

AMD Confidential



ROCm (DRAFT)

Release Notes v2.10

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Advanced Micro Devices 

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As of Jun 19, 2019, Radeon Instinct™ MI50 and MI60 “Vega 7nm” technology-based accelerators support PCIe® Gen 4.0* providing up to 64 GB/s peak theoretical transport data bandwidth from CPL to GPU per card. Previous Gen Radeon Instinct compute GPU cards are based on PCIe Gen 3.0 providing up to 32 GB/s peak theoretical transport rate bandwidth performance. Peak theoretical transport rate performance is calculated by Baud Rate * width in bytes * # directions = GB/s per card. PCIe Gen3: $8 * 2 * 2 = 32$ GB/s. PCIe Gen4: $16 * 2 * 2 = 64$ GB/s. Radeon Instinct™ MI50 and MI60 “Vega 7nm” technology-based accelerators include dual Infinity Fabric™ Links providing up to 184 GB/s peak theoretical GPU to GPU or Peer-to-Peer (P2P) transport rate bandwidth performance per GPU card. Combined with PCIe Gen 4 compatibility providing an aggregate GPU card I/O peak bandwidth of up to 248 GB/s. Performance guidelines are estimated only and may vary. Previous Gen Radeon Instinct compute GPU cards provide up to 32 GB/s peak PCIe Gen 3.0 bandwidth performance. Infinity Fabric Link technology peak theoretical transport rate performance is calculated by Baud Rate * width in bytes * # directions * # links = GB/s per card. Infinity Fabric Link: $23 * 2 * 2 = 92$ GB/s. MI50 | MI60 each have two links: $92 \text{ GB/s} * 2 \text{ links per GPU} = 184 \text{ GB/s}$. Refer to server manufacture PCIe Gen 4.0 compatibility and performance guidelines for potential peak performance of the specified server model numbers. Server manufacturers may vary configuration offerings yielding different results. <https://pcisig.com/>, <https://www.chipestimate.com/PCI-Express-Gen-4-a-Big-Pipe-for-Big-Data/Cadence/Technical-Article/2014/04/15>, <https://www.tomshardware.com/news/pcie-4.0-power-speed-express,32525.html> AMD has not independently tested or verified external/third party results/data and bears no responsibility for any errors or omissions therein. R14-18

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1.0 Rev. 1.0 November 2019

Revision History

Date	Revision	Description
October 2019	1.0	Initial preliminary release
November 2019	2.0	Revision for new features

Chapter 1 Introduction

This document describes the new features, fixed issues, information about downloading and installing the ROCm software.

It also covers known issues and deprecated features in the ROCm v2.10 release.

1.1 What Is ROCm?

ROCm is a universal platform for GPU-accelerated computing. This modular design allows any hardware vendor to build drivers that support the ROCm framework. ROCm also integrates multiple programming languages and makes it easy to add support for other languages.

1.1.1 Getting the ROCm Software

ROCm is built from open source software. You can download the source code, modify and rebuild the ROCm components. To ensure you are downloading the correct version, the ROCm repository consists of a repo manifest file called *default.xml*. You can use the *default.xml* file to download the source code for ROCm.

Note: You can clone the source code for ROCm components from the GitHub repositories.

Installing Repositories

The Google repo tool allows you to manage multiple Git repositories simultaneously. Execute the following example commands to install the repositories:

```
mkdir -p ~/bin/  
  
curl https://storage.googleapis.com/git-repo-downloads/repo > ~/bin/repo  
  
chmod a+x ~/bin/repo
```

Note: The *~/bin/* directory is an example. You can choose a different folder to install the repositories.

Downloading the ROCm source code

The following example shows how to download the ROCm source code. Note, if you choose a different directory than *~/bin/* to install the repo, you must use that directory to download the ROCm source code.

```
mkdir -p ~/ROCM/  
  
cd ~/ROCM/
```

```
~/bin/repo init -u https://github.com/RadeonOpenCompute/ROCm.git -b roc-2.9.0
repo sync
```

Note: Using the above example will result in downloading the open source code associated with the ROCm release in its entirety. It is important to ensure that you have the *ssh* keys configured on your machine for your GitHub ID.

Building the ROCm Source Code

Each ROCm component repository contains directions for building the component. You must access the desired repository for specific instructions on how to build it.

1.1.2 ROCm Components

The latest supported version of the drivers, tools, libraries, and source code for the ROCm platform are released and available at the following location:

https://rocm-documentation.readthedocs.io/en/latest/Installation_Guide/Installation-Guide.html

[Roopa] Can the link be separated and made independent from the Installation Guide?

