

Ukesoppgaver 9 – Multitasking og Linux-VMer

RØD - Obligoppgaver

GUL – Ikke obligoppgaver

TURKIS – Ukens nøtt og utfordringer

1. UKENS NØTTS

Dette er en C++-kode som genererer et array med tilfeldige tall, skriver ut de første 10 tallene og summerer deretter alle tall som er større enn 127: **oppg1Uke9.sh**

```
[s364520@data2500: ~]$ vim oppg1Uke9.sh
[s364520@data2500: ~]$ cat oppg1Uke9.sh
#include <algorithm>
#include <iostream>

using namespace std;

int main()
{
    // Lager et data-array
    int i,c;
    int arraySize = 32768;
    int data[arraySize];

    for (c = 0; c < arraySize; ++c)
    {
        data[c] = rand() % 256;
    }

    // Gir tilfeldig tall mellom 0 og 255
    // Gir samme array med tall for hver kjøring

    // sort(data, data + arraySize);
    // sorterter data-arrayet

    // Skriver ut de 10 første verdiene
    for (c = 0; c < 10; c++)
        cout << data[c] << "\n";

    // Legger sammen alle tall større enn 127
    long sum = 0;

    // Ytre løkke for at det skal ta litt tid...
    for (i = 0; i < 50000; ++i)
    {
        // Indre løkke
        for (c = 0; c < arraySize; ++c)
        {
            if (data[c] > 127)
                sum += data[c];
        }
    }

    cout << "sum = " << sum << "\n";
}
```

Under er det kompilert versjon av koden som ble kjørt:

```
|s364520@data2500:~$ time ./oppg1Uke9Kompilert  
103  
198  
105  
115  
81  
255  
74  
236  
41  
205  
sum = 157465800000  
  
real    0m13,217s  
user    0m13,216s  
sys     0m0,000s
```

- **real:** den totale tiden programmet brukte fra start til slutt
 - **user:** tiden programmet brukte på kjøring av selve programmet
 - **sys:** tiden programmet brukte på systemkall

User er mengde cpu brukt i usermode hvorav system er mengde tid brukt av programmet i kernel mode.

I dette tilfellet brukte programmet 13,217 sekunder totalt, hvorav 13,216 sekunder var bruk på selve programmet og 0 sekunder på systemkall.

Ved å bruke kodelinjen med sort forbedres ytelsen på grunn av begrepet om «speculative executions». Vi snakket i forelesningen om at spekulativ utførelse blir brukt til å beskrive

en teknikk som CPU-er bruker for å øke ytelsen ved å utføre instruksjoner som ikke nødvendigvis blir utført senere i programmet. CPU-en spekulerer hvilken vei programmet vil gå, og utfører deretter de tilsvarende instruksjonene før programmet når den aktuelle beslutningsgrenen. Hvis den gjettet riktig, kan den lagre tid ved å allerede ha utført instruksjonene, hvis det er feil, forkastes resultatene av den spekulativer utførelsen.

I dette tilfellet, når sorteringen ble kommentert ut, kunne CPU-en spekulere i om det var nødvendig å sortere dataene. Hvis gjettningen var at sorteringen var unødvendig, ville CPU-en spare tid ved å ikke utføre sorteringen. Men hvis gjettningen var feil, ville CPU-en måtte utføre sorteringen på et senere tidspunkt. Derfor kan fjerningen av kommentartegnet føre til bedre ytelse på grunn av spekulativ utførelse.

Man kan observere stor forskjell i tiden på begge bildene.

2. (Oblig)

Under bruker jeg wget på min data2500:

```
s364520@data2500:~$ wget https://os.cs.oslomet.no/os/regn
--2023-03-07 17:28:30-- https://os.cs.oslomet.no/os/regn
Resolving os.cs.oslomet.no (os.cs.oslomet.no)... 2001:700:740:1::24, 128.39.28.24
Connecting to os.cs.oslomet.no (os.cs.oslomet.no)|2001:700:740:1::24|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 194
Saving to: 'regn'

regn          100%[=====>]    194  --.-KB/s   in 0s

2023-03-07 17:28:31 (501 MB/s) - 'regn' saved [194/194]

s364520@data2500:~$ chmod 700 regn
s364520@data2500:~$ ./regn
./regn: line 6: echo: command not found
./regn : regner....
./regn, resultat: 14045002650000
```

Koden som omdirigerer output til res.txt og feilmeldinger til err.txt:

```
[s364520@data2500:~$ ./regn > res.txt 2> err.txt
```

Under er innholdet i rex.txt fra kjøringen av regn

```
[s364520@data2500:~$ cat res.txt  
./regn : regner....  
./regn, resultat: 14045002650000
```

Under er innholdet fra err.txt som er feilmeldinga:

```
[s364520@data2500:~$ cat err.txt  
./regn: line 6: ehco: command not found
```

3. (Oblig)

Under kjøres regn med kommandoen tegn:

```
./regn. line 6. echo. command not found  
[s3645520@data2500:~]$ time ./regn  
./regn: line 6: echo: command not found  
. /regn : regner....  
. ./regn, resultat: 14045002650000  
  
real    0m24.441s  
user    0m23.167s  
sys     0m1.332s
```

Endrer formatet til time og runner igjen. Det kan tolkes som:

- Real er tiden det tok for kommandoen for å kjøre fra start til slutt som ventetid på input/output, og andre aktiviteter som ikke krever CPU-tid.
 - User viser CPU-tid brukt i user-mode (prosessen selv som regner)
 - System viser CPU-tid brukt i kernel-mode (av OS-kjernene)
 - %P gir prosentandel CPU denne prosessen har brukt

```
[s364520@data2500:~]$ TIMEFORMAT="Real:%R User:%U System:%S %P%<br>%<br>[s364520@data2500:~]$ time ./regn<br>./regn: line 6: ehco: command not found<br>./regn : regner....<br>./regn, resultat: 14045002650000<br>Real:24,335 User:22,935 System:1,396 99,98%
```

- Real: 24,3.
 - «P%» står for prosentandelen av CPU-tiden brukt av prosessen (i forhold til den totale tiden prosessen kjørte): 99.9.

