

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**.

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-529)
- 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
- Sync-after-Write
- Sync-before-Close
- Use O_DIRECT
- Use O_LARGEFILE
- Use O_APPEND
- Do-CRC
- Unlink
- Verify-Mount
- Auto-Mount
- Un-Mount
- Lazy Unmount
- Force Unmount
- Use FSTATFS

Buttons: Apply, OK, Batch-Create, Cancel

- A. Name is **nfs-writer001**.
- B. FS-Type: **NFS**.
- C. Port is **eth1#0**.
- D. Min-RW and Max-RW sizes are **4k**.
- E. Min/Max File sizes are **1MB**.
- F. Min/Max Write rates are **100Mbps**.
- G. Quiesce After is **Forever**.
- H. Server is **10.17.1.1:/mnt/tmpfs1** (use your own file server settings here).
- I. Make sure Read/Write is set to **Write**.
- J. 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:

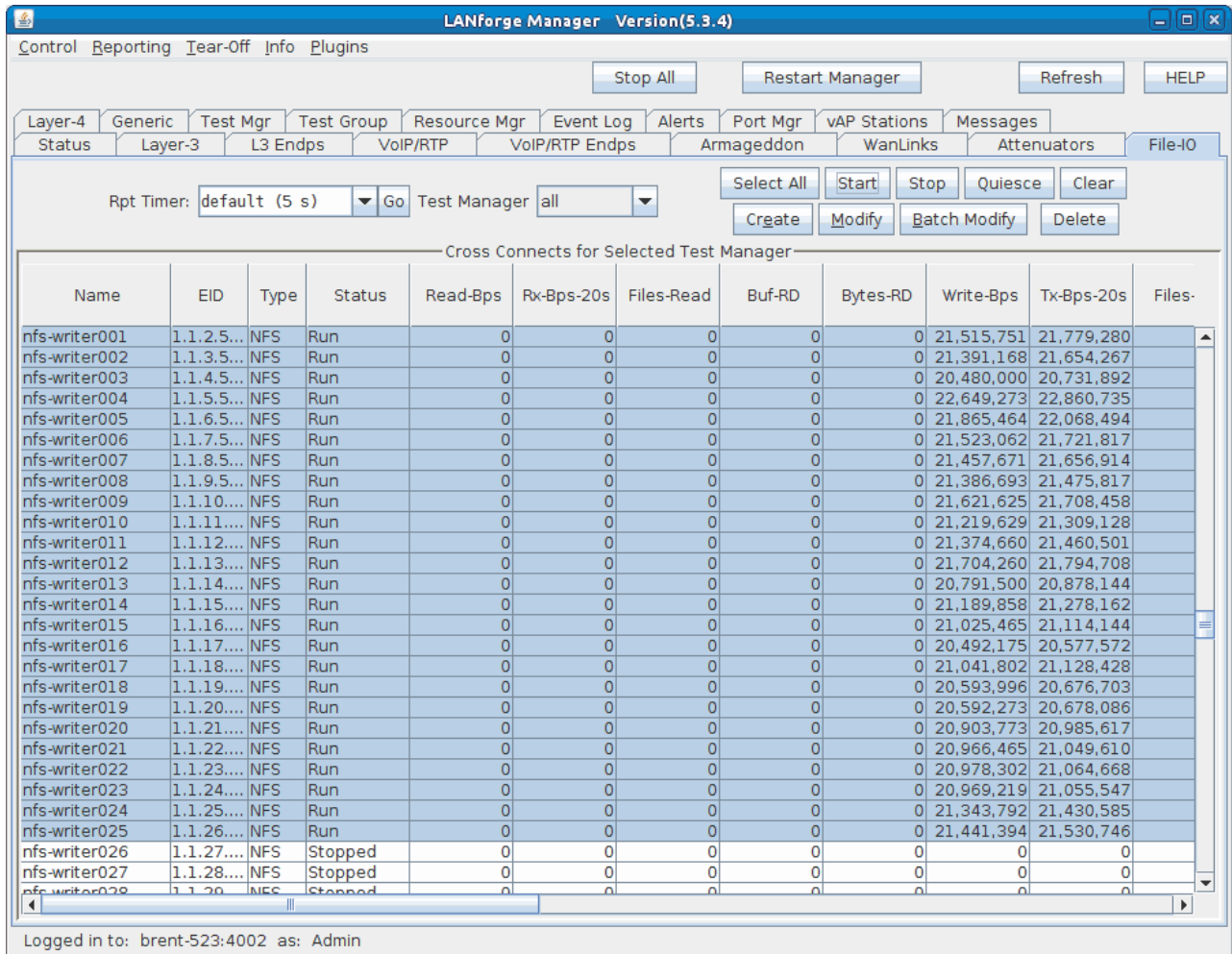
- Name: **nfs-reader001**
- Rpt Timer: default (5 s)
- FS-Type: **NFS**
- Test Manager: default_tm
- Shelf: 1
- Resource: 1 (brent-529)
- Port: **252 (eth1#250)**
- Endp ID: 0
- Min-RW-Size: **4k (4 KB)**
- Max-RW-Size: **4k (4 KB)**
- Min File Size: **Large (1 MB)**
- Max File Size: **Large (1 MB)**
- 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**
- Sync-after-Write
- Sync-before-Close
- Use O_DIRECT
- Use O_LARGEFILE
- Use O_APPEND
- Do-CRC
- Unlink
- Verify-Mount
- Auto-Mount
- Un-Mount
- Lazy Unmount
- Force Unmount
- Use FSTATFS

