

# 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**

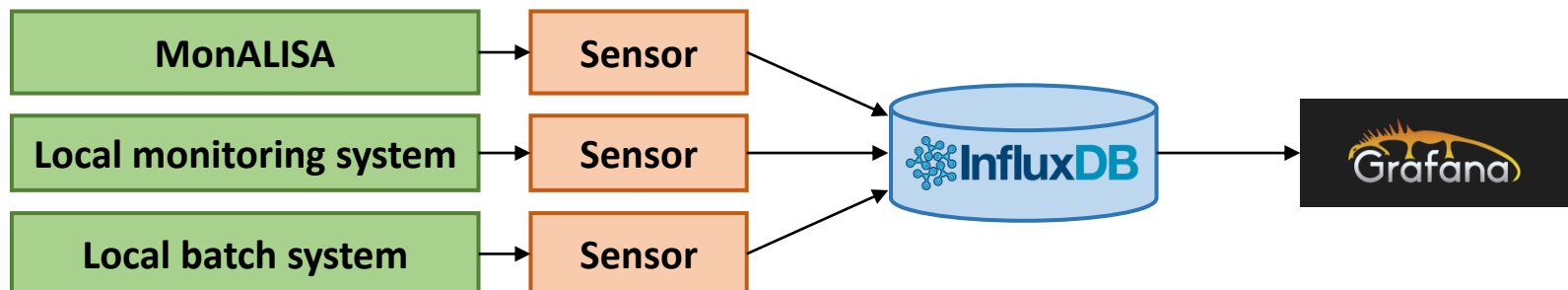
## **DASHBOARD FOR THE ALICE COMPUTING IN ITALY**

- 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

## 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



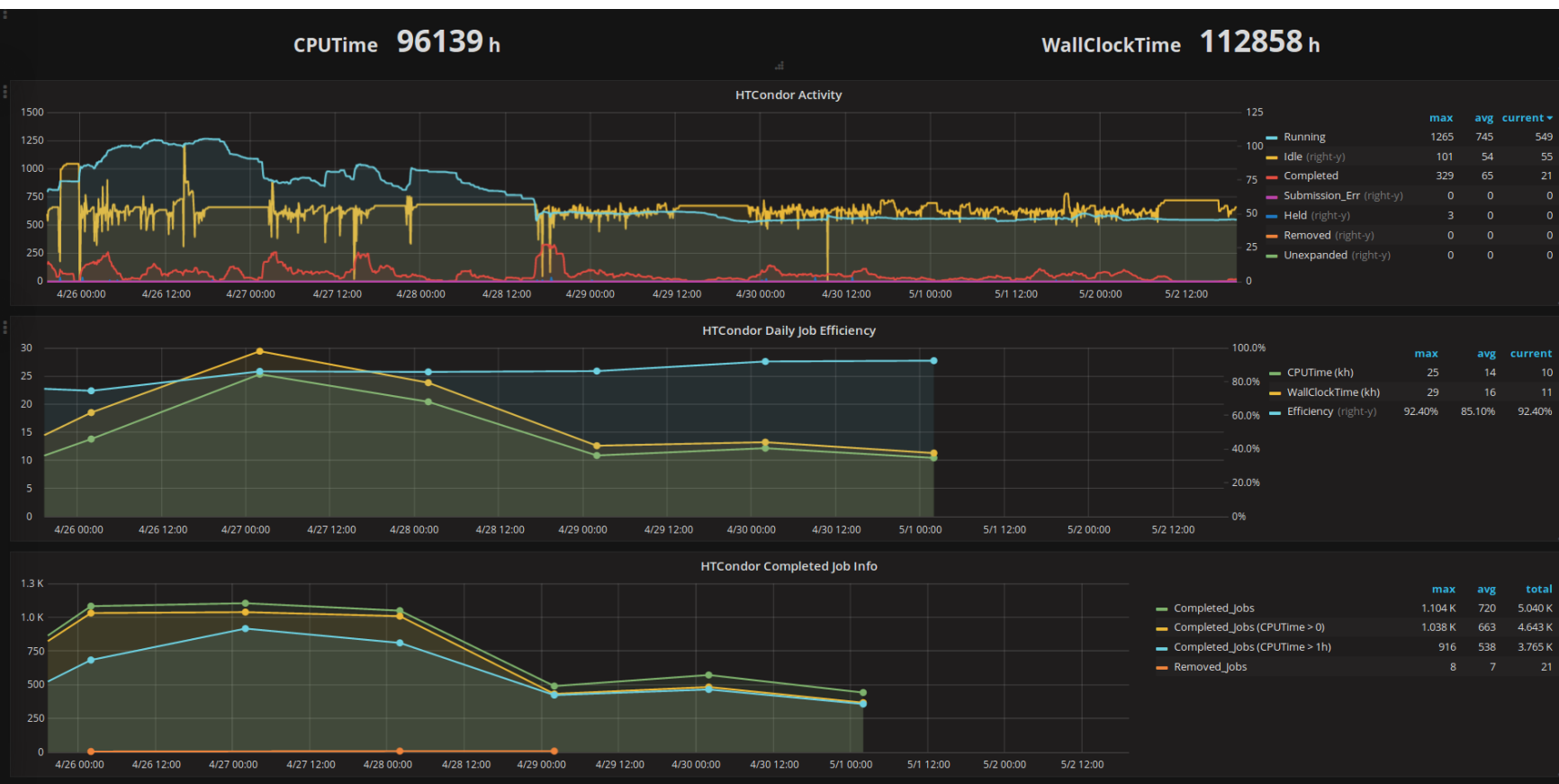
# DASHBOARD FOR THE ALICE COMPUTING IN ITALY

