

- 1.使用Serial GC
 - 1.1.启动服务
 - 1.2.ab压测
 - 1.3.压测结果:
 - 1.4.jvisualVm监控
 - 1.5.jstat查看GC
 - 1.6.jmap 查看heap信息
- 2.使用Parallel GC
 - 2.1.启动服务
 - 2.2.ab压测
 - 2.3.压测结果:
 - 2.4.jvisualVm监控
 - 2.5.jstat查看GC
 - 2.6.jmap 查看heap信息
- 3.使用CMS GC
 - 3.1.启动服务
 - 3.2.ab压测
 - 3.3.压测结果
 - 3.4.jvisualVm监控
 - 3.5.jstat查看GC
 - 3.6.jmap 查看heap信息
- 4.使用G1 GC
 - 4.1.启动服务
 - 4.2.ab压测
 - 4.3.压测结果
 - 4.4.jvisualVm监控
 - 4.5.jstat查看GC
 - 4.6.jmap 查看heap信息
- 测试结果对比
 - Full GC 次数
 - QPS
 - 90%响应时间 (ms)
 - 服务标准差 (越小越稳定)

1.使用Serial GC

1.1.启动服务

```
java -jar -Xms1g -Xmx1g -XX:-UseAdaptiveSizePolicy -XX:+UseSerialGC gateway-server-0.0.1-SNAPSHOT.jar
```

1.2.ab压测

```
ab -n 1000000 -c 1000 http://localhost:8088/api/hello
```

1.3.压测结果:

This is ApacheBench, Version 2.3 <\$Revision: 1879490 \$>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, <http://www.zeustech.net/>
Licensed to The Apache Software Foundation, <http://www.apache.org/>

Benchmarking localhost (be patient)

Completed 100000 requests
Completed 200000 requests
Completed 300000 requests
Completed 400000 requests
Completed 500000 requests
Completed 600000 requests
Completed 700000 requests
Completed 800000 requests
Completed 900000 requests
Completed 1000000 requests
Finished 1000000 requests

Server Software:

Server Hostname: localhost

Server Port: 8088

Document Path: /api/hello

Document Length: 11 bytes

Concurrency Level: 1000

Time taken for tests: 202.621 seconds

Complete requests: 1000000

Failed requests: 0

Total transferred: 144000000 bytes

HTML transferred: 11000000 bytes

Requests per second: 4935.33 [#/sec] (mean)

Time per request: 202.621 [ms] (mean)

Time per request: 0.203 [ms] (mean, across all concurrent requests)

Transfer rate: 694.03 [Kbytes/sec] received

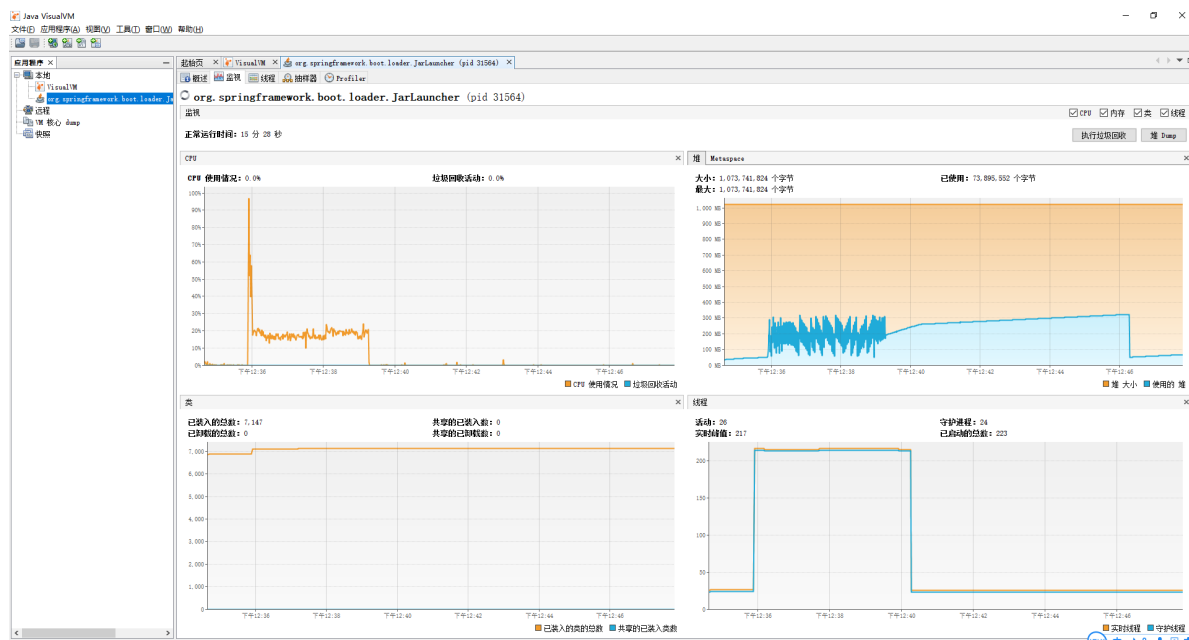
Connection Times (ms)

	min	mean[+/-sd]	median	max
Connect:	0	0 0.9	0	523
Processing:	34	202 43.3	203	1821
Waiting:	22	143 51.5	145	1503
Total:	34	202 43.3	203	1821

Percentage of the requests served within a certain time (ms)

50%	203
66%	211
75%	215
80%	217
90%	224
95%	235
98%	256
99%	272
100%	1821 (longest request)

1.4 jvisualVm监控



1.5 jstat查看GC

```
$ jstat -gcutil 31564 1000 1000
```

	S0	S1	E	O	M	CCS	YGC	YGCT	FGC	FGCT	GCT
0.435	0.23	0.00	64.14	7.88	94.81	91.60	42	0.225	2	0.210	
0.438	0.00	0.23	7.72	7.88	94.81	91.60	43	0.228	2	0.210	
0.438	0.00	0.23	52.43	7.88	94.81	91.60	43	0.228	2	0.210	
0.438	0.00	0.23	97.10	7.88	94.81	91.60	43	0.228	2	0.210	
0.441	0.23	0.00	46.64	7.88	94.81	91.60	44	0.231	2	0.210	
0.441	0.23	0.00	92.36	7.88	94.81	91.60	44	0.231	2	0.210	
0.444	0.00	0.22	36.59	7.88	94.81	91.60	45	0.234	2	0.210	
0.444	0.00	0.22	84.63	7.88	94.81	91.60	45	0.234	2	0.210	
0.448	0.23	0.00	28.73	7.88	94.81	91.60	46	0.238	2	0.210	
0.448	0.23	0.00	74.91	7.88	94.81	91.60	46	0.238	2	0.210	
0.451	0.00	0.23	21.02	7.88	94.81	91.60	47	0.241	2	0.210	
0.451	0.00	0.23	67.31	7.88	94.81	91.60	47	0.241	2	0.210	
0.455	0.23	0.00	12.79	7.88	94.81	91.60	48	0.244	2	0.210	
0.455	0.23	0.00	58.16	7.88	94.81	91.60	48	0.244	2	0.210	
0.458	0.00	0.22	9.67	7.88	94.81	91.60	49	0.248	2	0.210	
0.458	0.00	0.22	38.08	7.88	94.81	91.60	49	0.248	2	0.210	

0.00 0.458	0.22	97.27	7.88	94.81	91.60	49	0.248	2	0.210	
0.461	0.22	0.00	54.04	7.88	94.81	91.60	50	0.251	2	0.210
0.465	0.00	0.06	11.32	7.89	94.82	91.60	51	0.255	2	0.210
0.465	0.00	0.06	57.04	7.89	94.82	91.60	51	0.255	2	0.210
0.468	0.06	0.00	0.23	7.89	94.82	91.60	52	0.258	2	0.210
0.468	0.06	0.00	47.08	7.89	94.82	91.60	52	0.258	2	0.210
0.468	0.06	0.00	96.10	7.89	94.82	91.60	52	0.258	2	0.210
0.470	0.00	0.07	43.45	7.89	94.82	91.60	53	0.260	2	0.210
0.470	0.00	0.07	89.87	7.89	94.82	91.60	53	0.260	2	0.210
0.473	0.06	0.00	37.25	7.89	94.82	91.60	54	0.263	2	0.210
0.473	0.06	0.00	83.83	7.89	94.82	91.60	54	0.263	2	0.210
0.476	0.00	0.07	33.09	7.89	94.82	91.60	55	0.266	2	0.210
0.476	0.00	0.07	76.76	7.89	94.82	91.60	55	0.266	2	0.210
0.479	0.12	0.00	24.04	7.89	94.82	91.60	56	0.269	2	0.210
0.479	0.12	0.00	70.97	7.89	94.82	91.60	56	0.269	2	0.210
0.481	0.00	0.11	17.26	7.89	94.82	91.60	57	0.271	2	0.210
0.481	0.00	0.11	63.34	7.89	94.82	91.60	57	0.271	2	0.210
0.485	0.12	0.00	13.57	7.89	94.82	91.60	58	0.275	2	0.210
0.485	0.12	0.00	60.50	7.89	94.82	91.60	58	0.275	2	0.210
0.488	0.00	0.12	8.02	7.89	94.82	91.60	59	0.278	2	0.210
0.488	0.00	0.12	54.42	7.89	94.82	91.60	59	0.278	2	0.210
0.491	0.12	0.00	5.29	7.89	94.83	91.60	60	0.281	2	0.210
0.491	0.12	0.00	51.58	7.89	94.83	91.60	60	0.281	2	0.210
0.491	0.12	0.00	98.29	7.89	94.83	91.60	60	0.281	2	0.210
0.494	0.00	0.12	45.99	7.89	94.83	91.60	61	0.284	2	0.210
0.494	0.00	0.12	95.00	7.89	94.83	91.60	61	0.284	2	0.210
0.497	0.12	0.00	42.47	7.89	94.83	91.60	62	0.287	2	0.210
0.497	0.12	0.00	89.20	7.89	94.83	91.60	62	0.287	2	0.210
0.499	0.00	0.12	36.12	7.89	94.83	91.60	63	0.289	2	0.210

