Minimal Perl for UNIX & Linux People

Part I: For all UNIX & Linux Users

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11/13/06 Printing

Maximal Perl

Is the traditional view of Perl

Perl's famous motto:

- *There's More Than One Way to Do It!*

But nobody *really* needs

- **several different ways to express each common operation**

Minimal Perl
a carefully crafted dialect of Perl

POLICY:

- **there's no need for a UNIX user to learn *all* of Perl!**
  - at least, not initially

ALTERNATIVE:

- **concentrate on the UNIX-like features of Perl**
- **so you can learn quickly by capitalizing on your existing knowledge**

Target Audience for Part I
"UNIX/Linux People"

UNIX users

- **who have used `grep`**
  - to extract lines that match
- **maybe also `sed`**
  - to change text non-interactively
- **probably also `awk`**
  - maybe just for field processing

. . . but aren't necessarily *"Programmers"*

UNIX Shell Skills
help you learn Perl

Commands

- **have options and arguments**

Input is read from

- **filename arguments**
- **or STDIN -- pipe or keyboard**

Quoting

- **SQs disallow processing**
- **DQs allow some substitutions**

More UNIX Shell Skills
help you learn more Perl!

Many other elements same or similar

- **file tests**
  - `-r`, `-w`, etc.
- **here docs**
  - *something* `<<Eof`
- **logical operators**
  - `||`, `&&`

Even More UNIX Shell Skills
help you learn even more Perl!

Many other elements same or similar

- **filename generation**
  - `*.txt`, `[aeiou]*`
- **regular expressions**
  - `.*txt$`, `^[aeiou].*`
- **vi/sed-like commands**
  - `s/old/new/g`

Goals of this Talk

- **to teach you some Perl**
  - and that Perl is worth learning
- **to impress you with how much you can do with Perl**
  - while learning so little
- **to *inspire* you to learn more Perl later**

Dealing with Invocation Options

Common Obstacles
aka Stumbling Blocks

I'm confused about Perl's options; which ones should I use?

perhaps:

- `perl -wlne`

or maybe:

- `perl -wnl -e`

or how about:

- `perl -00 -Fwlnea`

Never fear, help is on the way!

Simplifying Perl Invocation Options
via aliases!

- **For commands that will only do output:**
  - alias `perl_o=' perl -wl'`
- **For input only, or input/output:**
  - alias `perl_io=' perl -wnl'`
- **For input/output with automatic printing:**
  - alias `perl_iop=' perl -wpl'`
- **For input only, or input/output, with fields:**
  - alias `perl_f=' perl -wnla'`

Simplifying Perl Invocation Options (cont.)
for Paragraph mode

- alias `Perl_io=' perl -00 -wnl'`
- alias `Perl_iop='perl -00 -wpl'`
- alias `Perl_f='  perl -00 -wnla'`

What Invocation Options Mean

`-wl:`	warnings, automatic carriage returns
`-wnl:`	adds input processing
`-wnla:`	adds field processing
`-00:`	enables "paragraph" mode
`-p:`	adds automatic printing
`-e:`	execute program in following argument

Okay, now forget those details; use the aliases!

Sample Output Program
performing a calculation

- **The `-e` argument introduces the program**
  - the aliases are incomplete without it
  - needs SQs around following program argument

UNIX command

```
$ expr 127 / 3
42
```

Perl alternative

```
$ perl_o -e 'print 127 / 3'
42.3333333333333
```

Sample Filter Program

Grepping for stuff

UNIX command

- `grep 'error'` *F1 ...*

Perl alternative

- `perl_io -e '/error/ and print;'` *F1 ...*

Perl as a (better) `grep` command

Capabilities of greppers vs. Perl

CAPABILITY	Classic greppers	POSIX greppers	Perl
Word boundary metacharacter	-	Y	Y
Compact character class shortcuts	-	?	Y
Control character representation	-	-	Y
Binary file matching	Y	Y	?
Line spanning matches	-	-	Y
Repetition ranges	Y	Y	Y
Metacharacter quoting	Y	Y	Y+
Advanced RE features	-	-	Y
Backreferences	Y	Y	Y+
Arbitrary record definitions	-	-	Y
Access to match components	-	-	Y
Match highlighting	-	Y	?
Custom output formatting	-	-	Y
Embedded commentary	-	-	Y
Directory file skipping	-	?	Y