1.1.3 Supported Operating Systems

The ROCm v2.10.x platform supports the following operating systems:

- SLES 15 SP1
- Ubuntu 16.04.6(Kernel 4.15) and 18.04.3(Kernel 5.0)
- CentOS 7.6 (Using devtoolset-7 runtime support)
- RHEL 7.6 (Using devtoolset-7 runtime support)

For details about deploying the ROCm v2.10.x on these operating systems, see the [Deploying ROCm](#) section later in the document.

Chapter 2 What's New in Version 2.10

2.1 New Features

2.1.1 rocBLAS - Support for Complex GEMM in Vega20

The rocBLAS library is a fast gpu-accelerated implementation of the standard Basic Linear Algebra Subroutines (BLAS). rocBLAS enables you to develop algorithms, including high performance computing, image analysis, and machine learning.

In the AMD ROCm release v2.10, support is extended to the General Matrix Multiply (GEMM) routine for multiple small matrices processed simultaneously for rocBLAS in Vega20. Both single and double precision, CGEMM and ZGEMM, are now supported in rocBLAS.

2.1.2 Support for SLES 15 SP1

In the AMD ROCm v2.10 release, support is added for SUSE Linux Enterprise Server (SLES) 15 SP1. SLES is a modular operating system for both multimodal and traditional IT.

Note: The SUSE Linux Enterprise Server is a licensed platform. Ensure you have registered and have a license key prior to installation. Use the following SUSE command line to apply your license:

```
SUSEConnect -r < Key>
```

2.1.2.1 SLES 15 SP1

The following section tells you how to perform a clean install and uninstall of SLES 15 SP 1.

Note: A clean install overwrites all other content on the hard disk. Unlike a typical operating system upgrade, a clean install removes the current operating system and user files during the installation process.

Run the following commands once for a fresh install on an operating system:

```
sudo usermod -a -G video $LOGNAME  
sudo usermod -a -G sudo $LOGNAME  
sudo reboot
```


Installation

1. Install the "dkms" package.

```
sudo SUSEConnect --product PackageHub/15.1/x86_64
sudo zypper install dkms
```

2. Add the ROCm repo.

```
sudo zypper addrepo --no-gpgcheck
http://compute-artifactory/artifactory/list/rocm-osdb-sles/compute-rocm-
dkms-no-npi-971/ rocm
sudo zypper ref #To refresh repos
sudo zypper install --oldpackage --force kernel-default-devel-$(uname -r)
#Add the value from "uname -r" in the above command. For example, 4.12.14-
197.15
sudo zypper install rocm-dkms
sudo reboot
#Run the following command once
cat <<EOF | sudo tee /etc/modprobe.d/10-unsupported-modules.conf
allow_unsupported_modules 1
EOF
sudo modprobe amdgpu
```

3. Verify the ROCm installation.

Run `/opt/rocm/bin/rocminfo` and `/opt/rocm/ocl/bin/x86_64/clinfo` commands to list the GPUs and verify that ROCm installation is successful.

Commented [MR1]: Review this with Aakash

Commented [MR2]: This is an internal repo. Get the external version from Aakash.

Uninstallation

```
sudo zypper remove rock-dkms rocm-openssl hsa* hip* rocm-smi comgr rocm-  
device-libs rocm-cmake
```

#and any other package/component installed must be removed

Note: Ensure all the content in the `/opt/rocm` directory is completely removed.

For installation and uninstallation on deploying ROCm on other operating systems, see [Deploying ROCm](#).

Chapter 3 Fixed Issues

3.1 Running TensorFlow and PyTorch Frameworks Consecutively Results in Memory Access Fault Error

Issue: Running the TensorFlow and PyTorch in quick succession results in a Memory access Fault error.

Resolution: This issue is resolved, and the error no longer appears.

<http://ontrack-internal.amd.com/browse/SWDEV-201252>

2.10 SWDEV-201252

Description in the release notes.

Chapter 4 Known Limitations

4.1 Known Issues

4.2 Deprecated Features

The following features are deprecated in the AMD ROCm v2.10 release.

4.2.1 Depreciated Repository

4.2.1.1 Peer-to-Peer bridge driver for PeerDirect

The Peer-to-Peer bridge driver for the PeerDirect feature still works in the current release, however, it is now included as part of the ROCm Kernel Driver. ROCmRDMA allows third-party kernel drivers to utilize DMA access to the GPU memory. It allows a direct path for data exchange (peer-to-peer) using the standard features of PCI Express.

Currently, ROCmRDMA provides the following benefits:

- Direct access to ROCm memory for 3rd party PCIe devices
- Support for PeerDirect(c) interface to offloads the CPU when dealing with ROCm memory for RDMA network stacks

Chapter 5 Getting ROCm Software

What sections do we document here?

