



# **FSCT Test Results for G80 Pro**

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# 1. Introduction

## 1.1 What is FSCT?

FSCT (File Server Capacity Tools) was developed by Microsoft to provide accurate and detailed results when testing file server capacity and identifying performance bottlenecks. For Morro system, we can use it to simulate multiple users access shares at the same time and identify how many users we can handle under the different hardware configuration.

## 2. FSCT Test System Components

### 2.1 Components

DUT Server	<ul style="list-style-type: none"><li>• Device Under Test File Server - Morro Data CacheDrive</li><li>• VM or Physical Appliance</li><li>• Memory Size</li><li>• Cache Disk (SSD or HDD) and Size</li><li>• Firmware Version</li></ul>
FSCT Controller	<ul style="list-style-type: none"><li>• Windows edition: Windows Server 2016 Standard</li><li>• System type: 64-bit Operating System, x64-based processor</li><li>• CPU: Intel(R) Xeon(R) Silver 4110 CPU @ 2.10GHz 2.10 GHz</li><li>• Memory: 4 GB</li><li>• Disk: 300 GB VMware Virtual disk</li></ul>
Client 1	<ul style="list-style-type: none"><li>• Windows edition: Windows 10 Enterprise</li><li>• System type: 64-bit Operating System, x64-based processor</li><li>• CPU: Intel(R) Xeon(R) Silver 4110 CPU @ 2.10GHz 2.10 GHz</li><li>• Memory: 32 GB</li><li>• Disk: 100 GB VMware Virtual disk</li></ul>
Client 2	<ul style="list-style-type: none"><li>• Windows edition: Windows 10 Pro</li><li>• System type: 64-bit Operating System, x64-based processor</li><li>• CPU: Intel(R) Core(TM) i7-3770 CPU @ 3.40GHz 3.40 GHz</li><li>• Memory: 12 GB</li><li>• Disk: 1TB WDC WDS100T2B0A</li></ul>
Client 3	<ul style="list-style-type: none"><li>• Windows edition: Windows 10 Pro</li><li>• System type: 64-bit Operating System, x64-based processor</li><li>• CPU: Intel(R) Core(TM) i7-7700 CPU @ 3.60GHz 3.60 GHz</li><li>• Memory: 16 GB</li><li>• Disk: 1.8 TB TOSHIBA DT01ACA200</li></ul>

# 3. Test Results

## CacheDrive G80 Pro

Morro Data SKU: G8022P1 with 4TB SSD Cache, 8GB DRAM

Results (0~1900 users)					
Users	Overload	Throughput	Errors	Errors (%)	Duration (ms)
100	0%	9	0	0%	900625
200	0%	18	0	0%	900657
300	0%	27	0	0%	900234
400	0%	36	0	0%	1370797
500	0%	45	0	0%	900250
600	0%	55	0	0%	900157
700	0%	64	0	0%	900141
800	0%	73	0	0%	900141
900	0%	82	0	0%	900187
1000	0%	91	0	0%	900297
1100	0%	101	0	0%	900171
1200	0%	110	0	0%	900453
1300	0%	119	0	0%	900188
1400	0%	128	0	0%	900500
1500	0%	137	0	0%	900187
1600	0%	147	0	0%	900328
1700	0%	156	0	0%	900125
1800	0%	165	0	0%	900203
1900	0%	175	17	0%	900266

# 4. Configuration & Preparation

## 4.1 Hardware Configuration

There are three types of physical computer components in an FSCT test configuration: **the controller, the server, and the clients**. In the case of an Active Directory environment, we also need a domain controller.

Controller	Server	Clients
The controller is used to synchronize test activity and collect test data. The controller must be running on a Microsoft Windows operating system.	The server is responsible for sharing files, and it is the server’s performance that is tested during an FSCT run phase.	Multiple client computers are required to generate a workload sufficient to saturate the server’s capacity. Clients can simulate one or more users on the same computer. The total number of users should represent the expected load on the server when testing for capacity planning.

## 4.2 Network Configuration

G80 acts as a file server and joins with Controller and Clients on Active Directory. Every client accesses files in the G80 via SMB protocol with multiple users.

