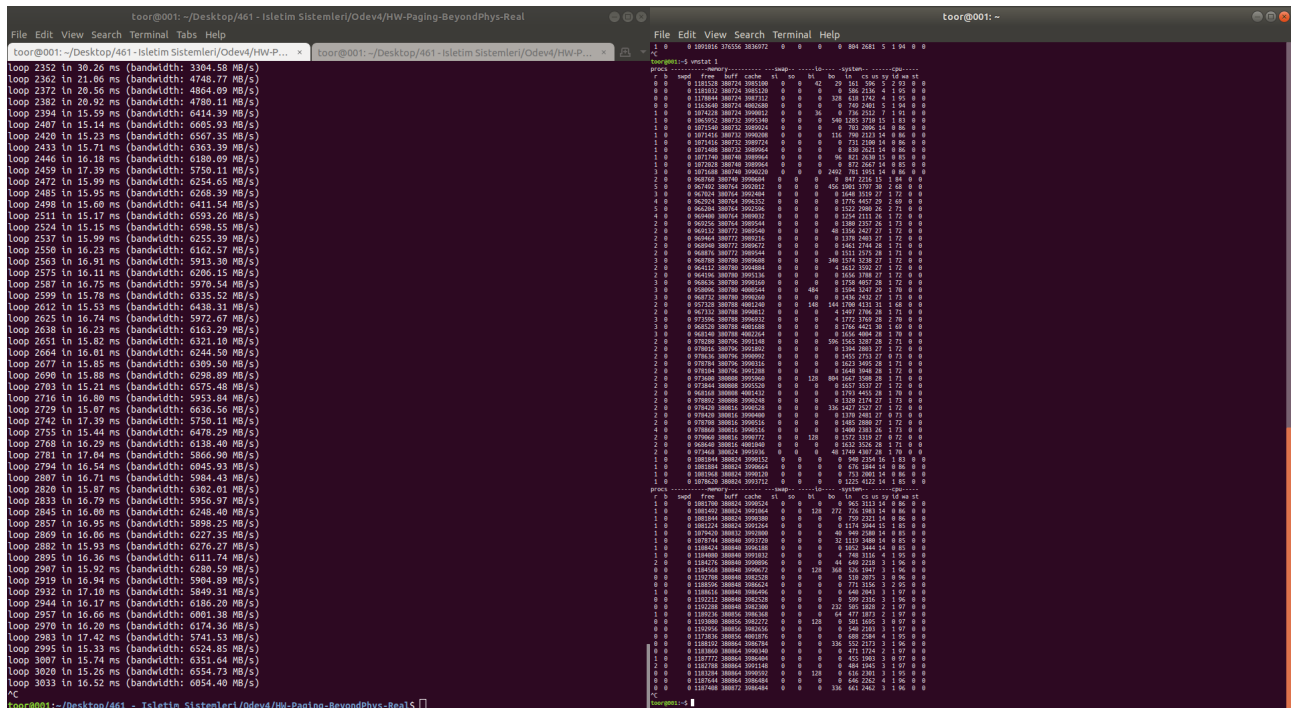


Bil 461 – Ödev 4
Fatih Furkan Has
141101024

1-)



Sol taraftaki terminalde ./mem 100 komutu sağ taraftaki terminalde ise vmstat 1 komutunu çalıştırdım. Daha sonra ise sol taraftaki terminalde yeni bir sekme açarak bir ./mem 100 komutu daha çalıştırdım. Us değeri ilk başta en yüksek 7 değerine ulaştı tek bir mem çalışırken ise 15 değerine kadar çıktı ikinci mem çalışırken ise bu değer 30'a kadar ulaştı. Cpu usage için ise man vmstat yazarak kolonların neyi ifade ettiğine baktım sonuç:

CPU

These are percentages of total CPU time.

us: Time spent running non-kernel code. (user time, including nice time)

sy: Time spent running kernel code. (system time)

id: Time spent idle. Prior to Linux 2.5.41, this includes IO-wait time.

wa: Time spent waiting for IO. Prior to Linux 2.5.41, included in idle.

st: Time stolen from a virtual machine. Prior to Linux 2.6.11, unknown.

