

环境:

jdk 1.8.0\_221

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C:\WINDOWS\system32>java -version
java version "1.8.0_221"
Java(TM) SE Runtime Environment (build 1.8.0_221-b11)
Java HotSpot(TM) 64-Bit Server VM (build 25.221-b11, mixed mode)
```

操作系统: Window10

CUP: 12核 24线程。amd 3900x

内存: 16G

基准速度: 4.00 GHz

插槽: 1

内核: 12

逻辑处理器: 24

运行项目: 老师提供的GCLogAnalysis的文件

## 测试一参数设置:

-Xmx128m -Xms128m -XX:+PrintGCDetails

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1 [GC (Allocation Failure) [PSYoungGen: 32838K->5104K(38400K)] 328
38K->13317K(125952K), 0.0030788 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]
2 [GC (Allocation Failure) [PSYoungGen: 38337K->5118K(38400K)] 465
50K->21830K(125952K), 0.0028358 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]
3 [GC (Allocation Failure) [PSYoungGen: 38060K->5114K(38400K)] 547
72K->35959K(125952K), 0.0031797 secs] [Times: user=0.03 sys=0.27,
real=0.00 secs]
4 [GC (Allocation Failure) [PSYoungGen: 38393K->5118K(38400K)] 692
38K->46567K(125952K), 0.0034937 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]
5 [GC (Allocation Failure) [PSYoungGen: 38273K->5110K(38400K)] 797
23K->59076K(125952K), 0.0028188 secs] [Times: user=0.02 sys=0.26,
real=0.00 secs]
6 [GC (Allocation Failure) [PSYoungGen: 38390K->5109K(19968K)] 923
56K->71535K(107520K), 0.0028586 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]
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7 [GC (Allocation Failure) [PSYoungGen: 19470K->8867K(29184K)] 858
96K->76712K(116736K), 0.0010856 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]

8 [GC (Allocation Failure) [PSYoungGen: 23386K->11292K(29184K)] 91
230K->80689K(116736K), 0.0011463 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]

9 [GC (Allocation Failure) [PSYoungGen: 26112K->12811K(29184K)] 95
509K->84343K(116736K), 0.0014579 secs] [Times: user=0.00 sys=0.00,
real=0.00 secs]

10 [Full GC (Ergonomics) [PSYoungGen: 12811K->0K(29184K)] [ParOldG
en: 71531K->79635K(87552K)] 84343K->79635K(116736K), [Metaspace: 3
288K->3288K(1056768K)], 0.0092779 secs] [Times: user=0.00
sys=0.00, real=0.01 secs]

11 [Full GC (Ergonomics) [PSYoungGen: 14792K->0K(29184K)] [ParOldG
en: 79635K->84879K(87552K)] 94427K->84879K(116736K), [Metaspace: 3
289K->3289K(1056768K)], 0.0134138 secs] [Times: user=0.02
sys=0.00, real=0.01 secs]

12 [Full GC (Ergonomics) [PSYoungGen: 14229K->1654K(29184K)] [ParO
ldGen: 84879K->87532K(87552K)] 99108K->89186K(116736K),
[Metaspace: 3289K->3289K(1056768K)], 0.0122686 secs] [Times:
user=0.22 sys=0.06, real=0.01 secs]

13 [Full GC (Ergonomics) [PSYoungGen: 14673K->6967K(29184K)] [ParO
ldGen: 87532K->87039K(87552K)] 102205K->94006K(116736K), [Metaspa
ce: 3289K->3289K(1056768K)], 0.0085378 secs] [Times: user=0.28
sys=0.00, real=0.01 secs]

14 [Full GC (Ergonomics) [PSYoungGen: 14715K->8748K(29184K)] [ParO
ldGen: 87039K->86980K(87552K)] 101754K->95729K(116736K), [Metaspa
ce: 3289K->3289K(1056768K)], 0.0121164 secs] [Times: user=0.28
sys=0.00, real=0.01 secs]

15 [Full GC (Ergonomics) [PSYoungGen: 14841K->9935K(29184K)] [ParO
ldGen: 86980K->87159K(87552K)] 101821K->97094K(116736K), [Metaspa
ce: 3289K->3289K(1056768K)], 0.0123689 secs] [Times: user=0.00
sys=0.00, real=0.01 secs]

16 [Full GC (Ergonomics) [PSYoungGen: 14848K->10700K(29184K)] [Par
OldGen: 87159K->87159K(87552K)] 102007K->97860K(116736K), [Metaspa
ce: 3289K->3289K(1056768K)], 0.0025506 secs] [Times: user=0.00
sys=0.00, real=0.00 secs]

17 [Full GC (Ergonomics) [PSYoungGen: 14596K->11054K(29184K)] [Par
OldGen: 87159K->87159K(87552K)] 101755K->98214K(116736K), [Metaspa
ce: 3289K->3289K(1056768K)], 0.0019562 secs] [Times: user=0.00
sys=0.00, real=0.00 secs]

18 [Full GC (Ergonomics) [PSYoungGen: 14791K->12569K(29184K)] [Par
OldGen: 87159K->87495K(87552K)] 101950K->100065K(116736K), [Metasp
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ace: 3289K->3289K(1056768K)], 0.0120832 secs] [Times: user=0.23 sy
s=0.02, real=0.01 secs]
19 [Full GC (Ergonomics) [PSYoungGen: 14618K->13231K(29184K)] [Par
OldGen: 87495K->87445K(87552K)] 102114K->100676K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0050695 secs] [Times: user=0.00 sy
s=0.00, real=0.01 secs]
20 [Full GC (Ergonomics) [PSYoungGen: 14636K->13652K(29184K)] [Par
OldGen: 87445K->86888K(87552K)] 102081K->100540K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0094073 secs] [Times: user=0.28 sy
s=0.00, real=0.01 secs]
21 [Full GC (Ergonomics) [PSYoungGen: 14612K->13669K(29184K)] [Par
OldGen: 86888K->86888K(87552K)] 101500K->100558K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0022857 secs] [Times: user=0.00 sy
s=0.00, real=0.00 secs]
22 [Full GC (Ergonomics) [PSYoungGen: 14753K->13957K(29184K)] [Par
OldGen: 86888K->86888K(87552K)] 101642K->100846K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0016058 secs] [Times: user=0.00 sy
s=0.00, real=0.00 secs]
23 [Full GC (Ergonomics) [PSYoungGen: 14789K->13813K(29184K)] [Par
OldGen: 86888K->86888K(87552K)] 101678K->100702K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0016050 secs] [Times: user=0.00 sy
s=0.00, real=0.00 secs]
24 [Full GC (Ergonomics) [PSYoungGen: 14511K->14182K(29184K)] [Par
OldGen: 86888K->86888K(87552K)] 101399K->101070K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0019515 secs] [Times: user=0.00 sy
s=0.00, real=0.00 secs]
25 [Full GC (Ergonomics) [PSYoungGen: 14650K->14222K(29184K)] [Par
OldGen: 86888K->86888K(87552K)] 101538K->101110K(116736K), [Metasp
ace: 3289K->3289K(1056768K)], 0.0017191 secs] [Times: user=0.00 sy
s=0.00, real=0.00 secs]
26 [Full GC (Allocation Failure) [PSYoungGen: 14222K-
>14222K(29184K)] [ParOldGen: 86888K->86862K(87552K)] 101110K->1010
85K(116736K), [Metaspace: 3289K->3289K(1056768K)], 0.0141370 secs]
[Times: user=0.28 sys=0.00, real=0.01 secs]
27 Exception in thread "main" java.lang.OutOfMemoryError: Java heap
space
28 at week2.GCLogAnalysis.generateGarbage(GCLogAnalysis.java:49)
29 at week2.GCLogAnalysis.main(GCLogAnalysis.java:26)
30 Heap
31 PSYoungGen total 29184K, used 14539K [0x0000000fd580000, 0x00
00000100000000, 0x0000000100000000)
32 eden space 14848K, 97% used [0x0000000fd580000, 0x0000000fe3b
2f38, 0x0000000fe400000)
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33  from space 14336K, 0% used [0x00000000fe400000,0x00000000fe400
    000,0x00000000ff200000)
34  to space 14336K, 0% used [0x00000000ff200000,0x00000000ff20000
    0,0x00000000100000000)
35  ParOldGen total 87552K, used 86862K [0x00000000f8000000, 0x000
    0000fd580000, 0x00000000fd580000)
36  object space 87552K, 99% used [0x00000000f8000000,0x00000000fd
    4d3b98,0x00000000fd580000)
37  Metaspace used 3319K, capacity 4500K, committed 4864K, reserve
    d 1056768K
38  class space used 362K, capacity 388K, committed 512K, reserved
    1048576K

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分析:

- 128M大小的堆。Young 大小: 29M。Old 大小: 87M。开始阶段都是 YoungGC。Young内存空间不断的被清理, 堆占用的内存不断增大。
- 到Old区放不下的时候发生FULL GC。这时Young也被清空。
- 当程序继续运行, Old 区没有空间存放Young 转移过来的对象时, 就出现了 OOM。

## 测试二参数设置: 串行

-XX:+PrintGCDetails -XX:+UseSerialGC -Xms512m -Xmx512m -  
XX:+PrintGCDateStamps

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1  2020-10-25T16:49:18.954+0800: [GC (Allocation Failure) 2020-10-2
    5T16:49:18.954+0800: [DefNew: 139675K->17471K(157248K), 0.0164086
    secs] 139675K->49147K(506816K), 0.0166853 secs] [Times: user=0.02
    sys=0.00, real=0.02 secs]
2  2020-10-25T16:49:18.990+0800: [GC (Allocation Failure) 2020-10-2
    5T16:49:18.990+0800: [DefNew: 157082K->17471K(157248K), 0.0197072
    secs] 188757K->89035K(506816K), 0.0197449 secs] [Times: user=0.02
    sys=0.02, real=0.02 secs]
3  2020-10-25T16:49:19.029+0800: [GC (Allocation Failure) 2020-10-2
    5T16:49:19.029+0800: [DefNew: 157247K->17471K(157248K), 0.0171495
    secs] 228811K->133895K(506816K), 0.0172009 secs] [Times: user=0.02
    sys=0.00, real=0.02 secs]
4  2020-10-25T16:49:19.064+0800: [GC (Allocation Failure) 2020-10-2
    5T16:49:19.064+0800: [DefNew: 157247K->17467K(157248K), 0.0172775
    secs] 273671K->178568K(506816K), 0.0173129 secs] [Times: user=0.00
    sys=0.02, real=0.02 secs]

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5 2020-10-25T16:49:19.100+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.100+0800: [DefNew: 157243K->17469K(157248K), 0.0197459 secs] 318344K->228984K(506816K), 0.0197825 secs] [Times: user=0.00 sys=0.03, real=0.02 secs]

6 2020-10-25T16:49:19.137+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.137+0800: [DefNew: 156983K->17471K(157248K), 0.0183602 secs] 368498K->273360K(506816K), 0.0183946 secs] [Times: user=0.00 sys=0.00, real=0.02 secs]

7 2020-10-25T16:49:19.173+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.173+0800: [DefNew: 157179K->17470K(157248K), 0.0192100 secs] 413068K->323414K(506816K), 0.0192525 secs] [Times: user=0.00 sys=0.01, real=0.02 secs]

8 2020-10-25T16:49:19.210+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.210+0800: [DefNew: 157246K->157246K(157248K), 0.0000143 secs] 2020-10-25T16:49:19.210+0800: [Tenured: 305944K->271826K(349568K), 0.0252851 secs] 463190K->271826K(506816K), [Metaspace: 3288K->3288K(1056768K)], 0.0256705 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

9 2020-10-25T16:49:19.253+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.253+0800: [DefNew: 139776K->17470K(157248K), 0.0050486 secs] 411602K->317557K(506816K), 0.0050845 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

10 2020-10-25T16:49:19.275+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.275+0800: [DefNew: 156882K->156882K(157248K), 0.0000140 secs] 2020-10-25T16:49:19.275+0800: [Tenured: 300086K->301540K(349568K), 0.0290846 secs] 456968K->301540K(506816K), [Metaspace: 3288K->3288K(1056768K)], 0.0291445 secs] [Times: user=0.02 sys=0.00, real=0.03 secs]

11 2020-10-25T16:49:19.321+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.321+0800: [DefNew: 139748K->139748K(157248K), 0.0000153 secs] 2020-10-25T16:49:19.321+0800: [Tenured: 301540K->313552K(349568K), 0.0320952 secs] 441289K->313552K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0321586 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

12 2020-10-25T16:49:19.370+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.370+0800: [DefNew: 139776K->139776K(157248K), 0.0000167 secs] 2020-10-25T16:49:19.370+0800: [Tenured: 313552K->308401K(349568K), 0.0304073 secs] 453328K->308401K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0304754 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

13 2020-10-25T16:49:19.419+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.419+0800: [DefNew: 139657K->139657K(157248K), 0.0000150 secs] 2020-10-25T16:49:19.419+0800: [Tenured: 308401K->335393K(349568K), 0.0255121 secs] 448058K->335393K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0255777 secs] [Times: user=0.01 sys=0.00, real=0.03 secs]
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14 2020-10-25T16:49:19.461+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.461+0800: [DefNew: 139776K->139776K(157248K), 0.0000143 secs]2020-10-25T16:49:19.461+0800: [Tenured: 335393K->337256K(349568K), 0.0275875 secs] 475169K->337256K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0276474 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

15 2020-10-25T16:49:19.506+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.506+0800: [DefNew: 139478K->139478K(157248K), 0.0000147 secs]2020-10-25T16:49:19.507+0800: [Tenured: 337256K->344219K(349568K), 0.0335618 secs] 476735K->344219K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0336255 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

16 2020-10-25T16:49:19.557+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.557+0800: [DefNew: 139776K->139776K(157248K), 0.0000122 secs]2020-10-25T16:49:19.557+0800: [Tenured: 344219K->334395K(349568K), 0.0346481 secs] 483995K->334395K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0347063 secs] [Times: user=0.03 sys=0.00, real=0.04 secs]

17 2020-10-25T16:49:19.610+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.610+0800: [DefNew: 139776K->139776K(157248K), 0.0000129 secs]2020-10-25T16:49:19.610+0800: [Tenured: 334395K->348777K(349568K), 0.0247459 secs] 474171K->348777K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0248012 secs] [Times: user=0.02 sys=0.02, real=0.03 secs]

18 2020-10-25T16:49:19.653+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.653+0800: [DefNew: 139748K->139748K(157248K), 0.0000131 secs]2020-10-25T16:49:19.653+0800: [Tenured: 348777K->349544K(349568K), 0.0293702 secs] 488525K->352120K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0294268 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

19 2020-10-25T16:49:19.702+0800: [Full GC (Allocation Failure) 2020-10-25T16:49:19.702+0800: [Tenured: 349544K->349311K(349568K), 0.0317439 secs] 506364K->360214K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0317837 secs] [Times: user=0.03 sys=0.00, real=0.03 secs]

20 2020-10-25T16:49:19.753+0800: [Full GC (Allocation Failure) 2020-10-25T16:49:19.753+0800: [Tenured: 349446K->346472K(349568K), 0.0379022 secs] 506688K->346472K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0379457 secs] [Times: user=0.05 sys=0.00, real=0.04 secs]

21 2020-10-25T16:49:19.811+0800: [GC (Allocation Failure) 2020-10-25T16:49:19.811+0800: [DefNew: 139776K->139776K(157248K), 0.0000131 secs]2020-10-25T16:49:19.811+0800: [Tenured: 346472K->349516K(349568K), 0.0224362 secs] 486248K->372035K(506816K), [Metaspace: 3799K->3799K(1056768K)], 0.0224899 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]
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22 2020-10-25T16:49:19.853+0800: [Full GC (Allocation Failure) 2020-10-25T16:49:19.853+0800: [Tenured: 349516K->349206K(349568K), 0.0322300 secs] 506661K->369017K(506816K), [Metaspace: 3799K->3799K(1056768K)], 0.0322723 secs] [Times: user=0.05 sys=0.00, real=0.03 secs]
23 执行结束!共生成对象次数:12146
24 Heap
25 def new generation total 157248K, used 155936K [0x00000000e0000000, 0x00000000eaaa0000, 0x00000000eaaa0000)
26 eden space 139776K, 100% used [0x00000000e0000000, 0x00000000e8880000, 0x00000000e8880000)
27 from space 17472K, 92% used [0x00000000e8880000, 0x00000000e9848270, 0x00000000e9990000)
28 to space 17472K, 0% used [0x00000000e9990000, 0x00000000e9990000, 0x00000000eaaa0000)
29 tenured generation total 349568K, used 349206K [0x00000000eaaa0000, 0x0000000100000000, 0x0000000100000000)
30 the space 349568K, 99% used [0x00000000eaaa0000, 0x00000000fffa5858, 0x00000000fffa5a00, 0x0000000100000000)
31 Metaspace used 3806K, capacity 4540K, committed 4864K, reserved 1056768K
32 class space used 420K, capacity 428K, committed 512K, reserved 1048576K

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分析:

- 当内存设置成512M的时候, 系统并没有发生OOM。
- 发生了3次FULL GC, 花费的时间是0.03 秒
- YoungGC 花费的时间是0.03秒
- Young GC 每次释放内存大约是Young 区域的87%。

-XX:+PrintGCDetails -XX:+UseSerialGC -Xms2048m -Xmx2048m -XX:+PrintGCDateStamps

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1 2020-10-25T17:09:16.161+0800: [GC (Allocation Failure) 2020-10-25T17:09:16.161+0800: [DefNew: 559232K->69888K(629120K), 0.0530110 secs] 559232K->149957K(2027264K), 0.0530623 secs] [Times: user=0.05 sys=0.06, real=0.05 secs]
2 2020-10-25T17:09:16.293+0800: [GC (Allocation Failure) 2020-10-25T17:09:16.293+0800: [DefNew: 629120K->69887K(629120K), 0.0639886

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secs] 709189K->270005K(2027264K), 0.0640252 secs] [Times: user=0.0
3 sys=0.03, real=0.06 secs]
3 2020-10-25T17:09:16.433+0800: [GC (Allocation Failure) 2020-10-2
5T17:09:16.433+0800: [DefNew: 629119K->69887K(629120K), 0.0498649
secs] 829237K->394057K(2027264K), 0.0499012 secs] [Times: user=0.0
3 sys=0.02, real=0.05 secs]
4 2020-10-25T17:09:16.556+0800: [GC (Allocation Failure) 2020-10-2
5T17:09:16.556+0800: [DefNew: 629119K->69887K(629120K), 0.0493688
secs] 953289K->521839K(2027264K), 0.0494027 secs] [Times: user=0.0
3 sys=0.03, real=0.05 secs]
5 2020-10-25T17:09:16.684+0800: [GC (Allocation Failure) 2020-10-2
5T17:09:16.684+0800: [DefNew: 629119K->69887K(629120K), 0.0496685
secs] 1081071K->650163K(2027264K), 0.0497106 secs] [Times: user=0.
01 sys=0.03, real=0.05 secs]
6 2020-10-25T17:09:16.815+0800: [GC (Allocation Failure) 2020-10-2
5T17:09:16.815+0800: [DefNew: 629119K->69888K(629120K), 0.0519584
secs] 1209395K->778364K(2027264K), 0.0519945 secs] [Times: user=0.
03 sys=0.02, real=0.05 secs]
7 2020-10-25T17:09:16.949+0800: [GC (Allocation Failure) 2020-10-2
5T17:09:16.949+0800: [DefNew: 629120K->69888K(629120K), 0.0520001
secs] 1337596K->906361K(2027264K), 0.0520350 secs] [Times: user=0.
00 sys=0.05, real=0.05 secs]
8 执行结束!共生成对象次数:14642
9 Heap
10 def new generation total 629120K, used 86590K [0x0000000080000
000, 0x00000000aaaa0000, 0x00000000aaaa0000)
11 eden space 559232K, 2% used [0x0000000080000000, 0x00000000810
4fa50, 0x00000000a2220000)
12 from space 69888K, 100% used [0x00000000a6660000, 0x00000000aa
aa0000, 0x00000000aaaa0000)
13 to space 69888K, 0% used [0x00000000a2220000, 0x00000000a22200
00, 0x00000000a6660000)
14 tenured generation total 1398144K, used 836473K [0x00000000aaa
a0000, 0x0000000100000000, 0x0000000100000000)
15 the space 1398144K, 59% used [0x00000000aaaa0000, 0x00000000dd
b7e700, 0x00000000ddb7e800, 0x0000000100000000)
16 Metaspace used 3805K, capacity 4540K, committed 4864K, reserve
d 1056768K
17 class space used 420K, capacity 428K, committed 512K, reserved
1048576K

