Monitoring the EGEE/WLCG Grid Services

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CERN – IT

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Information Society and Media

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Outline

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

gLite middleware history

- 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 middleware: Services and Scope

- **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)

Service Scopes

- **gLite services scopes:**
  - User
  - Site
  - Virtual Organization (VO):
    - Biomedical
    - High Energy Physics
    - etc...
  - and global (i.e.multi-VO)

gLite Services 1/2

- **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

gLite Services 2/2

- **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)**

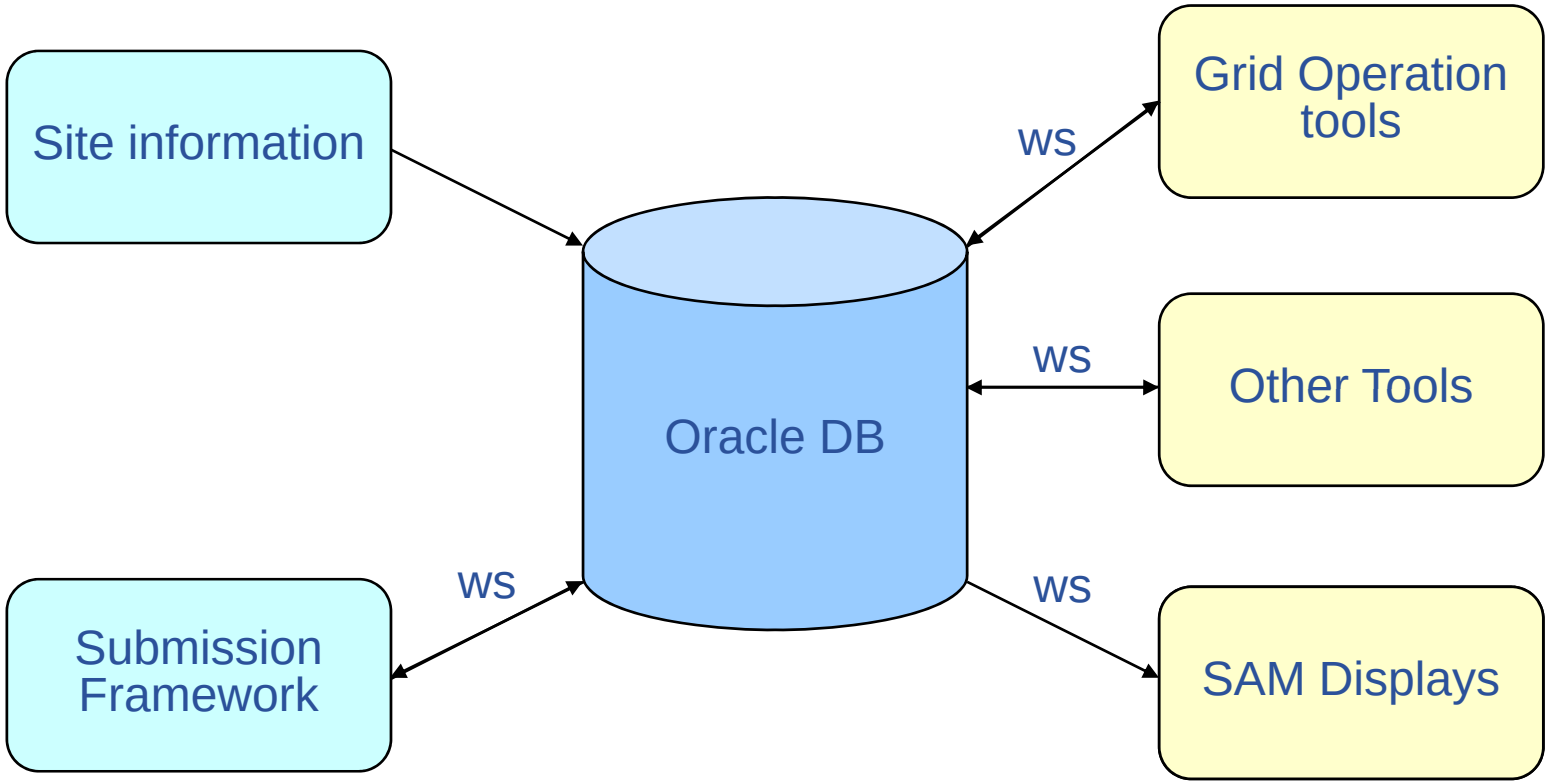
SAM introduction

- **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**

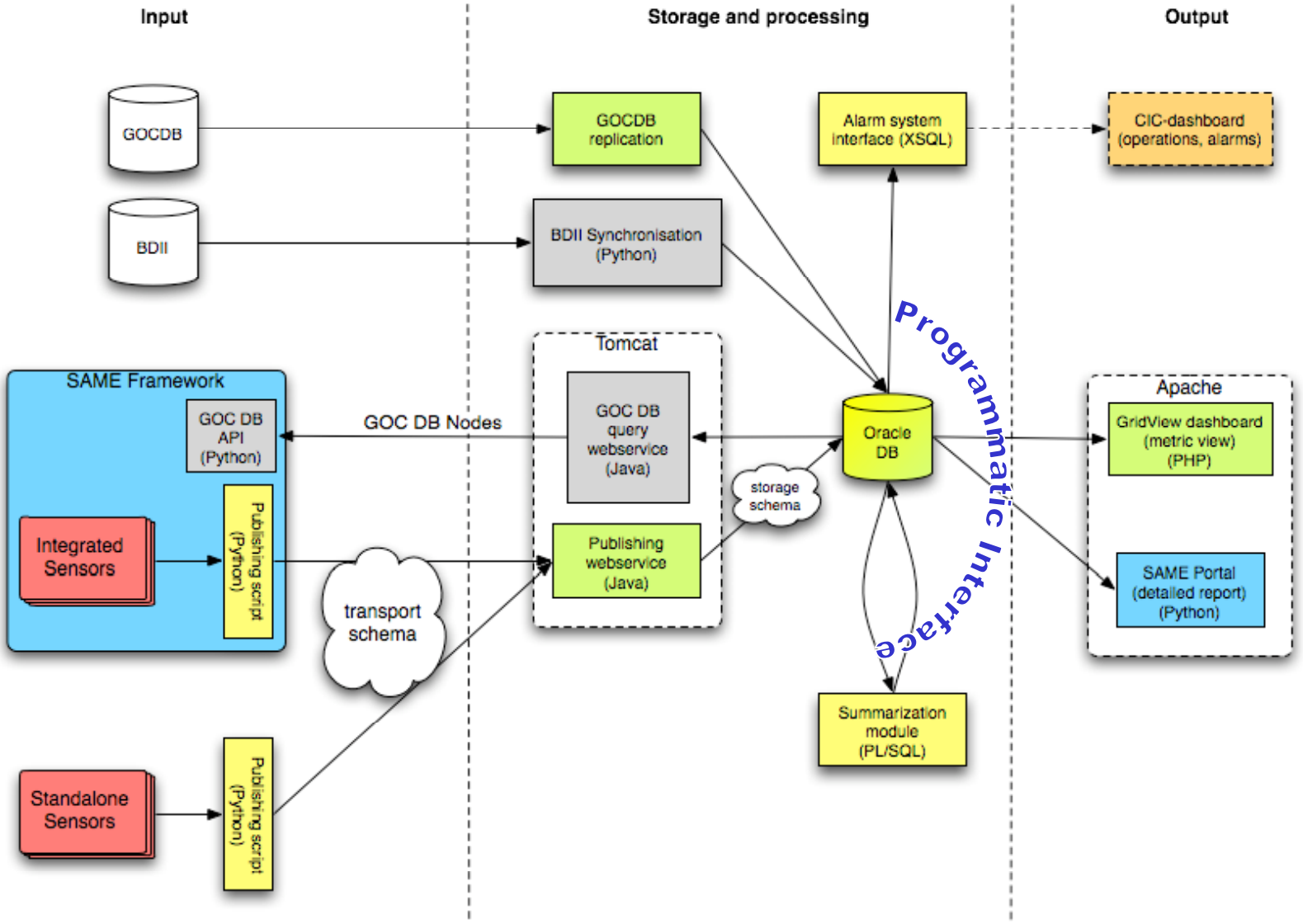
Service Availability Monitoring (SAM)

