GridDB: Data-Centric Services for Scientific Grids

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Status Quo: Process-centric middleware

- Status Quo: Process-centric middleware; provides low-level, OS-like interfaces
- BUT: Scientific data analysis requires higher-level data-centric interfaces and services
GridDB: A Data-Centric Overlay

- GridDB: A data-centric overlay
  - Frame requests in terms of data rather than processes
  - Built on-top of process-centric middleware to preserve pre-existing science codes
  - A confluence of workflow and database technology
GridDB User Experience

data-centric services:
(1) declarative interfaces
(2) data-centric computational steering
AND MORE ...
GridDB User Experience

Workflow/Data Description (Functional Data Model with Relational Covers schema)

data-centric services:
(1) declarative interfaces
(2) data-centric computational steering
AND MORE ...
Grid Workflows Have Relations

Inputs and Outputs Relational!
Functional Data Model with Relational Covers (FDM/RC)
Demo Setup
The Demo: Fish N Sharks

- Setup (Data Definition Language)
  - Create Workflow, define data
- Analysis (SQL)
  - Data Procurement (INSERT)
  - View Data (SELECT)
  - Computational Steering (UPDATE)
The Demo
Data-Centric Services

Workflow/Data Description (Functional Data Model with Relational Covers schema)

- data-centric services:
  1. declarative interfaces
  2. data-centric computational steering
  3. type-checking
  4. work-sharing, memoization
  5. data provenance
  6. query relaxation
  7. speculative computation
  8. data-centric smart scheduling
Data-Centric Smart Scheduling

$p_{mas}$ vs. $im_{as}$ (20 point sample with smart scheduling)

$p_{mas}$ vs. $im_{as}$ (20 point sample with dumb scheduling)
Status

- Workflow/Data Model, Data Definition Language (DDL), Data Manipulation Language (DML) developed
- Prototype built: ~19,000 LOC
- Use cases:
  - SDSS clusterfinding (with Annis)
  - ATLAS (with Tull, Gardner, Smirnov)
  - LSST (with Ghaleb Abdulla)
- Preliminary Experimental Results
- VLDB’04 paper:
Related Work/Systems
GridDB and LSST Synergies

- GridDB middleware provides services interesting to LSST: modularity, declarative interfaces, real-time monitoring and computational steering
- LSST team will provide a cutting-edge application for GridDB: real pipelines, scales, queries
- Synergy between the two collaborations
- UCB Database Group also at the forefront of Data Stream Processing (ala TelegraphCQ project)
Test-Case: SuperMacho’s pipemaster

- Ran SuperMacho a PipeLine through GridDB as a test-case
- Specified a model to encapsulate workflow
- Have working:
  - Data Procurement
  - Partial-Result examination
  - Computational Steering

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SuperMacho’s pipemaster

- Have working:
  - Data Procurement
  - Partial-Result examination
  - Computational Steering

- SuperMacho pushes GridDB to the limit!

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Conclusion

• The FDM/RC models both workflow and data information

• GridDB provides data-centric services by exploiting FDM/RC schema information

• Currently: Working with Ghaleb Abdulla + Livermore LSST group to expand upon our GridDB implementation of pipemaster
Backup
Astronomy Cluster
Finding

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getCands: a nested composite function