Introduction to Tcl/Tk

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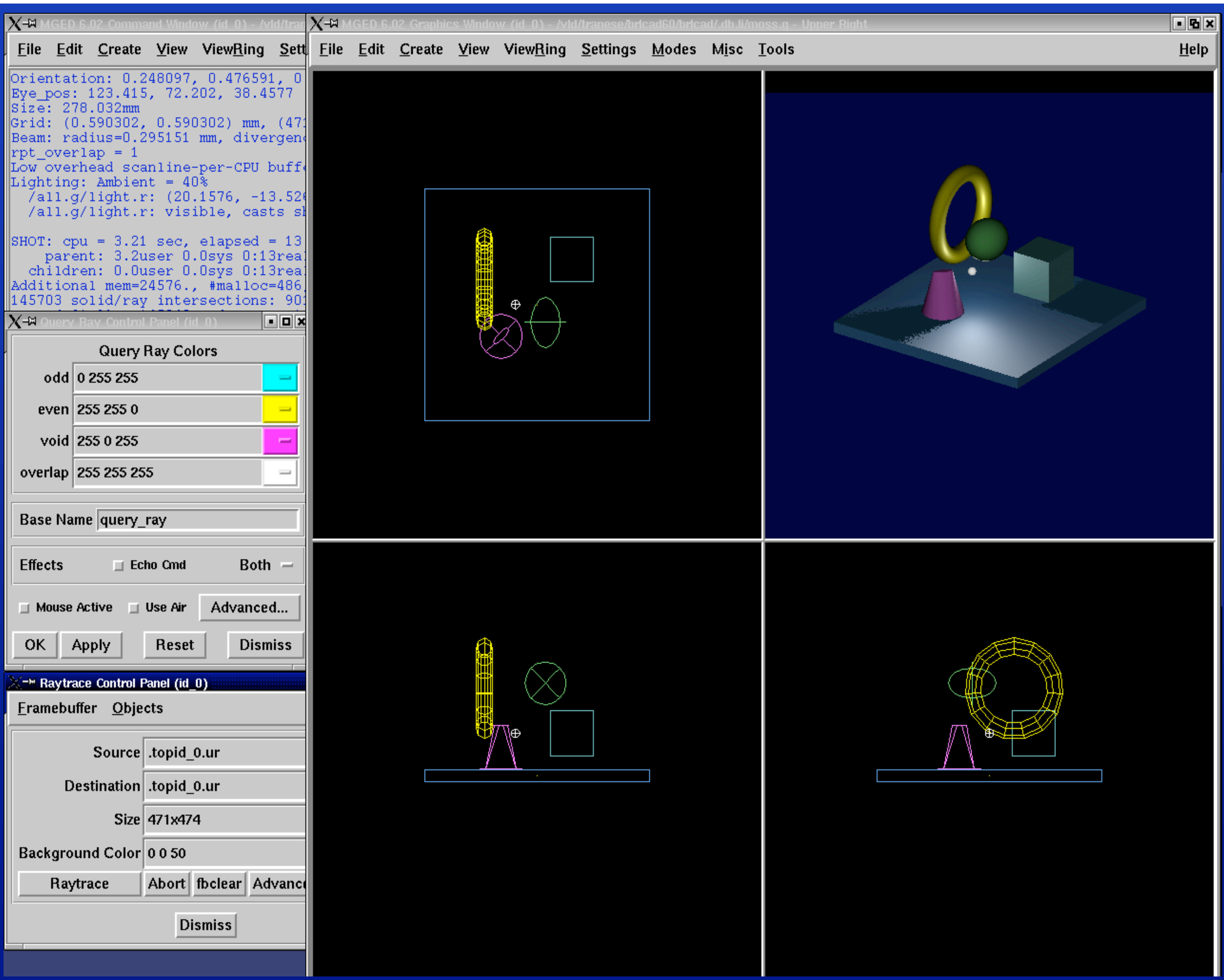
What is Tcl/Tk?

