The AliEn Grid monitoring with MonALISA

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- Requirements
- What we monitor
- MonALISA overview
- Monitoring architecture in AliEn
- Examples
Why we need monitoring

- Worldwide distributed system
  - Various platforms
  - Various error conditions
  - Various software
- Key parameters
  - System status
  - Resource usage
- Debugging
- Correlating events
- Taking automated actions based on the monitored data
Requirements

- Global view of the distributed system
- Non-intrusiveness
- Accuracy
- Near real-time image of the status
- Long-term history of aggregated data
What we monitor

- AliEn Components
  - Central Services
    - Task Queue, Information Service, Optimizers, API etc.
  - Site Services
    - Cluster Monitor, Computing & Storage Elements
    - Job Agents
  - Jobs status & resource usage

- Other Services
  - CastorGrid staging & migration, Xrootd, MySQL

- Nodes
  - Central, site, worker nodes

- Network traffic – inter & intra site
  - Via Xrootd
  - Via FTD
MonALISA overview

- MonALISA is a Dynamic, Distributed Service Architecture capable to collect any type of information from different systems, to analyze it in near real time and to provide support for automated control decisions and global optimization of workflows in complex grid systems.
ML Discovery System & Services

- The framework is based on a hierarchical structure of loosely coupled agents acting as distributed services which are independent & autonomous entities able to discover themselves and to cooperate using a dynamic set of proxies or self describing protocols.
ApMon – Application Monitoring

- Lightweight library of APIs (C, C++, Java, Perl, Python) that can be used to send any information to MonALISA Services
- High comm. performance
- Flexible
- Accounting
- Sys Mon

Lightweight library of APIs (C, C++, Java, Perl, Python) that can be used to send any information to MonALISA Services.

- High comm. performance
- Flexible
- Accounting
- Sys Mon

ApMon configuration generated automatically by a servlet / CGI script.
Actions framework

- Based on monitoring information, actions can be taken in:
  - ML Service
  - ML Repository
- Actions can be triggered by:
  - Values above/below given thresholds
  - Absence/presence of values
  - Correlation between multiple values
- Possible actions types:
  - Alerts
    - e-mail
    - Instant messaging
  - External commands
  - Event logging
Monitoring architecture in AliEn

http://pcalimonitor.cern.ch:8889/
ML Service deployment

- MonALISA is packaged and prepared for installation by the AliEn Build System (BITS)
ML Service configuration

- From site administrators point of view, it is just like any other AliEn service
  - You start it with `alien StartMonaLisa`
  - You stop it with `alien StopMonaLisa`
  - Check status with `alien StatusMonaLisa`
- Configuration files for ML are generated automatically from AliEn LDAP
Job status monitoring

- Global summaries
  - For each/all statuses
  - For each/all sites
  - For each/all users
  - Running & cumulative
- Error statuses
- From job agents
- From central services
- Real-time map view
- Integrated pie charts
- History plots
Job status & traffic - real-time map
Job status – integrated pie charts

<table>
<thead>
<tr>
<th>Job status:</th>
<th>Assigned</th>
<th>Started</th>
<th>Running</th>
<th>Saving</th>
<th>Saved</th>
<th>Killed</th>
<th>Failed</th>
<th>Zombie</th>
<th>Error</th>
</tr>
</thead>
</table>

Done jobs views: 
- History
- Histogram

Sites:
- Athens
- Bari
- Birmingham
- BITP
- Bologna
- Cagliari
- Catania
- CCIN2P3
- CERN
- CERN-LN
- CERNMAC
- Clermont
- CNAF
- Cyfrowe
- FZK
- GOI
- Houston
- INHEP
- INFN
- IPP
- JINR
- KNU
- Kolkata
- LBL
- Legnaro
- Madrid
- Muenster
- NIHAM
- NIKHEF
- OSC
- PNNI
- Prague
- RAL
- RRC-KI
- SARA
- Sejong
- SNF
- SPbSU
- Subatech
- Torino
- Troitsk
- UHE

