Design and Implemention of a Plugin Scheduler for DIET

March 11, 2005

Outline

1. Background on DIET
   - Computational Grid Computing
   - DIET Framework
   - Motivation for Plugin Scheduler

2. Plugin Scheduler
   - Design
   - Implementation
   - Current Status
   - (Near-)Future Work

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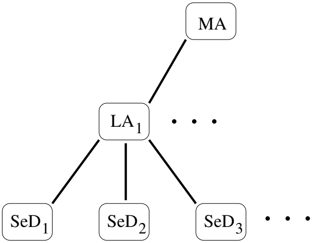
The Computational Grid and DIET

- Grid platforms
  - heterogeneous computational resources
  - irregular network topologies
  - dynamic resource performance
- DIET philosophy and design principles
  - server and broker agent model
  - hierarchical organization
  - flexible deployment options

DIET Overview

DIET hiearachy:



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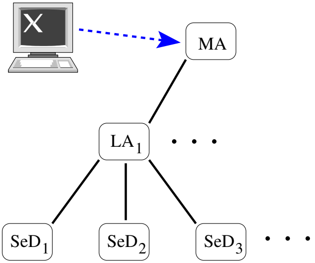

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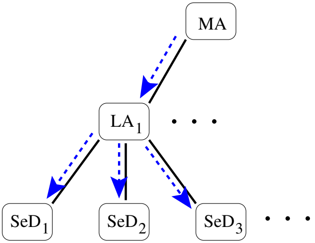

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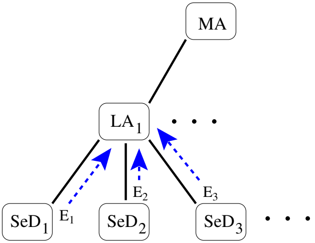

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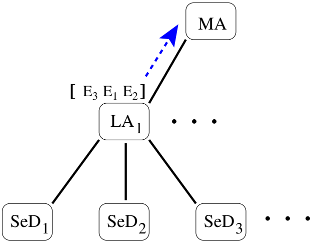

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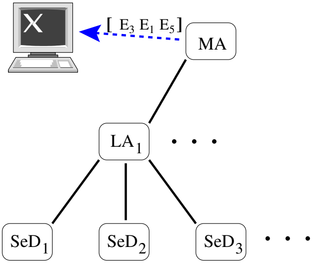

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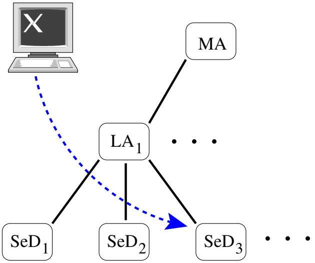

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- Client launches service directly on SeD

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Communication infrastructure

- CORBA-based model
- omniORB implementation

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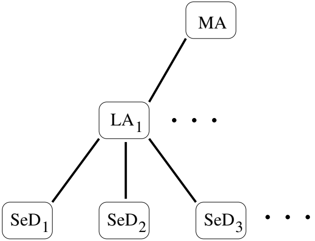

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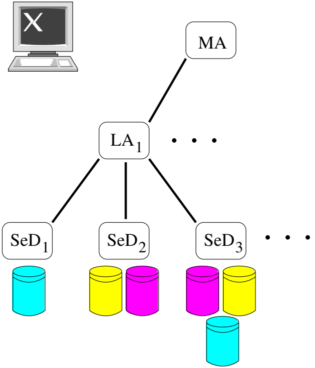

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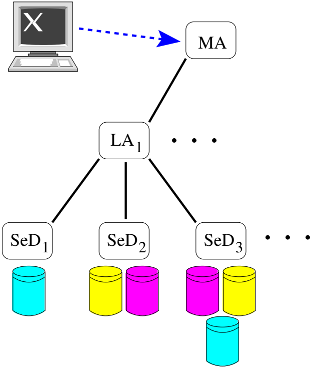

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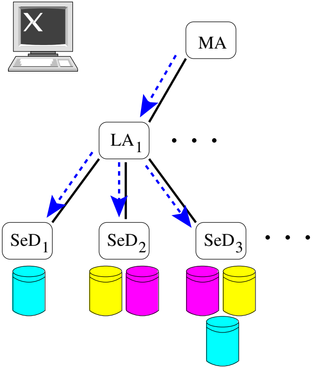

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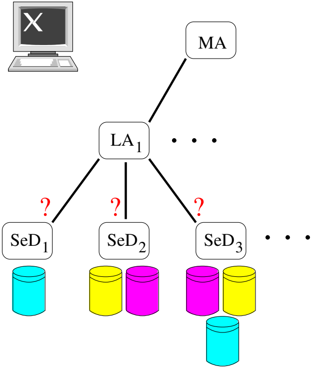

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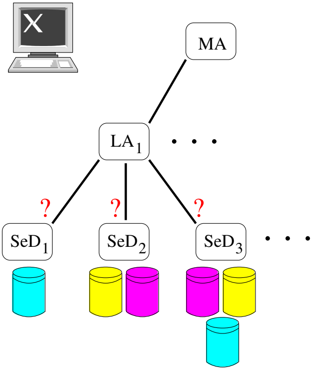