- Tool **C**ommand **L**anguage/Tool**K**it.
- Tcl is an embeddable and extensible interpreted language.
- Tk is a toolkit for building user interfaces.
- Combined, they provide a programming system for development and use of GUI applications.

Benefits of Tcl/Tk

- Rapid development
- Ease of providing applications with a powerful scripting language
- An excellent “glue language”
- User convenience
- Portability

Tcl/Tk-Based GUI for MGED


MGED 6.02 Command Window (id_0) - /vld/tra
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MGED 6.02 Graphics Window (id_0) - /vld/tranese/brlcad60/brlcad/.db.li/moss.g - Upper Right
File Edit Create View ViewRing Settings Modes Misc Tools Help
Query Ray Control Panel (id_0)
Effects
Echo Cmd
Both
Mouse Active
Use Air
Advanced...
OK
Apply
Reset
Dismiss
Raytrace Control Panel (id_0)
Framebuffer
Objects
Raytrace
Abort
fbclear
Advanc
Dismiss

```
Orientation: 0.248097, 0.476591, 0
Eye_pos: 123.415, 72.202, 38.4577
Size: 278.032mm
Grid: (0.590302, 0.590302) mm, (47
Beam: radius=0.295151 mm, divergen
rpt_overlap = 1
Low overhead scanline-per-CPU buff
Lighting: Ambient = 40%
  /all.g/light.r: (20.1576, -13.52
  /all.g/light.r: visible, casts s

SHOT: cpu = 3.21 sec, elapsed = 13
    parent: 3.2user 0.0sys 0:13rea
  children: 0.0user 0.0sys 0:13rea
Additional mem=24576., #malloc=486
145703 solid/ray intersections: 90
```

Query Ray Colors

odd	0 255 255
even	255 255 0
void	255 0 255
overlap	255 255 255

Base Name: query_ray

Source	.topid_0.ur
Destination	.topid_0.ur
Size	471x474
Background Color	0 0 50

Tcl Syntax

- A command is a list of words.
- First word on the command line is the command name, any additional words are arguments.
  - *command* [*arg1 … argn*]

```
mged> puts “Hello World”
Hello World
```

- Words can be grouped with double quotes (“ ”) or curly braces ({}).
- Commands are terminated with a newline or semicolon.

Variables

- Variable names are case-sensitive.
- Declarations are not necessary.
- **set** *varName* [*value*]
  - Assigns *value* to the variable *varName*.

```
mged> set day Friday
Friday
mged> set day
Friday
mged> set day 25
25
```

Lists

- An ordered set of strings
- Specified with curly braces

```
mged> set colors {red yellow green blue}
red yellow green blue
```

- Sometimes created with “list” command

```
mged> set colors [list red yellow green blue]
red yellow green blue
```

- Can extract elements from the list using the “lindex” command

```
mged> lindex {red yellow green blue} 2
blue
```

Arrays

- Uses associative arrays
  - Strings used to index the array elements

```
mged> set profit(January) 1500
1500
mged> set profit(February) -200
-200
mged> set profit(January)
1500
```

Special Characters

- Dollar sign $
  - Substitutes the value of the variable
- Square brackets [ ]
  - Replaces contents with the result of evaluating the command
- Backslash \
  - Allows special characters such as newlines, [, and $ to be inserted without being treated specially
- Double quotes “ ”
  - Allows special characters to be processed normally
- Curly braces {}
  - Disables special characters
- Parentheses ()
  - Delimits key values in arrays
- Hashmark #
  - At the beginning of a line, signifies a comment to follow

Special Character Examples

```
mged> set name Elvis
Elvis
mged> puts “Hello name”
Hello name
mged> puts “Hello $name”
Hello Elvis
mged> set len [string length $name]
5
```

