

Draft v0.1



# GOC responsibilities and Monitoring

LCG-2 Administrator's Course

Oxford

21<sup>st</sup> July 2004

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- Within the scope of LCG we are responsible for monitoring how the grid is running – who is up, who is down, and why
- Identifying Problems, Contact the Right People, Suggest Actions
- Providing scalable solutions to allow other people to monitor resources
- Manage site Information – definitive source of information
- Accounting – Aggregate Job Throughput (per Site, per VO)
- Established at CLRC (RAL)
- Status of LCG2 Grid here:
- <http://goc.grid-support.ac.uk/>

## □ Why We Monitor

- Keep systems up and running
- Notice failures; grid-wide services mds;
- Knowing what services a site should be running
  - no point raising an alert if the site isn't meant to run it!
  - definition of services and which sites run them (SLA)

## □ What Tools Do We Use

- Job Submission; Gridlce; Nagios
- How – Database
- Developments Planned nagios

## □ Plans over next 12 months

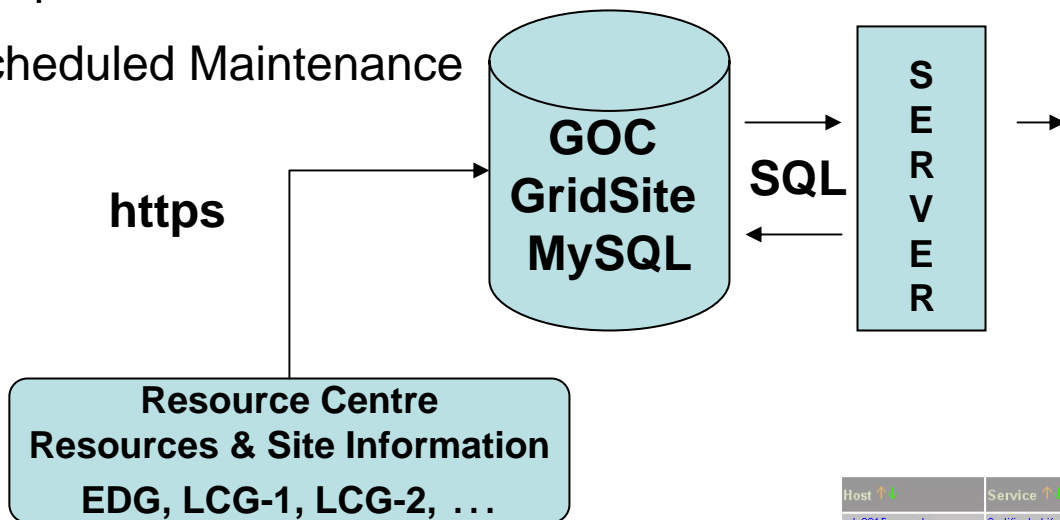
## GOC Site Database

- Develop and maintain a database to hold Site Information
- Contact Lists, Nodes, IP, URLs, Scheduled Maintenance
- Each Site has its own Administration Page where Access is Controlled through the use of X509 certificates. (GridSite)
- Monitoring Scripts read information in database and run a set of customised tools to monitor the infrastructure
- To be included in the monitoring a site must register its resources (CE,SE,RB,RC,RLS,MDS,RGMA,BDII,..)

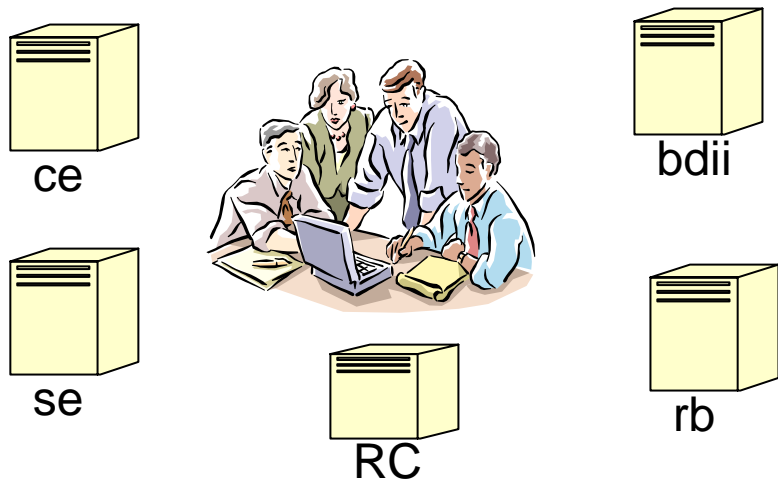
Secure Database Management via HTTPS / X.509

People, Contact Information, Resources

Scheduled Maintenance



Monitoring



Host	Service	Status	Last Check	Duration	Attempt	Status Information
adc0015.cern.ch	Certificate Lifetime	OK	21-01-2004 11:03:21	2d 1h 14m 51s	1/3	Certificate expires: (37)wks,(6)days,(2)hrs,(46)min,(12)sec
	GlueCEInfoHostName	CRITICAL	21-01-2004 11:26:30	0d 0h 25m 7s	3/3	(Return code of 127 is out of bounds - plugin may be missing)
	GlueCEInfoSiteName	CRITICAL	21-01-2004 11:43:38	0d 0h 9m 57s	3/3	(Return code of 127 is out of bounds - plugin may be missing)
	GateKeeper Authentication Test	OK	21-01-2004 11:48:47	5d 16h 38m 42s	1/3	GRAM Authentication test successful
	GridFTP Service	OK	21-01-2004 11:03:38	5d 16h 18m 34s	1/3	GRIDFTP Test Pass
	adc0018.cern.ch	Certificate Lifetime	OK	21-01-2004 11:16:47	5d 16h 58m 25s	1/3
GlueCEInfoHostName		CRITICAL	21-01-2004 11:43:55	0d 0h 9m 37s	3/3	(Return code of 127 is out of bounds - plugin may be missing)
GlueCEInfoSiteName		CRITICAL	21-01-2004 11:49:03	0d 0h 4m 37s	1/3	(Return code of 127 is out of bounds - plugin may be missing)
GateKeeper Authentication Test		OK	21-01-2004 11:03:55	5d 16h 38m 17s	1/3	GRAM Authentication test successful
GridFTP Service		OK	21-01-2004 11:19:03	5d 16h 18m 8s	1/3	GRIDFTP Test Pass
atlas004.cern.ch		Certificate Lifetime	OK	21-01-2004 11:34:29	5d 16h 37m 26s	1/3
	GlueCEInfoHostName	CRITICAL	21-01-2004 11:49:37	0d 0h 3m 57s	1/3	(Return code of 127 is out of bounds - plugin may be missing)
	GlueCEInfoSiteName	CRITICAL	21-01-2004 11:04:29	0d 0h 49m 7s	1/3	(Return code of 127 is out of bounds - plugin may be missing)
	GateKeeper Authentication Test	OK	21-01-2004 11:19:37	5d 16h 17m 18s	1/3	GRAM Authentication test successful

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## People: Who do we notify when there are problems



### Contacts:


Name	Description	Email address	Tel	Hours	
Trevor Daniels	Deployment Team Member	<a href="mailto:t.daniels@rl.ac.uk">t.daniels@rl.ac.uk</a>	+44 (0)1235 778093	0800 - 1700 (Mon-Wed)	<a href="#">Edit</a> <a href="#">Delete</a>
Dave Kant	Deployment Team Member	<a href="mailto:d.kant@rl.ac.uk">d.kant@rl.ac.uk</a>	+44 (0)1235 778178	0900 - 18.00 (Mon-Fri)	<a href="#">Edit</a> <a href="#">Delete</a>
Martin Bly	Deployment Team Member	<a href="mailto:m.j.bly@rl.ac.uk">m.j.bly@rl.ac.uk</a>	+44 (0)1235 446981		<a href="#">Edit</a> <a href="#">Delete</a>
Steve Traylen	Deployment Team Member	<a href="mailto:s.traylen@rl.ac.uk">s.traylen@rl.ac.uk</a>	+44 (0)1235 446777		<a href="#">Edit</a> <a href="#">Delete</a>
Andrew Sansum	Deployment Team Member	<a href="mailto:r.a.sansum@rl.ac.uk">r.a.sansum@rl.ac.uk</a>	+44 (0)1235 445863		<a href="#">Edit</a> <a href="#">Delete</a>
John Gordon	Deployment Team Member	<a href="mailto:j.c.gordon@rl.ac.uk">j.c.gordon@rl.ac.uk</a>	+44 (0)1235 446574		<a href="#">Edit</a> <a href="#">Delete</a>
Alistair Mills	-	<a href="mailto:a.b.mills@rl.ac.uk">a.b.mills@rl.ac.uk</a>	+44 (0)1235 446084		<a href="#">Edit</a> <a href="#">Delete</a>
Matt Thorpe	GOC DB Web Admin	<a href="mailto:m.s.thorpe@rl.ac.uk">m.s.thorpe@rl.ac.uk</a>	+44 (0)1235 778178	0830 - 1700 (Mon-Fri)	<a href="#">Edit</a> <a href="#">Delete</a>

[\[Click to add a new contact\]](#)

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## Node Information (Type, Hostname, IP Address, Group)


