

A shell is simply a program that supplies certain services to users.

As such, a shell may take parameters whose values modify or define certain behaviors.

These parameters (or *shell variables* or global *environment variables*) typically have values that are set in certain *configuration files*.

When you install Linux, or use your rlogin account, many of these parameters will have default values determined by the system administrator or by Linux installer.

You may generally modify those default values and even define new parameters by editing configuration files within your home directory.

Open a bash shell and enter the command **\$HOME**... this will show the current value of the environment variable **HOME**.

The environment variable that is most often encountered is the **PATH** variable, which determines which directories the shell will search (and in what order) when the shell attempts to locate programs you are attempting to execute.

```
#1002 wmcquain: ~> $PATH
-bash:
./:/usr/local/bin:/usr/local/sbin:/usr/bin:/usr/sbin:/home/wmcquain/bin:
```

We see that the default **PATH** for this CentOS installation contains the directories:

```
./
/usr/local/bin
/usr/local/sbin
/usr/bin
/usr/sbin
/home/wmcquain/bin
```

By default, the shell will only find executables that are in these directories...

... for executables in other directories, we'd have to include the path...

... or modify **PATH**

Here, we have an executable but the shell can't find it:

```
#1007 wmcquain: ~> ll development/mergerv3
```

```
-rw-rw-r--. 1 wmcquain wmcquain 3814 Mar  2 13:11 Config.c  
-rw-rw-r--. 1 wmcquain wmcquain  408 Mar  2 13:11 Config.h  
-rw-rw-r--. 1 wmcquain wmcquain 10030 Mar  6 18:21 csvList.c  
-rw-rw-r--. 1 wmcquain wmcquain  850 Mar  2 13:48 csvList.h  
-rwxrwxr-x. 1 wmcquain wmcquain 62120 Mar  6 18:23 csvmerger  
-rw-rw-r--. 1 wmcquain wmcquain 2599 Mar  2 13:47 csvmerger.c  
-rw-rw-r--. 1 wmcquain wmcquain  904 Mar  6 18:23 Partners.c  
-rw-rw-r--. 1 wmcquain wmcquain  167 Mar  2 13:48 Partners.h  
-rw-rw-r--. 1 wmcquain wmcquain  864 Mar  6 18:23 Utilities.c  
-rw-rw-r--. 1 wmcquain wmcquain  126 Mar  6 18:16 Utilities.h
```

```
#1008 wmcquain: ~> csvmerger  
bash: csvmerger: command not found...
```

If we know where the executable is, we can specify that in the command:

```
#1010 wmcquain: ~> ./development/mergerv3/csvmerger
```

Invocation:

```
merger -h=NN -s=NN [-c] [-p] [-t] <mergefile> <csv1> <csv2> {<csv3> . .  
.<csvk>}
```

But... this becomes tedious... especially for long paths...

You can change the value of a shell variable from the command line.

Let's add the directory for one of my tools to the **PATH**:

```
#1001 wmcquain: ~> PATH=$PATH:~/development/mergerv3/
#1002 wmcquain: ~> csvmerger

Invocation:
  merger -h=NN -s=NN [-c] [-p] [-t] <mergefile> <csv1> <csv2> {<csv3> . .
.<csvk>}
```

Note that we can now run the user program **csvmerger** without specifying the path.

But... this only resets **PATH** for the current shell session.

When a bash shell is started, it automatically executes commands stored in certain files.

There are three kinds of shells:

(interactive) login shells

/etc/profile

~/.bash_profile

~/.bash_login

~/.profile

(sets values for various shell variables)

a system file that only the **root** user can modify files in your **HOME** directory that you can change

interactive non-login shells

/etc/bashrc

~/.bashrc

(inherits login shell variables from files above)

another system file

another file in your **HOME** directory

non-interactive shells

files named by the environment variable **BASH_ENV**

(inherits login shell variables from files above)

If you try the **ls** command in your home directory, you will notice that the file **.bash_profile** is not listed.

Filenames that begin with a period are hidden by default.

You can use the **ls -a** command will show hidden files as well as non-hidden files.

When you open an interactive terminal session in Linux, the sequence described on the preceding slide is probably NOT followed by default.

In particular, `~/.bash_profile` is not executed automatically, and therefore changes you make to it will not be effective.

There is a simple fix for the issue:

- open a terminal session and go to Edit/Profile Preferences
- select the Title and Command tab
- check the box for “Run command as a login shell”

In fact, in my rlogin installation, `~/.bash_profile` did not exist initially; I had to create it with a text editor.

You should use **~/.bash_profile** to set changes to the PATH variable because **~/.bash_profile** is only executed once.

Here is a sample **.bash_profile** taken from Sobell:

```
if [ -f ~/.bashrc ]; then      # if .bashrc exists
                              #   in the home directory
    source ~/.bashrc          #   run it
fi

PATH=$PATH:.                  # add working directory to the path

export PS1='[\h \W \!]\$ '    # configure the shell prompt
```

Normally, **~/.bashrc** is invoked from another configuration file, as shown here.

