ZGC

zero pause gc ?

马士兵

Revision

- 2019年8月2日 – 马士兵

GC设计方法论

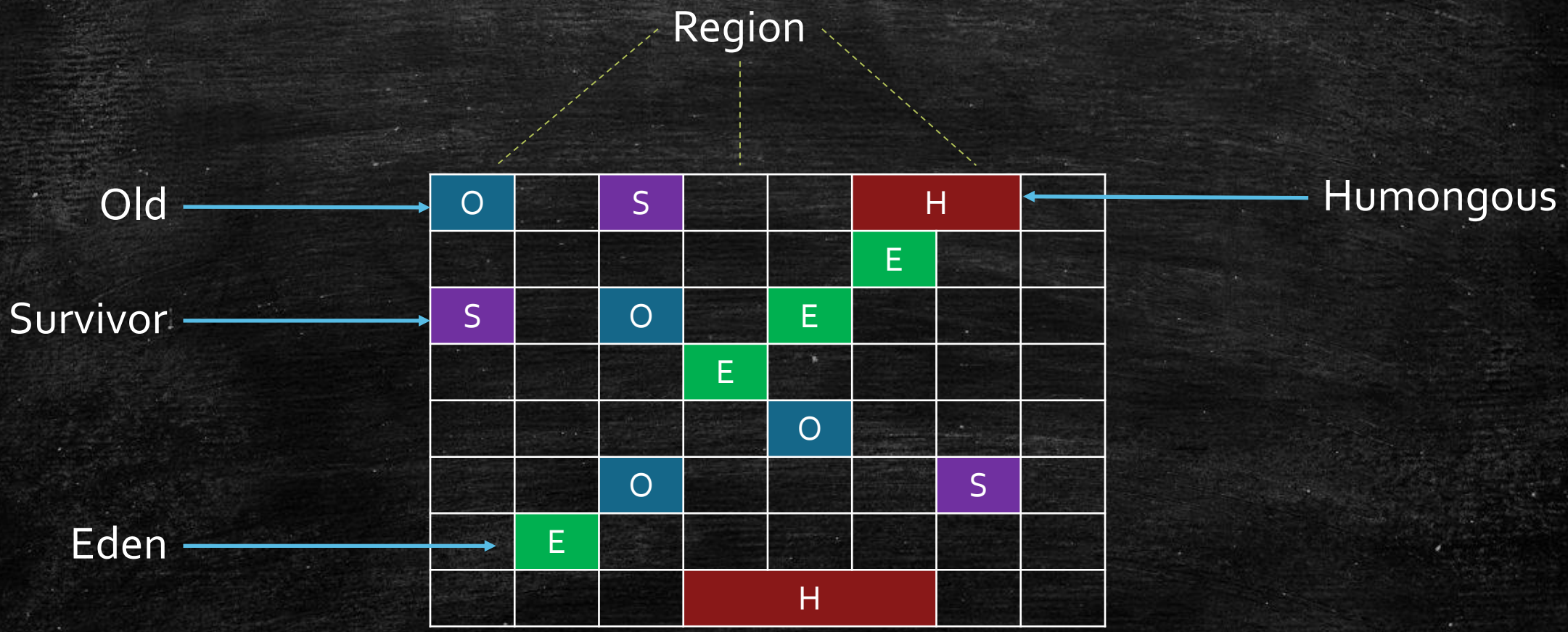
1. 是否分代
2. GC算法
    1. throughput
    2. latency
        1. 减少STW时间
            1. 尽量concurrent
            2. 并行标记后的整理阶段通过内存屏障规避STW
                1. 读屏障 ZGC获取堆变量地址的时候
                2. 写屏障 G1并发标记阶段


