

Centre de Calcul de l'Institut National de Physique Nucléaire et de Physique des Particules

# Service France Grilles DIRAC

10ème Journées Informatiques de l'IN2P3 IRFU  
28 septembre 2016

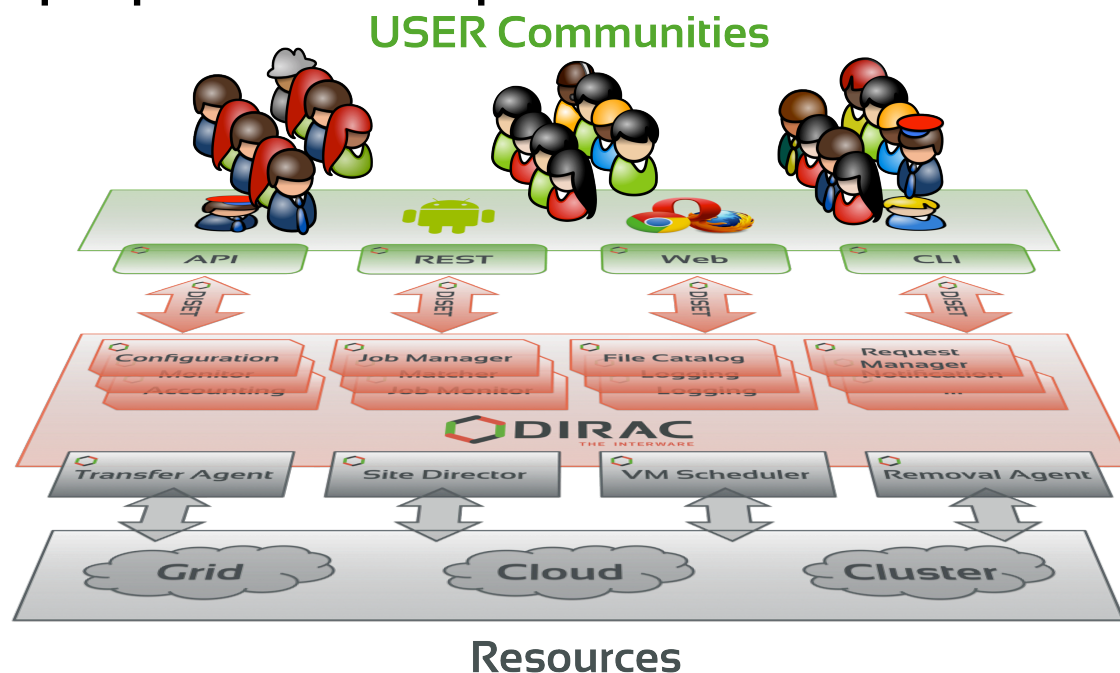


- ▶ Qu'est-ce que DIRAC ?
- ▶ L'histoire... en bref
- ▶ La collaboration DIRAC et France Grilles
- ▶ DIRAC : Ordinateur distribué

# Qu'est-ce que DIRAC ?

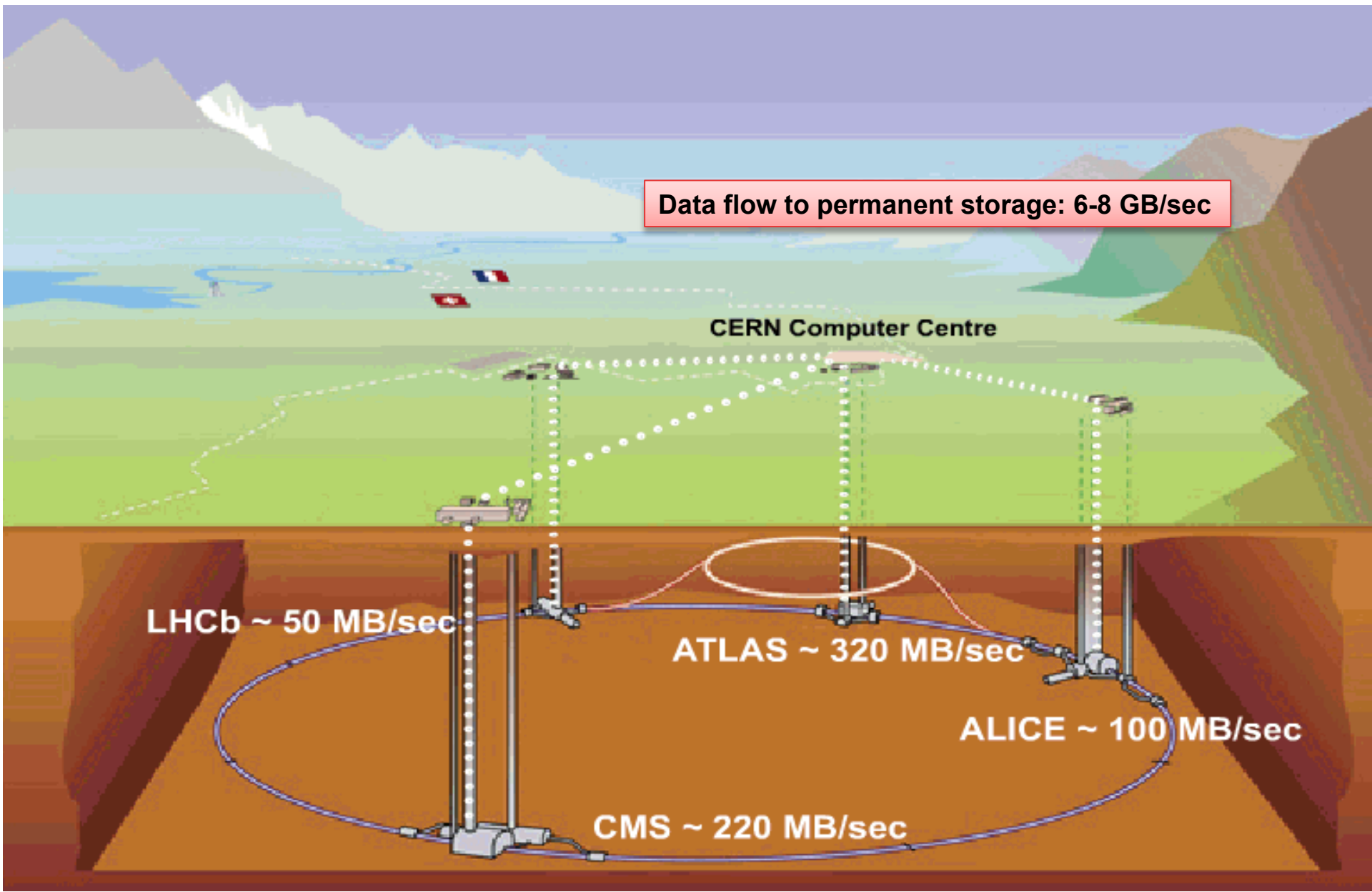
- **DIRAC** fournit tous les composants nécessaires pour construire des grilles de calcul à partir de l'interconnexion des ressources informatiques de différents types, permettant l'interopérabilité et la simplification des interfaces.