0.00 0.499	0.12	86.84	7.89	94.83	91.60	63	0.289	2	0.210
0.11 0.503	0.00	31.02	7.89	94.83	91.60	64	0.293	2	0.210
0.11 0.503	0.00	72.40	7.89	94.83	91.60	64	0.293	2	0.210
0.00 0.505	0.12	20.50	7.89	94.84	91.60	65	0.295	2	0.210
0.00 0.505	0.12	69.00	7.89	94.84	91.60	65	0.295	2	0.210
0.12 0.508	0.00	21.73	7.89	94.84	91.60	66	0.298	2	0.210
0.12 0.508	0.00	75.57	7.89	94.84	91.60	66	0.298	2	0.210
0.00 0.510	0.12	29.57	7.89	94.84	91.60	67	0.300	2	0.210
0.00 0.510	0.12	83.01	7.89	94.84	91.60	67	0.300	2	0.210
0.12 0.514	0.00	40.01	7.89	94.84	91.60	68	0.304	2	0.210
0.12 0.514	0.00	90.57	7.89	94.84	91.60	68	0.304	2	0.210
0.00 0.517	0.11	45.09	7.89	94.84	91.60	69	0.307	2	0.210
0.00 0.517	0.11	98.99	7.89	94.84	91.60	69	0.307	2	0.210
0.12 0.520	0.00	52.68	7.89	94.84	91.60	70	0.310	2	0.210
0.00 0.523	0.12	4.64	7.89	94.84	91.60	71	0.313	2	0.210
0.00 0.523	0.12	55.68	7.89	94.84	91.60	71	0.313	2	0.210
0.11 0.526	0.00	12.18	7.89	94.84	91.60	72	0.316	2	0.210
0.11 0.526	0.00	65.16	7.89	94.84	91.60	72	0.316	2	0.210
0.00 0.530	0.12	19.45	7.89	94.84	91.60	73	0.320	2	0.210
0.00 0.530	0.12	73.44	7.89	94.84	91.60	73	0.320	2	0.210
0.11 0.532	0.00	27.87	7.89	94.84	91.60	74	0.322	2	0.210
0.11 0.532	0.00	83.95	7.89	94.84	91.60	74	0.322	2	0.210
0.00 0.535	0.11	38.76	7.89	94.84	91.60	75	0.325	2	0.210
0.00 0.535	0.11	92.69	7.89	94.84	91.60	75	0.325	2	0.210
0.11 0.538	0.00	46.92	7.89	94.84	91.60	76	0.328	2	0.210
0.00 0.540	0.12	0.99	7.89	94.84	91.60	77	0.330	2	0.210
0.00 0.540	0.12	57.89	7.89	94.84	91.60	77	0.330	2	0.210

1.6 jmap 查看heap信息

```
$ jmap -heap 12344
Attaching to process ID 12344, please wait...
Debugger attached successfully.
Server compiler detected.
JVM version is 25.261-b12

using thread-local object allocation.
Mark Sweep Compact GC

Heap Configuration:
  MinHeapFreeRatio      = 40
  MaxHeapFreeRatio      = 70
  MaxHeapSize           = 1073741824 (1024.0MB)
  NewSize               = 357892096 (341.3125MB)
  MaxNewSize            = 357892096 (341.3125MB)
  OldSize               = 715849728 (682.6875MB)
  NewRatio              = 2
  SurvivorRatio         = 8
  MetaspaceSize         = 21807104 (20.796875MB)
  CompressedClassSpaceSize = 1073741824 (1024.0MB)
  MaxMetaspaceSize      = 17592186044415 MB
  G1HeapRegionSize      = 0 (0.0MB)

Heap Usage:
New Generation (Eden + 1 Survivor Space):
  capacity = 322109440 (307.1875MB)
  used     = 105348392 (100.46805572509766MB)
  free     = 216761048 (206.71944427490234MB)
  32.70577602444685% used
Eden Space:
  capacity = 286326784 (273.0625MB)
  used     = 105308224 (100.42974853515625MB)
  free     = 181018560 (172.63275146484375MB)
  36.77903356746395% used
From Space:
  capacity = 35782656 (34.125MB)
  used     = 40168 (0.03830718994140625MB)
  free     = 35742488 (34.086692810058594MB)
  0.11225550165979853% used
To Space:
  capacity = 35782656 (34.125MB)
  used     = 0 (0.0MB)
  free     = 35782656 (34.125MB)
  0.0% used
tenured generation:
  capacity = 715849728 (682.6875MB)
  used     = 41834792 (39.896766662597656MB)
  free     = 674014936 (642.7907333374023MB)
  5.844074582088826% used

18401 interned Strings occupying 2351736 bytes.
```

2.使用Parallel GC

2.1.启动服务

```
java -jar -Xms1g -Xmx1g -XX:-UseAdaptiveSizePolicy -XX:+UseParallelGC gateway-server-0.0.1-SNAPSHOT.jar
```

2.2.ab压测

```
ab -n 1000000 -c 1000 http://localhost:8088/api/hello
```

2.3.压测结果:

```
This is ApacheBench, Version 2.3 <$Revision: 1879490 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/

Benchmarking localhost (be patient)
Completed 100000 requests
Completed 200000 requests
Completed 300000 requests
Completed 400000 requests
Completed 500000 requests
Completed 600000 requests
Completed 700000 requests
Completed 800000 requests
Completed 900000 requests
Completed 1000000 requests
Finished 1000000 requests


Server Software:
Server Hostname:      localhost
Server Port:          8088


Document Path:        /api/hello
Document Length:      11 bytes


Concurrency Level:    1000
Time taken for tests:  216.921 seconds
Complete requests:    1000000
Failed requests:      0
Total transferred:    144000000 bytes
HTML transferred:     11000000 bytes
Requests per second:  4609.96 [#/sec] (mean)
Time per request:     216.921 [ms] (mean)
Time per request:     0.217 [ms] (mean, across all concurrent requests)
Transfer rate:        648.28 [Kbytes/sec] received


Connection Times (ms)
              min  mean[+/-sd] median   max
Connect:        0    0   1.9      0   1522
Processing:    27   216  68.2     214  1847
Waiting:       10   128  83.1     126  1840
Total:         27   216  68.3     214  1847
```

50%	214
66%	219
75%	223
80%	225
90%	235
95%	248
98%	271
99%	301
100%	1847 (longest request)

The screenshot shows the IntelliJ IDEA interface with the Spring Framework boot loader JarLauncher (pid 29704) running. The interface displays various monitoring panels:

- Overview:** Shows the application name, PID (29704), and status (Running). It also displays the start time (09:15:10) and the time taken to start (0.15s).
- CPU:** A line graph showing CPU usage over time. The usage is mostly low, with a significant spike around 09:15:10. The legend indicates "CPU 使用情况" (CPU usage) and "启动时内存活动" (Memory activity at startup).
- Memory:** A line graph showing memory usage over time. The usage is mostly low, with a significant spike around 09:15:10. The legend indicates "堆" (Heap) and "Metaspace".
- Class:** A line graph showing the number of classes loaded over time. The number of classes loaded is mostly low, with a significant spike around 09:15:10. The legend indicates "已加载的总数" (Total loaded) and "共享的已加载数" (Shared loaded).
- Thread:** A line graph showing the number of threads running over time. The number of threads is mostly low, with a significant spike around 09:15:10. The legend indicates "守护线程" (Daemon threads) and "非守护线程" (Non-daemon threads).

The interface also includes a sidebar with navigation options (Local, Remote, Recent, etc.) and a top bar with application settings (File, Edit, View, etc.).

\$ jstat
-gcutil
29704
1000
1000
S0
S1
E
O
M
CCS
YGC
YGCT
FGC
FGCT
GCT
0.00
0.00
9.71
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
9.71
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
10.11
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
10.11
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
10.11
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
10.11
2.55
95.40
92.80
3
0.034
2
0.096
0.130
0.00
0.00
10.51
2.55
95.40
92.80
3
0.034
2
0.096
0.130