```

分析:



- 当内存设置增加4倍的时候，并没有发生FULL GC
- Young GC 花费的时间边长。是0.05秒

## 测试三参数设置：并行

-XX:+PrintGCDetails -XX:+UseParallelGC -Xms512m -Xmx512m -  
XX:+PrintGCDateStamps

```
1 2020-10-25T17:13:26.163+0800: [GC (Allocation Failure) [PSYoungG
en: 131584K->21478K(153088K)] 131584K->42551K(502784K), 0.0081718
secs] [Times: user=0.00 sys=0.28, real=0.01 secs]
2 2020-10-25T17:13:26.191+0800: [GC (Allocation Failure) [PSYoungG
en: 153003K->21491K(153088K)] 174076K->82868K(502784K), 0.0107980
secs] [Times: user=0.02 sys=0.27, real=0.01 secs]
3 2020-10-25T17:13:26.220+0800: [GC (Allocation Failure) [PSYoungG
en: 153041K->21492K(153088K)] 214418K->125584K(502784K), 0.0090751
secs] [Times: user=0.22 sys=0.06, real=0.01 secs]
4 2020-10-25T17:13:26.247+0800: [GC (Allocation Failure) [PSYoungG
en: 153076K->21494K(153088K)] 257168K->170199K(502784K), 0.0106940
secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
5 2020-10-25T17:13:26.277+0800: [GC (Allocation Failure) [PSYoungG
en: 152989K->21490K(153088K)] 301694K->210308K(502784K), 0.0093067
secs] [Times: user=0.00 sys=0.00, real=0.01 secs]
6 2020-10-25T17:13:26.306+0800: [GC (Allocation Failure) [PSYoungG
en: 153074K->21492K(80384K)] 341892K->253902K(430080K), 0.0098736
secs] [Times: user=0.28 sys=0.00, real=0.01 secs]
7 2020-10-25T17:13:26.324+0800: [GC (Allocation Failure) [PSYoungG
en: 80310K->32841K(116736K)] 312719K->270037K(466432K), 0.0037668
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
8 2020-10-25T17:13:26.336+0800: [GC (Allocation Failure) [PSYoungG
en: 91721K->48282K(116736K)] 328917K->291177K(466432K), 0.0057284
secs] [Times: user=0.25 sys=0.02, real=0.01 secs]
9 2020-10-25T17:13:26.352+0800: [GC (Allocation Failure) [PSYoungG
en: 107162K->54862K(116736K)] 350057K->306751K(466432K), 0.0066893
secs] [Times: user=0.28 sys=0.00, real=0.01 secs]
10 2020-10-25T17:13:26.366+0800: [GC (Allocation Failure) [PSYoung
Gen: 113742K->42436K(116736K)] 365631K->327797K(466432K), 0.007525
5 secs] [Times: user=0.05 sys=0.23, real=0.01 secs]
11 2020-10-25T17:13:26.382+0800: [GC (Allocation Failure) [PSYoung
Gen: 101316K->22730K(116736K)] 386677K->346867K(466432K), 0.008183
2 secs] [Times: user=0.06 sys=0.20, real=0.01 secs]
```

```
12 2020-10-25T17:13:26.390+0800: [Full GC (Ergonomics)
[PSYoungGen: 22730K->0K(116736K)] [ParOldGen: 324136K->237448K(349
696K)] 346867K->237448K(466432K), [Metaspace: 3288K-
>3288K(1056768K)], 0.0294435 secs] [Times: user=0.55 sys=0.00, rea
l=0.03 secs]
13 2020-10-25T17:13:26.428+0800: [GC (Allocation Failure) [PSYoung
Gen: 58880K->17507K(116736K)] 296328K->254956K(466432K), 0.0026778
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
14 2020-10-25T17:13:26.440+0800: [GC (Allocation Failure) [PSYoung
Gen: 75866K->18835K(116736K)] 313315K->272607K(466432K), 0.0035623
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
15 2020-10-25T17:13:26.451+0800: [GC (Allocation Failure) [PSYoung
Gen: 77537K->23709K(116736K)] 331309K->294937K(466432K), 0.0037048
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
16 2020-10-25T17:13:26.463+0800: [GC (Allocation Failure) [PSYoung
Gen: 82406K->17711K(116736K)] 353633K->311485K(466432K), 0.0036271
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
17 2020-10-25T17:13:26.474+0800: [GC (Allocation Failure) [PSYoung
Gen: 76562K->21497K(116736K)] 370336K->332238K(466432K), 0.0035883
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
18 2020-10-25T17:13:26.477+0800: [Full GC (Ergonomics)
[PSYoungGen: 21497K->0K(116736K)] [ParOldGen: 310740K->263937K(349
696K)] 332238K->263937K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0268240 secs] [Times: user=0.30 sys=0.00, rea
l=0.03 secs]
19 2020-10-25T17:13:26.514+0800: [GC (Allocation Failure) [PSYoung
Gen: 58880K->16983K(116736K)] 322817K->280921K(466432K), 0.0023462
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
20 2020-10-25T17:13:26.525+0800: [GC (Allocation Failure) [PSYoung
Gen: 75757K->19328K(116736K)] 339694K->299270K(466432K), 0.0035428
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
21 2020-10-25T17:13:26.536+0800: [GC (Allocation Failure) [PSYoung
Gen: 78208K->21964K(116736K)] 358150K->319331K(466432K), 0.0041986
secs] [Times: user=0.02 sys=0.00, real=0.00 secs]
22 2020-10-25T17:13:26.549+0800: [GC (Allocation Failure) [PSYoung
Gen: 80844K->19318K(116736K)] 378211K->337498K(466432K), 0.0043854
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
23 2020-10-25T17:13:26.554+0800: [Full GC (Ergonomics)
[PSYoungGen: 19318K->0K(116736K)] [ParOldGen: 318180K->280872K(349
696K)] 337498K->280872K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0297907 secs] [Times: user=0.30 sys=0.00, rea
l=0.03 secs]
24 2020-10-25T17:13:26.591+0800: [GC (Allocation Failure) [PSYoung
Gen: 58864K->24532K(116736K)] 339737K->305404K(466432K), 0.0032532
```

```
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
25 2020-10-25T17:13:26.603+0800: [GC (Allocation Failure) [PSYoung
Gen: 83298K->19043K(116736K)] 364171K->323686K(466432K), 0.0042529
secs] [Times: user=0.25 sys=0.00, real=0.00 secs]
26 2020-10-25T17:13:26.615+0800: [GC (Allocation Failure) [PSYoung
Gen: 77733K->21988K(116736K)] 382376K->344247K(466432K), 0.0033720
secs] [Times: user=0.02 sys=0.02, real=0.00 secs]
27 2020-10-25T17:13:26.619+0800: [Full GC (Ergonomics)
[PSYoungGen: 21988K->0K(116736K)] [ParOldGen: 322258K->299339K(349
696K)] 344247K->299339K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0330645 secs] [Times: user=0.53 sys=0.00, rea
l=0.03 secs]
28 2020-10-25T17:13:26.660+0800: [GC (Allocation Failure) [PSYoung
Gen: 58880K->16886K(116736K)] 358219K->316225K(466432K), 0.0020473
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
29 2020-10-25T17:13:26.670+0800: [GC (Allocation Failure) [PSYoung
Gen: 75766K->22516K(116736K)] 375105K->337429K(466432K), 0.0045601
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
30 2020-10-25T17:13:26.675+0800: [Full GC (Ergonomics)
[PSYoungGen: 22516K->0K(116736K)] [ParOldGen: 314913K->308750K(349
696K)] 337429K->308750K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0311386 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]
31 2020-10-25T17:13:26.713+0800: [GC (Allocation Failure) [PSYoung
Gen: 58880K->19755K(116736K)] 367630K->328506K(466432K), 0.0023190
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
32 2020-10-25T17:13:26.723+0800: [GC (Allocation Failure) [PSYoung
Gen: 78635K->22124K(116736K)] 387386K->349762K(466432K), 0.0044310
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
33 2020-10-25T17:13:26.727+0800: [Full GC (Ergonomics)
[PSYoungGen: 22124K->0K(116736K)] [ParOldGen: 327638K->318785K(349
696K)] 349762K->318785K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0343033 secs] [Times: user=0.56 sys=0.00, rea
l=0.04 secs]
34 2020-10-25T17:13:26.772+0800: [Full GC (Ergonomics)
[PSYoungGen: 58775K->0K(116736K)] [ParOldGen: 318785K->324528K(349
696K)] 377561K->324528K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0328354 secs] [Times: user=0.38 sys=0.00, rea
l=0.03 secs]
35 2020-10-25T17:13:26.815+0800: [Full GC (Ergonomics)
[PSYoungGen: 58685K->0K(116736K)] [ParOldGen: 324528K->326736K(349
696K)] 383213K->326736K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0312478 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]
```

```
36 2020-10-25T17:13:26.854+0800: [Full GC (Ergonomics)
[PSYoungGen: 58880K->0K(116736K)] [ParOldGen: 326736K->331909K(349
696K)] 385616K->331909K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0307518 secs] [Times: user=0.28 sys=0.00, rea
l=0.03 secs]

37 2020-10-25T17:13:26.894+0800: [Full GC (Ergonomics)
[PSYoungGen: 58880K->0K(116736K)] [ParOldGen: 331909K->331454K(349
696K)] 390789K->331454K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0322696 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]

38 2020-10-25T17:13:26.936+0800: [Full GC (Ergonomics)
[PSYoungGen: 58880K->0K(116736K)] [ParOldGen: 331454K->330519K(349
696K)] 390334K->330519K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0335214 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]

39 2020-10-25T17:13:26.979+0800: [Full GC (Ergonomics)
[PSYoungGen: 58557K->0K(116736K)] [ParOldGen: 330519K->330909K(349
696K)] 389077K->330909K(466432K), [Metaspace: 3289K-
>3289K(1056768K)], 0.0356888 secs] [Times: user=0.55 sys=0.00, rea
l=0.04 secs]

40 2020-10-25T17:13:27.027+0800: [Full GC (Ergonomics)
[PSYoungGen: 58880K->0K(116736K)] [ParOldGen: 330909K->332379K(349
696K)] 389789K->332379K(466432K), [Metaspace: 3595K-
>3595K(1056768K)], 0.0315431 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]

41 2020-10-25T17:13:27.067+0800: [Full GC (Ergonomics)
[PSYoungGen: 58704K->0K(116736K)] [ParOldGen: 332379K->336300K(349
696K)] 391084K->336300K(466432K), [Metaspace: 3798K-
>3798K(1056768K)], 0.0333592 secs] [Times: user=0.56 sys=0.00, rea
l=0.03 secs]

42 执行结束!共生成对象次数:9572

43 Heap

44 PSYoungGen total 116736K, used 55203K [0x00000000f5580000, 0x0
000000100000000, 0x0000000100000000)

45 eden space 58880K, 93% used [0x00000000f5580000,0x00000000f8b6
8de0,0x00000000f8f00000)

46 from space 57856K, 0% used [0x00000000f8f00000,0x00000000f8f00
000,0x00000000fc780000)

47 to space 57856K, 0% used [0x00000000fc780000,0x00000000fc78000
0,0x0000000100000000)

48 ParOldGen total 349696K, used 336300K [0x00000000e0000000, 0x0
0000000f5580000, 0x00000000f5580000)

49 object space 349696K, 96% used [0x00000000e0000000,0x00000000f
486b1a8,0x00000000f5580000)
```

```
50 Metaspace used 3805K, capacity 4540K, committed 4864K, reserved 1056768K
51 class space used 420K, capacity 428K, committed 512K, reserved 1048576K
```

分析:

- Young GC 时, 内存释放了大概85%
- Young GC花费的时间0.01秒
- 当发生FULL GC时, Young 区域的内存全部释放。
- FULL GC 花费的时间0.03秒

-XX:+PrintGCDetails -XX:+UseParallelGC -Xms2048m -Xmx2048m -  
XX:+PrintGCDateStamps

```
1 2020-10-25T17:21:45.499+0800: [GC (Allocation Failure) [PSYoungG
en: 524800K->87032K(611840K)] 524800K->154976K(2010112K), 0.025674
1 secs] [Times: user=0.30 sys=0.27, real=0.03 secs]
2 2020-10-25T17:21:45.608+0800: [GC (Allocation Failure) [PSYoungG
en: 611832K->87037K(611840K)] 679776K->268605K(2010112K), 0.034862
5 secs] [Times: user=0.09 sys=0.47, real=0.03 secs]
3 2020-10-25T17:21:45.714+0800: [GC (Allocation Failure) [PSYoungG
en: 611517K->87027K(611840K)] 793085K->382108K(2010112K), 0.027665
0 secs] [Times: user=0.03 sys=0.25, real=0.03 secs]
4 2020-10-25T17:21:45.816+0800: [GC (Allocation Failure) [PSYoungG
en: 611827K->87027K(611840K)] 906908K->499082K(2010112K), 0.028739
2 secs] [Times: user=0.33 sys=0.23, real=0.03 secs]
5 2020-10-25T17:21:45.913+0800: [GC (Allocation Failure) [PSYoungG
en: 611827K->87037K(611840K)] 1023882K->619482K(2010112K), 0.03136
30 secs] [Times: user=0.30 sys=0.27, real=0.03 secs]
6 2020-10-25T17:21:46.017+0800: [GC (Allocation Failure) [PSYoungG
en: 611837K->87032K(326144K)] 1144282K->714922K(1724416K), 0.02648
20 secs] [Times: user=0.30 sys=0.23, real=0.03 secs]
7 2020-10-25T17:21:46.078+0800: [GC (Allocation Failure) [PSYoungG
en: 326136K->141643K(380928K)] 954026K->775349K(1779200K), 0.01404
22 secs] [Times: user=0.23 sys=0.05, real=0.01 secs]
8 2020-10-25T17:21:46.125+0800: [GC (Allocation Failure) [PSYoungG
en: 380747K->181977K(468992K)] 1014453K->827845K(1867264K), 0.0189
133 secs] [Times: user=0.28 sys=0.00, real=0.02 secs]
9 2020-10-25T17:21:46.179+0800: [GC (Allocation Failure) [PSYoungG
en: 417966K->193484K(465920K)] 1063834K->873213K(1864192K), 0.0200
```

```

037 secs] [Times: user=0.36 sys=0.17, real=0.02 secs]
10 2020-10-25T17:21:46.233+0800: [GC (Allocation Failure) [PSYoung
Gen: 429516K->138442K(462848K)] 1109245K->908462K(1861120K), 0.021
6605 secs] [Times: user=0.05 sys=0.23, real=0.02 secs]
11 2020-10-25T17:21:46.291+0800: [GC (Allocation Failure) [PSYoung
Gen: 372426K->72473K(306688K)] 1142446K->957492K(1704960K), 0.0250
640 secs] [Times: user=0.03 sys=0.25, real=0.03 secs]
12 执行结束!共生成对象次数:16497
13 Heap
14 PSYoungGen total 306688K, used 162211K [0x00000000d5580000, 0x
0000000100000000, 0x0000000100000000)
15 eden space 233984K, 38% used [0x00000000d5580000,0x00000000dad
22658,0x00000000e3a00000)
16 from space 72704K, 99% used [0x00000000e3a00000,0x00000000e80c
6708,0x00000000e8100000)
17 to space 232960K, 0% used [0x00000000f1c80000,0x00000000f1c800
00,0x0000000100000000)
18 ParOldGen total 1398272K, used 885018K [0x0000000080000000, 0x
00000000d5580000, 0x00000000d5580000)
19 object space 1398272K, 63% used [0x0000000080000000,0x00000000
b60469c0,0x00000000d5580000)
20 Metaspace used 3805K, capacity 4540K, committed 4864K, reserve
d 1056768K
21 class space used 420K, capacity 428K, committed 512K, reserved
1048576K

```

分析:

- Young GC 时, 内存释放了大概85%
- 堆内存增大了4倍, 结果并没有发生FULL GC
- Young GC花费的时间0.03秒

-XX:+PrintGCDetails -XX:+UseParallelGC -Xms4096m -Xmx4096m -

XX:+PrintGCDateStamps

```

1 2020-10-25T22:13:53.181+0800: [GC (Allocation Failure) [PSYoungG
en: 1048576K->174578K(1223168K)] 1048576K->220895K(4019712K), 0.03
62019 secs] [Times: user=0.06 sys=0.52, real=0.04 secs]
2 2020-10-25T22:13:53.360+0800: [GC (Allocation Failure) [PSYoungG
en: 1223154K->174577K(1223168K)] 1269471K->345586K(4019712K), 0.04
83943 secs] [Times: user=0.05 sys=0.80, real=0.05 secs]

```



```

3 2020-10-25T22:13:53.545+0800: [GC (Allocation Failure) [PSYoungGen: 1223144K->174590K(1223168K)] 1394153K->470470K(4019712K), 0.0360274 secs] [Times: user=0.30 sys=0.27, real=0.04 secs]
4 2020-10-25T22:13:53.719+0800: [GC (Allocation Failure) [PSYoungGen: 1223166K->174580K(1223168K)] 1519046K->587375K(4019712K), 0.0357234 secs] [Times: user=0.33 sys=0.23, real=0.04 secs]
5 执行结束!共生成对象次数:18549
6 Heap
7 PSYoungGen total 1223168K, used 1016392K [0x000000076ab00000, 0x00000007c0000000, 0x00000007c0000000)
8 eden space 1048576K, 80% used [0x000000076ab00000,0x000000079e115148,0x00000007aab00000)
9 from space 174592K, 99% used [0x00000007b5580000,0x00000007bffffd1e8,0x00000007c0000000)
10 to space 174592K, 0% used [0x00000007aab00000,0x00000007aab00000,0x00000007b5580000)
11 ParOldGen total 2796544K, used 412794K [0x00000006c0000000, 0x000000076ab00000, 0x000000076ab00000)
12 object space 2796544K, 14% used [0x00000006c0000000,0x00000006d931eb70,0x000000076ab00000)
13 Metaspace used 3805K, capacity 4540K, committed 4864K, reserved 1056768K
14 class space used 420K, capacity 428K, committed 512K, reserved 1048576K