Buttons: Apply, OK, Batch-Create, Cancel

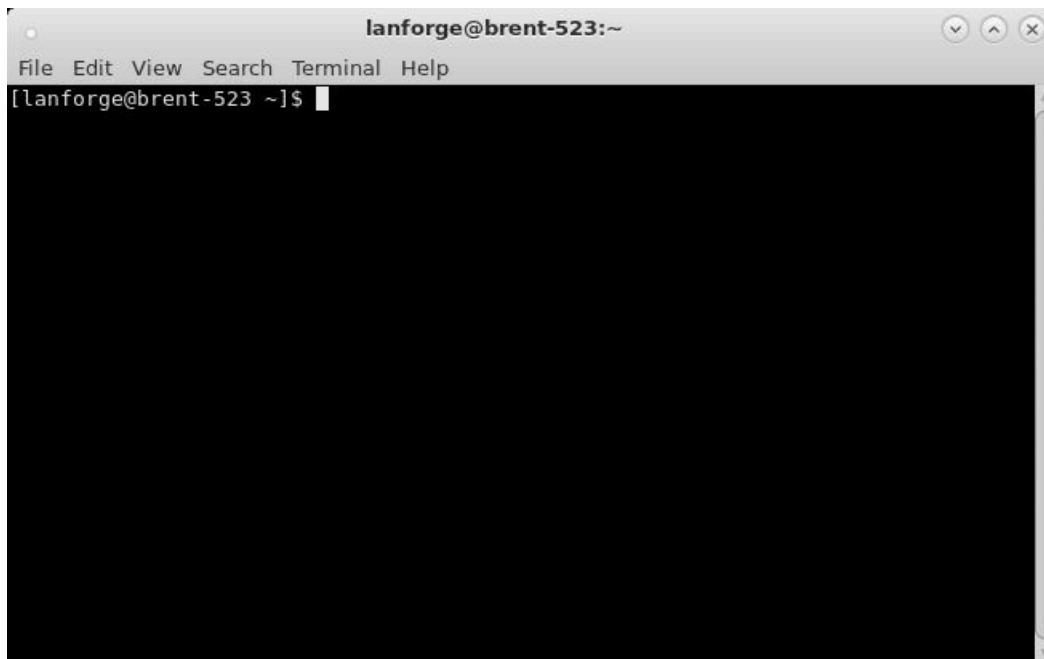
- A. Name is **nfs-reader001**.
- B. FS-Type: **NFS**.
- C. Port is **eth1#250**.
- D. Min-RW and Max-RW sizes are **4k**.
- E. Min/Max File sizes are **1MB**.
- F. Min/Max Write rates are **100Mbps**.
- G. Quiesce After is **Forever**.
- H. Server is **10.17.1.1:/mnt/tmpfs1** (use your own file server settings here).
- I. Set Read/Write to **Read**.
- J. Set Prefix to **nfs-writer001**.
- K. 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.



