The Bash Shell and You

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- Slides: `http://web.mst.edu/~nmjxv3/articles/shell.pdf`
- Files: `http://web.mst.edu/~nmjxv3/articles/shell/`

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What's so cool about shells?

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- You can find 'em on the beach
- They look nice
- Cool ocean sounds
- Sometimes have crabs inside!

What's so cool about shells?

- Pretty fast for some tasks
- Works well over a slow internet connection
- Can construct complex tools out of simple ones
- Easy to automate tasks!

What *is* a shell, anyway?

- A shell takes commands, runs them, and shows you the output
- Linux has a bunch of shells: `bash`, `zsh`, `dash`, `csh`, `tcsh`, ...
- Shells usually provide some tools for connecting programs together, running multiple programs, &c.

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Is PuTTY a shell? Nope, it's a terminal!

- Terminals connect your keyboard and screen to your shell
- They run on your machine and connect to a shell (either on your machine or somewhere else)
  - Linux: `xterm`, `gnome-terminal`, &c.
  - Mac: Terminal.app
  - Windows: PuTTY
- Can connect to remote shells via `ssh` (secure shell)

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- `ls`: List (files and directories)
  - `-l` Display a detailed list of information about each file
  - `-h` Display human-readable file sizes
  - `-a` Display all files, even hidden ones (files that start with a `.`)

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Some neat tricks:

- `ls *.txt`
- `ls **/*.cpp`

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- `cp`
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- `rm`
  - `-f`: Forcibly remove files (even if write-protected)
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Another neat trick: `mv bob.{coo,cpp}`

Help!

- `help`: Help with built-in Bash commands and features
- `man`: Help with **E V E R Y T H I N G**
  - Scroll with arrow keys, j/k, or PgUp and PgDn
  - q quits
  - To search for something: `/search-term` Enter
  - n goes to next match; N goes to previous match
  - h shows more navigation hints

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- `head` and `tail`: Display the first or last ten lines of a file

Looking for stuff

- `find`: Find files in a directory (and do stuff to them)
  - The first argument is a directory to search in
  - After that you can specify things to search for:
    - `-name`: Search by name or glob
    - `-type`: Search for `f`iles or `d`irectories
  - After that you can specify an action:
    - `-ls`: Show file output like `ls -l` does
    - `-delete`: Delete files!
    - `-exec`: Execute a command

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  - After that you can specify an action:
    - `-ls`: Show file output like `ls -l` does
    - `-delete`: Delete files!
    - `-exec`: Execute a command
- `grep`: Search for stuff inside files
  - `-i`: Perform case-insensitive match
  - `-v`: Invert the match (print lines that don't match)
  - `-C 5`: Show 5 lines of context around matches

Standard input and output

Every program has one "input stream" (called `STDIN`) and two "output streams" (called `STDOUT` and `STDERR`). In C++, `STDIN` is connected to `cin`, `STDOUT` to `cout`, and `STDERR` to `cerr`.

Typically `STDIN` reads from your keyboard and `STDOUT` (and `STDERR`) write to the screen.

Writing output to files

You can use > and >> to redirect a command's output to a file instead!

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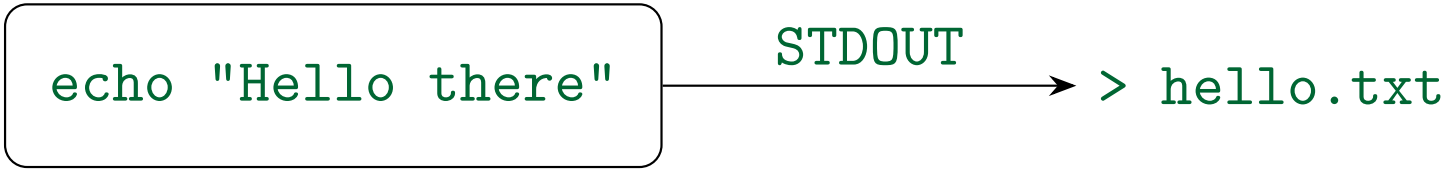
```
echo "Hello there" > hello.txt
```



Capturing STDERR

Typically, you want to capture BOTH standard output and standard error. To do this, redirect standard error into standard output with the incantation `2>&1`.

