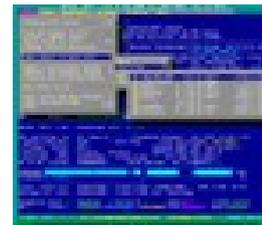


TxWin enhanced scripting

Jan van Wijk

TX enhanced scripting language
(as available in DFSee 9.03 and up)

FSYS - *software*



TxWin

Presentation contents

- DFSee scripting history, design goals and alternatives
- High level layout of TxScript programs
- Script parameters and variables
- Expressions, available operators
- Built-in functions
- Control structures, program flow
- Expression substitution in commands
- Example scripts fragments, from DFSee usage

Who am I ?

Jan van Wijk

- Software Engineer, C, Rexx, Assembly, PHP
- Founded FSYS Software in 2001, developing and supporting DFSee from version 4 to 12.x
- First OS/2 experience in 1987, developing parts of OS/2 1.0 EE (Query Manager, later DB2)
- Used to be a systems-integration architect at a large bank, 500 servers and 7500 workstations
- Developing embedded software for machine control and appliances from 2008 onwards

Home page: <http://www.dfsee.com>

Dfsee scripting history

- Over time, to automate repeating and more complex tasks, several scripting methods have been (and still are!) used with DFSee:
 - BAT/CMD/SHELL scripts, calling DFSee
 - Rexx subcmd environment for OS/2 version
 - Native scripting, being a simple list of DFSee commands, executed sequentially, with simple error handling and parameter substitution

TxScript design goals

- Backwards compatible with existing .DFS scripts as far as possible, allowing re-use
- Direct access to much DFSee internal info, including disk sectors from a script
- Powerful expressions, variables and functions
Can be used from and in the DFSee commandline too
- Conditional and looping control to allow more intelligent and powerful scripts

Note: For 'DFSee' you can read any hosting program that uses the TxScript engine from the TxLib library

Do we need another language ?

- Trying to avoid re-inventing yet another wheel, some alternatives have been considered:
 - Rexx, as used in OS/2 version already
 - Python, clean OO type language
 - Perl, very powerful, hackers heaven :-)
 - PHP, Ruby etc as used in WEB environments
- All had problems with integration in the hosting program (DFSee), availability on all required platforms, or added complexity for install etc.
- Developing a new language is fun, so YES :-)

High level layout of TxScript

- LINE-oriented, but ignores whitespace usage within and between lines. Each line is either:
 - A comment line (ignored mostly :-)
 - An interpreter 'pragma' altering its behaviour
 - Program flow statements like IF or WHILE
 - An assignment to one or more script variables
 - A command to be passed to the host (DFSee) to be executed, including substitution of expressions

Example for script layout

```
;script example
```

```
;;defaultparam 1 5
```

```
IF $1 < $_parts
```

```
    Say $1 is OK!
```

```
ENDIF
```

- A comment line
- A pragma
- Control statement with an expression
- A command to be executed by DFSee
- End of the Control statement

Script parameters and variables

- Parameters to the script are positional, and named \$1 through \$9, \$0 is the scriptname
- Variables follow the 'Perl' syntax where possible, with a subset of the functionality
 - \$variable a scalar variable
 - \$array[index] scalar taken from an array
 - %array whole array
 - \$hash{key} scalar taken from a hash
 - #hash whole hash variable

System variables

- Variablenames starting with '\$_' are system variables (DFSee) and are read-only
 - They come as scalar and scalar-from-array variants
- Some examples (there are dozens :-)
 - `$_parts` total number of partitions, 1..n
 - `$_disk` current opened disk number
 - `$_this` sector number for current sector
 - `$_d_size[X]` size in sectors for disk nr X
 - `$_p_fsform[Y]` FS-format for partition nr Y
 - `$_b_sector[Z]` Contents of sector nr Z, in a (512 byte) binary string

Expression and variable values

- Variable and expression values are either:
 - A character string of arbitrary length, may contain any value from 0..255, allowing binary data manipulation
 - A 64-bit signed integer value, allowing huge numbers while maintaining the exact integer value
- Expression operators and built-in functions automatically convert between these
 - Other types like floating-point may be added later

Expressions, operators, functions

- Expression syntax and semantics are pretty close to those defined in 'Perl' and 'C' but are not exactly identical
- Operators work on 1, 2 or 3 operands:
 - Unary, like + - ! NOT 1 operand
 - Binary, like + * < = 2 operands
 - Ternary, (cond) ? exp1 : exp2 3 operands
- Textual operators like 'AND' must be uppercase!
- Functions take zero or more arguments and return a value (in an expression)

Operator precedence, high to low

\$name[]++ --

Atom, Term

- + ! ~

* / %

+ -

x

.

