Information Technology Journal, 3 (2): 139-141, 2004
ISSN 1682-6027

Hyper-threading Technology in E-learning Environments

Dr. Ayman Nsour and Samia Abul-Rub
Computer Science Department, Al-Isra Private University, Jordan

Abstract: In this study, the performance of an e-learning environment is analyzed and evaluated in terms of average network traffic and upload/download rates under various processing capabilities. In particular, we study the influence of hyper-threading technology. As a result of this work, we conclude that hyper-threading can be a costly solution for e-learning environments; the improvement on uploading and downloading rates were marginal as opposite to multi-processing. Moreover, the reduction in network traffic which hyper-threading offers may not justify the cost.

Key words: Synchronous e-learning, hyper-threading technology, download and upload rates, average network traffic

INTRODUCTION

Recent years have witnessed a revolutionized learning. Ever since the mid-nineties, educators gradually moved from conventional approaches and adopted an electronic learning (e-learning) approach.

Bersin[1] classified e-learning applications into four categories: broadcast of new information, important knowledge transfer, developing new skills and creating certified competencies. The fundamental strategies critical to developing efficient and effective e-learning environments were identified by Steiner[2]. Among the most important issues is performing a comprehensive, realistic analysis regarding the technical needs and specification of the e-learning project.

Hyper-threading technology is a groundbreaking innovation from Intel® Corporation[3] that enables multi-threaded software applications to execute threads in parallel. Hyper-threading provides thread-level parallelism (TLP) on each processor resulting in increased utilization of processor execution resources.

Our main focus is on e-learning in Higher Education and, as a special case, at Al-Isra Private University. We consider all four categories as well as a sub-area of the analysis- the processing capability. We study how worthwhile it would be to introduce hyper-threading in e-learning.

Considerable work has been done on studying e-learning environments. Albon and Tinidad[4] at Curtin University of Technology developed a Learner Mediated Approach (LMA) based on the nature of learning communities in which multiple approaches to learning reflect the learning process. They conducted an assessment of tasks, role of technology and student processes in constructing knowledge and concluded that LMA provides an approach in which the assessment drives the learning and the technology drives the model, creating a simultaneous and harmonious building of a learning community.

Dede[5] studied the evolution of innovative learning devices including smart objects, information infrastructures and shared synthetic environments and addressed the importance of careful design of the interface among the devices, learners and instructors, in order to improve instructional outcomes.

The effectiveness of web-bases resources for teaching logic and discrete mathematics was examined by Mudgett *et al.*[6] at the Pennsylvania State University. They observed improved student satisfaction (96% of the students surveyed) in the course after developing a course web-site and using web-based resources.

MATERIALS AND METHODS

We aim at studying the influence of hyper-threading technology in an e-learning environment in terms of average network traffic, upload and download rates.

The present study took place at Al-Isra Private University labs. The e-learning environment is synchronous and uses both audio and video conferencing, in addition to chat rooms. In order to achieve our aim, certain system arguments were taken into

Corresponding Author: Dr. Ayman Nsour, Assistant Professor, Computer Science Department, Al-Isra Private University, Jordan E-mail: ayman@isra.edu.jo

consideration and assigned values which are shown in Table 1. These values are set for each LAN, whereas each lab represents a stand-alone LAN.

The assumptions in our model can be summarized as follows:

- The instructor may not be physically available in the lab
- Each lab is connected to one printer
- Every student (client) may use a web cam and a microphone

The workloads used in this study are classified as follows:

- Real-system workloads
- Artificial workloads

Real-system workloads are essential in order to reflect the reality involved in an e-learning environment. The workloads used in this study were collected at 9 labs meeting the stated assumptions and operating under single-processing capability.

Table 2 illustrates two different usages of labs; those running for 1 h and having the capacity of 20 clients and others running for 2 h with a capacity of 40 clients. The reason behind this classification lies in following the standards followed at Al-Isra Private University in offering such durations depending on the nature of the course. In either case, workloads were collected at 10 different sessions to give a more representative average case.

On the other hand, artificial workloads were also used. The reason behind using artificial workloads is the unavailability of multi-processing capability or hyper-threading processors. Therefore, a simulator was built in order to study the influence of these capabilities on the environment. Workloads were generated and fed to the simulator. The simulator was run under the same environmental factors present in the real single-processing environment.

The simulator was built by developing a process structure that identifies all attributes needed for a network process that covers all previously stated model assumptions.

Table 1: System Arguments

Argument	Value
Network Bandwidth	10 Mb
Printer Job Size	50 Kb
Voice Packet Size	25 Kb
Text Packet Size	8 Kb
Process Queue Size	60
Image Size	17 Kb
Image Upload Rate	5 Kbps

Table 2: Real-System Workloads

Site	Collection Duration	No. of Clients	Number of Sessions
Lab 1-7	60 Minutes	20	10
Lab 8-9	120 Minutes	40	10

Each operation category (uploading for example) has its own separate queue that is limited, not by the number of processes in the queue, but by the configuration assigned for environment variables designed for that queue. Threading was used in order to allow for multiple clients to operate at the same time.

RESULTS AND DISCUSSION

All experiments operated on both real-system and artificial workloads. We classify the results as follows:

The influence of hyper-threading technology on average upload/download rates: As shown in Fig. 1 and 2, the differences between hyper-threading and multi-processing on the average upload/download rates are marginal. The same result was obtained over a period of 120 min. This implies that the decision of upgrading an e-learning environment to a hyper-threading processing capability might be costly since the cost outweighs the benefits.