http://mashibing.com

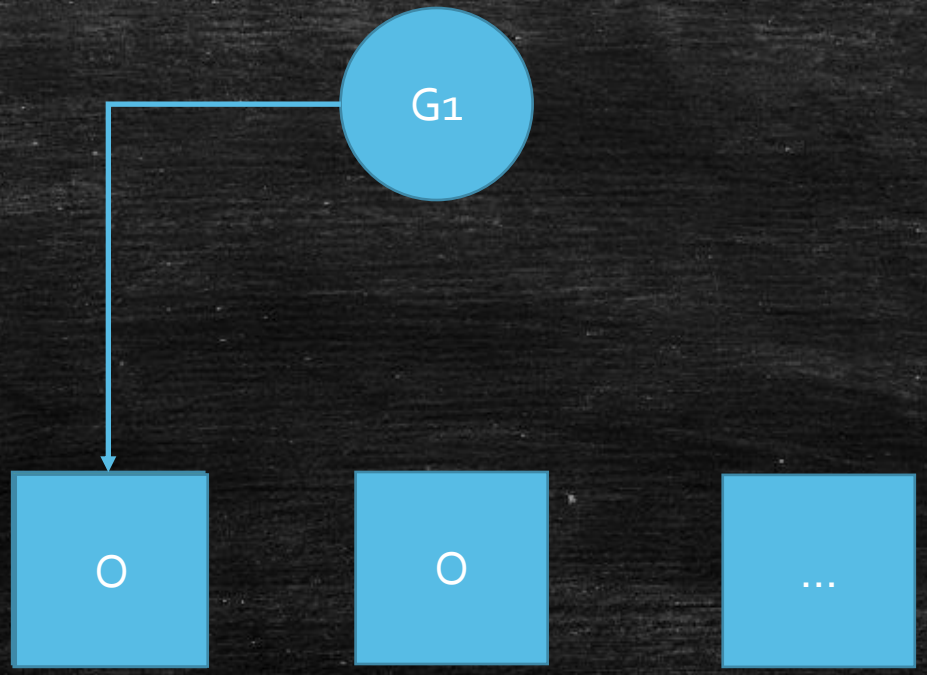
预备知识

- 年轻代
  - Eden
  - Survivor
- 老年代
  - Tenured

ZGC



G1的内存区域不是固定的E或者O



Why G1

- 追求响应时间
  - XX:MaxGCPauseMillis 200
  - 对STW进行控制
- 灵活
  - 分Region回收
  - 优先回收花费时间少、垃圾比例高的Region

每个Region有多大

- headpRegion.cpp
- 取值
  - 1 2 4 8 16 32
- 手工指定
  - XX:G1HeapRegionSize

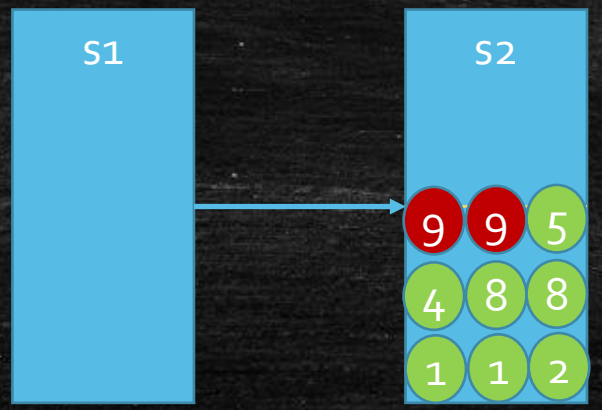
```
// Minimum region size; we won't go lower than that.
// We might want to decrease this in the future, to deal with small
// heaps a bit more efficiently.
#define MIN_REGION_SIZE  (      1024 * 1024 )

// Maximum region size; we don't go higher than that. There's a good
// reason for having an upper bound. We don't want regions to get too
// large, otherwise cleanup's effectiveness would decrease as there
// will be fewer opportunities to find totally empty regions after
// marking.
#define MAX_REGION_SIZE  ( 32 * 1024 * 1024 )

// The automatic region size calculation will try to have around this
// many regions in the heap (based on the min heap size).
#define TARGET_REGION_NUMBER          2048
```

新老年代比例

- 5% - 60%
  - 一般不用手工指定

对象何时进入老年代

- 超过 XX:MaxTenuringThreshold 指定次数（YGC）
  - Parallel Scavenge 15
  - CMS 6
  - G1 15
- 动态年龄
  - s1 - > s2超过50%
  - 把年龄最大的放入O



humongous object

- 超过单个region的50%

GC何时触发

- YGC
  - Eden空间不足
  - 多线程并行执行
- FGC
  - Old空间不足
  - System.gc()

