Python

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USER GUIDE

The ROCm™ Data Center Tool simplifies the administration and addresses key infrastructure challenges in AMD GPUs in cluster and datacenter environments. The main features are:

- GPU telemetry
- GPU statistics for jobs
- Integration with third-party tools
- Open source

CHAPTER

ONE

INTRODUCTION TO ROCM DATA CENTER TOOL USER GUIDE

The ROCm™ Data Center Tool™ (RDC) simplifies the administration and addresses key infrastructure challenges in AMD GPUs in cluster and datacenter environments. The main features are:

• GPU telemetry

• GPU statistics for jobs

• Integration with third-party tools

• Open source

You can use the tool in standalone mode if all components are installed. However, the existing management tools can use the same set of features available in a library format.

For details on different modes of operation, refer to *Starting RDC*.

1.1 Objective

This user guide is intended to:

• Provide an overview of the RDC tool features.

• Describe how system administrators and Data Center (or HPC) users can administer and configure AMD GPUs.

• Describe the components.

• Provide an overview of the open source developer handbook.

1.2 Terminology

Table 1: Terminologies and Abbreviations

Term	Description
RDC	ROCm Data Center tool
Compute node (CN)	One of many nodes containing one or more GPUs in the Data Center on which compute jobs are run
Management node (MN) or Main console	A machine running system administration applications to administer and manage the Data Center
GPU Groups	Logical grouping of one or more GPUs in a compute node
Fields	A metric that can be monitored by the RDC, such as GPU temperature, memory usage, and power usage
Field Groups	Logical grouping of multiple fields
Job	A workload that is submitted to one or more compute nodes

1.3 Target Audience

The audience for the AMD RDC tool consists of:

• Administrators: The tool provides the cluster administrator with the capability of monitoring, validating, and configuring policies.

• HPC Users: Provides GPU-centric feedback for their workload submissions.

• OEM: Add GPU information to their existing cluster management software.

• Open source Contributors: RDC is open source and accepts contributions from the community.

1.4 Data Center Tool: Installation and Integration

1.4.1 Supported Platforms

The RDC tool is part of the AMD ROCm software and available on the distributions supported by AMD ROCm.

To see the list of supported operating systems, refer to the ROCm installation guide at https://docs.amd.com.

1.4.2 Prerequisites

For RDC installation from prebuilt packages, follow the instructions in this section.

The list of dependencies can be found on the README.md on GitHub.

1.4.3 Install gRPC

To see the instructions for building gRPC and protoc, refer to the README.md on GitHub.

Authentication Keys

The RDC tool can be used with or without authentication. If authentication is required, you must configure proper authentication keys.

For configuring SSL keys, refer to the section on Authentication below.

1.4.4 Prebuilt Packages

The RDC tool is packaged as part of the ROCm software repository. You must install the AMD ROCm software before installing RDC. For details on ROCm installation, see the AMD ROCm Installation Guide.

To install RDC after installing the ROCm package, follow the instructions below.

Ubuntu

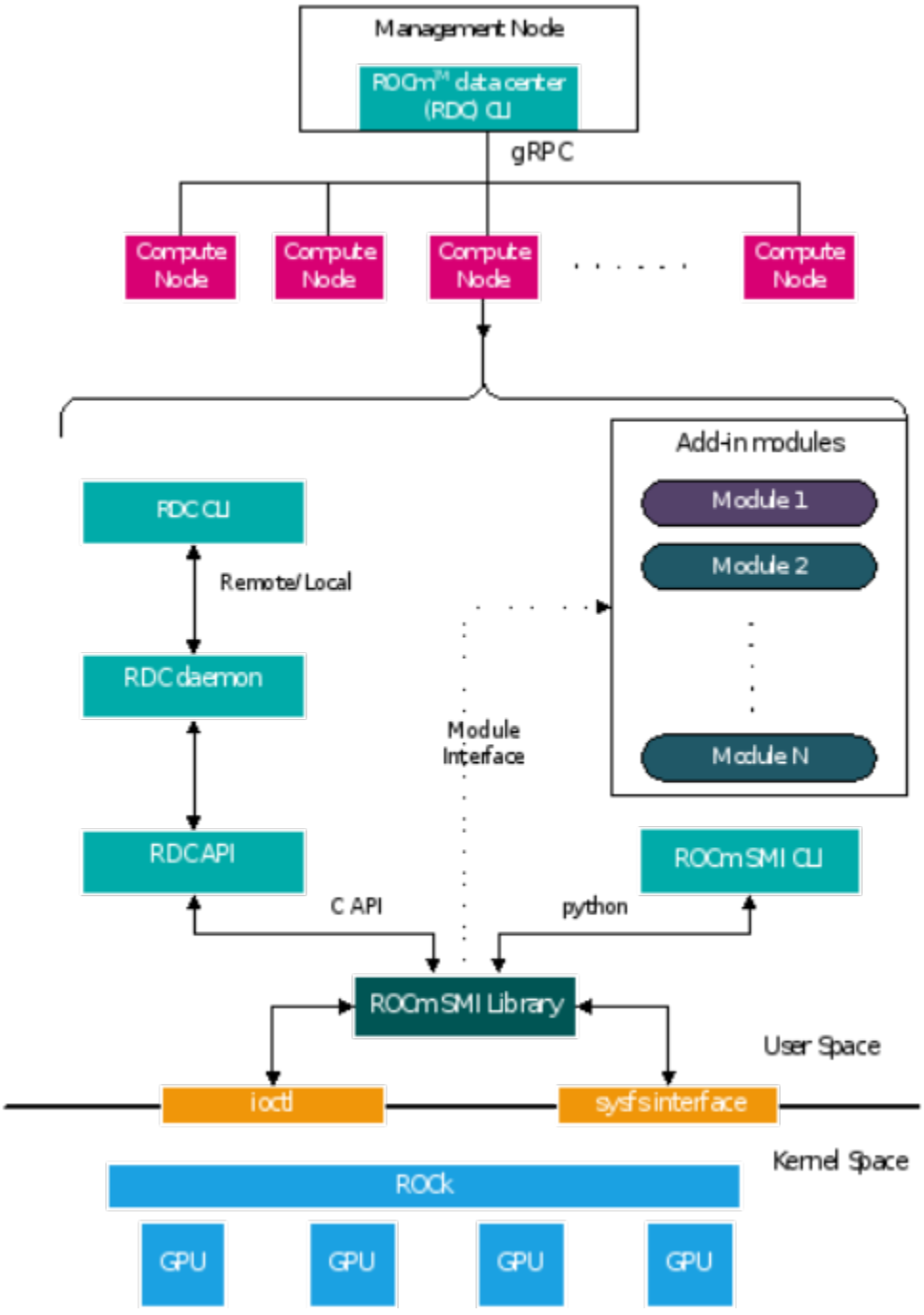
```
$ sudo apt-get install rdc
# to install a specific version
$ sudo apt-get install rdc<x.y.z>
SLES 15 Service Pack 3
$ sudo zypper install rdc
# to install a specific version
$ sudo zypper install rdc<x.y.z>
```

SLES 15 Service Pack 3

```
$ sudo zypper install rdc
# to install a specific version
$ sudo zypper install rdc<x.y.z>
```

1.4.5 Components

The components of RDC tool are as shown below:



High-level diagram of RDC components.

RDC (API) Library

This library is the central piece, which interacts with different modules and provides all the features described. This shared library provides C API and Python bindings so that third-party tools should be able to use it directly if required.

RDC Daemon (rdcd)

The daemon records telemetry information from GPUs. It also provides an interface to RDC command-line tool (rdci) running locally or remotely. It relies on the above RDC Library for all the core features.

RDC Command Line Tool (rdci)

A command-line tool to invoke all the features of the RDC tool. This CLI can be run locally or remotely.

ROCm-SMI Library

A stateless system management library that provides low-level interfaces to access GPU information

1.4.6 Start RDC

The RDC tool can be run in the following two modes. The feature set is similar in both the cases. Users have the flexibility to choose the right option that best fits their environment.

• Standalone mode

• Embedded mode

The capability in each mode depends on the privileges the user has for starting RDC. A normal user has access only to monitor (access to GPU telemetry) capabilities. A privileged user can run the tool with full capability. In the full capability mode, GPU configuration features can be invoked. This may or may not affect all the users and processes sharing the GPU.

Standalone Mode

This is the preferred mode of operation, as it does not have any external dependencies. To start RDC in standalone mode, RDC Server Daemon (rdcd) must run on each compute node. You can start RDC daemon (rdcd) as a systemd service or directly from the command-line.

Start RDC Tool Using systemd

If multiple RDC versions are installed, copy `/opt/rocm-<x.y.z>/rdc/lib/rdc.service`, which is installed with the desired RDC version, to the systemd folder. The capability of RDC can be configured by modifying the rdc.service system configuration file. Use the systemctl command to start rdcd.

```
$ systemctl start rdc
```

By default, rdcd starts with full capability. To change to monitor only, comment out the following two lines:

```
$ sudo vi /lib/systemd/system/rdc.service
# CapabilityBoundingSet=CAP_DAC_OVERRIDE
# AmbientCapabilities=CAP_DAC_OVERRIDE
```

NOTE: rdcd can be started by using the systemctl command.

```
$ systemctl start rdc
```

If the GPU reset fails, restart the server. Note that restarting the server also initiates rdcd. Users may then encounter the following two scenarios:

• rdcd returns the correct GPU information to rdci.

• rdcd returns the “No GPUs found on the system” error to rdci. To resolve this error, restart rdcd with the following instruction:

```
  sudo systemctl restart rdcd
```

Start RDC Tool from Command-line

While systemctl is the preferred way to start rdcd, you can also start directly from the command-line. The installation scripts create a default user - "rdc". Users have the option to edit the profile file (rdc.service installed at /lib/systemd/system) and change these lines accordingly:

```
[Service]
User=rdc
Group=rdc
```

```
#Start as user rdc
$ sudo -u rdc rdcd

# Start as root
$ sudo rdcd
```

From the command-line, start rdcd as a user (for example, rdc) or root.

Note that in this use case, the rdc.service file mentioned in the previous section is not involved. Here, the capability of RDC is determined by the privilege of the user starting rdcd. If rdcd is running under a normal user account, it has the Monitor-only capability. If rdcd is running as root, rdcd has full capability.

NOTE: If a user other than rdc or root starts the rdcd daemon, the file ownership of the SSL keys mentioned in the Authentication section must be modified to allow read and write access.

Troubleshoot rdcd

When rdcd is started using systemctl, the logs can be viewed using the following command:

```
$ journalctl -u rdc
```

These messages provide useful status and debugging information. The logs can also help debug problems like rdcd failing to start, communication issues with a client, and others.

