



ATLAS
EXPERIMENT



MONITORING OF DISTRIBUTED DATA PRODUCTION AND ANALYSIS FOR HIGH ENERGY PHYSICS EXPERIMENTS

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06/12/2019, Ivannikov ISP RAS Open Conference

OUTLINE

ATLAS Distributed Computing

BigPanDA monitoring system

Example of monitoring use-case for physicist

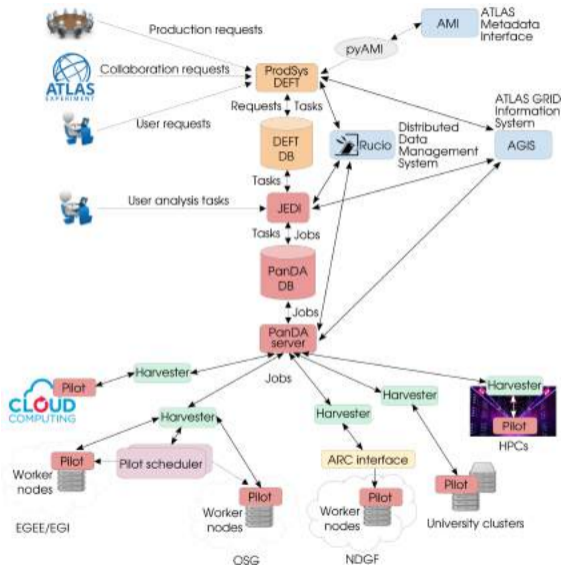
Example of monitoring use-case for production manager

Adaptation of BigPanDA monitoring system for COMPASS

Results



ATLAS DISTRIBUTED COMPUTING



- ▶ ProdSys - Production system;
- ▶ DEFT - Database Engine For Tasks;
- ▶ PanDA - Production and Distributed Analysis;
- ▶ JEDI - Job Execution and Definition Interface;
- ▶ PanDA server - the main component of the PanDA system that distributes and manages jobs among computing resources;
- ▶ Harvester - resource-facing service between the PanDA server and collection of pilots;
- ▶ AMI - ATLAS Metadata Interface;
- ▶ AGIS - ATLAS Grid Information System;

Figure 1 – ATLAS Workflow Management System scheme



ATLAS DISTRIBUTED COMPUTING

Computing resources usage during Run2 (from 2015 to 2018)



Figure 2 – Number of running CPU core slots grouped by resource type: GRID sites, HPC with closed network infrastructure, Clouds, HPC with closed network infrastructure, BOINC - volunteered computing resources



ATLAS DISTRIBUTED COMPUTING

PanDA processing scales at ATLAS

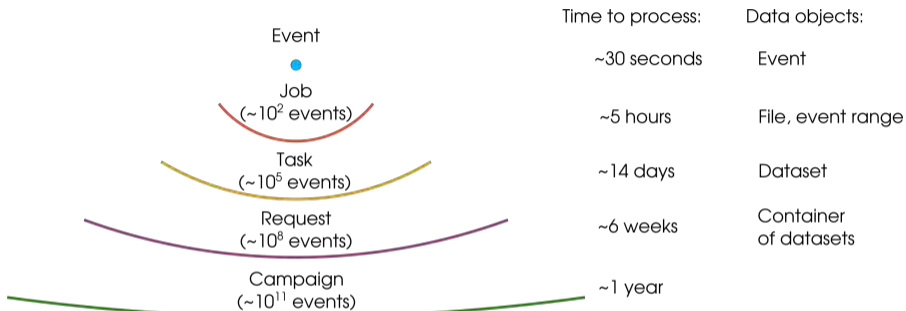


Figure 3 – Objects of PanDA system



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MONITORING

1. **Monitoring of current system state, access to logs for troubleshooting, and providing a comprehensive and coherent view of the tasks and jobs executed by the system, from high level summaries to detailed drill-down job diagnostics for short-term period;**
2. A system state analytics in medium term and resource usage accounting.
3. Analytics of a system working in long term period by finding correlations, trends, anomaly detection and building models for prediction of system behaviour in future.



A purpose of the BigPanDA monitoring system is providing a way for fast errors troubleshooting and tracking production and analysis tasks progress



BIGPANDA MONITORING

Requirements

- ▶ System state monitoring and troubleshooting by immediate access to logs;
- ▶ 24/7 accessibility;
- ▶ Ability to scale;
- ▶ Acceptable response time for different usage scenarios;
- ▶ Possibility to aggregate data from various sources:
 - ▶ DB (Oracle, MySQL, PostgreSQL);
 - ▶ Indexed data from Elasticsearch and Kibana visualizations;
 - ▶ log files in text or JSON format from Rucio;
 - ▶ plots from MONIT accounting service based on Grafana.
- ▶ Developing a common visualization mechanism to satisfy monitoring needs of different groups of users:
 - ▶ Physicists;
 - ▶ Operators or experts;
 - ▶ Computing site administrators;
 - ▶ Production managers;
 - ▶ Coordinators;
 - ▶ Software developers.
- ▶ Providing an API for programmatic analysis of system objects state.



BIGPANDA MONITORING

Use-case Diagram for «Physicist»

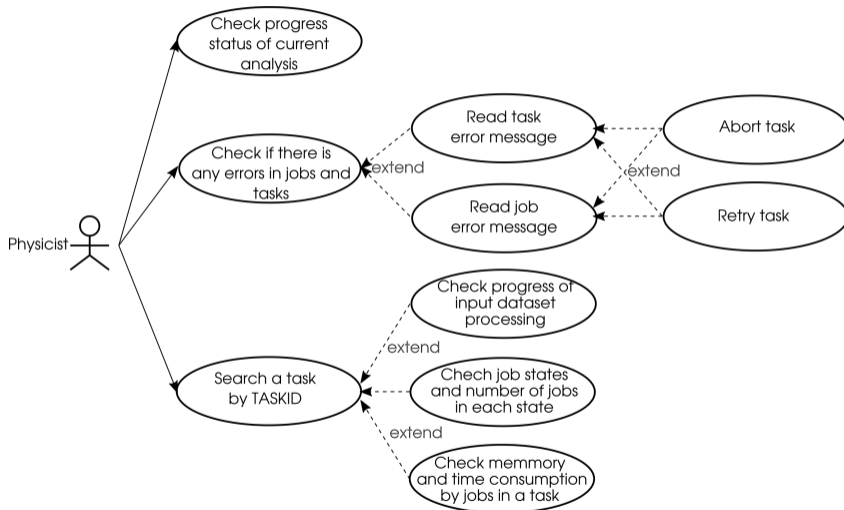


Figure 4 – Use-case Diagram for «Physicist» Actor



BIGPANDA MONITORING SYSTEM

Technology stack

1. Using Model-Template-View approach provided by Django framework;
2. Various DB backends (**Oracle**, MySQL, PostgreSQL);
3. Apache + WSGI;
4. NGINX server as load balancer;
5. Ceph as shared file storage between nodes;
6. OAuth2 for SSO provided by CERN, Google, and GitHub;
7. Angular и Ajax, jQuery for dynamic data delivery;
8. Responsive Web designing with ZURB Foundation;
9. DataTables plugin;
10. D3.js for advanced plots generation on client side;
11. Matplotlib for plots generation on server side;
12. ELK-stack for self-monitoring system (more details in a talk presented by Aleksandr Alekseev).