G1中的MixedGC

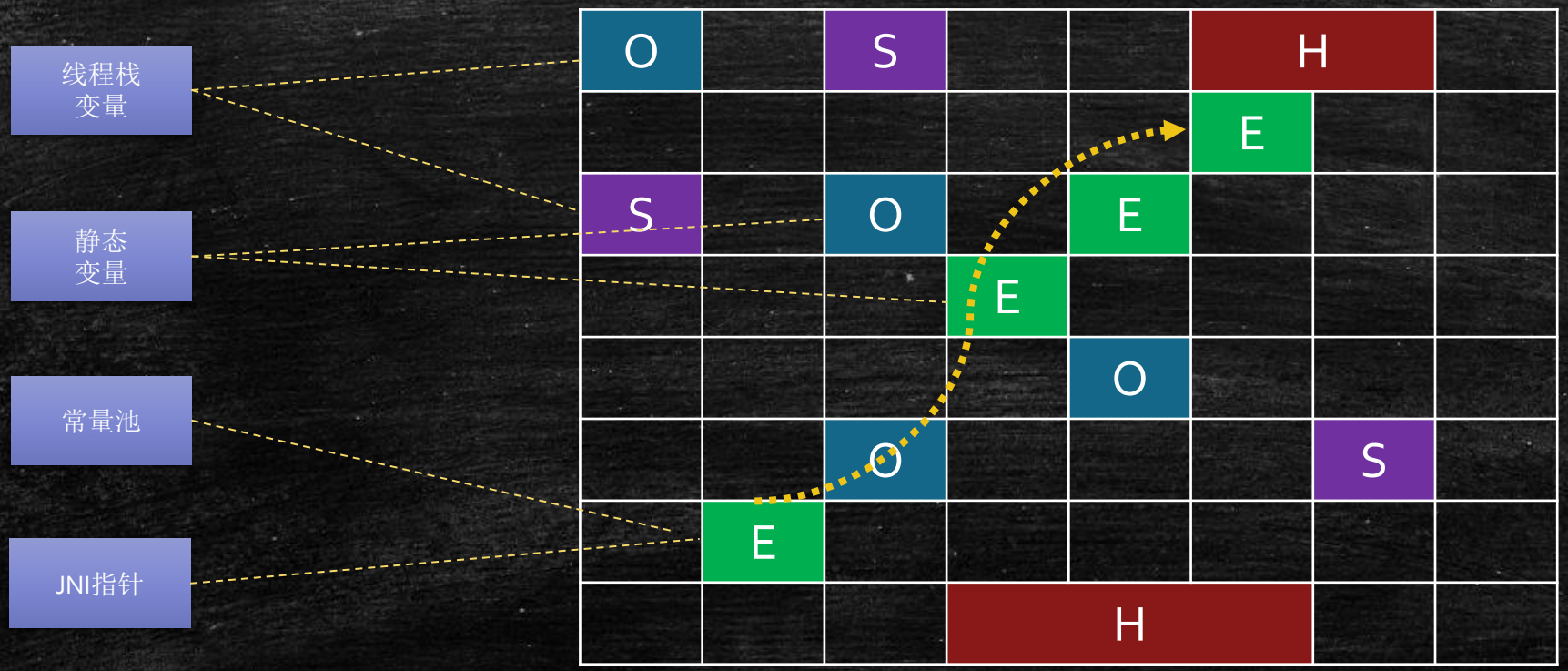
- XX:InitiatingHeapOccupacyPercent
  - 默认值45%
  - 当O超过这个值时，启动MixedGC