St ve wa değerleri hep 0 olarak kaldı. Sy değeri 0-2 arasında oldu. Us değeri ise yukarıda açıkladığım şekilde oldu.

2-)

```
toor@001: ~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real
File Edit View Search Terminal Help
loop 410 tn 162.39 ms (bandwidth: 6365.99 MB/s)
loop 412 tn 162.48 ms (bandwidth: 6362.24 MB/s)
loop 414 tn 160.03 ms (bandwidth: 6398.92 MB/s)
loop 416 tn 164.07 ms (bandwidth: 6241.05 MB/s)
loop 418 tn 168.10 ms (bandwidth: 6091.79 MB/s)
loop 420 tn 168.96 ms (bandwidth: 6060.47 MB/s)
loop 422 tn 166.03 ms (bandwidth: 6167.38 MB/s)
loop 424 tn 162.56 ms (bandwidth: 6299.06 MB/s)
loop 426 tn 164.77 ms (bandwidth: 6214.57 MB/s)
loop 428 tn 163.49 ms (bandwidth: 6263.39 MB/s)
loop 430 tn 160.31 ms (bandwidth: 6387.55 MB/s)
loop 432 tn 164.53 ms (bandwidth: 6223.79 MB/s)
loop 434 tn 168.99 ms (bandwidth: 6050.38 MB/s)
loop 436 tn 162.10 ms (bandwidth: 6316.93 MB/s)
loop 438 tn 160.91 ms (bandwidth: 6363.64 MB/s)
loop 440 tn 166.20 ms (bandwidth: 6161.10 MB/s)
loop 442 tn 160.26 ms (bandwidth: 6389.78 MB/s)
loop 444 tn 160.98 ms (bandwidth: 6360.84 MB/s)
loop 446 tn 165.32 ms (bandwidth: 6194.02 MB/s)
loop 448 tn 159.52 ms (bandwidth: 6419.34 MB/s)
loop 450 tn 162.78 ms (bandwidth: 6290.89 MB/s)
loop 452 tn 168.92 ms (bandwidth: 6061.94 MB/s)
loop 454 tn 161.45 ms (bandwidth: 6342.45 MB/s)
loop 456 tn 157.84 ms (bandwidth: 6487.50 MB/s)
loop 458 tn 165.74 ms (bandwidth: 6178.47 MB/s)
loop 460 tn 162.42 ms (bandwidth: 6304.69 MB/s)
loop 462 tn 158.08 ms (bandwidth: 6477.65 MB/s)
loop 464 tn 164.50 ms (bandwidth: 6224.96 MB/s)
loop 466 tn 159.98 ms (bandwidth: 6480.64 MB/s)
loop 468 tn 165.58 ms (bandwidth: 6184.37 MB/s)
loop 470 tn 165.64 ms (bandwidth: 6182.16 MB/s)
loop 472 tn 159.92 ms (bandwidth: 6483.33 MB/s)
loop 474 tn 168.01 ms (bandwidth: 6095.02 MB/s)
loop 476 tn 160.43 ms (bandwidth: 6382.69 MB/s)
loop 478 tn 158.87 ms (bandwidth: 6445.69 MB/s)
loop 480 tn 160.93 ms (bandwidth: 6363.14 MB/s)
loop 482 tn 165.98 ms (bandwidth: 6169.56 MB/s)
loop 484 tn 159.10 ms (bandwidth: 6436.08 MB/s)
loop 486 tn 162.14 ms (bandwidth: 6315.34 MB/s)
loop 488 tn 164.41 ms (bandwidth: 6228.22 MB/s)
loop 490 tn 159.71 ms (bandwidth: 6411.62 MB/s)
loop 492 tn 158.26 ms (bandwidth: 6470.41 MB/s)
loop 494 tn 164.84 ms (bandwidth: 6211.90 MB/s)
loop 496 tn 160.34 ms (bandwidth: 6386.31 MB/s)
loop 498 tn 160.53 ms (bandwidth: 6378.71 MB/s)
loop 500 tn 161.55 ms (bandwidth: 6338.68 MB/s)
loop 502 tn 171.39 ms (bandwidth: 5974.25 MB/s)
loop 504 tn 166.21 ms (bandwidth: 6160.70 MB/s)
loop 506 tn 165.91 ms (bandwidth: 6172.09 MB/s)
loop 508 tn 162.95 ms (bandwidth: 6284.29 MB/s)
loop 510 tn 161.34 ms (bandwidth: 6346.85 MB/s)
loop 512 tn 174.61 ms (bandwidth: 5864.57 MB/s)
loop 514 tn 173.47 ms (bandwidth: 5903.07 MB/s)
loop 516 tn 165.33 ms (bandwidth: 6193.03 MB/s)
loop 518 tn 161.91 ms (bandwidth: 6324.42 MB/s)
loop 520 tn 168.75 ms (bandwidth: 6068.26 MB/s)
^C
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real

File Edit View Search Terminal Help
0 0 0 0 1574 4984 16 2 82 0 0
