Intel® SDK for OpenCL™ Applications 2019 Update 4

Release Notes

31 May 2019

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
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	7th 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, including answers to questions not addressed in this product, visit the technical support forum, FAQs, and other support information at Intel® SDK for OpenCL™ Applications Support or Developer Zone Support.

Please remember to register your product at registration center by providing your email address. Registration grants free tier installation technical support via the Intel Online Service Center.

To provide feedback and suggestions or submit an issue visit the forum.

Contents

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.

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.

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

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

2.1 New Features

- **The OpenCL™ CPU Kernel Debugger feature in this release requires version 18.1 or newer of Intel® CPU Runtime for OpenCL™ Applications, available for [Linux*](#) and [Microsoft Windows*](#) OSes.**
  - **For more information, please see [Intel® CPU Runtime for OpenCL™ Applications Release Notes](#) and for any questions, see the [OpenCL* Support Forum](#).**
- **Intel® SDK for OpenCL™ Applications supports DCH Intel® Graphics Driver for Windows* 10 in this release.**
- **Intel® Debugger for Heterogeneous Compute supports:**
  - **Intel® Graphics Compute Runtime for OpenCL™ Driver 18.51 (released 21 Dec 2018) or newer on Linux**
  - **DCH Intel® Graphics Driver 25.20.100.6577 (released 25 Feb 2019) or newer on Windows**
- **Intel® OpenCL™ Converter from Kernel Development Framework session to Microsoft Visual Studio* OpenCL™ project. More information is available in the [developer guide](#). Microsoft Visual Studio* OpenCL™ project now integrates with VTune™.**

Intel® SDK for OpenCL™ Applications Update 4 includes new features, bug fixes and security updates. Users should update to the latest version.

Intel® SDK for OpenCL™ Applications 2019 Update 4 includes all the features previously available in Intel® SDK for OpenCL™ Applications 2019 Update 3.

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

3 Known Issues

3.1 General Limitations

- Eclipse 2018-12 R is only supported on Linux distributions;
- Conversion from a Microsoft* Visual Studio Visual C++ project to an OpenCL project does not work properly in Visual Studio 2017;
- Kernel Development Framework couldn't be loaded and Offline Compiler (32-bit version) couldn't work if there is no x86 runtime on machine.
- Conversion from a Kernel Development Framework session to a Microsoft Visual Studio* OpenCL™ project cannot convert an x64 session to an x86 project. It cannot convert an x86 session to an x64 project.
- OpenCL application could not be executed if you have Intel® Graphics Compute Runtime for OpenCL™ Driver version 19.15 or newer and installed Intel® Debugger for Heterogeneous Compute. You could use latest release version 19.11.12599 of Intel® Graphics Compute Runtime for OpenCL™ Driver version to avoid it.
- 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 2015 and for Visual Studio 2017;
    - To avoid the warning, run the Visual Studio in Experimental mode with the command: `devenv.exe /RootSuffix Exp`.
- `gdbserver-igfx` from Intel® Debugger for Heterogeneous Compute returns `"Failed to initalize"` error on Linux.

  Verify that `igfxdcd` module is installed and loaded on the system:
    - `modinfo igfxdcd`
    - `lsmod | grep igfxdcd`

  In case it's not available on the system, please install debugger target packages:

  CentOS*:
    - `cd/opt/intel/system_studio_2019/opencl/gt_debugger_2016.0/gdb/targets/idhs/install/`
    - `sudo yum localinstall gdbserver-ia-8.2.1-1.x86_64 gdbserver-igfx-8.2.1-1.x86_64 igfxdcd-dkms-1.2.1-1.x86_64 libelfdwarf-1.2.1-1.x86_64 libigfxdbg-1.2.1-1.x86_64`
  Ubuntu:
    - `cd/opt/intel/system_studio_2019/opencl/gt_debugger_2016.0/gdb/targets/idhs/install/`
    - `sudo dpkg -i gdbserver-ia_8.2.1_amd64.deb gdbserver igfx_8.2.1_amd64.deb igfxdcd-dkms_1.2.1_all.deb libelfdwarf_1.2.1_amd64.deb libigfxdbg_1.2.1_amd64.deb`