1.4.7 Embedded Mode

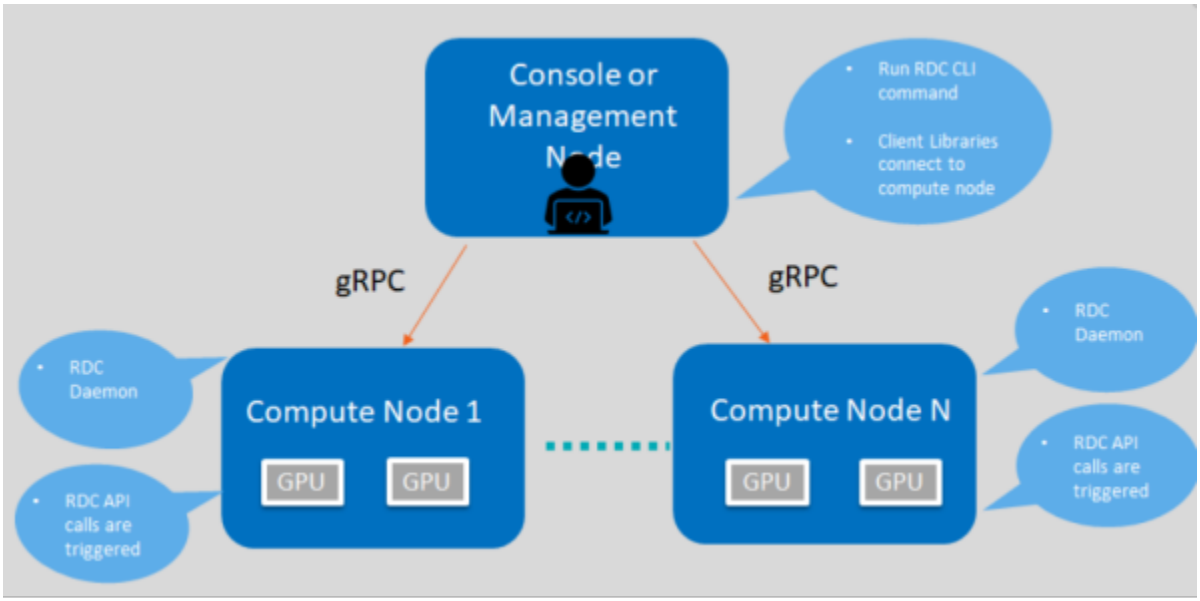
The embedded mode is useful if the end user has a monitoring agent running on the compute node. The monitoring agent can directly use the RDC library and will have a finer-grain control on how and when RDC features are invoked. For example, if the monitoring agent has a facility to synchronize across multiple nodes, it can synchronize GPU telemetry across these nodes.

The RDC daemon rdcd can be used as a reference code for this purpose. The dependency on gRPC is also eliminated if the RDC library is directly used.

CAUTION: RDC command-line rdci will not function in this mode. Third-party monitoring software is responsible for providing the user interface and remote access/monitoring.

1.5 Data Center Tool: Feature Overview

Note that RDC Tool is in active development. This section highlights the current feature set.



RDC components and framework for describing features

1.5.1 Discovery

The Discovery feature enables you to locate and display information of GPUs present in the compute node.

Example:

```
$ rdci discovery <host_name> -l
 2 GPUs found
```

GPU Index	Device Information
0	Name: AMD Radeon Instinct™ MI50 Accelerator
1	Name: AMD Radeon Instinct™ MI50 Accelerator

```
$ rdci -l : list available GPUs
$ rdci -u: No SSL authentication
```

1.5.2 Groups

This section explains the GPU and field groups features.

GPU Groups

With the GPU groups feature, you can create, delete, and list logical groups of GPU.

```
$ rdci group -c GPU_GROUP
Successfully created a group with a group ID 1

$ rdci group -g 1 -a 0,1
Successfully added the GPU 0,1 to group 1

$ rdci group -l

1 group found
```

Group ID	Group Name	GPU Index
1	GPU_GROUP	0, 1

```
$ rdci group -d 1
Successfully removed group 1

-c create; -g group id; -a add GPU index; -l list; -d delete group
```

Field Groups

The Field Groups feature provides you the options to create, delete, and list field groups.

```
$ rdci fieldgroup -c <fgroup> -f 150,155
Successfully created a field group with a group ID 1

$ rdci fieldgroup -l

1 group found
```

Group ID	Group Name	Field Ids
1	Fgroup	150, 155

```
$ rdci fieldgroup -d 1
Successfully removed field group 1

rdci dmon -l
Supported fields Ids:
100 RDC_FI_GPU_CLOCK:  Current GPU clock freq.
150 RDC_FI_GPU_TEMP:  GPU temp. in milli Celsius.
155 RDC_FI_POWER_USAGE:  Power usage in microwatts.
203 RDC_FI_GPU_UTIL:  GPU busy percentage.
525 RDC_FI_GPU_MEMORY_USAGE: VRAM Memory usage in bytes

-c create; -g group id; -a add GPU index; -l list; -d delete group
```

Monitor Errors

You can define RDC_FI_ECC_CORRECT_TOTAL or RDC_FI_ECC_UNCORRECT_TOTAL field to get the RAS Error-Correcting Code (ECC) counter:

• 312 RDC_FI_ECC_CORRECT_TOTAL: Accumulated correctable ECC errors

• 313 RDC_FI_ECC_UNCORRECT_TOTAL: Accumulated uncorrectable ECC errors

1.5.3 Device Monitoring

The RDC Tool enables you to monitor the GPU fields.

```
$ rdci dmon -f <field_group> -g <gpu_group> -c 5 -d 1000


1 group found
```

GPU Index	TEMP (m°C)	POWER (µW)
0	25000	520500

```
rdci dmon -l
Supported fields Ids:
100 RDC_FI_GPU_CLOCK:  Current GPU clock freq.
150 RDC_FI_GPU_TEMP:  GPU temp. in milli Celsius.
155 RDC_FI_POWER_USAGE:  Power usage in microwatts.
203 RDC_FI_GPU_UTIL:  GPU busy percentage.
525 RDC_FI_GPU_MEMORY_USAGE: VRAM Memory usage in bytes

-e field ids; -i GPU index; -c count; -d delay; -l list; -f fieldgroup id
```

1.5.4 Job Stats

You can display GPU statistics for any given workload.

```
$ rdci stats -s 2 -g 1
Successfully started recording job 2 with a group ID 1

$ rdci stats -j 2
```

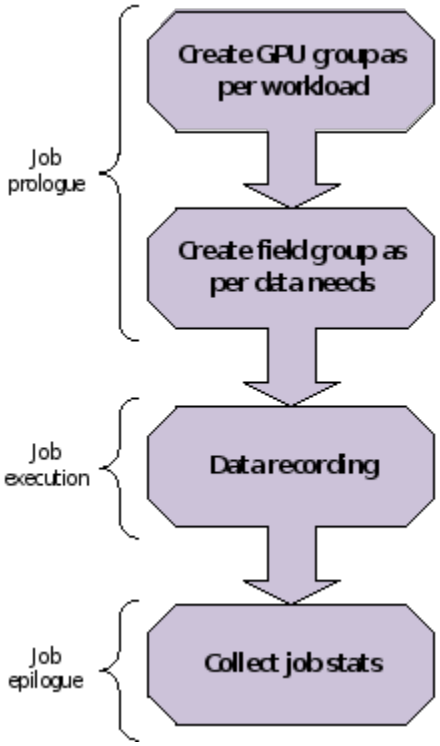
Summary	Executive Status
Start time	1586795401
End time	1586795445
Total execution time	44
————————————	———————————-
Energy Consumed (Joules)	21682
Power Usage (Watts)	Max: 49 Min: 13 Avg: 34
GPU Clock (MHz)	Max: 1000 Min: 300 Avg: 903
GPU Utilization (%)	Max: 69 Min: 0 Avg: 2
Max GPU Memory Used (bytes)	524320768
Memory Utilization (%)	Max: 12 Min: 11 Avg: 12

```
$ rdci stats -x 2
Successfully stopped recording job 2

-s start recording on job id; -g group id; -j display job stats; -x stop recording.
```

1.5.5 Job Stats Use Case

A common use case is to record GPU statistics associated with any job or workload. The following example shows how all these features can be put together for this use case:



An example showing how job statistics can be recorded

rdci commands

```
$ rdci group -c group1

successfully created a group with a group ID 1

$ rdci group -g 1 -a 0,1

GPU 0,1 is added to group 1 successfully.

rdci stats -s 123 -g 1

job 123 recorded successfully with the group ID

rdci stats -x 123
```

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```
job 123 stops recording successfully

rdci stats -j 123

job stats printed
```

1.5.6 Error-Correcting Code Output

In the job output, this feature prints out the Error-Correcting Code (ECC) errors while running the job.

1.5.7 Diagnostic

You can run diagnostic on a GPU group as shown below:

```
$ rdci diag -g <gpu_group>

No compute process:  Pass
Node topology check:  Pass
GPU parameters check:  Pass
Compute Queue ready:  Pass
System memory check:  Pass
 =============== Diagnostic Details ==================
No compute process:  No processes running on any devices.
Node topology check:  No link detected.
GPU parameters check:  GPU 0 Critical Edge temperature in range.
Compute Queue ready:  Run binary search task on GPU 0 Pass.
↪CPUAccessToGPUMemoryTest for GPU 0 Pass. GPUAccessToCPUMemoryTest for GPU 0 Pass.
```

1.6 Data Center Tool: Third-Party Integration

This section lists all the third-party plugins such as Prometheus, Grafana, and Reliability, Availability and Serviceability (RAS) plugin.

1.6.1 Python Bindings

The RDC Tool provides a generic Python class RdcReader to simplify telemetry gathering. RdcReader simplifies usage by providing the following functionalities:

• The user only needs to specify telemetry fields. RdcReader creates the necessary groups and fieldgroups, watch the fields, and fetch the fields.

• The RdcReader can support embedded and standalone mode. The standalone mode can be with or without authentication.

• In standalone mode, the RdcReader can automatically reconnect to rdcd if the connection is lost.

• When rdcd is restarted, the previously created group and fieldgroup may be lost. The RdcReader can re-create them and watch the fields after reconnecting.

• If the client is restarted, RdcReader can detect the groups and fieldgroups created before and avoid re-creating them.

• A custom unit converter can be passed to RdcReader to override the default RDC unit.

See the sample program to monitor the power and GPU utilization using the RdcReader below:

```
from RdcReader import RdcReader
from RdcUtil import RdcUtil
from rdc_bootstrap import *

default_field_ids = [
        rdc_field_t.RDC_FI_POWER_USAGE,
        rdc_field_t.RDC_FI_GPU_UTIL
]

class SimpleRdcReader(RdcReader):
    def __init__(self):
        RdcReader.__init__(self,ip_port=None, field_ids = default_field_ids, update_
↪freq=1000000)
    def handle_field(self, gpu_index, value):
        field_name = self.rdc_util.field_id_string(value.field_id).lower()
        print("%d %d:%s %d" % (value.ts, gpu_index, field_name, value.value.l_int))

if __name__ == '__main__':
    reader = SimpleRdcReader()
while True:
      time.sleep(1)
        reader.process()
```

In the sample program,

• Class SimpleRdcReader is derived from the RdcReader.

• The field “ip_port=None” in RdcReader dictates that the RDC tool runs in the embedded mode.

• SimpleRdcReader::process(), then, fetches fields specified in default_field_ids. RdcReader.py can be found in the python_binding folder located at RDC install path.

To run the example, use:

```
# Ensure that RDC shared libraries are in the library path and
# RdcReader.py is in PYTHONPATH

$ python SimpleReader.py
```

1.6.2 Prometheus Plugin

Prometheus plugin helps to monitor events and send alerts. The Prometheus installation and integration details are given below.

Prometheus Plugin Installation

The RDC tool's Prometheus plugin rdc_prometheus.py can be found in the python_binding folder.

NOTE: Ensure the Prometheus client is installed before the Prometheus plugin installation process.

```
$ pip install prometheus_client
```

To view the options provided with the plugin, use –help.