0.00 0.130	0.00	10.51	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	10.51	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	10.51	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	10.51	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	10.51	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	86.63	2.55	95.40	92.80	3	0.034	2	0.096
0.00 0.130	0.00	88.68	2.55	95.40	92.80	3	0.034	2	0.096
59.53 0.142	0.00	42.62	2.56	94.92	92.23	4	0.046	2	0.096
59.53 0.142	0.00	74.81	2.56	94.92	92.23	4	0.046	2	0.096
0.00 0.150	60.53	32.22	2.56	94.78	92.28	5	0.054	2	0.096
0.00 0.150	60.53	83.88	2.56	94.78	92.28	5	0.054	2	0.096
60.82 0.158	0.00	38.30	2.56	94.87	92.42	6	0.062	2	0.096
0.00 0.162	60.71	0.00	2.56	94.87	92.42	7	0.066	2	0.096
0.00 0.162	60.71	69.34	2.56	94.87	92.42	7	0.066	2	0.096
60.53 0.167	0.00	38.85	2.56	94.87	92.42	8	0.071	2	0.096
0.00 0.172	60.71	6.91	2.56	94.88	92.42	9	0.076	2	0.096
0.00 0.172	60.71	71.67	2.56	94.88	92.42	9	0.076	2	0.096
60.53 0.177	0.00	37.95	2.56	94.88	92.42	10	0.081	2	0.096
0.00 0.182	60.60	2.75	2.56	94.89	92.42	11	0.086	2	0.096
0.00 0.182	60.60	69.30	2.56	94.89	92.42	11	0.086	2	0.096
60.45 0.187	0.00	32.01	2.57	94.90	92.42	12	0.091	2	0.096
60.45 0.187	0.00	89.88	2.57	94.90	92.42	12	0.091	2	0.096
0.00 0.192	60.71	54.92	2.57	94.90	92.42	13	0.095	2	0.096
60.75 0.196	0.00	17.07	2.57	94.90	92.42	14	0.100	2	0.096
60.75 0.196	0.00	74.83	2.57	94.90	92.42	14	0.100	2	0.096
0.00 0.201	60.64	39.55	2.57	94.90	92.42	15	0.105	2	0.096
60.41 0.205	0.00	1.32	2.57	94.90	92.42	16	0.109	2	0.096
60.41 0.205	0.00	61.42	2.57	94.90	92.42	16	0.109	2	0.096
0.00 0.210	60.49	24.81	2.57	94.90	92.42	17	0.114	2	0.096
0.00 0.210	60.49	88.33	2.57	94.90	92.42	17	0.114	2	0.096

60.82 0.214	0.00	52.94	2.57	94.91	92.42	18	0.118	2	0.096
0.00 0.221	4.19	17.56	5.67	94.91	92.42	19	0.125	2	0.096
0.00 0.221	4.19	81.05	5.67	94.91	92.42	19	0.125	2	0.096
0.74 0.223	0.00	37.86	5.87	94.91	92.42	20	0.127	2	0.096
0.74 0.223	0.00	90.71	5.87	94.91	92.42	20	0.127	2	0.096
0.00 0.224	0.66	45.19	5.88	94.95	92.42	21	0.128	2	0.096
0.59 0.226	0.00	0.39	5.88	94.95	92.42	22	0.130	2	0.096
0.59 0.226	0.00	53.86	5.88	94.95	92.42	22	0.130	2	0.096
0.00 0.227	0.74	7.81	5.89	94.95	92.42	23	0.131	2	0.096
0.00 0.227	0.74	61.45	5.89	94.95	92.42	23	0.131	2	0.096
0.66 0.229	0.00	15.71	5.89	94.95	92.42	24	0.133	2	0.096
0.66 0.229	0.00	71.76	5.89	94.95	92.42	24	0.133	2	0.096
0.00 0.230	0.59	25.53	5.89	94.95	92.42	25	0.134	2	0.096
0.00 0.230	0.59	78.56	5.89	94.95	92.42	25	0.134	2	0.096
0.66 0.232	0.00	34.93	5.89	94.95	92.42	26	0.136	2	0.096
0.66 0.232	0.00	87.89	5.89	94.95	92.42	26	0.136	2	0.096
0.00 0.233	0.59	41.83	5.89	94.96	92.42	27	0.137	2	0.096
0.00 0.233	0.59	94.51	5.89	94.96	92.42	27	0.137	2	0.096
0.51 0.235	0.00	48.00	5.89	94.96	92.42	28	0.139	2	0.096
0.51 0.235	0.00	95.10	5.89	94.96	92.42	28	0.139	2	0.096
0.00 0.236	0.66	44.65	5.89	94.96	92.42	29	0.140	2	0.096
0.00 0.236	0.66	93.67	5.89	94.96	92.42	29	0.140	2	0.096
0.66 0.238	0.00	43.56	5.89	94.96	92.42	30	0.142	2	0.096
0.66 0.238	0.00	94.80	5.89	94.96	92.42	30	0.142	2	0.096
0.00 0.239	0.59	45.10	5.91	94.97	92.42	31	0.143	2	0.096
0.00 0.239	0.59	94.08	5.91	94.97	92.42	31	0.143	2	0.096
0.66 0.241	0.00	44.15	5.91	94.97	92.42	32	0.145	2	0.096
0.66 0.241	0.00	90.42	5.91	94.97	92.42	32	0.145	2	0.096
0.00 0.243	0.51	36.86	5.91	94.97	92.42	33	0.147	2	0.096

0.00 0.243	0.51	86.36	5.91	94.97	92.42	33	0.147	2	0.096
0.74 0.245	0.00	36.70	5.91	94.97	92.42	34	0.149	2	0.096
0.74 0.245	0.00	86.59	5.91	94.97	92.42	34	0.149	2	0.096
0.00 0.246	0.59	38.75	5.91	94.98	92.42	35	0.150	2	0.096
0.00 0.246	0.59	86.59	5.91	94.98	92.42	35	0.150	2	0.096
0.74 0.248	0.00	36.58	5.91	94.98	92.42	36	0.152	2	0.096
0.74 0.248	0.00	86.16	5.91	94.98	92.42	36	0.152	2	0.096
0.00 0.249	0.59	38.74	5.91	94.98	92.43	37	0.153	2	0.096
0.00 0.249	0.59	88.29	5.91	94.98	92.43	37	0.153	2	0.096
0.66 0.251	0.00	38.22	5.91	94.98	92.43	38	0.155	2	0.096
0.66 0.251	0.00	87.45	5.91	94.98	92.43	38	0.155	2	0.096
0.00 0.252	0.66	38.54	5.91	94.98	92.43	39	0.156	2	0.096
0.00 0.252	0.66	86.11	5.91	94.98	92.43	39	0.156	2	0.096
0.59 0.254	0.00	33.75	5.92	94.98	92.43	40	0.158	2	0.096
0.59 0.254	0.00	81.49	5.92	94.98	92.43	40	0.158	2	0.096
0.00 0.256	0.66	30.53	5.92	94.98	92.43	41	0.160	2	0.096
0.00 0.256	0.66	78.44	5.92	94.98	92.43	41	0.160	2	0.096
0.74 0.258	0.00	28.79	5.92	94.98	92.43	42	0.161	2	0.096
0.74 0.258	0.00	74.20	5.92	94.98	92.43	42	0.161	2	0.096
0.00 0.259	0.81	23.85	5.92	94.98	92.43	43	0.163	2	0.096
0.00 0.259	0.81	73.06	5.92	94.98	92.43	43	0.163	2	0.096
0.74 0.261	0.00	25.90	5.92	94.98	92.43	44	0.165	2	0.096
0.74 0.261	0.00	74.17	5.92	94.98	92.43	44	0.165	2	0.096
0.00 0.263	0.59	21.43	5.92	94.98	92.43	45	0.167	2	0.096
0.00 0.263	0.59	71.42	5.92	94.98	92.43	45	0.167	2	0.096
0.66 0.264	0.00	27.46	5.93	94.98	92.44	46	0.168	2	0.096
0.66 0.264	0.00	81.91	5.93	94.98	92.44	46	0.168	2	0.096
0.00 0.266	0.66	39.53	5.93	94.98	92.44	47	0.170	2	0.096
0.00 0.266	0.66	98.70	5.93	94.98	92.44	47	0.170	2	0.096

0.74 0.268	0.00	55.02	5.93	94.98	92.44	48	0.172	2	0.096
0.00 0.269	0.74	12.55	5.93	94.98	92.44	49	0.173	2	0.096
0.00 0.269	0.74	63.74	5.93	94.98	92.44	49	0.173	2	0.096
0.81 0.271	0.00	21.04	5.93	94.98	92.44	50	0.175	2	0.096
0.81 0.271	0.00	74.69	5.93	94.98	92.44	50	0.175	2	0.096
0.00 0.273	0.74	31.18	5.93	94.98	92.44	51	0.177	2	0.096
0.00 0.273	0.74	84.36	5.93	94.98	92.44	51	0.177	2	0.096
0.81 0.274	0.00	23.27	5.94	94.99	92.44	52	0.178	2	0.096
0.81 0.274	0.00	63.96	5.94	94.99	92.44	52	0.178	2	0.096
0.00 0.276	0.81	5.35	5.94	94.99	92.44	53	0.180	2	0.096
0.00 0.276	0.81	49.82	5.94	94.99	92.44	53	0.180	2	0.096
0.00 0.276	0.81	97.00	5.94	94.99	92.44	53	0.180	2	0.096
0.66 0.278	0.00	46.81	5.94	94.99	92.44	54	0.182	2	0.096
0.66 0.278	0.00	95.47	5.94	94.99	92.44	54	0.182	2	0.096
0.00 0.279	0.66	45.89	5.94	94.99	92.44	55	0.183	2	0.096
0.00 0.279	0.66	88.33	5.94	94.99	92.44	55	0.183	2	0.096
0.74 0.281	0.00	37.40	5.94	94.99	92.44	56	0.185	2	0.096
0.74 0.281	0.00	86.60	5.94	94.99	92.44	56	0.185	2	0.096
0.00 0.282	0.81	41.13	5.94	94.99	92.44	57	0.186	2	0.096
0.00 0.282	0.81	91.29	5.94	94.99	92.44	57	0.186	2	0.096
0.81 0.284	0.00	42.11	5.94	94.99	92.44	58	0.187	2	0.096
0.81 0.284	0.00	91.93	5.94	94.99	92.44	58	0.187	2	0.096
0.00 0.285	1.10	45.13	5.94	94.99	92.44	59	0.189	2	0.096
0.00 0.285	1.10	94.35	5.94	94.99	92.44	59	0.189	2	0.096
0.66 0.286	0.00	44.93	5.94	94.99	92.44	60	0.190	2	0.096
0.66 0.286	0.00	89.52	5.94	94.99	92.44	60	0.190	2	0.096
0.00 0.288	0.66	41.83	5.94	94.99	92.44	61	0.192	2	0.096
0.00 0.288	0.66	92.13	5.94	94.99	92.44	61	0.192	2	0.096
0.74 0.289	0.00	40.32	5.94	94.99	92.44	62	0.193	2	0.096

