

1) How many states could has a process in Linux?

Created, ready, running, waiting, terminated

Выполнение (отрабатывает или ожидает передачи процессору с целью выполнения)

Ожидание (ож. ввода, сигнала от другого процессора, выделения ресурсов)

Завершен

Зомби

2) Examine the pstree command. Make output (highlight) the chain (ancestors) of the current process. student@CsnKhai:~\$ sleep 10000 &

[1] 2725

student@CsnKhai:~\$ pstree 2725

sleep

student@CsnKhai:~\$ pstree -s 2725

init—sshd—sshd—sshd—bash—sleep

3) What is a proc file system?

/proc pseudo-filesystem which provides an interface to kernel data structures.

4) Print information about the processor (its type, supported technologies, etc.).

cat /proc/cpuinfo

processor : 0

vendor_id : AuthenticAMD

cpu family : 23

model : 113

model name : AMD Ryzen 5 3600 6-Core Processor

stepping : 0

microcode : 0xffffffff

cpu MHz : 3333.038

cache size : 512 KB

physical id : 0

siblings : 4

core id : 0

cpu cores : 4

apicid : 0

initial apicid : 0

fdiv_bug : no

f00f_bug : no

coma_bug : no

fpu : yes

fpu_exception : yes

cpuid level : 13

wp : yes

flags : fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov pat pse36

clflush mmx fxsr sse sse2 ht syscall nx fxsr_opt rdtscp constant_tsc nonstop_tsc extd_apicid pni

ssse3 cx16 sse4_1 sse4_2 lahf_lm cmp_legacy cr8_legacy arat vmcall fsgsbase

bogomips : 6666.07

clflush size : 64

cache_alignment : 64

address sizes : 48 bits physical, 48 bits virtual

power management:

5) Use the ps command to get information about the process. The information should be as follows: the owner of the process, the arguments with which the process was launched for execution, the group owner of this process, etc.

root@CsnKhai:~# ps -o pid,user,group,args 27417

PID	USER	GROUP	COMMAND
27417	root	root	sleep 10000

6) How to define kernel processes and user processes?

При выводе через ps роцессы ядра имеют [] в названии

Процессы ядра linux запускаются самим ядром, при этом родительским процессом якобы их породившим, назначается процесс kthread, с PID=2. Таким образом процессами ядра надо считать сам процесс с PID=2, а так же процессы у которых PPID (т.е. pid родителя) равен 2. pstree без параметров показывает только дерево процессов порожденных init, т.е. пользовательских процессов. Процессы ядра покажет sudo pstree 2.

Процессы ядра:

```
sudo ps --ppid=2 --pid=2
pstree 2
```

Пользовательские:

```
sudo ps -N --ppid=2 --pid=2
pstree
```

7) Print the list of processes to the terminal. Briefly describe the statuses of the processes. What condition are they in, or can they be arriving in?

R : процесс выполняется в данный момент;

S : процесс ожидает (т.е. спит менее 20 секунд);

I : процесс бездействует (т.е. спит больше 20 секунд);

D : процесс ожидает ввода-вывода (или другого недолгого события), непрерываемый;

Z : zombie или defunct процесс, то есть завершившийся процесс, код возврата которого пока не считан родителем;

T : процесс остановлен;

W : процесс в свопе;

< : процесс в приоритетном режиме;

N : процесс в режиме низкого приоритета;

L : real-time процесс, имеются страницы, заблокированные в памяти;

s : лидер сессии.

8) Display only the processes of a specific user.

ps uU student

USER	PID	%CPU	%MEM	VSZ	RSS	TTY	STAT	START	TIME	COMMAND
student	1305	0.0	0.1	6668	2796	tty1	S+	13:45	0:00	-bash
student	2177	0.0	0.1	8956	2212	?	S	19:29	0:00	sshd: student@pts/2
student	2178	0.0	0.1	6668	3044	pts/2	Ss+	19:29	0:00	-bash
student	2210	0.0	0.0	8648	1688	?	S	19:29	0:00	sshd: student@notty
student	2211	0.0	0.0	2464	824	?	Ss	19:29	0:00	/usr/lib/openssh/sftp-server
student	2578	0.0	0.1	8920	2300	?	S	19:52	0:00	sshd: student@pts/5
student	2579	0.0	0.1	6668	3028	pts/5	Ss+	19:52	0:00	-bash
student	2587	0.0	0.0	8616	1552	?	S	19:52	0:00	sshd: student@notty
student	2588	0.0	0.0	2464	824	?	Ss	19:52	0:00	/usr/lib/openssh/sftp-server
student	2725	0.0	0.0	4228	532	pts/5	S	20:50	0:00	sleep 10000

9) What utilities can be used to analyze existing running tasks (by analyzing the help for the ps command)?

