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SYNERGETICS
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Microsoft Partner
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Memory Management & JVM Internals

Agenda

- JVM internals, tuning
- Garbage Collection
- Heap & Stack memory
- Stack Overflow / Stack trace
- Perm Space, String Pool

JVM Internals

- The Java Virtual Machine
- Garbage Collection
- Code Security

Java Virtual Machine

- Provides hardware platform specifications
- Reads compiled byte codes that are platform independent
- Is implemented as software.
- Is implemented in a Java technology development tool.

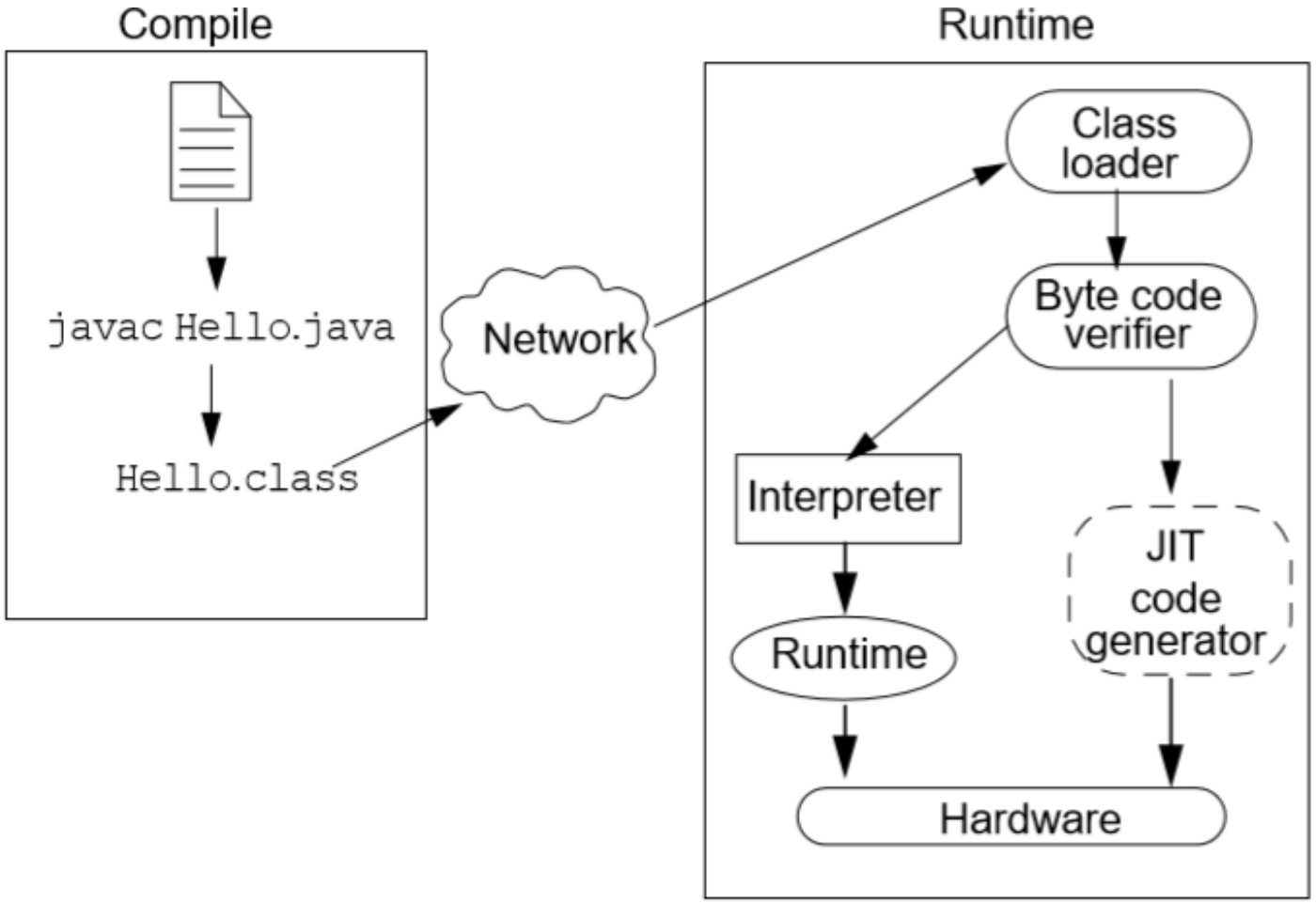
Java Virtual Machine

- JVM Provides definitions for
  - Instruction Set (CPU)
  - Register Set
  - Class File format
  - Stack
  - Garbage collected heap
  - Memory area

Java Virtual Machine

- Bytecode maintains proper type discipline from the code.
- Majority of type checking is done when the code is compiled.
- Every oracle approved implementation of JVM must be able to run any compliant class file.