```

分析:

- 没有发生FULL GC
- Young GC 花费的时间0.04秒
- Young GC 时, 内存释放了大概84%

## 测试四参数设置: CMS(并发)

-XX:+PrintGCDetails -XX:+UseConcMarkSweepGC -Xms512m -Xmx512m -XX:+PrintGCDateStamps

```

1 2020-10-25T17:28:17.811+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.811+0800: [ParNew: 139318K->17472K(157248K), 0.0092261 secs] 139318K->48561K(506816K), 0.0092880 secs] [Times: user=0.00 sys=0.00, real=0.01 secs]

```

```
2 2020-10-25T17:28:17.840+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.840+0800: [ParNew: 157248K->17472K(157248K), 0.0125426 secs] 188337K->89905K(506816K), 0.0125821 secs] [Times: user=0.00 sys=0.02, real=0.01 secs]

3 2020-10-25T17:28:17.871+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.871+0800: [ParNew: 157248K->17472K(157248K), 0.0166588 secs] 229681K->130536K(506816K), 0.0167018 secs] [Times: user=0.27 sys=0.02, real=0.02 secs]

4 2020-10-25T17:28:17.907+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.907+0800: [ParNew: 157248K->17471K(157248K), 0.0173966 secs] 270312K->176753K(506816K), 0.0174410 secs] [Times: user=0.27 sys=0.02, real=0.02 secs]

5 2020-10-25T17:28:17.945+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.945+0800: [ParNew: 157247K->17471K(157248K), 0.0167972 secs] 316529K->219902K(506816K), 0.0168334 secs] [Times: user=0.27 sys=0.02, real=0.02 secs]

6 2020-10-25T17:28:17.962+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 202431K(349568K)] 220479K(506816K), 0.0002418 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

7 2020-10-25T17:28:17.962+0800: [CMS-concurrent-mark-start]

8 2020-10-25T17:28:17.964+0800: [CMS-concurrent-mark: 0.002/0.002 secs] [Times: user=0.01 sys=0.06, real=0.00 secs]

9 2020-10-25T17:28:17.964+0800: [CMS-concurrent-preclean-start]

10 2020-10-25T17:28:17.964+0800: [CMS-concurrent-preclean: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

11 2020-10-25T17:28:17.964+0800: [CMS-concurrent-abortable-preclean-start]

12 2020-10-25T17:28:17.981+0800: [GC (Allocation Failure) 2020-10-25T17:28:17.981+0800: [ParNew: 157237K->17471K(157248K), 0.0183363 secs] 359669K->270016K(506816K), 0.0183777 secs] [Times: user=0.25 sys=0.02, real=0.02 secs]

13 2020-10-25T17:28:18.020+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.020+0800: [ParNew: 157004K->17470K(157248K), 0.0168511 secs] 409549K->314144K(506816K), 0.0168927 secs] [Times: user=0.27 sys=0.02, real=0.02 secs]

14 2020-10-25T17:28:18.055+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.055+0800: [ParNew: 157246K->17469K(157248K), 0.0168383 secs] 453920K->359176K(506816K), 0.0168830 secs] [Times: user=0.28 sys=0.00, real=0.02 secs]

15 2020-10-25T17:28:18.071+0800: [CMS-concurrent-abortable-preclean: 0.002/0.107 secs] [Times: user=0.86 sys=0.05, real=0.11 secs]

16 2020-10-25T17:28:18.072+0800: [GC (CMS Final Remark) [YG occupancy: 21320 K (157248 K)]2020-10-25T17:28:18.072+0800: [Rescan (par
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allel) , 0.0002844 secs]2020-10-25T17:28:18.072+0800: [weak refs p
rocessing, 0.0000144 secs]2020-10-25T17:28:18.072+0800: [class un
loading, 0.0002388 secs]2020-10-25T17:28:18.072+0800: [scrub symbol
table, 0.0003695 secs]2020-10-25T17:28:18.073+0800: [scrub string
table, 0.0000765 secs][1 CMS-remark: 341707K(349568K)] 363028K(506
816K), 0.0010373 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
17 2020-10-25T17:28:18.073+0800: [CMS-concurrent-sweep-start]
18 2020-10-25T17:28:18.073+0800: [CMS-concurrent-sweep: 0.001/0.00
1 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
19 2020-10-25T17:28:18.073+0800: [CMS-concurrent-reset-start]
20 2020-10-25T17:28:18.074+0800: [CMS-concurrent-reset: 0.001/0.00
1 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
21 2020-10-25T17:28:18.091+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.091+0800: [ParNew: 157245K->157245K(157248K), 0.000017
5 secs]2020-10-25T17:28:18.091+0800: [CMS: 302267K-
>256541K(349568K), 0.0304945 secs] 459513K->256541K(506816K), [Met
aspace: 3289K->3289K(1056768K)], 0.0305730 secs] [Times: user=0.03
sys=0.00, real=0.03 secs]
22 2020-10-25T17:28:18.122+0800: [GC (CMS Initial Mark) [1 CMS-ini
tial-mark: 256541K(349568K)] 257303K(506816K), 0.0002632 secs] [Ti
mes: user=0.00 sys=0.00, real=0.00 secs]
23 2020-10-25T17:28:18.122+0800: [CMS-concurrent-mark-start]
24 2020-10-25T17:28:18.123+0800: [CMS-concurrent-mark: 0.001/0.001
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
25 2020-10-25T17:28:18.123+0800: [CMS-concurrent-preclean-start]
26 2020-10-25T17:28:18.123+0800: [CMS-concurrent-preclean:
0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
27 2020-10-25T17:28:18.123+0800: [CMS-concurrent-abortable-preclea
n-start]
28 2020-10-25T17:28:18.140+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.140+0800: [ParNew: 139364K->17471K(157248K), 0.0055895
secs] 395905K->307160K(506816K), 0.0056295 secs] [Times: user=0.00
sys=0.00, real=0.00 secs]
29 2020-10-25T17:28:18.164+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.164+0800: [ParNew: 157247K->17471K(157248K), 0.0062607
secs] 446936K->348903K(506816K), 0.0063013 secs] [Times: user=0.28
sys=0.00, real=0.01 secs]
30 2020-10-25T17:28:18.171+0800: [CMS-concurrent-abortable-preclea
n: 0.002/0.047 secs] [Times: user=0.31 sys=0.00, real=0.05 secs]
31 2020-10-25T17:28:18.171+0800: [GC (CMS Final Remark) [YG occupa
ncy: 25432 K (157248 K)]2020-10-25T17:28:18.171+0800: [Rescan (par
allel) , 0.0003277 secs]2020-10-25T17:28:18.171+0800: [weak refs p
rocessing, 0.0000096 secs]2020-10-25T17:28:18.171+0800: [class un
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loading, 0.0002939 secs]2020-10-25T17:28:18.171+0800: [scrub symbol
table, 0.0004689 secs]2020-10-25T17:28:18.172+0800: [scrub string
table, 0.0000753 secs][1 CMS-remark: 331431K(349568K)] 356863K(506
816K), 0.0012320 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
32 2020-10-25T17:28:18.172+0800: [CMS-concurrent-sweep-start]
33 2020-10-25T17:28:18.172+0800: [CMS-concurrent-sweep: 0.001/0.00
1 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
34 2020-10-25T17:28:18.172+0800: [CMS-concurrent-reset-start]
35 2020-10-25T17:28:18.173+0800: [CMS-concurrent-reset: 0.000/0.00
0 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
36 2020-10-25T17:28:18.193+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.193+0800: [ParNew: 157247K->157247K(157248K), 0.000017
4 secs]2020-10-25T17:28:18.193+0800: [CMS: 331133K-
>299554K(349568K), 0.0340859 secs] 488381K->299554K(506816K), [Met
aspace: 3289K->3289K(1056768K)], 0.0341530 secs] [Times: user=0.03
sys=0.00, real=0.03 secs]
37 2020-10-25T17:28:18.227+0800: [GC (CMS Initial Mark) [1 CMS-ini
tial-mark: 299554K(349568K)] 300142K(506816K), 0.0002496 secs] [Ti
mes: user=0.02 sys=0.00, real=0.00 secs]
38 2020-10-25T17:28:18.228+0800: [CMS-concurrent-mark-start]
39 2020-10-25T17:28:18.228+0800: [CMS-concurrent-mark: 0.001/0.001
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
40 2020-10-25T17:28:18.229+0800: [CMS-concurrent-preclean-start]
41 2020-10-25T17:28:18.229+0800: [CMS-concurrent-preclean:
0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
42 2020-10-25T17:28:18.229+0800: [CMS-concurrent-abortable-preclea
n-start]
43 2020-10-25T17:28:18.244+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.244+0800: [ParNew: 139721K->17470K(157248K), 0.0064084
secs] 439276K->346600K(506816K), 0.0064526 secs] [Times: user=0.00
sys=0.00, real=0.01 secs]
44 2020-10-25T17:28:18.251+0800: [CMS-concurrent-abortable-preclea
n: 0.001/0.022 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]
45 2020-10-25T17:28:18.251+0800: [GC (CMS Final Remark) [YG occupa
ncy: 24355 K (157248 K)]2020-10-25T17:28:18.251+0800: [Rescan (par
allel) , 0.0003287 secs]2020-10-25T17:28:18.252+0800: [weak refs p
rocessing, 0.0000102 secs]2020-10-25T17:28:18.252+0800: [class unl
oading, 0.0002138 secs]2020-10-25T17:28:18.252+0800: [scrub symbol
table, 0.0003684 secs]2020-10-25T17:28:18.252+0800: [scrub string
table, 0.0000714 secs][1 CMS-remark: 329129K(349568K)] 353484K(506
816K), 0.0010508 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
46 2020-10-25T17:28:18.252+0800: [CMS-concurrent-sweep-start]
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47 2020-10-25T17:28:18.253+0800: [CMS-concurrent-sweep: 0.000/0.000
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
48 2020-10-25T17:28:18.253+0800: [CMS-concurrent-reset-start]
49 2020-10-25T17:28:18.253+0800: [CMS-concurrent-reset: 0.000/0.000
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
50 2020-10-25T17:28:18.270+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.270+0800: [ParNew: 156972K->156972K(157248K), 0.000020
9 secs]2020-10-25T17:28:18.270+0800: [CMS: 327168K-
>316847K(349568K), 0.0350717 secs] 484140K->316847K(506816K), [Met
aspace: 3289K->3289K(1056768K)], 0.0351362 secs] [Times: user=0.03
sys=0.00, real=0.04 secs]
51 2020-10-25T17:28:18.305+0800: [GC (CMS Initial Mark) [1 CMS-ini
tial-mark: 316847K(349568K)] 317135K(506816K), 0.0002452 secs] [Ti
mes: user=0.00 sys=0.00, real=0.00 secs]
52 2020-10-25T17:28:18.306+0800: [CMS-concurrent-mark-start]
53 2020-10-25T17:28:18.307+0800: [CMS-concurrent-mark: 0.001/0.001
secs] [Times: user=0.09 sys=0.00, real=0.00 secs]
54 2020-10-25T17:28:18.307+0800: [CMS-concurrent-preclean-start]
55 2020-10-25T17:28:18.307+0800: [CMS-concurrent-preclean:
0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
56 2020-10-25T17:28:18.307+0800: [CMS-concurrent-abortable-preclea
n-start]
57 2020-10-25T17:28:18.322+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.322+0800: [ParNew: 139100K->17471K(157248K), 0.0072886
secs] 455947K->365682K(506816K), 0.0073309 secs] [Times: user=0.00
sys=0.00, real=0.01 secs]
58 2020-10-25T17:28:18.330+0800: [CMS-concurrent-abortable-preclea
n: 0.000/0.023 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]
59 2020-10-25T17:28:18.330+0800: [GC (CMS Final Remark) [YG occupa
ncy: 18176 K (157248 K)]2020-10-25T17:28:18.330+0800: [Rescan (par
allel) , 0.0002862 secs]2020-10-25T17:28:18.330+0800: [weak refs p
rocessing, 0.0000092 secs]2020-10-25T17:28:18.330+0800: [class unl
oading, 0.0002278 secs]2020-10-25T17:28:18.330+0800: [scrub symbol
table, 0.0003932 secs]2020-10-25T17:28:18.331+0800: [scrub string
table, 0.0000796 secs][1 CMS-remark: 348211K(349568K)] 366387K(506
816K), 0.0010438 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
60 2020-10-25T17:28:18.331+0800: [CMS-concurrent-sweep-start]
61 2020-10-25T17:28:18.331+0800: [CMS-concurrent-sweep: 0.000/0.000
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
62 2020-10-25T17:28:18.331+0800: [CMS-concurrent-reset-start]
63 2020-10-25T17:28:18.332+0800: [CMS-concurrent-reset: 0.000/0.000
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
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64 2020-10-25T17:28:18.350+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.350+0800: [ParNew: 157173K->157173K(157248K), 0.0000167 secs]2020-10-25T17:28:18.350+0800: [CMS: 345801K->317724K(349568K), 0.0345564 secs] 502975K->317724K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0346217 secs] [Times: user=0.05 sys=0.00, real=0.04 secs]

65 2020-10-25T17:28:18.385+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 317724K(349568K)] 318214K(506816K), 0.0002689 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

66 2020-10-25T17:28:18.385+0800: [CMS-concurrent-mark-start]

67 2020-10-25T17:28:18.386+0800: [CMS-concurrent-mark: 0.001/0.001 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

68 2020-10-25T17:28:18.386+0800: [CMS-concurrent-preclean-start]

69 2020-10-25T17:28:18.386+0800: [CMS-concurrent-preclean: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

70 2020-10-25T17:28:18.386+0800: [CMS-concurrent-abortable-preclean-start]

71 2020-10-25T17:28:18.405+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.405+0800: [ParNew: 139776K->139776K(157248K), 0.0000263 secs]2020-10-25T17:28:18.405+0800: [CMS2020-10-25T17:28:18.405+0800: [CMS-concurrent-abortable-preclean: 0.000/0.019 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]

72 (concurrent mode failure): 317724K->322302K(349568K), 0.0399840 secs] 457500K->322302K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0400761 secs] [Times: user=0.03 sys=0.00, real=0.04 secs]

73 2020-10-25T17:28:18.464+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.464+0800: [ParNew: 139776K->139776K(157248K), 0.0000239 secs]2020-10-25T17:28:18.464+0800: [CMS: 322302K->325447K(349568K), 0.0386502 secs] 462078K->325447K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0387320 secs] [Times: user=0.03 sys=0.00, real=0.04 secs]

74 2020-10-25T17:28:18.503+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 325447K(349568K)] 325735K(506816K), 0.0002398 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

75 2020-10-25T17:28:18.503+0800: [CMS-concurrent-mark-start]

76 2020-10-25T17:28:18.504+0800: [CMS-concurrent-mark: 0.001/0.001 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

77 2020-10-25T17:28:18.504+0800: [CMS-concurrent-preclean-start]

78 2020-10-25T17:28:18.505+0800: [CMS-concurrent-preclean: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

79 2020-10-25T17:28:18.505+0800: [CMS-concurrent-abortable-preclean-start]
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80 2020-10-25T17:28:18.523+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.523+0800: [ParNew: 139776K->139776K(157248K), 0.000019 secs]2020-10-25T17:28:18.523+0800: [CMS2020-10-25T17:28:18.523+0800: [CMS-concurrent-abortable-preclean: 0.000/0.019 secs] [Times: user=0.02 sys=0.00, real=0.02 secs]

81 (concurrent mode failure): 325447K->330539K(349568K), 0.0374650 secs] 465223K->330539K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0375314 secs] [Times: user=0.05 sys=0.00, real=0.04 secs]

82 2020-10-25T17:28:18.578+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.578+0800: [ParNew: 139457K->139457K(157248K), 0.000017 secs]2020-10-25T17:28:18.578+0800: [CMS: 330539K->339947K(349568K), 0.0370981 secs] 469997K->339947K(506816K), [Metaspace: 3289K->3289K(1056768K)], 0.0371622 secs] [Times: user=0.03 sys=0.00, real=0.04 secs]

83 2020-10-25T17:28:18.615+0800: [GC (CMS Initial Mark) [1 CMS-initial-mark: 339947K(349568K)] 340324K(506816K), 0.0002974 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

84 2020-10-25T17:28:18.616+0800: [CMS-concurrent-mark-start]

85 2020-10-25T17:28:18.617+0800: [CMS-concurrent-mark: 0.001/0.001 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

86 2020-10-25T17:28:18.617+0800: [CMS-concurrent-preclean-start]

87 2020-10-25T17:28:18.617+0800: [CMS-concurrent-preclean: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

88 2020-10-25T17:28:18.617+0800: [CMS-concurrent-abortable-preclean-start]

89 2020-10-25T17:28:18.617+0800: [CMS-concurrent-abortable-preclean: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

90 2020-10-25T17:28:18.617+0800: [GC (CMS Final Remark) [YG occupancy: 10072 K (157248 K)]2020-10-25T17:28:18.617+0800: [Rescan (parallel) , 0.0004004 secs]2020-10-25T17:28:18.617+0800: [weak refs processing, 0.0000106 secs]2020-10-25T17:28:18.617+0800: [class unloading, 0.0002251 secs]2020-10-25T17:28:18.618+0800: [scrub symbol table, 0.0003692 secs]2020-10-25T17:28:18.618+0800: [scrub string table, 0.0000758 secs][1 CMS-remark: 339947K(349568K)] 350020K(506816K), 0.0011332 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

91 2020-10-25T17:28:18.618+0800: [CMS-concurrent-sweep-start]

92 2020-10-25T17:28:18.619+0800: [CMS-concurrent-sweep: 0.000/0.000 secs] [Times: user=0.03 sys=0.00, real=0.00 secs]

93 2020-10-25T17:28:18.619+0800: [CMS-concurrent-reset-start]

94 2020-10-25T17:28:18.619+0800: [CMS-concurrent-reset: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

95 2020-10-25T17:28:18.637+0800: [GC (Allocation Failure) 2020-10-25T17:28:18.637+0800: [ParNew: 139098K->139098K(157248K), 0.000022
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4 secs]2020-10-25T17:28:18.637+0800: [CMS: 339783K-
>349485K(349568K), 0.0480484 secs] 478882K->350542K(506816K), [Met
aspace: 3289K->3289K(1056768K)], 0.0481220 secs] [Times: user=0.05
sys=0.00, real=0.05 secs]

96 2020-10-25T17:28:18.684+0800: [GC (CMS Initial Mark) [1 CMS-ini
tial-mark: 349485K(349568K)] 351339K(506816K), 0.0002484 secs] [Ti
mes: user=0.00 sys=0.00, real=0.00 secs]

97 2020-10-25T17:28:18.685+0800: [CMS-concurrent-mark-start]

98 2020-10-25T17:28:18.686+0800: [CMS-concurrent-mark: 0.001/0.001
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

99 2020-10-25T17:28:18.686+0800: [CMS-concurrent-preclean-start]

100 2020-10-25T17:28:18.687+0800: [CMS-concurrent-preclean:
0.001/0.001 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

101 2020-10-25T17:28:18.687+0800: [CMS-concurrent-abortable-preclea
n-start]

102 2020-10-25T17:28:18.687+0800: [CMS-concurrent-abortable-preclea
n: 0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

103 2020-10-25T17:28:18.687+0800: [GC (CMS Final Remark) [YG occupa
ncy: 19509 K (157248 K)]2020-10-25T17:28:18.687+0800: [Rescan (par
allel) , 0.0005264 secs]2020-10-25T17:28:18.688+0800: [weak refs p
rocessing, 0.0000131 secs]2020-10-25T17:28:18.688+0800: [class unl
oading, 0.0002935 secs]2020-10-25T17:28:18.688+0800: [scrub symbol
table, 0.0004687 secs]2020-10-25T17:28:18.688+0800: [scrub string
table, 0.0001332 secs][1 CMS-remark: 349485K(349568K)] 368994K(506
816K), 0.0015121 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

104 2020-10-25T17:28:18.689+0800: [CMS-concurrent-sweep-start]

105 2020-10-25T17:28:18.689+0800: [CMS-concurrent-sweep: 0.000/0.00
0 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

106 2020-10-25T17:28:18.689+0800: [CMS-concurrent-reset-start]

107 2020-10-25T17:28:18.689+0800: [CMS-concurrent-reset: 0.000/0.00
0 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]

108 2020-10-25T17:28:18.708+0800: [GC (Allocation Failure) 2020-10-
25T17:28:18.708+0800: [ParNew: 156832K->156832K(157248K), 0.000014
9 secs]2020-10-25T17:28:18.708+0800: [CMS: 349415K-
>349201K(349568K), 0.0452152 secs] 506248K->356481K(506816K), [Met
aspace: 3799K->3799K(1056768K)], 0.0452805 secs] [Times: user=0.05
sys=0.00, real=0.05 secs]

109 2020-10-25T17:28:18.753+0800: [GC (CMS Initial Mark) [1 CMS-ini
tial-mark: 349201K(349568K)] 357149K(506816K), 0.0002930 secs] [Ti
mes: user=0.00 sys=0.00, real=0.00 secs]

110 2020-10-25T17:28:18.754+0800: [CMS-concurrent-mark-start]

111 2020-10-25T17:28:18.755+0800: [CMS-concurrent-mark: 0.001/0.001
secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
```

