

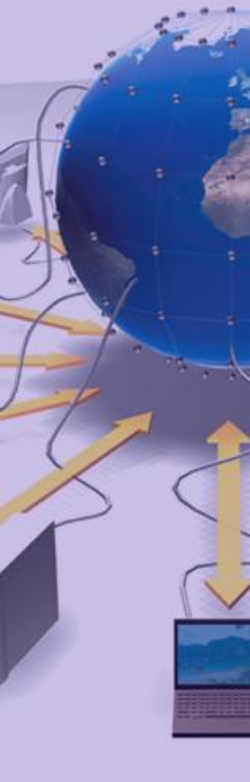
Dashboard System for Monitoring Computing Activities of the LHC Experiments

Aram Apyan

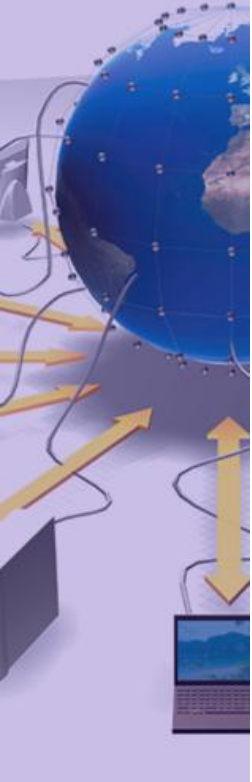
Illinois Institute of Technology

Supervisors: Pablo Saiz

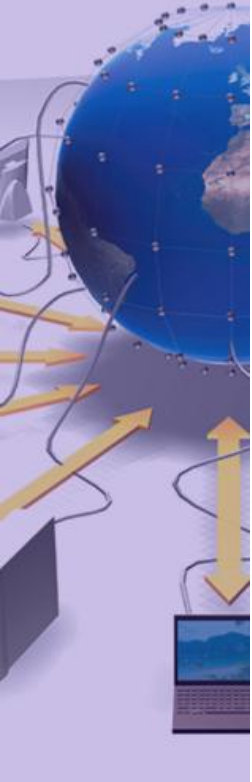
Julia Andreeva



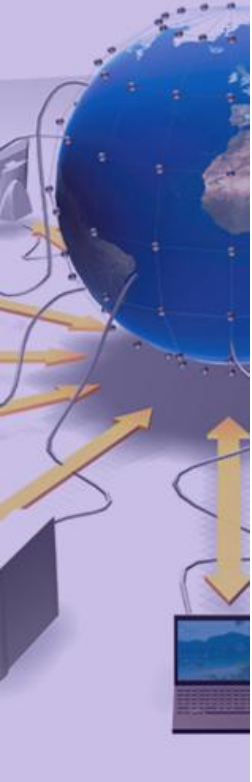
- LHC is estimated to produce about 15 petabytes of data per year.
- Seamless access to the LHC data has to be provided to about 5,000 physicists from 500 scientific institutions.
- This data has to be distributed to computing centers all over the world with a primary copy being stored on tape at CERN.
- WLCG provides data storage and computational resources for the high energy physics community.
- Integrates 140 computing centers in 33 countries all over the world.



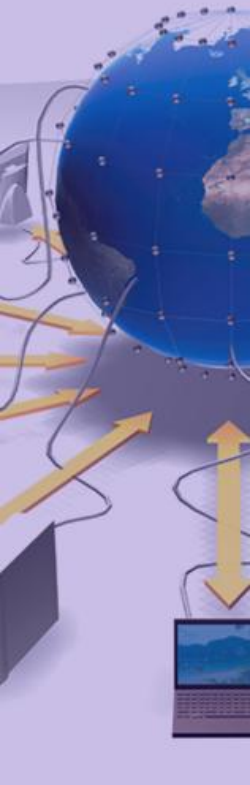
- LHC job processing activity can be split in two categories: processing raw data and largescale Monte-Carlo production, and user analysis.
- A generic monitoring framework was developed for the LHC experiments—the Experiment Dashboard.
- User communities of the LHC experiments are organized into virtual organizations (VOs)
- The Experiment Dashboard provides several job monitoring solutions for various use cases, namely the generic job monitoring applications, monitoring for ATLAS and CMS production systems, and applications focused on the needs of the analysis users.

