

Scalability Testing with NFS File-IO

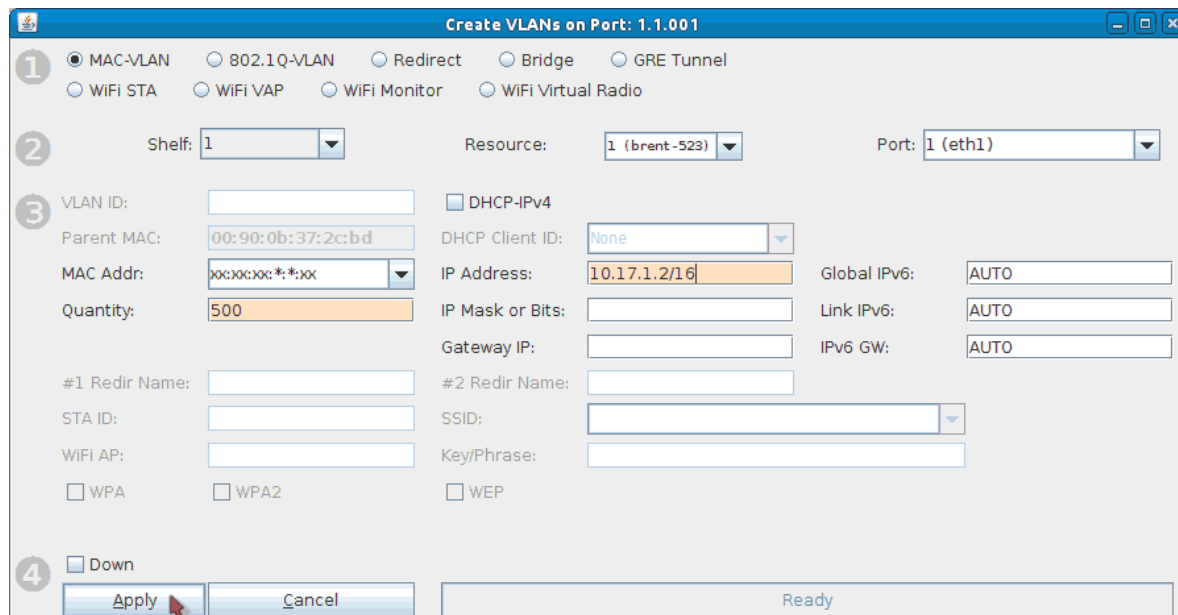
Goal: Analyze memory usage as the number of NFS clients is scaled up, and also when NFS endpoint settings are tweaked.

Hopefully by the end of this cookbook you'll have an idea how to assess how many File-IO endpoints and associated settings your system can support. This cookbook connects a LANforge system to a NFS file server. The file server in this example will be 10.17.1.1. It will be sharing 10.17.1.1:/mnt/tmpfs1. We will create 100, 250, then 500 readers and writers and compare memory usage as we also tweak the RW Size setting.

Note: For this example, we are using a **CT523** with 8GB of memory. It is physically connected to the NFS file server.

1. First, **500** MAC-VLANs will need to be created.

A. In the **Port-Mgr** tab select port **eth1** and click **Create**.



The screenshot shows a dialog box titled "Create VLANs on Port: 1.1.001". It has several sections:

- 1** Selection options: MAC-VLAN, 802.1Q-VLAN, Redirect, Bridge, GRE Tunnel, WIFI STA, WIFI VAP, WIFI Monitor, WIFI Virtual Radio.
- 2** Shelf: 1, Resource: 1 (brent-523), Port: 1 (eth1).
- 3** VLAN ID: (empty), Parent MAC: 00:90:0b:37:2c:bd, MAC Addr: xx:xx:xx:*:*:xx, Quantity: 500, IP Address: 10.17.1.2/16, Global IPv6: AUTO, Link IPv6: AUTO, IPv6 GW: AUTO.
- 4** #1 Redir Name: (empty), #2 Redir Name: (empty), STA ID: (empty), SSID: (empty), WiFi AP: (empty), Key/Phrase: (empty), WPA, WPA2, WEP.
- Buttons: Down, (with mouse cursor), ,

A. Select **MAC-VLAN**.

B. Set **Quantity** to **500**.

C. The starting IP address is 10.17.1.2/16 for this test. If your file server is on a different network, change the IP here accordingly. Make sure not to use the file server's IP address.

