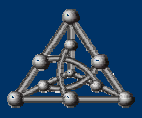

InteGrade: Object-Oriented Grid Middleware Leveraging Idle Computing Power of Desktop Machines

http://gsd.ime.usp.br/integrade

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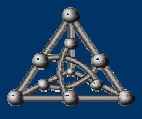

InteGrade: Description

- Middleware to build a grid of commodity machines
- Desktop users (Resource Providers) export their resources into the grid
- Grid applications use only idle resources
- Advantages over traditional dedicated clusters of commodity hardware

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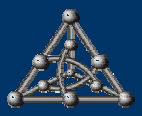

InteGrade: Key Features

- **Based on Distributed Object Oriented Technology (CORBA)**
- **Preserves Resource Provider's QoS at all costs**
- **Supports a wide Range of Parallel Applications**
- **Usage Pattern Collection and Analysis**

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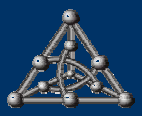

Feature: Preserves Resource Provider's QoS

- **User Level Scheduler (DSRT)**
- **Lightweight ORB**
- **Configurable Resource Sharing (Optional)**

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InteGrade

IME - USP

Feature: Usage Pattern Collection and Analysis

- Enhances scheduling by offering an idea of resource usage
- Usage Data regarding short intervals (e.g. 5 min.) is collected
- Data is grouped in larger intervals called Periods
- Clustering Algorithms Applied to data will derive Behavioral Categories (e.g. night, lunch-break, week-days, etc)
- Each machine will have a schedule representing its resources availability throughout the week

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Feature: Support for a Wide Range of Parallel Applications

- Often unsupported by other grid initiatives, especially ones that make opportunistic use of shared resources
  - Normally parallel applications must have little or even no communication between the application nodes
- InteGrade's architecture addresses those needs
- Network information about lines interconnecting nodes must be available

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Feature: Ensures Application Progress

- **Usage Pattern Collection and Analysis provides hints, minimizing checkpointing situations**
- **Checkpointing for sequential applications**
  - **Must be machine and OS independent**
- **Progress of parallel applications is more difficult to ensure**
- **Possible solution: Use BSP as parallel application model**

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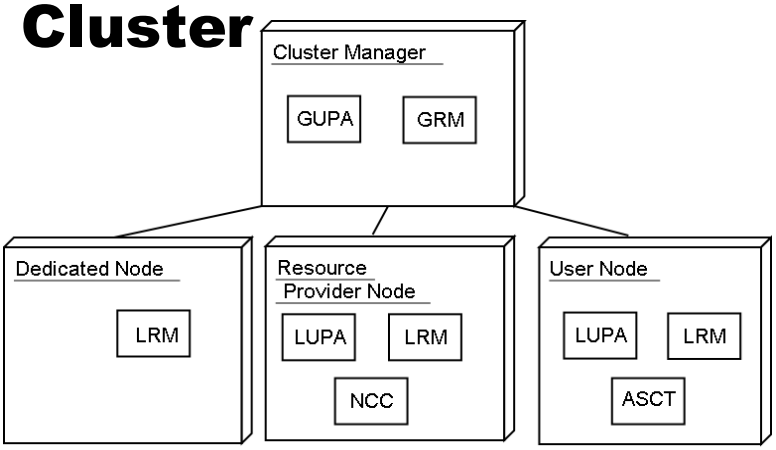
Architecture: Intra-Cluster



LRM - Local Resource Manager
GRM - Global Resource Manager

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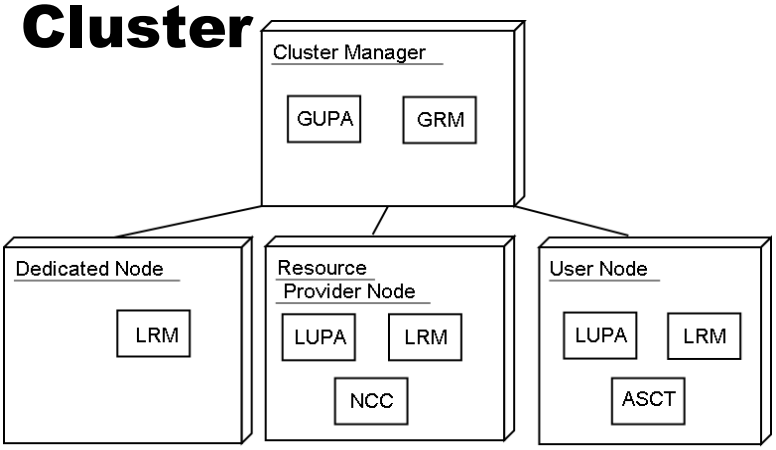
Architecture: Intra-Cluster