0.74 0.289	0.00	49.09	5.94	94.99	92.44	62	0.193	2	0.096
0.74 0.289	0.00	61.36	5.94	94.99	92.44	62	0.193	2	0.096
0.00 0.291	0.74	4.63	5.94	94.99	92.44	63	0.195	2	0.096
0.00 0.291	0.74	54.31	5.94	94.99	92.44	63	0.195	2	0.096
0.81 0.292	0.00	4.33	5.94	94.99	92.44	64	0.196	2	0.096
0.81 0.292	0.00	54.50	5.94	94.99	92.44	64	0.196	2	0.096
0.00 0.294	0.59	5.19	5.97	94.99	92.44	65	0.198	2	0.096
0.00 0.294	0.59	55.36	5.97	94.99	92.44	65	0.198	2	0.096
0.59 0.296	0.00	6.43	5.97	95.00	92.44	66	0.199	2	0.096
0.59 0.296	0.00	56.55	5.97	95.00	92.44	66	0.199	2	0.096
0.00 0.297	0.59	6.70	5.97	95.00	92.44	67	0.201	2	0.096
0.00 0.297	0.59	57.18	5.97	95.00	92.44	67	0.201	2	0.096
0.59 0.299	0.00	11.00	5.97	95.00	92.44	68	0.203	2	0.096
0.59 0.299	0.00	59.65	5.97	95.00	92.44	68	0.203	2	0.096
0.00 0.300	0.59	6.60	5.97	95.00	92.44	69	0.204	2	0.096
0.00 0.300	0.59	54.74	5.97	95.00	92.44	69	0.204	2	0.096
0.59 0.302	0.00	10.37	5.97	95.00	92.44	70	0.206	2	0.096
0.59 0.302	0.00	67.03	5.97	95.00	92.44	70	0.206	2	0.096
0.00 0.303	0.59	23.22	5.97	95.01	92.44	71	0.207	2	0.096
0.00 0.303	0.59	53.46	5.97	95.01	92.44	71	0.207	2	0.096
0.59 0.305	0.00	11.30	5.97	95.01	92.44	72	0.209	2	0.096
0.59 0.305	0.00	63.10	5.97	95.01	92.44	72	0.209	2	0.096
0.00 0.307	0.66	10.17	5.97	95.01	92.44	73	0.211	2	0.096
0.00 0.307	0.66	57.79	5.97	95.01	92.44	73	0.211	2	0.096
0.59 0.308	0.00	10.70	5.97	95.01	92.44	74	0.212	2	0.096
0.59 0.308	0.00	59.84	5.97	95.01	92.44	74	0.212	2	0.096
0.00 0.310	0.59	7.76	5.97	95.01	92.44	75	0.214	2	0.096
0.00 0.310	0.59	57.09	5.97	95.01	92.44	75	0.214	2	0.096
0.59 0.312	0.00	2.75	5.97	95.01	92.44	76	0.216	2	0.096

0.59	0.00	50.49	5.97	95.01	92.44	76	0.216	2	0.096
0.312									
0.00	0.59	3.93	5.97	95.04	92.44	77	0.217	2	0.096
0.313									
0.00	0.59	53.82	5.97	95.04	92.44	77	0.217	2	0.096
0.313									
0.59	0.00	4.37	5.98	95.04	92.44	78	0.219	2	0.096
0.315									
0.59	0.00	54.96	5.98	95.04	92.44	78	0.219	2	0.096
0.315									
0.00	0.59	7.59	5.98	95.04	92.44	79	0.220	2	0.096
0.316									
0.00	0.59	58.51	5.98	95.04	92.44	79	0.220	2	0.096
0.316									
0.59	0.00	6.38	5.99	95.04	92.44	80	0.222	2	0.096
0.318									
0.59	0.00	53.10	5.99	95.04	92.44	80	0.222	2	0.096
0.318									
0.00	0.59	4.47	5.99	95.04	92.44	81	0.223	2	0.096
0.319									
0.00	0.59	50.05	5.99	95.04	92.44	81	0.223	2	0.096
0.319									
0.00	0.59	94.14	5.99	95.04	92.44	81	0.223	2	0.096
0.319									

2.6 jmap 查看heap信息

```
$ jmap -heap 29704
Attaching to process ID 29704, please wait...
Debugger attached successfully.
Server compiler detected.
JVM version is 25.261-b12

using thread-local object allocation.
Parallel GC with 8 thread(s)

Heap Configuration:
  MinHeapFreeRatio      = 40
  MaxHeapFreeRatio      = 70
  MaxHeapSize            = 1073741824 (1024.0MB)
  NewSize                = 357564416 (341.0MB)
  MaxNewSize             = 357564416 (341.0MB)
  OldSize                = 716177408 (683.0MB)
  NewRatio                = 2
  SurvivorRatio          = 8
  MetaspaceSize          = 21807104 (20.796875MB)
  CompressedClassSpaceSize = 1073741824 (1024.0MB)
  MaxMetaspaceSize       = 17592186044415 MB
  G1HeapRegionSize       = 0 (0.0MB)

Heap Usage:
PS Young Generation
Eden Space:
  capacity = 268435456 (256.0MB)
  used     = 132259936 (126.13290405273438MB)
  free     = 136175520 (129.86709594726562MB)
```

```
49.270665645599365% used
From Space:
  capacity = 44564480 (42.5MB)
  used      = 327680 (0.3125MB)
  free      = 44236800 (42.1875MB)
0.7352941176470589% used
To Space:
  capacity = 44564480 (42.5MB)
  used      = 0 (0.0MB)
  free      = 44564480 (42.5MB)
0.0% used
PS Old Generation
  capacity = 716177408 (683.0MB)
  used      = 42576728 (40.604331970214844MB)
  free      = 673600680 (642.3956680297852MB)
5.944997360207151% used

18404 interned Strings occupying 2357504 bytes.
```

3.使用CMS GC

3.1.启动服务

```
java -jar -Xms1g -Xmx1g -XX:-UseAdaptiveSizePolicy -XX:+UseConcMarkSweepGC
gateway-server-0.0.1-SNAPSHOT.jar
```

3.2.ab压测

```
ab -n 1000000 -c 1000 http://localhost:8088/api/hello
```

3.3.压测结果

```
This is ApacheBench, Version 2.3 <$Revision: 1879490 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
```

```
Benchmarking localhost (be patient)
Completed 100000 requests
Completed 200000 requests
Completed 300000 requests
Completed 400000 requests
Completed 500000 requests
Completed 600000 requests
Completed 700000 requests
Completed 800000 requests
Completed 900000 requests
Completed 1000000 requests
Finished 1000000 requests
```

```
Server Software:
Server Hostname:      localhost
Server Port:          8088
```

Document Path: /api/hello
Document Length: 11 bytes

Concurrency Level: 1000
Time taken for tests: 203.791 seconds
Complete requests: 1000000
Failed requests: 0
Total transferred: 144000000 bytes
HTML transferred: 11000000 bytes
Requests per second: 4907.00 [# /sec] (mean)
Time per request: 203.791 [ms] (mean)
Time per request: 0.204 [ms] (mean, across all concurrent requests)
Transfer rate: 690.05 [Kbytes/sec] received

Connection Times (ms)

	min	mean	mean[+/-sd]	median	max
Connect:	0	0	2.3	0	1514
Processing:	28	203	78.9	195	1746
Waiting:	19	150	77.4	146	1738
Total:	28	203	79.0	195	1746

Percentage of the requests served within a certain time (ms)

50%	195
66%	200
75%	205
80%	208
90%	221
95%	241
98%	277
99%	334
100%	1746 (longest request)

3.4. jvisualVm监控



3.5.jstat查看GC

```
$ jstat -gcutil 14876 1000 1000
  S0    S1     E      O      M     CCS     YGC     YGCT     FGC     FGCT     GCT
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.14   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.54   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  49.94   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  50.34   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 69.13   0.00  54.35   0.00   94.94  91.56      2     0.025     2     0.018
0.042
 0.00    80.75  52.35   0.76   95.02  92.27      3     0.047     2     0.018
0.065
```

