01: jvisualvm to sample Java heap memory

Posted on March 15, 2016 by Arulkumaran Kumaraswamipillai

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Java does not have a **sizeof** operator like C++ does. Java uses automatic memory management known as the Garbage Collection, hence it is not that important to evaluate size of various objects. But, for the purpose of learning & fixing any potential memory issues, I have used “jvisualvm”, which is a very handy & free profiling tool that gets shipped with the JDK. This compliments Java primitives & objects – memory consumption interview Q&A

Step 1: Java code to “sample with jvisualvm”

Never ending while loop is used so that the application stay alive to sample the Java memory to see how much memory

does “MyWrapper” object occupy.

```
1
2  import java.util.concurrent.TimeUnit;
3
4  public class ObjectSize {
5
6      public static void main(String[] args) throw
7
8          MyWrapper five = new MyWrapper(5);
9
10         while(true) {
11             TimeUnit.SECONDS.sleep(10);
12             System.out.println(five);
13         }
14     }
15
16     //inner class
17     static class MyWrapper {
18         int number ; // 4 bytes each
19
20         public MyWrapper(int number) {
21             this.number = number;
22         }
23     }
24 }
25
26
```

Step 2: Start jvisualvm

Run the above code as a stand-alone Java application:

1) **jps** will give the process id of the
2) **jvisualvm** will start the profiler that is shipped with JDK.

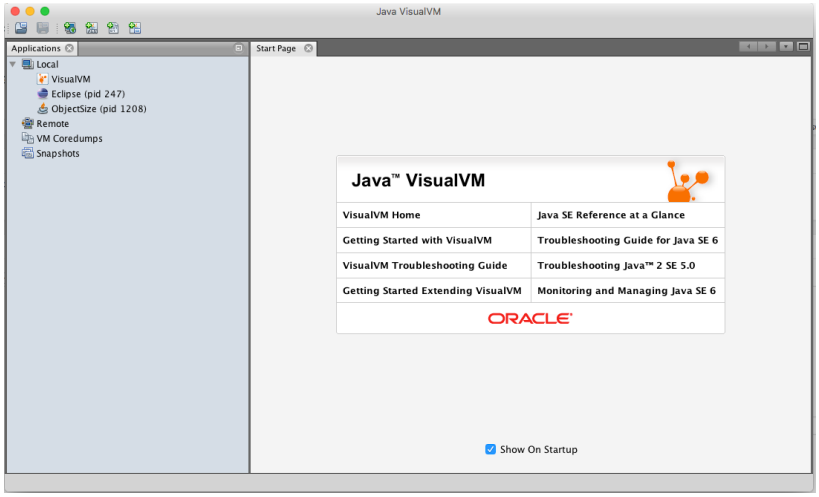
```
1
2 $ jps
3 247
4 1208 ObjectSize
5 1209 Jps
6
```

1208 is the pid (i.e process id) of the JVM in which “ObjectSize” is running.

```
1
2 $ jvisualvm
3
```


16 Technical Key Areas

Step 3: jvisualvm GUI opens up as shown below

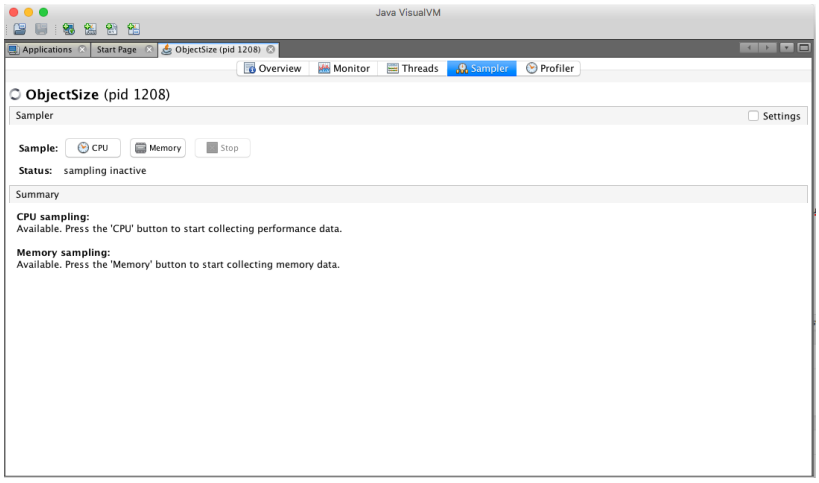


VisualVM

You can see **ObjectSize** with pid 1208.

Step 4: jvisualvm tabs

Double click on "**ObjectSize** with pid 1208." You will get the following screen, and select the "Sampler" tab.