```
% python rdc_prometheus.py -help
usage: rdc_prometheus.py [-h] [--listen_port LISTEN_PORT] [--rdc_embedded]
  [--rdc_ip_port RDC_IP_PORT] [--rdc_unauth]
  [--rdc_update_freq RDC_UPDATE_FREQ]
  [--rdc_max_keep_age RDC_MAX_KEEP_AGE]
  [--rdc_max_keep_samples RDC_MAX_KEEP_SAMPLES]
  [--rdc_fields RDC_FIELDS [RDC_FIELDS ...]]
  [--rdc_fields_file RDC_FIELDS_FILE]
  [--rdc_gpu_indexes RDC_GPU_INDEXES [RDC_GPU_INDEXES ...]]
  [--enable_plugin_monitoring]

RDC Prometheus plugin.

optional arguments:
  -h, --help  show this help message and exit
  --listen_port LISTEN_PORT
  The listen port of the plugin (default: 5000)
  --rdc_embedded  Run RDC in embedded mode (default: standalone mode)
  --rdc_ip_port RDC_IP_PORT
  The rdcd IP and port in standalone mode (default:
  localhost:50051)
  --rdc_unauth  Set this option if the rdcd is running with unauth in
  standalone mode (default: false)
  --rdc_update_freq RDC_UPDATE_FREQ
  The fields update frequency in seconds (default: 10))
  --rdc_max_keep_age RDC_MAX_KEEP_AGE
  The max keep age of the fields in seconds (default:
  3600)
  --rdc_max_keep_samples RDC_MAX_KEEP_SAMPLES
  The max samples to keep for each field in the cache
  (default: 1000)
  --rdc_fields RDC_FIELDS [RDC_FIELDS ...]
  The list of fields name needs to be watched, for
  example, " --rdc_fields RDC_FI_GPU_TEMP
  RDC_FI_POWER_USAGE " (default: fields in the
  plugin)
  --rdc_fields_file RDC_FIELDS_FILE
  The list of fields name can also be read from a file
  with each field name in a separated line (default:
  None)
  --rdc_gpu_indexes RDC_GPU_INDEXES [RDC_GPU_INDEXES ...]
  The list of GPUs to be watched (default: All GPUs)
  --enable_plugin_monitoring
  Set this option to collect process metrics of
```

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```
  the plugin itself (default: false)
```

By default, the plugin runs in the standalone mode and connects to rdcd at localhost:50051 to fetch fields. The plugin should use the same authentication mode as rdcd, e.g., if rdcd is running with -u/–unauth flag, the plugin should use –rdc_unauth flag. You can use the plugin in the embedded mode without rdcd by setting –rdc_embedded flag.

To override the default fields that are monitored, you can use the –rdc_fields option to specify the list of fields. If the fields list is long, the –rdc_fields_file option provides a convenient way to fetch fields list from a file. You can use the max_keep_age and max_keep_samples to control how the fields are cached.

The plugin can provide the metrics of the plugin itself, including the plugin process CPU, memory, file descriptor usage, and native threads count, including the process start and up times. You can enable this using –enable_plugin_monitoring.

You can test the plugin with the default settings.

```
# Ensure that rdcd is running on the same machine
$ python rdc_prometheus.py

# Check the plugin using curl
$ curl localhost:5000
# HELP gpu_util gpu_util
# TYPE gpu_util gauge
gpu_util{gpu_index="0"} 0.0
# HELP gpu_clock gpu_clock
# TYPE gpu_clock gauge
gpu_clock{gpu_index="0"} 300.0
# HELP gpu_memory_total gpu_memory_total
# TYPE gpu_memory_total gauge
gpu_memory_total{gpu_index="0"} 4294.0
# HELP gpu_temp gpu_temp
# TYPE gpu_temp gauge
# HELP power_usage power_usage
# TYPE power_usage gauge
power_usage{gpu_index="0"} 9.0
# HELP gpu_memory_usage gpu_memory_usage
# TYPE gpu_memory_usage gauge
gpu_memory_usage{gpu_index="0"} 134.0
```

1.6.3 Prometheus Integration

Follow these steps:

1. Download and install Prometheus in the management machine.
2. Use the example configuration file rdc_prometheus_example.yml in the python_binding folder. You can use this file in its original state. However, note that this file refers to prometheus_targets.json. Ensure that this is modified to point to the correct compute nodes.

```
// Sample file: prometheus_targets.json
// Replace rdc_test*.amd.com to point the correct compute nodes
// Add as many compute nodes as necessary
[
```

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```
  {
  "targets": [
  "rdc_test1.amd.com:5000",
  "rdc_test2.amd.com:5000"
  ]
  }
]
```

NOTE: In the above example, there are two compute nodes, rdc_test1.adm.com and rdc_test2.adm.com. Ensure that the Prometheus plugin is running on those compute nodes.

3. Start the Prometheus plugin.

```
% prometheus --config.file=<full path of the rdc_prometheus_example.yml>
```

4. From the management node, using a browser, open the URL http://localhost:9090.
5. Select one of the available metrics.

Example: gpu_clock

The Prometheus image showing the GPU clock for both rdc_test1 and rdc_test2.

1.6.4 Grafana Plugin

Grafana is a common monitoring stack used for storing and visualizing time series data. Prometheus acts as the storage backend, and Grafana is used as the interface for analysis and visualization. Grafana has a plethora of visualization options and can be integrated with Prometheus for the RDC tool's dashboard.

Grafana Plugin Installation

To install Grafana plugin, follow these steps:

1. [Download Grafana](https://grafana.com/grafana/download)
2. Read the [installation instructions](https://grafana.com/docs/grafana/latest/setup-grafana/installation/debian/) to install Grafana
3. To start Grafana, follow these instructions:

```
sudo systemctl start grafana-server
sudo systemctl status grafana-server
```

4. Browse to http://localhost:3000/.
5. Log in using the default username and password (admin/admin) as shown in the image below:

Grafana Integration

As a prerequisite, ensure:

• The RDC Prometheus plugin is running in each compute node.

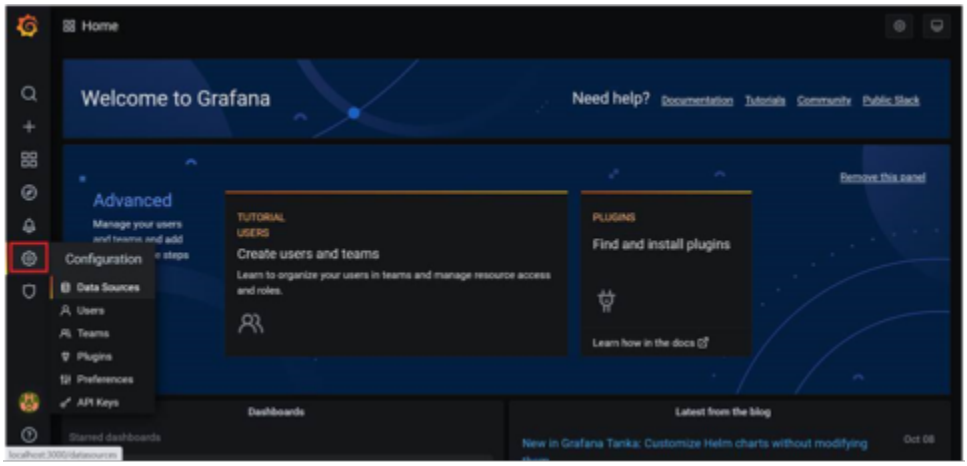
• Prometheus is set up to collect metrics from the plugin.

For more information about installing and configuring Prometheus, see the section on Prometheus Plugin.

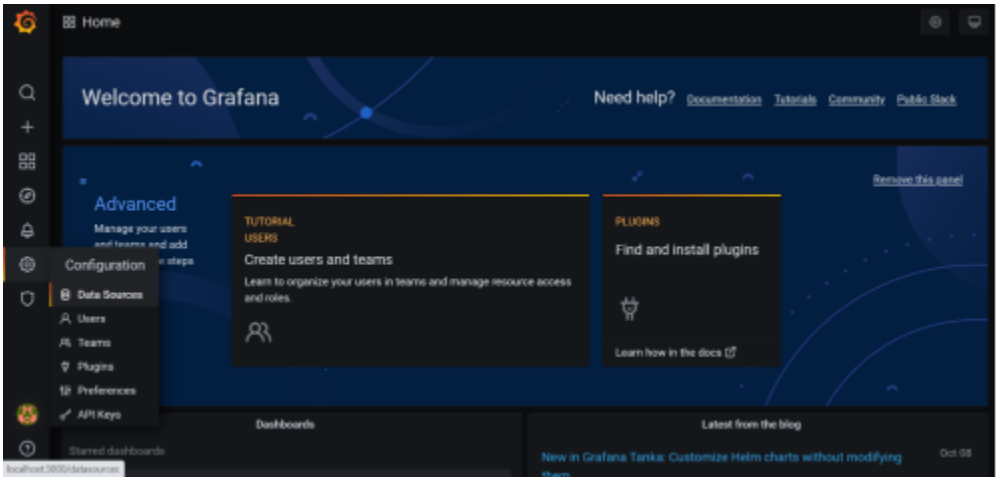
Grafana Configuration

Follow these steps:

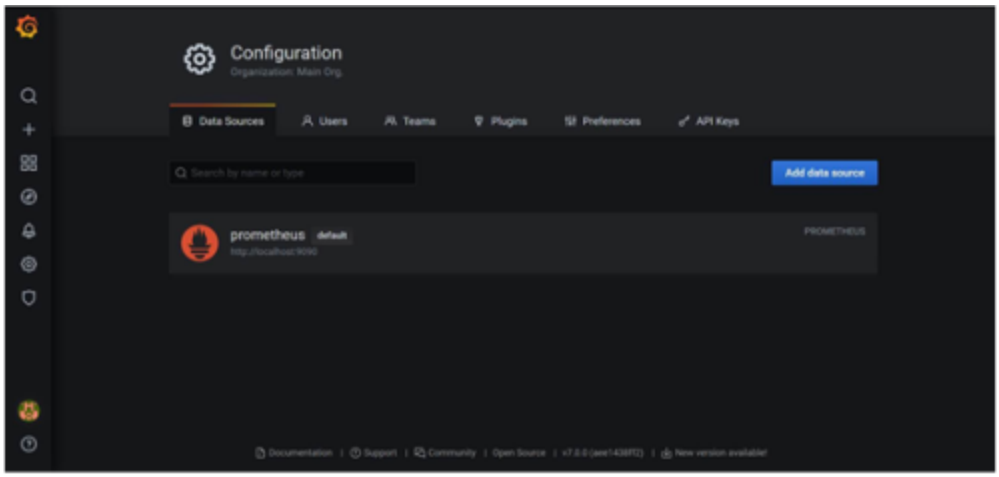
1. Click Configuration.



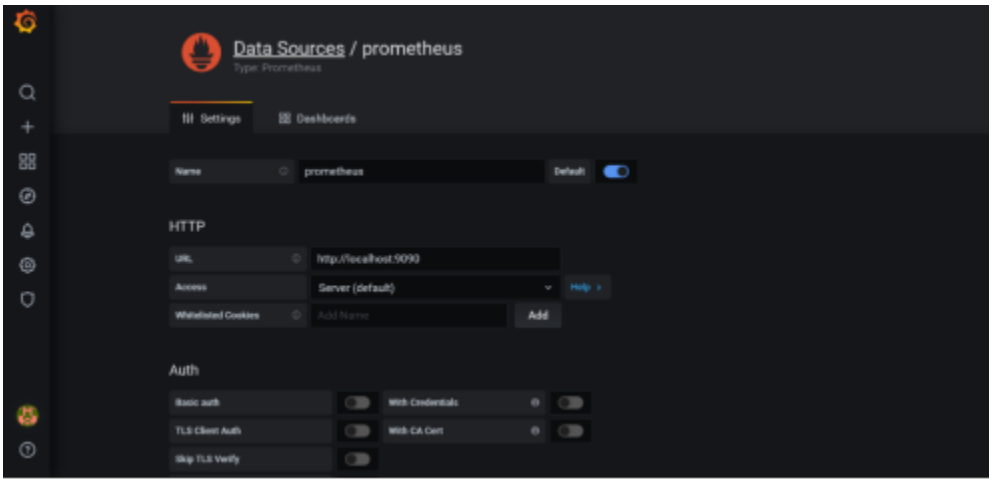
2. Select Data Sources, as shown in the image below:



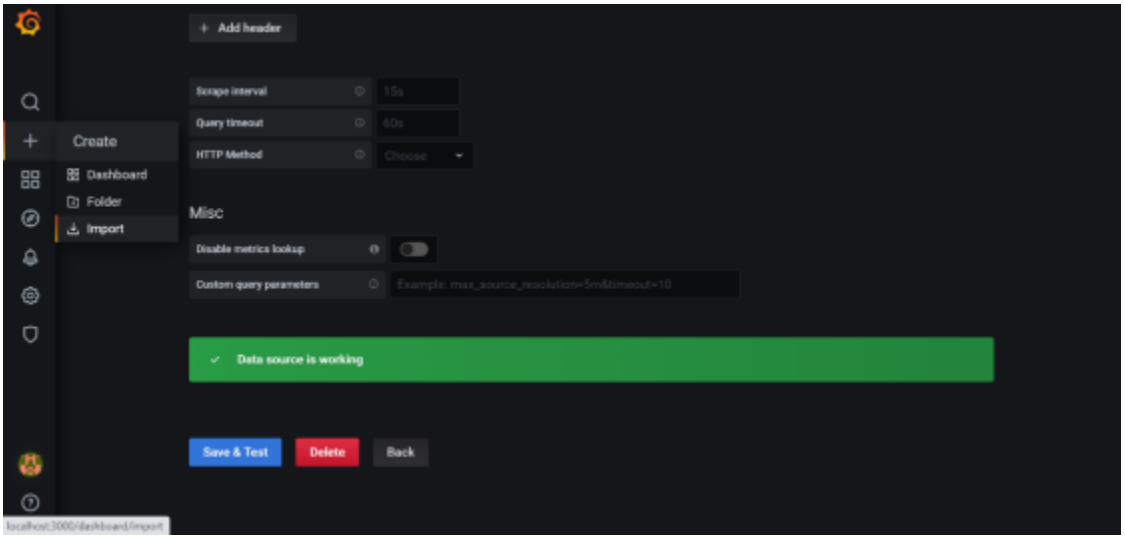
3. Click Add data source.



4. Select Prometheus.



NOTE: Ensure the name of the data source is “Prometheus.” If Prometheus and Grafana are running on the same machine, use the default URL http://localhost:9090. Otherwise, ensure the URL matches the Prometheus URL, save, and test it.

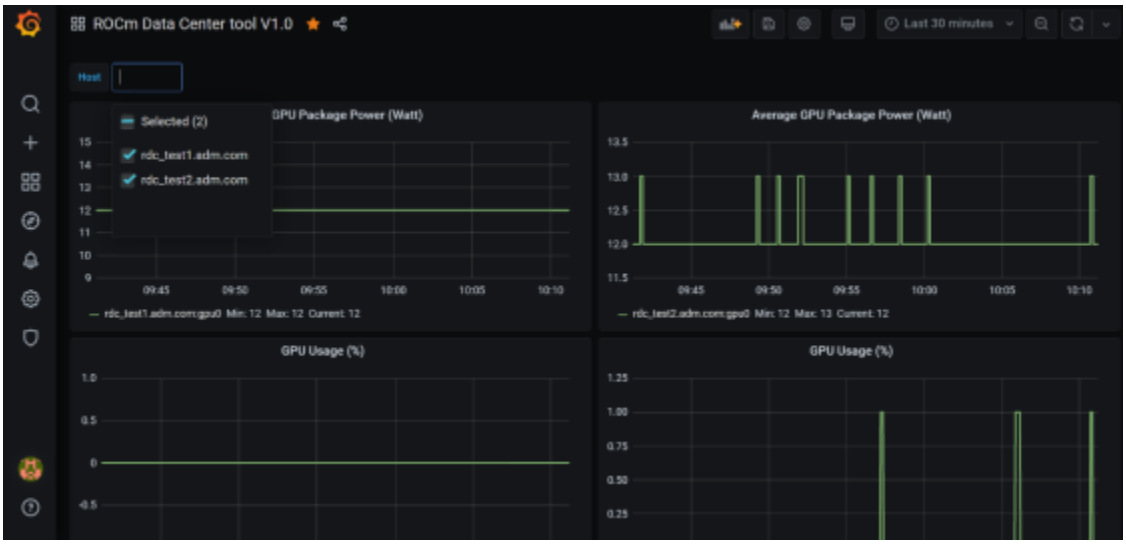


5. To import the RDC tool dashboard, click “+” and select Import.

6. Click the Upload.json file.

7. Choose rdc_grafana_dashboard_example.json, which is in the python_binding folder.

8. Import the rdc_grafana_dashboard_example.json file, and select the desired compute node on the dashboard, as shown in the image below:



1.6.5 Prometheus (Grafana) Integration with Automatic Node Detection

The RDC tool enables you to use Consul to discover the rdc_prometheus service automatically. Consul is “a service mesh solution providing a fully featured control plane with service discovery, configuration, and segmentation functionality.” For more information, refer to Consul.

The RDC tool uses Consul for health checks of RDC’s integration with the Prometheus plug-in (rdc_prometheus), and these checks provide information on its efficiency.

Previously, when a new compute node was added, users had to manually change prometheus_targets.json to use Consul. Now, with the Consul agent integration, a new compute node can be discovered automatically.

Installing the Consul Agent for Compute and Management Nodes

To install the latest Consul agent for compute and management nodes, follow the instructions below:

1. Set up the apt repository to download and install the Consul agent.