C'est ce qui permet de parler de la **Interware DIRAC**.

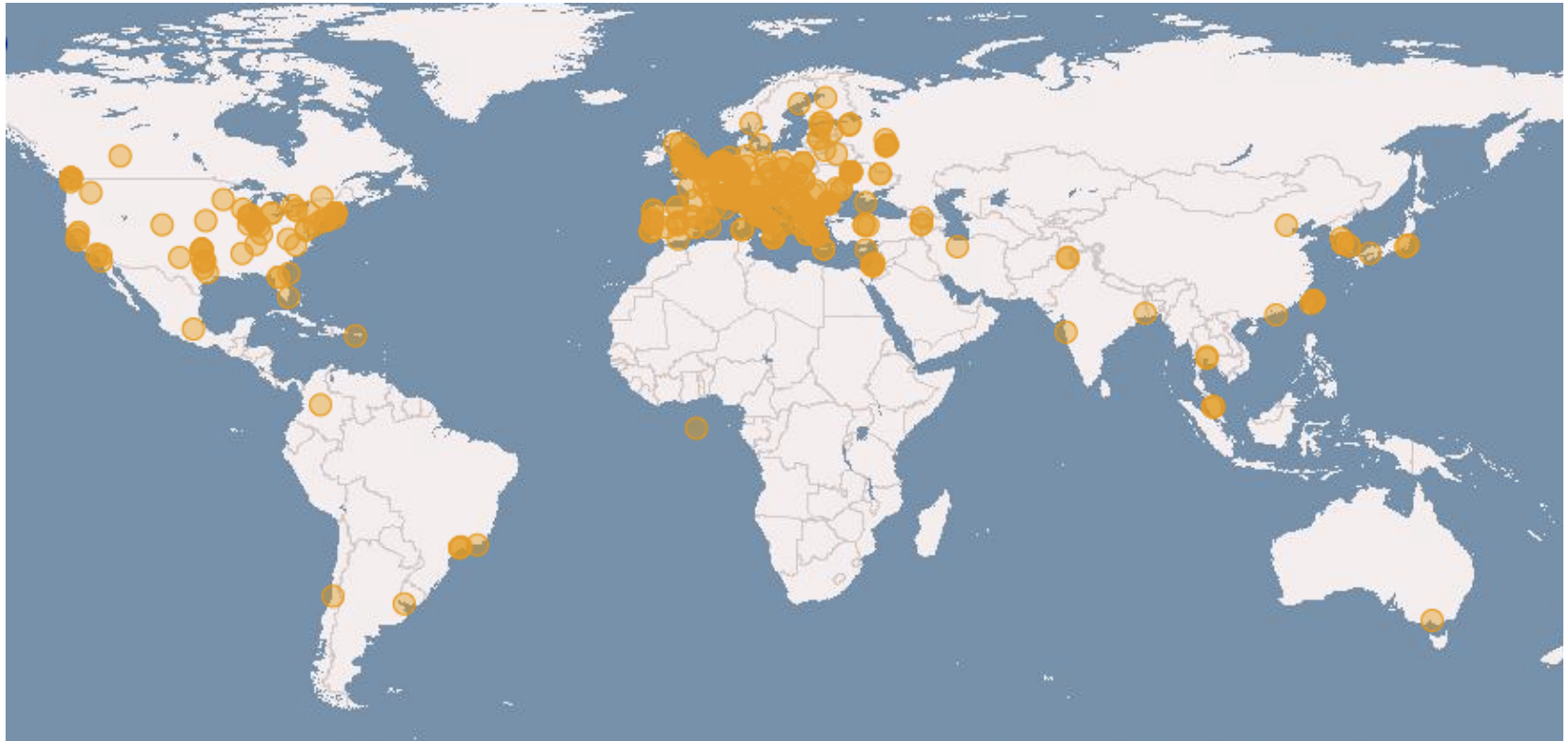




# L'histoire... en bref



- ▶ >100 PB des données au CERN et plus de 150 centres de calcul dans 42 pays
  - Grille de calcul la plus puissante avec ~50k cores CPUs,
  - 12 Tiers2 avec 2-30k cores CPU
- ▶ Infrastructure distribuée des données, services et opérations.



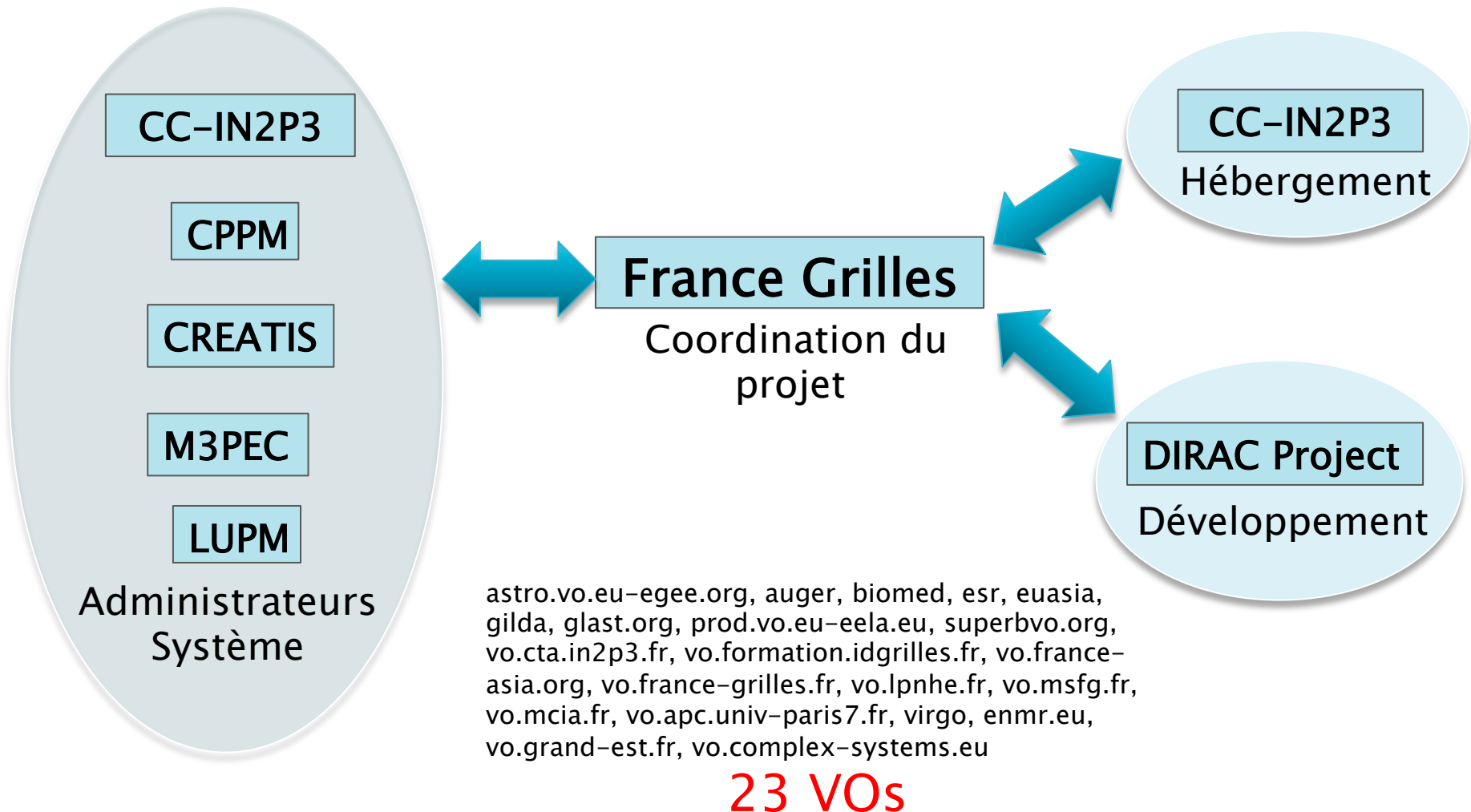
- ▶ Chaque expérience du LHC a développé son propre « middleware » pour résoudre des problèmes particuliers :
  - PANDA , AliEn , glideIn WMS , PhEDEx , ...
- ▶ DIRAC a été développé à l'origine pour l'expérience LHCb.
  - Les expériences recueillies avec un système de production d'une grande expérience sont très précieux.

