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VIRTUAL IMAGING PLATFORM

Biomedical community accessing grid resources via the EGI Workload Manager

Sorina Pop, Axel Bonnet

EGI Conference 2021, 21/10/2021

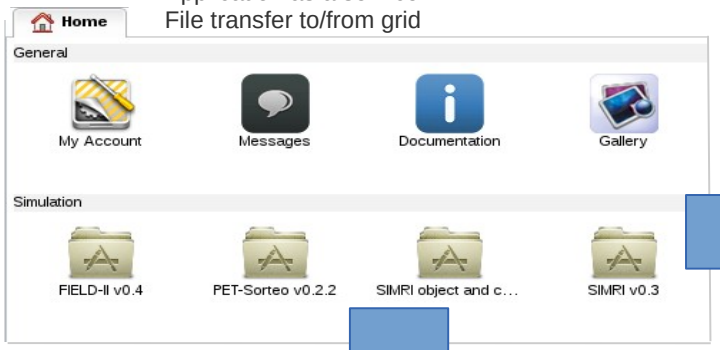
Medical Imaging Research Laboratory

https://vip.creatis.insa-lyon.fr

www.creatis.insa-lyon.fr

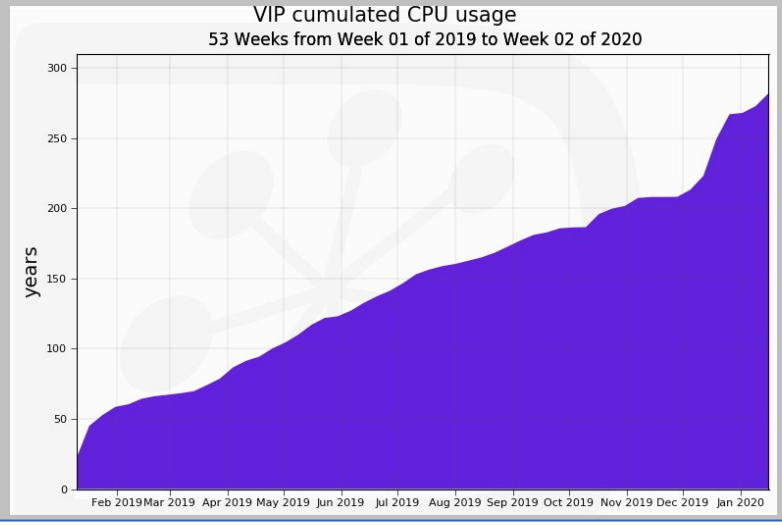
Web portal

Application as a service
File transfer to/from grid



Infrastructure

Supported by EGI Infrastructure
Uses biomed VO (~65 sites in Europe and beyond)
VIP consumes ~**23 CPU years** every month

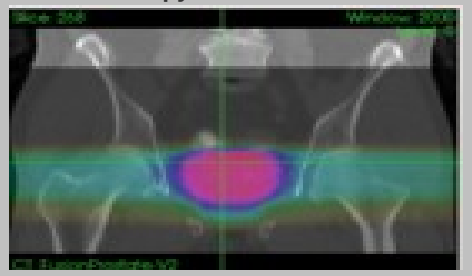


France-Grilles

DIRAC

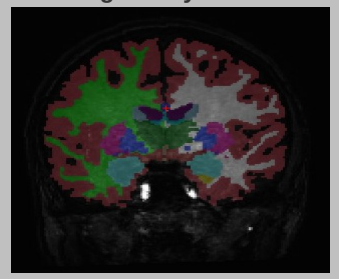
Scientific applications

Cancer therapy simulation



Prostate radiotherapy plan simulated with GATE(L. Grevillot and D. Sarrut)

Neuro-image analysis

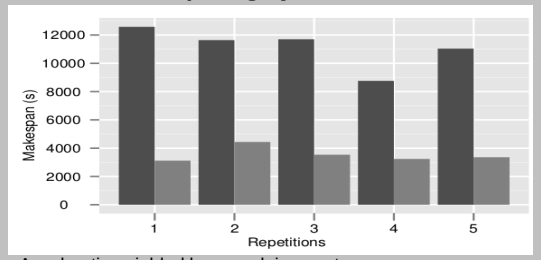


Brain tissue segmentation with Freesurfer

Image simulation

Echocardiography simulated with FIELD-II (O. Bernard *et al*)

