数据中心实验报告

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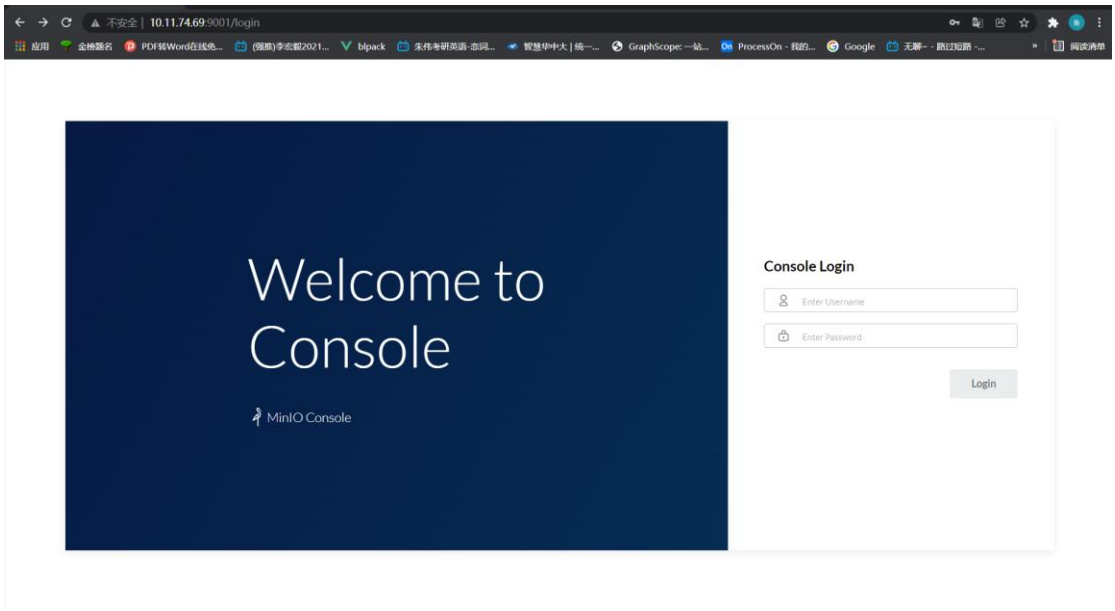
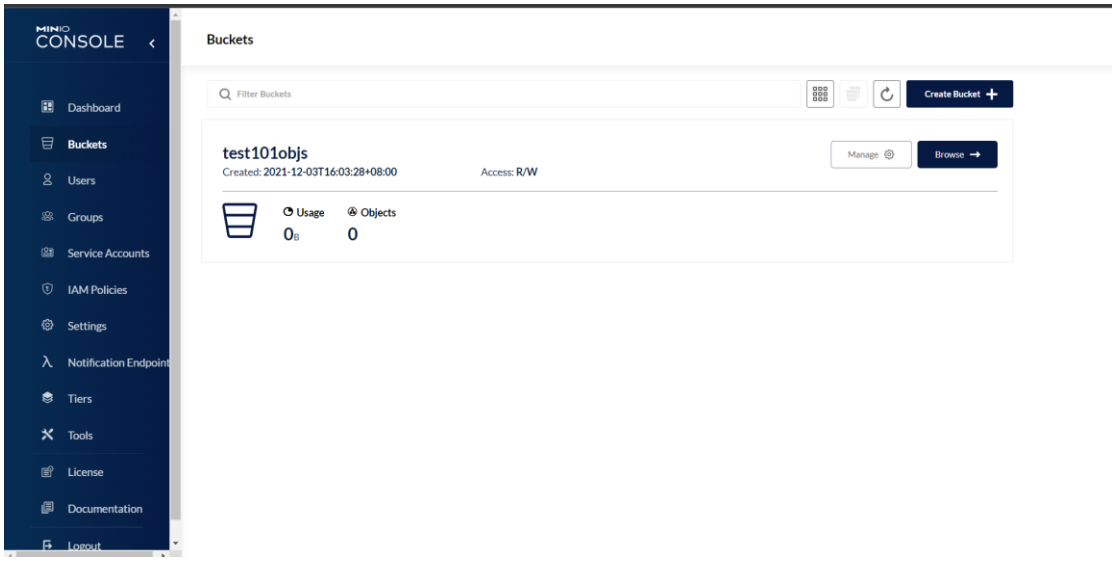
实验一环境搭建

