



Tier-1 Operations at CC-IN2P3

Renaud Vernet – Apr. 2nd 2012



Outline



- The CC-IN2P3 in not so brief
- « Operation » team
 - Organization
 - Activities
- Watch and monitoring tools
- Transition to Oracle Grid Engine
- Preparing the future...



The CC-IN2P3



- IN2P3
 - National Institute for Nuclear and Particle Physics
- Computing Center originally created for physics purposes (nuclear & HEP)

→ The core of our activities

- Now serving also non-physics fields
 - Biology, medical imaging, neurosciences, humanities...
- Other activities
 - Grid development (portals)
 - Web hosting service (education purposes...)
- ~80 persons at CC
 - Some of them (user support group, 10 people) work in close contact with users/experiments

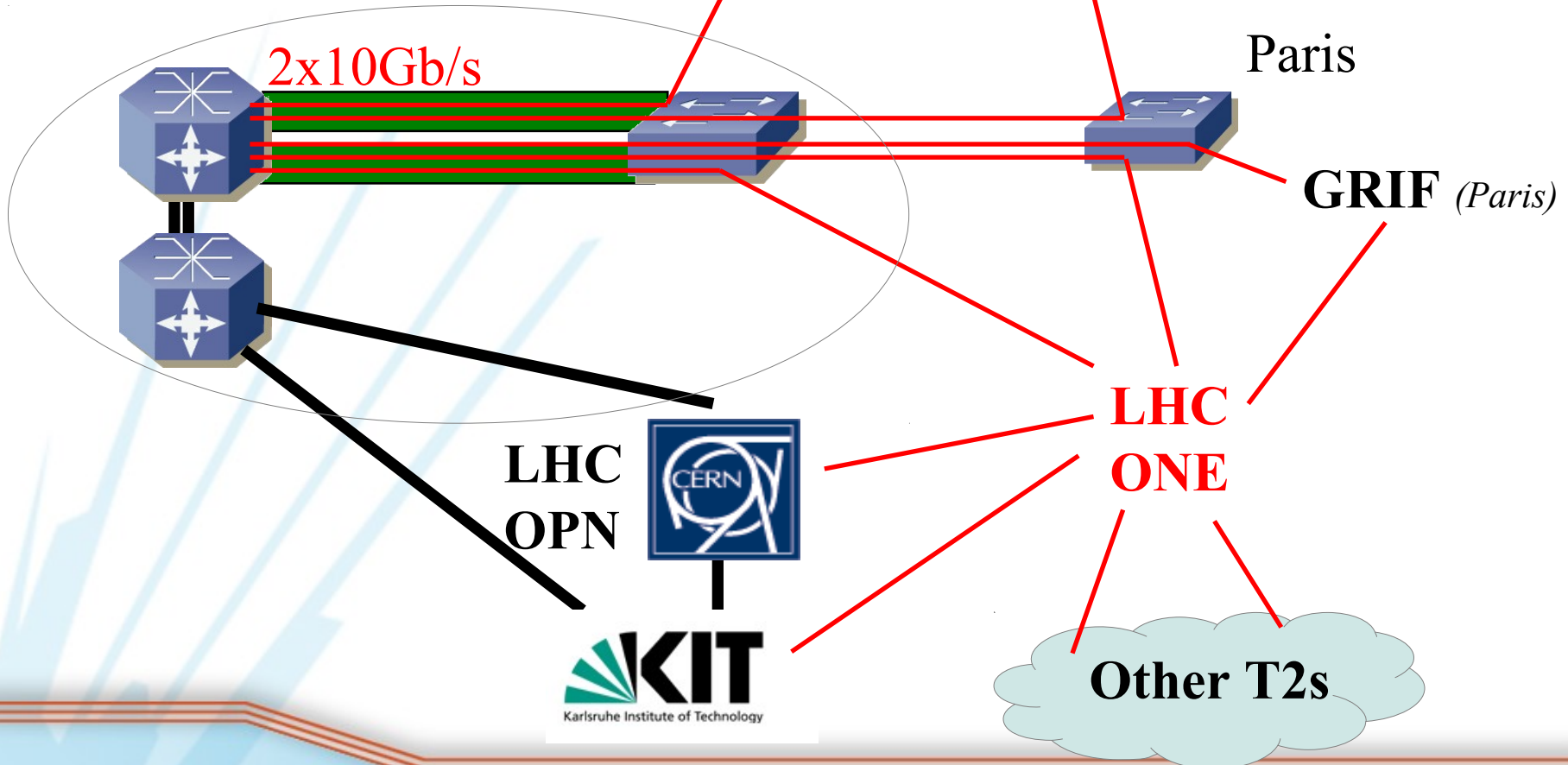
The CC-IN2P3



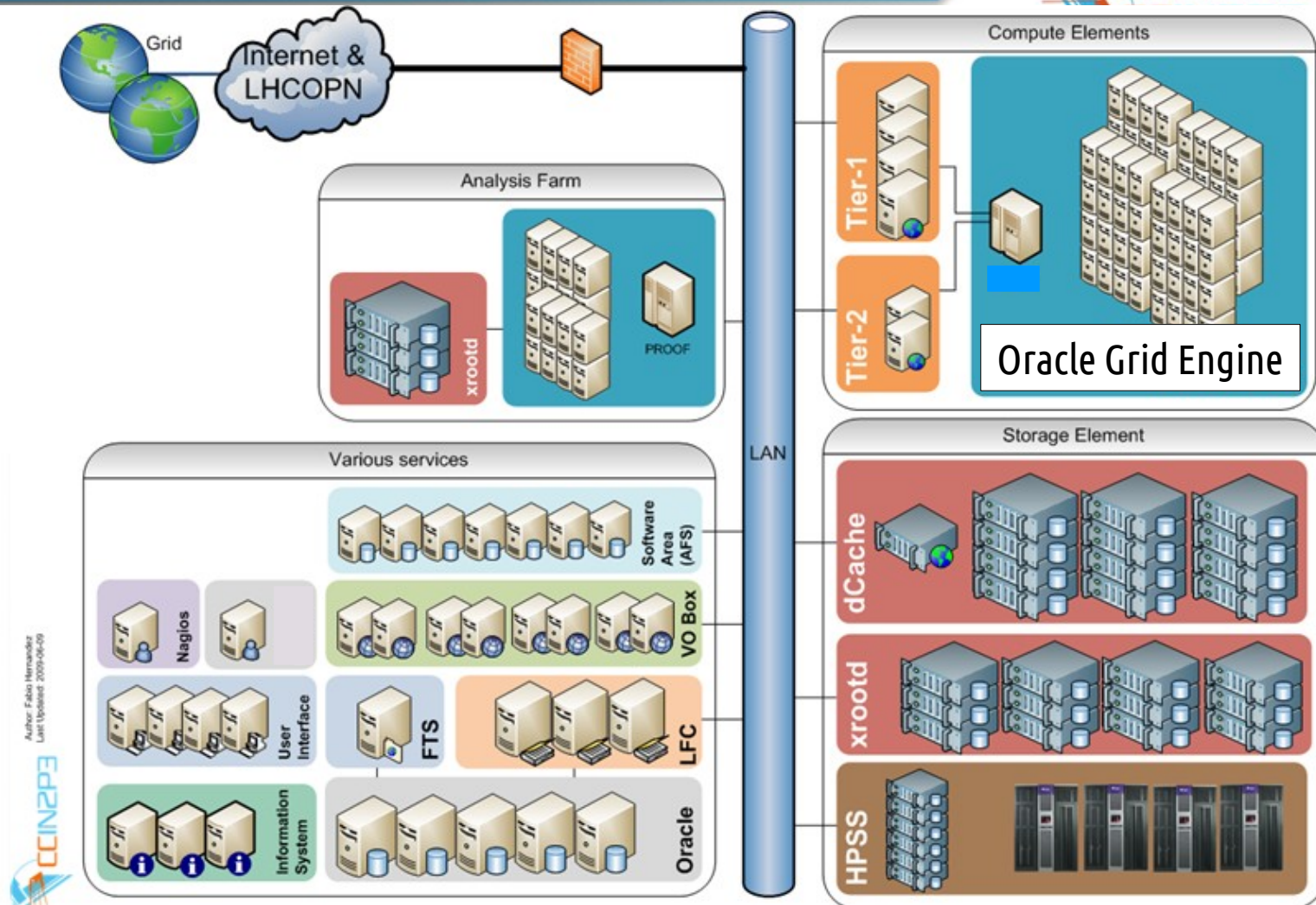
- Located in Lyon
 - ~150km from Geneva
- Hardware partners
 - Dell, Oracle, IBM, Cisco
- Network connectivity
 - LHC OPN
 - LHC ONE
 - Renater



Network



Resources overview



17 PB HPSS
1 PB TSM

tape

8.2 PB dCache
1.9 PB irods
1.7 PB xrootd
1.2 PB GPFS
0.3 PB SRB

disk

~16k workpoints (essentially SL5)
~30PB storage (tape+disk)