Modeling and optimization of distributed computing systems



Acceleration yielded by non-clairvoyant task replication (R. Ferreira da Silva *et al*)

Users

1300+ registered users in September 2021
61 publications since 2011

Latest success story: MSSEG-2

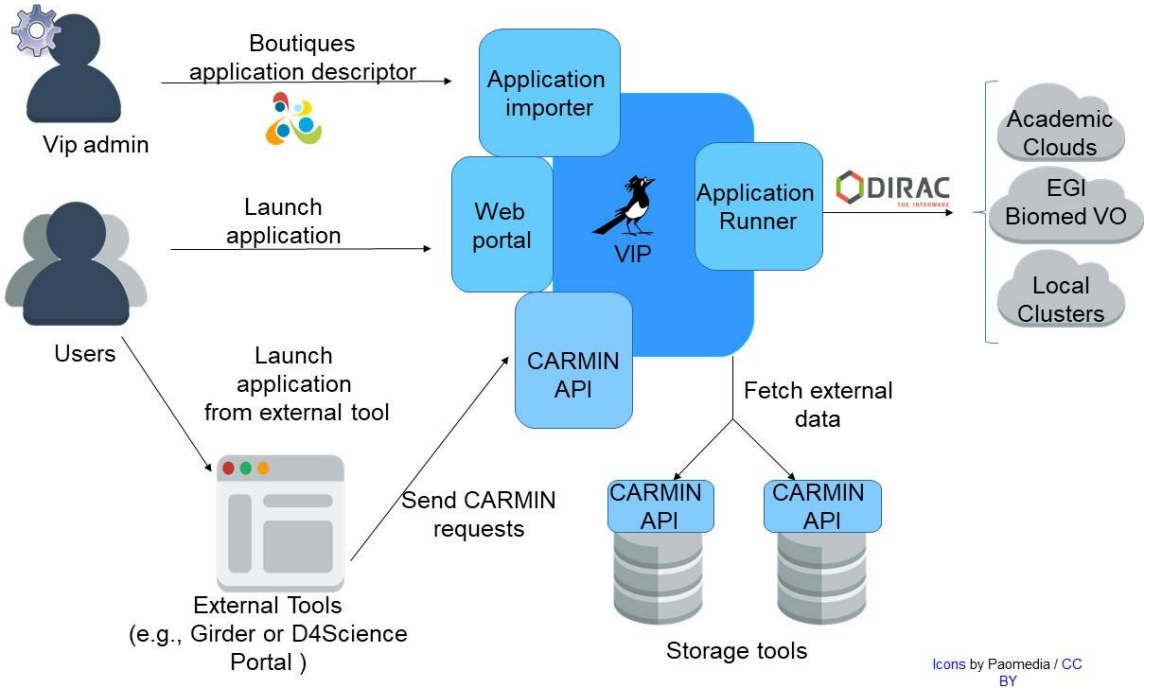
- A scientific challenge
  - Research teams work on solving a common scientific hard problem
  - Their solutions are evaluated on a given set of data according to the guidelines given by the organizers

- MSSEG-2
  - 2nd Multiple Sclerosis (MS) Segmentation (Seg)
  - Automatic segmentation of tissus and lesions in MRI brain scans
  - Detection of lesions appearing bewteen two patient's visits
  - https://portal.fli-iam.irisa.fr/msseg-2/