0.00 0.065	80.75	73.93	0.76	95.02	92.27	3	0.047	2	0.018
97.89 0.086	0.00	28.74	2.10	94.99	92.30	4	0.068	2	0.018
97.89 0.086	0.00	53.07	2.10	94.99	92.30	4	0.068	2	0.018
97.89 0.086	0.00	88.72	2.10	94.99	92.30	4	0.068	2	0.018
0.00 0.104	74.84	29.80	6.31	95.06	92.42	5	0.087	2	0.018
0.00 0.104	74.84	82.90	6.31	95.06	92.42	5	0.087	2	0.018
18.77 0.109	0.00	20.62	6.31	95.11	92.48	6	0.091	2	0.018
18.77 0.109	0.00	78.08	6.31	95.11	92.48	6	0.091	2	0.018
0.00 0.114	4.73	40.01	6.31	95.11	92.48	7	0.097	2	0.018
0.00 0.114	4.73	94.66	6.31	95.11	92.48	7	0.097	2	0.018
1.23 0.119	0.00	53.87	6.31	95.13	92.48	8	0.102	2	0.018
0.00 0.124	0.49	16.37	6.31	95.13	92.48	9	0.106	2	0.018
0.00 0.124	0.49	72.62	6.31	95.13	92.48	9	0.106	2	0.018
0.35 0.129	0.00	29.75	6.31	95.13	92.48	10	0.111	2	0.018
0.35 0.129	0.00	83.80	6.31	95.13	92.48	10	0.111	2	0.018
0.00 0.134	0.29	48.34	6.32	95.13	92.48	11	0.116	2	0.018
0.13 0.139	0.00	6.45	6.32	95.14	92.48	12	0.121	2	0.018
0.13 0.139	0.00	63.42	6.32	95.14	92.48	12	0.121	2	0.018
0.00 0.144	0.09	21.59	6.32	95.14	92.48	13	0.126	2	0.018
0.00 0.144	0.09	76.43	6.32	95.14	92.48	13	0.126	2	0.018
0.39 0.148	0.00	26.98	6.32	95.16	92.48	14	0.130	2	0.018
0.39 0.148	0.00	82.94	6.32	95.16	92.48	14	0.130	2	0.018
0.00 0.153	0.55	32.38	6.32	95.16	92.48	15	0.135	2	0.018
0.00 0.153	0.55	91.26	6.32	95.16	92.48	15	0.135	2	0.018
0.54 0.157	0.00	53.20	6.32	95.16	92.48	16	0.140	2	0.018
0.00 0.162	0.61	17.90	6.32	95.16	92.48	17	0.145	2	0.018
0.00 0.162	0.61	77.20	6.32	95.16	92.48	17	0.145	2	0.018
0.52 0.167	0.00	37.84	6.32	95.17	92.48	18	0.149	2	0.018
0.52 0.167	0.00	98.33	6.32	95.17	92.48	18	0.149	2	0.018

0.00 0.172	0.59	58.98	6.32	95.20	92.48	19	0.154	2	0.018
0.24 0.177	0.00	19.50	6.33	95.20	92.48	20	0.159	2	0.018
0.24 0.177	0.00	73.83	6.33	95.20	92.48	20	0.159	2	0.018
0.00 0.182	0.17	23.97	6.33	95.20	92.48	21	0.165	2	0.018
0.00 0.182	0.17	66.96	6.33	95.20	92.48	21	0.165	2	0.018
0.18 0.187	0.00	21.61	6.33	95.21	92.48	22	0.169	2	0.018
0.18 0.187	0.00	79.60	6.33	95.21	92.48	22	0.169	2	0.018
0.00 0.191	0.20	35.21	6.33	95.21	92.48	23	0.173	2	0.018
0.00 0.191	0.20	64.59	6.33	95.21	92.48	23	0.173	2	0.018
0.20 0.196	0.00	20.57	6.33	95.21	92.48	24	0.178	2	0.018
0.20 0.196	0.00	75.32	6.33	95.21	92.48	24	0.178	2	0.018
0.00 0.201	0.16	25.96	6.33	95.21	92.48	25	0.183	2	0.018
0.00 0.201	0.16	74.86	6.33	95.21	92.48	25	0.183	2	0.018
0.19 0.205	0.00	20.82	6.33	95.21	92.48	26	0.188	2	0.018
0.19 0.205	0.00	70.33	6.33	95.21	92.48	26	0.188	2	0.018
0.00 0.210	0.16	23.93	6.34	95.21	92.48	27	0.193	2	0.018
0.00 0.210	0.16	74.01	6.34	95.21	92.48	27	0.193	2	0.018
0.11 0.215	0.00	24.81	6.34	95.21	92.48	28	0.198	2	0.018
0.11 0.215	0.00	75.92	6.34	95.21	92.48	28	0.198	2	0.018
0.00 0.220	0.12	27.40	6.34	95.22	92.48	29	0.203	2	0.018
0.00 0.220	0.12	78.11	6.34	95.22	92.48	29	0.203	2	0.018
0.22 0.225	0.00	29.97	6.34	95.22	92.48	30	0.207	2	0.018
0.22 0.225	0.00	82.15	6.34	95.22	92.48	30	0.207	2	0.018
0.00 0.230	0.30	33.96	6.34	95.22	92.48	31	0.212	2	0.018
0.00 0.230	0.30	85.67	6.34	95.22	92.48	31	0.212	2	0.018
0.30 0.235	0.00	40.26	6.34	95.22	92.48	32	0.217	2	0.018
0.30 0.235	0.00	90.77	6.34	95.22	92.48	32	0.217	2	0.018
0.00 0.240	0.25	41.75	6.34	95.23	92.48	33	0.223	2	0.018
0.00 0.240	0.25	93.63	6.34	95.23	92.48	33	0.223	2	0.018

0.29 0.245	0.00	39.10	6.34	95.23	92.48	34	0.228	2	0.018
0.29 0.245	0.00	91.89	6.34	95.23	92.48	34	0.228	2	0.018
0.00 0.250	0.33	45.30	6.34	95.23	92.48	35	0.233	2	0.018
0.00 0.250	0.33	97.54	6.34	95.23	92.48	35	0.233	2	0.018
0.17 0.255	0.00	50.52	6.34	95.23	92.48	36	0.238	2	0.018
0.00 0.260	0.11	7.28	6.34	95.23	92.48	37	0.243	2	0.018
0.00 0.260	0.11	59.40	6.34	95.23	92.48	37	0.243	2	0.018
0.11 0.266	0.00	10.10	6.34	95.23	92.48	38	0.248	2	0.018
0.11 0.266	0.00	57.56	6.34	95.23	92.48	38	0.248	2	0.018
0.00 0.271	0.10	5.73	6.34	95.23	92.48	39	0.253	2	0.018
0.00 0.271	0.10	55.78	6.34	95.23	92.48	39	0.253	2	0.018
0.14 0.275	0.00	8.12	6.34	95.23	92.48	40	0.258	2	0.018
0.14 0.275	0.00	58.72	6.34	95.23	92.48	40	0.258	2	0.018
0.00 0.280	0.11	9.77	6.34	95.23	92.49	41	0.263	2	0.018
0.00 0.280	0.11	60.08	6.34	95.23	92.49	41	0.263	2	0.018
0.08 0.285	0.00	11.80	6.34	95.23	92.49	42	0.268	2	0.018
0.08 0.285	0.00	62.41	6.34	95.23	92.49	42	0.268	2	0.018
0.00 0.290	0.09	13.27	6.35	95.23	92.49	43	0.273	2	0.018
0.00 0.290	0.09	34.95	6.35	95.23	92.49	43	0.273	2	0.018
0.00 0.290	0.09	38.59	6.35	95.23	92.49	43	0.273	2	0.018
0.00 0.290	0.09	88.34	6.35	95.23	92.49	43	0.273	2	0.018
0.14 0.295	0.00	43.04	6.35	95.23	92.50	44	0.277	2	0.018
0.14 0.295	0.00	96.49	6.35	95.23	92.50	44	0.277	2	0.018
0.00 0.299	0.15	47.61	6.35	95.23	92.50	45	0.282	2	0.018
0.00 0.299	0.15	92.97	6.35	95.23	92.50	45	0.282	2	0.018
0.18 0.305	0.00	12.70	6.35	95.23	92.50	46	0.287	2	0.018
0.18 0.305	0.00	17.89	6.35	95.23	92.50	46	0.287	2	0.018
0.18 0.305	0.00	70.61	6.35	95.23	92.50	46	0.287	2	0.018
0.00 0.310	0.20	23.47	6.35	95.23	92.50	47	0.292	2	0.018

0.00 0.310	0.20	73.92	6.35	95.23	92.50	47	0.292	2	0.018
0.24 0.314	0.00	26.11	6.35	95.23	92.50	48	0.297	2	0.018
0.24 0.314	0.00	81.14	6.35	95.23	92.50	48	0.297	2	0.018
0.00 0.319	1.40	31.71	6.35	95.23	92.50	49	0.302	2	0.018
0.00 0.319	1.40	82.70	6.35	95.23	92.50	49	0.302	2	0.018
0.87 0.324	0.00	33.62	6.35	95.24	92.50	50	0.307	2	0.018
0.87 0.324	0.00	85.78	6.35	95.24	92.50	50	0.307	2	0.018
0.00 0.329	0.30	26.45	6.35	95.24	92.50	51	0.312	2	0.018
0.00 0.329	0.30	72.46	6.35	95.24	92.50	51	0.312	2	0.018
0.11 0.334	0.00	23.56	6.35	95.24	92.50	52	0.317	2	0.018
0.11 0.334	0.00	73.89	6.35	95.24	92.50	52	0.317	2	0.018
0.00 0.339	0.08	22.05	6.35	95.24	92.50	53	0.322	2	0.018
0.00 0.339	0.08	73.58	6.35	95.24	92.50	53	0.322	2	0.018
0.09 0.344	0.00	25.86	6.35	95.24	92.50	54	0.327	2	0.018
0.09 0.344	0.00	73.57	6.35	95.24	92.50	54	0.327	2	0.018
0.00 0.349	0.63	27.86	6.35	95.24	92.50	55	0.331	2	0.018
0.00 0.349	0.63	76.50	6.35	95.24	92.50	55	0.331	2	0.018
0.79 0.354	0.00	29.44	6.35	95.24	92.50	56	0.337	2	0.018
0.79 0.354	0.00	83.30	6.35	95.24	92.50	56	0.337	2	0.018
0.00 0.359	0.67	36.91	6.35	95.24	92.50	57	0.341	2	0.018
0.00 0.359	0.67	89.66	6.35	95.24	92.50	57	0.341	2	0.018
0.81 0.364	0.00	43.09	6.35	95.24	92.50	58	0.346	2	0.018
0.81 0.364	0.00	95.46	6.35	95.24	92.50	58	0.346	2	0.018
0.00 0.369	0.68	46.95	6.35	95.24	92.50	59	0.351	2	0.018
0.00 0.369	0.68	94.77	6.35	95.24	92.50	59	0.351	2	0.018
0.81 0.374	0.00	43.17	6.35	95.24	92.50	60	0.356	2	0.018
0.81 0.374	0.00	95.99	6.35	95.24	92.50	60	0.356	2	0.018
0.00 0.379	0.32	49.48	6.37	95.24	92.50	61	0.361	2	0.018
0.12 0.384	0.00	3.76	6.37	95.24	92.50	62	0.366	2	0.018