<< >>

== != < > <= >=

=== !==

EQ NE LT GT LE GE

- Variable, indexed and auto incr/decr
- String, number, function nested-expr or ternary
- Unary operators
- Binary multiply/division
- Binary plus/minus
- String replication
- String concatenation
- Numeric bit-shift
- Numeric compare
- Same value AND type
- String compare

Operator precedence, part 2

&

^

|

- Bitwise AND
- Bitwise XOR
- Bitwise OR

&&

||

- Logical AND (C-style)
- Logical OR (C-style)

=

,

- Assignment
- Comma, multi-expression

NOT

AND

OR

- Logical NOT (Perl style)
- Logical AND (Perl style)
- Logical OR (Perl style)

Built-in functions, A-F

abs
b32
b2asc
b2int
chr
canceled
confirmed
defined
drivefs
drivelabel
drives
drivespace
exists
filext
fnbase

- Absolute value, numeric
- Clip to 32-bit unsigned
- Binary string to ASCII
- Binary string to reversed int
- ASCII value for number
- Test for canceled last operation
- Confirmation Yes/No/Cancel
- Is variable defined
- FS-name for drive letter
- Label string for drive letter
- All drive letters in string
- Freespace in KiB for drive
- File exists
- Set default file extension
- Extract filename without ext

Built-in functions, G-M

fnfile
fnpath
getcwd
h2asc
h2int
i2dec
i2hex
index
lc
left
length
mkdir
max
min
message

- Extract filename without path
- Extract path only, no filename
- Get current working directory
- Get string from hex-ascii str
- Get integer from hex-ascii str
- Convert int to decimal str
- Convert int to hexadecimal str
- Find substring in string
- Return lowercased string
- Left adjust string, pad/clip
- Get length of string
- Create full directory path
- Ret maximum of values
- Ret minimum of values
- Message popup, until [OK]

Built-in functions, O-Z

ord
prompt
replace
sec2gib
sec2kib
sec2mib
reverse
right
rindex
strip

substr
uc
undef

- Numeric value 1st char in str
- Popup question, return string
- Replace characters in string
- Get GiB value for #sectors
- Get KiB value for #sectors
- Get MiB value for #sectors
- Reverse characters in string
- Right adjust string pad/clip
- Reverse find substring in str
- Strip leading/trailing chars from a string (default spaces)
- Extract substring from string
- Return uppercased string
- Undefine (free) a variable releasing any used storage

Control structures, branching

IF (condition)

statement-list

- Like the Perl IF, not using a {} block but an ENDIF keyword

ELSEIF (condition)

statement-list

- () parenthesis on conditions optional

ELSE

statement-list

- Any number of the ELSEIF clause

ENDIF

- ELIF, ELSIF and ELSEIF accepted

Control structures, looping

WHILE (condition)
 statement-list
ENDWHILE label

FOR init;condition;iterator
 statement-list
ENDFOR label

DO label
 Statement-list
UNTIL (condition)

- 'C' like, explicit END replaces any {} block
- () parenthesis on conditions optional
- 'break' exits the loop, can take a 'label' too
- 'continue' skips code upto the loop iterator
- Labels are optional

Control structures, more looping

LOOP

Statement-list

ENDLOOP

- Endless loop, no condition at all

LOOP

EXIT label WHEN (cond1)

Statement-list

IF (condition2)

Statement-list

break label

ENDIF

Statement-list

EXIT label WHEN (cond3)

ENDLOOP label

- LOOP with one or more exit conditions at arbitrary positions
- Mainly useful when using the LABELS in nested loops :)

