



Enabling Grids for E-science

Monitoring the EGEE/WLCG Grid Services

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CERN – IT

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www.eu-egee.org



- **SAM (Service Availability Monitoring): the platform**
- **Use of SAM: testbeds, sites, grids**
- **Focus on HEP VOs use cases**
- **Conclusions**

- **80 developers (12 research centers)**
- **gLite 1.0: initial version, released in April 2005**
- **gLite 1.5: latest LCG-independent version, released in Jan. 2006**
- **gLite 3.0: merging LCG 2.7 and gLite 1.5, May 2006**
- **since 3.0 no separate releases of LCG and gLite middleware**



- **gLite services groups:**
 - Access and Security Services
 - Information and Monitoring Services
 - Data Services
 - Job Management Services
- **gLite services scopes:**
 - User
 - Site
 - Virtual Organization (VO):
 - Biomedical
 - High Energy Physics
 - etc...
 - and global (i.e. multi-VO)

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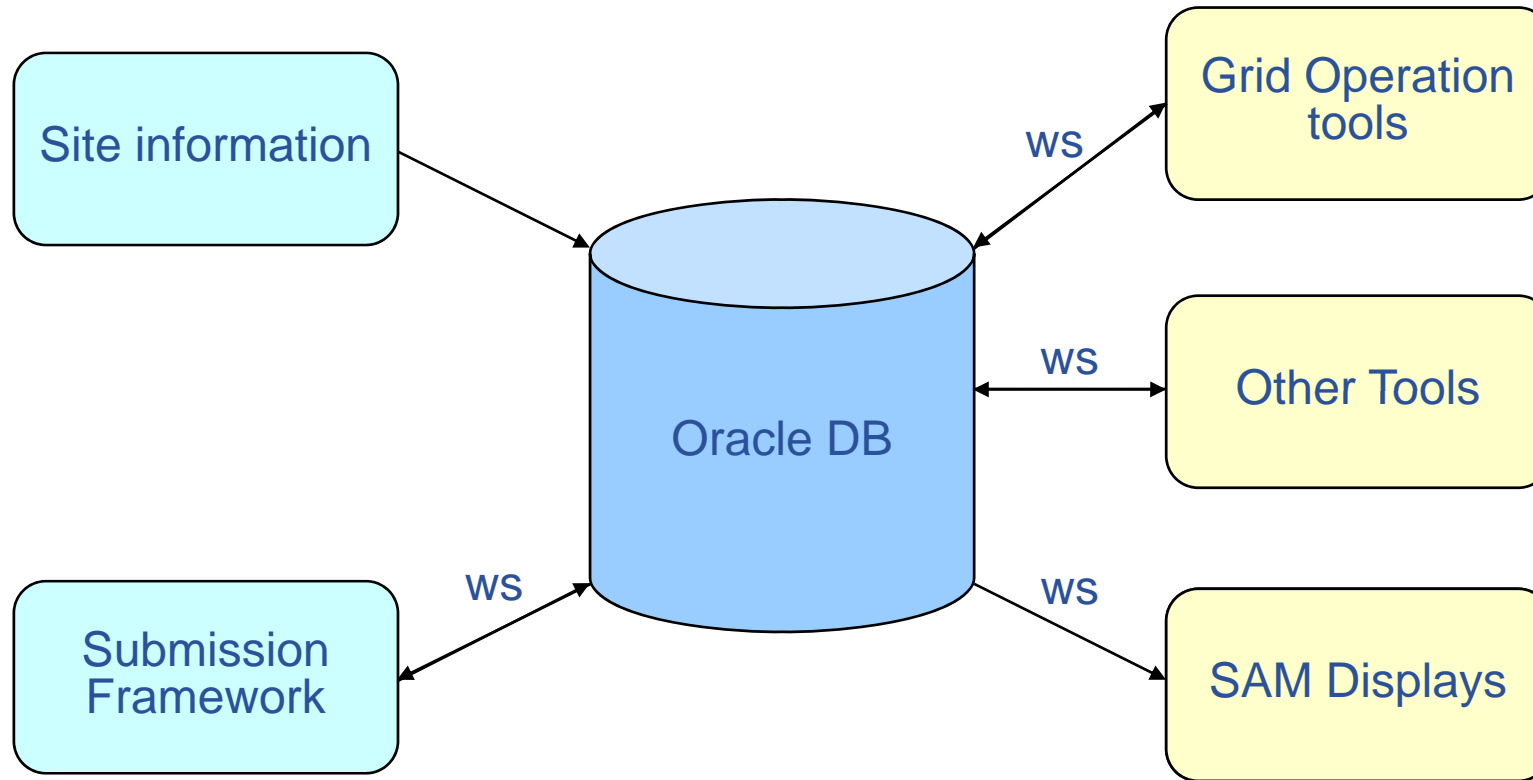
- **Access and Security Services**
 - Identifies users, allowing or denying access to services, on the basis of some agreed policies.
 - provides credentials using Public Key Infrastructure (PKI) X.509
 - Certification Authorities as trusted third parties.
- **Information Service (IS) and Monitoring:**
 - Provides information about the gLite resources and their status.
 - used to locate resources
 - and for monitoring and accounting purposes.
 - Data published to the IS conforms to a schema

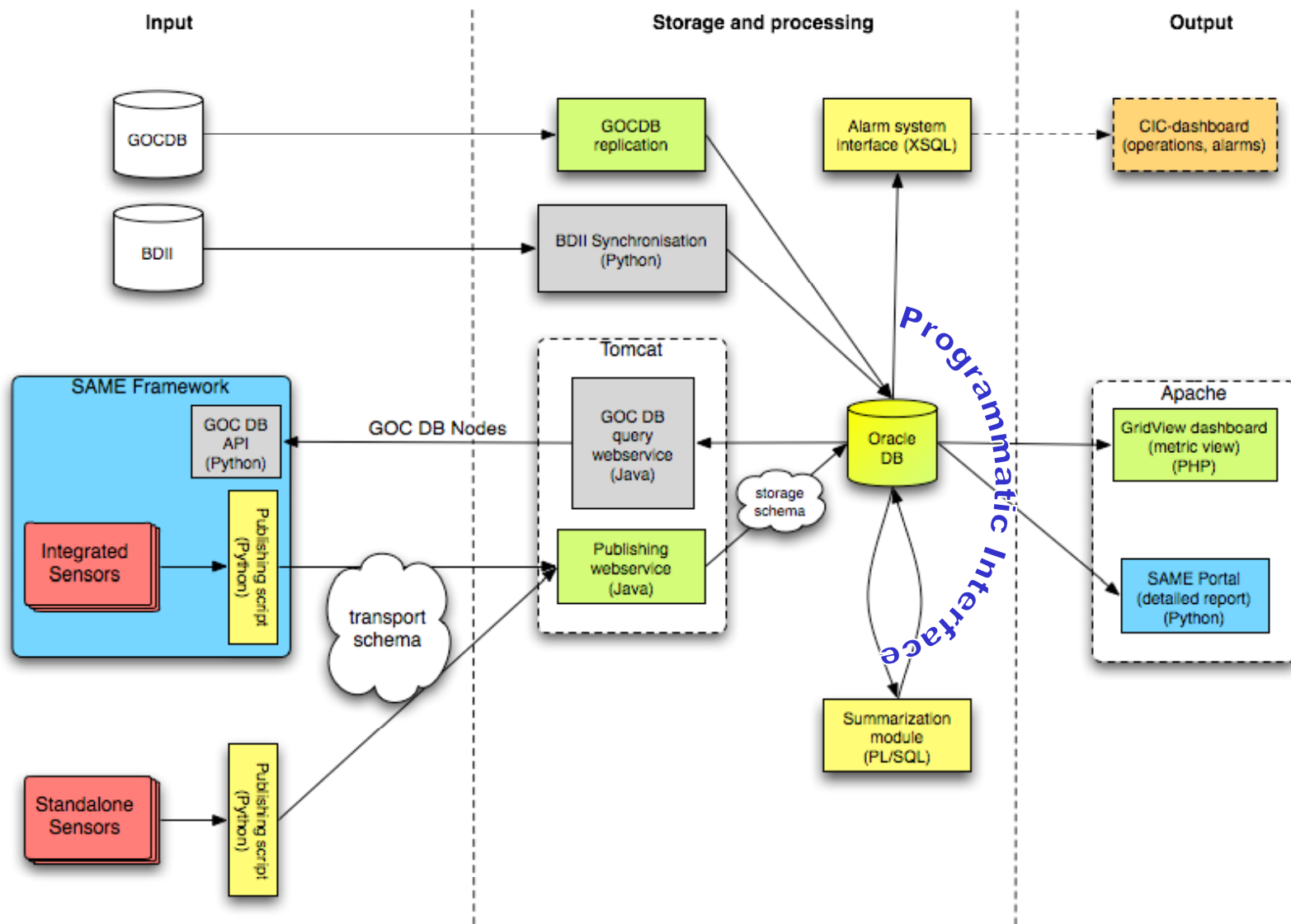
- **Job Management System**
 - Computing Element (CE) service
 - computing resources localized at a site (clusters with Worker Nodes)
 - Workload Management System (WMS) - (global)
 - matching jobs to CEs according to job requirements and optimization
 - managing full life-cycle of the job across sites.
- **Data Management System**
 - **storage back-end (site)**
 - **stored files registered in a central catalogue (LFC) (global)**

