Day 10: System Interaction

Suggested reading: *Learning Perl* (4th Ed.)

Chapter 14: Process Management

Turn In Homework

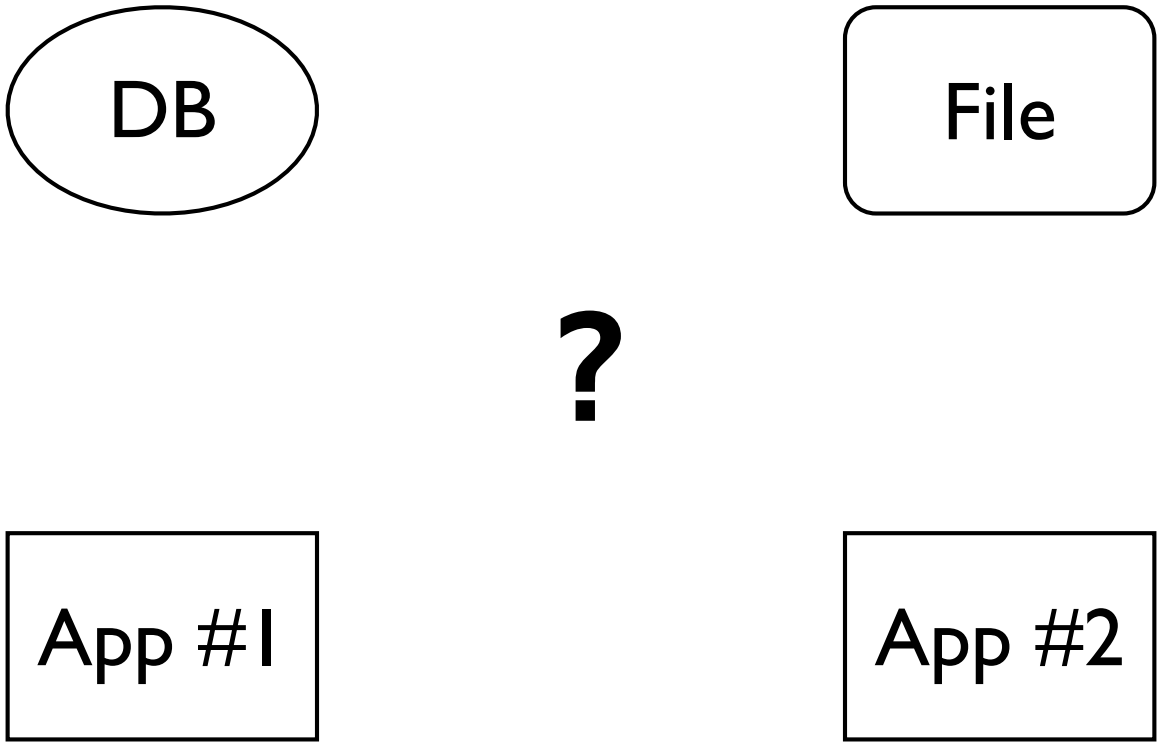
Homework #9 Comments

- Never use `{1}`
- Never start with `.*` or `^.*`
- Never end with `.*` or `.*$`

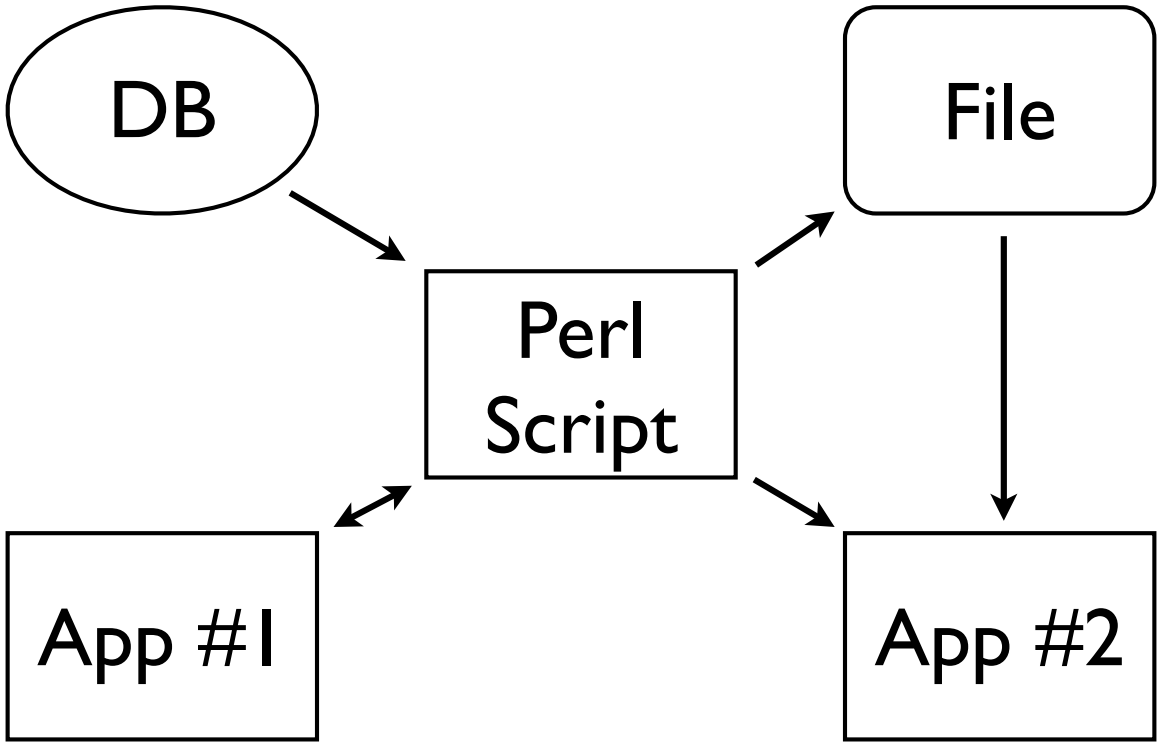
Why?

