



Operating Systems

Shell and BashScript

Fall 2020

vahid@DESKTOP-J20MVJH:~\$ cat os.logo
.....Operating Systems.....



```
.....K.....
.....E.....
.....M E M O R Y.....P R O C E S S.....
.....A N.....Presented By:.....Y.....
.....N E.....Professor Mohsen Sharifi.....S.....
.....A L.....-----.....T.....
.....G.....Tutors:.....T H R E A D.....
.....E.....Vahid Mohsseni.....M.....
.....M.....Ehsan SeyedAliAkbar.....C.....
..S C H E D U L E R.....Farbod Shahinfar.....A.....
.....N.....M A L L O C.....
.....T.....Iran University of Science and Technology.....L.....
.....Fall 2020.....
```

```
vahid@DESKTOP-J20MVJH:~$ curl -L https://os-course.github.io/fall20/ClassTime
>>>> SCHEDULE <<<<<br>
> Sundays and Tuesdays <<br>
> 10:30 - 12:00 <<br>

```

Groups Collaboration

- Set a day for the online meeting
- At the weekend
- a 10-minute discussion for each group on skype

So far ...

How a computer starts up?

What is the bootloader role!

What is assembly-level of coding in bootloader!

How to write program in C?

Pointers!

Expectation

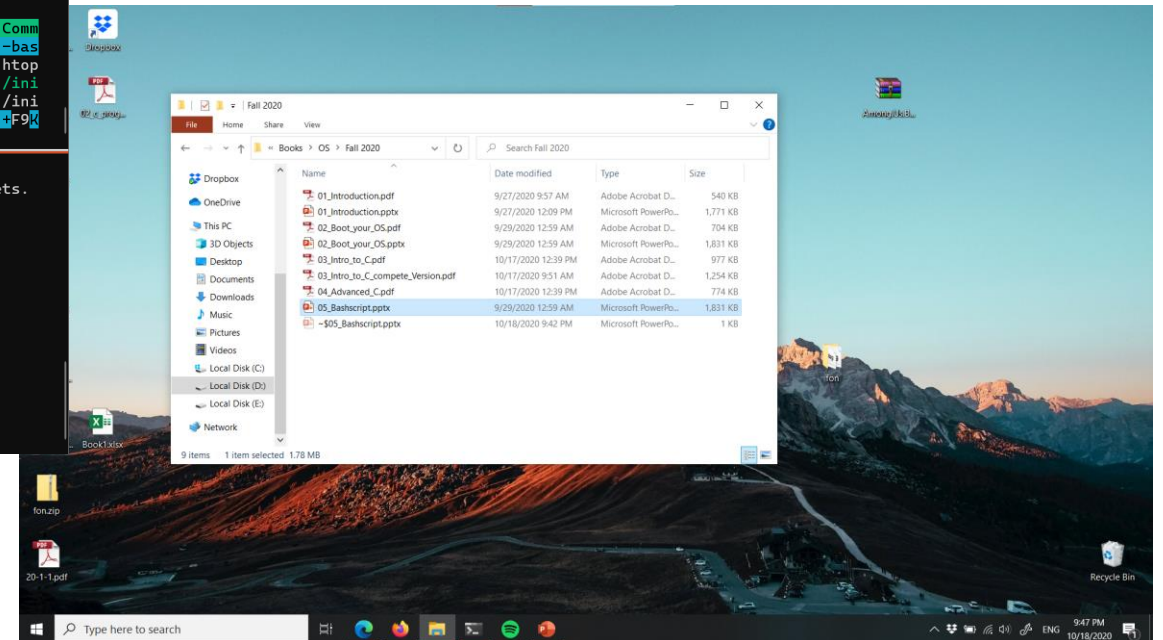
What should happen after computer boots up and OS is loaded?

```
vahid@DESKTOP-J20MVJH:~$ ls -al
total 0
dr-xr-xr-x 12 root root 0 Oct 18 21:48 .
drwxr-xr-x  1 root root 512 Oct 12 2019 ..
drwxr-xr-x  2 root root 0 Oct 18 21:48 block
drwxr-xr-x  2 root root 0 Oct 18 21:48 bus
drwxr-xr-x  7 root root 0 Oct 18 21:48 class
drwxr-xr-x  2 root root 0 Oct 18 21:48 dev
drwxr-xr-x  4 root root 0 Oct 18 21:48 devices
drwxr-xr-x  2 root root 0 Oct 18 21:48 firmware
drwxr-xr-x  3 root root 0 Oct 18 21:48 fs
drwxr-xr-x  5 root root 0 Oct 18 21:48 kernel
drwxr-xr-x  3 root root 0 Oct 18 21:48 module
drwxr-xr-x  2 root root 0 Oct 18 21:48 power
vahid@DESKTOP-J20MVJH:~$
```

```
 1 [||]          2.0%]  5 [ |          1.3%]
 2 [ |]          2.0%]  6 [ |          0.0%]
 3 [ |]          1.3%]  7 [ |          0.0%]
 4 [ |]          0.0%]  8 [ |          0.7%]
Mem[|||||||] 5.80G/15.9G] Tasks: 8, 1 thr; 1 running
Swp[|]          0K/14.7G] Load average: 0.52 0.58 0.59
                               Uptime: 00:02:56
```

