IT Monitoring Service
Status and Progress

Outline

• Monitoring Overview
• DC Monitoring with Collectd
Monitoring

Data Centres Monitoring
- Monitoring of DCs at CERN and Wigner
- Hardware, operating system, and services
- Data Centres equipment (PDUs, temperature sensors, etc.)

Experiment Dashboards
- WLCG Monitoring
- Sites availability, data transfers, job information, reports
- Used by WLCG, experiments, sites and users

Both hosted by CERN IT, in different teams

Mandate
- Regroup monitoring activities hosted by CERN/IT (Data Centres, Experiment Dashboards and others)
- Continue existing services, but conform with CERN IT practices
Data Centres Monitoring

<table>
<thead>
<tr>
<th>COMPUTING</th>
<th>STORAGE</th>
<th>NETWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Servers (Meyrin)</td>
<td>Disks (Meyrin)</td>
<td>Star Points</td>
</tr>
<tr>
<td>14.3 K</td>
<td>86.1 K</td>
<td>657</td>
</tr>
<tr>
<td>Cores (Meyrin)</td>
<td>Tape Drives</td>
<td>Routers</td>
</tr>
<tr>
<td>169 K</td>
<td>104</td>
<td>223</td>
</tr>
<tr>
<td>Servers (Wigner)</td>
<td>Disks (Wigner)</td>
<td>Switches</td>
</tr>
<tr>
<td>3.5 K</td>
<td>29.7 K</td>
<td>3.7 K</td>
</tr>
<tr>
<td>Cores (Wigner)</td>
<td>Tape Cartridges</td>
<td>Wifi Points</td>
</tr>
<tr>
<td>56.0 K</td>
<td>23.3 K</td>
<td>2.0 K</td>
</tr>
</tbody>
</table>

Graphs showing data on batch jobs, EOS active data transfers, file transfer throughput, virtual machines created, database transactions, and Wigner network links.
Experiment Dashboards

- Operation Teams
- Sites
- Data Management Monitoring
  - Data transfer
  - Data access
- Job Monitoring
  - Analysis + Production
  - Real time and Accounting views
- Outreach
- General Public
- Google Earth Dashboard
- Infrastructure Monitoring
  - Site Status Board
  - SAM3

300-500 users per day
Experiment Dashboards

- Job monitoring, sites availability, data management and transfers
- Used by experiments operation teams, sites, users, WLCG
Mandate

- Regroup monitoring activities hosted by CERN/IT
  - Data Centres, WLCG and Experiment Dashboards
  - ETF, HammerCloud
- Uniform with CERN IT practices
- Management of services, communication, tools (e.g. GGUS and SNOW tickets)
- Review existing monitoring usage and needs (IT, WLCG, etc)
- Investigate established open source technologies
- Continue support while we prepare the new service
Architecture and Data Flow
Unified Monitoring Architecture

Data Sources
- FTS
- Rucio
- XRoad
- Jobs
- ...
- Lemon
- syslog
- app log

User Data
- AMQ
- DB
- HTTP feed
- Logs
- Lemon metrics
- Flume AMQ
- Flume DB
- Flume HTTP
- Flume Log GW
- Flume Metric GW

Transport
- Kafka cluster (buffering)

Processing
- Data enrichment
- Data aggregation
- Batch Processing

Storage & Search
- Flume sinks
- HDFS
- Elastic Search
- Others (influxdb)

Data Access
- UserViews
- Kibana
- Grafana
- AppStack

Today: 500 GB/day, 48h Kafka
Unified Data Sources

- Data is all channeled via Flume via gateways
- Validated and normalized if necessary (e.g. standard names, date formats)
- Adding new Data Sources is documented and fairly simple
- Collecting Metrics (IT, WLCG, etc.) and Logs (hw logs, OS logs, syslogs, app logs)
Unified Processing

Proven useful many times

Transport

Kafka cluster (buffering) *

Processing

(e.g. Enrich FTS transfer metrics with WLCG topology from AGIS/Gocdb)

Flume sinks

Flume sinks

Flume sinks

User Jobs

Flume

Kafka sink

Flume Kafka sink
Data Processing

Stream processing
Data enrichment
  • Join information from several sources (e.g. WLCG topology)

Data aggregation
  • Over time (e.g. summary statistics for a time bin)
  • Over other dimensions (e.g. compute a cumulative metric for a set of machines hosting the same service)

Data correlation
  • Advanced Alarming: detect anomalies and failures correlating data from multiple sources (e.g. data centre topology-aware alarms)

Batch processing
  • Reprocessing, data compression, reports
Unified Access

- Multiple data access methods (dashboards, notebooks, CLI)
- Dashboards, reports and access via scripts
- Mainstream and established technologies
Outline

- Monitoring Overview
- DC Monitoring with Collectd
New DC Monitoring using collectd

- Lemon Agent is the last component in production from the old Lemon/DC Monitoring
- Moving to collectd
  - collect system and service metrics
  - optimized to handle thousands of metrics
  - modular and portable with hundreds of plugins available
  - easy to develop new plugins in Python/Java/C
  - continuously improving and well documented
Collect Data Source

Data Sources
- FTS
- Rucio
- XRootD
- Jobs
- User Data
- Lemon
- syslog
- app log
- collectd
- LogStash

Transport
- Flume AMQ
- Flume DB
- Flume HTTP
- Flume Log GW
- Flume Lemon Metric GW
- Flume Metric GW
- Flume Kafka sink

- Only component to add and use the full MONIT infrastructure
- All existing IT monitoring will be replaced (meter, notifications, dashboards)
Collectd Data Source

Sampling

Client on the host

Enrichment
(e.g. host information, environment)

