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
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DASHBOARD FOR THE ALICE COMPUTING IN ITALY

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
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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- Anomaly Detector

- Root Cause Analysis
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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
- Flume (InfluxDB)
- Flume (ElasticSearch)
- Flume (HDFS)
- Spark Streaming / Spark
- HBase
- Zeppelin

Tools:
- Grafana
- kibana
- InfluxDB
- ElasticSearch

Technology Stack:
Data sources:

• Syslog:
  • Information on system processes
  • 5 - 6 million of logs per day
  • Stored more than 70 GB starting from 18 November 2016
MONITORING FOR LARGE AND DISTRIBUTED CENTERS

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
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
MONITORING FOR LARGE AND DISTRIBUTED CENTERS

Data sources:

- Syslog
- Zabbix
- HTCondor
- Openstack + Ceilometer:
  - Resource usage and services information
  - Sensor being written in Python
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**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
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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
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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, infrastructure 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
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