0.12 0.384	0.00	59.74	6.37	95.24	92.50	62	0.366	2	0.018
0.00 0.388	0.09	13.78	6.37	95.24	92.50	63	0.371	2	0.018
0.00 0.388	0.09	67.27	6.37	95.24	92.50	63	0.371	2	0.018
0.09 0.393	0.00	19.73	6.37	95.26	92.50	64	0.375	2	0.018
0.09 0.393	0.00	70.93	6.37	95.26	92.50	64	0.375	2	0.018
0.00 0.398	0.16	14.94	6.37	95.26	92.50	65	0.381	2	0.018
0.00 0.398	0.16	56.85	6.37	95.26	92.50	65	0.381	2	0.018
0.20 0.404	0.00	7.50	6.37	95.26	92.50	66	0.386	2	0.018
0.20 0.404	0.00	57.47	6.37	95.26	92.50	66	0.386	2	0.018
0.00 0.408	0.23	11.07	6.37	95.26	92.50	67	0.391	2	0.018
0.00 0.408	0.23	64.14	6.37	95.26	92.50	67	0.391	2	0.018
0.22 0.413	0.00	13.19	6.37	95.26	92.50	68	0.396	2	0.018
0.22 0.413	0.00	61.23	6.37	95.26	92.50	68	0.396	2	0.018
0.00 0.418	0.18	11.22	6.37	95.26	92.50	69	0.401	2	0.018
0.00 0.418	0.18	61.60	6.37	95.26	92.50	69	0.401	2	0.018
0.21 0.423	0.00	13.26	6.37	95.26	92.50	70	0.405	2	0.018
0.21 0.423	0.00	61.36	6.37	95.26	92.50	70	0.405	2	0.018
0.00 0.428	0.15	12.52	6.38	95.26	92.50	71	0.410	2	0.018
0.00 0.428	0.15	60.74	6.38	95.26	92.50	71	0.410	2	0.018
0.17 0.433	0.00	7.64	6.38	95.26	92.50	72	0.415	2	0.018
0.17 0.433	0.00	55.54	6.38	95.26	92.50	72	0.415	2	0.018
0.00 0.438	0.13	8.58	6.38	95.26	92.50	73	0.420	2	0.018
0.00 0.438	0.13	58.81	6.38	95.26	92.50	73	0.420	2	0.018
0.15 0.442	0.00	8.62	6.38	95.26	92.50	74	0.425	2	0.018
0.15 0.442	0.00	57.72	6.38	95.26	92.50	74	0.425	2	0.018
0.00 0.447	0.17	7.48	6.38	95.26	92.50	75	0.430	2	0.018
0.00 0.447	0.17	53.71	6.38	95.26	92.50	75	0.430	2	0.018
0.19 0.452	0.00	5.89	6.38	95.26	92.50	76	0.434	2	0.018
0.19 0.452	0.00	58.02	6.38	95.26	92.50	76	0.434	2	0.018

0.00 0.456	0.20	9.36	6.38	95.26	92.50	77	0.439	2	0.018
0.00 0.456	0.20	59.89	6.38	95.26	92.50	77	0.439	2	0.018
0.20 0.461	0.00	9.99	6.38	95.27	92.50	78	0.444	2	0.018
0.20 0.461	0.00	59.74	6.38	95.27	92.50	78	0.444	2	0.018
0.00 0.466	0.20	13.49	6.38	95.27	92.50	79	0.448	2	0.018
0.00 0.466	0.20	59.16	6.38	95.27	92.50	79	0.448	2	0.018
0.20 0.471	0.00	9.86	6.38	95.29	92.50	80	0.453	2	0.018
0.20 0.471	0.00	61.84	6.38	95.29	92.50	80	0.453	2	0.018
0.00 0.476	0.15	17.07	6.38	95.29	92.50	81	0.458	2	0.018
0.00 0.476	0.15	65.48	6.38	95.29	92.50	81	0.458	2	0.018
0.42 0.481	0.00	10.22	6.38	95.29	92.50	82	0.463	2	0.018
0.42 0.481	0.00	57.95	6.38	95.29	92.50	82	0.463	2	0.018
0.00 0.486	0.62	13.91	6.38	95.29	92.50	83	0.469	2	0.018
0.00 0.486	0.62	67.59	6.38	95.29	92.50	83	0.469	2	0.018
0.65 0.491	0.00	20.58	6.38	95.29	92.50	84	0.473	2	0.018
0.65 0.491	0.00	68.03	6.38	95.29	92.50	84	0.473	2	0.018
0.00 0.496	0.56	5.49	6.38	95.29	92.50	85	0.478	2	0.018
0.00 0.496	0.56	53.70	6.38	95.29	92.50	85	0.478	2	0.018
0.67 0.500	0.00	8.16	6.38	95.29	92.50	86	0.483	2	0.018
0.67 0.500	0.00	59.81	6.38	95.29	92.50	86	0.483	2	0.018
0.00 0.505	0.50	12.11	6.38	95.29	92.50	87	0.488	2	0.018
0.00 0.505	0.50	62.98	6.38	95.29	92.50	87	0.488	2	0.018
0.36 0.510	0.00	15.38	6.40	95.30	92.50	88	0.492	2	0.018
0.36 0.510	0.00	66.86	6.40	95.30	92.50	88	0.492	2	0.018
0.00 0.514	0.13	19.11	6.40	95.30	92.50	89	0.497	2	0.018
0.00 0.514	0.13	69.84	6.40	95.30	92.50	89	0.497	2	0.018
0.10 0.519	0.00	23.61	6.40	95.30	92.50	90	0.502	2	0.018
0.10 0.519	0.00	74.63	6.40	95.30	92.50	90	0.502	2	0.018
0.00 0.524	0.10	25.98	6.40	95.31	92.50	91	0.507	2	0.018

0.00 0.524	0.10	77.85	6.40	95.31	92.50	91	0.507	2	0.018
0.10 0.529	0.00	27.21	6.40	95.32	92.50	92	0.511	2	0.018
0.10 0.529	0.00	71.62	6.40	95.32	92.50	92	0.511	2	0.018
0.00 0.534	0.09	22.95	6.40	95.32	92.50	93	0.516	2	0.018
0.00 0.534	0.09	72.45	6.40	95.32	92.50	93	0.516	2	0.018
0.10 0.539	0.00	25.98	6.40	95.32	92.50	94	0.521	2	0.018
0.10 0.539	0.00	79.53	6.40	95.32	92.50	94	0.521	2	0.018
0.00 0.543	0.10	32.09	6.40	95.32	92.50	95	0.526	2	0.018
0.00 0.543	0.10	84.27	6.40	95.32	92.50	95	0.526	2	0.018
0.09 0.548	0.00	37.45	6.40	95.33	92.50	96	0.531	2	0.018
0.09 0.548	0.00	92.82	6.40	95.33	92.50	96	0.531	2	0.018
0.00 0.553	0.10	46.14	6.40	95.33	92.50	97	0.536	2	0.018
0.11 0.558	0.00	0.00	6.40	95.33	92.50	98	0.541	2	0.018
0.11 0.558	0.00	49.48	6.40	95.33	92.50	98	0.541	2	0.018
0.00 0.563	0.11	1.17	6.40	95.33	92.50	99	0.545	2	0.018
0.00 0.563	0.11	53.04	6.40	95.33	92.50	99	0.545	2	0.018
0.10 0.568	0.00	5.49	6.40	95.34	92.50	100	0.550	2	0.018
0.10 0.568	0.00	52.00	6.40	95.34	92.50	100	0.550	2	0.018
0.00 0.572	0.10	3.85	6.40	95.35	92.50	101	0.555	2	0.018
0.00 0.572	0.10	54.46	6.40	95.35	92.50	101	0.555	2	0.018
0.11 0.577	0.00	7.67	6.40	95.35	92.50	102	0.560	2	0.018
0.11 0.577	0.00	57.71	6.40	95.35	92.50	102	0.560	2	0.018
0.00 0.582	0.11	10.55	6.40	95.35	92.50	103	0.564	2	0.018
0.00 0.582	0.11	61.42	6.40	95.35	92.50	103	0.564	2	0.018
0.10 0.587	0.00	16.13	6.40	95.38	92.50	104	0.569	2	0.018
0.10 0.587	0.00	65.67	6.40	95.38	92.50	104	0.569	2	0.018
0.00 0.592	0.11	11.61	6.40	95.38	92.50	105	0.574	2	0.018
0.00 0.592	0.11	12.04	6.40	95.38	92.50	105	0.574	2	0.018
0.00 0.592	0.11	12.45	6.40	95.38	92.50	105	0.574	2	0.018