Homework Review

Problem



(One) Solution



Introducing … The Shell

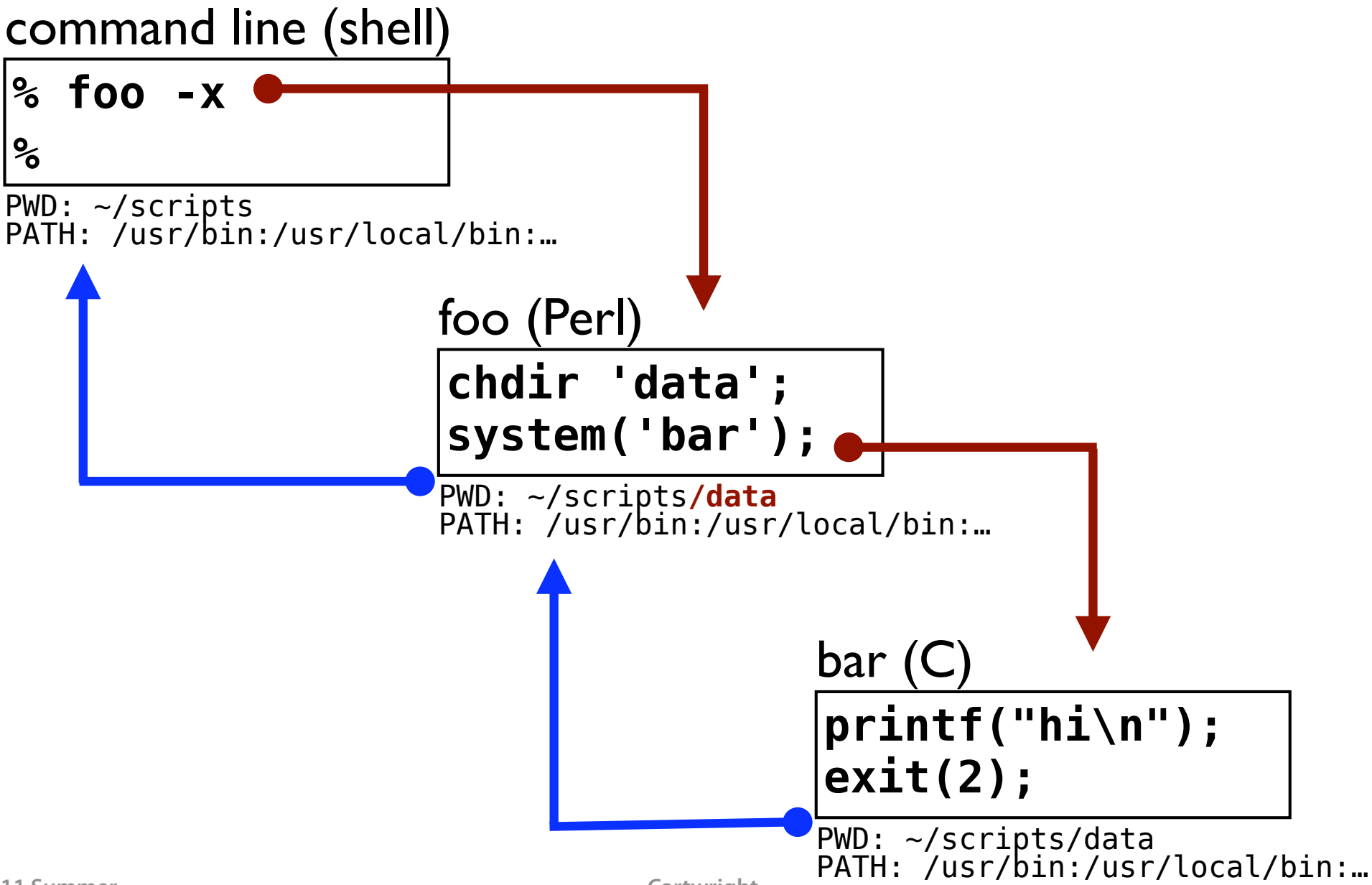
The Shell

- Is a ***program*** — e.g., **`/bin/sh`**
- Is another interpreted scripting language (like Perl)
- Runs "commands", but most are separate programs
- Has variables, control structures, functions, …
- Gives control over input and output
- Supports basic workflows via I/O pipelines (|)
- Interactive (the command line) or scripted

