Altera SDK for OpenCL Version 16.0 Release Notes

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The *Altera SDK for OpenCL Release Notes* provides late-breaking information about the Altera® Software Development Kit (SDK) for OpenCL™[1] (AOCL[2]) and the Altera Runtime Environment (RTE) for OpenCL version 16.0.

New Features and Enhancements

The Altera SDK for OpenCL and the Altera RTE for OpenCL version 16.0 include the following new features:

- Implementation of OpenCL pipes
- Thread-safe host runtime environment, as outlined in the OpenCL Specification version 1.2
- An `ivdep` pragma (that is `#pragma ivdep`) for asserting to the AOC that accesses to memory does not cause loop-carried dependencies in a single work-item kernel
- Support for emulating multiple devices alongside other OpenCL SDKs via the Khronos ICD Loader Library
- Advanced feature: OpenCL library support

The AOCL version 16.0 includes the following beta features:

- Support for shared virtual memory (SVM), as outlined in the OpenCL Specification version 2.0
- Support for image arrays, as outlined in the OpenCL Specification version 1.2
- HTML area report, which you can review on-screen by invoking the `analyze-area` AOCL utility command
- Enhanced optimization reports
- Single-cycle floating-point accumulator for single work-item kernels targeting Arria 10 devices
- Advanced features for additional control of the AOC, memory configuration, and design architecture:

  - Kernel attributes for configuring on-chip local memory
  - Kernel attributes for reducing the amount of overhead on a single work-item kernel's hardware usage
  - Automatic kernel replication

- Altera Arria 10 GX FPGA Development Kit Reference Platform

  Contact your local Altera representative for more information.

  Attention: Partial Reconfiguration (PR) capability is an early-access feature.

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[1] OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission of the Khronos Group™.

[2] The Altera SDK for OpenCL is based on a published Khronos Specification, and has passed the Khronos Conformance Testing Process. Current conformance status can be found at **www.khronos.org/conformance**.

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Operating System Support

Information about OS support for the Altera SDK for OpenCL is available on the Operating System Support page of the Altera website.

Related Information
Operating System Support

Changes to Software Behavior

Items listed in the following table represent cases in which the behavior of the current release of the Altera SDK for OpenCL and the Altera RTE for OpenCL differs from the previous version.

Description	Workaround

The format in which the Altera Offline Compiler reports kernel-specific resource usage estimates has changed.
 	
The AOC no longer generates a **<kernel_filename>/area_report/<kernel_filename>.area** file that you can access.
	The AOC generates a **<kernel_filename>.aoco-area-report.html** or a **<kernel_filename>.aocx-area-report.html** area report that you can open in the browser when you invoke
	
	`aocl analyze-area <kernel_filename>.aoco`
	
	or
	
	`aocl analyze-area <kernel_filename>.aocx`

Items listed in the following table represent cases in which the behavior of the current releases of the AOCL Custom Platform Toolkit and Reference Platforms differ from the previous version.

Description	Workaround
The implementation requirement for the `program` utility has changed.	Custom Platforms must provide a program utility that takes both the **fpga.bin** file and the **.aocx** file as arguments.
In the **board_spec.xml** file, the `qsys_file` attribute for the `compile` element now accepts the value `none`.	Assign the value `none` to `qsys_file` if the Quartus® Prime software does not need to generate a top-level **.qsys** file for your design.

Known Issues and Workarounds

This section provides information about the following known issues that affect the Altera SDK for OpenCL and the Altera RTE for OpenCL version 16.0.

Description	Workaround
Compilations times for Arria® 10 designs will be longer than in previous versions of AOCL. The increase in compilation time might be more noticeable in smaller Arria 10 designs.	—

This section provides information about the following known issues that affect the current releases of the AOCL Custom Platform Toolkit and Reference Platforms. These issues might also affect Custom Platforms you create for use with the AOCL.

