OpenCL™ Runtime 14.2 Release Notes

Installation Guide and Release Notes

13 August 2014

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1   Introduction

OpenCL™ Runtime 14.2 adds OpenCL support to Intel® Xeon® processors and Intel® Xeon Phi™ coprocessors. In addition, it provides CPU only OpenCL support for Intel® Core™ processors without integrated Intel® Graphics or without OpenCL support with Intel® Graphics.

Also use the Intel® SDK for OpenCL™ Applications to optimize development time and maximize platform performance with OpenCL™ and Intel Architecture. See more information at http://intel.com/software/opencl.

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

To learn more about this product's:

- New features, see *What's New* section in the help.

- Documentation, help, and samples, see the OpenCL SDK documentation item in the Intel® Software Documentation Library.

- Technical support, including answers to questions not addressed in the installed product, visit the technical support forum at: https://software.intel.com/en-us/forums/intel-opencl-sdk.

2   What's New

Update 14.2 changes include:

- Added support for offline kernel compilation and kernel binary distribution on Intel® Xeon Phi™ coprocessors. With this release, on both Intel® Xeon Phi™ coprocessor and Intel CPU, the kernel binary is the final executable binary in contrast to the previous release, where the kernel binary on Intel Xeon Phi coprocessor was an intermediate code.

- Improved kernel invocation time on Intel Xeon Phi coprocessor device in case of batching kernel commands into in-order queues

- Optimized compiler vectorizer

- New feature - User logger for API tracing and debugging functional failures in OpenCL applications

- New environment variable CL_CONFIG_CPU_VECTORIZER_MODE

- SPIR is now conformant on Intel Xeon Phi coprocessor

- Bug fixes

Update 14.1 changes include:

- Support for OpenCL Standard Portable Intermediate Representation (SPIR) 1.2 consumption.

- Intel® Manycore Platform Software Stack (Intel® MPSS) 3.2 and 3.2.3 support.

  NOTE: Using OpenCL Runtime 14.1 with MPSS 3.2.1 is not recommended, as this combination introduces stability issues.

- Performance improvements:

  o Faster execution of code dominated by statically diverging dynamically uniform branches

  o More efficient event traversing algorithm

  o NO_DMA mode is default, which improves buffer creation speed (not a preview feature anymore)

  o Improved device side memory pool control

- CPU only: Starting with this release, kernel binary is the very final machine code. This enables creating the kernel binary offline and distributing it with the application machine

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code binary. This also eliminates the compilation time at the end-use product (`clCreateProgramWithBinary`)

- Bug fixed (for Intel® Xeon Phi™ coprocessors only): Compilation crash when a struct is defined globally in the CL file.

- New performance-related environment variables on Intel Xeon Phi –see the user guide for details

    o `CL_CONFIG_MIC_DEVICE_FORCE_BUFFERS_PINNING_ON_HOST`

    o `CL_CONFIG_MIC_DEVICE_2MB_POOL_FINI_SIZE_MB`

    o `CL_CONFIG_MIC_DEVICE_2MB_POOL_INIT_SIZE_MB`

- Added 32-bit version of the runtime for Windows OS.

- Added OpenCL CPU device support on Intel Core™ processors.

3   System Requirements

For an explanation of architecture names, see http://software.intel.com/en-us/articles/intel-architecture-platform-terminology/.

Processor Requirements

The OpenCL Runtime provides only OpenCL CPU device support on the following processors:

- Intel® Core™ Processors

- Intel Xeon Processor E3 Family

- Intel® Celeron® Processor J1000/N2000 Series

- Intel Pentium Processor J2000/N3000 Series

- Intel® Atom™ Processor Family code named Bay Trail

To enable GPU device support on the aforementioned processors, install the Intel Graphics driver.

NOTE: Incompatible or proprietary instructions in non-Intel processors may cause the analysis capabilities of this product to function incorrectly. Any attempt to analyze code not supported by Intel® processors may lead to failures in this product.

Supported Operating Systems

The following is the list of supported operating systems:

Linux* Operating Systems:

- Red Hat Enterprise Linux* OS 6.1 or higher (64-bit version)

- SUSE Linux Enterprise Server* 11.2 or higher (64-bit version)

Windows* Operating Systems (32- and 64-bit):

- Microsoft Windows* 7 SP1

- Microsoft Windows 8

- Microsoft Windows Server 2008 R2

- Microsoft Windows Server 2012

Due to possible Intel® AVX issues with the default glibc 2.11.1 implementation, the product libraries might require glibc-2.12-1.47 or higher. Refer to the OS documentation for more information.