1 使用 minio，在 minio.exe 目录下使用命令 E:\sjzx\minio.exe server E:\Data --console-address ":9001"

2 登录网页，创建 bucket





实验二：性能观测

使用 s3bench 观测性能，通过调整环境参数对象尺寸、并发性、服务器数量。查看指标，包含：吞吐率 Throughput、延迟 latency，

1 初始配置 -numClients=10 -numSamples=100 -objectSize=1024

```
E:\sjzx>s3bench.exe  -accessKey=admin -accessSecret=password -e
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       10
numSamples:       100
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (2.0004ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       10
numSamples:       100
verbose:       %!d(bool=false)


Results Summary for Write Operation(s)
Total Transferred: 0.098 MB
Total Throughput:  0.18 MB/s
Total Duration:    0.528 s
Number of Errors:  0
-----------------------------------
Write times Max:       0.105 s
Write times 99th %ile: 0.105 s
Write times 90th %ile: 0.079 s
Write times 75th %ile: 0.064 s
Write times 50th %ile: 0.060 s
Write times 25th %ile: 0.031 s
Write times Min:       0.004 s


Results Summary for Read Operation(s)
Total Transferred: 0.098 MB
Total Throughput:  7.64 MB/s
Total Duration:    0.013 s
Number of Errors:  0
-----------------------------------
Read times Max:       0.002 s
Read times 99th %ile: 0.002 s
Read times 90th %ile: 0.002 s
Read times 75th %ile: 0.002 s
Read times 50th %ile: 0.001 s
Read times 25th %ile: 0.001 s
Read times Min:       0.001 s


Cleaning up 100 objects...
Deleting a batch of 100 objects in range {0, 99}... Succeeded
Successfully deleted 100/100 objects in 63.0457ms
```

2 调整配置使客户端数量翻倍 -numClients=20 -numSamples=100 -objectSize=1024

```
E:\sjzx>s3bench.exe  -accessKey=admin -accessSecret=password -endpo
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       20
numSamples:       100
verbose:       %!d(bool=false)

Generating in-memory sample data... Done (1.0001ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       20
numSamples:       100
verbose:       %!d(bool=false)


Results Summary for Write Operation(s)
Total Transferred: 0.098 MB
Total Throughput:  0.21 MB/s
Total Duration:    0.476 s
Number of Errors:  0
---------------------------------
Write times Max:       0.142 s
Write times 99th %ile: 0.142 s
Write times 90th %ile: 0.110 s
Write times 75th %ile: 0.108 s
Write times 50th %ile: 0.094 s
Write times 25th %ile: 0.081 s
Write times Min:       0.032 s


Results Summary for Read Operation(s)
Total Transferred: 0.098 MB
Total Throughput:  9.41 MB/s
Total Duration:    0.010 s
Number of Errors:  0
---------------------------------
Read times Max:       0.004 s
Read times 99th %ile: 0.004 s
Read times 90th %ile: 0.003 s
Read times 75th %ile: 0.002 s
Read times 50th %ile: 0.002 s
Read times 25th %ile: 0.002 s
Read times Min:       0.001 s


Cleaning up 100 objects...
Deleting a batch of 100 objects in range {0, 99}... Succeeded
Successfully deleted 100/100 objects in 63.234ms
```

