華中科技大學

数据中心技术实验报告

题 目：对象存储入门实践

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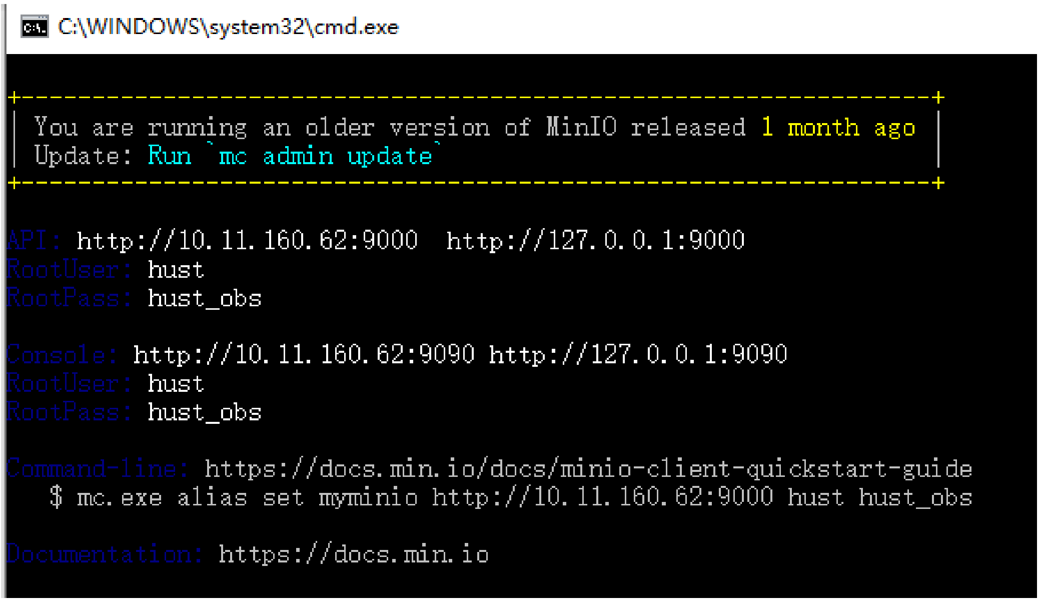
实验一：系统搭建