Description	Workaround
When porting your Custom Platform design from the Arria 10 GX FPGA Development Kit Reference Platform, PR might not function as expected because it is an early-access feature.	To override the default PR mechanism, set the *ACL_PCIE_USE_JTAG_PROGRAMMING* environment variable to 1 to reconfigure your Arria 10 device via JTAG full-chip programming. For more information on JTAG programming for the Arria 10 GX FPGA Development Kit Reference Platform, contact your local Altera representative.
The Forward-Compatibility flow for migrating a version 16.0 Arria 10 Custom Platform to a future AOCL version causes longer compilation times for OpenCL designs targeting Arria 10 devices.	If you do not want to experience a longer compilation time, you have to option to disable the Forward Compatibility flow. However, You must recompile your Arria 10 Custom Platform for every future release of AOCL. **Attention:** Altera does not recommend that you disable the Forward Compatibility flow.
The Forward-Compatibility flow for migrating a version 16.0 Arria 10 Custom Platform to a future AOCL version might fail.	Recompile your Arria 10 Custom Platform to match the AOCL version. For more information on the error message, refer to the **Altera Knowledge Base article**.

For additional known issue information for the current AOCL version, refer to the Altera Knowledge Base webpage.

Addition Known Software Issues Affecting the Altera SDK for OpenCL version 16.0

Latest Known Altera SDK for OpenCL Software Issues

You can find known issue information for previous AOCL versions on the Altera Knowledge Base webpage.

Related Information
Altera Knowledge Base

Software Issues Resolved

The following issues were corrected or otherwise resolved in the Altera SDK for OpenCL and the Altera RTE for OpenCL version 16.0.

Table 1: Issues Resolved in the Altera SDK for OpenCL Version 16.0

Description	Workaround
In AOCL version 15.1, if you had a multi-threaded design where a thread made a call to the OpenCL driver and exited, while other threads were still waiting for returned signals from the driver, these other threads might not receive the returned signals.	Instead of sending all returned signals to the exited thread, the OpenCL driver now sends returned signals to the corresponding threads.
In AOCL version 15.0, the `clGetPlatformIDs` (*num_entries*, *&platforms*, *&num_platforms*) function erroneously returned the value `CL_INVALID_VALUE` when neither of the following scenarios were true: • *num_entries* equaled zero and *&platforms* was not NULL • Both *&num_platforms* and *&platforms* were NULL	The `clGetPlatformIDs` function now behaves as expected.

Software Patches Included in this Release

Table 2: Software Patches Included in the Altera SDK for OpenCL Version 16.0

Software Version	Patch
Altera SDK for OpenCL version 15.1.1	1.02cl
Altera SDK for OpenCL version 15.1.1	1.0cl

Document Revision History

Table 3: Altera SDK for OpenCL Version 16.0 Release Notes Document Revision History

Date	Document Version	Changes

May 2016	2016.05.02	• Included the following new features and enhancements:
		
		   • OpenCL pipes
		   • Thread-safe host runtime environment
		   • `#pragma ivdep`
		   • Support for multi-device emulation
		   • OpenCL library
		   • Enhanced optimization reports
		• Included the following beta features and enhancements:
		
		   • SVM support
		   • Image array support
		   • Enhanced area report
		   • Arria 10-specific single-cycle floating-point accumulator for single work-item kernels
		   • Advanced features for enhanced design configuration:
		
		      • Kernel attributes for configuring on-chip local memory
		      • Kernel attributes for reducing hardware overhead for single work-item kernels
		      • Automatic kernel replication
		   • Altera Arria 10 GX FPGA Development Kit Reference Platform
		
		For AOCL users:
		
		• Noted that the AOC no longer creates a kernel-specific **.area** file that users can access.
		• For board developers, noted that the implementation of the AOCL `program` utility has changed.
		• Noted that designs targeting Arria 10 devices take longer to compile.
		
		For board developers:
		
		• Noted that in the **board_spec.xml** file, the `qsys_file` attribute now accepts the value `none`.
		• Advised that porting the Arria 10 GX FPGA Development Kit Reference Platform to use JTAG full-chip programming if PR does not function as expected.
		• Noted that the Forward Compatibility flow necessary for porting the Arria 10 GX FPGA Development Kit Reference Platform increases compilation time. The Forward Compatibility flow might also fail.