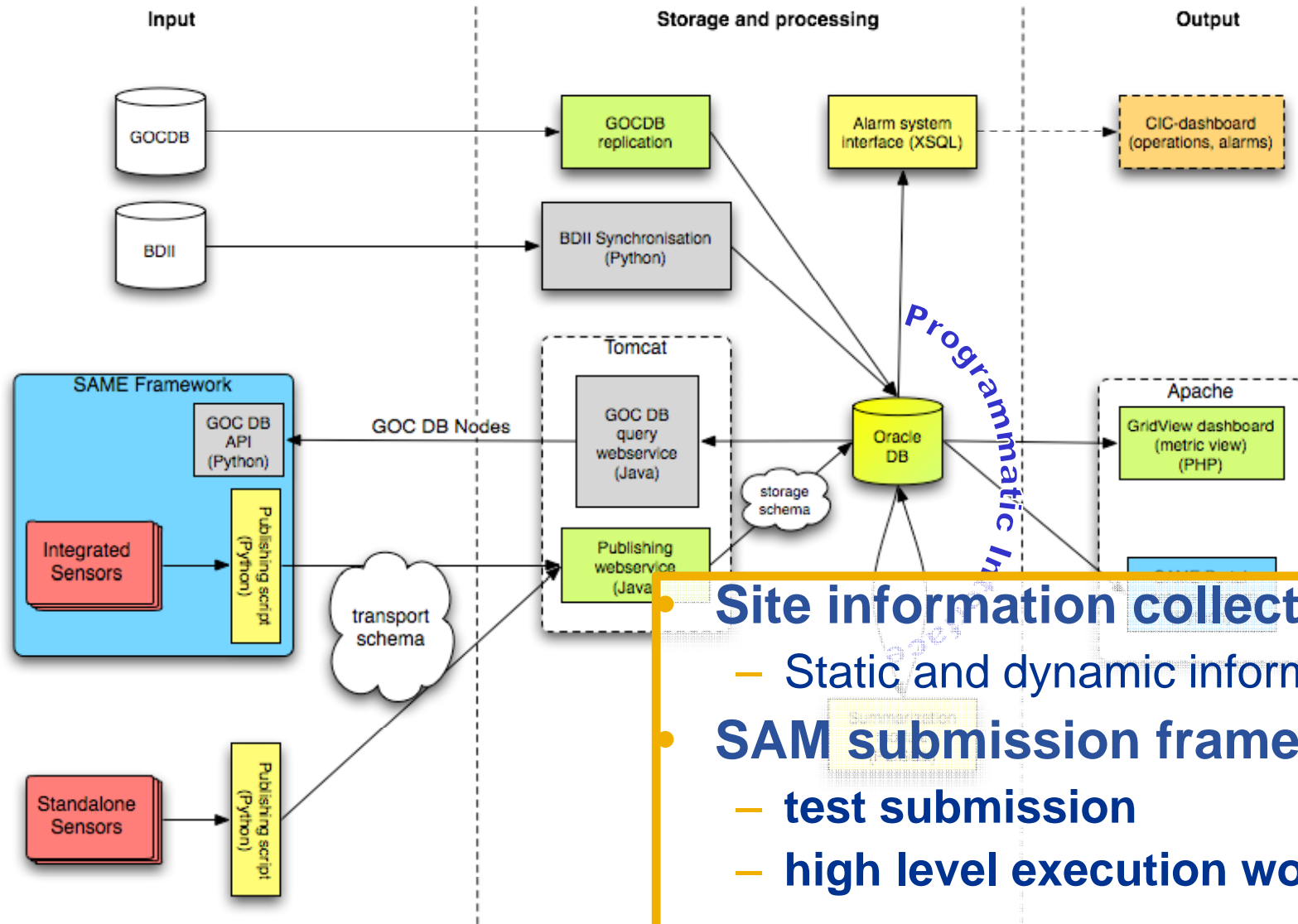
- **Monitoring EGEE/WLCG grid infrastructure**
- **Service level monitoring**
 - Service availability (and functionality) checked by launching tests on the monitored sites
- **In production since June 2006**
- **Managing a growing infrastructure**
 - 20 sites --> 60 sites --> 200 sites (in four years)
- **Main source of information for Grid Operations**
- **Basis for Availability**

- SAM Framework structure
 - **Submission framework**
 - **Oracle DB**
 - **Web Services**
 - **Visualization part (SAM displays)**

SAM (simplified) architecture

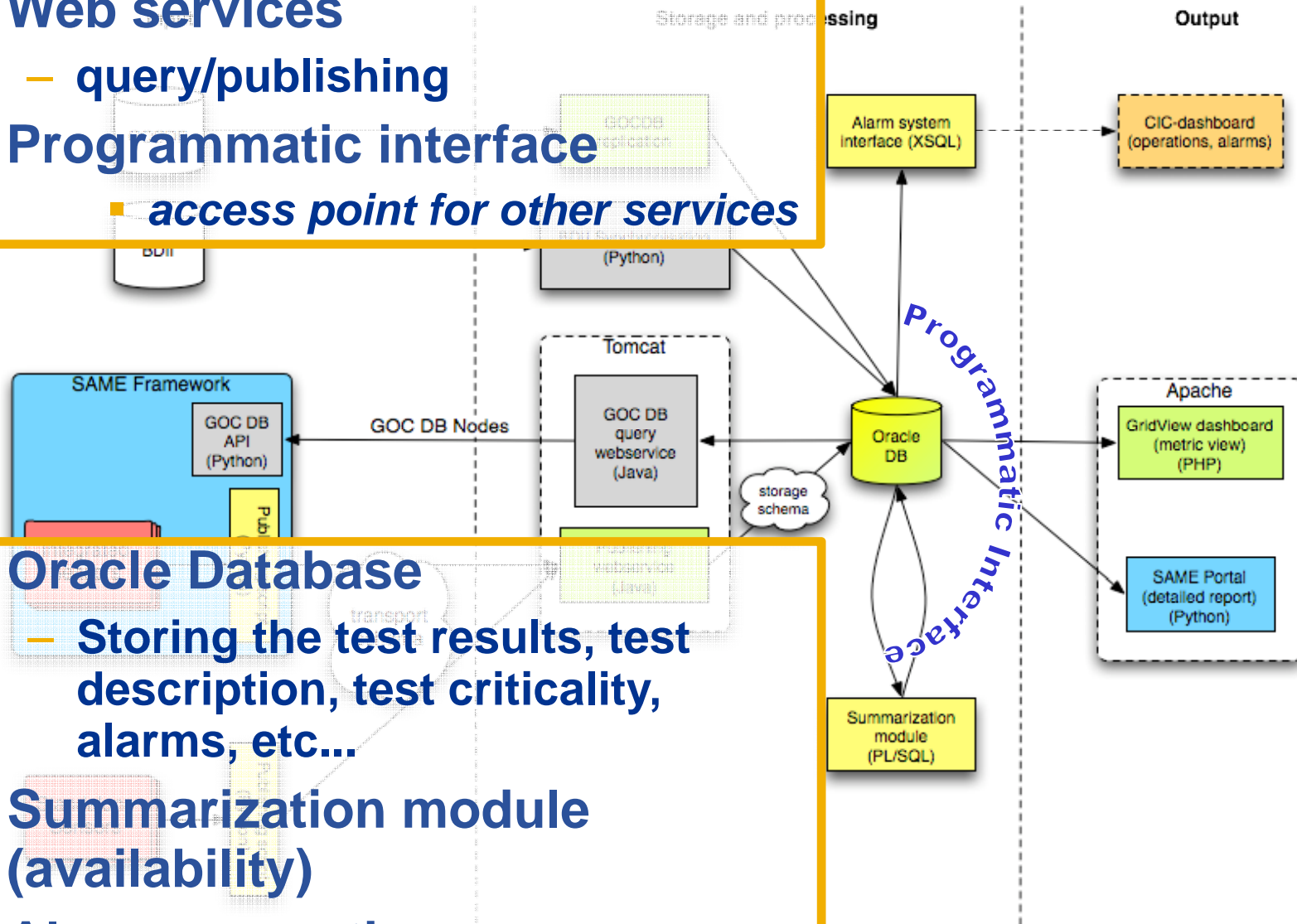




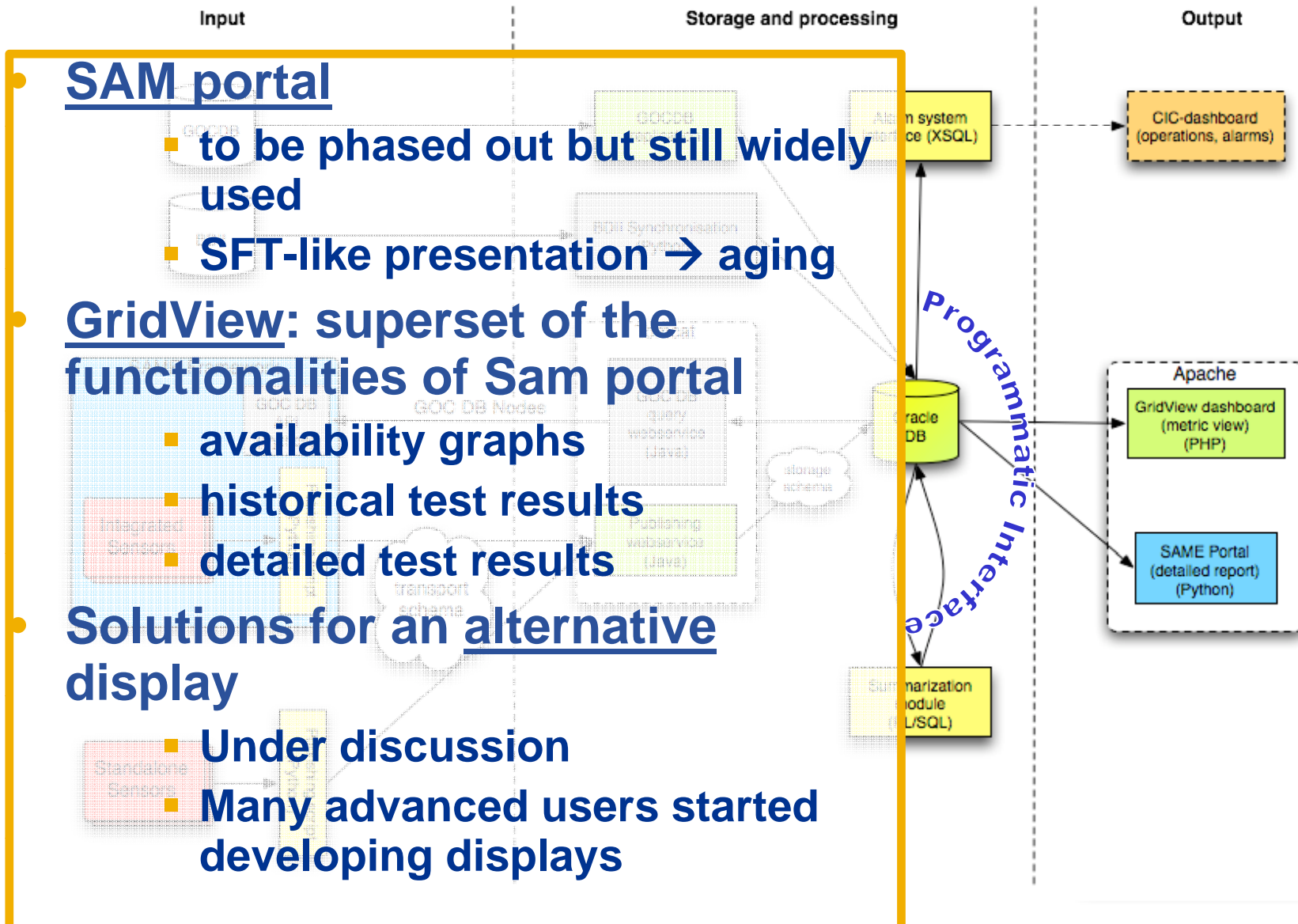


- **Site information collection tools**
 - Static and dynamic information
- **SAM submission framework**
 - test submission
 - high level execution workflow