基础环境：python；minio

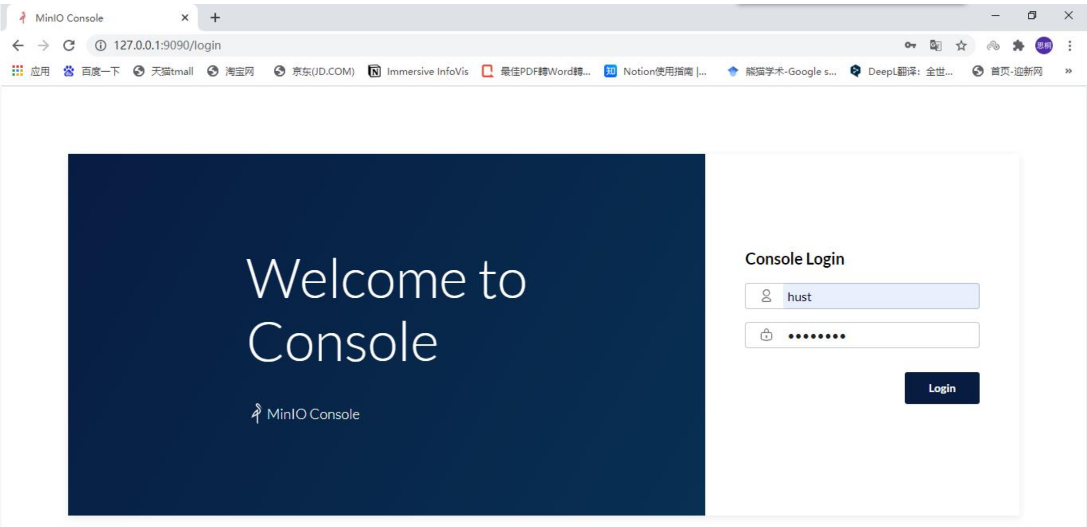
1.1 启动 minion



C:\WINDOWS\system32\cmd.exe

```
+-----------------------------------------------------------------------+
| You are running an older version of MinIO released 1 month ago        |
| Update: Run `mc admin update`                                         |
+-----------------------------------------------------------------------+

API: http://10.11.160.62:9000  http://127.0.0.1:9000
RootUser: hust
RootPass: hust_obs

Console: http://10.11.160.62:9090 http://127.0.0.1:9090
RootUser: hust
RootPass: hust_obs

Command-line: https://docs.min.io/docs/minio-client-quickstart-guide
   $ mc.exe alias set myminio http://10.11.160.62:9000 hust hust_obs

Documentation: https://docs.min.io
```

1.2 根据所给信息登录网页，创建一个 bucket



127.0.0.1:9090/login

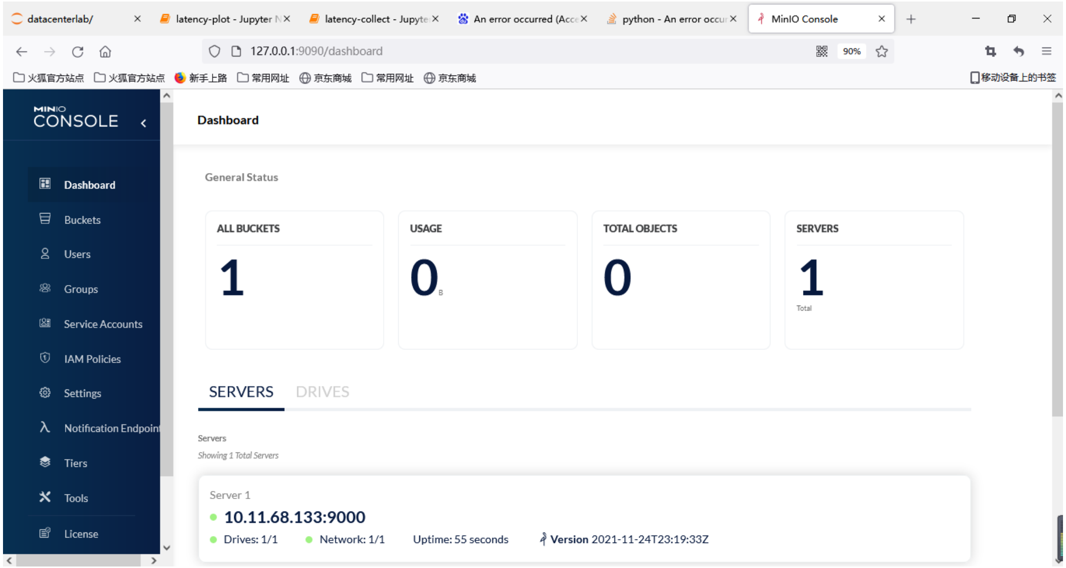
Welcome to Console

Console Login

hust

••••••••

如图所示，Web 前端可以观察当前服务端的情况，可直接利用前端界面创建Bucket 或者上传数据等操作。Minio 包含了 PUT/POST、GET、PUT/POST/PATCH 和 DELETE 等 CRUD 操作。