MSSEG-2 on VIP

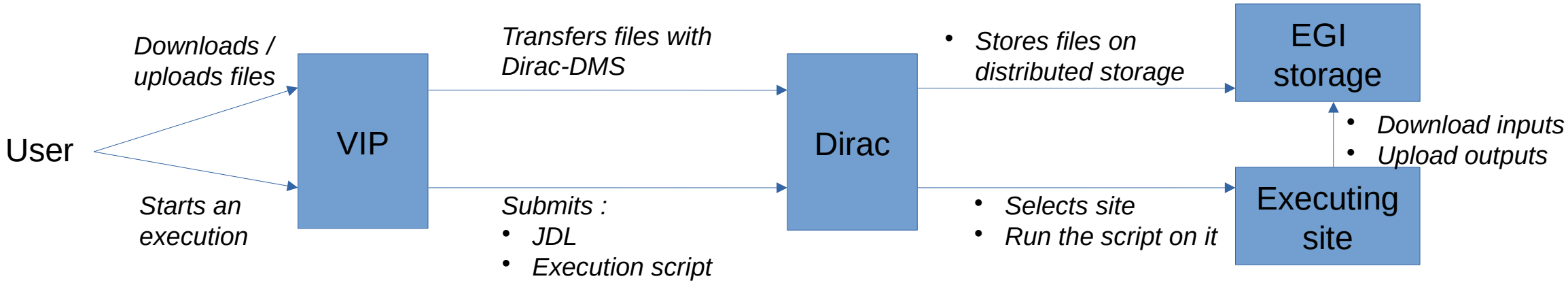
- 31 pipelines integrated in VIP for the challenge (24 teams)
  - Using Docker images and Boutiques descriptors
  - Challengers tested and validated the pipeline execution on training images
    - Simple and user-friendly access through the VIP Portal
  - VIP team executed pipelines over the 60 patients of the testing set
    - Automation using of the CARMIN API
- VIP used
  - The DIRAC EGI Workload Manager Service
  - EGI Cloud resources within the Biomed VO (IN2P3 IRES, CESNET, SAVBA).

  The resources were « booked » during the testing duration
  - A few local (Creatis) VMs



VIP – Dirac interface

- Global Architecture



- Dirac usage through VIP is 100% transparent for end users

Data management in VIP with Dirac

- Users must upload inputs files on VIP before starting an execution
- VIP uploads/replicates them on the Dirac File Catalog (DFC)
  - VIP uses `dirac-dms-add-file / dirac-dms-replicate-lfn`
- When an execution is finished
  - The result is available on the DFC
  - VIP uses `dirac-dms-get-file` to get it

Job submission in VIP on Dirac

- Job information specified in a JDL file :
  - Used with `dirac-wms-job-submit *.jdl`
  - Specify sites requirements if needed
  - Includes the script in the sandbox

```
JobName = "VIP-Freesurfer job";
Executable = "freesurfer-789630895241448.sh";
StdOutput = "std.out";
StdError = "std.err";
InputSandbox = {"/workflows/workflow-DqVneo/freesurfer-789630895241448.sh"};
OutputSandbox = {"std.out", "std.err"};
CPUTime = "1800";
Priority = 1;
Site = "";
BannedSite = "";
```

Job execution in VIP with Dirac

- Once Dirac finds an available site :
  - Dirac deploys the execution script on it
  - It is a Bash script generated by VIP
  - It is specific to the execution (includes inputs / outputs / executable link)
- Script steps :
  - Download the input files (From the DFC)
  - Obtain the application executable (From the DFC or from CVMFS)
  - Run the application with the users inputs
  - Upload the results (From the DFC)

Job monitoring in VIP with Dirac

- VIP uses several Dirac commands to monitor jobs
  - dirac-wms-job-status to know each job is queued/running/finished
  - dirac-wms-job-get-output to obtain execution logs

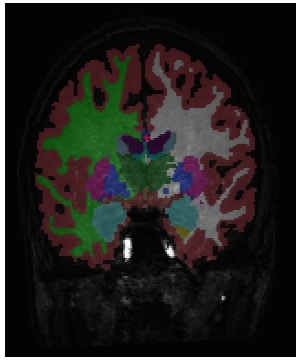
- In case of failure or stalled jobs
  - VIP automatically resubmits the same job
  - But if failure rate is too high, VIPs stops resubmiting and kills all linked running jobs to not waste resources

Notes about the VIP-Dirac interface

- Authentication/Authorization : VIP uses a robot certificate to contact Dirac
- VIP uses a workflow engine :
  - A single execution can generates hundreds of Dirac jobs
- VIP can launch applications in containers through Dirac
  - Singularity on some grid sites
  - UDocker is experimented
  - Docker is used on VMs (also with GPUs)

EGI Biomed VO

- Life Sciences sector with three main thematic groups
  - Medical image analysis
  - Bioinformatics
  - Drug discovery
- EGI's biomed VO
  - Operating since 2004
  - Heterogeneous resources and user profiles
  - Technical teams on shift for monitoring
- Open access
  - For non-commercial users
  - For life-science applications
- Biomed users directly added to Dirac instance



Brain tissue segmentation with Freesurfer

Advice to new users

- Analyse your needs
  - Direct access to Dirac or passing through a platform such as VIP
- Don’t hesitate to contact us !
  - Vip-support@creatis.insa-lyon.fr

Thank you for your attention!

Questions?