BIGPANDA MONITORING

Architecture

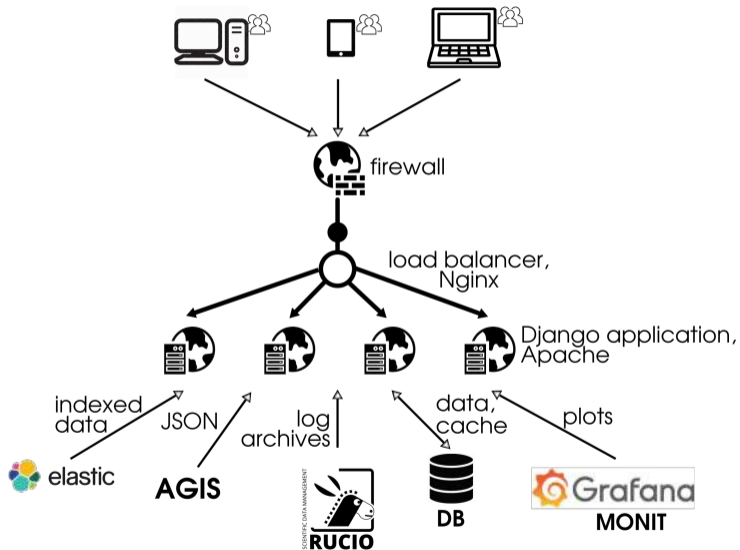


Figure 5 – Generalized scheme of BigPanDA monitoring system architecture



DATA FLOW IN BIGPANDA MONITORING SYSTEM

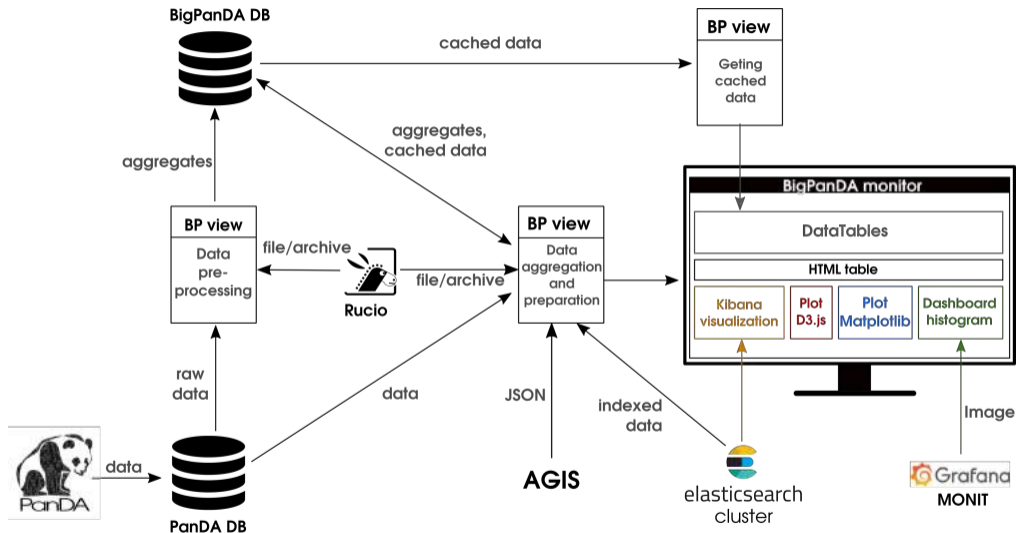


Figure 6 – Data-flow diagram of BigPanDA monitoring system



OUTLINE

ATLAS Distributed Computing

BigPanDA monitoring system

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USE-CASE DIAGRAM FOR «PHYSISIST»

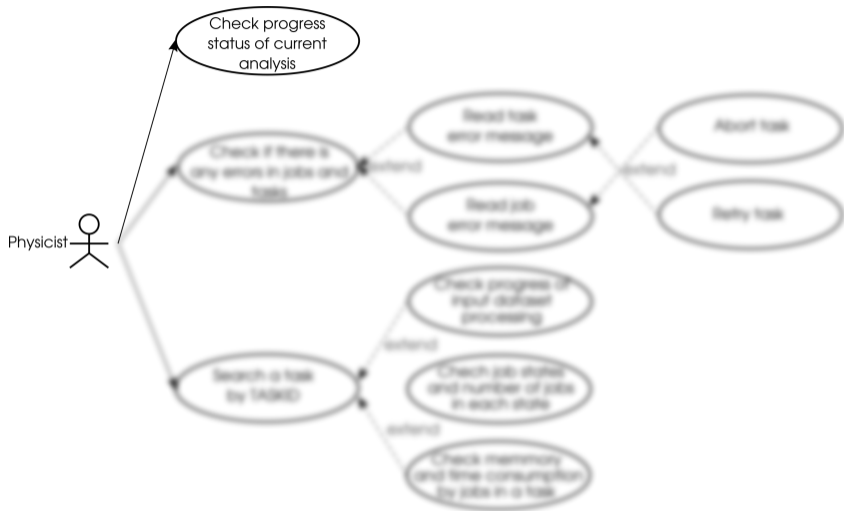


Figure 7 – Use-case Diagram for «Physisist»



USER PAGE EXAMPLE (1/4)

ATLAS PanDA Dash * Tasks * Jobs * Errors * Users * Sites * Harvester * My BigPanDA Job by ID - Enter... Prodsys * Services * Help * Tatiana *

PanDA user **Tatiana Lyubushkina** last 72 hours. Params: limit=5000 alpanda206 | 08:42:20, Reload

Stats from the user DB (updated every few hours)

User	Latest job in the DB stats	Personal CPU-hrs - 1 day	Personal CPU-hrs - 7 days	Group CPU-hrs - 1 day	Group CPU-hrs - 7 days
Tatiana Lyubushkina	2019-11-27 09:39:25	479.0	1265.1	0.0	0.0

Task attribute summary, 3 tasks

corecount (1)	1 (3)
eventservice (1)	ordinary (3)
gshare (1)	User Analysis (3)
processingtype (2)	panda-client-1.4.4-jedi-athena (2) panda-client-1.4.4-jedi-athena-trf (1)
ramcount (1)	2-3GB (3)
reqid (3)	20587 (1) 20588 (1) 20590 (1)
status (2)	exhausted (1) running (2)
status (ProdSys2) (2)	exhausted (1) running (2)
taskpriority (1)	1001 (3)

Figure 8 – Tasks attribute summary for last 3 days on the user page



USER PAGE EXAMPLE (2/4)

3 tasks, sorted by jedid taskid [Show in task list page](#)

ID Parent	Jobset	Task name TaskType/ProcessingType Campaign Group User Logged status	Task status Nfiles	Input files finish% fail% Nfinish Nfail	Started	Modified	State changed	Priority
19847334	20590	user.tyubush.mc12_8TeV.Bcst_Bcm_jpsiMu_208491.NTUPr42/ anal/panda-client-1.4.4-jedi-athena Tatiana Lyubushkina	running 16	6% 1	2019-11-22 15:30:08	2019-11-25 19:03:07	2019-11-22 15:31:12	1001
19847270	20585	user.tyubush.mc12_8TeV.Bcst_Bcp_jpsiMu_208490.NTUPr42/ anal/panda-client-1.4.4-jedi-athena Tatiana Lyubushkina	running 16		2019-11-22 15:27:00	2019-11-26 00:01:52	2019-11-22 15:27:48	1001
19820547	20587	user.tyubush.MC16.999015.deriv.DAOD_BC3MU.e7289_a875_r10724_p3809_r700/ anal/panda-client-1.4.4-jedi-athena-trf Tatiana Lyubushkina log brokerage failed for 1 input datasets when trying 1 datasets. timeout while in pending since 2019/11/20 16:31:57	exhausted 20		2019-11-20 16:30:35	2019-11-21 17:36:39	2019-11-21 17:36:39	1001

Figure 9 – List of tasks for last 3 days on the user page



USE-CASE DIAGRAM FOR «PHYSISIST»

