

## Using Unix

For more info check out the Unix man pages

-or-

<http://www.cs.rpi.edu/~hollingd/unix>

-or-

Unix in a Nutshell (an O'Reilly book).

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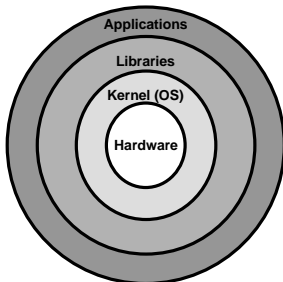
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## Remember This Picture?



There are many standard applications:

- file system commands
- interactive shells
- text editors
- compilers
- text processing

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## Logging In

- To log in to a Unix machine you can either:
  - sit at the *console* (the computer itself)
  - access via the net (using telnet, rsh, ssh, kermi, or some other remote access client).
- The system prompts you for your username and password.
- Usernames and passwords are case sensitive!

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## Session Startup

- Once you log in, your shell will be started and it will display a prompt.
- When the shell is started it looks in your home directory for some customization files.
  - You can change the shell prompt, your PATH, and a bunch of other things by creating customization files.

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## Your Home Directory

- Every Unix process\* has a notion of the “current working directory”.
- Your shell (which is a process) starts with the current working directory set to your home directory.

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## Interacting with the Shell

- The shell prints a prompt and waits for you to type in a command.
- The shell can deal with a couple of types of commands:
  - shell internals - commands that the shell handles directly.
  - External programs - the shell runs a program for you.

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## Some Simple Commands

- Here are some simple commands to get you started:
  - **ls** lists file names (like DOS dir command).
  - **who** lists users currently logged in.
  - **date** shows the current time and date.
  - **pwd** print working directory

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## The ls command

- The ls command displays the names of some files.
- If you give it the name of a directory as a *command line parameter* it will list all the files in the named directory.

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## ls Command Line Options

- We can modify the output format of the **ls** program with a *command line option*.
- The ls command support a bunch of options:
  - **l** *long* format (include file times, owner and permissions)
  - **a** *all* (shows hidden\* files as well as regular files)
  - **F** include special char to indicate file types.

\*hidden files have names that start with "."

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## Moving Around in the Filesystem

- There `cd` command can change the current working directory:

```
cd    change directory
```

- The general form is:

```
cd [directoryname]
```

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## `cd`

- With no parameter, the `cd` command changes the current directory to your home directory.
- You can also give `cd` a relative or absolute pathname:

```
cd /usr
```

```
cd ..
```

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## Some more commands and command line options

- `ls -R` will list everything in a directory and in all the subdirectories recursively (the entire hierarchy).
  - you might want to know that Ctrl-C will cancel a command (stop the command)!
- `pwd`: print working directory
- `df`: shows what disk holds a directory.

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## Copying Files

- The **cp** command copies files:  
`cp [options] source dest`
- The source is the name of the file you want to copy.
- dest is the name of the new file.
- source and dest can be relative or absolute.

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## Another form of **cp**

- If you specify a dest that is a directory, cp will put a copy of the source in the directory.
- The filename will be the same as the filename of the source file.

```
cp [options] source destdir
```

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## Deleting (removing) Files

- The **rm** command deletes files:  
`rm [options] names...`
  - **rm** stands for "remove".
  - You can remove many files at once:
- ```
rm foo /tmp/blah /users/clinton/intern
```

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## File attributes

- Every file has some attributes:
  - Access Times:
    - when the file was created
    - when the file was last changed
    - when the file was last read
  - Size
  - Owners (user and group)
  - Permissions

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## File Time Attributes

- Time Attributes:
  - when the file was last changed `ls -l`
  - when the file was created\* `ls -lc`
  - when the file was last read (accessed) `ls -ul`

\*actually it's the time the file status last changed.

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## Other filesystem and file commands

- **mkdir** make directory
- **rmdir** remove directory
- **touch** change file timestamp (can also create a blank file)
- **cat** concatenate files and print out to terminal.

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## Shells

Also known as: Unix Command Interpreter

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## Shell as a user interface

- A shell is a command interpreter that turns text that you type (at the command line) in to actions:
  - runs a program, perhaps the `ls` program.
  - allows you to edit a *command line*.
  - can establish alternative sources of input and destinations for output for programs.