| PID | USER | PRI | NI | VIRT | RES | SHR | S | CPU% | MEM% | TIME+ | Comm |
|-----|-------|-----|----|-------|------|------|---|------|------|---------|------|
| 63 | vahid | 20 | 0 | 17020 | 3732 | 3456 | S | 0.0 | 0.0 | 0:00.57 | -bas |
| 100 | vahid | 20 | 0 | 15200 | 2088 | 1564 | R | 0.0 | 0.0 | 0:00.04 | htop |
| 7 | root | 20 | 0 | 9216 | 664 | 316 | S | 0.0 | 0.0 | 0:00.00 | /ini |
| 1 | root | 20 | 0 | 9216 | 664 | 316 | S | 0.0 | 0.0 | 0:00.12 | /ini |

```
vahid@DESKTOP-J20MVJH:~$ service ebttables status
* Error: insufficient privileges to access the ebttables rulesets.
* No kernel support for ebttables.
vahid@DESKTOP-J20MVJH:~$ service ssh status
* sshd is not running
vahid@DESKTOP-J20MVJH:~$ serv
servertool.exe services.exe services.msc
service services.mof
vahid@DESKTOP-J20MVJH:~$ service uidd stat
Usage: /etc/init.d/uidd {start|stop|restart|force-reload}
vahid@DESKTOP-J20MVJH:~$ service uidd status
/usr/sbin/uidd is NOT running
vahid@DESKTOP-J20MVJH:~$ service cron status
* cron is not running
vahid@DESKTOP-J20MVJH:~$
```



User Interfaces

- Command Line Interface (CLI)
- Graphical User Interface (GUI)
- Menu Driven
- Form Based
- Natural Language
- Gesture Driven

The choice?

```
vahid@DESKTOP-J20MVJH: ~  
vahid@DESKTOP-J20MVJH:/sys$ ls -al  
total 0  
dr-xr-xr-x 12 root root 0 Oct 18 21:48 .  
drwxr-xr-x 1 root root 512 Oct 12 2019 ..  
drwxr-xr-x 2 root root 0 Oct 18 21:48 block  
drwxr-xr-x 2 root root 0 Oct 18 21:48 bus  
drwxr-xr-x 7 root root 0 Oct 18 21:48 class  
drwxr-xr-x 2 root root 0 Oct 18 21:48 dev  
drwxr-xr-x 4 root root 0 Oct 18 21:48 devices  
drwxr-xr-x 2 root root 0 Oct 18 21:48 firmware  
drwxr-xr-x 3 root root 0 Oct 18 21:48 fs  
drwxr-xr-x 5 root root 0 Oct 18 21:48 kernel  
drwxr-xr-x 3 root root 0 Oct 18 21:48 module  
drwxr-xr-x 2 root root 0 Oct 18 21:48 power  
vahid@DESKTOP-J20MVJH:/sys$
```

```
 1 [||] 2.0% 5 [ | 1.3%  
 2 [ | 2.0% 6 [ 0.0%  
 3 [ | 1.3% 7 [ 0.0%  
 4 [ 0.0% 8 [ | 0.7%  
Mem[|||||] 5.80G/15.9G Tasks: 8, 1 thr; 1 running  
Swp[ 0K/14.7G Load average: 0.52 0.58 0.59  
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| 7 | root | 20 | 0 | 9216 | 664 | 316 | S | 0.0 | 0.0 | 0:00.00 | /ini |
| 1 | root | 20 | 0 | 9216 | 664 | 316 | S | 0.0 | 0.0 | 0:00.12 | /ini |