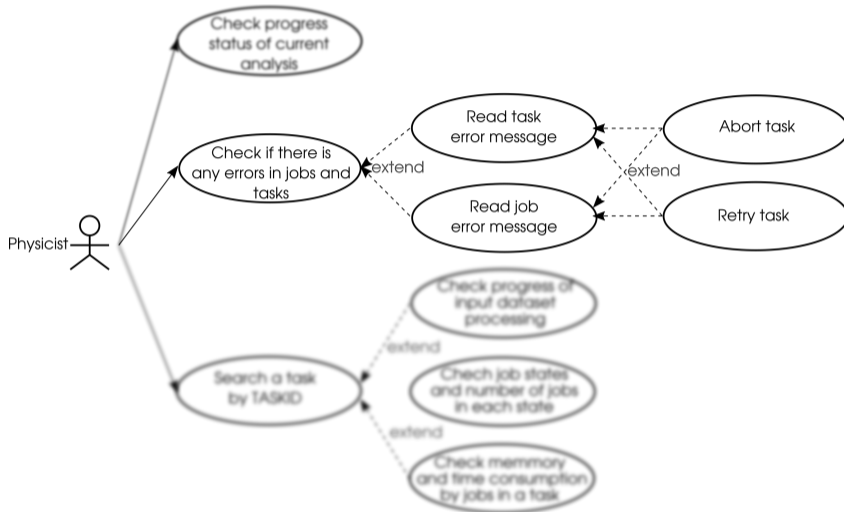


Figure 10 – Use-case Diagram for «Physicist»



TASK PAGE EXAMPLE

19820547 task: user.tlyubush.MC16.999015.deriv.DAOD_BC3MU.e7289_a875_r10724_p3809_r700/ alpanda204 | 11-27 09:46:21, [Reload](#)

Task ID	Jobset	Type	Working Group	User	Destination	Task status	Nevents used	HS06*sec Expected Total done failed	Ninputfiles finished failed	Created	Modified	Cores	Priority	Parent
19820547	20687	analy		Tatiana Lyubushkina		exhausted	100000 0 (0%)	None 0 0 0	20 0 (0%)	2019-11-20 16:30:35	2019-11-21 17:36:39	1	1001	

Task extra info Show jobs Task parameters and help Memory & walltime usage Other plots **Finish** **Abort**

States of jobs in this task (merge jobs excluded) [Show all jobs](#) [Switch to nodrop mode](#)

defined	waiting	pending	assigned	throttled	activated	sent	starting	running	holding	transferring	finished	failed	cancelled	merging	closed
---------	---------	---------	-----------------	-----------	-----------	------	----------	---------	---------	--------------	----------	--------	-----------	---------	--------

```
Logged status: log brokerage failed for 1 input datasets when trying 1 datasets. timeout while in pending since 2019/11/20 16:31:57

2019-11-21 16:34:28.356943 : totalInputSize=0 GB
2019-11-21 16:34:27.534233 : getting the list of available files for user.tlyubush:user.tlyubush.mc16_13TeV.999015.BCVEGPYPythia8EvtGen_A14CTEQ6L1_Bc29p
2019-11-21 16:34:27.534145 : no candidates
2019-11-21 16:34:27.534064 : preassigned site ANALY_JINR did not pass all tests
2019-11-21 16:34:26.211037 : 83 candidates passed inclusion/exclusion/cloud
```

Figure 11 – Task page



USER PAGE EXAMPLE (3/4)

87 jobs

Job **modification times** in this listing range from **2019-11-24 08:42:16** to **2019-11-27 08:42:16**.

Job **current priorities** in this listing range from **994** to **2000**. See priorityrange in the job attribute summary to see how priorities are distributed.

Recent job attributes	
atlasrelease (1)	Atlas-17.2.14 (87)
attemptnr (7)	2 (16) 3 (16) 4 (3) 5 (19) 6 (19) 7 (2) 8 (2)
cloud (6)	CERN (16) DE (33) IT (15) ND (3) UK (2) US (18)
computingsite (7)	ANALY_ARNES_DIRECT (3) ANALY_CERN_T0 (16) ANALY_DESY-HH (16) ANALY_GOEGRID (17) ANALY_INFN-LECCE (15) ANALY_MANC_UCORE (2) ANALY_MWT2_UCORE (18)
durationmin (22)	0-0 (17) 1-180 (38) 180-359 (0) 359-538 (1) 538-717 (0) 717-896 (0) 896-1075 (0) 1075-1254 (0) 1254-1433 (4) 1433-1612 (10) 1612-1791 (0) 1791-1970 (0) 1970-2149 (2) 2149-2328 (3) 2328-2507 (5) 2507-2686 (0) 2686-2865 (2) 2865-3044 (0) 3044-3223 (3) 3223-3402 (0) 3402-3581 (1) 3581-3760 (1)
homepackage (1)	AnalysisTransforms-AtlasProduction_17.2.14.12 (87)
inputfileproject (1)	mc12_8TeV (77)
inputfiletype (1)	AOD (77)
jeditaskid (2)	19847270 (33) 19847334 (54)
jobsetid (2)	20588 (33) 20590 (54)
jobsetrange (1)	20500:20599 (87)
jobstatus (6)	assigned (7) cancelled (9) closed (1) failed (53) finished (5) running (12)

Figure 12 – Jobs attribute summary for last 3 days on the user page



USER PAGE EXAMPLE (4/4)

87 recent jobs Note that with JEDI, tasks are the best tool to monitor the progress of your submissions! See the help section below.

PanDA ID	Owner Group	Task ID	Transformation	Status	Created	Time to start d:h:m:s	Duration d:h:m:s	Mod	Cloud Site	Priority	Job info
4559292379	Tatiana Lyubushkina	19847270	runAthena-00-00-12	running	2019-11-26 00:01:51	0:7:14:32	1:1:25:57	2019-11-27 08:38:23	DE ANALY_GOEGRID	997	
Job name: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42/.4555880563											
Datasets: In: mc12_8TeV:mc12_8TeV.208490.Pythia8B_AU2_CTEQ6L1_FakeBcst_Bcp_Jpsi_mu2p5mu2p5_mu2p5_nu.merge.AOD.e7479_a874_a270_a271_r4348_tid17988287_00 Out: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42_EXT0.283040398											
4559292383	Tatiana Lyubushkina	19847270	runAthena-00-00-12	failed	2019-11-26 00:01:51	0:7:14:42	1:0:39:17	2019-11-27 08:01:23	DE ANALY_GOEGRID	996	pilot, 1212: Payload ran out of memory trans, 40: Athena crash - consult log file
Job name: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42/.4555880570											
Datasets: In: mc12_8TeV:mc12_8TeV.208490.Pythia8B_AU2_CTEQ6L1_FakeBcst_Bcp_Jpsi_mu2p5mu2p5_mu2p5_nu.merge.AOD.e7479_a874_a270_a271_r4348_tid17988287_00 Out: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42_EXT0.283040398											
4557635926	Tatiana Lyubushkina	19847270	runAthena-00-00-12	failed	2019-11-24 07:41:01	0:0:03:02	0:0:03:29	2019-11-26 00:00:51	US ANALY_MWT2_UCORE	998	trans, 40: Athena crash - consult log file
Job name: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42/.4555880586											

Figure 13 – List of jobs for last 3 days on the user page



JOB PAGE EXAMPLE

Job details for PanDA job 4557635926 aipanda207 | 16:08:31, [Reload](#)

PandaID	Owner	Request Task ID	Status	Created	Time to start d:h:m:s	Duration d:h:m:s	Modified	Cloud Site	Priority
4557635926	Tatiana Lyubushkina	20588 19847270	failed	2019-11-24 07:41:01	0:0:03:02	0:0:03:29	2019-11-26 00:00:51	US ANALY_MWT2_UCORE	998