0 0 0 0 922 2876 14 1 85 0 0
0 0 0 0 882 2633 14 0 85 0 0
0 0 0 0 28 889 2516 14 1 85 0 0
0 0 0 0 8 717 1985 14 0 86 0 0
0 0 0 0 92 1653 4549 16 1 83 0 0
0 0 0 0 1854 6114 18 1 81 0 0
0 0 0 0 1487 5733 14 1 85 0 0
0 0 0 0 568 1489 5478 17 2 82 0 0
procs -----memory----- --swap----- --lo-- --system-- --cpu--
r b swpd free buff cache si so bi bo in cs us sy id wa st
1 0 0 186424 382864 3933088 0 0 484 508 1531 5981 15 1 84 0 0
1 0 0 185376 382864 3933640 0 0 0 1016 3790 14 0 86 0 0
4 0 0 176184 382864 3943408 0 0 32 108 1281 5468 16 1 84 0 0
1 0 0 175064 382864 3943928 0 0 108 12 1023 6596 17 1 82 0 0
1 0 0 155312 382864 3923568 0 0 0 4 1213 4958 14 1 85 0 0
1 0 0 184496 382872 3933816 0 0 0 108 1325 5675 15 1 85 0 0
1 0 0 183848 382872 3934728 0 0 0 4 1842 8177 17 2 81 0 0
2 0 0 184552 382872 3934216 0 0 0 1421 5083 15 1 84 0 0
1 0 0 183776 382872 3934920 0 0 128 0 1226 5084 14 1 85 0 0
1 0 0 183832 382872 3934512 0 0 0 0 1177 4669 15 1 85 0 0
1 0 0 184316 382912 3934056 0 0 0 528 1486 5566 15 1 84 0 0
1 0 0 184104 382912 3934624 0 0 0 0 1176 4814 15 1 85 0 0
1 0 0 184796 382912 3934140 0 0 0 0 1442 6196 15 1 84 0 0
2 0 0 183488 382912 3936600 0 0 0 0 1207 4459 15 0 85 0 0
1 0 0 183344 382912 3935664 0 0 128 0 1147 4414 14 0 85 0 0
1 0 0 184680 382912 3934268 0 0 0 816 1305 4991 14 1 85 0 0
2 0 0 185956 382912 3932684 0 0 0 0 1844 5998 17 1 82 0 0
1 0 0 186876 382912 3932780 0 0 0 0 1281 4365 14 0 86 0 0
1 0 0 191160 382912 3928140 0 0 0 0 830 2375 13 0 87 0 0
1 0 0 192100 382920 3927692 0 0 0 368 883 2725 14 0 86 0 0
1 0 0 192320 382920 3927132 0 0 128 0 723 2024 14 0 86 0 0
1 0 0 192396 382920 3927456 0 0 0 0 723 2082 14 0 86 0 0
1 0 0 192648 382920 3926944 0 0 0 0 792 2028 14 0 86 0 0
1 0 0 192152 382920 3927456 0 0 0 0 688 1955 14 0 86 0 0
1 0 0 192684 382920 3927072 0 0 0 0 775 2084 14 1 86 0 0
1 0 0 192648 382928 3927072 0 0 0 48 704 1925 13 0 86 0 0
1 0 0 193888 382936 3927708 0 0 128 944 796 1945 13 0 86 0 0
1 0 0 193316 382936 3927196 0 0 0 0 748 1976 14 0 86 0 0
1 0 0 192840 382936 3927708 0 0 0 0 724 1943 13 0 86 0 0
1 0 0 192636 382944 3927708 0 0 0 72 785 2080 14 0 86 0 0
1 0 0 193336 382944 3927192 0 0 0 0 863 2246 14 1 86 0 0
1 0 0 193212 382944 3927704 0 0 0 0 680 1868 14 0 86 0 0
2 0 0 193180 382944 3927704 0 0 0 0 744 1974 14 0 86 0 0
2 0 0 193116 382944 3927192 0 0 128 0 834 1966 13 0 86 0 0
1 0 0 192468 382952 3927832 0 0 124 827 2127 13 1 86 0 0
1 0 0 192704 382952 3927376 0 0 0 0 879 2727 14 0 86 0 0
4 0 0 192220 382952 3927844 0 0 0 0 713 2129 14 0 86 0 0
1 0 0 181684 382952 3938388 0 0 0 0 1304 4460 14 1 85 0 0
0 0 0 1242812 382968 3928148 0 0 0 0 1115 3677 12 1 87 0 0
0 0 0 1242128 382968 3927648 0 0 0 80 652 2756 3 1 97 0 0
0 0 0 1231984 382968 3938588 0 0 128 332 649 2442 3 1 96 0 0
0 0 0 1231888 382968 3938304 0 0 0 0 507 1966 3 1 97 0 0
0 0 0 1242156 382968 3927124 0 0 0 0 538 1948 3 1 96 0 0
0 0 0 1246848 382968 3923152 0 0 0 0 429 1648 2 1 97 0 0
0 0 0 1242568 382968 3927620 0 0 0 0 529 2072 3 1 97 0 0
^C
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real
```