jvisualvm sampler

Step 5: jvisualvm memory sampling

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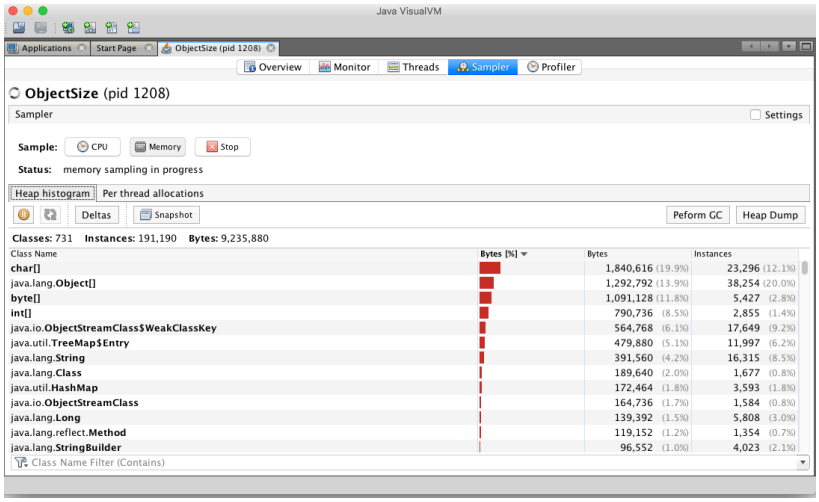
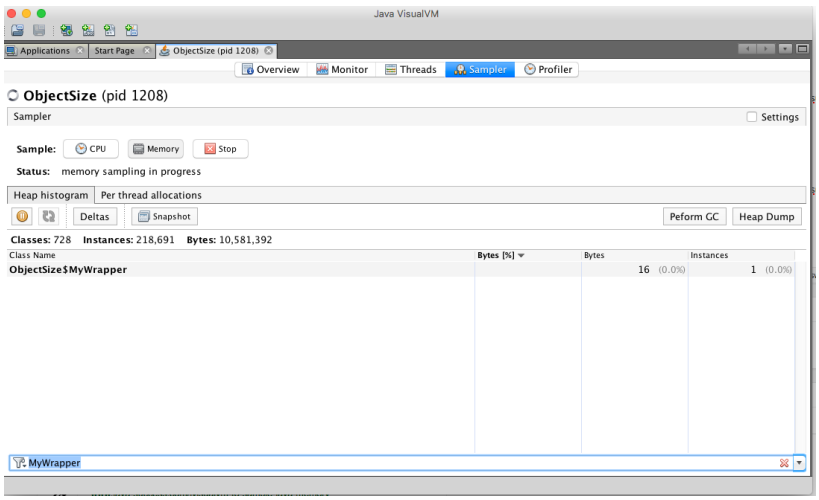
Click on the “memory” button,



jvisualvm histogram

Filter “MyWrapper” by typing it at the bottom



MyWrapper Object on the JVM heap

Step 6: Why 16 bytes when primitive int data is only 4 bytes?

The Object metadata (aka header information) consumes memory in the heap as described below

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1) Class information: 32 bits = **4 bytes**.

2) Flags: array or not, hashCode, etc : 32 bits = **4 bytes**.

3) Lock information: synchronization 32 bits = **4 bytes**.

int number = 32 bits = **4 bytes**.

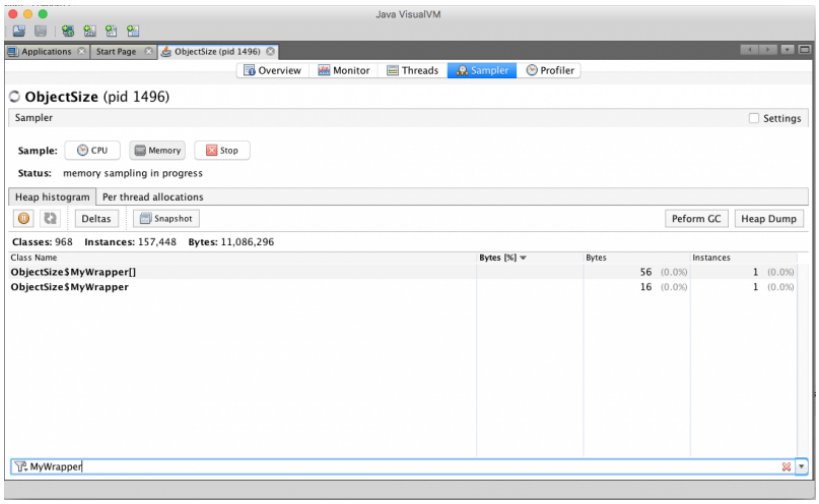
So, total 12 bytes of meta data + 4 bytes of data = **16 bytes**.

How about an array that can hold 10 MyWrapper objects

```
1
2  import java.util.concurrent.TimeUnit;
3
4  public class ObjectSize {
5
6      public static void main(String[] args) throw
7
8          MyWrapper[] five = new MyWrapper[10];
9          five[0] = new MyWrapper(0);
10
11         while(true) {
12             TimeUnit.SECONDS.sleep(10);
13             System.out.println(five);
14         }
15     }
16
17     static class MyWrapper {
18         int number ;
19
20         public MyWrapper(int number) {
21             this.number = number;
22         }
23     }
24 }
25
```

How much memory does the above MyWrapper[ ] take?

Follow the same steps as above.



MyWrapper[ ] heap histogram

1) The “MyWrapper” object takes “16 bytes” as before

2) The array MyWrapper [ ] takes 4 bytes * 10 = **40 bytes** for 10 elements.

The remaining 16 bytes are for the Object meta data (aka array header information).

1) Class information: 32 bits = **4 bytes**.
2) Flags: array or not, hashCode, etc: 32 bits = **4 bytes**.
3) Lock information: synchronization: 32 bits = **4 bytes**.
4) Size of the array 32 bits = **4 bytes**.

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