  Load `igfxdcd` module by running - `modprobe igfxdcd`

- o If you have an error message: `modprobe: Fatal: Module igfxdcd`
- o CentOS and Ubuntu
  - Check that igfxdcd module is available on the system
    - `modinfo igfxdcd`
  - Install igfxdcd module in case it's not present on the system
    - `sudo dkms install igfxdcd -v 1.2.1`
  - Load the module on the system
    - `sudo modprobe igfxdcd`
  - Verify that it was loaded
    - `lsmod | grep igfxdcd`
  - Now you may use the Intel® Debugger for Heterogeneous Compute. In case of any other problems check Intel® Graphics Compute Runtime for OpenCL™ version. Follow the links to find the latest released version for Ubuntu and CentOS.

3.2 Intel® Code Builder for OpenCL™ API IDE Plug-in Limitations

- Build feature limitations:
  - o 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.
- GPU Kernel Debugger for the Visual Studio IDE:
  - o The GPU kernel debugger is supported for 64-bit applications only.
  - o When passing `-s` build option to a `clBuildProgram()` method call, if path to the source file contains spaces, you must enclose it in double quotes. Note that enclosing path containing spaces in single quotes or escaping spaces *does not work correctly*.
- CPU Kernel Debugger for the Visual Studio IDE does not support:
  - o Edit and continue capability
  - o Multithreaded debugging
  - o Two instances of Visual Studio running simultaneously
  - o Unions
- OpenCL™ API Debugger:
  - o Concurrent debug sessions with **API Debugger** are not supported. This includes attaching the Visual Studio debugger to more than one process, or opening multiple instances of Visual Studio and debugging processes concurrently.
- Code Analyzer Limitations:
  - o Kernel Analysis window could not be opened with error 'java.lang.StackOverflowError' on Ubuntu 16.04 and 18.04.
  - o Kernel analysis features are not supported on Intel® processors older than 4th Generation Intel® Core™ processors
  - o Latency and occupancy reports cannot be generated for built-in kernels that are generated with `clCreateProgramWithBuiltInKernels`

- o Calling the API functions `clCreateProgramWithBuiltInKernels` or `clCreateAcceleratorINTEL` generates additional OpenCL APIs in the API Analyze report; these APIs do not appear in the code.
    - o Occupancy analysis is not supported on an application that includes a call to Microsoft D3D11 API `GetData()`. Running Occupancy analysis on such an application leads to application crash with an exception.
    - o Kernel analysis, hardware counters, and some of the hints are available only for kernels that run on GPU (shared context is not supported).
    - o Host and kernel level analysis are not supported on an application that uses the motion estimation extension.
- Intel® Code Builder for OpenCL™ API's Report feature does not work correctly in the Konqueror* browser.

3.3 Known Installation and Configuration Issues

- On Ubuntu* 16.04 systems, Intel Code Builder for OpenCL API works only on Eclipse Oxygen (4.7) and requires that Java* Runtime Environment 8 be installed.
- On Windows* OS systems, components in Intel® Parallel Studio XE 2018 and earlier may conflict with the Intel SDK for OpenCL Applications install process.
    - o 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:
    - o 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.
    - o Obtain the latest version of the Intel® Graphics Driver from download center.
    - o Recent revisions of Windows* OS systems will preinstall a reference Intel® Graphics Driver package.
    - o 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 2019 for Windows* cannot be found. Try the installation again using a valid copy of the installation package 'intel_sdk_for_opencl_2019_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...**

3.4   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](#).
- The OpenCL™ Driver is available on systems with Intel® Processor Graphics and discrete graphics cards (Windows OS only):
  - Capabilities of both discrete and integrated graphics are available if display is connected to:
    - Integrated graphics card display port
    - Discrete and integrated graphics cards simultaneously
  - Capabilities of a discrete card only are available if the display is connected to:
    - Discrete graphics card display port
    - Integrated graphics card, and a discrete graphics card without display ports.