## Bari Storage activity



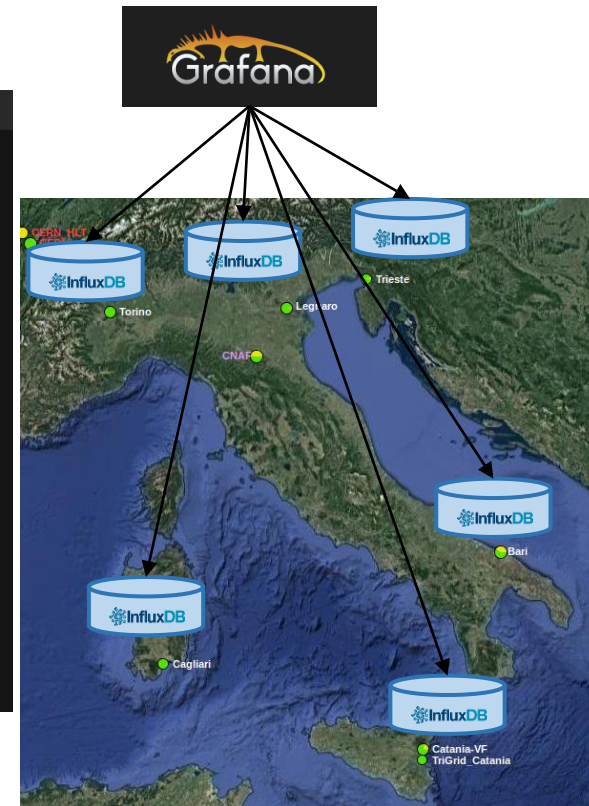
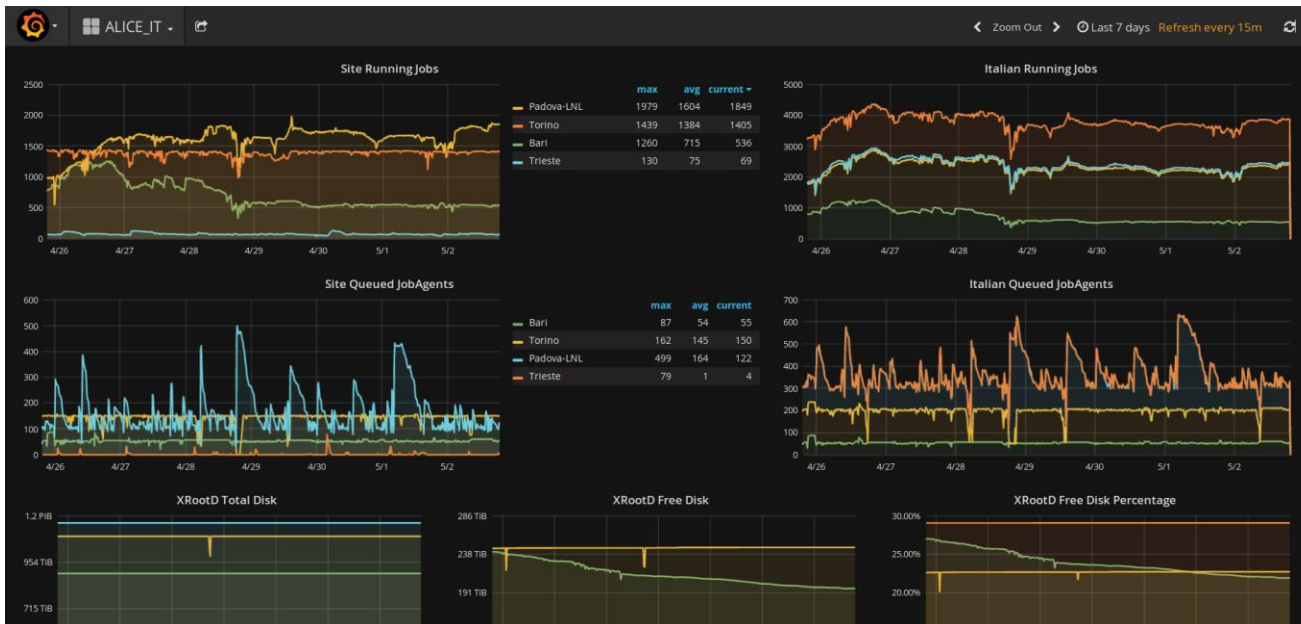
# DASHBOARD FOR THE ALICE COMPUTING IN ITALY

