

## Lab 9 Report

### Step 1 - File Creation:

File creation Screenshot using ls -la command

```
-rw-r--r--. 1 myamazakidorr dip 100000 Dec 2 16:42 file1.txt
-rw-r--r--. 1 myamazakidorr dip 1000000 Dec 2 16:42 file2.txt
-rw-r--r--. 1 myamazakidorr dip 10000000 Dec 2 16:42 file3.txt
-rw-r--r--. 1 myamazakidorr dip 100000000 Dec 2 16:43 file4.txt
```

### Step 2 - Reading files of differing sizes with buffer 10000:

*Time Measurements:*

	file1.txt	file2.txt	file3.txt	file4.txt
<b>real</b>	0m0.010s	0m0.011s	0m0.014s	0m0.053s
<b>user</b>	0m0.000s	0m0.000s	0m0.002s	0m0.016s
<b>sys</b>	0m0.002s	0m0.002s	0m0.005s	0m0.031s

*Analysis:*

As seen from the data, the bigger the file size, the longer it takes to read it completely which is to be expected.

### Step 3 - Reading files with various buffer sizes:

*Time Measurements:*

file1.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.010s	0m0.009s	0m0.009s	0m0.009s
<b>user</b>	0m0.001s	0m0.002s	0m0.002s	0m0.000s
<b>sys</b>	0m0.002s	0m0.000s	0m0.000s	0m0.002s

file2.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.009s	0m0.009s	0m0.009s	0m0.009s
<b>user</b>	0m0.003s	0m0.000s	0m0.001s	0m0.001s
<b>sys</b>	0m0.000s	0m0.003s	0m0.002s	0m0.001s

file3.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.017s	0m0.014s	0m0.013s	0m0.011s
<b>user</b>	0m0.004s	0m0.002s	0m0.002s	0m0.000s
<b>sys</b>	0m0.006s	0m0.005s	0m0.004s	0m0.005s

file4.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.071s	0m0.042s	0m0.033s	0m0.028s
<b>user</b>	0m0.034s	0m0.011s	0m0.010s	0m0.001s
<b>sys</b>	0m0.031s	0m0.023s	0m0.017s	0m0.019s

#### *Analysis:*

For file1.txt and file2.txt, the different buffer sizes don't significantly change the amount of time it takes to read the file. Starting from file3.txt, we see a drastic decrease in time from buffer size 100 to 1000 as seen by 0m0.017s vs 0m0.014s for file3.txt and 0m0.071s vs 0m0.042s for file4.txt. With further reducing improvements for higher buffer sizes. This is expected since higher buffer sizes can hold more data, thus reducing the amount of time it takes to read a file. The reason we are only seeing improvements in file 3 and file 4 may be that file 1 and file 2 are too small to be significantly impacted by greater buffer sizes.

#### **Step 4 - Reading and Copying files with various buffer sizes:**

##### *Time Measurements:*

file1.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.068s	0m0.022s	0m0.021s	0m0.022s
<b>user</b>	0m0.000s	0m0.002s	0m0.003s	0m0.000s
<b>sys</b>	0m0.024s	0m0.001s	0m0.000s	0m0.002s

file2.txt	Buffer Size			
	100	1000	10000	100000
<b>real</b>	0m0.055s	0m0.040s	0m0.041s	0m0.040s
<b>user</b>	0m0.003s	0m0.001s	0m0.002s	0m0.000s
<b>sys</b>	0m0.002s	0m0.004s	0m0.003s	0m0.004s

file3.txt	Buffer Size			
	100	1000	10000	100000
real	0m0.152s	0m0.145s	0m0.139s	0m0.148s
user	0m0.008s	0m0.004s	0m0.000s	0m0.000s
sys	0m0.020s	0m0.019s	0m0.018s	0m0.020s

file4.txt	Buffer Size			
	100	1000	10000	100000
real	0m1.317s	0m1.283s	0m1.254s	0m1.166s
user	0m0.073s	0m0.036s	0m0.022s	0m0.005s
sys	0m0.141s	0m0.159s	0m0.174s	0m0.130s

#### Analysis:

For file1.txt and file2.txt, there are drastic reductions in time taken from buffer sizes 100 to 1000 (0m0.068s to 0m0.022s for file1.txt and 0m0.055s to 0m0.040s for file2.txt), with reduced reductions for greater buffer size. For file3.txt, there are reductions in time from buffer sizes 100 to 1000 to 10000 with an increase for buffer size 100000, which may just be an outlier, since it is expected that the time performance would become better with greater buffer sizes. For file4.txt, as the buffer size increases, the time taken to copy the file reduces.