3.5   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 `-llvm` option is no longer supported in 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.
  - The `-asm` option does not produce the correct assembly code with Intel® CPU Runtime for OpenCL™ Applications 18.1.
- 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.

- o 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.
- o 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 2019 is an optional component of Intel® System Studio 2019. 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 page.

6 System Requirements

6.1 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
7th and 8th Generation Intel® Core™ processors with Intel® Iris® Pro graphics and Intel® HD Graphics	2.1	✓	✓	✓
6th and 5th 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	✓	✓	✓
1st through 4th 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* 16.04/ 18.04	CentOS* 7.4	CentOS 7.4		Ubuntu 16.04/18.04	
				CPU	GPU	CPU	GPU
8th, 7th and 6th Generation Intel® Core™ processors with Intel® Iris® Pro graphics and HD Graphics	2.1	✓	✓	✓	✓	✓	✓
Pentium® processor N4200/5, N3350/5, N3450/5	2.0	✓				✓	✓
5th 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	✓	✓	✓	✓	✓	✓
1st-4th Generation Intel Core processors (**CPU only**)	1.2	✓	✓	✓		✓	
Intel Xeon processor product family (**CPU only**)	1.2	✓	✓	✓		✓	

Note the following:
- Intel® Code Builder for OpenCL™ API IDE plug in requires an IA-32 or Intel® 64 architecture processor.
- 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 2019 on Linux* OS operating systems (including launching the Eclipse IDE).
- Intel® SDK for OpenCL™ Applications 2019 for Linux is compatible with the following OpenCL runtimes:
    - Intel® CPU Runtime for OpenCL™ Applications 18.1

    For more information on the supported runtime and kernel mode drivers, see the **OpenCL™ Runtimes for Intel® Architecture** article.
- Intel® SDK for OpenCL™ Applications plugin for the Eclipse IDE requires Java Runtime Environment 11 installed on your Windows* or Linux* OS machine.
- Intel® Graphics Compute Runtime for OpenCL™ Driver supports the following platforms:
    - Intel® Core™ processors with 8th Generation Intel® Graphics Devices (formerly known as Intel® microarchitecture code name Broadwell) with OpenCL 2.1 Runtime;

- o 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;
  - o 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;
  - o 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.](#)

6.2 Driver Requirements

6.2.1 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™ Drivers and Runtimes for Intel® Architecture page.](#)

6.2.2 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

7.1 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.

The SDK installation includes the following components:
- 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;
- OpenCL Code Builder plug-in for Visual Studio 2015 and higher including comprehensive environment for building, debugging and analyzing OpenCL applications;
- Intel® CPU Runtime for OpenCL™ Applications 18.1

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

7.2 Installation on Linux* OS

You can obtain Intel® SDK for OpenCL™ Applications with Intel® System Studio 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
```

The SDK installation includes the following components:

- 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® Code Builder for OpenCL™ API plug-in for Eclipse 2018-12 R including Kernel Development Framework for building OpenCL applications;
  - o Intel® System Studio 2019 Update 3 includes Eclipse 2018-12 R as an installable component, capable of launching the plug-in;
  - o Intel® SDK for OpenCL™ Applications plugin for the Eclipse IDE requires that Java Runtime Environment 11 be installed.
- Intel® CPU Runtime for OpenCL™ Applications 18.1.

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`

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

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

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8   Attributions

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pyyaml tests	llvm/test/YAMLParser/{*.data, LICENSE.TXT}
ARM contributions	llvm/lib/Target/ARM/LICENSE.TXT
md5 contributions	llvm/lib/Support/MD5.cpp llvm/include/llvm/Support/MD5.h

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Windows Installer XML

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