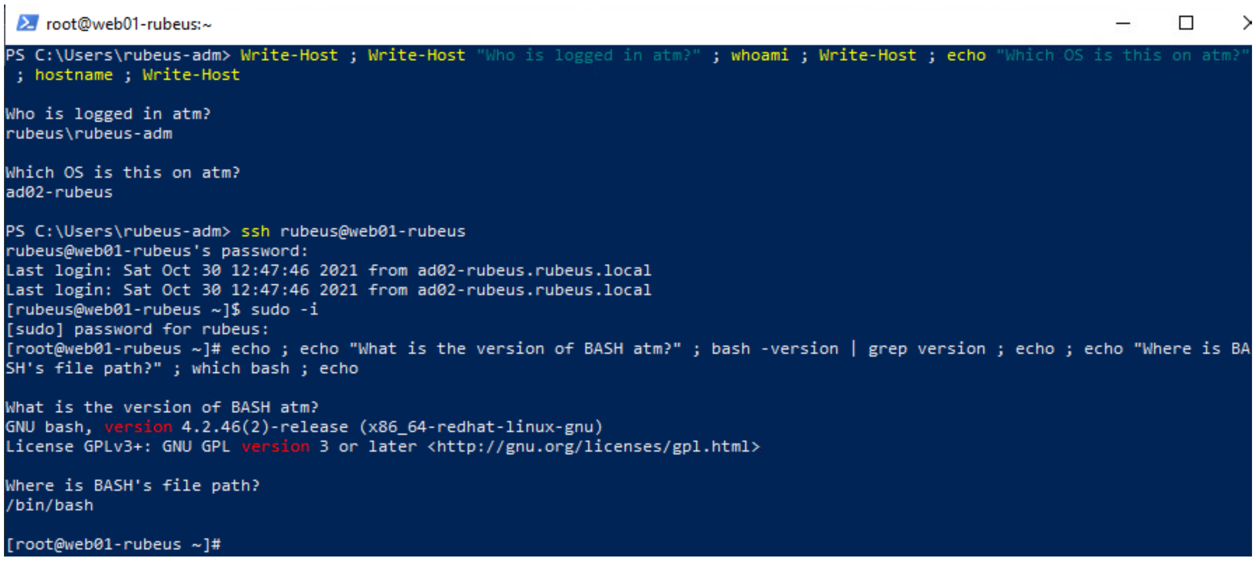
Bash Scripting

💡Scripting is a valuable part of any sysadmin's toolkit. You have been exposed to bash during both your dhcp02 and web01 labs, so this module will focus directly on the use of **B**ourne **A**gain **Sh**ell, either *interactively* (engages you, the user, for input), or through the use of a script (run and done).

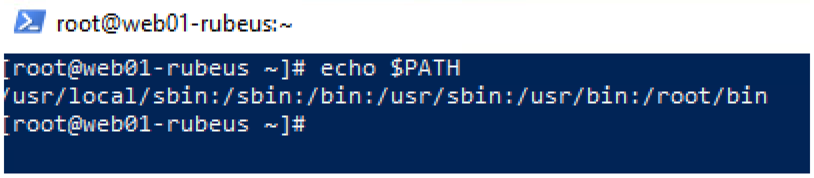
You will need fw02, ad02 and web01.

SSH into your Linux server from wks01 as a named Linux user (as opposed to domain user), and elevate to root, and then determine your bash version and where the actual bash program resides. Consider downloading PuTTY if you are having formatting issues with ssh in Powershell.



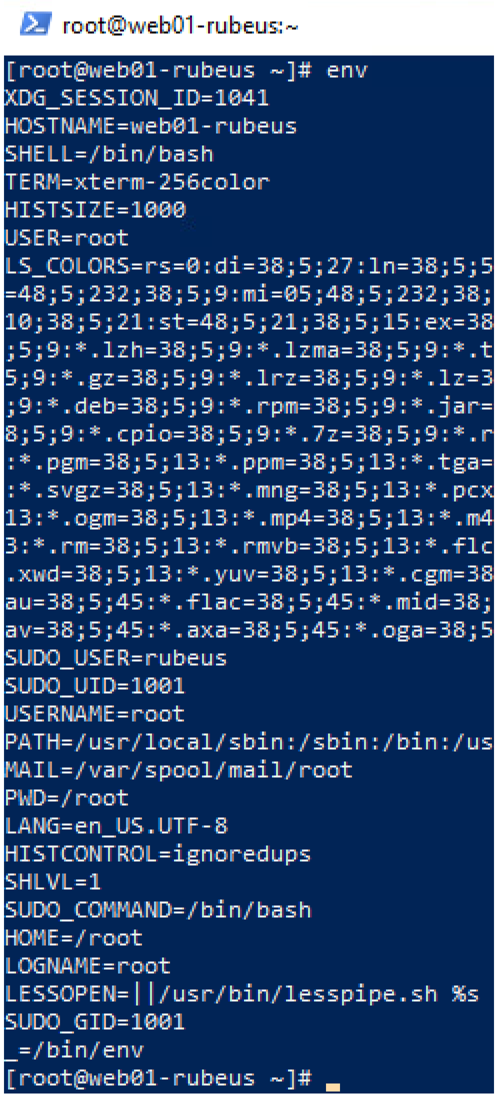
```
PS C:\Users\rubeus-adm> Write-Host ; Write-Host "Who is logged in atm?" ; whoami ; Write-Host ; echo "Which OS is this on atm?"
 ; hostname ; Write-Host

Who is logged in atm?
rubeus\rubeus-adm

Which OS is this on atm?
ad02-rubeus

PS C:\Users\rubeus-adm> ssh rubeus@web01-rubeus
rubeus@web01-rubeus's password:
Last login: Sat Oct 30 12:47:46 2021 from ad02-rubeus.rubeus.local
Last login: Sat Oct 30 12:47:46 2021 from ad02-rubeus.rubeus.local
[rubeus@web01-rubeus ~]$ sudo -i
[sudo] password for rubeus:
[root@web01-rubeus ~]# echo ; echo "What is the version of BASH atm?" ; bash -version | grep version ; echo ; echo "Where is BA
SH's file path?" ; which bash ; echo

What is the version of BASH atm?
GNU bash, version 4.2.46(2)-release (x86_64-redhat-linux-gnu)
License GPLv3+: GNU GPL version 3 or later <http://gnu.org/licenses/gpl.html>

Where is BASH's file path?
/bin/bash

[root@web01-rubeus ~]#
```

The Path Environment Variable is very important. It tells your Bash interpreter, which directories to scan for applications that match your command.