4   Installation Notes

Installation on Microsoft Windows* OS

To install the OpenCL™ Runtime on Windows operating systems, download and install the Runtime package and follow the installer prompts.

To remove the OpenCL Runtime, use the **Control Panel** > **Programs and Features** > **OpenCL™ Runtime** > **Uninstall**.

The uninstaller removes all originally installed files, leaving any temporary or newly created files. To ensure a clean uninstallation, verify that the INTELOCLSDKROOT, INTELOCLSAMPLESROOT, and PATH environment variables are in their preinstall state.

NOTE: For Intel Xeon Phi coprocessor device support, you must install the 3.2 or 3.2.3 version of Intel MPSS available at http://software.intel.com/en-us/articles/intel-manycore-platform-software-stack-mpss-archive

Installation on RedHat* and SUSE* Linux Enterprise* OS

All RPM packages of the OpenCL Runtime are digitally signed.

Verify signature of each RPM package after downloading.

To verify signatures, do the following:

1. Download the public key at http://registrationcenter.intel.com/irc_nas/4181/Intel-E901-172E-EF96-900F-B8E1-4184-D7BE-0E73-F789-186F.pub.

2. Import public key into rpm database by use of the following command:

   ```
   # sudo rpm --import Intel-E901-172E-EF96-900F-B8E1-4184-D7BE-
   0E73-F789-186F.pub
   ```

3. Verify signature of RPM package:

   ```
   # rpm --checksig <rpm name>.rpm
   ```

   where `<rpm name>` is the name of the RPM package.

Expected output for RPM with a valid digital signature is:

```
<rpm name>.rpm: rsa sha1 (md5) pgp md5 OK
```

NOTE: For Intel Xeon Phi coprocessor device support, you must install the 3.2 or 3.2.3 version of Intel MPSS, available at http://software.intel.com/en-us/articles/intel-manycore-platform-software-stack-mpss-archive

Installation Using RPM Package Manager

To install the OpenCL Runtime on Linux* OS, download and unpack the `opencl_runtime_14.2_x64_4.5.0.8.tgz` package, and run the following commands:

On Red Hat Enterprise Linux* OS:

```
# sudo yum install *base*.rpm *intel-cpu*.rpm
```

On SUSE* Linux Enterprise Server OS:

```
# sudo zypper install *base*.rpm *intel-cpu*.rpm
```

To install the CPU and Intel Xeon Phi coprocessor runtime, run following commands:

On Red Hat Enterprise Linux OS:

```
# sudo yum install *base*.rpm *intel-cpu*.rpm *intel-mic*.rpm
```

On SUSE Linux Enterprise Server OS:

```
# sudo zypper install *base*.rpm *intel-cpu*.rpm *intel-mic*.rpm
```

NOTE: If the CPU-only runtime is already installed, the installation of the CPU and the Intel Xeon Phi coprocessor runtime adds the Intel Xeon Phi coprocessor support without removing the CPU runtime.

NOTE: If you encounter a message saying that `libcoi_host.so.0()(64bit)` or `libcoi_host.so.0(COI_1.0)(64bit)` is needed, install the Intel MPSS.

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Installation Using Shell Scripts

To install only the CPU runtime, run the following command:

```
# sudo ./install-cpu.sh
```

To install the CPU and Intel Xeon Phi coprocessor runtime, run the following command:

```
# sudo ./install-cpu+mic.sh
```

NOTE: Installing the CPU and Intel Xeon Phi coprocessor runtime using scripts without prior to uninstallation of the CPU-only runtime is not supported.

Uninstalling from RedHat* and SUSE Linux Enterprise* OS

To uninstall the product using the uninstallation script, do the following:

1. Go to the folder to which you extracted the TGZ archive content.

2. Run the uninstall.sh script.

You can use the OS-specific command to remove all the packages, starting with "`opencl-1.2-`". To do so, run the following commands:

For Red Hat Enterprise Linux OS:

```
# sudo yum remove "opencl-1.2-*"
```

For SUSE Linux Enterprise OS:

```
# sudo zypper remove "opencl-1.2-*"
```

5   Installation and Configuration Issues

OpenCL™ Runtime package installer adds the target installation folder of the CPU runtime to the end of the system `PATH` environment variable. If the variable is too long, the application might not be able to load the CPU runtime DLL files. To solve the problem, move the folders to the beginning of the `PATH` variable or delete unnecessary folders from the `PATH`.