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112 2020-10-25T17:28:18.755+0800: [CMS-concurrent-preclean-start]
113 2020-10-25T17:28:18.756+0800: [CMS-concurrent-preclean:
0.001/0.001 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
114 2020-10-25T17:28:18.756+0800: [CMS-concurrent-abortable-preclean-start]
115 2020-10-25T17:28:18.756+0800: [CMS-concurrent-abortable-preclean:
0.000/0.000 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
116 2020-10-25T17:28:18.756+0800: [GC (CMS Final Remark) [YG occupancy: 24616 K (157248 K)]2020-10-25T17:28:18.756+0800: [Rescan (parallel) , 0.0003692 secs]2020-10-25T17:28:18.756+0800: [weak refs processing, 0.0000103 secs]2020-10-25T17:28:18.756+0800: [class unloading, 0.0002613 secs]2020-10-25T17:28:18.757+0800: [scrub symbol table, 0.0004235 secs]2020-10-25T17:28:18.757+0800: [scrub string table, 0.0000997 secs][1 CMS-remark: 349201K(349568K)] 373818K(506816K), 0.0012185 secs] [Times: user=0.00 sys=0.00, real=0.00 secs]
117 2020-10-25T17:28:18.757+0800: [CMS-concurrent-sweep-start]
118 执行结束!共生成对象次数:11776
119 Heap
120 par new generation total 157248K, used 26015K [0x00000000e0000000, 0x00000000eaaa0000, 0x00000000eaaa0000)
121 eden space 139776K, 18% used2020-10-25T17:28:18.757+0800: [0x00000000e0000000, 0x00000000e1967c30, 0x00000000e8880000)
122 from space 17472K, 0% used [0x00000000e8880000, 0x00000000e8880000, 0x00000000e9990000)
123 to [CMS-concurrent-sweep: 0.000/0.000 secs] space 17472K, 0% used [0x00000000e9990000, 0x00000000e9990000, 0x00000000eaaa0000)
124 concurrent mark-sweep generation [Times: user=0.00 sys=0.00, real=0.00 secs] total 349568K, used 348885K [0x00000000eaaa0000, 0x0000000010000000, 0x0000000010000000)
125
126 Metaspace used 3806K, capacity 4540K, committed 4864K, reserved 1056768K
127 class space used 420K, capacity 428K, committed 512K, reserved 1048576K
128 2020-10-25T17:28:18.758+0800: [CMS-concurrent-reset-start]

```

分析:

- GC算法变得复杂。CMS 回收器总共有6个阶段
- CMS Initial Mark 阶段, 花费时间在几毫秒。时间非常短。

-XX:+PrintGCDetails -XX:+UseConcMarkSweepGC -Xms4096m -Xmx4096m -XX:+PrintGCDateStamps

```
1 2020-10-25T22:08:55.135+0800: [GC (Allocation Failure) 2020-10-25T22:08:55.135+0800: [ParNew: 1118528K->139776K(1258304K), 0.0476598 secs] 1118528K->243342K(4054528K), 0.0477271 secs] [Times: user=0.31 sys=0.53, real=0.05 secs]
2 2020-10-25T22:08:55.343+0800: [GC (Allocation Failure) 2020-10-25T22:08:55.343+0800: [ParNew: 1258304K->139775K(1258304K), 0.0527840 secs] 1361870K->396860K(4054528K), 0.0528263 secs] [Times: user=0.09 sys=0.75, real=0.05 secs]
3 2020-10-25T22:08:55.545+0800: [GC (Allocation Failure) 2020-10-25T22:08:55.545+0800: [ParNew: 1258303K->139776K(1258304K), 0.0738860 secs] 1515388K->551285K(4054528K), 0.0739250 secs] [Times: user=1.31 sys=0.06, real=0.07 secs]
4 执行结束!共生成对象次数:16181
5 Heap
6 par new generation total 1258304K, used 1194230K [0x00000006c0000000, 0x0000000715550000, 0x0000000715550000)
7 eden space 1118528K, 94% used [0x00000006c0000000, 0x00000007005bd9e8, 0x0000000704450000)
8 from space 139776K, 100% used [0x000000070ccd0000, 0x0000000715550000, 0x0000000715550000)
9 to space 139776K, 0% used [0x0000000704450000, 0x0000000704450000, 0x000000070ccd0000)
10 concurrent mark-sweep generation total 2796224K, used 411509K [0x0000000715550000, 0x00000007c0000000, 0x00000007c0000000)
11 Metaspace used 3805K, capacity 4540K, committed 4864K, reserved 1056768K
12 class space used 420K, capacity 428K, committed 512K, reserved 1048576K
```

分析:

- 堆内存增加到4G。结果没有发生FULL GC。
- Young GC 花费的时间0.05秒
- Young GC 时，内存释放了大概85%

## 测试五参数设置: G1

-XX:+PrintGC -XX:+UseG1GC -Xms512m -Xmx512m -XX:+PrintGCDateStamps