+ GPFS

Author: Fabio Hernandez
Last Updated: 2009-06-09

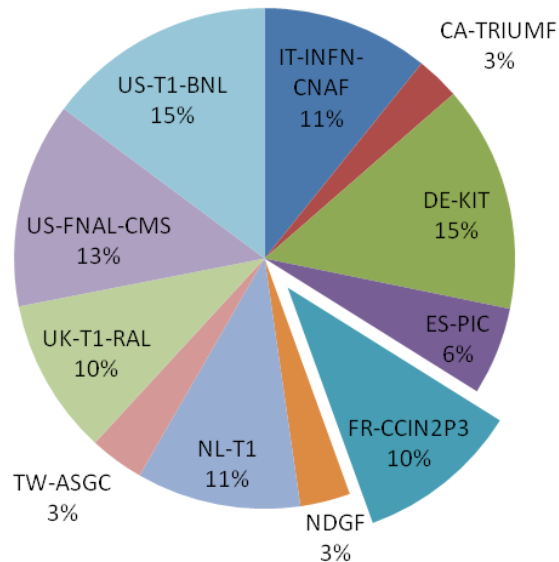




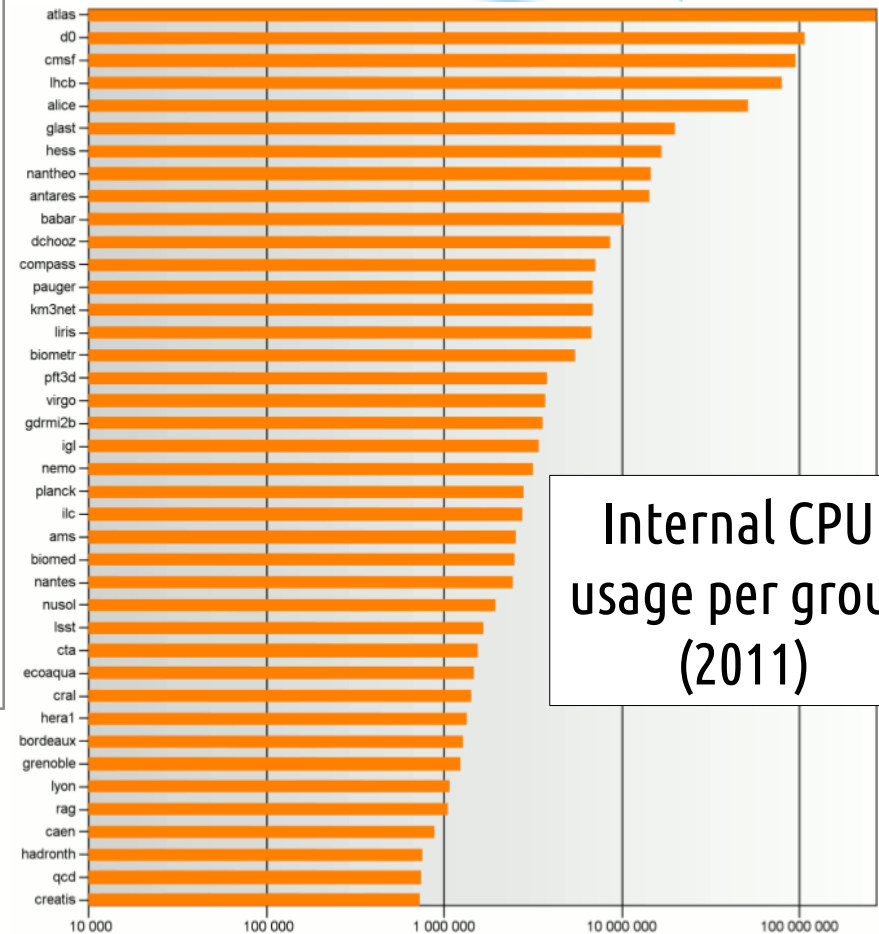
CPU views



CPU 2011 of T1s



Share in WLCG



Internal CPU
usage per group
(2011)

(Log scale)

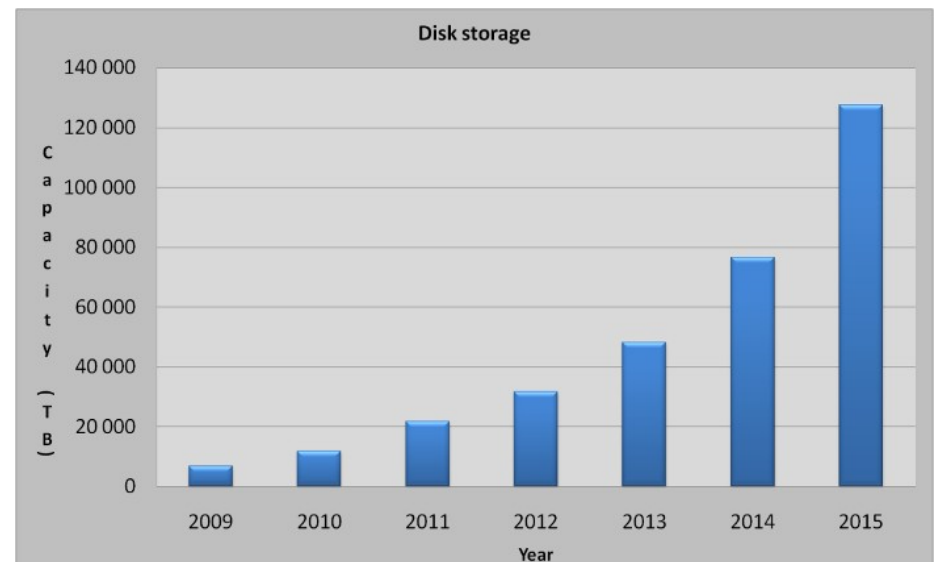
HS06.h

Extension of CC-IN2P3



- Previous architecture of CC-IN2P3 could not face the upcoming growth of computing resources
 - Space, cooling reasons
- A new building was built to cope with these needs
 - Twice more space
 - New cooling technologies
 - Environmental aspects

A big design phase, a big investment
for a big project :
unique opportunities in
scientific data processing



Extension of CC-IN2P3



June 2010



April 2011





Operations



Operation in Tier1



- Tier 1 role
 - reliability, availability, storage custody → MoU
- More complexity in its organization than for T2-T3
 - Most experts might be contacted anytime
- F. Carminati @ InGRID'12 :
 - « it's more about people than machines »

Organization



Conseil de Laboratoire Comité Hygiène et Sécurité

Chargés de Mission

Sécurité Informatique : Benoît Delaunay
Formation permanente : Virginie Dutruel
Autorité de certification grille : Mirvat Aljogami
Qualité: Rolf Rumler

