

1. 使用GCLogAnalysis.java 自己演练一遍串行/并行/CMS/G1的案例；

- 当堆内存设置过小，不管使用何种GC配置都会容易出现outofmemory，Full GC次数比较频繁，因此设置合适的初始堆大小，默认建议设置机器内存的1/4

```
java -XX:+UseSerialGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
```

```
2020-10-27T23:03:37.014+0800: [Full GC (Allocation Failure) 2020-10-27T23:03:37.014+0800: [Tenured: 87395K->87395K(87424K), 0.0017927 secs] 126090K->126090K(126096K), 0.0017927 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:03:37.016+0800: [Full GC (Allocation Failure) 2020-10-27T23:03:37.016+0800: [Tenured: 87395K->87395K(87424K), 0.0017029 secs] 126069K->126069K(126096K), 0.0017029 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
Exception in thread "main" java.lang.OutOfMemoryError: Java heap space
    at GCLogAnalysis.generateGarbage(GCLogAnalysis.java:48)
    at GCLogAnalysis.main(GCLogAnalysis.java:25)
Heap
 def new generation      total 39296K, used 38837K [0x04c00000, 0x076a0000)
  eden space 34944K, 100% used [0x04c00000, 0x06e20000, 0x06e20000)
  from space 4352K, 89% used [0x06e20000, 0x071ed770, 0x07260000)
  to space 4352K, 0% used [0x07260000, 0x07260000, 0x076a0000)
  tenured generation      total 87424K, used 87395K [0x076a0000, 0x0cc00000, 0x0cc00000)
   the space 87424K, 99% used [0x076a0000, 0x0cbf8f30, 0x0cbf9000, 0x0cc00000)
  Metaspace               used 100K, capacity 2244K, committed 2368K, reserved 4480K
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis|
```

```
java -XX:+UseParallelGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
```

```
2020-10-27T23:04:07.390+0800: [Full GC (Ergonomics) [PSYoungGen: 14803K->14703K(29184K)] [ParOldGen: 87543K->87392K(87552K)] 102346K->102096K(116736K), [r=0.06 sys=0.00, real=0.01 secs]
2020-10-27T23:04:07.405+0800: [Full GC (Ergonomics) [PSYoungGen: 14811K->14811K(29184K)] [ParOldGen: 87392K->87392K(87552K)] 102203K->102203K(116736K), [r=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:04:07.408+0800: [Full GC (Allocation Failure) [PSYoungGen: 14811K->14811K(29184K)] [ParOldGen: 87392K->87392K(87552K)] 102203K->102186K(116736K), [Times: user=0.00 sys=0.00, real=0.03 secs]
Exception in thread "main" java.lang.OutOfMemoryError: Java heap space
    at GCLogAnalysis.generateGarbage(GCLogAnalysis.java:48)
    at GCLogAnalysis.main(GCLogAnalysis.java:25)
Heap
 PSYoungGen      total 29184K, used 14848K [0x09d80000, 0x0c000000, 0x0c000000)
  eden space 14848K, 100% used [0x09d80000, 0x09d80000, 0x09d80000)
  from space 14336K, 0% used [0x09d80000, 0x09d80000, 0x09d80000)
  to space 14336K, 0% used [0x09d80000, 0x09d80000, 0x09d80000)
 ParOldGen       total 87552K, used 87376K [0x0c000000, 0x0c000000, 0x0c000000)
  object space 87552K, 99% used [0x0c000000, 0x0c000000, 0x0c000000)
  Metaspace      used 100K, capacity 2244K, committed 2368K, reserved 4480K
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseParallelGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis|
```

```
java -XX:+UseConcMarkSweepGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
```

```
2020-10-27T23:04:17.192+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 87127K(87424K)] 126228K(126720K), 0.0003083 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:04:17.193+0800: [CMS-concurrent-mark-start]
2020-10-27T23:04:17.194+0800: [Full GC (Allocation Failure) 2020-10-27T23:04:17.194+0800: [CMS2020-10-27T23:04:17.196+0800: [CMS-concurrent-mark: 0.002/0.002 (concurrent mode failure): 87319K->86966K(87424K), 0.0225040 secs] 126469K->126570K(126720K), [Metaspace: 99K->99K(4480K)], 0.0230232 secs] [Times: user=0.02 sys=0.02 sys=0.00, real=0.02 secs]
2020-10-27T23:04:17.218+0800: [Full GC (Allocation Failure) 2020-10-27T23:04:17.218+0800: [CMS: 87256K->86895K(87424K), 0.0175739 secs] 126418K->126023K(126720K), 0.0175739 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]
2020-10-27T23:04:17.236+0800: [Full GC (Allocation Failure) 2020-10-27T23:04:17.236+0800: [CMS: 86895K->86895K(87424K), 0.0028460 secs] 126023K->126023K(126720K), 0.0028460 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:04:17.240+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 86895K(87424K)] 126023K(126720K), 0.0007829 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:04:17.242+0800:Exception in thread "main" : [CMS-concurrent-mark-start]
    java.lang.OutOfMemoryError: Java heap space
        at GCLogAnalysis.generateGarbage(GCLogAnalysis.java:48)
        at GCLogAnalysis.main(GCLogAnalysis.java:25)
Heap
 par new generation      total 39296K, used 39213K [0x04a00000, 0x074a0000, 0x074a0000)
  eden space 34944K, 100% used [0x04a00000, 0x06c20000, 0x06c20000)
  from space 4352K, 98% used [0x06c20000, 0x0740b7b0, 0x074a0000)
  to space 4352K, 0% used [0x074a0000, 0x074a0000, 0x074a0000)
  concurrent mark-sweep generation total 87424K, used 86895K [0x074a0000, 0x0ca00000, 0x0ca00000)
  Metaspace               used 100K, capacity 2244K, committed 2368K, reserved 4480K
2020-10-27T23:04:17.245+0800: [CMS-concurrent-mark: 0.002/0.002 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseConcMarkSweepGC -Xms128m -Xmx128m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis|
```

```
java -XX:+UseG1GC -Xms128m -Xmx128m -XX:+PrintGC -XX:+PrintGCDateStamps GCLogAnalysis
```

```
2020-10-27T23:04:28.551+0800: [GC concurrent-mark-abort]
2020-10-27T23:04:28.551+0800: [GC pause (G1 Humongous Allocation) (young)-- 99M->99M(128M), 0.0005188 secs]
2020-10-27T23:04:28.552+0800: [Full GC (Allocation Failure) 99M->99M(128M), 0.0023955 secs]
2020-10-27T23:04:28.555+0800: [GC pause (G1 Evacuation Pause) (young) (initial-mark) 99M->99M(128M), 0.0007166 secs]
2020-10-27T23:04:28.555+0800: [GC concurrent-root-region-scan-start]
2020-10-27T23:04:28.556+0800: 2020-10-27T23:04:28.556+0800: [GC concurrent-root-region-scan-end, 0.0001796 secs]
[GC pause (G1 Evacuation Pause) (young)2020-10-27T23:04:28.556+0800: [GC concurrent-mark-start]
99M->99M(128M), 0.0007604 secs]
2020-10-27T23:04:28.556+0800: [Full GC (Allocation Failure) 99M->99M(128M), 0.0046038 secs]
2020-10-27T23:04:28.561+0800: [Full GC (Allocation Failure) 99M->99M(128M), 0.0028943 secs]
2020-10-27T23:04:28.564+0800: [GC concurrent-mark-abort]
2020-10-27T23:04:28.565+0800: [GC pause (G1 Evacuation Pause) (young) 99M->99M(128M), 0.0005369 secs]
2020-10-27T23:04:28.565+0800: [GC pause (G1 Evacuation Pause) (young) 99M->99M(128M), 0.0004780 secs]
2020-10-27T23:04:28.566+0800: [Full GC (Allocation Failure) 99M->976K(128M), 0.0027337 secs]
Exception in thread "main" java.lang.OutOfMemoryError: Java heap space
    at GCLogAnalysis.generateGarbage(GCLogAnalysis.java:48)
    at GCLogAnalysis.main(GCLogAnalysis.java:25)
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseG1GC -Xms128m -Xmx128m -XX:+PrintGC -XX:+PrintGCDateStamps GCLogAnalysis|
```