写期间延迟变大吞吐量年达

读期间可以看到指标吞吐率由 7.64MB/s 编程 9.41MB/s，最大时延由 0.002s 增长到 0.004s 总时间减少

3 调整配置使样例数量翻倍 -numClients=10 -numSamples=200 -objectSize=1024

```
E:\sjzx>s3bench.exe  -accessKey=admin -accessSecret=password -endp
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       10
numSamples:       200
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (1.0001ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0010 MB
numClients:       10
numSamples:       200
verbose:       %!d(bool=false)


Results Summary for Write Operation(s)
Total Transferred: 0.195 MB
Total Throughput:  0.19 MB/s
Total Duration:    1.029 s
Number of Errors:  0
-----------------------------------
Write times Max:       0.107 s
Write times 99th %ile: 0.106 s
Write times 90th %ile: 0.078 s
Write times 75th %ile: 0.063 s
Write times 50th %ile: 0.048 s
Write times 25th %ile: 0.031 s
Write times Min:       0.004 s


Results Summary for Read Operation(s)
Total Transferred: 0.195 MB
Total Throughput:  8.29 MB/s
Total Duration:    0.024 s
Number of Errors:  0
-----------------------------------
Read times Max:       0.004 s
Read times 99th %ile: 0.004 s
Read times 90th %ile: 0.002 s
Read times 75th %ile: 0.001 s
Read times 50th %ile: 0.001 s
Read times 25th %ile: 0.001 s
Read times Min:       0.001 s


Cleaning up 200 objects...
Deleting a batch of 200 objects in range {0, 199}... Succeeded
Successfully deleted 200/200 objects in 129.1128ms
```

写期间持续时间变长

读期间可以看到指标吞吐率由 7.64MB/s 变成 8.29MB/s，最大时延由 0.002s 增长到 0.004s 但 75%都能在 0.001s 内跑完，总时间显著增加。

4 调整配置使对象尺寸翻倍 -numClients=10 -numSamples=100 -objectSize=2048

```
E:\sjzx>s3bench.exe  -accessKey=admin -accessSecret=password -endp
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0020 MB
numClients:       10
numSamples:       100
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (1.0006ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           test101objs
objectNamePrefix: test101objs
objectSize:       0.0020 MB
numClients:       10
numSamples:       100
verbose:       %!d(bool=false)


Results Summary for Write Operation(s)
Total Transferred: 0.195 MB
Total Throughput:  0.44 MB/s
Total Duration:    0.441 s
Number of Errors:  0
-----------------------------------
Write times Max:       0.110 s
Write times 99th %ile: 0.110 s
Write times 90th %ile: 0.067 s
Write times 75th %ile: 0.062 s
Write times 50th %ile: 0.045 s
Write times 25th %ile: 0.030 s
Write times Min:       0.004 s


Results Summary for Read Operation(s)
Total Transferred: 0.195 MB
Total Throughput:  17.08 MB/s
Total Duration:    0.011 s
Number of Errors:  0
-----------------------------------
Read times Max:       0.002 s
Read times 99th %ile: 0.002 s
Read times 90th %ile: 0.002 s
Read times 75th %ile: 0.001 s
Read times 50th %ile: 0.001 s
Read times 25th %ile: 0.001 s
Read times Min:       0.001 s


Cleaning up 100 objects...
Deleting a batch of 100 objects in range {0, 99}... Succeeded
Successfully deleted 100/100 objects in 64.2714ms
```