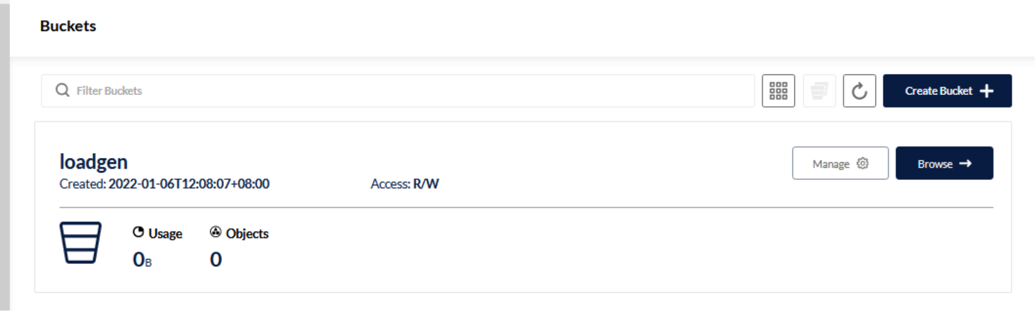
Servers

Showing 1 Total Servers

Server 1

● 10.11.68.133:9000

● Drives: 1/1 ● Network: 1/1 Uptime: 55 seconds Version 2021-11-24T23:19:33Z



loadgen

Created: 2022-01-06T12:08:07+08:00 Access: R/W

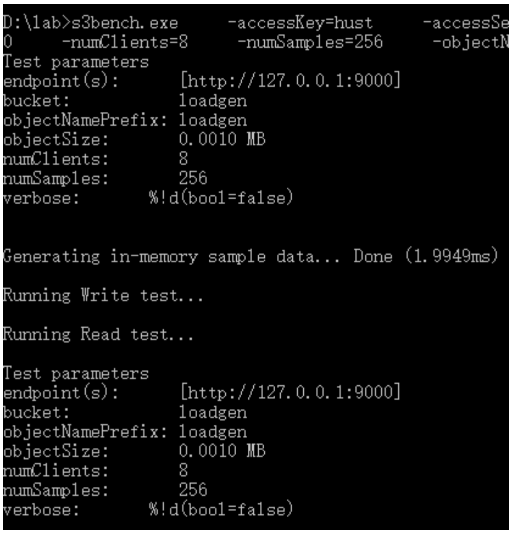
Usage 0B

Objects 0

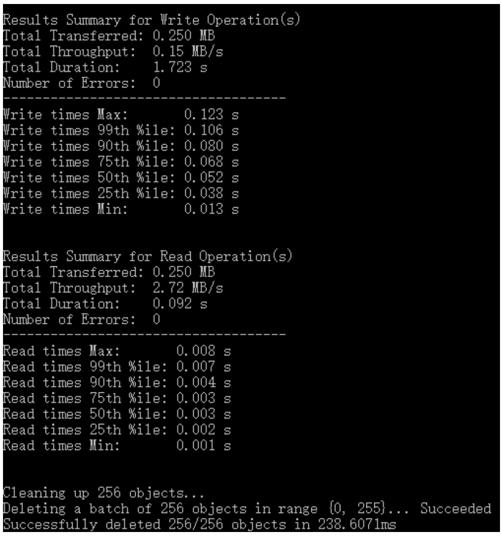
实验二：性能观测

指标：吞吐率 Throughput、延迟 Latency，以及环境参数：对象尺寸 object size、并发性、服务器数量。

设置参数为：-numClients=8　-numSamples=256　-objectSize=1024

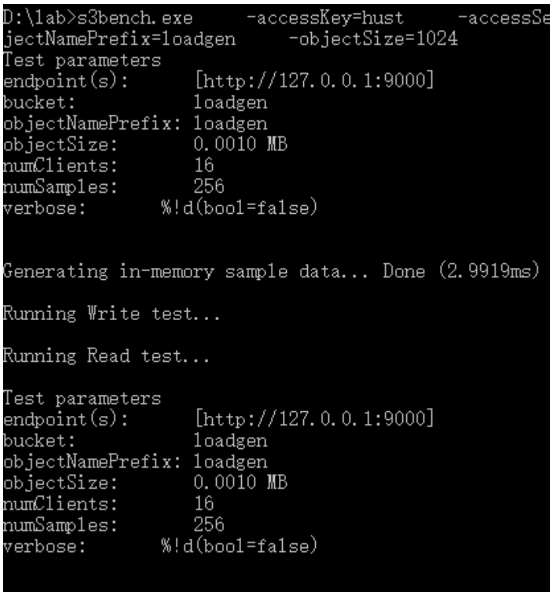


```
D:\lab>s3bench.exe     -accessKey=hust     -accessSe
0     -numClients=8     -numSamples=256     -objectN
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       8
numSamples:       256
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (1.9949ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       8
numSamples:       256
verbose:       %!d(bool=false)
```