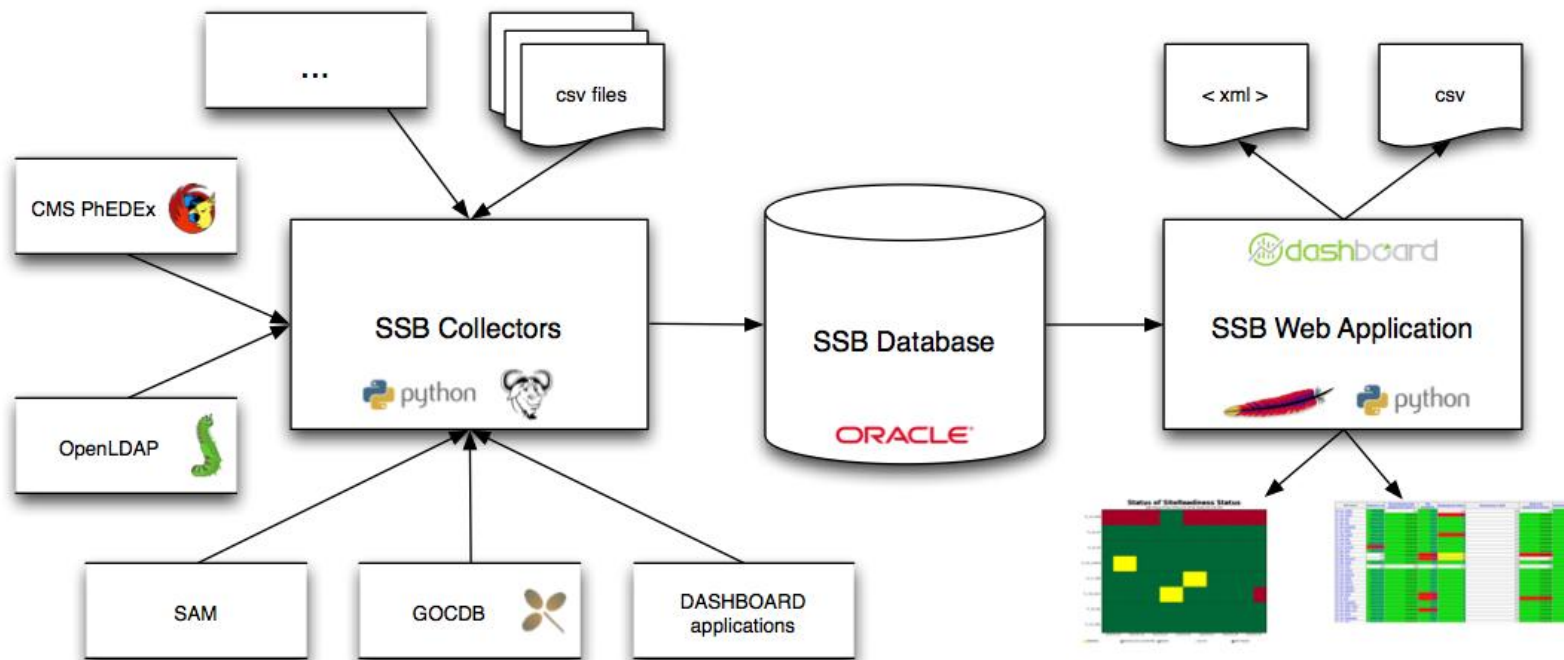


- Performance is based on metrics defined by the VO
- VO administrators manage the metrics via a X509-authenticated Web interface.
- The administrators can define which metrics are critical and they can also group the metrics together in a flexible way for visualization purposes.
- Alternative views can be created based on this grouping.
- Metrics can have different sources
 - CSV files providing the values
 - Specific data collectors (BDII, PhEDEx, SAM...)