SEE ALSO

pgrep(1), pstree(1), top(1), proc(5).

+htop

10) What information does top command display?

top - 20:50:40 up 6:17, 3 users, load average: 0.00, 0.01, 0.05

Tasks: 97 total, 1 running, 96 sleeping, 0 stopped, 0 zombie

%Cpu(s): 0.0 us, 0.0 sy, 0.0 ni, 100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st

KiB Mem: 2064092 total, 276596 used, 1787496 free, 14896 buffers

KiB Swap: 0 total, 0 used, 0 free. 215664 cached Mem

11) Display the processes of the specific user using the top command

user filter - [u] key

```
top - 20:52:41 up 6:19, 3 users, load average: 0.00, 0.01, 0.05
Tasks: 97 total, 1 running, 96 sleeping, 0 stopped, 0 zombie
%Cpu(s): 0.0 us, 0.0 sy, 0.0 ni,100.0 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
KiB Mem: 2064092 total, 278648 used, 1785444 free, 14996 buffers
KiB Swap: 0 total, 0 used, 0 free. 216960 cached Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
899	student	20	0	8956	2216	1256	S	0.0	0.1	0:00.56	sshd
900	student	20	0	6668	3024	1668	S	0.0	0.1	0:00.05	bash
931	student	20	0	8648	1688	940	S	0.0	0.1	0:00.00	sshd
934	student	20	0	2464	624	532	S	0.0	0.0	0:00.00	sftp-server
956	student	20	0	8956	2228	1288	S	0.0	0.1	0:00.64	sshd
957	student	20	0	6668	3012	1664	S	0.0	0.1	0:00.02	bash
990	student	20	0	8648	1684	936	S	0.0	0.1	0:00.00	sshd
991	student	20	0	2464	628	532	S	0.0	0.0	0:00.00	sftp-server
993	student	20	0	6848	2440	1984	S	0.0	0.1	0:00.33	ssh
1028	student	20	0	6668	2792	1512	S	0.0	0.1	0:00.03	bash

12) What interactive commands can be used to control the top command? Give a couple of examples.

Global-defaults

- 'A' - Alt display Off (full-screen)
- * 'd' - Delay time 3.0 seconds
- * 'H' - Threads mode Off (summarize as tasks)
- 'I' - Irix mode On (no, 'solaris' smp)
- * 'p' - PID monitoring Off (show all processes)
- * 's' - Secure mode Off (unsecured)
- 'B' - Bold enable On (yes, bold globally)

Summary-Area-defaults

- 'l' - Load Avg/Uptime On (thus program name)
- 't' - Task/Cpu states On (1+1 lines, see 'l')
- 'm' - Mem/Swap usage On (2 lines worth)
- '1' - Single Cpu On (thus 1 line if smp)

Task-Area-defaults

- 'b' - Bold hilite On (not 'reverse')
- * 'c' - Command line Off (name, not cmdline)
- * 'i' - Idle tasks On (show all tasks)
- 'J' - Num align right On (not left justify)
- 'j' - Str align right Off (not right justify)
- 'R' - Reverse sort On (pids high-to-low)
- * 'S' - Cumulative time Off (no, dead children)
- * 'u' - User filter Off (show euid only)
- * 'U' - User filter Off (show any uid)
- 'x' - Column hilite Off (no, sort field)
- 'y' - Row hilite On (yes, running tasks)
- 'z' - color/mono Off (no, colors)

<Shift>+<N> - sort by PID;
 <Shift>+<P> - sort by CPU usage;
 <Shift>+<M> - sort by Memory usage;
 <Shift>+<T> - sort by Time usage;
 <Shift>+<Z> - change colors;

13) Sort the contents of the processes window using various parameters (for example, the amount of processor time taken up, etc.)

[shift]+[m] sort by ram used

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMA
935	root	20	0	8648	3856	3088	S	0.0	0.2	0:00.06	sshd
877	root	20	0	8648	3848	3088	S	0.0	0.2	0:00.10	sshd
880	root	20	0	8648	3632	2884	S	0.0	0.2	0:00.04	sshd
937	root	20	0	8648	3632	2884	S	0.0	0.2	0:00.07	sshd
1044	root	20	0	6600	3068	1776	S	0.0	0.1	0:00.22	bash