- **Web services**
 - query/publishing
- **Programmatic interface**
 - *access point for other services*



- **Oracle Database**
 - Storing the test results, test description, test criticality, alarms, etc...
- **Summarization module (availability)**
- **Alarm generation**





GridView visualization of SAM results

Enabling Grids for E-science

Gridview: Visualization and Monitoring Tool for LCG - Windows Internet Explorer provided by CERN

http://gridview.cern.ch/GRIDVIEW/same_index.php

Monitoring and Visualization Tool for LCG

Data Transfer | Job Status | Service Availability
(Version: gridview-3.0.2, Installation Date: Jan 08, 2007)

Detailed SAM Test Results

Site	: CERNPR	Node	: ce107.cern.ch	Service	: CE
Test Name	: CE-sft-job	Test VO	: LHCb	Test Help	: ?
Critical	: N	Criticality Defining VO	: OPS		

Timestamp	Status ID	Status Info	Test Env	Result Summary	Detail Result
at 00:09:05 on 23/01/2007	10	ok	Test Env		Detail Result
at 00:13:43 on 23/01/2007	10	ok	Test Env		Detail Result
at 00:42:44 on 23/01/2007	10	ok	Test Env		Detail Result
at 00:58:09 on 23/01/2007	50	error	Test Env	timeout	Detail Result
at 04:55:02 on 23/01/2007	50	error	Test Env	timeout	Detail Result
at 05:13:34 on 23/01/2007	10	ok	Test Env		Detail Result

Generating JDL LHCb file:

```

Executable = "/bin/sh";
Arguments = "-c 'tar xzf testjob.tgz ; export SAME_WORK='pwd'/work ; bin/same-exec -c same.conf -
StdOutput = "testjob.out";
StdError = "testjob.out";
InputSandbox = {"testjob.tgz","same.conf"};
OutputSandbox = {"testjob.out","testjob-results.tgz"};
Requirements = other.GlueCEInfoHostName == "ce107.cern.ch";

```

Submitting a LHCb job

Local intranet 100% 10:31 AM

- **Service Availability is computed**
 - Per Service Instance
 - Per Service Type (eg. CE) for a site
 - Per Site
 - Over various periodicities like Hourly, Daily, Weekly and Monthly

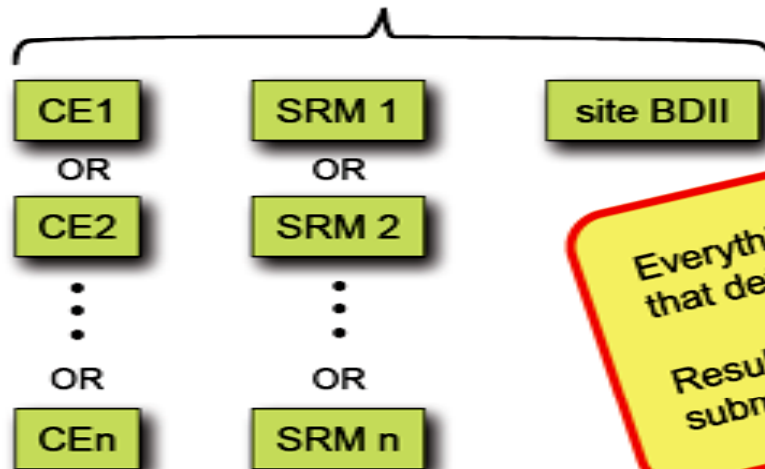
Status of node N = $\bigwedge_{t \in \text{CriticalTests}} \text{TestResult}(N,t)$

\wedge = boolean AND
 \vee = boolean OR

Status of central service C = $\bigvee_{N \in \text{instances}(C)} \text{Status}(N)$

Status of site S =

AND

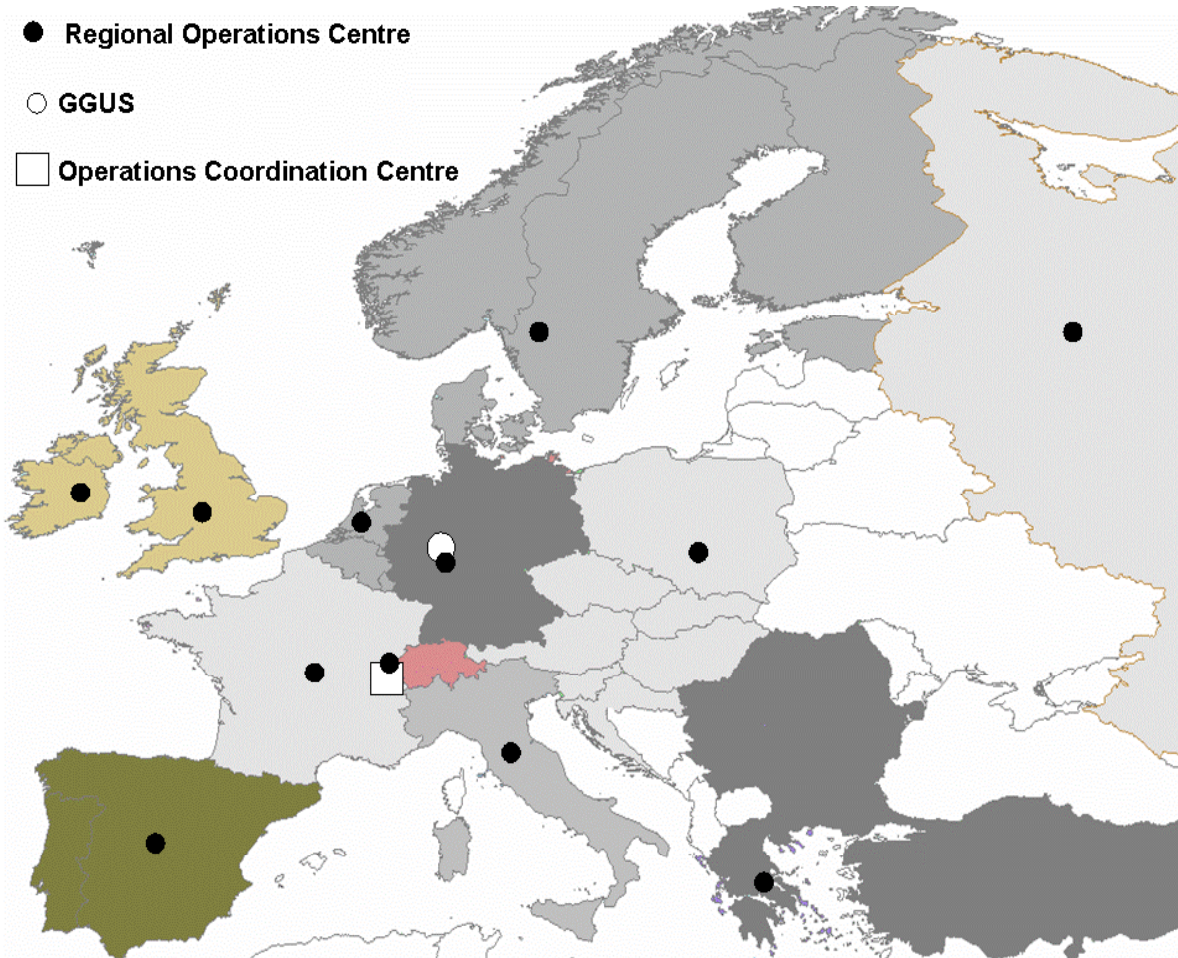


Everything is calculated for each VO that defined critical tests in FCR
 Results make sense only if VO submits tests!!!

- EGEE/WLCG infrastructure;
 - **~200 sites**
 - **11 federations or regions**
- ROC:
 - **responsibility for the services within its region**
 - **conformity to a set of agreed operation procedures.**
- Grid Operators (COD):
 - **monitoring the availability and performance of the grid services.**

- COD is Operator on Duty
- **global WLCG/EGEE GRID monitoring**
- **SAM tests raise alarms about site failures which are reported to COD**
- **Then COD:**
 - **detect issues affecting the grid services**
 - **provides a first analysis**
 - **reports existing problems to the relevant ROCs**
 - **validates the solution provided**
- **1 (2) ROCs responsible for the whole GRID operations at a time**
 - 11 ROCs involved
 - weekly rotation

- Regional Operations Centre
- GGUS
- Operations Coordination Centre



- **Regional Operations Centres (ROC)**

- One in each region (incl. Asia-Pacific)
- Front-line support for user and operations issues
 - point of contact for sites in the region
- Provide local knowledge and adaptations
- Manage daily Grid operations – oversight, troubleshooting
- Run infrastructure services

- **for Asia-Pacific region**

- Asia-Pacific
 - roc@lists.grid.sinica.edu.tw
 - Jason Shih, Min-Hong Tsai, Shu-Ting Liao
- CERN (catch-all ROC)
 - egee-roc-cern@cern.ch
 - Nicholas Thackray

- **SAM platform in use in EGEE-SA3 (Integration/Testing/Release) for middleware certification purposes**
- **Standard tests used as basic functionality and regression tests**
- **Additional tests (e.g. LB, BLAH) integrated locally**
- **Lightweight display interfaced directly SAM DB**
 - (<https://lxb0714.cern.ch/easysam/perl/easysam.cgi>)

- **Grid Operations**
 - Grid Operator-on-Duty (COD)
 - Alarms shown by COD Dashboard are generated by SAM
- **Site Certification**
 - Technical suitability, convenient level of quality
 - SAM test results are crucial in the certification procedures of most EGEE/WLCG ROCs.
 - On demand submission (web interface, Poznan)
 - Official hourly submission (CERN)
- **Availability**
 - ROC reports
- **Site monitoring**
 - site admins, ROC, etc...