- 同一GC配置，随着对内存增加，GC次数减少，降低发生OOM的概率，但随着内存增大到一定程度，系统处理能力不会有显著增加，例如生成对象的次数不再成倍增加。使用串行GC,堆内存分别从256M,512M,1024M,1280M,1536M,1664M; 256M到1536M,生成对象次数在逐步递增，但是到1664M后没有增加，反而有小范围下降。

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms256m -Xmx256m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:17:04.422+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.423+0800: [DefNew: 69334K->8704K(78656K), 0.0256448 secs] 69334K->21948K(253440K), 0.0266001
.03 secs]
2020-10-27T23:17:04.480+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.480+0800: [DefNew: 78656K->8702K(78656K), 0.0388267 secs] 91900K->48433K(253440K), 0.0397318
.04 secs]
2020-10-27T23:17:04.551+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.552+0800: [DefNew: 78612K->8702K(78656K), 0.0334053 secs] 118344K->75544K(253440K), 0.0343056
.03 secs]
2020-10-27T23:17:04.618+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.618+0800: [DefNew: 78604K->8701K(78656K), 0.0295810 secs] 145406K->99291K(253440K), 0.0303094
.03 secs]
2020-10-27T23:17:04.680+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.681+0800: [DefNew: 78578K->8701K(78656K), 0.0344266 secs] 169168K->125145K(253440K), 0.0351118
.04 secs]
2020-10-27T23:17:04.751+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.751+0800: [DefNew: 78481K->8699K(78656K), 0.0314438 secs] 194925K->149355K(253440K), 0.032156
.03 secs]
2020-10-27T23:17:04.813+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.815+0800: [DefNew: 78551K->8703K(78656K), 0.0359799 secs] 219307K->17869K(253440K), 0.03763
2020-10-27T23:17:04.884+0800: [GC (Allocation Failure) 2020-10-27T23:17:04.884+0800: [DefNew: 78655K->78655K(78656K), 0.0002707 secs] 2020-10-27T23:17:04.885+0800: [Ten
secs] 248651K->177319K(253440K), [Metaspace: 1711K->1711K(4480K)], 0.0504448 secs] [Times: user=0.05 sys=0.00, real=0.06 secs]
2020-10-27T23:17:04.972+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:04.972+0800: [Tenured: 174771K->174641K(174784K), 0.0576699 secs] 253415K->19485K(253440K)
8000 secs] [Times: user=0.06 sys=0.00, real=0.06 secs]
2020-10-27T23:17:05.051+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:05.052+0800: [Tenured: 174641K->174762K(174784K), 0.0624019 secs] 253190K->20016K(253440K)
8020 secs] [Times: user=0.06 sys=0.00, real=0.06 secs]
2020-10-27T23:17:05.136+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:05.136+0800: [Tenured: 174762K->174758K(174784K), 0.0702611 secs] 253169K->203074K(253440K)
9226 secs] [Times: user=0.06 sys=0.00, real=0.07 secs]
2020-10-27T23:17:05.226+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:05.227+0800: [Tenured: 174758K->174758K(174784K), 0.0128078 secs] 252985K->215920K(253440K)
8519 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
2020-10-27T23:17:05.252+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:05.252+0800: [Tenured: 174758K->174565K(174784K), 0.0410536 secs] 253193K->224582K(253440K)
5507 secs] [Times: user=0.05 sys=0.00, real=0.05 secs]
2020-10-27T23:17:05.303+0800: [Full GC (Allocation Failure) 2020-10-27T23:17:05.303+0800: [Tenured: 174781K->17471K(174784K), 0.0404323 secs] 253369K->227597K(253440K)
3000 secs] [Times: user=0.05 sys=0.00, real=0.05 secs]
执行结束!共生成对象次数: 3216
Heap
def new generation total 78656K, used 56949K [0x0e00000, 0xa350000, 0xa350000)
  eden space 69952K, 81% used [0x0e00000, 0xa09d338, 0x0920000)
    from space 8704K, 0% used [0x09ad000, 0x09ad000, 0xa350000)
    to space 8704K, 0% used [0x0920000, 0x0920000, 0x09ad000)
  tenured generation total 174784K, 99% used [0xa350000, 0x14dfcd38, 0x14dfce00, 0x14e0000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms512m -Xmx512m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:17:17.258+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.258+0800: [DefNew: 139776K->17472K(157248K), 0.0486625 secs] 139776K->56678K(506816K), 0.
l=0.05 secs]
2020-10-27T23:17:17.358+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.358+0800: [DefNew: 157248K->17471K(157248K), 0.0517594 secs] 196454K->98675K(506816K), 0.
l=0.05 secs]
2020-10-27T23:17:17.468+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.469+0800: [DefNew: 157247K->17471K(157248K), 0.0481023 secs] 238451K->139160K(506816K), 0.
al=0.05 secs]
2020-10-27T23:17:17.571+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.571+0800: [DefNew: 157247K->17471K(157248K), 0.0640886 secs] 278936K->188510K(506816K), 0.
al=0.06 secs]
2020-10-27T23:17:17.697+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.697+0800: [DefNew: 157247K->17471K(157248K), 0.0508160 secs] 328286K->231713K(506816K), 0.
al=0.06 secs]
