Applying Big Data solutions for log analytics in the PanDA infrastructure

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Outline

- ATLAS, PanDA, JEDI, BigPanDA

- Reasons for choosing filebeat and logstash and results of implementation for PanDA, JEDI and BigPanDA logs

- Results of integration with BigPanDA monitoring

- BigPanDA logs processing. Notification system for BigPanDA monitoring

Introduction

- **ATLAS** is one of two general-purpose detectors at the Large Hadron Collider (LHC). 1PB/sec from all sub-detectors reduces to ~1GB/sec raw data which is saved to Data Center.
- **PanDA** (**P**roduction **an**d **D**istributed **A**nalysis) is the workflow management system of the ATLAS experiment at the LHC and is responsible for generating, brokering and monitoring up to two million jobs per day across 150 computing centers in the Worldwide LHC Computing Grid.
- **JEDI** (**J**ob **E**xecution and **D**efinition **I**nterface) is an intelligent component in the PanDA system to have capability for task-level workload management.
- **BigPanDA** is a monitoring system which provides a comprehensive and coherent view of the tasks and jobs executed by the system, from high level summaries to detailed drill-down job diagnostics.

Motivation

- Centralized storage for PanDA server, JEDI and BigPanDA logs

- 400GB daily logs

- Average size of the one log file can be up to 2 GB

- Quick search of errors and potential problems

- Notification features

- **ELK (Elasticsearch+Logstash+Kibana) have more performance than Flume and parses/indexes messages**

ELK stack and Flume

- **ELK stack**

    - **Logstash** is an special open source software for collecting, filtering and normalizing logs. It is used to collect collect log events from different log types.
    - **ElasticSearch** is a distributed open source software for storing and searching information. In our case, Logstash writes all log events into the ElasticSearch repository.
    - **Kibana** is an open source data visualization plugin for Elasticsearch. It is used for visualization of data from Elasticsearch cluster.

