

```
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
```

```
#define MAXPAROLA 30
#define MAXRIGA 80
```

```
int main(int argc, char *argv[])
```

```
{
    int freq[MAXPAROLA]; /* vettore di contatori
delle frequenze delle lunghezze delle parole */
    char riga[MAXRIGA];
    int i, inizio, lunghezza;
    FILE * f;
```

```
    for(i=0; i<MAXPAROLA; i++)
        freq[i]=0;
```

```
    if(argc != 2)
```

```
    {
        fprintf(stderr, "ERRORE: serve un parametro con il nome del file\n");
        exit(1);
    }
```

```
    f = fopen(argv[1], "r");
    if(f==NULL)
```

```
    {
        fprintf(stderr, "ERRORE: impossibile aprire il file %s\n", argv[1]);
        exit(1);
    }
```

```
    while( fgets( riga, MAXRIGA, f ) != NULL )
```

# UNIX/Linux Operating System

## Shells

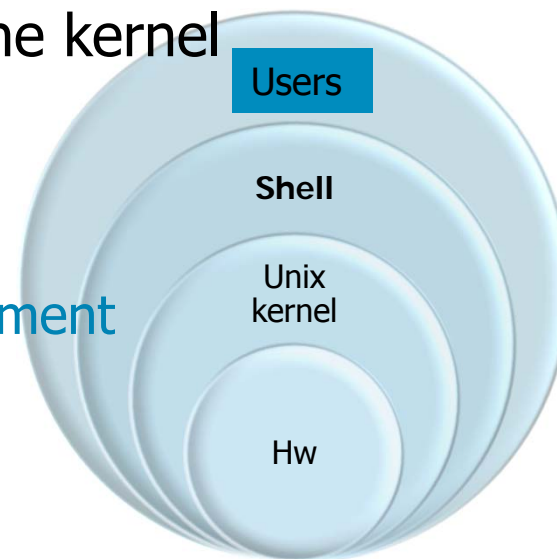
Stefano Quer and Pietro Laface

Dipartimento di Automatica e Informatica

Politecnico di Torino

## Introduction to shells

- ❖ The outermost layer of the operating system
  - It provides the user interface, which interprets the user commands
  - It was the unique interface before the introduction of graphics servers
- ❖ In Unix, a shell is not part of the kernel
  - It is a normal user process
  - Similar to DOS **command**
    - but more powerful
  - Offers a programming environment



## Introduction to shells

- ❖ A shell allows
  - Submitting commands
  - Writing shell programs (scripts)
    - Storing commands in a script file
    - Script execution by submitting the script file
- ❖ Writing a script avoids
  - Typing complex command sequences repeatedly
  - Automating tedious, repetitive and error prone tasks

## Main shells

Shell	Characteristics
Bourne shell (sh)	Original shell, often used in Unix system programming
C-shell (csh)	Berkeley shell, very good for interactive usage, and for user scripts. Uses a syntax similar to C language
Korn shell (ksh)	Bourne shell rewritten by AT&T to be similar to C-shell
Tahoe C-shell (tcsh)	Tahoe project, an improved C-shell (superset)
<b>Bourne again shell (bash)</b>	Is compatible but extends csh and ksh Standard GNU Shell; POSIX conformant; powerful but not complex. Most sh scripts are interpreted by bash without changes

## Introduction to shells

- ❖ Often **/bin/sh** is a link to the current shell
  - The default shell can be modified
    - **chsh** (change login shell)
- ❖ Different shells may accept slightly different commands

<b>tcsh</b>	<b>bash</b>
<b>set</b> myVar = "ciao"	myVar="ciao"
<b>setenv</b> MY_DIR /home/usr/	<b>export</b> MY_VAR=/home/usr/
if (\$str1==\$str2) then ... else ... endif	if test \$str1=\$str2 then ... else ... fi if [ \$str1=\$str2 ]; then ... else ... fi

## shell execution

- ❖ A shell can be activated
  - Automatically at login
  - Nested within another shell
  - As a user program
    - `/bin/tcsh`, `/bin/bash`, ...
- ❖ A shell exit by typing
  - Command `exit`
  - The EOF character (usually CTRL-d)
    - Exiting an inner shell will return to the outer shell