2020-10-27T23:17:17.805+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.805+0800: [DefNew: 157247K->17471K(157248K), 0.0534625 secs] 371489K->278323K(506816K), 0.
al=0.05 secs]
2020-10-27T23:17:17.910+0800: [GC (Allocation Failure) 2020-10-27T23:17:17.910+0800: [DefNew: 157247K->17470K(157248K), 0.0520889 secs] 418099K->326398K(506816K), 0.
al=0.05 secs]
188 secs] 466170K->277477K(506816K), [Metaspace: 1711K->1711K(4480K)], 0.0810476 secs] [Times: user=0.08 sys=0.00, real=0.08 secs]
执行结束!共生成对象次数: 4584
Heap
def new generation total 157248K, used 137108K [0x0e00000, 0xf8a0000, 0xf8a0000)
  eden space 139776K, 98% used [0x0e00000, 0xd3ef230, 0xd6d0000)
    from space 17472K, 0% used [0xf879000, 0xf879000, 0xf8a0000)
    to space 17472K, 0% used [0xd6d0000, 0xd6d0000, 0xf879000)
  tenured generation total 349568K, used 277477K [0xf8a0000, 0x24e0000, 0x24e0000)
    the space 349568K, 79% used [0xf8a0000, 0x2079900, 0x2079900, 0x24e0000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms1024m -Xmx1024m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:17:27.522+0800: [GC (Allocation Failure) 2020-10-27T23:17:27.523+0800: [DefNew: 279616K->34944K(314560K), 0.0729886 secs] 279616K->83738K(1013632K), 0.0737025 secs]
al=0.07 secs]
2020-10-27T23:17:27.702+0800: [GC (Allocation Failure) 2020-10-27T23:17:27.703+0800: [DefNew: 314560K->34944K(314560K), 0.0949488 secs] 363354K->167503K(1013632K), 0.0955579 secs]
eal=0.10 secs]
2020-10-27T23:17:28.069+0800: [GC (Allocation Failure) 2020-10-27T23:17:28.069+0800: [DefNew: 314560K->34944K(314560K), 0.0832219 secs] 538053K->334602K(1013632K), 0.0839607 secs]
eal=0.08 secs]
2020-10-27T23:17:28.245+0800: [GC (Allocation Failure) 2020-10-27T23:17:28.246+0800: [DefNew: 314560K->34943K(314560K), 0.0804877 secs] 614210K->412254K(1013632K), 0.0851296 secs]
eal=0.08 secs]
执行结束!共生成对象次数: 5335
Heap
def new generation total 314560K, used 46270K [0x0e00000, 0xa550000, 0xa550000)
  eden space 279616K, 16% used [0x0e00000, 0xf0ded28, 0x1610000)
    from space 34944K, 99% used [0x1833000, 0xa54ffff, 0xa550000)
    to space 34944K, 0% used [0x1610000, 0x1611000, 0x1833000)
  tenured generation total 699072K, used 377310K [0xa550000, 0x4500000, 0x4500000)
    the space 699072K, 53% used [0xa550000, 0x15c7a70, 0x15c7c00, 0x4500000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms1280m -Xmx1280m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:18:22.115+0800: [GC (Allocation Failure) 2020-10-27T23:18:22.116+0800: [DefNew: 349568K->43648K(393216K), 0.0823742 secs] 349568K->104035K(1267072K), 0.0831378 secs]
eal=0.00 secs]
2020-10-27T23:18:22.319+0800: [GC (Allocation Failure) 2020-10-27T23:18:22.319+0800: [DefNew: 393216K->43647K(393216K), 0.1069007 secs] 453603K->193019K(1267072K), 0.1077092 secs]
2020-10-27T23:18:22.539+0800: [GC (Allocation Failure) 2020-10-27T23:18:22.539+0800: [DefNew: 393215K->43647K(393216K), 0.0849515 secs] 545287K->200007K(1267072K), 0.0855560 secs]
eal=0.09 secs]
2020-10-27T23:18:22.740+0800: [GC (Allocation Failure) 2020-10-27T23:18:22.741+0800: [DefNew: 393215K->43647K(393216K), 0.0893802 secs] 629575K->370939K(1267072K), 0.0901163 secs]
eal=0.09 secs]
执行结束!共生成对象次数: 5297
Heap
def new generation total 393216K, used 86580K [0x0500000, 0x1fea000, 0x1fea000)
  eden space 349568K, 12% used [0x0500000, 0xf0ded28, 0x1610000)
    from space 43648K, 99% used [0x1a96000, 0x1d3ffff, 0x1d40000)
    to space 43648K, 0% used [0x1d40000, 0x1d40000, 0x1fea000)
  tenured generation total 873856K, used 327292K [0x1fea000, 0x5540000, 0x5540000)
    the space 873856K, 37% used [0x1fea000, 0x33e3f00, 0x33e3f00, 0x5540000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms1536m -Xmx1536m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:19:14.501+0800: [GC (Allocation Failure) 2020-10-27T23:19:14.501+0800: [DefNew: 419456K->52416K(471872K), 0.0914568 secs] 419456K->119059K(152040K), 0.092
eal=0.09 secs]
2020-10-27T23:19:14.768+0800: [GC (Allocation Failure) 2020-10-27T23:19:14.768+0800: [DefNew: 471872K->52415K(471872K), 0.1260255 secs] 538515K->235025K(152040K), 0.126
eal=0.13 secs]
2020-10-27T23:19:15.024+0800: [GC (Allocation Failure) 2020-10-27T23:19:15.024+0800: [DefNew: 471871K->52416K(471872K), 0.1003237 secs] 654081K->342308K(152040K), 0.100
eal=0.10 secs]
执行结束!共生成对象次数: 5709
Heap
def new generation total 471872K, used 318913K [0x0500000, 0x2500000, 0x2500000)
  eden space 419456K, 63% used [0x0500000, 0x1540600, 0x19ea000)
    from space 52416K, 100% used [0x21cd000, 0x2500000, 0x2500000)
    to space 52416K, 0% used [0x19ea000, 0x19ea000, 0x21cd000)
  tenured generation total 1048576K, used 209884K [0x2500000, 0x6500000, 0x6500000)