**Nodes:**

Type	Hostname	IP Address	Group	
LCFG	lcfg	130.246.183.111	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
MDS	lcgcs01	130.246.183.187	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
RB	lcgrb01	130.246.183.184	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
CE	lcgce01	130.246.183.182	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
SE	lcgse01	130.246.183.181	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
UI	lcgui01	130.246.183.183	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
BDII	lcgbdii	130.246.183.185	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
PROX	lcgrbp01	130.246.183.186	LCG-1	<a href="#">Edit</a> <a href="#">Delete</a>
 RB	lcgrb02	130.246.183.189	LCG-2	<a href="#">Edit</a> <a href="#">Delete</a>
CE	lcgce02	130.246.183.188	LCG-2	<a href="#">Edit</a> <a href="#">Delete</a>
BDII	lcgbdii02	130.246.183.191	LCG-2	<a href="#">Edit</a> <a href="#">Delete</a>
UI	lcgui02	130.246.183.194	LCG-2	<a href="#">Edit</a> <a href="#">Delete</a>
UI	gppui04	130.246.183.172	EDG	<a href="#">Edit</a> <a href="#">Delete</a>
CE	gppce05	130.246.187.142	EDG	<a href="#">Edit</a> <a href="#">Delete</a>
RB	gppse05	130.246.187.140	EDG	<a href="#">Edit</a> <a href="#">Delete</a>
RLS	gpprls05	130.246.187.153	EDG	<a href="#">Edit</a> <a href="#">Delete</a>
MON	gpprg05	130.246.187.151	EDG	<a href="#">Edit</a> <a href="#">Delete</a>
NM	gppnm06	130.246.187.145	EDG	<a href="#">Edit</a> <a href="#">Delete</a>

[\[Click to add a new node\]](#)

## Monitoring Services

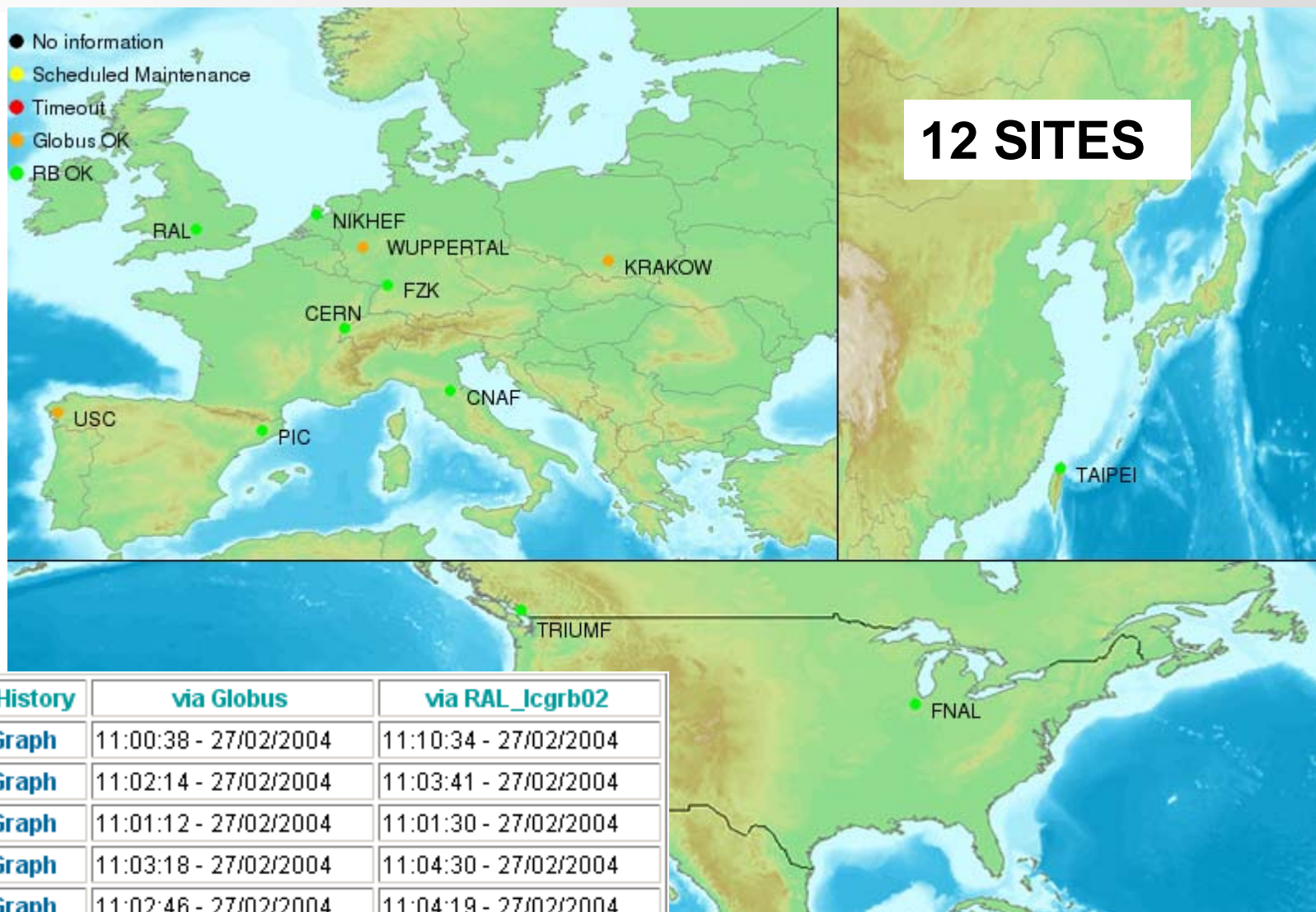
- There are many frameworks which can be used to monitor distributed environments
  - MAPCENTRE <http://mapcenter.in2p3.fr/>
  - GPPMON <http://goc.grid-support.ac.uk/>
  - GRIDICE <http://edt002.cnaf.infn.it:50080/gridice/>
  - NAGIOS <http://www.nagios.org/>
  - MONALISA <http://monalisa.cacr.caltech.edu/>
- 
- Example: Mapcentre 30 sites ~ 500 lines in config file (static version)
  - Example: Nagios 30 sites, 12 individual config files with dependencies
  - Developed Tools to Configure these services to make the job easier  
NAGIOS, MAPCENTER and GPPMON



## GOC Features – GPPMon

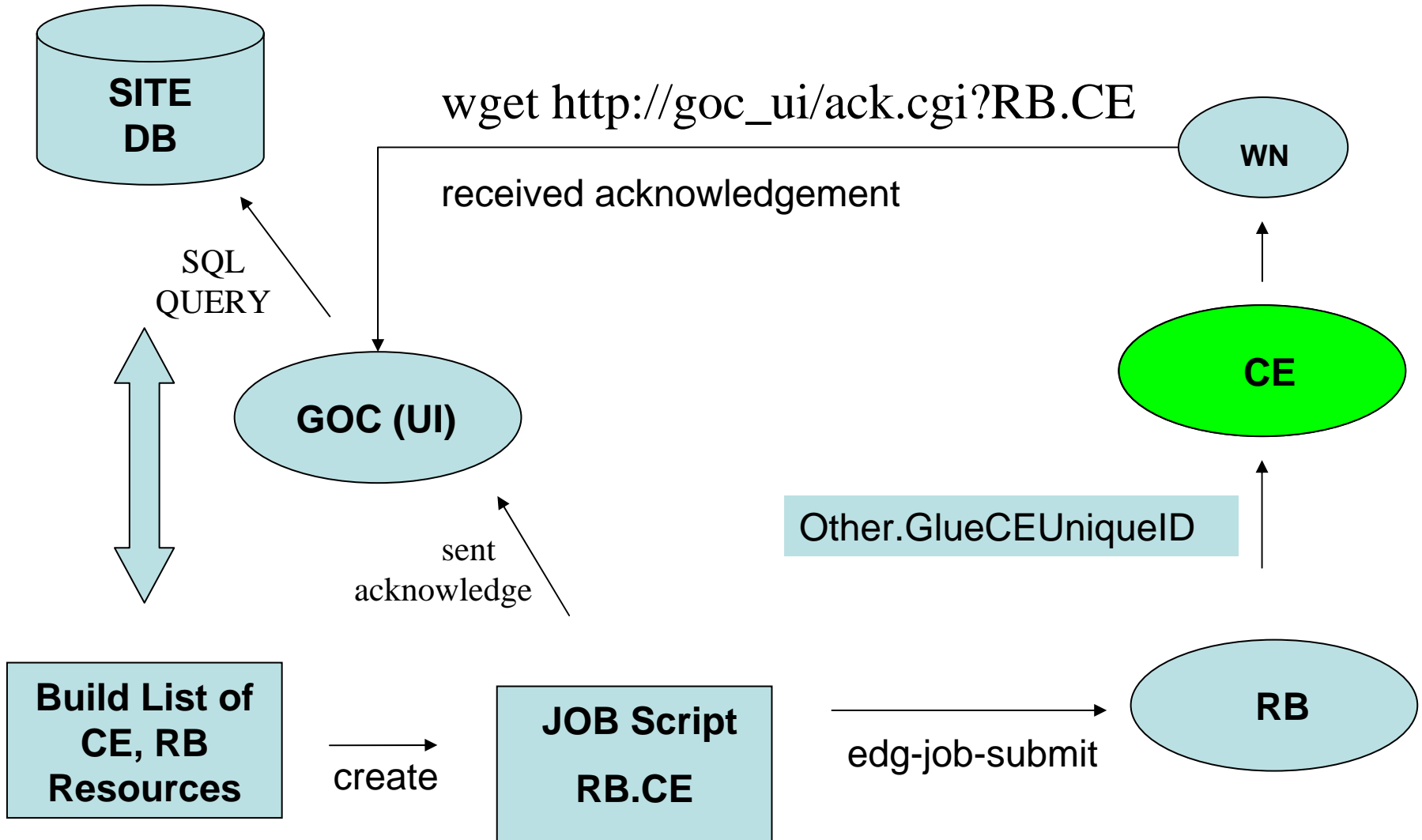
Status of Grid, based on the success of job submission to resources, displayed as a world map, with sites represented by coloured dots