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

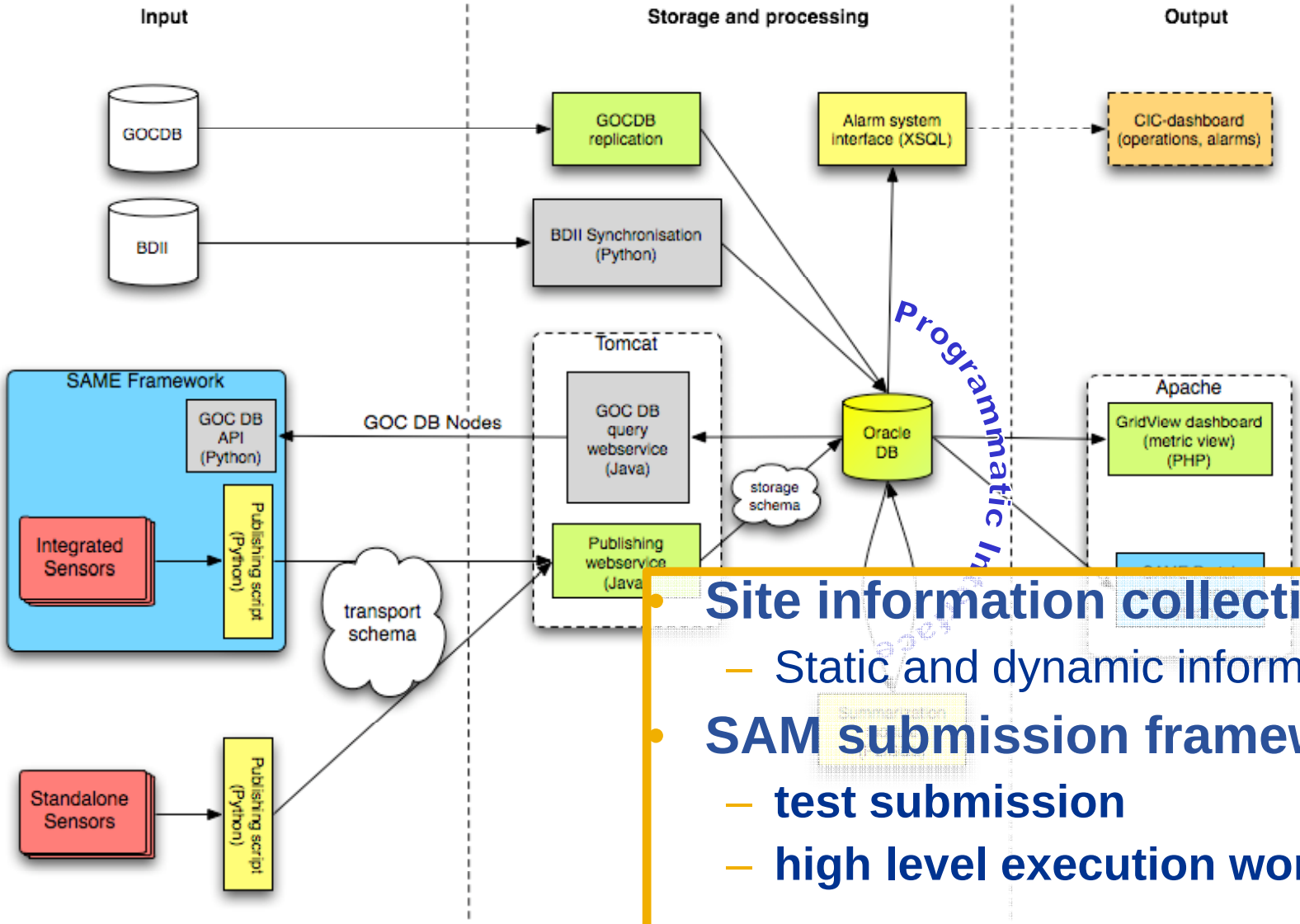
SAM (simplified) architecture



SAM Architecture



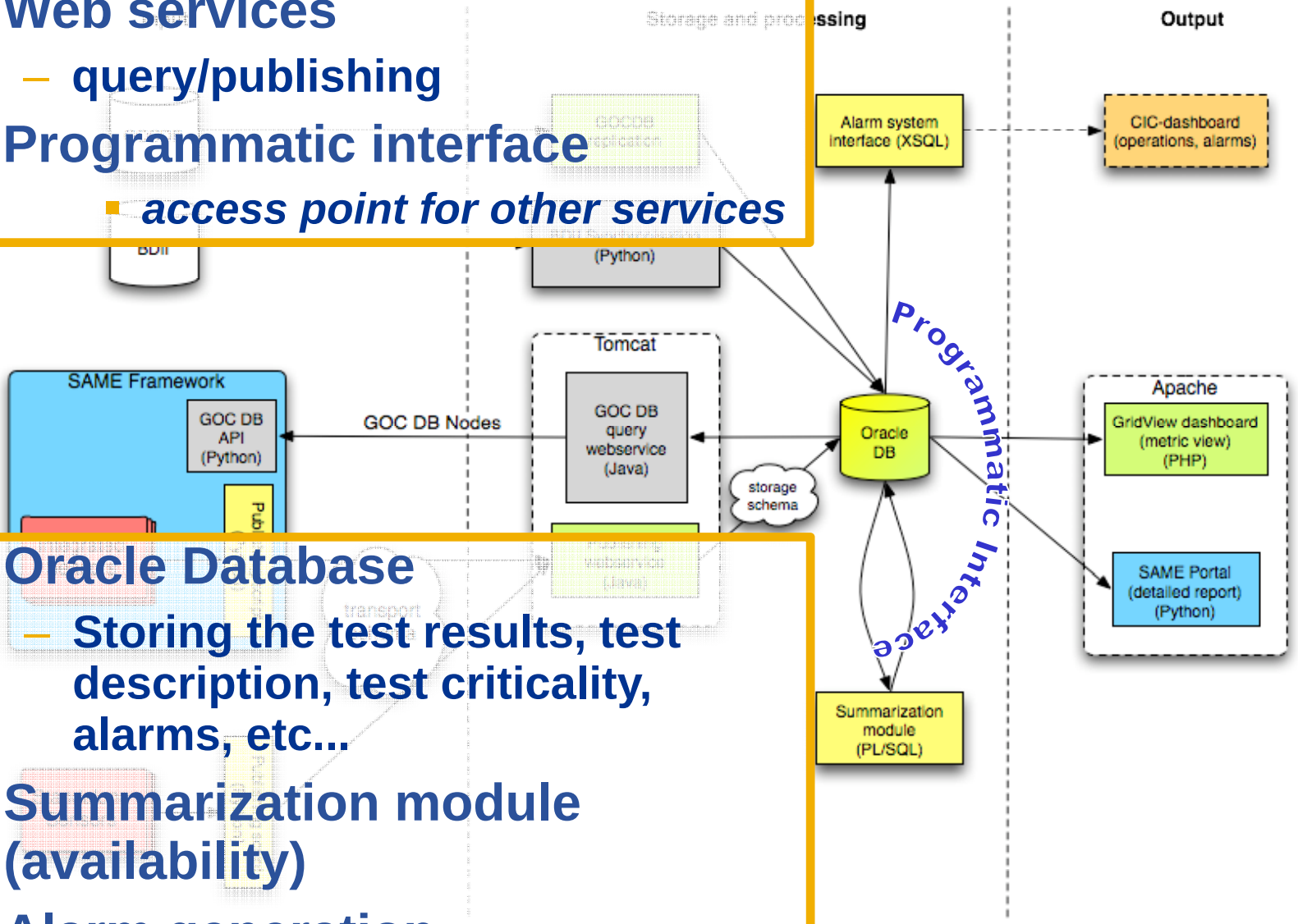
SAM framework: input



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

SAM framework: Storage and processing

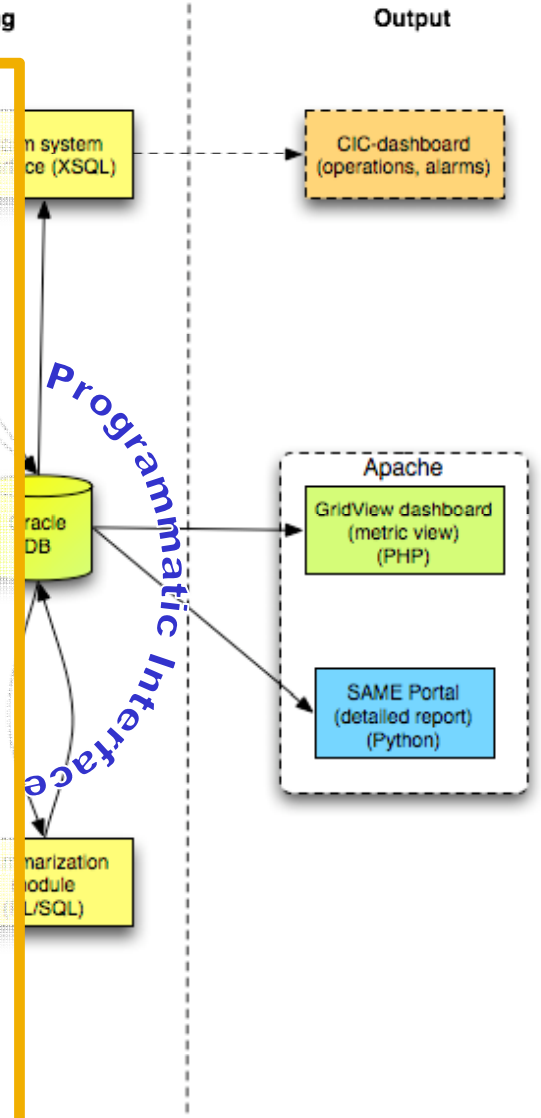
- **Web services**
  - **query/publishing**
- **Programmatic interface**
  - ***access point for other services***