    the space 1048576K, 27% used [0x2500000, 0x36b1728, 0x36b1740, 0x6500000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms1664m -Xmx1664m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:21:41.424+0800: [GC (Allocation Failure) 2020-10-27T23:21:41.424+0800: [DefNew: 454400K->56768K(51168K), 0.1063771 secs] 454400K->138440K(1647168K), 0.106
eal=0.11 secs]
2020-10-27T23:21:41.681+0800: [GC (Allocation Failure) 2020-10-27T23:21:41.682+0800: [DefNew: 511168K->56766K(51168K), 0.1388622 secs] 592840K->297752K(1647168K), 0.138
eal=0.14 secs]
2020-10-27T23:21:41.959+0800: [GC (Allocation Failure) 2020-10-27T23:21:41.959+0800: [DefNew: 511166K->56768K(51168K), 0.1109726 secs] 712152K->371108K(1647168K), 0.110
eal=0.11 secs]
执行结束!共生成对象次数: 5075
Heap
def new generation total 511168K, used 75064K [0x0500000, 0x27ea000, 0x27ea000)
  eden space 454400K, 4% used [0x0500000, 0x065de070, 0x20fc000)
    from space 56768K, 100% used [0x20fc000, 0x27ea000, 0x27ea000)
    to space 56768K, 0% used [0x20fc000, 0x20fc000, 0x27ea000)
  tenured generation total 113600K, used 31832K [0x27ea000, 0x6d40000, 0x6d40000)
    the space 113600K, 27% used [0x27ea000, 0x3b19900, 0x3b19900, 0x6d40000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseSerialGC -Xms1664m -Xmx1664m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GLogAnalysis
正在执行...
2020-10-27T23:21:49.287+0800: [GC (Allocation Failure) 2020-10-27T23:21:49.287+0800: [DefNew: 454400K->56768K(51168K), 0.0946446 secs] 454400K->122559K(1647168K), 0.094
eal=0.09 secs]
2020-10-27T23:21:49.533+0800: [GC (Allocation Failure) 2020-10-27T23:21:49.533+0800: [DefNew: 511168K->56767K(51168K), 0.1271713 secs] 576959K->238873K(1647168K), 0.127
eal=0.13 secs]
2020-10-27T23:21:49.800+0800: [GC (Allocation Failure) 2020-10-27T23:21:49.800+0800: [DefNew: 511167K->56768K(51168K), 0.1049068 secs] 693273K->352761K(1647168K), 0.104
eal=0.11 secs]
执行结束!共生成对象次数: 5000
Heap
def new generation total 511168K, used 142826K [0x0500000, 0x27ea000, 0x27ea000)
  eden space 454400K, 18% used [0x0500000, 0xa8a8a00, 0x20fc000)
    from space 56768K, 100% used [0x20fc000, 0x27ea000, 0x27ea000)
    to space 56768K, 0% used [0x20fc000, 0x20fc000, 0x27ea000)
  tenured generation total 113600K, used 295939K [0x27ea000, 0x6d40000, 0x6d40000)
    the space 113600K, 26% used [0x27ea000, 0x39fae7a0, 0x39fae80, 0x6d40000)
  Metaspace used 1715K, capacity 2244K, committed 2368K, reserved 4480K
```

- 并行GC下，如果不指定-Xms，GC次数会提前
- 指定-Xms为256M.65M时，做了一次YongGC

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseParallelGC -Xms256m -Xms256m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
正在执行...
2020-10-27T23:41:59.980+0800: [GC (Allocation Failure) [PSYoungGen: 65207K->10747K(76544K)] 56207K->23379K(251392K), 0.0106993 secs] [Times: user=0.02 sys=0.00, real=0.01 secs]
2020-10-27T23:41:51.019+0800: [GC (Allocation Failure) [PSYoungGen: 70409K->10747K(76544K)] 69404K->48549K(251392K), 0.0159400 secs] [Times: user=0.00 sys=0.06, real=0.02 secs]
2020-10-27T23:41:51.063+0800: [GC (Allocation Failure) [PSYoungGen: 76254K->10747K(76544K)] 11185K->46833K(251392K), 0.0109562 secs] [Times: user=0.00 sys=0.00, real=0.02 secs]
2020-10-27T23:41:51.112+0800: [GC (Allocation Failure) [PSYoungGen: 76438K->10745K(76544K)] 132529K->87587K(251392K), 0.0104823 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]
2020-10-27T23:41:51.156+0800: [GC (Allocation Failure) [PSYoungGen: 76374K->10750K(76544K)] 153216K->109804K(251392K), 0.0174916 secs] [Times: user=0.02 sys=0.05, real=0.02 secs]
2020-10-27T23:41:51.209+0800: [GC (Allocation Failure) [PSYoungGen: 76542K->10742K(408192K)] 176596K->126029K(215040K), 0.0129206 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
2020-10-27T23:41:51.232+0800: [GC (Allocation Failure) [PSYoungGen: 40192K->15279K(58368K)] 158469K->13971K(233216K), 0.0115276 secs] [Times: user=0.05 sys=0.00, real=0.01 secs]
2020-10-27T23:41:51.259+0800: [GC (Allocation Failure) [PSYoungGen: 44468K->23979K(58368K)] 163903K->145226K(233216K), 0.0094527 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
2020-10-27T23:41:51.281+0800: [GC (Allocation Failure) [PSYoungGen: 53267K->20924K(58368K)] 174514K->154256K(233216K), 0.0202836 secs] [Times: user=0.05 sys=0.00, real=0.02 secs]
2020-10-27T23:41:51.312+0800: [GC (Allocation Failure) [PSYoungGen: 57018K->19552K(58368K)] 183149K->163783K(233216K), 0.0188371 secs] [Times: user=0.03 sys=0.01, real=0.02 secs]
2020-10-27T23:41:51.332+0800: [Full GC (Ergonomics) [PSYoungGen: 19552K->0K(58368K)] [ParOldGen: 144231K->141307K(174048K)] 163783K->141307K(233216K), [Metaspace: 1711K->1711K(4080K)], user=0.14 sys=0.02, real=0.06 secs]
```