Grep Shortcomings

- **can't match across lines** *(all greps)*
- **can't arbitrarily define records** *(all greps)*
- **can't show match in custom context, e.g., paragraph or page** *(all greps)***:**

```
    lines of paragraph above match
    line containing match
    lines of paragraph below match
```

- **no unambiguous way to represent control-characters** *(all greps)*
- **can't highlight matches** *(UNIX greps)*

Grep Shortcomings
(continued)

- **no later access to:** *(all greps)*
  - match itself (as opposed to its record)
  - individual components of match
  - pre- and post-match data
- **!! No *Standard Collection* of Metacharacters !!**
  - UNIX & GNU versions of `grep` & `egrep` are different

Surprise!

- **Perl corrects all these deficiencies**

Grep-like Perl Commands
how they work

```
perl_io -e '/RE/ and print;' F
```

`/RE/`: match regex against current line

`and`: makes print conditional on match

`print`: print current line (that contains match)

`F`: file to be examined for matches

Matching in Paragraph Mode
to see match context

Lines are matched by default:

```
$ perl_io -e '/Muddy/ and print ;' F
Muddy Waters (aka McKinley Morganfield)
```

Paragraphs matched using P* aliases

```
$ Perl_io -e '/Muddy/ and print ;' F
Muddy Waters (aka McKinley Morganfield)
was born in Rolling Fork, MS
```

NOTE: **grep** can't do this!

Displaying the Match Only

via "match" variable, `$&`

Problem: Want to see US postal codes only

Solution: Use "match" variable, `$&`

```
$ cat members
Jeff Healey M5T 1A1
Matthew Stull 98115

$ perl_io -e '/\d{5}$/ and
               print $&;' members
98115
$
```

NOTE: `\d` represents a digit; `{`*num*`}` specifies a quantity

Perl's String Escapes

STRING ESCAPE	NAME
\n	newline
\r	return
\t	tab
\f	form-feed
\e	escape
\NNN	octal value
\x*NN*	hex value
\c*X*	control character

Matching Using String Escapes

- **Can be hard to get a SQ into a SQ'd string:**

```
$ perl_io -e '/D'A/ and print;' data
>    # Shell is waiting for closing quote!
```

- **Effective, but difficult solution:**

```
$ perl_io -e '/D'"'"'A/ and print;' data
D'Addario & Company Inc.
```

- **Easier way:**

```
$ perl_io -e '/D\047A/ and print;' data
```

`\047`: "string escape" for apostrophe

Outlining Slashdot

a web-scraping application

- **Character #267 marks bullet items on some web-sites**
  - can be used to extract outline

```
$  lwp-request -o text slashdot.org |
>   perl_io -e '/\267/ and print;'
     · Microsoft Tracking Newsgroup Posters
     · SCO Prepares To Sue Linux End Users
     · Talk About A Security Hole, Go To Jail?
```

NOTE: **`grep`** lacks string escapes

The Matching Operator

format variations

Form	Meaning
/*RE*/	Match against $_
m:*RE*:	Match against $_
string =~ /*RE*/	Match against *string*
string =~ m:*RE*:	Match against *string*
string !~ m:*RE*:	Non-match against *string*
string !~ /*RE*/	Non-match against *string*

Advanced Matching
with line-spanning match

The following command

- **reads, and matches against, a paragraph at a time**
- **matches across lines within paragraphs**
  - using the "don't care" `.*` sequence
    - with `/s`, which allows `.` to match newline
- **captures (`(RE)`) and retrieves (`$1`) a portion of the match**