Kırmızı ile gösterdiğim anda ./mem 1024 proccess'ini durdum. Çıktıları incelediğimizde ise program sonlandığında free değerimiz artış göstermiştir. Çalışırken ve sonlandıktan sonra ise sürekli olarak artış ve azalış göstermiştir.

3-)

```
toor@001: ~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real
File Edit View Search Terminal Help
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real$ ls -al
total 40
drwxrwxr-x 2 toor toor 4096 Haz 28 20:59
drwxrwxr-x 3 toor toor 4096 Haz 28 21:59
-rw-r--r-- 1 toor toor 58 Tem 6 2016 Makefile
-rw-r--r-- 1 toor toor 239 Tem 6 2016 _Makefile
-rwxr-xr-x 1 toor toor 12856 Haz 28 20:59 mem
-rw-r--r-- 1 toor toor 239 Tem 6 2016 _mem.c
-rw-r--r-- 1 toor toor 1035 Tem 6 2016 mem.c
-rw-r--r-- 1 toor toor 2901 Tem 6 2016 README
-rw-r--r-- 1 toor toor 239 Tem 6 2016 _README
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real$ ./mem 4096
allocating 4294967296 bytes (4096.00 MB)
number of integers in array: 1073741824
loop 0 in 1550.46 ms (bandwidth: 2641.79 MB/s)
loop 1 in 616.88 ms (bandwidth: 6639.83 MB/s)
loop 2 in 616.44 ms (bandwidth: 6644.60 MB/s)
loop 3 in 612.23 ms (bandwidth: 6690.31 MB/s)
loop 4 in 613.57 ms (bandwidth: 6675.72 MB/s)
loop 5 in 617.02 ms (bandwidth: 6638.34 MB/s)
loop 6 in 615.59 ms (bandwidth: 6653.82 MB/s)
loop 7 in 621.20 ms (bandwidth: 6593.65 MB/s)
loop 8 in 614.81 ms (bandwidth: 6670.94 MB/s)
loop 9 in 636.33 ms (bandwidth: 6436.89 MB/s)
loop 10 in 619.01 ms (bandwidth: 6617.86 MB/s)
loop 11 in 615.17 ms (bandwidth: 6658.32 MB/s)
loop 12 in 616.11 ms (bandwidth: 6648.18 MB/s)
loop 13 in 617.16 ms (bandwidth: 6636.90 MB/s)
^C
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real$ ./mem 5000
allocating 5242880000 bytes (5000.00 MB)
number of integers in array: 1310720000
loop 0 in 1952.94 ms (bandwidth: 2589.24 MB/s)
loop 1 in 750.05 ms (bandwidth: 6666.23 MB/s)
loop 2 in 749.11 ms (bandwidth: 6674.62 MB/s)
loop 3 in 744.26 ms (bandwidth: 6718.06 MB/s)
loop 4 in 764.57 ms (bandwidth: 6539.59 MB/s)
loop 5 in 749.24 ms (bandwidth: 6673.39 MB/s)
loop 6 in 750.39 ms (bandwidth: 6663.21 MB/s)
loop 7 in 748.25 ms (bandwidth: 6682.29 MB/s)
loop 8 in 765.86 ms (bandwidth: 6528.59 MB/s)
loop 9 in 766.90 ms (bandwidth: 6519.79 MB/s)
loop 10 in 774.52 ms (bandwidth: 6455.60 MB/s)
^C
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real$ ./mem 6000
allocating 6291456000 bytes (6000.00 MB)