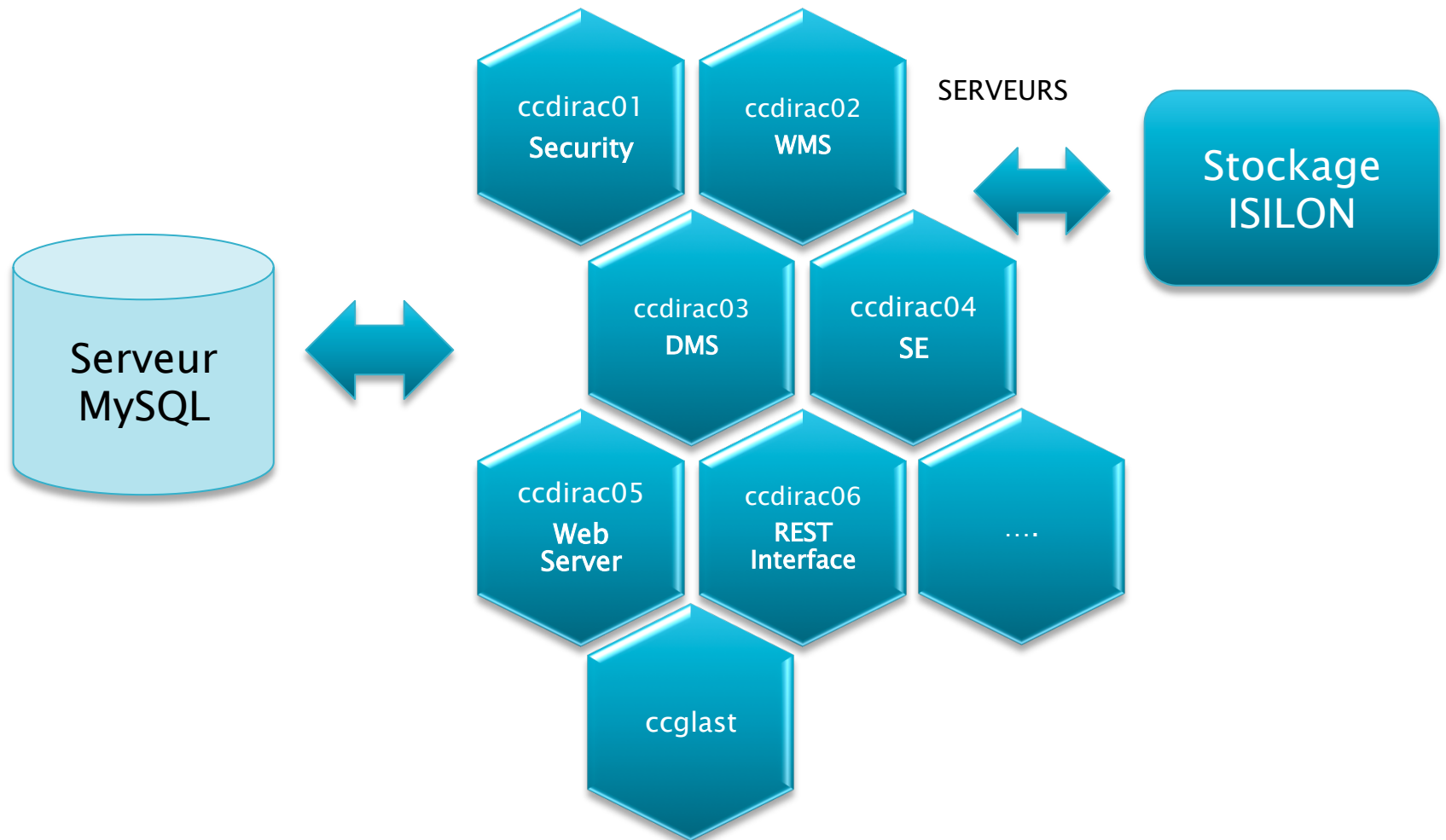
- ▶ Grace aux outils développés, plusieurs nouvelles expériences ont exprimé leur intérêt pour utiliser DIRAC.
- ▶ En 2009, l'équipe de développement de DIRAC de base a décidé de généraliser le logiciel pour le rendre approprié pour diverses communautés d'utilisateurs.
  - Le consortium a été créé pour développer, maintenir et promouvoir le logiciel DIRAC :
    - CERN
    - CNRS
    - Université de Barcelone
    - IHEP
    - KEK
- ▶ Les résultats de ces travaux permettent d'offrir DIRAC dans un cadre général de l'informatique à l'usage distribué.