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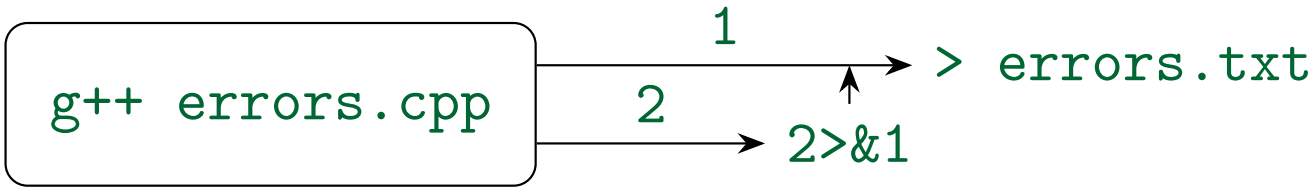
```
g++ errors.cpp > errors.txt 2>&1
```



Writing output to other programs

You can also redirect one program's `STDOUT` to another program's `STDIN`! This is done with the pipe (`|`) character.

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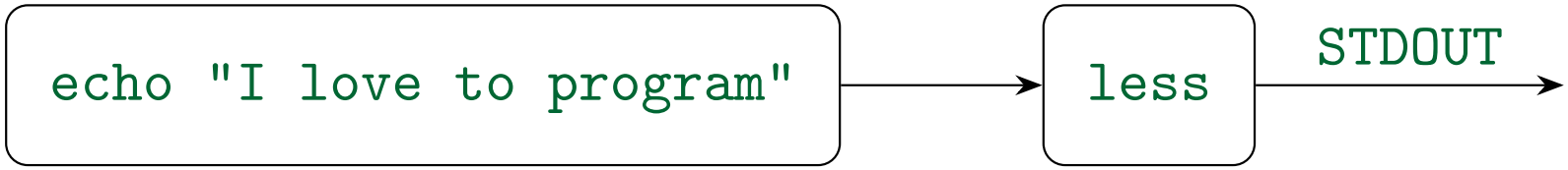
```
echo "I love to program" | less
```



Shell script anatomy

```
#!/bin/bash

g++ *.cpp -o program
./program
```

A shell script is comprised of two things:

1. A "shebang" line: starts with `#!`; contains the command that executes the script
2. A bunch of bash commands

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- To assign a value to a variable: `num_cows=5` (note: NO SPACES)
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```
#! /bin/bash

g++ *.cpp -o $1
./$1
```

Checking for failures

Our script has two problems right now:

1. If our code doesn't compile, we probably don't want it to run!
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More special variables:

- `$?`: The return value of the last program run
- `$#`: The number of command-line arguments passed

Checking for failures

```
#! /bin/bash
progname="program"

if [[ $# -ge 1 ]]; then
        progname=$1
fi

g++ *.cpp -o $progname

if [[ $? -eq 0 ]]; then
        ./$progname
fi
```

Doing stuff to a bunch of files

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With a for loop!

```
#! /bin/bash

for file in *.sh; do
        echo "Copying $file to $file.bak"
        cp $file $file.bak
done
```

Looping over command-line arguments

Let's print out each command line argument on its own line:

```
#! /bin/bash

for arg in $@; do
        echo $arg
done
```

Running commands from anywhere

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```
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For more variables that control how `bash` works, see `help variables`.

Making new commands the quick ‘n easy way

- `alias name=command`: Make a shorthand name for an existing command
- Bash functions: `function-name() { commands }`

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```
rungcc() {
        progname="program"

        if [[ $# -ge 1 ]]; then
                progname=$1
        fi

        g++ *.cpp -o $progname

        if [[ $? -eq 0 ]]; then
                ./$progname
        fi
}
```

Where to from here?

Take CS 1585! `http://web.mst.edu/~nmjxv3/cs1001/`

- List of Bash Commands:
  `https://ss64.com/bash/`
- Bash Reference Manual:
  `https://www.gnu.org/software/bash/manual/`
- All About Pipes:
  `http://www.linfo.org/pipe.html`
- Software Carpentry Shell Tutorial:
  `http://swcarpentry.github.io/shell-novice/`
- Bash Tutorial:
  `http://tldp.org/LDP/Bash-Beginners-Guide/html/`

Pictured: Annie (left) and Lion (right)