写期间吞吐量变大

读期间可以看到指标吞吐率由 7.64MB/s 变成 17.08MB/s，最大时延不变，总时间不变

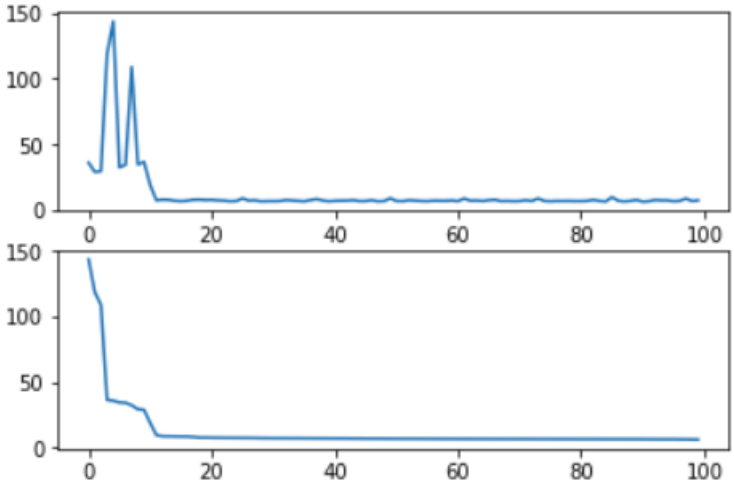
5 总结

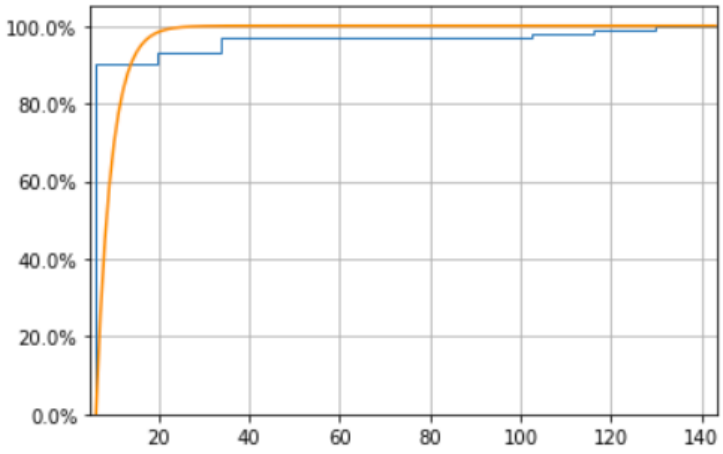
numClients	numSamples	Objectsize	吞吐率（写）MB/s	总延迟（写）s	吞吐率（读）MB/s	总延迟（读）s
10	100	1024	0.18	0.528	7.64	0.013
20	100	1024	0.21	0.476	9.41	0.010
10	200	1024	0.19	1.029	8.29	0.024
10	100	2048	0.44	0.441	17.08	0.011

