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Operating Systems

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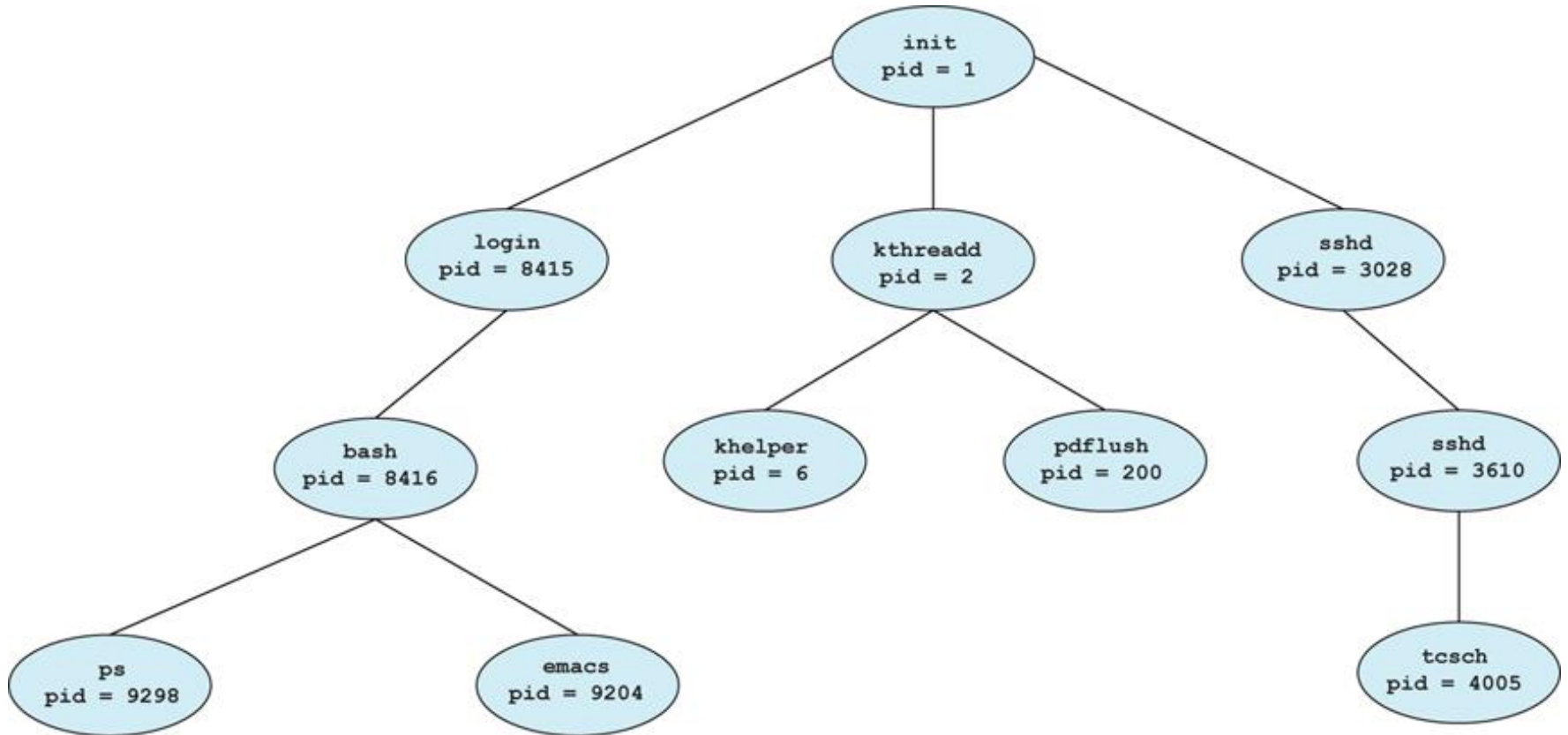
<http://daze.ho.ua>

Lecture 5:

Processes.