Dominique Boutigny
Directeur

Pierre-Etienne Macchi
Directeur Adjoint

Christèle Aulas
Responsable
Administrative

Coordination Achats

Pierre Larrieu

Communication / Partenariats

Gaëlle Shifrin
Virginie Dutruel

Cellule Webcast

Olivier Devron

ACMO

Jean-Louis Perrot

Opération

R. Rumler

Exploitation

S. Poulat

F. Azevedo
F. Bompard
H. Cordier
Z. Goutali
M. Hausard
N. Lajili
P. Larrieu
G. Mathieu
P. Olivero

Support

G. Rahal

D. Bouvet
P. Calvat
Y. Cardenas
S. Gadrat
R. Lemrani
S. Loikkanen
E. Vamvakopoulos
A. Vedaae
R. Vernet

21

Infrastructure

B. Delaunay

Système

Y. Perret

X. Canehan
C. Eloto
P-Y. Fontanière
J. Garnier
P. Girard
A. Gounon
M. Puel
F. Wernli

Stockage

J-Y. Nief

N. Bernard
P-E. Brinette
Y. Calas
R. Ferrand
A. Georget
L. Tortay

Réseau =network

L. Caillat-Vallet

J. Bernier
G. Devron

C. Rondelet

21

Développements

J-R. Rouet

Développeurs

O. Aïdel
E. Cervera
D. Cathala-Martinez
B. Chambon
P. Cheynet
P. Correia
J. Devémy
C. Evesque
C. Flieller
C. Harb-Rémond
T. Kachelhoffer
O. Lequeux
D. Mège
C. L'Orphelin
S. Reynaud
L. Schwarz
P. Veyre

18

Recherche

F. Suter

Administration

C. Aulas

H. Aïdel
C. Durand
S. Duray
L. Gaillard
Y. Gervais
S. Jacquot
S. Minet
E. Momier

9

Services Generaux

P. Trouvé

D. Perrin
J-L. Perrot
S. Reniaud
A. Deletraz

5



Operation team organization



■ Two operation groups

– Exploitation

- Batch system, shares & objectives per group, farm status control, robotics, alarms...

– User support

- Interface with experiments, VOs, new groups, ressource requests
- Dedicated support : LHC + Astroparticles + Biology
- General support : all the other users & experiments

■ 1 control room

– Front line helpdesk

- Fast reaction to tickets, problems
- News & information to the community (downtimes, interventions...)

– Always 1 person from each group in the c.r. during working hours

– Weekly turnover

The control room





Main operation activities



- Ensure working state of relevant services for the experiment
 - CE's, batch system, storage, inter-siter transfers
- Inform and report about activity and problems
 - Main tools : savannah, ggus, CERN elogs, email...
- Operation duties very different depending on VO
- Different computing models mean different :
 - Services
 - Monitoring tools
 - Communication channels
 - Organization wrt other sites and T0
 - ...

→ basically different on « everything »

→ we employ ~0.5 FTE support person* per VO

** physicists aware of the computing activities of the experiment*

Not talking about
hardware maintenance,
which is done by another team



Watch & alarms



- Most services at CC-IN2P3 are monitored by **Nagios®**
 - (Mass) storage systems
 - dCache, xrootd, iRODS, HPSS
 - File systems
 - AFS
 - Batch system and nodes, grid elements
 - Databases

Quote from our
nagiosmaster
(HEPIX fall '09)



OPERATION REQUIREMENTS

- tests are written by the service admin and given to Nagios
- 4 states : **OK**, **warning**, **critical**, **unknown**

- Probes to monitor specific systems
 - Monitoring platform should be redundant
 - Configuration should be updated easily while on production
- NAGIOS is flexible enough to be the ideal tool but needs a fair amount of configuration

Watch & alarms



CC-IN2P3 Nagios portal

Web ccnagios.in2p3.fr/nagios/

Nagios®

General

- Home
- Documentation

Current Status

- Tactical Overview
- Map
- Hosts
- Services
- Host Groups
 - Summary
 - Grid
- Service Groups
 - Summary
 - Grid
- Problems
 - Services (Unhandled)
 - Hosts (Unhandled)
 - Network Outages

Quick Search:

Reports

- Availability
- Trends
- Alerts
 - History
 - Summary
 - Histogram
- Notifications
- Event Log

System

- Comments
- Downtime
- Process Info
- Performance Info
- Scheduling Queue
- Configuration

Current Network Status
Last Updated: Tue Mar 20 15:24:30 CET 2012
Updated every 90 seconds
Nagios® Core™ 3.2.3 - www.nagios.org
Logged in as centre

[View Service Status Detail For All Host Groups](#)
[View Host Status Detail For All Host Groups](#)
[View Status Summary For All Host Groups](#)
[View Status Grid For All Host Groups](#)

Host Status Totals

Up	Down	Unreachable	Pending
90	0	0	0

Service Status Totals

Ok	Warning	Unknown	Critical	Pending
295	2	0	0	0

Views

Service Overview For All Host Groups

Alias names (alias-hostgroup)

