1 experimental CPU only runtime for Linux*.
July 2016	2016 U2 (Linux)	GPU Kernel debugger Beta and kernel level analysis for Linux.
June 2016	2016 U2 (Windows)	OpenCL 2.1 support, new features in Kernel Development Framework.
April 2016	2016	GPU Kernel debugger Beta and standalone release for Linux.
Nov. 17, 2016	2015 U3	Standalone release for Microsoft Windows*.
April 28, 2015	2015 U2	Visual Studio 2015 support.

Jan 22, 2015	2015 U1	Released as part of Intel® Integrated Native Developer Experience (Intel® INDE).
--------------	---------	----------------------------------------------------------------------------------

Customer Support

For technical support visit the technical support [forum](#), FAQs, and other support information at Intel® SDK for OpenCL™ Applications Support or [Developer Zone Support](#). For issue submission and feedback visit the forum or Developer Zone Support.

Please consider product registration at the [registration center](#) by providing your email address. Registration grants free tier installation technical support via the [Intel Online Service Center](#). Product registration is critical to inform Intel® how to improve developer products.

Contents

1	Introduction	5
2	New in This Release	6
3	Known Issues	7
4	Related Documentation	10
5	Where to Find the Release	11
6	System Requirements	12
7	Installation Notes	15
8	Attributions	17
9	Legal Information	24

1 Introduction

[Intel® SDK for OpenCL™ Applications](#) (also known as [Intel® System Studio: OpenCL™ Tools component](#)) helps to create, build, debug, and analyze PC and mobile applications developed with the OpenCL™ API on Microsoft Windows* and Linux* OSes.

The Linux* OS version includes:

- OpenCL code C/C++ header files and libraries, redistributed from the [Khronos* reference implementations](#);
- Intel® SDK for OpenCL™ - Offline Compiler command-line utility 32- and 64-bit version;
- [Intel® CPU Runtime for OpenCL™ Applications 18.1](#).

The Windows* OS version includes:

- OpenCL code C/C++ header files and libraries, redistributed from the [Khronos* reference implementations](#);
- Intel® SDK for OpenCL™ - Offline Compiler command-line utility 32- and 64-bit version;
- [Intel® CPU Runtime for OpenCL™ Applications 18.1](#).

This document contains information about features, system requirements, installation instructions, fixed bugs, limitations, and known issues.

NOTE: Running applications developed with the SDK requires OpenCL driver/runtime packages installed for Intel® processors.

For more information on how to choose which driver/runtime package you need and how to download it, please see [OpenCL™ Runtimes for Intel® Processors page](#).

To learn more about the product, see:

- New features listed in the [New in This Release](#) section below
- Reference documentation listed in the [Related Documentation](#) section below
- Installation instructions at [Installation Notes](#)

2 New in This Release

- **Important Note:** This is the last planned release of the Intel® SDK for OpenCL Applications. The transition to Intel® oneAPI and its unified, cross-architecture programming model brings greater efficiency and reuse across hardware targets. See the Intel® oneAPI Programming Guide for information on [migrating OpenCL code](#), and [OpenCL interoperability](#) by way of SYCL* objects. Choose an [Intel® oneAPI Toolkit](#) tailored to your industry and workload, and try out Intel oneAPI using the [Intel® DevCloud](#), where you can start developing your DPC++ code or run DPC++ sample programs without installing any software tools.

Runtime packages are available if you want to continue using OpenCL in your applications.

- To download the GPU runtimes:
 - Windows— On the [Graphics Drivers Downloads](#) page, select the latest version of Intel® Graphics - Windows® 10 DCH Drivers.
 - Linux— On the [General Purpose GPU Installation Guides](#) page, follow the installation instructions for your operating system.
- To download the CPU runtimes:
 - Follow the instructions in the article [Intel® CPU Runtime for OpenCL™ Applications with SYCL Support](#). Note that Linux runtimes are not yet available.