Under har jeg klart å få til å legge inn timeformat resultatet inn i err.txt

```
[s364520@data2500:~$ { time ./regn ; } 2> err.txt
./regn : regner...
./regn, resultat: 14045002650000
[s364520@data2500:~$ cat err.txt
./regn: line 6: echo: command not found
Real:24,456 User:23,042 System:1,412 99,99%
```

4. OPPGAVE Bruker wget og kjører med ./regn&

```
[s364520@data2500:~$ wget https://os.cs.oslomet.no/os/regn
--2023-03-07 19:17:44-- https://os.cs.oslomet.no/os/regn
Resolving os.cs.oslomet.no (os.cs.oslomet.no)... 2001:700:740:1::24, 128.39.28.24
Connecting to os.cs.oslomet.no (os.cs.oslomet.no)|2001:700:740:1::24|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 194
Saving to: 'regn.1'

regn.1          100%[=====]      194  --.-KB/s   in 0s

2023-03-07 19:17:44 (208 MB/s) - 'regn.1' saved [194/194]
[s364520@data2500:~$ ./regn&
[1] 1660901
```

Man kan se under at kommandoen regn bruker 100% CPU-tid.

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1661104	s364520	20	0	9836	3796	3456	R	99.7	0.0	0:11.10	regn
1660947	root	20	0	0	0	0	I	0.7	0.0	0:00.80	kworker/1:0-ev+ 1
1661107	s364520	20	0	22652	5088	4236	R	0.3	0.1	0:00.02	top
1	root	20	0	148610	14024	7608	S	0.0	0.2	2:15.82	svctempd

Under har jeg tre regn prosesser som kjører samtidig og alle tre får 100% CPU-tid. Data2500 har 4 CPU som kan brukes

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1661283	s364520	20	0	9836	3648	3296	R	100.0	0.0	0:08.57	regn
1661277	s364520	20	0	9836	3684	3336	R	99.7	0.0	0:16.95	regn
1661287	s364520	20	0	9836	3724	3372	R	99.7	0.0	0:05.40	regn
1	root	20	0	0	0	0	T	< 2	0.0	0:01.05	kworker/1:0-ev+ 1

Stoppe prosessene med brukernavn i stedet for å bruke prosessID (kill xxxx):

```
s364518 23/2140 0.0 0.0 24464 6/96 pts/10 I Mar01 0:00 ssh s364518@stud
[s364520@data2500:~$ pkill regn
```

5. (Oblig)

Under kompilerer og kjøres programmet, og det kan observeres i top at begge prosessene får 100% CPU-tid.

```
[s364520@data2500:~$ gcc -O run.c
[s364520@data2500:~$ ./a.out&
[1] 1663025
[s364520@data2500:~$ top

top - 19:40:23 up 12 days, 5:14, 16 users, load average: 0.44, 0.27, 0.18
Tasks: 214 total, 3 running, 207 sleeping, 4 stopped, 0 zombie
%Cpu(s): 49.6 us, 0.2 sy, 0.0 ni, 49.3 id, 0.2 wa, 0.0 hi, 0.7 si, 0.1 st
MiB Mem : 7957.0 total, 3273.0 free, 561.7 used, 4222.3 buff/cache
MiB Swap: 1952.0 total, 1952.0 free, 0.0 used. 7186.3 avail Mem

          PID USER      PR  NI    VIRT    RES    SHR S %CPU %MEM     TIME+ COMMAND
1663025 s364520   20   0   2236   496   432 R 99.7  0.0  0:08.64 a.out
1663037 s364526   20   0   2236   500   436 R 99.7  0.0  0:05.48 a.out
769147 zabbix    20   0   16528  3268  2396 S  0.3  0.0  0:25.44 zabbix_agentd
1663039 s364526   20   0   22508  4292  3608 S  0.3  0.1  0:00.01 top
  1 root      20   0   168640 14024  7608 S  0.0  0.2  2:16.11 systemd
  2 root      20   0       0     0   0 S  0.0  0.0  0:00.42 kthreadd
  3 root      20   0       0     0   0 T  0.0  0.0  0:00.00 ksoftqnd
```

Etter å ha tastet 1 vises alle CPU-ene på toppen. Data2500 har 4 CPU-er.

```
top - 19:42:52 up 12 days, 5:16, 16 users, load average: 0.54, 0.51, 0.29
Tasks: 212 total, 1 running, 207 sleeping, 4 stopped, 0 zombie
%Cpu0 : 0.3 us, 0.3 sy, 0.0 ni, 99.3 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu1 : 0.0 us, 0.3 sy, 0.0 ni, 99.7 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu2 : 0.0 us, 0.0 sy, 0.0 ni, 100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu3 : 0.0 us, 0.0 sy, 0.0 ni, 100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 7882.2 total, 3195.0 free, 561.6 used, 4125.7 buff/cache
MiB Swap: 1952.0 total, 1952.0 free, 0.0 used. 7031.7 avail Mem
```

Lager en for løkke som skal få prosessen til å kjøre 5 ganger:

```
[s364520@data2500:~$ for((i=0;i<5;i++)); do ./a.out& done
[1] 1664260
[2] 1664261
[3] 1664262
[4] 1664263
[5] 1664264
```

Under kan man se at de fem prosesene kjøres:

```
top - 19:55:10 up 12 days, 5:29, 16 users, load average: 1.22, 0.39, 0.25
Tasks: 214 total, 6 running, 204 sleeping, 4 stopped, 0 zombie
%Cpu0 :100.0 us, 0.0 sy, 0.0 ni, 0.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu1 :100.0 us, 0.0 sy, 0.0 ni, 0.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu2 :100.0 us, 0.0 sy, 0.0 ni, 0.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
%Cpu3 : 99.3 us, 0.3 sy, 0.0 ni, 0.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.3 st
MiB Mem : 7869.6 total, 3184.3 free, 556.9 used, 4128.4 buff/cache
MiB Swap: 1952.0 total, 1952.0 free, 0.0 used. 7023.7 avail Mem

PID USER PR NI VIRT RES SHR S %CPU %MEM TIME+ COMMAND
1664261 s364520 20 0 2236 560 496 R 86.0 0.0 0:12.97 a.out
1664263 s364520 20 0 2236 564 500 R 84.4 0.0 0:12.81 a.out
1664260 s364520 20 0 2236 564 496 R 80.7 0.0 0:13.24 a.out
1664264 s364520 20 0 2236 496 432 R 78.7 0.0 0:12.82 a.out
1664262 s364520 20 0 2236 560 496 R 69.8 0.0 0:12.39 a.out
1664267 root 20 0 0 0 0 T 0.0 0.0 0:15.43 kworker/1:0-evu+
```

