An Introduction To Writing Tcl Scripts

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Language Overview

Two parts to learning Tcl:

1. **Syntax and substitution rules:**

   Substitutions simple but may be confusing at first.

2. **Built-in commands:**

   Can learn individually as needed.

   Control structures are commands, not syntax.

Basics

Tcl script =

- Sequence of commands.
- Commands separated by newlines, semi-colons.

Tcl command =

- One or more words separated by spaces.
- First word is command name, others are arguments.

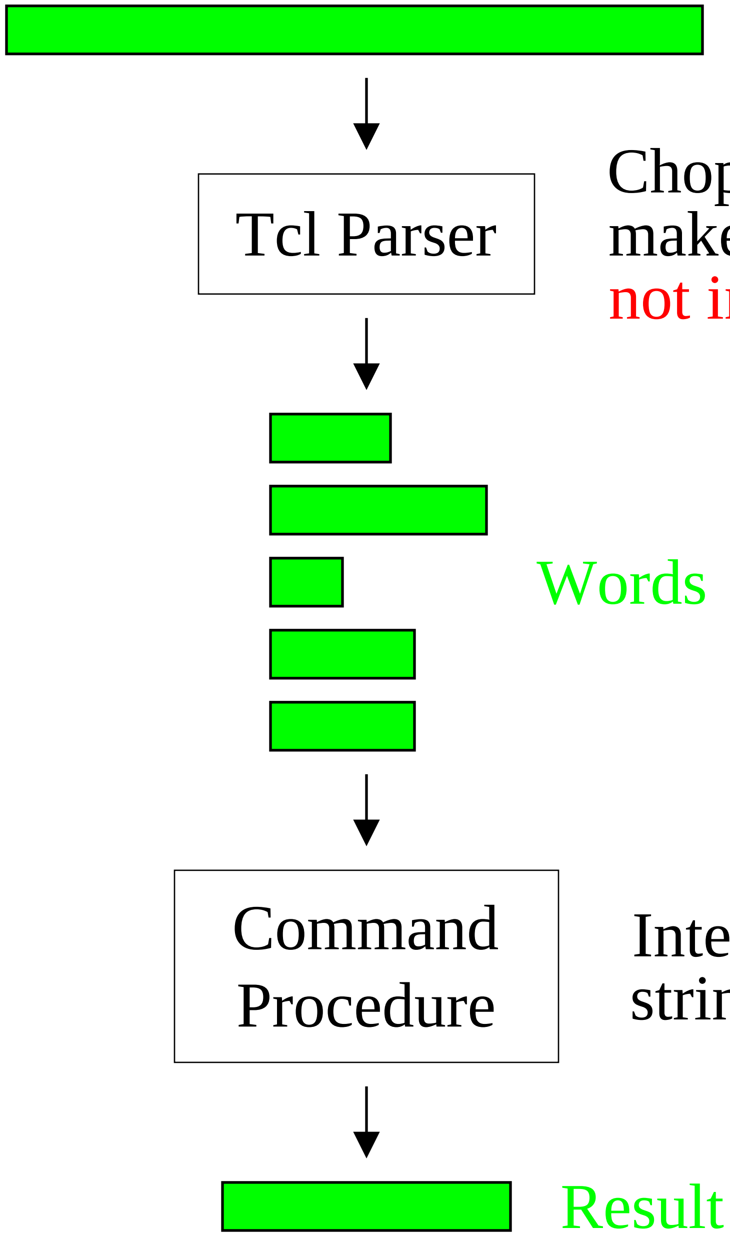
Examples:

```
set a 22; set b 33
```

```
set a 22
set b 33
```

Division of Responsibility

Command



Chops command into words, makes substitutions. Does not interpret values of words.

Interprets words, produces string result.

Arguments

Parser assigns no meaning to arguments (quoting by default, evaluation is special):

C: `x = 4; y = x+10;`

y is 14

Tcl: `set x 4; set y x+10`

y is ‘‘x+10’’

Different commands assign different meanings to their arguments:

```
set a 122
expr 24/3.2
eval "set a 122"
button .b -text Hello -fg red
string length Abracadabra
```

Variable Substitution

- Syntax: **$***varName*
- Variable name is letters, digits, underscores.
- May occur anywhere within a word.