```
F1 Help F2 Setup F3 Search F4 Filter F5 Tree F6 SortBy F7 Nice -F8 Nice +F9
```

```
vahid@DESKTOP-J20MVJH:~$ service ebttables status  
* Error: insufficient privileges to access the ebttables rulesets.  
* No kernel support for ebttables.  
vahid@DESKTOP-J20MVJH:~$ service ssh status  
* sshd is not running  
vahid@DESKTOP-J20MVJH:~$ serv  
servertool.exe services.exe services.msc  
service services.mof  
vahid@DESKTOP-J20MVJH:~$ service uidd stat  
Usage: /etc/init.d/uidd {start|stop|restart|force-reload}  
vahid@DESKTOP-J20MVJH:~$ service uidd status  
/usr/sbin/uidd is NOT running  
vahid@DESKTOP-J20MVJH:~$ service cron status  
* cron is not running  
vahid@DESKTOP-J20MVJH:~$ |
```

Flash-back

OS provides

- mechanisms for users to satisfies their requirements,
- besides its ability to manage the resources and prioritize the processes.

What is an Operating System?

An illusionist!

Provides clean, easy to use abstraction of physical resources.

- Infinite memory, dedicated machine
- Higher level objects: files, users, message, and etc.
- Masking limitations, virtualization

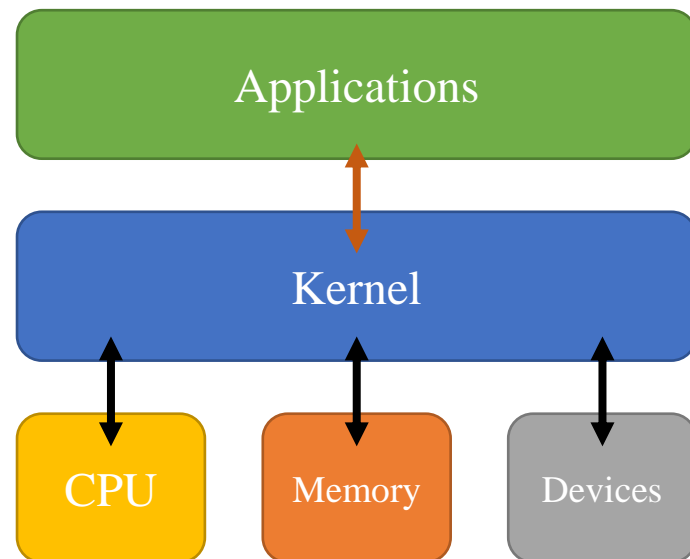


Kernel

A computer program

Controls everything in the system

Facilitates the interaction between hardware and software



API

- Application Programming Interface
- Interacts between multiple software intermediaries
- Calls and Requests
- Some level of abstractions

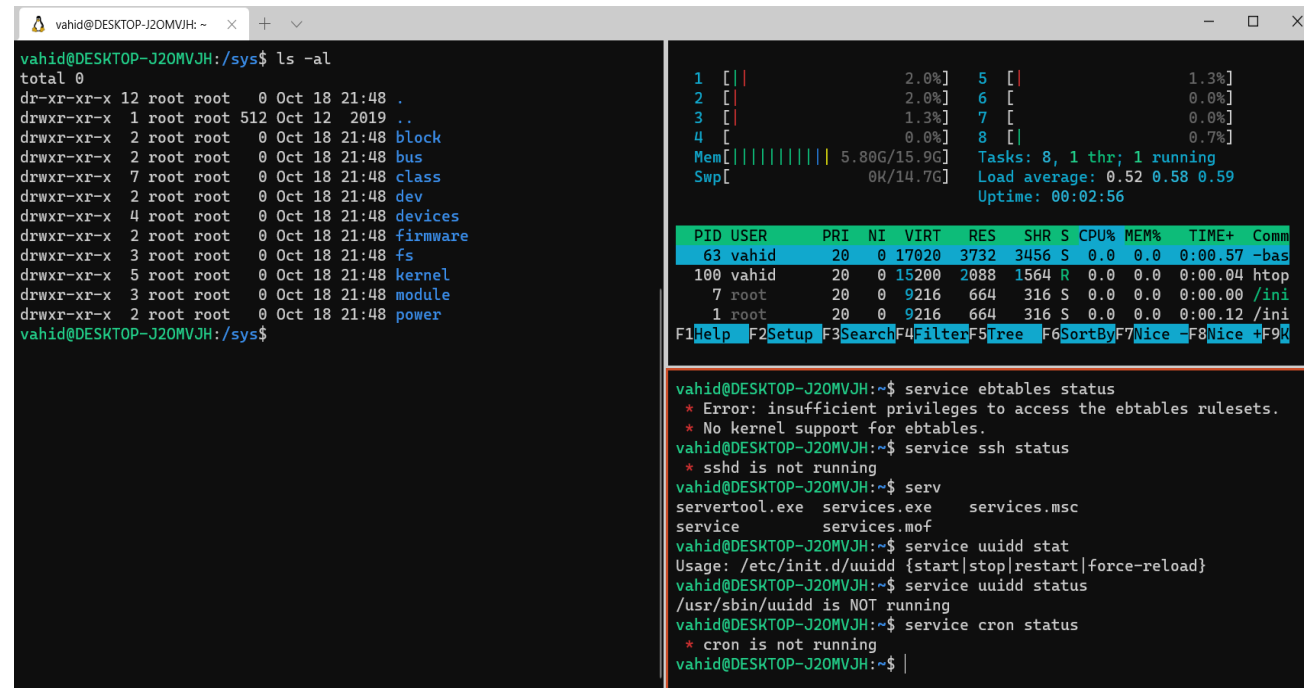
Commands

System Call

Shell

What is shell?

It is called shell because it is the outermost layer around the OS kernel.