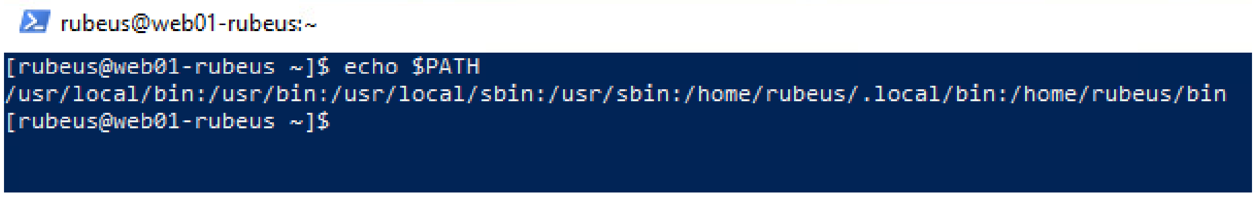
```
[root@web01-rubeus ~]# echo $PATH
/usr/local/sbin:/sbin:/bin:/usr/sbin:/usr/bin:/root/bin
[root@web01-rubeus ~]#
```

To show all Environment Variables, enter *env*.



```
root@web01-rubeus:~
[root@web01-rubeus ~]# env
XDG_SESSION_ID=1041
HOSTNAME=web01-rubeus
SHELL=/bin/bash
TERM=xterm-256color
HISTSIZE=1000
USER=root
LS_COLORS=rs=0:di=38;5;27:ln=38;5;5
=48;5;232;38;5;9:mi=05;48;5;232;38;
10;38;5;21:st=48;5;21;38;5;15:ex=38
;5;9:*.lzh=38;5;9:*.lzma=38;5;9:*.t
5;9:*.gz=38;5;9:*.lrz=38;5;9:*.lz=3
;9:*.deb=38;5;9:*.rpm=38;5;9:*.jar=
8;5;9:*.cpio=38;5;9:*.7z=38;5;9:*.r
:*.pgm=38;5;13:*.ppm=38;5;13:*.tga=
:*.svgz=38;5;13:*.mng=38;5;13:*.pcx
13:*.ogm=38;5;13:*.mp4=38;5;13:*.m4
3:*.rm=38;5;13:*.rmvb=38;5;13:*.flc
.xwd=38;5;13:*.yuv=38;5;13:*.cgm=38
au=38;5;45:*.flac=38;5;45:*.mid=38;
av=38;5;45:*.axa=38;5;45:*.oga=38;5
SUDO_USER=rubeus
SUDO_UID=1001
USERNAME=root
PATH=/usr/local/sbin:/sbin:/bin:/us
MAIL=/var/spool/mail/root
PWD=/root
LANG=en_US.UTF-8
HISTCONTROL=ignoredups
SHLVL=1
SUDO_COMMAND=/bin/bash
HOME=/root
LOGNAME=root
LESSOPEN=||/usr/bin/lesspipe.sh %s
SUDO_GID=1001
_=/bin/env
[root@web01-rubeus ~]#
```

Go back to the normal user with exit, and check out your path.



```
rubeus@web01-rubeus:~
[rubeus@web01-rubeus ~]$ echo $PATH
/usr/local/bin:/usr/bin:/usr/local/sbin:/usr/sbin:/home/rubeus/.local/bin:/home/rubeus/bin
[rubeus@web01-rubeus ~]$
```

What has changed? And where does this change come from? Your profile information comes from several files in /etc, as well as your home directory.

If you want to modify the path for *all* users, then you would do so in a file in /etc. If you are just changing the user's *specific* environment, then you would do it in configurations located in their home directory.

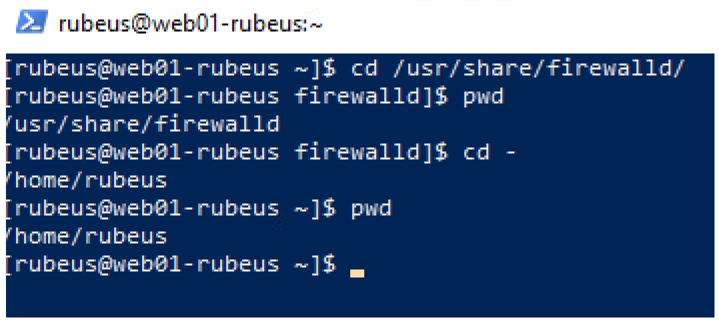
https://www.gnu.org/software/bash/manual/html_node/Bash-Startup-Files.html

The hidden files .bash_profile and .bashrc are the user specific configuration files in the user's home directory.

