Report on DIRAC usage for SuperB use cases

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Outline

- Testbed description
- Simple test jobs
  - Features exploited
- Analysis use case
  - Test results
  - What is still missing
- Data Management test
  - Catalogue and other info
  - Put/Get/delete features
  - Replica
  - High level features
    - Interactive usage
    - Metadata
    - Ancestors
- Future works
- People involved

Testbed description

- 1 "production" Dirac server installed @CNAF with DIRAC v5r13p2 (stable release)
- 1 "test" Dirac server installed @INFN-BARI with DIRAC v6rxx (still under development)
- Production Grid sites configured on DIRAC server
  - We configured a sub-set of sites officially supporting SuperB activities
  - There are sites from gLite and OSG grid
    - At the moment we only tested job submission on gLite sites
  - Both Computing Element and Storage Element of each site should be configured
- Thanks to interaction with DIRAC developers we find the right server configuration needed to exploit all the required features

Simple job test

- The job is described through a JDL file
- Main features tested:
  - InputSandbox (using Dirac File Catalogue)
  - OutputSandbox (using Dirac File Catalogue)
  - InputData (using Dirac File Catalogue)
  - OutputData (using Dirac File Catalogue)
  - Parametric Jobs (with and without Parametric InputData)
- All tests are executed mainly using CLI interface for submission, and both CLI and Web Interface for monitoring the status

Simple job test: details

- The Job submitted to DIRAC, is executed by mean of a wrapper script that takes care of:
  - Preparing the environment before job execution
  - Staging the output after job execution
  - Checking and reporting the exit code of each step
- The executable of the job is registered in the Dirac File Catalogue and copied by the user on a SuperB Storage Element before job submission
  - As the Input Sandbox too
- The Output Sandbox and the Output Data of the job is automatically registered in the catalogue by the wrapper
  - It is possible to choose in the JDL the SE where to store the output:
    - You can use more than one SE: if the first fail the second will be used, etc

Simple job test: details (2)

- Parametric Jobs:
  - A single DIRAC JDL can describe several (10-100-1000...) jobs
  - The end user submit only one JDL and all the jobs are automatically created by the system and should be monitored separately
  - Parameters could be:
    - Numbers (e.g. from 1 to 100)
    - List of strings (e.g. "aa ab ac ad ...")
  - The Input and the output files could also be parametric in order to deal with different Input/Output files per each job

- InputData:
  - It is possible to send the job on the computing elements close to the SE where the files are stored, using one or few files registered on the Dirac File Catalogue
    - This is valid for each sub-jobs in a parametric job if the files are parametric

- The wrapper of the job check the status of each step for each sub-job
  - If a sub-job fail, only that job will be automatically resubmitted

Analysis use case

- Executable used:
  - runPhrReduce (Thanks to Elisa Manoni)
- Input Files:
  - 1260 files
  - ~190GB in total
- Sandbox
  - Both input and output sandbox are registered on the Dirac File catalogue
- Output file:
  - 3 files for each job (1 root + 2 txt)
- Grid Site used:
  - CNAF, INFN-Pisa
- Sub-jobs
  - 126 jobs
  - Each job will process 10 input files

Analysis use case (2)

- It is quite inefficient to deal with very small input files:
  - So we packed 10 input file together and stored in the catalogue (~1.6GB each file)
  - Each job processed only one "packed file"
  - The name of each input file contains a string that is "parametric" (e.g. "aa ab ac …")
- Each file is replicate using DIRAC File Cataloque in both sites
  - Each job could be scheduled on both sites
- The output files are automatically stored in a directory in the catalogue that is specific for each job
- The executable is transferred as InputSandbox while we exploited the SuperB software installation already available in each site

Analysis use case – Results

- The analysis is carried out using a script that takes care of:
  - Untarring input file
  - Setting up the needed environment variables
  - Running the real executable with the needed parameters
  - Tar the output files
  - No need to interact with grid service!
- 126 job correctly executed in less than 30 min
  - From submitting to having the results back in the home directory
- The jobs were correctly distributed between CNAF (~60%) and INFN-PISA (~40%)
- No jobs failures from the user point of view

Analysis use case – Still missing

- To automatize the "input package builder"
  - Packing the small input files
  - Uploading to the grid and registering in the catalogue
- Automatically writing the JDL
- Automatically writing the user script
- Retrieving all the output and merging together

- Typically those operation could be covered by GANGA or similar tool
  - We need to explore this option before writing new code!

Catalogue

- All the test has been carried on with DIRAC File Catalogue
  - This will be interesting because we will have both File Catalogue features and Metadata feature
- Using the Storage Element already configured in DIRAC instance
  - Configuring the SE is not at all a trivial task!!
  - We succeeded to use both OSG and gLite SE
- The typical grid file catalogue features are available
  - copy-and-register, replicate, delete, get, etc...