Host	Status	Services	Actions
ccacsls	UP	5 OK	
ccexpl	UP	3 OK	
ccmysqlvip	UP	2 OK	
ccnagios	UP	1 OK	
ccnagiosui	UP	1 OK	
ccsmurf	UP	1 OK	
ccsqfatiasli01	UP	2 OK	
ccsqfatiasli02	UP	2 OK	
ccsrml	UP	2 OK	
ccsrml02	UP	2 OK	
ccsrml12	UP	No matching services	
cctools	UP	No matching services	
lfc-biomed	UP	No matching services	
lfc-egae	UP	No matching services	
lfc-egaeode	UP	No matching services	
lfc-prod	UP	No matching services	
myproxy	UP	1 OK	

Alias lbnamed (alias-lbnamed-hostgroup)

Host	Status	Services	Actions
ccage	UP	1 OK	
ccali	UP	1 OK	
ccdevli	UP	1 OK	
ccirods	UP	1 OK	
ccicgip01	UP	3 OK	
ccicgip03	UP	3 OK	
ccicgipbdi01	UP	2 OK	

All hosts (all-hostgroup)

Host	Status	Services	Actions
ccacsls	UP	5 OK	
cccreamceli05	UP	2 OK	
cccreamceli06	UP	3 OK	
cccreamceli07	UP	3 OK	
cccreamceli08	UP	3 OK	
cccreamceli09	UP	3 OK	
cccreamceli10	UP	3 OK	
ccdcamcli03	UP	7 OK	
ccdcamcli04	UP	7 OK	
ccdcamcli05	UP	7 OK	
ccdcamcli13	UP	5 OK	
ccexpl	UP	3 OK	
ccchps01	UP	No matching services	
ccchfrs001	UP	2 OK	
ccchfrs002	UP	2 OK	
ccchfrs003	UP	2 OK	
ccirods02	UP	19 OK	

Monitored hosts (grouped by services)



Watch & alarms

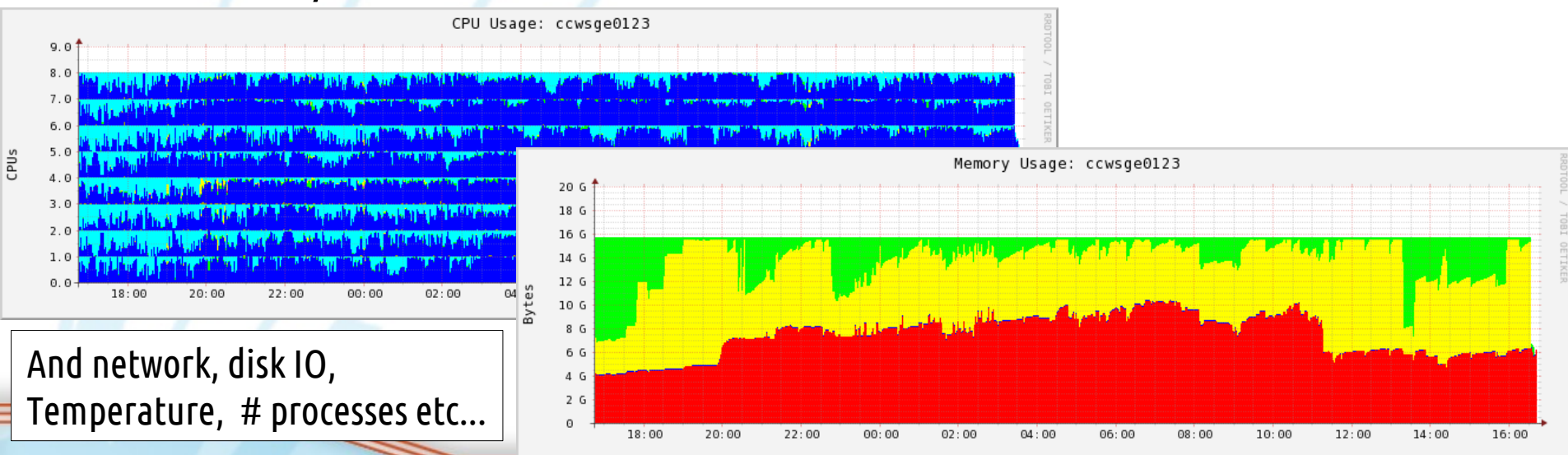


- Notification
 - email, sms, central system console
- Short automatic message describing the problem
- Link to wiki
 - each probe has a documentation and recipes in a wiki page
 - Used by operation (working hours) and shifter (otherwise)
- **Nagios**[®] is mainly for operation (services)
 - Sysadmins have got their own tools for system monitoring