```
curl -fsSL https://apt.releases.hashicorp.com/gpg | sudo apt-key add -
sudo apt-add-repository "deb [arch=amd64]  https://apt.releases.hashicorp.com $(lsb_
↪release -cs) main"
sudo apt-get update && sudo apt-get install consul
```

2. Generate a key to encrypt the communication between consul agents. Note that you can generate the key once, and both the compute and management nodes use the same key for communication.

```
$ consul keygen
```

For the purposes of this feature documentation, the following key is used in the configuration file:

```
$ consul keygen
4lgGQXr3/R2QeTi5vEp7q5Xs1KoYBhCsk9+VgJZZHAo=
```

Setting up the Consul Server in Management Nodes

While Consul can function with one server, it is recommended to use three to five servers to avoid failure scenarios, which often lead to data loss.

NOTE: For example purposes, the configuration settings documented below are for a single server.

Follow these steps:

1. Create a configuration file /etc/consul.d/server.hcl.

```
server = true
encrypt = "<CONSUL_ENCRYPTION_KEY>"
bootstrap_expect = 1
ui = true
client_addr = "0.0.0.0"
bind_addr = "<The IP address can be reached by client>"
```

2. Run the agent in server mode, and set the encrypt to the key generated in the first step. The bootstrap_expect variable indicates the number of servers required to form the first Consul cluster.

3. Set the number of servers to 1 to allow a cluster with a single server.

• The User Interface (UI) variable is used to enable the Consul Web UI.

• The client_addr variable is used to connect the API and UI.

• The bind_addr variable is used to connect the client to the server. If you have multiple private IP addresses, use the address that can connect to a client.

4. Start the agent using the following instruction:

```
sudo consul agent -config-dir=/etc/consul.d/
```

5. Browse to http://localhost:8500/ on the management node. You will see a single instance running.

Setting up the Consul Client in Compute Nodes

Follow these steps:

1. Create a configuration file /etc/consul.d/client.hcl.

```
server = false
encrypt = "<CONSUL_ENCRYPTION_KEY>"
retry_join = ["<The consul server address>"]
client_addr = "0.0.0.0"
bind_addr = "<The IP address can reach server>"
```

NOTE: Use the same CONSUL_ENCRYPTION_KEY as the servers. In the retry_join, use the IP address of the management nodes.

2. Start the Consul agent.

```
sudo consul agent -config-dir=/etc/consul.d/
```

The client has now joined the Consul.

```
$ consul members
Node              Address           Status  Type    Build  Protocol  DC   Segment
management-node   10.4.22.70:8301   alive   server  1.9.3  2         dc1  <all>
compute-node      10.4.22.112:8301  alive   client  1.9.3  2         dc1  <default>
```

3. Set up the Consul client to monitor the health of the RDC Prometheus plugin.

4. Start the RDC Prometheus plugin.

```
python rdc_prometheus.py --rdc_embedded
```

5. Add the configuration file /etc/consul.d/rdc_prometheus.hcl.

```
{
  "service": {
    "name": "rdc_prometheus",
    "tags": [
      "rdc_prometheus",
      "rdc"
    ],
    "port": 5000,
    "check": {
      "id": "rdc_plugin",
      "name": "RDC Prometheus plugin on port 5000",
      "http": "http://localhost:5000",
      "method": "GET",
      "interval": "15s",
      "timeout": "1s"
    }
  }
}
```

NOTE: By default, the Prometheus plugin uses port 5000. If you do not use the default setting, ensure you change the configuration file accordingly.

After the configuration file is changed, restart the Consul client agent.

```
sudo consul agent -config-dir=/etc/consul.d/
```

6. Enable the Prometheus integration in the Management node. For more information, refer to the Prometheus Integration section above.

7. In the Management node, inspect the service.

```
$ consul catalog nodes -service=rdc_prometheus

Node              ID        Address      DC
compute-node      76694ab1  10.4.22.112  dc1
```

8. Create a new Prometheus configuration rdc_prometheus_consul.yml file for the Consul integration.

```
global:
  scrape_interval:     15s # Set the scrape interval to every 15 seconds. Default is every 1 minute.
  evaluation_interval: 15s # Evaluate rules every 15 seconds. The default is every 1 minute.
scrape_configs:
  - job_name: 'consul'
    consul_sd_configs:
      - server: 'localhost:8500'
    relabel_configs:
      - source_labels: [__meta_consul_tags]
        regex: .*,rdc,.*
        action: keep
      - source_labels: [__meta_consul_service]
        target_label: job
```

NOTE: If you are not running the consul server and Prometheus in the same machine, change the server under consul_sd_configs to your consul server address.

9. Start Prometheus.

```
$ ./prometheus --config.file="rdc_prometheus_consul.yml"
```

10. Browse the Prometheus UI at http://localhost:9090 on the Management node and query RDC Prometheus metrics. Ensure that the plugin starts before running the query.

1.6.6 Reliability, Availability, and Serviceability Plugin

The RAS plugin helps to gather and count errors. The details of RAS integration with RDC are given below.

RAS Plugin Installation

In this release, the RDC tool extends support to the Reliability, Availability, and Serviceability (RAS) integration. When the RAS feature is enabled in the graphic card, users can use RDC to monitor RAS errors.

Prerequisite

You must ensure the graphic card supports RAS.

NOTE: The RAS library is installed as part of the RDC installation, and no additional configuration is required for RDC.

The RDC tool installation dynamically loads the RAS library librdc_ras.so. The configuration files required by the RAS library are installed in the sp3 and config folders.