```
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drwxr-xr-x  3 root root  0 Oct 18 21:48 module  
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vahid@DESKTOP-J20MVJH:/sys$
```

```
 1 [|||]          2.0%]  5 [|||          1.3%]  
 2 [|||]          2.0%]  6 [|||          0.0%]  
 3 [|||]          1.3%]  7 [|||          0.0%]  
 4 [|||]          0.0%]  8 [|||          0.7%]  
Mem[|||||] 5.80G/15.9G  
Swp[|||||] 0K/14.7G  
Tasks: 8, 1 thr; 1 running  
Load average: 0.52 0.58 0.59  
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```
F1Help F2Setup F3Search F4Filter F5Tree F6SortBy F7Nice F8Nice F9K
```

```
vahid@DESKTOP-J20MVJH:~$ service ebtables status  
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servertool.exe services.exe services.msc  
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vahid@DESKTOP-J20MVJH:~$ service uuid stat  
Usage: /etc/init.d/uuid {start|stop|restart|force-reload}  
vahid@DESKTOP-J20MVJH:~$ service uuid status  
/usr/sbin/uuid is NOT running  
vahid@DESKTOP-J20MVJH:~$ service cron status  
* cron is not running  
vahid@DESKTOP-J20MVJH:~$
```

Bash

- Bash is a Unix Shell.
- Command-line Language
- It can be executed from script files (bash script)
- `chmod +x script.sh`

Like programming Languages ...

Bash has:

- Variables
- Arguments
- Array
- Operator
- If ... else ...
- Loop
- Pipelines
- Regex
- ...

Hello World!

Every Bash Script should start with

```
#!/bin/bash
```

Comments in Bash Script starts with #

A simple HelloWorld!

```
#!/bin/bash  
  
echo "Hello World!"  
  