- A number of grid infrastructures are currently monitored by SAM. Major examples:
 - **EGEE/WLCG**
 - **SEE-Grid**
 - **EELA**
 - **Health-e-Child**
 - **EuMedGrid**
 - **EuChinaGrid**
 - **BalticGrid**
- SAM platforms were deployed for those projects in slightly different configurations, according to the number of sites monitored, hardware and software resources.

- All the four LHC experiments are running (or planning to run) custom tests using the production instance of SAM
- Goal: sanity checks against selected **grid** and **application** services.
 - **CMS, Alice, LHCb**
 - running custom tests in production using
 - two different submission approaches
 - **Atlas**
 - running standard tests in production using Atlas proxy.
 - preparing to submit custom tests
- The production SAM platform is supporting the four VOs
 - **Only minor changes were needed to support Alice**

Two different approaches

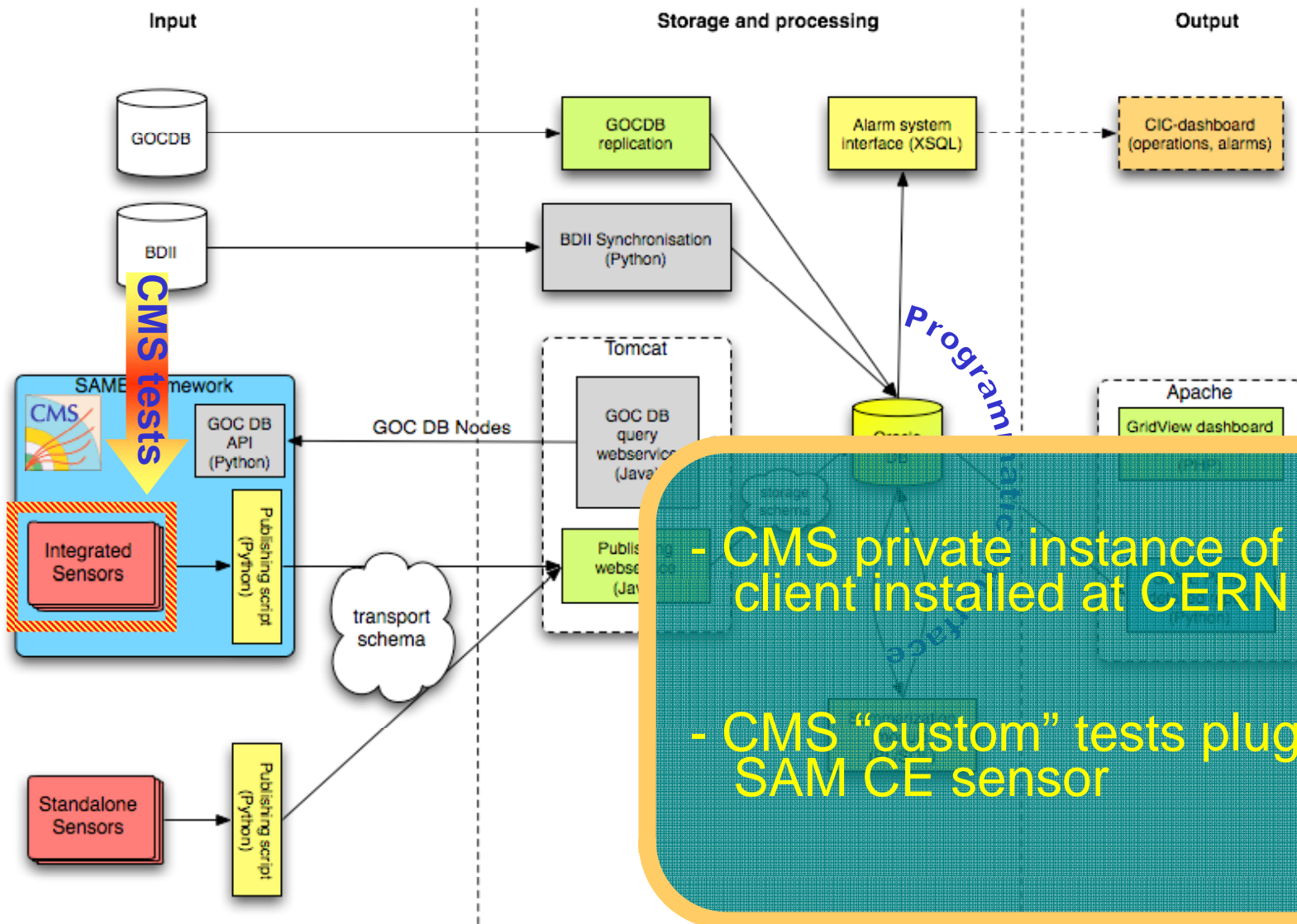
1. Advanced usage of the Submission Framework
 - **CMS, (Atlas)**
2. Hybrid submission methods
 - **ALICE, LHCb**

Both approaches successful and interesting ...

A Clean Integration: CMS

- **CE tests submitted by CMS since early 2007**
 - CMS software area
 - Site local configuration
 - CMS version test
 - local stage out (WN → SE)
 - Discovery of local Squid server
 - Read Calibration data via Squid server
- **SRMv1 and v2 tests also in production**
 - Verify translation LFN → SURL
 - Test data access UI → remote SE
 - push, pull, delete file
 - get file metadata

Credit: Andrea Sciaba' - CMS



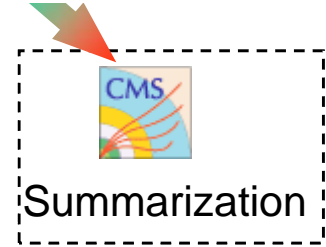
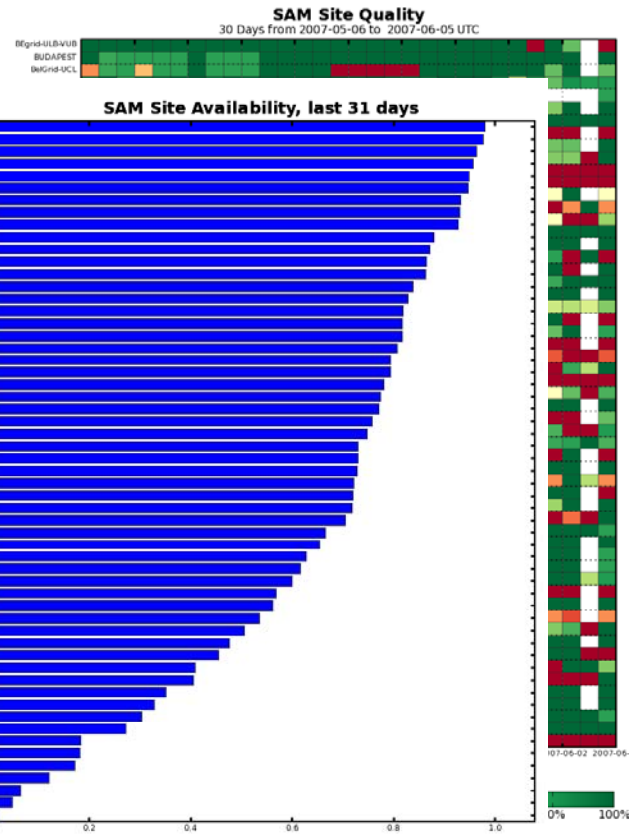
- CMS private instance of SAM client installed at CERN
- CMS "custom" tests plugged in SAM CE sensor

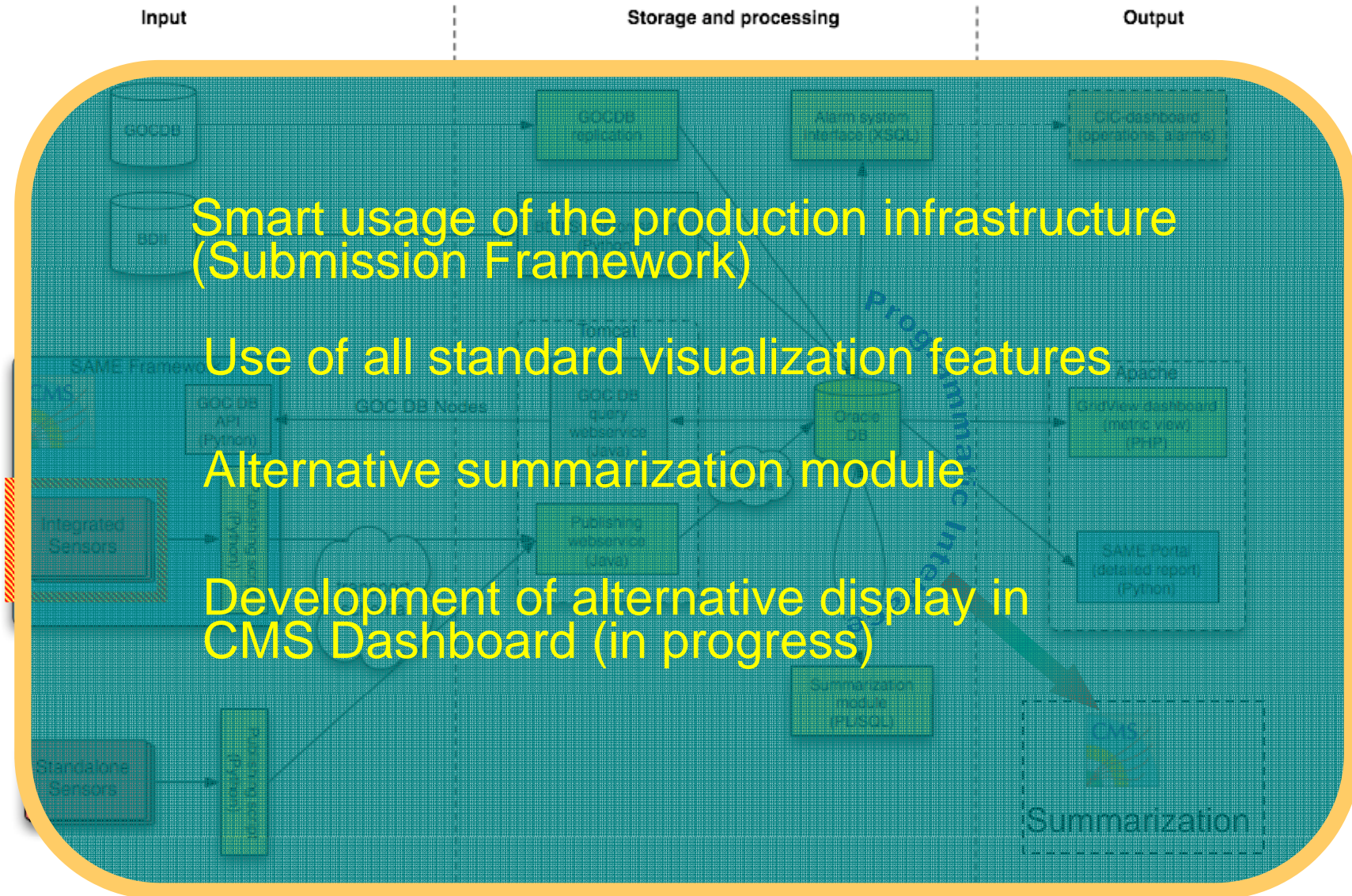
- Results of CMS tests are used to calculate availability according to CMS specific metrics
- Data accessed through the Programmatic Interface
- Daily site availability calculated according CMS metrics
- CMS Availability = $\frac{\text{running time}}{\text{total time}}$
- CMS Reliability = $\frac{\text{running time}}{\text{total time} - \text{scheduled downtime}}$