- string length $name returns 5
- len gets the value 5

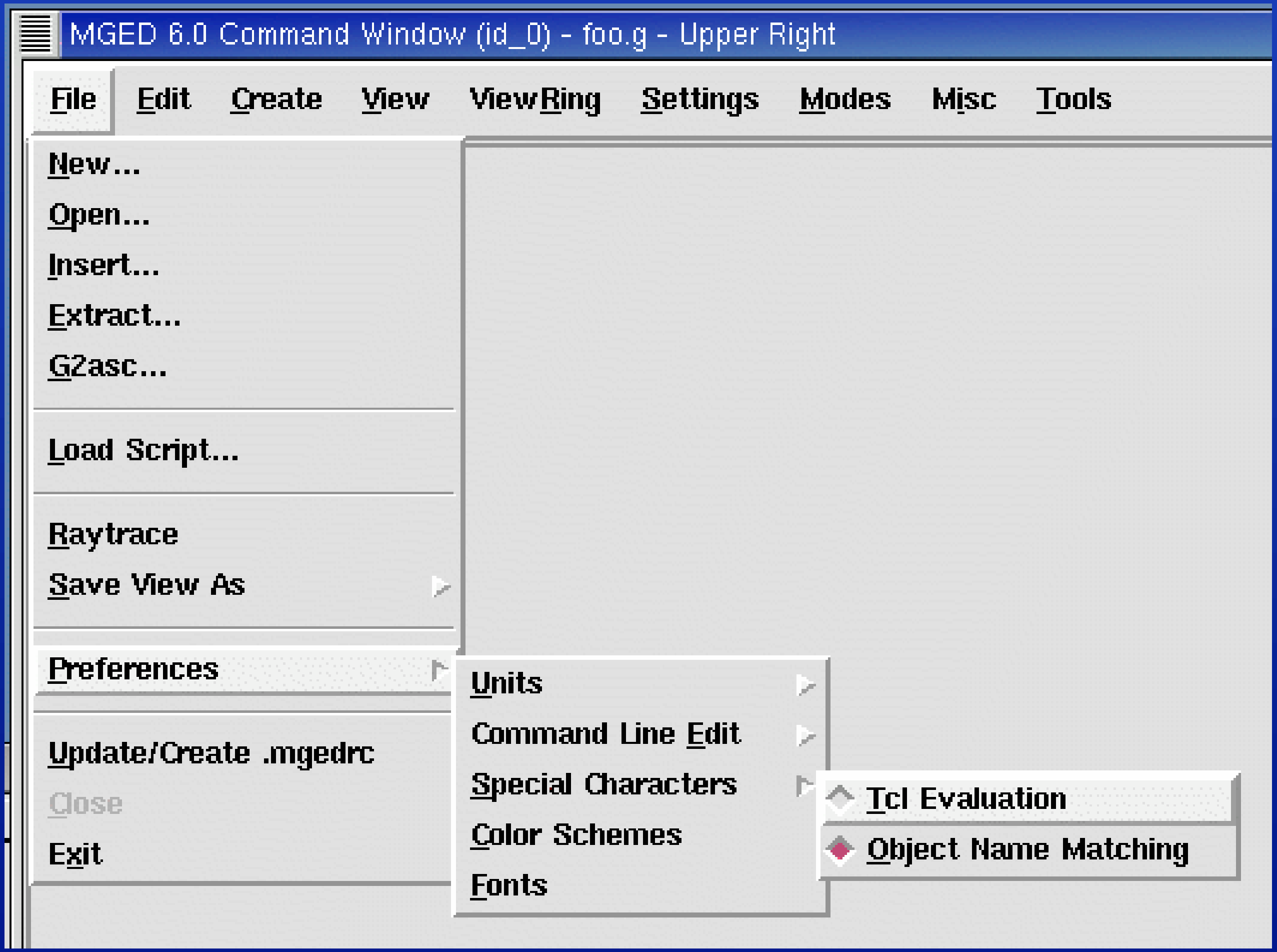
Special Character Examples (cont'd)

```
mged> set price 1.41
1.41
mged> puts "Gasoline: \$ $price/gallon"
Gasoline: $1.41/gallon
mged> puts {Gasoline: \$ $price/gallon}
Gasoline: \$ $price/gallon
mged> set product 1; #This is a comment
1
```