Catalogue – 2

- The DIRAC File Catalogue has a good number of added features:
  - Checksum
  - CreationDate
  - ModificationDate
  - Owner
  - OwnerGroup
  - Size
- DIRAC provides both "batch" and "interactive" command line
  - Web interface still to be tested
- The system is able to provide also an index of the Storage Element configured
  - They can be used with user-friendly names

Catalogue – 3

- It is possible to have both catalogue and storage metadata:

dirac-dms-lfn-metadata /superbvo.org/user/g/donvito/test3
{'Failed': {},
 'Successful': {'/superbvo.org/user/g/donvito/test3': {'Checksum': 'a0683f04',
                                   'ChecksumType': 'Adler32',
                                   'CreationDate': datetime.datetime(2011, 6, 17, 9, 24, 48),
                                   'FileID': 14L,
                                   'GID': 1,
                                   'GUID': '8531C86D-BD55-A983-3F09-124523587E1F',
                                   'Mode': 775,
                                   'ModificationDate': datetime.datetime(2011, 6, 17, 9, 24, 48),
                                   'Owner': 'gdonvito',
                                   'OwnerGroup': 'user',
                                   'Size': 967L,
                                   'Status': 1,
                                   'UID': 2}}}

Put/Get/delete features

- PUT:
  - dirac-dms-add-file /superbvo.org/user/g/donvito/ dir_test/test2 /lustre/donvito/dirac/bashrc BARI-INFN
    - The storage element name should be one of those configured in DIRAC
      {'Failed': {},
       'Successful': {'/superbvo.org/user/g/donvito/dir_test/test2': {'put': 7.4923808574676514,
                                                    'register': 0.52035999298095703}}}

      dirac-dms-lfn-replicas /superbvo.org/user/g/donvito/dir_test/test2
      {'Failed': {},
       'Successful': {'/superbvo.org/user/g/donvito/dir_test/test2': {'BARI-INFN': 'srm://storm-se-01.ba.infn.it:8444/srm/manager?SFN=/superbvo.org/superbvo.org/user/g/donvito/dir_test/test2'}}}

Put/Get/delete features

- GET:
  - dirac-dms-get-file /superbvo.org/user/g/donvito/dir_test/test2
    - The Storage Element is automatically choosen
- DELETE:
  - dirac-dms-remove-lfn
    - Remove LFN and *all* associated replicas from Storage Elements and File Catalogs.
  - dirac-dms-remove-lfn-replica /superbvo.org/user/g/donvito/dir_test/test2 FERRARA-INFN
    - Remove replica of LFN from specified Storage Element and File catalogs.

REPLICA features

- Replica:
  - Quite an easy task for the end user:

    -bash-3.2$ dirac-dms-lfn-replicas /superbvo.org/user/g/donvito/dir_test/test2

    {'Failed': {},

    'Successful': {'/superbvo.org/user/g/donvito/dir_test/test2': {'BARI-INFN': 'srm://storm-se-01.ba.infn.it:8444/srm/manager?SFN=/superbvo.org/superbvo.org/user/g/donvito/dir_test/test2'}}}

    -bash-3.2$

    -bash-3.2$ dirac-dms-replicate-lfn /superbvo.org/user/g/donvito/dir_test/test2   FERRARA-INFN

    {'Failed': {},

    'Successful': {'/superbvo.org/user/g/donvito/dir_test/test2': {'register': 0.52092003822232666,

    -bash-3.2$ 'replicate': 15.390527009963989}}}

    -bash-3.2$ dirac-dms-lfn-replicas /superbvo.org/user/g/donvito/dir_test/test2

    {'Failed': {},

    'Successful': {'/superbvo.org/user/g/donvito/dir_test/test2': {'BARI-INFN': 'srm://storm-se-01.ba.infn.it:8444/srm/manager?SFN=/superbvo.org/superbvo.org/user/g/donvito/dir_test/test2',

    'FERRARA-INFN': 'srm://grid2.fe.infn.it:8444/srm/manager?SFN=///superbvo.org/user/g/donvito/dir_test/test2'}}}

High level features: interactive usage

- The interactive usage is much more intuitive (and fast) when it is needed a long "data-management session"

```
-bash-3.2$ dirac-dms-filecatalog-cli
Starting DIRAC FileCatalog client
File Catalog Client $Revision: 1.17 $Date:

FC:/> help
Documented commands (type help <topic>):
========================================
add        chgrp     exit  guid meta     replicas  rmreplica
ancestor   chmod     find  id   mkdir    replicate size
ancestorset chown    get   lcd  pwd      rm        unregister
cd         descendent group ls  register rmdir     user

FC:/> cd /superbvo.org/user/g/donvito/dir_test/
FC:/superbvo.org/user/g/donvito/dir_test>ls -l
-r-----rwx 0 gdonvito user    967 2011-06-22 17:10:45 test2
-r-----rwx 0 gdonvito user    967 2011-06-21 09:39:34 test3
```

High level features: Metadata

- The DIRAC File Catalogue give also metadata features embedded on the same tool:

  FC:/> meta set /superbvo.org/user/g/donvito/test3 Creator GiacintoDonvito

  FC:/> meta set /superbvo.org/user/g/donvito/test3 Group GSuperB

  FC:/> meta get /superbvo.org/user/g/donvito/test3
        Group : GSuperB
       Creator : GiacintoDonvito