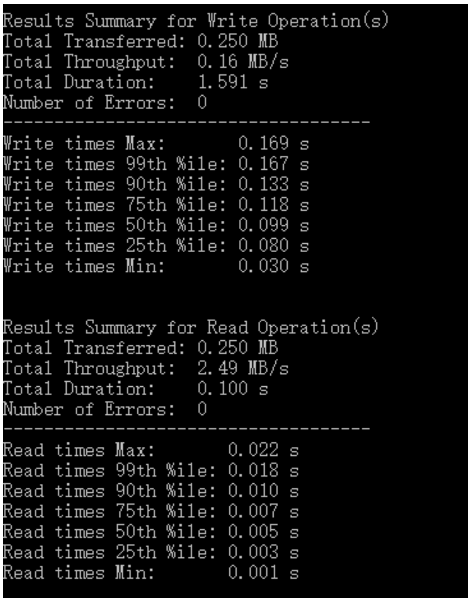


```
Results Summary for Write Operation(s)
Total Transferred: 0.250 MB
Total Throughput:  0.15 MB/s
Total Duration:    1.723 s
Number of Errors:  0
------------------------------------
Write times Max:       0.123 s
Write times 99th %ile: 0.106 s
Write times 90th %ile: 0.080 s
Write times 75th %ile: 0.068 s
Write times 50th %ile: 0.052 s
Write times 25th %ile: 0.038 s
Write times Min:       0.013 s


Results Summary for Read Operation(s)
Total Transferred: 0.250 MB
Total Throughput:  2.72 MB/s
Total Duration:    0.092 s
Number of Errors:  0
------------------------------------
Read times Max:       0.008 s
Read times 99th %ile: 0.007 s
Read times 90th %ile: 0.004 s
Read times 75th %ile: 0.003 s
Read times 50th %ile: 0.003 s
Read times 25th %ile: 0.002 s
Read times Min:       0.001 s


Cleaning up 256 objects...
Deleting a batch of 256 objects in range {0, 255}... Succeeded
Successfully deleted 256/256 objects in 238.6071ms
```

-numClients=16　-numSamples=256　-objectSize=1024：

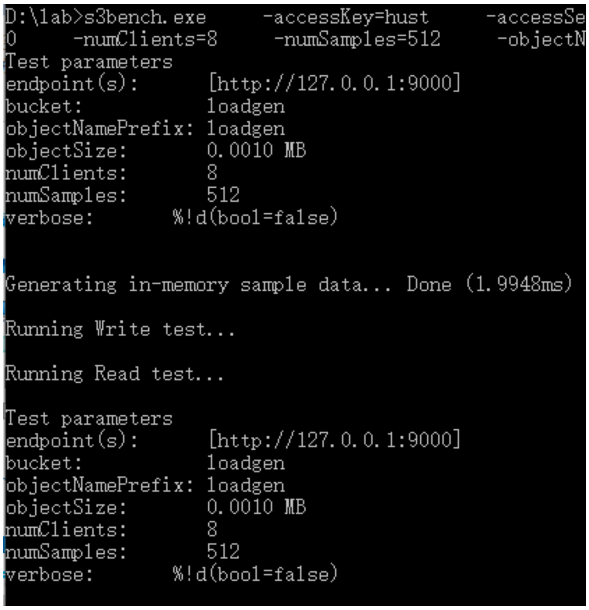


```
D:\lab>s3bench.exe     -accessKey=hust     -accessSe
jectNamePrefix=loadgen     -objectSize=1024
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       16
numSamples:       256
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (2.9919ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       16
numSamples:       256
verbose:       %!d(bool=false)
```