Storage processing

Alerts

Summarization module (PL/SQL)

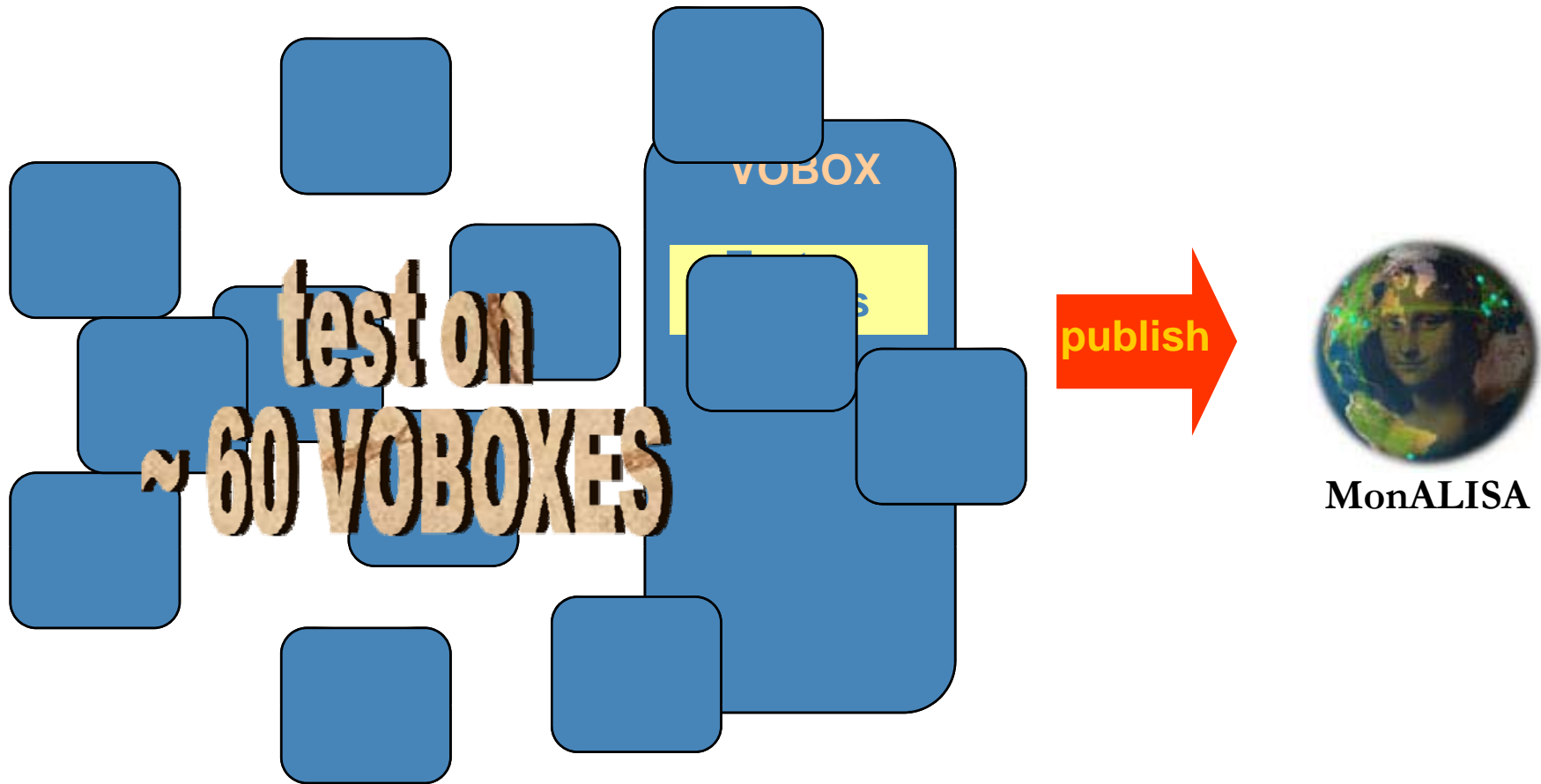




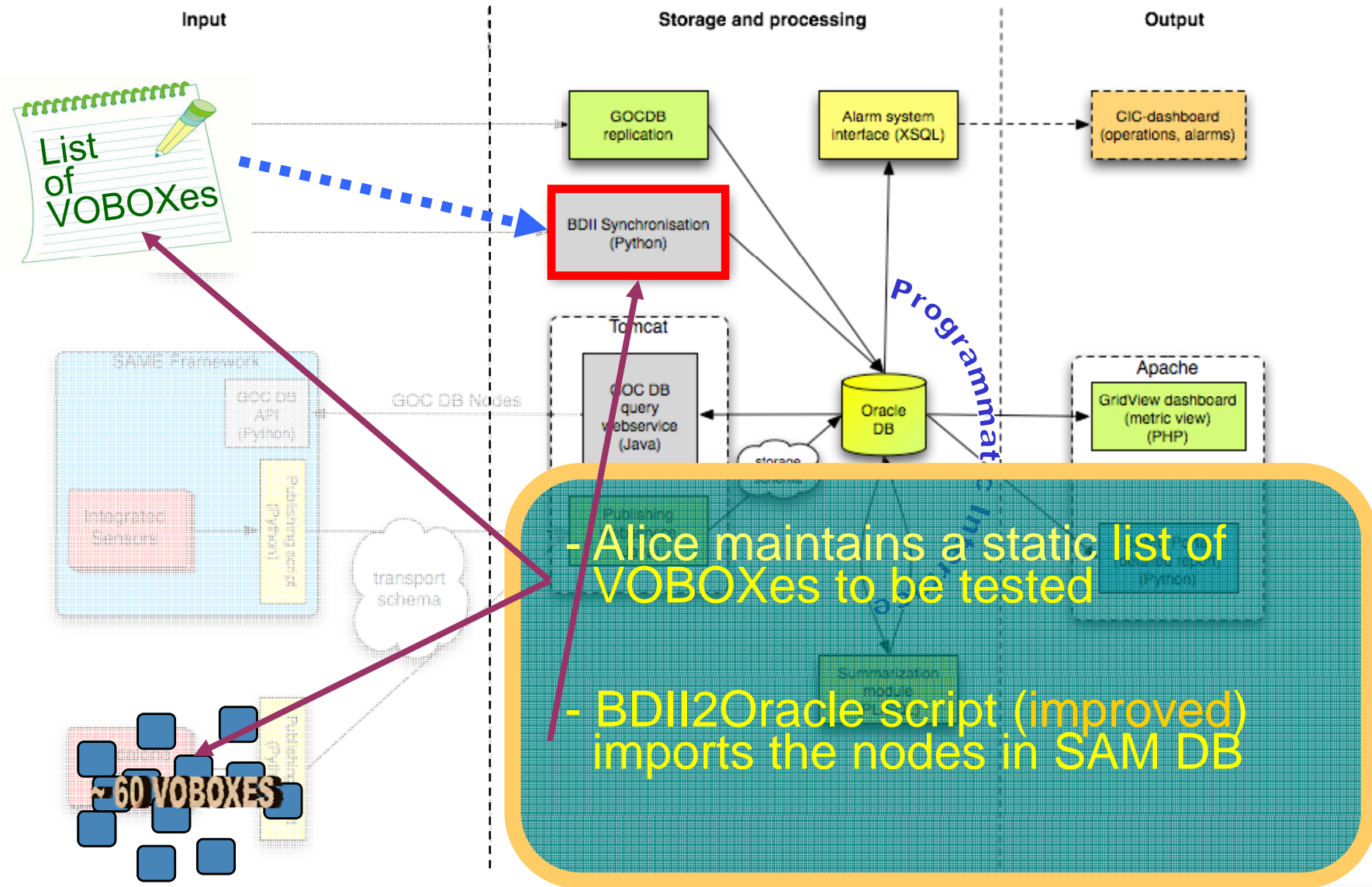
- **Off-the-shelf SAM client used to submit standard tests with an Atlas proxy**
- **Developing custom tests and new sensors**
 - **SE Sensor: access to DQ2 directories with new lcg-utils**
 - **Custom SRM: to run low-level test on SRMs**
 - **Sanity check of software installation**
- **Planning an “orthodox” use of Submission Framework**
- **Developing visualization on ARDA dashboard**