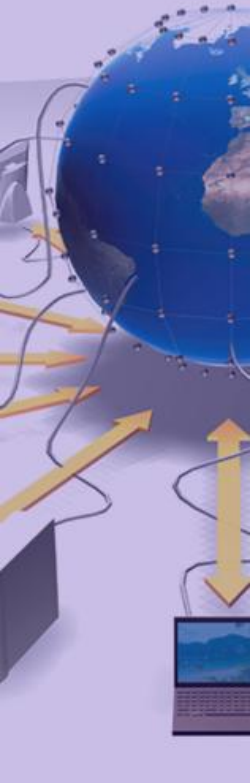
- Developed under CMS request
 - computing shifts
 - site commissioning
 - space monitoring
- Also widely used by LHCb
 - job monitoring
 - space monitoring
- **100-150 unique visitors access SSB application daily just in CMS VO**
- **Over 170 different metrics stored for the four experiments**





SSB has three components: collectors that gather information, a data repository, and a Web portal that displays the results.

- Metrics use a color code and value to represent their status
- Site global status depends on metrics marked as critical
- Metric criticality can be redefined at any time
- Combination of metrics
 - **OK** if all metrics are OK
 - **warning** if at least one metric is in warning but none is failing
 - **error** if at least one metric is failing but none is in maintenance
 - **maintenance** if at least one metric is under maintenance



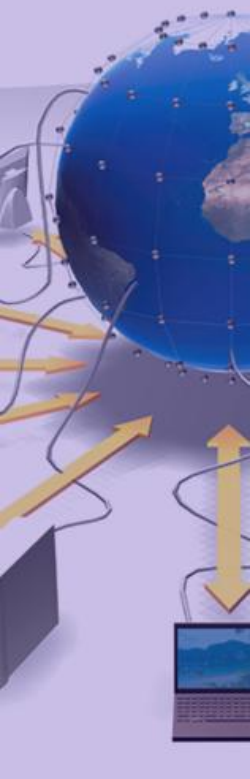
Site Name	SiteComm JR	Commissioned Links (expand this column)	Site availability	SiteReadiness Status	Maintenance in SAM	Good links (expand this column)	IsSiteInSiteDB?
T0_CH_CERN	94%(300)	n/a	100%	n/a	n/a	n/a	true
T1_CH_CERN	94%(300)	combined	100%	NR	n/a	combined	true
T1_DE_KIT	100%(300)	combined	100%	R	n/a	combined	true
T1_ES_PIC	100%(400)	combined	100%	R	n/a	combined	true
T1_FR_CCIN2P3	100%(300)	combined	100%	R	n/a	combined	true
T1_IT_CNAF	92%(300)	combined	100%	R	n/a	combined	true
T1_TW_ASGC	100%(100)	combined	100%	NR	n/a	combined	true
T1_UK_RAL	100%(300)	combined	100%	R	n/a	combined	true
T1_US_FNAL	100%(1000)	combined	100%	R	n/a	combined	true
T2_AT_Vienna	57%(100)	combined	100%	R	n/a	combined	true
T2_BE_IHE	100%(400)	combined	100%	R	n/a	combined	true
T2_BE_UCL	n/a	combined	20%	W	n/a	combined	true
T2_BR_SPRACE	n/a	combined	0%	W	n/a	n/a	true
T2_BR_UERJ	100%(300)	combined	84%	R	n/a	combined	true
T2_CH_CAF	n/a	n/a	n/a	n/a	n/a	n/a	true
T2_CH_CSCS	100%(300)	combined	100%	R	n/a	combined	true
T2_CN_Beijing	100%(400)	combined	100%	R	n/a	combined	true
T2_DE_DESY	98%(400)	combined	100%	R	n/a	combined	true
T2_DE_RWTH	100%(600)	combined	100%	R	n/a	combined	true
T2_EE_Estonia	100%(500)	combined	100%	R	n/a	combined	true
T2_ES_CIEMAT	100%(300)	combined	100%	R	n/a	combined	true
T2_ES_IFCA	100%(400)	combined	72%	R	n/a	combined	true
T2_FL_HIP	100%(300)	combined	0%	R	n/a	combined	true
T2_FR_CCIN2P3	100%(500)	combined	100%	R	n/a	combined	true
T2_FR_GRIF_IRFU	100%(600)	combined	100%	R	n/a	combined	true
T2_FR_GRIF_LLR	85%(700)	combined	72%	R	n/a	combined	true
T2_FR_IPHC	98%(500)	combined	100%	R	n/a	combined	true
T2_HU_Budapest	100%(600)	combined	100%	R	n/a	combined	true
T2_IN_ITEP	100%(300)	combined	100%	R	n/a	combined	true