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

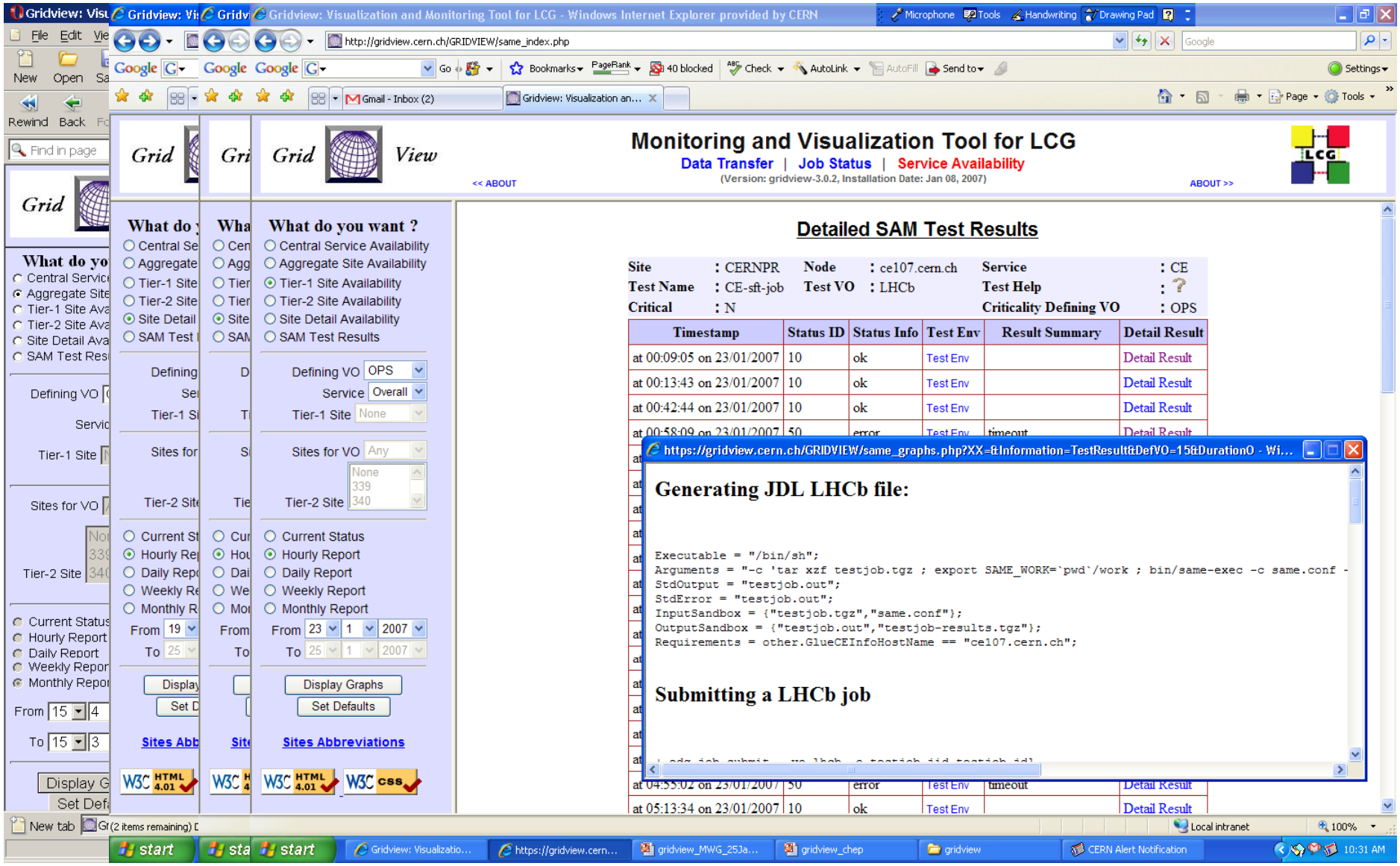
SAM framework: Output

- **SAM portal**
  - to be phased out but still widely used
  - SFT-like presentation → aging
- **GridView**: superset of the functionalities of Sam portal
  - availability graphs
  - historical test results
  - detailed test results
- Solutions for an **alternative** display
  - Under discussion
  - Many advanced users started developing displays



GridView visualization of SAM results

Enabling Grids for E-sciencE



Computation of Availability Metrics

- **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

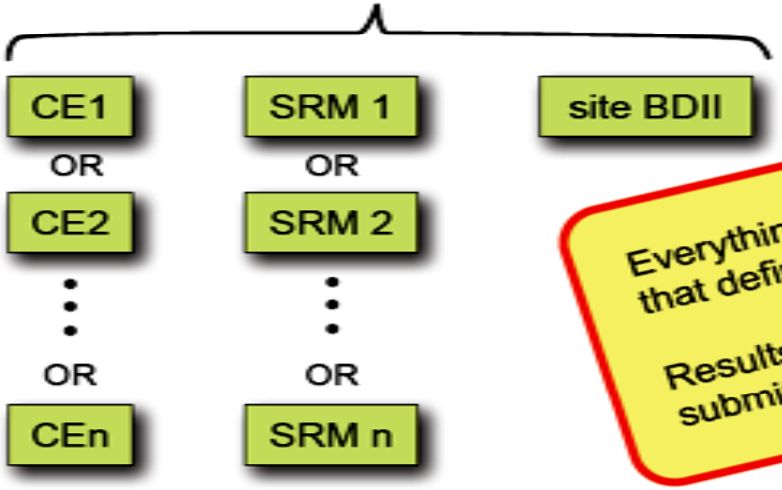
Availability metrics

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

∧ = boolean AND
∨ = boolean OR

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

Status of site S = AND



Everything is calculated for each VO that defined critical tests in FCR

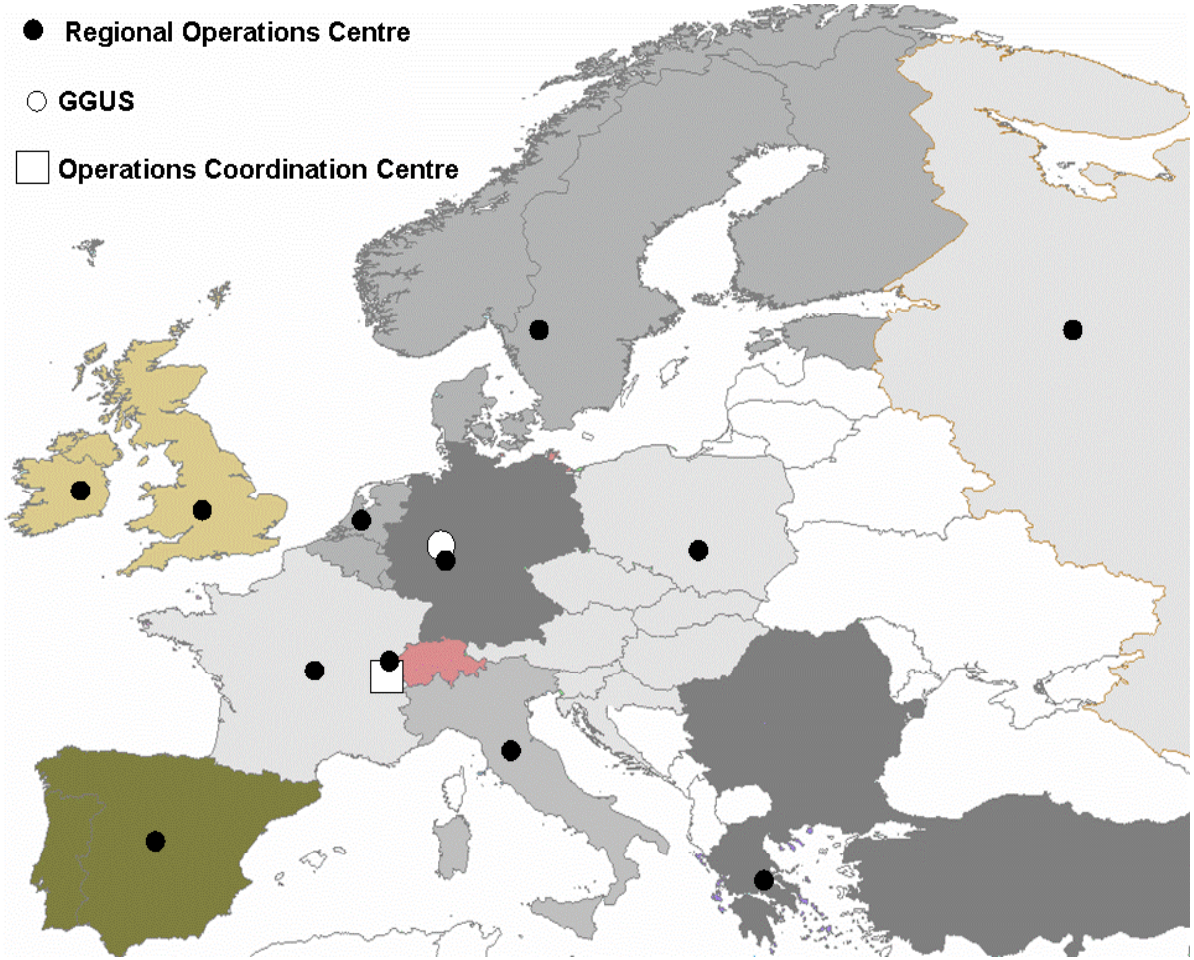
Results make sense only if VO submits tests!!!