Pipes and filters

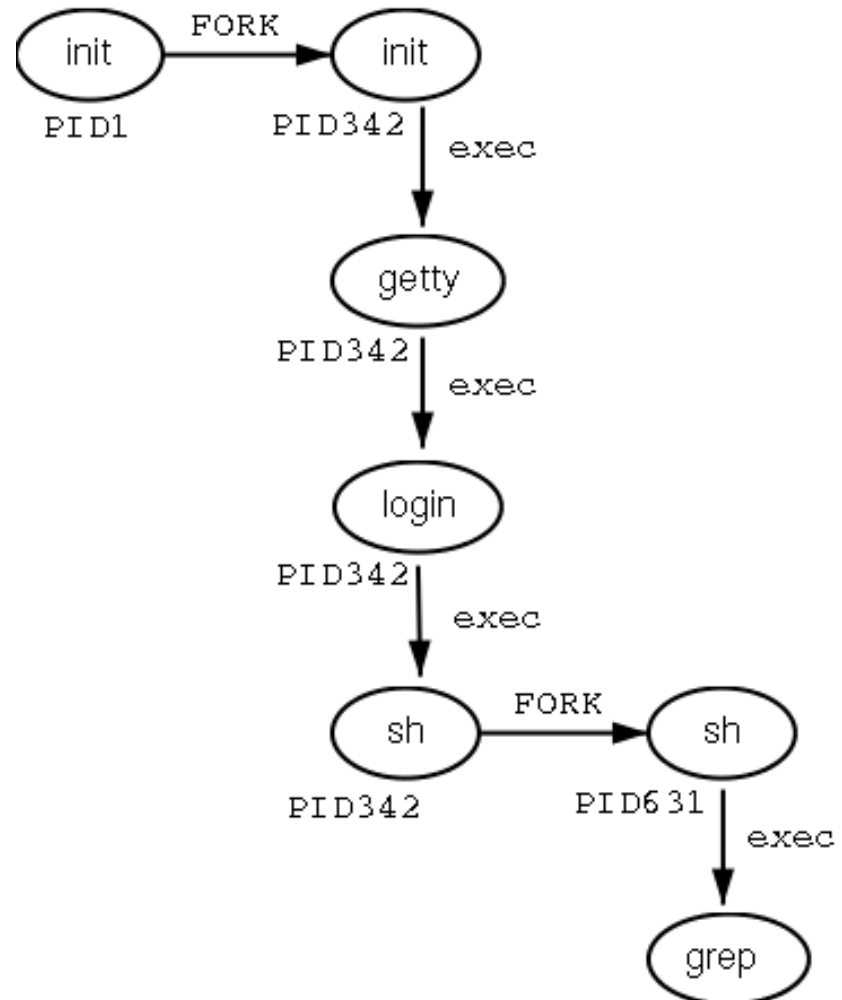
Processes tree



Fork & Exec

Fork – duplicate (clone)
the process

Exec – run
Executable file



Attributes of a process

- Flags: 1, 4
- State: D,R,S, T, X, Z
- User identifier (UID)
- Process identifier (PID)
- Parent process identifier (PPID)
- Priority (PRI, NI)
- Terminal (TTY)
- Command (CMD)

```

4 S      0  1705      1  0  80    0 - 13284 poll_s ?      00:00:00 udisksd
0 S    1000  1732  1173  0  80    0 -   7383 poll_s ?      00:00:00 gvfs-gphoto2-v
0 S    1000  1745  1173  0  80    0 -   7105 poll_s ?      00:00:00 gvfs-mtp-volum
0 S    1000  1752  1173  0  80    0 -   2707 poll_s ?      00:00:00 gconfd-2
0 S    1000  1754  1173  0  80    0 -   9892 poll_s ?      00:00:00 gvfs-afc-volum
0 S    1000  1783  1173  0  80    0 -  16075 poll_s ?      00:00:00 gvfsd-trash
0 S    1000  1790  1173  0  80    0 -   9294 poll_s ?      00:00:00 gvfsd-burn
0 S    1000  1808  1343  0  80    0 -  20914 poll_s ?      00:00:00 telepathy-indi
0 S    1000  1816  1173  0  80    0 -  11147 poll_s ?      00:00:00 mission-contro
0 S    1000  1829  1343  0  80    0 -  15116 poll_s ?      00:00:00 zeitgeist-data
0 S    1000  1834  1173  0  80    0 -  10590 poll_s ?      00:00:00 zeitgeist-daem
0 S    1000  1840  1173  0  80    0 -  14015 poll_s ?      00:00:00 zeitgeist-fts
0 S    1000  1849  1840  0  80    0 -   1369 unix_s ?      00:00:00 cat
0 S    1000  1882  1343  0  80    0 -  18059 poll_s ?      00:00:00 update-notifie
0 S    1000  1905  1343  0  80    0 -  16293 poll_s ?      00:00:00 deja-dup-monit
1 S      0  2006      2  0  80    0 -      0 worker ?      00:00:00 kworker/u2:0
1 S      0  2047      2  0  80    0 -      0 worker ?      00:00:00 kworker/u2:2
4 S      0  2049      1  0  80    0 -   1114 wait   tty1      00:00:00 login
1 S      0  2124      2  0  80    0 -      0 worker ?      00:00:00 kworker/0:0
4 S    1000  2125  2049  0  80    0 -   2048 wait   tty1      00:00:00 bash
1 S      0  2175      2  0  80    0 -      0 worker ?      00:00:00 kworker/u2:1
0 R    1000  2176  2125  0  80    0 -   1554 -      tty1      00:00:00 ps