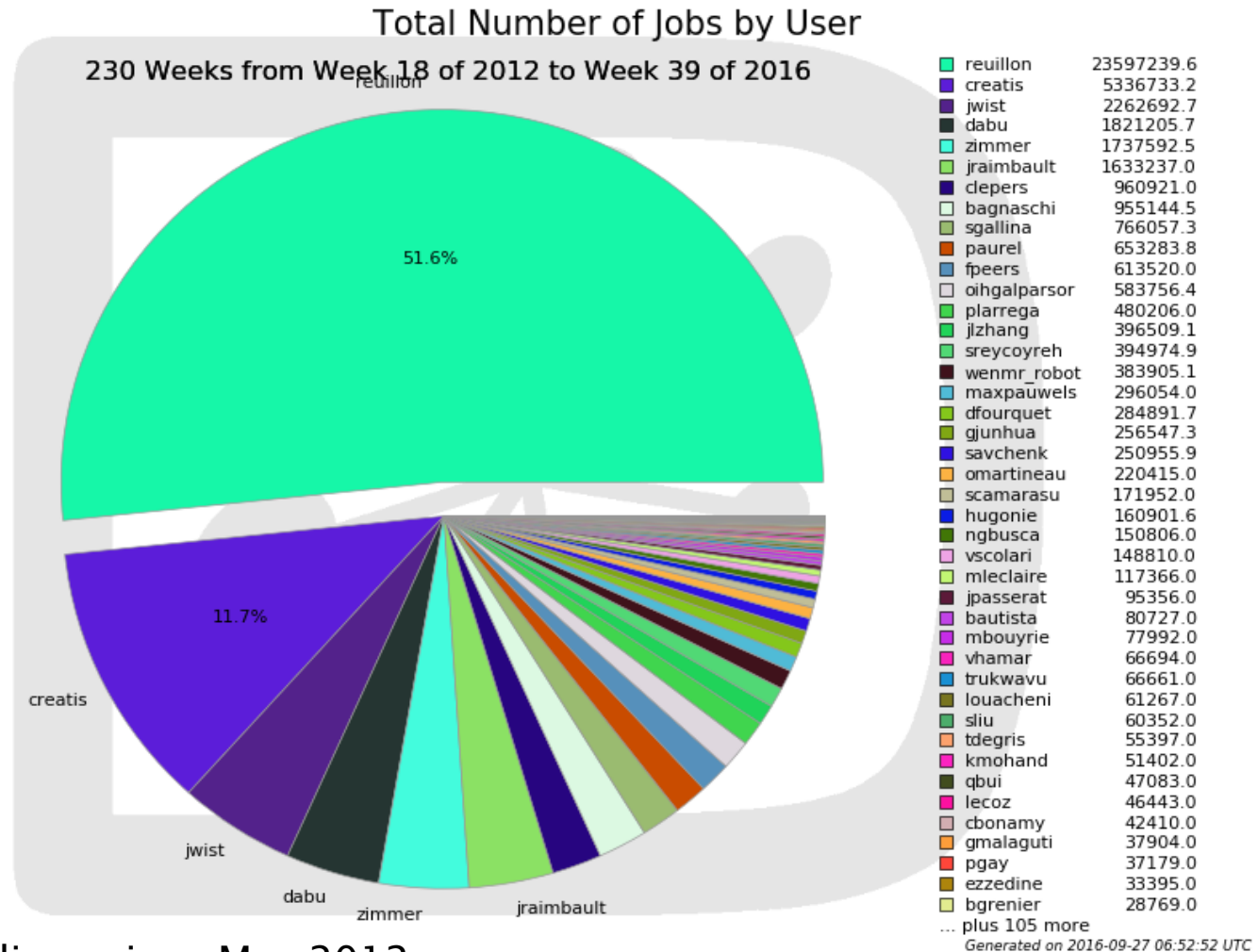
# La collaboration DIRAC et France Grilles

- ▶ L'instance de DIRAC de France Grilles à commencé comme support pour les tutoriels des utilisateurs.
- ▶ Il y avait plusieurs installations régionales
  - Entretien complexe
- ▶ Grace à un effort conjoint de France Grilles et les divers laboratoires la première instance DIRAC multi-VO a été mise en production en mai 2012.

