# Garbage Collection

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# Topics

- What is Garbage Collection (GC)?
- Why GC?
- When does GC occur?
- How does GC get performed?
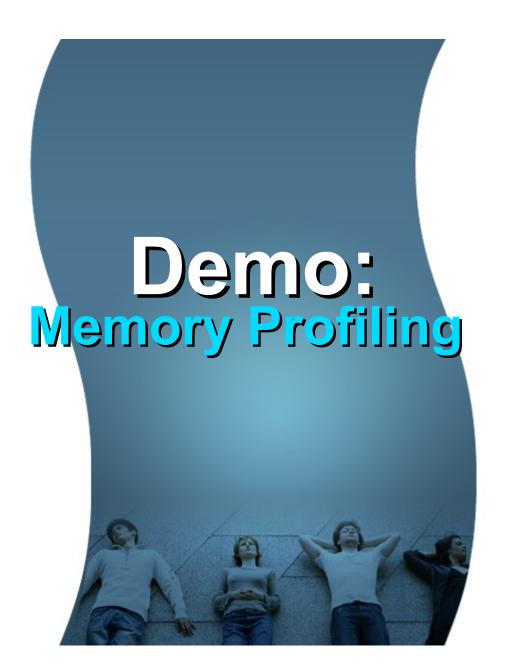
# What is Garbage Collection (GC)?

# What is GC?

- The Java virtual machine's heap stores all objects created by a running Java application.

- Objects are created by the program through *new* keyword, but never freed explicitly by the program

  > No need to call free().

- Garbage collection is the process of automatically freeing objects that are no longer needed

- An object is determined to be "no longer needed" when there is no other object referencing to it

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# Why Garbage Collection (GC)?

# Advantages of GC

- Programmer is free from memory management
  - > Less error prone code

- System cannot crash due to memory management
  - > More reliable application
  - > Memory-leak is still possible, however - you can use memory profiler to find out where memory-leaking code is located

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# Demo:
## Memory Profiling

# Disadvantages of GC

- GC could add overhead
  - > Many GC schemes are focused on minimizing GC overhead

- GC can occur in an non-deterministic way
  - > Real-time Java addresses this

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# When and How Garbage Collection (GC) Occur?

# When Does GC Occur?

- JVM performs GC when it determines the amount of free heap space is below a threshold
  - > This threshold can be set when a Java application is run

# How Does JVM Perform GC?

- The garbage collector must somehow determine which objects are no longer referenced and make available the heap space occupied by such unreferenced objects.

- The simplest and most crude scheme is to keep reference counter to each object

- There are many different schemes - years of research

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# Java API

# GC Related Java API

- *finalize() method* in Object class
  - > Called by the garbage collector on an object when garbage collection determines that there are no more references to the object.

- gc() method in System class
  - > Runs the garbage collector.
  - > Calling the gc method suggests that the Java Virtual Machine expend effort toward recycling unused objects in order to make the memory they currently occupy available for quick reuse.
  - > When control returns from the method call, the Java Virtual Machine has made a best effort to reclaim space from all discarded objects.

# Thank you!

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