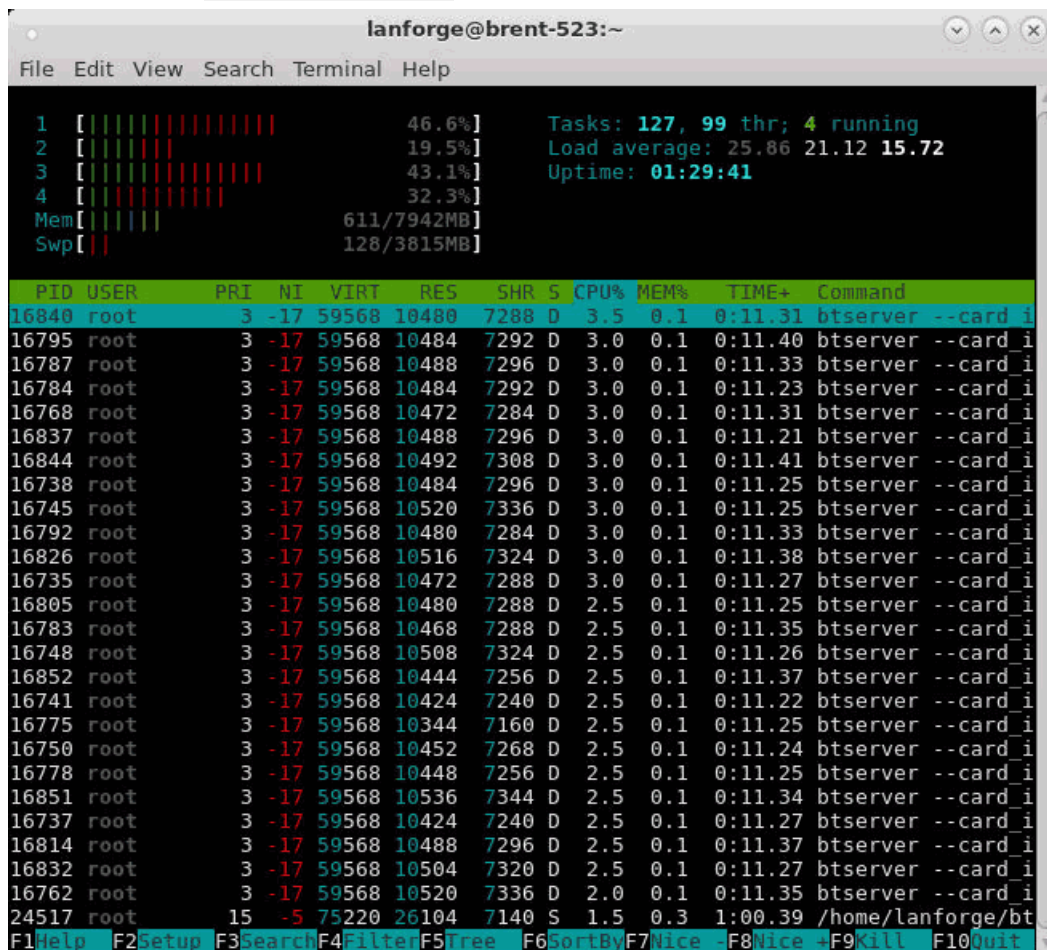
4. Now that 50 File-IO endpoints are running, the memory will be analyzed via htop.
 - A. Open a terminal on the LANforge system using a preferred method (either directly or remotely through ssh, rdesktop, or vncviewer).



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`



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.

The image shows two terminal windows from a user named lanforge on a machine named brent-523. The top terminal shows a single command execution: `ps aux | grep btserver | awk '{s+=$6} END {print s}'`, which outputs `1130916`. The bottom terminal shows a looped command: `while sleep 1; do ps aux | grep btserver | awk '{s+=$6} END {print s}'; done`, which outputs a list of memory usage values: `1130916`, `1130916`, `1130984`, `1130936`, `1130920`, `1130912`, `1130972`, `1130984`, `1130976`, `1130880`, `1130916`, `1130940`, `1130880`, `1130908`, `1130892`, and `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        15  -5 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+=$6} END {print s}'
1233688
[lanforge@brent-523 ~]$