D. Click **Apply** and close the Port Create window once all ports are configured. Make sure all MAC-VLANs get IPs, this may take some time.

2. Create **250** NFS writers and **250** NFS readers. Batch create **50** at a time (49 for first batch of reader/writers). More information on creating File-IO endpoints can be found here: [LANforge File-IO with CIFS and NFS](#)

A. Any non-default settings for the **NFS writers** are listed below.

The screenshot shows the 'Create/Modify File Endpoint' dialog box for an NFS writer. The settings are as follows:

- Name: **nfs-writer001**
- Rpt Timer: default (5 s)
- FS-Type: **NFS**
- Test Manager: default_tm
- Shelf: 1
- Resource: 1 (brent-523)
- Port: **2 (eth1#0)**
- Endp ID: 0
- Min-RW-Size: 4k (4 KB)
- Max-RW-Size: 4k (4 KB)
- Min File Size: Large (1 MB)
- Max File Size: Large (1 MB)
- Min Read Rate: T1 (1.544 Mbps)
- Max Read Rate: T1 (1.544 Mbps)
- Min Write Rate: 100M (100 Mbps)
- Max Write Rate: 100M (100 Mbps)
- File #: 2
- Directory: AUTO
- Mount-Dir: AUTO
- Quiesce After: Forever (0)
- Server: 10.17.1.1:/mnt/tmpfs1
- Options: (empty)
- iSCSI-Volume: (empty)
- Retry-Timer: 1s (1 s)
- Read/Write: **Write**
- Quiesce: 3 (3 sec)
- Pattern: increasing
- Prefix: AUTO
- Buttons: Sync-after-Write, Sync-before-Close, Use O_DIRECT, Use O_LARGEFILE, Use O_APPEND, Do-CRC, Unlink
- Buttons: Verify-Mount, Auto-Mount, Un-Mount, Lazy Unmount, Force Unmount, Use FSTATFS
- Custom payload (in HEX): (empty)
- Buttons: Apply, OK, Batch-Create, Cancel

- Name is **nfs-writer001**.
- FS-Type: **NFS**.
- Port is **eth1#0**.
- Min-RW and Max-RW sizes are **4k**.
- Min/Max File sizes are **1MB**.
- Min/Max Write rates are **100Mbps**.
- Quiesce After is **Forever**.
- Server is **10.17.1.1:/mnt/tmpfs1** (use your own file server settings here).
- Make sure Read/Write is set to **Write**.
- Turn on the **Use O_DIRECT** checkbox.

B. Any non-default settings for the **NFS readers** are listed below.

The screenshot shows the 'Create/Modify File Endpoint' dialog box for an NFS reader. The settings are as follows:

- Name: **nfs-reader001**
- Rpt Timer: default (5 s)
- FS-Type: **NFS**
- Test Manager: default_tm
- Shelf: 1
- Resource: 1 (brent-523)
- Port: **252 (eth1#250)**
- Endp ID: 0
- Min-RW-Size: 4k (4 KB)
- Max-RW-Size: 4k (4 KB)
- Min File Size: Large (1 MB)
- Max File Size: Large (1 MB)
- Min Read Rate: T1 (1.544 Mbps)
- Max Read Rate: T1 (1.544 Mbps)
- Min Write Rate: 100M (100 Mbps)
- Max Write Rate: 100M (100 Mbps)
- File #: 2
- Directory: AUTO
- Mount-Dir: AUTO
- Quiesce After: Forever (0)
- Server: 10.17.1.1:/mnt/tmpfs1
- Options: (empty)
- iSCSI-Volume: (empty)
- Retry-Timer: 1s (1 s)
- Read/Write: **Read**
- Quiesce: 3 (3 sec)
- Pattern: increasing
- Prefix: **nfs-writer001**
- Buttons: Sync-after-Write, Sync-before-Close, Use O_DIRECT, Use O_LARGEFILE, Use O_APPEND, Do-CRC, Unlink
- Buttons: Verify-Mount, Auto-Mount, Un-Mount, Lazy Unmount, Force Unmount, Use FSTATFS
- Custom payload (in HEX): (empty)
- Buttons: Apply, OK, Batch-Create, Cancel