3.6 jmap 查看heap信息

```
$ jmap -heap 14876
Attaching to process ID 14876, please wait...
Debugger attached successfully.
Server compiler detected.
JVM version is 25.261-b12

using parallel threads in the new generation.
using thread-local object allocation.
Concurrent Mark-Sweep GC

Heap Configuration:
  MinHeapFreeRatio      = 40
  MaxHeapFreeRatio      = 70
  MaxHeapSize           = 1073741824 (1024.0MB)
  NewSize               = 357892096 (341.3125MB)
  MaxNewSize            = 357892096 (341.3125MB)
  OldSize               = 715849728 (682.6875MB)
  NewRatio              = 2
  SurvivorRatio         = 8
  MetaspaceSize         = 21807104 (20.796875MB)
  CompressedClassSpaceSize = 1073741824 (1024.0MB)
  MaxMetaspaceSize      = 17592186044415 MB
  G1HeapRegionSize      = 0 (0.0MB)

Heap Usage:
New Generation (Eden + 1 Survivor Space):
  capacity = 322109440 (307.1875MB)
  used     = 41762696 (39.82801055908203MB)
  free     = 280346744 (267.35948944091797MB)
  12.965374749650305% used
Eden Space:
  capacity = 286326784 (273.0625MB)
  used     = 41698280 (39.766578674316406MB)
  free     = 244628504 (233.2959213256836MB)
  14.56317827395428% used
From Space:
  capacity = 35782656 (34.125MB)
  used     = 64416 (0.061431884765625MB)
  free     = 35718240 (34.063568115234375MB)
  0.18002017513736263% used
To Space:
  capacity = 35782656 (34.125MB)
  used     = 0 (0.0MB)
  free     = 35782656 (34.125MB)
  0.0% used
concurrent mark-sweep generation:
  capacity = 715849728 (682.6875MB)
  used     = 45421656 (43.317466735839844MB)
  free     = 670428072 (639.3700332641602MB)
  6.345138403125858% used

18896 interned Strings occupying 2441968 bytes.
```

4.使用G1 GC

4.1.启动服务

```
java -jar -Xms1g -Xmx1g -XX:-UseAdaptiveSizePolicy -XX:+UseG1GC gateway-server-0.0.1-SNAPSHOT.jar
```

4.2.ab压测

```
ab -n 1000000 -c 1000 http://localhost:8088/api/hello
```

4.3.压测结果

```
This is ApacheBench, Version 2.3 <$Revision: 1879490 $>
Copyright 1996 Adam Twiss, Zeus Technology Ltd, http://www.zeustech.net/
Licensed to The Apache Software Foundation, http://www.apache.org/
```

Benchmarking localhost (be patient)

```
Completed 100000 requests
Completed 200000 requests
Completed 300000 requests
Completed 400000 requests
Completed 500000 requests
Completed 600000 requests
Completed 700000 requests
Completed 800000 requests
Completed 900000 requests
Completed 1000000 requests
Finished 1000000 requests
```

Server Software:

Server Hostname: localhost

Server Port: 8088

Document Path: /api/hello

Document Length: 11 bytes

Concurrency Level: 1000

Time taken for tests: 185.777 seconds

Complete requests: 1000000

Failed requests: 0

Total transferred: 144000000 bytes

HTML transferred: 11000000 bytes

Requests per second: 5382.80 [#/sec] (mean)

Time per request: 185.777 [ms] (mean)

Time per request: 0.186 [ms] (mean, across all concurrent requests)

Transfer rate: 756.96 [Kbytes/sec] received

Connection Times (ms)

	min	mean	mean[+/-sd]	median	max
Connect:	0	0	1.4	0	1010
Processing:	22	185	56.5	182	1567
Waiting:	15	108	63.5	106	1212
Total:	22	185	56.5	182	1567

50%	182
66%	189
75%	193
80%	195
90%	205
95%	220
98%	258
99%	284
100%	1567 (longest request)

[illegible][illegible]

[illegible]

0.00	100.00	87.70	4.16	94.89	92.39		11	0.133	0	0.000
0.133										
0.00	100.00	20.39	4.03	94.93	92.39		12	0.139	0	0.000
0.139										
0.00	100.00	47.09	4.03	94.93	92.39		12	0.139	0	0.000
0.139										
0.00	100.00	73.30	4.03	94.93	92.39		12	0.139	0	0.000
0.139										
0.00	100.00	5.34	4.03	94.94	92.39		13	0.145	0	0.000
0.145										
0.00	100.00	32.04	4.03	94.94	92.39		13	0.145	0	0.000
0.145										
0.00	100.00	58.58	4.03	94.94	92.39		13	0.145	0	0.000
0.145										
0.00	100.00	83.50	4.03	94.94	92.39		13	0.145	0	0.000
0.145										
0.00	100.00	13.11	4.03	94.94	92.39		14	0.150	0	0.000
0.150										
0.00	100.00	36.08	4.03	94.94	92.39		14	0.150	0	0.000
0.150										
0.00	100.00	59.39	4.03	94.94	92.39		14	0.150	0	0.000
0.150										
0.00	100.00	82.52	4.03	94.94	92.39		14	0.150	0	0.000
0.150										
0.00	100.00	11.49	4.16	94.94	92.39		15	0.156	0	0.000
0.156										
0.00	100.00	35.28	4.16	94.94	92.39		15	0.156	0	0.000
0.156										
0.00	100.00	58.74	4.16	94.94	92.39		15	0.156	0	0.000
0.156										
0.00	100.00	82.20	4.16	94.94	92.39		15	0.156	0	0.000
0.156										
0.00	100.00	11.00	4.16	94.94	92.39		16	0.162	0	0.000
0.162										
0.00	100.00	34.47	4.16	94.94	92.39		16	0.162	0	0.000
0.162										
0.00	100.00	56.80	4.16	94.94	92.39		16	0.162	0	0.000
0.162										
0.00	100.00	79.13	4.16	94.94	92.39		16	0.162	0	0.000
0.162										
0.00	100.00	7.93	4.16	94.97	92.39		17	0.168	0	0.000
0.168										
0.00	100.00	31.23	4.16	94.97	92.39		17	0.168	0	0.000
0.168										
0.00	100.00	54.37	4.16	94.97	92.39		17	0.168	0	0.000
0.168										
0.00	100.00	77.83	4.16	94.97	92.39		17	0.168	0	0.000
0.168										
0.00	100.00	5.02	4.03	94.97	92.39		18	0.174	0	0.000
0.174										
0.00	100.00	28.32	4.03	94.97	92.39		18	0.174	0	0.000
0.174										
0.00	100.00	50.65	4.03	94.97	92.39		18	0.174	0	0.0

[illegible]

0.00	100.00	15.22	11.64	94.99	92.39	26	0.200	0	0.000
0.200									
0.00	100.00	37.42	11.64	94.99	92.39	26	0.200	0	0.000
0.200									
0.00	100.00	59.78	11.64	94.99	92.39	26	0.200	0	0.000
0.200									
0.00	100.00	82.61	11.64	94.99	92.39	26	0.200	0	0.000
0.200									
0.00	100.00	10.40	11.65	94.99	92.39	27	0.202	0	0.000
0.202									
0.00	100.00	32.61	11.65	94.99	92.39	27	0.202	0	0.000
0.202									
0.00	100.00	54.97	11.65	94.99	92.39	27	0.202	0	0.000
0.202									
0.00	100.00	77.64	11.65	94.99	92.39	27	0.202	0	0.000
0.202									
0.00	100.00	6.06	11.65	94.99	92.39	28	0.203	0	0.000
0.203									
0.00	100.00	28.88	11.65	94.99	92.39	28	0.203	0	0.000
0.203									
0.00	100.00	51.40	11.65	94.99	92.39	28	0.203	0	0.000
0.203									
0.00	100.00	74.53	11.65	94.99	92.39	28	0.203	0	0.000
0.203									
0.00	100.00	90.06	11.65	94.99	92.39	28	0.203	0	0.000
0.203									
0.00	100.00	15.37	11.64	95.00	92.41	29	0.206	0	0.000
0.206									
0.00	100.00	24.84	11.64	95.00	92.41	29	0.206	0	0.000
0.206									
0.00	100.00	44.57	11.64	95.00	92.41	29	0.206	0	0.000
0.206									
0.00	100.00	67.24	11.64	95.00	92.41	29	0.206	0	0.000
0.206									
0.00	100.00	90.53	11.64	95.00	92.41	29	0.206	0	0.000
0.206									
0.00	100.00	22.98	11.65	95.00	92.41	30	0.207	0	0.000
0.207									
0.00	100.00	49.84	11.65	95.00	92.41	30	0.207	0	0.000
0.207									
0.00	100.00	76.40	11.65	95.00	92.41	30	0.207	0	0.000
0.207									
0.00	100.00	8.39	11.65	95.00	92.41	31	0.209	0	0.000
0.209									
0.00	100.00	31.83	11.65	95.00	92.41	31	0.209	0	0.000
0.209									
0.00	100.00	55.90	11.65	95.00	92.41	31	0.209	0	0.000
0.209									
0.00	100.00	81.68	11.65	95.00	92.41	31	0.209	0	0.000
0.209									
0.00	100.00	13.98	11.66	95.00	92.41	32	0.210	0	0.000
0.210									
0.00	100.00	38.66	11.66	95.00	92.41	32	0.210	0	0.000
0.210									
0.00	100.00	65.37	11.66	95.00	92.41	32	0.210	0	0.000
0.210									
0.00	100.00	90.68	11.66	95.00	92.41	32	0.210	0	0.000
0.210									

