

Лабораторная работа №6

Управление процессами

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Цель работы

Получить навыки управления процессами и заданиями в Linux: запуск, приостановка, завершение, изменение приоритетов и работа с сигналами.

Ход выполнения работы

Получение прав администратора

```
titukaev@titukaev:~$ su
Password:
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# sleep 3600 &
[1] 3307
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[2] 3379
root@titukaev:/home/titukaev# sleep 7200
^Z
[3]+  Stopped                  sleep 7200
root@titukaev:/home/titukaev# jobs
[1]  Running                  sleep 3600 &
[2]-  Running                  dd if=/dev/zero of=/dev/null &
[3]+  Stopped                  sleep 7200
root@titukaev:/home/titukaev# bg 3
[3]+  sleep 7200 &
root@titukaev:/home/titukaev# fg 1
sleep 3600
^C
root@titukaev:/home/titukaev# fg 2
dd if=/dev/zero of=/dev/null
^C106375032+0 records in
106375032+0 records out
54464016384 bytes (54 GB, 51 GiB) copied, 75.4229 s, 722 MB/s

root@titukaev:/home/titukaev# fg 3
sleep 7200
^C
root@titukaev:/home/titukaev# █
```

Рис. 1: Получение прав администратора

Запуск и управление заданиями

```
titukaev@titukaev:~ - top
titukaev@titukaev:/home/titukaev

top - 13:53:52 up 5 min, 4 users, load average: 0.37, 0.33, 0.17
Tasks: 296 total, 2 running, 294 sleeping, 0 stopped, 0 zombie
%Cpu(s): 3.6 us, 3.6 sy, 0.0 ni, 92.9 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 3908.5 total, 1274.2 free, 1460.9 used, 1410.7 buff/cache
MiB Swap: 4040.0 total, 4040.0 free, 0.0 used, 2447.6 avail Mem

  PID USER      PR  NI   VIRT   RES   SHR  S  %CPU  %MEM     TIME+ COMMAND
 3857 titukaev  20   0 226848  1816  1816 R 100.0   0.0   0:19.24 dd
    1 root       20   0   49192  41108 10328 S   0.0   1.0   0:01.66 systemd
    2 root       20   0        0        0      0 S   0.0   0.0   0:00.00 kthreadd
    3 root       20   0        0        0      0 S   0.0   0.0   0:00.00 pool_workqueue_release
    4 root        0 -20        0        0      0 I   0.0   0.0   0:00.00 kworker/R-rcu_gp
    5 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/R-sync_wq
    6 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/R-slub_flushq
    7 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/R-netns
    8 root       20   0        0        0      0 I   0.0   0.0   0:00.01 kworker/0:0-rcu_gp
    9 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/0:1-events
   10 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/0:0H-events_highpri
   11 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/u24:0-events_unbound
   12 root       20   0        0        0      0 I   0.0   0.0   0:00.02 kworker/u24:1-netns
   13 root       20   0        0        0      0 I   0.0   0.0   0:00.00 kworker/R-mn_percpu_wq
   14 root       20   0        0        0      0 I   0.0   0.0   0:00.00 rcu_tasks_kthread
   15 root       20   0        0        0      0 I   0.0   0.0   0:00.00 rcu_tasks_rude_kthread
   16 root       20   0        0        0      0 I   0.0   0.0   0:00.00 rcu_tasks_trace_kthread
   17 root       20   0        0        0      0 S   0.0   0.0   0:00.00 ksoftirqd/0
   18 root       20   0        0        0      0 I   0.0   0.0   0:00.11 rcu_preempt
   19 root       20   0        0        0      0 S   0.0   0.0   0:00.00 rcu_exp_par_gp_kthread_worker/0
   20 root       20   0        0        0      0 S   0.0   0.0   0:00.03 rcu_exp_gp_kthread_worker
   21 root       rt    0        0        0      0 S   0.0   0.0   0:00.05 migration/0
   22 root      -51   0        0        0      0 S   0.0   0.0   0:00.00 idle_inject/0
   23 root       20   0        0        0      0 S   0.0   0.0   0:00.00 cpuhp/0
```

