

Rethinking RAM: Testing alternative models of computation (Progress)

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1 Project Summary

General Area: Models of Computation in Algorithms

Keywords: RAM model, computational models, benchmark

Question: The RAM model of computation is the traditionally assumed environment of most algorithm analysis, but it is questionable whether it serves as an accurate model of modern computers. This project will experimentally test the RAM model versus the recently proposed Virtual Address Translation (VAT) model. *Is Jurkiewicz and Mehlhorn's Virtual Address Translation model experimentally superior to the traditional Random Access Machine for modeling computational complexity?*

Responsibilities:

LACHUT Benchmark Algorithms, Write/Edit Reports, Analyze Algorithms with VAT Model, Assist K. Lahiri

LAHIRI Compare Models/Experiments, Analyze Algorithms with VAT Model, Write/Edit Reports, Assist D. Lachut

Budget: \$6,165.92

Deliverables: Progress Report, Final Report, Presentation Slides

2 Original Schedule

The project's original schedule was:

Submit Project Proposal	27 February 2013
Benchmark Procedures	13 March 2013
Be Competent to Use VAT Model	20 March 2013
Submit Progress Report	27 March 2013
Algorithms Analyzed with VAT Model	10 April 2013
Submit Draft Report & Presentation	17 April 2013
Oral Presentation	29 April 2013
Submit Final Report	15 May 2013

3 Status

Using the original schedule as a plan, the project team began work on the project. They here note the progress in carrying out the plan, and discuss the work they will accomplish moving forward.

3.1 Progress

The team's primary accomplishment thus far is in implementing a set of standard reference algorithms as procedures in C. By selecting algorithms such as heapsort, permute, binary search, etc., they bypassed need to analyze these procedures under the RAM model, as these algorithms are already well understood and well documented.

Additionally, the team has attended to its overhead responsibilities by delivering this progress report with its accompanying outline of the final report.

3.2 Remaining Work

Much remains to be done. The step of benchmarking the procedures on real hardware has taken longer than intended, as has the task of understanding the VAT model of computation. However, these difficulties were foreseen and the next section of this report comments more fully on them.

Also remaining is the work originally scheduled for the next several weeks. The selected algorithms must be analyzed using the VAT model. Following such analyses, the team will present its findings in draft and final reports and, possibly, in a presentation.

4 Issues

In the project proposal, the project team noted two primary difficulties to be overcome for the completion of the project. They were:

VAT Analysis: As the Virtual Address Translation computing model is very new, little can be known about it. Prior to starting this project, the investigators know of only two people who currently understand the model and have done work with it. This entails some things.

Will the model work: Prior to beginning the project, the investigators cannot know if algorithm analysis under the new model will be a tractable problem in every attempted case.

Complexity: Even the tractable analyses will be substantially more complex than the corresponding analyses done with the RAM model.

Lack of helpful resources: There is necessarily a lack of resources to assist the investigators should the model prove especially difficult to master or the analyses especially difficult to formulate.

Benchmarking: It may be difficult to devise the most correct way to benchmark the running times of the implementations of the selected algorithms. Each tested procedure must run multiple times on multiple, varied inputs, and perhaps even on different operating systems to determine if there is a single model of computation that is superior.

These two areas remain the two primary difficulties being overcome.

5 Revised Schedule

In light of the team's progress and difficulties, the revised schedule is as follows:

Submit Project Proposal	27 February 2013
Submit Progress Report	27 March 2013
Benchmark Procedures	3 April 2013
Algorithms Analyzed with VAT Model	10 April 2013
Submit Draft Report & Presentation	17 April 2013
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Final Outline

Draft outline of the final report follows.

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