See the note in Sobell regarding adding the working directory to the path; a bit of (weak) security advice is to NEVER add the current working directory at the beginning of the path!

Sobell has a good discussion of the various options for the appearance of the prompt.

Here is a sample `~/.bashrc` adapted from Sobell:

```
if [ -f /etc/bashrc ]; then # if global bashrc exists, run it
    source /etc/bashrc      # note: no period in file name
fi
if [ -d "$HOME/bin" ] ; then # add user's bin directory to path
    PATH="$HOME/bin:$PATH"
fi
set -o noclobber           # prevent silent overwriting of files
                           # (by redirection)

alias rm='rm -i'          # always use interactive rm cmd
alias cp='cp -i'          # and interactive cp cmd
alias recent='history | tail' # displays last few cmds run
alias ll='ls -alF'
```

alias commands are a convenient way to create mnemonics for specialized execution of system commands.

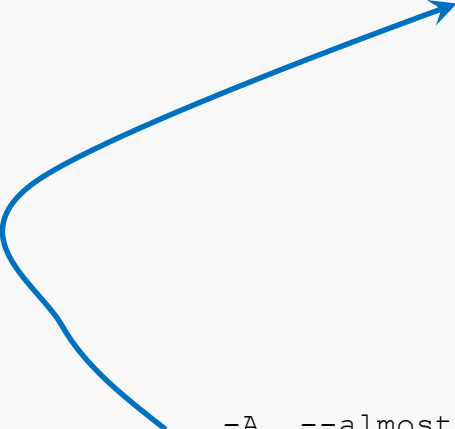
alias commands are a convenient way to create mnemonics for specialized execution of system commands.

The syntax (for the bash shell) is:

```
alias <mnemonic>='command to be run'
```

There are no spaces around the equal sign, and the specification of the command to be run must be enclosed in single quotes if it contains spaces.

```
alias list='ls -gAFG -t -r --time-style=long-iso'
```



```
#1017 wdm@Centos65:code> list
total 12
-rw-rw-r--. 1 3442 2014-10-23 22:34 BinaryInt.c
-rw-rw-r--. 1  816 2014-10-23 22:34 driver.c
-rw-rw-r--. 1 2183 2014-10-23 22:34 BinaryInt.h
```

-A, --almost-all
do not list implied . and ..

-F, --classify
append indicator (one of */=>@|) to entries

-g like -l, but do not list owner

-G, --no-group
in a long listing, don't print group names

-r, --reverse
reverse order while sorting

-t sort by modification time

--time-style=STYLE
with -l, show times using style STYLE: full-iso, long-iso, iso, . . .

The shell supports a built-in programming language, called a scripting language.

(Different shells support different scripting languages.)

We will explore shell scripting in detail later in the course.

For now, we'll show a couple of examples to illustrate how the bash scripting language works.

```

first_vowel() {                                # utility fn called by piggy()

    return `expr index "$1" aeiouAEIOU`
}

piggy() {                                       # translates params to pig-Latin

    for x; do                                   # iterate through params
        first_vowel $x                         # locate first vowel in param
        retval="$?"                            # save return value from first_vowel()

        if [[ $retval -eq 1 ]]; then           # vowel is at front of param
            echo -n $x"way "
        else                                     # vowel is not at front of param
            length=`expr length "$x"`
            prefix=`expr substr "$x" 1 $((retval-1))`
            suffix=`expr substr "$x" $retval $length`
            echo -n $suffix$prefix"ay "
        fi

    done                                         # end of for loop body
    echo                                         # bang out a newline
    return 0
}
    
```

```
first_vowel() {                                     # utility fn called by piggy()
                                                    # no return type, param list
    return `expr index "$1" aeiouAEIOU`
}
```

```
. . .
first_vowel $x   # call passes param; syntax like command-line invocation
. . .
```

```
retval="$?"      # return value accessed as $?
```

```
. . .
if [[ $retval -eq 1 ]]; then      # have if-then construct

    echo -n $x"way "

else                              # else is optional

    length=`expr length "$x"`
    prefix=`expr substr "$x" 1 $((retval-1))`
    suffix=`expr substr "$x" $retval $length`
    echo -n $suffix$prefix"ay "

fi                                # if/fi pair delimit if body
. . .
```

If we add the function(s) to the **.bashrc** file, they become available in future shell invocations:

```
#1004 wmcquain: ~> source .bashrc
```

"Reloads" .bashrc

```
#1006 wmcquain: ~> piggy wash your hands  
ashway ouryay andshay
```

```
#1007 wmcquain: ~> piggy we are pilgrims in an unholy land  
eway areway ilgrimspay inway anyway unholyway andlay
```

Of course, this is just a "joke" function...

```
protect() {  
  
    if [[ $# -eq 0 ]]; then                # check for a parameter  
        echo "Invocation:  protect filename"  
        return 1;  
    fi  
  
    if [[ ! -f $1 ]]; then                # see if it's a regular file  
        echo "$1 is not a regular file."  
        return 2;  
    fi  
  
    chmod g-rwx,o-rwx $1                # if so, remove all group/other access to it  
  
    return 0  
}
```