Note: Since early 2020, the Intel® CPU Runtime for OpenCL™ Applications has been separated from the Intel® Graphics Compute Runtime for OpenCL™ Driver installation package.

- For a full list of features, refer to the [Intel® SDK for OpenCL™ Applications Developer Guide](#).

3 Known Issues

General Limitations

- If you install 2020 Intel® System Studio release under 2019 release the Eclipse in 2019 version is opened with “Intel Code Builder for OpenCL API – Error” because of Kernel Development Framework functionality was removed in new release. To avoid this problem, you could delete CodeBuilder.jar from plugins folder for Eclipse in 2019 release of Intel® System Studio. If you want to use Kernel development framework, please use only 2019 release of Intel® System Studio.
- CPU Kernel Debugger doesn't work with OpenCL CPU Runtime from Intel® Graphics Driver installed on system. Works with Intel® CPU Runtime for OpenCL™ Applications 18.1 which delivered as a part of the product. Be sure that there are no artifacts from Intel® Graphics Driver on your system.
- Visual Studio shows the warning message “‘The Scc Display Information’ package did not load correctly”. You can find more info about this issue on the MSDN* forum for [Visual Studio 2017](#);
 - To avoid the warning, run the Visual Studio in Experimental mode with the command:
`devenv.exe /RootSuffix Exp.`
- Build feature limitations:
 - Source code mapping between Intel® Graphics Technology assembly code and OpenCL code is not supported with Intel® Graphics Compute Runtime for OpenCL™ 18.48.11934.
- CPU Kernel Debugger for the Visual Studio IDE does not support:
 - Edit and continue capability
 - Multithreaded debugging
 - Two instances of Visual Studio running simultaneously
 - Unions

Known Installation and Configuration Issues

- On Windows* OS systems, components in Intel® Parallel Studio XE 2018 and earlier may conflict with the Intel SDK for OpenCL Applications install process.
 - Consider upgrading Intel® Parallel Studio XE 2018 to a newer version.
- On Windows* OS, if the debugger tools, analysis tools, or OpenCL applications have an issue detecting available Intel® Graphics Technology platforms after installing the SDK, update the Intel® Graphics Driver for your platform. The Intel® Graphics Driver deployment package for Microsoft Windows* OS contains OpenCL™ implementations for Intel Graphics Technology and Intel® CPUs. The following are graphics driver distribution options:
 - Many vendors provide their own distributions of Intel®-compatible graphics drivers online. Intel® does not support these drivers, but such graphics drivers may be functional for OpenCL runtime distributions. Vendors may tie vendor support to exclusive usage of vendor-provided drivers. Review any support agreements in vendor documentation.
 - Obtain the latest version of the Intel® Graphics Driver from [download center](#).
 - Recent revisions of Windows* OS systems will preinstall a reference Intel® Graphics Driver package.

- See [OpenCL™ Runtimes for Intel® Processors page](#) for more information.
- If the PATH environment variable exceeds 256 characters in length upon installation, you might encounter issues related to `System32` directory use.
- In case of uninstallation through **Control panel > Uninstall a program**, you may encounter the "*Error opening installation log file. Verify that the specified log file location exists and is writable*" error. It is a known issue in the Microsoft* data base at [Microsoft* support](#). Uninstall the SDK running the original installer or reboot the machine to proceed with the uninstallation.
- In case of uninstallation through **Control panel > Uninstall a program**, you may encounter an error similar to "*ERROR: MSI Error: An installation package for the product Intel® SDK for OpenCL™ Applications 2020 for Windows* cannot be found. Try the installation again using a valid copy of the installation package 'intel_sdk_for_opencl_2020_x64_setup.msi'*". To resolve the issue, uninstall the SDK running the original installer. If it doesn't help, collect the uninstallation log files from `%temp%\intel_tmp_<userid>` and ask for support on the [Intel® SDK for OpenCL™ Applications forum](#).
- Intel SDK for OpenCL Applications may launch a web browser instance to direct users to product pages. If the Mozilla Firefox* browser shows the **Network Error (dns_unresolved_hostname)** screen with the message "*Your requested host 'localhost' could not be resolved by DNS. For assistance, contact your network support team.*" instead of a report, please use the "*Auto-detect proxy settings for this network*" option: **Options > Advanced > Network tab > Settings...**