An Hybrid Integration: Alice, LHCb

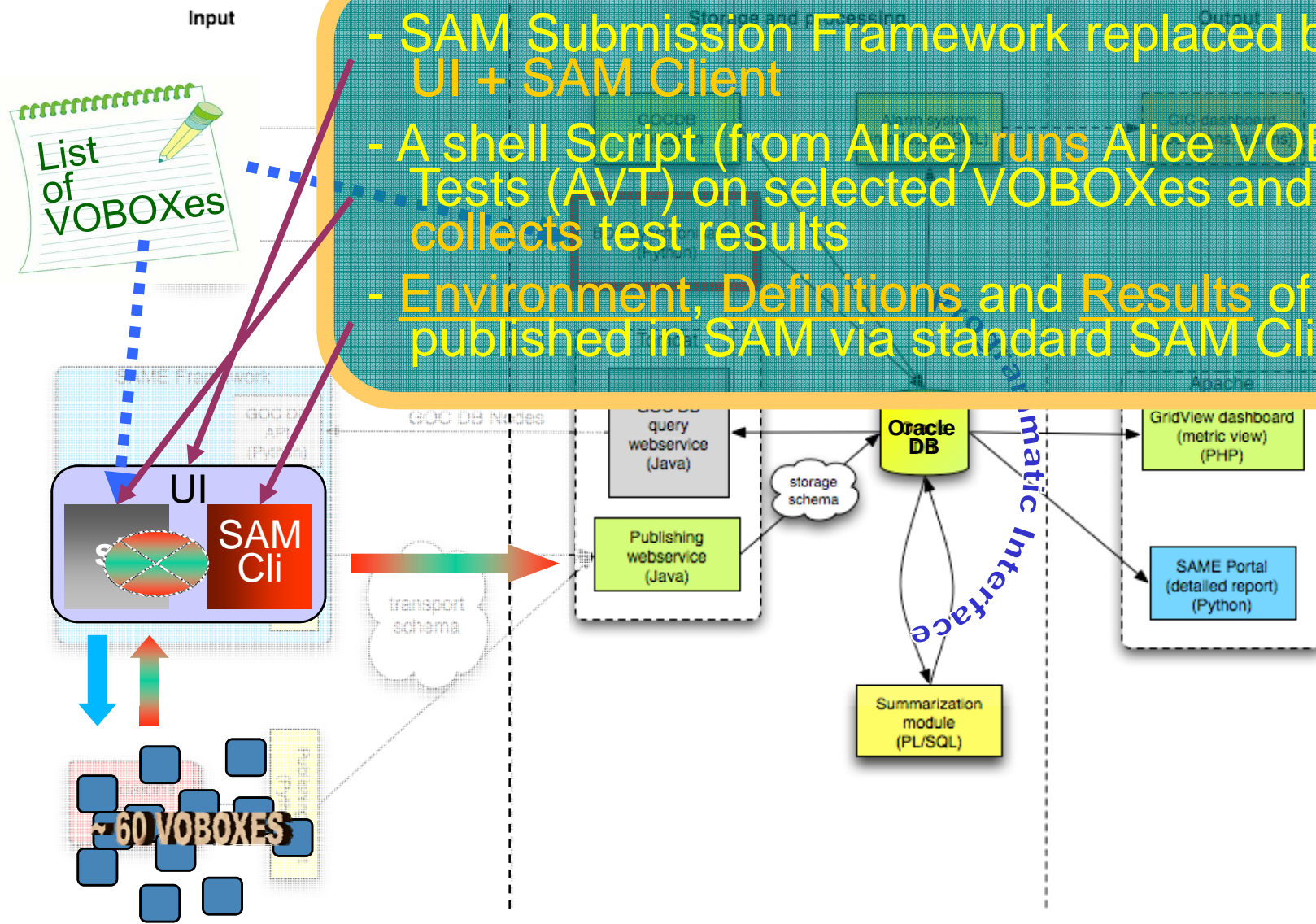
- Alice has developed test scripts to be run on VOBOXES
- Results to be visible in *MonALISA* ...
- Test to be repeated at all Alice sites (~60)...



Alice test case deposited to the MonALISA VOBOXES



- SAM Submission Framework replaced by + UI + SAM Client
- A shell Script (from Alice) runs Alice VOBOX Tests (AVT) on selected VOBOXes and collects test results
- Environment, Definitions and Results of tests published in SAM via standard SAM Client



Input

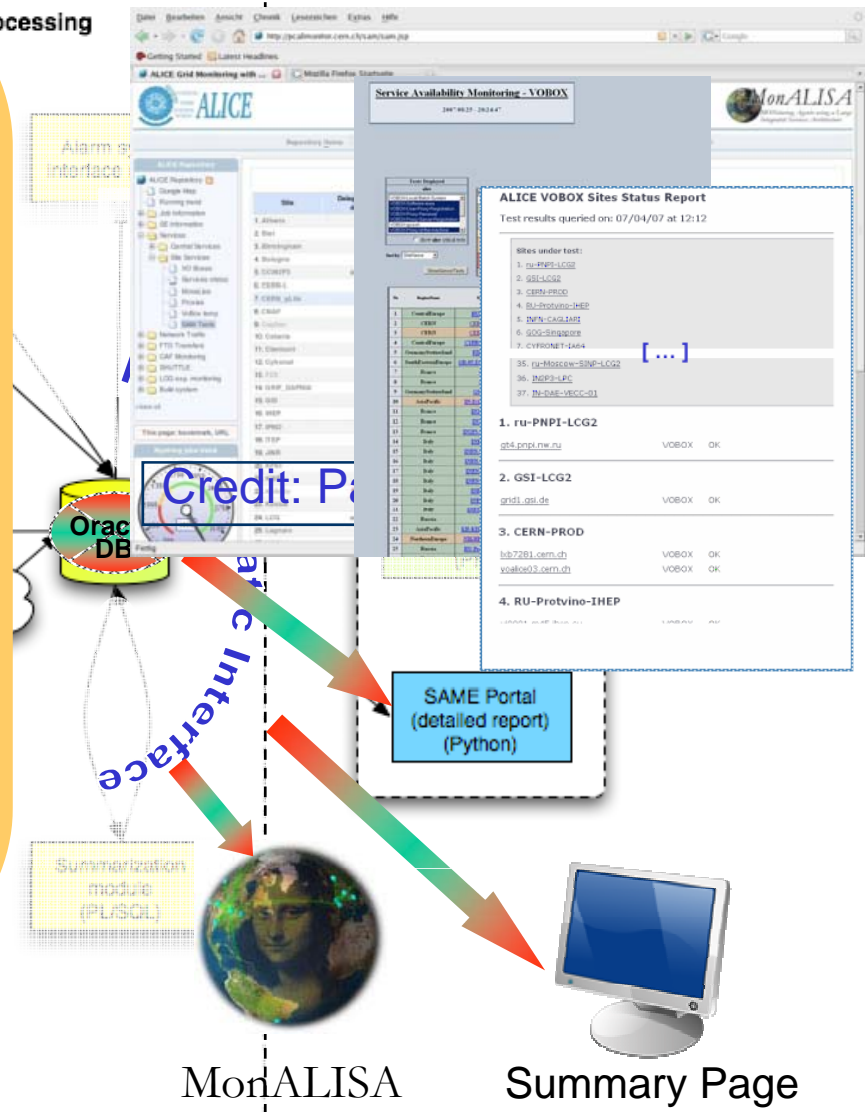
Storage and processing

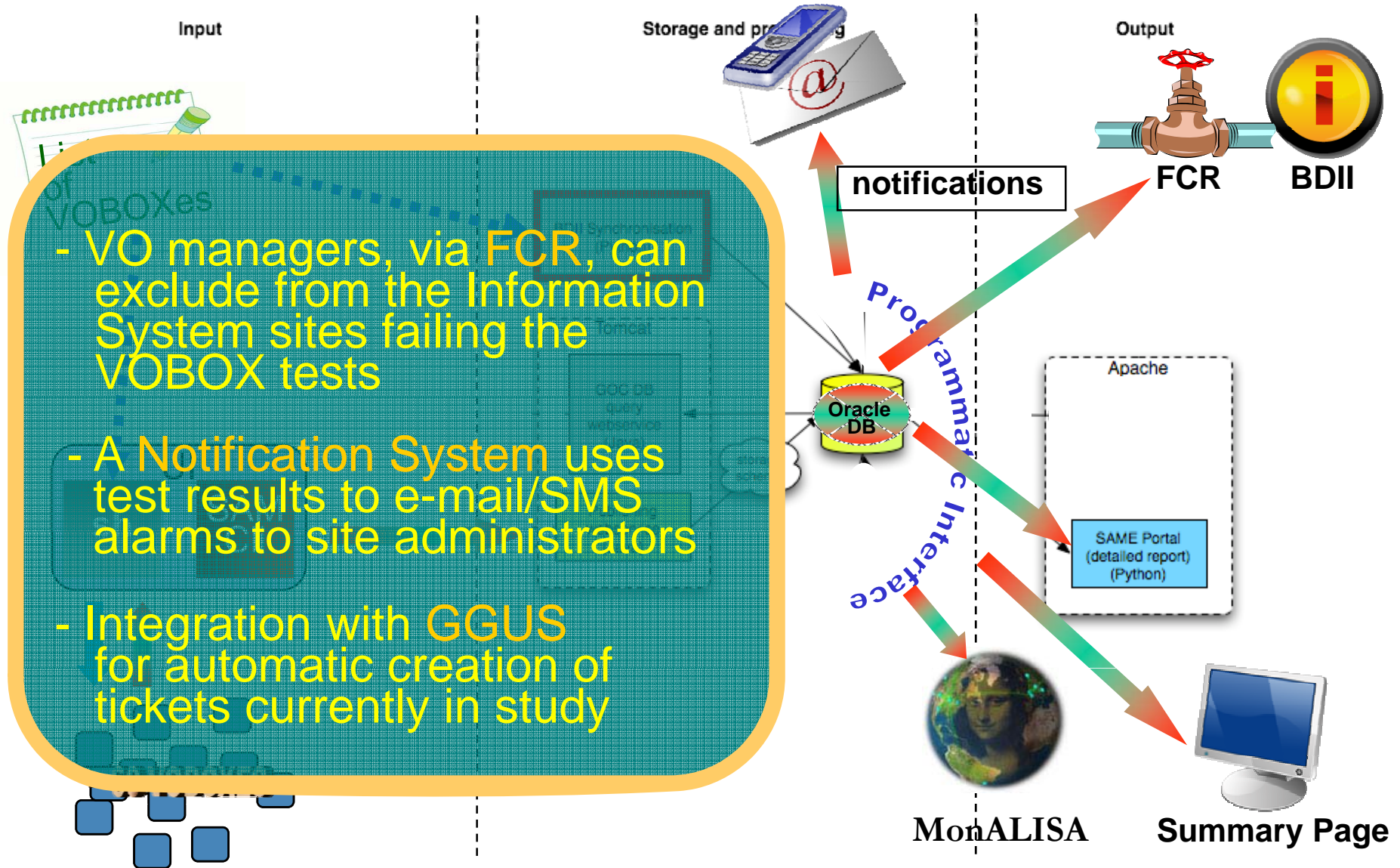
VOBOX test results available to MonALISA via the SAM Programmatic Interface