- Name is **nfs-reader001**.
- FS-Type: **NFS**.
- Port is **eth1#250**.
- Min-RW and Max-RW sizes are **4k**.
- Min/Max File sizes are **1MB**.
- Min/Max Write rates are **100Mbps**.
- Quiesce After is **Forever**.
- Server is **10.17.1.1:/mnt/tmpfs1** (use your own file server settings here).
- Set Read/Write to **Read**.
- Set Prefix to **nfs-writer001**.
- Turn on the **Use O_DIRECT** checkbox.

3. Start the first **50 writers** then the first **50 readers**. It's recommended to slowly start File-IO endpoints, for example, starting 25 writers then 25 readers then the same again until you have the desired amount running. The reason to do this is because the system may become unresponsive if it can't handle the number of File-IO endpoints.

Note: If you notice the system slowing down, connections not starting, or connections stuck in WAITING state, or any weirdness in general, you should stop 25 or 50 writers/readers at a time until the system clears up.

LANforge Manager Version(5.3.4)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr vAP Stations Messages

Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators File-IO

Rpt Timer: default (5 s) Go Test Manager all

Select All Start Stop Quiesce Clear

Create Modify Batch Modify Delete

Cross Connects for Selected Test Manager

Name	EID	Type	Status	Read-Bps	Rx-Bps-20s	Files-Read	Buf-RD	Bytes-RD	Write-Bps	Tx-Bps-20s	Files-
nfs-writer001	1.1.2.5...	NFS	Run	0	0	0	0	0	21,515,751	21,779,280	
nfs-writer002	1.1.3.5...	NFS	Run	0	0	0	0	0	21,391,168	21,654,267	
nfs-writer003	1.1.4.5...	NFS	Run	0	0	0	0	0	20,480,000	20,731,892	
nfs-writer004	1.1.5.5...	NFS	Run	0	0	0	0	0	22,649,273	22,860,735	
nfs-writer005	1.1.6.5...	NFS	Run	0	0	0	0	0	21,865,464	22,068,494	
nfs-writer006	1.1.7.5...	NFS	Run	0	0	0	0	0	21,523,062	21,721,817	
nfs-writer007	1.1.8.5...	NFS	Run	0	0	0	0	0	21,457,671	21,656,914	
nfs-writer008	1.1.9.5...	NFS	Run	0	0	0	0	0	21,386,693	21,475,817	
nfs-writer009	1.1.10...	NFS	Run	0	0	0	0	0	21,621,625	21,708,458	
nfs-writer010	1.1.11...	NFS	Run	0	0	0	0	0	21,219,629	21,309,128	
nfs-writer011	1.1.12...	NFS	Run	0	0	0	0	0	21,374,660	21,460,501	
nfs-writer012	1.1.13...	NFS	Run	0	0	0	0	0	21,704,260	21,794,708	
nfs-writer013	1.1.14...	NFS	Run	0	0	0	0	0	20,791,500	20,878,144	
nfs-writer014	1.1.15...	NFS	Run	0	0	0	0	0	21,189,858	21,278,162	
nfs-writer015	1.1.16...	NFS	Run	0	0	0	0	0	21,025,465	21,114,144	
nfs-writer016	1.1.17...	NFS	Run	0	0	0	0	0	20,492,175	20,577,572	
nfs-writer017	1.1.18...	NFS	Run	0	0	0	0	0	21,041,802	21,128,428	
nfs-writer018	1.1.19...	NFS	Run	0	0	0	0	0	20,593,996	20,676,703	
nfs-writer019	1.1.20...	NFS	Run	0	0	0	0	0	20,592,273	20,678,086	
nfs-writer020	1.1.21...	NFS	Run	0	0	0	0	0	20,903,773	20,985,617	
nfs-writer021	1.1.22...	NFS	Run	0	0	0	0	0	20,966,465	21,049,610	
nfs-writer022	1.1.23...	NFS	Run	0	0	0	0	0	20,978,302	21,064,668	
nfs-writer023	1.1.24...	NFS	Run	0	0	0	0	0	20,969,219	21,055,547	
nfs-writer024	1.1.25...	NFS	Run	0	0	0	0	0	21,343,792	21,430,585	
nfs-writer025	1.1.26...	NFS	Run	0	0	0	0	0	21,441,394	21,530,746	
nfs-writer026	1.1.27...	NFS	Stopped	0	0	0	0	0	0	0	
nfs-writer027	1.1.28...	NFS	Stopped	0	0	0	0	0	0	0	
nfs-writer028	1.1.29...	NFS	Stopped	0	0	0	0	0	0	0	