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## Running a Program

- You type in the name of a program and some command line options:
  - The shell reads this line, finds the program and runs it, feeding it the options you specified.
- The shell establishes 3 I/O *channels*:
  - Standard Input
  - Standard Output
  - Standard Error

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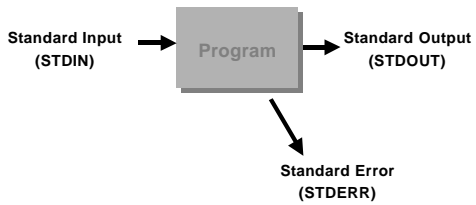
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## Programs and Standard I/O



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## Unix Commands

- Most Unix commands (programs):
  - read something from standard input.
  - send something to standard output (typically depends on what the input is!).
  - send error messages to standard error.

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## Defaults for I/O

- When a shell runs a program for you:
  - standard input is your keyboard.
  - standard output is your screen/window.
  - standard error is your screen/window.

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## Terminating Standard Input

- If standard input is your keyboard, you can type stuff in that goes to a program.
- To end the input you press Ctrl-D (^D) on a line by itself, this ends the input *stream*.
- The shell is a program that reads from standard input.
- What happens when you give the shell ^D?

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## Popular Shells

|             |                    |
|-------------|--------------------|
| <b>sh</b>   | Bourne Shell       |
| <b>ksh</b>  | Korn Shell         |
| <b>cs</b>   | C Shell            |
| <b>bash</b> | Bourne-Again Shell |

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## Customization

- Each shell supports some customization.
  - User prompt
  - Where to find mail
  - Shortcuts
- The customization takes place in *startup* files – files that are read by the shell when it starts up

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## Startup files

```
sh,ksh:
/etc/profile (system defaults)
~/.profile
bash:
 ~/.bash_profile
 ~/.bashrc
 ~/.bash_logout
csh:
 ~/.cshrc
 ~/.login
 ~/.logout
```

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## Wildcards (metacharacters) for filename abbreviation

- When you type in a command line the shell treats some characters as special.
- These special characters make it easy to specify filenames.
- The shell processes what you give it, using the special characters to replace your command line with one that includes a bunch of file names.

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## The special character \*

- \* matches anything.
- If you give the shell \* by itself (as a command line argument) the shell will remove the \* and replace it with all the filenames in the current directory.
- "a\*b" matches all files in the current directory that start with **a** and end with **b**.

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## Understanding \*

- The **echo** command prints out whatever you give it:  

```
> echo hi  
hi
```
- Try this:  

```
> echo *
```

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## \* and **ls**

- Things to try:  

```
ls *  
ls -al *  
ls a*  
ls *b
```

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## Input Redirection

- The shell can attach things other than your keyboard to standard input.
  - A file (the contents of the file are fed to a program as if you typed it).
  - A pipe (the output of another program is fed as input as if you typed it).

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## Output Redirection

- The shell can attach things other than your screen to standard output (or stderr).
  - A file (the output of a program is stored in file).
  - A pipe (the output of a program is fed as input to another program).

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## How to tell the shell to redirect things

- To tell the shell to store the output of your program in a file, follow the command line for the program with the “>” character followed by the filename:

```
ls > lsout
```

the command above will create a file named **lsout** and put the output of the **ls** command in the file.

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## Input redirection

- To tell the shell to get standard input from a file, use the “<” character:

```
sort < nums
```
- The command above would sort the lines in the file **nums** and send the result to **stdout**.

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You can do both!

```
sort < nums > sortednums
```

```
tr a-z A-Z < letter > rudeletter
```

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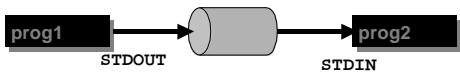
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## Pipes

- A pipe is a holder for a stream of data.
- A pipe can be used to hold the output of one program and feed it to the input of another.



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## Asking for a pipe

- Separate 2 commands with the “|” character.
- The shell does all the work!

```
ls | sort  
ls | sort > sortedls
```

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## Shell Variables

- The shell keeps track of a set of parameter names and values.
- Some of these parameters determine the behavior of the shell.
- We can access these variables:
  - set new values for some to customize the shell.
  - find out the value of some to help accomplish a task.