Рис. 2: Проверка состояния заданий

Завершение процессов через top

```
top - 13:54:13 up 5 min, 4 users, load average: 0.55, 0.38, 0.19
Tasks: 285 total, 1 running, 284 sleeping, 0 stopped, 0 zombie
%Cpu(s): 3.4 us, 4.4 sy, 0.0 ni, 92.0 id, 0.0 wa, 0.2 hi, 0.0 si, 0.0 st
MiB Mem : 3908.5 total, 1234.6 free, 1500.1 used, 1411.0 buff/cache
MiB Swap: 4040.0 total, 4040.0 free, 0.0 used, 2408.3 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
3041	titukaev	20	0	4155112	352076	100992	S	3.4	8.8	0:04.17	ptxix
2130	titukaev	20	0	5393764	353176	123656	S	1.9	8.8	0:04.53	gnome-shell
3262	root	20	0	0	0	0	I	0.6	0.0	0:00.13	kworker/u26:3-events_unbound
1	root	20	0	49192	41108	10328	S	0.0	1.0	0:01.66	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.00	kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pool_workqueue_release
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-rcu_gp
5	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-sync_wq
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-slub_flushwq
7	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-netns
8	root	20	0	0	0	0	I	0.0	0.0	0:00.01	kworker/0:0-events
10	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H-events_highpri
11	root	20	0	0	0	0	I	0.0	0.0	0:00.00	kworker/u24:0-events_unbound
12	root	20	0	0	0	0	I	0.0	0.0	0:00.02	kworker/u24:1-netns
13	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-mm_percpu_wq
14	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_kthread
15	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_rude_kthread
16	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_trace_kthread
17	root	20	0	0	0	0	S	0.0	0.0	0:00.00	ksoftirqd/0
18	root	20	0	0	0	0	I	0.0	0.0	0:00.11	rcu_preempt
19	root	20	0	0	0	0	S	0.0	0.0	0:00.00	rcu_exp_par_gp_kthread_worker/0
20	root	20	0	0	0	0	S	0.0	0.0	0:00.03	rcu_exp_gp_kthread_worker
21	root	rt	0	0	0	0	S	0.0	0.0	0:00.05	migration/0
22	root	-51	0	0	0	0	S	0.0	0.0	0:00.00	idle_inject/0

Рис. 3: Завершение процесса dd в top

Запуск нескольких процессов dd

```
root@titukaev:/home/titukaev#
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[1] 4323
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[2] 4325
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[3] 4327
root@titukaev:/home/titukaev# ps aux | grep dd
root      2  0.0  0.0      0  0 ?        S   13:48   0:00 [kthreadd]
root     111  0.0  0.0      0  0 ?        I<  13:48   0:00 [kworker/R-ipv6_addrconf]
root    1182  0.0  0.0 512956 2940 ?        Sl   13:48   0:00 /usr/sbin/VBoxService --pidfile /var/run/vboxadd-service.sh
titukaev 2590  0.0  0.6 1036404 25440 ?        Ssl  13:49   0:00 /usr/libexec/evolution-addressbook-factory
root     4323 99.3  0.0 226848 1832 pts/0    R   13:56   0:09 dd if=/dev/zero of=/dev/null
root     4325 99.4  0.0 226848 1760 pts/0    R   13:56   0:07 dd if=/dev/zero of=/dev/null
root     4327 99.7  0.0 226848 1760 pts/0    R   13:56   0:06 dd if=/dev/zero of=/dev/null
root     4355  0.0  0.0 227688 2040 pts/0    S+  13:56   0:00 grep --color=auto dd
root@titukaev:/home/titukaev# renice -n 4323
renice: not enough arguments
Try 'renice --help' for more information.
root@titukaev:/home/titukaev# renice -n 5 4323
4323 (process ID) old priority 0, new priority 5
root@titukaev:/home/titukaev#
```

Рис. 4: Изменение приоритета процесса dd

Просмотр и изменение приоритета процессов dd.

Анализ и завершение процессов dd

```
Process Exited from Signal 9 Restart

952 ?    Sns  0:00 /usr/sbin/alsactl -s -n 19 -c -E ALSA_CONFIG_PATH=/etc/alsa/alsactl.conf --initfile=/lib/alsa/init/00main rdaemon
987 ?    S   0:00 /usr/sbin/chronyd -F 2
992 ?    Ssl  0:00 /usr/sbin/ModemManager
994 ?    Ssl  0:00 /usr/bin/python3 -sP /usr/sbin/firewalld --nofork --nopid
1180 ?   Sl   0:00 /usr/bin/VBoxDRMClient
1182 ?   Sl   0:00 /usr/sbin/VBoxService --pidfile /var/run/vboxadd-service.sh

