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strategy

MPE CI Programming for 7.5

... and other tidbits

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outline

(read the notes too!)

- UDCs and scripts
- parameters
- variables
- entry points
- expressions and functions
- i/o redirection and file I/O
- error handling
- script cleanup techniques
- debugging and good practices
- lots of examples
- appendix

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common CI “programming” commands

• IF, ELSEIF, ELSE, ENDIF ESCAPE, RETURN	branching
• WHILE, ENDWHILE	looping
• ECHO, INPUT	terminal, console, file I/O
• SETVAR, DELETEVAR SHOWVAR	create/modify/delete/display a variable
• ERRCLEAR	sets CI error variables to 0
• RUN XEQ	invoke a program invoke a program or script
• PAUSE	sleep; job synchronization
• OPTION recursion	only way to get recursion in UDCs

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UDCs

- user defined command files (UDCs) - a single file that contains 1 or more command definitions, separated by a row of asterisks (***)

- features:
  - simple way to execute several commands via one command
  - allow built-in MPE commands to be overridden
  - can be invoked each time the user logs on
  - require lock and (read or eXecute) access to the file
  - cataloged (defined to the system) for easy viewing and prevention of accidental deletion -- see SETCATALOG and SHOWCATALOG commands
  - can be defined for each user or account or at the system level
  - more difficult to modify since file is usually opened by users

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command files (scripts)

- command file - a file that contains a single command definition

- features:
  - similar usage as UDCs
  - searched for after UDCs and built-in commands using HPPATH
    - default HPPATH is: logon-group, PUB.logon-acct, PUB.SYS, ARPA.SYS
  - require read or eXecute access
  - easy to modify since file is only in use while it is being executed
  - very similar to unix scripts or DOS bat files

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UDC / script comparisons

- similarities:
  - ASCII, NOCCTL, numbered or unnumbered, max 511 byte record width
  - optional parameter line ok - max of 255 arguments
  - optional options, e.g. HELP, NOBREAK, RECURSION
  - optional body (actual commands)
    - no inline data, unlike Unix 'here' files :(
  - can protect file contents by allowing eXecute access-only security, i.e., denying read access

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UDC / script comparisons (cont)

- differences:
  - scripts can be variable record width files
  - UDCs require lock access, scripts don't
  - script names can be in POSIX syntax, UDC filenames must be in MPE syntax
  - UDC name cannot exceed 16 chars, script name length follows rules for MPE and POSIX named files
  - EOF for a script is the real eof, end of a UDC command is one or more asterisks, starting in column one

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UDCs vs. scripts

- option logon
  - UDCs only (a script can be executed from an “option logon” UDC)
  - logon UDCs executed in this order:
    - 1. System level 2. Account level 3. User level
      (opposite of the non-logon execution order!)

- CI command search order:
  - A. UDCs (1. User level 2. Account level 3. System level)
    - thus UDCs can override built-in commands
  - B. built-in MPE commands, e.g. LISTFILE
  - C. script and program files. HPPATH variable used to qualify unqualified filenames
  - :XEQ command allows script to be same name as UDC or built-in command, e.g. :xeq listf.scripts.sys

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UDCs vs. scripts (cont.)

- performance
  - logon time:
    9 UDC files, 379 UDCs, 6050 lines: 1/2 sec.

    most overhead in opening and cataloging the UDC files
    - to make logons faster remove unneeded UDCs

  - execution time:
    identical (within 1 msec) for simple UDCs vs scripts,
    however:
    - factorial script:
      :fac 12 157 msec
    - factorial UDC (option recursion):
      :facudc 12 100 msec
    - file close logging impacts performance for scripts more since they are opened/closed for each invocation

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UDCs vs. scripts (cont.)

- maintenance / flexibility / security
  - SETCATALOG opens UDC file, cannot edit without un-cataloging file, but difficult to accidentally purge UDC file
  - UDC commands grouped together in same file, easier to view and organize
  - UDC file can be lockword protected but users don't need to know lockword to execute a UDC

  - scripts opened while being executed (no cataloging), can be purged and edited more easily than UDCs
  - scripts can live anywhere on system. Convention is to place general scripts in a common location that grants read or eXecute access to all, e.g. "XEQ.SYS" group
  - if script protected by lockword then it must be supplied each time the script is executed

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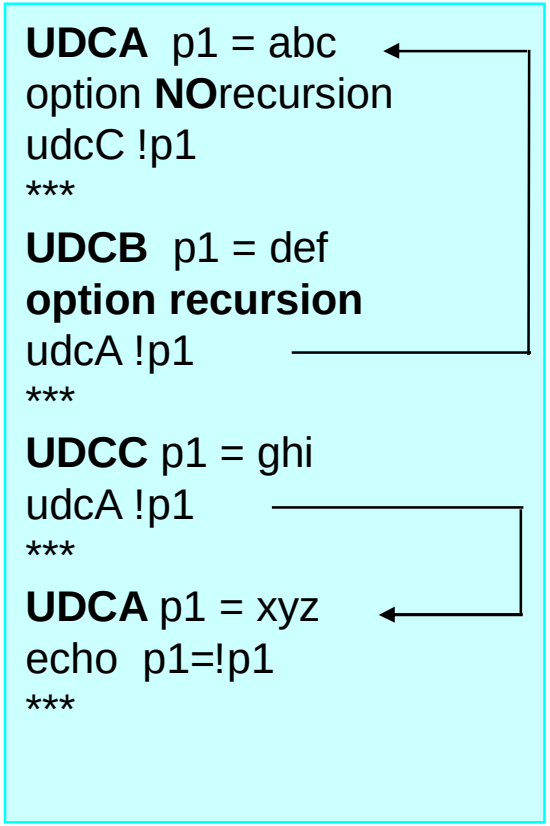
UDC search order