```
1 2020-10-25T22:19:39.025+0800: [GC pause (G1 Evacuation Pause) (young) 29M->10M(512M), 0.0027250 secs]
2 2020-10-25T22:19:39.037+0800: [GC pause (G1 Evacuation Pause) (young) 45M->20M(512M), 0.0029197 secs]
3 2020-10-25T22:19:39.062+0800: [GC pause (G1 Evacuation Pause) (young) 101M->44M(512M), 0.0053205 secs]
4 2020-10-25T22:19:39.080+0800: [GC pause (G1 Evacuation Pause) (young) 124M->69M(512M), 0.0053995 secs]
5 2020-10-25T22:19:39.157+0800: [GC pause (G1 Evacuation Pause) (young) 339M->144M(512M), 0.0126394 secs]
6 2020-10-25T22:19:39.182+0800: [GC pause (G1 Evacuation Pause) (young) 248M->175M(512M), 0.0083041 secs]
7 2020-10-25T22:19:39.206+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 293M->212M(512M), 0.0059660 secs]
8 2020-10-25T22:19:39.212+0800: [GC concurrent-root-region-scan-start]
9 2020-10-25T22:19:39.212+0800: [GC concurrent-root-region-scan-end, 0.0001622 secs]
10 2020-10-25T22:19:39.212+0800: [GC concurrent-mark-start]
11 2020-10-25T22:19:39.213+0800: [GC concurrent-mark-end, 0.0009608 secs]
12 2020-10-25T22:19:39.213+0800: [GC remark, 0.0015802 secs]
13 2020-10-25T22:19:39.215+0800: [GC cleanup 221M->221M(512M), 0.0010077 secs]
14 2020-10-25T22:19:39.243+0800: [GC pause (G1 Evacuation Pause) (young)-- 426M->366M(512M), 0.0041974 secs]
15 2020-10-25T22:19:39.248+0800: [GC pause (G1 Evacuation Pause) (mixed) 374M->362M(512M), 0.0030095 secs]
16 2020-10-25T22:19:39.251+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 365M->363M(512M), 0.0015179 secs]
17 2020-10-25T22:19:39.253+0800: [GC concurrent-root-region-scan-start]
18 2020-10-25T22:19:39.253+0800: [GC concurrent-root-region-scan-end, 0.0000837 secs]
19 2020-10-25T22:19:39.253+0800: [GC concurrent-mark-start]
20 2020-10-25T22:19:39.254+0800: [GC concurrent-mark-end, 0.0010847 secs]
21 2020-10-25T22:19:39.254+0800: [GC remark, 0.0016497 secs]
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22 2020-10-25T22:19:39.256+0800: [GC cleanup 375M->373M(512M), 0.0010985 secs]
23 2020-10-25T22:19:39.257+0800: [GC concurrent-cleanup-start]
24 2020-10-25T22:19:39.257+0800: [GC concurrent-cleanup-end, 0.0000133 secs]
25 2020-10-25T22:19:39.261+0800: [GC pause (G1 Evacuation Pause) (young) 404M->379M(512M), 0.0025110 secs]
26 2020-10-25T22:19:39.266+0800: [GC pause (G1 Evacuation Pause) (mixed) 406M->341M(512M), 0.0024191 secs]
27 2020-10-25T22:19:39.272+0800: [GC pause (G1 Evacuation Pause) (mixed) 366M->311M(512M), 0.0032848 secs]
28 2020-10-25T22:19:39.279+0800: [GC pause (G1 Evacuation Pause) (mixed) 338M->290M(512M), 0.0041467 secs]
29 2020-10-25T22:19:39.286+0800: [GC pause (G1 Evacuation Pause) (mixed) 317M->295M(512M), 0.0021336 secs]
30 2020-10-25T22:19:39.289+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 296M->295M(512M), 0.0014033 secs]
31 2020-10-25T22:19:39.290+0800: [GC concurrent-root-region-scan-start]
32 2020-10-25T22:19:39.290+0800: [GC concurrent-root-region-scan-end, 0.0001079 secs]
33 2020-10-25T22:19:39.290+0800: [GC concurrent-mark-start]
34 2020-10-25T22:19:39.291+0800: [GC concurrent-mark-end, 0.0009630 secs]
35 2020-10-25T22:19:39.291+0800: [GC remark, 0.0016132 secs]
36 2020-10-25T22:19:39.293+0800: [GC cleanup 305M->305M(512M), 0.0009570 secs]
37 2020-10-25T22:19:39.304+0800: [GC pause (G1 Evacuation Pause) (young) 391M->313M(512M), 0.0041888 secs]
38 2020-10-25T22:19:39.311+0800: [GC pause (G1 Evacuation Pause) (mixed) 330M->295M(512M), 0.0044372 secs]
39 2020-10-25T22:19:39.316+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 296M->296M(512M), 0.0014152 secs]
40 2020-10-25T22:19:39.317+0800: [GC concurrent-root-region-scan-start]
41 2020-10-25T22:19:39.317+0800: [GC concurrent-root-region-scan-end, 0.0000883 secs]
42 2020-10-25T22:19:39.317+0800: [GC concurrent-mark-start]
43 2020-10-25T22:19:39.318+0800: [GC concurrent-mark-end, 0.0010509 secs]
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44 2020-10-25T22:19:39.318+0800: [GC remark, 0.0014380 secs]
45 2020-10-25T22:19:39.320+0800: [GC cleanup 305M->304M(512M), 0.0010058 secs]
46 2020-10-25T22:19:39.321+0800: [GC concurrent-cleanup-start]
47 2020-10-25T22:19:39.321+0800: [GC concurrent-cleanup-end, 0.0000159 secs]
48 2020-10-25T22:19:39.332+0800: [GC pause (G1 Evacuation Pause) (young) 399M->327M(512M), 0.0043026 secs]
49 2020-10-25T22:19:39.339+0800: [GC pause (G1 Evacuation Pause) (mixed) 345M->314M(512M), 0.0045073 secs]
50 2020-10-25T22:19:39.344+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 314M->314M(512M), 0.0012341 secs]
51 2020-10-25T22:19:39.345+0800: [GC concurrent-root-region-scan-start]
52 2020-10-25T22:19:39.345+0800: [GC concurrent-root-region-scan-end, 0.0000814 secs]
53 2020-10-25T22:19:39.345+0800: [GC concurrent-mark-start]
54 2020-10-25T22:19:39.346+0800: [GC concurrent-mark-end, 0.0010382 secs]
55 2020-10-25T22:19:39.346+0800: [GC remark, 0.0014283 secs]
56 2020-10-25T22:19:39.348+0800: [GC cleanup 322M->322M(512M), 0.0010477 secs]
57 2020-10-25T22:19:39.359+0800: [GC pause (G1 Evacuation Pause) (young) 403M->338M(512M), 0.0039587 secs]
58 2020-10-25T22:19:39.366+0800: [GC pause (G1 Evacuation Pause) (mixed) 355M->317M(512M), 0.0055401 secs]
59 2020-10-25T22:19:39.371+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 317M->316M(512M), 0.0013741 secs]
60 2020-10-25T22:19:39.373+0800: [GC concurrent-root-region-scan-start]
61 2020-10-25T22:19:39.373+0800: [GC concurrent-root-region-scan-end, 0.0001051 secs]
62 2020-10-25T22:19:39.373+0800: [GC concurrent-mark-start]
63 2020-10-25T22:19:39.374+0800: [GC concurrent-mark-end, 0.0010608 secs]
64 2020-10-25T22:19:39.374+0800: [GC remark, 0.0014876 secs]
65 2020-10-25T22:19:39.378+0800: [GC cleanup 325M->325M(512M), 0.0009647 secs]
66 2020-10-25T22:19:39.391+0800: [GC pause (G1 Evacuation Pause) (young) 414M->341M(512M), 0.0037044 secs]
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67 2020-10-25T22:19:39.398+0800: [GC pause (G1 Evacuation Pause)
(mixed) 358M->330M(512M), 0.0048139 secs]
68 2020-10-25T22:19:39.404+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 334M->330M(512M), 0.0016841 secs]
69 2020-10-25T22:19:39.406+0800: [GC concurrent-root-region-scan-s
tart]
70 2020-10-25T22:19:39.406+0800: [GC concurrent-root-region-scan-e
nd, 0.0000981 secs]
71 2020-10-25T22:19:39.406+0800: [GC concurrent-mark-start]
72 2020-10-25T22:19:39.407+0800: [GC concurrent-mark-end, 0.001273
9 secs]
73 2020-10-25T22:19:39.407+0800: [GC remark, 0.0015917 secs]
74 2020-10-25T22:19:39.409+0800: [GC cleanup 339M->339M(512M), 0.0
010875 secs]
75 2020-10-25T22:19:39.419+0800: [GC pause (G1 Evacuation Pause)
(young) 404M->348M(512M), 0.0046160 secs]
76 2020-10-25T22:19:39.427+0800: [GC pause (G1 Evacuation Pause)
(mixed) 368M->336M(512M), 0.0052240 secs]
77 2020-10-25T22:19:39.433+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 337M->337M(512M), 0.0018552 secs]
78 2020-10-25T22:19:39.435+0800: [GC concurrent-root-region-scan-s
tart]
79 2020-10-25T22:19:39.435+0800: [GC concurrent-root-region-scan-e
nd, 0.0001565 secs]
80 2020-10-25T22:19:39.435+0800: [GC concurrent-mark-start]
81 2020-10-25T22:19:39.436+0800: [GC concurrent-mark-end, 0.001565
8 secs]
82 2020-10-25T22:19:39.437+0800: [GC remark, 0.0020011 secs]
83 2020-10-25T22:19:39.439+0800: [GC cleanup 347M->347M(512M), 0.0
010655 secs]
84 2020-10-25T22:19:39.449+0800: [GC pause (G1 Evacuation Pause)
(young) 407M->356M(512M), 0.0044027 secs]
85 2020-10-25T22:19:39.458+0800: [GC pause (G1 Evacuation Pause)
(mixed) 381M->348M(512M), 0.0049557 secs]
86 2020-10-25T22:19:39.463+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 349M->348M(512M), 0.0016695 secs]
87 2020-10-25T22:19:39.464+0800: [GC concurrent-root-region-scan-s
tart]
88 2020-10-25T22:19:39.465+0800: [GC concurrent-root-region-scan-e
nd, 0.0001101 secs]
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89 2020-10-25T22:19:39.465+0800: [GC concurrent-mark-start]
90 2020-10-25T22:19:39.466+0800: [GC concurrent-mark-end, 0.001060
1 secs]
91 2020-10-25T22:19:39.466+0800: [GC remark, 0.0015996 secs]
92 2020-10-25T22:19:39.467+0800: [GC cleanup 355M->355M(512M), 0.0
010840 secs]
93 2020-10-25T22:19:39.474+0800: [GC pause (G1 Evacuation Pause)
(young) 400M->359M(512M), 0.0032540 secs]
94 2020-10-25T22:19:39.481+0800: [GC pause (G1 Evacuation Pause)
(mixed) 383M->343M(512M), 0.0048865 secs]
95 2020-10-25T22:19:39.487+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 345M->342M(512M), 0.0015084 secs]
96 2020-10-25T22:19:39.488+0800: [GC concurrent-root-region-scan-s
tart]
97 2020-10-25T22:19:39.488+0800: [GC concurrent-root-region-scan-e
nd, 0.0000871 secs]
98 2020-10-25T22:19:39.488+0800: [GC concurrent-mark-start]
99 2020-10-25T22:19:39.489+0800: [GC concurrent-mark-end, 0.001057
0 secs]
100 2020-10-25T22:19:39.489+0800: [GC remark, 0.0016234 secs]
101 2020-10-25T22:19:39.491+0800: [GC cleanup 355M->355M(512M), 0.0
010923 secs]
102 2020-10-25T22:19:39.499+0800: [GC pause (G1 Evacuation Pause)