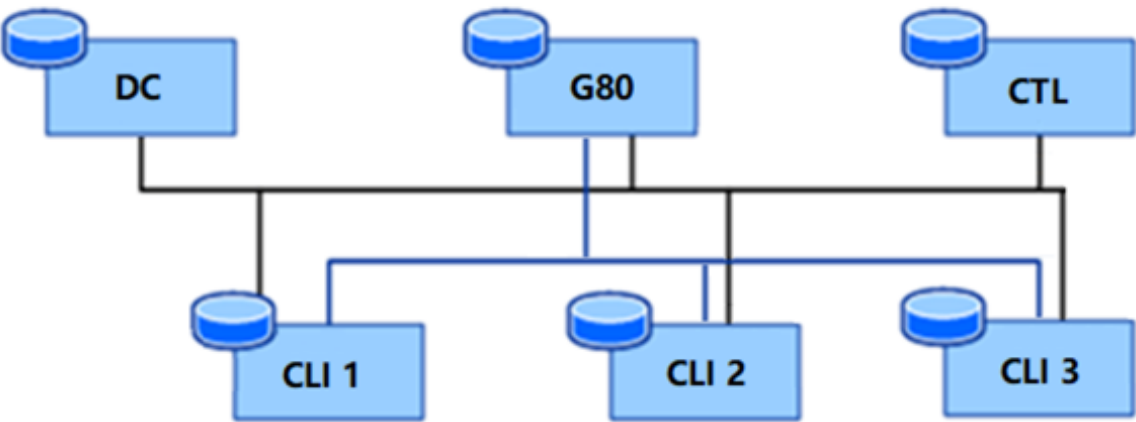


Figure 1. Network Configuration

## 4.3 FSCT Configuration

- Workload: HomeFolders (FSCT default workload)
- Duration: 90 seconds

- Volume number: 1
- User number step: 100
- Command:

```
FSCT run controller /server G80 /password password /volumes \\G80\fsroot1 /clients
Client1,Client2,Client3 /min_users 100 /max_users 1000 /step 100 /duration 900
/workload HomeFolders
```

#### 4.4 Precondition

CacheDrive is not a Windows system, so we only can run FSCT in ADS mode. Therefore, the Morro server (CacheDrive), the controller (Windows Server) and the clients (Windows) all need to join ADS.

FSCT will access the CacheDrive from the clients by using the designated number of users. So if not in the ADS mode, one would need to create hundreds or thousands of user accounts on both the CacheDrive and the Windows clients. In the ADS mode, FSCT has the command to create large numbers of ADS users.

On clients, we need to enable the “Remote Registry” service and disable the firewall. Otherwise, the controller cannot collect the performance counter data of the clients.

Download and uncompress the FSCT package, then copy it to the “C:\” on the DC, controller, and clients.

#### 4.5 Preparation

##### 4.5.1 Prepare Domain Controller

Running below command on domain controller command prompt to prepare DC.

```
fsct prepare dc /users <number of users> /password <password> /clients <client1,client2,...>
```

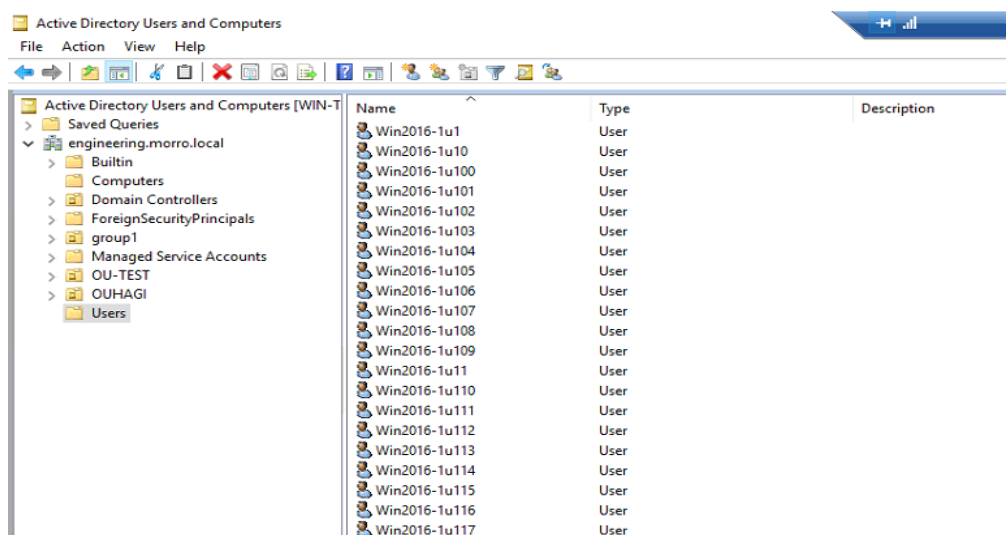


Figure 2. Prepare Domain Controller

FSCT will create AD users according to the number in the command, the user name will be “client name-x”, “x” is number from 1. And the password of all users will be the same.