0.00	100.00	21.74	11.66	95.00	92.41	33	0.212	0	0.000
0.212									
0.00	100.00	47.36	11.66	95.00	92.41	33	0.212	0	0.000
0.212									
0.00	100.00	74.07	11.66	95.00	92.41	33	0.212	0	0.000
0.212									
0.00	100.00	6.21	11.66	95.02	92.41	34	0.214	0	0.000
0.214									
0.00	100.00	25.78	11.66	95.02	92.41	34	0.214	0	0.000
0.214									
0.00	100.00	28.88	11.66	95.02	92.41	34	0.214	0	0.000
0.214									
0.00	100.00	53.11	11.66	95.02	92.41	34	0.214	0	0.000
0.214									
0.00	100.00	78.11	11.66	95.02	92.41	34	0.214	0	0.000
0.214									
0.00	100.00	7.92	11.67	95.02	92.41	35	0.215	0	0.000
0.215									
0.00	100.00	34.63	11.67	95.02	92.41	35	0.215	0	0.000
0.215									
0.00	100.00	61.34	11.67	95.02	92.41	35	0.215	0	0.000
0.215									
0.00	100.00	88.20	11.67	95.02	92.41	35	0.215	0	0.000
0.215									
0.00	100.00	17.08	11.66	95.02	92.41	36	0.217	0	0.000
0.217									
0.00	100.00	40.53	11.66	95.02	92.41	36	0.217	0	0.000
0.217									
0.00	100.00	66.61	11.66	95.02	92.41	36	0.217	0	0.000
0.217									
0.00	100.00	92.86	11.66	95.02	92.41	36	0.217	0	0.000
0.217									
0.00	100.00	24.38	11.67	95.02	92.41	37	0.219	0	0.000
0.219									
0.00	100.00	49.07	11.67	95.02	92.41	37	0.219	0	0.000
0.219									
0.00	100.00	71.58	11.67	95.02	92.41	37	0.219	0	0.000
0.219									
0.00	100.00	92.24	11.67	95.02	92.41	37	0.219	0	0.000
0.219									
0.00	100.00	22.52	11.67	95.02	92.41	38	0.220	0	0.000
0.220									
0.00	100.00	48.60	11.67	95.02	92.41	38	0.220	0	0.000
0.220									
0.00	100.00	72.36	11.67	95.02	92.41	38	0.220	0	0.000
0.220									
0.00	100.00	4.35	11.67	95.02	92.41	39	0.222	0	0.000
0.222									
0.00	100.00	30.12	11.67	95.02	92.41	39	0.222	0	0.000
0.222									
0.00	100.00	53.57	11.67	95.02	92.41	39	0.222	0	0.000
0.222									
0.00	100.00	72.52	11.67	95.02	92.41	39	0.222	0	0.000
0.222									
0.00	100.00	92.70	11.67	95.02	92.41	39	0.222	0	0.000
0.222									

0.00	100.00	44.57	11.68	95.02	92.41	40	0.224	0	0.000
0.224									
0.00	100.00	65.06	11.68	95.02	92.41	40	0.224	0	0.000
0.224									
0.00	100.00	85.09	11.68	95.02	92.41	40	0.224	0	0.000
0.224									
0.00	100.00	9.94	11.67	95.02	92.41	41	0.226	0	0.000
0.226									
0.00	100.00	32.45	11.67	95.02	92.41	41	0.226	0	0.000
0.226									
0.00	100.00	57.61	11.67	95.02	92.41	41	0.226	0	0.000
0.226									
0.00	100.00	83.23	11.67	95.02	92.41	41	0.226	0	0.000
0.226									
0.00	100.00	13.66	11.67	95.02	92.41	42	0.227	0	0.000
0.227									
0.00	100.00	37.11	11.67	95.02	92.41	42	0.227	0	0.000
0.227									
0.00	100.00	60.40	11.67	95.02	92.41	42	0.227	0	0.000
0.227									
0.00	100.00	85.09	11.67	95.02	92.41	42	0.227	0	0.000
0.227									
0.00	100.00	17.24	11.68	95.02	92.41	43	0.229	0	0.000
0.229									
0.00	100.00	43.01	11.68	95.02	92.41	43	0.229	0	0.000
0.229									
0.00	100.00	69.10	11.68	95.02	92.41	43	0.229	0	0.000
0.229									
0.00	100.00	94.57	11.68	95.02	92.41	43	0.229	0	0.000
0.229									
0.00	100.00	25.78	11.68	95.02	92.41	44	0.231	0	0.000
0.231									
0.00	100.00	51.24	11.68	95.02	92.41	44	0.231	0	0.000
0.231									
0.00	100.00	77.17	11.68	95.02	92.41	44	0.231	0	0.000
0.231									
0.00	100.00	8.23	11.69	95.02	92.41	45	0.233	0	0.000
0.233									
0.00	100.00	32.92	11.69	95.02	92.41	45	0.233	0	0.000
0.233									
0.00	100.00	58.23	11.69	95.02	92.41	45	0.233	0	0.000
0.233									
0.00	100.00	81.99	11.69	95.02	92.41	45	0.233	0	0.000
0.233									
0.00	100.00	12.58	11.67	95.02	92.41	46	0.234	0	0.000
0.234									
0.00	100.00	38.20	11.67	95.02	92.41	46	0.234	0	0.000
0.234									
0.00	100.00	61.49	11.67	95.02	92.41	46	0.234	0	0.000
0.234									
0.00	100.00	86.80	11.67	95.02	92.41	46	0.234	0	0.000
0.234									
0.00	100.00	16.61	11.69	95.03	92.41	47	0.236	0	0.000
0.236									
0.00	100.00	40.06	11.69	95.03	92.41	47	0.236	0	0.000
0.236					</				

0.00	100.00	88.20	11.69	95.03	92.41	47	0.236	0	0.000
0.236									
0.00	100.00	16.15	11.68	95.03	92.41	48	0.237	0	0.000
0.237									
0.00	100.00	38.20	11.68	95.03	92.41	48	0.237	0	0.000
0.237									
0.00	100.00	59.01	11.68	95.03	92.41	48	0.237	0	0.000
0.237									
0.00	100.00	82.45	11.68	95.03	92.41	48	0.237	0	0.000
0.237									
0.00	100.00	11.96	11.69	95.05	92.41	49	0.239	0	0.000
0.239									
0.00	100.00	36.96	11.69	95.05	92.41	49	0.239	0	0.000
0.239									
0.00	100.00	60.40	11.69	95.05	92.41	49	0.239	0	0.000
0.239									
0.00	100.00	85.71	11.69	95.05	92.41	49	0.239	0	0.000
0.239									
0.00	100.00	14.91	11.70	95.06	92.41	50	0.241	0	0.000
0.241									
0.00	100.00	15.06	11.70	95.06	92.41	50	0.241	0	0.000
0.241									
0.00	100.00	15.22	11.70	95.06	92.41	50	0.241	0	0.000
0.241									
0.00	100.00	15.37	11.70	95.06	92.41	50	0.241	0	0.000
0.241									

4.6 jmap 查看heap信息

```
$ jmap -heap 29964
Attaching to process ID 29964, please wait...
Debugger attached successfully.
Server compiler detected.
JVM version is 25.261-b12

using thread-local object allocation.
Garbage-First (G1) GC with 8 thread(s)

Heap Configuration:
  MinHeapFreeRatio      = 40
  MaxHeapFreeRatio      = 70
  MaxHeapSize           = 1073741824 (1024.0MB)
  NewSize               = 1363144 (1.2999954223632812MB)
  MaxNewSize            = 643825664 (614.0MB)
  OldSize               = 5452592 (5.1999969482421875MB)
  NewRatio              = 2
  SurvivorRatio         = 8
  MetaspaceSize         = 21807104 (20.796875MB)
  CompressedClassSpaceSize = 1073741824 (1024.0MB)
  MaxMetaspaceSize      = 17592186044415 MB
  G1HeapRegionSize      = 1048576 (1.0MB)

Heap Usage:
G1 Heap:
  regions = 1024
  capacity = 1073741824 (1024.0MB)
  used = 221449128 (211.19034576416016MB)
```

```
free      = 852292696 (812.8096542358398MB)
20.624057203531265% used
G1 Young Generation:
Eden Space:
  regions  = 166
  capacity = 675282944 (644.0MB)
  used     = 174063616 (166.0MB)
  free     = 501219328 (478.0MB)
  25.77639751552795% used
Survivor Space:
  regions  = 1
  capacity = 1048576 (1.0MB)
  used     = 1048576 (1.0MB)
  free     = 0 (0.0MB)
  100.0% used
G1 Old Generation:
  regions  = 45
  capacity = 397410304 (379.0MB)
  used     = 46336936 (44.190345764160156MB)
  free     = 351073368 (334.80965423583984MB)
  11.659721837509275% used

18832 interned Strings occupying 2436760 bytes.
```

测试结果对比

jvm参数: Xmx1g, Xms1g, -XX:-UseAdaptiveSizePolicy

并发数: 1000

请求次数: 1000000

硬件: CPU:i5-10210U 逻辑核数: 8core

内存: 16G

Full GC 次数

Serial GC	Parallel GC	CMS GC	G1 GC
2	2	2	0

QPS

Serial GC	Parallel GC	CMS GC	G1 GC
4935.33	4609.96	4907.00	5382.80

90%响应时间 (ms)

Serial GC	Parallel GC	CMS GC	G1 GC
<=224	<=235	<=221	<=205

服务标准差（越小越稳定）

Serial GC	Parallel GC	CMS GC	G1 GC
43.3	68.3	79.0	56.5