Job name: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42_4555880586 **type:** panda-client-1.4.4-jedi-athena **transformation:** runAthena-00-00-12

Datasets: In: mc12_8TeV:mc12_8TeV:208490.Pythia8B_AU2_CTEQ6L1_FakeBcst_Bcp_Jpsi_mu2p5mu2p5_mu2p5_nu.merge.AOD.e7479_a874_a270_a271_r4348_tid17988267_00
Out: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUPr42_EXT0.282477627

Dataset summary: input: 2, size: 2404.87(MB); log: 1; output: 1

Error description trans, 40: Athena crash - consult log file

LogsGo toShowJump toMemory and IO plots

Log files

- Pilot job stdout
- Pilot job stderr
- Batch log of pilot job
- Pilot job jdl
- Pilot records
- Action logger (Kibana)
- Open all logs

Figure 14 – Job page, a way to access job logs example



FILE BROWSER PAGE EXAMPLE

File listing

Show 100 entries

Search:

9 files listed, total size is 0.27 MB

Modification time	Size [B]	File
2019 Nov 24 07:45:32	96503	pilotlog.txt
2019 Nov 24 07:45:28	799	memory_monitor_summary.json
2019 Nov 24 07:44:46	177123	payload.stdout
2019 Nov 24 07:44:46	476	PoolFileCatalog.xml
2019 Nov 24 07:44:35	225	memory_monitor_output.txt
2019 Nov 24 07:44:31	4267	.asetup.save
2019 Nov 24 07:44:25	7067	.envBefore_asetup.sh_17
2019 Nov 24 07:44:19	1045	container_script.sh
2019 Nov 24 07:44:15	0	payload.stderr

Showing 1 to 9 of 9 entries

Previous 1 Next

Figure 15 – File browser page example showing a content of logs archive file



LOG FILE BROWSING EXAMPLE

```
Py:inputFilePeeker ERROR Unable to build inputFileSummary from any of the specified input files. There is probably a problem.
Py:AutoConfiguration ERROR No RunNumber stored in InputFile!
Shortened traceback (most recent call last):
  File "/BPhysAnalysisMasterAuto.Bc2S.MC.py", line 77, in <module>
    include ("RecExCommon/RecExCommon_topOptions.py")
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasReconstruction/17.2.14/InstallArea/jobOptions/RecExCommon/RecExCommon_topOptions.py", line 97, in <module>
    include ("RecExCond/RecExCommon_flags.py")
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/jobOptions/RecExCond/RecExCommon_flags.py", line
235, in <module>
    ConfigureFromListOfKeys(rec.AutoConfiguration())
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/AutoConfiguration.py", line 909,
in ConfigureFromListOfKeys
    rec.projectName=GetProjectName()
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/AutoConfiguration.py", line 294,
in GetProjectName
    from RecExConfig.GetCool import cool
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/GetCool.py", line 32, in <module>
    cool=_setup()
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/GetCool.py", line 19, in _setup
    lb=GetLBNumber()
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/AutoConfiguration.py", line 69,
in GetLBNumber
    if inputFileSummary['nentries']==0:
KeyError: 'nentries'
Python: INFO Leaving with code 8: "an unknown exception occurred"
Traceback (most recent call last):
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasEvent/17.2.14/InstallArea/python/RecExConfig/InputFilePeeker.py", line 49, in
_setup
    fi = athFile.fopen(inFile)
  File "<string>", line 2, in fopen
  File "/cvmfs/atlas.cern.ch/repo/sw/software/1686-slc5-gcc43-opt/17.2.14/AtlasProduction/17.2.14.12/InstallArea/python/PyUtils/AthFile/_init_.py", line
33, in _update_cache
    res = fct(*args)
  File "<string>", line 2, in fopen
  File "/cvmfs/atlas.cern.ch/repo/tools/slc6/cmt/InstallArea/python/PyCmt/Decorators.py", line 109, in forking
    status, result = pickle.load(f)
EOFError
```

Figure 16 – Example of «payload.stdout» job log



USE-CASE DIAGRAM FOR «PHYSISIST»

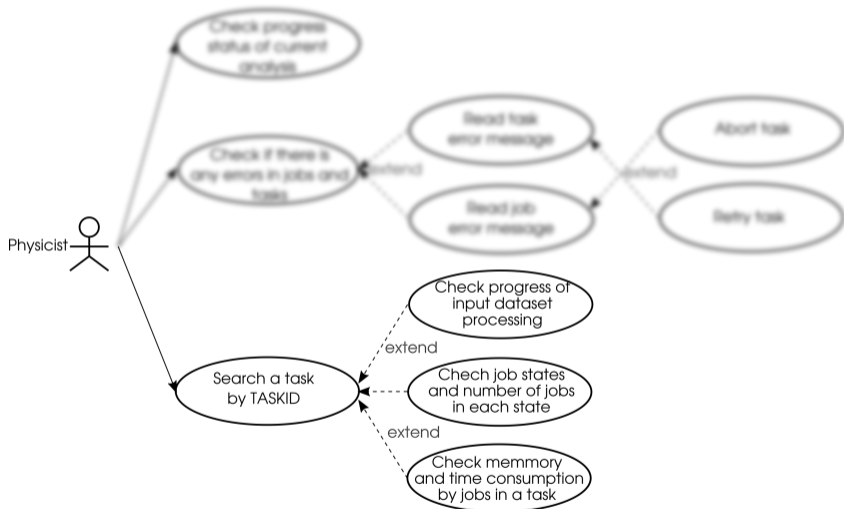


Figure 17 – Use-case Diagram for «Physisist»



TASK PAGE EXAMPLE

19847270 task: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUP.r42/

aipanda206 | 11-27 10:04:44, [Reload](#)

19847270 task: user.tlyubush.mc12_8TeV.Bcst_Bcp_JpsiMu_208490.NTUP.r42/

Task ID	Jobset	Type	Working Group	User	Destination	Task status	Nevents used	HS06*sec Expected Total done failed	Ninputfiles finished failed	Created	Modified	Cores	Priority	Parent
19847270	20588	anaty		Tatiana Lyubushkina		running	77000 0 (0%)	None 11408441 26791 11381650	16 0 (0%)	2019-11-22 15:26:58	2019-11-26 00:01:52	1	1001	

Task extra info

Show jobs

Task parameters and help

Memory & walltime usage

Other plots

Finish

Abort

States of jobs in this task (merge jobs excluded) [Show all jobs](#) [Switch to nodrop mode](#)

defined	waiting	pending	assigned	throttled	activated	sent	starting	running	holding	transferring	finished	failed	cancelled	merging	closed
								8	1		2	10			

Dataset, container name * Type Stream Status Nfiles Nfiles finished Nfiles failed % Links

mc12_8TeV:mc12_8TeV.208490.Pythia8B_AU2_CTEQ6L1_FakeBcst_Bcp_Jpsi_mu2p5mu2p57_00	input	IN	ready	16	0	0	0	0	Jobs
panda.1122152742.288828.Jib_.19847270	lib		registered	-	-	-	-	-	Jobs
panda.1122154225.457341.Jib_.19847270	lib		registered	-	-	-	-	-	Jobs
panda.1122155733.107436.Jib_.19847270	lib		registered	-	-	-	-	-	Jobs

Figure 18 – Task page example showing a way to access information of jobs memory consumption