💡Unlike Windows, Linux hidden files are those files that have a leading period ("."). To see these files, enter `ls -la`

Shortcuts

Tab Completion. From your home directory, navigate to /usr/share/firewalld/tests/ just using the minimal number of characters and the tab key to complete. Once there, enter *cd* - to go back to the last directory you were in.


rubeus@web01-rubeus:~

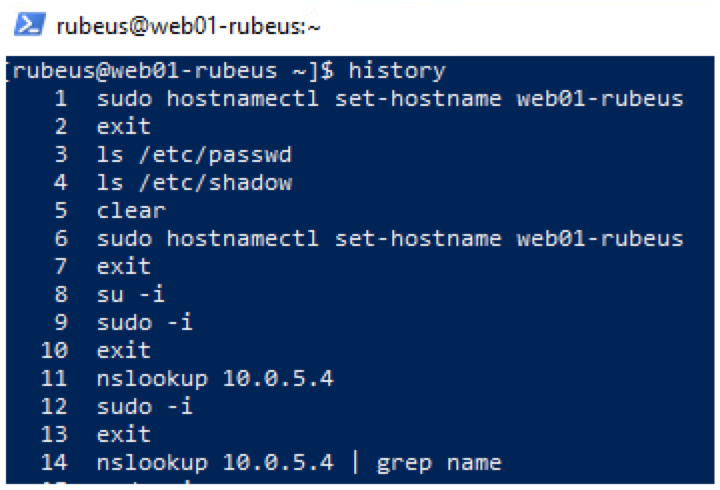
```
[rubeus@web01-rubeus ~]$ cd /usr/share/firewalld/
[rubeus@web01-rubeus firewalld]$ pwd
/usr/share/firewalld
[rubeus@web01-rubeus firewalld]$ cd -
/home/rubeus
[rubeus@web01-rubeus ~]$ pwd
/home/rubeus
[rubeus@web01-rubeus ~]$ 
```

Up and Down Arrows
Hit the up arrow until you get back to your original cd statement

History
Type history to see what has gone on before. If you echo the $HISTSIZE environment variable, it shows you how many entries are saved.

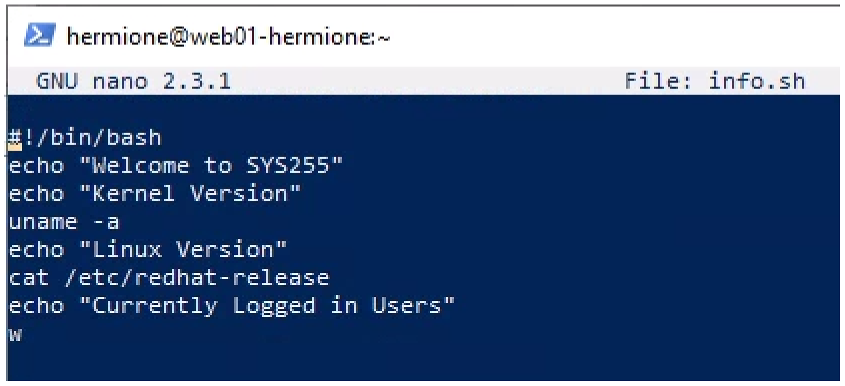
💣This saved history can be a security vulnerability if clear text passwords or other sensitive material is typed and saved as command line parameters. It is also a juicy artifact of interest for digital forensics professionals.

Note: Things like MySQL, Python, and some other services store some info in .history files. It's best to clear them regularly on a production server, or chmod them in a way they are not readable by all users/groups.



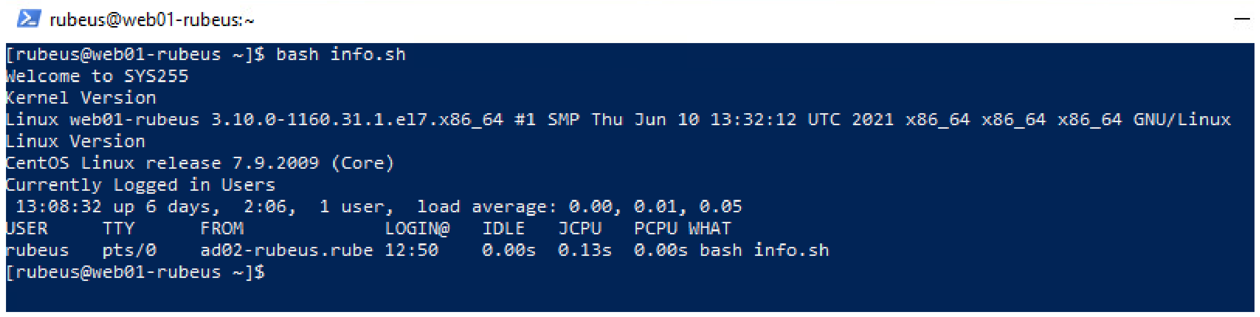
```
rubeus@web01-rubeus:~
[rubeus@web01-rubeus ~]$ history
    1  sudo hostnamectl set-hostname web01-rubeus
    2  exit
    3  ls /etc/passwd
    4  ls /etc/shadow
    5  clear
    6  sudo hostnamectl set-hostname web01-rubeus
    7  exit
    8  su -i
    9  sudo -i
   10  exit
   11  nslookup 10.0.5.4
   12  sudo -i
   13  exit
   14  nslookup 10.0.5.4 | grep name
```

The following shows a simple bash script. Use either nano or vi to author this.



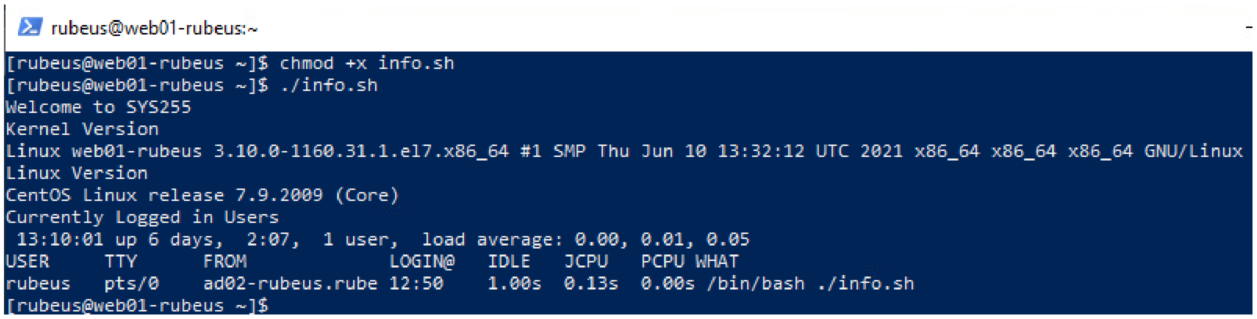
```
hermione@web01-hermione:~
  GNU nano 2.3.1                          File: info.sh

#!/bin/bash
echo "Welcome to SYS255"
echo "Kernel Version"
uname -a
echo "Linux Version"
cat /etc/redhat-release
echo "Currently Logged in Users"
w
```

You can explicitly invoke bash, and pass your new script as a file parameter.