EGEE/WLCG infrastructure and operations

- 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.**

Operator on Duty

- 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 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

Use of SAM: gLite middleware certification testbed

- 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)

Use of SAM: EGEE/WLCG operations

- **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...

Use of SAM: Grid infrastructures

- 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.

Use of SAM: LHC VOs

- 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**

How the VOs submit to SAM

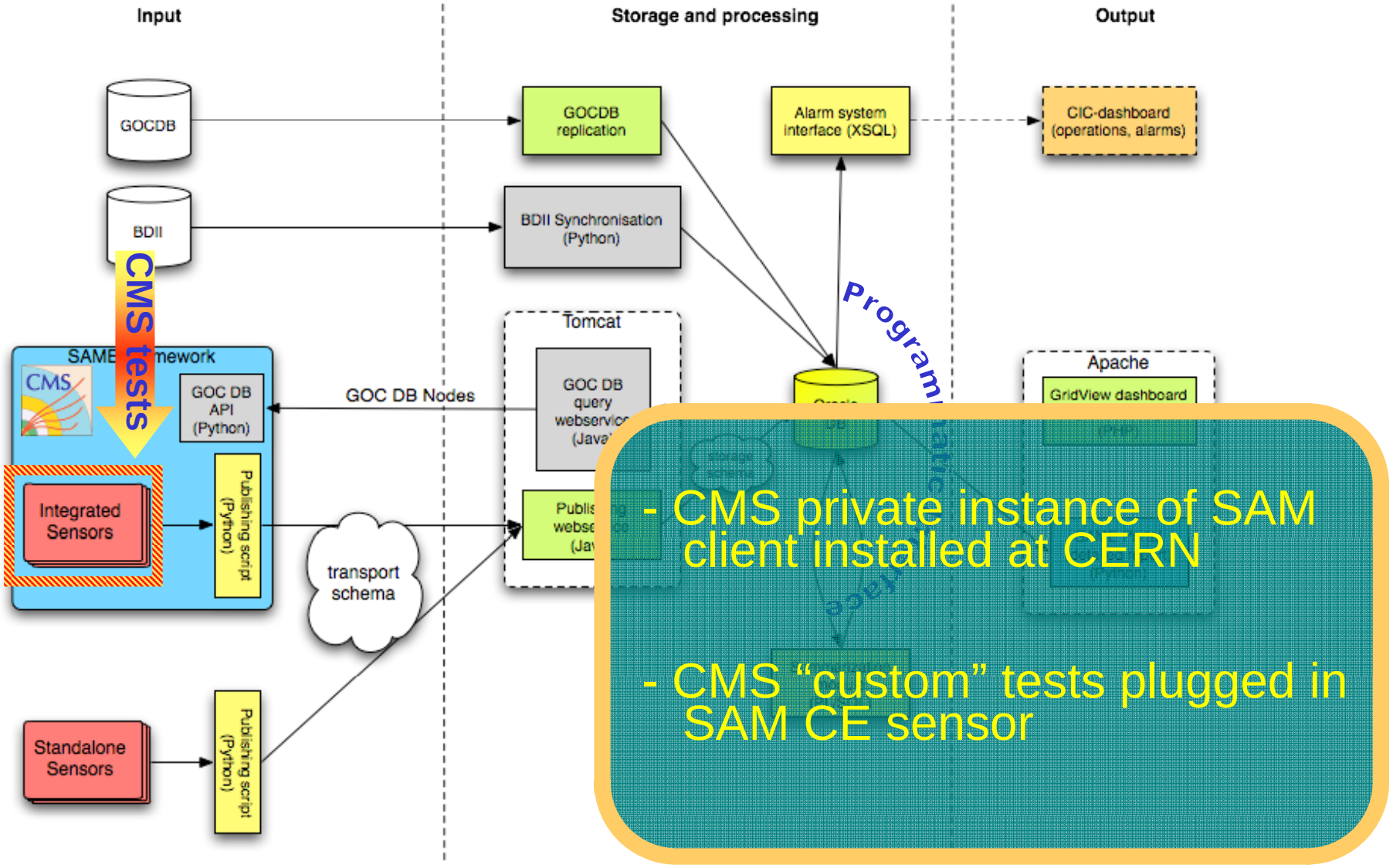
Two different approaches

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

Both approaches successful and interesting …

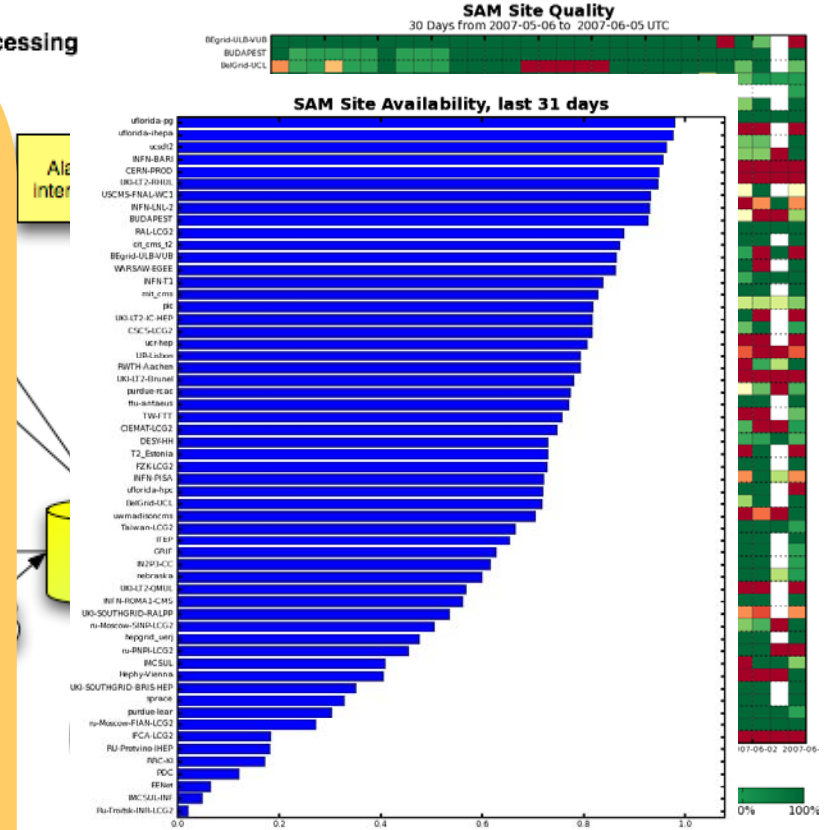
A Clean Integration: CMS

CMS Integration: Submission



CMS Integration: Availability

- 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 = running time / total time
- CMS Reliability = running time / (total time – scheduled downtime)