Results are also visible in the standard SAM Portal display

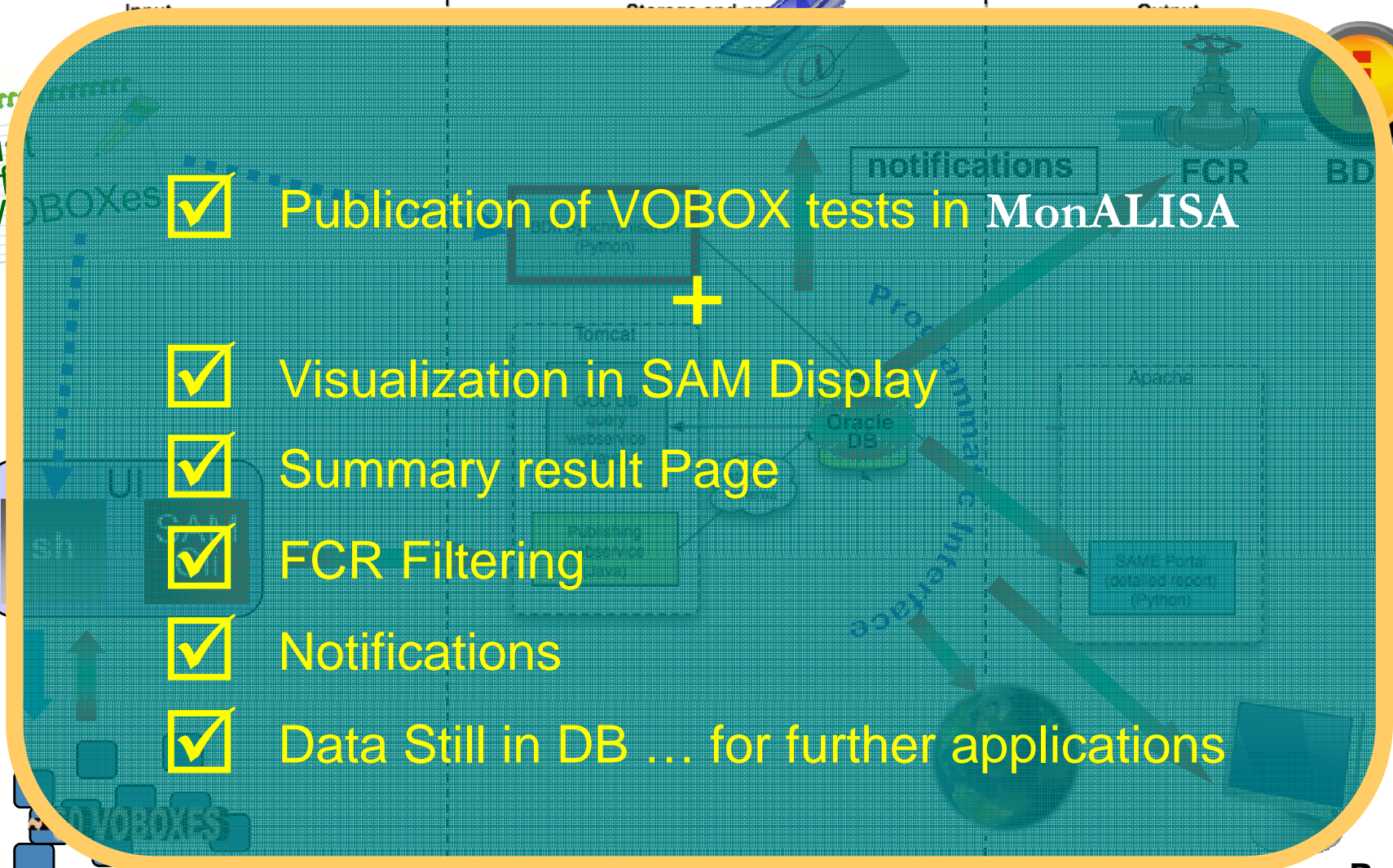
A Web Page with a summary of VOBOX test results at all Alice sites is generated. Data accessed through the Programmatic Interface

~60 VOBOXES





- VO managers, via FCR, can exclude from the Information System sites failing the VOBOX tests
- A Notification System uses test results to e-mail/SMS alarms to site administrators
- Integration with GGUS for automatic creation of tickets currently in study



- ✓ Publication of VOBOX tests in MonALISA
- +
- ✓ Visualization in SAM Display
- ✓ Summary result Page
- ✓ FCR Filtering
- ✓ Notifications
- ✓ Data Still in DB ... for further applications

MONALISA

Summary Page

- **Critical tests for LHCb applications ...**
 - Length of LHCb queue on the CE
 - OS and architecture check
 - Whole MC chain of LHCb applications
- **... and Grid Services ...**
 - SRM
- **Installation of LHCb software and publishing tags**

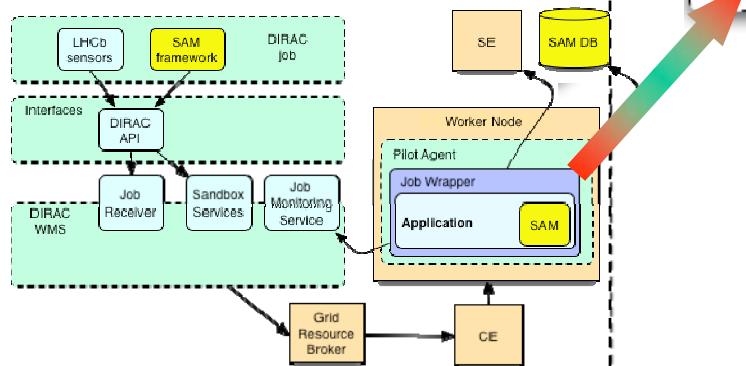
Credit: Roberto Santinelli - LHCb

DIRAC Monitoring (Test)

http://lhcb.pic.es/DIRAC/Monitoring/Test/

Accounting	Overview	Transfer Accounting	Dashboard	Details
985480	waiting	Unknown	PilotAgent Submission	ANY mailarme.cnh.uam.es 2007-08-10 06:01:02 sam_manager
985488	waiting	Unknown	PilotAgent Response	ANY prep-ce-02.pd.infn.it 2007-08-10 13:55:21 sam_manager
985490	waiting	Unknown	PilotAgent Response	ANY tbn20.nikhef.nl 2007-08-10 13:59:06 sam_manager
985226	running	Unknown	Starting the application	LCG.NCP.pk penep04.nep.zdu.pk 2007-08-10 13:51:34 sam_manager
985227	running	Unknown	Starting the application	LCG.PAKGRID.pk CE.pakgrid.org.pk 2007-08-10 13:59:19 sam_manager
98528	outputready	Unknown	Job finished successfully	LCG.LPC.fr cfrlegce02.a2p3.fr 2007-08-10 09:33:26 sam_manager
98529	outputready	Unknown	Job finished successfully	LCG.LPC.fr cfrlegce01.a2p3.fr 2007-08-10 10:23:51 sam_manager
98530	running	Unknown	Starting the application	LCG.Oxford.uk r2ce07.physics.ox.ac.uk 2007-08-10 13:44:08 sam_manager
98531	running	Unknown	Starting the application	LCG.Napoli-Atlas.it atlasce01.na.infn.it 2007-08-10 13:54:09 sam_manager
98532	waiting	Unknown	PilotAgent Response	ANY bognd5.bo.infn.it 2007-08-10 13:59:06 sam_manager
98533	outputready	Unknown	Job finished successfully	LCG.HHP.su ce0001.m45.thep.su 2007-08-10 11:45:39 sam_manager
98534	outputready	Unknown	Job finished successfully	LCG.Imperial.uk ce00.hep.ph.ic.ac.uk 2007-08-10 10:49:20 sam_manager
98535	outputready	Unknown	Job finished successfully	LCG.FORTH.gr ce01.aragati.hellasgrid.gr 2007-08-10 11:02:55 sam_manager
98536	outputready	Unknown	Job finished successfully	LCG.FTE-RTH.lv ce01.grid.est.m.lv 2007-08-10 10:21:11 sam_manager
98537	waiting	Unknown	PilotAgent Response	ANY ce02.esc.gml.ac.uk 2007-08-10 13:11:13 sam_manager
98538	outputready	Unknown	Job finished successfully	LCG.ACAD.bg ce02.grid.acad.bg 2007-08-10 12:06:10 sam_manager
98539	outputready	Unknown	Job finished successfully	LCG.CNAF-sic4.it ce054g.er.cna.infn.it 2007-08-10 11:10:05 sam_manager
98540	outputready	Unknown	Job finished successfully	LCG.CFRN-sic4.ch ce109.cern.ch 2007-08-10 11:06:10 sam_manager
98541	outputready	Unknown	Job finished successfully	LCG.CFRN-sic4.ch ce112.cern.ch 2007-08-10 11:41:11 sam_manager
			Job finished	2007-08-10

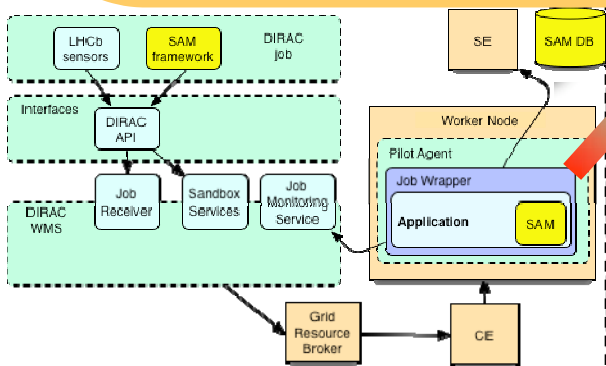
- Submission method conceptually very similar to Alice's
- A DIRAC jobs is used to run tests locally on the WNs
- Results are published with a SAM client shipped on the WN by the DIRAC job
- The progress of the SAM test jobs can be followed with the DIRAC monitoring system