Note: “Win2016-1” is my client computer name.

#### 4.5.2 Prepare Server

Running below command on the controller to prepare server.

```
fsct prepare server /clients <client1,client2,...> /password <password> /users <number of users> /domain <domain name> /volumes \\<server name>\<share> /workload <workload name> /create_only_fileset
```

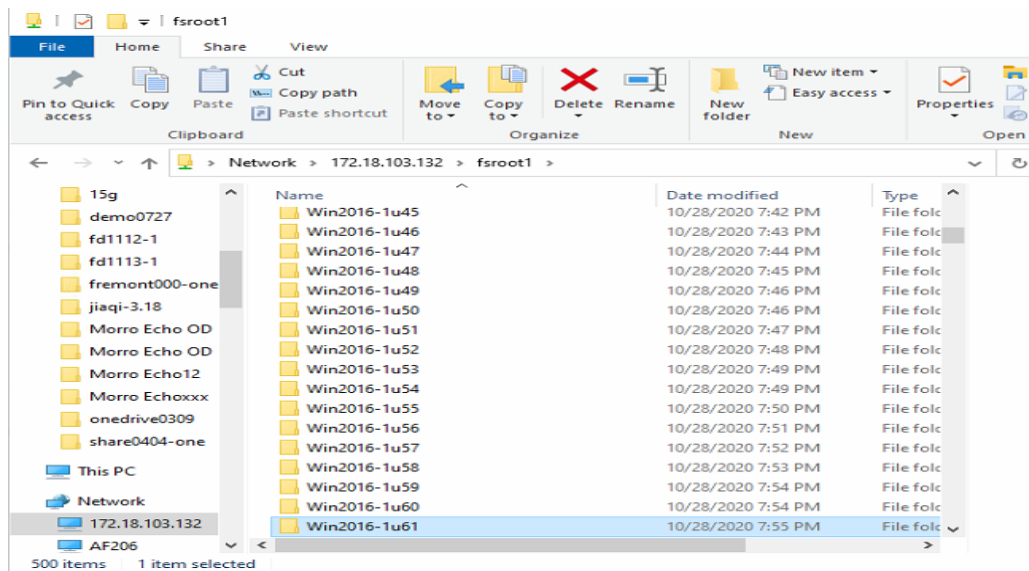


Figure 3. Prepare Server

FSCT will create a home folder (includes sub-folders and files) for every user. The subfolders and files are dependent on the file “Fileset.xml” for the workload (will mention it later in 5.1 Workload). The share name on CacheDrive must be “fsrootx”, where “x” is a number like 1, 2 ...

Note: “Win2016-1” is the client computer name.

#### 4.5.3 Prepare Controller

Running below command on the controller to prepare server.

```
fsct prepare controller
```

FSCT will remove the “result” folder on the controller. “result” contains the test result for the last test.

#### 4.5.4 Prepare Clients

Running below command on the clients to prepare clients.

```
fsct prepare client /server <server name> /password <password> /users <number of users> /domain <domain name> /server_ip <server IP address>
```

```
172.18.103.132 V200-610
172.18.103.132 V200-610u1
172.18.103.132 V200-610u2
172.18.103.132 V200-610u3
172.18.103.132 V200-610u4
172.18.103.132 V200-610u5
172.18.103.132 V200-610u6
172.18.103.132 V200-610u7
172.18.103.132 V200-610u8
172.18.103.132 V200-610u9
```

Figure 4. Prepare Clients

FSCT will add "server\_ip server\_name" to the "hosts" file on clients, and also will add "server\_ip server\_nameux" (x is number from 1 to the total users' number) to the "hosts" file. Every user will connect the corresponding server name. For example, the user "Win2016-u1" will log in to the server "V200-610u1". "V200-610" is the example hostname of the DUT CacheDrive.



# 5. Test Assessment

- Run below command on clients first.

```
fscf run client /controller <controller name> /server <server name> /password <password>
```

- Then run the below command on the controller.

```
fscf run controller /server <server name> /password <server password> /volumes \\<server  
name>\<share> /clients <client1,client2,...> /min_users <minusers> /max_users <maxusers> /step  
<usersstep> /duration <duration> /workload <workload name>
```

## 5.1 Workload

FSCT Workload defines what kind of information is stored on and transferred between the server and the clients, which operations are performed on the file set, how many iterations of each test will be run, and what thresholds are used to determine that the test has finished.