不指定-Xms，4M时就做了一次YongGC

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseParallelGC -Xms256m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
正在执行...
2020-10-27T23:42:16.302+0800: [GC (Allocation Failure) [PSYoungGen: 4325K->502K(4864K)] 4325K->1351K(15872K), 0.0023270 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:42:16.346+0800: [GC (Allocation Failure) [PSYoungGen: 4837K->509K(4864K)] 5687K->2044K(15872K), 0.0022703 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:42:16.352+0800: [GC (Allocation Failure) [PSYoungGen: 4083K->500K(4864K)] 6789K->2091K(15872K), 0.0000405 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:42:16.359+0800: [GC (Allocation Failure) [PSYoungGen: 4797K->452K(9216K)] 8289K->4073K(20224K), 0.0021409 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:42:16.366+0800: [GC (Allocation Failure) [PSYoungGen: 9078K->500K(9216K)] 13198K->9927K(20224K), 0.0073246 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
2020-10-27T23:42:16.374+0800: [Full GC (Ergonomics) [PSYoungGen: 504K->0K(9216K)] [ParOldGen: 9403K->9899K(19712K)] 9927K->9899K(20928K), [Metaspace: 1711K->1711K(4080K)], 0.0069405
+0.00, real=0.01 secs]
2020-10-27T23:42:16.388+0800: [GC (Allocation Failure) [PSYoungGen: 8345K->3584K(20736K)] 18245K->13484K(40448K), 0.0037189 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-27T23:42:16.402+0800: [GC (Allocation Failure) [PSYoungGen: 19507K->5615K(21760K)] 29407K->18258K(41472K), 0.0076249 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
2020-10-27T23:42:16.414+0800: [GC (Allocation Failure) [PSYoungGen: 21490K->6001K(34380K)] 34133K->23624K(65552K), 0.0098123 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
```

- 初始堆内存和最大堆内存为512M，比较并行GC, CMSGC和G1GC生成的对象次数差不多，并行GC，在一次FullGC后，年轻代可以全部回收

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseParallelGC -Xms512m -Xmx512m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
正在执行...
2020-10-28T00:02:19.102+0800: [GC (Allocation Failure) [PSYoungGen: 130626K->21757K(152832K)] 138626K->46926K(502528K), 0.0181336 secs] [Times: user=0.03 sys=0.03, real=0.0
2020-10-28T00:02:19.174+0800: [GC (Allocation Failure) [PSYoungGen: 152829K->21755K(152832K)] 177998K->99314K(502528K), 0.0305261 secs] [Times: user=0.08 sys=0.05, real=0.0
2020-10-28T00:02:19.261+0800: [GC (Allocation Failure) [PSYoungGen: 152829K->21755K(152832K)] 224141K->13853K(502528K), 0.0300918 secs] [Times: user=0.06 sys=0.06, real=0.0
2020-10-28T00:02:19.338+0800: [GC (Allocation Failure) [PSYoungGen: 152827K->21759K(152832K)] 269655K->181708K(502528K), 0.0262850 secs] [Times: user=0.05 sys=0.09, real=0.0
2020-10-28T00:02:19.414+0800: [GC (Allocation Failure) [PSYoungGen: 152831K->21752K(152832K)] 312780K->226879K(502528K), 0.0275733 secs] [Times: user=0.03 sys=0.03, real=0.0
2020-10-28T00:02:19.490+0800: [GC (Allocation Failure) [PSYoungGen: 152824K->21752K(80128K)] 357951K->269018K(429824K), 0.0256802 secs] [Times: user=0.06 sys=0.05, real=0.0
2020-10-28T00:02:19.543+0800: [GC (Allocation Failure) [PSYoungGen: 79690K->37465K(116480K)] 326956K->291005K(466176K), 0.0175374 secs] [Times: user=0.05 sys=0.00, real=0.0
2020-10-28T00:02:19.563+0800: [GC (Allocation Failure) [PSYoungGen: 96629K->40240K(116480K)] 309169K->309527K(466176K), 0.0270803 secs] [Times: user=0.09 sys=0.00, real=0.0
2020-10-28T00:02:19.634+0800: [GC (Allocation Failure) [PSYoungGen: 107614K->58891K(116480K)] 367895K->33352K(466176K), 0.0270233 secs] [Times: user=0.06 sys=0.00, real=0.0
2020-10-28T00:02:19.688+0800: [GC (Allocation Failure) [PSYoungGen: 116032K->31200K(116480K)] 381694K->336092K(466176K), 0.0298333 secs] [Times: user=0.06 sys=0.06, real=0.0
2020-10-28T00:02:19.717+0800: [Full GC (Ergonomics) [PSYoungGen: 31200K->0K(116480K)] [ParOldGen: 304892K->237471K(349696K)] 336092K->237471K(466176K), [Metaspace: 1711K->1
user=0.28 sys=0.01, real=0.08 secs]
2020-10-28T00:02:19.827+0800: [GC (Allocation Failure) [PSYoungGen: 58357K->10791K(116480K)] 298829K->256263K(466176K), 0.0076069 secs] [Times: user=0.05 sys=0.00, real=0.0
2020-10-28T00:02:19.862+0800: [GC (Allocation Failure) [PSYoungGen: 77153K->16969K(116480K)] 310620K->272922K(466176K), 0.0100641 secs] [Times: user=0.03 sys=0.00, real=0.0
2020-10-28T00:02:19.904+0800: [GC (Allocation Failure) [PSYoungGen: 75206K->22675K(116480K)] 331158K->294782K(466176K), 0.0180704 secs] [Times: user=0.05 sys=0.00, real=0.0
2020-10-28T00:02:19.948+0800: [GC (Allocation Failure) [PSYoungGen: 80448K->20021K(116480K)] 352555K->331596K(466176K), 0.0165572 secs] [Times: user=0.06 sys=0.00, real=0.0
执行结束!共生成对象数:4960
Heap
PSYoungGen      total 116480K, used 75621K [0x10b00000, 0x24600000, 0x24600000)
  eden space 88368K, 95% used [0x10b00000, 0x1dc1ce00, 0x1dc1ce00)
    from space 58112K, 34% used [0x20d40000, 0x220cd600, 0x24600000)
    to   space 58112K, 0% used [0x1d400000, 0x1d400000, 0x20d40000)
  ParOldGen      total 349696K, used 293574K [0x04600000, 0x19b00000, 0x19b00000)
    object space 349696K, 83% used [0x04600000, 0x164db100, 0x19b00000)
  Metaspace      used 1715K, capacity 2244K, committed 2368K, reserved 4408K
PS G:\2020年10月Java进阶训练营\作业\第二周作业>
```