ROCm is a collection of software comprising of drivers, runtimes, libraries, and developer tools. In AMD's package distributions, these software projects are provided as separate packages. This allows users to customize installations.

Note: By default, the software package installs AMD ROCm software in the `/opt/rocm/` directory.

Currently, AMD hosts the Debian and RPM Package Manager (RPM) repositories for the ROCm 2.10.x packages. The packages in the Debian repository are signed to ensure package integrity.

5.1 ROCm Binary Package Structure

ROCm Core Components	ROCm Support Software	ROCm Development Tools	ROCm Libraries
rock-dkms	rocm-smi	hcc	rocblas
ROCK Kernel Driver	ROCm SMI	HCC compiler	rocBLAS
hsa-rocr-dev, hsa-ext-rocr-dev	rocm-cmake	hip_base, hip_doc, hip_hcc, hip_samples	hipblas
ROCm Runtime	ROCm cmake	HIP	hipBLAS

hsakmt-roct, hsakmt-roct-dev ROCr Thunk Interface	rocminfo rocminfo	rocm-device-libs ROCm Device Libraries	rocfft rocFFT
	rocm_bandwidth_test ROCm Bandwidth Test	rocm-ocl, rocm-ocl-devel (on RHEL/CentOS), rocm-ocl-dev (on Ubuntu) ROCm OpenCL	rocrand rocRAND
		rocm-clang-ocl ROCm Clang-OCL Kernel Compiler	rocspase rocSPARSE
		atmi Asynchronous Task and Memory Interface (ATMI)	hipspase hipSPARSE
		rocr_debug_agent ROCr Debug Agent	rocalution rocALUTION
		comgr ROCm Code Object Manager	miopengemm MIOpenGEMM
		rocprofiler-dev ROC Profiler	MIOpen-HIP (for the HIP version), MIOpen-OpenCL (for the OpenCL version) MIOpen
		roctracer-dev ROC Tracer	rocm_smi_lib64 ROCm SMI Lib
		rocm-profiler Radeon Compute Profiler	rccl RCCL

			mivisionx MIVisionX
			rocThrust rocThrust
			hipCUB hipCUB

Will the "installation instructions" area be broken down further for individual Linux distributions like Red Hat / SUSE / Ubuntu / etc? I assume this document will cover at least all the prominent enterprise Linux distribution.

Chapter 6 Deploying ROCm

Currently, AMD hosts both Debian and RPM repositories for the ROCm v2.10x packages. For more information on ROCm installation, see the ROCm Installation Guide at

https://rocm-documentation.readthedocs.io/en/latest/Installation_Guide/Installation-Guide.html

6.1 Ubuntu

This section contains instructions on how to install and uninstall ROCm on supported Debian-based systems such as Ubuntu 16.04.6(Kernel 4.15) and 18.04.3(Kernel 5.0).

Installation

```
sudo rm -rf /var/cache/apt/*

sudo apt-get clean all

sudo sh -c 'echo deb [arch=amd64 trusted=yes]
http://compute-artifactory.amd.com/artifactory/list/rocm-release-archive-deb/
2.10 rel-2 > /etc/apt/sources.list.d/rocm.list'

sudo apt-get update

sudo apt-get -y install rocm-dkms

sudo apt-get -y install rocm-libs miopen-hip miopengemm rocm_bandwidth_test
```

```
sudo reboot
```

Uninstallation

```
sudo apt-get autoremove rocm-libs miopen-hip miopengemm rocm_bandwidth_test ;  
  
#Remove all optional packages first  
  
sudo apt-get autoremove rocm-dkms ;  
  
#Now remove base rocm  
  
#check for /opt/rocm contents
```

Note: You must not see the files once the above-mentioned commands are successfully executed. In case of an unsuccessful uninstallation of the files, run the following command to remove any leftover components:

```
sudo dpkg --purge <component>
```

```
sudo rm -rf /opt/rocm ;  
  
sudo rm -rf /var/cache/apt/*  
  
sudo apt-get clean all  
  
sudo reboot
```

Note: If the recommended method for uninstallation of files and components does not work, run the following command for a clean uninstall:

```
sudo apt-get purge rocm-dkms rock-dkms rocblas hipblas rocfft rocrand  
rocspase hipspase rocalution rocprim miopen-hip miopengemm hsa-amd-  
aqlprofile hsa-ext-rocr-dev hsa-rocr-dev hsakmt-roct hsakmt-roct-dev  
hip_base hip_doc hip_samples hip_hcc rocm-smi rocm-cmake rocm-device-libs  
rocm_bandwidth_test rocminfo comgr rocr_debug_agent rocm-dbgapi mivisionx  
roctracer-dev rocprofiler-dev  
  
sudo reboot
```

6.2 CentOS

This section contains information on how to install and uninstall ROCm on CentOS 7.6 (using devtoolset-7 runtime support).