Logged in to: brent-523:4002 as: Admin

4. Now that 50 File-IO endpoints are running, the memory will be analyzed via htop.

A. Open a terminal on the LANforge system using a preferred method (either directly or remotely through ssh, rdesktop, or vncviewer).

```
lanforge@brent-523:~  
File Edit View Search Terminal Help  
[lanforge@brent-523 ~]$
```

B. Show a list of btserver processes (LANforge processes) by running the command:

```
htop -p `pgrep btserver` | tr "\n" " " | sed 's/,,$//'
```

If htop isn't installed run: `sudo yum install htop`

```
lanforge@brent-523:~  
File Edit View Search Terminal Help  
1 [|||||] 46.6% Tasks: 127, 99 thr; 4 running  
2 [|||||] 19.5% Load average: 25.86 21.12 15.72  
3 [|||||] 43.1% Uptime: 01:29:41  
4 [|||||] 32.3%  
Mem[|||||] 611/7942MB  
Swp[||] 128/3815MB  
PID USER PRI NI VIRT RES SHR S CPU% MEM% TIME+ Command  
16840 root 3 -17 59568 10480 7288 D 3.5 0.1 0:11.31 btserver --card_i  
16795 root 3 -17 59568 10484 7292 D 3.0 0.1 0:11.40 btserver --card_i  
16787 root 3 -17 59568 10488 7296 D 3.0 0.1 0:11.33 btserver --card_i  
16784 root 3 -17 59568 10484 7292 D 3.0 0.1 0:11.23 btserver --card_i  
16768 root 3 -17 59568 10472 7284 D 3.0 0.1 0:11.31 btserver --card_i  
16837 root 3 -17 59568 10488 7296 D 3.0 0.1 0:11.21 btserver --card_i  
16844 root 3 -17 59568 10492 7308 D 3.0 0.1 0:11.41 btserver --card_i  
16738 root 3 -17 59568 10484 7296 D 3.0 0.1 0:11.25 btserver --card_i  
16745 root 3 -17 59568 10520 7336 D 3.0 0.1 0:11.25 btserver --card_i  
16792 root 3 -17 59568 10480 7284 D 3.0 0.1 0:11.33 btserver --card_i  
16826 root 3 -17 59568 10516 7324 D 3.0 0.1 0:11.38 btserver --card_i  
16735 root 3 -17 59568 10472 7288 D 3.0 0.1 0:11.27 btserver --card_i  
16805 root 3 -17 59568 10480 7288 D 2.5 0.1 0:11.25 btserver --card_i  
16783 root 3 -17 59568 10468 7288 D 2.5 0.1 0:11.35 btserver --card_i  
16748 root 3 -17 59568 10508 7324 D 2.5 0.1 0:11.26 btserver --card_i  
16852 root 3 -17 59568 10444 7256 D 2.5 0.1 0:11.37 btserver --card_i  
16741 root 3 -17 59568 10424 7240 D 2.5 0.1 0:11.22 btserver --card_i  
16775 root 3 -17 59568 10344 7160 D 2.5 0.1 0:11.25 btserver --card_i  
16750 root 3 -17 59568 10452 7268 D 2.5 0.1 0:11.24 btserver --card_i  
16778 root 3 -17 59568 10448 7256 D 2.5 0.1 0:11.25 btserver --card_i  
16851 root 3 -17 59568 10536 7344 D 2.5 0.1 0:11.34 btserver --card_i  
16737 root 3 -17 59568 10424 7240 D 2.5 0.1 0:11.27 btserver --card_i  
16814 root 3 -17 59568 10488 7296 D 2.5 0.1 0:11.37 btserver --card_i  
16832 root 3 -17 59568 10504 7320 D 2.5 0.1 0:11.27 btserver --card_i  
16762 root 3 -17 59568 10520 7336 D 2.0 0.1 0:11.35 btserver --card_i  
24517 root 15 -5 75220 26104 7140 S 1.5 0.3 1:00.39 /home/lanforge/bt  
F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice F8Nice F9Kill F10Quit
```