Monitoring Infrastructure

Validation Transformation
# Collectd Metrics and Plugins

<table>
<thead>
<tr>
<th>Lemon Metric Classes</th>
<th>Lemon Sensors</th>
<th>Collectd Support</th>
<th>Collectd Plugin</th>
</tr>
</thead>
<tbody>
<tr>
<td>file.ssltime</td>
<td>file</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>system.CPUInfo</td>
<td>linux</td>
<td>?</td>
<td></td>
</tr>
<tr>
<td>system.mempinfo</td>
<td>linux</td>
<td>Official</td>
<td><a href="https://collectd.org/wiki/index.php/Plugin:Memory">https://collectd.org/wiki/index.php/Plugin:Memory</a></td>
</tr>
<tr>
<td>system.memoryShared</td>
<td>linux</td>
<td>Official</td>
<td><a href="https://collectd.org/wiki/index.php/Plugin:Memory">https://collectd.org/wiki/index.php/Plugin:Memory</a></td>
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<tr>
<td>system.memoryStats</td>
<td>linux</td>
<td>Official</td>
<td><a href="https://collectd.org/wiki/index.php/Plugin:Memory">https://collectd.org/wiki/index.php/Plugin:Memory</a></td>
</tr>
<tr>
<td>system.networkInterfaceInfo</td>
<td>linux</td>
<td>?</td>
<td></td>
</tr>
</tbody>
</table>
Replacement Strategy

1. Use an existing collectd plugin (recommended)
   • Straightforward: main logic can be reused
   • Many similarities at API level
     • registerMetric() => register_read()
     • storeSample() => dispatch()

2. Extend standard collectd plugin
   • Requires development

3. Run lemon sensor using collectd wrapper
Services Provided

Monitor, collect, visualize, process, aggregate, alarm

- Metrics and Logs

Infrastructure operations and scale

Helping and supporting

- Interfacing new data sources
- Developing custom processing, aggregations, alarms
- Building dashboards and reports
Reference and Contact

Dashboards (CERN SSO login)
Kibana: monit.cern.ch
Grafana: monit-grafana.cern.ch

Contact/Requests (SNOW or email)
cern.ch/monit-support
monit-support@cern.ch

Early-Stage Documentation
cern.ch/monitdocs
Examples

- Kibana
- Grafana
- Zeppelin
monit.cern.ch

- Kibana homepage

Data Available
- FTS
- XRootD
- Job Monitoring Real-Time
- Job Monitoring Accounting
- SAM raw data
  - ETF
  - ALICE

Examples

Documentation

Link to Custom Projects
Transfer failures over IPV6
Success and failures from a src_site or a domain
Investigate and filter for a specific error.
Filter and then access the raw data and logs
Site Overview showing:
- FTS
- Jobs
- ETF
Grafana

Access several sources in the same dashboard

METER and MONIT
Grafana (in dev)
Notebooks with Zeppelin

Extract Data from HDFS or ES
Manipulate the data and plot with common languages and tools

Python
Scala
numpy
Notebooks with Swan
Extract Data from ES
ROOT
Python
C++
CVMFS
Sending Logs
- ES
- HDFS

OpenStack data
OpenStack

Custom fields from logs
OpenStack dashboards
Job Monitoring

Real Time and Accounting

Filter by Site, User, cores, etc.
Site Overview showing
- FTS
- Jobs
- SAM Raw
cern.ch hosts
Access to raw data select by any of the fields

Important to know the structure of the data

These fields are those used for all the searches, visualizations and the filters in the Kibana dashboards in this portal. See some how they are used in the Kibana Examples.
Data on service and hosts

Select cern.ch hosts
Select the errors (CRITICAL)

See all details of the errors
Data Access

Data collected by the monitoring infrastructure can be accessed in different ways.

Dashboards

The main entry point is: https://monit.cern.ch

This service includes two main types of dashboards:

- public views: listed in the homepage
- private views: shared with a dedicated links

Use the articles in the left panel learn about:

- Monit Kibana portal
- Discovering data in the portal
- Naming conventions to follow
- Examples of Kibana dashboards

Support: To report any request or incident please refer to this support page: http://cern.ch/monit-support.
Common fields

Due to the diversity of WLCG producers, several common fields are defined across all data sets:

- data.vo
- data.user
- data.src_country / data.dst_country
- data.src_site / data.dst_site
- data.src_experiment_site / data.dst_experiment_site
- data.src_federation / data.dst_federation
- data.src_tier / data.dst_tier

For data management related producers, the following additional fields are also defined:

- data_throughput
- data.operation_time
Managed by MONIT team

Official

MONIT title (e.g. MONIT FTS Throughput)

Examples

EXAMPLE title (e.g. EXAMPLE FTS Transfers Plots)

Managed by MONIT users

Users

_user account title (e.g. _user john doe FTS Error Investigation)

Projects

_project projectname title (e.g. _project FTS C5 Report)

VOs

_vo vo name title (e.g. _vo CMS FTS Error Investigation)

Sites

_site sitename title (e.g. _site IN2P3 Site Overview or _site INFN Global Overview)
Access to the raw data and to plot and select by any of the fields.

ES Documents and Fields

You will then be able to see all fields in each document and the more popular fields.

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Architecture: Security

Stream processing (enrichment, aggregation)

1) Krb AuthN + SSL
2) Base AuthN + SSL
3) IP Filtering
4) SSO

ACLs on folders
ACLs on indices
ACLs on topics
ACLs on DBs

AMQ (FTS)
DB (Panda)
HTTP (AGIS)
Collectd
Logs (EOS)

kafka

InfluxDB

CLIs
APIs

26/04/17 MONIT Infrastructure 55