Command expression substitution

- Transparent, replacing expressions by the result of the expression, when starting with a variable:
 - `$_this + 100`
 - `Wipe z $start $_d_cylsize * 25`
 - `Say You have $_parts partitions on $_disks disks`
- Explicit, enclose in **double** curly brackets if NOT starting with a variable, or any conflicting syntax:
 - `Restore {{$imgfile}} -P:$partition ; -P conflicting`
 - `Say we are in: {{getcwd()}} ; not a variable`

Miscellaneous comments

- Keywords are case-insensitive (IF, WHILE)
- Parenthesis on conditions are optional
- Conditions must be on a single line, or use explicit line continuation
- Lines are 'continued' using '\' as last char allowing long expressions to be spread over more than one physical line

Miscellaneous comments

- Script syntax is checked BEFORE running any statement, except expressions to be substituted in commands (to be refined :-)
- Single '\$' characters in commands will be left 'as-is' so can be used freely, but when directly followed by any alphabetic a-z/A-Z it could be mistaken for a variable and you need to escape that by doubling the '\$' character as: '\$\$'
- There may be application level mechanisms too, that allow switching variable substitution on/off. Would result in better readable commands ...

Considered improvements

- User defined functions or subroutines
- More/better array and hash variable handling and manipulation (perl like)
- Floating point variables
- Basic file-I/O, read/write text and binary

Example code fragments - 1

Set default parameters, in named variables

```
;;defaultparam 1 0 ;disk to work on, 0 = auto
;;defaultparam 2 '$0' ;default image name
;;defaultparam 3 2 ;minimum number of disks
;;defaultparam 4 99 ;maximum number of disks
;
log $0 ;same as scriptname
$stick = $1
$image = $2
$dmin = $3
$dmax = $4
$stickmsg = "bootable multi-ISO, (USB) disk"
```

Example code fragments - 2

Check DFSee version and number of disks

```
if $_version >= 1000
  if ($_disks >= $dmin) && ($_disks <= $dmax)
    ; ... do the real work ...
  else
    confirm Need $dmin to $dmax disks, got: $_disks
  endif
else
  confirm Script needs DFSee 10.x (this is $_version)
endif
```

Example code fragments - 3

Get size + number smallest accessible disk
(taken from the DFSUSB32.DFS script)

```
$size = 999999999
for $disk = 1; $disk <= $_disks; $disk++
    if $_d_size[ $disk] < $size
        if $_d_access[ $disk]
            $stick = $disk
            $size = $_d_size[ $stick]
        endif
    endif
endfor
```

Example code fragments - 4

;Create a FAT32 partition on a memory stick

```
cr -d:$stick pri fat32 -M -o -L:"-v:Sdata -p:Stick2 -l:*"
if $_rc == 0
  'format' -f:32 -v:DfStickdata
  if $_rc == 0
    lvm -n:DFSeeUSBStickBIG -d:$stick
    $exitmsg = FAT32 created and formatted."
  else
    $exitmsg = Create FAT32 partition failed!"
  endif
endif
part -d:$stick
```

Example – recovery script core

```
confirm -y Recreate $parts partitions on disk $work
if $_rc == 0
    $done = 0
    while (1) ;single pass, allow break from section
        ; ... multiple recovery sections here (see next slide)
        break
    endwhile
    part -d -n
    if $done == $parts
        confirm $done partitions done~~Press a key to exit
    endif
else
    confirm Recovery canceled by user
endif
```

Example – recovery script section

;add one section for every partition, with specific message

```
cr pri bmgr 1 -a:0,c -F -l-
```

```
if $_rc == 0
```

```
    $done++
```

```
else
```

```
    confirm Create partition $done +1 failed $abortmsg
```

```
    break
```

```
endif
```

```
cr log hpfs 2000 -at:6001,c -L:"-v:eCS -p:Boot -l:C -menu"
```

```
if $_rc == 0
```

```
    $done++
```

```
else
```

```
    confirm Create partition $done +1 failed $abortmsg
```

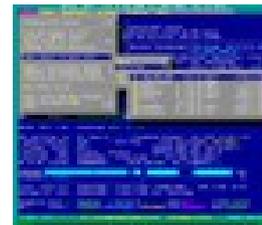
```
    break
```

```
endif
```

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Questions ?

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