900	student	20	0	6668	3024	1668	S	0.0	0.1	0:00.05	bash
957	student	20	0	6668	3012	1664	S	0.0	0.1	0:00.02	bash
1028	student	20	0	6668	2792	1512	S	0.0	0.1	0:00.03	bash
799	root	20	0	7812	2528	2040	S	0.0	0.1	0:00.02	sshd
993	student	20	0	6848	2440	1984	S	0.0	0.1	0:00.33	ssh

[shift]+[p] sort by cpu usage

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1468	student	20	0	6668	3028	1668	S	4.0	0.1	0:00.27	bash
18	root	20	0	0	0	0	S	1.3	0.0	0:00.18	ksoftirqd/2
60	root	20	0	0	0	0	S	1.0	0.0	0:00.62	kworker/2:1
1467	student	20	0	8956	2116	1228	S	0.7	0.1	0:00.07	sshd
7	root	20	0	0	0	0	S	0.3	0.0	0:00.09	rcu_sched
1445	root	20	0	5432	1464	1080	R	0.3	0.1	0:00.16	top
1	root	20	0	4180	2228	1420	S	0.0	0.1	0:01.60	init
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd

14) Concept of priority, what commands are used to set priority?

Команды nice и renice

The default niceness of a process is set to 0 (which results in the priority value of 20). By applying a negative niceness, you increase the priority. Use a positive niceness to decrease the priority.

15) Can I change the priority of a process using the top command? If so, how?

[r] , ввести pid, ввести величину, которая добавится или отнимется от приоритета

Renice PID 1468 to value 5

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1468	student	20	0	6748	3108	1668	S	1.7	0.2	0:01.69	bash
899	student	20	0	8956	2216	1256	S	0.0	0.1	0:01.14	sshd
900	student	20	0	6668	3024	1668	S	0.0	0.1	0:00.05	bash

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1468	student	25	5	6952	3312	1668	S	2.0	0.2	0:03.61	bash
899	student	20	0	8956	2216	1256	S	0.0	0.1	0:01.14	sshd

16) Examine the kill command. How to send with the kill command process control signal? Give an example of commonly used signals.

kill [options] <pid>

kill -s SIGNAL pid (SIGNAL = номер либо название сигнала)

Часто используемые для убийства процесса - 9 и 15

Список возможных сигналов- kill -l

- | | | | | |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| 1) SIGHUP | 2) SIGINT | 3) SIGQUIT | 4) SIGILL | 5) SIGTRAP |
| 6) SIGABRT | 7) SIGBUS | 8) SIGFPE | 9) SIGKILL | 10) SIGUSR1 |
| 11) SIGSEGV | 12) SIGUSR2 | 13) SIGPIPE | 14) SIGALRM | 15) SIGTERM |
| 16) SIGSTKFLT | 17) SIGCHLD | 18) SIGCONT | 19) SIGSTOP | 20) SIGTSTP |
| 21) SIGTTIN | 22) SIGTTOU | 23) SIGURG | 24) SIGXCPU | 25) SIGXFSZ |
| 26) SIGVTALRM | 27) SIGPROF | 28) SIGWINCH | 29) SIGIO | 30) SIGPWR |
| 31) SIGSYS | 34) SIGRTMIN | 35) SIGRTMIN+1 | 36) SIGRTMIN+2 | 37) SIGRTMIN+3 |
| 38) SIGRTMIN+4 | 39) SIGRTMIN+5 | 40) SIGRTMIN+6 | 41) SIGRTMIN+7 | 42) SIGRTMIN+8 |
| 43) SIGRTMIN+9 | 44) SIGRTMIN+10 | 45) SIGRTMIN+11 | 46) SIGRTMIN+12 | 47) SIGRTMIN+13 |
| 48) SIGRTMIN+14 | 49) SIGRTMIN+15 | 50) SIGRTMAX-14 | 51) SIGRTMAX-13 | 52) SIGRTMAX-12 |

53) SIGRTMAX-11 54) SIGRTMAX-10 55) SIGRTMAX-9 56) SIGRTMAX-8 57) SIGRTMAX-7
58) SIGRTMAX-6 59) SIGRTMAX-5 60) SIGRTMAX-4 61) SIGRTMAX-3 62) SIGRTMAX-2
63) SIGRTMAX-1 64) SIGRTMAX

17) Commands jobs, fg, bg, nohup. What are they for? Use the sleep, yes command to demonstrate the process control mechanism with fg, bg

jobs – список текущих фоновых задач

ponir - дает возможность, чтобы при выходе из системы процесс продолжал работу в фоновом режиме.

nohup command Arg(s) &

bg - перевод в фон после *ctrl+Z*, (сигнал TSTR)

fg – возврат задачи в терминал