Code Security



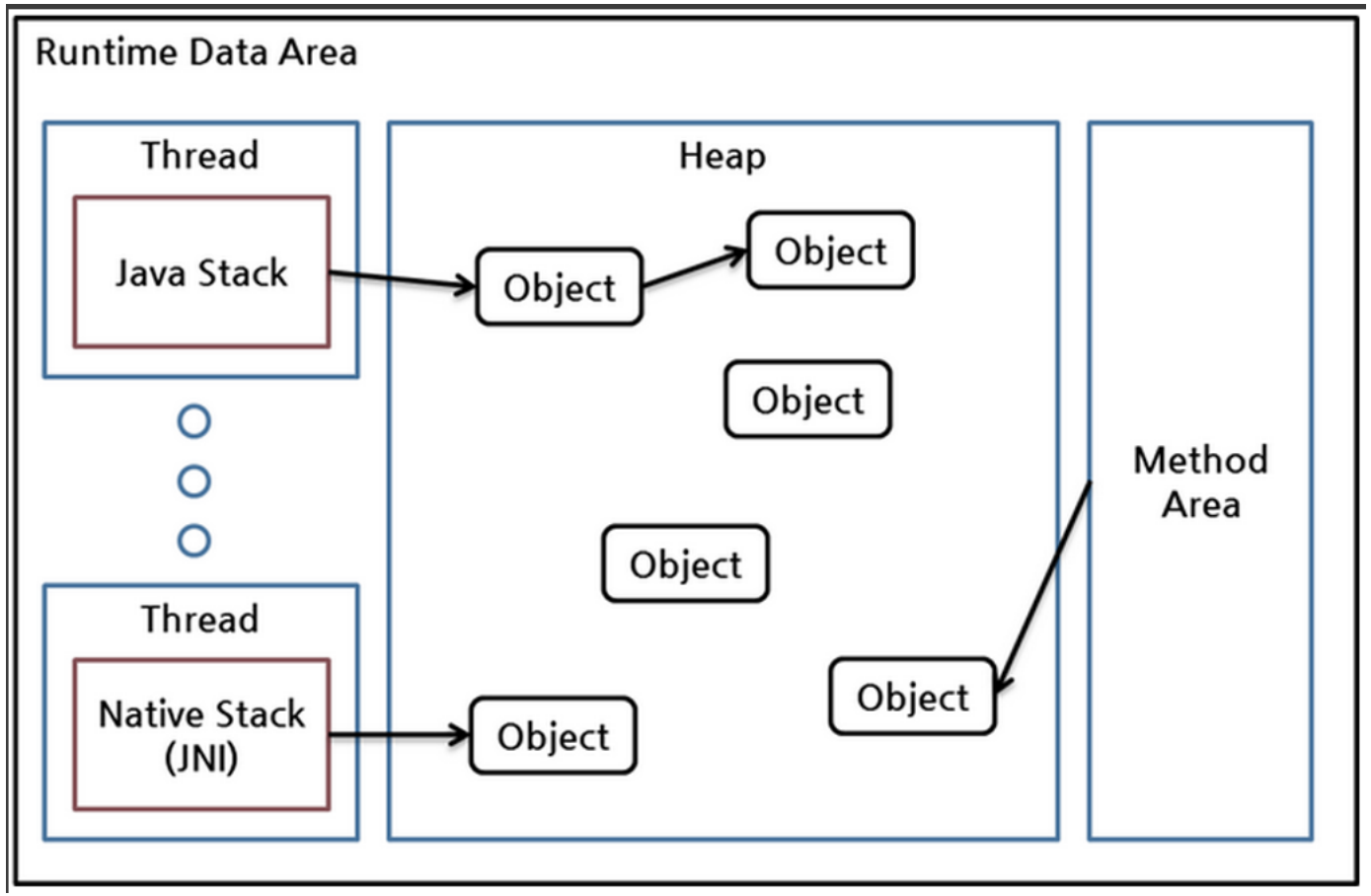
Class Loader

- Loads all classes necessary for the execution of a program
- Maintains classes of the local file system in separate "namespaces"
- Prevents spoofing