FSCT includes a default workload – “HomeFolders”. For a workload, there are 3 main files:

**Profile.cfg**

**Perf.txt**

**Fileset.xml**

Profile.cfg	Perf.txt	Fileset.xml
Contain configuration details for the scenarios that will be run during the test, commands defining warm-up routines, commands defining how the cache will be used during the test, and a list of files that will be used during each scenario.	Contain the names of performance counters to be collected and the interval at which they will be collected on the Server and on all Clients. This file can be edited to add or remove performance counters collected.	Contain details about the files, destination path, and source path that will be created on the server for use by clients during the test. This directory may contain additional files that represent subsets of the file set. They are used if a scenario DLL should use only part of the file set.

```

profile.cfg - 记事本
文件(F) 编辑(E) 格式(O) 查看(V) 帮助(H)
<?xml version="1.0" encoding="utf-8"?>
<Profile>
  <Scenarios>
    <Scenario name="CmdLineNavigate.dll">
      <RunsPerUserPerHour>15</RunsPerUserPerHour>
      <FilesetParameters>
        <Parameter name="filelist">static_dirs.xml</Parameter>
      </FilesetParameters>
    </Scenario>

    <Scenario name="CmdLineFileDownload.dll">
      <RunsPerUserPerHour>150</RunsPerUserPerHour>
      <FilesetParameters>
        <Parameter name="filelist">static.xml</Parameter>
      </FilesetParameters>
    </Scenario>

    <Scenario name="CmdLineFileUpload.dll">
      <RunsPerUserPerHour>40</RunsPerUserPerHour>
      <FilesetParameters>
        <Parameter name="filelist">new.xml</Parameter>
      </FilesetParameters>
    </Scenario>

  <WarmupTime>30</WarmupTime>
  <Fileset>
    <!--<CacheSizePerUser>64</CacheSizePerUser>-->
    <!--<CacheHitRatio>100</CacheHitRatio>-->
  </Fileset>
</Profile>

```

Figure 6. Part of the “profile.cfg” File

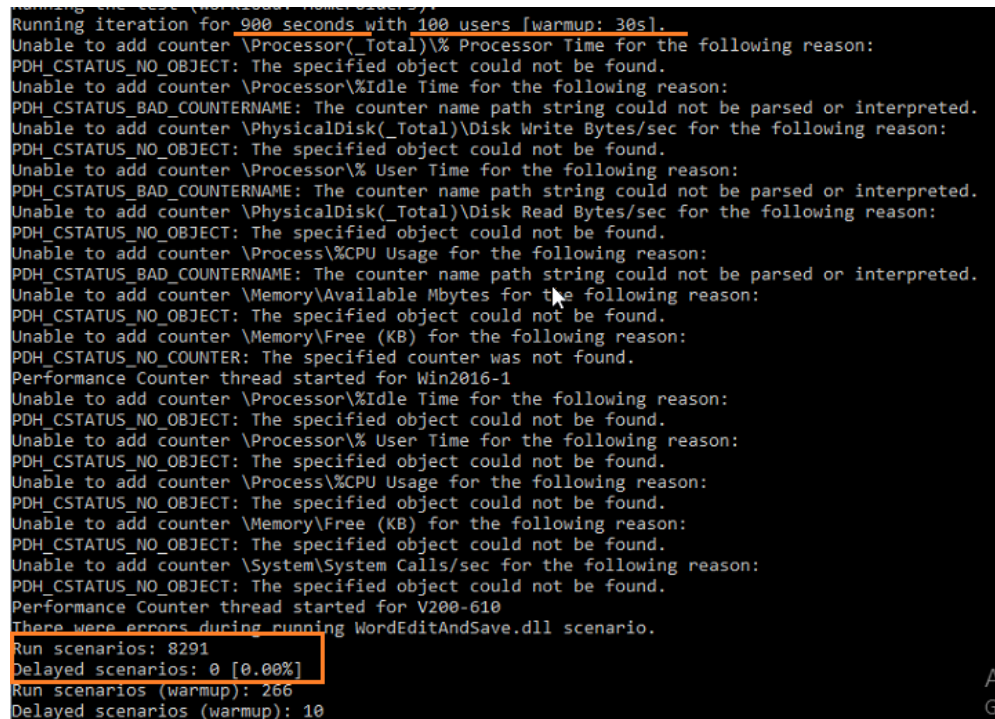
Scenario	Runs per user per hour	File set
CmdLineNavigate.dll	15	static_dirs.xml
CmdLineFileDownload.dll	150	static.xml
CmdLineFileUpload.dll	40	new.xml
CmdLineFileDelete.dll	7	volatile.xml
ExplorerNavigate.dll	15	static_dirs.xml
ExplorerDragDropFileDownload.dll	50	static.xml
ExplorerDragDropFileUpload.dll	15	new.xml
ExplorerFileDelete.dll	5	volatile.xml
ExplorerSelect.dll	15	static.xml
WordFileOpen.dll	7	static.xml
WordFileClose.dll	7	static.xml
WordEditAndSave.dll	5	volatile.xml