System monitoring



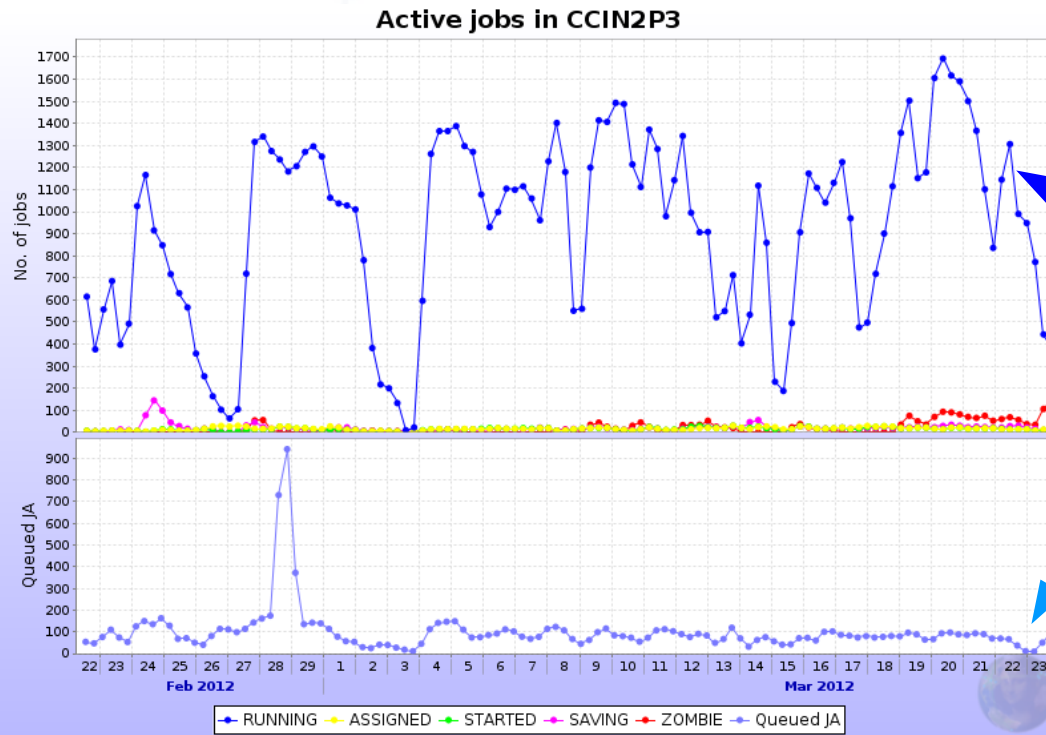
- Home-made package based on RRDtool & perl
 - Gathers system information over time, fills DB, plots
- Manages
 - Site metadata
 - Machine info. vs time
 - Client/server interaction



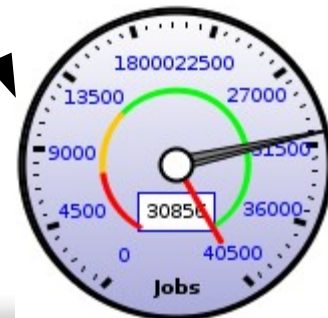
Example of ALICE support activities



- Mix of internal (CCIN2P3) and external (ALICE) tools
- ALICE tools for operation :

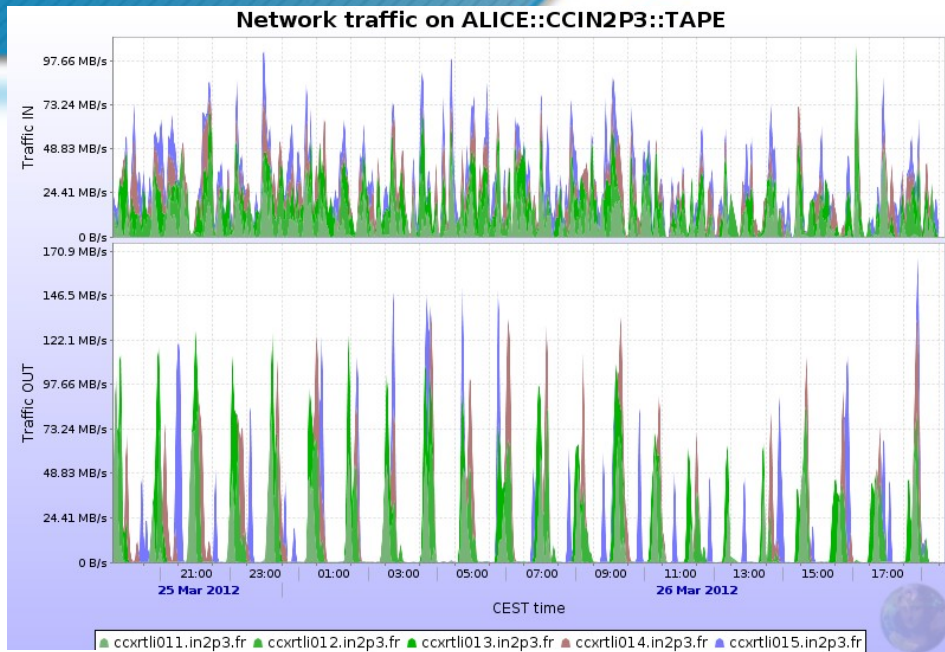


- check running jobs
- understand zombie jobs
- check queued job agents
- check global trend



Example of ALICE support activities

■ Raw data transfer monitoring



Transfer requests (add new request)

