Altera SDK for OpenCL Version 15.1 Release Notes

2015.11.02

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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 15.1.

New Features and Enhancements

The Altera SDK for OpenCL and the Altera RTE for OpenCL version 15.1 include the following new features:

- Support for Windows versions 7 and 8.1.
- Support for double precision floating-point built-in scalar data types. The following double precision floating-point functions conform to the OpenCL Specification version 1.0:

  add / subtract / multiply / divide / ceil / floor / rint / trunc / fabs / fmax / fmin / sqrt / rsqrt / exp / exp2 / exp10 / log / log2 / log10 / sin / cos / asin / acos / sinh / cosh / tanh / asinh / acosh / atanh / pow / pown / powr / tanh / atan / atan2 / ldexp / log1p / sincos
- A `--high-effort` Altera Offline Compiler (AOC) command option for resolving hardware generation fitting errors during kernel compilation.
- Support for the OpenCL Installable Client Driver (ICD) extension from the Khronos Group.
- Inclusion of the Altera Client Driver (ACD) in Custom Platforms to allow the AOCL to find and load Custom Platform libraries at host runtime.
- Support for sub buffers, as outlined in the OpenCL Specification version 1.2.
- Ability to access the AOC help menu by invoking the `aoc` command with no argument.

The AOCL version 15.1 includes the following beta features:

- Implementation of OpenCL pipes.
- Thread-safe host runtime environment, as outlined in the OpenCL Specification version 1.2.
- Support for image arrays, as outlined in the OpenCL Specification version 1.2.
- Support for shared virtual memory (SVM), as outlined in the OpenCL Specification version 2.0.

The AOCL version 15.1 includes the OpenCL Library as an early access feature. Contact your Altera representative for more information.

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(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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101 Innovation Drive, San Jose, CA 95134

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 installation instructions for the AOCL have changed.	Download the AOCL, the Quartus® Prime software, and the device support as a bundle in a tar file. To install the software and device support, run the **setup.bat|sh** and **setup_pro.bat|sh** files. **Attention:** Your development system must have at least 85 gigabytes (GB) of free disk space for software installation. For more information, refer to the *Downloading the Altera SDK for OpenCL* and *Installing the Altera SDK for OpenCL* sections in the *Altera SDK for OpenCL Getting Started Guide*.
Starting in 15.1, you can no longer download the AOCL as a stand-alone software.	You must download the AOCL, the Quartus Prime software, and the device support as a bundle in a tar file.
In addition to setting the *AOCL_BOARD_PACKAGE_ROOT* user environment variable, before targeting an OpenCL kernel to a device, you must set the *QUARTUS_ROOTDIR_OVERRIDE* user environment variable.	The *QUARTUS_ROOTDIR_OVERRIDE* environment variable points to the correct edition of the Quartus Prime software. For Arria® 10 devices, *QUARTUS_ROOTDIR_OVERRIDE* must point to the Quartus Prime Pro Edition software. For non-Arria 10 devices, set *QUARTUS_ROOTDIR_OVERRIDE* to point to the Quartus Prime Standard Edition software.
Starting in 15.1, you no longer need to consolidate your kernel source code into a single **.cl** file before compiling it using the Altera Offline Compiler.	You can now compile multiple **.cl** kernel source files simultaneously by listing all the **.cl** files in the `aoc` command. For example, to compile your kernels to generate a consolidated **.aocx**hardware configuration file, invoke the following command: `aoc <your_kernel_filename1>.cl [<your_kernel_filename2>.cl ...]` where [***<your_kernel_filename2>*.cl** ...] are the optional space-delimited file names of the kernels.
Starting in 15.0, OpenCL design examples no longer provide precompiled Altera Offline Compiler Executable files (**.aocx**).	Each design example includes a **.cl** kernel source file. You must use the AOCL to compile the **.cl** file and create the **.aocx** file.