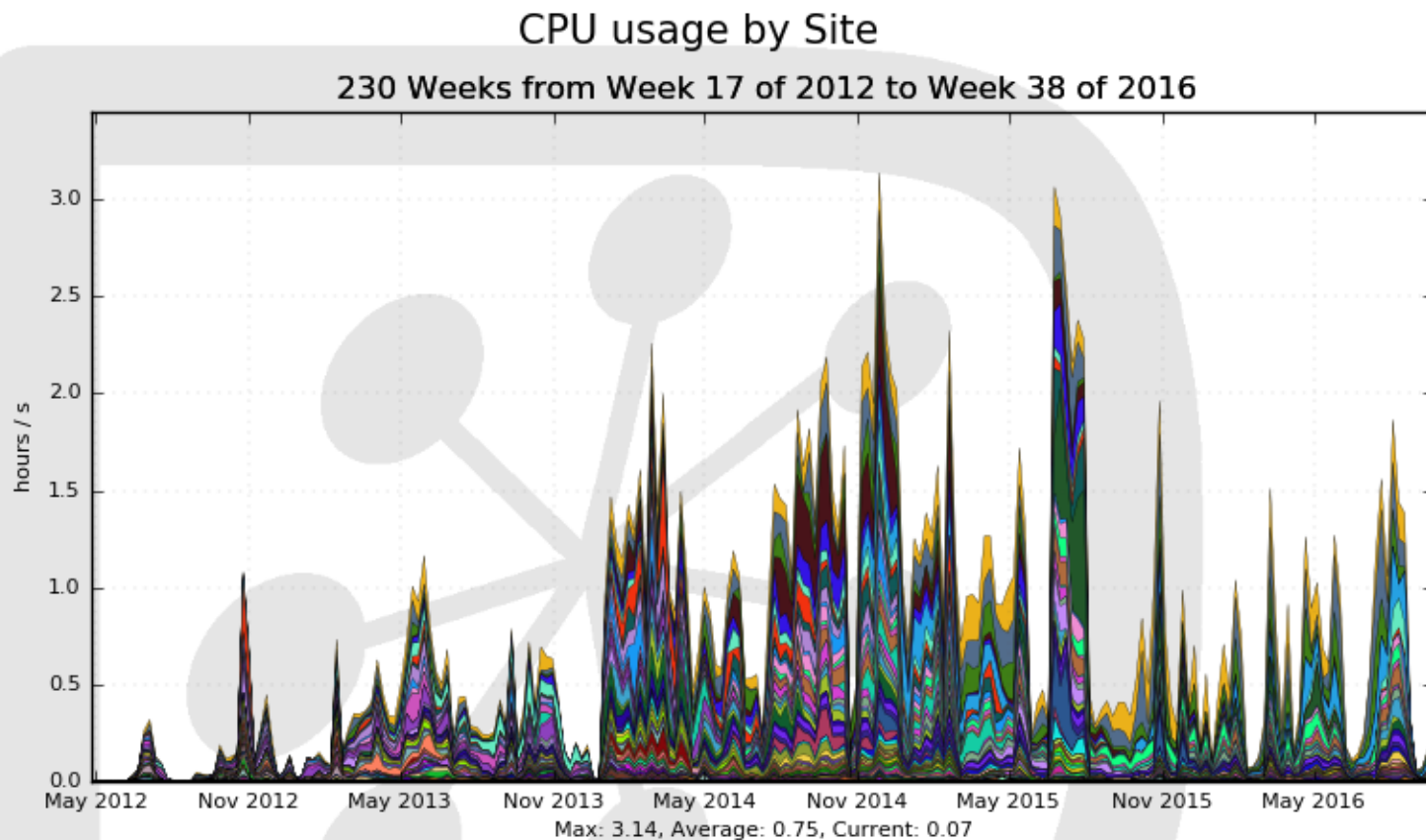






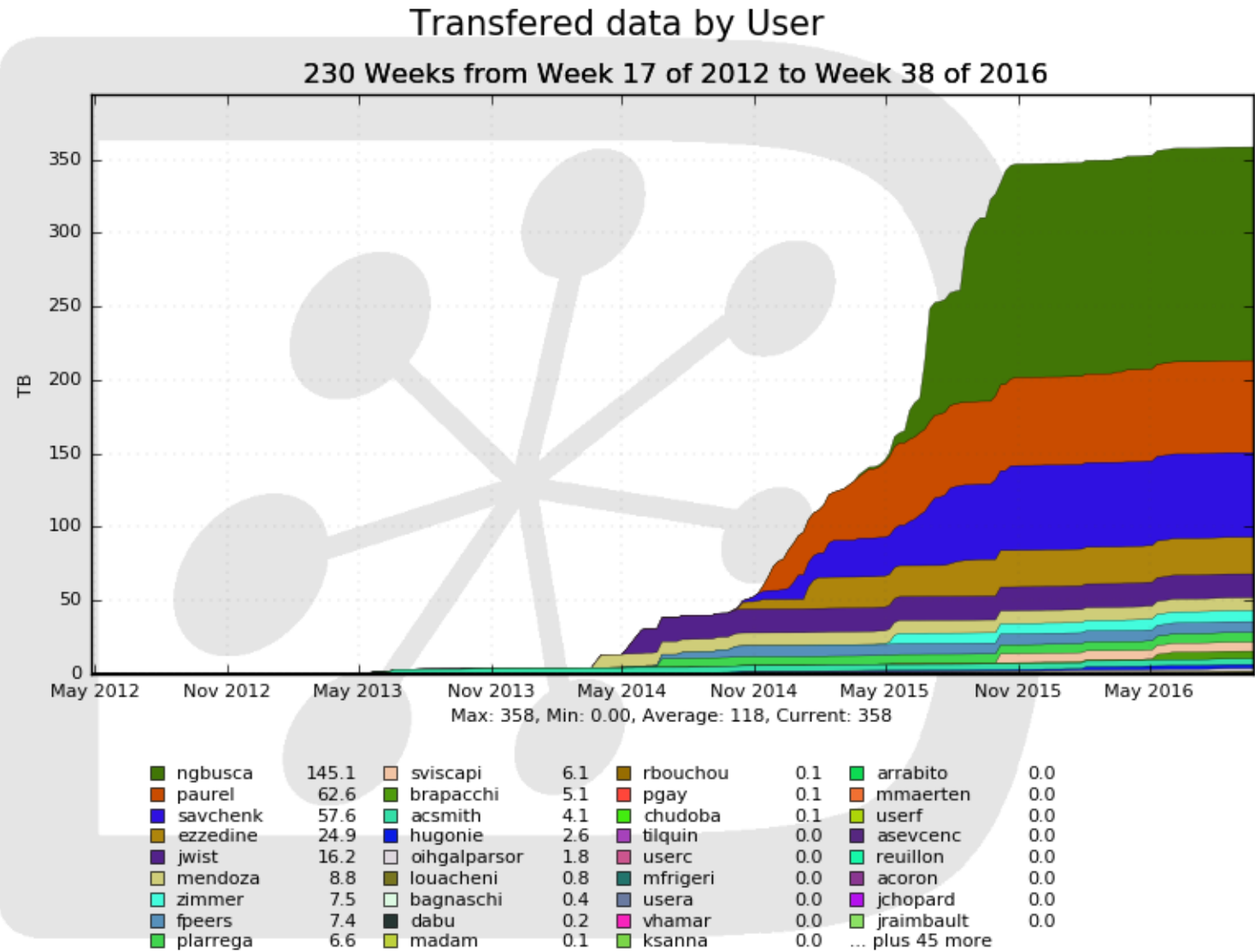


More than 40 millions since May 2012  
 36% France Grilles  
 34% Biomed  
 30% Complex



■ LCG.M3PEC.fr	9.8%	■ ARC.RAL.uk	2.7%	■ LCG.IN2P3.fr	1.7%	■ LCG.UKIQ.uk	1.3%
■ LCG.LAL.fr	9.6%	■ LCG.UNINA.it	2.5%	■ LCG.CPPM.fr	1.6%	■ LCG.AC.uk	1.1%
■ LCG.LPNHE.fr	6.2%	■ LCG.CNAF.it	2.4%	■ LCG.BARI.it	1.6%	■ LCG.OBSPM.fr	0.8%
■ LCG.UKIM.uk	5.7%	■ LCG.CIEMAT.es	2.4%	■ LCG.UKIL.uk	1.6%	■ LCG.UKILH.uk	0.8%
■ LCG.SARA.nl	4.0%	■ LCG.CC.fr	2.3%	■ LCG.NIKHEFE.nl	1.5%	■ LCG.HEP.uk	0.7%
■ LCG.GRIF.fr	4.0%	■ LCG.DATAGRID.fr	2.2%	■ LCG.PSNC.pl	1.5%	■ LCG.PADOVA.it	0.7%
■ LCG.SBG.fr	3.6%	■ LCG.LPC.fr	2.1%	■ LCG.CREATIS.fr	1.4%	■ LCG.EFDA.or	0.6%
■ LCG.PISA.it	3.5%	■ LCG.IPNL.fr	1.9%	■ LCG.AUVERGRID.fr	1.4%	■ LCG.LPSC.fr	0.6%
■ LCG.UKIAC.uk	3.4%	■ LCG.NIKHEF.nl	1.7%	■ LCG.ROMA3.it	1.3%	■ ... plus 111 more	

Generated on 2016-09-27 06:44:58 UTC



Generated on 2016-09-27 06:54:07 UTC

# DIRAC : Ordinateur distribué

- ▶ DIRAC forme une abstraction d'un simple ordinateur qui à le pouvoir de milliers de processeurs et mégaoctets de stockage derrière la scène provenant de diverses sources et diverses technologies (grilles, nuages , etc.)