A. The majority of btserver processes with the same or similar values here represent the running File-IO endpoints. The **RES** (resident value) column represents the memory used by these File-IO endpoints. The current test uses an average of about 10,400 KiB or **10.6 MB** per btserver process. These values should be monitored as the File-IO settings are adjusted.

NOTE: You will need to restart htop if the endpoints are stopped/restarted. Just press **q** to quit out and run the above htop command again.

C. Total up the RES memory used by btserver. This is useful to compare memory usage between a different number of connections. For example you could compare how much memory 100 endpoints use compared to 500 endpoints.

```
lanforge@brent-523:~  
File Edit View Search Terminal Help  
[lanforge@brent-523 ~]$ ps aux | grep btserver | awk '{s+=$6} END {print s}'  
1130916  
[lanforge@brent-523 ~]$
```

```
lanforge@brent-523:~  
File Edit View Search Terminal Help  
[lanforge@brent-523 ~]$ while sleep 1; do ps aux | grep btserver | awk '{s+=$6}'  
END {print s}'; done  
1130916  
1130916  
1130984  
1130936  
1130920  
1130912  
1130972  
1130984  
1130976  
1130880  
1130916  
1130940  
1130880  
1130908  
1130892  
1130880
```

- A. To show the total RES memory used, run the command:
`ps aux | grep btserver | awk '{s+=$6} END {print s}'`
To repeat it every second, use the below command. Press **Ctrl+C** to stop.
`while sleep 1; do ps aux | grep btserver | awk '{s+=$6} END {print s}'; done`
- B. The total memory for 50 NFS File-IO endpoints with a **Min/Max RW rate of 4k** is about 1,130,000 KiB which converts to around **1,157 MB**.

5. While the File-IO endpoints are running, change the **Min-RW** and **Max-RW** settings.

A. Select all File-IO endpoints and click **Batch Modify**.

Min Read Rate:	NA	Max Read Rate:	NA
Min Write Rate:	NA	Max Write Rate:	NA
Min-RW-Size:	1MB (1 MB)	Max-RW-Size:	1MB (1 MB)
Min File Size:	NA	Max File Size:	NA
Pattern:	NA	Prefix:	NA
Server:	NA	Options:	NA
File #:	NA	Flags:	NA
Do-CRC	NA	Retry-Timer:	NA
Read/Write:	NA	FS-Type:	NA
Quiesce After	NA (-1)		