Function: Integrate

Interval selection: Last month or
- 14.10.2000
- 2000
- 15-10-2000
- 09:00

Image size:
- 800x600
- Plot

Annotations enabled

Done jobs statistics

- Athens: 87
- Bari: 767
- Birmingham: 98
- BITP: 10
- Bologna: 213
- Cagliari: 627
- Catania: 3,745
- CCIN2P3: 4,296
- CERN: 3,825
- CERN-LN: 8,239
- Clermont: 1,929
- CNAF: 5,820
- FZK: 2,272
- GOI: 40
- Houston: 9
- INHEP: 217
- INFN: 985
- ISS: 1,795
- ITHEP: 360
- JINR: 98
- KNU: 80
- Kolkata: 372
- Legnaro: 3,108
- Madrid: 2,753
- Muenster: 1,164
- NIHAM: 2,987
- NIKHEF: 1,321
- OSC: 616
- PNNI: 896
- Prague: 1,955
- RRC-KI: 740
- Sejong: 148
- SNF: 796
- SPbSU: 36
- Subatech: 544
- Torino: 948
- Troitsk: 254
- UHE: 30

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Job status – history plots

Running Jobs

Running Jobs views: Piechart | Histogram

Form | Last value | Min | Avg | Max
--- | --- | --- | --- | ---
Athens | 0 | 0 | 4.748 | 15
Bari | 13 | 13 | 37.65 | 80
Birmingham | 0 | 0 | 0 | 0
BITP | 16 | 0 | 16.62 | 35
Bologna | 5 | 0 | 4.291 | 5
Cagliari | 22 | 13 | 21.13 | 33
Catania | 135 | 85 | 155.2 | 144
CCIN2P3 | 180 | 84 | 184.1 | 234
CERN | 0 | 0 | 0.941 | 1
CERN-L | 413 | 236 | 390.0 | 591
Clusif | 50 | 20 | 42.66 | 50
CNAP | 176 | 100 | 224.7 | 340
GSI | 111 | 1 | 86.0 | 172
Houston | 7 | 0 | 25.84 | 94
IHEP | 0 | 0 | 0 | 0
IPNO | 26 | 12 | 23.29 | 25
ISS | 0 | 0 | 4.968 | 20
ITCP | 10 | 2 | 18.26 | 20
JINR | 7 | 0 | 4.365 | 8
KNU | 0 | 0 | 0 | 0
Kolkata | 20 | 0 | 15.47 | 20
LEL | 248 | 0 | 132.2 | 262
Legnaro | 93 | 41 | 88.90 | 102
Madrid | 80 | 21 | 57.56 | 88
Muenster | 0 | 0 | 0 | 0
NIHAN | 93 | 39 | 87.2 | 95
OSC | 0 | 0 | 6.976 | 34
PNPI | 37 | 9 | 33.59 | 40
Prague | 48 | 0 | 37.88 | 67
RAL | 0 | 0 | 0 | 0
RRC-KI | 27 | 1 | 21.67 | 31
Sejong | 2 | 1 | 8.715 | 10
SINP | 27 | 12 | 35.10 | 45
SPbSU | 3 | 0 | 2.965 | 4
Subatech | 15 | 7 | 13.0 | 15
Torino | 22 | 17 | 37.63 | 53
Trolsk | 8 | 6 | 7.72 | 10
UIB | 19 | 4 | 17.64 | 24
Total | 1899 | 1776
Job resource usage monitoring

- Cumulative parameters
  - CPU Time & CPU KSI2K
  - Wall time & Wall KSI2K
  - Read & written files
  - Input & output traffic (xrootd)

- Running parameters
  - Resident memory
  - Virtual memory
  - Open files
  - Workdir size
  - Disk usage
  - CPU usage

- Aggregated per site
Job agents monitoring

- From Job Agent itself
  - Requesting job
  - Installing packages
  - Running job
  - Done
  - Error statuses

- From Computing Element
  - Available job slots
  - Queued Job Agents
  - Running Job Agents
Job network traffic monitoring

- Based on Jobs’ xrootd transfers
- Aggregated statistics for
  - Sites (incoming, outgoing, site to site, internal)
  - Storage Elements (incoming, outgoing)
- On
  - Read and written files
  - Transferred MB/s
AliEn & LCG Services monitoring

- AliEn services
  - Periodically checked
  - PID check + SOAP call
  - Simple functional tests
  - SE space usage
  - Efficiency

- LCG environment and tools
  - Proxy, gsiscp, LCG CE/SE, Job submission, BDII, Local catalog, sw. area etc.
  - Error messages in case of failure
  - Efficiency