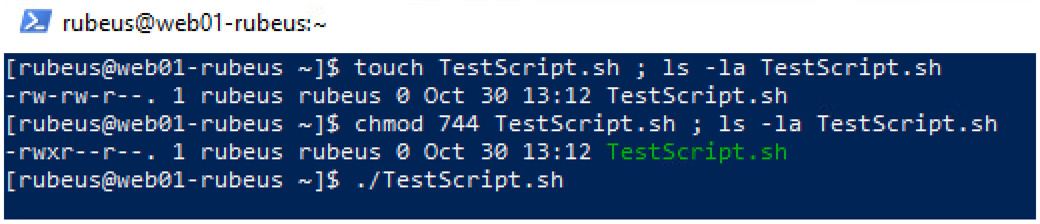
```
rubeus@web01-rubeus:~
[rubeus@web01-rubeus ~]$ bash info.sh
Welcome to SYS255
Kernel Version
Linux web01-rubeus 3.10.0-1160.31.1.el7.x86_64 #1 SMP Thu Jun 10 13:32:12 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
Linux Version
CentOS Linux release 7.9.2009 (Core)
Currently Logged in Users
 13:08:32 up 6 days,  2:06,  1 user,  load average: 0.00, 0.01, 0.05
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
rubeus   pts/0    ad02-rubeus.rube 12:50    0.00s  0.13s  0.00s bash info.sh
[rubeus@web01-rubeus ~]$
```

Or, the most common thing to do is to change the file permissions to executable for the current user and leverage the shebang line. Note: in order to execute a file, the file must have the executable flag set. The call to the script must be prepended with **./** in order to execute in the current directory. If there is another test.sh in the path, then it could be invoked with just test.sh.



```
[rubeus@web01-rubeus ~]$ chmod +x info.sh
[rubeus@web01-rubeus ~]$ ./info.sh
Welcome to SYS255
Kernel Version
Linux web01-rubeus 3.10.0-1160.31.1.el7.x86_64 #1 SMP Thu Jun 10 13:32:12 UTC 2021 x86_64 x86_64 x86_64 GNU/Linux
Linux Version
CentOS Linux release 7.9.2009 (Core)
Currently Logged in Users
 13:10:01 up 6 days,  2:07,  1 user,  load average: 0.00, 0.01, 0.05
USER     TTY      FROM             LOGIN@   IDLE   JCPU   PCPU WHAT
rubeus   pts/0    ad02-rubeus.rube 12:50    1.00s  0.13s  0.00s /bin/bash ./info.sh
[rubeus@web01-rubeus ~]$
```

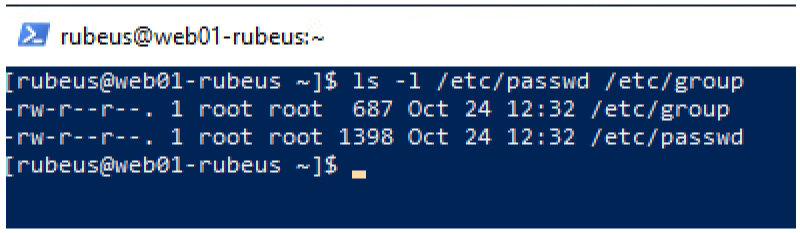
Example of changing the permissions of a script file:



```
[rubeus@web01-rubeus ~]$ touch TestScript.sh ; ls -la TestScript.sh
-rw-rw-r--. 1 rubeus rubeus 0 Oct 30 13:12 TestScript.sh
[rubeus@web01-rubeus ~]$ chmod 744 TestScript.sh ; ls -la TestScript.sh
-rwxr--r--. 1 rubeus rubeus 0 Oct 30 13:12 TestScript.sh
[rubeus@web01-rubeus ~]$ ./TestScript.sh
```

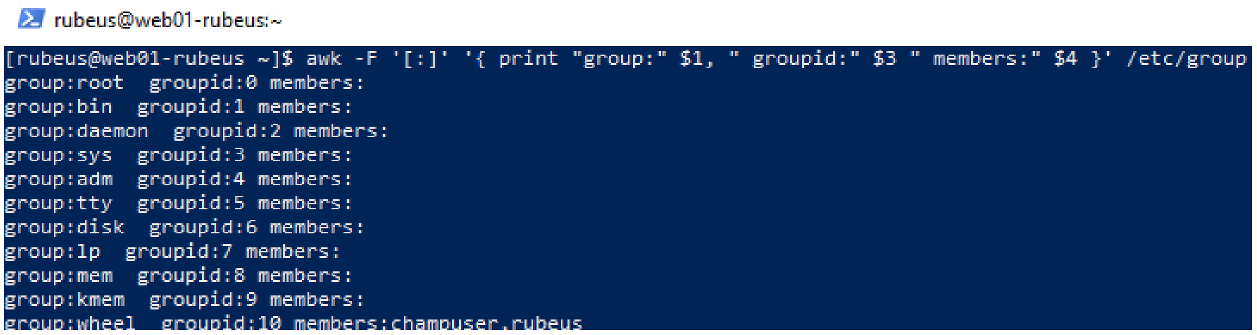
A parsing script.