TASK PAGE EXAMPLE

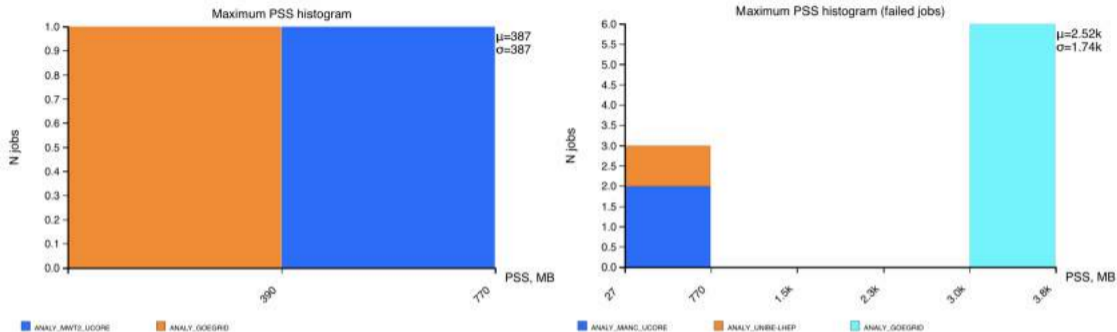


Figure 19 – Part of task page presenting jobs memory consumption histograms



JOB MEMORY CONSUMPTION EXAMPLE

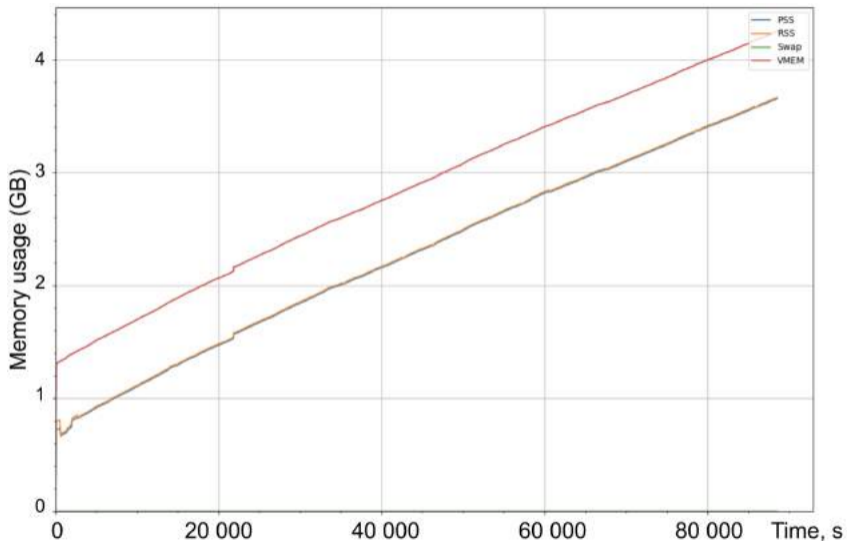


Figure 20 – Job memory consumption during its processing



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Results



JOBS PAGE EXAMPLE

PanDA jobs, last 12 hours. Params: **jobtype=production** hours=12 Total jobs found ~ 590000

aipanda203 | 08:10:23, [Reload](#)

576357 jobs in this selection

Job type: production

Job attribute summary, sort by count, alpha	
actualcorecount (18)	1 (378917) 2 (70) 3 (45) 4 (7825) 5 (37) 6 (6575) 7 (112) 8 (171174) 12 (1898) 16 (853) 32 (3038) 36 (2) 48 (235) 64 (127) 72 (792) 80 (56) ... more
atlasrelease (61)	Atlas-19.2.3 (1841) Atlas-19.2.4 (3) Atlas-19.2.5 (16125) Atlas-20.7.5 (21519) Atlas-20.7.7 (1677) Atlas-20.7.8 (1414) Atlas-20.7.9 (54776) Atlas-21.0.102 (5) Atlas-21.0.103 (49119) Atlas-21.0.15 (86478) Atlas-21.0.16 (2654) Atlas-21.0.19 (58) Atlas-21.0.20 (7368) Atlas-21.0.31 (70651) Atlas-21.0.40 ... more
attemptnr (29)	1 (409156) 2 (71991) 3 (38932) 4 (30058) 5 (13133) 6 (2665) 7 (839) 8 (434) 9 (350) 10 (280) 11 (105) 12 (123) 13 (78) 14 (30) 15 (33) 16 (93) ... more
gshare (14)	Data Derivations (50381) Event Index (298) Express (6208) HLT Reprocessing (1043) MC 16 (128838) MC 16 evgen (133626) MC 16 simul (102209) MC Derivations (38835) MC merge (13662) MC Other (17098) Reprocessing default (49073) Special (25015) Test (7879) Validation (2192)
harvesterinstance (9)	CERN-dev (137) CERN_central_0 (36048) CERN_central_1 (4018) CERN_central_A (133028) CERN_central_ACTA (141164) CERN_central_B (87430) cern_cloud (129) harvester_k8s (552) NERSC_test (4043)
jobstatus (15)	activated (116831) assigned (14641) cancelled (34) closed (40997) closed:toreassign (122) defined (38) failed (34516) finished (209777) holding (1755) merging (4749) pending (177) running (93134) sent (2257) starting (11521) transferring (45808)
priorityrange (13)	0:99 (23765) 100:199 (69682) 200:299 (99562) 300:399 (141882) 400:499 (69397) 500:599 (26680) 600:699 (861) 800:899 (114564) 900:999 (17363) 1000:1099 (1740) 1100:1199 (1025) 5000:5999 (2577) 10000:10999 (6599)

Figure 21 – Production jobs attribute summary for last 8 hours



RUNNING PRODUCTION TASKS PAGE EXAMPLE (1/2)

Running production task list

alpanda205 | 08:57:04, [Reload](#)

Selection Preset

Working group

Processing type

Campaign

Status

All

All

All

All

All

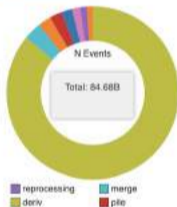
HPC

ES

Jumbo

[Go!](#)

Events + , show historical trend



Allocated slots



Task age

Task age histogram

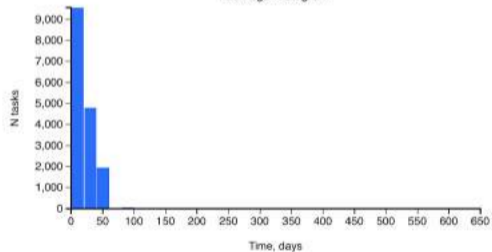


Figure 22 – Part of Running Production Tasks page showing events and slots summary



RUNNING PRODUCTION TASKS PAGE EXAMPLE (2/2)

Show entries

Search:

16403 tasks listed

Campaign	Req ID	Run	Task ID	RJobs	Status (PS2)	Status (JEDI)	Type	Evts total	Evts done	Evts running	Evts to be used	%	Failed files	Priority	Age
data18	20176	00363198	19843359	2	running	running	eventindex	801,715,279	799,831,690	1,883,589	1,883,589	99.8	0	900	11
MC16e	26997	411287	19291746	2	running	running	evgen	210,000,000	207,000,000	1,000,000	3,000,000	98.6	400	900	61.4
MC16a	27851	411346	19772769	0	running	running	evgen	200,000,000	199,982,000	2,000	18,000	100.0	16	900	18.9
data16_13TeV	27253	411221	19421168	0	running	pending	evgen	199,991,000	15,038,000	2,100,000	134,912,000	72.5	4050	580	18.8
mc16	24224	366001	19917830	0	running	running	archive	140,297,000	85,421,000	3,239,000	59,876,000	55.0	0	800	1.9
mc16	24224	301000	19923238	2	running	running	archive	139,665,000	139,125,000	540,000	540,000	99.6	0	900	0.9
data16_13TeV	28235	00302872	19924654	0	running	running	deriv	131,571,245	549,102	35,687,960	131,022,143	0.4	0	880	0.7
mc16	24224	366001	19917828	32	running	running	archive	108,999,000	58,387,000	18,955,000	50,612,000	53.6	0	888	1.9
data16_13TeV	28235	00302393	19924644	0	running	running	deriv	106,733,895	761,555	7,202,583	105,972,340	0.7	0	880	0.7