High level features: Metadata – 2

- The DIRAC File Catalogue also provide metadata "search" features:

FC:/superbvo.org/user/g/donvito>meta set dir_test Owner string

/superbvo.org/user/g/donvito/dir_test Owner string

FC:/superbvo.org/user/g/donvito>meta get dir_test

    !Owner : string

    Meta1 : test_dir

  !NewMetaInt : 0

FC:/superbvo.org/user/g/donvito>

FC:/superbvo.org/user/g/donvito>meta set dir_test NewMetaInt 3

/superbvo.org/user/g/donvito/dir_test NewMetaInt 3

FC:/superbvo.org/user/g/donvito>meta get dir_test

    !Owner : string

    Meta1 : test_dir

  !NewMetaInt : 3

FC:/superbvo.org/user/g/donvito>meta set dir_test Owner Giacinto

/superbvo.org/user/g/donvito/dir_test Owner Giacinto

High level features: Metadata – 3

FC:/superbvo.org/user/g/donvito>find NewMetaInt>2 Owner=Giacinto

Query: {'Owner': 'Giacinto', 'NewMetaInt': {'>': 2}}

/superbvo.org/user/g/donvito/dir_test/test2

/superbvo.org/user/g/donvito/dir_test/test3

FC:/superbvo.org/user/g/donvito>find NewMetaInt>2 Owner=DGiacinto

Query: {'Owner': 'DGiacinto', 'NewMetaInt': {'>': 2}}

FC:/superbvo.org/user/g/donvito>find NewMetaInt>0 Owner=DGiacinto

Query: {'Owner': 'DGiacinto', 'NewMetaInt': {'>': 0}}

/superbvo.org/user/g/donvito/test_2_dir/test1

/superbvo.org/user/g/donvito/test_2_dir/test2

High level features: Metadata – 4

- How to do it not interactively
  -bash-3.2$ cat test_cli
  find NewMetaInt>0 Owner=DGiacinto
  exit

  -bash-3.2$ dirac-dms-filecatalog-cli < test_cli
  Starting DIRAC FileCatalog client
  File Catalog Client $Revision: 1.17 $Date:
  FC:/> Query: {'Owner': 'DGiacinto', 'NewMetaInt': {'>': 0}}

  /superbvo.org/user/g/donvito/test_2_dir/test1
  /superbvo.org/user/g/donvito/test_2_dir/test2

High level features: Ancestors

- The DIRAC File Catalogue give also "File Provenance" features embedded on the same tool:

  FC:/superbvo.org/user/g/donvito/test_2_dir>ancestorset test1 /superbvo.org/user/g/donvito/dir_test/test3

  Added 1 ancestors to file /superbvo.org/user/g/donvito/test_2_dir/test1

  FC:/superbvo.org/user/g/donvito/test_2_dir>ancestorset test2 test1

  Added 1 ancestors to file /superbvo.org/user/g/donvito/test_2_dir/test2

  FC:/superbvo.org/user/g/donvito/test_2_dir>ancestor test2 2

  /superbvo.org/user/g/donvito/test_2_dir/test2

  1   /superbvo.org/user/g/donvito/test_2_dir/test1

  2   /superbvo.org/user/g/donvito/dir_test/test3

  FC:/superbvo.org/user/g/donvito/test_2_dir>descendent /superbvo.org/user/g/donvito/dir_test/test3 2

  /superbvo.org/user/g/donvito/dir_test/test3

  1   /superbvo.org/user/g/donvito/test_2_dir/test1

  2   /superbvo.org/user/g/donvito/test_2_dir/test2

Job Submission: feedback

- It is needed to learn the JDL language
- Powerful all-in-one system for managing DM and Job Submission over a grid environment
- Stage-in and stage-out features
  - With failover capabilities
- Efficient monitoring mechanism for each step of the job
  - The exit status of: stage input, stage output, application execution is checked
  - If something fails, the job is re-submitted until the maximum number of resubmission is reached
- Peek job capabilities
  - A "tail" of the output of the job every X minutes
- Data-driven and load balancing job brokering
- Well integrated with gLite grid infrastructure
- Documentation is the main weak point

DMS: feedback

- Interesting features integrated in the same tool
  - Grid File Catalogue
  - Replica Cli
  - Metadata & ancestor
- It is flexible enough to cover different use cases
- Documentation is the main weak point
- Wildcard (*) not usable for bulk operations

DIRAC Test planned

- Configuring and Testing all the SuperB sites
  - Testing OSG job submission
- Porting the Monte Carlo Production use case into DIRAC
- FTS Usage
- Scalability tests
  - Both DMS and job submission
- Adding a detailed monitoring feature
  - Building a python script that exploit the DIRAC monitoring class
- Performance evaluation
- DB replica for HA purposes
- Try to build a simple automatic procedure to replicate a large dataset of files and check performance and reliability

People involved

- People working on DIRAC test
  - Giacinto Donvito – INFN-Bari
  - Bruno Santeramo – INFN-Bari
  - Armando Fella – INFN-Pisa

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