Existing views

View	Columns	Actions
default	all non-debug	
commission	SiteComm JR,Commissioned Links,Site availability,Good links,IsSiteInSiteDB?,Maintenance in SAM,SiteReadiness Status	<input type="button" value="modify"/> <input type="button" value="remove"/>
expert	Pledged, TB,Pledged slots,SiteSize	<input type="button" value="modify"/> <input type="button" value="remove"/>
space	on site(phedex), TB,on site(DBS), TB,Pledged, TB,onsite(Russia), TB,custodial subscription, TB,Combined Space Monitoring,subscribed(Russia), TB,custodial on site, TB,BDII used space,Available BDII space,subscription, TB	<input type="button" value="modify"/> <input type="button" value="remove"/>
maint	OSG downtime,Savannah,Maintenance in SAM,GOC downtime,Savannah CMS,Savannah manual,SAM Maintenance 2,Under investigation,Maintenance,CIC downtime	<input type="button" value="modify"/> <input type="button" value="remove"/>
transfers	# Links,To T0,In rate,To_T3_phedex,To_T0_phedex,In_rate_phedex,Transfer rate,To_T2_phedex,To_T1_phedex,Out_rate_phedex,Transfer_rate_phedex,To T3,To T2,To T1,Out rate	<input type="button" value="modify"/> <input type="button" value="remove"/>
jobrobot_debug	JobRobot_24h,JobRobot_1h	<input type="button" value="modify"/> <input type="button" value="remove"/>
storage	on site(DBS), TB,Pledged disk,Used tape,PhEDEX non-custodial,Pledged tape,Used disk,PhEDEX coming,Free tape,Free disk,Savannah CMS	<input type="button" value="modify"/> <input type="button" value="remove"/>
test	CE,Analysis	<input type="button" value="modify"/> <input type="button" value="remove"/>
develop		<input type="button" value="modify"/> <input type="button" value="remove"/>

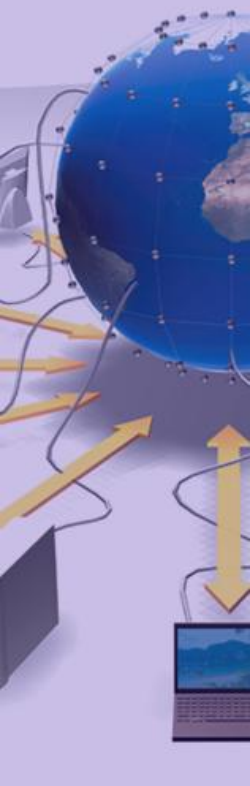
Add new view:

- Users with special privileges can create custom views and define which metrics to include
- Views can be modified or removed without data loss