Advanced Matching (cont.)
with line-spanning match

```
$ ifconfig # Linux system
eth0  Link encap:Ethernet  HWaddr 00:D0:59:33:5F:60
      …
      UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
      …

lo    Link encap:Local Loopback
      …
      UP LOOPBACK RUNNING  MTU:16436  Metric:1
      …
$ ifconfig |
>   Perl_io '/^eth0 .*MTU:(\d+)/s and
         print "MTU for eth0 is: $1";'
MTU for eth0 is: 1500
```

NOTE: **grep** can't do line-spanning matches

Grep-like Perl commands

A Summary

grep command	Perl counterpart
grep '*RE*' file	perl -wnl -e '/*RE*/ and print;' file
grep -i '*RE*' file	perl -wnl -e '/*RE*/i and print;' file
grep -v '*RE*' file	perl -wnl -e '/*RE*/ or print;' file
grep -l '*RE*' file	perl -wnl -e '/*RE*/ and print $ARGV and close ARGV;' file
fgrep '*string*' file	perl -wnl -e '/\Q*string*\E/ and print;' file

Perl as a (better) `sed` command

The Sed Command
(not as famous as grep)

sed

- **main text processing command of early UNIX**
- **AWK replaced it in 1977 for most uses**
- **still used for text substitutions**

```
$ date | sed 's/Sat/Saturday/'
Saturday Apr 19 15:14:52 PDT 2003
$
```

Why Awk Replaced Sed

```
$ cat N   # : is field separator
Mr. Spongebob:Squarepants:SPONGE
Mr. Squidward:Tentacles:SQUID

$ awk -F':' '{ print $2 ", " $1 }' N
Squarepants, Mr. Spongebob
Tentacles, Mr. Squidward

$ sed 's/^\([^:][^:]*\):\([^:][^:]*\):.*$/\2, \1/' N
Squarepants, Mr. Spongebob
Tentacles, Mr. Squidward
```

IS THAT sed COMMAND A JOKE?

- No, we really used to process fields like that!

Sed Shortcomings

- **Deficiencies of UNIX sed**
  - can't match across lines
  - can't define custom records
  - match replacement not easily customizable
  - no string escapes to represent special characters
  - no "ignore-case" option *(UNIX* **sed***)*
  - can't modify original file *(UNIX* **sed***)*
    - *serious drawback for an editor!*

Perl as a Better Sed Command

Mass Editing: the Webmaster's Friend

- **Help! Our company's domain name just changed!**

```
$ cd HTML      # 5,362 files here!
$ perl_iop -i.bak -e '
>   s/\bacme.com\b/yakme.com/g;
>   ' *.html
$   # All done!
```

Perl as a Better Sed Command

How it Works

```
perl_iop -i.bak -e 's/old/new/g;' F
```

-i.*bak*: requests "in-place" editing

F.*bak*: stores copy of original file

Even More Better Perl Sed-er
Using Computed Replacements

- **eval**
  - is a Perl built-in function
  - compiles and executes Perl source code
- `s/RE/code/e`
  - `e` modifier on substitution operator
  - invokes Perl's `eval` facility
    - replaces RE with `code`'s *computed result*

Converting Miles to Kilometers
Using Perl's "eval" in a Substitution

```
$ cat drive_dist
            Van        Win        Tor
Vancouver   0          1380       2790
Winnipeg    1380       0          1300
Toronto     2790       1300       0

$ next_page_command drive_dist
            Van        Win        Tor
Vancouver   0          2208       4464
Winnipeg    2208       0          2080
Toronto     4464       2080       0
$
```

Converting Miles to Kilometers (cont.)