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseConcMarkSweepGC -Xms512m -Xmx512m -XX:+PrintGCDetails -XX:+PrintGCDateStamps GCLogAnalysis
正在执行...
2020-10-28T00:02:41.488+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.488+0800: [ParNew: 139685K->17469K(157248K), 0.0161492 secs] 139685K->46171K(506816K), 0.0169314 s
l=0.02 secs]
2020-10-28T00:02:41.561+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.561+0800: [ParNew: 157245K->17470K(157248K), 0.0260799 secs] 185947K->90788K(506816K), 0.0270767 s
l=0.03 secs]
2020-10-28T00:02:41.650+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.650+0800: [ParNew: 157246K->17472K(157248K), 0.0376324 secs] 230564K->127399K(506816K), 0.0383186
al=0.04 secs]
2020-10-28T00:02:41.743+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.744+0800: [ParNew: 157189K->17470K(157248K), 0.0387605 secs] 267116K->167357K(506816K), 0.0393068
al=0.00 secs]
2020-10-28T00:02:41.833+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.833+0800: [ParNew: 157246K->17472K(157248K), 0.0451442 secs] 307133K->214253K(506816K), 0.0456718
al=0.05 secs]
2020-10-28T00:02:41.880+0800: [GC (CMS Initial Mark) [1 CMS-Initial-mark: 196781K(349568K)] 214710K(506816K), 0.0004055 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-28T00:02:41.880+0800: [CMS-concurrent-mark-start]
2020-10-28T00:02:41.896+0800: [CMS-concurrent-mark: 0.016/0.016 secs] [Times: user=0.05 sys=0.00, real=0.02 secs]
2020-10-28T00:02:41.897+0800: [CMS-concurrent-preclean-start]
2020-10-28T00:02:41.900+0800: [CMS-concurrent-preclean: 0.002/0.002 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-28T00:02:41.900+0800: [CMS-concurrent-abortable-preclean-start]
2020-10-28T00:02:41.934+0800: [GC (Allocation Failure) 2020-10-28T00:02:41.934+0800: [ParNew: 157248K->17472K(157248K), 0.0495436 secs] 354029K->264435K(506816K), 0.0499689
al=0.05 secs]
2020-10-28T00:02:42.034+0800: [GC (Allocation Failure) 2020-10-28T00:02:42.035+0800: [ParNew: 157248K->17472K(157248K), 0.0350357 secs] 404211K->299016K(506816K), 0.0355732
al=0.00 secs]
2020-10-28T00:02:42.122+0800: [GC (Allocation Failure) 2020-10-28T00:02:42.122+0800: [ParNew: 157248K->17472K(157248K), 0.0406246 secs] 438792K->340831K(506816K), 0.0409872
al=0.04 secs]
2020-10-28T00:02:42.215+0800: [GC (Allocation Failure) 2020-10-28T00:02:42.215+0800: [ParNew: 157248K->157248K(157248K), 0.0001804 secs] 2020-10-28T00:02:42.216+0800: [CMS2020
urrent-abortable-preclean: 0.010/0.016 secs] [Times: user=0.06 sys=0.00, real=0.02 secs]
[Concurrent mode failed]: 323359K->248551K(349568K), 0.0816092 secs] 408607K->248551K(506816K), [Metaspace: 1711K->1711K(4080K)], 0.0826092 secs] [Times: user=0.08 sys=0.0
2020-10-28T00:02:42.352+0800: [GC (Allocation Failure) 2020-10-28T00:02:42.352+0800: [ParNew: 139776K->17472K(157248K), 0.0190490 secs] 388327K->294592K(506816K), 0.0203709
al=0.02 secs]
2020-10-28T00:02:42.373+0800: [GC (CMS Initial Mark) [1 CMS-Initial-mark: 277120K(349568K)] 295340K(506816K), 0.0016163 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
2020-10-28T00:02:42.378+0800: [CMS-concurrent-mark-start]
执行结束!共生成对象数:6332
Heap
par new generation total 157248K, used 23089K [0x04a00000, 0x0f4a0000, 0x0f4a0000)
  eden space 139776K, 4% used [0x04a00000, 0x05030430, 0x0f4a0000)
    from space 17472K, 100% used [0x05030000, 0x0f4a0000, 0x0f4a0000)
    to   space 17472K, 0% used [0x0d200000, 0x0d200000, 0x0e300000)
  concurrent mark-sweep generation total 349568K, used 277120K [0x0f4a0000, 0x24a00000, 0x24a00000)
  Metaspace      used 1715K, capacity 2244K, committed 2368K, reserved 4408K
```