>> Hello World!
```

Variables

- Define Variables
 - `name="Vahid"`
 - notice that there is **no space** among variable name and equal sign and its value!
 - `std_no=94521207`
- Using variables with `$` before the name

```
name="Vahid"

std_no=94521207

echo Name: ${name}, ID: $std_no

>> Name: Vahid, 94521207

echo Name: name , ID: std_no

>> Name: name , ID: std_no
```

Arrays

```
my_array=(apple banana "Fruit Basket" orange)
echo  ${#my_array[@]}    # 4
echo  ${my_array[@]}    #(apple banana "Fruit Basket" orange)
my_array[4]="carrot"
echo  ${#my_array[@]}    # 5
echo  ${my_array[${#my_array[@]}-1]}    # carrot
```


Operators

- **a + b** addition (a plus b)
- **a - b** subtraction (a minus b)
- **a * b** multiplication (a times b)
- **a / b** division (integer) (a divided by b)
- **a % b** modulo (the integer remainder of a divided by b)
- **a ** b** exponentiation (a to the power of b)

if ... elif ... else ...

```
NAME="George"

if [ "$NAME" = "John" ]; then

    echo "John Lennon"

elif [ "$NAME" = "George" ]; then

    echo "George Harrison"

else

    echo "This leaves us with Paul and Ringo"

fi
```

if ... elif ... else ...

- for numeric comparison

| comparison | Evaluated to true when |
|--------------------------|--------------------------------------|
| <code>\$a -lt \$b</code> | <code>\$a < \$b</code> |
| <code>\$a -gt \$b</code> | <code>\$a > \$b</code> |
| <code>\$a -le \$b</code> | <code>\$a <= \$b</code> |
| <code>\$a -ge \$b</code> | <code>\$a >= \$b</code> |
| <code>\$a -eq \$b</code> | <code>\$a is equal to \$b</code> |
| <code>\$a -ne \$b</code> | <code>\$a is not equal to \$b</code> |

- for string comparison

| comparison | Evaluated to true when |
|-----------------------------|--|
| <code>"\$a" = "\$b"</code> | <code>\$a is the same as \$b</code> |
| <code>"\$a" == "\$b"</code> | <code>\$a is the same as \$b</code> |
| <code>"\$a" != "\$b"</code> | <code>\$a is different from \$b</code> |
| <code>-z "\$a"</code> | <code>\$a is empty</code> |

Switch Case

```
mycase=1  
  
case $mycase in  
    1) echo "You selected bash";;  
    2) echo "You selected perl";;  
    3) echo "You selected python";;  
    4) echo "You selected c++";;  
    5) exit  
  
esac
```

Loops

```
NAMES=(Joe Jenny Sara Tony)
```

```
for N in ${NAMES[@]} ; do
```

```
    echo "My name is $N"
```

```
done
```

```
for f in $( ls prog.sh /etc/localtime ) ; do
```

```
    echo "File is: $f"
```

```
done
```

Loops

```
COUNT=4

while [ $COUNT -gt 0 ]; do

    echo "Value of count is: $COUNT"

    COUNT=$(( $COUNT - 1 ))

done
```

Functions

```
function function_B {
    echo "Function B."
}

function function_A {
    echo "$1"
}

function adder {
    echo "$(($1 + $2))"
}

function_A "Hello!"      # Hello!

function_B                # Function B.

# Pass two parameters to function adder

adder 12 56              # 68
```

Special Variables

- `$0` - The filename of the current script.
- `$n` - The Nth argument passed to script was invoked or function was called.
- `$#` - The number of argument passed to script or function.
- `$@` - All arguments passed to script or function.
- `$*` - All arguments passed to script or function.
- `$?` - The exit status of the last command executed.
- `$$` - The process ID of the current shell. For shell scripts, this is the process ID under which they are executing.
- `#!` - The process number of the last background command.

Pipelines

```
command1 | command2 | command3 | ...
```

```
#!/bin/bash
```

```
    cat /proc/cpuinfo | grep processor | wc -l
```

man

- `man` command
 - shows documentation about the command
 - its description
 - its arguments
 - its flags

Class Assignment

Write a bash script with 3 functions and it takes your birthdate (day, month, year) and weekday of birth as inputs which:

The first function should validate the weekday of birth is True or not.

The second function should calculate the number of passed days after your birthday if less than 6 months is passed; otherwise, the number of remaining days to your birthday.

The third function should calculate the days' difference between your birthdate and any other date.

Questions?

?