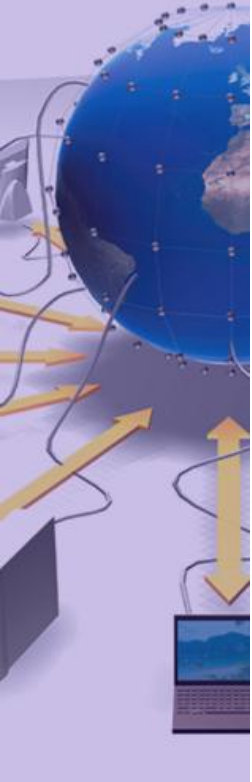


T0 +T1	T2		
✓ T0_CH_CERN	✓ T2_BE_UCL	● T2_AT_Vienna	✓ T2_BE_IIHE
✓ T1_CH_CERN	✓ T2_CH_CSCS	●● T2_BR_SPRACE	✓ T2_BR_UERJ
✓ T1_DE_KIT	✓ T2_DE_RWTH	✓ T2_CN_Beijing	✓ T2_DE_DESY
✓ T1_ES_PIC	✓ T2_ES_IFCA	● T2_EE_Estonia	✓ T2_ES_CIEMAT
✓ T1_FR_CCIN2P3	✓ T2_FR_GRIF_IRFU	✓ T2_FI_HIP	✓ T2_FR_CCIN2P3
✓ T1_IT_CNAF	✓ T2_HU_Budapest	✓ T2_FR_GRIF_LLRF	✓ T2_FR_IPHC
✓ T1_TW_ASGC	✓ T2_IT_Legnaro	✓ T2_IN_TIFR	● T2_IT_Bari
✓ T1_UK_RAL	✓ T2_KR_KNU	✓ T2_IT_Pisa	✓ T2_IT_Rome
✓ T1_US_FNAL	✓ T2_PT_NCG_Lisbon	✓ T2_PL_Warsaw	✓ T2_PT_LIP_Lisbon
	✓ T2_RU ITEP	✓ T2_RU_IHEP	✓ T2_RU_INR
	✓ T2_TR_METU	✓ T2_RU_JINR	✓ T2_RU_SINP
	✓ T2_UK_London_Brunel	✓ T2_TW_Taiwan	✓ T2_UA_KIPT
	✓ T2_UK_SGrid_RALPP	✓ T2_UK_London_IC	✓ T2_UK_SGrid_Bristol
	✓ T2_US_MIT	✓ T2_US_Caltech	✓ T2_US_Florida
	✓ T2_US_UCSD	✓ T2_US_Nebraska	✓ T2_US_Purdue
		✓ T2_US_Wisconsin	
T2 waiting room			
T3			

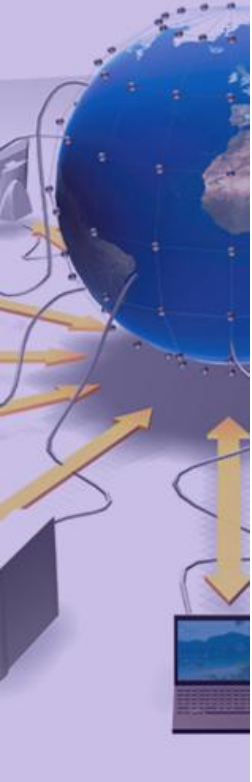
- Sites are arranged by groups
- Status is calculated from metrics defined as critical by VO
- Icon represents current status
 - ✓ ✓ ● ●●
- Site maintenance information
 - ⚠
- Links to support tickets when site under investigation



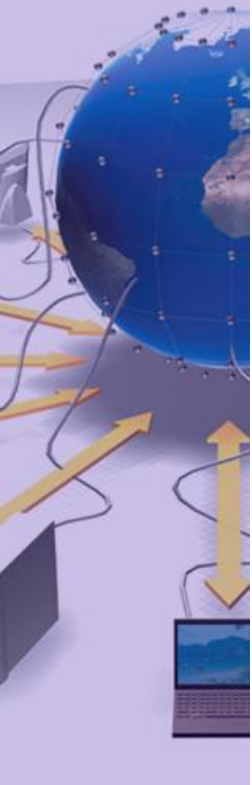
- A responsible and description fields were added to the metrics.
- A new field was added to alternative views and metrics that allows for these to be visible only to the developers and administrators.
- Possibility of inserting text comments and links in the SSB pages was added. Each view will have its own links and text comments.