```

daze@daze-fast:~\$

daze@daze-fast:~\$

daze@daze-fast:~\$

daze@daze-fast:~\$ ps -l

```








F S      UID      PID  PPID   C PRI  NI ADDR  SZ  WCHAN   TTY          TIME CMD
4 S    1000    2125   2049   0  80    0 -   2048 wait   tty1      00:00:00 bash
0 R    1000    2177   2125   0  80    0 -   1554 -      tty1      00:00:00 ps

```

daze@daze-fast:~\$

Basic commands

- file-name – start a process
 - file-name & – start a process in background
 - ps – processes list
 - kill [signal] PID – send a signal
-
- ps -e all processes
 - ps -l long output
 - kill -9 PID compulsory termination



daze@daze-fast: ~/dima

daze@daze-fast:~/dima\$
daze@daze-fast:~/dima\$
daze@daze-fast:~/dima\$ ls -l dummy
-rwxrwxr-x 1 daze daze 35 anp. 28 13:21 dummy
daze@daze-fast:~/dima\$ cat dummy
while /bin/true
do
echo hello
done
daze@daze-fast:~/dima\$./dummy > /dev/null &
[1] 12709
daze@daze-fast:~/dima\$ ps
PID TTY TIME CMD
4789 pts/0 00:00:00 bash
12709 pts/0 00:00:02 bash
13912 pts/0 00:00:00 ps
daze@daze-fast:~/dima\$ kill 12709
daze@daze-fast:~/dima\$ ps
PID TTY TIME CMD
4789 pts/0 00:00:00 bash
16036 pts/0 00:00:00 ps
[1]+ Terminated
daze@daze-fast:~/dima\$

./dummy > /dev/null

Priorities

- nice [*Option*]... [*Command* [*Arg*]...]
- sudo nice -n 10 echo Hello
- renice Priority -p PID
- renice 16 -p 13245