## Bari Batch system activity



# DASHBOARD FOR THE ALICE COMPUTING IN ITALY

## Italian computing activity





# **MONITORING FOR LARGE AND DISTRIBUTED CENTERS**

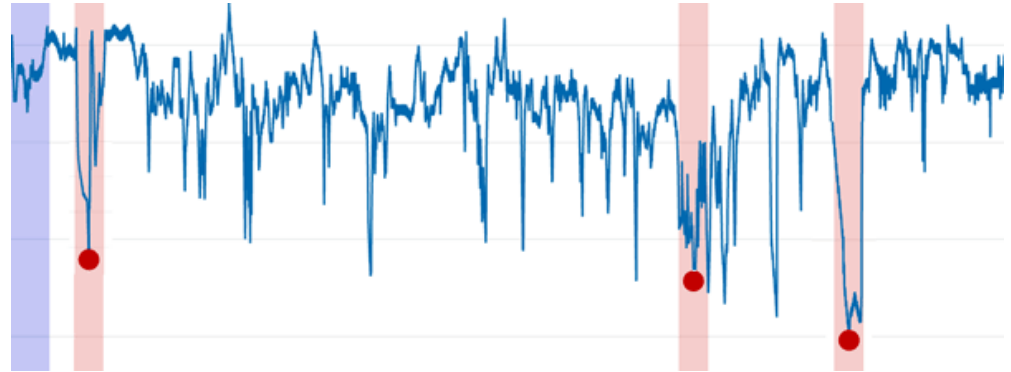
Designing of a monitoring system able to support the management of large and distributed datacenters

## **Key features:**

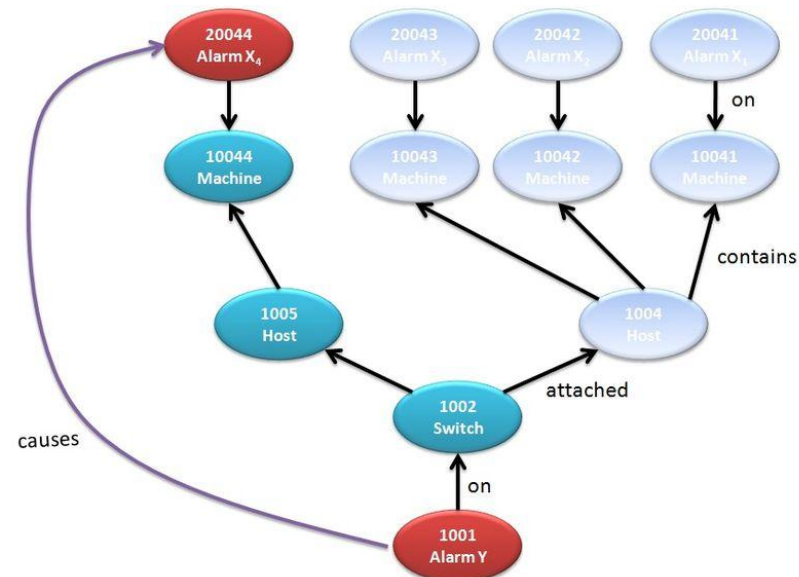
- Collecting heterogenous data from different data sources:
  - Services
  - Cloud platform (OpenStack)
  - Hardware Devices
- Analysis on the gathered data:
  - Anomaly Detector
  - Root Cause Analysis