(young) 404M->359M(512M), 0.0033384 secs]
103 2020-10-25T22:19:39.506+0800: [GC pause (G1 Evacuation Pause)
(mixed) 382M->346M(512M), 0.0049968 secs]
104 2020-10-25T22:19:39.512+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 354M->347M(512M), 0.0015922 secs]
105 2020-10-25T22:19:39.514+0800: [GC concurrent-root-region-scan-s
tart]
106 2020-10-25T22:19:39.514+0800: [GC concurrent-root-region-scan-e
nd, 0.0000862 secs]
107 2020-10-25T22:19:39.514+0800: [GC concurrent-mark-start]
108 2020-10-25T22:19:39.515+0800: [GC concurrent-mark-end, 0.001147
4 secs]
109 2020-10-25T22:19:39.515+0800: [GC remark, 0.0014754 secs]
110 2020-10-25T22:19:39.517+0800: [GC cleanup 359M->359M(512M), 0.0
010017 secs]
111 2020-10-25T22:19:39.524+0800: [GC pause (G1 Evacuation Pause)
(young) 406M->363M(512M), 0.0037877 secs]
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112 2020-10-25T22:19:39.530+0800: [GC pause (G1 Evacuation Pause)
(mixed) 385M->350M(512M), 0.0046481 secs]
113 2020-10-25T22:19:39.535+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 351M->350M(512M), 0.0014834 secs]
114 2020-10-25T22:19:39.537+0800: [GC concurrent-root-region-scan-start]
115 2020-10-25T22:19:39.537+0800: [GC concurrent-root-region-scan-end,
0.0000828 secs]
116 2020-10-25T22:19:39.537+0800: [GC concurrent-mark-start]
117 2020-10-25T22:19:39.538+0800: [GC concurrent-mark-end, 0.0010947
secs]
118 2020-10-25T22:19:39.538+0800: [GC remark, 0.0016006 secs]
119 2020-10-25T22:19:39.540+0800: [GC cleanup 361M->361M(512M), 0.0011323
secs]
120 2020-10-25T22:19:39.546+0800: [GC pause (G1 Evacuation Pause)
(young) 405M->367M(512M), 0.0031621 secs]
121 2020-10-25T22:19:39.552+0800: [GC pause (G1 Evacuation Pause)
(mixed) 391M->359M(512M), 0.0048592 secs]
122 2020-10-25T22:19:39.557+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 359M->359M(512M), 0.0015276 secs]
123 2020-10-25T22:19:39.559+0800: [GC concurrent-root-region-scan-start]
124 2020-10-25T22:19:39.559+0800: [GC concurrent-root-region-scan-end,
0.0000732 secs]
125 2020-10-25T22:19:39.559+0800: [GC concurrent-mark-start]
126 2020-10-25T22:19:39.560+0800: [GC concurrent-mark-end, 0.0011477
secs]
127 2020-10-25T22:19:39.560+0800: [GC remark, 0.0014826 secs]
128 2020-10-25T22:19:39.562+0800: [GC cleanup 370M->370M(512M), 0.0009403
secs]
129 2020-10-25T22:19:39.567+0800: [GC pause (G1 Evacuation Pause)
(young) 402M->369M(512M), 0.0023742 secs]
130 2020-10-25T22:19:39.573+0800: [GC pause (G1 Evacuation Pause)
(mixed) 393M->359M(512M), 0.0058374 secs]
131 2020-10-25T22:19:39.582+0800: [GC pause (G1 Evacuation Pause)
(mixed) 385M->366M(512M), 0.0024561 secs]
132 2020-10-25T22:19:39.585+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 369M->367M(512M), 0.0012798 secs]
133 2020-10-25T22:19:39.586+0800: [GC concurrent-root-region-scan-start]
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134 2020-10-25T22:19:39.586+0800: [GC concurrent-root-region-scan-
    end, 0.0000867 secs]
135 2020-10-25T22:19:39.586+0800: [GC concurrent-mark-start]
136 2020-10-25T22:19:39.587+0800: [GC concurrent-mark-end, 0.001160
    2 secs]
137 2020-10-25T22:19:39.587+0800: [GC remark, 0.0015638 secs]
138 2020-10-25T22:19:39.589+0800: [GC cleanup 377M->377M(512M), 0.0
    009940 secs]
139 2020-10-25T22:19:39.593+0800: [GC pause (G1 Evacuation Pause)
    (young) 400M->373M(512M), 0.0019825 secs]
140 2020-10-25T22:19:39.599+0800: [GC pause (G1 Evacuation Pause)
    (mixed) 396M->359M(512M), 0.0045662 secs]
141 2020-10-25T22:19:39.606+0800: [GC pause (G1 Evacuation Pause)
    (mixed) 382M->362M(512M), 0.0028145 secs]
142 2020-10-25T22:19:39.610+0800: [GC pause (G1 Humongous Allocatio
    n) (young) (initial-mark) 365M->363M(512M), 0.0013628 secs]
143 2020-10-25T22:19:39.611+0800: [GC concurrent-root-region-scan-s
    tart]
144 2020-10-25T22:19:39.611+0800: [GC concurrent-root-region-scan-e
    nd, 0.0000851 secs]
145 2020-10-25T22:19:39.611+0800: [GC concurrent-mark-start]
146 2020-10-25T22:19:39.612+0800: [GC concurrent-mark-end, 0.001158
    1 secs]
147 2020-10-25T22:19:39.612+0800: [GC remark, 0.0014865 secs]
148 2020-10-25T22:19:39.614+0800: [GC cleanup 373M->373M(512M), 0.0
    010399 secs]
149 2020-10-25T22:19:39.621+0800: [GC pause (G1 Evacuation Pause)
    (young) 412M->376M(512M), 0.0029230 secs]
150 2020-10-25T22:19:39.627+0800: [GC pause (G1 Evacuation Pause)
    (mixed) 398M->357M(512M), 0.0052626 secs]
151 2020-10-25T22:19:39.635+0800: [GC pause (G1 Evacuation Pause)
    (mixed) 383M->364M(512M), 0.0026278 secs]
152 2020-10-25T22:19:39.638+0800: [GC pause (G1 Humongous Allocatio
    n) (young) (initial-mark) 365M->363M(512M), 0.0016386 secs]
153 2020-10-25T22:19:39.640+0800: [GC concurrent-root-region-scan-s
    tart]
154 2020-10-25T22:19:39.640+0800: [GC concurrent-root-region-scan-e
    nd, 0.0000856 secs]
155 2020-10-25T22:19:39.640+0800: [GC concurrent-mark-start]
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156 2020-10-25T22:19:39.641+0800: [GC concurrent-mark-end, 0.001265
6 secs]
157 2020-10-25T22:19:39.642+0800: [GC remark, 0.0016533 secs]
158 2020-10-25T22:19:39.643+0800: [GC cleanup 374M->374M(512M), 0.0
010885 secs]
159 2020-10-25T22:19:39.649+0800: [GC pause (G1 Evacuation Pause)
(young) 411M->378M(512M), 0.0032692 secs]
160 2020-10-25T22:19:39.656+0800: [GC pause (G1 Evacuation Pause)
(mixed) 402M->361M(512M), 0.0045322 secs]
161 2020-10-25T22:19:39.664+0800: [GC pause (G1 Evacuation Pause)
(mixed) 386M->363M(512M), 0.0032664 secs]
162 2020-10-25T22:19:39.669+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 374M->366M(512M), 0.0015597 secs]
163 2020-10-25T22:19:39.671+0800: [GC concurrent-root-region-scan-s
tart]
164 2020-10-25T22:19:39.671+0800: [GC concurrent-root-region-scan-e
nd, 0.0000891 secs]
165 2020-10-25T22:19:39.671+0800: [GC concurrent-mark-start]
166 2020-10-25T22:19:39.672+0800: [GC concurrent-mark-end, 0.001135
1 secs]
167 2020-10-25T22:19:39.672+0800: [GC remark, 0.0014358 secs]
168 2020-10-25T22:19:39.674+0800: [GC cleanup 377M->377M(512M), 0.0
010517 secs]
169 2020-10-25T22:19:39.680+0800: [GC pause (G1 Evacuation Pause)
(young) 416M->379M(512M), 0.0033955 secs]
170 2020-10-25T22:19:39.686+0800: [GC pause (G1 Evacuation Pause)
(mixed) 402M->366M(512M), 0.0056416 secs]
171 2020-10-25T22:19:39.696+0800: [GC pause (G1 Evacuation Pause)
(mixed) 391M->371M(512M), 0.0025446 secs]
172 2020-10-25T22:19:39.699+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 377M->372M(512M), 0.0015996 secs]
173 2020-10-25T22:19:39.701+0800: [GC concurrent-root-region-scan-s
tart]
174 2020-10-25T22:19:39.701+0800: [GC concurrent-root-region-scan-e
nd, 0.0001195 secs]
175 2020-10-25T22:19:39.701+0800: [GC concurrent-mark-start]
176 2020-10-25T22:19:39.702+0800: [GC concurrent-mark-end, 0.001193
1 secs]
177 2020-10-25T22:19:39.702+0800: [GC remark, 0.0017947 secs]
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178 2020-10-25T22:19:39.704+0800: [GC cleanup 381M->381M(512M), 0.0008964 secs]
179 2020-10-25T22:19:39.708+0800: [GC pause (G1 Evacuation Pause) (young) 408M->386M(512M), 0.0025563 secs]
180 2020-10-25T22:19:39.715+0800: [GC pause (G1 Evacuation Pause) (mixed) 409M->375M(512M), 0.0059003 secs]
181 2020-10-25T22:19:39.724+0800: [GC pause (G1 Evacuation Pause) (mixed) 401M->379M(512M), 0.0025276 secs]
182 2020-10-25T22:19:39.727+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 380M->378M(512M), 0.0016322 secs]
183 2020-10-25T22:19:39.729+0800: [GC concurrent-root-region-scan-start]
184 2020-10-25T22:19:39.729+0800: [GC concurrent-root-region-scan-end, 0.0000984 secs]
185 2020-10-25T22:19:39.729+0800: [GC concurrent-mark-start]
186 2020-10-25T22:19:39.730+0800: [GC concurrent-mark-end, 0.0013050 secs]
187 2020-10-25T22:19:39.730+0800: [GC remark, 0.0016728 secs]
188 2020-10-25T22:19:39.732+0800: [GC cleanup 389M->389M(512M), 0.0011100 secs]
189 2020-10-25T22:19:39.736+0800: [GC pause (G1 Evacuation Pause) (young) 410M->390M(512M), 0.0024545 secs]
190 2020-10-25T22:19:39.743+0800: [GC pause (G1 Evacuation Pause) (mixed)-- 417M->388M(512M), 0.0055948 secs]
191 2020-10-25T22:19:39.752+0800: [GC pause (G1 Evacuation Pause) (mixed) 414M->393M(512M), 0.0025087 secs]
192 2020-10-25T22:19:39.755+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 399M->395M(512M), 0.0020214 secs]
193 2020-10-25T22:19:39.757+0800: [GC concurrent-root-region-scan-start]
194 2020-10-25T22:19:39.757+0800: [GC concurrent-root-region-scan-end, 0.0001051 secs]
195 2020-10-25T22:19:39.757+0800: [GC concurrent-mark-start]
196 2020-10-25T22:19:39.759+0800: [GC concurrent-mark-end, 0.0012498 secs]
197 2020-10-25T22:19:39.759+0800: [GC remark, 0.0016868 secs]
198 2020-10-25T22:19:39.760+0800: [GC cleanup 408M->408M(512M), 0.0012335 secs]
199 2020-10-25T22:19:39.764+0800: [GC pause (G1 Evacuation Pause) (young) 420M->402M(512M), 0.0022435 secs]
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200 2020-10-25T22:19:39.770+0800: [GC pause (G1 Evacuation Pause)