## Introduction to bash

- ❖ At login a shell looks for, and executes, some configuration files that contain initialization commands
  - For each login with password, the shell executes
    - Global scripts
    - `/etc/profile`
    - User scripts (executes the first existing file among)
      - `~/.bash_profile`, `~/.bash_login`,  
`~/.profile`
  - For each login without a password, the shell executes
    - `~/.bashrc`
  - For each logout, the shell executes
    - `~/.bash_logout`

## shell command expansion

- ❖ Some characters have special meaning within the shell
- ❖ bash provide complex substitution mechanisms
  - After dividing the command line into tokens, the shell expands or solves these tokens, i.e., it applies different types of replacement
    - Braces, tilde, variables and parameters, commands, arithmetic expressions, etc.
  - The substitution is complex and takes place with a specific order



## Parentheses

### ❖ Parentheses (), [], {}

- Enclose variables, arithmetic operations, etc.
- In some cases, they are subject to automatic expansion (brace expansion)

```
➤ name=Jean  
➤ echo $namePaul  
  
➤ echo {$name}Paul  
{Jean}Paul  
➤ echo ${name}Paul  
JeanPaul
```

echo: print command

This variable  
does not exist

## Quoting

❖ "Quoting" means the use of for quotation marks

➤ Quotes ' '

- Variables within quotes are not expanded
- They cannot be nested

➤ Double quotes " "

- Variables within double quotes are expanded
- They can be nested

➤ Backslash \

- Identifies the escape character, which remove the special meaning of the character that follows it

## Examples

```
➤ myVar="A string"
➤ echo $myVar
A string

➤ echo 'v = $myVar'
v = $myVar

➤ echo "v = $myVar"
v = A string

➤ echo \$myVar
$myVar
➤ echo "double quote\""
double quote"
```

variable usage:

- set without \$
- used with \$

' ... ' →

no expansion

" ... " → expansion

\ cancels the meaning  
of the next character,  
which becomes a  
"meta-character"

## Using the output of command

- ❖ The standard output of a command can be captured by
  - Enclosing the command in `$ (...)`
  - Enclosing the command in **backquotes** ```
- ❖ In particular, the output of a command can be stored in a variable

```
➤ d=$(date)
➤ echo $d
➤ Fri Nov 22 10:00:0 \
    CET 2013
➤ d=`date`
...

```

```
➤ out=`cat file.txt`
➤ echo $out
➤ ... file content ...

➤ out=`< file.txt`
➤ echo $out
➤ ... file content ...

```

## Command execution

### ❖ In a shell a command can be executed

#### ➤ Directly

- `cd /home ; ls`

The current shell executes the command; change directory to `/home`; executes `ls`; at the end of the working directory is `/home`

#### ➤ Indirectly

- `(cd /home; ls)`

The current shell executes the command **in a subprocess**; change directory to `/home`; executes `ls`; at the end of the working directory is **the original directory**

## History

### ❖ A shell

- Keeps the list of the last submitted commands
  - In bash, the list is stored in file `.bash_history`
  - Stored in the user home directory
- Shell commands allow reference this list

Command	Meaning
<code>history</code>	Displays the list of the last submitted commands
<code>!n</code>	Executes command number <code>n</code> in the history list
<code>!str</code>	Executes last command beginning by <code>str</code>
<code>^str1^str2</code>	Executes last command replacing <code>str1</code> by <code>str2</code>

## Aliasing

❖ In shell you can define new names to existing commands

➤ The **alias** command allows defining these names

- **alias name="string"**

- defines a new alias for "string"

No blanks near symbol =

➤ The shell maintains a list of aliases

- **alias**

- provides the list of active aliases used in the shell

➤ Old aliases can be deleted

- **unalias name**

- Deletes the alias name from the shell

## Examples

➤ **alias**

```
alias egrep='egrep --color=auto'
alias emacs='emacs -r -geometry 100x36 -fn 9x15 &'
alias fgrep='fgrep --color=auto'
alias grep='grep --color=auto'
alias ls='ls --color=auto'
alias mx='xdvi -mfmode ljfour:1200'
```

Existent aliases

➤ **alias ll= "ls -la"**

Definition of a new alias

➤ **unalias emacs**

➤ **unalias ll**

Deletion of a pre-existing alias.