# MONITORING FOR LARGE AND DISTRIBUTED CENTERS

- Anomaly Detector



- Root Cause Analysis



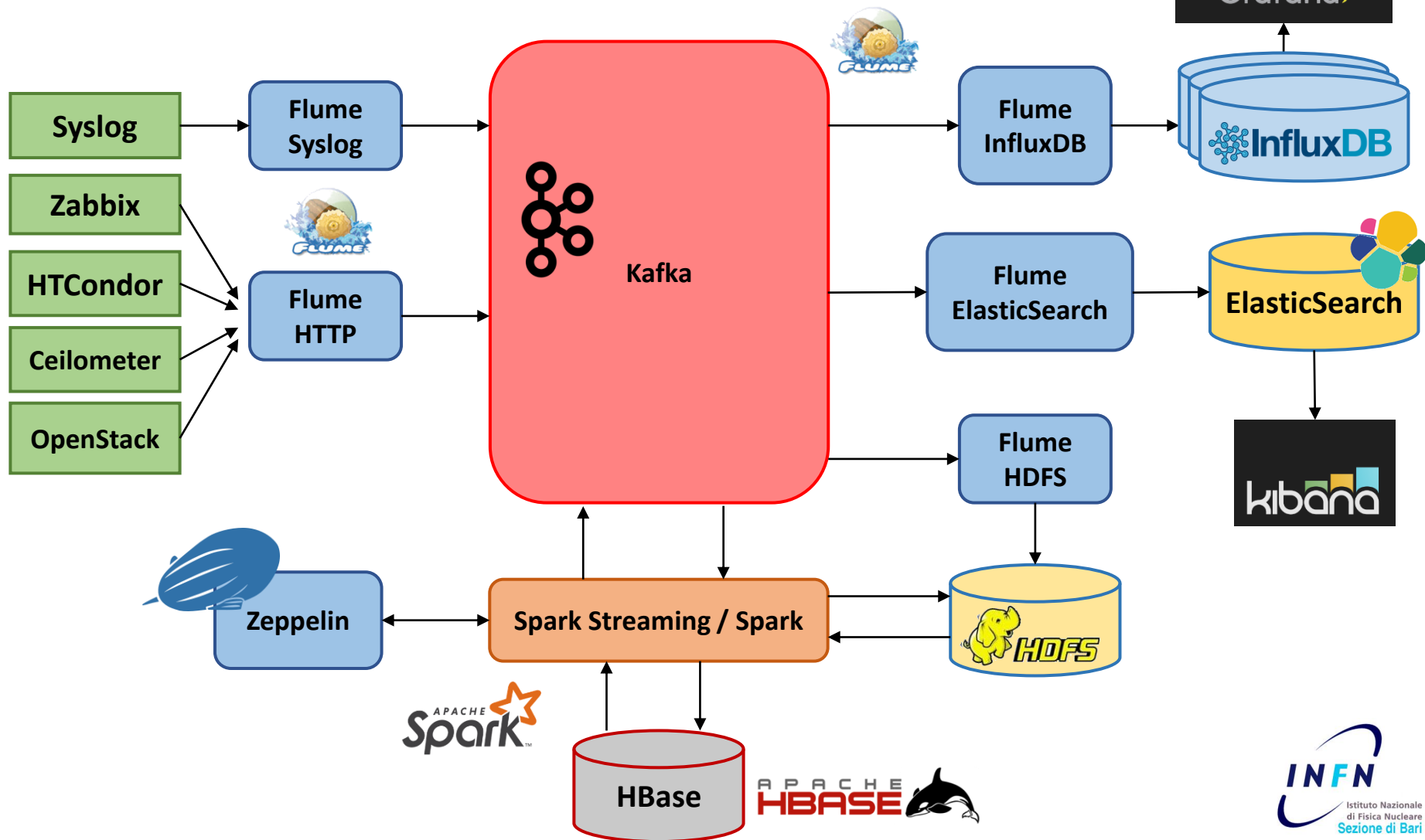
## MONITORING FOR LARGE AND DISTRIBUTED CENTERS