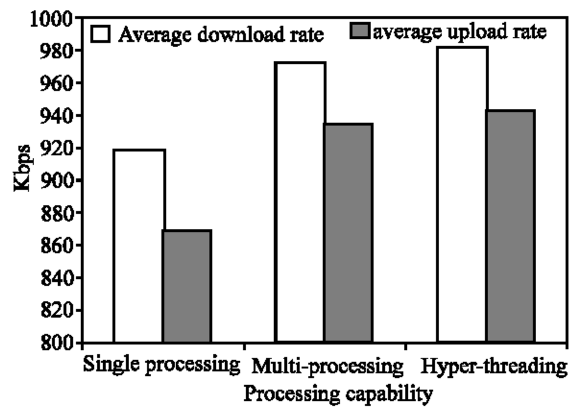

Fig. 1: Average upload/download rates for a 60-min. duration

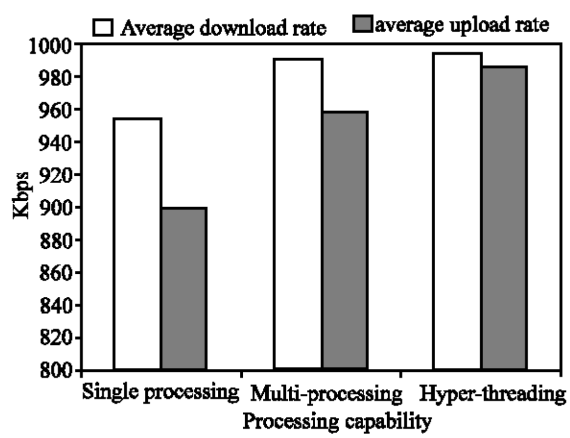

Fig. 2: Average upload/download rates for a 120-min. duration

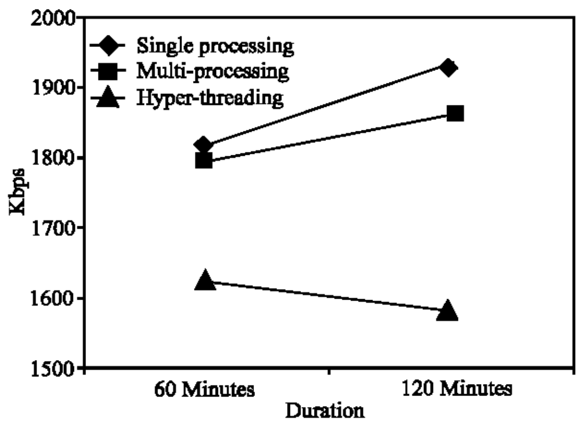

Fig. 3: Average network traffic for all processing capabilities

The influence of hyper-threading technology on average network traffic: Fig. 3 shows that hyper-threading forced an inverse relationship between time and average network traffic. As opposite to single and multi-processing, hyper-threading resulted in a noticeable improvement in network traffic over a short period of time.

Having conducted the previously stated experiments and analyzed the obtained results, we conclude that hyper-threading is a costly solution for e-learning as a multi-processing capability or even single-processing can be sufficient considering the average performance improvement hyper-threading offers.

REFERENCES

1. Bersin, J., 2003. The Four Categories of E-Learning, retrieved July 30, 2003 from http://www.bersin.com/tips_techniques/breeze2.htm.
2. Steiner, M., 2003. Critical strategies for a successful e-learning project, retrieved July 30, 2003 from http://www.macromedia.com/devnet/education/articles/aw_planning.html.
3. Intel of Canada, 2003. Hyper-Threading Technology: Turbo-Charging PCs to Hit a New High in Performance, retrieved July 5, 2003 from http://www.intel.com/ca/pressroom/kits/p4/cpk/HTT/HTbackgrounderCANADA.pdf
4. Albon, R. And S. Tinidad, 2002. Building Learning Communities Through Technology, retrieved July 5, 2003 from www.library.cqu.edu.au/conference/papers/Albon_Trinidad.pdf
5. Dede, C., 1996. The Evolution of Learning Devices: Smart Objects, Information Infrastructures and Shared Synthetic Environments, retrieved July 5, 2003 from http://www.ed.gov/Technology/Futures/dede.html
6. Mudgett, D., A. Freed and F. Ritter, 2002. Web-Based Resources for Teaching Discrete Mathematics to Students of Information Sciences and Technology. *Learning Technol.,* 4: http://lttf.ieee.org/learn_tech/issues/july2002/.
7. Beilawski, L. And D. Metcalf, 2002. Blended eLearning, Human Resource Developmetn Pr.
8. Horton, W., 2001. *Evaluating E-Learning*, American Society for Training and Development.
9. Marr, D., F. Binns, D. Hill, G. Hinton, D. Koufaty, J. Miller and M. Upton, 2002. Hyper-Threading Technology Architecture and Microarchitecture. Intel Technol. J., 6. pp: http://www.intel.com/technology/itj/2002/volume06issue01/art01_hyper/vol6iss1_art01.pdf
10. Paynter, J., 2002. A comparison of computer mediated training tools. *Learning Technol.,* 4. http://lttf.ieee.org/learn_tech/issues/july2002/
11. Ryan, B. And S. Walmsley, 2003. Implementing metadata collection. *Learning Technol.,* 5. http://lttf.ieee.org/learn_tech/issues/january2003/
12. Simpson, W., 2002. Online learning: a project to develop an innovative approach to control. *Learning Technol.,* 4. http://lttf.ieee.org/learn_tech/issues/july2002/