Intel® Processor Graphics Device Limitations

- For known issues with the OpenCL implementation on Intel® Iris® graphics, Iris® Pro graphics, and Intel® HD Graphics Driver, refer to the relevant driver release notes.
- Timeout Detection & Recovery (TDRs) may be observed when running OpenCL benchmarks including Kishonti CLBenchmark, Kishonti CompuBench CL*, and SiSoftware Sandra* (GP (GPU/CPU/APU) Processing OpenCL™ benchmarks). Also some OpenCL workloads may cause TDRs, especially workloads with complex, time-consuming kernels and large local work size or workloads that use profiling feature. Increase the TDR delay to avoid the TDRs. For details, refer to the [article](#).
- On Windows* OS, the OpenCL™ driver facilitates OpenCL programs on systems with Intel® Processor Graphics and discrete graphics devices under these conditions:
 - if the display is connected to:
 - Intel® Processor graphics device display port OR...
 - Discrete and integrated graphics device simultaneously...
 ...then OpenCL facilities of **both** discrete and Intel® Processor graphics are exposed.
 - Otherwise, if the display is connected to:
 - Discrete graphics device display port OR...
 - Intel® Processor graphics device, next to a discrete graphics device without display ports...
 ...then OpenCL facilities will be exposed for the **discrete devices only**.

Intel® CPU Runtime for OpenCL™ Applications Limitations

- The following options exposed through the *ioc64* utility are limited with Intel® CPU Runtime for OpenCL™ Applications 18.1:
 - The `-l1vm` option is no longer supported for Intel® CPU Runtime for OpenCL™ Applications 18.1 and it will be deprecated for CPU devices in the next release of Intel® SDK for OpenCL™ Applications.
- Intel® CPU Runtime for OpenCL™ Applications has a dependency on Intel® Threading Building Blocks (Intel® TBB) version 2017 Update 8 on Linux and 2018 Update 2 on Windows* OS. The library is included with the Intel® CPU Runtime for OpenCL™ Applications installation.
 - In the Linux* OS case:

Make sure there is no other Intel TBB® library in your OpenCL host application library search path on Linux* OS. Intel® CPU Runtime for OpenCL™ Applications was tested only with Intel® TBB libraries included in the package.

If your OpenCL host application intentionally uses features of a standalone Intel TBB library, ensure that it is of a higher version than the library version in the package and is found earlier in the shared library search procedure. If standalone Intel® TBB libraries are loaded, functionality and performance may vary.
 - In Windows* OS case:

In Windows* OS product distribution, Intel® TBB libraries included in the package have different names than in the standard shipment. This ensures that no load conflict takes place with pre-installed libraries.

If your OpenCL host code uses features of a standalone Intel® TBB libraries, application performance may vary (for example, oversubscription may occur due to both the standalone library pool and OpenCL thread pool being fully loaded).

4 Related Documentation

- [Get Started with Intel® SDK for OpenCL™ Applications](#)
- [Developer Guide for Intel® SDK for OpenCL™ Applications](#)
- [OpenCL™ Developer Guide for Intel® Processor Graphics](#)
- [OpenCL™ Developer Guide for Intel® Core™ and Intel® Xeon® Processors](#)
- [Intel® CPU Runtime for OpenCL™ Applications Release Notes](#)
- [Developer Reference: Intel® CPU Runtime for OpenCL™ Applications](#)
- [Developer Reference: OpenCL™ Runtime and Compiler for Intel® Graphics](#)

5 Where to Find the Release

Intel® SDK for OpenCL™ Applications 2020 Update 2 is available for download through its [web portal](#). It is available as a:

- Standalone deployment
- Suite component:
 - Intel® SDK for OpenCL™ Applications 2020 Update 2 is an optional component of Intel® System Studio 2020 Update 2 suite. In Intel® System Studio it is listed as the OpenCL™ Tools component.
 - Intel® System Studio [download page](#).