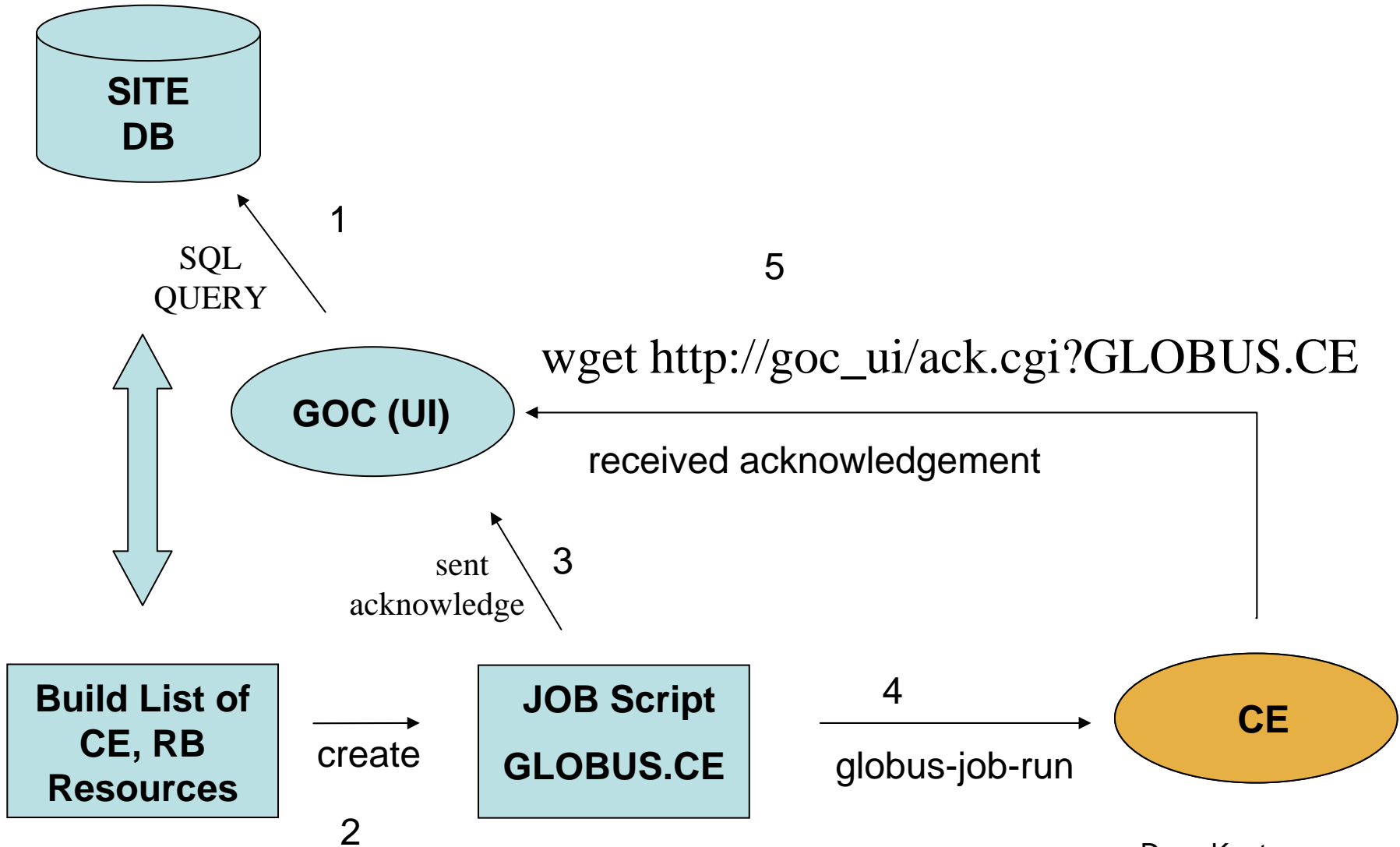
- SQL Query of Database -> List of Resources (CE , RB)
  - Job Submission to each Site in Two Ways:
    - Direct to CE = globus-job-run
    - Indirect to CE via Resource Brokers = edg-job-submit
  - Responses Collected and Translated into a Site Status Colour Index
    - Success via RB = Green, Globus Only = Orange, Fail = Red
  - Geographical View Presented Against World Map

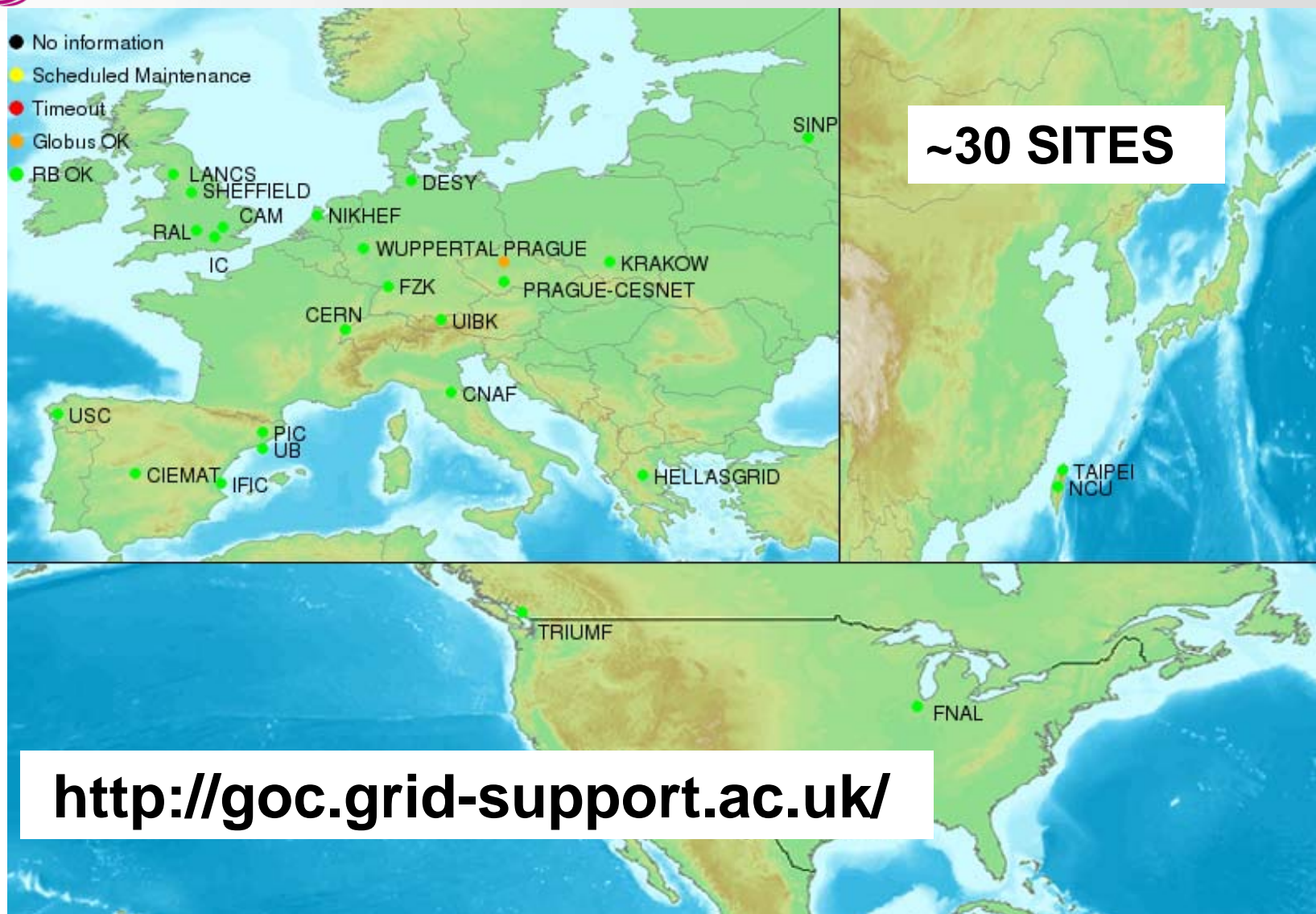


Site	History	via Globus	via RAL_lcg2
CERN	<a href="#">Graph</a>	11:00:38 - 27/02/2004	11:10:34 - 27/02/2004
CNAF	<a href="#">Graph</a>	11:02:14 - 27/02/2004	11:03:41 - 27/02/2004
FNAL	<a href="#">Graph</a>	11:01:12 - 27/02/2004	11:01:30 - 27/02/2004
FZK	<a href="#">Graph</a>	11:03:18 - 27/02/2004	11:04:30 - 27/02/2004
PIC	<a href="#">Graph</a>	11:02:46 - 27/02/2004	11:04:19 - 27/02/2004
RAL	<a href="#">Graph</a>	11:01:42 - 27/02/2004	11:03:11 - 27/02/2004
Taiwan	<a href="#">Graph</a>	11:03:56 - 27/02/2004	11:05:42 - 27/02/2004