- **Apache flume (or Flume)** is a distributed service for collecting, aggregating, and moving large amounts of log data.
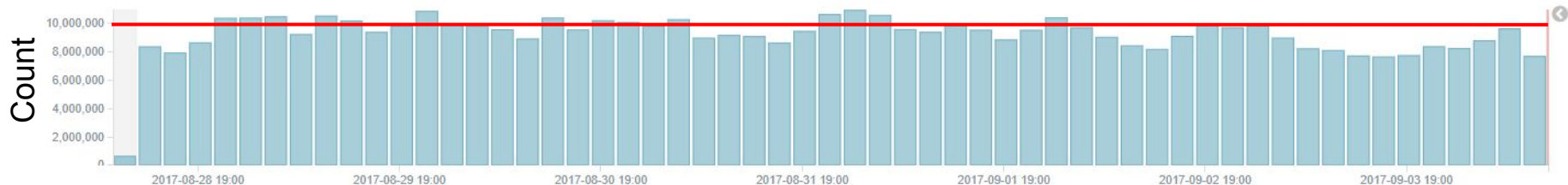
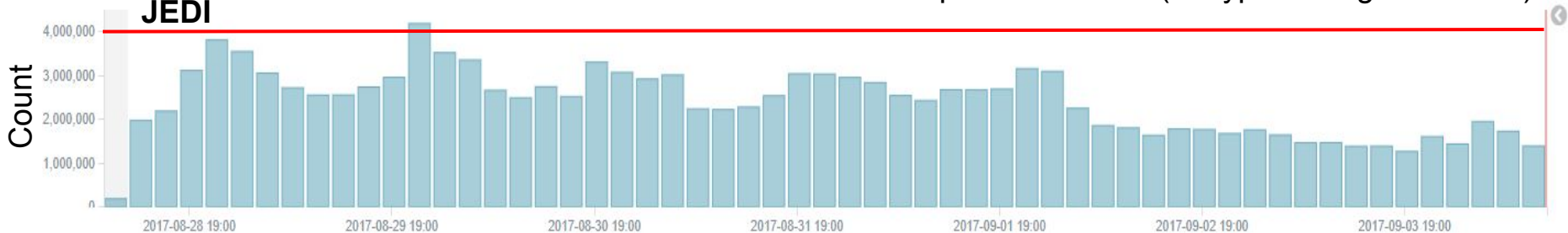# PanDA infrastructure
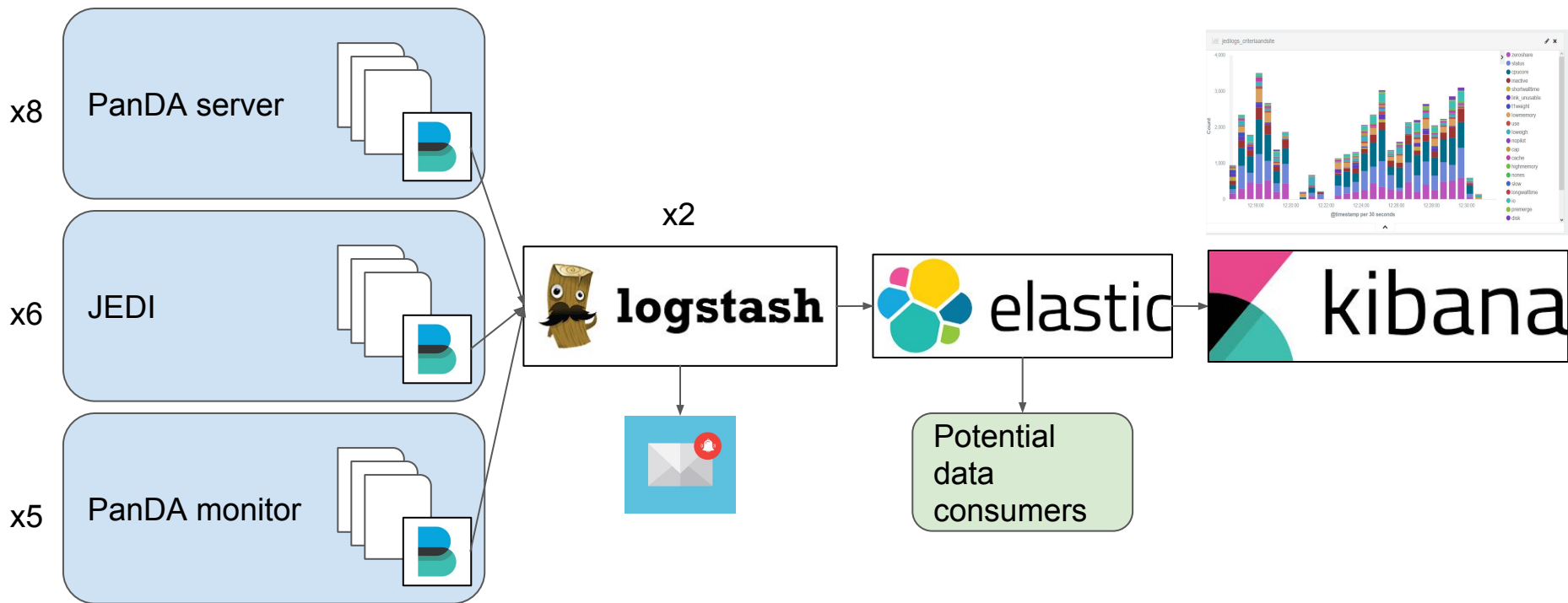
Scale of the Problem