#### Step 5 - Reading files and copying them 2, 8, 32, and 64 times with various buffer sizes:

##### Time Measurements:

File: file1.txt	Number of Copies			
Buffer: 100	2	8	32	64
real	0m0.121s	0m0.166s	0m0.396s	0m0.209s
user	0m0.003s	0m0.014s	0m0.092s	0m0.194s
sys	0m0.020s	0m0.061s	0m0.270s	0m0.128s
File: file1.txt	Number of Copies			
Buffer: 1000	2	8	32	64
real	0m0.023s	0m0.037s	0m0.071s	0m0.128s
user	0m0.002s	0m0.032s	0m0.105s	0m0.182s
sys	0m0.002s	0m0.006s	0m0.022s	0m0.034s
File: file1.txt	Number of Copies			
Buffer: 10000	2	8	32	64

<b>real</b>	0m0.021s	0m0.034s	0m0.069s	0m0.119s
<b>user</b>	0m0.001s	0m0.025s	0m0.096s	0m0.156s
<b>sys</b>	0m0.002s	0m0.008s	0m0.018s	0m0.037s
<b>File: file1.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 100000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.022s	0m0.036s	0m0.105s	0m0.148s
<b>user</b>	0m0.000s	0m0.028s	0m0.095s	0m0.185s
<b>sys</b>	0m0.004s	0m0.005s	0m0.018s	0m0.042s
<b>File: file2.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 100</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.083s	0m0.161s	0m0.400s	0m0.710s
<b>user</b>	0m0.016s	0m0.353s	0m1.045s	0m2.075s
<b>sys</b>	0m0.003s	0m0.024s	0m0.050s	0m0.138s
<b>File: file2.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 1000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.101s	0m0.164s	0m0.399s	0m0.742s
<b>user</b>	0m0.056s	0m0.387s	0m1.132s	0m2.071s
<b>sys</b>	0m0.007s	0m0.025s	0m0.058s	0m0.144s
<b>File: file2.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 10000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.100s	0m0.173s	0m0.395s	0m0.727s
<b>user</b>	0m0.040s	0m0.400s	0m1.106s	0m2.046s
<b>sys</b>	0m0.006s	0m0.019s	0m0.062s	0m0.111s
<b>File: file2.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 100000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.074s	0m0.166s	0m0.409s	0m0.694s
<b>user</b>	0m0.025s	0m0.417s	0m1.108s	0m1.831s
<b>sys</b>	0m0.004s	0m0.021s	0m0.059s	0m0.113s
<b>File: file3.txt</b>	<b>Number of Copies</b>			

<b>Buffer: 100</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.566s	0m1.492s	0m4.972s	0m10.873s
<b>user</b>	0m0.344s	0m2.838s	0m9.215s	0m16.511s
<b>sys</b>	0m0.026s	0m0.098s	0m0.454s	0m0.924s
<b>File: file3.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 1000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.531s	0m1.734s	0m5.061s	0m10.270s
<b>user</b>	0m0.400s	0m2.733s	0m9.020s	0m15.587s
<b>sys</b>	0m0.031s	0m0.132s	0m0.509s	0m0.902s
<b>File: file3.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 10000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.528s	0m1.513s	0m5.408s	0m10.550s
<b>user</b>	0m0.377s	0m2.607s	0m9.142s	0m16.242s
<b>sys</b>	0m0.026s	0m0.128s	0m0.521s	0m0.953s
<b>File: file3.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 100000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m0.502s	0m1.424s	0m5.026s	0m10.563s
<b>user</b>	0m0.384s	0m2.463s	0m9.191s	0m16.624s
<b>sys</b>	0m0.030s	0m0.131s	0m0.456s	0m0.909s
<b>File: file4.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 100</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m5.575s	0m14.224s	0m40.282s	1m8.085s
<b>user</b>	0m3.080s	0m20.468s	1m16.094s	2m33.146s
<b>sys</b>	0m0.240s	0m0.980s	0m3.640s	0m6.078s
<b>File: file4.txt</b>	<b>Number of Copies</b>			
<b>Buffer: 1000</b>	<b>2</b>	<b>8</b>	<b>32</b>	<b>64</b>
<b>real</b>	0m4.241s	0m14.510s	0m42.500s	1m4.446s
<b>user</b>	0m3.375s	0m19.357s	1m15.599s	2m25.273s
<b>sys</b>	0m0.220s	0m1.112s	0m4.023s	0m6.460s

File: file4.txt	Number of Copies			
Buffer: 10000	2	8	32	64
<b>real</b>	0m4.458s	0m16.854s	0m40.196s	1m3.374s
<b>user</b>	0m2.922s	0m19.302s	1m15.647s	2m21.864s
<b>sys</b>	0m0.248s	0m1.353s	0m4.277s	0m6.359s
File: file4.txt	Number of Copies			
Buffer: 100000	2	8	32	64
<b>real</b>	0m4.278s	0m15.246s	0m41.123s	1m4.836s
<b>user</b>	0m2.902s	0m20.308s	1m14.895s	2m19.719s
<b>sys</b>	0m0.251s	0m1.156s	0m4.620s	0m6.200s

*Analysis:*

As seen from the data, as the number of copies increases, the longer it takes for the program to finish execution. In general, the greater the buffer size leads to reduced completion time, however there are outliers here and there. Overall, the results are not surprising and are as expected.