Apply OK Cancel

A. Set the **Min/Max RW sizes** to **1MB**.

B. Click **OK**

6. Analyze how the Min/Max RW size setting change has affected the memory (see steps 4B and 4C).

```

lanforge@brent-523:~
File Edit View Search Terminal Help

 1 [||||]          13.3%]   Tasks: 204, 102 thr; 1 running
 2 [||||]          6.7%]   Load average: 46.19 54.05 54.10
 3 [|||]           4.3%]   Uptime: 01:01:02
 4 [||||]          11.0%]
Mem[|||||]        906/7942MB]
Swp[|]            0/3815MB]

PID USER      PRI  NI  VIRT   RES   SHR  S  CPU% MEM%   TIME+  Command
2376 root         3  -17 97840 48036 7508 S  1.0  0.6  1:24.07 /home/lanforge/bt
2394 root         3  -17 75256 25312 7388 S  0.5  0.3  0:50.77 /home/lanforge/bt
22182 root         3  -17 60600 11496 7284 S  0.5  0.1  0:29.35 btserver --card_i
22316 root         3  -17 60600 11544 7332 D  0.5  0.1  0:29.21 btserver --card_i
22210 root         3  -17 60600 11612 7396 S  0.5  0.1  0:29.12 btserver --card_i
22315 root         3  -17 60600 11548 7332 S  0.5  0.1  0:29.76 btserver --card_i
22263 root         3  -17 60600 11612 7396 D  0.5  0.1  0:29.17 btserver --card_i
22192 root         3  -17 60600 11636 7420 D  0.5  0.1  0:29.19 btserver --card_i
22153 root         3  -17 60600 11548 7336 D  0.5  0.1  0:29.17 btserver --card_i
22261 root         3  -17 60600 11620 7408 D  0.5  0.1  0:29.35 btserver --card_i
22313 root         3  -17 60600 11612 7396 D  0.5  0.1  0:29.08 btserver --card_i
22197 root         3  -17 60600 11520 7308 D  0.5  0.1  0:29.21 btserver --card_i
22169 root         3  -17 60600 11556 7340 D  0.5  0.1  0:29.05 btserver --card_i
22292 root         3  -17 60600 11628 7412 D  0.5  0.1  0:29.69 btserver --card_i
23304 root         3  -17 60600 11628 7420 S  0.5  0.1  0:07.70 btserver --card_i
22013 root         3  -17 60600 11624 7412 D  0.0  0.1  0:31.33 btserver --card_i
22140 root         3  -17 60600 11592 7376 D  0.0  0.1  0:29.00 btserver --card_i
22194 root         3  -17 60600 11616 7400 D  0.0  0.1  0:29.21 btserver --card_i
22230 root         3  -17 60600 11584 7368 D  0.0  0.1  0:29.15 btserver --card_i
22296 root         3  -17 60600 11632 7420 D  0.0  0.1  0:29.17 btserver --card_i
23130 root         3  -17 60600 11564 7352 S  0.0  0.1  0:07.62 btserver --card_i
23207 root         3  -17 60600 11604 7396 S  0.0  0.1  0:07.62 btserver --card_i

lanforge@brent-523:~
File Edit View Search Terminal Help
[lanforge@brent-523 ~]$ ps aux | grep btserver | awk '{s+=$6} END {print s}'
1233688
[lanforge@brent-523 ~]$

```

A. Changing the Min/Max RW sizes to 1MB increased the btserver memory use to about 11,600 KiB or **11.9 MB** from 10,400 KiB or **10.6 MB**. About a 1,200 KiB or **1.3 MB** difference.

The total memory increased to 1,233,000 KiB, **1,262 MB** from 1,130,000 KiB, **1,157 MB**. About a 103,000 KiB or **105 MB** difference.

