

†

*

Cost Optimization in Economic Computational Grids Using Learning Automata

Yasser Mahdavifar Mohammad Reza Meybodi

Soft Computing Lab.

Computer Engineering and Information Technology Department
Amirkabir University of Technology, Tehran, Iran

Abstract

In economic computational grids, resources have price and the users must pay for executing their applications. The user determines his deadline and budget and then requests cost or time optimization. A scheduling algorithm that adopts cost optimization strategy, should allocate heterogeneous grid resources to heterogeneous user jobs so that their execution finishes in the specified deadline with minimum cost. In this paper, two new algorithms are introduced for this purpose that use learning automata. It is shown by using simulation that suggested algorithms have higher performance and perform users' requests with less cost with respect to the reported heuristics.

Keywords: Computational Grid, Economic Scheduling, Cost Optimization, Learning Automata

() [2-5]

.[6-9]

() ()

BCO ()
AEBCO EBCO ABCO [10,11]
[]

ALACO⁸ LACO⁷

[12] GridSim

()

$\alpha = \{\alpha_1, ..., \alpha_r\}$ $E \equiv \{\alpha, \beta, c\}$
 β $c = \{c_1, ..., c_r\}$ $\beta = \{\beta_1, ..., \beta_m\}$
 $\beta(n)$ Q $\beta_2 = 0$ $\beta_1 = 1$ P
 α_i c_i [0,1] S [0,1]
 c_i



:()

$\{\alpha, \beta, p, T\}$:
 $p = \{p_1, p_2, \dots, p_m\}$ $\beta = \{\beta_1, \beta_2, \dots, \beta_m\}$ $\alpha = \{\alpha_1, \alpha_2, \dots, \alpha_r\}$
 $p(n+1) = T[\alpha(n), \beta(n), p(n)]$

•

• • •

[]

LACO : **(LACO)**

 $1/r$

i

i

i

r

LACO

()

LACO

: .1

: .۲

.a

.b

.i

.ii

.C

.d

: ۳.

LACO : ()

LACO

$$\text{ALACO} \quad :(\text{ALACO})$$

LACO

LACO

ALACO

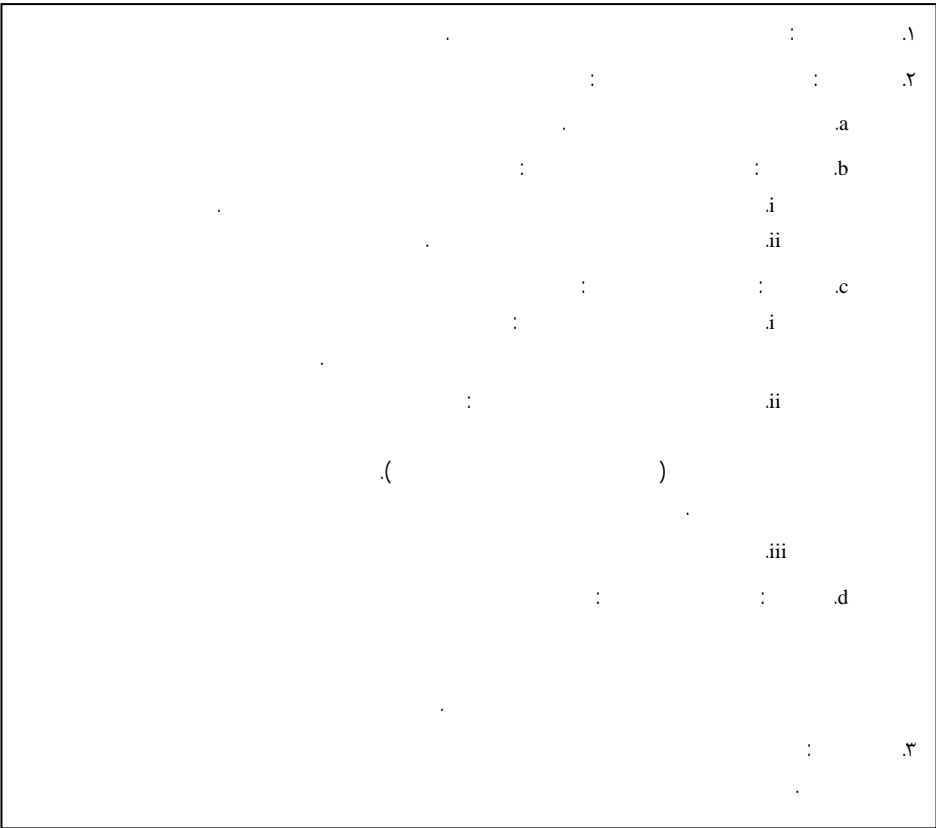
(

)

(

)

ALACO
() ALACO



ALACO : ()

[11] GridSim

()

(...)