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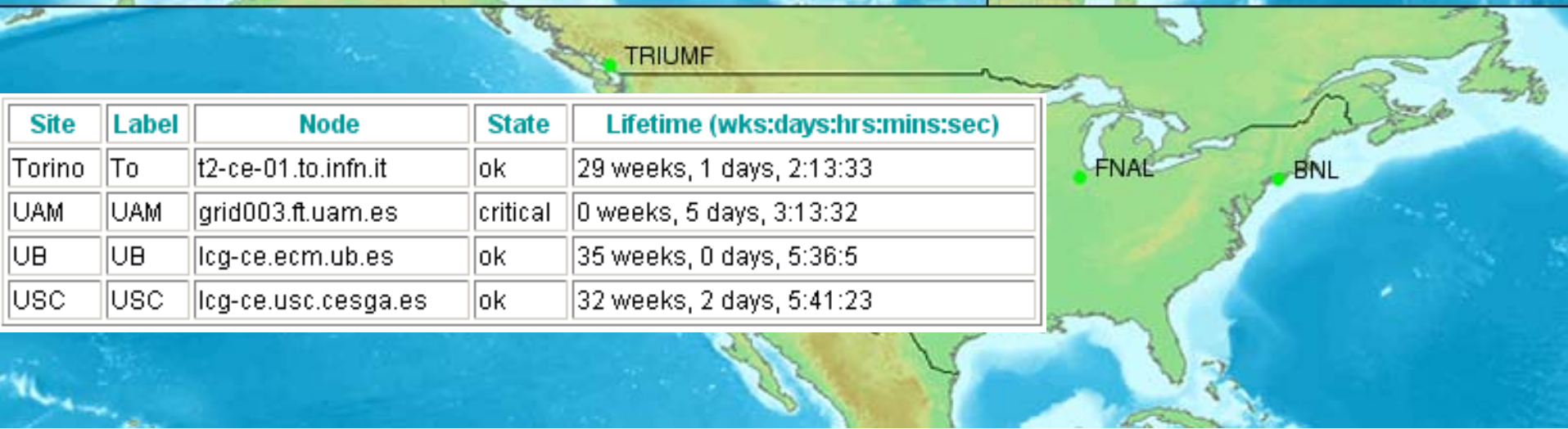






# LCG1 CERT Status: 27 Feb 2004

- No information
- ▲ Expired
- Critical
- Alert
- Warning
- OK



Site	Label	Node	State	Lifetime (wks:days:hrs:mins:sec)
Torino	To	t2-ce-01.to.infn.it	ok	29 weeks, 1 days, 2:13:33
UAM	UAM	grid003.ft.uam.es	critical	0 weeks, 5 days, 3:13:32
UB	UB	lcg-ce.ecm.ub.es	ok	35 weeks, 0 days, 5:36:5
USC	USC	lcg-ce.usc.cesga.es	ok	32 weeks, 2 days, 5:41:23

## GOC Features – Nagios Monitoring

Nagios is a powerful monitoring service that supports notifications, and the execution of remote agents to correct problems when faults are discovered.

- Advantages => proactively monitor grid (NRPE daemon)
- Automatic Configuration of Nagios based on Database
- Developed a set of plugins which focus on service behaviour and data consistency
  - Do RBs find resources?
  - Does Site GHS's publish correct hostname?
  - Is the site running the latest stable software release?
  - Does the Gatekeeper authentication service work?
  - Are the host certificates valid e.g Issued by Trusted CA
  - Are essential services running e.g GridFTP
- Further plugins are being developed (e.g certification)

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## Service Summary for Nodes:

Certificate Lifetime Check , GridFTP , GRAM Authentication


Site Attributes via GUIS (siteName, Tag, ...)

HOST	PLUGIN	STATUS	STATUS INFORMATION			
Host	Service	Status	Last Check	Duration	Attempt	Status Information
<a href="#">adc0015.cern.ch</a>	<a href="#">Certificate Lifetime</a>	OK	03-02-2004 13:27:59	7d 21h 49m 45s	1/3	Certificate expires: {36}wks,{0}dys,{0}hrs,{21}min,{34}sec
	<a href="#">GUIS attr GlueCEInfoHostName</a>	OK	03-02-2004 12:41:39	7d 21h 11m 39s	1/3	GlueCEInfoHostName attribute is adc0015.cern.ch
	<a href="#">GUIS attr siteName</a>	OK	03-02-2004 12:54:40	7d 20h 58m 7s	1/3	siteName is CERN-LCG1 dataGridVersion is LCG1-1_1_3
	<a href="#">GateKeeper Authentication Test</a>	OK	03-02-2004 13:07:49	7d 21h 49m 29s	1/3	GRAM Authentication test successful
	<a href="#">GridFTP Service</a>	OK	03-02-2004 13:28:00	7d 21h 31m 7s	1/3	GRIDFTP Test Pass
<a href="#">atlasgrid04.usatlas.bnl.gov</a>	<a href="#">Certificate Lifetime</a>	OK	03-02-2004 13:28:00	7d 21h 30m 25s	1/3	Certificate expires: {46}wks,{0}dys,{0}hrs,{42}min,{29}sec
	<a href="#">GUIS attr GlueCEInfoHostName</a>	CRITICAL	03-02-2004 12:43:00	7d 21h 48m 20s	1/3	IO::Socket::INET: connect: Connection refused
	<a href="#">GUIS attr siteName</a>	CRITICAL	03-02-2004 12:55:32	7d 20h 57m 13s	1/3	IO::Socket::INET: connect: Connection refused
	<a href="#">GateKeeper Authentication Test</a>	OK	03-02-2004 13:08:30	7d 20h 43m 43s	1/3	GRAM Authentication test successful
	<a href="#">GridFTP Service</a>	OK	03-02-2004 13:28:20	7d 21h 48m 9s	1/3	GRIDFTP Test Pass
	<a href="#">RRDTool</a>	OK	03-02-2004 13:34:17	7d 21h 9m 3s	1/1	GRAM Authentication test successful


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GridICE is monitoring



the eyes of the Grid



GridICE is a product of



Site view
VO view
Geo view
Gris view
Help
about

Select Site  and/or Role

Site	Computing Resources						Storage Resources				
	Slot#	SlotFree	SlotLoad	RunJob	WaitJob	Power	CPU#	CPUload	Available	Total	%
<b>cern.ch</b>	408	180	<div style="width: 55%; background-color: red;">55%</div>	0	0	-	-	-	67.5 Gb	69.1 Gb	<div style="width: 2%; background-color: black;">2%</div>
cnaf.infn.it	-	-	-	-	-	-	-	-	-	-	-
<b>cr.cnaf.infn.it</b>	2154	1086	<div style="width: 49%; background-color: green;">49%</div>	253	0	762647	387	<div style="width: 54%; background-color: red;">54%</div>	868.0 Gb	999.7 Gb	<div style="width: 13%; background-color: green;">13%</div>
fnal.gov	12	12	<div style="width: 0%; background-color: black;">0%</div>	0	0	-	-	-	-	-	-
<b>fzk.de</b>	-	-	-	-	-	-	-	-	-	-	-
gridka.de	-	-	-	-	-	-	-	-	-	-	-
<b>gridpp.rl.ac.uk</b>	438	273	<div style="width: 37%; background-color: green;">37%</div>	55	0	-	-	-	59.8 Gb	69.0 Gb	<div style="width: 13%; background-color: green;">13%</div>
grid.sinica.edu.tw	294	294	<div style="width: 0%; background-color: black;">0%</div>	0	0	-	-	-	-	-	-
<b>hep.ph.ic.ac.uk</b>	126	126	<div style="width: 0%; background-color: black;">0%</div>	0	0	-	-	-	9.2 Gb	16.8 Gb	<div style="width: 45%; background-color: green;">45%</div>
<b>ifae.es</b>	480	480	<div style="width: 0%; background-color: black;">0%</div>	0	0	433978	160	<div style="width: 0%; background-color: black;">0%</div>	5.6 Tb	22.4 Tb	<div style="width: 25%; background-color: green;">25%</div>
nikhef.nl	500	230	<div style="width: 54%; background-color: red;">54%</div>	137	13	-	-	-	1.4 Tb	1.7 Tb	<div style="width: 20%; background-color: green;">20%</div>
<b>triumf.ca</b>	4490	30	<div style="width: 99%; background-color: red;">99%</div>	0	0	-	-	-	729.1 Gb	731.1 Gb	<div style="width: 0%; background-color: black;">0%</div>
<b>TOTAL</b>	8902	2711	<div style="width: 33%; background-color: green;">33%</div>	445	13	1196625	547	<div style="width: 26%; background-color: green;">26%</div>	8.6 Tb	25.9 Tb	<div style="width: 17%; background-color: green;">17%</div>