<table>
<thead>
<tr>
<th>Service</th>
<th>Site</th>
<th>Service Name</th>
<th>Included in LDAP</th>
<th>Machine's proxy</th>
<th>Renewal</th>
<th>Server</th>
<th>Connection</th>
<th>Query</th>
<th>User proxy registration</th>
<th>WOBOX registration</th>
<th>gsiscp</th>
<th>Publication of SE</th>
<th>LCG CE</th>
<th>Job submission</th>
<th>LFC def. in LDAP</th>
<th>Local EDII</th>
<th>Local BDII</th>
<th>Local catalog</th>
<th>Software area</th>
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<td>2. Barbi</td>
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</tr>
</tbody>
</table>

[Error message: Couldn’t find a valid proxy. Use -debug for further information. DN not specified and unable to get DN from user proxy.]

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CastorGrid scripts monitoring

- Migration
  - Amount, speed, errors
- Staging
  - Amount, speed, errors
- Nodes
  - Host parameters
- Xrootd resource usage
- File cache status
  - Used space, no. of files

[Migration to Castor2 graph]

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API Services monitoring

- API Service sessions
  - Established, active
- API Service users
  - Active, total
- Statistics
  - Executed commands
VOBox monitoring

- Machine parameters, real-time & history
- Load, memory & swap usage, processes, sockets

### VO Box machine status

<table>
<thead>
<tr>
<th>Site name</th>
<th>Last seen online</th>
<th>Loads</th>
<th>Usage</th>
<th>User</th>
<th>System</th>
<th>Swap</th>
<th>Eth1 [kB/s]</th>
<th>Eth2 [kB/s]</th>
<th>System</th>
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<td></td>
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<td>CPU</td>
<td>Mem [% MIB]</td>
<td>Swap [% MIB]</td>
<td>Eth1 [kB/s]</td>
<td>Eth2 [kB/s]</td>
<td>System</td>
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<td></td>
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<tr>
<td>Athens</td>
<td>2006-10-17 08h</td>
<td>0.28%</td>
<td>14.6</td>
<td>11.82</td>
<td>2.781</td>
<td>1</td>
<td>2880</td>
<td>20</td>
<td>1892</td>
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<td>4.187</td>
<td>2.357</td>
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<td>1800</td>
<td>55</td>
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<td>0.39%</td>
<td>17.58</td>
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<td>3.889</td>
<td>2</td>
<td>280</td>
<td>53</td>
<td>1000</td>
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<td>2006-10-17 08h</td>
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<td>1.018</td>
<td>0.501</td>
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<td>0.06%</td>
<td>1.75</td>
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<td>0.59</td>
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<td>Bayern</td>
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<td>0.29%</td>
<td>1.019</td>
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<td>0.455</td>
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<td>3199</td>
<td>11</td>
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<td>Catalina</td>
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<td>0.075%</td>
<td>1.912</td>
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<td>2799</td>
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<td>CERNNAC</td>
<td>2006-10-17 08h</td>
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<td>14.18</td>
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<td>CNAF</td>
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<td>-</td>
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<tr>
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<td>1390</td>
<td>43</td>
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</tbody>
</table>
PROOF CAF Monitoring

- Each host reports
  - CPU, memory, swap, network
- Each slave reports
  - Summaries per query type
  - CPU, memory
  - Event rate
  - File rate
  - I/O vs. network rate

![Graph showing the history of load1](image)
FTD Monitoring

- Status of the transfers
- Transfer rates
- Success/failures
Alerts and actions

MySQL daemon is automatically restarted when it runs out of memory
Trigger: threshold on VSZ memory usage

ALICE Production jobs queue is automatically kept full by the automatic resubmission
Trigger: threshold on the number of aliprod waiting jobs

Administrators are kept up-to-date on the services’ status
Trigger: presence/absence of monitored information
Summary

- Monitoring is vital in a large distributed system
  - Distributed systems should have built-in monitoring capabilities
- We have to deal with a lot of data
  - We need decentralization
  - And aggregation
- MonALISA is very flexible and powerful
  - Monitoring is just the beginning
  - Gathered data can be used for intelligent control and decisions taking
Questions?

Thank you!

http://alien.cern.ch

http://monalisa.caltech.edu