Bytecode verifier

- Ensure that code adheres to the JVM Specification
- Ensure that code does not violet system integrity
- Code causes no operand stack overflows / underflows
- Correct parameter types for all operational code
- No illegal data conversions

Memory Area

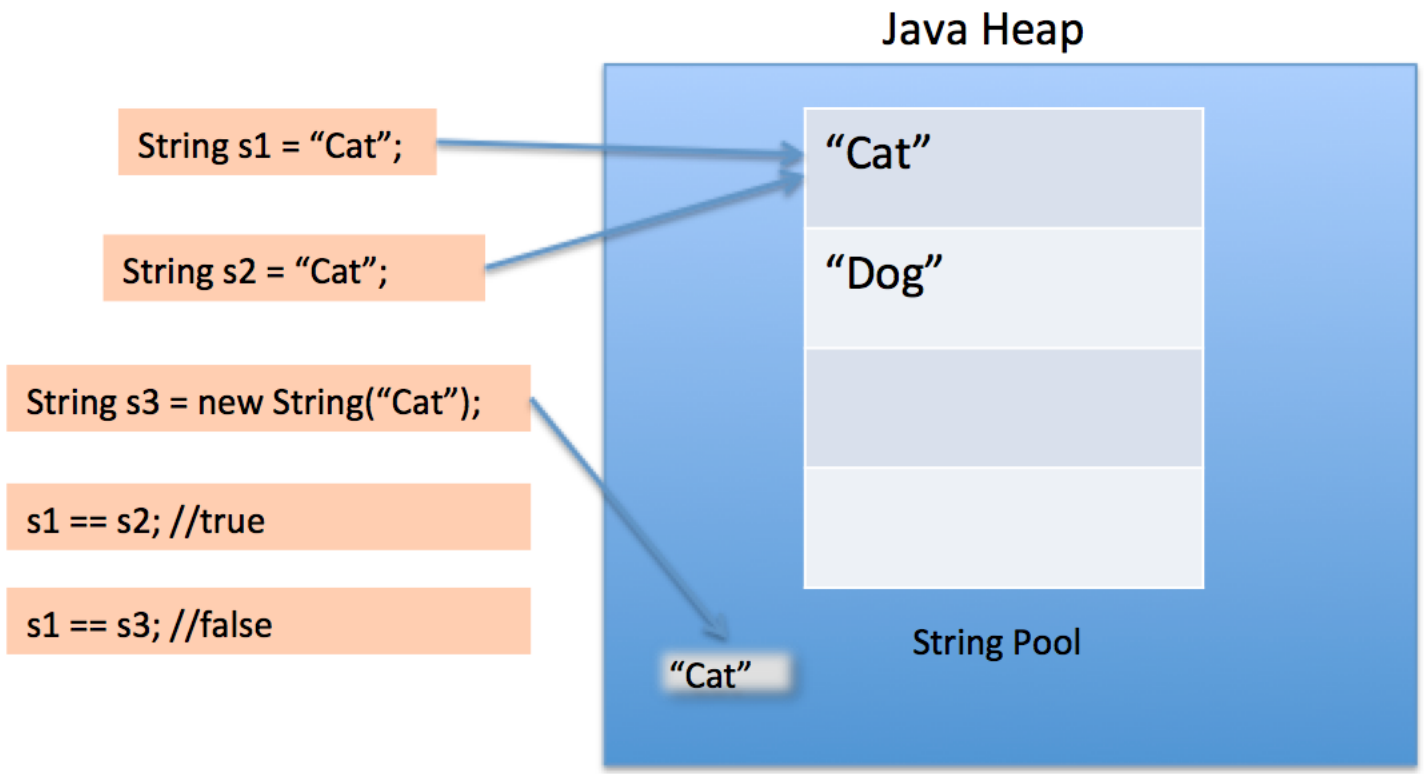

Runtime Data Area
Thread
Java Stack
Thread
Native Stack
(JNI)
Heap
Object
Object
Object
Object
Object
Object
Method
Area

PermGen

- Permanent Generation
- Used for keeping information about loaded classes and other features like “String Pool”
- Garbage collector would be helpless to clear this one.
- No longer exists from Java 8 onwards (replaced with meta-space)
- Results in OutOfMemoryError
- Use following JVM Argument for Max Memory Setting

