Standard Input/Output, UNIX filters.

Jan Trdlička

Department of Computer Systems
Faculty of Information Technology
Czech Technical University in Prague

trdlicka@fit.cvut.cz

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Contents

Standard Input/Output

- Where are the standard I/O of process connected by default?
  - Standard input from keyboard.
  - Standard output and standard error output to terminal.
- How to redirect the standard I/O?
  - By symbols: `<`, `<<`, `>`, `>>`, `2>`, `2>>`, `n>&m`, and `|`.
- What is the meaning of file descriptors: 0, 1, and 2?
  - 0 = stdin (standard input).
  - 1 = stdout (standard output).
  - 2 = sterr (standard error output).
- Is the order of redirection important?

```
ls ~ foo 2>&1 >f1
ls ~ foo >f1 2>&1
```

  - Yes.
- How to discard the command error output?
  - `ls . foo 2>/dev/null`

Standard Input/Output

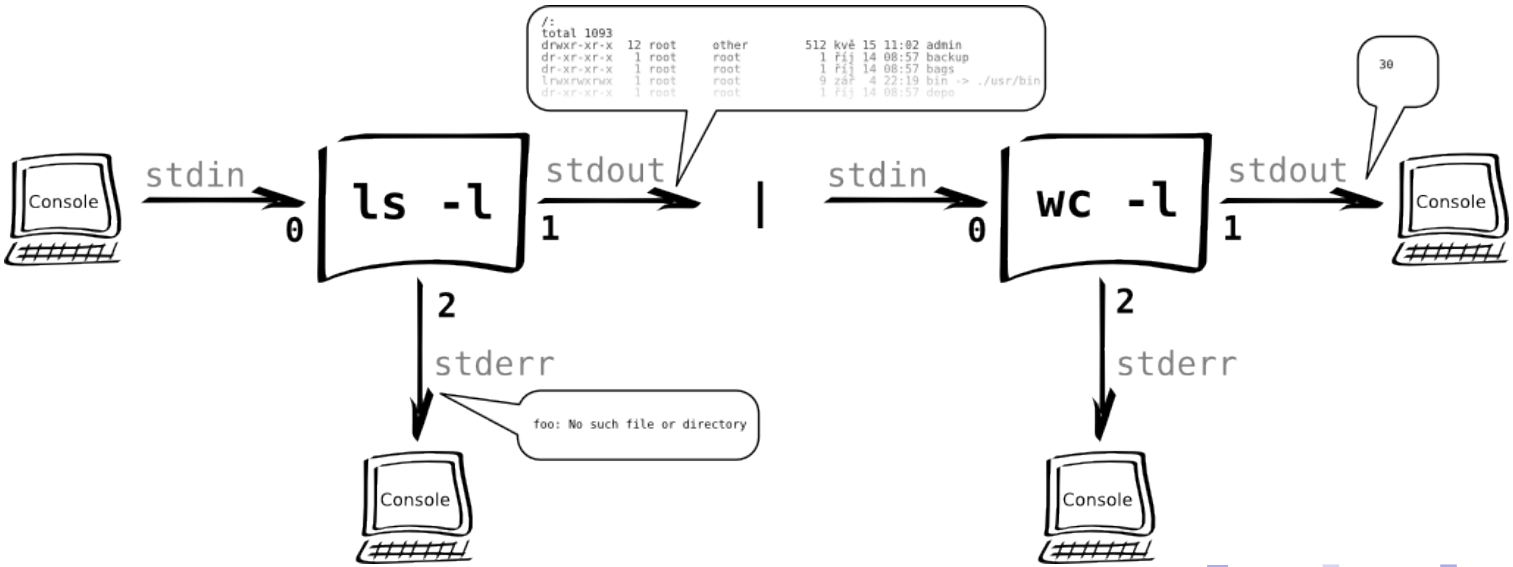
- Is the following redirection valid for more lines?

```
ls ~ foo >std.out 2>std.err
ls ~ foo
```

  - No.
  - Permanent redirection can be made by command `exec`

```
exec >std.out 2>std.err
```

- What is the pipe?



Standard Input/Output

- How to redirect the standard output to the file `out.txt` and the standard error output to the file `err.txt` for the following command?

```
ls -la / foo
```

  - `ls -la / foo >out.txt 2>err.txt`

- How to append the standard output and the standard error output to the file `out.txt` for the following command?

```
ls -la / foo
```

  - `ls -la / foo >>out.txt 2>&1`

- How to count the number of lines written on the standard output by the command `find /ect`?