Date	Document Version	Changes
November 2015	2015.11.02	- Included the following production features and enhancements: - Windows 8.1 support. - Additional double precision floating-point functions. `--high-effort` AOC command option. - Support for ICD and ACD. - Sub-buffers support. `aoc` command without any argument. - Included the following beta features and enhancements: OpenCL pipes support, thread-safe host, image arrays support, and SVM support. - Included OpenCL Library as an early access feature. - Noted that there is a 64 kB lower limit on global memory allocation imposed by the runtime. - Noted that the AOCL is only downloadable as a tar file that also includes the Quartus Prime software and device support. - Noted that you must set the *QUARTUS_ROOTDIR_OVERRIDE* environment variable to point to the correction edition of the Quartus Prime software. - Added emulation to the recommended setup flow for the AOCL. - Noted that OpenCL design examples no longer provide precompiled **.aocx** files. - Noted that the Emulator now supports kernels that implement pipes, including kernels that pass pipes and kernels by reference. - Noted that the **board_env.xml** file a Custom Platform must include the `mmdlib` XML element. - Noted that the AOCL `diagnose` utility must now support three internal calling modes. - Noted that installing unsigned drivers for AOCL running on Windows 8.1 might result in an error. - Noted that a license is not necessary to run the Altera RTE for OpenCL.

Date	Document Version	Changes
May 2015	15.0.0	- Included support for double precision floating-point functions as a new feature and listed the OpenCL-conformant functions. - Included the following beta features: - Implementation of OpenCL pipes `--high-effort` Altera Offline Compiler (AOC) command option - OpenCL Installable Client Driver (ICD) extension support - Altera Client Driver (ACD) - Noted that naming a kernel source file kernel.cl causes a compilation error. - Noted that emulation of an OpenCL kernel design targeting an SoC must be performed on a non-SoC board. - Noted automigration is a change in software behavior starting in 14.1. - Noted that declaring a `__constant` pointer kernel argument in a kernel targeting a Cyclone V device might degrade kernel performance. - Noted the following Profiler limitations: - Do not include spaces in directory and file names. - Do not use the same kernel names across different `.aocx` files. - Adjusting the magnification of the **Kernel Executaion** tab might cause subtle changes to the time scale. - Noted that for Linux Power systems, the **init_opencl.sh** script now sets the correct paths for the *LD_LIBRARY_PATH* environment variable. - Noted that a third-party OpenCL SDK kernel with pipes implementation must be modified before running on the AOCL. - Noted that if a kernel with pipes implementation is

Date	Document Version	Changes
December 2014	14.1.0	- Included the following new features: - Single OpenCL license. - AOCL `uninstall` utility. - Hard floating-point support. - An **ALTERAOCLSDKROOT/init_opencl** script for setting environment variables transiently. - Custom Platform automigration as a beta functionality. - Noted that RHEL version 5.x is no longer supported. - Noted that a routing error might be solved by reducing kernel size. - Added notice the AOCL `program` and `diagnose` utilities now support the Cyclone V SoC Development Kit (c5soc). - Noted that emulation is not available to kernels targeting c5soc. - Noted that the end of an NDRange kernel cannot include a memory barrier. - Noted the erroneous *LD_LIBRARY_PATH* settings in the **ALTERAOCLSDKROOT/init_opencl.sh** script for big-endian systems. - Added notice that improper installation of the PLDA QuickUDP IP license might result in an error message that refers to the QuickTCP IP. - Added change notice for the command you run to verify that CMA is enabled successfully for c5soc. - Noted that the AOC might generate incorrect hardware for kernels targeting a board with only one bank of memory. - Noted that the `--util <N>` and `-O3` AOC options are deprecated. - Noted that the **board_spec.xml** file now includes a `compile` XML element. - Added notice of updated specifications for the `version` XML attributes in the **board_env.xml** and **board_spec.xml** files. - Added notice about new enum value arguments for the `aocl_mmd_get_offline_info` MMD API call. - Added notice about board partition in the c5soc Reference Platform. - Added notice that you no longer need to remove the **libstdc++** library files from the **ALTERAOCLSDKROOT/host/linux64/lib** directory.