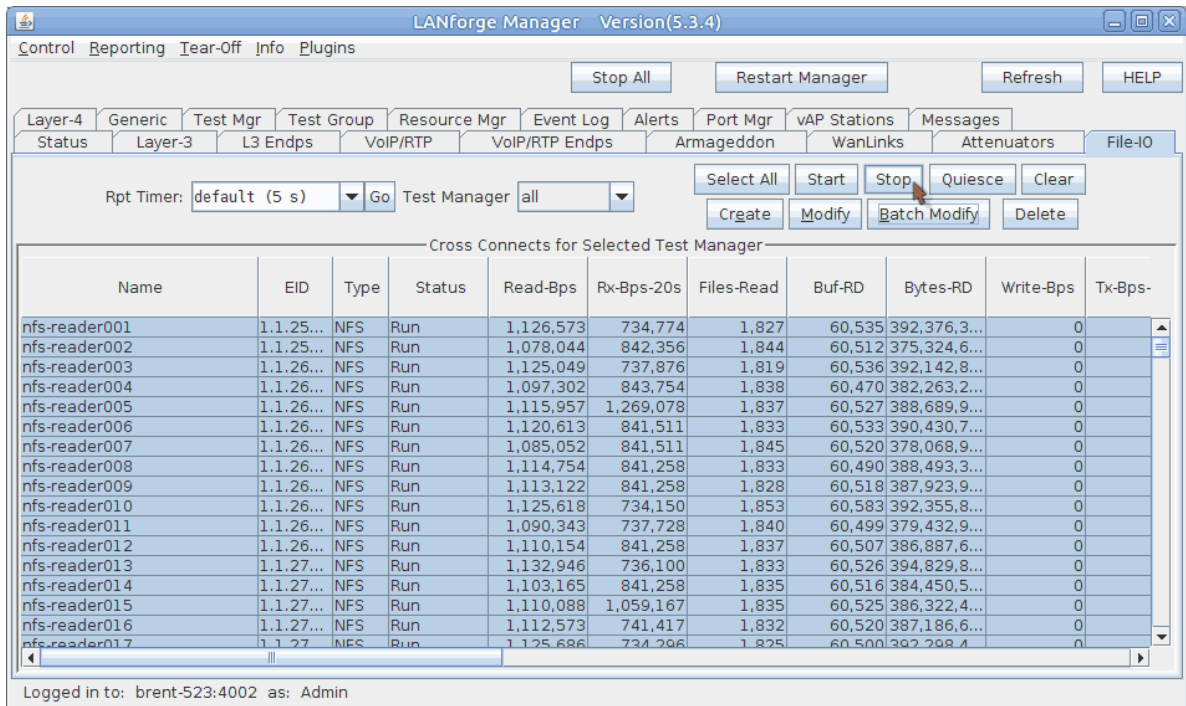
```

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.

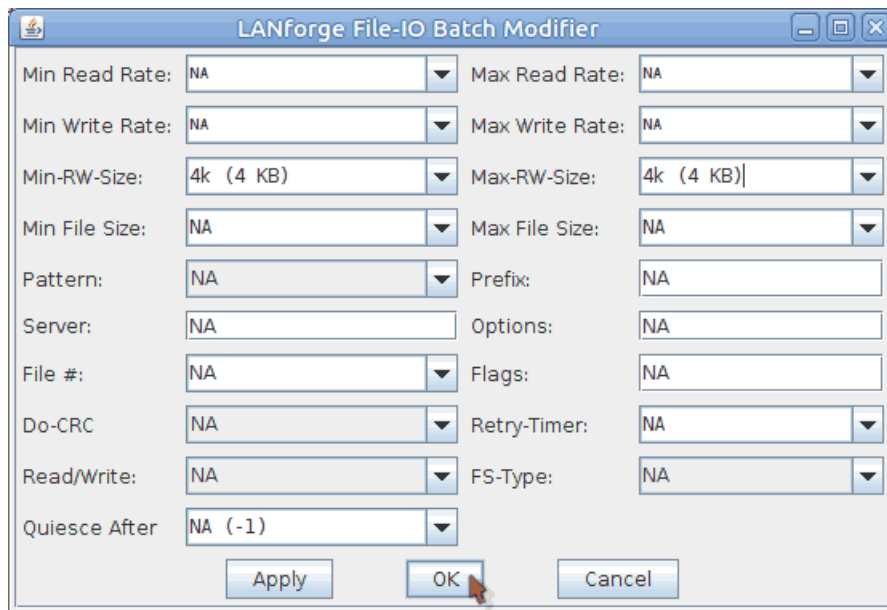
The total memory increased to 1,233,000 KiB, **1,262 MB** from 1,130,000 KiB, **1,157 MB**. About a 103,000 KiB or **105 MB** difference.

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

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



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



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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