Monitoring system for large and federated datacenters

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OUTLINE

• **Initial development**: Dashboard for ALICE computing in Italy
• **Evolution**: Monitoring for large and distributed centers
• **Application for O2**: Contribution to WP8 (modular stack)
• **Outlook**
DASHBOARD FOR THE ALICE COMPUTING IN ITALY

Motivation:

• Concentrate in a single graphical interface all the information concerning the ALICE activity in each site (MonALISA, local Batch system, local Monitoring system metrics)

• Concentrate in a custom graphical interface all the needed information concerning the ALICE activity in Italy

• Provide a better debug tool using real-time value coming from multiple sources
DASHBOARD FOR THE ALICE COMPUTING IN ITALY

• The Bari site was used as testbed and the Dashboard is active and running from Oct 2014

• Currently it is running in all ALICE T2 and WLCG sites in Italy from Nov 2016

• Presented to CHEP’ 16
The Dashboard system consists of:

- **InfluxDB**, an open source time-series database
- **Grafana**, dashboard builder with powerful visualization features for time series data
- **Sensors**, python scripts able to gather data from datasources and send them to the database
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DASHBOARD FOR THE ALICE COMPUTING IN ITALY

Bari Storage activity
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DASHBOARD FOR THE ALICE COMPUTING IN ITALY

Bari Batch system activity
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DASHBOARD FOR THE ALICE COMPUTING IN ITALY

Italian computing activity
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MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Designing of a monitoring system able to support the management of large and distributed datacenters

Key features:

• Collecting heterogenous data from different data sources:
  • Services
  • Cloud platform (OpenStack)
  • Hardware Devices

• Analysis on the gathered data:
  • Anomaly Detector
  • Root Cause Analysis
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MONITORING FOR LARGE AND DISTRIBUTED CENTERS

• Anomaly Detector

• Root Cause Analysis
Testbed: Datacenter ReCaS in Bari

- 128 server with 8192 cores
- Disk space: 3.5 PB
- Tape: 2.5 PB
- Cloud platform: OpenStack
- Cluster HPC composed of 20 servers with 800 cores
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MONITORING FOR LARGE AND DISTRIBUTED

- Syslog
- Zabbix
- HTCondor
- Ceilometer
- OpenStack

- Flume Syslog
- Flume HTTP
- Kafka
- Spark Streaming / Spark
- HBase

- Flume InfluxDB
- Flume ElasticSearch
- Flume HDFS

- Grafana
- InfluxDB
- ElasticSearch
- Kibana

Zeppelin

Apache Spark
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MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Data sources:

• Syslog:
  • Information on system processes
  • 5 - 6 million of logs per day
  • Stored more than 70 GB starting from 18 November 2016
Data sources:

- Syslog
- Zabbix:
  - Resource usage of nodes, information on OpenStack components and services
  - Sensor written in Python
  - Sampled 42000 values every 10 minutes
  - Collected 3 GB starting from 19 July 2016
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MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Data sources:

• Syslog
• Zabbix
• HTCondor:
  • Scheduler states, completed and running job information
  • Sensor written in Python
  • Sampled 750000 values every 5 minutes
  • Collected 11 GB starting from 18 July 2016
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MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Data sources:

• Syslog
• Zabbix
• HTCondor
• Openstack + Ceilometer:
  • Resource usage and services information
  • Sensor being written in Python
MONITORING FOR ...

Transport layer:

• Apache Flume
  • Distributed, reliable, and available service for efficiently collecting, aggregating and moving large amounts of log data.
  • Robust, fault tolerant and provides ready-to-use interfaces

• Apache Kafka
  • Distributed streaming platform, reliable and allows data replication on multiple nodes

• Apache Flume + Kafka (aka Flafka)
  • Take advantage of both
MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Storage:

• HDFS (Hadoop Distributed File System)
  • Used as long term storage of batch jobs

• HBase
  • Very fast key-value database on top of HDFS
  • Serve real-time requests

• InfluxDB
  • With Grafana, used to visualize time-series data

• ElasticSearch
  • With Kibana, used to plot information about log data
MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Processing Components:
• Apache Spark:
  • Execute batch jobs on data stored in HDFS
• Apache Spark Streaming:
  • Execute real-time analysis on acquired data

Support Components:
• Spark SQL, Spark GraphX, Spark MLlib, Apache Zeppelin
O2 WP8 CONTRIBUTION - MISSION

- **Data Collection** of system monitoring, infrasstructure monitoring and application monitoring (~600 kHz)
- **Processing** like Data suppression, Data enrichment, Data aggregation and Data correlation.
- **Storage**
- **Graphical display**

Three main alternative options currently under evaluation:
- MonALISA, Modular Stack, Zabbix
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**O2 WP8 CONTRIBUTION – MODULAR STACK**

Different tools used to accomplish the goal:

- **CollectD**, used to collect host information
- **Apache Flume**, used as transport layer
- **InfluxDB**, used as TimeSeries Database
- **Grafana**, used as Dashboard for Timeseries data
OUTLOOK

• Implement algorithms for Anomaly Detector and Root Cause Analysis
• Use Apache Mesos or DC/OS as resource manager
• Design and implement bottleneck analysis
• Test the project on multiple datacenters

• Finalize system choice for O2 monitoring
• Upgrade of the Dashboard of ALICE activity in Italy using the knowledge acquired on Apache components
THANKS FOR YOUR ATTENTION