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## About DRM4G

DRM4G is an open platform, based on [?GridWay](#) , to define, submit, and manage computational jobs. DRM4G is a [?Python \(2.6+, 3.3+\)](#) implementation that provides a single point of control for computing resources without installing any intermediate middlewares. As a result, a user is able to run the same job on laptops, desktops, workstations, clusters, supercomputers, and any grid.

## Start Guide

In order to install DRM4G, an installation script is provided. Type the command below on your shell terminal:

```
$ wget --no-check-certificate -O- https://meteo.unican.es/work/DRM4G/install.sh | bash

=====
DRM4G installation script
=====

--> Checking the last version of DRM4G ...

--> DRM4G version selected: 2.4.1

--> Downloading drm4g-2.4.1.tar.gz ...

--> Unpacking drm4g-2.4.1.tar.gz in directory /home/USER ...

--> Installing DRM4G python requirements locally ...

=====
Installation of DRM4G 2.4.1 is done!
=====

In order to work with DRM4G you have to enable its
environment with the command:

    . /home/USER/drm4g/bin/drm4g_init.sh

You need to run the above command on every new shell you
open before using DRM4G, but just once per session.
```

By default, it will install DRM4G on your current directory. But, you can download the installation script:

```
$ wget --no-check-certificate https://meteo.unican.es/work/DRM4G/install.sh
```

And run it manually:

```
$ bash ./install.sh [options]
```

The options available are:

- -d, --dir DIRECTORY: Install DRM4G into a directory.
- -V, --version: Version to install.
- -h, --help: Print help text.

## My first job

If the the directory `~/ .drm4g` does not exist, `drm4g` will create one with a local configuration

1. Enable DRM4G:

```
[user@mycomputer~]$ . /home/user/drm4g/bin/drm4g_init.sh
```

## 2. Start up DRM4G :

```
[user@mycomputer~]$ drm4g start
Creating a DRM4G local configuration in '/home/user/.drm4g'
Creating '/home/user/.drm4g/var/acct' directory
Coping from '/home/user/drm4g/etc' to '/home/user/.drm4g/etc'
Starting DRM4G ....
OK
Starting ssh-agent ...
OK
```

## 3. Show information about all available resources and their host :

```
[user@mycomputer~]$ drm4g resource list
RESOURCE          STATE
localmachine      enabled

[user@mycomputer~]$ drm4g host list
HID ARCH          JOBS(R/T) LRMS      HOST
0  x86_64          0/0 fork    localmachine

[user@mycomputer~]$ drm4g host list 0
HID ARCH          JOBS(R/T) LRMS      HOST
0  x86_64          0/0 fork    localmachine

QUEUENAME          JOBS(R/T) WALLT CPUT  MAXR  MAXQ
default            0/0 0     0     1     1
```

## 4. Create a job template :

```
[user@mycomputer~]$ echo "EXECUTABLE=/bin/date" > date.job
```

## 5. Submit the job :

```
[user@mycomputer~]$ drm4g job submit date.job
ID: 0
```

## 6. Check the evolution of the job :

```
[user@mycomputer~]$ drm4g job list 0
JID DM  EM  START  END      EXEC  XFER  EXIT NAME      HOST
0  pend ---- 19:39:09 --:--:-- 0:00:00 0:00:00 --  date.job      --
```

If you execute successive `drm4g job list 0`, you will see the different states of this job:

```
0  pend ---- 19:39:09 --:--:-- 0:00:00 0:00:00 --  date.job      --
0  prol ---- 19:39:09 --:--:-- 0:00:00 0:00:00 --  date.job      --
0  wrap pend 19:39:09 --:--:-- 0:00:00 0:00:00 --  date.job localhost/fork
0  wrap actv 19:39:09 --:--:-- 0:00:05 0:00:00 --  date.job localhost/fork
0  epil ---- 19:39:09 --:--:-- 0:00:10 0:00:00 --  date.job localhost/fork
0  done ---- 19:39:09 19:39:27 0:00:10 0:00:01 0  date.job localhost/fork
```

- `pend`: The job is waiting for a resource to run on.
- `prol`: The remote system is being prepared for execution.
- `wrap pend`: The job has been successfully submitted to the computing resource and it is waiting.
- `wrap actv`: The job is being executed by the computing resource.
- `epil`: The job is finalizing.