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- existence of data
- avail. free memory
- specific architecture
- previous scheduling decisions
- application-specific measures
- composite requirements
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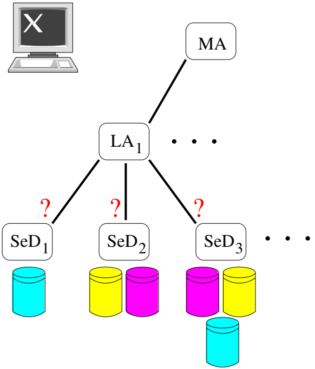

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Plugin scheduling facilities to enable

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Design changes

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Client	CLIENT CODE UNCHANGED	

Plugin Scheduling Enhancements

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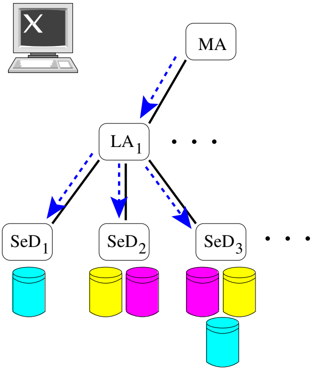

Example: Client request for comparison operation on blue database

- request arrives at SeD level

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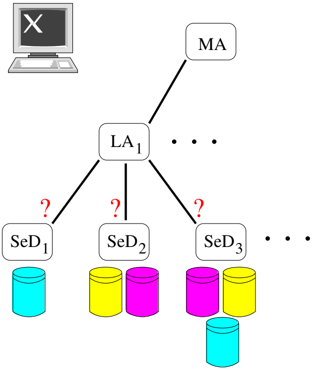

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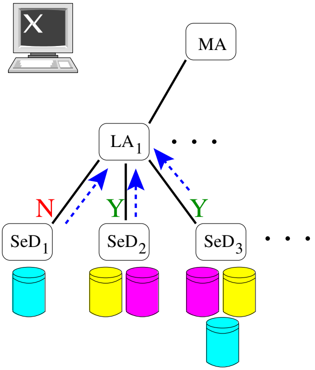

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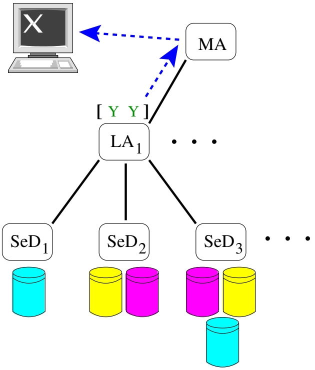

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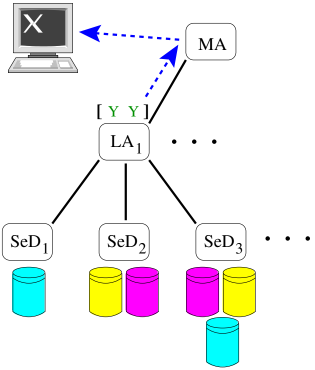

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- request arrives at SeD level
- only positive responses need to be propagated through the hierarchy
- simple example: client gets random choice of two feasible servers
- more realistic: other factors used to decide
  - processor speed, memory
  - database contention
  - future requests

Implementation Mechanisms

What mechanisms are needed to implement this framework?

- **SeD-level** (response to client request)
  - interrogate the system performance
  - store selected performance metrics
- **Agent-level** (aggregation of server responses)
  - collect server responses and extract stored performance estimates
  - order responses from children, based on provided metrics
  - forward ordered responses to next higher level

SeD-level Interface

Estimation Vector

- Dynamic array of *estimation values*:
    - tag (byte) + value (float)
    - `estVector_t new_estVector()`
    - `int estVector_addEstimation(estVector_t, diet_est_tag_t, double)`

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- Tags and access functions for existing performance metrics
    - FAST/NWS (e.g, `int diet_estimate_fast(estVector_t, const diet_profile_t*)`)
    - SeD execution timestamp (to approximate Round-robin scheduling)

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- User-defined tags
- Equivalent CORBA object and marshalling function

Agent-level Interface

New Profile Parameters

- New dynamic array of prioritized *optimization directives*:
  - *tag*: basis for comparison
  - *semantics*: maximize, minimize, etc.
- At service registration time, directives are fixed
- At runtime, directives used to order server responses

Modules' Status

Estimation Vector

- Fully functional API for storage of raw values
- Basic library of standard estimators
- Interface for user-defined metrics to be redesigned

DIET Profile Enhancements

- Existing scheduling strategy (i.e., preference for FAST) re-implemented using estimation vector
- User-defined metrics currently ignored
- Providing access to DIET agent hiearchy not previously supported

Work in Progress

Near-term Milestones

- Profile parameter extension to support priority optimization
- New performance estimator routines
    - alternative performance measurement systems (e.g., ganglia)
    - emerging DIET functionality (e.g., SeD-level queues)
- Initial plugin scheduler: DIET release 2.0

Open Issues

- Enforcement of optimization strategy over entire hiearchy
- Evaluate need for more expressive aggregation methods
- Incorporate runtime scheduling preferences