# Programming Exercise Homework12

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Note: We had access to both a normal HD (our school computer) and semi-solid state drive (my personal mac). Thus we utilized both of these to complete our exercise.

1. Run `rdev` to find the name of the drive you're running on.
2. Run `sudo hdparm -I [drive name]` to find out information about the drive. This will tell you if you're using a solid state or a normal hard drive. It also gives you information about the number of cylinders, heads, sectors, and a bunch of other cool stuff. See below: http://www.youtube.com/watch?v=3owqvmMf6No

```
cj@cj:~/sched$ sudo hdparm -I /dev/sdb5

/dev/sdb5:

ATA device, with non-removable media
       Model Number:       WDC WD1002FAEX-00Y9A0
       Serial Number:      WD-WCAW31824989
       Firmware Revision:  05.01D05
       Transport:          Serial, SATA 1.0a, SATA II Extensions, SATA Rev 2.5,
SATA Rev 2.6
Standards:
       Supported: 8 7 6 5
       Likely used: 8
Configuration:
       Logical      max    current
       cylinders    16383   16383
       heads        16     16
       sectors/track   63         63
       --
       CHS current addressable sectors:   16514064
       LBA    user addressable sectors:  268435455
       LBA48  user addressable sectors: 1953525168
       Logical/Physical Sector size:           512 bytes
       device size with M = 1024*1024:   953869 MBytes
       device size with M = 1000*1000:   1000204 MBytes (1000 GB)
       cache/buffer size  = unknown
Capabilities:
       LBA, IORDY(can be disabled)
       Queue depth: 32
       Standby timer values: spec'd by Standard, with device specific minimum
       R/W multiple sector transfer: Max = 16  Current = 0
       Recommended acoustic management value: 128, current value: 254
       DMA: mdma0 mdma1 mdma2 udma0 udma1 udma2 udma3 udma4 udma5 *udma6
              Cycle time: min=120ns recommended=120ns
       PIO: pio0 pio1 pio2 pio3 pio4
              Cycle time: no flow control=120ns  IORDY flow control=120ns
Commands/features:
       Enabled Supported:
       *      SMART feature set
              Security Mode feature set
       *      Power Management feature set
       *      Write cache
       *      Look-ahead
       *      Host Protected Area feature set
       *      WRITE_BUFFER command
       *      READ_BUFFER command
       *      NOP cmd
```

```
        *       DOWNLOAD_MICROCODE
                Power-Up In Standby feature set
        *       SET_FEATURES required to spinup after power up
                SET_MAX security extension
                Automatic Acoustic Management feature set
        *       48-bit Address feature set
        *       Mandatory FLUSH_CACHE
        *       FLUSH_CACHE_EXT
        *       SMART error logging
        *       SMART self-test
        *       General Purpose Logging feature set
        *       64-bit World wide name
        *       {READ,WRITE}_DMA_EXT_GPL commands
        *       Segmented DOWNLOAD_MICROCODE
        *       Gen1 signaling speed (1.5Gb/s)
        *       Gen2 signaling speed (3.0Gb/s)
        *       Gen3 signaling speed (6.0Gb/s)
        *       Native Command Queueing (NCQ)
        *       Host-initiated interface power management
        *       Phy event counters
        *       NCQ priority information
        *       DMA Setup Auto-Activate optimization
        *       Software settings preservation
        *       SMART Command Transport (SCT) feature set
        *       SCT LBA Segment Access (AC2)
        *       SCT Features Control (AC4)
        *       SCT Data Tables (AC5)
                unknown 206[12] (vendor specific)
                unknown 206[13] (vendor specific)
Security:
        Master password revision code = 65534
                supported
        not     enabled
        not     locked
        not     frozen
        not     expired: security count
                supported: enhanced erase
        174min for SECURITY ERASE UNIT. 174min for ENHANCED SECURITY ERASE UNIT.
Logical Unit WWN Device Identifier: 50014ee2b06d128f
        NAA             : 5
        IEEE OUI        : 0014ee
        Unique ID       : 2b06d128f
```

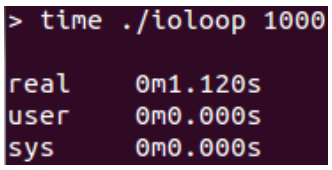
3. Use ioloop.c (from homework 4) to write characters to the disk, and see how long it takes. We were able to compare the performance of the two types of disks. When initially starting to run ioloop.c on our windows and mac, the performance was similar. As we ran ioloop.c, the disparity between the windows and mac becomes apparent. See below (left is windows, right is mac).

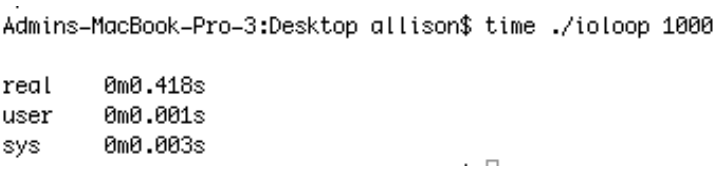
Windows:

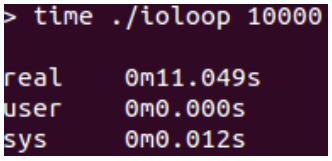
```
> time ./ioloop 100

real    0m0.159s
user    0m0.000s
sys     0m0.000s
```

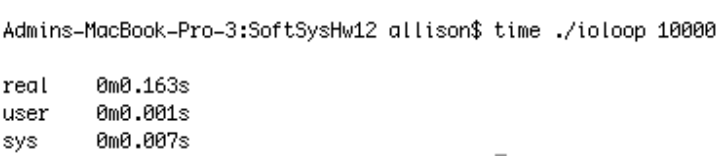
Mac:

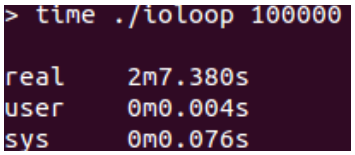
```
Admins-MacBook-Pro-3:Desktop allison$ time ./ioloop 100

real    0m0.007s
user    0m0.001s
sys     0m0.002s
```

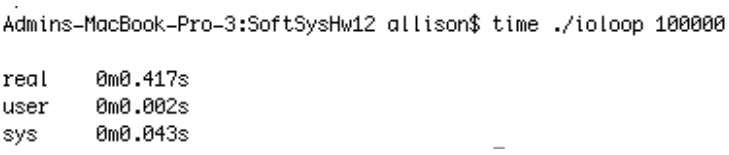



Between ioloop 1000 and 10000, we posit that ioloop.c moved from disk storage to solid state storage on the mac. (On a semi-solid state machine, programs used frequently are stored on the solid state memory while programs not used often are on the HD. When we first started ioloop.c, it hadn't been used before and thus should have been stored on the HD. But after running thousands of times, the OS moved its storage to the solid state memory). Therefore, just the last two runs truly show the difference between solid state memory and traditionally HD performance. The disparity is obvious. On the last run, the solid state memory outperformed the hard drive by over 300%.