Description	Workaround
You can now instruct the AOCL to display the AOC command options by invoking the `aoc` command without any argument.	To display the AOC command options, invoke one of the following commands: • `aoc` • `aoc --help` • `aoc -h`
Emulation is now part of the AOCL setup process.	When setting up the AOCL, Altera recommends that you verify the functionality of the host runtime by emulating the hello_world design example. Refer to the *Verifying Host Runtime Functionality* section in the *Altera SDK for OpenCL Getting Started Guide* for more information.
The host runtime is now thread safe.	Starting in 15.1, you may call all OpenCL APIs from a multi-threaded host application. For more information on the AOCL thread-safe host, refer to the following sections: • *Multiple Host Threads* in the *Altera SDK for OpenCL Programming Guide* • *Multi-Threaded Host Application* in the *Altera SDK for OpenCL Best Practices Guide*.
The Emulator now supports the subset of OpenCL pipes support that is implemented for the FPGA hardware.	—
Starting in 15.1, you may specify large pipe and channel depths in your kernels for emulation.	The Emulator and FPGA might differ in the actual implementation of the pipe or channel depth. As a result, you might see different failures between the Emulator and FPGA if the specified depth does not meet the requirements of its application.
The Emulator now supports a kernel that passes pipes and kernels by reference.	For more information, refer to the *Emulating a Kernel that Passes Pipes and Channels by Reference* section in the *Altera SDK for OpenCL Programming Guide*.
The number of FPGA devices you can install in your system and present to your OpenCL host runtime has increased from 16 to 32.	—

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
Starting in 15.1, the **board_env.xml** file of a Custom Platform must include an `mmdlib` XML element.	The `mmdlib` element specifies the path to Custom Platform's MMD library. Refer to *Creating the board_env.xml File* in the *Altera SDK for OpenCL Custom Platform Toolkit User Guide* for more information.
Starting in 15.1, all Custom Platforms must provide a `diagnose` utility that supports three internal calling modes.	For more information on the three internal calling modes, refer to the *Providing AOCL Utilities Support* section in the *Altera SDK for OpenCL Custom Platform Toolkit User Guide*.

Related Information

- **Creating the board_env.xml File**
- **Verifying Host Runtime Functionality (Windows)**
- **Verifying Host Runtime Functionality (Linux)**
- **Providing AOCL Utilities Support**
- **Emulating a Kernel that Passes Pipes or Channels by Reference**
- **Multiple Host Threads**
- **Multi-Threaded Host Application**

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 15.1.

Description	Workaround
When running the AOCL on Windows 8.1, you might encounter an error when you install an unsigned driver.	Disable driver signature enforcement prior to installing the driver. For more information, refer to the **Altera Knowledge Database**.
There is a lower limit for global memory allocation. The runtime allocates 64 kilobytes (kB) of device memory when a context is created. The runtime allocates another 64 kB of device memory if a kernel uses the `printf` function.	Reserve at least 64 kB of device memory for the runtime. Do not allocate this memory to kernels or Custom Platforms.
In the *Altera RTE for OpenCL Getting Started Guide* version 15.0 and prior, the licensing instructions are incorrect.	You do not need a license to run the RTE. The licensing information has been removed from the document.
If multiple, different **.aocx** files in your OpenCL application have the same kernel names in them, the profile data will be wrong for these kernels.	When profiling kernels, do not use the same kernel names across different `.aocx` files.

Description	Workaround
In the **Kernel Execution** tab of the Profiler GUI, adjusting the magnification by zooming in or out might cause subtle changes to the granularity of the time scale.	—

Software Issues Resolved

The following issues were corrected or otherwise resolved in the Altera SDK for OpenCL and the Altera RTE for OpenCL version 15.1.

Description	Workaround
In the AOCL version 14.1, if your Custom Platform included a board that had only one bank of memory, you had to modify the **board_spec.xml** file to prevent the Altera Offline Compiler from generating incorrect hardware for a kernel targeting that board.	Starting in the AOCL version 14.1.1, you no longer need to modify the `interface` element specified for the `global_mem` element in the **board_spec.xml** file of your Custom Platform.
In the AOCL versions 15.0 and prior, the Profiler did not support directory and file names containing spaces.	You can now use the AOCL Profiler to profile kernel that have directories and file names that include spaces.

Document Revision History

Table 1: Altera SDK for OpenCL Version 15.1 Release Notes Document Revision History

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 **$ALTERAOCLSDKROOT/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.