--
2521 ?   Ssl  0:00 \_ /usr/libexec/goa-daemon
2526 ?   Ssl  0:00 \_ /usr/libexec/gvfs-gphoto2-volume-monitor
2529 ?   Ssl  0:00 \_ /usr/libexec/evolution-calendar-factory
2536 ?   Ssl  0:00 \_ /usr/libexec/goa-identity-service
2548 ?   Ssl  0:00 \_ /usr/libexec/gvfs-goa-volume-monitor
2590 ?   Ssl  0:00 \_ /usr/libexec/evolution-addressbook-factory

--
3041 ?   Ssl  0:06 \_ /usr/bin/ptxixs --gapplcation-service
3049 ?   Ssl  0:00 | \_ /usr/libexec/ptxixs-agent --socket-fd=3
3140 pts/0 Ss   0:00 | \_ /usr/bin/bash
3183 pts/0 S    0:00 | | \_ su
3234 pts/0 S    0:00 | | \_ bash
4323 pts/0 RN   1:03 | | \_ dd if=/dev/zero of=/dev/null
4325 pts/0 R    1:01 | | \_ dd if=/dev/zero of=/dev/null
4327 pts/0 R    1:00 | | \_ dd if=/dev/zero of=/dev/null
4473 pts/0 R+   0:00 | | \_ ps fax
4474 pts/0 S+   0:00 | | \_ grep --color=auto -B5 dd

root@titukaev:/home/titukaev# kill -9 3140
root@titukaev:/home/titukaev#
Hangup
```

Рис. 5: Завершение процессов dd через родительский процесс

Остановка родительского процесса завершает все дочерние.

Изменение приоритетов процессов dd

```
titukaev@titukaev:~$ su
Password:
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[1] 4703
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[2] 4705
root@titukaev:/home/titukaev# dd if=/dev/zero of=/dev/null &
[3] 4707
root@titukaev:/home/titukaev# renice -n 5 4703
4703 (process ID) old priority 0, new priority 5
root@titukaev:/home/titukaev# renice -n 15 4703
4703 (process ID) old priority 5, new priority 15
root@titukaev:/home/titukaev# killall dd
[1] Terminated dd if=/dev/zero of=/dev/null
[2]- Terminated dd if=/dev/zero of=/dev/null
[3]+ Terminated dd if=/dev/zero of=/dev/null
root@titukaev:/home/titukaev#
```

Рис. 6: Запуск процессов dd в фоновом режиме

Сравнение приоритетов процессов при разных значениях `nice`.

Запуск и приостановка yes

```
root@titukaev:/home/titukaev# yes > /dev/null &  
[1] 5242  
root@titukaev:/home/titukaev#  
root@titukaev:/home/titukaev# yes > /dev/null  
^Z  
[2]+  Stopped                  yes > /dev/null  
root@titukaev:/home/titukaev# yes > /dev/null  
^C  
root@titukaev:/home/titukaev# jobs  
[1]-  Running                  yes > /dev/null &  
[2]+  Stopped                  yes > /dev/null  
root@titukaev:/home/titukaev# █
```

Рис. 7: Запуск и приостановка процессов yes

Работа с фоновыми и приостановленными заданиями.

Проверка выполнения yes