MixedGC的过程

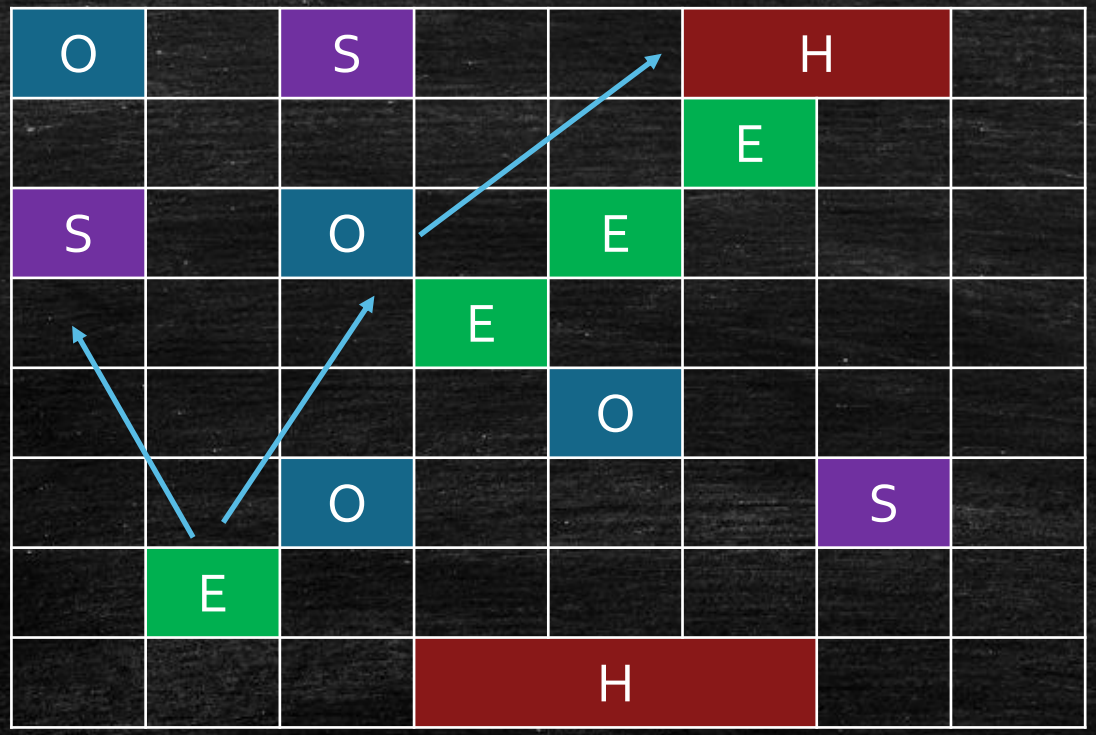
- 初始标记 STW
- 并发标记
- 最终标记 STW
- 并行回收 STW

初始标记

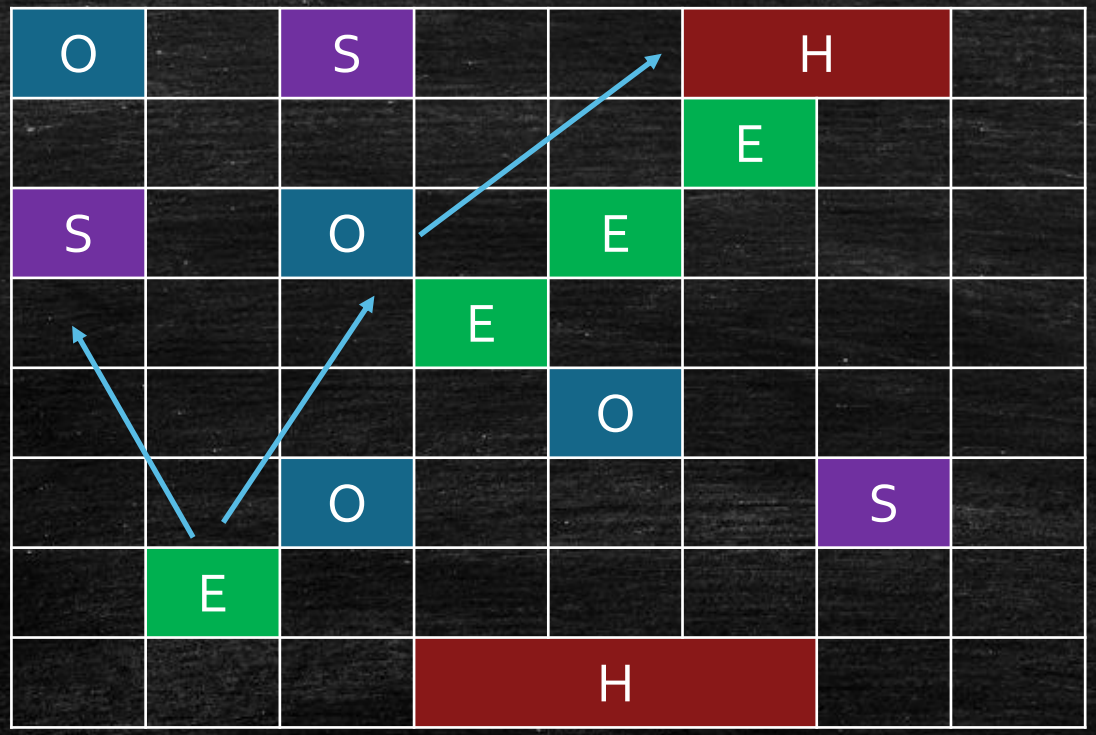
GC roots



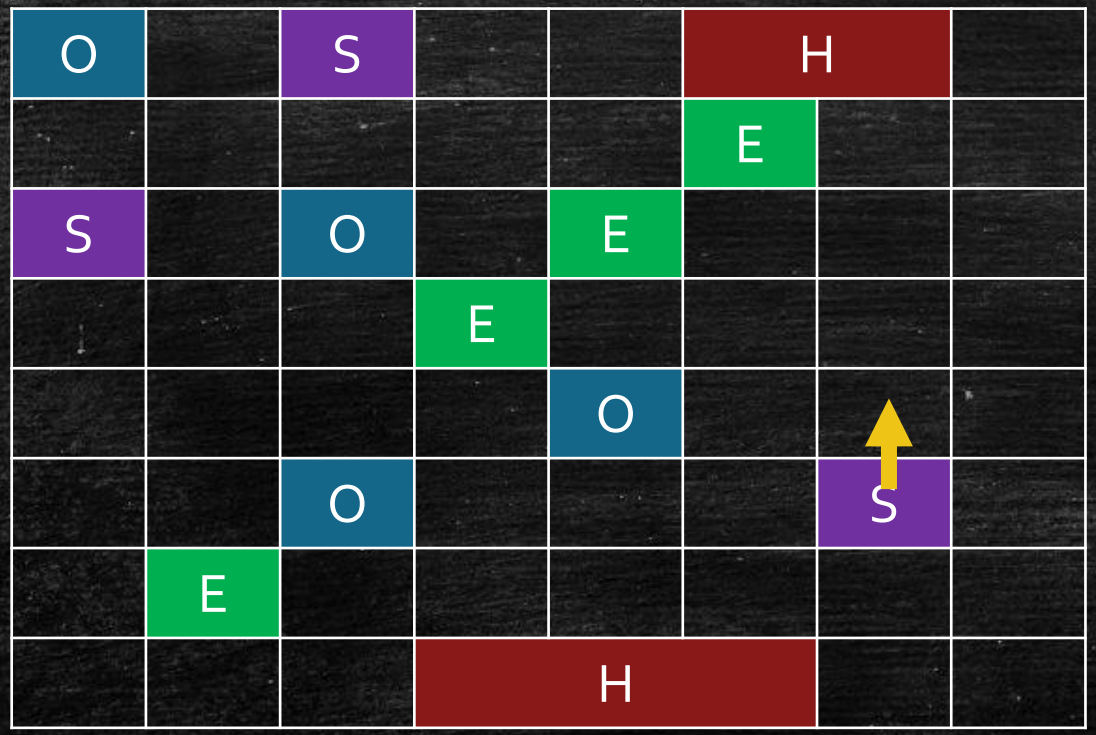
并发标记



最终标记



复制回收



参数设定

总结

- what is G1
- why G1
- how G1 works

展望未来

设计目标：

1. 暂停时间不超过10ms
2. 暂停时间不随堆的大小变化而变化
3. 处理内存从数百M到几个T

技术特点：

1. concurrent
2. region-based
3. compacting
4. NUMA-aware
5. colored pointers
6. load barriers

ZGC

马士兵教育

标题和包含图表的内容布局