```

2020-10-28T00:02:57.299+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 339M->336M(512M), 0.0050044 secs]
2020-10-28T00:02:57.305+0800: [GC concurrent-root-region-scan-start]
2020-10-28T00:02:57.306+0800: [GC concurrent-root-region-scan-end, 0.0009116 secs]
2020-10-28T00:02:57.307+0800: [GC concurrent-mark-start]
2020-10-28T00:02:57.313+0800: [GC concurrent-mark-end, 0.0058278 secs]
2020-10-28T00:02:57.314+0800: [GC remark, 0.0023850 secs]
2020-10-28T00:02:57.317+0800: [GC cleanup 370M->370M(512M), 0.0017413 secs]
2020-10-28T00:02:57.336+0800: [GC pause (G1 Evacuation Pause) (young) 421M->363M(512M), 0.0098300 secs]
2020-10-28T00:02:57.355+0800: [GC pause (G1 Evacuation Pause) (mixed) 382M->325M(512M), 0.0088619 secs]
2020-10-28T00:02:57.375+0800: [GC pause (G1 Evacuation Pause) (mixed) 353M->302M(512M), 0.0114673 secs]
2020-10-28T00:02:57.400+0800: [GC pause (G1 Evacuation Pause) (mixed) 334M->311M(512M), 0.0103564 secs]
2020-10-28T00:02:57.410+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 312M->312M(512M), 0.0018712 secs]
2020-10-28T00:02:57.412+0800: [GC concurrent-root-region-scan-start]
2020-10-28T00:02:57.413+0800: [GC concurrent-root-region-scan-end, 0.0003889 secs]
2020-10-28T00:02:57.413+0800: [GC concurrent-mark-start]
2020-10-28T00:02:57.422+0800: [GC concurrent-mark-end, 0.0086750 secs]
2020-10-28T00:02:57.423+0800: [GC remark, 0.0027348 secs]
2020-10-28T00:02:57.426+0800: [GC cleanup 331M->331M(512M), 0.0005932 secs]
2020-10-28T00:02:57.449+0800: [GC pause (G1 Evacuation Pause) (young) 399M->333M(512M), 0.0122559 secs]
2020-10-28T00:02:57.468+0800: [GC pause (G1 Evacuation Pause) (mixed) 350M->312M(512M), 0.0133076 secs]
2020-10-28T00:02:57.494+0800: [GC pause (G1 Evacuation Pause) (mixed) 341M->321M(512M), 0.0036428 secs]
2020-10-28T00:02:57.498+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 322M->321M(512M), 0.0038300 secs]
2020-10-28T00:02:57.502+0800: [GC concurrent-root-region-scan-start]
2020-10-28T00:02:57.503+0800: [GC concurrent-root-region-scan-end, 0.0007773 secs]
2020-10-28T00:02:57.504+0800: [GC concurrent-mark-start]
2020-10-28T00:02:57.512+0800: [GC concurrent-mark-end, 0.0081182 secs]
2020-10-28T00:02:57.512+0800: [GC remark, 0.0018953 secs]
2020-10-28T00:02:57.514+0800: [GC cleanup 309M->308M(512M), 0.0005117 secs]
2020-10-28T00:02:57.515+0800: [GC concurrent-cleanup-start]
2020-10-28T00:02:57.515+0800: [GC concurrent-cleanup-end, 0.0014339 secs]
2020-10-28T00:02:57.534+0800: [GC pause (G1 Evacuation Pause) (young) 402M->340M(512M), 0.0129344 secs]
2020-10-28T00:02:57.556+0800: [GC pause (G1 Evacuation Pause) (mixed) 360M->321M(512M), 0.0129610 secs]
2020-10-28T00:02:57.570+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 323M->321M(512M), 0.0034018 secs]
2020-10-28T00:02:57.574+0800: [GC concurrent-root-region-scan-start]
2020-10-28T00:02:57.575+0800: [GC concurrent-root-region-scan-end, 0.0008981 secs]
2020-10-28T00:02:57.576+0800: [GC concurrent-mark-start]
