Introduction to DIRAC Data Management System

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Probably a bit late with respect to the agenda

Motivations

- **New users in the room**

- **Probably has never been done**

- **Good incentive to write documentation**

- **I need a talk to justify my trip to Lyon**

- **"DIRAC has very limited Data Management capabilities" Very Gentleman @ 1st RUCIO workshop**

Why do you need DMS?

- "In the beginning God created the Files and the Storage. Now the LHC was empty, darkness was over the surface of the deep.
And God said 'let there be beam', and there was beam." Genesis 1:1

- And now you are left with a shitload of files and storages to manage, just by yourself, without His help.

Data Management in DIRAC

- **All here**

- **You can:**
  - Abstract data from its location
  - Access it in many ways
  - Describe it (datasets, metadata)
  - Replicate it
  - Remove it
  - Lose it..

DMS concepts

- **After all, it's all about "Files"**

- **Logical File Name (LFN)**
  - Unique identifier within DIRAC of a file
  - No "physical" existence
  - Described as a path "/lhcb/user/c/chaen/holidays2018/sexyBeach.jpg"
  - Starts with the VO name
  - Belongs to a user/group
  - **ONLY** way to refer to a file for users and other DIRAC systems

DMS concepts

- **StorageElement**
  - Abstraction of storage endpoints
  - Where physical copies of LFN are stored
  - (LFN,SE): **ONLY** way to refer to a specific replica for users and other DIRAC systems

- **FileCatalog**
  - Namespace of DIRAC, based on LFN
  - Metadata, replicas, datasets, etc

StorageElement

- **Protocol & technology agnostic**
  - Based on plugins (see dedicated talk tomorrow)
- **Late URL resolution:**
  - (LFN,SE) is all you need
  - Physical move of SE are easy to handle, just configuration
- **Fully integrated to RSS (see Federico's talk)**
- **Interface for space occupancy**
- **All the definition is in the CS**
  - Configuration details

StorageElement

```
CERN-EOS
{
  BackendType = eos # backend type of storage element
  SEType = T0D1 # Tape or Disk SE
  UseCatalogURL = True # used the stored url or generate it (default False)
  ReadAccess = True # Allowed for Read if no RSS enabled
  WriteAccess = True # Allowed for Write if no RSS enabled
  CheckAccess = True # Allowed for Check if no RSS enabled
  RemoveAccess = True # Allowed for Remove if no RSS enabled
  GFAL2_SRM2 # Protocol section
  {
    Host = srm-eoslhcb.cern.ch
    Port = 8443
    PluginName = GFAL2_SRM2 # If different from the section name
    Protocol = srm # primary protocol
    Path = /eos/lhcb/grid/prod # base path
    Access = remote
    SpaceToken = LHCb-EOS
    WSUrl = /srm/v2/server?SFN=
  }
}
```

StorageElement advanced

- **BaseStorageElement**
  - Factorize the configuration for common options (host, port, etc)

- **StorageElementGroup**
  - Group storages together, useful for big DM operations

- **Multi-protocol:**
  - Details tomorrow
  - Copy from A to B guaranteed, no matter what

FileCatalog advanced

- **Configuration** **details**

- **Multiple catalogs**

  - Doable, and done (LHCb)

  - One catalog is the Master

  - Involves consistency checks

- **Conditional FC**

  - Only use a given catalog under certain conditions

  - Conditions use plugins and Boolean algebra

  - *Use catalog if group = "user" and "holidayPictures" not in lfn*

DFC

- **DIRAC comes with its own catalog**
  - Guess what DFC stands for...
- **Just like any other DIRAC service**
- **Full replica and metadata catalog**
  - Very useful for high level description *"data from run 1235 under condition Y"*
- **Complete doc here**

Metadata

- Additional information to classify directory/file content with a key/value store
- Can be set per directory or per file
- Directory metadata inherited in sub-directories, must be unique in hierarchy
- Can be anything (text, numbers)
- Can be used to find files via script or for transformations

Using Metadata

- In the *dirac-dms-filecatalog-cli*: `help meta`

- Create a new key: `meta index`

- Set a value: `meta set`

- Get the metadata for lfn or directory: `meta get`

- Find LFNs:
    - *dirac-dms-filecatalog-cli*: `find`
    - The command *dirac-dms-find-lfns*