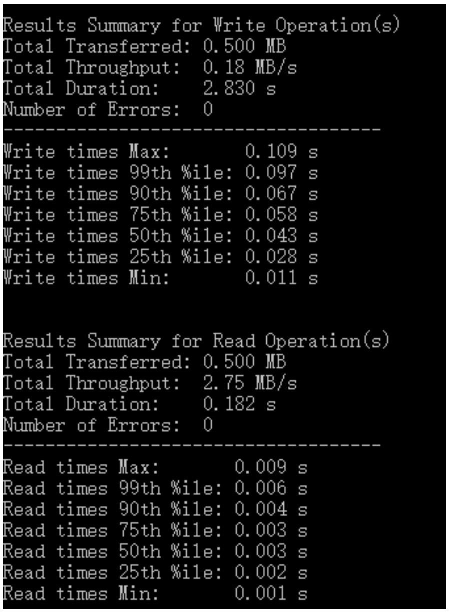


```
Results Summary for Write Operation(s)
Total Transferred: 0.250 MB
Total Throughput:  0.16 MB/s
Total Duration:    1.591 s
Number of Errors:  0
------------------------------------
Write times Max:       0.169 s
Write times 99th %ile: 0.167 s
Write times 90th %ile: 0.133 s
Write times 75th %ile: 0.118 s
Write times 50th %ile: 0.099 s
Write times 25th %ile: 0.080 s
Write times Min:       0.030 s


Results Summary for Read Operation(s)
Total Transferred: 0.250 MB
Total Throughput:  2.49 MB/s
Total Duration:    0.100 s
Number of Errors:  0
------------------------------------
Read times Max:       0.022 s
Read times 99th %ile: 0.018 s
Read times 90th %ile: 0.010 s
Read times 75th %ile: 0.007 s
Read times 50th %ile: 0.005 s
Read times 25th %ile: 0.003 s
Read times Min:       0.001 s
```

-numClients=8　-numSamples=512　-objectSize=1024：



```
D:\lab>s3bench.exe     -accessKey=hust     -accessSe
0     -numClients=8     -numSamples=512     -objectN
Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       8
numSamples:       512
verbose:       %!d(bool=false)


Generating in-memory sample data... Done (1.9948ms)

Running Write test...

Running Read test...

Test parameters
endpoint(s):      [http://127.0.0.1:9000]
bucket:           loadgen
objectNamePrefix: loadgen
objectSize:       0.0010 MB
numClients:       8
numSamples:       512
verbose:       %!d(bool=false)
```



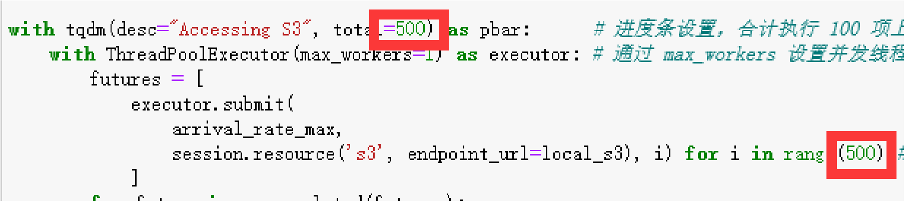
```
Results Summary for Write Operation(s)
Total Transferred: 0.500 MB
Total Throughput:  0.18 MB/s
Total Duration:    2.830 s
Number of Errors:  0
------------------------------------
Write times Max:       0.109 s
Write times 99th %ile: 0.097 s
Write times 90th %ile: 0.067 s
Write times 75th %ile: 0.058 s
Write times 50th %ile: 0.043 s
Write times 25th %ile: 0.028 s
Write times Min:       0.011 s


Results Summary for Read Operation(s)
Total Transferred: 0.500 MB
Total Throughput:  2.75 MB/s
Total Duration:    0.182 s
Number of Errors:  0
------------------------------------
Read times Max:       0.009 s
Read times 99th %ile: 0.006 s
Read times 90th %ile: 0.004 s
Read times 75th %ile: 0.003 s
Read times 50th %ile: 0.003 s
Read times 25th %ile: 0.002 s
Read times Min:       0.001 s
```

结果汇总：

参数			实验结果（单位为 MB/s 与 s）			
numClients	numSample	objectSize	吞吐率（写）	总延迟（写）	吞吐率(读）	总延迟（读）
8	256	1024	0.15	1.723	2.72	0.092
16	256	1024	0.16	1.591	2.49	0.100
8	512	1024	0.18	2.830	2.75	0.182