Showing 1 to 20 of 16,403 entries

Previous **1** 2 3 4 5 ... 821 Next

Figure 23 – Part of Running Production Tasks page showing list of tasks



OUTLINE

ATLAS Distributed Computing

BigPanDA monitoring system

Example of monitoring use-case for physicist

Example of monitoring use-case for production manager

Adaptation of BigPanDA monitoring system for COMPASS

Results



ADAPTATION OF BIGPANDA MONITORING SYSTEM FOR COMPASS

COMPASS experiment

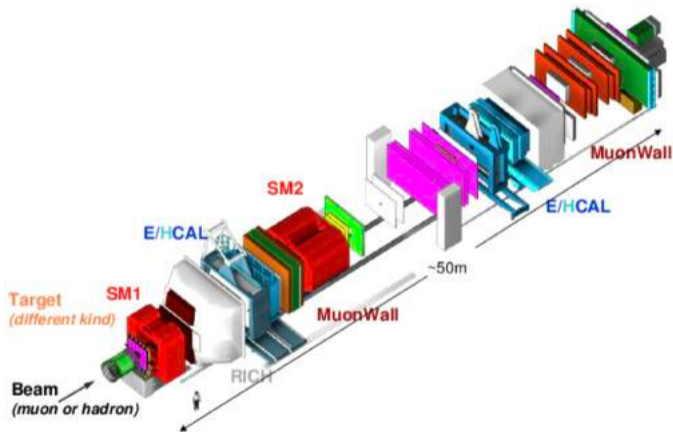


Figure 24 – COMPASS detector scheme

- ▶ **CO**mmun **MU**on **P**roton **A**pparatus for **S**tructure and **S**pectroscopy;
- ▶ The purpose of the experiment is the study of hadron structure and hadron spectroscopy with high intensity muon and hadron beams;
- ▶ First data taking run started in summer 2002 and sessions continue;
- ▶ Each data taking session containing from 1.5 to 3 PB of data;
- ▶ More than 200 physicists from 13 countries and 25 institutes are the analysis user community of COMPASS.

ADAPTATION OF BIGPANDA MONITORING SYSTEM FOR COMPASS

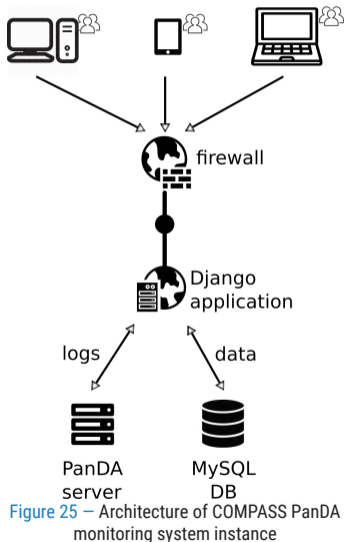


Figure 25 – Architecture of COMPASS PanDA monitoring system instance

- ▶ a new instance at JINR, Dubna;
- ▶ core views (jobs, files, dash, errors, sites) needed minor changes;
- ▶ tasks module was adapted to COMPASS production system;
- ▶ a completely new module was designed and implemented on the top of existed architecture;
- ▶ it is in production since November 2017 serving 300 requests/day.

The screenshot shows the 'Tasks' page in the COMPASS PanDA monitoring system. The page title is 'COMPASS PanDA monitor' and the current view is 'Tasks'. The table below lists various tasks and their associated job IDs, errors, and COMPASS status.

Task	Job by ID	Errors	COMPASS
home (4)	jobs/compass-ml.com.ua (2)	jobs/compass.com.ua (20)	jobs/projects/compass (2)
max_attempts (14)	10 (14)	11 (1)	15 (2)
path (5)	data2015 (4)	data2016 (1)	prod (1)
period (20)	P00 (2)	P01 (2)	P02 (1)
producer (2)	7 (2)	8 (0)	
product (1)	1 (0)	2 (0)	3 (0)
production (15)	2015P01-1 (1)	2015P01-2 (1)	2015P01-3 (1)
url (15)	jobs/compass-ml.com.ua (1)	jobs/compass.com.ua (1)	jobs/projects/compass (1)
status (8)	active (8)	failed (0)	pending (0)
template (3)	template.com.ua (3)	template.com.ua (3)	
type (8)	DDO filtering (0)	mass production (0)	MC generation (0)
year (14)	2004 (1)	2008 (2)	2010 (1)

Figure 26 – Tasks page example of COMPASS PanDA monitoring



PRODUCTION SUMMARY PAGE IN COMPASS PANDA MONITORING

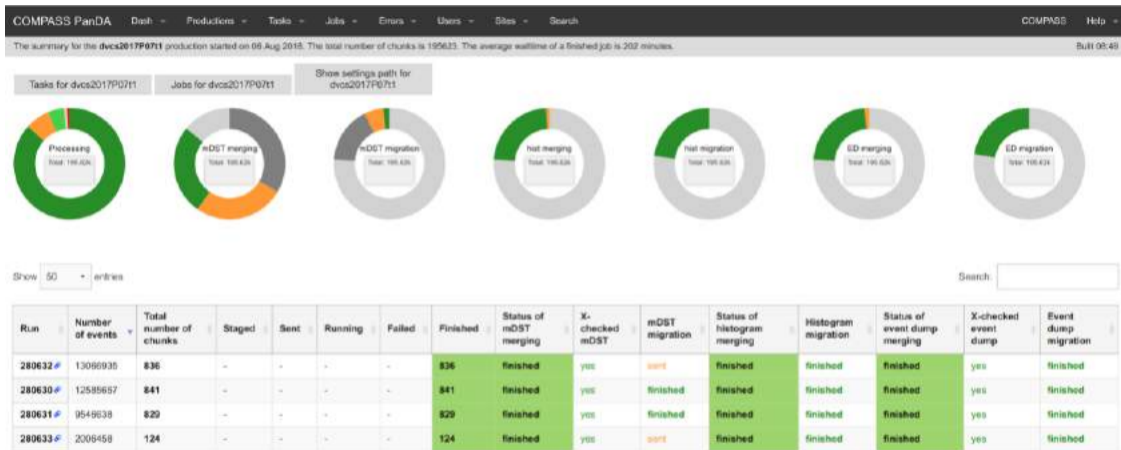


Figure 27 – Production summary page example



OUTLINE

ATLAS Distributed Computing

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BIGPANDA MONITORING SYSTEM STRUCTURE