Generated: Mon, 22 Mar 2004 15:50:30 +0000
GridICE Homepage



Site view    VO view    Geo view    Gris view    Help    about

Select Site  and/or Role

**gridpp.rl.ac.uk**

**lcgrb02.gridpp.rl.ac.uk** RB    UpTime: 1-2:11    Reg.OpenFiles.: 3141    Socket: TCP(29) UDP(17)    FS NA PA Full

Process	Status	Inst#	Instances		CPU		Memory		Time	
			First	Last	1Max	All	1Max	Avg	1Max	All
condorg-scheduler	S	1	1-3:15	1-3:15	0	0	0	0	0-0:0	0-0:0
condor-master	S	1	1-3:15	1-3:15	0	0	0	0	0-0:0	0-0:0
fmon-agent	S	1	1-3:16	1-3:16	0	0	0	0	0-0:0	0-0:0
ftp-server	S	1	1-2:16	1-2:16	0	0	0	0	0-0:0	0-0:0
job-controller	S	1	1-3:15	1-3:15	0	0	0	0	0-0:2	0-0:2
local-logger	S	1	1-2:1	1-2:1	0	0	0	0	0-0:0	0-0:0
local-logger-interlog	S	6	1-4:1	0-3:11	0	0	0	0	0-0:3	0-0:3
logging-and-bookkeeping	S	11	1-2:55	0-0:7	0	0	0	0	0-0:0	0-0:0
log-monitor	S	1	1-3:11	1-3:11	0	0	1	1	0-0:2	0-0:2
network-server	S	21	1-3:13	1-3:13	0	0	1	1	0-0:3	0-0:4
proxy-renewal	S	4	1-3:16	1-3:14	0	0	0	0	0-0:0	0-0:0
workload-manager	S	4	1-3:16	1-3:16	0	0	1	1	0-0:4	0-0:8

**lcgce02.gridpp.rl.ac.uk** CE    UpTime: 7-22:3    Reg.OpenFiles.: 2822    Socket: TCP(38) UDP(18)    FS NA PA Full

**lcgse01.gridpp.rl.ac.uk** SE    UpTime: 7-22:34    Reg.OpenFiles.: 1287    Socket: TCP(16) UDP(19)    FS NA PA Full

CE  
PBS/LSF  
Jobmanager Log

GateKeeper  
Listens on port 2119  
GRAM Authentication

GIIS  
LDAP Information  
Server

We have an accounting solution.

The Accounting is provided by RGMA

At each site, log-file data is processed from different sources and published into a local database.

MON  
RGMA  
Database

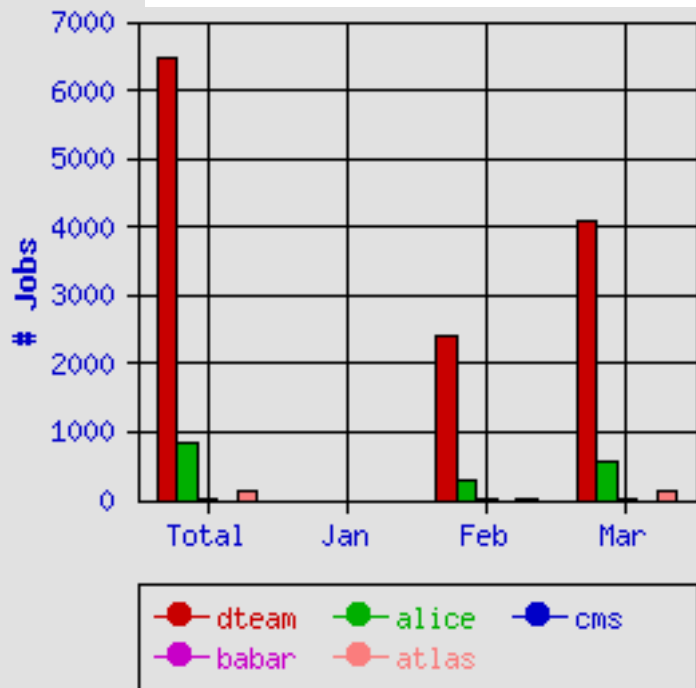
GOC provides an interface to produce accounting plots “on-demand”

Total Number of Jobs per VO per Site (ok)

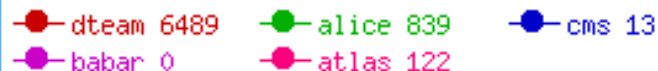
Total Number of Jobs per VO aggregated over all sites (to be done)

Tailor plots according to the requirements of the user community

Taipei Statistics Feb/Mar



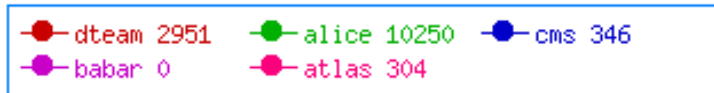
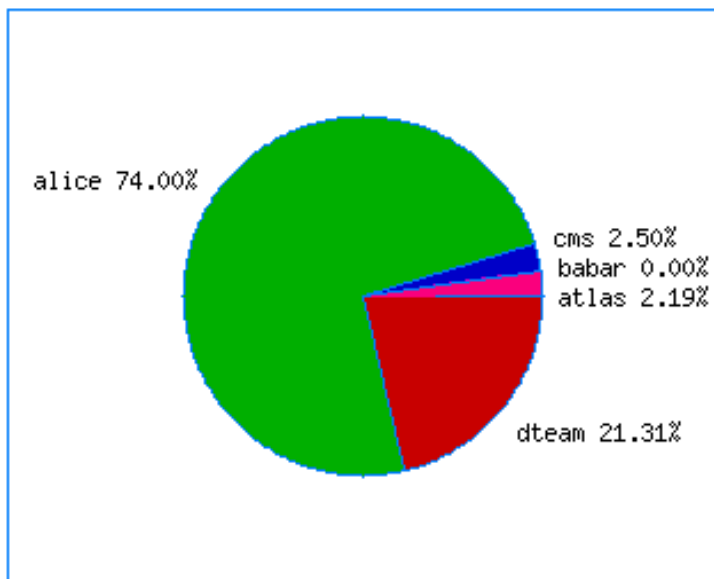
~ 1000 Alice Jobs



## CNAF Statistics March

~ 10,000 Alice Jobs

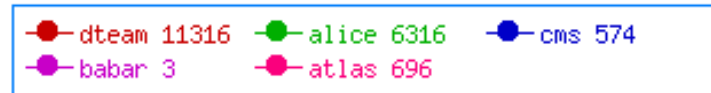
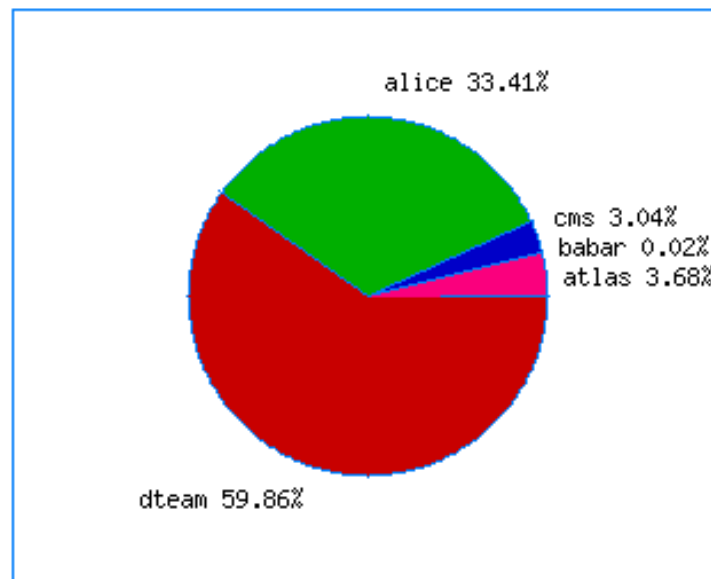
Mar