PanDA server   ~ 210 GB per week in ES (34 types of log filters/files)
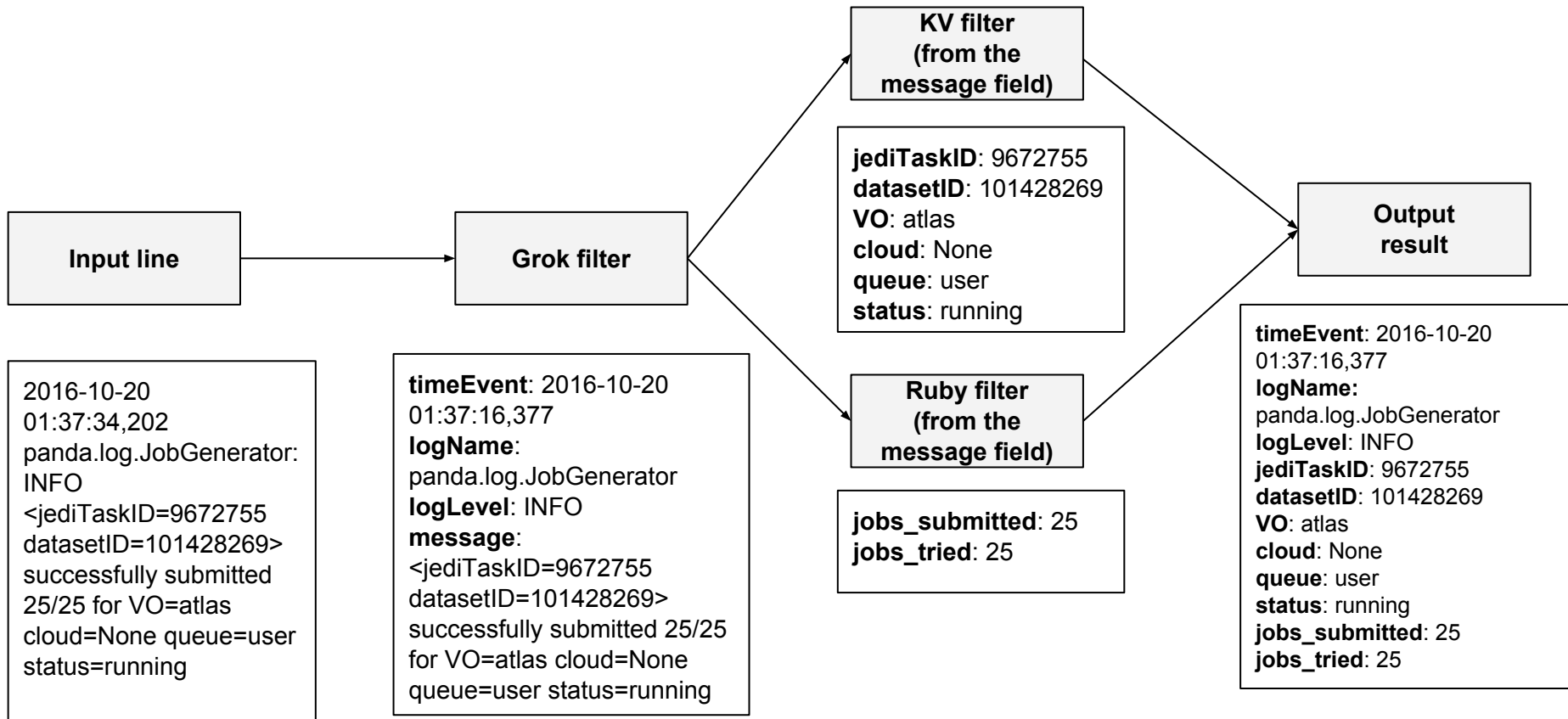