22/05/18   **DMS Intro - C.HAEN**

DFC

- **Highly configurable**
- **One Service, many backends**
  - Aspect oriented: 1 manager for Files, 1 for Folders, 1 for permissions, etc
- **Two main sets of managers**
  - Standard: full features, most used
  - LHCb: untested (=unsupported) features (metadata & datasets), optimized for performance, scaling & consistency

Let's get our hands dirty

- **What you need**
  - 2 SEs:
    - Just configuration lines in /Resources/StorageElements
    - DIRAC has its own SE implementation if you need a toy
  - DFC:
    - 1 service + its configuration
    - A database
    - Declare it as a Catalog in /Resources/FileCatalogs

Let's get our hands dirty

```
$dirac-dms-add-file /lhcb/user/c/chaen/sexyBeach.jpg sexyBeach.jpg CERN-USER
  Successfully uploaded sexyBeach.jpg to CERN-USER (1.1 seconds)

$dirac-dms-replicate-lfn /lhcb/user/c/chaen/sexyBeach.jpg RAL-USER
  Successful :
    RAL-USER :
        /lhcb/user/c/chaen/sexyBeach.jpg :
            register : 0.553272008896
            replicate : 9.3123319149

$dirac-dms-lfn-replicas /lhcb/user/c/chaen/sexyBeach.jpg
  Successful :
    /lhcb/user/c/chaen/sexyBeach.jpg :
        CERN-USER : srm://srm-eoslhcb.cern.ch:8443/srm/v2/server?SFN=/eos/lhcb/grid/user/lhcb/user/c/chaen/sexyBeach.jpg
        RAL-USER : srm://srm-lhcb.gridpp.rl.ac.uk:8443/srm/managerv2?SFN=/castor/ads.rl.ac.uk/prod/lhcb/user/c/chaen/sexyBeach.jpg

$dirac-dms-lfn-metadata /lhcb/user/c/chaen/sexyBeach.jpg
  Successful :
    /lhcb/user/c/chaen/sexyBeach.jpg :
                Checksum : 25bb9869
        ModificationDate : 2018-05-18 12:21:23
                   Owner : chaen
                    Size : 1298
                     [...]

$dirac-dms-pfn-metadata /lhcb/user/c/chaen/sexyBeach.jpg RAL-USER
  Getting replicas for 1 files : completed in 5.8 seconds
  Getting SE metadata of 1 replicas : completed in 1.1 seconds
  Successful :
    /lhcb/user/c/chaen/sexyBeach.jpg :
        RAL-USER :
                Accessible : True
                    Cached : 1
                  Checksum : 25bb9869
                     [...]

$dirac-dms-remove-files /lhcb/user/c/chaen/sexyBeach.jpg
  Removing 1 files : completed in 4.1 seconds
  Successfully removed 1 files
```
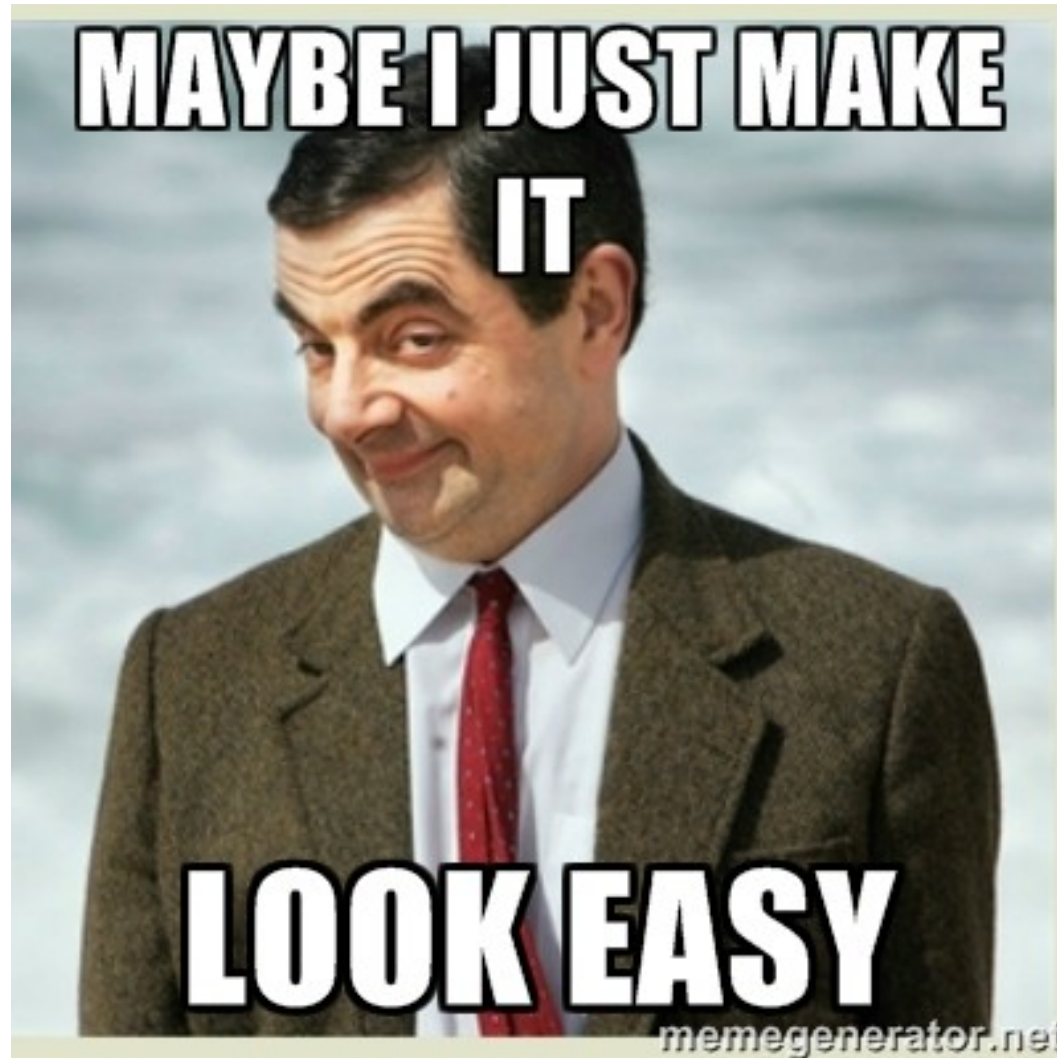
You're done!

