
Garbage Collection

: [Java™ Platform Performance : Strategies and Tactics](#) [Appendix A – The Truth About Garbage Collection](#)

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Garbage collection(GC)

가

. GC

garbage collector

garbage collection

가

garbage collection

A.1 Garbage Collection

가?

가

RAM

가

가 가

가

JVM(Java Virtual

Machine)

가

. 가

(

)

, GC

A.2 GC가

(Specification) garbage collection
Java Virtual Machine
Specification(JVMS)
(heap) virtual machine
(garbage collector)
virtual
machine 가 가
,
.¹
, garbage collection
- garbage collection
가 , garbage
collection
garbage collector
GC *Java Language Specification* JVMS

A.3

Garbage collection ,

가 .

1. Created
2. In use(strongly reachable)
3. Invisible

¹ Tim Lindholm and Frank Yellin, *The Java Virtual Machine Specification, Second Edition*, Section 3.5.3. Addison-Wesley, 1999

- 4. Unreachable
- 5. Collected
- 6. Finalized
- 7. Deallocated

A.3.1 Created

가 , 가 :²

1. .
 2. .
 3. (superclass) 가 .
 4. 가 .
 5. .
- 가 , JVM
- 가 .
- 가 In Use

A.3.2 In Use

strong reference *in use*

. JDK 1.1.x , 가 strong reference . Java 2

reference가 : weak, soft phantom. (reference

A.4.1 .) Listing A - 1

² James Gosling, Bill Joy, and Guy Steele, *The Java Language Specification, Second Edition*. Addison-Wesley, 2000

```

public class CatTest {
    static Vector catList = new Vector();
    static void makeCat() {
        Object cat = new Cat();
        catList.addElement(cat);
    }

    public static void main(String[] arg) {
        makeCat();
        // do more stuff
    }
}

```

Listing A - 1

Figure A - 1 makeCat 가 VM strong reference가 Cat 가 .

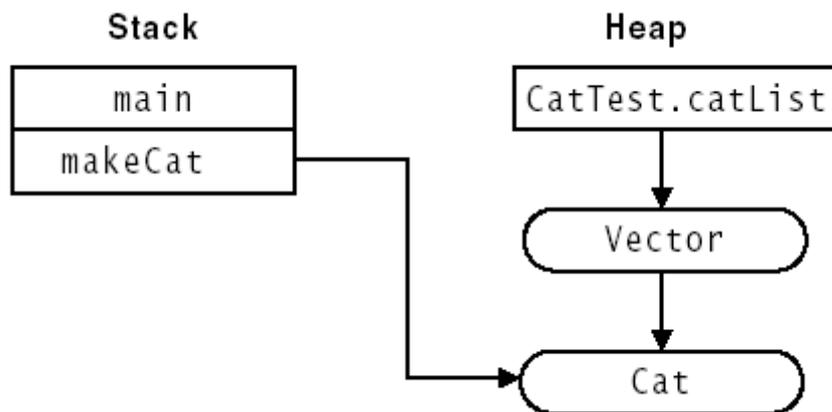


Figure A - 1

makeCat 가 , (stack frame) 가
 . makeCat 가 , Cat catList
 (Vector) 가 .

A.3.3 Invisible

가 가 가 strong reference가

invisible

invisible

Listing A - 2 *invisible* 가

```

public void run() {
    try {
        Object foo = new Object();
        foo.doSomething();
    } catch (Exception e) {
        // whatever
    }
    while (true) { // do stuff } // loop forever
}

```

Listing A - 2 Invisible

, foo try 가
foo 가 가 ,
try , foo
가 , JVM 가
foo
run 가 strongly reference 가 ,
. Invisible ,
가 , garbage
collection 가 null .

A.3.4 Unreachable

strong reference가 *unreachable*
가 . 가 unreachable 가 , garbage collection 가
: , 가 garbage collection 가
가 . JVM
가 가 garbage collection
strong reference .

garbage collection 가 가 . GC

- ()
- ()
- JNI native

strong reference가

. Listing A - 3

```
public void buildDog() {
    Dog newDog = new Dog();
    Tail newTail = new Tail();
    newDog.tail = newTail;
    newTail.dog = newDog;
}
```

Listing A - 3

Figure A - 2 buildDog 가
가 , buildDog
strong reference

Dog Tail 가

Figure A - 3 buildDog 가
, Dog Tail 가 unreachable 가 garbage collection
가 (VM).