```
% ls /opt/rocm-4.2.0/rdc/lib
... librdc_ras.so ...
... sp3 ... config ...
```

RAS Integration

RAS exposes a list of Error-Correcting Code (ECC) correctable and uncorrectable errors for different IP blocks and enables users to successfully troubleshoot issues.

For example, the dmon command passes the ECC_CORRECT and ECC_UNCORRECT counters field id to the command.

```
rdci dmon -i 0 -e 600,601
```

The dmon command monitors GPU index 0, field 600, and 601, where 600 is for the ECC_CORRECT counter and 601 is for the ECC_UNCORRECT counter.

```
% rdci dmon -l
... ...
600 RDC_FI_ECC_CORRECT_TOTAL : Accumulated Single Error Correction.
601 RDC_FI_ECC_UNCORRECT_TOTAL : Accumulated Double Error Detection.
602 RDC_FI_ECC_SDMA_SEC : SDMA Single Error Correction.
603 RDC_FI_ECC_SDMA_DED : SDMA Double Error Detection.
604 RDC_FI_ECC_GFX_SEC : GFX Single Error Correction.
605 RDC_FI_ECC_GFX_DED : GFX Double Error Detection.
606 RDC_FI_ECC_MMHUB_SEC : MMHUB Single Error Correction.
607 RDC_FI_ECC_MMHUB_DED : MMHUB Double Error Detection.
608 RDC_FI_ECC_ATHUB_SEC : ATHUB Single Error Correction.
609 RDC_FI_ECC_ATHUB_DED : ATHUB Double Error Detection.
610 RDC_FI_ECC_BIF_SEC : BIF Single Error Correction.
611 RDC_FI_ECC_BIF_DED : BIF Double Error Detection.
612 RDC_FI_ECC_HDP_SEC : HDP Single Error Correction.
613 RDC_FI_ECC_HDP_DED : HDP Double Error Detection.
```

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```
614 RDC_FI_ECC_XGMI_WAFL_SEC : XGMI WAFL Single Error Correction.
615 RDC_FI_ECC_XGMI_WAFL_DED : XGMI WAFL Double Error Detection.
616 RDC_FI_ECC_DF_SEC : DF Single Error Correction.
617 RDC_FI_ECC_DF_DED : DF Double Error Detection.
618 RDC_FI_ECC_SMN_SEC : SMN Single Error Correction.
619 RDC_FI_ECC_SMN_DED : SMN Double Error Detection.
620 RDC_FI_ECC_SEM_SEC : SEM Single Error Correction.
621 RDC_FI_ECC_SEM_DED : SEM Double Error Detection.
622 RDC_FI_ECC_MP0_SEC : MP0 Single Error Correction.
623 RDC_FI_ECC_MP0_DED : MP0 Double Error Detection.
624 RDC_FI_ECC_MP1_SEC : MP1 Single Error Correction.

625 RDC_FI_ECC_MP1_DED : MP1 Double Error Detection.
626 RDC_FI_ECC_FUSE_SEC : FUSE Single Error Correction.
627 RDC_FI_ECC_FUSE_DED : FUSE Double Error Detection.
628 RDC_FI_ECC_UMC_SEC : UMC Single Error Correction.
629 RDC_FI_ECC_UMC_DED : UMC Double Error Detection.
... ...
```

To access the ECC correctable and uncorrectable error counters, use the following command:

```
% rdci dmon -i 0 -e 600,601
GPU     ECC_CORRECT          ECC_UNCORRECT
0       0                    0
0       0                    0
0       0                    0
```

1.7 Data Center Tool: Developer Handbook

The RDC tool is open source and available under the MIT License. This section is helpful for open source developers. Third-party integrators may also find this information useful.

1.7.1 Prerequisites for Building RDC

NOTE: The RDC tool is tested on the following software versions. Earlier versions may not work.

• CMake 3.15

• g++ (5.4.0)

• AMD ROCm, which includes AMD ROCm SMI Library

• gRPC and protoc

The following components are required to build the latest documentation:

• Doxygen (1.8.11)

• Latex (pdfTeX 3.14159265-2.6-1.40.16)

```
$ sudo apt install libcap-dev
$ sudo apt install -y doxygen
```

1.7.2 Build and Install RDC

To build and install, clone the RDC source code from GitHub and use CMake.

```
$ git clone <GitHub for RDC>
$ cd rdc
$ mkdir -p build; cd build
$ cmake -DROCM_DIR=/opt/rocm -DGRPC_ROOT="$GRPC_PROTOC_ROOT"..
$ make
#Install library file and header and the default location is /opt/rocm
$ make install
```

1.7.3 Build Documentation

You can generate PDF documentation after a successful build. The reference manual, refman.pdf, appears in the latex directory.

```
$ make doc
$ cd latex
$ make
```

1.7.4 Build Unit Tests for RDC Tool

```
$ cd rdc/tests/rdc_tests
$ mkdir -p build; cd build
$ cmake -DROCM_DIR=/opt/rocm -DGRPC_ROOT="$GRPC_PROTOC_ROOT"..
$ make

# To run the tests

$ cd build/rdctst_tests
$ ./rdctst
```

1.7.5 Test

```
# Run rdcd daemon
$ LD_LIBRARY_PATH=$PWD/rdc_libs/  ./server/rdcd -u

# In another console run the RDC command-line
$ LD_LIBRARY_PATH=$PWD/rdc_libs/  ./rdci/rdci discovery -l -u
```

1.7.6 Authentication

The RDC tool supports encrypted communications between clients and servers.

Generate Files for Authentication

The communication between the client and server can be configured to be authenticated or unauthenticated. By default, authentication is enabled.

To disable authentication, when starting the server, use the "–unauth_comm" flag (or "-u" for short). You must also use "-u" in rdci to access unauth rdcd. The /lib/systemd/system/rdc.service file can be edited to pass arguments to rdcd on starting. On the client side, when calling rdc_channel_create(), the "secure" argument must be set to False.

Scripts

RDC users manage their own keys and certificates. However, some scripts generate self-signed certificates in the RDC source tree in the authentication directory for test purposes. The following flowchart depicts how to generate the root certificates using the openssl command in 01gen_root_cert.sh:

A picture containing sign, drawing Description automatically generated

Generation of root certificates using openssl command

The section where the default responses to openssl questions can be specified is included in openssl.conf. To locate the section, look for the following comment line:

```
# < ** REPLACE VALUES IN THIS SECTION WITH APPROPRIATE VALUES FOR YOUR ORG. **>
```

It is helpful to modify this section with values appropriate for your organization if you expect to call this script many times. Additionally, you must replace the dummy values and update the alt_names section for your environment.

To generate the keys and certificates using these scripts, make the following calls:

```
$ 01gen_root_cert.sh
# provide answers to posed questions
$ 02gen_ssl_artifacts.sh
# provide answers to posed questions
```

At this point, the keys and certificates are in the newly created "CA/artifacts" directory. You must delete this directory if you need to rerun the scripts.

To install the keys and certificates, access the artifacts directory and run the install.sh script as root, specifying the install location. By default, RDC expects this to be in /etc/rdc:

```
$ cd CA/artifacts
$ sudo install_<client|server>.sh /etc/rdc
```

These files must be copied to and installed on all client and server machines that are expected to communicate with one another.

Known Limitation

The RDC tool has the following authentication limitation:

The client and server are hardcoded to look for the openssl certificate and key files in /etc/rdc. There is no workaround available currently. Verify Files for Authentication

Several SSL keys and certificates must be generated and installed on clients and servers for authentication to work properly. By default, the RDC server will look in the /etc/rdc folder for the following keys and certificates:

Client

```
$ sudo tree /etc/rdc
/etc/rdc
|-- client
|-- certs
| |-- rdc_cacert.pem
| |-- rdc_client_cert.pem
|-- private
|-- rdc_client_cert.key
```

NOTE: Machines that are clients and servers consist of both directory structures.

Server

```
$ sudo tree /etc/rdc
/etc/rdc
|-- server
|-- certs
| |-- rdc_cacert.pem
| |-- rdc_server_cert.pem
|-- private
|-- rdc_server_cert.key
```

1.8 ROCm Data Center API

Disclaimer: This is the alpha version of RDC API™ and is subject to change without notice. The primary purpose of this API is to solicit feedback. AMD accepts no responsibility for any software breakage caused by API changes.

1.8.1 RDC API

The RDC tool API is the core library that provides all the RDC features. This section focuses on how RDC API can be used by third-party software.

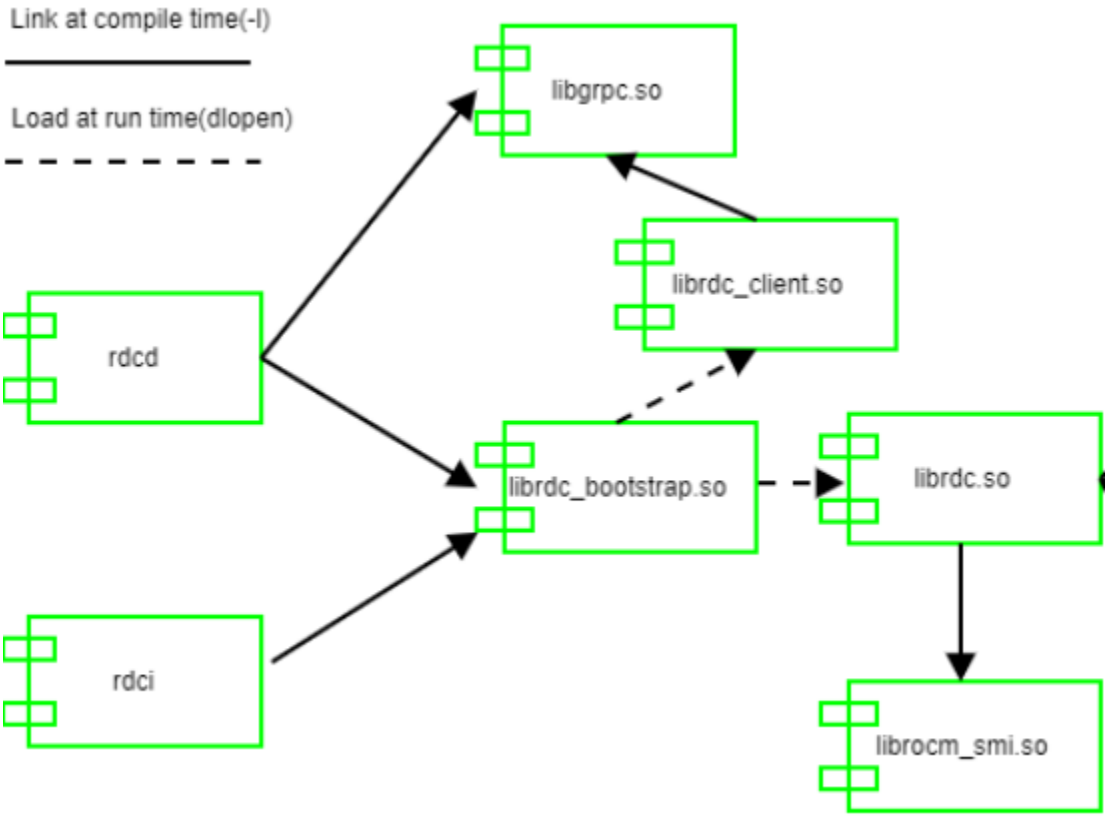
The RDC includes the following libraries:

• librdc_bootstrap.so: Loads during runtime one of the two libraries by detecting the mode.