Under har jeg endret til «last used CPU» (kolonne helt til høyre):

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND	P
1665085	s364520	20	0	2236	500	436	R	84.1	0.0	0:09.20	a.out	2
1665082	s364520	20	0	2236	496	432	R	81.1	0.0	0:09.18	a.out	3
1665084	s364520	20	0	2236	492	432	R	80.4	0.0	0:09.38	a.out	1
1665081	s364520	20	0	2236	496	432	R	78.1	0.0	0:09.44	a.out	0
1665083	s364520	20	0	2236	564	500	R	75.1	0.0	0:08.99	a.out	3
1665086	s364520	20	0	22636	5008	4160	R	0.3	0.1	0:00.01	top	1
1	root	20	0	168640	14024	7608	S	0.0	0.2	2:16.53	systemd	1
2	root	20	0	0	0	0	S	0.0	0.0	0:00.42	kthreadd	2
3	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	rcu_gp	2
4	root	0	-20	0	0	0	T	0.0	0.0	0:00.00	rcu_par_gp	0

Hvis hver CPU har 100% kapasitet å utdele en prosess vil 4 CPU-er (400% kapasitet) fordeles på 5 prosesser: 80. Derfor vil hver av de fem programmene få tildelt omtrent 80% av CPU-ressursene.

6. OPPGAVE Logget inn på Linux-VM og lastet ned gcc

```
[group25@os25:~$ wget https://os.cs.oslomet.no/os/run.c
--2023-03-07 20:29:40-- https://os.cs.oslomet.no/os/run.c
Resolving os.cs.oslomet.no (os.cs.oslomet.no)... 128.39.28.24, 2001:700:740:1::24
Connecting to os.cs.oslomet.no (os.cs.oslomet.no)|128.39.28.24|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 190 [text/x-csrc]
Saving to: 'run.c'

run.c          100%[=====]      190  --.-KB/s   in 0s

2023-03-07 20:29:40 (90.0 MB/s) - 'run.c' saved [190/190]

[group25@os25:~$ sudo apt install gcc
[sudo] password for group25:
Reading package lists... Done
Building dependency tree
Reading state information... Done
gcc is already the newest version (4:9.3.0-1ubuntu2).
0 upgraded, 0 newly installed, 0 to remove and 13 not upgraded.
```

Kompilerer og runner:

```
[group25@os25: ~$ gcc -O run.c
[group25@os25: ~$ ./a.out&
[1] 21412
[group25@os25: ~$ top
```

Ser at prosessen kjører med 100% CPU i top:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
21412	group25	20	0	2356	512	448	R	99.7	0.0	0:07.17	a.out
1	root	20	0	2608	596	528	S	0.0	0.0	0:00.04	sh
61	root	20	0	2608	1640	1548	S	0.0	0.0	0:00.40	sh

Dreper en prosess uten å finne prosessID, bruker heller navn.

```
[group25@os25: ~$ pkill a.out
```

Med en for løkke: **for((i=0;i<2;i++)); do ./a.out& done** kjøres tre prosesser:

```
[group25@os25: ~$ for((i=0;i<3;i++)); do ./a.out& done
[1] 22605
[2] 22606
[3] 22607
```

3 program som kjører:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
22605	group25	20	0	2356	576	512	R	66.7	0.0	0:03.77	a.out
22606	group25	20	0	2356	576	512	R	66.3	0.0	0:03.75	a.out
22607	group25	20	0	2356	580	512	R	66.0	0.0	0:03.74	a.out
1	root	20	0	2608	596	528	S	0.0	0.0	0:00.04	sh

Det ser ut til at det finnes 60 CPU, men vi får kun lov til å bruke 3 CPU-er?

Kommentert [AD1]: Er usikker, skjønner ikke

Hvis jeg regner på hvor mange CPU-er det ser ut til å bli brukt er det: 2.

Under har jeg kjørt tre programmer og det brukes tre ulike prosesser:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND	P
25270	group25	20	0	2356	576	512	R	66.8	0.0	0:09.31	a.out	42
25272	group25	20	0	2356	576	512	R	66.8	0.0	0:09.32	a.out	50
25271	group25	20	0	2356	576	512	R	66.4	0.0	0:09.30	a.out	45
162	root	20	0	3205612	46820	33424	S	0.3	0.0	11:48.78	containerd	83
1	root	20	0	2608	596	528	S	0.0	0.0	0:00.04	sh	64
61	root	20	0	2608	1640	1548	S	0.0	0.0	0:00.40	sh	85
71	rroot	20	0	12180	4324	3400	S	0.0	0.0	0:00.13	sshd	29

7. UKENS NØTT 2

10 minutter for å fullføre en 100% CPU-intensiv prosess

Så for en server med:

- 1 CPU vil det ta 10 min, 60 min for 6
 - 2 CPU vil det ta halvparten av tiden, 5 min, 30 min for 6
 - 4 CPU vil det ta $\frac{1}{4}$, 2,5 min, 15 min for 6
 - 6 CPU vil det ta 1,67 min, 10 min for 6
 - 8 CPU vil det ta 1,25 min, 7,5min for 6

8. UKENS NØTT 2

Endrer koden til den ytre løkka med j slik at den runnes en gang:

```
[group25@os25:~/uke9AD$ jed run.c
[group25@os25:~/uke9AD$ cat run.c
#include <stdio.h>

int main()
{
    float sum = 10;
    int i,j;
    for (j = 0; j < 1;j++)
        for (i = 1; i < 1510000000;i++)
    {
        sum = sum/(1.0*i);
    }
    printf("SUM: %2.6f",sum);
}
```