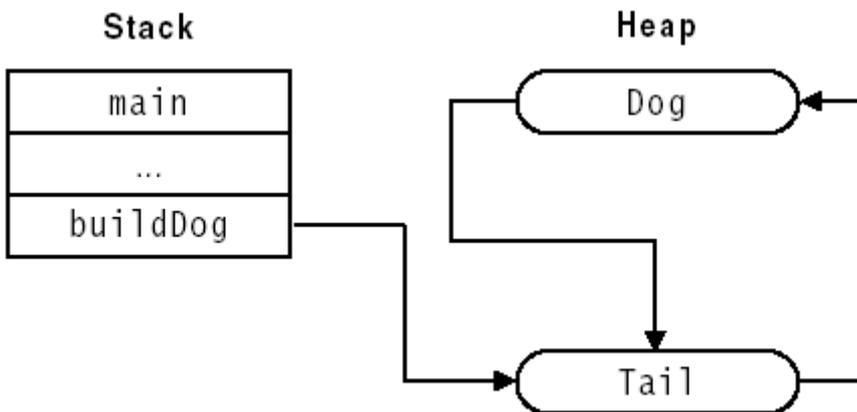


Figure A - 2 buildDog 가

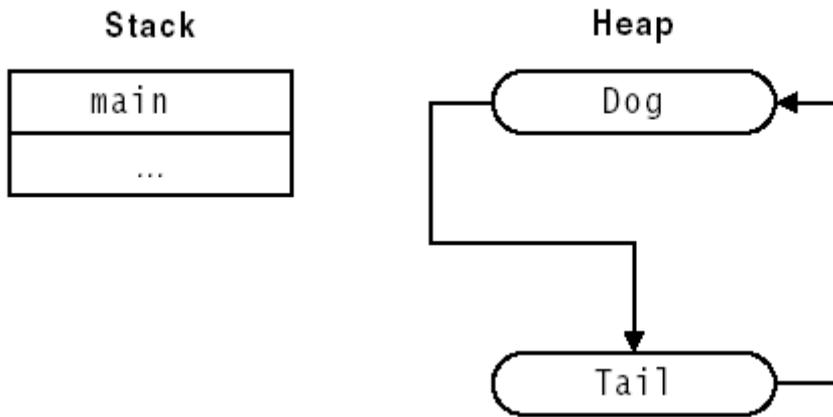


Figure A - 3 buildDog 가

A.3.5 Collected

Garbage collector가 가 unreachable 가 , *collected* 가 finalize 가 , finalization finalize 가 , finalized 가 finalize , finalizer 가 . finalizer

A.3.6 Finalized

finalize 가 (finalize 가) 가 unreachable , *finalized* 가 . 가 Finalizer가 VM 가 finalizer 가 finalize finalizer finalizer 가 finalizer

GC finalize (QA : Quality Assurance)
 Swing QA GUI
 가

OutOfMemoryError 가 finalizer
 가 10,000 Graphics
 finalize finalizer
 가 Graphics
 Swing

Graphics , 가
 dispose
 finalize , 가
 JVM JVM finalize 가
 linked list finalization
 가

A.3.7 Deallocated

Garbage Collection deallocated 가
 unreachable , 가
 가 JVM

A.4

Java 2 , 가 strong
 System.gc 가 가 garbage collector

java.lang.ref Java 2 . Figure A - 4
 garbage collector
 garbage
 collector가 가 가
 reachability

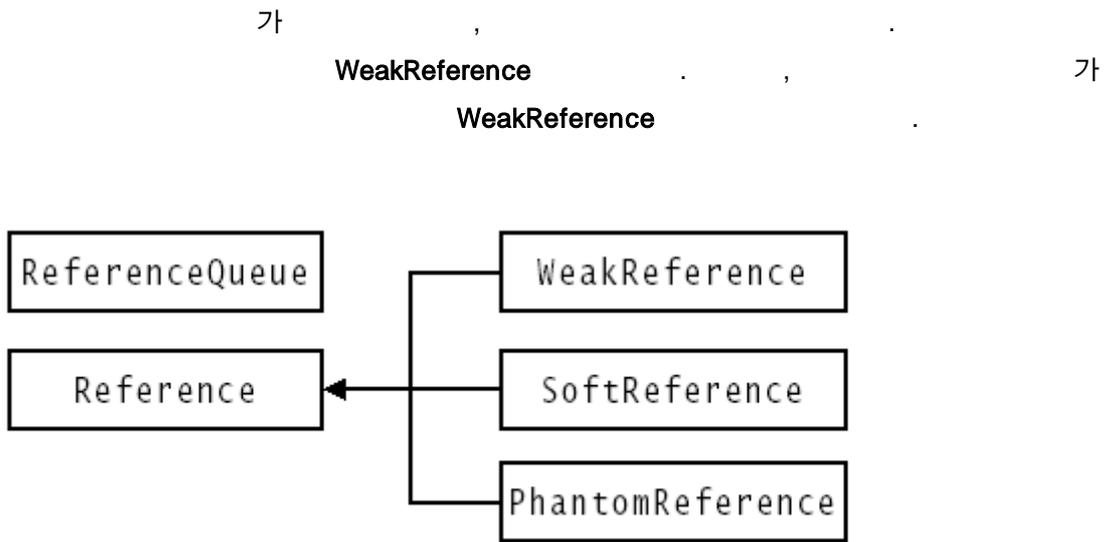


Figure A - 4

(Resurrection)

finalize 가 , strong
 가 . in-use 가 .
 (resurrection) .
 finalizer가 . Finalizer

, Ken Arnold and James Gosling, *The Java Programming Language*, Section 2.10.2. Addison-Wesley, 1998 .