For more info on how to choose which driver/runtime package you need and how to download it, please see [OpenCL™ Runtimes for Intel® Processors article](#).

6 System Requirements

Supported Architectures and Terminology

For an explanation of architecture names, see the [product names page](#).

The following tables determine Intel® processors supported on Windows* OS and Linux* OS operating systems.

6.1.1 Intel® SDK for OpenCL™ Applications for Windows* OS:

Intel® Platform	OpenCL version	Host Platform	Target Application Platform	
		Windows® 10	Windows* 10	
			CPU	GPU
7 th , 8 th , 9 th , 11 th Generation Intel® Core™ processors with Intel® Iris® Pro graphics and Intel® HD Graphics	2.1	✓	✓	✓
6 th and 5 th Generation Intel Core processors with Intel Iris Pro graphics and Intel HD Graphics	2.0	✓	✓	✓
Intel® Xeon® Processor E3-1200 v4 Family with C226 chipset and E3-1500 v5 Family with C236 chipset	2.0	✓	✓	✓
1 st through 4 th Generation Intel Core processors and Intel® Xeon® processor (CPU only)	1.2	✓	✓	

6.1.2 Intel® SDK for OpenCL™ Applications for Linux* OS:

Intel® Platform	OpenCL version	Host Platform		Target Application Platform			
		Ubuntu* 18.04	CentOS* 7.4	CentOS 7.4/8.0		Ubuntu 18.04	
				CPU	GPU	CPU	GPU
11 th , 9 th , 8 th , 7 th and 6 th Generation Intel® Core™ processors with Intel® Iris® Pro graphics and HD Graphics	2.1	✓	✓	✓	✓	✓	✓
Pentium® processor N4200/5, N3350/5, N3450/5	2.0	✓				✓	✓
5 th Generation Intel Core processors with Intel Iris Pro graphics and HD Graphics	2.0	✓	✓	✓	✓	✓	✓
Intel® Xeon® processor E3-1200 v4 Family with C226 chipset and E3-1500 v5 Family with C236 chipset	2.0	✓	✓	✓	✓	✓	✓
1 st -4 th Generation Intel Core processors (CPU only)	1.2	✓	✓	✓		✓	
Intel Xeon processor product family (CPU only)	1.2	✓	✓	✓		✓	

Note the following:

- This product is not designed for use on non-Intel processors and any such usage is at your own risk as it may lead to erroneous results.
- You must have root privileges (or use the `sudo` command) to run the Intel® SDK for OpenCL™ Applications 2020 on Linux* OS operating systems (including launching the Eclipse IDE).
- Intel® SDK for OpenCL™ Applications 2020 for Linux* OS is compatible with the following OpenCL runtimes:
 - Intel® CPU Runtime for OpenCL™ Applications 18.1
 - Intel® Graphics Compute Runtime for OpenCL™ Driver

For more information on the supported runtime and kernel mode drivers, see the **OpenCL™ Runtimes for Intel® Architecture** [article](#).

- Intel® Graphics Compute Runtime for OpenCL™ Driver supports the following platforms:
 - Intel® Core™ processors with 11th Generation Intel® Graphics Devices (formerly known as Intel® microarchitecture code name Ice Lake) with OpenCL 2.1 Runtime; Intel® Core™ processors with 8th Generation Intel® Graphics Devices (formerly known as Intel® microarchitecture code name Broadwell) with OpenCL 2.1 Runtime;

- Intel® Core™ processors with 9th Generation Intel® Graphics Devices (formerly known as Intel microarchitecture code name Skylake, Intel microarchitecture code-named Kaby Lake, Intel microarchitecture code-named Coffee Lake) with OpenCL 2.1 Runtime;
- Intel Atom® Processors with 9th Generation Intel® Graphics Devices (formerly known as Intel microarchitecture code-named Apollo Lake, Intel microarchitecture code-named Gemini Lake) with OpenCL 1.2 Runtime;
- Please look for future Intel® platform support to be added to Intel® Graphics Compute Runtime for OpenCL™ Driver.