The screenshot displays the DIRAC web portal interface. The main window is titled "Configuration Manager" and shows a tree view of the system configuration. Overlaid on this are two other windows: "Job Monitor" and "Job Launchpad".

The "Job Monitor" window displays a table of jobs with the following columns: JobId, Status, MinorS, ApplicationStatus, Site, JobNar, LastUpdate[UTC], LastSignOfLife[UTC], and SubmissionTime[UTC]. The table contains several rows of job data, including JobId 1461 and 1258, both with a status of "Waiting".

The "Job Launchpad" window shows the configuration for a job. It includes fields for Proxy Status (Valid), Executable (/bin/lis), JobName (DIRAC\_atsareg\_688261), Arguments (-lra), and OutputSandbox (std.out, std.err). There is also an Input Sandbox field and an LFN field. The window has "Submit" and "Reset" buttons.



**Job Launchpad** [Icons]

Proxy Status: **Valid** + Add Parameters ▾

**JDL**

Executable:

JobName:

Arguments:

OutputSandbox:

**Input Sandbox**

LFN:

Priority

ParameterStep

Parameters

OutputSE

StdError

Site

CPUTime

OutputPath

Platform

SubmitPools

ParameterStart

StdOutput

BannedSite

ParameterFactor

InputData

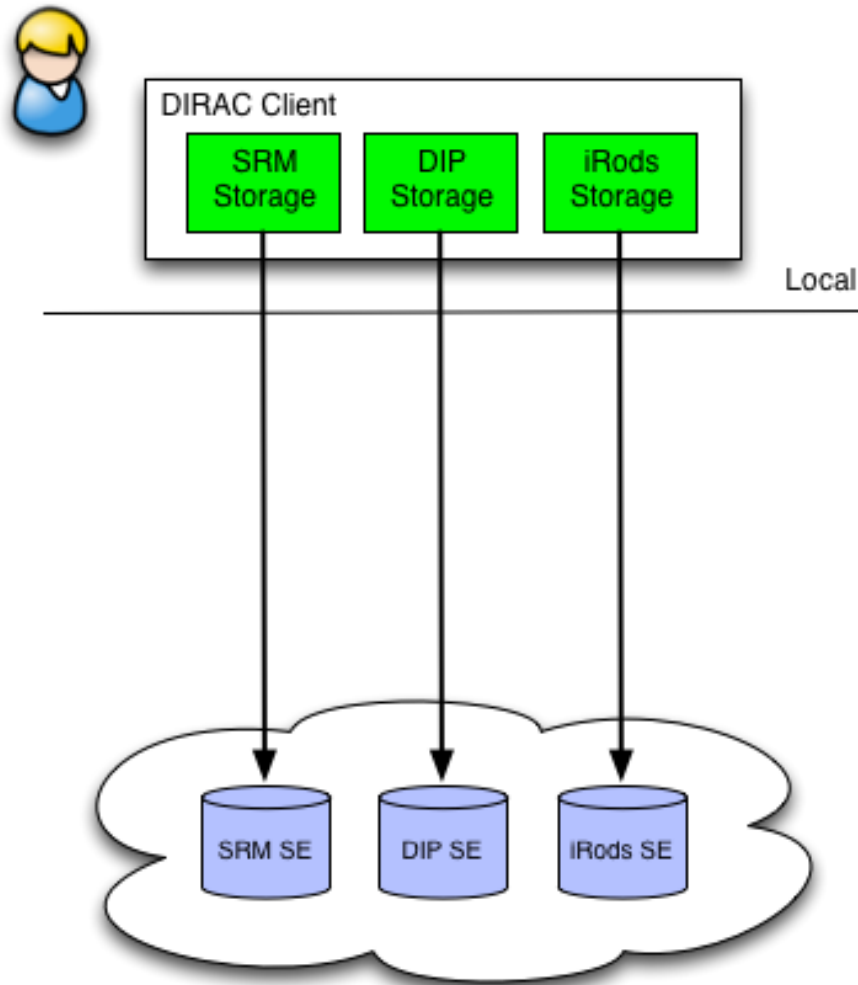
OutputData

Submit  Reset

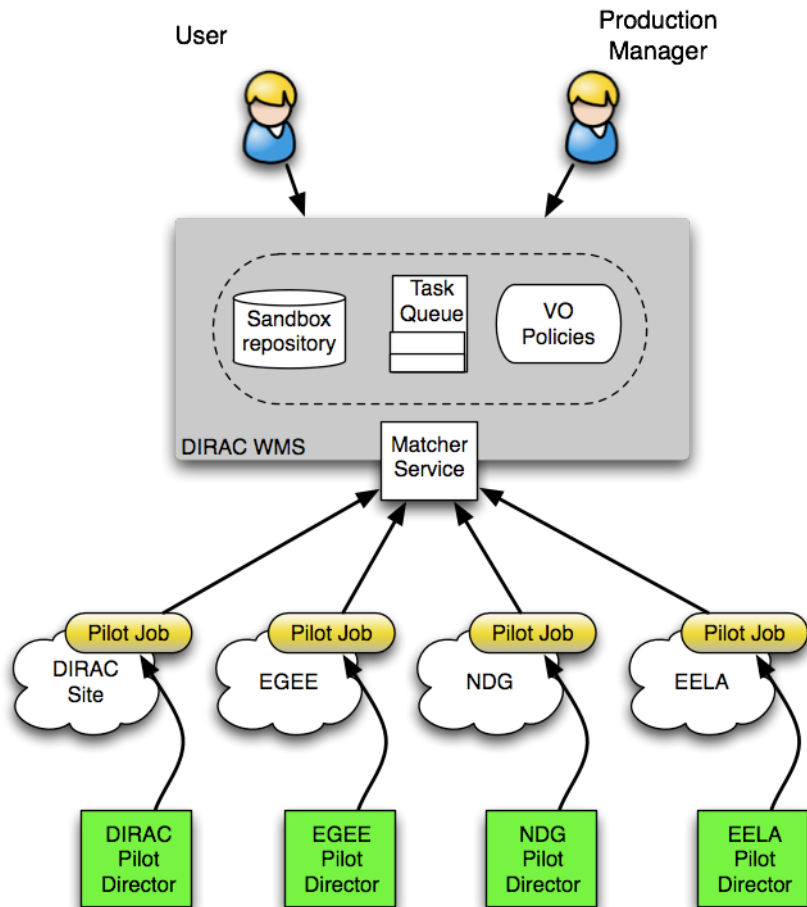
Items per page: 1000 Page 1 of 1 Updated: 2016-09-27 08:16 [UTC](0 00:01) Display