Timestamp per 3 hours
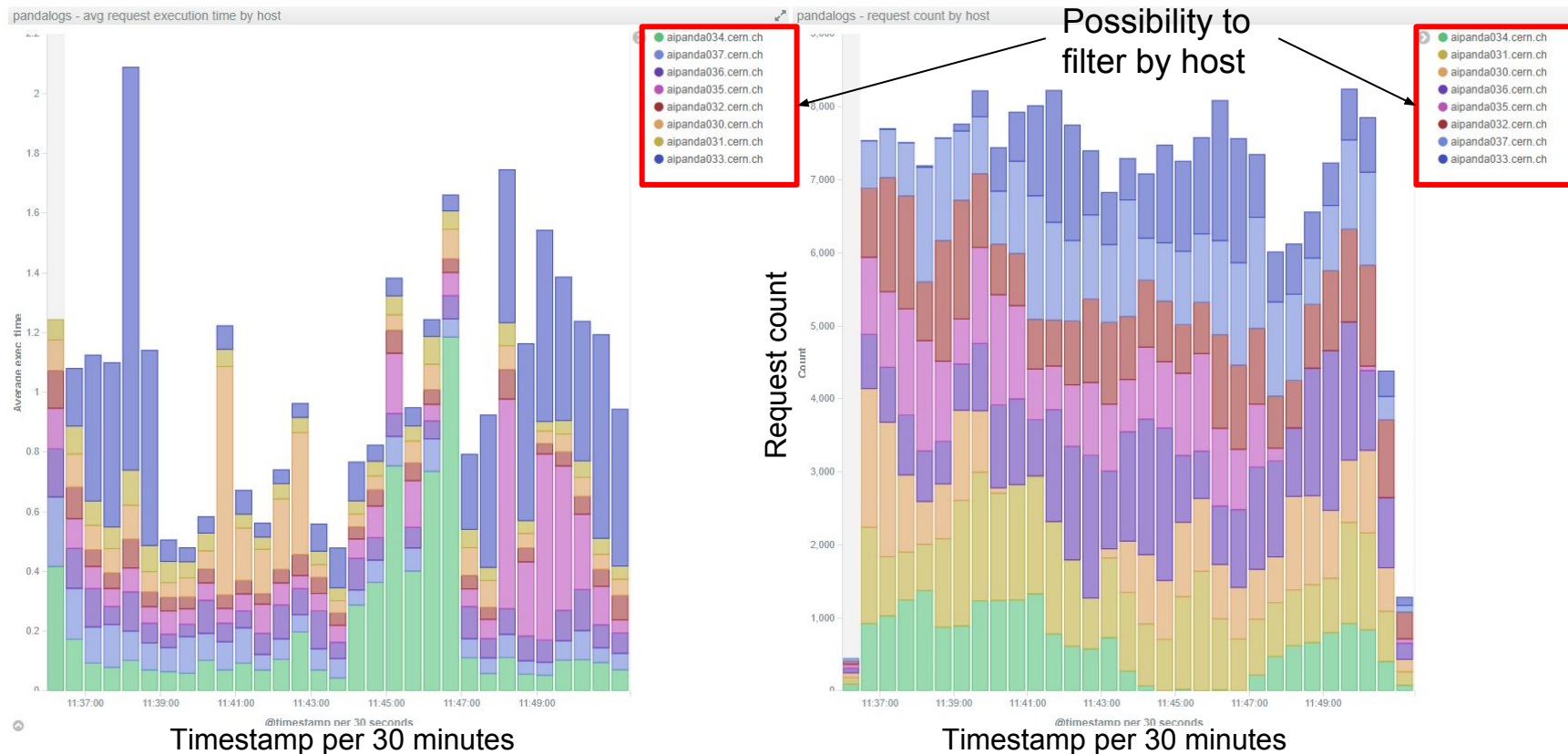
~ 73 GB per week in ES (27 types of log filters/files)

JEDI

Timestamp per 3 hours

Example of log processing

Input line

2016-10-20
01:37:34,202
panda.log.JobGenerator:
INFO
<jediTaskID=9672755
datasetID=101428269>
successfully submitted
25/25 for VO=atlas
cloud=None queue=user
status=running

Grok filter

timeEvent: 2016-10-20
01:37:16,377
logName:
panda.log.JobGenerator
logLevel: INFO
message:
<jediTaskID=9672755
datasetID=101428269>
successfully submitted 25/25
for VO=atlas cloud=None
queue=user status=running

**KV filter
(from the
message field)**

jediTaskID: 9672755
datasetID: 101428269
VO: atlas
cloud: None
queue: user
status: running