No Hang Up

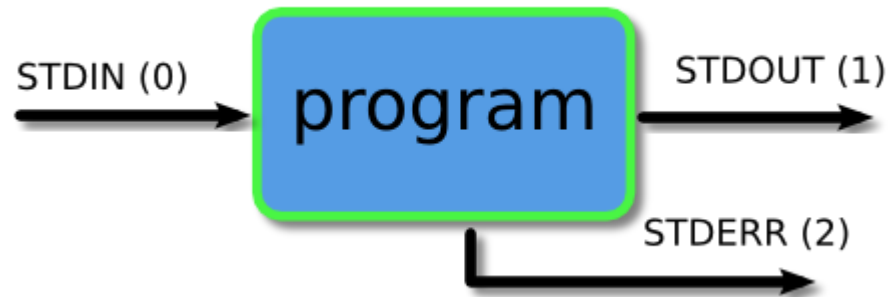
- nohup command arguments
- Output: \$HOME/nohup.out
- nohup ./dummy > dummy-work &
- exit
- login
- ps

```
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$ ps -lU daze
F S  UID  PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
1 S  1000  1459    1   0  69 -11 - 25357 poll_s ?           00:00:00 pulseaudio
0 R  1000  2975    1  21  80  0 -   568 -      ?           00:00:53 sh
0 R  1000  5969  6461   0  80  0 -  1613 -      tty1        00:00:00 ps
4 S  1000  6461  4433   0  80  0 -  2048 wait     tty1        00:00:00 bash
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$ ls -l dummy-work
-rw-rw-r-- 1 daze daze 409110 anp.  28 15:46 dummy-work
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$ ps -lU daze
F S  UID  PID  PPID  C PRI  NI ADDR SZ WCHAN  TTY          TIME CMD
1 S  1000  1459    1   0  69 -11 - 25357 poll_s ?           00:00:00 pulseaudio
0 R  1000  2975    1  21  80  0 -   568 -      ?           00:00:56 sh
4 S  1000  6461  4433   0  80  0 -  2048 wait     tty1        00:00:00 bash
0 R  1000  9844  6461   0  80  0 -  1613 -      tty1        00:00:00 ps
daze@daze-fast:~/dima$
daze@daze-fast:~/dima$ ls -l dummy-work
-rw-rw-r-- 1 daze daze 437646 anp.  28 15:46 dummy-work
daze@daze-fast:~/dima$
```

Start on a schedule

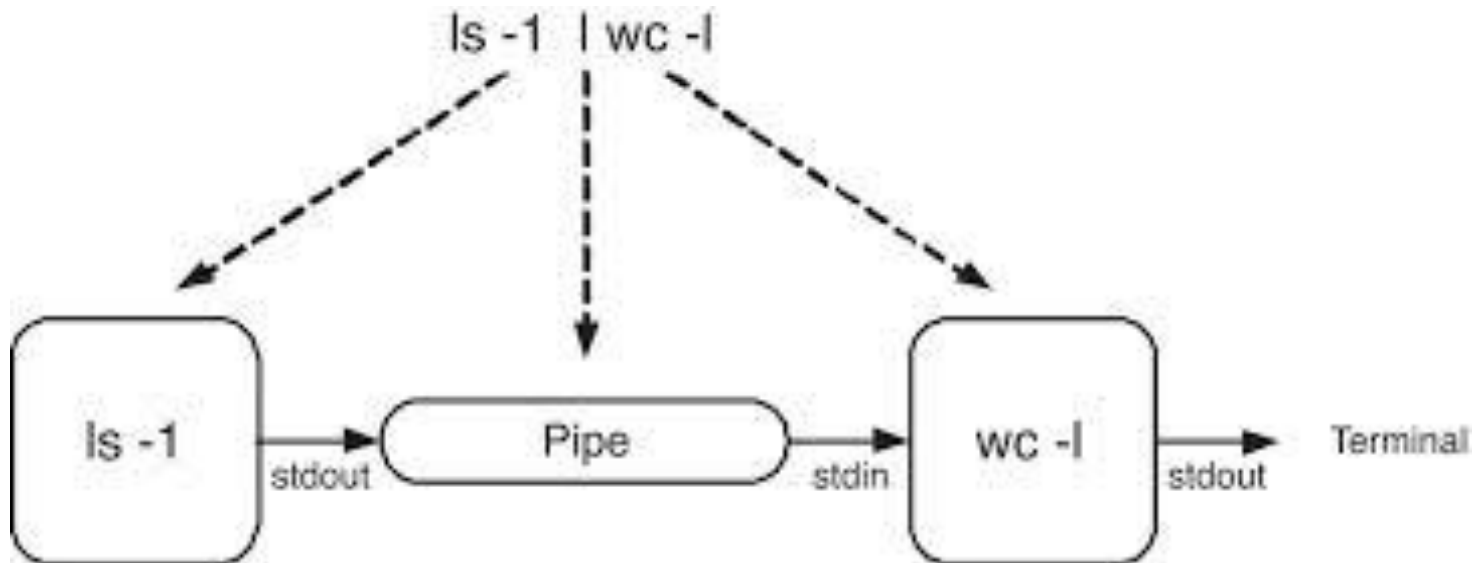
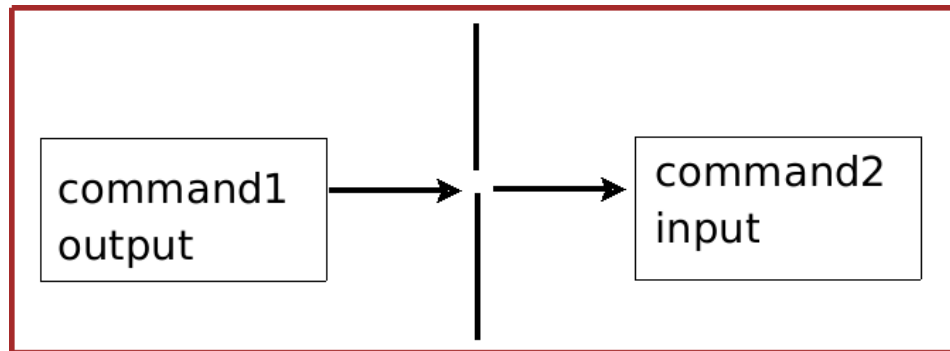
- `at -f file TIME`
 - `at -f file -t time-arg`
 - `atq`
 - `batch`
-
- `at -f ./eee 16:00`

