A Study of Mobile Agents
Liveness Properties
on MobiGrid *

Rodrigo M. Barbosa and Alfredo Goldman
Department of Computer Science
Institute of Mathematics and Statistics
University of São Paulo
{rodbar, gold}@ime.usp.br

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Motivation

- MobiGrid is a subproject of the InteGrade Project (http://gsd.ime.usp.br/integrade)
- InteGrade: a middleware infrastructure to enable the use of idle processing time of machines already owned by public or private institutions
- InteGrade main goals
  - use idle time to solve many kinds of problems
  - do not disturb the workstations owners
- Our goal: allow the use of “all” available idle time
MobiGrid

• MobriGrid
  – mobile agents infrastructure for InteGrade

• Meets two major InteGrade goals:
  – the system must be transparent in terms of performance to the machine user
  – the idle resources must be used in the best possible way

• Mobile agents can be used in complementary way to InteGrade, allowing a even better utilization of computational resources.
Main Idea

• Have long running process as mobile agents
  – May be sequential tasks
  – Bag-of-tasks (as parametric applications)

• Required characteristics
  – No strict deadline
  – There can be many

• Examples
  – *Seti@Home*, patterns search on molecular biology
Framework Overview (1)

- **task**: long running application, encapsulated in a mobile agent

- **manager**: responsible for registering tasks. The two most important functions of the manager:
  - migration
  - liveness
Framework Overview (2)

- **server**: provides a execution environment for the tasks
- **daemon**: turns on the server when the local machine is idle; turns off the server when the local user is back to its machine
- **client**: provides the user with tools to submit tasks to the framework
MobiGrid Strategies (1)

- There are a few options for dealing with a mobile task when the resource is no longer available:
  - **migration**: could cause the local user to face a performance loss, since migration may be a costly process
  - **termination**: we would need remote checkpointing - this could be a costly solution and was not implemented
  - **suspension**: as we work in a highly dynamic environment where the resources might be busy for long periods of time, we do not consider suspension as a good option
MobiGrid Strategies (2)

- Alternative to migration:
  - To have multiple copies of each task
  - can work as a recovery strategy
- We call this property *liveness*
- In the case where there is the necessity to free the machine resources for the local user, if this machine is executing a MobiGrid task, it can be immediately killed
- When the MobiGrid infrastructure notices the death of a task,
  - first, a clone of a copy is created
  - then it is migrated to another machine
Initial Experimental Data

• Comparison of two strategies on a real environment:
  – migration
  – cloning with liveness

• With two different agents
  – Sorting operation (large amount of data)
  – A scheduling problem (small amount of data)

• Pure migration is much more costly than cloning

• The cloning operation almost does not affect the task execution
Simulator Proposal

• Idea: Provide initial results on liveness

• Simplifications assumptions:
  – The time to clone an agent is negligible
  – The migration operation does not interfere on the execution time

• Additional assumptions
  – No more than one agent by processing node
  – Only one cloning operation is done simultaneously
The Simulator

- Tasks times
  - Execution 60 minutes
  - Migration 5 minutes
- 10 tasks on a grid with 100 machines
- Probability of dying $p$, at each minute
  - from 1 to 10%
  - machines may be available again with the same probability
  - search for dead tasks: every minute
Number of finished tasks

Graph 1

Average Number of Task Groups that Finished

Probability

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Average execution time of finished tasks

Graph 2

Probability

Time

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Conclusion and Future Work

- With larger liveness degrees
  - more tasks groups finished
  - more concurrency to obtain processors
- There is a trade-off on liveness degree

- More simulation results
- Do experiments in a real environment