You're done!

- **It REALLY is that easy**
- **With this setup:**
  - User can play with their files
  - Jobs can have input/output data
  - Etc
- **But you would struggle for the management of big amount of data...**

Large Scale DM replications

- **File Transfer Service (FTS):**
  - Useful for large scale data management transfers
  - Copies the files from where you tell it to where you tell it to
  - http://fts.web.cern.ch/
  - V2 has disappeared, only v3 is left → same happens to DIRAC as of v6r20

FTS in DIRAC

- **2 systems currently existing together in DIRAC:**

  - FTS: works for FTS2 and FTS3 → will disappear

  - FTS3: FTS3 only & optimized

  - Documentation still exists for both here and there

- **Heavily tested by ILC, thanks !**

- **Supports FTS Activities&Priorities, user files transfers**

FTS in DIRAC

- **How to use FTS from DIRAC:**

  - You need the RMS (see tomorrow's talk)

  - You need the 3 usual components:

    - FTS3DB

    - FTS3Manager

    - FTS3Agent

- **That's it, you're ready to submit big DM transformations (see Luisa's talk) and let FTS transfer for you**

In summary

- **Just a few users submitting jobs?**
  - DFC + a few configuration lines is all you need
- **What ? You use tapes as well ?**
  - Just install the StorageManagement system
- **Ah, you grew up, have many users and a lot of data ?**
  - Add the RMS, FTS and the TS

What this talk did not cover

- **Staging**
  - DIRAC has all you need
- **Permissions**
  - Quite some flexibility
  - FileCatalog (+RSS) for within DIRAC
  - VOMS/Site dependant for physical files
- **Transformation Plugins**
  - See Luisa's and Philippe's talk
- **Good practices**

Find a DataManager

You see, in this world there's two kinds of experiment, my friend: those with a DataManager and the very small ones.