  - `find /etc | wc -l`

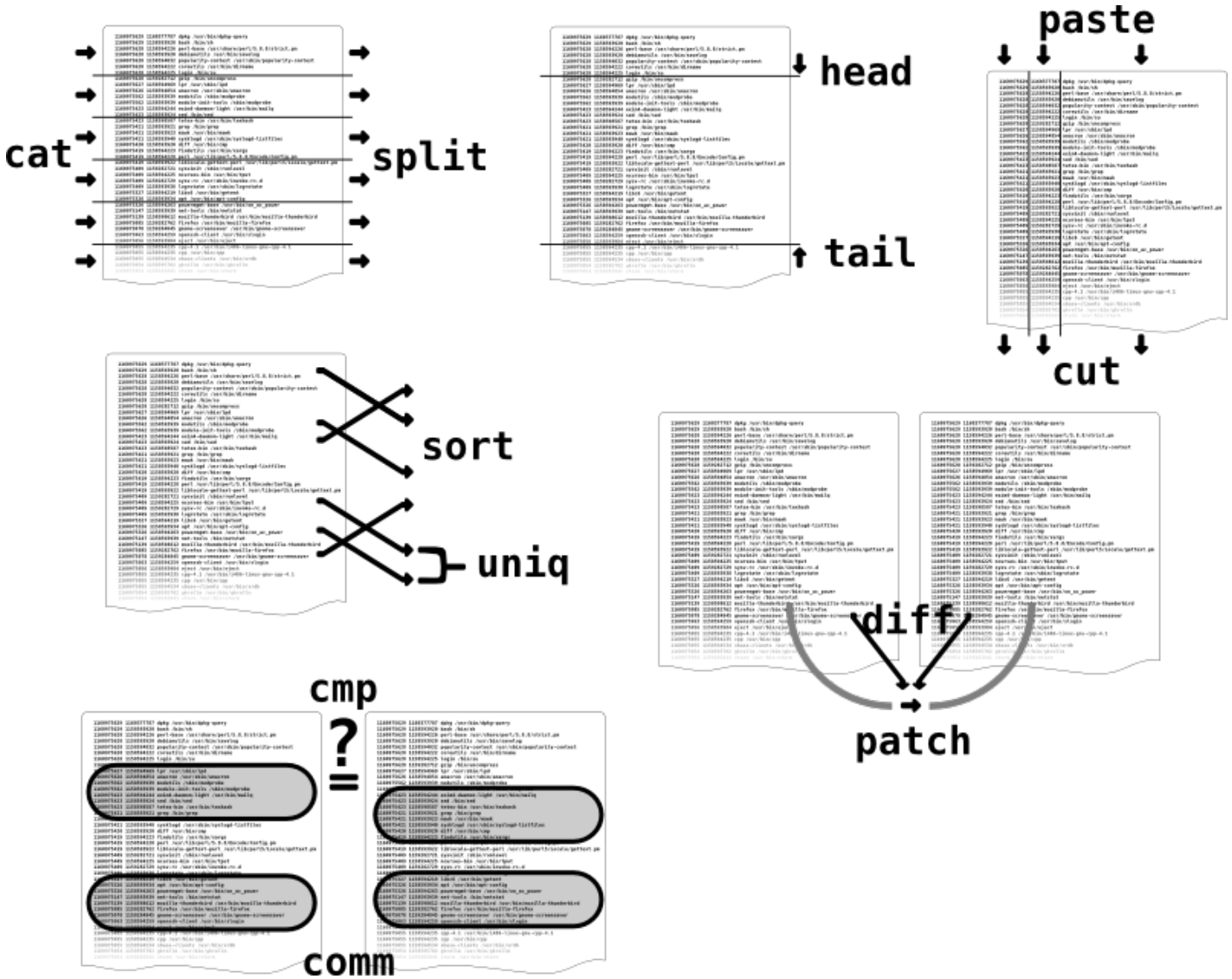
- How to discard the error mesages from the previous solution?

  - `find /etc 2>/dev/null | wc -l`

UNIX filters – overview

- What is the meaning of the following filters?
  - `tee`,
  - `split`, `cat`,
  - `head`, `tail`,
  - `cut`, `paste`,
  - `sort`, `uniq`,
  - `diff`, `patch`,
  - `cmp`, `comm`.

UNIX filters – overview



UNIX filters

- How to number all lines of manual page of the command `bash`?

```
man bash | cat -n
```

```
man bash | nl -ba
```

- How to number all lines of output of the command `/usr/sbin/useradd`?

```
/usr/sbin/useradd 2>&1 | cat -n
```

- How to number all lines of manual page of the command `bash` and print only lines from 100 to 105 to the standard output?

```
man bash | cat -n | tail -n+100 | head -6    # Linux
man bash | cat -n | tail +100   | head -6    # Solaris
```

```
man bash | cat -n | head -105 | tail -6
```

- How to print only the number of lines of the file `/etc/passwd`?

```
wc -l </etc/passwd
```

```
wc -l /etc/passwd | cut -d' ' -f1
```

UNIX filters

- How to print the number of users currently logged in to the current host?