ATLAS PanDA monitor

COMPASS PanDA monitor

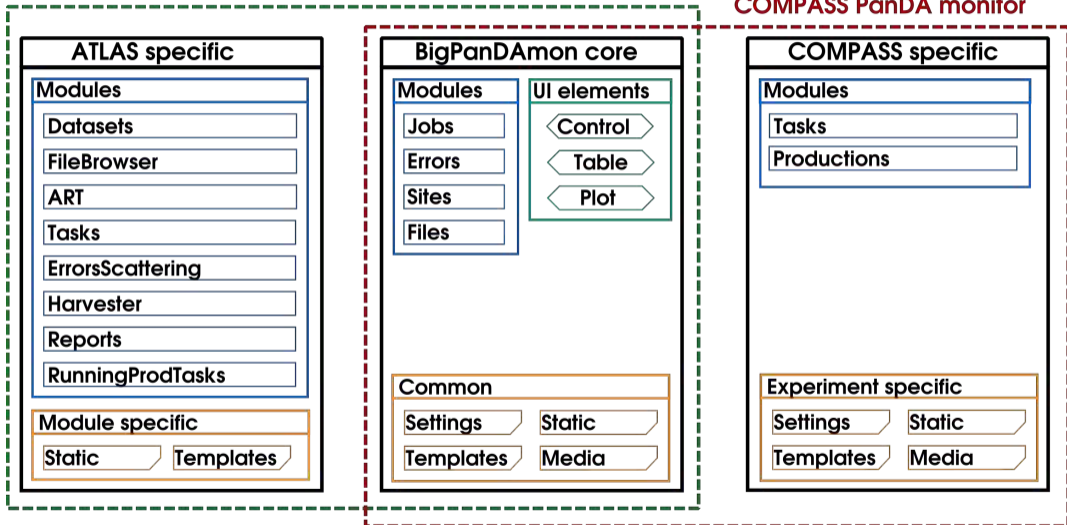


Figure 28 – Structure of BigPanDA monitoring system views



ATLAS BIGPANDA MONITORING SYSTEM USAGE STATISTICS

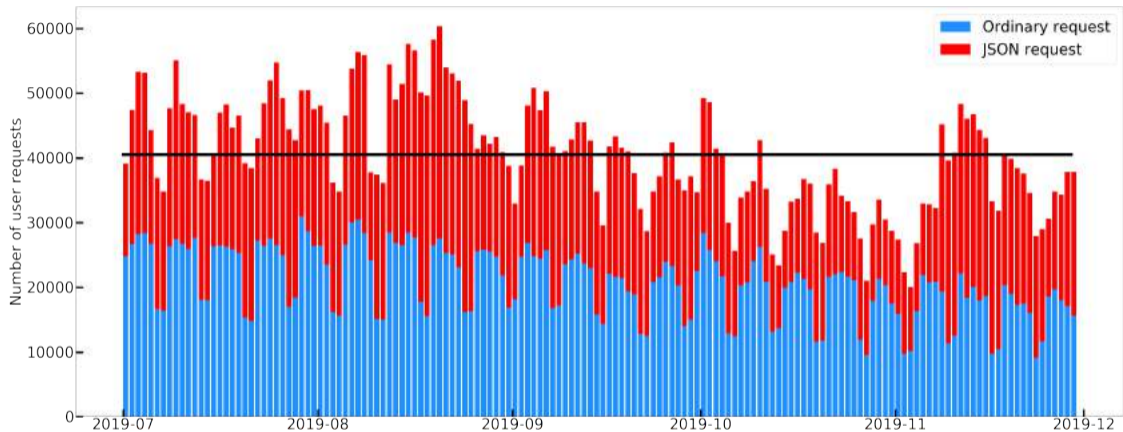


Figure 29 – Number of daily user requests, from July of 2019 to December of 2019



ATLAS BIGPANDA MONITORING SYSTEM USAGE STATISTICS

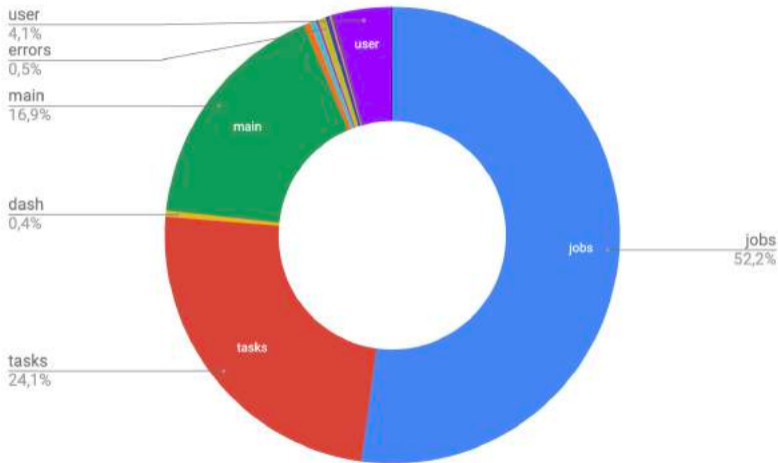


Figure 30 – Requests

- ▶ from 1 to 626 pages a day per user;
- ▶ 342 unique daily users;
- ▶ 1110 unique monthly active users.



RESULTS

1. ATLAS PanDA monitoring system serving needs of different groups of users to monitor and troubleshooting of up to $2 \cdot 10^6$ jobs distributed among 170 sites including Grid, Clouds, HPCs, and volunteer computing resources;
2. For 5 years in production, the system has only an average of 183 minutes of downtime per year (lasting more than 10 minutes) which proves a high availability – 99,965%;
3. Developed architecture allows to effectively serve $40 \cdot 10^3$ of daily requests in average;
4. The core of PanDA monitoring system has been successfully integrated into COMPASS experiment at SPS and provide various views for monitoring up to $1 \cdot 10^5$ jobs per day.

Acknowledgements:

This work was partially funded by the Russian Science Foundation under contract No.19-71-30008 (research is conducted in Plekhanov Russian University of Economics).



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Large Hadron Collider (LHC)