Special Character Conflicts

- MGED traditional “name globbing” characters conflict with Tcl/Tk usage:
  - MGED follows Unix shell filename patterns.
  - Tcl/Tk has different interpretation of * and [].
- Users can select which interpretation of special characters:
  - .mgedrc: set MGED variable glob_compat_mode
    - set glob_compat_mode 0 (for Tcl evaluation)
    - set glob_compat_mode 1 (for object name matching)
  - Menu: File->Preferences->Special Characters

Special Character Interpretation



Expressions

- The **expr** command is used to evaluate math expressions.

```
mged> expr 2 + 2
4
mged> expr (3 + 2) * 4
20
mged> in ball.s sph 0 0 0 [expr 3 + 4]
```

  - A sphere is created with a vertex (0,0,0) and a radius of 7.

Control Flow

- **if** {*test*} {*body1*} [**else** {*body2*}]

```
mged> set temp 90
90
mged> if {$temp > 75} {
              puts “It’s hot”
          } else {
              puts “It’s moderate”
          }
It’s hot
```

Control Flow (cont'd)

- **while** {*test*} {*body*}

```
mged> set time 3
3
mged> while {$time > 0} {
              puts "Time is $time"
              set time [expr $time - 1]
          }
Time is 3
Time is 2
Time is 1
```

Control Flow (cont'd)

- **for** {*init*} {*test*} {*reinit*} {*body*}

```
mged> for {set time 3} {$time > 0} {set time [expr $time - 1]} {
            puts "Time is $time"
      }
Time is 3
Time is 2
Time is 1
```

Control Flow (cont'd)

- **foreach** *varList list* {*body*}

```
mged> foreach fruit {apples pears peaches} {
                puts "I like $fruit"
        }
I like apples
I like pears
I like peaches

mged> foreach {key val} {sky blue grass green snow white} {
                puts "The $key is $val"
        }
The sky is blue
The grass is green
The snow is white
```

MGED Commands

- **get** *obj* [*attr*]
  - Returns a list of the object's attributes. If *attr* is specified, only the value for that attribute is returned.

```
mged> get foo.r
comb region yes id 200 los 100 GIFTmater 2 rgb {100 100 100}
mged> get foo.r rgb
100 100 100
mged> get foo.s
ell V {0 0 0} A {4 0 0} B {0 4 0} C {0 0 4}
```

MGED Commands (cont’d)

- **adjust** *obj attr value* [*attr value*]
  - Modifies the object’s attribute(s) by adjusting the value of the attribute(s) to the new value(s).
- **ls** [-*c* -*r* -*s*]
  - Without any options, lists every object in the database.
  - With the *c* option, lists all nonhidden combinations; *r* option lists all nonhidden regions; and *s* option lists all nonhidden primitives.

MGED Examples

- Task: Change the color of all regions to blue.

```
mged> foreach region [ls -r] {
        adjust $region rgb {0 0 255}
    }
```

- Task: Print all regions with nonzero air codes.

```
mged> foreach reg [ls -r] {
        if {[get $reg air] != 0} {
            puts "$reg"
        }
    }
```

MGED Examples (cont’d)

- Task: Print all objects with the inherit flag set.

```
mged> foreach obj [ls -c] {
              if {[get $obj inherit] == “yes”} {
                        puts “$obj”
              }
          }
```

Procedures

- User-defined commands
- **proc** *procName* {*args*} {*body*}

```
mged> proc add {x y} {
                set answer [expr $x + $y]
                return $answer
        }
mged> add 123 456
579
```