number of integers in array: 157264000
loop 0 in 3287.90 ms (bandwidth: 1824.87 MB/s)
loop 1 in 980.88 ms (bandwidth: 6116.96 MB/s)
loop 2 in 905.93 ms (bandwidth: 6623.86 MB/s)
loop 3 in 903.64 ms (bandwidth: 6639.81 MB/s)
loop 4 in 907.37 ms (bandwidth: 6612.51 MB/s)
loop 5 in 902.18 ms (bandwidth: 6650.58 MB/s)
loop 6 in 899.06 ms (bandwidth: 6672.66 MB/s)
loop 7 in 912.78 ms (bandwidth: 6573.35 MB/s)
loop 8 in 903.77 ms (bandwidth: 6638.89 MB/s)
^C
toor@001:~/Desktop/461 - Isletim Sistemleri/Odev4/HW-Paging-BeyondPhys-Real$
```

```
toor@001:~$ vmstat 1
procs-----memory-----swap-----io-----system-----cpu-----
r b swpd free buff cache si so bi bo in cs us sy id wa st
0 0 0 3799020 244100 2406048 0 0 1634 58 431 934 13 0 77 1 0
0 0 0 3807400 244100 2403524 0 0 0 0 479 1650 2 1 97 0 0
0 0 0 3807616 244100 2403508 0 0 0 0 169 476 0 0 100 0 0
0 0 0 3824332 244100 2387764 0 0 0 0 48 483 1082 1 1 98 0 0
0 0 0 3824976 244100 2387244 0 0 0 0 281 1382 1 0 98 0 0
0 0 0 3824480 244112 2387924 0 0 4 0 204 689 0 0 100 0 0
0 0 0 3824892 244112 2387908 0 0 0 0 332 360 1226 1 0 99 0 0
1 0 0 3593684 244128 2387524 0 0 10 120 353 867 1 1 98 0 0
1 0 0 3577204 244128 2386244 0 0 0 0 402 449 6 6 97 0 0
1 0 0 3599020 242000 1860740 0 0 0 0 569 824 10 4 86 0 0
1 0 0 149588 242000 1862020 0 0 0 0 481 763 13 0 87 0 0
1 0 0 147604 242000 1863820 0 0 0 7944 470 580 13 0 87 0 0
1 0 0 147604 242000 1863820 0 0 0 0 451 614 13 0 87 0 0
1 0 0 148972 242000 1862444 0 0 0 60 456 646 13 0 87 0 0
2 0 0 146056 242000 1864580 0 0 0 0 428 556 13 0 87 0 0
1 0 0 148692 242000 1862796 0 0 0 0 491 607 13 0 87 0 0
2 0 0 148692 242000 1862804 0 0 0 0 276 477 279 13 0 87 0 0
0 0 0 4346040 242616 1867932 0 0 0 0 340 511 1134 9 1 90 0 0
0 0 0 4345900 242616 1867900 0 0 0 0 289 514 0 0 100 0 0
^C
toor@001:~$ vmstat 1
procs-----memory-----swap-----io-----system-----cpu-----
r b swpd free buff cache si so bi bo in cs us sy id wa st
0 0 0 4350536 243136 1862976 0 0 1411 58 378 822 12 7 80 1 0
0 0 0 4342180 243144 1865276 0 0 2824 48 544 2319 1 1 98 0 0
2 0 0 4322636 243144 1884492 0 0 0 0 529 1731 2 1 97 0 0
0 0 0 4311444 243144 1891792 0 0 0 0 279 1207 1 1 99 0 0
0 0 0 4332384 243144 1871300 0 0 0 0 261 1061 1 0 99 0 0
1 0 0 3703248 243144 1867512 0 0 0 0 276 815 2 2 96 0 0
1 0 0 391740 243144 1867508 0 0 0 0 580 692 7 6 87 0 0
1 0 1024 153016 83180 1098162 0 724 200 776 734 905 0 0 84 0 0