ID	Path	Target SE	Status	Progress	Files	Total size	Started	Ended
3409.	/alice/data/2011/LHC11a/000146686/collection	ALICE::CCIN2P3::TAPE	Running		360	1.012 TB	22 Mar 2012 07:59	
3407.	/alice/data/2011/LHC11a/000146689/collection	ALICE::CCIN2P3::TAPE	Running		1147	3.182 TB	22 Mar 2012 07:59	
3405.	/alice/data/2011/LHC11a/000146746/collection	ALICE::CCIN2P3::TAPE	Running		400	1.091 TB	22 Mar 2012 07:59	
3404.	/alice/data/2011/LHC11a/000146747/collection	ALICE::CCIN2P3::TAPE	Running		1360	3.86 TB	22 Mar 2012 07:59	
3403.	/alice/data/2011/LHC11a/000146748/collection	ALICE::CCIN2P3::TAPE	Running		560	1.567 TB	22 Mar 2012 07:59	
3402.	/alice/data/2011/LHC11a/000146801/collection	ALICE::CCIN2P3::TAPE	Running		760	2.107 TB	22 Mar 2012 07:59	
3400.	/alice/data/2011/LHC11a/000146803/collection	ALICE::CCIN2P3::TAPE	Running		160	388 GB	22 Mar 2012 07:59	
3399.	/alice/data/2011/LHC11a/000146804/collection	ALICE::CCIN2P3::TAPE	Running		3297	9.496 TB	22 Mar 2012 07:59	
3394.	/alice/data/2011/LHC11a/000146812/collection	ALICE::CCIN2P3::TAPE	Running		286	818.9 GB	22 Mar 2012 07:59	
3392.	/alice/data/2011/LHC11a/000146814/collection	ALICE::CCIN2P3::TAPE	Running		760	2.122 TB	22 Mar 2012 07:59	
3389.	/alice/data/2011/LHC11a/000146817/collection	ALICE::CCIN2P3::TAPE	Running		680	1.859 TB	22 Mar 2012 07:59	
3385.	/alice/data/2011/LHC11a/000146856/collection	ALICE::CCIN2P3::TAPE	Running		1120	3.214 TB	22 Mar 2012 07:59	
12 requests					10890	30.69 TB		

Requests per page: 100

Use of internal system tools and host access remains however essential in case of trouble.



Feedback on OGE batch system



- Smooth transition from BQS to OGE in 2011
 - From Spring (open OGE) to Fall (close BQS)
- New nice features available
 - Interactive nodes, multicore jobs, array jobs
- Use of opensource version till february, then Oracle
- Difficulties we have encountered
 - Stability
 - Publication to CREAM-CE
 - Monitoring and accounting
 - Retrieve relevant info and understand it
 - Quite slower reactivity of the online support

→ quite a bit fine tuning had to be done
→ ongoing Requests For Improvement
→ still several points to fix to run smoothly



Preparing the future...



Parallel computing



- Increasing interest for parallel computing
- Already used by
 - Astroparticles (Planck)
 - Lattice QCD
 - ...
- Multicore jobs
- Interest on GPU
 - ALICE
 - Lattice QCD
 - Astroparticles

MPI jobs
(1024 cores)

Dedicated infrastructure
to be provided very soon
(Dell, chassis with 4 GPU blades)



■ Main goals

- Build an academic community cloud, integrated to wider federations
- HTC use case is no option

■ Motivation & user needs

- Users need flexibility (elasticity)
- Another way of achieving distributed computing
- Satisfying new use cases (servers on demand...)

■ Steps

- Offer IAAS ressources through generic interfaces (EC2/OCCI)
- Integrate national/european/worldwide academic federations



■ Work in progress

- Evaluation of existing/upcoming technologies
 - Proprietary : IBM, Dell/Canonical, VMWare, Oracle, RedHat
 - OSS : OpenNebula, Openstack, Nimbus...
- Reuse experience
- Identify hot spots
 - Security, storage, performance, networking