Using Perl's "eval" in a Substitution

- **can replace numeric values by ones 8/5ths greater**
  - using calculation on `$&`, which contains what was matched
- **can use `|` as alternate delimiter for `/`**

```
perl_iop -e 's|\d+| $& * (8/5) |ge;'
```

How does it Work?

```
perl_iop -e 's|\d+| $& * (8/5) |ge;' F
```

`s|`*`RE`*`|`*`X`*`|ge:` replace each match by result of ***X***

`\d+:` matches one or more digits

`$&:` contents of last match

Perl as a (better) `AWK` command

The Awk Command

The "Swiss Army Knife" of UNIX

AWK

- **combines** *Pattern Matching* **with** *Conditional Execution*
- **is designed for** *Data Validation*, *File Conversion*, *Report Generation*
- **automatically splits input into fields**
- **most common use:**
  - *field processing*

The Awk Command
Deficiencies

Deficiencies of AWK

- **few, given brilliance of its design; main ones are:**
  - no way to specify a range of fields
  - variable substitution doesn't occur within quotes

Awk vs. Perl
how they match up

Perl Advantages:

- **Perl has nearly all of AWK's capabilities**
- **Plus a whole lot more**

Perl Disadvantage:

- **Perl solutions are *never* as compact as their AWK counterparts**

Perl as AWK

Problem

Print first two fields in reverse order

AWK Solution

```
awk '{ print $2, $1 }' F
```

Perl Solution

```
perl_f -e '($A,$B)=@F;  # load fields
     print "$B  $A"' F
```

`@F`: field container, used by `-a`

`($A,$B)=@F`: copies field 1 into `$A`, 2 into `$B`

Perl as AWK
continued

- **Print first field if second matches pattern**
  - TAB character (\t) is field separator

```
perl_f -F'\t' -e '($A,$B)=@F;
      $B =~ /\b98107\b/  and
           print $A;' file
```

Input

```
Torbin Ulrich--->98107
Yeshe Sherpa---->98117
```

Output

```
Torbin Ulrich
```

Perl as (a better) Awk

Extracting Fields

- **Simple Perl field extractor**
  - by default, field separators are SPs and TABs
  - can list field numbers within [ ] in desired order
    - first field in `@F` array is #0
  - ascending range 1-3 specified as 1..3, etc.

Examples

```
perl_f -e 'print "@F[4,1..3]";' F
```

Extracting Fields: Example

```
$ cat staff
NAME PHONE DEP
Joel x3210 715
Jane x2046 229
 0    1    2       <= Field Numbers
$ perl_f -e 'print "@F[2,0,1]";' staff
DEP NAME PHONE
715 Joel x3210
229 Jane x2046
$
```

Perl as (a better) Awk
File Editing Applications

Unlike AWK,

- **Perl can do in-place editing on input file**
  - using `-i.bak` option

Examples

```
perl_f -i.bak -e 'print "@F[4,1..3]";' F
```

NOTE: `@F[4,1..3]`) is a shortcut for `@F[4,1,2,3]`;

AWK has no such shortcut

Perl has String Interpolation

AWK lacks it

AWK line-numbering program:

```
awk      '{ print NR  ": "  $0 }' file
```

Perl counterpart written AWKishly:

```
perl_io '  print $., ": ", $_; ' file
```

Perl counterpart written Perlishly:

```
perl_io '  print "$.: $_"; '     file
```

NOTE: The double-quoted string acts as a "template" for the output, making it easier to visualize

Perl has Pattern Ranges

Format:

```
/RE1/ ... /RE2/ and print;
```

Result:

- **Prints records between first that matches *RE1* and next that matches *RE2***

Example:

```
$ perl_io -e  '/^Oops:/ ... /^Code:/
>                and print;' messages
```

NOTE: *For simplicity, the timestamp-prefix has been removed from each line in* `messages`

Perl has Pattern Ranges (cont.)
like AWK

Match for `/^Oops:/ ... /^Code:/`

```
Oops: 0001
CPU:    0
EIP:    0010:[__remove_inode_page+79/144]
...
Process kswapd (pid: 4, stackpage=c9f31000)
...
Call Trace:    [shrink_cache+656/896] ? ...
...
Code: 89 50 24 89 02 c7 43 24 00 00 00 ...
```

NOTE: *An "Oops" message documents a problem with the Linux kernel.*

Perl as a (better) `find` command

`find | xargs` *`cmd`*

- **fiendishly clever technique for**
  - converting `find`'s output into `cmd`'s arguments
  - works around argument-size limitations
  - minimizes invocations of `cmd`

`find | xargs` *cmd* example

Problem:

- **Find most recently modified regular file**
  - latest payment, newest subscriber, etc.