Date	Document Version	Changes
June 2014	14.0.0	• Included Cyclone V SoC support and big-endian architecture support as new features. • Included the following new features: RTE, AOCL channels extension, optimization report for single work-item kernels, and AOCL Custom Platform. • Included emulator and profiler as new beta features. • Included RPM installation option for AOCL and RTE. • Added notice that `float3` argument types are supported in 14.0. • Added notice that kernel clock reconfiguration issue during **.aocx** file generation is fixed in 14.0. • Added notice that the issue with excessive memory consumption during full compilation is fixed in 14.0. • Added deprecation notices for the `--estimate-throughput` and `--sw-dimm-partition` AOC options. • Added deprecation notices for the `num_share_resources`, `max_share_resources`, `max_unroll_loop` and `task` kernel attributes. • Updated Linux version support. • Added support notice for OpenCL C++ bindings. • Added notice that, for Windows systems, trailing slashes in include paths are illegal. • Added notice that, for Windows systems, compilation fails if the file path to the kernel source file exceeds 260 characters in length. • Added notice that to disable burst-interleaving for the default global memory, `--no-interleaving` requires a default argument. • Added notice that AOC options for floating-point operations have been renamed (that is, `--fp-relaxed` and `--fpc`). • Added notice that the `program` and `flash` AOCL utilities require a device name argument. • Added notice that `aocl diagnostic` has been renamed to `aocl diagnose`. Invoking `aocl diagnose` queries a list of devices. Invoking `aocl diagnose <device_name>` runs board vendor's diagnostic tests on a specific board. • Added notices of Cyclone V SoC-specific AOCL limitations. • Added notice to exclude the `num_compute_units` kernel attribute in OpenCL kernel programs targeting big-endian systems. • Added notices of the *Altera SDK for OpenCL Optimization Guide* and the APBPP board package have been renamed.

Date	Document Version	Changes
December 2013	13.1.1	• Included multiple devices support as a new beta feature. • Included heterogeneous memory system as a new beta feature. • Included the `--no-interleaving <memory_type>` option of the aoc command. • Included new `buffer_location` kernel attribute. • Added notice to modify the contents of **$ALTERAOCLSDK-ROOT/host/linux64/lib** to remove OpenCL runtime incompatibility with C++ code compiled with GCC versions 4.3 and later.
November 2013	13.1.0	• Included the `--estimate-throughput` option of the aoc command. • Included new `task` kernel attribute. • Included restrictions on OpenCL filenames. • Updated installation and uninstallation instructions. • Updated location where OpenCL example applications can be downloaded. • Updated the name of the folder or directory to which the installer extracts the AOCL. • Updated setting of the *PATH* environment variable. • Updated setting to *LD_LIBRARY_PATH* environment variable. • Updated output of the `--report` flag of the aoc command. • Updated the AOCL support status for BittWare FPGA boards. • Updated the AOCL support status for kernel parameters. • Updated support status for `float3` argument types. • Included notice on premature termination of host application debugging process in GDB. • Included notice to modify **top.qsf** to avoid large memory consumption during full compilation.

Date	Document Version	Changes
June 2013	13.0 SP1.0	• Included new kernel attributes and new design example. • Updated *LM_LICENSE_FILE* setting for Windows and Linux systems. • Updated board driver installation instructions. • Updated the SDK installation instructions for Linux systems without preexisting **.cshrc** or **.bashrc** files. • Updated the locations of the board drivers for Nallatech and Bittware boards. • Updated the implementation status of the AOCL utility for the BittWare board. • Updated vendor and device IDs on Windows systems. • Updated path to design examples. • Updated path to the moving_average design example. • Updated flash programming instructions. • Updated file type support for **.aocx** files. • Updated support status of complex exit paths in kernel source code. • Added notices on figure updates in the *Altera SDK for OpenCL Optimization Guide*.
May 2013	13.0.0	• Initial Release.