Master Thesis

Expiration Classes for Implicit Memory Management

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- Build a real time memory management for Java
- Allow the programmer to improve the system by giving additional information
 - Improve performance
 - Improve predictability
 - Improve correctness

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- Java uses garbage collection
 - No predictability
 - No garbage collection algorithm is independent of the amount used memory
- How to use other memory management systems in Java?
 - No deallocation command available
- Which additional information can improve the system?

Expiration Class Analysis

- A concept to analyze memory management systems
 - Reveals costs and their origins

Definition

An **expiration class** is a set of objects which are deallocated at the same time.

Definition

The event which leads to the deallocation of an expiration class is called **expiration event**.

• We used expiration class analysis to identify proper memory management systems

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Tracing Garbage Collection

• First implementation of garbage collection [1]



Figure: Example for Tracing

The tracing garbage collector provides the correctness we want to achieve

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Definition

An **allocation site** is the command in the source code which allocates an object.

• Allocates objects of an allocation site into a cyclic buffer. [2]



Figure: Cyclic Allocation

Cyclic allocation provides the predictability we want to achieve

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• Combination of tracing garbage collection and cyclic allocation



Figure: Allocation in AGC

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- Trade-off between Correctness of Garbage Collection and Predictability of Cyclic Allocation
 - Controlled by additional information given by the programmer
 - Predictable allocation time for objects with cyclic allocation
 - Correctness for objects in the garbage collected heap
- The use of cyclic allocation improves the performance of the system
- Overhead
 - Some space overhead because of buffer management
 - Some time overhead because of cross-heap-segment references

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Benchmark: Monte Carlo



Figure: Monte Carlo: Average Time

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Benchmark: JLayer MP3 Encoder



Figure: JLayer: Average Results

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Benchmark: Cyclic Allocation Program



Figure: Cyclic Allocation Program: Average Results

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- Expiration Class Analysis is a good help for understanding memory management systems
- Our System AGC either guarantees correctness or predictability for every allocation site
- The performance results justify the use of AGC

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Thank you for your attention! Questions?

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