2020-10-28T00:02:57.586+0800: [GC concurrent-mark-end, 0.0105618 secs]
2020-10-28T00:02:57.587+0800: [GC remark, 0.0027677 secs]
2020-10-28T00:02:57.591+0800: [GC cleanup 351M->350M(512M), 0.0005514 secs]
2020-10-28T00:02:57.591+0800: [GC concurrent-cleanup-start]
2020-10-28T00:02:57.592+0800: [GC concurrent-cleanup-end, 0.0001911 secs]
2020-10-28T00:02:57.608+0800: [GC pause (G1 Evacuation Pause) (young) 397M->338M(512M), 0.0062934 secs]
2020-10-28T00:02:57.625+0800: [GC pause (G1 Evacuation Pause) (mixed) 358M->326M(512M), 0.0131975 secs]
2020-10-28T00:02:57.640+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 320M->326M(512M), 0.0031325 secs]
2020-10-28T00:02:57.643+0800: [GC concurrent-root-region-scan-start]
2020-10-28T00:02:57.643+0800: [GC concurrent-root-region-scan-end, 0.0003174 secs]
2020-10-28T00:02:57.644+0800: [GC concurrent-mark-start]
2020-10-28T00:02:57.652+0800: [GC concurrent-mark-end, 0.0077049 secs]
2020-10-28T00:02:57.656+0800: [GC remark, 0.0026012 secs]
2020-10-28T00:02:57.659+0800: [GC cleanup 359M->359M(512M), 0.0005162 secs]
执行结束!共生成对象次数:5712
PS G:\2020年10月Java进阶训练营\作业\第二周作业> java -XX:+UseG1GC -Xms512m -Xmx512m -XX:+PrintGC -XX:+PrintGCDateStamps GCLogAnalysis|

```

2. 使用压测工具 (wrk或sb) , 演练gateway-server-0.0.1-SNAPSHOT.jar 示例

不同GC配置, 相同并发, 20个并发持续时间30秒

- 串行GC,RPS:1693

java -jar -XX:+UseSerialGC gateway-server-0.0.1-SNAPSHOT.jar

```

PS G:\2020年10月Java进阶训练营\作业\第二周作业> sb -u http://localhost:8088/api/hello -c 20 -N 30
Starting at 2020/10/28 0:10:59
[Press C to stop the test]
52688 (RPS: 1464.9)
-----Finished!-----
Finished at 2020/10/28 0:11:36 (took 00:00:36.3662804)
Status 200: 52688

RPS: 1693 (requests/second)
Max: 685ms
Min: 0ms
Avg: 1.3ms

```

- 并行GC

java -jar -XX:+UseParallelGC gateway-server-0.0.1-SNAPSHOT.jar

```

PS G:\2020年10月Java进阶训练营\作业\第二周作业> sb -u http://localhost:8088/api/hello -c 20 -N 30
Starting at 2020/10/28 0:13:50
[Press C to stop the test]
74713 (RPS: 2093.9)
-----Finished!-----
Finished at 2020/10/28 0:14:26 (took 00:00:35.8581233)
Status 200: 74723

RPS: 2398.8 (requests/second)
Max: 247ms
Min: 0ms
Avg: 0.6ms

```

- CMSGC

java -jar -XX:+UseConcMarkSweepGC gateway-server-0.0.1-SNAPSHOT.jar

```

PS G:\2020年10月Java进阶训练营\作业\第二周作业> sb -u http://localhost:8088/api/hello -c 20 -N 30
Starting at 2020/10/28 0:15:05
[Press C to stop the test]
68637 (RPS: 1926.2)
-----Finished!-----
Finished at 2020/10/28 0:15:41 (took 00:00:35.8389123)
Status 200: 68637

RPS: 2202.3 (requests/second)
Max: 279ms
Min: 0ms
Avg: 0.7ms

```

- o G1GC

java -jar -XX:+UseG1GC gateway-server-0.0.1-SNAPSHOT.jar

```
PS G:\2020年10月Java进阶训练营\作业\第二周作业> sb -u http://localhost:8088/api/hello -c 20 -N 30
Starting at 2020/10/28 0:16:53
[Press C to stop the test]
70732 (RPS: 1977.7)
-----Finished!-----
Finished at 2020/10/28 0:17:29 (took 00:00:35.9946742)
Status 200: 70740

RPS: 2266.9 (requests/second)
Max: 270ms
Min: 0ms
Avg: 0.7ms
```

总结：并行GC配置RPS最高，串行GC配置RPS最低，并行GC，CMS和G1GC的RPS差不多平均时间在0.1ms。