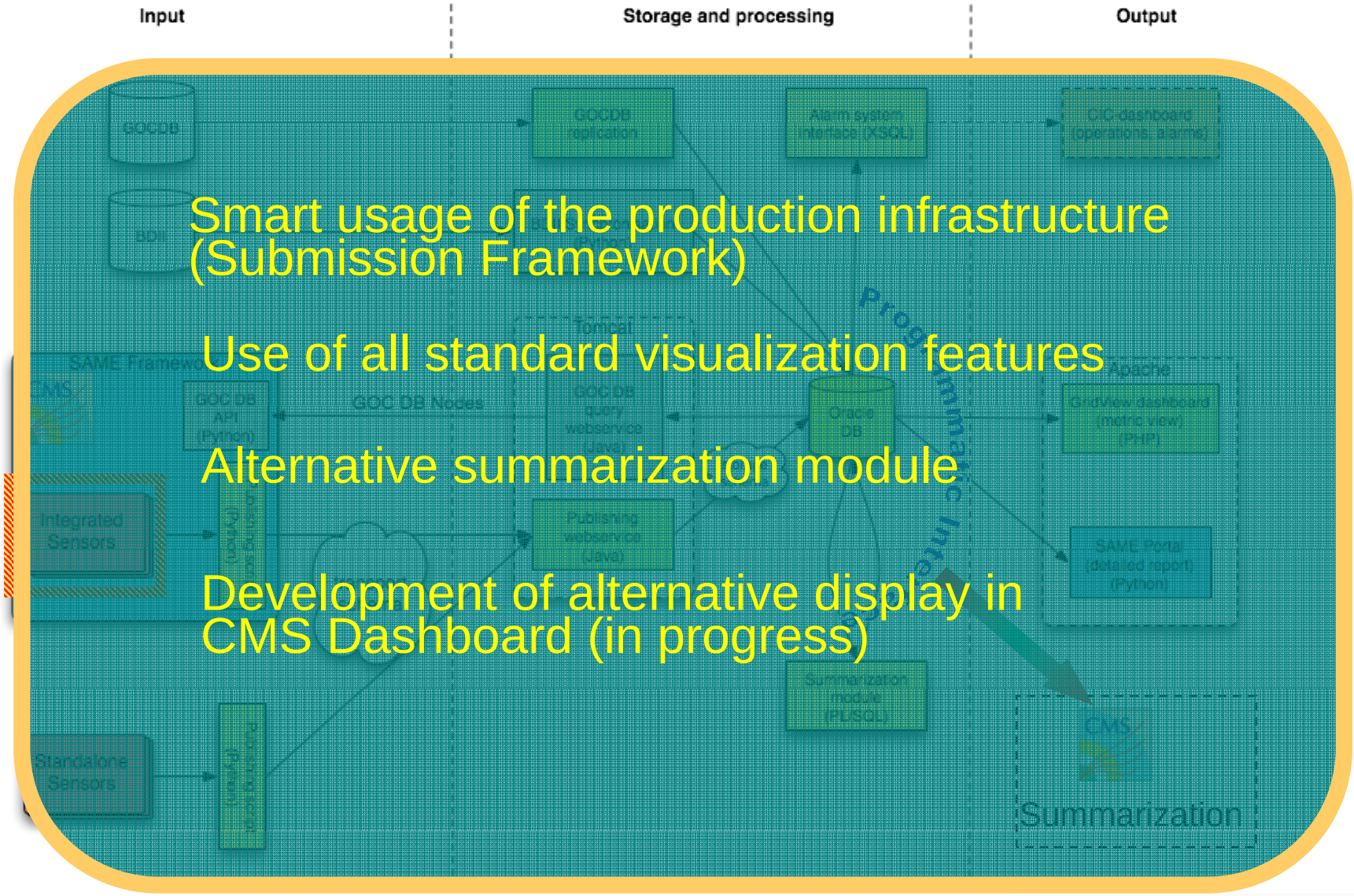


CMS: "Custom" Use Cases

- **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 Integration: Conclusions



ATLAS Integration

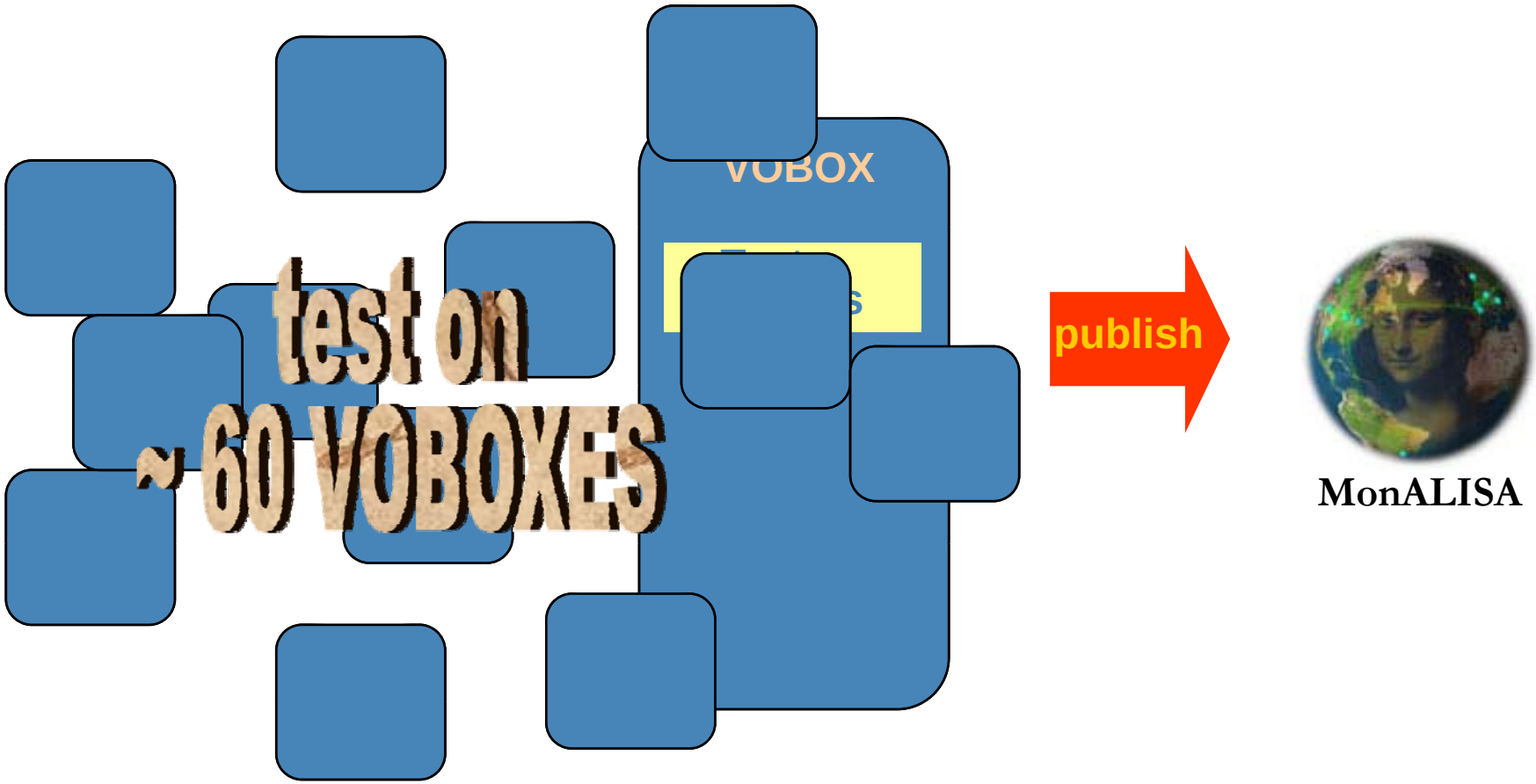
- Off-the-shelf SAM client used to submit standard tests with an Atlas proxy
- Developing custom tests and new sensors
  - SE Sensor: access to DQ2 directories with new lcg-utils
  - Custom SRM: to run low-level test on SRMs
  - Sanity check of software installation
- Planning an “orthodox” use of Submission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