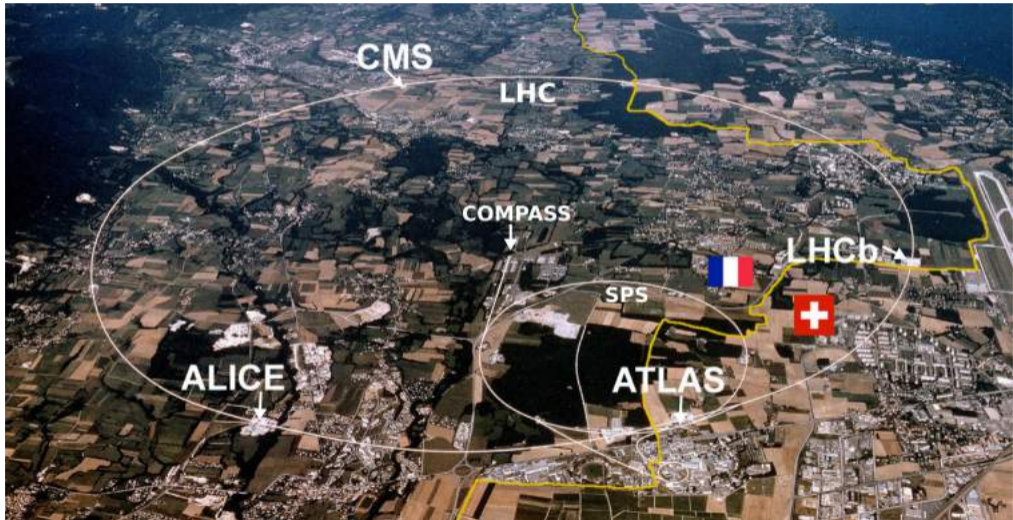


Figure 31 – LHC experiments

ATLAS EXPERIMENT

Collaboration

▶ >5 000 physicists, students, engineers, technicians

▶ >1 000 PhD students

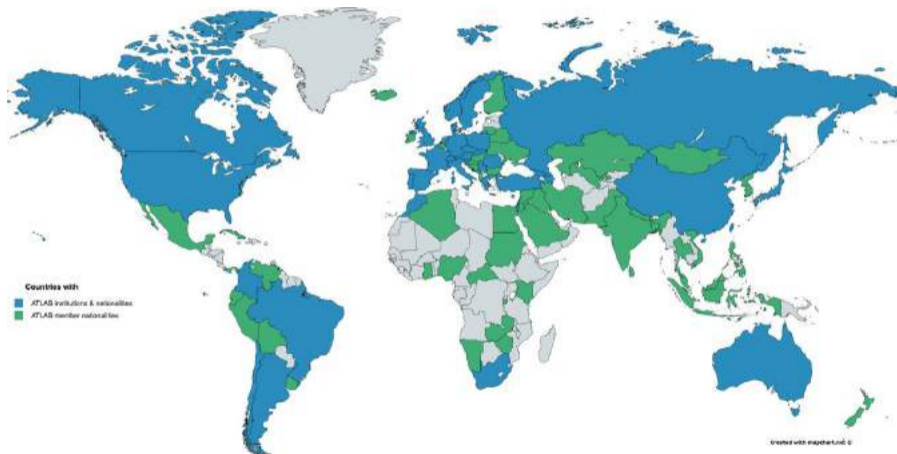


Figure 32 – ATLAS Collaboration members nationalities

ATLAS EXPERIMENT

Detector

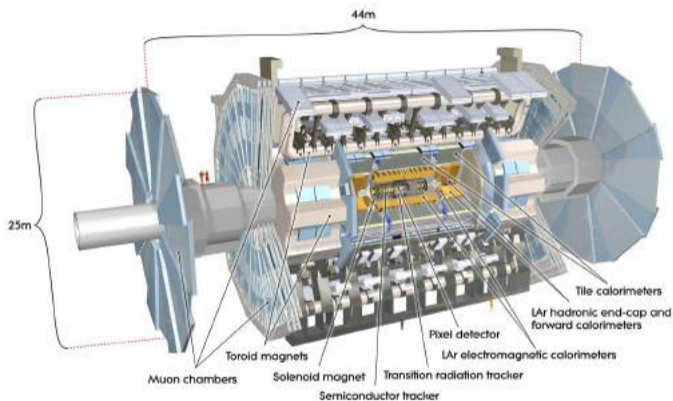


Figure 33 – Scheme of ATLAS detector

- ▶ 25×44 m., 7 000 tonnes
- ▶ ~ 101 million of electronic channels
- ▶ ~ 1 billion of charged particle bunch collisions per second
- ▶ trigger system filter the most interesting events in real time, which decreases data flow from ~1PB/s to ~1GB/s



DATA PRODUCTION IN ATLAS EXPERIMENT

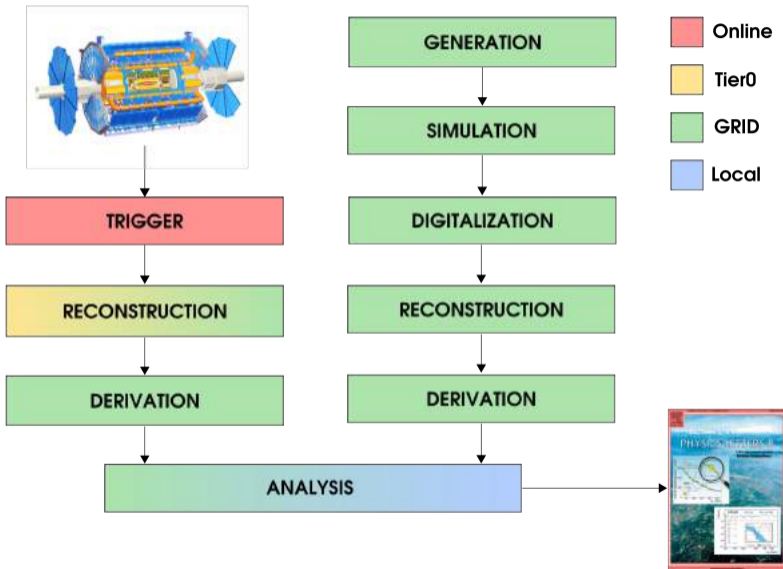


Figure 34 – Scheme of data production and analysis cycle in ATLAS experiment



WORLDWIDE LHC COMPUTING GRID (WLCG)

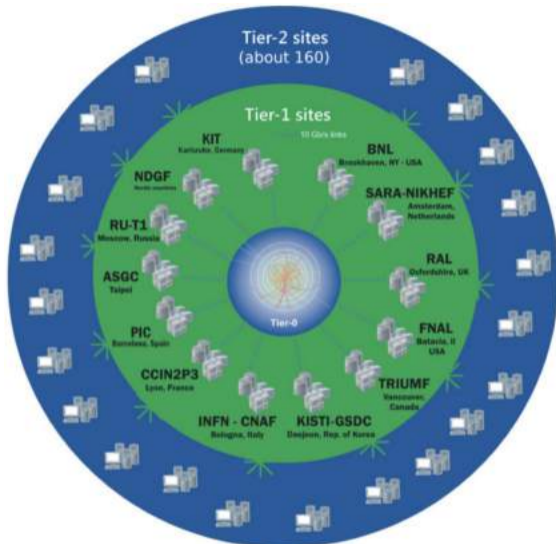


Figure 35 – WLCG scheme

WLCG: an International collaboration to distribute and analyse LHC data

Integrates computer centres worldwide that provide computing and storage resource into a single infrastructure accessible by all LHC physicists.

- ▶ Tier-0: data recording, reconstruction and distribution;
- ▶ Tier-1: permanent storage, re-processing, analysis;
- ▶ Tier-2: Simulation, end-user analysis;
- ▶ ~ 170 sites, 42 countries;
- ▶ ~ 1 M CPU cores;
- ▶ ~ 1 EB of storage;
- ▶ > 2 million jobs/day;
- ▶ 10-100 Gb links.



WLCG INFRASTRUCTURE

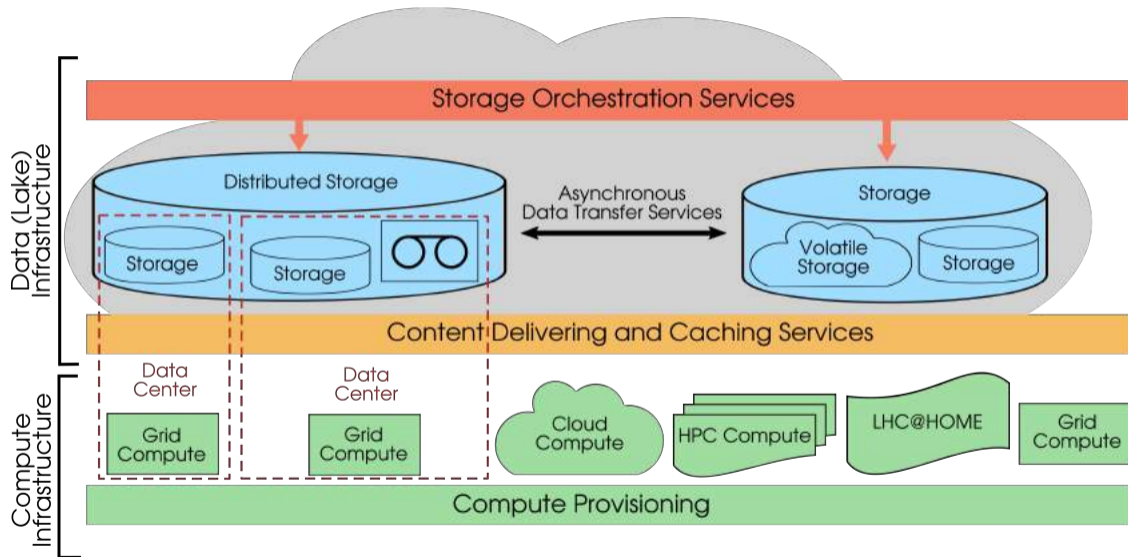


Figure 36 – WLCG Infrastructure scheme