**Ruby filter
(from the
message field)**

jobs_submitted: 25
jobs_tried: 25

**Output
result**

timeEvent: 2016-10-20
01:37:16,377
logName:
panda.log.JobGenerator
logLevel: INFO
jediTaskID: 9672755
datasetID: 101428269
VO: atlas
cloud: None
queue: user
status: running
jobs_submitted: 25
jobs_tried: 25

Examples: Panda server health metrics

pandalogs - avg request execution time by host

- aipanda034.cern.ch
- aipanda037.cern.ch
- aipanda036.cern.ch
- aipanda035.cern.ch
- aipanda032.cern.ch
- aipanda030.cern.ch
- aipanda031.cern.ch
- aipanda033.cern.ch

Average response time (seconds)

Timestamp per 30 minutes

Possibility to filter by host

pandalogs - request count by host

- aipanda034.cern.ch
- aipanda031.cern.ch
- aipanda030.cern.ch
- aipanda036.cern.ch
- aipanda035.cern.ch
- aipanda032.cern.ch
- aipanda037.cern.ch
- aipanda033.cern.ch

Request count

Timestamp per 30 minutes

Integration with BigPanDA monitoring. Logs page

Logs	Tasks and Jobs	Prod job brokerage	Analy job brokerage	Throttle: queued vs running

JEDI

Type	Level(count)
atlasprodtaskbroker (?)	INFO(14687) DEBUG(2345)
atlasanaljobbroker (?)	INFO(4216525) ERROR(4063)
atlasprodjobbroker (?)	INFO(919857) ERROR(678)

Type	Level(count)
jobgenerator (?)	DEBUG(1378069) INFO(262862) WARNING(2) ERROR(4771)
atlasprodjobthrottler (?)	INFO(83318) WARNING(15829) ERROR(1)
jobsplitter (?)	DEBUG(495025)

Tooltip

Type	Level(count)
taskrefiner (?)	
postprocessor (	Generates tasks in JEDI from definitions found in DEFT
taskcommando (?)	ERROR(2202)
atlastasksetupper (?)	INFO(606763) ERROR(15)

PANDA Server

Type	Level(count)
retrialmodule (?)	INFO(36999) ERROR(3)
dbproxyfiltered (?)	INFO(70979) ERROR(13357)
serveraccess (?)	INFO(8202664)
entry (?)	INFO(7990110) ERROR(36)
userif (?)	INFO(72)
pilotrequest (?)	DEBUG(3717655) INFO(1235203)
servererror (?)	INFO(22364)

Type	Level(count)
activatorlog (?)	DEBUG(43772)
copyarchive (?)	DEBUG(7088)
finisher (?)	DEBUG(604927)

Log types ordered by interest

Log level and number of entries

Integration with BigPanDA monitoring. Dashboards implementation
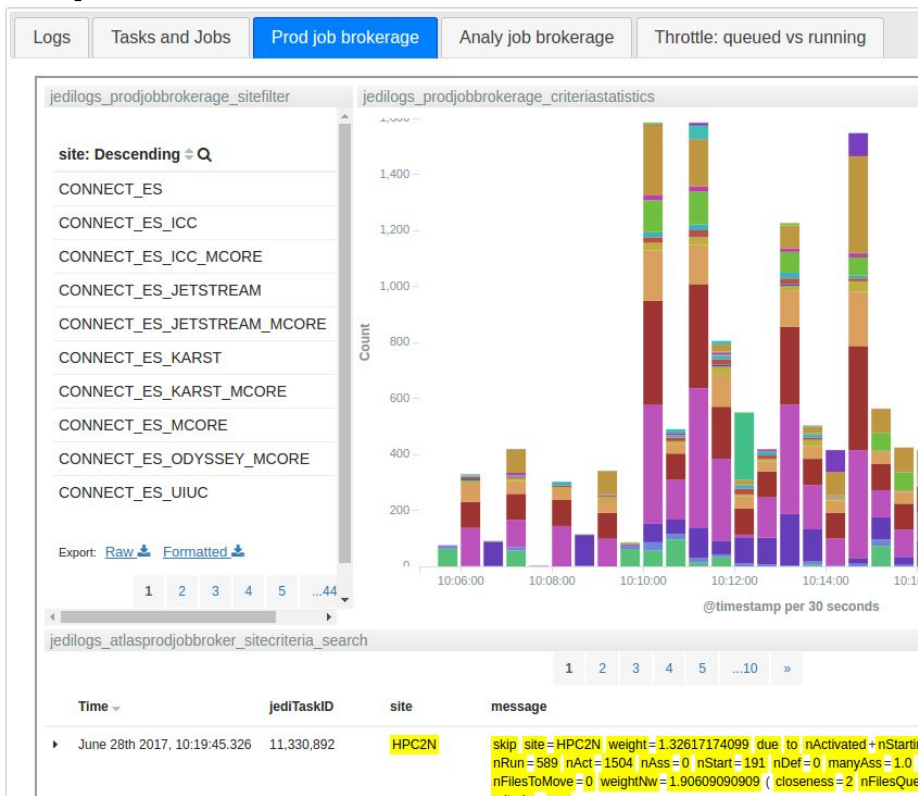
Notification system. Example of notification message