```
root@CsnKhai:~# sleep 23456
```

 Z

```
[1]+  Stopped                  sleep 23456
```

```
root@CsnKhai:~# bg
```

[1]+ sleep 23456 &

```
root@CsnKhai:~# sleep 75453
```

 $^{\wedge}Z$

```
[2]+  Stopped                  sleep 75453
```

```
root@CsnKhair:~# bg
```

```
[2]+ sleep 75453 &
```

```
root@CsnKhai:~# jobs
```

```
[1]- Running sleep 23456 &
```

```
[2]+  Running                 sleep 75453 &
```

```
root@CsnKhai:~# fg 1
```

sleep 23456

[^]C

Part 2

1) Check the implementability of the most frequently used OPENSSH commands in the MS Windows operating system. (Description of the expected result of the commands + screenshots: command - result should be presented)

```
usage: ssh [-46AaCfGgKkMNnqsTtVvXxYy] [-b bind_address] [-c cipher_spec]
```

```
[-D [bind address:]port] [-E log file] [-e escape char]
```

```
[-F configfile] [-I pkcs11] [-i identity_file]
```

```
[ -J [user@]host[:port]] [-L address] [-l login name] [-m mac spec]
```

```
[-O ctl cmd] [-o option] [-p port] [-Q query option] [-R address]
```

```
[-S ctl_path] [-W host:port] [-w local_tun[:remote_tun]]
```

```
destination [command]
```

```
ssh student@192.168.56.1 -p 222
```

```
C:\Users\bohda>ssh student@192.168.56.1 -p 222
```

```
The authenticity of host '[192.168.56.1]:222 ([192.168.56.1]:222)' can't be established.
```

ECDSA key fingerprint is SHA256:yp8IN0s6pk/gVv7G84N/cRT3KsgxLPiH81jZ/cRpz0o.

```
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
```

Warning: Permanently added '[192.168.56.1]:222' (ECDSA) to the list of known hosts.

```
student@192.168.56.1's password:
```

```
Welcome to Ubuntu 14.04.6 LTS (GNU/Linux 3.13.0-63-generic i686)
```

```
* Documentation: https://help.ubuntu.com/
```

New release '16.04.7 LTS' available.

Run 'do-release-upgrade' to upgrade to it.

```
Last login: Fri Dec 24 21:07:22 2021 from 10.0.2.2
```

```
scp -P 222 student@192.168.56.1:/home/student/hello.txt Games
```

```
C:\Users\bohdan>scp -P 222 student@192.168.56.1:/home/student/hello.txt "e:\Dev ops"
```

```
student@192.168.56.1's password:
```

```
hello.txt 100% 0 0.0KB/s 00:00
```

2) Implement basic SSH settings to increase the security of the client-server connection (at least

- С помощью ssh-keygen сгенерировать пару приватный-публичный ключ
 - Передать публичный ключ на удаленный сервер
- ```
ssh-copy-id -i ~/.ssh/id_rsa.pub student@192.168.56.102
```
- Выполнить настройки на клиенте

☒ Use private key C:\Users\bohdan\AppData\Roaming

3) List the options for choosing keys for encryption in SSH. Implement 3 of them

```
mcedit /etc/ssh/sshd_config
```

Изменить порт ссш

```
What ports, IPs and protocols we listen for
Port 22
```

Разрешить подключаться руту

```
PermitRootLogin yes
```

Разрешить подключение по паролю

```
Change to no to disable tunnelled clear text passwords
#PasswordAuthentication yes
```

4) Implement port forwarding for the SSH client from the host machine to the guest Linux virtual machine behind NAT

V\_mach1 - Settings

**General**  
System  
Display  
Storage  
Audio

**Network**

Adapter 1 Adapter 2 Adapter 3 Adapter 4

☒ Enable Network Adapter

Attached to: NAT

Name:

| Name   | Protocol | Host IP      | Host Port | Guest IP  | Guest Port |
|--------|----------|--------------|-----------|-----------|------------|
| Rule 1 | TCP      | 192.168.56.1 | 222       | 10.0.2.15 | 22         |