```
top - 14:05:26 up 17 min, 5 users, load average: 1.65, 0.88, 0.53
Tasks: 293 total, 3 running, 290 sleeping, 0 stopped, 0 zombie
%Cpu(s): 9.6 us, 13.5 sy, 0.0 ni, 76.9 id, 0.0 wa, 0.0 hi, 0.0 si, 0.0 st
MiB Mem : 3908.5 total, 1304.1 free, 1382.6 used, 1459.7 buff/cache
MiB Swap: 4040.0 total, 4040.0 free, 0.0 used, 2525.9 avail Mem
```

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
5523	root	20	0	226820	1760	1760	R	90.9	0.0	0:52.84	yes
5245	root	20	0	226820	1760	1760	R	81.8	0.0	1:14.77	yes
3041	titukaev	20	0	4155112	362092	101156	S	9.1	9.0	0:12.40	ptyxis
1	root	20	0	49192	41236	10328	S	0.0	1.0	0:02.35	systemd
2	root	20	0	0	0	0	S	0.0	0.0	0:00.01	kthreadd
3	root	20	0	0	0	0	S	0.0	0.0	0:00.00	pool_workqueue_release
4	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-rcu_gp
5	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-sync_wq
6	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-slub_flushwq
7	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-netns
10	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/0:0H-events_highpri
11	root	20	0	0	0	0	I	0.0	0.0	0:00.00	kworker/u24:0-events_unbound
12	root	20	0	0	0	0	I	0.0	0.0	0:00.07	kworker/u24:1-netns
13	root	0	-20	0	0	0	I	0.0	0.0	0:00.00	kworker/R-mm_percpu_wq
14	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_kthread
15	root	20	0	0	0	0	I	0.0	0.0	0:00.00	rcu_tasks_rude_kthread

Рис. 8: Проверка выполнения процессов yes в top

Мониторинг активности процессов yes через top.

Управление и завершение yes

```
root@titukaev:/home/titukaev#  
root@titukaev:/home/titukaev# yes > /dev/null &  
[1] 5786  
root@titukaev:/home/titukaev# yes > /dev/null &  
[2] 5789  
root@titukaev:/home/titukaev# yes > /dev/null &  
[3] 5793  
root@titukaev:/home/titukaev# kill 5786  
[1] Terminated yes > /dev/null  
root@titukaev:/home/titukaev# fg 2  
yes > /dev/null  
^C  
root@titukaev:/home/titukaev# kill -1 5793  
[3]+ Hangup yes > /dev/null  
root@titukaev:/home/titukaev# kill -1 5245  
root@titukaev:/home/titukaev# yes > /dev/null &  
[1] 5901  
root@titukaev:/home/titukaev# yes > /dev/null &  
[2] 5903  
root@titukaev:/home/titukaev# yes > /dev/null &  
[3] 5905  
root@titukaev:/home/titukaev# killall yes  
[1] Terminated yes > /dev/null  
[2]- Terminated yes > /dev/null  
[3]+ Terminated yes > /dev/null  
root@titukaev:/home/titukaev#
```

Рис. 9: Управление процессами yes и их завершение

Изменение приоритетов yes

```
root@titukaev:/home/titukaev# yes > /dev/null &
[1] 6109
root@titukaev:/home/titukaev# nice -n 5 yes > /dev/null &
[2] 6154
root@titukaev:/home/titukaev# ps -l
```

F	S	UID	PID	PPID	C	PRI	NI	ADDR	SZ	WCHAN	TTY	TIME	CMD
4	S	0	5649	3894	0	80	0	- 58153	do_wai	pts/2		00:00:00	su
4	S	0	5662	5649	0	80	0	- 57575	do_wai	pts/2		00:00:00	bash
4	R	0	6109	5662	99	80	0	- 56705	-	pts/2		00:00:23	yes
4	R	0	6154	5662	99	85	5	- 56705	-	pts/2		00:00:02	yes
4	R	0	6166	5662	0	80	0	- 57682	-	pts/2		00:00:00	ps

```
root@titukaev:/home/titukaev# renice -n 5 5662
5662 (process ID) old priority 0, new priority 5
root@titukaev:/home/titukaev# ps -l
```

F	S	UID	PID	PPID	C	PRI	NI	ADDR	SZ	WCHAN	TTY	TIME	CMD
4	S	0	5649	3894	0	80	0	- 58153	do_wai	pts/2		00:00:00	su
4	S	0	5662	5649	0	85	5	- 57575	do_wai	pts/2		00:00:00	bash
4	R	0	6109	5662	99	80	0	- 56705	-	pts/2		00:00:40	yes
4	R	0	6154	5662	99	85	5	- 56705	-	pts/2		00:00:18	yes
4	R	0	6207	5662	0	85	5	- 57682	-	pts/2		00:00:00	ps

```
root@titukaev:/home/titukaev#
```

Рис. 10: Изменение приоритетов процессов yes

Итоги работы

Выполнены практические действия по управлению заданиями и процессами в Linux. Освоены приёмы работы с приоритетами, сигналами, фоновыми задачами и системным мониторингом.