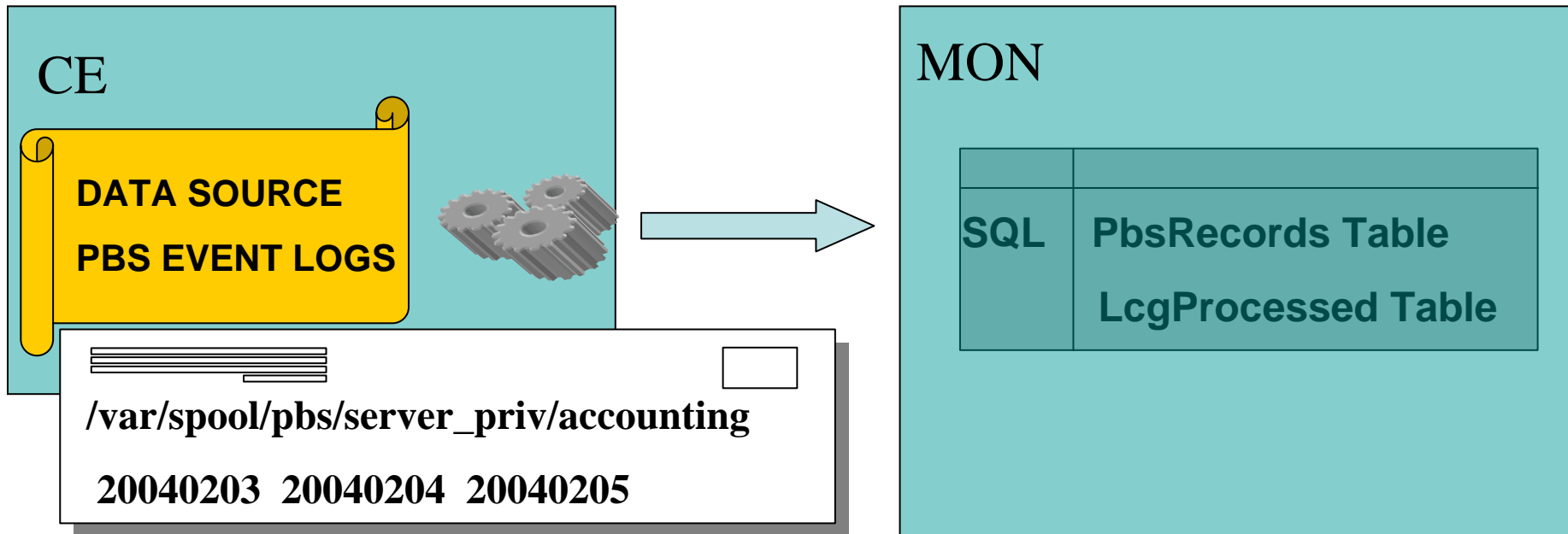


## RAL Statistics March

~ 6,300 Alice Jobs

Mar





PBS filter to extract data from the event log records.

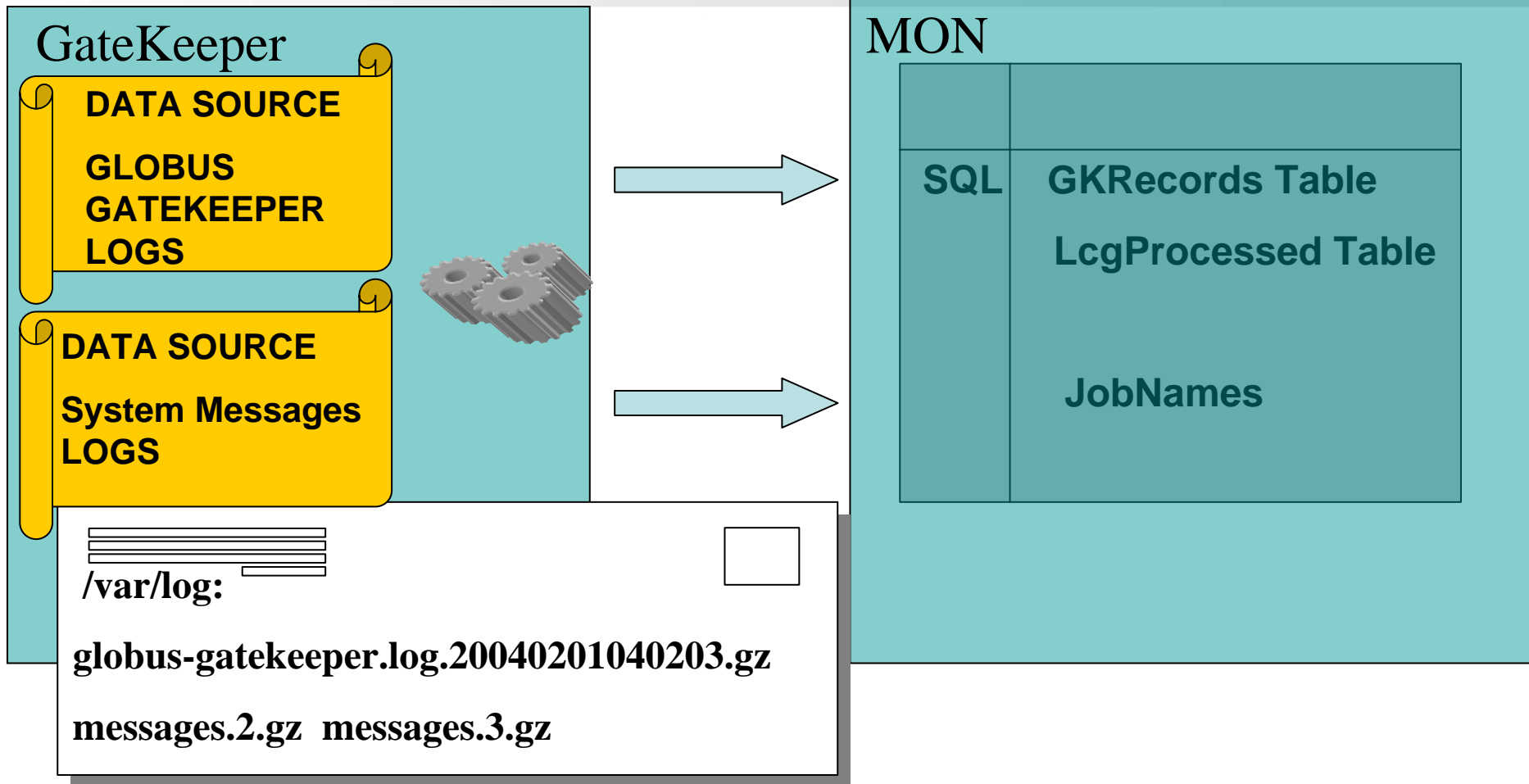
RGMA-API publishes data to a PbsRecords database table on the MON box and records the names of the processed logs for book-keeping

## “END” EVENT RECORDS CONTAIN THE FOLLOWING INFORMATION

Field	Type
RecordIdentityP	varchar(255)
SiteName	varchar(50)
JobName	varchar(100)
LocalUserID	varchar(20)
LocalUserGroup	varchar(20)
WallDuration	varchar(30)
CpuDuration	varchar(30)
WallDurationSeconds	int(11)
CpuDurationSeconds	int(11)
StartTime	varchar(30)
StopTime	varchar(30)
SubmitHost	varchar(50)



The actual table schema contains more information than is shown here.



Extract data from globus-gatekeeper and system messages logs

Record a list of files processed to reduce network traffic/load



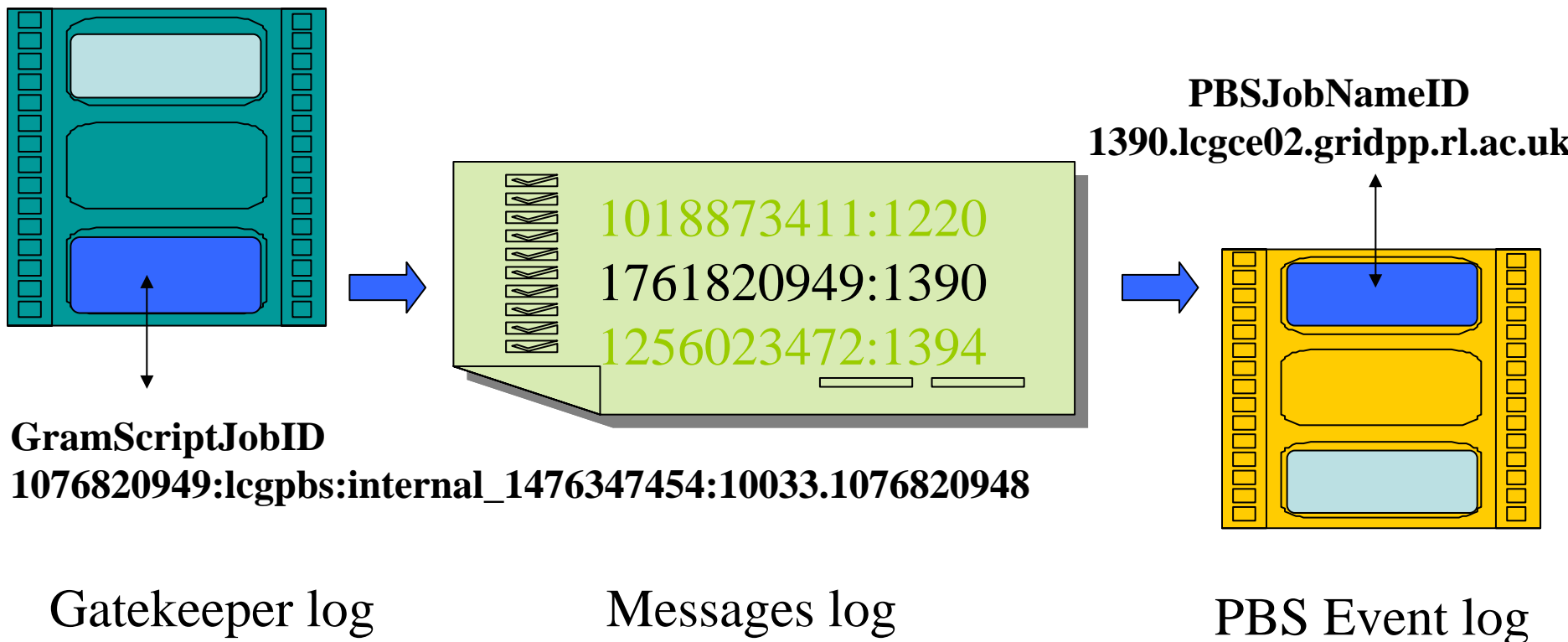
Field	Type
RecordIdentityG	varchar(255)
GramScriptJobID	varchar(100)
LocalJobID	varchar(50)
GlobalUserName	varchar(255)
SubmitHost	varchar(50)
SiteName	varchar(50)
ValidFrom	date
ValidUntil	date