Under kompileres og kjøres programmet:

```
[group25@os25:~/uke9AD$ for((i=0;i<6;i++)); do time ./a.out& done
[1] 26694
[2] 26695
[3] 26696
[4] 26698
[5] 26701
[6] 26702
```

Her er top ved kjøring av de 6 prosessene:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
26515	group25	20	0	2356	512	448	R	34.3	0.0	0:02.91	a.out
26507	group25	20	0	2356	576	512	R	33.7	0.0	0:02.90	a.out
26512	group25	20	0	2356	516	448	R	33.0	0.0	0:02.83	a.out
26516	group25	20	0	2356	516	448	R	33.0	0.0	0:02.88	a.out
26509	group25	20	0	2356	516	448	R	32.7	0.0	0:02.86	a.out
26513	group25	20	0	2356	576	512	R	32.3	0.0	0:02.81	a.out
162	root	20	0	3205612	47456	33488	S	0.3	0.0	12:09.96	containerd
1	root	20	0	2608	596	528	S	0.0	0.0	0:00.04	sh

Under kan man se ved Real at ved kjøring av 6 prosesser stemmer gitt i sekunder:

```
SUM: 0.000000Real:25.774 User:8.740 System:0.000 33.90%
SUM: 0.000000Real:25.853 User:8.739 System:0.000 33.80%
SUM: 0.000000Real:25.879 User:8.740 System:0.000 33.77%
SUM: 0.000000Real:26.100 User:8.739 System:0.000 33.48%
SUM: 0.000000Real:26.121 User:8.736 System:0.000 33.44%
SUM: 0.000000Real:26.243 User:8.738 System:0.000 33.29%
```

9. (Oblig)

Legger til brukeren min med vanlig studentnummer som brukernavn:

```
[group25@os25:~$ sudo adduser s364520
Adding user `s364520' ...
Adding new group `s364520' (1003) ...
Adding new user `s364520' (1003) with group `s364520' ...
Creating home directory `/home/s364520' ...
Copying files from `/etc/skel' ...
New password:
[Retype new password:
passwd: password updated successfully
Changing the user information for s364520
Enter the new value, or press ENTER for the default
[ Full Name []: s364520
[ Room Number []:
[ Work Phone []:
[ Home Phone []:
[ Other []:
Is the information correct? [Y/n] Y
```

Det kan nå observeres at brukeren min er lagt til som en bruker i /etc/shadow:

```
[group25@os25:~$ sudo grep s364520 /etc/shadow
s364520:$6$sYBK0qs.4sXrC8X3$Tkbxt8IOPQBwfBbUYTNBZvL97h/2bB3ZMYcSPId6TmyNC89dh3w/.3hV9
wFx1xMXJ.qcfMww8NCDdbRsa99V/:19423:0:99999:7:::
```

Kommando for gruppen jeg tilhører:

```
[root@localhost ~]$ groups s364520
s364520 : s364520
```

Under bytter jeg konto til den jeg lagde, og det er mulig å se at jeg ikke kan bli sudo bruker.

Jeg kan ikke kjøre kommandoen fordi jeg ikke er medlem av gruppen «sudo» eller «wheel» som gir brukeren tilgang til å utføre privilegerte kommandoer som root.

```
[root@localhost ~]$ su s364520
>Password:
[s364520@os25:/home/group25$ sudo su
[sudo] password for s364520:
s364520 is not in the sudoers file. This incident will be reported.
s364520@os25:/home/group25$
```

Skrev kommandoen cat /etc/group og tok skjermdump av at jeg har sudo nå:

```
tape:x:26:  
sudo:x:27:group25,s364561,s364520
```

Her ser jeg groups jeg er med i:

```
[s364520@os25:~]$ groups  
s364520 sudo
```

FRA CHATGPT:

Medlemmer i gruppen 'sudo' får sudo-rettigheter fordi det er definert i sudoers-konfigurasjonsfilen (/etc/sudoers) på systemer. I denne filen kan man spesifisere hvilke brukere eller grupper som skal ha tillatelse til å utføre kommandoer med sudo-rettigheter.

10. OPPGAVE

Under lager jeg mappa felles (med 20 etter fordi det er de siste sifrene i s-nr mitt):

Inni lager jeg fila info.txt. Lager sudogruppen os og legger til min bruker inni gruppa.

```
[group25@os25:~$ mkdir felles20  
[group25@os25:~$ cd felles20  
[group25@os25:~/felles20$ touch info.txt  
[group25@os25:~/felles20$ tree  
.  
└── info.txt  
  
0 directories, 1 file  
[group25@os25:~/felles20$ sudo addgroup os  
[sudo] password for group25:  
addgroup: The group `os' already exists.  
[group25@os25:~/felles20$ sudo addgroup s364520 os  
Adding user `s364520' to group `os' ...  
Adding user s364520 to group os  
Done.
```

Under er mappen felles20 laget av meg, også skriver jeg kommandoen «chgrp» med opsjonen -R for å endre rekursivt i alt innholdet inni også:

```
[group25@os25:~$ ls -l
total 32
-rw-rw-r-- 1 group25 group25 41 Mar 7 17:56 err.txt
drwxrwxr-x 2 group25 group25 4096 Mar 8 00:48 felles20
drwxrwxr-x 2 group25 os 4096 Mar 6 15:43 felles3
-rw-rw-r-- 1 group25 group25 0 Mar 4 00:31 fungerer.txt
-rw-rw-r-- 1 group25 group25 0 Mar 7 17:56 res.txt
-rw-rw-r-- 1 group25 group25 190 Mar 4 2020 run.c
drwxrwxrwx 3 group25 group25 4096 Mar 6 14:49 tmp
drwxrwxr-x 2 group25 group25 4096 Mar 7 19:30 uke10SE
drwxrwxr-x 2 group25 group25 4096 Mar 7 22:59 uke9AD
drwxrwxr-x 2 group25 group25 4096 Mar 3 23:09 uke9SE
[group25@os25:~$ chgrp os felles20
[group25@os25:~$ chgrp -R os ~/felles20
```