1 0 1024 149204 83180 1093844 0 0 1920 0 440 615 13 0 87 0 0
1 0 1024 146476 83180 1099756 0 0 0 0 397 556 13 0 87 0 0
1 0 1024 145112 83180 1098162 0 0 1940 0 477 553 13 0 87 0 0
1 0 1024 145112 83180 1098162 0 0 0 0 408 533 13 0 87 0 0
1 0 1024 146244 83192 1096572 0 0 40 0 460 732 13 0 87 0 0
1 0 1024 146724 83192 1096120 0 0 0 0 405 520 13 0 87 0 0
1 1 1024 145900 83192 1096860 0 0 476 0 895 2195 3 1 86 0 0
^C
toor@001:~$ vmstat 1
procs-----memory-----swap-----io-----system-----cpu-----
r b swpd free buff cache si so bi bo in cs us sy id wa st
1 0 1024 5240092 83892 1122272 0 1 1261 52 343 748 11 7 81 1 0
0 0 1024 515328 83892 1119160 0 0 24 0 575 2214 2 1 97 0 0
0 0 1024 5249348 83900 1121080 0 0 0 0 64 188 696 0 0 99 0 0
0 0 1024 5265328 83900 1105104 0 0 0 0 295 988 1 0 99 0 0
0 0 1024 5267436 83900 1105376 0 0 0 0 143 440 0 0 100 0 0
1 0 1024 2990816 83900 1102508 0 0 132 0 429 699 6 6 89 0 0
1 0 1024 339008 83900 1102700 0 0 0 0 508 519 605 0 6 87 0 0
0 5 369192 137012 452 204904 0 338280 38452 358316 1732 2790 2 12 72 14 0
1 0 674560 222544 592 263252 0 314556 51380 314556 1933 2589 9 5 74 12 0
1 0 674560 221852 892 264552 0 0 1160 0 945 720 13 0 87 0 0
1 0 674560 216304 1464 268452 32 0 3948 536 591 716 13 0 87 0 0
1 0 674560 203680 1740 280072 116 0 12620 0 739 1289 13 0 87 0 0
1 0 674560 201312 1740 282708 16 0 1360 0 469 641 13 0 87 0 0
1 0 674560 200828 1740 283040 0 0 364 0 441 546 13 0 87 0 0
1 0 674560 200704 1740 283076 40 0 40 0 439 613 13 0 87 0 0
1 0 674368 193140 1556 290368 332 0 7516 0 701 1320 13 0 87 0 0
0 0 674048 6303280 2252 335096 28 0 30856 48 1405 3876 3 2 93 2 0
^C
toor@001:~$
```

4096 (8GB’lık bir ram’e sahibim) ile çalıştırdığımızda swpd değeri değişmedi. Ancak bu değeri 5000 ve 6000 yaptığımızda ise 0 olan swpd değer çok yüksek sayılara ulaştı ve aynı zamanda free değerleri de düşmeye başladı. Si ve so değerlerine baktığımızda da yazılan ve okunan memory değerlerini görebiliriz. Swpd değeri ilk çalıştırmada hiç değişmedi 5000 ile çalıştığında 1024 oldu, 6000 ile çalıştığında ise 674560 gibi yüksek sayılara ulaştı.

man vmstat ile si ve so değerlerinin neyi ifade ettiğini görebiliriz:

Swap

si: Amount of memory swapped in from disk (/s).

so: Amount of memory swapped to disk (/s).

Bunu 9000 ve 1000 gibi değerlerle tekrar ettiğimde ise segmentation fault hatasıyla karşılaştım.