- done:The job has finished.

7. Results are standard output (stdout) and standard error (stderr), both files will be in the same directory of job template:

```
[user@mycomputer~]$ cat stdout.0
Mon Jul 28 12:29:43 CEST 2014

[user@mycomputer~]$ cat stderr.0
```

## How to configure a TORQUE/PBS resource

In order to configure a TORQUE/PBS cluster accessed through ssh protocol, you can follow the next steps:

1. Generate a public/private key pair without password :

```
[user@mycomputer~]$ ssh-keygen -t rsa -b 2048 -f $HOME/.ssh/meteo_rsa -N ""
```

2. Copy the new public key to the TORQUE/PBS resource :

```
[user@mycomputer~]$ ssh-copy-id -i $HOME/.ssh/meteo_rsa.pub user@ui.macc.unican.es
```

Configure the meteo resource :

```
[user@mycomputer~]$ drm4g resource edit
[meteo]
enable                = true
communicator          = ssh
username              = user
frontend              = ui.macc.unican.es
private_key            = ~/.ssh/meteo_rsa
lrms                   = pbs
queue                 = qrid
max_jobs_running      = 1
max_jobs_in_queue     = 2
```

4. List and check if resource has been created successfully :

```
[user@mycomputer~]$ drm4g resource list
RESOURCE      STATE
meteo         enabled

[user@mycomputer~]$ drm4g host list
HID ARCH      JOBS(R/T) LRMS      HOST
0   x86_64      0/0 pbs      meteo
```

That's it! Now, you can submit jobs to meteo.

## User Scenarios

In this section it will be described how to take advantage of DRM4G to calculate the number Pi. To do that, we will use three types of jobs **single**, **array** and **mpi**.

### Single Jobs

#### Code

```

#include <stdio.h>
#include <string.h>

int main (int argc, char** args)
{
    int task_id;
    int total_tasks;
    long long int n;
    long long int i;

    double l_sum, x, h;

    task_id = atoi(args[1]);
    total_tasks = atoi(args[2]);
    n = atoll(args[3]);

    fprintf(stderr, "task_id=%d total_tasks=%d n=%lld\n", task_id, total_tasks, n);

    h = 1.0/n;

    l_sum = 0.0;

    for (i = task_id; i < n; i += total_tasks)
    {
        x = (i + 0.5)*h;
        l_sum += 4.0/(1.0 + x*x);
    }

    l_sum *= h;

    printf("%0.12g\n", l_sum);

    return 0;
}

```

## Array Jobs

## MPI Jobs

## Code

```

#include "mpi.h"
#include <stdio.h>
#include <math.h>

int main( int argc, char *argv[])
{
    int done = 0, n, myid, numprocs, i;
    double PI25DT = 3.141592653589793238462643;
    double mypi, pi, h, sum, x;
    double startwtime = 0.0, endwtime;
    int namelen;
    char processor_name[MPI_MAX_PROCESSOR_NAME];

    MPI_Init(&argc,&argv);
    MPI_Comm_size(MPI_COMM_WORLD,&numprocs);
    MPI_Comm_rank(MPI_COMM_WORLD,&myid);
    MPI_Get_processor_name(processor_name,&namelen);

    printf("Process %d on %s\n", myid, processor_name);
}

```

```
n = 100000000;

startwtime = MPI_Wtime();

h = 1.0 / (double) n;
sum = 0.0;
for (i = myid + 1; i <= n; i += numprocs)
{
    x = h * ((double)i - 0.5);
    sum += 4.0 / (1.0 + x*x);
}
mypi = h * sum;

MPI_Reduce(&mypi, &pi, 1, MPI_DOUBLE, MPI_SUM, 0, MPI_COMM_WORLD);

if (myid == 0)
{
    printf("pi is approximately %.16f, Error is %.16f\n",
        pi, fabs(pi - PI25DT));
    endwtime = MPI_Wtime();
    printf("wall clock time = %f\n", endwtime-startwtime);
}

MPI_Finalize();

return 0;
}
```