Da endres gruppen:

```
[group25@os25:~$ ls -l
total 32
-rw-rw-r-- 1 group25 group25 41 Mar 7 17:56 err.txt
drwxrwxr-x 2 group25 os 4096 Mar 8 00:48 felles20
drwxrwxr-x 2 group25 os 4096 Mar 6 15:43 felles3
-rw-rw-r-- 1 group25 group25 0 Mar 4 00:31 fungerer.txt
-rw-rw-r-- 1 group25 group25 0 Mar 7 17:56 res.txt
-rw-rw-r-- 1 group25 group25 190 Mar 4 2020 run.c
drwxrwxrwx 3 group25 group25 4096 Mar 6 14:49 tmp
drwxrwxr-x 2 group25 group25 4096 Mar 7 19:30 uke10SE
drwxrwxr-x 2 group25 group25 4096 Mar 7 22:59 uke9AD
drwxrwxr-x 2 group25 group25 4096 Mar 3 23:09 uke9SE
```

Logger ut for å sjekke om andre kan redigere filen.

```
[group25@os25:~$ logout
Connection to os25.vlab.cs.oslomet.no closed.
s364520@os25:~$
```

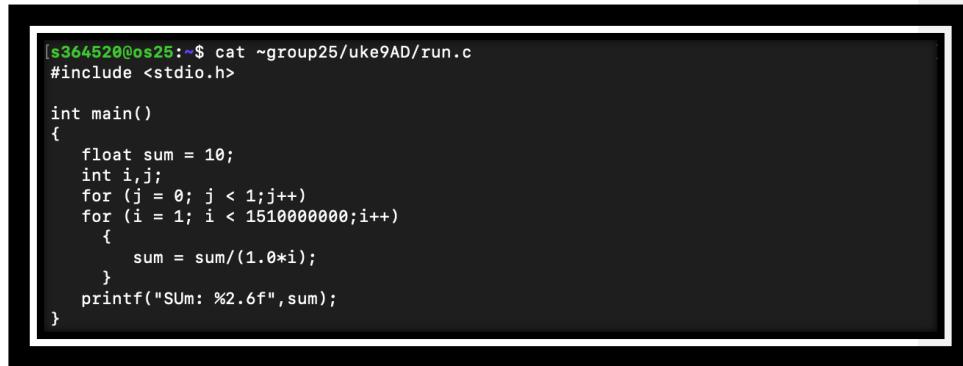
ER IKKE FERDIG HER

11. UKENS UTFORDRING

James Bond rettigheter:

```
[group25@os25:~$ chmod o+rwx,g-rwx,u-rwx ~/felles20
[group25@os25:~$ ls -l
total 32
-rw-rw-r-- 1 group25 group25 41 Mar 7 17:56 err.txt
d-----rwx 2 group25 os 4096 Mar 8 00:48 felles20
```

Jeg hadde ikke en fil.txt så under er jeg inne på data2500 og prøvde å se andre filer i felles20:



```
[s364520@os25:~$ cat ~group25/uke9AD/run.c
#include <stdio.h>

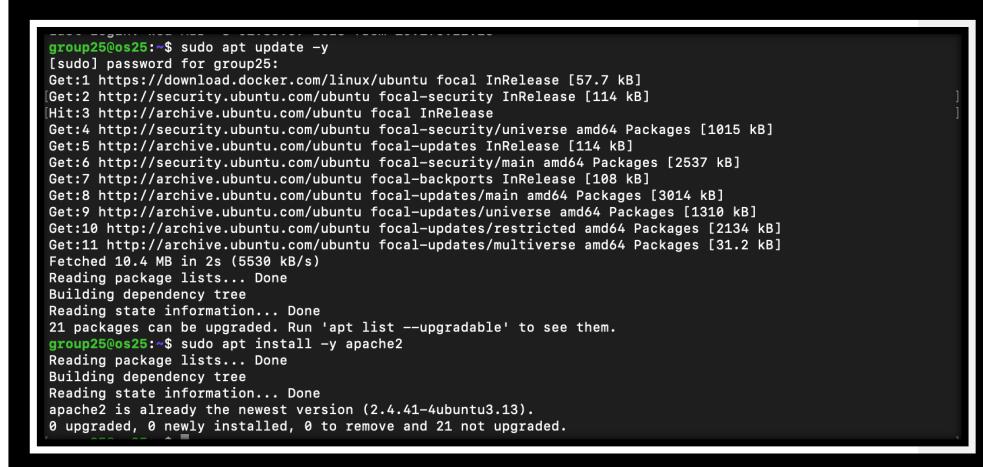
int main()
{
    float sum = 10;
    int i,j;
    for (j = 0; j < 1;j++)
        for (i = 1; i < 1510000000;i++)
    {
        sum = sum/(1.0*i);
    }
    printf("SUm: %2.6f",sum);
}
```

Siden alle andre enn bruker og gruppen har rettigheter kan andre folk gjøre hva de vil.

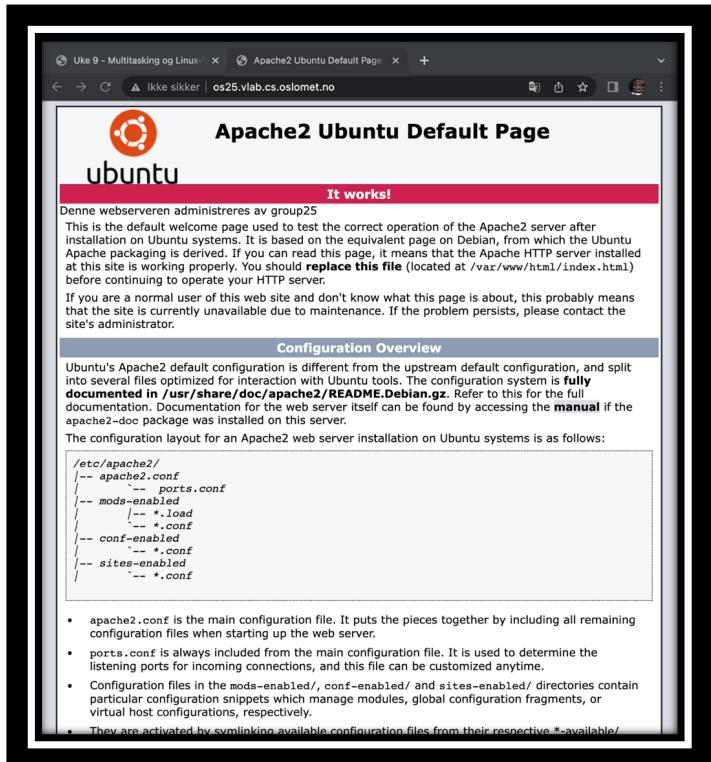
12. (Oblig)

