OpenCL™ Driver for Intel® HD, Iris™, and Iris™ Pro Graphics for Linux -- Release Notes

Version Information

This document covers the Intel® OpenCL Linux graphics device driver version r3.1-BUILD_ID, hereafter referred to as the intel-opencl-r3.1 driver, where BUILD_ID refers to the build ID of the distributed files.

Overview

The intel-opencl-r3.1 driver for Linux exposes the general-purpose parallel compute capabilities of Intel® graphics for OpenCL applications.

This release provides OpenCL 2.0 support for 5th, 6th and 7th generations of Intel® Core™ and Xeon™ processors with Intel® Processor Graphics Technology not previously disabled by the BIOS or motherboard settings, OpenCL 1.2 support for Intel Pentium J4000 and Intel Celeron J3000 and the following extensions:

- cl_intel_accelerator
- cl_intel_advanced_motion_estimation (version 2; see notes below)
- cl_intel_driver_diagnostics
- cl_intel_device_side_avc_motion_estimation (preliminary support for early evaluation; see notes below)
- cl_intel_motion_estimation
- cl_intel_packed_yuv
- cl_intel_required_subgroup_size
- cl_intel_subgroups
- cl_intel_subgroups_short
- cl_intel_va_api_media_sharing
- cl_khr_3d_image_writes
- cl_khr_byte_addressable_store
- cl_khr_depth_images
- cl_khr_fp16 (5th generation Intel® Core™ processors and above)
- cl_khr_fp64 (5th generation Intel® Core™ processors and above)
- cl_khr_global_int32_base_atomics
- cl_khr_global_int32_extended_atomics
- cl_khr_icd
- cl_khr_image2d_from_buffer (5th generation Intel® Core™ processors and above)
- cl_khr_local_int32_base_atomics
- cl_khr_local_int32_extended_atomics
- cl_khr_mipmap_image_writes
- cl_khr_mipmap_image
- cl_khr_spir
- cl_khr_subgroups (6th generation Intel® Core™ processors and above)

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System Requirements

The intel-opencl-r3.1 driver requires

- Intel® 5th, 6th or 7th generation Core™ processor
- Intel Pentium J4000 and Intel Celeron J3000
- Intel® Xeon® v4, or Intel® Xeon® v5 Processors with Intel® Graphics Technology enabled by the BIOS or motherboard settings.

See the intel-opencl-r3.1 driver installation document for more information to verify if the system meets the necessary requirements.

Changes Since intel-opencl-r3.0 Standalone Release

The intel-opencl-r3.1 driver includes the following new features introduced since the standalone intel-opencl-r3.0 release:

- Fixed low level page tables linux kernel bug
- New drivers signing certificate
- Added kernel patches to improve GPU frequency ramp for OpenCL workloads

Changes Since intel-opencl-r2.0 Standalone Release

The intel-opencl-r3.1 driver includes the following new features introduced since the standalone intel-opencl-r2.0 release:

- OpenCL 2.0 support for 7th generation Intel® Core™ processors
- OpenCL 1.2 support for Intel Pentium J4000 and Intel Celeron J3000
- Patches to the Linux 4.7 kernel are provided for generic Linux support. Previous patches for the Linux 4.4 kernel are deprecated.
- 4th generation Intel® Core™ processors are not formally supported in this release
- cl_intel_driver_diagnostics extension allows the driver to pass additional strings containing diagnostic information. The diagnostic messages can help to understand how the driver works and can provide guidance to modify an application to improve performance.
- cl_intel_subgroups_short extension that allows programmers to improve the performance of applications operating on 16-bit data types by extending the subgroup functions described in the cl_intel_subgroups extension to support 16-bit integer data types (shorts and ushorts).