A.4.1

가 가 ,
 가 : soft, weak phantom. reachability :
 ● Soft memory-sensitive .
 ● Weak ()
 ● Phantom Java finalization 가
 가

- Reachability : 가 가 가
- 가 ,
strongly reachable .
 - 가 strongly reachable soft ,
softly reachable .
 - 가 strongly reachable softly reachable weak
 , weakly reachable . Weakly reachable
weak , finalization
 .
 - 가 strongly, softly, weakly reachable , finalization
 , phantom ,
phantom reachable .
 - , unreachable
 , 가 .

A.4.2 WeakReference 가 Garbage Collection

strong garbage collection .
weak , GC
 . (가 , API .)

Figure A - 5

가 Dog 가 , Dog ,
가 GC . Figure A - 5 ,
Kennel GC
가 , (dog) (tail)가 (wag)
WagTask Dog .
Dog 가 , GC
가 dogCache
WeakReference 가
Tail Dog Dog
Tail , (Tail) (wagging)
가 , WeakReference가 가
가 , WeakReference null . Figure A -

6 wag 가

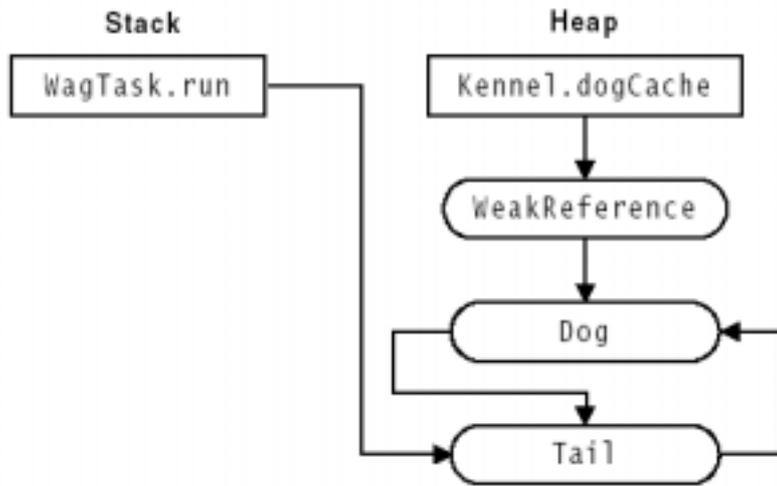


Figure A - 5

가 , Dog strong
 Tail strong , GC
 가 Dog
 strongly reachable 가 Dog Tail dogCache
 weakly reachable 가 . Garbage collector가 ()
 Garbage collector .), weak reference null
 Dog Tail 가 unreachable .
 가 , garbage collector .

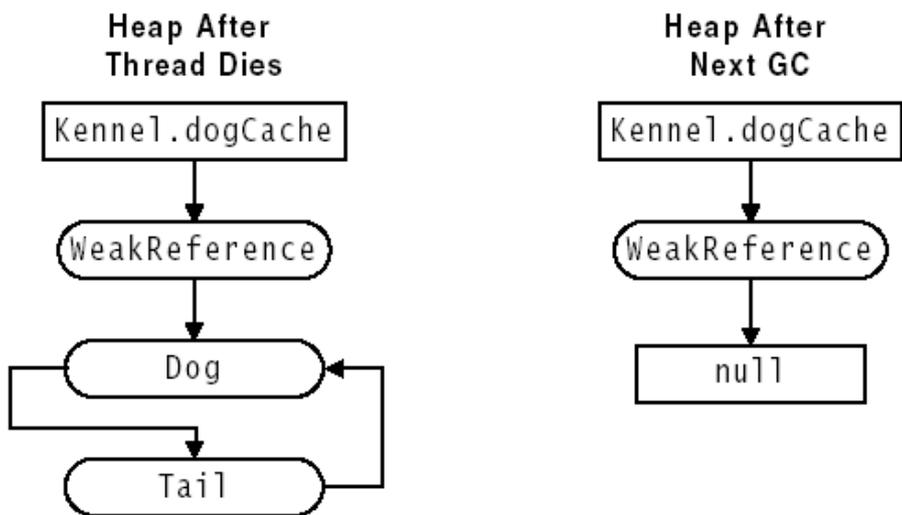


Figure A - 6 Garbage Collection

A.5 References on Garbage Collection

Arnold, Ken, and James Gosling. *The Java Programming Language, Second Edition*, Addison-Wesley, Reading, MA, 1998

Gosling, James, Bill Joy, and Guy Steele. *The Java Language Specification, Second Edition*, Addison-Wesley, Reading, MA, 2000.

Jones, Richard, and Rafael Lins. *Garbage Collection: Algorithms for Automatic Dynamic Memory Management*, John Wiley & Sons, New York, 1996.

Lindholm, Tim and Frank Yellin. *The Java Virtual Machine Specification. Second Edition*, Addison-Wesley, Reading, MA, 1999.