(mixed)-- 427M->415M(512M), 0.0044174 secs]
201 2020-10-25T22:19:39.777+0800: [GC pause (G1 Evacuation Pause)
(mixed)-- 444M->439M(512M), 0.0030565 secs]
202 2020-10-25T22:19:39.780+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 439M->439M(512M), 0.0014839 secs]
203 2020-10-25T22:19:39.782+0800: [GC concurrent-root-region-scan-start]
204 2020-10-25T22:19:39.782+0800: [GC concurrent-root-region-scan-end,
0.0000928 secs]
205 2020-10-25T22:19:39.782+0800: [GC concurrent-mark-start]
206 2020-10-25T22:19:39.783+0800: [GC concurrent-mark-end, 0.0013097
secs]
207 2020-10-25T22:19:39.783+0800: [GC remark, 0.0016639 secs]
208 2020-10-25T22:19:39.785+0800: [GC cleanup 451M->451M(512M), 0.0009642
secs]
209 2020-10-25T22:19:39.787+0800: [GC pause (G1 Humongous Allocation)
(young)-- 455M->450M(512M), 0.0020410 secs]
210 2020-10-25T22:19:39.790+0800: [GC pause (G1 Evacuation Pause)
(mixed)-- 455M->453M(512M), 0.0018528 secs]
211 2020-10-25T22:19:39.792+0800: [GC pause (G1 Evacuation Pause)
(mixed)-- 455M->455M(512M), 0.0018294 secs]
212 2020-10-25T22:19:39.794+0800: [Full GC (Allocation Failure)
455M->330M(512M), 0.0304577 secs]
213 2020-10-25T22:19:39.825+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 332M->330M(512M), 0.0011821 secs]
214 2020-10-25T22:19:39.826+0800: [GC concurrent-root-region-scan-start]
215 2020-10-25T22:19:39.826+0800: [GC concurrent-root-region-scan-end,
0.0001170 secs]
216 2020-10-25T22:19:39.826+0800: [GC concurrent-mark-start]
217 2020-10-25T22:19:39.827+0800: [GC concurrent-mark-end, 0.0011702
secs]
218 2020-10-25T22:19:39.827+0800: [GC remark, 0.0015951 secs]
219 2020-10-25T22:19:39.829+0800: [GC cleanup 342M->342M(512M), 0.0010796
secs]
220 2020-10-25T22:19:39.833+0800: [GC pause (G1 Evacuation Pause)
(young) 367M->339M(512M), 0.0021721 secs]
221 2020-10-25T22:19:39.835+0800: [GC pause (G1 Humongous Allocation)
(young) (initial-mark) 340M->338M(512M), 0.0013847 secs]
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222 2020-10-25T22:19:39.837+0800: [GC concurrent-root-region-scan-
tart]
223 2020-10-25T22:19:39.837+0800: [GC concurrent-root-region-scan-
nd, 0.0000845 secs]
224 2020-10-25T22:19:39.837+0800: [GC concurrent-mark-start]
225 2020-10-25T22:19:39.838+0800: [GC concurrent-mark-end, 0.00128
2 secs]
226 2020-10-25T22:19:39.838+0800: [GC remark, 0.0015339 secs]
227 2020-10-25T22:19:39.840+0800: [GC cleanup 347M->347M(512M), 0.0
010126 secs]
228 2020-10-25T22:19:39.844+0800: [GC pause (G1 Evacuation Pause)
(young) 367M->344M(512M), 0.0021351 secs]
229 2020-10-25T22:19:39.849+0800: [GC pause (G1 Evacuation Pause)
(mixed) 369M->350M(512M), 0.0029207 secs]
230 2020-10-25T22:19:39.853+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 352M->349M(512M), 0.0013326 secs]
231 2020-10-25T22:19:39.854+0800: [GC concurrent-root-region-scan-
tart]
232 2020-10-25T22:19:39.854+0800: [GC concurrent-root-region-scan-
nd, 0.0000801 secs]
233 2020-10-25T22:19:39.854+0800: [GC concurrent-mark-start]
234 2020-10-25T22:19:39.856+0800: [GC concurrent-mark-end, 0.001329
5 secs]
235 2020-10-25T22:19:39.856+0800: [GC remark, 0.0015776 secs]
236 2020-10-25T22:19:39.857+0800: [GC cleanup 364M->364M(512M), 0.0
012157 secs]
237 2020-10-25T22:19:39.861+0800: [GC pause (G1 Evacuation Pause)
(young) 380M->362M(512M), 0.0025189 secs]
238 2020-10-25T22:19:39.867+0800: [GC pause (G1 Evacuation Pause)
(mixed) 387M->361M(512M), 0.0034780 secs]
239 2020-10-25T22:19:39.871+0800: [GC pause (G1 Humongous Allocatio
n) (young) (initial-mark) 363M->361M(512M), 0.0013351 secs]
240 2020-10-25T22:19:39.873+0800: [GC concurrent-root-region-scan-
tart]
241 2020-10-25T22:19:39.873+0800: [GC concurrent-root-region-scan-
nd, 0.0001183 secs]
242 2020-10-25T22:19:39.873+0800: [GC concurrent-mark-start]
243 2020-10-25T22:19:39.874+0800: [GC concurrent-mark-end, 0.001165
3 secs]
244 2020-10-25T22:19:39.874+0800: [GC remark, 0.0015119 secs]
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245 2020-10-25T22:19:39.876+0800: [GC cleanup 373M->373M(512M), 0.0011703 secs]
246 2020-10-25T22:19:39.880+0800: [GC pause (G1 Evacuation Pause) (young) 388M->369M(512M), 0.0020294 secs]
247 2020-10-25T22:19:39.885+0800: [GC pause (G1 Evacuation Pause) (mixed)-- 398M->393M(512M), 0.0046092 secs]
248 2020-10-25T22:19:39.890+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 395M->393M(512M), 0.0019089 secs]
249 2020-10-25T22:19:39.892+0800: [GC concurrent-root-region-scan-start]
250 2020-10-25T22:19:39.892+0800: [GC concurrent-root-region-scan-end, 0.0001172 secs]
251 2020-10-25T22:19:39.892+0800: [GC concurrent-mark-start]
252 2020-10-25T22:19:39.894+0800: [GC concurrent-mark-end, 0.0013197 secs]
253 2020-10-25T22:19:39.894+0800: [GC remark, 0.0015863 secs]
254 2020-10-25T22:19:39.895+0800: [GC cleanup 404M->404M(512M), 0.0010189 secs]
255 2020-10-25T22:19:39.899+0800: [GC pause (G1 Evacuation Pause) (young)-- 422M->407M(512M), 0.0025736 secs]
256 2020-10-25T22:19:39.905+0800: [GC pause (G1 Humongous Allocation) (mixed)-- 431M->423M(512M), 0.0026321 secs]
257 2020-10-25T22:19:39.909+0800: [GC pause (G1 Evacuation Pause) (mixed)-- 433M->431M(512M), 0.0016979 secs]
258 2020-10-25T22:19:39.911+0800: [GC pause (G1 Evacuation Pause) (young)-- 435M->435M(512M), 0.0012966 secs]
259 2020-10-25T22:19:39.913+0800: [GC pause (G1 Evacuation Pause) (young) (initial-mark) 435M->435M(512M), 0.0012790 secs]
260 2020-10-25T22:19:39.914+0800: [GC concurrent-root-region-scan-start]
261 2020-10-25T22:19:39.914+0800: [GC concurrent-root-region-scan-end, 0.0000117 secs]
262 2020-10-25T22:19:39.914+0800: [GC concurrent-mark-start]
263 2020-10-25T22:19:39.914+0800: [GC pause (G1 Evacuation Pause) (young) 435M->435M(512M), 0.0014869 secs]
264 2020-10-25T22:19:39.916+0800: [Full GC (Allocation Failure) 435M->334M(512M), 0.0325225 secs]
265 2020-10-25T22:19:39.948+0800: [GC concurrent-mark-abort]
266 2020-10-25T22:19:39.949+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 337M->334M(512M), 0.0013969 secs]
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267 2020-10-25T22:19:39.950+0800: [GC concurrent-root-region-scan-start]
268 2020-10-25T22:19:39.950+0800: [GC concurrent-root-region-scan-end, 0.0000649 secs]
269 2020-10-25T22:19:39.950+0800: [GC concurrent-mark-start]
270 2020-10-25T22:19:39.951+0800: [GC concurrent-mark-end, 0.0010858 secs]
271 2020-10-25T22:19:39.951+0800: [GC remark, 0.0015018 secs]
272 2020-10-25T22:19:39.953+0800: [GC cleanup 346M->346M(512M), 0.0009804 secs]
273 2020-10-25T22:19:39.958+0800: [GC pause (G1 Evacuation Pause) (young) 372M->344M(512M), 0.0021878 secs]
274 2020-10-25T22:19:39.960+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 348M->343M(512M), 0.0014324 secs]
275 2020-10-25T22:19:39.962+0800: [GC concurrent-root-region-scan-start]
276 2020-10-25T22:19:39.962+0800: [GC concurrent-root-region-scan-end, 0.0001103 secs]
277 2020-10-25T22:19:39.962+0800: [GC concurrent-mark-start]
278 2020-10-25T22:19:39.963+0800: [GC concurrent-mark-end, 0.0012878 secs]
279 2020-10-25T22:19:39.963+0800: [GC remark, 0.0016612 secs]
280 2020-10-25T22:19:39.965+0800: [GC cleanup 356M->356M(512M), 0.0010963 secs]
281 2020-10-25T22:19:39.969+0800: [GC pause (G1 Evacuation Pause) (young) 375M->352M(512M), 0.0026796 secs]
282 2020-10-25T22:19:39.975+0800: [GC pause (G1 Evacuation Pause) (mixed) 377M->361M(512M), 0.0028223 secs]
283 2020-10-25T22:19:39.978+0800: [GC pause (G1 Humongous Allocation) (young) (initial-mark) 363M->362M(512M), 0.0017806 secs]
284 2020-10-25T22:19:39.980+0800: [GC concurrent-root-region-scan-start]
285 2020-10-25T22:19:39.980+0800: [GC concurrent-root-region-scan-end, 0.0001204 secs]
286 2020-10-25T22:19:39.980+0800: [GC concurrent-mark-start]
287 2020-10-25T22:19:39.982+0800: [GC concurrent-mark-end, 0.0015210 secs]
288 2020-10-25T22:19:39.982+0800: [GC remark, 0.0016520 secs]
289 2020-10-25T22:19:39.983+0800: [GC cleanup 377M->377M(512M), 0.0010231 secs]
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290 2020-10-25T22:19:39.987+0800: [GC pause (G1 Evacuation Pause)
    (young) 394M->371M(512M), 0.0022815 secs]
291 2020-10-25T22:19:39.993+0800: [GC pause (G1 Evacuation Pause)
    (mixed)-- 398M->395M(512M), 0.0039662 secs]
292 2020-10-25T22:19:39.997+0800: [GC pause (G1 Humongous Allocation)
    (young) (initial-mark) 399M->396M(512M), 0.0016708 secs]
293 2020-10-25T22:19:39.999+0800: [GC concurrent-root-region-scan-start]
294 2020-10-25T22:19:39.999+0800: [GC concurrent-root-region-scan-end,
    0.0000910 secs]
295 2020-10-25T22:19:39.999+0800: [GC concurrent-mark-start]
296 2020-10-25T22:19:40.000+0800: [GC concurrent-mark-end, 0.0013195
    secs]
297 2020-10-25T22:19:40.000+0800: [GC remark, 0.0015832 secs]
298 2020-10-25T22:19:40.002+0800: [GC cleanup 408M->408M(512M), 0.00
    010601 secs]
299 2020-10-25T22:19:40.006+0800: [GC pause (G1 Humongous Allocation)
    (young)-- 423M->418M(512M), 0.0017323 secs]
300 执行结束!共生成对象次数:11869