6   Known Issues on Intel Xeon Phi Coprocessors

- Device transfer from and to non-64B aligned host ptr, results in low throughput.

- `clEnqueueCopyBuffer` is suboptimal in case the source and the target buffers are already located on the same Intel Xeon Phi coprocessor device. In this case, doing the same with an optimized kernel might provide performance improvements.

- `clEnqueueCopyBufferRec` is suboptimal on Intel Xeon Phi coprocessor in the cases, with small buffer regions, higher and narrow regions (many rows and few columns). In these cases, you may like to copy the entire source buffer or write your own optimized kernel for this operation.

- JIT (kernel) profiling works with MPSS 3.2\3.2.3 and with update 16 and later versions of Intel VTune Amplifier XE 2013.

- Intel VTune Amplifier XE 2013 source-view: Function call stack might contain more call instances than expected, for example: a function was only called once but it appears as if it was called more than once. To mitigate this issue, use the "Source Function Stack" grouping in the top-down view.

- No support for OpenCL images object type.

- No support for sub devices (also known as device fission).

- 2MB page size support – OpenCL runtime allocates buffers on 2MB pages heap automatically, whenever the allocated size is greater than one KB. You can modify this threshold be setting the following environment variable with your preference number of KBs: `CL_CONFIG_MIC_DEVICE_2MB_BUF_MINSIZE_KB`. Setting this variable to zero, disables 2MB page allocation.

- `clEnqueueFillBuffer` crashes on device side when used in out-of-order queue.

- Using OpenCL event profiling with Intel Xeon Phi coprocessor may slow down and even create high volatility for OpenCL command execution. This happens when creating command queues for Intel Xeon Phi devices with the `CL_QUEUE_PROFILING_ENABLE` property and sending commands with attached events to these queues. The slowdown and volatility may happen due to extra overhead of calculating and sending profiling data over PCI for the START and END states of these commands. Overhead is large especially for short commands like NDRange with short global range.

  As an alternative and if possible, measure the duration of asynchronous OpenCL commands with host timers e.g., start a timer before the enqueue command and stop it immediately after waiting for this command to complete using `clFinish()` or `clWaitforEvents()`.

  Overall, use event profiling with Intel Xeon Phi devices only for debugging and analysis.

NOTE: Intel Xeon Phi coprocessor support is available with 64-bit version of the runtime. 32-bit package includes CPU runtime only.

7 Known Issues on Intel CPUs

- OpenCL Runtime requires Intel® Threading Building Blocks (Intel® TBB) version 4.2.5, which is included in the OpenCL Runtime package installation folder. Make sure there is no Intel® TBB version conflict in your system upon runtime installation.

- When an OpenCL application is invoked, the **OpenCL** path should be the first path in LD_LIBRARY_PATH.

  For example:

  CSH

  ```
  setenv LD_LIBRARY_PATH ${OCL_INSTALL_DIR}\bin:${LD_LIBRARY_PATH}
  ```

  BASH

  ```
  export LD_LIBRARY_PATH=${OCL_INSTALL_DIR}\bin:${LD_LIBRARY_PATH}
  ```

- Device fission extension is not supported. Only device fission core feature is supported.

- Known issues with Intel® VTune™ Amplifier XE 2013 source-view support:

  o Source-level profiling does not work properly when functions are included (using #include) from other files.

  o Note that due to function inlining, the profiling data is aggregated into the top-level kernel.

  o Source information for code built with "-g" does not appear on kernels, only on user functions.

- The current TBB version used with OpenCL/CPU is 4.2.5 (4.2 update 5).
  o Any standalone TBB package loaded by the OpenCL host-code should be of higher version that the OpenCL/TBB version.

  o The standalone TBB package must use the default TBB configuration, which is also used by the OpenCL runtime.

  o Make sure you use and load the right TBB libraries. For example, if you plan to use new features on a standalone TBB version higher than OpenCL, ensure that the corresponding standalone TBB libraries are correctly loaded (LD_LIBRARY_PATH in Linux or PATH in Windows is correct).

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