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## Example Shell Variables

**sh / ksh / bash**

**PWD**      *current working directory*  
**PATH**     *list of places to look for commands*  
**HOME**     *home directory of user*  
**MAIL**     *where your email is stored*  
**TERM**     *what kind of terminal you have*  
**HISTFILE**   *where your command history is saved*

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## Displaying Shell Variables

- Prefix the name of a shell variable with "\$".
- The **echo** command will do:
  - echo \$HOME**
  - echo \$PATH**
- You can use these variables on any command line:
  - ls -al \$HOME**

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## Setting Shell Variables

- You can change the value of a shell variable with an assignment command (this is a shell *builtin* command):

```
HOME=/etc
PATH=/usr/bin:/usr/etc:/sbin
NEWVAR="blah blah blah"
```

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## **set** command (shell builtin)

- The **set** command with no parameters will print out a list of all the shell variables.
- You'll probably get a pretty long list...
- Depending on your shell, you might get other stuff as well...

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## The **PATH**

- Each time you give the shell a command line it does the following:
  - Checks to see if the command is a shell built-in.
  - If not - tries to find a program whose name (the filename) is the same as the command.
- The **PATH** variable tells the shell where to look for programs (non built-in commands).

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## echo \$PATH

```
=====  
[foo.cs.rpi.edu] - 22:43:17 =====  
/cs/hollingd/introunix echo $PATH  
/home/hollingd/bin:/usr/bin:/bin:/usr/local/b  
in:/usr/sbin:/usr/bin/X11:/usr/games:/usr/l  
ocal/packages/netscape
```

- The **PATH** is a list of ":" delimited directories.
- The **PATH** is a list and a *search order*.
- You can add stuff to your PATH by changing the shell startup file (on RCS change ~/ **.bashrc**)

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## Job Control

- The shell allows you to manage *jobs*
  - place *jobs* in the *background*
  - move a job to the foreground
  - suspend a job
  - kill a job

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## Background jobs

- If you follow a command line with "&", the shell will run the *job* in the background.
  - you don't need to wait for the job to complete, you can type in a new command right away.
  - you can have a bunch of jobs running at once.
  - you can do all this with a single terminal (window).

```
ls -lR > saved_ls &
```

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## Listing jobs

- The command *jobs* will list all background jobs:  

```
> jobs
```

```
[1] Running      ls -lR > saved_ls &
```

```
>
```
- The shell assigns a number to each job (this one is job number 1).

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## Suspending and Killing the Foreground Job

- You can suspend the foreground job by pressing `^Z` (Ctrl-Z).
  - Suspend means the job is stopped, but not dead.
  - The job will show up in the `jobs` output.
- You can *kill* the foreground job by pressing `^C` (Ctrl-C).
  - It's gone...

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## Quoting - the problem

- We've already seen that some characters mean something special when typed on the command line: `* ? [ ]`
- What if we don't want the shell to treat these as special - we really mean `*`, not all the files in the current directory:

```
echo here is a star *
```

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## Quoting - the solution

- To turn off special meaning - surround a string with double quotes:

```
echo here is a star "*"
```

```
echo "here is a star"
```

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## Quoting Exceptions

- Some *special* characters are **not** ignored even if inside double quotes:
- \$ (prefix for variable names)
- " the quote character itself
- \ slash is always something special (\n)
  - you can use \\$ to mean \$ or \" to mean "

```
echo "This is a quote \" "
```

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## Single quotes

- You can use single quotes just like double quotes.
  - Nothing (except ') is treated special.

```
> echo 'This is a quote \" '
This is a quote \"
>
```

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## Backquotes are different!

- If you surround a string with backquotes the string is replaced with the result of running the command in backquotes:

```
> echo `ls`  
foo fee file?
```

```
> PS1=`date`
```

```
Tue Jan 25 00:32:04 EST 2000
```

*← new prompt!*

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## Programming

- Text editors
  - emacs, vi
  - Can also use any PC editor if you can get at the files from your PC.
- Compilers – gcc is probably best.
- Debuggers: gdb, xgdb

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