• librdc_client.so: Exposes RDC functionality using gRPC client.

• librdc.so: RDC API. This depends on librocm_smi.so.

• librocm_smi.so: Stateless low overhead access to GPU data.



Different libraries and how they are linked.

Note that librdc_bootstrap.so loads different libraries based on the modes.

Example:

• rdci: librdc_bootstrap.so loads librdc_client.so

• rdcd: librdc_bootstrap.so loads librdc.so

For more information, see the ROCm Data Center Tool API Guide at https://docs.amd.com.

1.8.2 Job Stats Use Case

The following pseudocode shows how RDC tool API can be directly used to record GPU statistics associated with any job or workload. Refer to the example code provided with RDC on how to build it.

For more information, see the *Job Stats section in Features*.

```
//Initialize the RDC
rdc_handle_t rdc_handle;
rdc_status_t result=rdc_init(0);

//Dynamically choose to run in standalone or embedded mode
bool standalone = false;
std::cin>> standalone;
if (standalone)
```

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```
  result = rdc_connect("127.0.0.1:50051", &rdc_handle, nullptr, nullptr, nullptr); //It␣
↪will connect to the daemon
else
  result = rdc_start_embedded(RDC_OPERATION_MODE_MANUAL, &rdc_handle); //call library␣
↪directly, here we run embedded in manual mode

//Now we can use the same API for both standalone and embedded
//(1) create group
rdc_gpu_group_t groupId;
result = rdc_group_gpu_create(rdc_handle, RDC_GROUP_EMPTY, "MyGroup1", &groupId);

//(2) Add the GPUs to the group
result = rdc_group_gpu_add(rdc_handle, groupId, 0); //Add GPU 0
result = rdc_group_gpu_add(rdc_handle, groupId, 1); //Add GPU 1

//(3) start the recording the Slurm job 123. Set the sample frequency to once per second
result = rdc_job_start_stats(rdc_handle, group_id,
  "123", 1000000);

//For standalone mode, the daemon will update and cache the samples
//In manual mode, we must call rdc_field_update_all periodically to take samples
if (!standalone) { //embedded manual mode
  for (int i=5; i>0; i--) { //As an example, we will take 5 samples
  result = rdc_field_update_all(rdc_handle, 0);
  usleep(1000000);
  }
} else { //standalone mode, do nothing
  usleep(5000000); //sleep 5 seconds before fetch the stats
}

//(4) stop the Slurm job 123, which will stop the watch
// Note: we do not have to stop the job to get stats. The rdc_job_get_stats can be␣
↪called at any time before stop
result = rdc_job_stop_stats(rdc_handle, "123");

//(5) Get the stats
rdc_job_info_t job_info;
result = rdc_job_get_stats(rdc_handle, "123", &job_info);
std::cout<<"Average Memory Utilization: " <<job_info.summary.memoryUtilization.average <
↪<std::endl;