Installation

```
sudo yum clean all

sudo rm -rf /var/cache/yum

sudo yum install -y epel-release

sudo yum install -y dkms kernel-headers-`uname -r` kernel-devel-`uname -r`

Note: Ensure there is no another repo present under "/etc/yum.repos.d"

sudo yum-config-manager --add-repo http://compute-artifactory.amd.com/artifactory/list/rocm-release-archive-rpm/2.10/rel-2/

sudo yum install --nogpgcheck -y rocm-dkms

sudo yum install --nogpgcheck -y rocm-libs miopen-hip mipengemm
rocm_bandwidth_test

sudo reboot
```

Configuring devtoolset-7 for CentOS

```
sudo yum install -y centos-release-scl

sudo yum install -y devtoolset-7

sudo yum list devtoolset-7\* # To validate

scl enable devtoolset-7 bash # Must be run for every terminal before a build
```

Uninstallation

```
sudo yum autoremove rocm-libs miopen-hip miopengemm rocm_bandwidth_test
#Remove all optional packages first

sudo yum autoremove rocm-dkms #Remove base rocm
```

```
sudo rm -rf /opt/rocm/*          #Remove any residue

sudo rm -rf /var/cache/yum      #Remove cache

sudo yum clean all

sudo rm -rf /etc/yum/repos.d/<*ROCm repo*>

sudo reboot
```

To verify the uninstallation:

```
sudo rpm -evv <packagename> ; #to remove the specific packages

sudo rpm -qa | grep <package name>; #to check if the package is present
```

6.3 RHEL

This section consists of instructions on how to install and uninstall ROCm on RHEL 7.6 (using devtoolset-7 runtime support).

Note, you must register to subscription-manager using the following commands with the root user/super user:

```
subscription-manager register --username amd64 --password opteron

subscription-manager attach --auto (for mapping a default repo based on the
system)

wget https://dl.fedoraproject.org/pub/epel/epel-release-latest-7.noarch.rpm
&& rpm -ivh epel-release-latest-7.noarch.rpm
```

Installation

```
sudo yum clean all

sudo rm -rf /var/cache/yum

sudo yum install -y epel-release

sudo yum install -y dkms kernel-headers-`uname -r` kernel-devel-`uname -r`
```

Note: Ensure there is no other repo present in the `"/etc/yum.repos.d"` directory.

```
sudo yum-config-manager --add-repo http://compute-artifactory.amd.com/artifactory/list/rocm-release-archive-rpm/2.10/rel-2/
```



```
sudo yum install --nogpgcheck -y rocm-dkms

sudo yum install --nogpgcheck -y rocm-libs miopen-hip mipengemm
rocm_bandwidth_test

sudo reboot
```

Configuring devtoolset-7 for RHEL

```
sudo yum install -y centos-release-scl

sudo yum install -y devtoolset-7

sudo yum list devtoolset-7\*    # To validate

scl enable devtoolset-7 bash   # Must be run for every terminal before a build
```

Uninstallation

```
sudo yum autoremove rocm-libs miopen-hip mipengemm rocm_bandwidth_test
#Remove all optional packages first

sudo yum autoremove rocm-dkms    #Remove base rocm

sudo rm -rf /opt/rocm/*          #Remove any residue

sudo rm -rf /var/cache/yum       #Remove cache

sudo yum clean all

sudo rm -rf /etc/yum/repos.d/<*ROCm repo*>

sudo reboot
```

To verify the uninstallation:

```
sudo rpm -evv <packagename>; #to remove specific packages

sudo rpm -qa | grep <package name>; #to check if a package is present
```

Chapter 7 Hardware and Software Support

7.1 Hardware Support

ROCm is focused on using AMD GPUs to accelerate computational tasks such as machine learning, engineering workloads, and scientific computing. In order to focus our development efforts on these domains of interest, ROCm supports the following targeted set of hardware configurations.

7.1.1 Supported Graphics Processing Units

7.1.1.1 GFX8 GPUs

ROCm offers support for three chips from AMD's "gfx8" generation of GPUs.

Note: The GPUs require a host CPU and platform with PCIe 3.0 with support for PCIe atomics.