We are going to work with the /etc/group and /etc/passwd files. We will run through the example using /etc/group, and you will extend the example to do similar things with the /etc/passwd file.



```
[rubeus@web01-rubeus ~]$ ls -l /etc/passwd /etc/group
-rw-r--r--. 1 root root  687 Oct 24 12:32 /etc/group
-rw-r--r--. 1 root root 1398 Oct 24 12:32 /etc/passwd
[rubeus@web01-rubeus ~]$
```

This one line command (i.e. “one-liner”) will parse the /etc/group file and pluck out the first, third and fourth fields as shown below using awk:

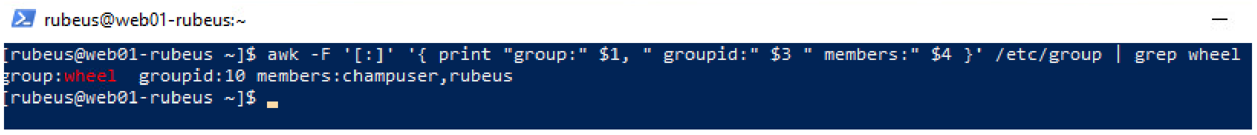


```
[rubeus@web01-rubeus ~]$ awk -F '[:]' '{ print "group:" $1, " groupid:" $3 " members:" $4 }' /etc/group
group:root  groupid:0 members:
group:bin  groupid:1 members:
group:daemon  groupid:2 members:
group:sys  groupid:3 members:
group:adm  groupid:4 members:
group:tty  groupid:5 members:
group:disk  groupid:6 members:
group:lp  groupid:7 members:
group:mem  groupid:8 members:
group:kmem  groupid:9 members:
group:wheel  groupid:10 members:champuser,rubeus
```

Pipelining with |

In many cases, we wish to filter the results of a script or command down using grep. In this case, we only want to show entries with the group "wheel", this should show your sudo users.

`Deliverable 1. Provide a screenshot similar to the one below:`



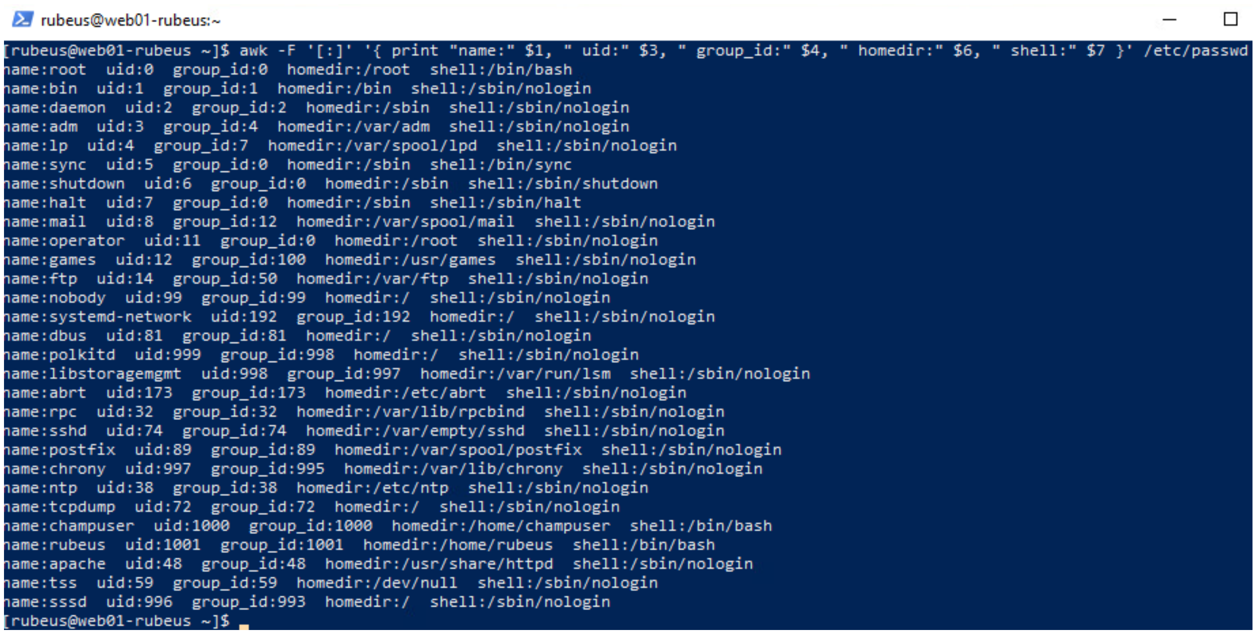
```
[rubeus@web01-rubeus ~]$ awk -F '[:]' '{ print "group:" $1, " groupid:" $3 " members:" $4 }' /etc/group | grep wheel
group:wheel  groupid:10 members:champuser,rubeus
[rubeus@web01-rubeus ~]$
```

Take a look at the following documentation:

http://linux.die.net/man/5/passwd

/etc/passwd

Your job is to create a similar script to the one that parsed /etc/group. We are interested in the name, uid, gid, directory and shell fields. Your output should look similar to this:



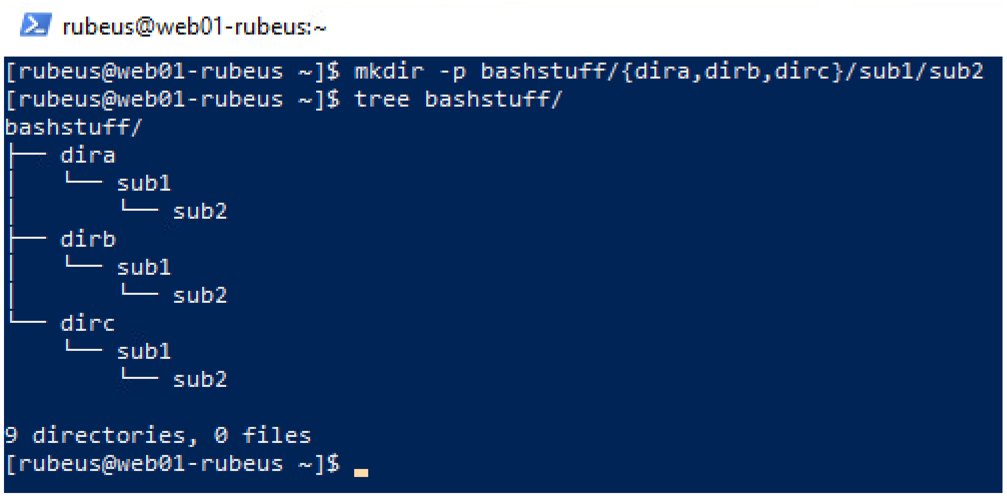
```
[rubeus@web01-rubeus ~]$ awk -F '[:]' '{ print "name:" $1, " uid:" $3, " group_id:" $4, " homedir:" $6, " shell:" $7 }' /etc/passwd
ame:root  uid:0  group_id:0  homedir:/root  shell:/bin/bash
ame:bin  uid:1  group_id:1  homedir:/bin  shell:/sbin/nologin
ame:daemon  uid:2  group_id:2  homedir:/sbin  shell:/sbin/nologin
ame:adm  uid:3  group_id:4  homedir:/var/adm  shell:/sbin/nologin
ame:lp  uid:4  group_id:7  homedir:/var/spool/lpd  shell:/sbin/nologin
ame:sync  uid:5  group_id:0  homedir:/sbin  shell:/bin/sync
ame:shutdown  uid:6  group_id:0  homedir:/sbin  shell:/sbin/shutdown
ame:halt  uid:7  group_id:0  homedir:/sbin  shell:/sbin/halt
ame:mail  uid:8  group_id:12  homedir:/var/spool/mail  shell:/sbin/nologin
ame:operator  uid:11  group_id:0  homedir:/root  shell:/sbin/nologin
ame:games  uid:12  group_id:100  homedir:/usr/games  shell:/sbin/nologin
ame:ftp  uid:14  group_id:50  homedir:/var/ftp  shell:/sbin/nologin
ame:nobody  uid:99  group_id:99  homedir:/  shell:/sbin/nologin
ame:systemd-network  uid:192  group_id:192  homedir:/  shell:/sbin/nologin
ame:dbus  uid:81  group_id:81  homedir:/  shell:/sbin/nologin
ame:polkitd  uid:999  group_id:998  homedir:/  shell:/sbin/nologin
ame:libstoragemgmt  uid:998  group_id:997  homedir:/var/run/lsm  shell:/sbin/nologin
ame:abrt  uid:173  group_id:173  homedir:/etc/abrt  shell:/sbin/nologin
ame:rpc  uid:32  group_id:32  homedir:/var/lib/rpcbind  shell:/sbin/nologin
ame:sshd  uid:74  group_id:74  homedir:/var/empty/sshd  shell:/sbin/nologin
ame:postfix  uid:89  group_id:89  homedir:/var/spool/postfix  shell:/sbin/nologin
ame:chrony  uid:997  group_id:995  homedir:/var/lib/chrony  shell:/sbin/nologin
ame:ntp  uid:38  group_id:38  homedir:/etc/ntp  shell:/sbin/nologin
ame:tcpdump  uid:72  group_id:72  homedir:/  shell:/sbin/nologin
ame:champuser  uid:1000  group_id:1000  homedir:/home/champuser  shell:/bin/bash
ame:rubeus  uid:1001  group_id:1001  homedir:/home/rubeus  shell:/bin/bash
ame:apache  uid:48  group_id:48  homedir:/usr/share/httpd  shell:/sbin/nologin
ame:tss  uid:59  group_id:59  homedir:/dev/null  shell:/sbin/nologin
ame:sssd  uid:996  group_id:993  homedir:/  shell:/sbin/nologin
[rubeus@web01-rubeus ~]$
```

```
Deliverable 2.  Provide the screenshot running a one liner and its
output that you used to produce the similar output above.
```

Brace expansion

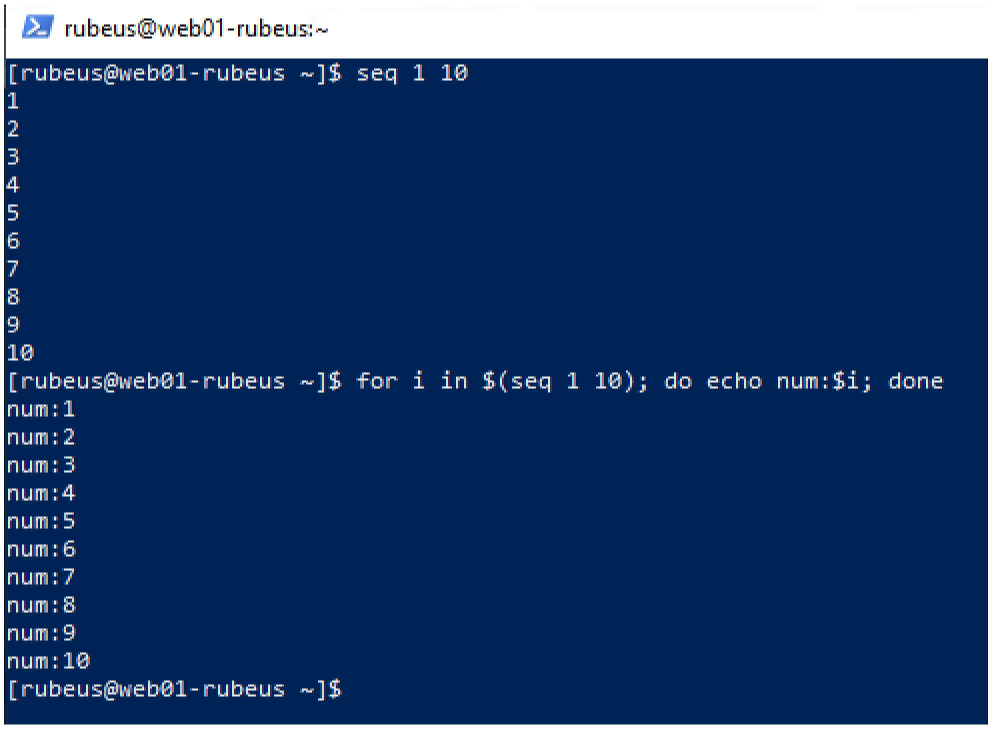
Go ahead and figure out how to install the **tree** package using yum if you haven't already done so (Similar to how we installed DHCP and Apache on Linux).