- Create new MGED commands
- Save in .mgedrc

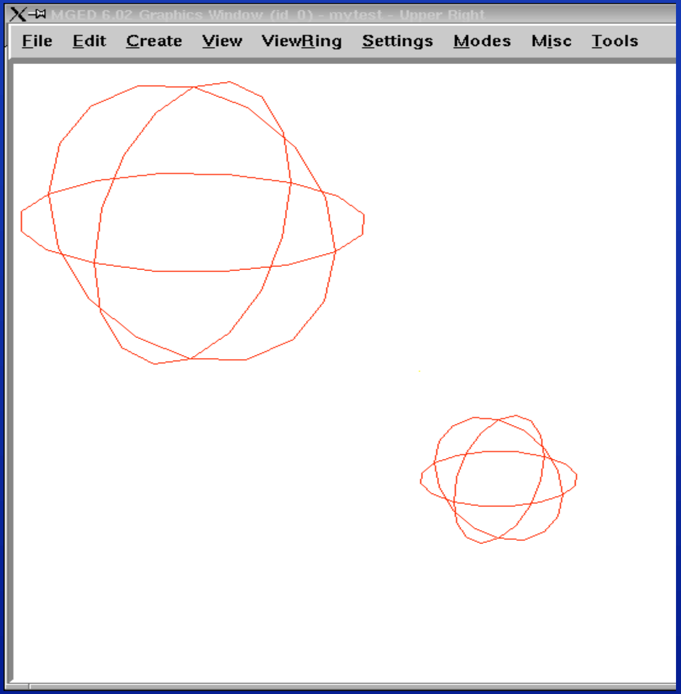
Procedure Example

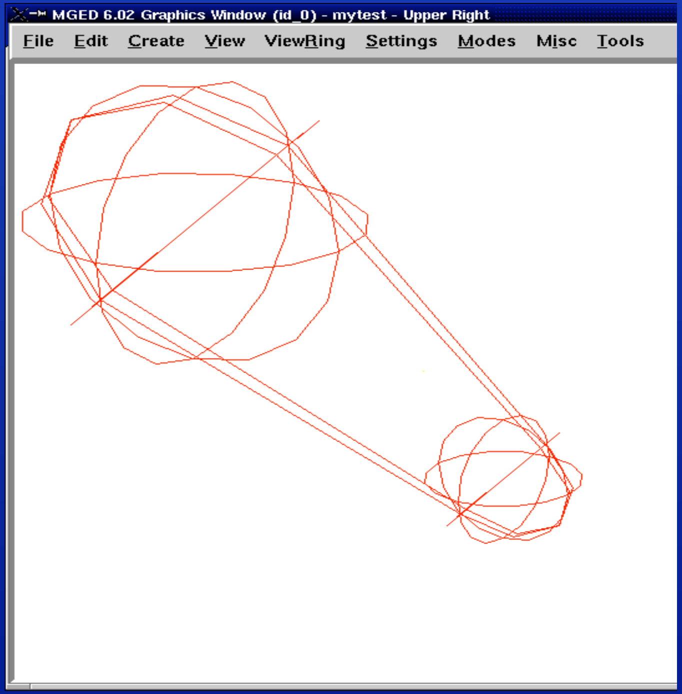
- Procedure that generates a PART that encompasses two specified SPHs

```
proc sph-part {sph1 sph2 newname} {
    foreach {vx1 vy1 vz1} [lindex [get $sph1 V] 0] {}
    foreach {vx2 vy2 vz2} [lindex [get $sph2 V] 0] {}
    foreach {ax1 ay1 az1} [lindex [get $sph1 A] 0] {}
    foreach {ax2 ay2 az2} [lindex [get $sph2 A] 0] {}

    set radius1 [expr sqrt($ax1*$ax1 + $ay1*$ay1 + $az1*$az1)]
    set radius2 [expr sqrt($ax2*$ax2 + $ay2*$ay2 + $az2*$az2)]
    set hx [expr $vx2-$vx1]
    set hy [expr $vy2-$vy1]
    set hz [expr $vz2-$vz1]

    in $newname part $vx1 $vy1 $vz1 $hx $hy $hz $radius1 $radius2
}
```

Procedure Example (cont'd)

```
mged> sph-part s1.s s2.s part.s
```


MGED 6.02 Graphics Window (id_0) - mytest - Upper Right
File Edit Create View ViewRing Settings Modes Misc Tools