Always check the release notes at [Intel® Graphics Compute Runtime for OpenCL™ Driver page](#) for the latest platform support and compatibility information.

For more information on OpenCL platforms and OS support, visit the Intel's OpenCL [technology page](#).

Driver Requirements

6.1.3 Windows* OS Driver Requirements:

For OpenCL support on Intel® Core™ processors with Intel® Processor Graphics, you must have an Intel® Graphics Driver (version 15.40 or higher) installed. For more information, please see the [driver support matrix](#) and [OpenCL™ Runtimes for Intel® Architecture page](#).

For other Intel® processor systems, please consider usage of the Intel® CPU Runtime for OpenCL™ Applications.

6.1.4 Linux* OS Driver and Runtime Requirements:

To deploy or develop with an OpenCL™ runtime supporting Intel® Graphics Technology, the system must have a compatible Intel® Graphics Driver. For recent implementations, Linux* kernel 4.11 or higher deployments are also expected. For supported platform information, see the [release notes](#) on the Intel® Graphics Compute Runtime for OpenCL™ Driver page.

For the CPU-only runtime package, please refer to the compatibility chart in [6.1.2](#).

For more information on supported runtimes and drivers for Linux* OS go to the [OpenCL™ Drivers and Runtimes for Intel® Architecture article](#).

7 Installation Notes

Installation on Microsoft Windows* OS

For OpenCL support on Intel® processors with Intel® Processor Graphics, you must have the Intel® Graphics Driver (version 15.40 or higher) installed.

System vendor graphics drivers may be a requirement to maintain support from system vendors. See your vendor website for more information. Alternatively, you can obtain the latest Intel® packaged driver version using the [Intel® Driver Update Utility](#) or [manually](#).

You can obtain Intel® SDK for OpenCL™ Applications with Intel® System Studio from the [Intel® System Studio web page](#).

Before installing the Intel® SDK for OpenCL™ Applications for Windows* operating systems, it is recommended to remove any previous version of the SDK from your computer.

NOTE: Intel® Graphics Driver for Windows* OS includes OpenCL support for both CPU and Intel® Processor Graphics.

Installation on Linux* OS (Ubuntu*)

You can obtain Intel® SDK for OpenCL™ Applications with Intel® System Studio: OpenCL™ Tools component from the [Intel® System Studio web page](#).

A driver or runtime package must also be installed: [OpenCL™ Drivers and Runtimes for Intel® Architecture page](#).

'Mono' package must be installed: [instruction page](#).

'Libicu55' package must be installed on Ubuntu. Please use the following commands to do so:

```
wget http://security.ubuntu.com/ubuntu/pool/main/i/icu/libicu55_55.1-7ubuntu0.4_amd64.deb
sudo apt install ./libicu55_55.1-7ubuntu0.4_amd64.deb
```

'cpio' package is a prerequisite for the SDK installer. Example deployment:

```
sudo -E apt update
sudo -E apt install cpio
```

If you have installed Intel® Graphics Compute Runtime for OpenCL™ Driver, ensure that eligible users are added to the video group. Intel® SDK for OpenCL™ - Offline Compiler may not execute through the graphics implementation without assigning the user video group membership.

To add user to the video group, use this command: `sudo usermod -a -G video USERNAME`

For either the included or a standalone install of Intel® CPU Runtime for OpenCL™ Applications 18.1, observe the following prerequisites: lsb-core libnuma1 zlib1g libxml2. Install example:

```
sudo -E apt update
sudo -E apt install lsb-core libnuma1 zlib1g libxml2
```

Prerequisite setup steps are recreated at the [getting started guidance article](#).

NOTE: All RPM packages of the Intel® SDK for OpenCL™ Applications are digitally signed.

8 Attributions

Boost

Boost is used, from boost distribution:

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.