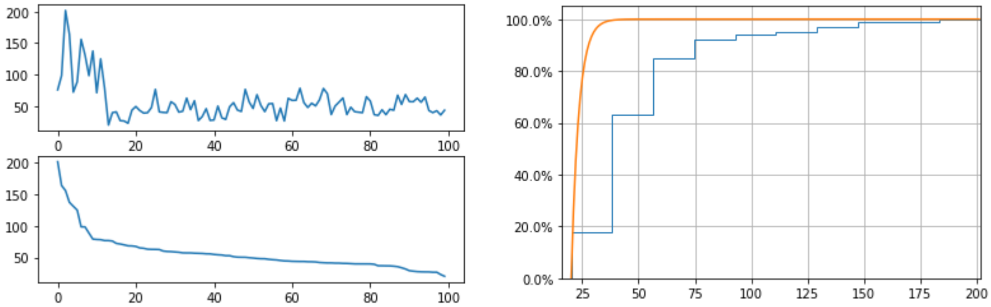
实验三：尾延迟

用排队论模型来拟合实测数据，修改任务项数观察不同实验结果

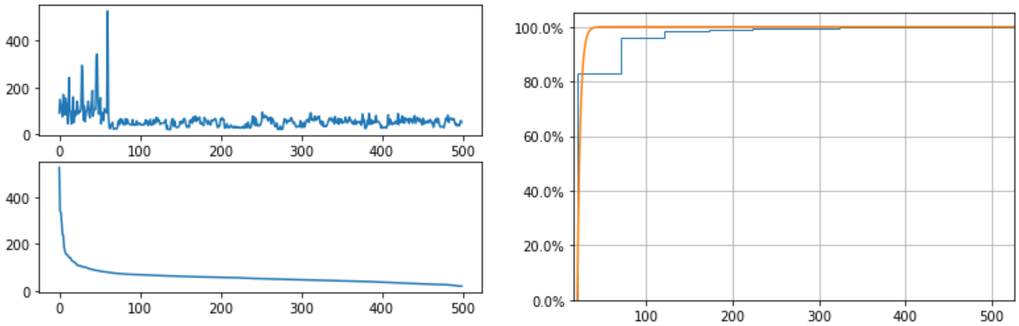


```
with tqdm(desc="Accessing S3", tota=500) as pbar:      # 进度条设置，合计执行 100 项
    with ThreadPoolExecutor(max_workers=1) as executor: # 通过 max_workers 设置并发线
        futures = [
            executor.submit(
                arrival_rate_max,
                session.resource('s3', endpoint_url=local_s3), i) for i in rang (500)
            ]
```

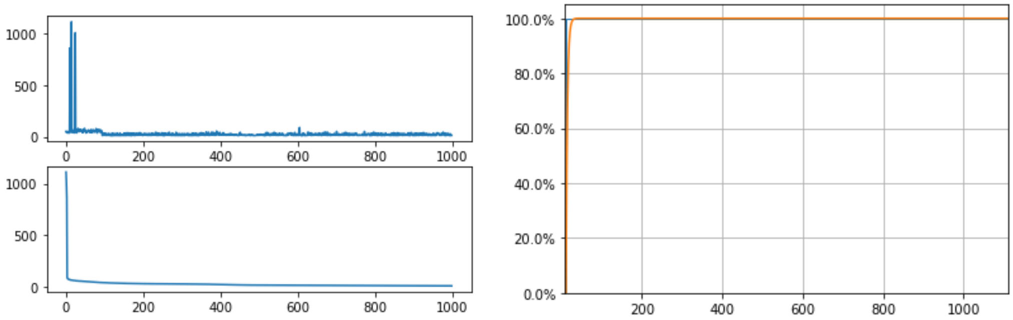
100 项上传任务：



500 项上传任务：



1000 项上传任务：


1000
500
0
200
400
600
800
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%