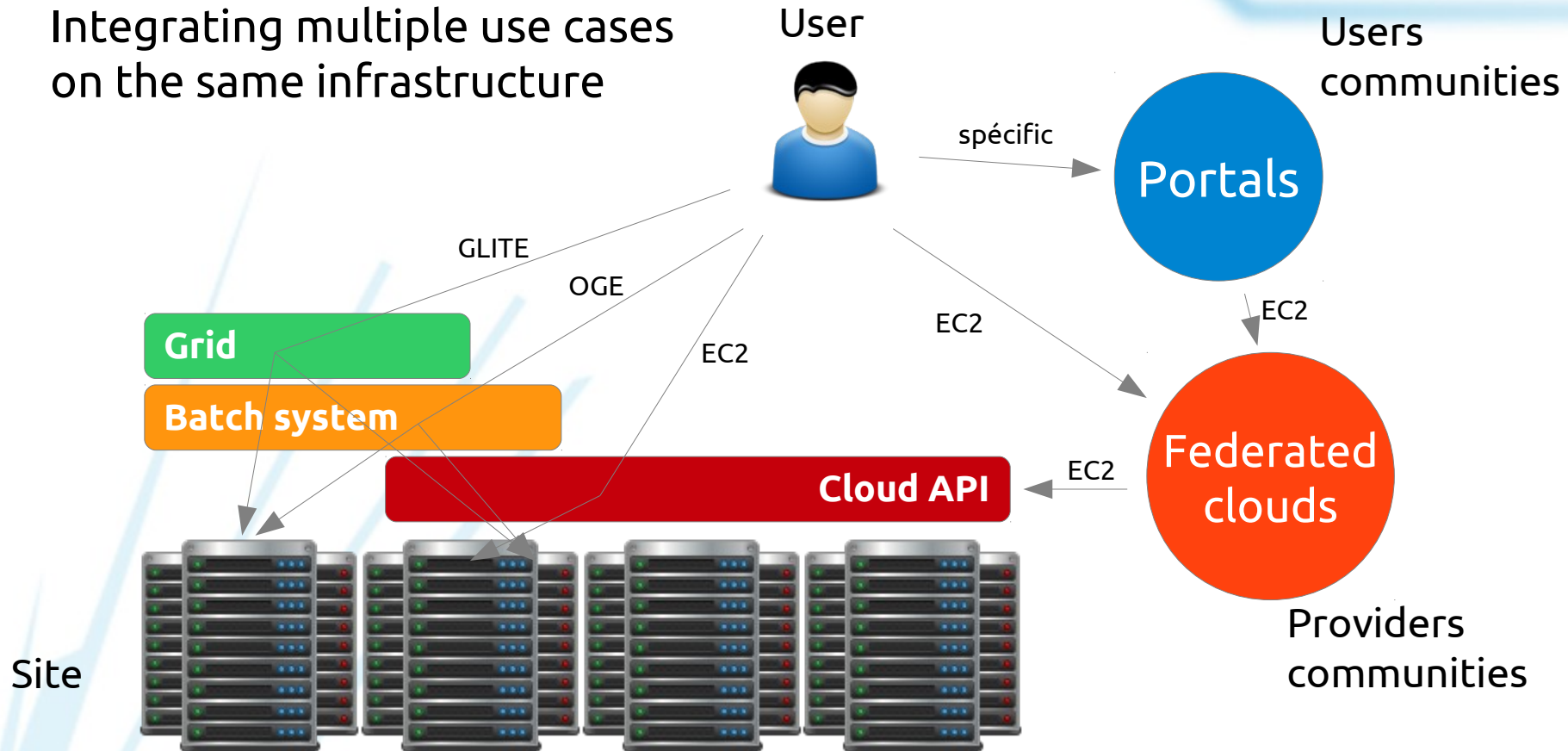
■ And then

- Open to new communities
 - Other scientific fields, academic institutes, industry ?
- High level tools for users (to PAAS/SAAS)
- Branch to the batch system
- How will the users follow these new technologies ?

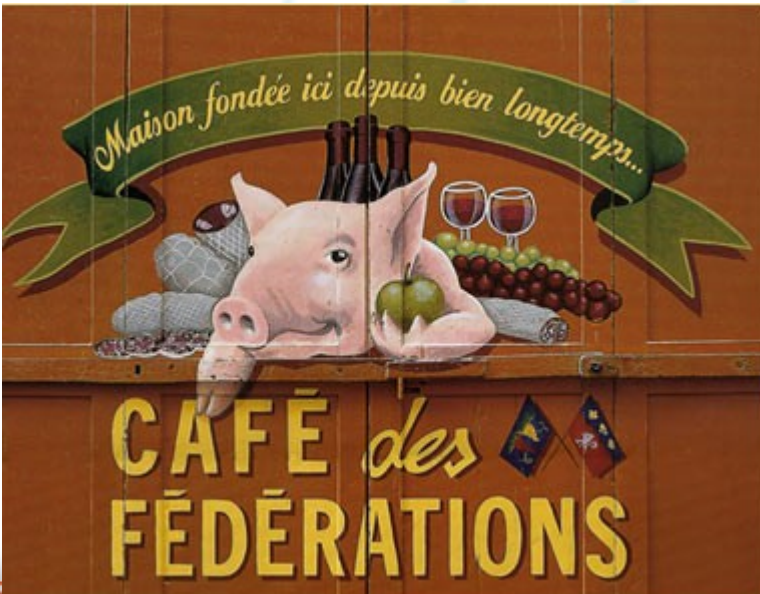
Computing and cloud interfaces



Integrating multiple use cases
on the same infrastructure



Visit us !



Lyon is a very nice city,
with famous gastronomy
and wines !



backup

Example : VO software deployment



■ ALICE

- Previously putting VO software on AFS
 - One common place accessible by any WN
 - Heavy load when many competing jobs
- Transition to bittorrent last summer
 - Software installed on each worker sandbox
 - Sizeable overhead due to download → fixed in new AliEn

■ LHCb, ATLAS

- CVMFS (same motivation as for ALICE)

■ CMS

- AFS (working fine for this VO)

→ operation team and sysadmins have to maintain and deal with different services

A cloudy approach to use cases



■ IAAS

has to conform to adopted standards (EC2/OCCI/CDMI...)

offer VMs instantiation

offer storage cloud resources (ala S3)

■ PAAS

Example : provide support for Grid Engine cluster instantiation

■ SAAS

integrate workflow management solutions (sysfera)

eg : support for jobs submission through web portals



Testbed infrastructure



- 16 Dell Poweredge C6100 hosts
- On each node
 - 2 Xeon 24cores X5675 @ 3.07GHz
 - 96GB RAM
 - 2TB raid 10 local storage (4 SAS 7.2 krpm)
- Catalog of images (1.4 TB)
- Public IPv4 subnet → full VM network isolation
- Powered by Openstack
- Available interfaces :
 - EC2 and Nova API at the moment
 - Ongoing work on OCCI



Cloud : identified use cases



- **EGI FCTF testbed** (HEP, traditional grid users)
provide IAAS ressources to former grid users, computing
- **Webimatics** (neurobiology)
medical image data analysis
- **Etriks** (academic and pharmaceutical companies)
data analysis
- **Sysfera**
SAAS approach to workflow management
- **Dirac**
Yet Another grid scheduler