JobId	Status	MinorStatus	ApplicationStatus	Site	JobName	LastUpdate[UTC]	LastSignOfLife[UTC]	SubmissionTime[UTC]
46380867	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380866	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:17:34	2016-09-27 07:17:34	2016-09-27 07:04:55
46380865	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380864	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380863	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:35	2016-09-27 07:18:35	2016-09-27 07:04:55
46380862	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:00	2016-09-27 07:18:00	2016-09-27 07:04:55
46380861	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380860	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380859	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380858	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380857	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380856	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:17:32	2016-09-27 07:17:32	2016-09-27 07:04:55
46380855	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380854	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:32	2016-09-27 07:18:32	2016-09-27 07:04:55
46380853	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:01	2016-09-27 07:18:01	2016-09-27 07:04:55
46380852	Running	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:27	2016-09-27 07:18:27	2016-09-27 07:04:55
46380851	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:30	2016-09-27 07:18:30	2016-09-27 07:04:55
46380850	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380849	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:58	2016-09-27 07:04:58	2016-09-27 07:04:55
46380848	Completed	Application Finished ...	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:35	2016-09-27 07:18:35	2016-09-27 07:04:55
46380847	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:05	2016-09-27 07:18:05	2016-09-27 07:04:55
46380846	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:57	2016-09-27 07:04:57	2016-09-27 07:04:55
46380845	Done	Execution Complete	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:18:35	2016-09-27 07:18:35	2016-09-27 07:04:55
46380844	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:57	2016-09-27 07:04:57	2016-09-27 07:04:55
46380843	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:57	2016-09-27 07:04:57	2016-09-27 07:04:55
46380842	Waiting	Pilot Agent Submission	Unknown	Cloud.CC.fr	DIRAC_vhamar_340...	2016-09-27 07:04:57	2016-09-27 07:04:57	2016-09-27 07:04:55

- JDL
- Attributes
- Parameters
- Logging info
- Peek StandardOutput
- Get LogFile
- Get Pending Request
- Get StagerReport
- Actions
- Pilot
- SandBox



- ▶ L'abstraction des éléments de stockage (SEs) est faite pour chaque protocole d'accès :
  - SRM, XROOTD, gfal2 based, etc
- ▶ Plugins basés en Gfal2 donnent accès à tous les protocoles qui supportent :
  - DCAP, WebDAV, S3, http, iRODS
- ▶ Chaque SE est vu pour les clients comme une entité logique



- ▶ Gestion de la charge des travaux sûr la base des jobs pilotes
  - Haute efficacité des jobs des utilisateurs.
  - Adapté à une utilisation avec des ressources hétérogènes
  - Permettre l'application des politiques communautaires

# DIRAC – Pilot Monitoring

https://dirac.france-grilles.fr/DIRAC/s:Dirac-Production/g:dirac\_admin/?view=desktop&theme=Grey&url\_state=0|DIRAC.JobMonitor.classes.JobMonitor::0:0:1512:752:0:0,-1,-1,-

Search

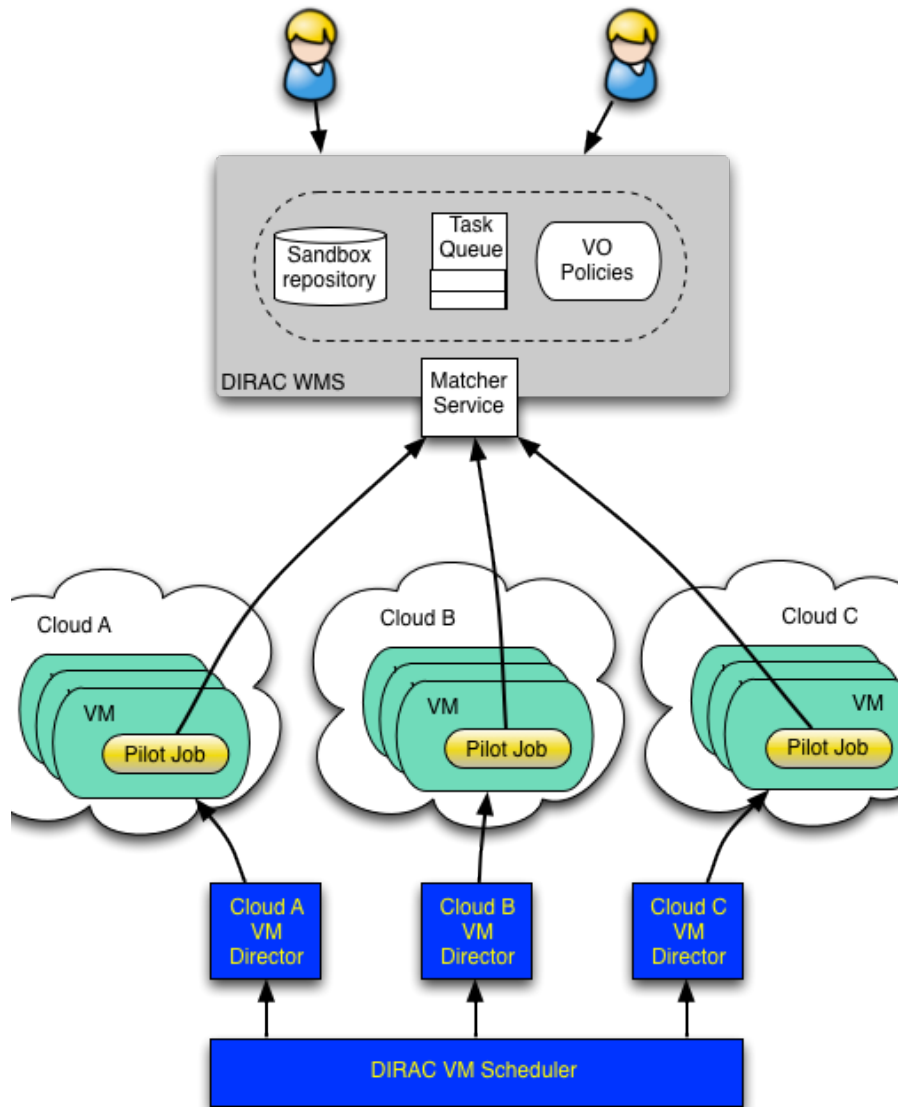
CC Grid Kibana Monitoring Most Visited Latest Headlines SAM Operations portal LL nono cours.md - master ... LL systeme:sysgrid [...]

