SP 2.1 Interactive Problem-Solving Environments

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Subsubprograms

SP 2.1.1 Interactive Algorithms: Distributed Cellular Automata (LGA/LBE)
SP 2.1.2 Legacy code: HLA services
SP 2.1.3 Fault Tolerance: CheckPointing services
SP 2.1.4 Integration SimVisInt
SP 2.1.5 Dissimination & Technology Transfer
SP 2.1.6 Software Engineering for Certification
Dynamite

- User-space checkpoint-migrate-restart system for sequential and parallel (PVM and MPI) programs on Linux.
- Single process checkpoint
- PVM library, allowing the migration of a single process in a running job in a single cluster. Intended for load balancing.
- MPICH library allowing checkpoint-and-continue and checkpoint-and-stop checkpoints of entire MPI jobs. Intended for fault-tolerance.
- MPICH load-balancing library.
- Maintenance issues: kernel, glibc versioning.
Parameter sweeping and multi-objective optimisation

- Collaboration with Abramson, Monash Univ. Melbourne.
- Exploration, optimisation, search.
- Computational experiments, simulations, etc.
- Applications to:
  - cellular developmental regulatory networks.
  - light scattering by interstellar dust particles, blood cells, etc.
  - inverse modelling of ground water models & flood warning.
  - bird migration routes.
  - coral growth patterns.
  - PECVD virtual reactor; optimising virtualisation.
  - image processing, pattern recognition.
  - text mining.
Nimrod

- manages execution of parameter studies across distributed computers.
- experiment management,
- manages distribution of files to remote systems, remote computation and gathering results.
- Architecture
  - Nimrod agents.
  - Nimcache database.
  - Python layer & SQL database.
  - Command-line interface.
  - Web portal.
Nimrod architecture
Nimrod experiments

- parameter sweeps & optimisation.
- plan file & schedule file.
- experiments.
- computational resources.
- submission.
- monitoring.
Nimrod portal
Extending Nimrod

- parallel MPI tasks.
- computational steering of optimisation processes.
- more expressive plan language: multi-tiered, adaptable, strategy-switching.
- augmenting strategies; SCEM, Sim Ann cooling schedules, parameter selection and fusion.
- multi-objective optimisation.
MPI Toolbox for Octave

  - medical imaging
  - biodiversity
  - biological
- MATLAB licensing issues.
- MPITB interface between MPI & Octave.
- Master/slave, job farming paradigm.
- SRB access.
High-level Architecture

- General purpose architecture for reuse and interoperability of computer simulation systems.
- Developed by the US Dept of Defense.
- Components
  - Interface specification to Runtime Infrastructure middleware (RTI).
  - The Object Model Template specifies what information is communicated between simulations.
  - Rules that simulations must obey to comply.
  - Base Object Models: reusable packages of information representing independent patterns of simulation interplay.
- Recently open-sourced: OHLA implements HLA RTI 1.3 and IEEE 1516.
HLA

Federation

Simulator Entity 1/Federate 1

Federate Ambassador

RTI Ambassador

Interface

Simulator Entity 1/Federate 2

Federate Ambassador

RTI Ambassador

Run-Time Infrastructure
The Grid HLA Management System

The Grid HLA Management System supports running HLA-based distributed interactive simulation applications in a Grid environment.

(Katarzyna Ryczew thesis defence 13 June)

**HLA speaking service** acts as interface to HLA legacy application code on its Grid site.

**HLA migration service** acts as a conductor for HLA speaking services on source and destination sites for required migrations. Uses GridFTP.

**Grid HLA Controller Library** interfaces HLA legacy code to the HLA speaking service. Enables checkpointing.

**Benchmark services** help make decisions about where to migrate.

**OCM-G HLA** wrappers to allow HLA legacy code to be monitored by the OCM-G monitoring system.

Versions: GT3.2 Globus GRAM v 2.4, tested with HLA RTI 1.3v5