- FCR used to filter sites in downtime
- Test results are used to calculate site availability according to LHCb policies
- Finally a Production Mask is produced with sites eligible for production

Mask for mode : production
Date : 30 Aug 2007
Time : 15:44:52

DIRAC.Bologna-T2.it	DIRAC.Bristol-HPC.uk	DIRAC.IF-UFRJ.br	DIRAC.LHCOnline.ch	DIRAC.Lyon.fr
DIRAC.ScotGrid.uk	DIRAC.UCD.ie	DIRAC.Zurich-MH.ch	DIRAC.Zurich-spz.ch	DIRAC.Zurich.ch
GLITE.BMGGrid.hk	GLITE.GR-04.gr	GLITE.PDC.se	GLITE.Padova.it	GLITE.ULAKBIM.tr
LCG.ACAD.bg	LCG.AUVE.fr	LCG.Alberta.ca	LCG.BHAM-HEP-slc4.uk	LCG.BHAM-HEP.uk
LCG.BIFI.es	LCG.Barcelona.es	LCG.Bari.it	LCG.Bologna.it	LCG.Bristol.uk
LCG.Brunei-slc4.uk	LCG.Brunei.uk	LCG.CERN-slc4.ch	LCG.CERN.ch	LCG.CESGA.es
LCG.CGG.fr	LCG.CIEMAT.es	LCG.CNAF-GRID.IT.it	LCG.CNAF-slc4.it	LCG.CNAF.it
LCG.CNB.es	LCG.CNIC.cn	LCG.CPPR-slc4.fr	LCG.CPPM.fr	LCG.CSCS-slc4.ch
LCG.CY01.cy	LCG.Cagliari.it	LCG.Cambridge.uk	LCG.Catania.it	LCG.Dortmund-slc4.de
LCG.Dortmund.de	LCG.Durham.uk	LCG.EELA-CIEMAT.es	LCG.EELA-UFRJ.br	LCG.EELA.br
LCG.EFDA.uk	LCG.ELTE.hu	LCG.ETP-RTH.lv	LCG.Edinburgh.uk	LCG.FEIS.br
LCG.FORTH.gr	LCG.Ferrara.it	LCG.Firenze.it	LCG.GOC.org	LCG.GR 01.gr
LCG.GR-03.gr	LCG.GR-04.gr	LCG.GR-05.gr	LCG.GRIDKA-slc4.de	LCG.GRNET.gr
LCG.Glasgow.uk	LCG.HG-02.gr	LCG.HG-04.gr	LCG.HG-05.gr	LCG.HP.pr
LCG.HPC2N.se	LCG.HellasGrid.gr	LCG.IC1.ro	LCG.IFH.de	LCG.IFIC.es
LCG.IHEP.cn	LCG.INEP3-slc4.fr	LCG.IN2P3.fr	LCG.INR.ru	LCG.INTA.es
LCG.IPP.bg	LCG.IPSL-IPGP-slc4.fr	LCG.IPSL-IPGP.fr	LCG.IPB.hr	LCG.ITEP.ru
LCG.IYH.de	LCG.Imperial-01a.uk	LCG.Imperial.uk	LCG.Iowa.us	LCG.JINR-slc4.ru
LCG.KBFI.es	LCG.KFKI.hu	LCG.KIAE.ru	LCG.KIAN.ru	LCG.KNU.kr
LCG.Krakow-fails.pl	LCG.Krakow.pl	LCG.LAL-slc4.fr	LCG.LAL.fr	LCG.LAPP.fr
LCG.LECCE.it	LCG.LEUVEN.be	LCG.LIP.pt	LCG.LISA.nl	LCG.LPC.fr
LCG.LPN-fails.fr	LCG.LPN-slc4.fr	LCG.LPN.fr	LCG.Lancashire.uk	LCG.LeSC.uk
LCG.Leparc.it	LCG.Liverpool.uk	LCG.MIF.it	LCG.MPI-BDG.de	LCG.Manchester.uk
LCG.Milano.it	LCG.Montreal.ca	LCG.NCP.pk	LCG.NCU.tw	LCG.NIIF.hu
LCG.NIKHEF.nl	LCG.NIPME.ro	LCG.NOVSU.ru	LCG.NSC.se	LCG.Napoli-Atlas.it
LCG.Napoli.it	LCG.OU.il	LCG.Oxford.uk	LCG.PAKGRID.pk	LCG.PAMUKALE.tr
LCG.PDC.se	LCG.PIC-slc4.es	LCG.PIC.es	LCG.PNPI.ru	LCG.Padova.it
LCG.Pisa.it	LCG.QMUL.uk	LCG.RAL-HEP.uk	LCG.RAL-slc4.uk	LCG.RAL.uk
LCG.RBDL.uk	LCG.SARA.nl	LCG.SINP.ru	LCG.SPACI.it	LCG.SRPF-slc4.hr
LCG.Sheffield.uk	LCG.Sofia.bg	LCG.TAD-slc4.il	LCG.TAU.il	LCG.TCD.ie
LCG.TIFR.in	LCG.Torino.it	LCG.Toronto.ca	LCG.Trieste-slc4.it	LCG.Trieste.it
LCG.UAM-FT.es	LCG.UCL-CCC.uk	LCG.UCL-HEP.uk	LCG.UERJ.br	LCG.UIB-BCCS.no
LCG.ULAKBIM.tr	LCG.UNI-KA.de	LCG.USC.es	LCG.WARSAN.pl	LCG.WCSS-slc4.pl
LCG.WCSS.pl	LCG.WEIZMANN.il	PFS.BRAN.uk	PFS.CERN.ch	PFS.CESGA.es
PFS.CESNET.cz	PFS.CNAF.it	PFS.CVP-RH.pl	PFS.DLGCZ.it	PFS.ESA.int
PFS.FRAUNHOFER.de	PFS.GRIDKA.de	PFS.IC.uk	PFS.IEETA.pt	PFS.IJS.si
PFS.IN2P3.fr	PFS.ISTT.it	PFS.LTB.er	PFS.ph.tr	PFS.PIC.es



Production Mask

Summary Page

- **It provides:**
 - status and utilization information at site and resource level
 - basic statistics
 - real-time alerts
 - geographic map
- **Main server based on Nagios (open source, host and network service monitor)**
- **Centralized architecture**
 - a main server periodically queries a set of nodes to extract information about the status of grid and network services, and the utilization of resources.
- **Collected information is stored in a DBMS and used to build aggregate statistics and trigger alerts**

- Information System monitoring web interface
- Analysing data published by the sites
 - **sanity of the data**
 - **reliability of the data**
 - **aggregated and detailed graphs**
 - **history plots**
- Provides information to SAM
- Gathers information the site publishes about the services running there

File Edit View Go Bookmarks Tools Help

http://goc.grid.sinica.edu.tw/gstat/INFN-BARI/

GStat: 11:48:17 06/14/06 GMT

[home](#) [alert](#) [table](#) [service](#) [regional](#) [service](#) [metrics](#) [links](#) [?](#) [prod](#) [pps](#) [test](#) [baltic](#) [eela](#) [euchina](#) [eumed](#) [seegrid](#)

INFN-BARI Status: OK ok GO graphs

GOCDDB Configuration information:
 status: Certified, type: Production
 giis url: ldap://gridba2.ba.infn.it:2170/mds-vo-name=infn-bari,o=grid

To test site GIIS:: ldapsearch -x -H ldap://gridba2.ba.infn.it:2170 -b mds-vo-name=infn-bari,o=grid

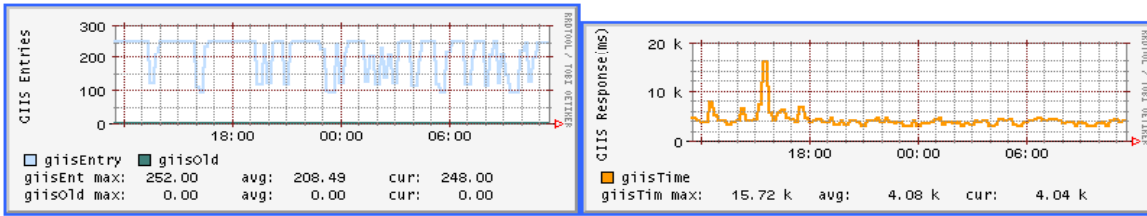
BDII Node Check: . alert_history [?](#)

CERN SE Check . alert_history [?](#)

No BDII Node to check in GOCDDB
 test: ldapsearch -xLLL -l 15 -h bdihostname -p 2170 -b 'GlueSEUniqueID=lxn1183.cern.ch,mds-vo-name=CERN-CIC,mds-vo-name=local,o=grid' '(GlueSEUniqueID=lxn1183.cern.ch)(objectclass=GlueSA)' GlueSEUniqueID

GIIS Perf Check: ok alert_history [?](#)

Query Response Time (ms): 4097.1 - OK
 GIIS Entries Found: 248 - OK
 GIIS Old Entries Found: 0 - OK



Legend for GIIS Entries graph:
 giisEntry max: 252.00 avg: 208.49 cur: 248.00
 giisOld max: 0.00 avg: 0.00 cur: 0.00

Legend for GIIS Response (ms) graph:
 giisTime max: 15.72 k avg: 4.08 k cur: 4.04 k

GIIS Sanity Check: ok alert_history [?](#)

Passed

To test site GIIS:: ldapsearch -x -H ldap://gridba2.ba.infn.it:2170 -b mds-vo-name=infn-bari,o=grid

Service Check: ok alert_history [?](#)

hostname	monitor	nodetypes	missing services	history
gridba2	Y	CE,None	none missing	alert_history
gridba6	Y	SE,None	none missing	alert_history
gridba6	Y	MON,SE	none missing	alert_history

Done

- Service Availability Monitoring or SAM, is currently used to
 - **Monitor some of the largest production grids available nowadays**
 - **Improve the **reliability** of the monitored grid services**
- SAM used within
 - **EGEE Middleware Certification**
 - **EGEE Grid Operations**
 - **Other grids**
 - **VO Application Monitoring**
- HEP VO use cases detailed
 - **Clean Integration**
 - **Hybrid Integration**

Thanks for the attention! 😊

Related Contributions at CHEP'07:

232 – Joel CLOSIER - Ensuring GRID resource availability with the SAM framework in LHCb