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分析:

- G1 Young GC花费时间基本在0.01秒以下
- FULL GC 花费额时间基本在0.03秒
- G1 回收器的策略与CMS类似很复杂

-XX:+PrintGC -XX:+UseG1GC -Xms4096m -Xmx4096m -XX:+PrintGCDateStamps

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1 2020-10-25T22:27:39.347+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 204M->69M(4096M), 0.0118731 secs]
2 2020-10-25T22:27:39.383+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 247M->131M(4096M), 0.0114381 secs]
3 2020-10-25T22:27:39.417+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 309M->180M(4096M), 0.0107919 secs]
4 2020-10-25T22:27:39.450+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 358M->238M(4096M), 0.0114486 secs]
5 2020-10-25T22:27:39.484+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 416M->293M(4096M), 0.0121666 secs]
6 2020-10-25T22:27:39.517+0800: [GC pause (G1 Evacuation Pause) (y
    ounge) 471M->346M(4096M), 0.0109310 secs]

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7 2020-10-25T22:27:39.553+0800: [GC pause (G1 Evacuation Pause) (young) 524M->411M(4096M), 0.0125209 secs]
8 2020-10-25T22:27:39.591+0800: [GC pause (G1 Evacuation Pause) (young) 611M->465M(4096M), 0.0132930 secs]
9 2020-10-25T22:27:39.645+0800: [GC pause (G1 Evacuation Pause) (young) 741M->551M(4096M), 0.0179020 secs]
10 2020-10-25T22:27:39.697+0800: [GC pause (G1 Evacuation Pause) (young) 833M->641M(4096M), 0.0175789 secs]
11 2020-10-25T22:27:39.761+0800: [GC pause (G1 Evacuation Pause) (young) 989M->736M(4096M), 0.0212710 secs]
12 2020-10-25T22:27:39.834+0800: [GC pause (G1 Evacuation Pause) (young) 1138M->847M(4096M), 0.0251013 secs]
13 2020-10-25T22:27:40.167+0800: [GC pause (G1 Evacuation Pause) (young) 2061M->1069M(4096M), 0.0500138 secs]
14 2020-10-25T22:27:40.274+0800: [GC pause (G1 Evacuation Pause) (young) 1527M->1155M(4096M), 0.0314428 secs]
15 执行结束!共生成对象次数:16183
```

分析:

- 没有发生FULL GC
- G1 Young GC花费时间基本在0.01秒

**总结:**

1. GC回收器的演进路径是:从开始的串行(单核CPU)、并行(多核CPU)、并发(CMS)、G1、ZGC。背后体现了GC架构设计中针对高可用的设计思想(提高可用时间,减少STW时间)。

a. 在服务器是单核时代如何进行回收。

b. 当服务器进入了多核时代,如何充分利用多核CPU进行回收

c. 当服务器CPU进入百核、内存达到T级别的时候,如何满足GC时间不会随着内存和CPU增加而线性增加。使GC时间变得可控。

2. 在服务器资源不紧张的情况下,系统分配的资源不能超过物理资源的70%。

3. 在使用jdk8的前提下,系统分配内存超过4G时,建议使用G1回收器。