7. Set the endpoints **Min/Max RW** size back to **4k**.

A. Stop all running file-IO endpoints by selecting them and clicking **Stop**.

LANforge Manager Version(5.3.4)

Control Reporting Tear-Off Info Plugins

Stop All Restart Manager Refresh HELP

Layer-4 Generic Test Mgr Test Group Resource Mgr Event Log Alerts Port Mgr vAP Stations Messages
 Status Layer-3 L3 Endps VoIP/RTP VoIP/RTP Endps Armageddon WanLinks Attenuators File-IO

Rpt Timer: default (5 s) Go Test Manager all

Select All Start Stop Quiesce Clear
 Create Modify Batch Modify Delete

Cross Connects for Selected Test Manager

Name	EID	Type	Status	Read-Bps	Rx-Bps-20s	Files-Read	Buf-RD	Bytes-RD	Write-Bps	Tx-Bps-
nfs-reader001	1.1.25...	NFS	Run	1,126,573	734,774	1,827	60,535	392,376,3...	0	
nfs-reader002	1.1.25...	NFS	Run	1,078,044	842,356	1,844	60,512	375,324,6...	0	
nfs-reader003	1.1.26...	NFS	Run	1,125,049	737,876	1,819	60,536	392,142,8...	0	
nfs-reader004	1.1.26...	NFS	Run	1,097,302	843,754	1,838	60,470	382,263,2...	0	
nfs-reader005	1.1.26...	NFS	Run	1,115,957	1,269,078	1,837	60,527	388,689,9...	0	
nfs-reader006	1.1.26...	NFS	Run	1,120,613	841,511	1,833	60,533	390,430,7...	0	
nfs-reader007	1.1.26...	NFS	Run	1,085,052	841,511	1,845	60,520	378,068,9...	0	
nfs-reader008	1.1.26...	NFS	Run	1,114,754	841,258	1,833	60,490	388,493,3...	0	
nfs-reader009	1.1.26...	NFS	Run	1,113,122	841,258	1,828	60,518	387,923,9...	0	
nfs-reader010	1.1.26...	NFS	Run	1,125,618	734,150	1,853	60,583	392,355,8...	0	
nfs-reader011	1.1.26...	NFS	Run	1,090,343	737,728	1,840	60,499	379,432,9...	0	
nfs-reader012	1.1.26...	NFS	Run	1,110,154	841,258	1,837	60,507	386,887,6...	0	
nfs-reader013	1.1.27...	NFS	Run	1,132,946	736,100	1,833	60,526	394,829,8...	0	
nfs-reader014	1.1.27...	NFS	Run	1,103,165	841,258	1,835	60,516	384,450,5...	0	
nfs-reader015	1.1.27...	NFS	Run	1,110,088	1,059,167	1,835	60,525	386,322,4...	0	
nfs-reader016	1.1.27...	NFS	Run	1,112,573	741,417	1,832	60,520	387,186,6...	0	
nfs-reader017	1.1.27...	NFS	Run	1,125,686	734,296	1,825	60,500	392,298,4...	0	

Logged in to: brent-523:4002 as: Admin

B. Select all file-IO endpoints and click **Batch Modify**.

LANforge File-IO Batch Modifier

Min Read Rate: NA Max Read Rate: NA

Min Write Rate: NA Max Write Rate: NA

Min-RW-Size: 4k (4 KB) Max-RW-Size: 4k (4 KB)

Min File Size: NA Max File Size: NA

Pattern: NA Prefix: NA

Server: NA Options: NA

File #: NA Flags: NA

Do-CRC: NA Retry-Timer: NA

Read/Write: NA FS-Type: NA

Quiesce After: NA (-1)

Apply OK Cancel

A. Set the **Min/Max RW sizes to 4k**.

B. Click **OK**.

8. Repeat steps **3 through 7** for **125 writers/readers** and then again for **250 writers/readers**.

9. The results from the above tests are shown in the below tables. They show how RW size affects 100, 250, and 500 NFS File-IO endpoints.

Individual Process Memory Usage (MB)				
		Number of File-IO Endpoints		
		100	250	500
RW Size	4 KB	10.6	10.8	10.8
	1 MB	11.9	11.9	11.8

Total Memory Usage (MB)				
		Number of File-IO Endpoints		
		100	250	500
RW Size	4 KB	1,157	2,804	4,134
	1 MB	1,262	3,031	6,013

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