The BigPanDA self-monitoring alarm system for ATLAS

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Outline

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- State-of-the-art approaches for monitoring of distributed systems
- Architecture of BigPanDA self-monitoring alarm system
- Processing notification messages stream
- Structure of notification message
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Motivation

- **BigPanDA** is a monitoring system which provides a comprehensive and coherent view of the tasks and jobs executed by the PanDA system, from high level summaries to detailed drill-down job diagnostics (*The BigPanDA monitoring system architecture, Korchuganova T. et al., Grid 2018*).

- Highly loaded service for analysis of Big Data in real-time
- ~35 000 requests to the system per day, including ~25 000 JSON requests
- Multicomponent/multi-module distributed service
  - 7 nodes + 1 node are working in load-balancer mode
  - Web-server (Apache), Load-balancer (Nginx), Database (Oracle), Distributed cache (Redis)
  - External authentication providers (CERN, Google, GitHub)

![Usage statistics](image-url)
Classification of BigPanDA system errors

- Internal BigPanDA system errors:
  - View errors (e.g. wrong variable type, none values, etc)*
  - User errors (e.g. wrong url requests to bigpanda system)
- External systems errors:
  - Database errors (e.g. exceeding the number of simultaneous sessions or Oracle database not available)*
  - Extended libraries errors (e.g. social-auth lib)
  - Cache errors (e.g redis not available)*
  - Extended components errors/critical problems (e.g. Apache, Nginx performance issues)
- Superfluous requests (DoS-attack, irresponsible user behavior)

* Critical
State-of-the-art approaches for monitoring of distributed systems

- Simple Network Management Protocol (SNMP)
- Logs

```plaintext
#Software: Microsoft Internet Information Services 8.0
#Fields: date time s-sitename cs-method cs-uri-stem cs-uri-query s-port cs-username c-ip cs(User-Agent) cs(Cookie) cs
2017-02-15 13:54:26 AZUREOVERVIEW__522C GET /X-ARR-LOG-ID=8b90ffae-54b1-43c7-abaa-af0fcb759fac 80 - 141.101.76.74 M
2017-02-15 13:54:26 AZUREOVERVIEW__522C GET /css/site.min.css X-ARR-LOG-ID=3a3cd496-76fe-42a4-be99-7e34fb69aa63 80 -
```
State-of-the-art approaches for monitoring of distributed systems

- Development of notification system using third-party libraries
- Using third-party monitoring software
  - Based on SNMP protocol (-) to adapt BigPanDA project for SNMP
    - Solarwinds Server and Application Monitor (SAM)
      + great capabilities for visualization, easy to install and set up
      - commercial, windows platform
    - Zabbix
      + open-source, integrating Django application metrics into Zabbix
      - need to install Agents, complicated customization for specific tasks
    - Nagios
      + open-source, easy to set up
      - customization and updates are bit difficult
  - Based on analysis of logs (-) online services
    - Graylog
      + open-source, rich opportunities for processing logs
    - ELK-stack (Logstash, Elasticsearch and Kibana)
      + open-source, rich opportunities for processing logs, existing ATLAS infrastructure
      - filters should be developed, need to install Filebeat
ELK - stack

- **Logstash** is an special open source software for collecting, filtering and normalizing logs. It is used to collect log events from different log types using special filters.

- **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.
Architecture of BigPanDA self-monitoring alarm system

System design diagram
Processing notification messages stream

- **Application logs.** Filtered by “Internal Server Error” condition. Catch the following errors:
  - Oracle database related
  - Django (framework) related
  - Social-auth lib related

- **Web-server logs.** Log types “port80_access” or “bigpanda_access_ssl” and size of message “538” bytes

- **Filtration efficiency.** ~4000 notification candidates generated daily. Most of them are from broken connections. The system delivers only tiny part of errors (~10) which require a BigPanDA operator attention

- **An error description** collected from the different log types and aggregated into one message
Structure of notification message

Error description


More information here:
https://es-atlas.cern.ch/kibana/app/kibana#/discover?_g=(refreshInterval:(display:Off,pause:If,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:fl,query:'*')),sort:!(@timestamp,desc))

Detailed information
Structure of notification message

- **Django log with error description**
- **Apache log with user request**
- **Total entries within 4 minutes**

![Graph showing time and request details with entries]

3. September 4th, 2017, 12:33:15.000 /etc/nginx logging/
Summary

● ELK based self-monitoring system for BigPanDA was developed
● The system is in production since May 2017 and processes ~1 million log messages daily
● Logstash filters for BigPanDA logs processing were developed. Self-monitoring brings attention to the errors which require human intervention
● Error messages are sent to the BigPanDA developers immediately and available via Kibana dashboards
● Monitoring different components of BigPanDA monitoring system
  ○ Apache, Nginx
  ○ Oracle database
  ○ Social-auth library
● **Leads to better understanding of BigPanDA production behaviour and system insights.** A patch for Nginx load balancer, WSGI garbage collector, DDoS protection mechanism implemented using obtained insights
● Our development can be adapted to other Web-based distributed systems in HEP and beyond
Effect of implementation

- Decreased number of 500 Internal server errors:
  - 13

- All errors

- 500 Internal server error
Thank you for your attention!
Backup slide

- Notification messages with total sessions and total active sessions count
  - Based on PandaDB
  - Sessions count > 50

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Error from aipanda108.cern.ch
noreply@mail.cern.ch [noreply@mail.cern.ch]

Sent: 15 May 2018 06:26
To:  Aleksandr Alekseev; Tatiana Korchuganova; Siarhei Padolski


More information here:
https://es-atlas.cern.ch/kibana/app/kibana#/discover?_g=(refreshInterval:(display:Off,pause:!f,value:0),time:(from:'2018-05-15T04:24:00.000Z',mode:absolute,to:'2018-05-15T04:28:00.000Z'))&_a=(columns:! (request),index:'atlas_bigpanda-*',interval:auto,query:(query_string:(analyze_wildcard:!t,lowercase_expanded_terms:!f,query:'type:%22djangolog%22%20OR%20response:%22500%22')),sort:!( '@timestamp',desc))<-
Backup slide

- Notification messages with internal server error description. Based on `port80_access` or `bigpanda_access_ssl` logs

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noreply@mail.cern.ch [noreply@mail.cern.ch]

**Sent:** 15 May 2018 06:26

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Backup slide

- Notification messages with full description of Social-auth library error. E.g Session value state error

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