Under kjører jeg kommandoene:

```
sudo apt update -y
sudo apt install -y apache2
```



```
group25@os25:~$ sudo apt update -y
[sudo] password for group25:
Get:1 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:2 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:3 http://archive.ubuntu.com/ubuntu focal InRelease
Get:4 http://security.ubuntu.com/ubuntu focal-security/universe amd64 Packages [1015 kB]
Get:5 http://archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security/main amd64 Packages [2537 kB]
Get:7 http://archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:8 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3014 kB]
Get:9 http://archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [1310 kB]
Get:10 http://archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [2134 kB]
Get:11 http://archive.ubuntu.com/ubuntu focal-updates/multiverse amd64 Packages [31.2 kB]
Fetched 10.4 MB in 2s (5530 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
21 packages can be upgraded. Run 'apt list --upgradable' to see them.
group25@os25:~$ sudo apt install -y apache2
Reading package lists... Done
Building dependency tree
Reading state information... Done
apache2 is already the newest version (2.4.41-4ubuntu3.13).
0 upgraded, 0 newly installed, 0 to remove and 21 not upgraded.
```



13. (Oblig)

Man lager et felles screen med «screen -dm -S fellesScreen». Under laster jeg bare ned nødvendige pakker:

```
s364520@x:1003:
group25os25:~$ sudo apt update -
[sudo] password for group25:
Hit:1 https://download.docker.com/linux/ubuntu focal InRelease
Get:2 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:3 http://archive.ubuntu.com/ubuntu focal InRelease
Get:4 http://archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:5 http://archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Fetched 336 kB in 1s (336 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
21 packages can be upgraded. Run 'apt list --upgradable' to see them.
group25os25:~$ sudo apt install -y screen
Reading package lists... Done
Building dependency tree
Reading state information... Done
screen is already the newest version (4.8.0-1ubuntu0.1).
0 upgraded, 0 newly installed, 0 to remove and 21 not upgraded.
```

14. (Oblig)

Under fungerer innlogging uten passord nå:

```
[s364520@data2500:~$ ssh-keygen
-----[REDACTED]-----
Generating public/private rsa key pair.
Enter file in which to save the key (/home/s364520/.ssh/id_rsa):
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/s364520/.ssh/id_rsa
Your public key has been saved in /home/s364520/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:xCs3u/exYfak0pZKgP12fSjkTURr7jDzNqStJho2cqY s364520@data2500
[The key's randomart image is:
+---[RSA 3072]---+
| . .
| . .
| . + .
| o . = .
| . o S O +
| o = / .
| . * +.*& .
| * * o.=O.=
| E ...**+o+.
+---SHA256---]
[s364520@data2500:~$ ssh-copy-id group25os25.vlab.cs.oslomet.no
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/s364520/.ssh/id_rsa.pub"
/usr/bin/ssh-copy-id: INFO: attempting to log in with the new key(s), to filter out any that are already installed
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now it is to install the new keys
group25os25.vlab.cs.oslomet.no's password:
Number of key(s) added: 1
Now try logging into the machine, with: "ssh 'group25os25.vlab.cs.oslomet.no'"
and check to make sure that only the key(s) you wanted were added.
```

```
s364520@data2500:~$ ssh group25os25.vlab.cs.oslomet.no
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.4.0-132-generic x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage
Last login: Wed Mar  8 10:36:04 2023 from 10.196.10.10
group25os25:~$
```

Under ser man vellykket kjøring:

```
s364520@data2500:~$ ./oppg14Uke9.sh
tar: Removing leading `/' from member names
dir.tgz
Working
Ferdig!
```

Koden:

```
#!/bin/bash

function handle_error {
    echo "Error occurred. Script failed."
}
trap 'handle_error' ERR

#OVER ER FEILHANDTERING

username="group25"          #setter variabler for brukernavn og IP-adresse til linux-VM
ip="os25.vlab.cs.oslomet.no"

tar cfz dir.tgz /tmp/dir    #pakker ned mappen /tmp/dir på data2500

scp dir.tgz $username@$ip:~ #kopierer pakken til brukerens hjemmemappe på Linux-VM med scp

if [ ! -d "/tmp/dir" ]; then #sjekker om /tmp/dir eksisterer
    echo "Directory /tmp/dir does not exist"
    echo "Making directory"
    ssh $username@$ip 'if [ ! -d "~/.tmp" ]; then mkdir ~/.tmp; fi' #lager mappen på VM
    exit 1
else
    echo "Working"
fi

#ssh $username@$ip 'chmod 777 ~/.tmp'
ssh $username@$ip 'tar xfz dir.tgz -C ~/.tmp' #pakk ut filene i tgz fila til mappa på VM
ssh $username@$ip 'rm dir.tgz'
echo "Ferdig!" #beskjed om at det funker
```

15. (Oblig)