-XX:MaxPermSize

String Pools



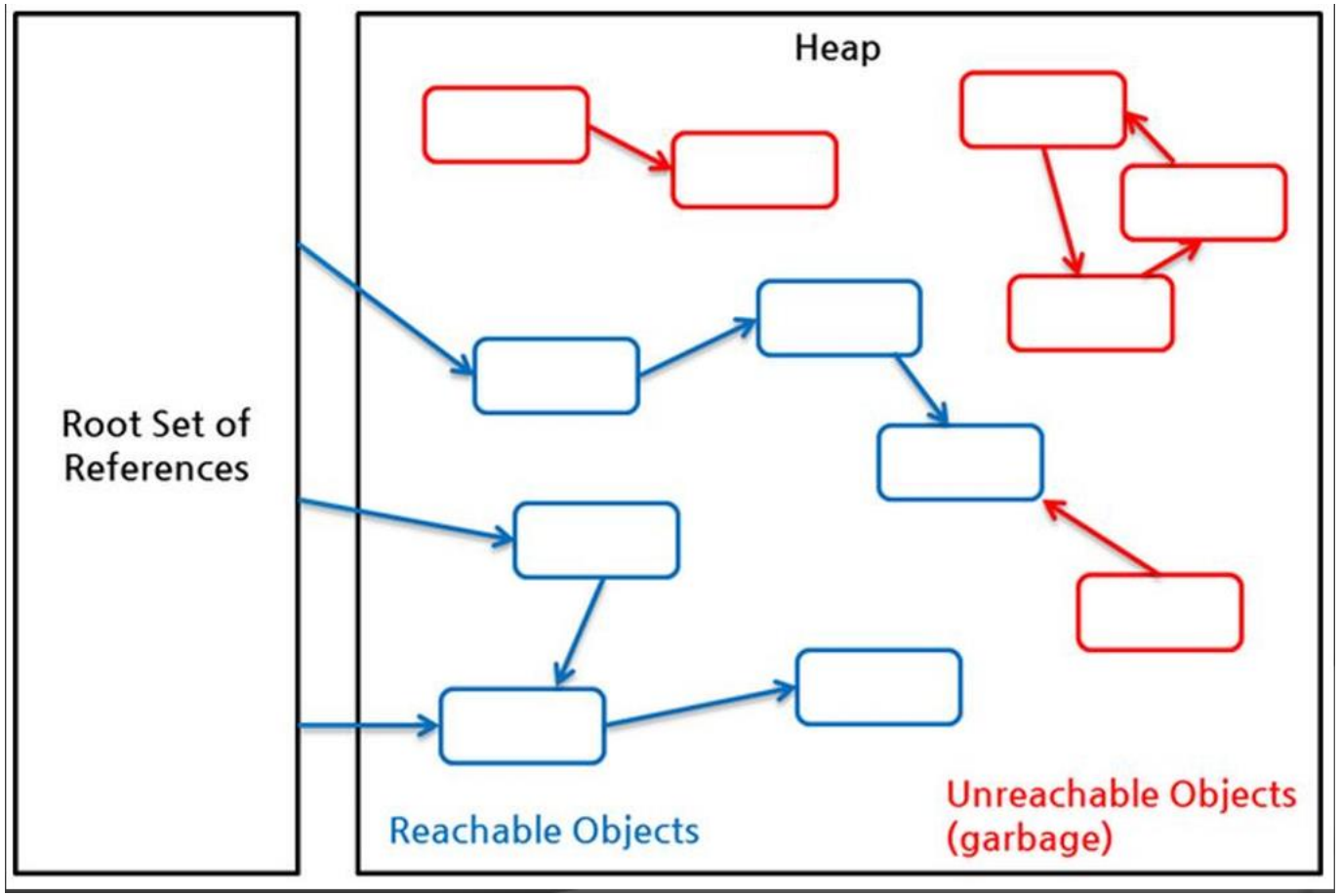
Override default memory allocation

- Each OS Allocates certain amount of memory to JVM
- Override using following JVM Argument
  - -Xmx Maximum Memory to Allocate
  - -Xms Initial memory to allocate

Garbage Collection

- Allocated memory that is no loger required needed should be deallocated.
- Java provides System level thread to track memory allocation.
- Garbage collection
  - Check for and frees memory no longer needed
  - Implicitly invoked.
  - Can vary across JVM implementation

Garbage Collector



http://haks1999.github.io/haklab-gc/serial.html

Stack Overflow

- Stack size exceeds the limit
- Causes:
  - Recursion
  - Allocating size grater than stack can handle

Stack Trace

- Details captured by Exception (And its parent exception)
- Allows debugging
- Use method “printStackTrace” to display entire stack trace on screen.