Sample command	**Result**
`set b 66`	`66`
`set a b`	`b`
`set a $b`	`66`
`set a $b+$b+$b`	`66+66+66`
`set a $b.3`	`66.3`
`set a $b4`	*no such variable*

Command Substitution

- Syntax: **[***script***]**
- Execute script, substitute result.
- May occur anywhere within a word.

Sample Command	**Result**
`set b 8`	`8`
`set a [expr $b+2]`	`10`
`set a "b-3 is [expr $b-3]"`	`b-3 is 5`

Controlling Word Structure

Words break at white space and semi-colons, except:

- Double-quotes prevent breaks:

```
set a "Funny word; has spaces"
```

- Curly braces prevent breaks and substitutions:

```
set a {nested {} braces}
```

- Backslashes quote special characters:

```
set a word\ with\ \$\ and\ space
```

Substitutions don’t change word structure:

```
set a "two words"
set b $a
```

Expressions

- C-like (int and double), extra support for string operations.
- Support for command and variable substitution within expressions.
- Used in **`expr`**, other commands.

Sample command	Result
`set b 5`	`5`
`expr ($b*4)-3`	`17`
`expr $b<=2`	`0`
`expr {$b * [fac 4]}`	`120`
`set a Bill`	`Bill`
`expr {$a < "Anne"}`	`0`

Lists

- Zero or more elements separated by white space:

```
red green blue
```

- Braces and backslashes for grouping:

```
a b {c d e} f
one\ word two three
```

- List-related commands:

```
concat     linsert    lreplace
foreach    list       lsearch
lappend    llength    lsort
lindex     lrange
```

- Example:

```
lindex {a b {c d e} f} 2
c d e
```

Control Structures

- C-like appearance.
- No new syntax: just commands that take Tcl scripts as arguments.
- Example:

```
if {$x < 3} {
   puts stdout "x is too small!"
   set x 3
}
```

- Commands:

```
if             case
for            break
foreach        continue
while          eval
```

Procedures

- **`proc`** command defines procedure:

```
proc sub1 x {expr $x-1}
```

name

list of argument names

body

- Procedures behave just like built-in commands:

```
sub1 3
```
returns `2`

- Arguments can have defaults:

```
proc decr {x {y 1}} {expr $x-$y}
```

- Can have variable number of arguments:

```
proc foo {a b args} { ... }
```

gets list of extra args

- Scoping: local and global variables.

Errors

- Errors normally abort commands in progress, application displays message:

```
set n 0
foreach i {1 2 3 4 5} {
   set n [expr {$n + i*i}]
}
syntax error in expression "$n + i*i"
```

- Global variable **`errorInfo`** provides stack trace:

```
set errorInfo
syntax error in expression "$n + i*i"
    while executing
"expr {$n + i*i}"
    invoked from within
"set n [expr {$n + i*i}]..."
    ("foreach" body line 2)
    invoked from within
"foreach i {1 2 3 4 5} {
    set n [expr {$n + i*i}]
}"
```

Advanced Error Handling

- Can catch errors:

```
catch {expr {2 +}} msg
1
set msg
syntax error in expression "2 +"
```

- Can generate errors:

```
error "bad argument"
```

- Global variable **`errorCode`** holds machine-readable information about errors (e.g. UNIX **`errno`** value).

Additional Tcl Features

1. String manipulation commands:

```
string    format    split
regexp    scan      join
```

2. File I/O commands:

```
open      seek      file
close     tell      glob
gets      flush     cd
read      eof       pwd
puts      source
```

3. Subprocesses with `exec` command:

```
exec grep foo << $input | wc
```

4. History (`history` command).

Additional Tcl Features, cont'd

5. Associative arrays:

```
set x(fred)44
set x(2) [expr $x(fred)+6]
array names x
fred 2
```

6. Variable scoping:

```
global      uplevel     upvar
```

7. Autoloading:

- Tcl procedures loaded on demand.
- Search path of directories.

8. Access to Tcl internals:

```
info        rename      trace
```

Tcl Syntax Summary

1. Script = commands separated by newlines, semi-colons.

2. Command = words separated by white space.

3. **$** causes variable substitution.

4. **[ ]** causes command substitution.

5. **""** quotes white space and semi-colons.

6. **{}** quotes all special characters.

7. **** quotes next character, provides C-like substitutions.

8. **#** for comments (must be at beginning of command).