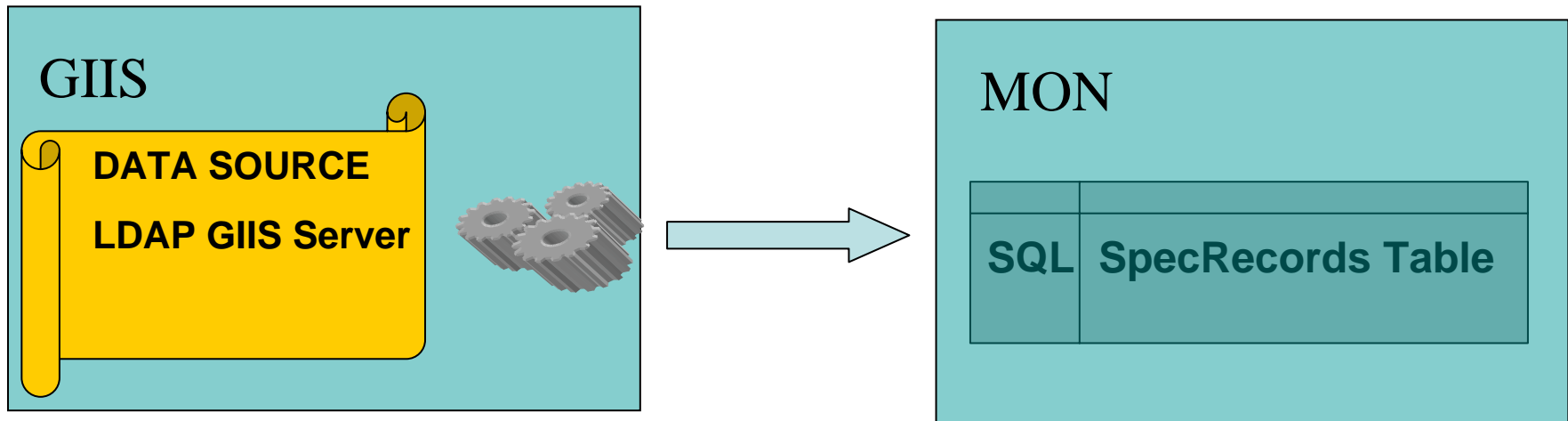


The actual table schema contains more information that is shown here.

In order to match the authenticated user DN's to the corresponding jobs we need to process the system message logs.

Record ID : [GK]     $\neq$     Record ID [PBS]



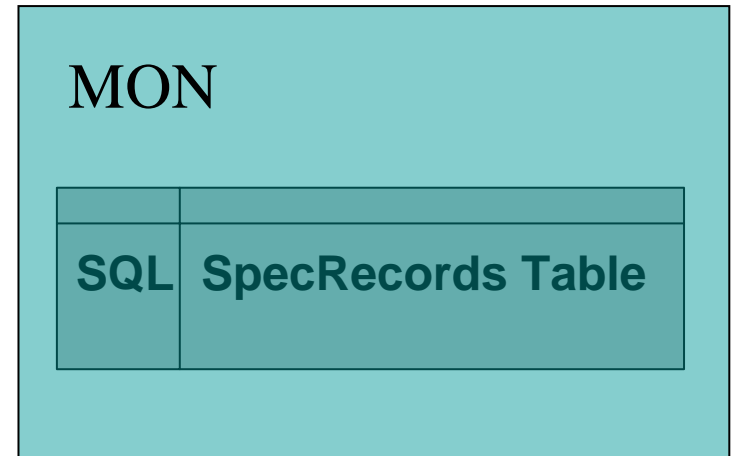


GIIS filter to collect CPU performance benchmarks for the worker nodes from the subclusters attached to the CE.

RGMA-API publishes data to SpecRecords database table on the MON box

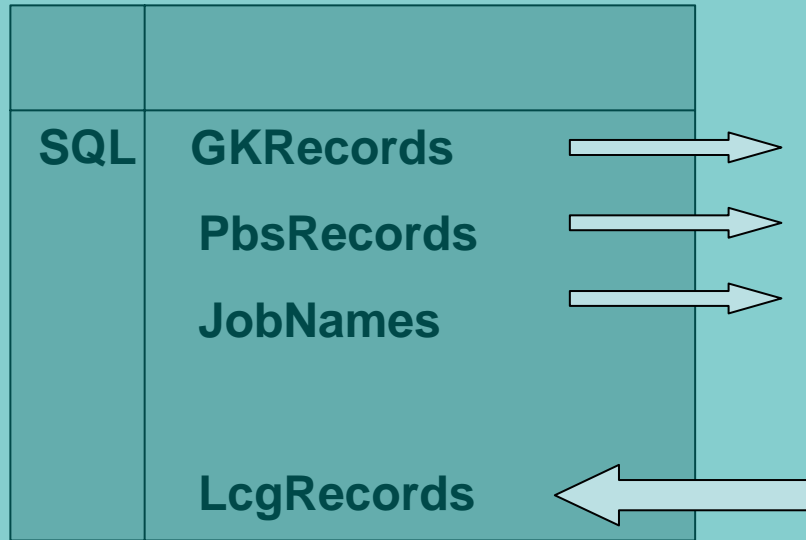
Field	Type
RecordIdentity	varchar(255)
SiteName	varchar(50)
ClusterID	varchar(50)
SubClusterID	varchar(50)
SpecInt2000	int(11)
SpecFloat2000	int(11)

CPU Performance benchmarks for the worker nodes in the subclusters attached to the CE



The actual table schema contains more information that is shown here.

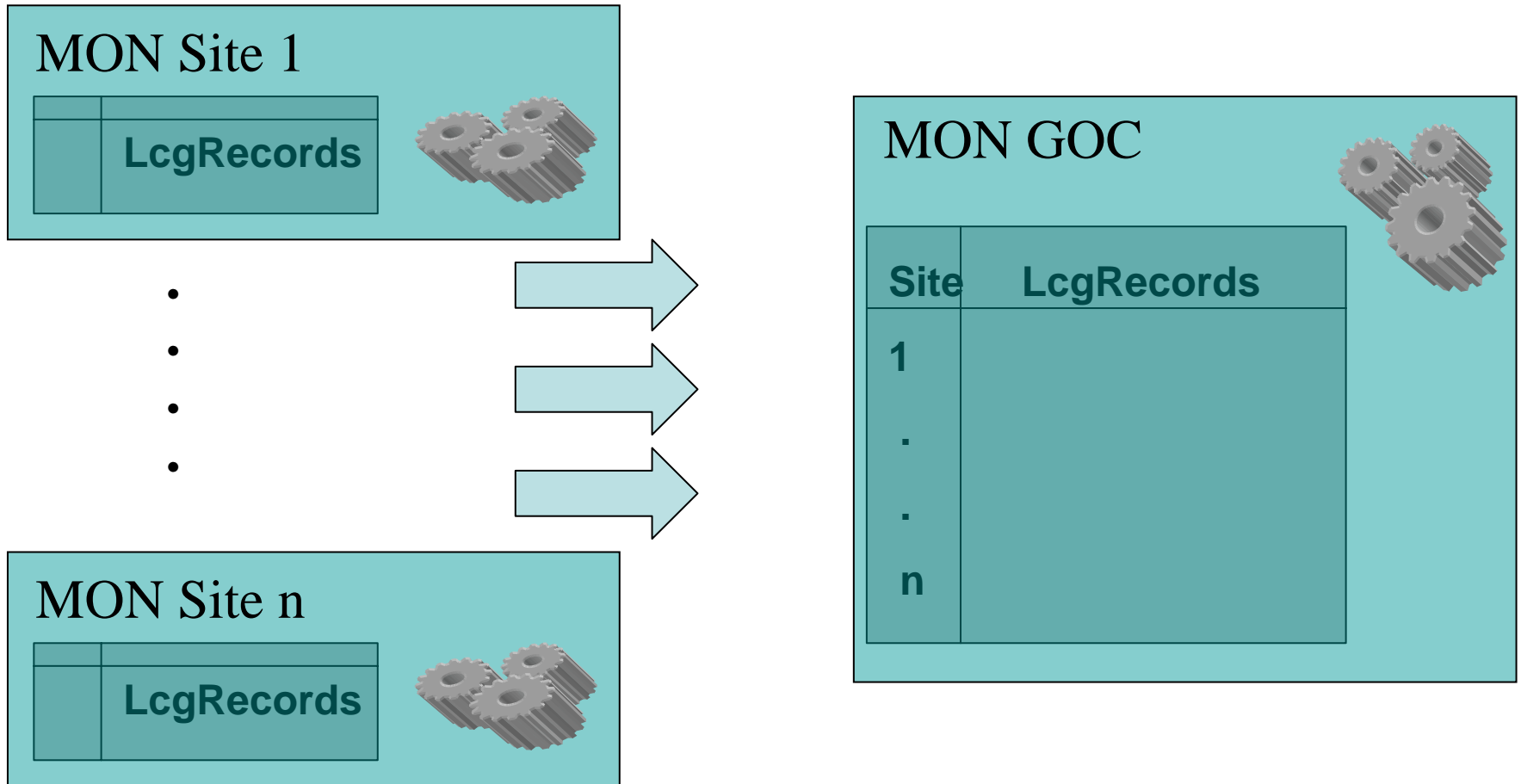
MON



3-Way join matches records and writes them to the LcgRecords Table.