Reply | Reply All | Forward | | X | Junk | Close

Error from aipanda107.cern.ch
noreply@mail.cern.ch [noreply@mail.cern.ch]

Sent: 04 September 2017 07:33
To: Aleksandr Alekseev; Tatiana Korchuganova; Siarhei Padolski

Error description

```
2017-09-04 05:33:27,025 Internal Server Error: /esatlaslogger/ Traceback (most recent call last): File
"/data/wenaus/virtualenv/twrpm/lib/python2.7/site-packages/django/core/handlers/exception.py", line 39, in inner response = get_response(request) File
"/data/wenaus/virtualenv/twrpm/lib/python2.7/site-packages/django/core/handlers/base.py", line 249, in _legacy_get_response response =
self._get_response(request) File "/data/wenaus/virtualenv/twrpm/lib/python2.7/site-packages/django/core/handlers/base.py", line 187, in _get_response
response = self.process_exception_by_middleware(e, request) File "/data/wenaus/virtualenv/twrpm/lib/python2.7/site-
packages/django/core/handlers/base.py", line 185, in _get_response response = wrapped_callback(request, *callback_args, **callback_kwargs) File
"/data/wenaus/virtualenv/twrpm/pythonpath/core/../core/views.py", line 9438, in esatlasPandaLogger cat = pandaDesc[agg['key']][0] KeyError:
u'panda.log.Watcher'
```

```
More information here:
->https://es-atlas.cern.ch/kibana/app/kibana#/discover?_g=(refreshInterval:(display:Off,pause:!f,value:0),time:(from:'2017-09-
04T05:31:00.000Z',mode:absolute,to:'2017-09-04T05:35:00.000Z'))&_a=(columns:!(request),index:'atlas_bigpanda-*',interval:auto,query:(query_string:
(analyze_wildcard:!t,lowercase_expanded_terms:!f,query:'*')),sort:!('@timestamp',desc))<-
```

Detailed information

Notification system. Information about error in ES

Total entries within 4 minutes

Django log with error description

Apache log with user request

Summary

- **Logstash infrastructure is set up to process PanDA server, JEDI and BigPanda logs**
  - 67 filters for PanDA, JEDI and BigPanDA logs are ready and in production
- **Improve the lifetime model of the logs**
  - for the moment we are only keeping all of them 20 days
- **The system has a lot of potential to monitor, investigate and understand PanDA and ProdSys**
  - The infrastructure is ready and several dashboards for real-life issues have been implemented
  - We need to continue looking/understanding the data and identify further necessary visualizations
- **Results were integrated with BigPanDA monitoring**
  - The special page with was created in BigPanDA monitoring
  - Further integration points with BigPanDA will be added
- **Notification system was created**
  - Error messages are sent to the BigPanDA developers immediately
  - Error messages are stored in ES

Thank you for your attention!