The following example shows how curly braces { } can be used in common commands to execute multiple commands at the same time.


rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ mkdir -p bashstuff/{dira,dirb,dirc}/sub1/sub2
[rubeus@web01-rubeus ~]$ tree bashstuff/
bashstuff/
├── dira
│   └── sub1
│       └── sub2
├── dirb
│   └── sub1
│       └── sub2
└── dirc
    └── sub1
        └── sub2

9 directories, 0 files
[rubeus@web01-rubeus ~]$
```

Loops

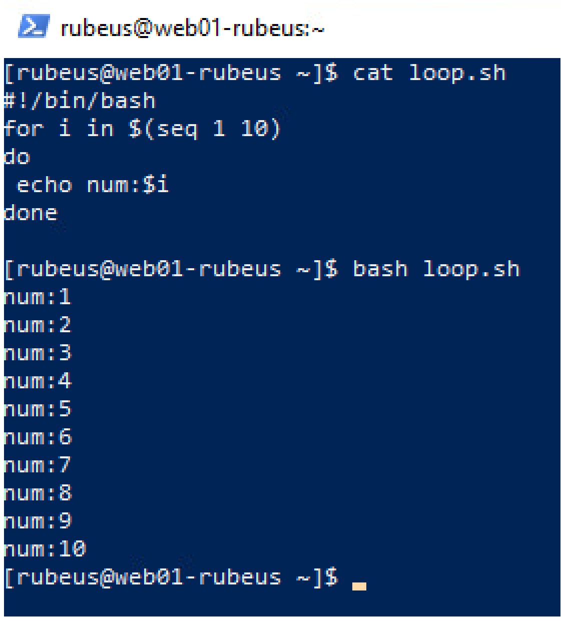


rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ seq 1 10
1
2
3
4
5
6
7
8
9
10
[rubeus@web01-rubeus ~]$ for i in $(seq 1 10); do echo num:$i; done
num:1
num:2
num:3
num:4
num:5
num:6
num:7
num:8
num:9
num:10
[rubeus@web01-rubeus ~]$
```

Convert to a script called loop.sh

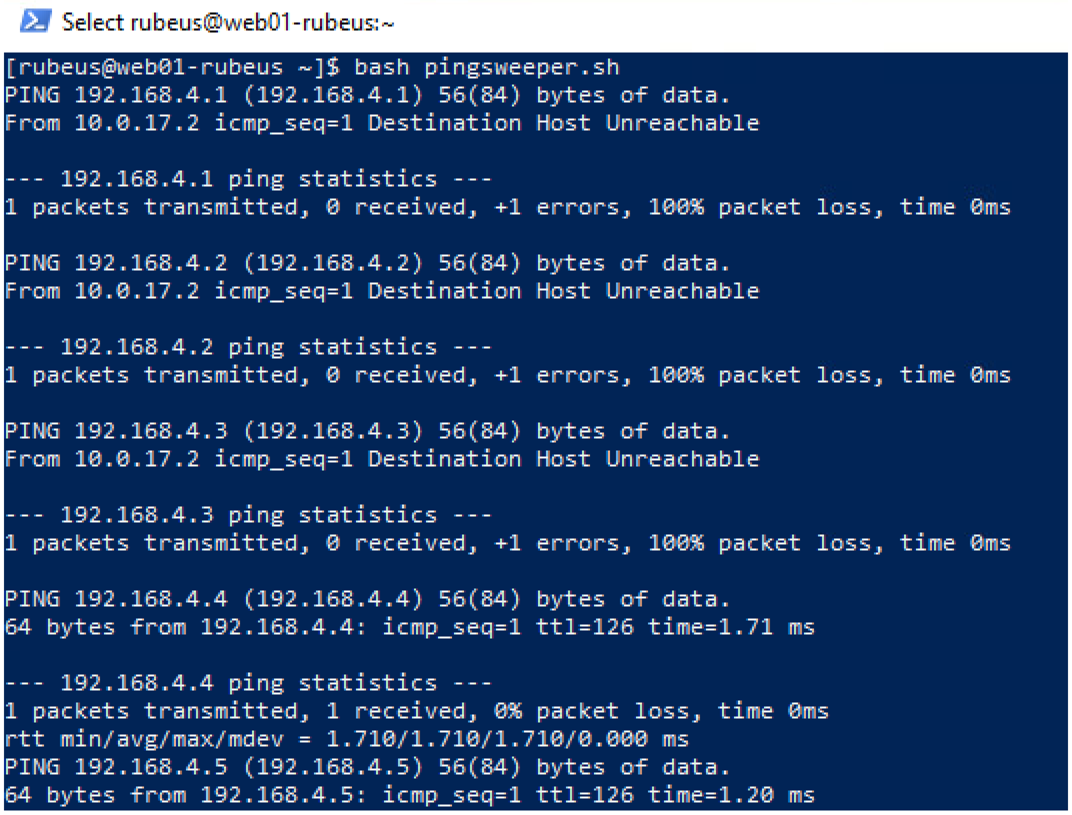
Note: the semicolons in the one liner are replaced by newlines in the script.



rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ cat loop.sh
#!/bin/bash
for i in $(seq 1 10)
do
 echo num:$i
done

[rubeus@web01-rubeus ~]$ bash loop.sh
num:1
num:2
num:3
num:4
num:5
num:6
num:7
num:8
num:9
num:10
[rubeus@web01-rubeus ~]$
```

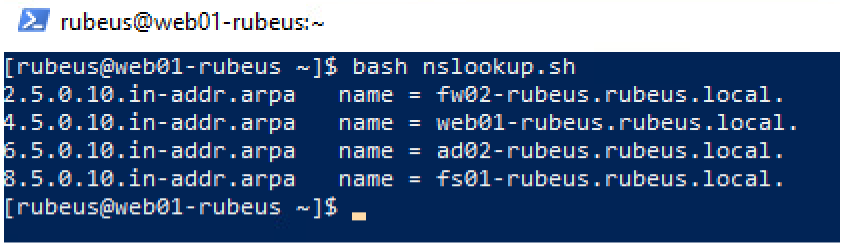
Deliverable 3. Ping Sweeper. Convert the script above, using both the echo and possibly the ping command on the following line (1 ping only). Attempt to ping 192.168.4.1-10. Provide a screenshot showing your updated bash script syntax, and its output. It should have output similar to that shown below. For a challenge, filter out the failed pings.


Select rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ bash pingsweeper.sh
PING 192.168.4.1 (192.168.4.1) 56(84) bytes of data.
From 10.0.17.2 icmp_seq=1 Destination Host Unreachable

--- 192.168.4.1 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

PING 192.168.4.2 (192.168.4.2) 56(84) bytes of data.
From 10.0.17.2 icmp_seq=1 Destination Host Unreachable

--- 192.168.4.2 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

PING 192.168.4.3 (192.168.4.3) 56(84) bytes of data.
From 10.0.17.2 icmp_seq=1 Destination Host Unreachable

--- 192.168.4.3 ping statistics ---
1 packets transmitted, 0 received, +1 errors, 100% packet loss, time 0ms

PING 192.168.4.4 (192.168.4.4) 56(84) bytes of data.
64 bytes from 192.168.4.4: icmp_seq=1 ttl=126 time=1.71 ms

--- 192.168.4.4 ping statistics ---
1 packets transmitted, 1 received, 0% packet loss, time 0ms
rtt min/avg/max/mdev = 1.710/1.710/1.710/0.000 ms
PING 192.168.4.5 (192.168.4.5) 56(84) bytes of data.
64 bytes from 192.168.4.5: icmp_seq=1 ttl=126 time=1.20 ms
```

Deliverable 4. Create an nslookup script (nslu.sh) that provides just the DNS names for those systems found. Use your Virtual LAN address space this time 10.0.5.x. Provide a screenshot showing your updated bash script syntax, and your output should look similar to the figure below.

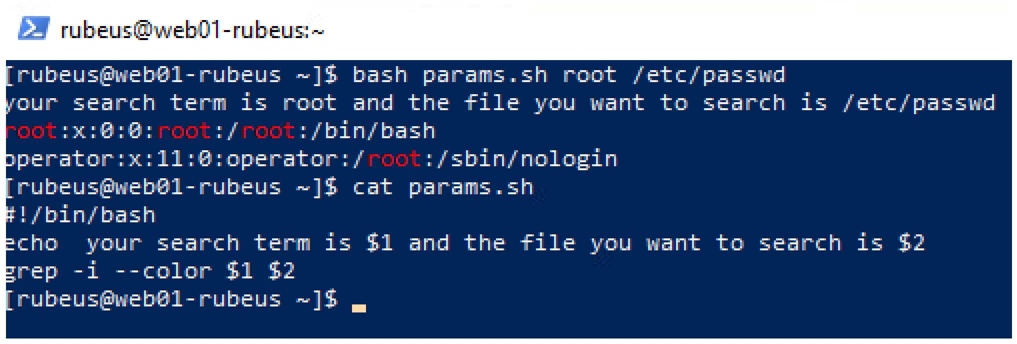
hint: http://tldp.org/LDP/Bash-Beginners-Guide/html/sect_08_02.html


rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ bash nslookup.sh
2.5.0.10.in-addr.arpa   name = fw02-rubeus.rubeus.local.
4.5.0.10.in-addr.arpa   name = web01-rubeus.rubeus.local.
6.5.0.10.in-addr.arpa   name = ad02-rubeus.rubeus.local.
8.5.0.10.in-addr.arpa   name = fs01-rubeus.rubeus.local.
[rubeus@web01-rubeus ~]$
```

Basic input Parameters

Take a look at the following params.sh file. $1 and $2 input variables map to the search term and file input to this script.



rubeus@web01-rubeus:~

```
[rubeus@web01-rubeus ~]$ bash params.sh root /etc/passwd
your search term is root and the file you want to search is /etc/passwd
root:x:0:0:root:/root:/bin/bash
operator:x:11:0:operator:/root:/sbin/nologin
[rubeus@web01-rubeus ~]$ cat params.sh
#!/bin/bash
echo  your search term is $1 and the file you want to search is $2
grep -i --color $1 $2
[rubeus@web01-rubeus ~]$ 
```

Deliverable 5. Modify one of your previous scripts to take an input parameter (perhaps a network prefix). Provide a screenshot of both the output and the shell script syntax.

Deliverable 6: Install nmap and create a bash script that will ask for user input on nmap parameters (hint: look up command switches for nmap parameters), and then execute those parameters after nmap is installed. Run an nmap quickscan against your **10.0.5.0/24** network. Provide a screenshot of your script output, as well as the script syntax.