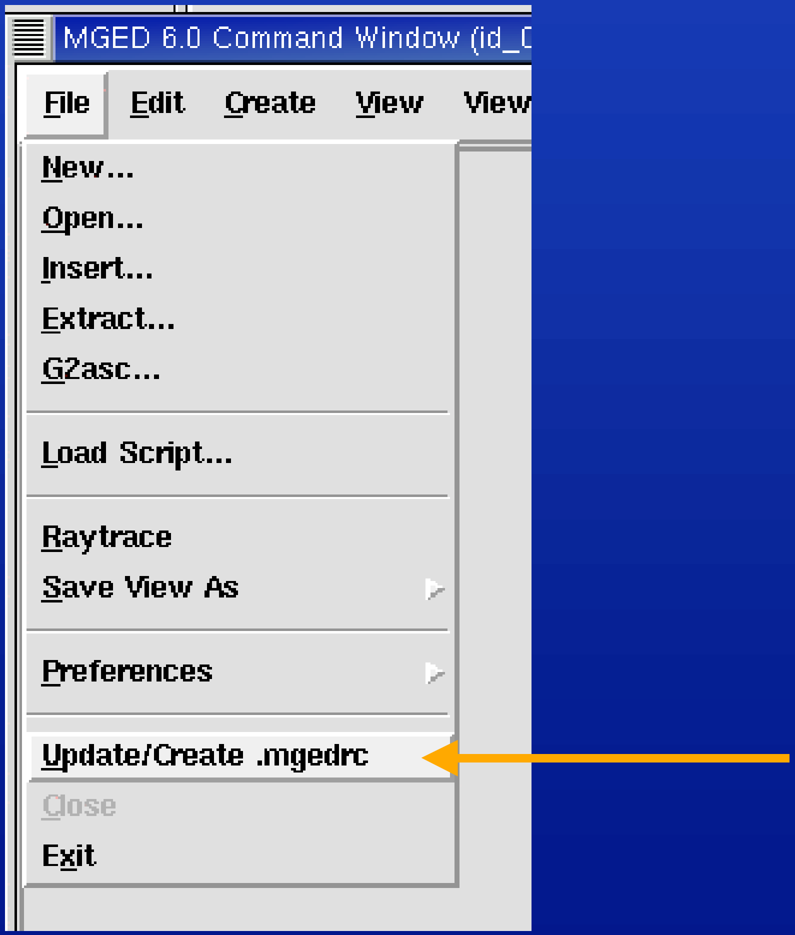

MGED 6.02 Graphics Window (id_0) - mytest - Upper Right
File Edit Create View ViewRing Settings Modes Misc Tools

The “source” Command

- **source** *fileName*
  - Reads and executes the file as a Tcl script.
- Create the file with a text editor.
- Reload the file with “source” if changes are made.
- The proc or the source command can be placed in .mgedrc.

MGED Defaults

- Create the default .mgedrc from inside MGED:



MGED Customization

- Placed in the file **.mgedrc**
  - In local directory or home

```
################## MGEDRC_HEADER ##################
# You can modify the values below. However, if you want
# to add new lines, add them above the MGEDRC_HEADER.
# Note - it's not a good idea to set the same variables
# above the MGEDRC_HEADER that are set below (i.e. the last
# value set wins).
...
# Determines the maximum number of lines of
# output displayed in the command window
set mged_default(max_text_lines) 1000
```

[incr Tcl/Tk]

- Object-oriented extension to Tcl.
- Provides support to build large programs.
- New applications in BRL-CAD are being written in [incr Tcl/Tk].

Useful References

- Raines, Paul. *Tcl/Tk Pocket Reference*. O'Reilly & Associates, Inc., Sebastopol, CA, 1998.
- Ousterhout, John K. *Tcl and the Tk Toolkit*. Addison -Wesley, Reading, MA, 1994.
- Welch, Brent B. *Practical Programming in Tcl and Tk Second Edition*. Prentice Hall, Upper Saddle River, NJ, 1997.

End of Intro to Tcl/Tk