An Hybrid Integration: Alice

Alice: “Custom” Use Cases

- 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: VOBOXES



Test tests scripts to be run on VOBOXES

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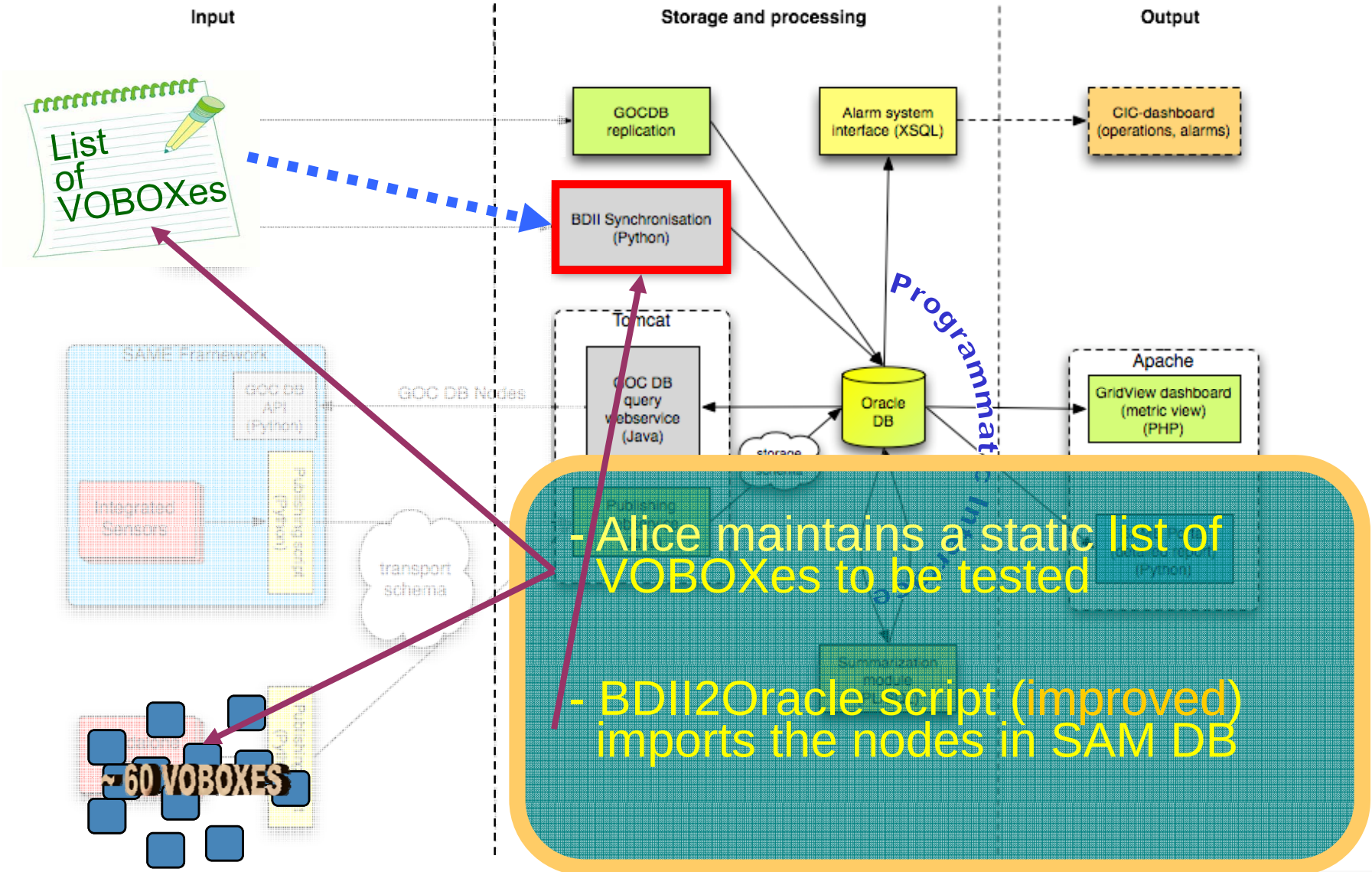
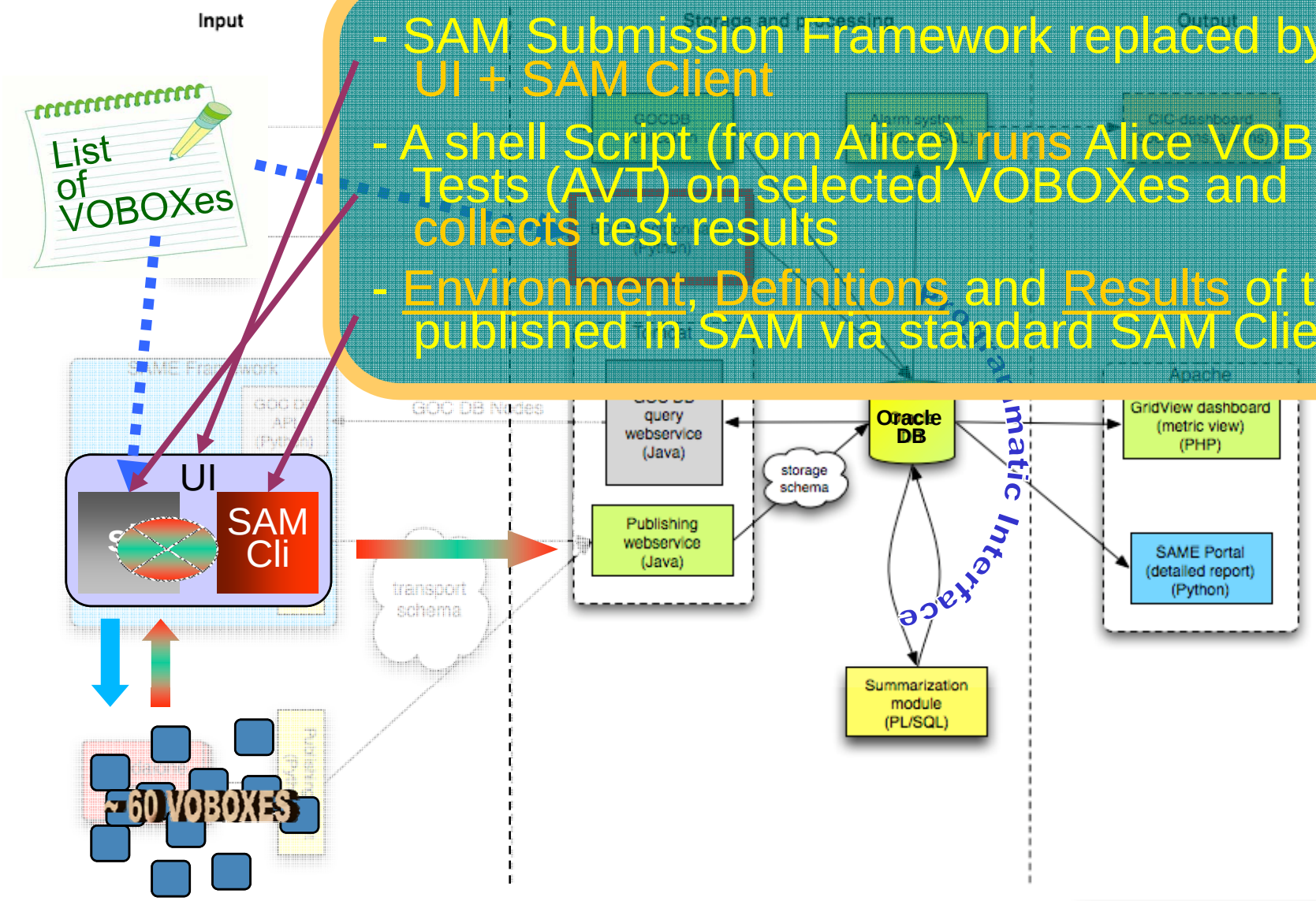
Alice Integration: test targets