Summary of the File “profile.cfg”

From the above table, for the workload “HomeFolders”, 331 scenarios will be run in one hour. So for 100 users and the duration is 900s (15 minutes), 8275 scenarios will be performed. This meets the real testing result (Figure 7).

Note:  $331 = 15 + 150 + 40 + 7 + 15 + 50 + 15 + 5 + 15 + 7 + 7 + 5$

$8275 = 331 * 100 / 4$



```

Running iteration for 900 seconds with 100 users [warmup: 30s].
Unable to add counter \Processor(_Total)\% Processor Time for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Processor\Idle Time for the following reason:
PDH_CSTATUS_BAD_COUNTERNAME: The counter name path string could not be parsed or interpreted.
Unable to add counter \PhysicalDisk(_Total)\Disk Write Bytes/sec for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Processor\% User Time for the following reason:
PDH_CSTATUS_BAD_COUNTERNAME: The counter name path string could not be parsed or interpreted.
Unable to add counter \PhysicalDisk(_Total)\Disk Read Bytes/sec for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Process\%CPU Usage for the following reason:
PDH_CSTATUS_BAD_COUNTERNAME: The counter name path string could not be parsed or interpreted.
Unable to add counter \Memory\Available Mbytes for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Memory\Free (KB) for the following reason:
PDH_CSTATUS_NO_COUNTER: The specified counter was not found.
Performance Counter thread started for Win2016-1
Unable to add counter \Processor\Idle Time for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Processor\% User Time for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Process\%CPU Usage for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \Memory\Free (KB) for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Unable to add counter \System\System Calls/sec for the following reason:
PDH_CSTATUS_NO_OBJECT: The specified object could not be found.
Performance Counter thread started for V200-610
There were errors during running WordEditAndSave.dll scenario.
Run scenarios: 8291
Delayed scenarios: 0 [0.00%]
Run scenarios (warmup): 266
Delayed scenarios (warmup): 10

```

Figure 7. Controller Running FSCT for 100 users and 900 seconds.

```

#interval 1
"\Processor(_Total)\% Privileged Time"
"\Processor(_Total)\% User Time"
"\System\Context Switches/sec"
"\System\System Calls/sec"
"\PhysicalDisk(_Total)\Avg. Disk Queue Length"
"\TCPv4\Segments Retransmitted/sec"
"\PhysicalDisk(_Total)\Avg. Disk Bytes/Read"
"\PhysicalDisk(_Total)\Avg. Disk Bytes/Write"
"\PhysicalDisk(_Total)\Disk Reads/sec"
"\PhysicalDisk(_Total)\Disk Writes/sec"
"\PhysicalDisk(_Total)\Avg. Disk sec/Read"
"\PhysicalDisk(_Total)\Avg. Disk sec/Write"

```

Figure 8. Part of the “perf.txt” File

Morro Data CacheDrive is not a Windows system, so the FSCT cannot collect the resources data such as CPU and memory message from the performance counters for the CacheDrive.

```
<?xml version="1.0" encoding="UTF-8"?>
- <Fileset>
  - <Directory>
    <Location>ServerPrivate</Location>
    <RelativePath>static</RelativePath>
  </Directory>
  - <Directory>
    <Location>ServerPrivate</Location>
    <RelativePath>static\4ocgzYtpetNo</RelativePath>
  </Directory>
  - <Directory>
    <Location>ServerPrivate</Location>
    <RelativePath>static\4ocgzYtpetNo\hdXiXF5btnf7h5</RelativePath>
  </Directory>
  - <File>
    <Location>ServerPrivate</Location>
    <RelativePath>static\4ocgzYtpetNo\hdXiXF5btnf7h5\meDrnewXvAe0R.u0Ej</RelativePath>
    <Size>41013</Size>
    <Usage>ReadOnly</Usage>
  </File>
```