$a = b = 0.01$ L_{RP}

:()

(G\$/1000MI)	(G\$/sec)	(MI/sec)	
			R1
			R2
			R3
			R4
			R5
			R6
			R7
			R8

ALACO LACO

[] AEBCO EBCO ABCO BCO

()

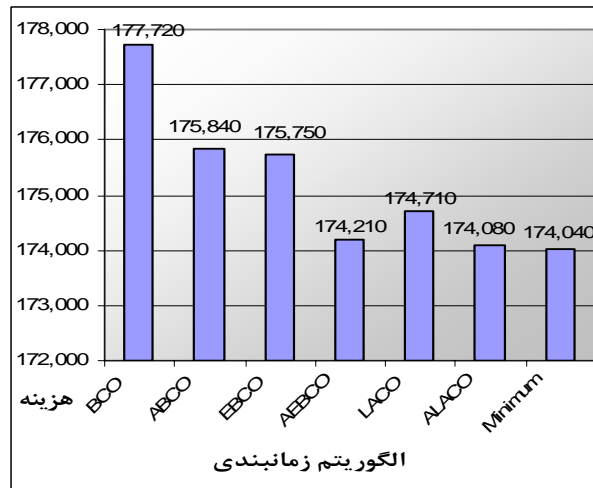
ALACO

(,)

(AEBCO)

ALACO

[]



() :

GridSim

(ALACO)

[]

- [2] I. Foster and C. Kesselman, *The Grid: Blueprint for a Future Computing Infrastructure*, Morgan Kaufmann, San Francisco, 1999.
- [3] I. Foster, C. Kesselman and S. Tuecke, "The anatomy of the Grid: Enabling scalable virtual organizations", *International Journal of Supercomputer Applications*, 2001.
- [4] M. Baker, R. Buyya and Domenico Laforenza, "Grids and Grid technologies for wide-area distributed computing", *The Journal of Concurrency and Computation: Practice and Experience*, Vol 14, Issue 13-15, Nov. 2002.
- [5] V. Berstis, *Fundamentals of Grid Computing*, IBM Redbooks, November 2002.
- [6] R. Buyya, D. Abramson, and J. Giddy, "A Case for Economy Grid Architecture for Service-Oriented Grid Computing", *Proceedings of the 10th IEEE International Heterogeneous Computing Workshop*, April 2001.
- [7] R. Buyya, D. Abramson, and J. Giddy, "An Economy Driven Resource Management Architecture for Global Computational Power Grids", *Proceedings of the 2000 International Conference on Parallel and Distributed Processing Techniques and Applications*, June 2000.

- [8] R. Buyya, D. Abramson, and J. Giddy, "*Nimrod-G: An Architecture for a Resource Management and Scheduling System in a Global Computational Grid*", The 4th International Conference on High Performance Computing in Asia-Pacific Region, May 2000.
- [9] R. Buyya, D. Abramson, J. Giddy, and H. Stockinger, "*Economic Models for Resource Management and Scheduling in Grid Computing*", The Journal of Concurrency and Computation: Practice and Experience, May 2002.
- [10] R. Buyya, J. Giddy, D. Abramson, "*An Evaluation of Economy-based Resource Trading and Scheduling on Computational Power Grids for Parameter Sweep Applications*", Proceedings of the 2nd International Workshop on Active Middleware Services, August 2000.
- [11] R. Buyya, *Economic-based Distributed Resource Management and Scheduling for Grid Computing*, Ph.D. Thesis, School of Computer Science and Software Engineering, Monash University, Melbourne, Australia, April 2002.
- [12] R. Buyya and M. Murshed, "*GridSim: A Toolkit for the Modeling and Simulation of Distributed Resource Management and Scheduling for Grid Computing*", Journal of Concurrency and Computation: Practice and Experience, pp. 1-32, May 2002.
- [13] K. Narendra and M. A. L. Thathachar, *Learning Automata: An Introduction*, Prentice Hall, Englewood Cliffs, New Jersey, 1989.
- [14] K. Najim and A. S. Poznyak, *Learning Automata: Theory and Application*, Elsevier Science Ltd., Tarrytown, NY, 1994.

-
- ¹ Computational Grids
 - ² Heterogeneous
 - ³ Workstations
 - ⁴ Commodity Market Model
 - ⁵ Deadline
 - ⁶ Heuristic
 - ⁷ Learning Automata Cost Optimization
 - ⁸ Advanced Learning Automata Cost Optimization
 - ⁹ Finite State Machine
 - ¹⁰ Variable structure
 - ¹¹ Linear reward penalty
 - ¹² Linear reward epsilon penalty
 - ¹³ Linear reward inaction
 - ¹⁴ Million Instruction
 - ¹⁵ Homogeneous
 - ¹⁶ Resource Discovery
 - ¹⁷ Resource Trading
 - ¹⁸ Admission Control
 - ¹⁹ Dispatching