MIT License

The following components are used and have MIT license:

Codrops Stapel,Unspecified

DataTables,1.10.3

Eclipse IDE Auto-generated Code,Unspecified

Eclipse Public License 1.0,Unspecified

JsLib,Unspecified

jQuery UI - jquery/jquery-ui on GitHub,Unspecified

syntaxhighlighter,Unspecified

From MIT License (MIT):

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.

Apache License

Windows OOK Language Integration is used. It has Apache license. From Apache License 2.0:

Copyright [APPACHE] [name of copyright owner] Licensed under the Apache License, Version 2.0 (the "License"); you may not use this file except in compliance with the License. You may obtain a copy of the License at

<http://www.apache.org/licenses/LICENSE-2.0>

Unless required by applicable law or agreed to in writing, software distributed under the License is distributed on an "AS IS" BASIS, WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied. See the License for the specific language governing permissions and limitations under the License.

Zlib License

tinycl2 is used. From Zlib license:

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.

BSD 2-Clause License

CodeProject - Drag and drop in WPF is used. From BSD 2-Clause License:

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES; LOSS OF USE, DATA, OR PROFITS; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

LLVM Release License

University of Illinois/NCSA
Open Source License

Copyright (c) 2003-2013 University of Illinois at Urbana-Champaign.
All rights reserved.

Developed by:

LLVM Team

University of Illinois at Urbana-Champaign

<http://llvm.org>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal with 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:

- * Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimers.
- * Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimers in the documentation and/or other materials provided with the distribution.
- * Neither the names of the LLVM Team, University of Illinois at Urbana-Champaign, nor the names of its contributors may be used to endorse or promote products derived from this Software without specific prior written permission.

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 CONTRIBUTORS 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 WITH THE SOFTWARE.

=====
Copyrights and Licenses for Third Party Software Distributed with LLVM:
=====

The LLVM software contains code written by third parties. Such software will have its own individual LICENSE.TXT file in the directory in which it appears. This file will describe the copyrights, license, and restrictions which apply to that code.

The disclaimer of warranty in the University of Illinois Open Source License applies to all code in the LLVM Distribution, and nothing in any of the other licenses gives permission to use the names of the LLVM Team or the University of Illinois to endorse or promote products derived from this Software.

The following pieces of software have additional or alternate copyrights, licenses, and/or restrictions:

Program	Directory
---------	-----------

-----	-----
Autoconf	llvm/autoconf llvm/projects/ModuleMaker/autoconf llvm/projects/sample/autoconf
Google Test	llvm/utils/unittest/googletest
OpenBSD regex	llvm/lib/Support/{reg*, COPYRIGHT.regex}
pyyaml tests	llvm/test/YAMLParse/{*.data, LICENSE.TXT}
ARM contributions	llvm/lib/Target/ARM/LICENSE.TXT
md5 contributions	llvm/lib/Support/MD5.cpp llvm/include/llvm/Support/MD5.h

MICROSOFT DIRECTX SOFTWARE DEVELOPMENT KIT (SDK)

These license terms are an agreement between Microsoft Corporation (or based on where you live, one of its affiliates) and you. Please read them. They apply to the software named above, which includes the media on which you received it, if any. The terms also apply to any Microsoft

- updates,

- supplements,

- Internet-based services, and

- support services

for this software, unless other terms accompany those items. If so, those terms apply.

BY USING THE SOFTWARE, YOU ACCEPT THESE TERMS. IF YOU DO NOT ACCEPT THEM, DO NOT USE THE SOFTWARE.

If you comply with these license terms, you have the rights below.

1. INSTALLATION AND USE RIGHTS.

a. Installation and Use. You may install and use any number of copies of the software on your devices.

b. Included Microsoft Programs. The software contains other Microsoft programs. The license terms with those programs apply to your use of them.