Redirecting input & output



- `cat > file`
- `ls -l >> file`
- `wc < file`
- `ls qq 2> errors`
- `ls qq 2>&1`

Pipes



Filters

- `ls | more`
- `uniq, cut, fmt, head, tail, tee, wc`
- `sort, grep, tr, sed, awk`

- `ps -el | head`
- `ps -el | cut -b 5-9 | uniq -u`

Sort

- `sort` - sort lines of text files
- `-n` numerical, `-r` reverse, `-m` merge, `-u` unique
- `-k` sort via key: `F[.C][OPTS][, F[.C][OPTS]]`
- `cat /etc/passwd | sort`
- `ls -l | sort -k 9r`
- `ps -e | sort -k 2`

daze@daze-fast: ~

```
drwxrwxr-x 4 daze daze 4096 anp. 28 15:59 dima
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Documents
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Downloads
-rw-r--r-- 1 daze daze 8980 anp. 27 10:29 examples.desktop
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Music
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Pictures
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Public
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Templates
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Videos
```

daze@daze-fast:~\$ ls -l|sort -k 9r

```
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Videos
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Templates
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Public
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Pictures
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Music
-rw-r--r-- 1 daze daze 8980 anp. 27 10:29 examples.desktop
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Downloads
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Documents
drwxrwxr-x 4 daze daze 4096 anp. 28 15:59 dima
drwxr-xr-x 2 daze daze 4096 anp. 27 11:27 Desktop
-rw-rw-r-- 1 daze daze 16 anp. 28 12:04 c
```

total 52

daze@daze-fast:~\$

Grep

- `grep` - print lines matching a pattern
- `-n` line number, `-r` recursive, `-i` ignore case
- regular expression: `?`, `*`, `+`, `[list]`, `[^list]`, `[range]`
- anchor: `^` beginning, `$` end

- `ls -l | grep -i music`
- `ls -l | grep s$`

daze@daze-fast: ~

daze@daze-fast:~\$

daze@daze-fast:~\$ ls -l

total 52

-rw-rw-r--	1	daze	daze	16	anp.	28	12:04	c
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Desktop
drwxrwxr-x	4	daze	daze	4096	anp.	28	15:59	dima
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Documents
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Downloads
-rw-r--r--	1	daze	daze	8980	anp.	27	10:29	examples.desktop
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Music
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Pictures
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Public
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Templates
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Videos

daze@daze-fast:~\$ ls -l | grep -i music

drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Music
------------	---	------	------	------	------	----	-------	-------

daze@daze-fast:~\$ ls -l | grep s\$

drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Document s
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Download s
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Picture s
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Template s
drwxr-xr-x	2	daze	daze	4096	anp.	27	11:27	Video s

daze@daze-fast:~\$