Comparative Study and measurement of performance of Serial, Parallel and Concurrent Mark Sweep Collectors algorithm on JVM

Dissertation

Submitted To

Central Department of Computer Science & Information Technology

Tribhuvan University

Kirtipur, Kathmandu

Nepal

In Partial Fulfillment of the Requirements for the Degree of Master of Science in Computer Science & Information Technology

Submitted By:-

Saroj Bhatta

August, 2014

Supervisor

Mr. Arjun Singh Saud

Tribhuvan University

Institute of Science and Technology

Central Department of Computer Science and Information Technology

Student's Declaration

I hereby declare that I am the only author of this work and that no sources other than the listed here have been used in this work.

… … … … … … …

Saroj Bhatta

Date: August, 2014

Tribhuvan University
Institute of Science and Technology
Central Department of Computer Science and Information Technology

Supervisor's Recommendation

I hereby recommend that the dissertation prepared under my supervision by **Mr. Saroj Bhatta** entitled "**Comparative Study and Measurement of Performance of Serial, Parallel, and Concurrent Mark Sweep Collectors on JVM** " be accepted as in fulfilling partial requirement for the completion of Masters Degree of Science in Computer Science & Information Technology.

Mr. Arjun Singh Saud
Lecturer,
Central Department of Computer Science and Information Technology,
Institute of Science and Technology,
Kirtipur, Kathmandu, Nepal

Date: August, 2014

Tribhuvan University

Institute of Science and Technology

Central Department of Computer Science and Information Technology

LETTER OF APPROVAL

We certify that we have read this dissertation work and in our opinion it is appreciable for the scope and quality as a dissertation in the partial fulfillment of the requirements of Masters Degree of Science in Computer Science & Information Technology.

Evaluation Committee

Asst. Prof. Nawaraj Paudel
Head of Department
Central Department of Computer Science
& Information Technology
Tribhuvan University
Kirtipur

Mr. Arjun Singh Saud
Lecturer
Central Department of Computer Science
and Information Technology
(Supervisor)

(External Examiner)

(Internal Examiner)

Date: August, 2014

ABSTRACT

Java Virtual Machine (JVM) works as a software module that executes java application bytecode and translates the byte code into hardware and operating system-specific instructions. By doing so, the JVM enables java program to be executed in different environments. It also performs the function of memory allocation as objects are created and freeing when they are no longer needed. In java programming language, garbage collector automatically manage the objects generated by the keyword new inside Java Virtual machine. But in other programming languages like C/C++ objects created are managed by free or delete.

Garbage collection is the process of automatic storage reclamation in which those objects which are no longer referenced from any live objects or from program are collected. One of the advantages of garbage collection is that the garbage collection ensures program integrity. It is an important part of java security strategy. Garbage collectors are becoming the essential part of compilers. Most of the high level languages like java and C# have incorporated garbage collectors for automatic memory management. This study compares three garbage collectors (Serial, Parallel and Concurrent Mark Sweep). After performing different tests, this dissertation work showed that Serial GC is better choice if we have to use single threaded programs and parallel GC is better choice in case of multithreaded.

Keywords: *Serial garbage Collector, Parallel Garbage Collector, Concurrent mark Sweep Garbage Collector, Java Virtual Machine, Java Heap Memory.*

Acknowledgement

I would like to express my gratitude to all the people who supported and accompanied me during the preparation of this dissertation **"Comparative Study and measurement of performance of Serial, Parallel, and Concurrent Mark Sweep Collectors algorithm on JVM".** This research work has been performed under Central Department of Computer Science and Information Technology (***Tribhuvan University***), Kirtipur. I am very grateful to my department for giving me an enthusiastic support.

Firstly, I would like to deeply extend my heartly acknowledgement to my respected teacher and dissertation supervisor **Mr. Arjun Singh Saud,** for his wholehearted cooperation, encouragement and strong guidelines throughout the preparation of this study. He is the one who listened to all my problems I faced during this thesis and showed me the way to overcome them.

Most importantly I would like to thank to respected Head of Department of Central Department of Computer Science and Information Technology, Asst. Prof. Nawaraj Paudel for his kind support, help and constructive suggestions. I am very much grateful and thankful to all the respected teachers Prof. Dr. Shashidharram Joshi, Prof. Dr. Subarna Sakya, Prof. Sudarsan Karanjit, Mr. Min Bahadur Khati, Mr. Bishnu Gautam, Mr. Jagdish Bhatta, Mr. Dheeraj Kedar Pandey, Mr. Sarbin Sayami, Mrs. Lalita Sthapit, Mr. Yoga Raj Joshi and Mr. Bikash Balami of CDCSIT, TU, for providing me such a broad knowledge and inspirations.

All my class fellows are worthy of my gratefulness for their direct or indirect support in completion of my dissertation. Finally, I would like to thank my friends Mr. Dabal Singh Mahara and Mr. Niranjan Kathayat for their kind co-operation during my work.

I have done my best to complete this research work. Suggestions from the readers are always welcomed, which will improve this work.

Saroj Bhatta
August, 2014

ABBREVIATIONS

CPU	Central Processing Unit
CMS	Concurrent Mark Sweep
DFS	Depth First Search
GB	Giga Byte
GC	Garbage Collector
GC	Garbage Collection
GHz	Giga Hertz
JDK	Java Development Kit
JVM	Java Virtual Machine
KB	Kilo Byte
MHz	Mega Hertz
PGC	Parallel Garbage Collection
SGC	Serial Garbage Collection

TABLE OF CONTENTS

Pages

LIST OF FIGURES

LIST OF TABLES