Under bytter jeg til Linux VM-konto:

```
[s364520@data2500:~$ ssh group25@os25.vlab.cs.oslomet.no
Welcome to Ubuntu 20.04.5 LTS (GNU/Linux 5.4.0-132-generic x86_64)

 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage
Last login: Wed Mar  8 12:44:12 2023 from 10.196.10.10
group25@os25:~$ sudo apt update -y
[sudo] password for group25:
Hit:1 https://download.docker.com/linux/ubuntu focal InRelease
|Get:2 http://ubuntu.com/ubuntu focal-security InRelease [114 kB]
Hit:3 http://archive.ubuntu.com/ubuntu focal InRelease
|Get:4 http://archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
|Get:5 http://archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Fetched 336 kB in 1s (336 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
21 packages can be upgraded. Run 'apt list --upgradable' to see them.
group25@os25:~$ sudo apt install -y rsync
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages will be upgraded:
  rsync
1 upgraded, 0 newly installed, 0 to remove and 20 not upgraded.
Need to get 322 kB of archives.
After this operation, 4096 B of additional disk space will be used.
Get:1 http://archive.ubuntu.com/ubuntu focal-updates/main amd64 rsync amd64 3.1.3-8ubuntu0.5 [322 kB]
Fetched 322 kB in 0s (1702 kB/s)
debconf: delaying package configuration, since apt-utils is not installed
(Reading database ... 29014 files and directories currently installed.)
Preparing to unpack .../rsync_3.1.3-8ubuntu0.5_amd64.deb ...
Unpacking rsync (3.1.3-8ubuntu0.5) over (3.1.3-8ubuntu0.4) ...
Setting up rsync (3.1.3-8ubuntu0.5) ...
invoke-rc.d: could not determine current runlevel
invoke-rc.d: policy-rc.d denied execution of restart.
Processing triggers for man-db (2.9.1-1) ...
Processing triggers for systemd (245.4-4ubuntu3.19) ...
```

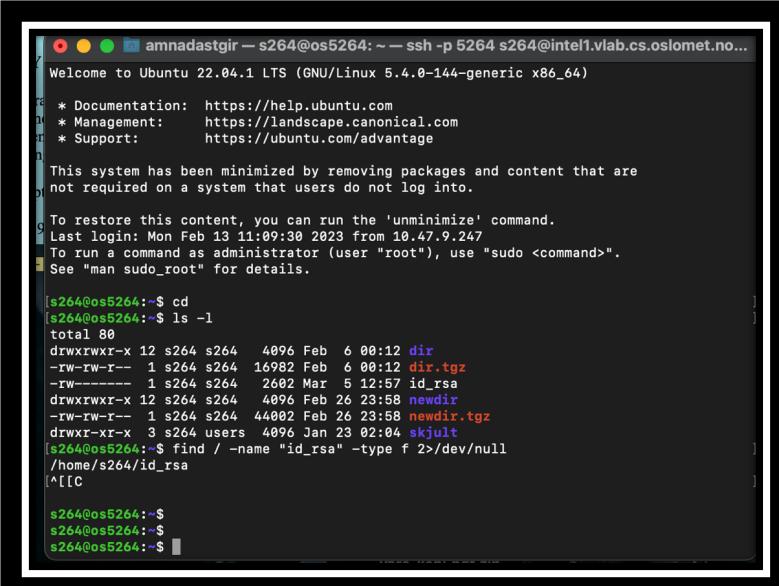
Under kjører jeg scriptet og ser at det blir gjort en backup:

```
[s364520@data2500:~$ ./backup.sh
[s364520@data2500:~$ cd ~/home
[s364520@data2500:~/home$ ls -l
total 4
drwx----- 14 s364520 20364520 4096 Mar  9 00:16 group25
s364520@data2500:~/home$ ]
```

Koden til scriptet backup.sh:

```
[s364520@data2500:~$ cat backup.sh
#!/bin/bash

#tar backup av mappen /home/group25, merk -r opsjon for rekursiv backup
rsync -r group25@os25.vlab.cs.oslomet.no:/home/group25 ~/home[s364520@data2500:~$ ]
```