分析得出，大致为，访问的线程越多，对象大小越大，尾延迟现象越明显。

实验三：尾延迟

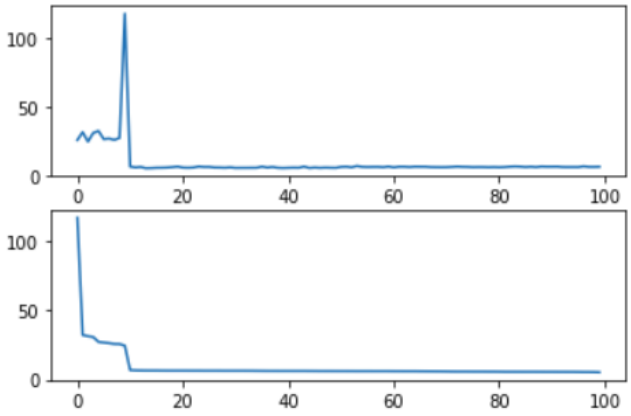
1 尾延迟观测，原始尾延迟，队列长度为 100

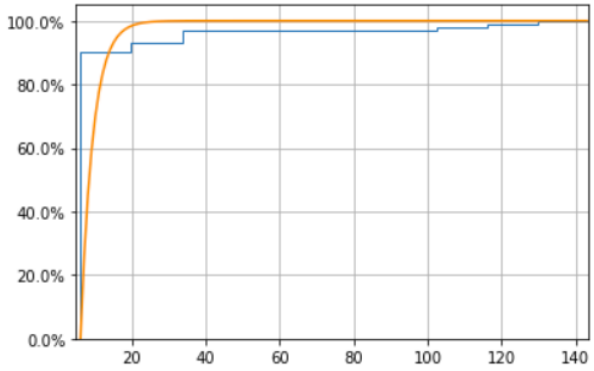




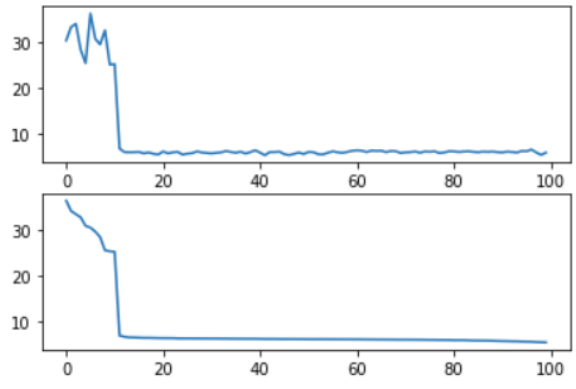
2 关联请求缓解尾延迟现象

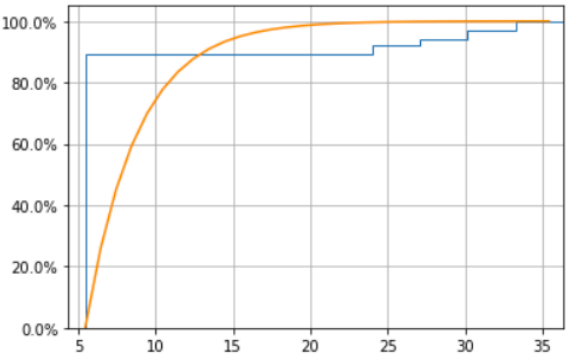
同时发送两个请求，响应时撤销后续请求尾延迟现象大幅降低，大部分请求都能在短时间内响应





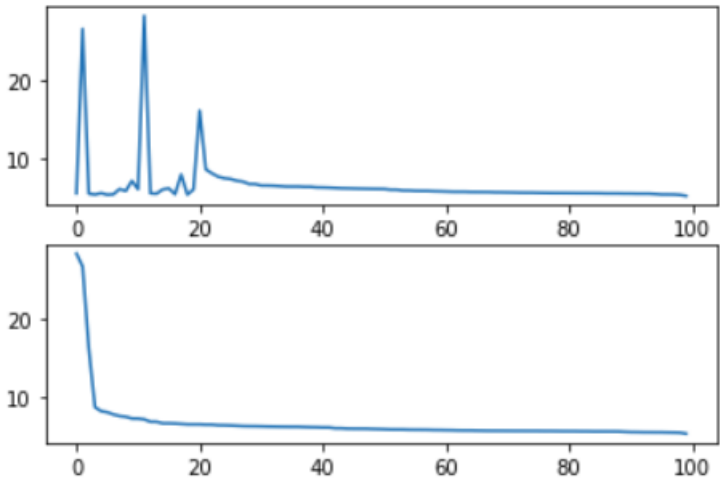
同时发送 3 个请求，尾延迟现象大大大大大幅降低，大部分请求都能在短时间内响应



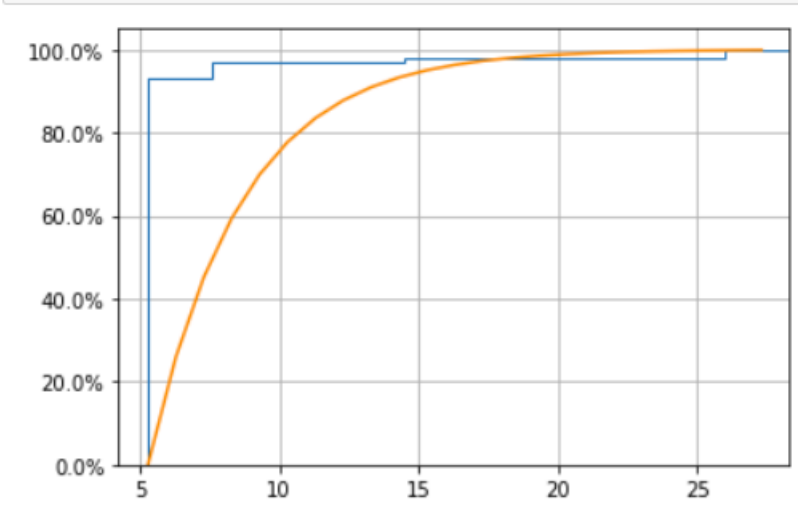


3 对冲请求，

在关联两个请求时，在此种情况下依旧有 5%的请求延迟过高，对这部分请求进行对冲结果



为



效果显著