GFX8 GPUs			
Fiji (AMD)	Polaris 10 (AMD)	Polaris 11 (AMD)	Polaris 12 (Lexa) (AMD)
<ul style="list-style-type: none"> • Radeon R9 Fury • Radeon R9 Nano • Radeon R9 Fury X • Radeon Pro Duo (Fiji) • FirePro S9300 X2 • Radeon Instinct MI8 	<ul style="list-style-type: none"> • Radeon RX 470 • Radeon RX 480 • Radeon RX 570 • Radeon RX 580 • Radeon Pro Duo (Polaris) • Radeon Pro WX 5100 • Radeon Pro WX 7100 • Radeon Instinct MI6 	<ul style="list-style-type: none"> • Radeon RX 460 • Radeon RX 560 • Radeon Pro WX 4100 	<ul style="list-style-type: none"> • Radeon RX 540 • Radeon RX 550 • Radeon Pro WX 2100 • Radeon Pro WX 3100

7.1.1.2 GFX9 GPUs

ROCm offers support for two chips from AMD's most recent "gfx9" generation of GPUs.

GFX9 GPUs	
Vega 10 (AMD)	Vega 7nm (AMD)
<ul style="list-style-type: none"> • Radeon RX Vega 56 • Radeon RX Vega 64 • Radeon Vega Frontier Edition • Radeon Pro WX 8200 • Radeon Pro WX 9100 • Radeon Pro V340 • Radeon Pro V340 MxGPU • Radeon Instinct MI25 <p>Note: ROCm does not support Radeon Pro SSG.</p>	<ul style="list-style-type: none"> • Radeon VII • Radeon Instinct MI50 • Radeon Instinct MI60

[Roopa] Do we need to provide details on the GPUs that are not supported? Isn't this implied when we say which ones are officially supported?

7.1.2 Supported CPUs

[Roopa] How comprehensive does this section need to get? The existing document on GitHub has a lot of content which all of our users need not know unless specifically asked. Do we need all of the information about PCIe in the Hardware section of the installation guide?

In the default ROCm configuration, GFX8 and GFX9 GPUs require PCI Express 3.0 with PCIe atomics. The ROCm platform leverages these advanced capabilities to allow features such as user-level submission of work from the host to the GPU. This includes PCIe atomic Fetch and Add, Compare and Swap, Unconditional Swap, and AtomicOp Completion.

Current CPUs which support PCIe 3.0 + PCIe Atomics:

AMD	INTEL
Ryzen CPUs (Family 17h Model 01h-0Fh – previously code-named Zen such as: <ul style="list-style-type: none"> • Ryzen 3 1300X • Ryzen 3 2300X • Ryzen 5 1600X 	Intel Core i3, i5, and i7 CPUs from Haswell and beyond. This includes: <ul style="list-style-type: none"> • Haswell CPUs such as the Core i7

<ul style="list-style-type: none"> • Ryzen 5 2600X • Ryzen 7 1800X • Ryzen 7 2700X 	<ul style="list-style-type: none"> • 4790K • Broadwell CPUs such as the Core i7 5775C • Skylake CPUs such as the Core i7 6700K • Kaby Lake CPUs such as the Core i7 7740X • Coffee Lake CPUs such as the Core i7 8700K • Xeon CPUs from “v3” and newer • Some models of “Ivy Bridge-E” processors
<p>Ryzen APUs (Family 17h Model 10h-1Fh – previously code-named Raven Ridge) such as:</p> <ul style="list-style-type: none"> • Athlon 200GE • Ryzen 5 2400G <p>Note: The integrated GPU in these devices is not guaranteed to work with ROCm.</p>	
<p>Ryzen Threadripper Workstation CPUs (Family 17h Model 01h-0Fh – previously code-named Zen) such as:</p> <ul style="list-style-type: none"> • Ryzen Threadripper 1950X • Ryzen Threadripper 2990WX 	
<p>EPYC Server CPUs (Family 17h Model 01h-0Fh – previously code-named Zen) such as:</p> <ul style="list-style-type: none"> • Epyc 7551P • Epyc 7601 	

7.2 Software Support

As of AMD ROCm v1.9.0, the ROCm user-level software is compatible with the AMD drivers in certain upstream Linux kernels. You have the following options:

- Use the ROCK kernel driver that is a part of AMD’s ROCm repositories or
- Use the upstream driver and only installing ROCm user-level utilities from AMD’s ROCm repositories.

The releases of the upstream Linux kernel support the following GPUs in ROCm:

- Fiji, Polaris 10, Polaris 11
- Fiji, Polaris 10, Polaris 11, Vega10

- Fiji, Polaris 10, Polaris 11, Vega10, Vega 7nm

7.2.1.1 Supported Products

- CUDA v8