LcgRecords records are unique

Site now has a copy of its own accounting data.



Data processed at each site is streamed to the GOC server

GOC has then aggregated information for all sites

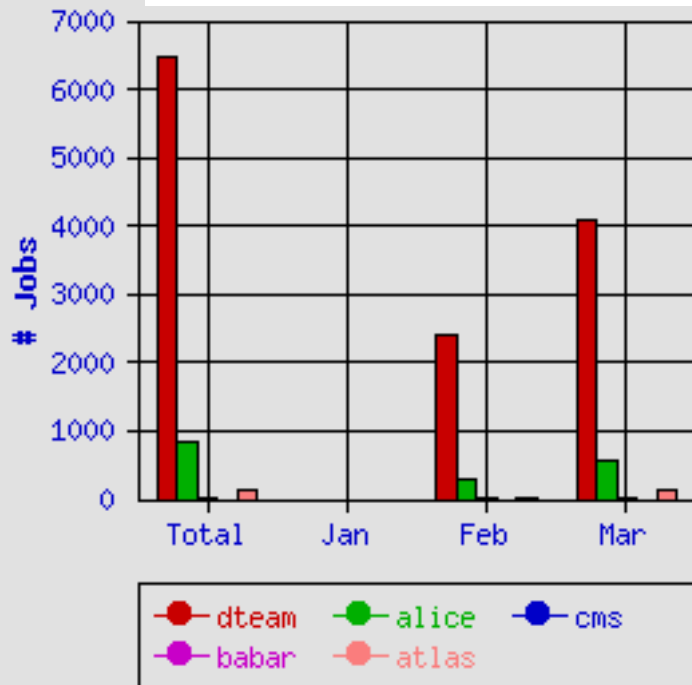
GOC provides an interface to produce accounting plots “on-demand”

Total Number of Jobs per VO per Site (ok)

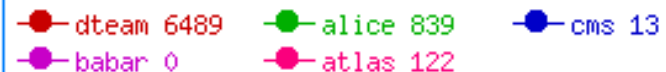
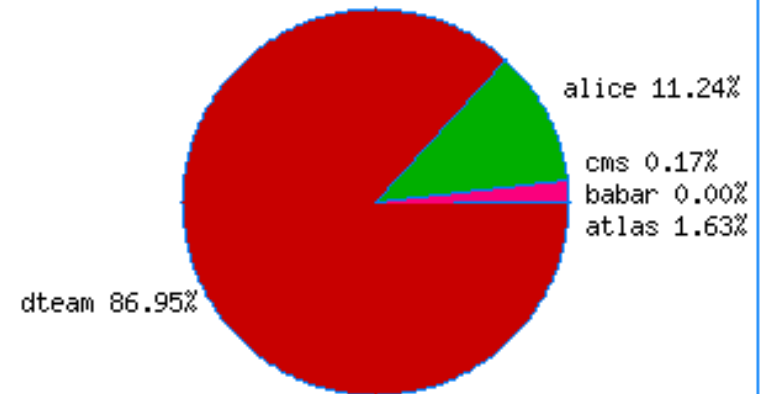
Total Number of Jobs per VO aggregated over all sites (to be done)

Tailor plots according to the requirements of the user community

Taipei Statistics Feb/Mar



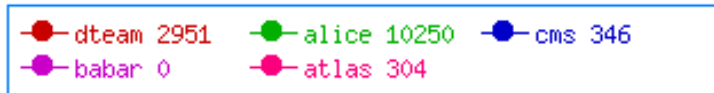
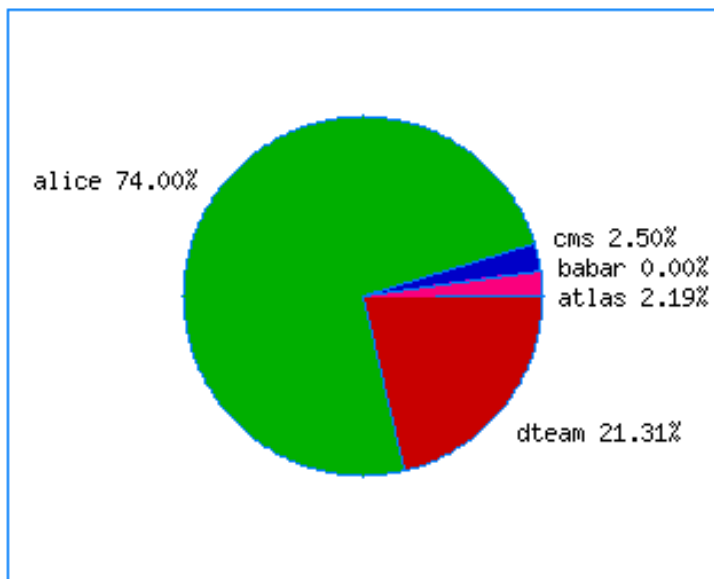
~ 1000 Alice Jobs



## CNAF Statistics March

~ 10,000 Alice Jobs

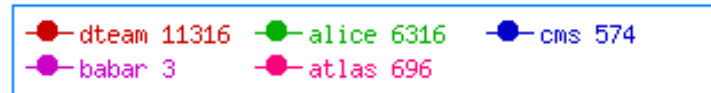
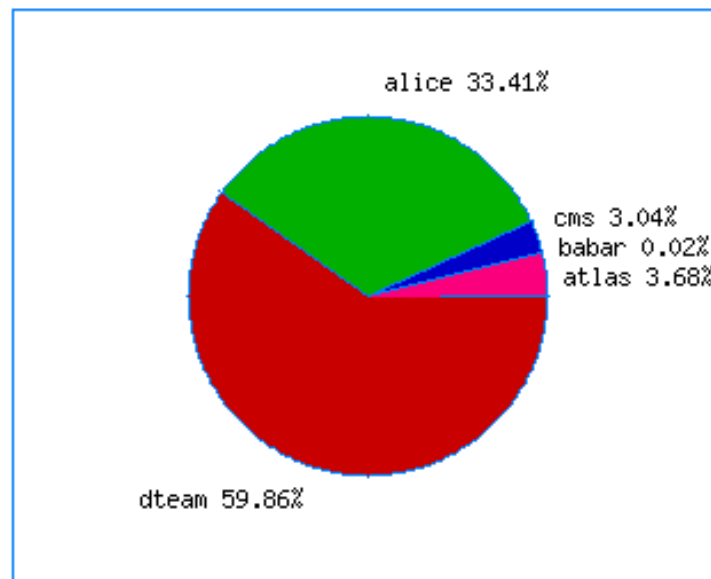
Mar



## RAL Statistics March

~ 6,300 Alice Jobs

Mar





1. PBS log processed daily on site CE to extract required data, filter acts as R-GMA DBProducer -> PbsRecords table
2. Gatekeeper log processed daily on site CE to extract required data, filter acts as R-GMA DBProducer -> GkRecords table
3. Site GUIS interrogated daily on site CE to obtain SpecInt and SpecFloat values for CE, acts as DBProducer -> SpecRecords table, one dated record per day
4. These three tables joined daily on MON to produce LcgRecords table. As each record is produced program acts as StreamProducer to send the entries to the LcgRecords table on the GOC site.
5. Site now has table containing its own accounting data; GOC has aggregated table over whole of LCG.
6. Interactive and regular reports produced by site or at GOC site as required.

1. There is no R-GMA infrastructure LCG-wide, so most sites are not able to install and run the accounting suite at present. It is expected that R-GMA and the MON boxes will be rolled out in LCG2 soon after the storage problems are resolved. Until this happens the complete batch and gatekeeper logs will have to be copied to the GOC site for processing.
2. The VO associated with a user's DN is not available in the batch or gatekeeper logs. It will be assumed that the group ID used to execute user jobs, which is available, is the same as the VO name. This needs to be acknowledged as an LCG requirement.
3. The global jobID assigned by the Resource Broker is not available in the batch or gatekeeper logs. This global jobID cannot therefore appear in the accounting reports. The RB Events Database contains this, but that is not accessible nor is it designed to be easily processed.
4. At present the logs provide no means of distinguishing sub-clusters of a CE which have nodes of differing processing power. Changes to the information logged by the batch system will be required before such heterogeneous sites can be accounted properly. At present it is believed all sites are homogeneous.

# Demonstrations

- TBC