Directory Search Performance Optimization of AMGA for the Belle II Experiment

Geunchul Park, Jae-Hyuck Kwak, Taesang Huh, Soonwook Wang

AMGA (ARDA Metadata Grid Application)
URL: http://amga.web.cern.ch/amga

- An official EMI Metadata Software Product
- Included in the EMI Repository and EGI UMD (EGI Software Repository)
- Registered at the XSEDE Technology Database (Evaluation completed)
- Provide and support a mechanism for locating scientific data files using descriptive information through Grid authentication
- Ensure competitive performance and scalability, along with a multi-threaded multi-process based on DB connection pooling, a hierarchical collection structure, replication and a federation mechanism

- KISTI: one of the product teams of EMI, contributing to the evolution and maintenance of AMGA
- EMI-3 (Monte Bianco) AMGA (v2.4.0) Released (March, 2013)
- AMGA (v2.5.0) released to improve performance (for Belle II)

AMGA V2.4.0
- Enhancement of a maintenance of AMGA
- Proves Belle II software architecture on the Belle II Grid
- Releases(March 2013), 2013 data

AMGA V2.5.0
- The response time is increased at constant rate
- The response time is stable at a constant value

AMGA Performance Improvement

- Why too slow?
  - All information of directories is stored in a masterindex table
  - AMGA Uses a POSIX-style regular expression as a directory pattern matching method
- But, the POSIX-style regular expression is costing too much

  SELECT "directory", "flags", "owner_name", "permissions", "acts" FROM public.masterindex WHERE "directory" LIKE '/belle/user/hideki/%%';

Solution

- Avoid using the POSIX-style regular expression of the directory pattern matching method
- Need to modify the masterindex table to use "low-cost" pattern matching style

- Add a new column to the masterindex table: parent
- Keep a parent directory information
- Query can be simplified by using the parent column

Test Result

Test environment and command

- Virtual machine on the PC: Inter Core i7 4770K CPU
- VM Setting: 16G Memory, 2 Processors, 128GB HDD
- "is path" command used to test
- Get 100 entries from target path
- Same schema such as a belle II metadata schema

- Schema

  status | varchar(128) | site | varchar(32) | parentid | int
  eventL | int | runL | smallint | date | timestamp
  eventT | int | events | int | runNT | smallint
  stream | smallint | versionL | smallint | guild | varchar(32)
  file | varchar(1024) | experiment | int | acl | int
  site | varchar(32) | user | varchar(32) | software | varchar(32)

Test Result

<table>
<thead>
<tr>
<th>AMGA Version</th>
<th>1K dirs</th>
<th>10K dirs</th>
<th>50K dirs</th>
<th>100K dirs</th>
<th>500K dirs</th>
<th>1000K dirs</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.4.0</td>
<td>0.0017</td>
<td>0.0018</td>
<td>0.0032</td>
<td>0.0036</td>
<td>0.0089</td>
<td>0.0130</td>
</tr>
<tr>
<td>V2.5.0</td>
<td>0.0017</td>
<td>0.0017</td>
<td>0.0017</td>
<td>0.0017</td>
<td>0.0018</td>
<td>0.0018</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AMGA Version</th>
<th>1K dirs</th>
<th>10K dirs</th>
<th>50K dirs</th>
<th>100K dirs</th>
<th>500K dirs</th>
<th>1000K dirs</th>
</tr>
</thead>
<tbody>
<tr>
<td>V2.4.0</td>
<td>0.0158</td>
<td>0.0447</td>
<td>0.0353</td>
<td>0.0464</td>
<td>0.0086</td>
<td>0.1081</td>
</tr>
<tr>
<td>V2.5.0</td>
<td>0.0018</td>
<td>0.0018</td>
<td>0.0018</td>
<td>0.0018</td>
<td>0.0018</td>
<td>0.0018</td>
</tr>
</tbody>
</table>

AMGA V2.4.0
- The response time is increased at constant rate

AMGA V2.5.0
- The response time is stable at a constant value

Future Plans

- More tests for performance tuning and optimizing
  - Optimized PostgreSQL and AMGA parameters
  - Testing on the various PostgreSQL versions
  - Testing on the high-spec server
- Checking memory pile up issue
  - Enhancement of a sub-processor management algorithm
  - Add new option of refreshing sub-processors

Belle II MC Production Campaign

- Participated in the MC mass production campaign using Belle II software on Grid
- Proves Belle II software architecture on the Belle II Grid
- Observes what happens during massive resource consumption and shares the information
- Grid sites, network, DIRAC, AMGA, and gBASF2 UI...
- MC Production : 15 countries/regions
  Australia, Austria, Canada, Czech R., Germany, Italy, Japan, Korea, Poland, Russia, Slovenia, Taiwan, Turkey, Ukraine, USA
  31 sites
  GRID: Grid, local cluster is available

- AMGA issue on MC 3
  - MC 3 : April 03 – May 02, 2014
  - Grown 2.5 times Jobs
  - Some AMGA issues reported
    - Access piled up and slow access
    - Heavy loads on the AMGA server
  - Checking AMGA performance
    - w/ Hideki Miyake(KEK)
    - Checking performance
      KEG AMGA Server vs KISTI AMGA Server
      Identifying a cause: directory search performance
  - AMGA performance during MC4
    - AMGA 2.5.0 Version applied
    - CPU Load is very mild (vs MC3 and 3.5)