This release provides preliminary support for the following capabilities:

- preliminary support for Intel device-side VME (video motion estimation) extension when the OpenCL build compile-time option "-D cl_intel_device_side_avc_vme_enable" is specified. It provides a set of built-in functions callable from OpenCL kernels that implement AVC motion estimation operations at a macroblock level. These can be used to implement the pre-ENC and ENC stages of an AVC encode pipeline using Intel GPUs (they can be used for HEVC as well with trade-offs in quality). It provides much more functionality and better performance than the released host-side extensions. The API specification, programming guide, and sample applications will be provided on request.

Changes Since 16.5 Release Included with Intel® Media Server Studio 2017

In addition to the changes since the standalone intel-opencl-r2.0 release, the intel-opencl-r3.1 driver includes the following new features introduced since the 16.5 release:
- Support for 7th generation Intel® Core™ processors
- OpenCL 1.2 support for Intel Pentium J4000 and Intel Celeron J3000
- cl_intel_driver_diagnostics extension
- cl_intel_subgroups_short extension
- This release does not support MSS 2017 media release
- Patches to the Linux 4.7 kernel are provided for generic Linux support. Previous patches for the Linux 4.4 kernel are deprecated. PLEASE NOTE: installation of this package where a “Gold” installation of Intel® Media Server Studio is used will disable the MSS media capabilities.

Supported Configurations

Intel validates the intel-opencl-r3.1 driver on CentOS 7.2 when running the following 64-bit kernels:

- Linux 4.7 kernel patched for OpenCL 2.0

Although Intel validates and provides technical support only for the above Linux kernels on CentOS 7.2, other distribution installations may be performed by utilizing our generic operating system (OS) installation steps.

The CPU OpenCL solution is also packaged with the intel-opencl-r3.1 driver. The combined GPU/CPU platform has been validated with this release.

Package Contents

The following files are included with the intel-opencl-r3.1 driver distribution:

- intel-opencl-r3.1-BUILD_ID-* (.rpm and .tar.xz)
  - the OpenCL 2.0 ICD loader, the OpenCL 2.0 ICD for Intel® HD, Iris, and Iris Pro graphics, and the Intel® OpenCL 2.0 driver and runtime for Intel® processor graphics
  - Kernel mode driver patches based against specific distributions or reference kernels
- intel-opencl-devel-r3.1-BUILD_ID-* (.rpm and .tar.xz)
  - Optional OpenCL 2.0 development files for compiling OpenCL applications
- intel-opencl-cpu-r3.1-BUILD_ID-* (.rpm and .tar.xz)
  - Intel® OpenCL 2.0 runtime for Intel® processor

Known Limitations

- For workloads that take longer than 1.5 seconds the i915 hang check will reset the GPU, output a kernel message for logging, and clear any pending work items. When necessary, the i915 hang check can be disabled on demand with

  $ sudo bash -c 'echo N > /sys/module/i915/parameters/enable_hangcheck'

  Although the GPU will no longer reset when executing with hang checks disabled, sufficiently large workloads may stall other GPU tasks such as screen updates. These situations can be recovered from by manually resetting the GPU with

  $ sudo bash -c 'echo 1 > /sys/kernel/debug/dri/0/i915_wedged'

- The trade-off between GPU busy (GPU being fed) vs. latency is that the driver might internally choose to submit or flush after \( n \) commands being queued and this is an expected behavior. Currently the driver is forced to flush after \( n=8 \) commands are queued.
The 4.7 Linux kernel has preliminary hardware support for Intel Pentium J4000 and Intel Celeron J3000 processors. To enable the OpenCL functionality for those platforms you need to add the parameter to the kernel command line:

```
1915.preliminary_hw_support=1
```

**Known Issues**

- Vtune support is not available for 7th generation Intel® Core™ processors – will be added in next release.

**Feedback and Support**

This user-mode driver and kernel patch set are focused on OpenCL compute use cases. Unless otherwise specified, interoperability with other drivers, operating systems, or platform features is not verified nor supported. We welcome feedback to continue to make this product better. Please direct your feedback, including future feature requests, through your primary Intel product support channels.

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