  Hints:

  1. Use command `finger` to get info about users currently logged.
  2. Use command `users` to get info about users currently logged.

  Solutions:

  1. ```
     finger | tail -n+2 | wc -l      # Linux
     finger -f | wc -l               # Solaris
     ```

  2. ```
     users | wc -w
     ```

UNIX filters

- How to modify the previous solution so, that every user is counted only one times?

1. ```
   finger | tail -n+2 | cut -d' ' -f1 | \
   sort -u | wc -l                          # Linux
   ```

2. ```
   users | tr ' ' '\n' | sort -u | wc -l
   ```

- How to create alias `load`, which prints the number of users currently logged in to the current host (the previous solutions) and the output should have the following format:

```
User␣load:␣␣13
```

1. ```
   alias load='echo "User load:  $(finger | \
   tail -n+2 | cut -d" " -f1 | sort -u | wc -l | \
   tr -d " ")"'
   ```

2. ```
   alias load='echo "User load:  $(users | \
   tr " " "\n" | sort -u | wc -l | tr -d " ")"'
   ```

UNIX filters

- How to print the number of users, that have account on the local host?
  Hint: Use command `getent passwd` to get info about user accounts.
  - ```
    getent passwd | wc -l
    ```
- How to save the sorted list of login names of users that have account on the local host to the file `list.txt` and at the same time to print the number of these names to standard output?
  - ```
    getent passwd | cut -d':' -f1 | sort | \
    tee list.txt | wc -l
    ```
- How to print only a name (the 5th column) of the user, that has the highest user ID (the 3rd column)?
  - ```
    getent passwd | sort -t3 -k3,3n | tail -1 | \
    cut -d':' -f5
    ```
    ```

UNIX filters

- How to print a frequency table "The number of processes per user", where the first column is the number of processes running by the user and the second column is the user name. The table should be sorted by the number of processes in descending order.

  Hint: Use command `ps -eo user` to get info about running processes on the current host.

  - ```
    ps -eo user | tail -n+2 | sort | uniq -c | \
    sort -k1,1nr                                  # Linux
    ```

- How to print only names of the 3 largest items in the directory `/usr/bin`?

  - ```
    ls -l /usr/bin | tail -n+2 | sort -k5,5n | \
    tail -10 | tr -s ' ' | cut -d' ' -f9-    # Linux
    ```

  - ```
    ls -Sr /usr/bin | tail -3
    ```
    ```

UNIX filters

- How to print a frequency table "The number of directories per group" of directory `/etc` (not recursively), where the first column is the number of directories owned by the group and the second column is the group name. The table should be sorted by the number of directories in ascending order.

  Hint: Use command `ls -ld` to get info about the content of directory (the 4th column is the group name).

  - ```
    ls -ld /etc/*/ | tr -s ' ' | cut -d' ' -f4 | \
    sort | uniq -c | sort -k1,1n
    ```

  - ```
    stat --printf="%G\n" /etc/*/ | \
    sort | uniq -c | sort -k1,1n
    ```

UNIX filters

- How to copy files and directories, that are listed in the shell variable `LIST`, to the directory, which name is saved in the file `Backup.txt` (you must create this directory first).
  The shell variable `LIST` contains filenames separated by colon (e.g. `/tmp/a:/etc:/usr/bin:...`) and filenames don't contain spaces and special characters. There are no aliases in the shell.
  - ```
    mkdir "$(cat Backup.txt)"
    ```
  - ```
    cp -r $(echo $LIST | tr ':' ' ') \
    "$(cat Backup.txt)"
    ```

UNIX filters

- The file `List.txt` contains the list of directories and it has the following structure:

```
Directory
---------
/etc/ssh
/bin
/usr/bin
...
```

How to create the file `Top.txt`, that contains names of the 5 largest directories from `List.txt`?

- ```
  du -s $(cat List.txt |tail -n+3) | \
  sort -k1,1nr | head -5 | \
  cut -d'TAB' -f2 >Top.txt
  ```
- To enter character TAB in bash, press CTRL+V and TAB (see `man bash`).
  ```

Homework

- Create alias `lss`, which prints names of files in the working directory sorted by file size.
- Create shell script that prints names of the 10 largest files (including their sizes), which are in your home directory and in its direct subdirectories.