### Pilot Monitor

Items per page: 1000 Page 21 of 131 Updated: 2016-09-27 21:30 [UTC](0 00:00) Displaying topics 1001 - 2000 of 130742

PilotJobReference	Status	Site	ComputingElement	Broker	CurrentJobID	GridType	TaskQueueID	BenchMark	OwnerGroup	LastUpdateTime[UTC]	Submiss
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383670	CREAM	1953439	6.3	complex_pilot	2016-09-27 21:17:46	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383641	CREAM	1953439	6.8	complex_pilot	2016-09-27 21:17:45	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383637	CREAM	1953439	7.5	complex_pilot	2016-09-27 21:17:24	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383456	CREAM	1953439	6.7	complex_pilot	2016-09-27 21:17:42	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383621	CREAM	1953439	10.4	complex_pilot	2016-09-27 21:16:59	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383673	CREAM	1953439	9.3	complex_pilot	2016-09-27 21:20:19	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383729	CREAM	1953439	8.4	complex_pilot	2016-09-27 21:22:00	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383676	CREAM	1953439	10.1	complex_pilot	2016-09-27 21:22:57	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383820	CREAM	1953439	9.2	complex_pilot	2016-09-27 21:25:04	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383797	CREAM	1953439	9.5	complex_pilot	2016-09-27 21:28:53	2016-09
<input type="checkbox"/> https://grid30.la...	Running	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	46383809	CREAM	1953439	9.9	complex_pilot	2016-09-27 21:29:57	2016-09
<input type="checkbox"/> https://grid30.la...	Scheduled	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	-	CREAM	1953439	0	complex_pilot	2016-09-27 21:22:05	2016-09
<input type="checkbox"/> https://grid30.la...	Scheduled	LCG.LAL.fr	grid30.lal.in2p3.fr	ccdiracl02.in2p...	-	CREAM	1953439	0	complex_pilot	2016-09-27 21:22:05	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383843	CREAM	1953439	10.6	complex_pilot	2016-09-27 20:56:19	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383850	CREAM	1953439	5.1	complex_pilot	2016-09-27 20:57:20	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383900	CREAM	1953439	5.5	complex_pilot	2016-09-27 20:57:14	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383448	CREAM	1953439	8.1	complex_pilot	2016-09-27 20:56:39	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383779	CREAM	1953439	8.8	complex_pilot	2016-09-27 20:56:26	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383816	CREAM	1953439	8.8	complex_pilot	2016-09-27 20:56:40	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383713	CREAM	1953439	5.5	complex_pilot	2016-09-27 20:54:11	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383293	CREAM	1953439	7.1	complex_pilot	2016-09-27 20:53:49	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383268	CREAM	1953439	11	complex_pilot	2016-09-27 20:53:40	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383666	CREAM	1953439	8.4	complex_pilot	2016-09-27 20:54:00	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383248	CREAM	1953439	8	complex_pilot	2016-09-27 20:54:06	2016-09
<input type="checkbox"/> https://lpnhe-cr...	Running	LCG.LPNHE.fr	lpnhe-cream.in2...	ccdiracl02.in2p...	46383255	CREAM	1953439	8.3	complex_pilot	2016-09-27 20:53:57	2016-09

Submit Reset Refresh



► Le scheduler des machines virtuelles de DIRAC est une interface aux clouds :

- OCCI
- Apache-libcloud
- EC2
  - OpenStack, OpenNebula
  - CloudStack
  - Amazon EC2
  - ...



Instances

Instance Name Filter  Filter

Instance Name	Image Name	IP Address	Size	Key Pair	Status	Availability Zone	Task	Power State	Time since created	Actions
<input type="checkbox"/> DIRAC_F0718AF4	official-SL-6x-x86_64	172.17.10.6 Floating IPs: 134.158.246.146	m1.large	DIRAC_test	Active	nova	None	Running	5 minutes	Create Snapshot
<input type="checkbox"/> DIRAC_BA3D27FA	official-SL-6x-x86_64	172.17.10.5 Floating IPs: 134.158.246.137	m1.large	DIRAC_test	Active	nova	None	Running	6 minutes	Create Snapshot
<input type="checkbox"/> DIRAC_66F098BE	official-SL-6x-x86_64	172.17.10.4 Floating IPs: 134.158.246.83	m1.large	DIRAC_test	Active	nova	None	Running	7 minutes	Create Snapshot
<input type="checkbox"/> DIRAC_0415725F	official-SL-6x-x86_64	172.17.10.3 Floating IPs: 134.158.246.68	m1.large	DIRAC_test	Active	nova	None	Running	8 minutes	Create Snapshot

Displaying 4 items

Plot: Average Load Timespan: All History Plot Rotation: No Rotation

VM Status: Running Updated: null Items per page: 100 Page 1 of 1

InstanceID	Image	RunningPod	EndPoint	Status	DIRAC VM ID	Endpoint VM ID	IP	Load	Uptime	Jobs	Last Update (UTC)	Error
<input type="checkbox"/> 398	SL6-large	biomed	Cloud.CC.fr::cck...	Running	C8B882DE	c9646d7-6fbd-43c9-86af-63f087f42e87	172.17.10.6	0.41	0:15:17	14	2016-09-27 08:23:26	
<input type="checkbox"/> 397	SL6-large	biomed	Cloud.CC.fr::cck...	Running	CS108F36	c0fc42ad-5385-4535-a383-f04199d4a88d	172.17.10.5	0.60	0:15:47	19	2016-09-27 08:22:57	
<input type="checkbox"/> 396	SL6-large	biomed	Cloud.CC.fr::cck...	Running	D2E71475	119e3b09-76e2-4b9e-8d88-347cbb82dc4b	172.17.10.4	0.72	0:15:41	36	2016-09-27 08:21:50	
<input type="checkbox"/> 395	SL6-large	biomed	Cloud.CC.fr::cck...	Running	77082FE9	70e3df4c-aa15-4c81-b6f9-434013f9fcd8	172.17.10.3	0.73	0:15:22	36	2016-09-27 08:20:32	



- ▶ L'architecture permet d'intégrer de façon transparente les différents types de grilles, des nuages et d'autres ressources informatiques
- ▶ Les services basés sur les technologies de DIRAC peuvent aider les utilisateurs à se lancer dans le monde de calculs distribués et de révéler son plein potentiel

**Merci beaucoup !**