2. ADDITIONAL LICENSING REQUIREMENTS AND/OR USE RIGHTS.

a. Media Elements and Templates. You may copy and use images, clip art, animations, sounds, music, shapes, video clips and templates provided with the software and identified for such use in documents and projects that you create. You may distribute those documents and projects non-commercially. If you wish to use these media elements or templates for any other purpose, go to www.microsoft.com/permission to learn whether that use is allowed.

b. Distributable Code.

Windows Installer XML

WiX Toolset License

The WiX toolset is released under the Microsoft Reciprocal License (MS-RL). A reciprocal license is used to ensure that others who build on the effort of the WiX community give back to the WiX community. Specifically the license changes and improvements to the WiX toolset must be published using the same license.

Sometimes the reciprocal license is incorrectly interpreted to also apply to bundles, packages, custom actions built using the WiX toolset. The Outercurve Foundation has provided this statement to clarify:

The WiX toolset (WiX) is licensed under the Microsoft Reciprocal License (MS-RL). The MS-RL governs the distribution of the software licensed under it, as well as derivative works, and incorporates the definition of a derivative work provided in U.S. copyright law. OuterCurve Foundation does not view the installer packages generated by WiX as falling within the definition of a derivative work, merely because they are produced using WiX. Thus, the installer packages generated by WiX will normally fall outside the scope of the MS-RL, and any of your source code, binaries, libraries, routines or other software components that are incorporated in installer packages generated by WiX can be governed by other licensing terms.

The full text of the MS-RL license is reproduced below. It can also be found in the LICENSE.TXT file included with the source code.

8.1.1 Microsoft Reciprocal License (MS-RL)

This license governs use of the accompanying software. If you use the software, you accept this license. If you do not accept the license, do not use the software.

1. Definitions

The terms "reproduce," "reproduction," "derivative works," and "distribution" have the same meaning here as under U.S. copyright law.

A "contribution" is the original software, or any additions or changes to the software.

A "contributor" is any person that distributes its contribution under this license.

"Licensed patents" are a contributor's patent claims that read directly on its contribution.

2. *Grant of Rights*

(A) Copyright Grant- Subject to the terms of this license, including the license conditions and limitations in section 3, each contributor grants you a non-exclusive, worldwide, royalty-free copyright license to reproduce its contribution, prepare derivative works of its contribution, and distribute its contribution or any derivative works that you create.

(B) Patent Grant- Subject to the terms of this license, including the license conditions and limitations in section 3, each contributor grants you a non-exclusive, worldwide, royalty-free license under its licensed patents to make, have made, use, sell, offer for sale, import, and/or otherwise dispose of its contribution in the software or derivative works of the contribution in the software.

3. *Conditions and Limitations*

(A) Reciprocal Grants- For any file you distribute that contains code from the software (in source code or binary format), you must provide recipients the source code to that file along with a copy of this license, which license will govern that file. You may license other files that are entirely your own work and do not contain code from the software under any terms you choose.

(B) No Trademark License- This license does not grant you rights to use any contributors' name, logo, or trademarks.

(C) If you bring a patent claim against any contributor over patents that you claim are infringed by the software, your patent license from such contributor to the software ends automatically.

(D) If you distribute any portion of the software, you must retain all copyright, patent, trademark, and attribution notices that are present in the software.

(E) If you distribute any portion of the software in source code form, you may do so only under this license by including a complete copy of this license with your distribution. If you distribute any portion of the software in compiled or object code form, you may only do so under a license that complies with this license.

(F) The software is licensed "as-is." You bear the risk of using it. The contributors give no express warranties, guarantees or conditions. You may have additional consumer rights under your local laws which this license cannot change. To the extent permitted under your local laws, the contributors exclude the implied warranties of merchantability, fitness for a particular purpose and non-infringement.

9 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, Intel Atom, Intel Atom Inside, Intel Core, Intel vPro, Intel Xeon Phi, Itanium, Pentium, Celeron, Ultrabook, VTune, 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.

© 2019 Intel Corporation

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission from Khronos.

Microsoft, Windows, and the Windows logo are trademarks, or registered trademarks of Microsoft Corporation in the United States and/or other countries.