LUPA - Local Usage Pattern Analyser
GUPA - Global Usage Pattern Analyser

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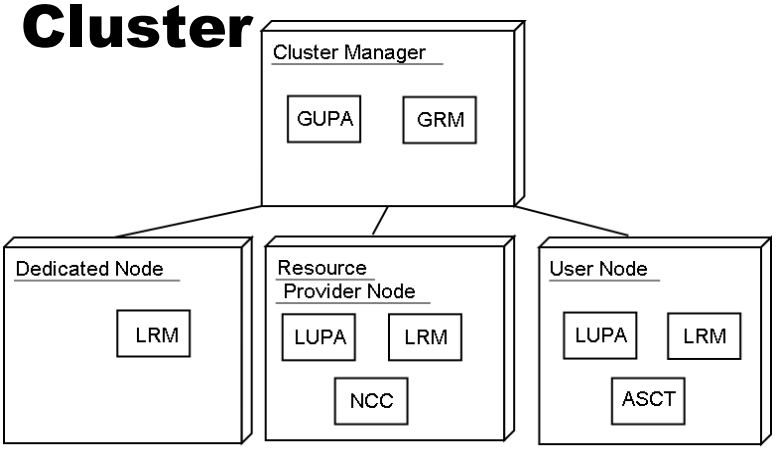
Architecture: Intra-Cluster



NCC - Node Control Center
ASCT - Application Submission and Control Tool

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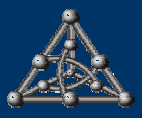
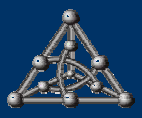
Related Work



- **Globus (Argonne National Labs / U. of Chicago / USC)**
  - **Does not focus on QoS-preserving utilization of desktop machines**
  - **InteGrade uses CORBA and OO design**
- **Legion (U. of Virginia)**
  - **Proprietary distributed object model**
  - **InteGrade has deeper focus on idle resource management and desktop machines**

Related Work (continued)



- **Condor (U. of Wisconsin-Madison)**
  - **Limitations regarding support for parallel applications**
- **SETI@Home (U. of California Berkeley)**
  - **Hard-coded application**
  - **No communication between application nodes**
- **BOINC (U. of California Berkeley)**
  - **Limited support for parallel applications**

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Implementation Status

- **Already Implemented:**
  - **Intra-Cluster Information Update Protocol**
  - **Intra-Cluster Execution Protocol (non-parallel applications only)**
- **Software used:**
  - **GRM: JacORB**
  - **LRM: C++ using Orbil**

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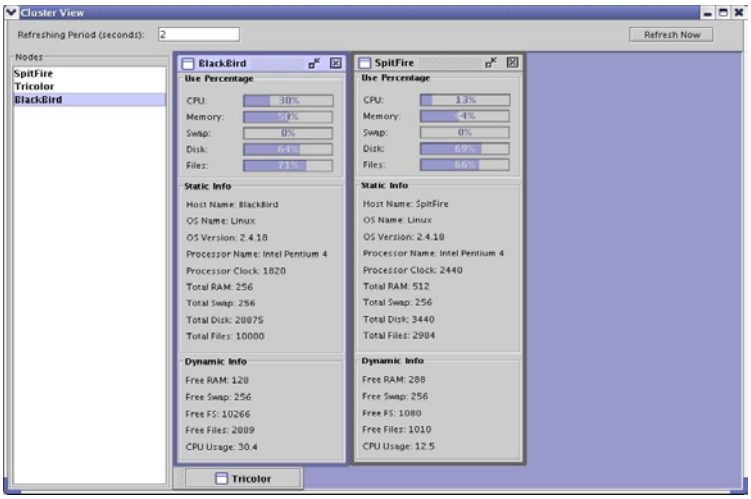
Implementation Status: ClusterView



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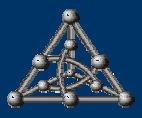

Project Information

- **Website: http://www.ime.usp.br/integrade**
- **Source code available (anonymous CVS checkout & web front end)**
- **Increasing number of students working on the project**
- **Initial working version expected for the end of 2003**

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