Solution:

```
 find . -type f  | # collect filenames
   xargs ls -lrt | # sort by mod-time
    tail -1        # show newest
-rw-r--r-- ...  2006-11-09 12:22 ./rygel.xvi
```

Cool!

- *Or maybe not ...*

`find | xargs` limitations

With this command:

```
find | xargs sorting-command | tail -1
```

- **no guarantee that all files will be sorted by a** *single invocation* **of** *sorting-command*
- **result will be the most recent file from the** *last batch processed*!

Perl as a (better) `find`/`xargs` Command
the solution

```
#! /usr/bin/perl -wnl
# most_recent_file

BEGIN { $newest=0; }

$mtime=(stat $_)[9]; # get file's mod-time

if (defined $mtime and $mtime > $newest) {
    $newest=$mtime; # save time
    $name=$_;       # save name
}

END { print $name; }  # report results
```

Perl as a (better) **`find`**/**`xargs`** Command *example*

```
$ find . -type f | most_recent_file
-rw-r--r-- ...  2006-11-09 12:22 ./scorpius
```

- **Not only *cool*, but this time it's *correct*!**

SUMMARY
Part I

With a prior understanding of UNIX

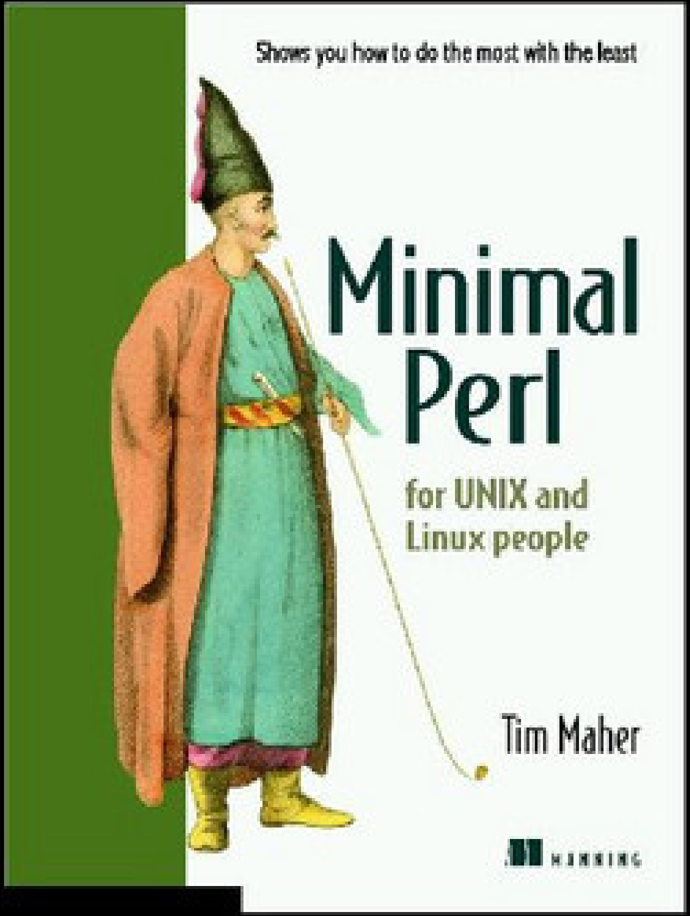
- **and knowledge of a few basic Perl techniques**
- **you can write simple Perl commands that are superior to their UNIX/Linux equivalents**

In Part II,

- **we'll show Shell Programmers how to write powerful Perl scripts**

CONCLUSION
and Shameless Plug

- I hope you enjoyed the presentation!
- To learn more along these lines,
  - check out my book!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