UKENS LINUX:

```
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.4.0-144-generic x86_64)

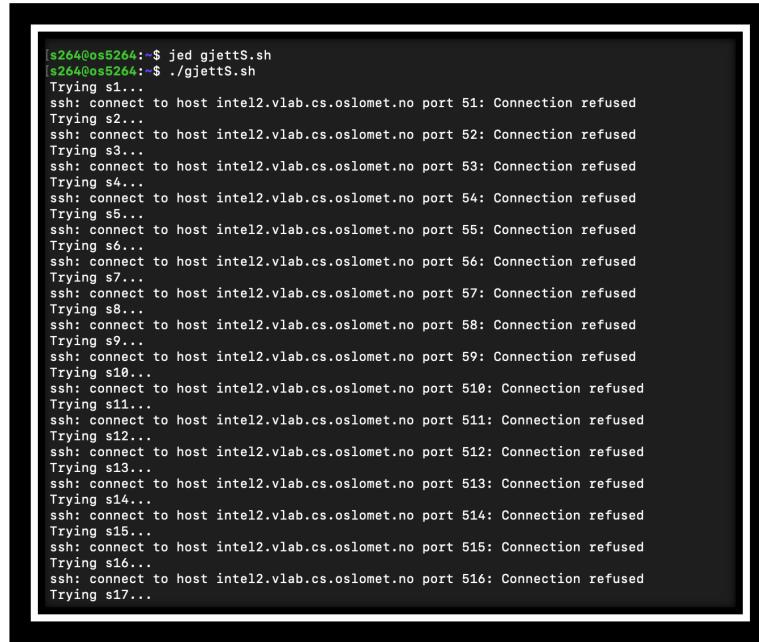
 * Documentation: https://help.ubuntu.com
 * Management: https://landscape.canonical.com
 * Support: https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.
Last login: Mon Feb 13 11:09:30 2023 from 10.47.9.247
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

[s264@os5264:~]$ cd
[s264@os5264:~]$ ls -l
total 80
drwxrwxr-x 12 s264 s264 4096 Feb 6 00:12 dir
-rw-rw-r-- 1 s264 s264 16982 Feb 6 00:12 dir.tgz
-rw----- 1 s264 s264 2602 Mar 5 12:57 id_rsa
drwxrwxr-x 12 s264 s264 4096 Feb 26 23:58 newdir
-rw-rw-r-- 1 s264 s264 44002 Feb 26 23:58 newdir.tgz
drwxr-xr-x 3 s264 users 4096 Jan 23 02:04 skjult
[s264@os5264:~]$ find / -name "id_rsa" -type f 2>/dev/null
/home/s264/id_rsa
[~][C]

[s264@os5264:~]$ 
[s264@os5264:~]$ 
[s264@os5264:~]$ 
```



```
[s264@os5264:~]$ jed gjettS.sh
[s264@os5264:~]$ ./gjettS.sh
Trying s1...
ssh: connect to host intel2.vlab.cs.oslomet.no port 51: Connection refused
Trying s2...
ssh: connect to host intel2.vlab.cs.oslomet.no port 52: Connection refused
Trying s3...
ssh: connect to host intel2.vlab.cs.oslomet.no port 53: Connection refused
Trying s4...
ssh: connect to host intel2.vlab.cs.oslomet.no port 54: Connection refused
Trying s5...
ssh: connect to host intel2.vlab.cs.oslomet.no port 55: Connection refused
Trying s6...
ssh: connect to host intel2.vlab.cs.oslomet.no port 56: Connection refused
Trying s7...
ssh: connect to host intel2.vlab.cs.oslomet.no port 57: Connection refused
Trying s8...
ssh: connect to host intel2.vlab.cs.oslomet.no port 58: Connection refused
Trying s9...
ssh: connect to host intel2.vlab.cs.oslomet.no port 59: Connection refused
Trying s10...
ssh: connect to host intel2.vlab.cs.oslomet.no port 510: Connection refused
Trying s11...
ssh: connect to host intel2.vlab.cs.oslomet.no port 511: Connection refused
Trying s12...
ssh: connect to host intel2.vlab.cs.oslomet.no port 512: Connection refused
Trying s13...
ssh: connect to host intel2.vlab.cs.oslomet.no port 513: Connection refused
Trying s14...
ssh: connect to host intel2.vlab.cs.oslomet.no port 514: Connection refused
Trying s15...
ssh: connect to host intel2.vlab.cs.oslomet.no port 515: Connection refused
Trying s16...
ssh: connect to host intel2.vlab.cs.oslomet.no port 516: Connection refused
Trying s17... 
```

```
Trying s147...
Warning: Permanently added '[intel2.vlab.cs.oslomet.no]:5147' (ED25519) to the list of known hosts.
s147@intel2.vlab.cs.oslomet.no: Permission denied (publickey,password).
Trying s148...
Warning: Permanently added '[intel2.vlab.cs.oslomet.no]:5148' (ED25519) to the list of known hosts.
Welcome to Ubuntu 22.04.1 LTS (GNU/Linux 5.4.0-144-generic x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/advantage

This system has been minimized by removing packages and content that are
not required on a system that users do not log into.

To restore this content, you can run the 'unminimize' command.

The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

[s148@os5148:~$ ssh -i id_rsa -p 5148 s148@intel2.vlab.cs.oslomet.no -o PasswordAuthentication
```

```
s148@os5148:~$ ls -l
total 0
s148@os5148:~$ ~
-bash: /home/s148: Is a directory
s148@os5148:~$ cd ~
s148@os5148:~$ ls -l gjettS.sh
ls: cannot access 'gjettS.sh': No such file or directory
s148@os5148:~$ ls -l
total 0
s148@os5148:~$ ls /root
ls: cannot open directory '/root': Permission denied
s148@os5148:~$ cat /root/code.txt
cat: /root/code.txt: Permission denied
s148@os5148:~$ ls -l
total 0
s148@os5148:~$ cd /
s148@os5148:/$ ls -l
total 68
lrwxrwxrwx 1 root root 7 Nov 1 21:15 bin -> usr/bin
drwxr-xr-x 2 root root 4096 Apr 18 2022 boot
drwxr-xr-x 5 root root 360 Mar 5 12:07 dev
drwxr-xr-x 1 root root 4096 Mar 3 16:50 etc
-rw-r--r-- 1 root root 3817 Nov 25 19:04 gpg
drwxr-xr-x 1 root root 4096 Mar 3 16:50 home
lrwxrwxrwx 1 root root 7 Nov 1 21:15 lib -> usr/lib
lrwxrwxrwx 1 root root 9 Nov 1 21:15 lib32 -> usr/lib32
lrwxrwxrwx 1 root root 9 Nov 1 21:15 lib64 -> usr/lib64
lrwxrwxrwx 1 root root 10 Nov 1 21:15 libx32 -> usr/libx32
drwxr-xr-x 2 root root 4096 Nov 1 21:15 media
drwxr-xr-x 2 root root 4096 Nov 1 21:15 mnt
drwxr-xr-x 2 root root 4096 Nov 1 21:15 opt
dr-xr-xr-x 3418 root root 0 Mar 5 12:07 proc
drwx----- 1 root root 4096 Mar 3 16:50 root
drwxr-xr-x 1 root root 4096 Mar 6 12:32 run
lrwxrwxrwx 1 root root 8 Nov 1 21:15 sbin -> usr/sbin
drwxr-xr-x 2 root root 4096 Nov 1 21:15 srv
-rw-r-xr-x 1 root root 302 Mar 3 16:50 startup.sh
dr-xr-xr-x 13 nobody nogroup 0 Mar 5 12:07 sys
drwxrwxrwt 1 root root 4096 Nov 29 11:02 tmp
drwxr-xr-x 1 root root 4096 Nov 1 21:15 usr
drwxr-xr-x 1 root root 4096 Nov 1 21:18 var
s148@os5148:/$ cd /root
-bash: cd: /root: Permission denied
s148@os5148:/$ cd root
-bash: cd: root: Permission denied
s148@os5148:/$ sudo su
root@os5148:~# cd /root
root@os5148:~# la -l
total 12
-rw-r--r-- 1 root root 3106 Oct 15 2021 .bashrc
-rw-r--r-- 1 root root 161 Jul 9 2019 .profile
-rw-r--r-- 1 s148 users 11 Mar 3 16:50 xfile
root@os5148:~# cat xfile
WYdHVav33y
root@os5148:~# exit
exit
s148@os5148:/$
```