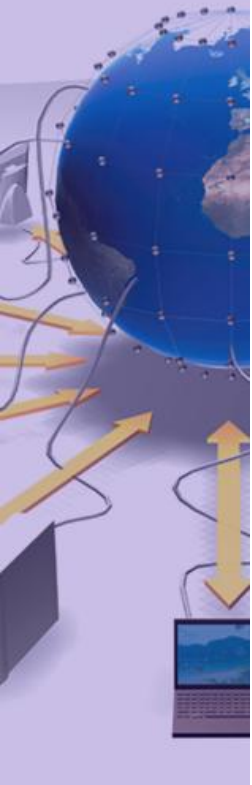
- SAM is a framework that allows the periodic execution of tests defined by the WLCG operators to verify the status of the grid services.
- It is also possible for each VO to define a set of VO-specific tests.
- Dashboard Site Availability Application enables a possibility for the VOs to define their own site availability and reliability definitions.



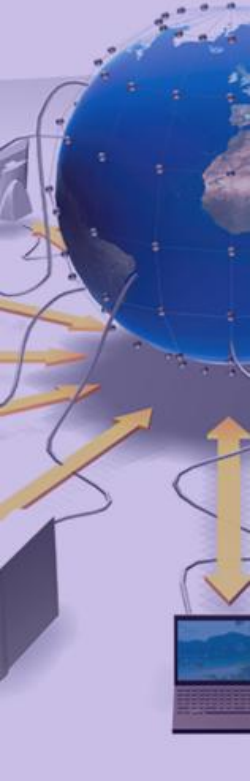
- Evaluated for Service Instance and Sites
- 4 different values
 - MAINT: Site/Service under maintenance (scheduled downtime)
 - N/A: Test result for 1+ test not available
 - DOWN: 1+ test failed
 - OK: All critical test passed
- *Availability=OK / total duration*
- *Reliability= OK / (OK +DOWN)*



- Request from ATLAS VO to include the results of two additional SAM tests in the SSB.
- A generic plugin, applicable to all SAM tests in the database, was created.

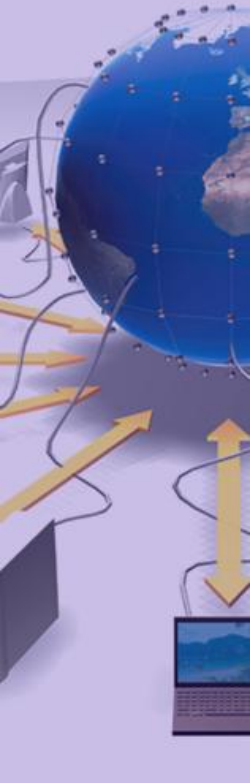


- Understanding of the LHC computing activities on the distributed Grid infrastructure.
- Good experience in designing web user interfaces.
- Development of the database applications for ORACLE backend.

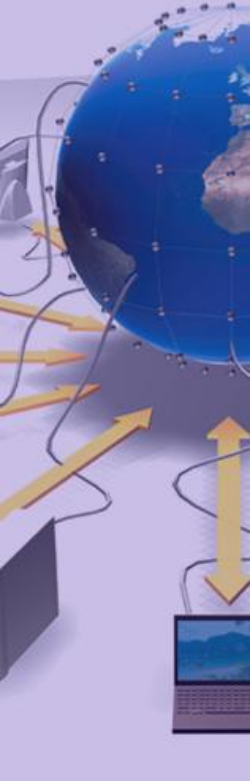


The list of the project computer knowledge:

- Python
- HTML
- XML
- XSLT
- SVN
- Databases
- Oracle, SQL Developer
- Java Script



- Pablo Saiz , Jacobo Tarragón, J. Andreeva, M. Devesas Campos, R. Rocha
CERN :: IT :: Experiment Support
- Michigan REU program: Jeremy Herr, Homer Neal, Jean Krisch, and Steven Goldfarb
- My fellow students
- National Science Foundation and CERN



- **Dashboard**
 - <http://dashboard.cern.ch>
- **CMS production SSB**
 - <http://dashb-ssb.cern.ch/ssb.html>
- **CMS development SSB**
 - <http://dashb-ssb-devel.cern.ch>
- **LHCb production SSB**
 - <http://dashb-lhcb-ssb.cern.ch>
- **ATLAS evaluation SSB**
 - <http://dashb-atlas-ssb.cern.ch>
- **ALICE evaluation SSB**
 - <http://dashb-alice-ssb.cern.ch>