### 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



# MONITORING FOR LARGE AND DISTRIBUTED



# 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

# 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



## MONITORING FOR ...

### Transport layer:

- Apache Flume

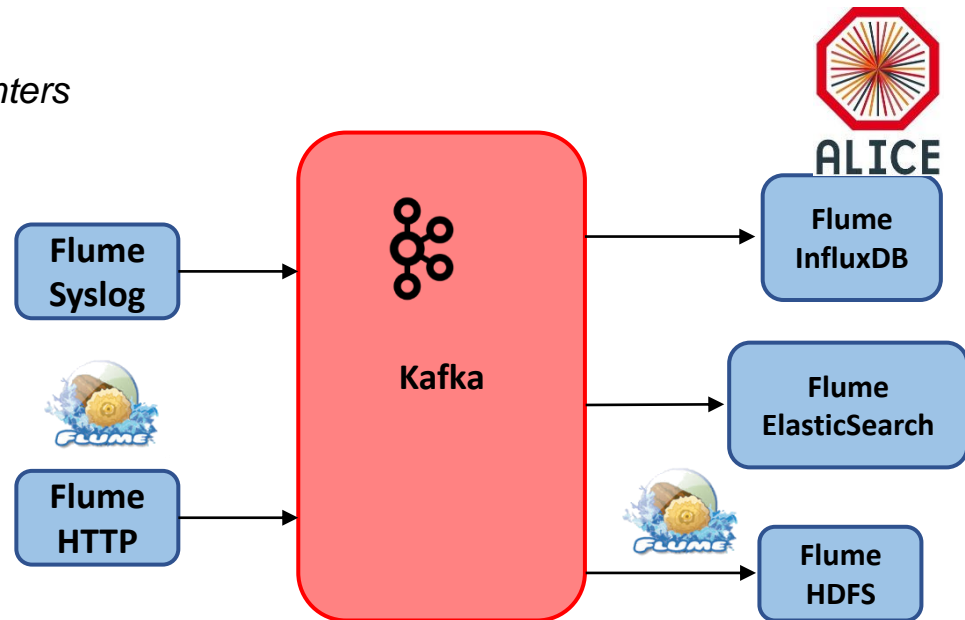
- Distributed, reliable, and available service for efficiently collecting, aggregating and moving large amounts of log data.
- Robust, fault tolerant and provides ready-to-use interfaces

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

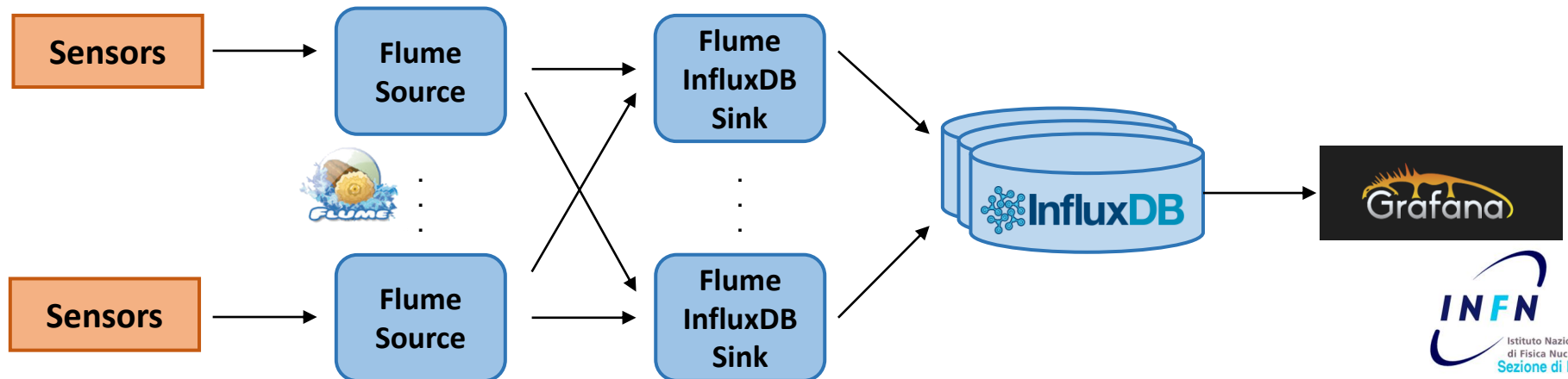
Three main alternative options currently under evaluation:

- MonALISA, Modular Stack, Zabbix

## 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**