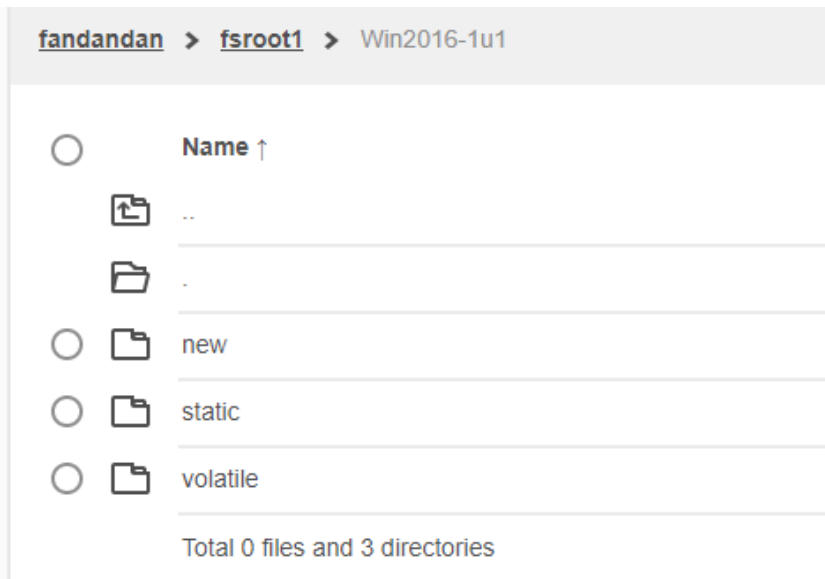


Figure 9. Part of the “fileset.xml” File and the corresponding folder view on MCM > Files

Part of the file “fileset.xml” about the fileset “static” is shown as an example. For the workload “HomeFolders”, the file “fileset.xml” defines 3 filesets: “static”, “new”, and “volatile”, so FSCT will create these 3 folders for each user in the share.

## 5.2 Iteration

We can specify the minimum and the maximum number of users and a step-for-one test. This tells the FSCT to run a number of iterations starting with the minimum number of users, and then adding the steps for the next iteration until it reaches the maximum number of users in the last run.

### 5.3 Duration

Duration means how long the one iteration will run, FSCT recommends the duration is for 10 minutes to 15 minutes (600 seconds to 900 seconds). If the time is too short, the results will have higher variance, and if the run time is too long, the workload may run out of files and start to report errors.

### 5.4 Test Process

FSCT collects the data (such as CPU and memory usage) from the Windows Performance counter, but our CacheDrive is not the Windows system, so the FSCT could not get the data. During the testing, please monitor the CPU and memory usage from the Morro Audit – Device – STATUS – CPU/Memory Usage to identify which resource will be exhausted first.

### 5.5 Test Result

We can find the test result of FSCT on the controller below path:

`C:\FSCT\results\FSCT_data.txt`

## Notes

- After a test has finished, we need to wait until all requests in the `req\_queue` have been completed before we can perform the next test.
- After a test has been finished, we need to clean the controller and clients with the below commands  
`fsct cleanup controller /backup <backup directory>`  
`fsct cleanup client /users <number of users>`
- In order to make sure the test result is accurate, every time before starting the testing, we should create a new share and run “Prepare server” again on the controller to prepare files on the CacheDrive. We did not delete the old share, so the new share will do file deduplication. The purpose of utilizing file deduplication is to more accurately test the SMB handling capability of the server which is the purpose of the FSCT test.

## 6. Discussions

- From the test results in Section 3, we show that CacheDrive G80 Pro is capable of supporting up to 1800 simultaneous users running the FSCT test. This shows that CacheDrive is efficient in handling the SMB interface. In real use scenarios, actual performance will depend on the applications used and the number of files simultaneously opened by the users.
- The FSCT test focuses on the SMB performance. For this reason, we configured the CacheDrive share so that the following computing components of CacheDrive from this FSCT test:
  - File upload to cloud (by making the files always deduped)
  - Simultaneous file downsync from the cloud to the CacheDrive (by using a single CacheDrive in the system)
- The size of DRAM in a CacheDrive will affect the number of simultaneous users in the FSCT test as each additional user would consume some memory resources. From the results of the current test, we recommend a CacheDrive, whether VM or physical appliance, to have at least 8GB of DRAM in a multiuser environment.