//The cleanup and shutdown ....
```

CHAPTER

TWO

API REFERENCE

struct **rdc_device_attributes_t**

#include <rdc.h> Represents attributes corresponding to a device.

Public Members

char **device_name**[RDC_MAX_STR_LENGTH]

Name of the device.

struct **rdc_diag_detail_t**

#include <rdc.h> details of the diagnostic errors

Public Members

char **msg**[MAX_DIAG_MSG_LENGTH]

The test result details.

uint32_t **code**

The low level error code.

struct **rdc_diag_per_gpu_result_t**

#include <rdc.h> details of the per gpu diagnostic results

Public Members

uint32_t **gpu_index**

The GPU index.

rdc_diag_detail_t **gpu_result**

The detail results.

struct **rdc_diag_response_t**

#include <rdc.h> The diagnostic responses for test cases.

Public Members

uint32_t **results_count**

rdc_diag_test_result_t **diag_info**[MAX_TEST_CASES]

struct **rdc_diag_test_result_t**

#include <rdc.h> The diagnostic results for all GPUs.

Public Members

rdc_diag_result_t **status**

The diagnostic result.

rdc_diag_detail_t **details**

The summary details.

rdc_diag_test_cases_t **test_case**

The test case to run.

uint32_t **per_gpu_result_count**

Result details.

How many gpu_results

rdc_diag_per_gpu_result_t **gpu_results**[RDC_MAX_NUM_DEVICES]

char **info**[MAX_DIAG_MSG_LENGTH]

Detail information.

struct **rdc_field_group_info_t**

#include <rdc.h> The structure to store the field group info.

Public Members

uint32_t **count**

count of fields in the group

char **group_name**[RDC_MAX_STR_LENGTH]

field group name

rdc_field_t **field_ids**[RDC_MAX_FIELD_IDS_PER_FIELD_GROUP]

The list of fields in the group

struct **rdc_field_value**

#include <rdc.h> The structure to store the field value.

Public Members

rdc_field_t **field_id**

The field id of the value.

int **status**

RDC_ST_OK or error status.

uint64_t **ts**

Timestamp in usec since 1970.

rdc_field_type_t **type**

The field type.

rdc_field_value_data **value**

Value of the field. Value type depends on the field type.

union **rdc_field_value_data**

#include <rdc.h> Field value data.

Public Members

int64_t **l_int**

double **dbl**

char **str**[RDC_MAX_STR_LENGTH]

struct **rdc_gpu_usage_info_t**

#include <rdc.h> The structure to hold the GPU usage information.

Public Members

uint32_t **gpu_id**

GPU_ID_INVALID for summary information.

uint64_t **start_time**

The time to start the watching.

uint64_t **end_time**

The time to stop the watching.

uint64_t **energy_consumed**

GPU Energy consumed.

uint64_t **ecc_correct**

Correctable errors.

uint64_t **ecc_uncorrect**

Uncorrectable errors.

rdc_stats_summary_t **pcie_tx**

Bytes sent over PCIe stats.

rdc_stats_summary_t **pcie_rx**

Bytes received over PCIe stats.

rdc_stats_summary_t **power_usage**

GPU Power usage stats.

rdc_stats_summary_t **gpu_clock**

GPU Clock speed stats.

rdc_stats_summary_t **memory_clock**

Mem. Clock speed stats.

rdc_stats_summary_t **gpu_utilization**

GPU Utilization stats.

rdc_stats_summary_t **gpu_temperature**

GPU temperature stats.

uint64_t **max_gpu_memory_used**

Maximum GPU memory used.

rdc_stats_summary_t **memory_utilization**

Memory Utilization statistics.

struct **rdc_group_info_t**

#include <rdc.h> The structure to store the group info.

Public Members

unsigned int **count**

count of GPUs in the group

char **group_name**[RDC_MAX_STR_LENGTH]

group name

uint32_t **entity_ids**[RDC_GROUP_MAX_ENTITIES]

The list of entities in the group

struct **rdc_job_group_info_t**

#include <rdc.h> The structure to store the job info.

Public Members

char **job_id**[RDC_MAX_STR_LENGTH]

job id

rdc_gpu_group_t **group_id**

group name

uint64_t **start_time**

job start time

uint64_t **stop_time**

job stop time

struct **rdc_job_info_t**

#include <rdc.h> The structure to hold the job stats.

Public Members

uint32_t **num_gpus**

Number of GPUs used by job.

rdc_gpu_usage_info_t **summary**

Job usage summary statistics (overall)

rdc_gpu_usage_info_t **gpus**[16]

Job usage summary statistics by GPU.

struct **rdc_stats_summary_t**

#include <rdc.h> The structure to store summary of data.

Public Members

uint64_t **max_value**

Maximum value measured.

uint64_t **min_value**

Minimum value measured.

uint64_t **average**

Average value measured.

double **standard_deviation**

The standard deviation.

namespace **std**

STL namespace.

file **rdc.h**

#include <stdint.h> The rocm_rdc library api is new, and therefore subject to change either at the ABI or API level. Instead of marking every function prototype as "unstable", we are instead saying the API is unstable (i.e., changes are possible) while the major version remains 0. This means that if the API/ABI changes, we will not increment the major version to 1. Once the ABI stabilizes, we will increment the major version to 1, and thereafter increment it on all ABI breaks.

Main header file for the ROCm RDC library. All required function, structure, enum, etc. definitions should be defined in this file.

Defines

GPU_ID_INVALID

ID used to represent an invalid GPU.

RDC_GROUP_ALL_GPUS

Used to specify all GPUs.

RDC_JOB_STATS_FIELDS

Used to specify all stats fields.

RDC_MAX_STR_LENGTH

The max rdc field string length.

RDC_GROUP_MAX_ENTITIES

The max entities in a group.

RDC_MAX_NUM_DEVICES

Max number of GPUs supported by RDC.

RDC_MAX_FIELD_IDS_PER_FIELD_GROUP

The max fields in a field group.

RDC_MAX_NUM_GROUPS

The max number of groups.

RDC_MAX_NUM_FIELD_GROUPS

The max number of the field groups.

RDC_EVNT_IS_NOTIF_FIELD(FIELD)

MAX_TEST_CASES

The maximum test cases to run.

MAX_DIAG_MSG_LENGTH

The maximum length of the diagnostic messages.

Typedefs

typedef void ***rdc_handle_t**

handlers used in various rdc calls

Handle used for an RDC session

typedef uint32_t **rdc_gpu_group_t**

GPU Group ID type.

typedef uint32_t **rdc_field_grp_t**

Field group ID type.

Enums

enum **rdc_status_t**

Error codes returned by rocm_rdc_lib functions.

Values:

enumerator **RDC_ST_OK**

Success.

enumerator **RDC_ST_NOT_SUPPORTED**

Not supported feature.

enumerator **RDC_ST_MSI_ERROR**

The MSI library error.

enumerator **RDC_ST_FAIL_LOAD_MODULE**

Fail to load the library.

enumerator **RDC_ST_INVALID_HANDLER**

Invalid handler.

enumerator **RDC_ST_BAD_PARAMETER**

A parameter is invalid.

enumerator **RDC_ST_NOT_FOUND**

Cannot find the value.

enumerator **RDC_ST_CONFLICT**

Conflict with current state.

enumerator **RDC_ST_CLIENT_ERROR**

The RDC client error.

enumerator **RDC_ST_ALREADY_EXIST**

The item already exists.

enumerator **RDC_ST_MAX_LIMIT**

Max limit recording for the object.

enumerator **RDC_ST_INSUFF_RESOURCES**

Not enough resources to complete operation

enumerator **RDC_ST_FILE_ERROR**

Failed to access a file.

enumerator **RDC_ST_NO_DATA**

Data was requested, but none was found

enumerator **RDC_ST_PERM_ERROR**

Insufficient permission to complete operation

enumerator **RDC_ST_UNKNOWN_ERROR**

Unknown error.

enum **rdc_operation_mode_t**

rdc operation mode rdc can run in auto mode where background threads will collect metrics. When run in manual mode, the user needs to periodically call rdc_field_update_all for data collection.

Values:

enumerator **RDC_OPERATION_MODE_AUTO**

enumerator **RDC_OPERATION_MODE_MANUAL**

enum **rdc_group_type_t**

type of GPU group

Values:

enumerator **RDC_GROUP_DEFAULT**

All GPUs on the Node.

enumerator **RDC_GROUP_EMPTY**

Empty group.

enum **rdc_field_type_t**

the type stored in the filed value

Values:

enumerator **INTEGER**

enumerator **DOUBLE**

enumerator **STRING**

enumerator **BLOB**

enum **rdc_field_t**

These enums are used to specify a particular field to be retrieved.

Values:

enumerator **RDC_FI_INVALID**

Identifier fields.

Invalid field value

enumerator **RDC_FI_GPU_COUNT**

GPU count in the system.

enumerator **RDC_FI_DEV_NAME**

Name of the device.

enumerator **RDC_FI_GPU_CLOCK**

The current clock for the GPU.

enumerator **RDC_FI_MEM_CLOCK**

Clock for the memory.

enumerator **RDC_FI_MEMORY_TEMP**

Memory temperature for the device.

enumerator **RDC_FI_GPU_TEMP**

Current temperature for the device.

enumerator **RDC_FI_POWER_USAGE**

Power usage for the device.

enumerator **RDC_FI_PCIE_TX**

PCIe Tx utilization information.

enumerator **RDC_FI_PCIE_RX**

PCIe Rx utilization information.

enumerator **RDC_FI_GPU_UTIL**

GPU Utilization.

enumerator **RDC_FI_GPU_MEMORY_USAGE**

Memory usage of the GPU instance.

enumerator **RDC_FI_GPU_MEMORY_TOTAL**

Total memory of the GPU instance.

enumerator **RDC_FI_ECC_CORRECT_TOTAL**

ECC related fields.

Accumulated correctable ECC errors

enumerator **RDC_FI_ECC_UNCORRECT_TOTAL**

Accumulated uncorrectable ECC errors.

enumerator **RDC_FI_ECC_SDMA_SEC**

SDMA Single Error Correction.

enumerator **RDC_FI_ECC_SDMA_DED**

SDMA Double Error Detection.

enumerator **RDC_FI_ECC_GFX_SEC**

GFX Single Error Correction.

enumerator **RDC_FI_ECC_GFX_DED**

GFX Double Error Detection.

enumerator **RDC_FI_ECC_MMHUB_SEC**

MMHUB Single Error Correction.

enumerator **RDC_FI_ECC_MMHUB_DED**
MMHUB Double Error Detection.

enumerator **RDC_FI_ECC_ATHUB_SEC**
ATHUB Single Error Correction.

enumerator **RDC_FI_ECC_ATHUB_DED**
ATHUB Double Error Detection.

enumerator **RDC_FI_ECC_BIF_SEC**
BIF Single Error Correction.

enumerator **RDC_FI_ECC_BIF_DED**
BIF Double Error Detection.

enumerator **RDC_FI_ECC_HDP_SEC**
HDP Single Error Correction.

enumerator **RDC_FI_ECC_HDP_DED**
HDP Double Error Detection.

enumerator **RDC_FI_ECC_XGMI_WAFL_SEC**
XGMI WAFL Single Error Correction.

enumerator **RDC_FI_ECC_XGMI_WAFL_DED**
XGMI WAFL Double Error Detection.

enumerator **RDC_FI_ECC_DF_SEC**
DF Single Error Correction.

enumerator **RDC_FI_ECC_DF_DED**
DF Double Error Detection.

enumerator **RDC_FI_ECC_SMN_SEC**
SMN Single Error Correction.

enumerator **RDC_FI_ECC_SMN_DED**
SMN Double Error Detection.

enumerator **RDC_FI_ECC_SEM_SEC**
SEM Single Error Correction.

enumerator **RDC_FI_ECC_SEM_DED**
SEM Double Error Detection.

enumerator **RDC_FI_ECC_MP0_SEC**
MP0 Single Error Correction.

enumerator **RDC_FI_ECC_MP0_DED**
MP0 Double Error Detection.

enumerator **RDC_FI_ECC_MP1_SEC**
MP1 Single Error Correction.

enumerator **RDC_FI_ECC_MP1_DED**
MP1 Double Error Detection.

enumerator **RDC_FI_ECC_FUSE_SEC**
FUSE Single Error Correction.

enumerator **RDC_FI_ECC_FUSE_DED**
FUSE Double Error Detection.

enumerator **RDC_FI_ECC_UMC_SEC**
UMC Single Error Correction.

enumerator **RDC_FI_ECC_UMC_DED**
UMC Double Error Detection.

enumerator **RDC_FI_PROF_ELAPSED_CYCLES**
ROC-profiler related fields.
Number of elapsed cycles over all SMs

enumerator **RDC_FI_PROF_ACTIVE_WAVES**
Number of Active Waves.

enumerator **RDC_FI_PROF_ACTIVE_CYCLES**
Number of Active Cycles.

enumerator **RDC_FI_PROF_CU_OCCUPANCY**
Active Waves / maximum active Waves supported.

enumerator **RDC_FI_PROF_CU_UTILIZATION**
Total active cycles / Total elapsed cycles.

enumerator **RDC_FI_PROF_FETCH_SIZE**
Number of kilobytes fetched from video memory.

enumerator **RDC_FI_PROF_WRITE_SIZE**
Number of kilobytes written to video memory.

enumerator **RDC_FI_PROF_FLOPS_16**

Number of fp16 OPS / second.

enumerator **RDC_FI_PROF_FLOPS_32**

Number of fp32 OPS / second.

enumerator **RDC_FI_PROF_FLOPS_64**

Number of fp64 OPS / second.

enumerator **RDC_FI_PROF_GFLOPS_16**

Number of fp16 GOPS / second.

enumerator **RDC_FI_PROF_GFLOPS_32**

Number of fp32 GOPS / second.

enumerator **RDC_FI_PROF_GFLOPS_64**

Number of fp64 GOPS / second.

enumerator **RDC_FI_PROF_MEMR_BW_KBPNS**

HBM Read Bandwidth in kilobytes / nanosecond.

enumerator **RDC_FI_PROF_MEMW_BW_KBPNS**

HBM Write Bandwidth in kilobytes / nanosecond.

enumerator **RDC_EVNT_XGMI_0_NOP_TX**

NOPs sent to neighbor 0.

enumerator **RDC_EVNT_XGMI_0_REQ_TX**

Outgoing requests to neighbor 0

enumerator **RDC_EVNT_XGMI_0_RESP_TX**

Outgoing responses to neighbor 0

enumerator **RDC_EVNT_XGMI_0_BEATS_TX**

Data beats sent to neighbor 0; Each beat represents 32 bytes.

XGMI throughput can be calculated by multiplying a BEATs event such as ::RSMI_EVNT_XGMI_0_BEATS_TX by 32 and dividing by the time for which event collection occurred, ::rsmi_counter_value_t.time_running (which is in nanoseconds). To get bytes per second, multiply this value by 10^9 .

Throughput = BEATS/time_running * 10^9 (bytes/second)

enumerator **RDC_EVNT_XGMI_1_NOP_TX**

NOPs sent to neighbor 1.

enumerator **RDC_EVNT_XGMI_1_REQ_TX**

Outgoing requests to neighbor 1

enumerator **RDC_EVNT_XGMI_1_RESP_TX**

Outgoing responses to neighbor 1

enumerator **RDC_EVNT_XGMI_1_BEATS_TX**

Data beats sent to neighbor 1; Each beat represents 32 bytes

enumerator **RDC_EVNT_XGMI_0_THRPUT**

Transmit throughput to XGMI neighbor 0 in byes/sec

enumerator **RDC_EVNT_XGMI_1_THRPUT**

Transmit throughput to XGMI neighbor 1 in byes/sec

enumerator **RDC_EVNT_XGMI_2_THRPUT**

Transmit throughput to XGMI neighbor 2 in byes/sec

enumerator **RDC_EVNT_XGMI_3_THRPUT**

Transmit throughput to XGMI neighbor 3 in byes/sec

enumerator **RDC_EVNT_XGMI_4_THRPUT**

Transmit throughput to XGMI neighbor 4 in byes/sec

enumerator **RDC_EVNT_XGMI_5_THRPUT**

Transmit throughput to XGMI neighbor 5 in byes/sec

enumerator **RDC_EVNT_NOTIF_VMFAULT**

VM page fault.

enumerator **RDC_EVNT_NOTIF_FIRST**

enumerator **RDC_EVNT_NOTIF_THERMAL_THROTTLE**

Clock frequency has decreased due to temperature rise

enumerator **RDC_EVNT_NOTIF_PRE_RESET**

GPU reset is about to occur.

enumerator **RDC_EVNT_NOTIF_POST_RESET**

GPU reset just occurred.

enumerator **RDC_EVNT_NOTIF_LAST**

enum **rdc_diag_level_t**

type of diagnostic level

Values:

enumerator **RDC_DIAG_LVL_INVALID**

invalid level

enumerator **RDC_DIAG_LVL_SHORT**

take a few seconds to run

enumerator **RDC_DIAG_LVL_MED**

take less than 2 minutes to run

enumerator **RDC_DIAG_LVL_LONG**

take up to 15 minutes to run

enum **rdc_diag_result_t**

type of diagnostic result

Values:

enumerator **RDC_DIAG_RESULT_PASS**

The diagnostic test pass.

enumerator **RDC_DIAG_RESULT_SKIP**

The diagnostic test skipped.

enumerator **RDC_DIAG_RESULT_WARN**

The diagnostic test has warnings.

enumerator **RDC_DIAG_RESULT_FAIL**

The diagnostic test fail.

enum **rdc_diag_test_cases_t**

The test cases to run.

Values:

enumerator **RDC_DIAG_TEST_FIRST**

The diagnostic test pass.

enumerator **RDC_DIAG_COMPUTE_PROCESS**

enumerator **RDC_DIAG_COMPUTE_QUEUE**

The Compute Queue is ready.

enumerator **RDC_DIAG_SYS_MEM_CHECK**

Check System memory.

enumerator **RDC_DIAG_NODE_TOPOLOGY**

Report node topology.

enumerator **RDC_DIAG_GPU_PARAMETERS**

GPU parameters in range.

enumerator **RDC_DIAG_TEST_LAST**

Functions

rdc_status_t **rdc_init**(uint64_t init_flags)

Initialize ROCm RDC.

When called, this initializes internal data structures, including those corresponding to sources of information that RDC provides. This must be called before *rdc_start_embedded()* or *rdc_connect()*

Parameters
init_flags – **[in]** init_flags Bit flags that tell RDC how to initialize.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_shutdown**()

Shutdown ROCm RDC.

Do any necessary clean up.

rdc_status_t **rdc_start_embedded**(*rdc_operation_mode_t* op_mode, *rdc_handle_t* *p_rdc_handle)

Start embedded RDC agent within this process.

The RDC is loaded as library so that it does not require rdcd daemon. In this mode, the user has to periodically call *rdc_field_update_all()* when op_mode is RDC_OPERATION_MODE_MANUAL, which tells RDC to collect the stats.

