Writing Well-behaved Unix Utilities

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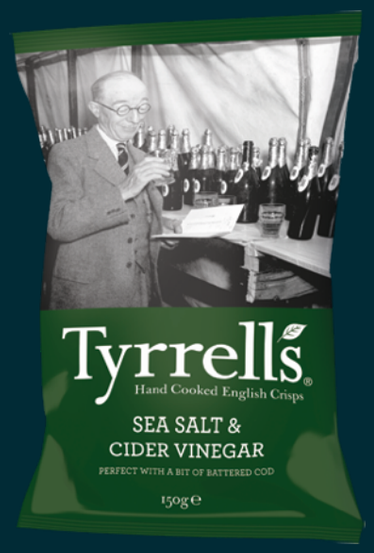
Who are you?

- Head of Digital at Big Fish
- We’re a design, branding and marketing consultancy

- Which is to say:



Who are you?

- I've been programming in Ruby for several years now
- But I don't do much web development any more
- My world is reporting, sysadmin, ops, general tools and utilities
- Ruby is my tool of choice

The command-line spectrum

- One-liner
- Script
- Application

The command-line spectrum

- ~~One-liner~~
- ~~Script~~
- Application

What makes something an “application”?

- Intended for use by others, or for the foreseeable future
- General-purpose
- Robust
- Reusable
- Built to last

An aside: “Unix”

- A grouping of computer operating systems that behave in a relatively standard way
- In practical terms:
  - Linux (Ubuntu, Debian, Fedora, etc.)
  - Mac OS X
  - BSDs (FreeBSD, OpenBSD, etc.)

The Unix Philosophy

"...no single program or idea makes [Unix] work well. Instead, what makes it effective is the approach to programming... at its heart is the idea that the power of a system comes more from the relationships among programs than from the programs themselves.

The Unix Philosophy

"Many UNIX programs do quite trivial things in isolation, but, combined with other programs, become general and useful tools."

— Brian Kernighan, 1984

The Unix Philosophy

"This is the Unix philosophy: write programs that do one thing and do it well. Write programs to work together. Write programs to handle text streams, because that is a universal interface."

— Doug McIlroy, c. 1978

The Unix Philosophy

- To summarise: good Unix applications *play well with others*
- They respect conventions
- They're reusable and general in nature
- They interact with other processes and accept interaction in standard ways (files, pipes, sockets)

In Ruby

- What does this mean in the concrete?
- How do we write Ruby applications that fit this philosophy?
- Why is Ruby a great choice for writing command-line applications?

A good application…

- works with standard input and output
- works with files
- communicates via its exit status
- respects resource limits
- handles signals
- accepts command-line options

…works with standard input and standard output

- Pipelines are the foundation of Unix
- The goal:

```
$ grep foo bar | your-app | head
```

- Assume that input will come from an arbitrary program, and that your output will be fed into one too

In Ruby

```ruby
$stdin.each do |line|
  puts some_modification(line)
end
```

- Processes input as a stream — handles arbitrarily large input (other streaming methods work too — `each_char`, `read(bytes)`, etc.)
- Outputs to `$stdout`, so can be redirected/piped by the user to a file/another process

...works with files too

- The goal:

```
$ cat foo.txt bar.txt | your-app
$ your-app foo.txt bar.txt
```

- The ultimate flexibility. As implemented by `cat`, `grep`, and most other Unix utilities

In Ruby

```ruby
ARGF.each do |line|
  # process a line of input
end
```

- No more effort than reading from standard input
- If `ARGV` is non-empty, its contents will be read as files
- If it is empty, standard input will be used instead

...sets an exit status

- The goal:

```
$ your-app
$ echo $?
```

- Was the process successful or not?
- `0` for success, `>0` for failure — so you can communicate up to 255 different failure states

In Ruby

```
if successful?
  exit
else
  exit 1
end
```

- Use `exit` to stop execution of your script and return a successful exit status
- Pass it an argument to alter the exit status
- Document them!

…respects resource limits

- Processes have resource limits
- You should respect them, but you can also alter them if you need to (be reasonable!)
- Avoid the dreaded `Errno::EMFILE: Too many open files`

In Ruby

```
hard, soft = Process.getrlimit(:NOFILE)
```

- Check what the limits of your current process are (both hard and soft) and take appropriate action
- Here we check `EMFILE`, the limit of the number of file descriptors that we can have open at one time

In Ruby

```
begin
  File.open(“foo.txt”)
rescue Errno::EMFILE
  # Do something graceful!
end
```

- Actually handle resource-limit–related errors, and do something sensible
- That might be: increase the limit and try the same operation again

In Ruby

```
Process.setrlimit(:NOFILE, 4096)
```

- Change the soft limit if you need to; you’re generally allowed to!
- Applies to the current process and its children, including subshells — so you can make sure third-party code behaves too

...handles signals

- The goal: to be able to communicate with our process using signals
- Common signals:
  - SIGINT: interrupt (Ctrl+C)
  - SIGCHLD: when a child process terminates
  - SIGHUP: when the terminal is closed
  - SIGUSR1, SIGUSR2: custom signals

In Ruby

```ruby
trap :INT do
  # close database connection,
  # other necessary cleanup
  exit
end
```

- `trap` registers a handler for a particular signal (in this case `SIGINT`)
- When that signal is sent, our block is executed

…accepts command-line options

- The goal:

```
$ your-app --verbose -o 'file.txt'
```

- Allow our users to change behaviour based on arguments passed
- Makes our options scriptable — not something that has to be chosen from a menu or read from a config file

In Ruby

```ruby
require “optparse”

options = { verbose: false }
OptionParser.new do |opts|
  opts.banner = "Usage: app.rb [options]"

  opts.on("-v", "--verbose") do |v|
    options[:verbose] = true
  end
end.parse!
```

In Ruby

- `OptionParser`, part of the standard library
- Gives you:
  - Options, including short aliases
  - Automatic `-h` help output
  - Removes options from `ARGV`, so `ARGF` works as you expect
- No need to use a Gem!

Wrapping Up