Common Shell Commands

- Built-in: **`cd`**, **`echo`**
- Manual pages: **`man`**
- List files: **`ls`**, **`find`**
- Change file privileges: **`chown`**, **`chmod`**
- File manipulation: **`cp`**, **`mv`**, **`rm`**, **`ln`**, **`unlink`**
- Directory manipulation: **`mkdir`**, **`rmdir`**
- View files: **`cat`**, **`more`**, **`less`**, **`wc`**
- Filter and/or manipulate files: **`grep`**, **`sed`**, **`awk`**
- Text editors: **`pico`**, **`vi`**, **`emacs`**
- Scripting: **`perl`**, **`python`**, **`ruby`**

Shells and Commands



The System ⇒ Your Script

Command-Line Arguments

$0	command (script) name
@ARGV	command-line arguments

```
% my_script data-42.txt 1200

#!/usr/bin/perl
use strict; use warnings;

my ($filename, $threshold) = @ARGV;

foreach my $argument (@ARGV) { … }

print "$0: arguments parsed ok!\n";
```

Arguably Better Arguments

```
% my_script --lo --with foo -aXb file1

use Getopt::Long;
my $lo = 0;
my $with = '';
GetOptions('lo'      => \$lo,
           'with=s' => \$with,
           # etc.);

my $file = $ARGV[0];
```

Environment

- **%ENV** : environment variables
- Readable and writable

```
my @path = split(/:/, $ENV{'PATH'});

my @new = grep(! m{/sbin}, @path);
$ENV{PATH} = join(':', @new);

delete $ENV{'BLAH'};
```

Your Script ⇒ The System

Running a Command

`system(…)`

- Runs the given command as a subprocess
- ***May*** create a shell to parse command
- Waits for command to finish
- Command inherits environment, etc.

```
system("gzip $output_file");
system('Rscript', 'foo.R', 1200, 42);
system("octave test-script > my_oct.log");
```

Sneaky system() Subtleties

Create a shell?

```
system('ls');                                   # no
system('ls >> my_file');                        # yes
system('ls', '>>', 'my_file');                  # no
```

Children do not affect parent

```
system('pwd');              # => /home/cat/foo
system('cd bar');
system('pwd');              # => ???
```

Sneaky system() Subtleties II

Watch out for quoting issues:

If a Perl script contains…

```
system("echo 'Don'\\''t say \"no\"!'");
```

… the actual string (command) is …

```
echo 'Don'\''t say "no"!'
```

… and the **echo** command prints …

```
Don't say "no"!
```

Return Values

- **`system()`** returns exit code × 256 (**`<< 8`**)
- Exit code of **`0`** is good in shell,
- But **`0`** is *false* in Perl, so…

```
system(…) and die('fail');     # confusing
!system(…) or die('fail');     # may miss !
```

- … instead, strive for clarity:

```
system(…) == 0 or die('fail');
if (system(…) != 0) {
    die('fail');
}
```

Errors

- `system()` return value ≡ `$?` ≡ exit code `<< 8`
- `$? == -1` means it failed to execute
- `$!` is the system error message

```
if ($? == -1) {
    print "failed to execute: $!\n";
} elsif ($? & 127) {
    print "died with signal";
} else {
    print "exited " . ($? >> 8) . "\n";
}
```

Getting Output

```
my $sys_date = `date`;
```

- Like **system()** but returns standard output
- **$?** and **$!** are set in the same way
- Need standard error, too?

```
my $sys_date = `date 2>&1`;
```

- In list context, returns list of lines in output
- Backticks interpolate!

```
my @files = `find $directory`;
```

Miscellaneous

Quit script with given exit code

```
exit 1;
```

Print message to standard error and exit (non-zero)

```
die 'message';
```

Print message to standard error

```
print STDERR 'message';
warn 'message';
```

When To Use

- Glue between existing commands
- More powerful shell
- Workflow management
- ***Not*** to replace Perl functions!
  - E.g., do not actually use `` `date` ``
- Your ideas?

Last 2 Slides…

Other Scripting Languages

- In command-line scripts, expect
  - Command-line arguments
  - Environment
  - Standard in, out, and error
  - System calls
  - Exit with status
  - Windows will be different…
- Embedded scripting (PHP, Lua, JavaScript, …)
  - Expect more restrictions

Homework

- Find IP addresses for image downloads
- Use external commands for:
  - Fetching an HTTP document (web page)
  - Looking up IP addresses
- Middle section will involve regular expressions