Parameters

- **op_mode** – **[in]** Operation modes. When RDC_OPERATION_MODE_AUTO, RDC schedules background task to collect the stats. When RDC_OPERATION_MODE_MANUAL, the user needs to call *rdc_field_update_all()* periodically.
- **p_rdc_handle** – **[inout]** Caller provided pointer to rdc_handle_t. Upon successful call, the value will contain the handler for following API calls.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_stop_embedded**(*rdc_handle_t* p_rdc_handle)

Stop embedded RDC agent.

Stop the embedded RDC agent, and p_rdc_handle becomes invalid after this call.

Parameters
p_rdc_handle – **[in]** The RDC handler that come from *rdc_start_embedded()*.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_connect**(const char *ipAndPort, *rdc_handle_t* *p_rdc_handle, const char *root_ca, const char *client_cert, const char *client_key)

Connect to rdcd daemon.

This method is used to connect to a remote stand-alone rdcd daemon.

Parameters

- **ipAndPort** – **[in]** The IP and port of the remote rdcd. The ipAndPort can be specified in this x.x.x.x:yyyy format, where x.x.x.x is the IP address and yyyy is the port.
- **p_rdc_handle** – **[inout]** Caller provided pointer to rdc_handle_t. Upon successful call, the value will contain the handler for following API calls.
- **root_ca** – **[in]** The root CA stored in the string in pem format. Set it as nullptr if the communication is not encrypted.
- **client_cert** – **[in]** The client certificate stored in the string in pem format. Set it as nullptr if the communication is not encrypted.
- **client_key** – **[in]** The client key stored in the string in pem format. Set it as nullptr if the communication is not encrypted.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_disconnect**(*rdc_handle_t* p_rdc_handle)

Disconnect from rdcd daemon.

Disconnect from rdcd daemon, and p_rdc_handle becomes invalid after this call.

Parameters
p_rdc_handle – **[in]** The RDC handler that come from *rdc_connect()*.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_job_start_stats**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, const char job_id[64], uint64_t update_freq)

Request the RDC to watch the job stats.

This should be executed as part of job prologue. The summary job stats can be retrieved using *rdc_job_get_stats()*. In RDC_OPERATION_MODE_MANUAL, user must call rdc_field_update_all(1) at least once, before call *rdc_job_get_stats()*

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The group of GPUs to be watched.
- **job_id** – **[in]** The name of the job.
- **update_freq** – **[in]** How often to update this field in usec.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_job_get_stats**(*rdc_handle_t* p_rdc_handle, const char job_id[64], *rdc_job_info_t* *p_job_info)

Get the stats of the job using the job id.

The stats can be retrieved at any point when the job is in process.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **job_id** – **[in]** The name of the job.
- **p_job_info** – **[inout]** Caller provided pointer to *rdc_job_info_t*. Upon successful call, the value will contain the stats of the job.

Return values

RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_job_stop_stats**(*rdc_handle_t* p_rdc_handle, const char job_id[64])

Request RDC to stop watching the stats of the job.

This should be execute as part of job epilogue. The job Id remains available to view the stats at any point. You must call rdc_watch_job_fields() before this call.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **job_id** – **[in]** The name of the job.

Return values

RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_job_remove**(*rdc_handle_t* p_rdc_handle, const char job_id[64])

Request RDC to stop tracking the job given by job_id.

After this call, you will no longer be able to call *rdc_job_get_stats()* on this job_id. But you will be able to reuse the job_id after this call.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **job_id** – **[in]** The name of the job.

Return values

RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_job_remove_all**(*rdc_handle_t* p_rdc_handle)

Request RDC to stop tracking all the jobs.

After this call, you will no longer be able to call *rdc_job_get_stats()* on any job id. But you will be able to reuse the any previous used job id after this call.

Parameters

p_rdc_handle – **[in]** The RDC handler.

Return values

RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_field_update_all**(*rdc_handle_t* p_rdc_handle, uint32_t wait_for_update)

Request RDC to update all fields to be watched.

In RDC_OPERATION_MODE_MANUAL, the user must call this method periodically.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **wait_for_update** – **[in]** Whether or not to wait for the update loop to complete before returning to the caller 1=wait. 0=do not wait.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_device_get_all**(*rdc_handle_t* p_rdc_handle, uint32_t gpu_index_list[RDC_MAX_NUM_DEVICES], uint32_t *count)

Get indexes corresponding to all the devices on the system.

Indexes represents RDC GPU Id corresponding to each GPU on the system and is immutable during the lifespan of the engine. The list should be queried again if the engine is restarted.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **gpu_index_list** – **[out]** Array reference to fill GPU indexes present on the system.
- **count** – **[out]** Number of GPUs returned in gpu_index_list.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_device_get_attributes**(*rdc_handle_t* p_rdc_handle, uint32_t gpu_index, *rdc_device_attributes_t* *p_rdc_attr)

Gets device attributes corresponding to the gpu_index.

Fetch the attributes, such as device name, of a GPU.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **gpu_index** – **[in]** GPU index corresponding to which the attributes should be fetched
- **p_rdc_attr** – **[out]** GPU attribute corresponding to the gpu_index.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_gpu_create**(*rdc_handle_t* p_rdc_handle, *rdc_group_type_t* type, const char *group_name, *rdc_gpu_group_t* *p_rdc_group_id)

Create a group contains multiple GPUs.

This method can create a group contains multiple GPUs. Instead of executing an operation separately for each GPU, the RDC group enables the user to execute same operation on all the GPUs present in the group as a single API call.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **type** – **[in]** The type of the group. RDC_GROUP_DEFAULT includes all the GPUs on the node, and RDC_GROUP_EMPTY creates an empty group.
- **group_name** – **[in]** The group name specified as NULL terminated C String
- **p_rdc_group_id** – **[inout]** Caller provided pointer to rdc_gpu_group_t. Upon successful call, the value will contain the group id for following group API calls.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_gpu_add**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, uint32_t gpu_index)

Add a GPU to the group.

This method can add a GPU to the group

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The group id to which the GPU will be added.
- **gpu_index** – **[in]** The GPU index to be added to the group.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_gpu_get_info**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* p_rdc_group_id, *rdc_group_info_t* *p_rdc_group_info)

Get information about a GPU group.

Get detail information about a GPU group created by rdc_group_gpu_create

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **p_rdc_group_id** – **[in]** The GPU group handler created by rdc_group_gpu_create
- **p_rdc_group_info** – **[out]** The information of the GPU group p_rdc_group_id.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_get_all_ids**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id_list[], uint32_t *count)

Used to get information about all GPU groups in the system.

Get the list of GPU group ids in the system.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id_list** – **[out]** Array reference to fill GPU group ids in the system.
- **count** – **[out]** Number of GPU group returned in group_id_list.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_gpu_destroy**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* p_rdc_group_id)

Destroy GPU group represented by p_rdc_group_id.

Delete the logic group represented by p_rdc_group_id

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **p_rdc_group_id** – **[in]** The group id

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_field_create**(*rdc_handle_t* p_rdc_handle, uint32_t num_field_ids, *rdc_field_t* *field_ids, const char *field_group_name, *rdc_field_grp_t* *rdc_field_group_id)

create a group of fields

The user can create a group of fields and perform an operation on a group of fields at once.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **num_field_ids** – **[in]** Number of field IDs that are being provided in field_ids.
- **field_ids** – **[in]** Field IDs to be added to the newly-created field group.
- **field_group_name** – **[in]** Unique name for this group of fields.
- **rdc_field_group_id** – **[out]** Handle to the newly-created field group

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_field_get_info**(*rdc_handle_t* p_rdc_handle, *rdc_field_grp_t* rdc_field_group_id, *rdc_field_group_info_t* *field_group_info)

Get information about a field group.

Get detail information about a field group created by rdc_group_field_create

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **rdc_field_group_id** – **[in]** The field group handler created by rdc_group_field_create
- **field_group_info** – **[out]** The information of the field group rdc_field_group_id.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_field_get_all_ids**(*rdc_handle_t* p_rdc_handle, *rdc_field_grp_t* field_group_id_list[], uint32_t *count)

Used to get information about all field groups in the system.

Get the list of field group ids in the system.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **field_group_id_list** – **[out]** Array reference to fill field group ids in the system.
- **count** – **[out]** Number of field group returned in field_group_id_list.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_group_field_destroy**(*rdc_handle_t* p_rdc_handle, *rdc_field_grp_t* rdc_field_group_id)

Destroy field group represented by rdc_field_group_id.

Delete the logic group represented by rdc_field_group_id

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **rdc_field_group_id** – **[in]** The field group id

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_field_watch**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, *rdc_field_grp_t* field_group_id, uint64_t update_freq, double max_keep_age, uint32_t max_keep_samples)

Request the RDC start recording updates for a given field collection.

Note that the first update of the field will not occur until the next field update cycle. To force a field update cycle, user must call rdc_field_update_all(1)

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The group of GPUs to be watched.
- **field_group_id** – **[in]** The collection of fields to record
- **update_freq** – **[in]** How often to update fields in usec.
- **max_keep_age** – **[in]** How long to keep data for fields in seconds.
- **max_keep_samples** – **[in]** Maximum number of samples to keep. 0=no limit.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_field_get_latest_value**(*rdc_handle_t* p_rdc_handle, uint32_t gpu_index, *rdc_field_t* field, *rdc_field_value* *value)

Request a latest cached field of a GPU.

Note that the field can be cached after called rdc_field_watch

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **gpu_index** – **[in]** The GPU index.
- **field** – **[in]** The field id
- **value** – **[out]** The field value got from cache.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_field_get_value_since**(*rdc_handle_t* p_rdc_handle, uint32_t gpu_index, *rdc_field_t* field, uint64_t since_time_stamp, uint64_t *next_since_time_stamp, *rdc_field_value* *value)

Request a history cached field of a GPU.

Note that the field can be cached after called rdc_field_watch

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **gpu_index** – **[in]** The GPU index.
- **field** – **[in]** The field id

- **since_time_stamp** – **[in]** Timestamp to request values since in usec since 1970.
- **next_since_time_stamp** – **[out]** Timestamp to use for sinceTimestamp on next call to this function
- **value** – **[out]** The field value got from cache.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_field_unwatch**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, *rdc_field_grp_t* field_group_id)

Stop record updates for a given field collection.

The cache of those fields will not be updated after this call

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The GPU group id.
- **field_group_id** – **[in]** The field group id.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_diagnostic_run**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, *rdc_diag_level_t* level, *rdc_diag_response_t* *response)

Run the diagnostic test cases.

Run the diagnostic test cases at different levels.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The GPU group id.
- **level** – **[in]** The level decides how long the test will run. The RDC_DIAG_LVL_SHORT only take a few seconds, and the the RDC_DIAG_LVL_LONG may take up to 15 minutes.
- **response** – **[inout]** The detail results of the tests run.

Return values
RDC_ST_OK – is returned upon successful call.

rdc_status_t **rdc_test_case_run**(*rdc_handle_t* p_rdc_handle, *rdc_gpu_group_t* group_id, *rdc_diag_test_cases_t* test_case, *rdc_diag_test_result_t* *result)

Run one diagnostic test case.

Run a specific diagnostic test case.

Parameters

- **p_rdc_handle** – **[in]** The RDC handler.
- **group_id** – **[in]** The GPU group id.
- **test_case** – **[in]** The test case to run.
- **result** – **[inout]** The results of the test.

Return values
RDC_ST_OK – is returned upon successful call.

const char *rdc_status_string(*rdc_status_t* status)

Get a description of a provided RDC error status.

return the string in human readable format.

Parameters
status – **[in]** The RDC status.

Return values
The – string to describe the RDC status.

const char *field_id_string(*rdc_field_t* field_id)

Get the name of a field.

return the string in human readable format.

Parameters
field_id – **[in]** The field id.

Return values
The – string to describe the field.

rdc_field_t get_field_id_from_name(const char *name)

Get the field id from name.

return the field id from field name.

Parameters
name – **[in]** The field name.

Return values
return – RDC_FI_INVALID if the field name is invalid.

const char *rdc_diagnostic_result_string(*rdc_diag_result_t* result)

Get a description of a diagnostic result.

return the string in human readable format.

Parameters
result – **[in]** The RDC diagnostic result.

Return values
The – string to describe the RDC diagnostic result.

dir /home/docs/checkouts/readthedocs.org/user_builds/advanced-micro-devices-rdc/checkouts/docs-5.6.0/include

dir /home/docs/checkouts/readthedocs.org/user_builds/advanced-micro-devices-rdc/checkouts/docs-5.6.0/include/rdc

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