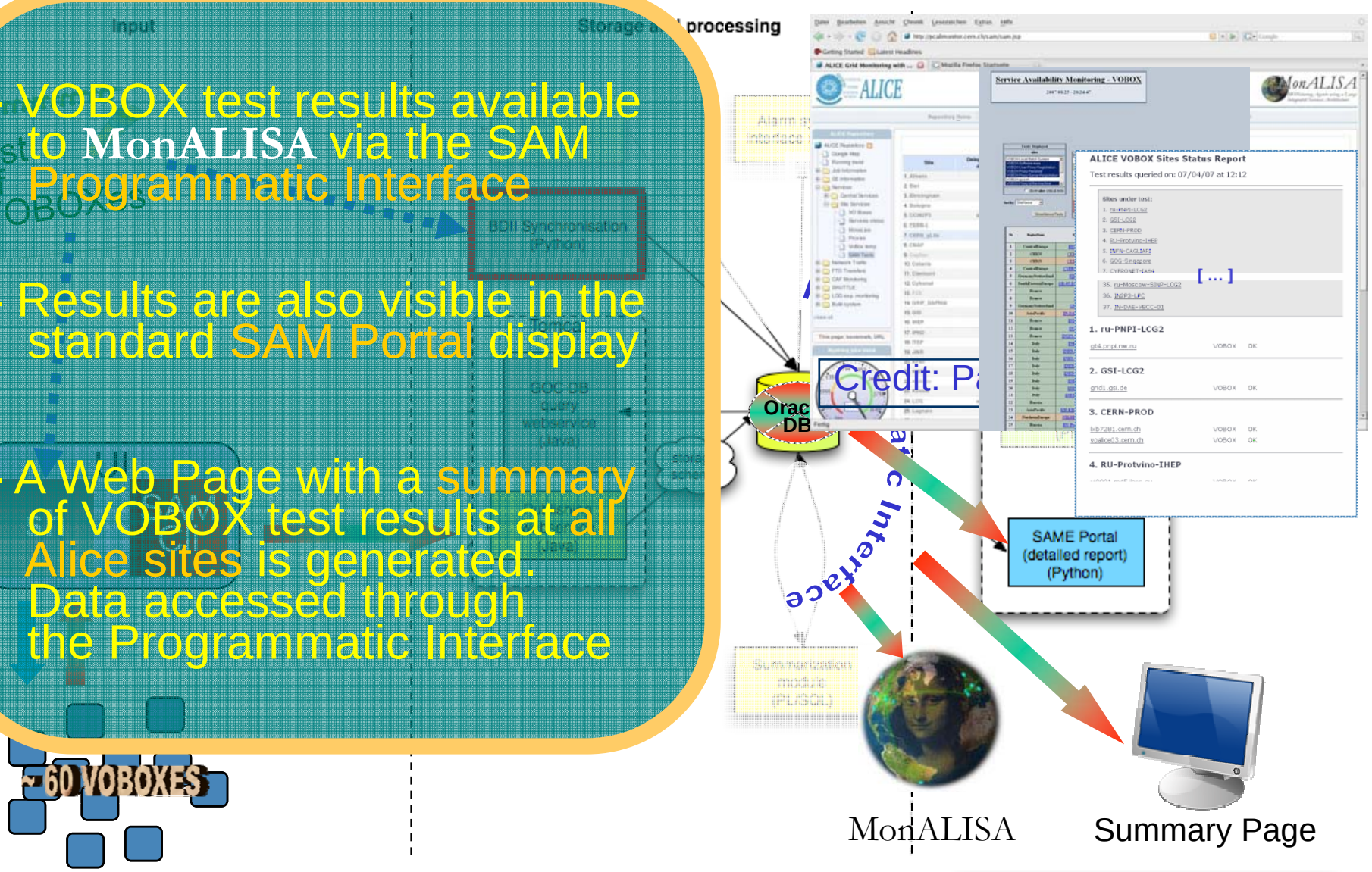
Alice Integration: submission

- 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



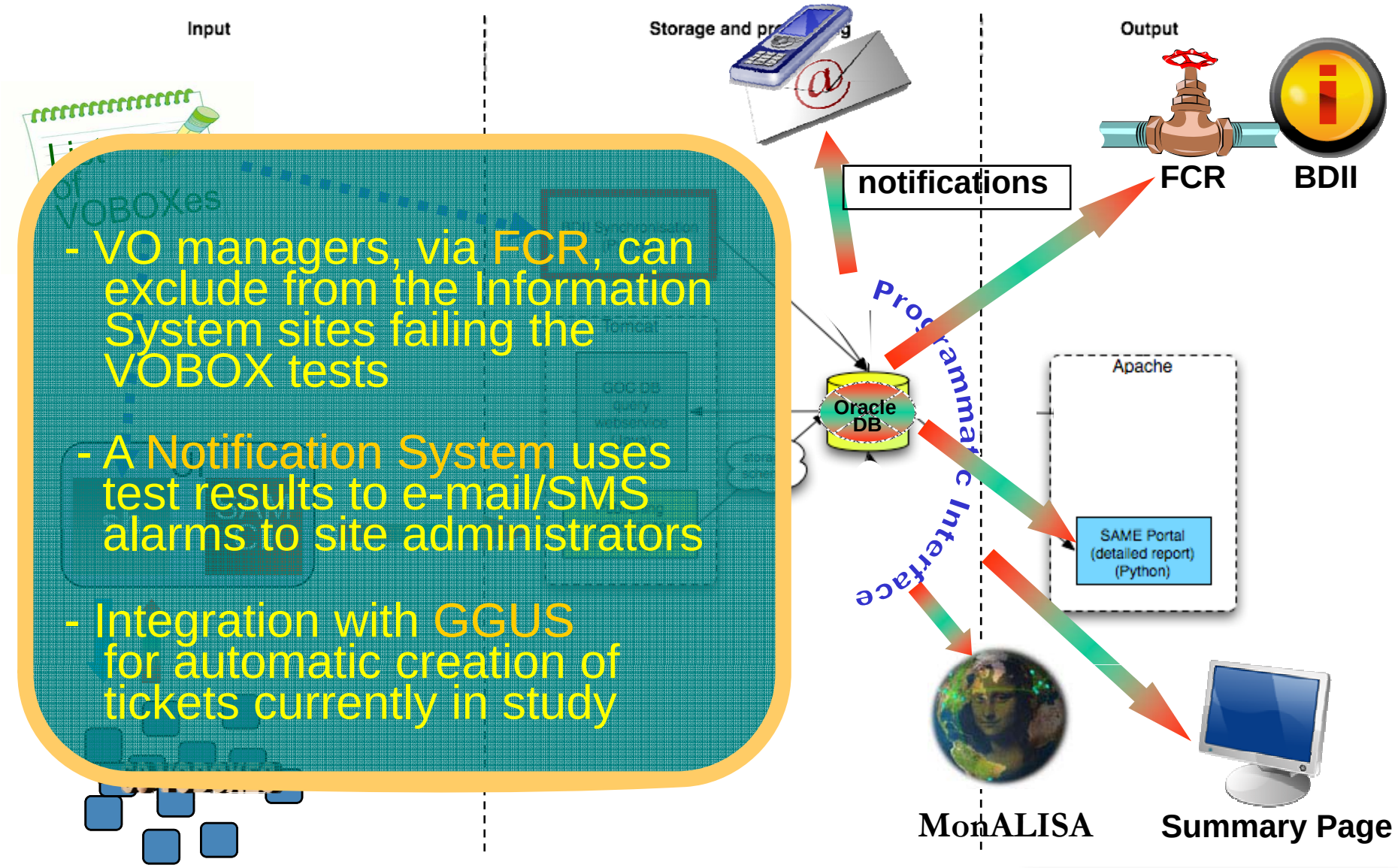
Alice Integration: visualization

- 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

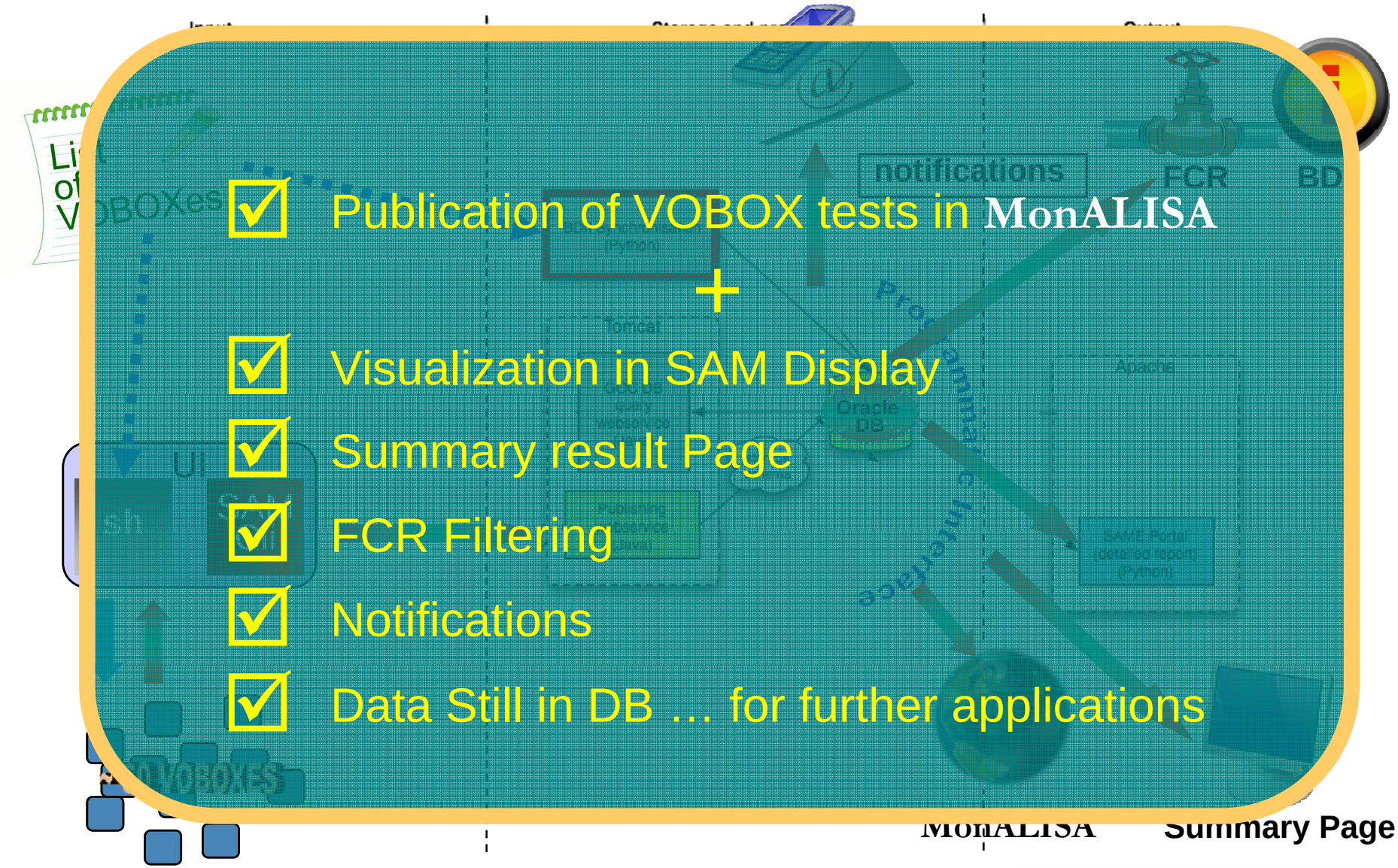


Alice Integration: operations

- 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

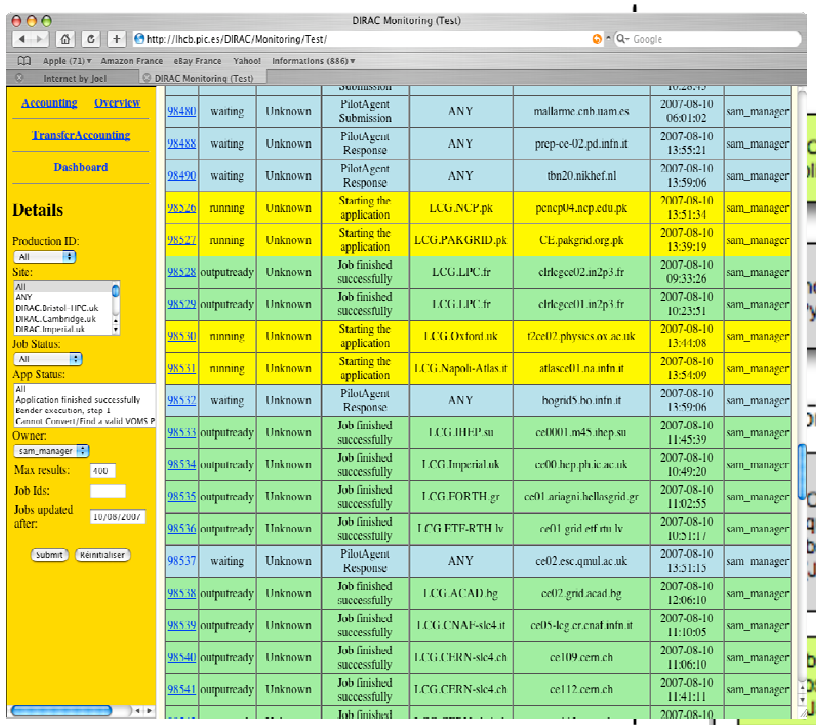


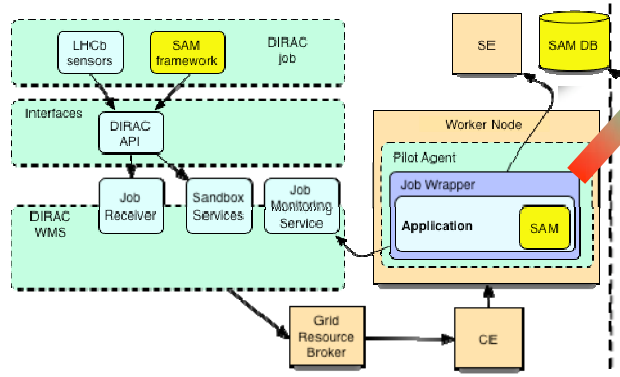
Alice Integration (conclusions)



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

LHCb Integration

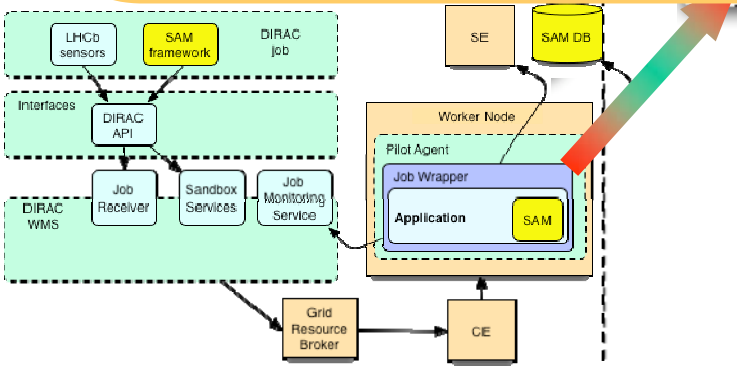




- Submission method conceptually very similar to Alice's
- A DIRAC jobs is used to run tests locally on the WNs
- Results are published with a SAM client shipped on the WN by the DIRAC job
- The progress of the SAM test jobs can be followed with the DIRAC monitoring system

LHCb Integration: operations

- 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.LHCBONLINE.ch	DIRAC.Lyon.fr
DIRAC.ScotGrid.uk	DIRAC.UCD.ie	DIRAC.Zurich-MH.ch	DIRAC.Zurich-spz.ch	DIRAC.Zurich.ch
GLITE.BMEGrid.hu	GLITE.GR-04.gr	GLITE.PDC.se	GLITE.Padova.it	GLITE.ULAKBIM.tr
LCG.ACAD.bg	LCG.AUVER.fr	LCG.Alberta.ca	LCG.BHAM-HEP-slc4.uk	LCG.BHAM-HEP.uk
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LCG.IHEP.su	LCG.IN2P3-slc4.fr	LCG.IN2P3.fr	LCG.INR.ru	LCG.INTA.es
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LCG.Sheffield.uk	LCG.Sofia.bg	LCG.TAU-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.WARSAW.pl	LCG.WCSS-slc4.pl
LCG.WCSS.pl	LCG.WEIZMANN.il	PPS.BHAM.uk	PPS.CERN.ch	PPS.CESGA.es
PPS.CESNET.cz	PPS.CNAF.it	PPS.CYF-KR.pl	PPS.DLGCE.it	PPS.ESA.int
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PPS.IN2P3.fr	PPS.ISTI.it	PPS.LIP.pt	PPS.PD.it	PPS.PIC.es

Production Mask

Summary Page

LHCb: "Custom" Use Cases

- SAM client run in a single Dirac task including 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

Other monitoring tools: GridICE

- **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**

Other monitoring tools: GStat

- 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 | GOC | graphs

```
GOCDB 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
```

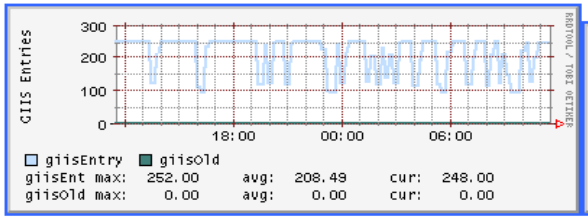
BDII Node Check: . alert_history

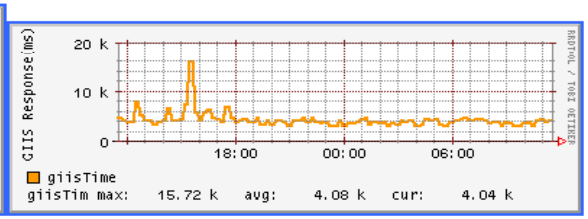
CERN SE Check . alert_history

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

GIIS Perf Check: ok alert_history

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





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

Conclusions

- 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**
- Discussed SAM use for
  - **Middleware Certification**
  - **Grid Operations**
  - **Site Certification**
  - **VO Application Monitoring**
- HEP VO use cases detailed
  - **Clean Integration**
  - **Hybrid Integration**

That's all folks!

Thanks for the attention! ☺

Related Contributions at CHEP'07:

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

Extra slides