UDCUSER.udc.finance

1. Invoke UDCC, which calls UDCA with the argument “ghi”
2. UDCA is found, starting after the UDCC definition (option NOrecursion default)
3. The line “p1=ghi” is echoed

4. Invoke UDCB, which calls UDCA passing the arg “def”. The recursion option causes the first UDCA to be found. This calls UDCC and follows the path at step 1 above
5. The line “p1=def” is echoed

File:



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script search order

- scripts and programs are searched for after the command is known not to be a UDC or built-in command
- same order for scripts and for program files
- fully or partially qualified names are executed without qualification
- unqualified names are combined with HPPATH elements to form qualified filenames:
  - first match is executed – could be a script, could be a program file
  - filecode = 1029, 1030 for program files
  - EOF > 0 and filecode in 0..1023 for script files
  - to execute POSIX named scripts with HPPATH qualification, a POSIX named directory must be present in HPPATH

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UDC file layout

filename: AUDC.PUB.SYS

header:

UDCcommandname [parm1] [p2 [= value]]
[**ANYPARM** parm4 [= value]]
[**OPTION** option_list]

body:

any MPE command, UDC or script
(option list or option recursion supported in body too)

end-of-UDC

********** (end of this command definition)

header:

NextUDCcommand [parm1]
[**PARM** P2, P3 = value]
[**OPTION** option _list]

body:

any MPE command etc…

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script file layout

filename: PRNT.SCRIPTS.SYS

header:

[**PARM** parm1, parm2 [= value]]
[**ANYPARM** parm3 [= value]]
[**OPTION** option_list]

body:

any MPE command, UDC or script
(:option list or :option recursion supported in body too)

eof

filename: LG.SCRIPTS.SYS

header:

PARM …
OPTION nohelp ...

body:

any MPE command etc...

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UDC / script exit

- EOF -- real EOF for scripts, a row of asterisks (starting in column 1) for UDCs
- :BYE, :EOJ, :EXIT -- terminate the CI too, to use BYE or EOJ must be the root CI
- :RETURN -- useful for entry point exit, error handling, help text - jumps back one call level
- :ESCAPE -- useful to jump all the back to the CI, or an active :CONTINUE. In a job without a :CONTINUE, :escape terminates the job. Sessions are not terminated by :escape. Can optionally set CIERROR and HPCIERR variables to an error number

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parameters

- syntax: ParmName [= value]
  - supplying a value means the parameter is optional. If no value is defined the parameter is considered required.
  - max parm name is 255 bytes, chars A-Z, 0-9, "_"
  - max parm value is limited by the CI's command buffer size (currently 511 characters)
  - all parm values are un-typed, regardless of quoting
  - Parms are separated by a space, comma or semicolon
  - default value may be a: number, string, !variable, ![expression], an earlier defined parm (!parm)
  - all parameters must be explicitly referenced in the UDC/script body, e.g. !parmname
  - the scope of a parm is the body of the UDC/script

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parameters (cont)

- all parameters are passed “by value”, meaning the parm value cannot be changed within the UDC/script
- a parm value can be the name of a CI variable, thus it is possible for a UDC/script to accept a variable name, via a parm, and modify that variable’s value, e.g.

```
SUM a, b, result_var
setvar !result_var !a + !b
*****
```

SUM is a UDC name

```
:SUM 10, 2^10, x
:showvar  x
```

X = 1034

```
:setvar I  10
:setvar J  12
:SUM  i, j, x
:showvar  x
```

inside SUM: setvar x, i + j
X = 22

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ANYPARM parameter

- all delimiters ignored
- must be last parameter defined in UDC/script
- only one ANYPARM allowed
- only way to capture user entered delimiters, without requiring user to quote everything
- example:

```
TELLT  user
ANYPARM msg = “”
# prepends timestamp and highlights msg text
tell !user; at !hptimef: ![chr(27)]&dB !msg


:TELLT  op.sys Hi,, what’s up; system seems fast!
FROM S68 JEFF.UI/3:27 PM: HI,, what’s up; system seems…
```

- `anyparm()` function is useful with ANYPARM parameters

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entry points

- simple convention for executing same UDC/script starting in different "sections" (or subroutines)
- a UDC/script invokes itself recursively passing in the name of an entry (subroutine) to execute
- the script detects that it should execute an alternate entry and skips all the code not relevant to that entry.
- most useful when combined with I/O redirection, but can provide the appearance of generic subroutines
- benefits are: fewer script files to maintain, slight performance gain since MPE opens an already opened file faster, can use variables already defined in script
- UDCs need OPTION RECURSION to use multiple entry points

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entry points (cont)

- two approaches for alternate entries:
  - define a parm to be the entry point name, defaulting to the main part of the code (“main”)
  - the UDC/script invokes itself recursively in the main code, and may use I/O redirection here too
  - each entry point returns when done (via :RETURN command)

---------- or ----------

  - test HPSTDIN or HPINTERACTIVE variable to detect if script/UDC has I/O redirected.
  - if TRUE then assume UDC/script invoked itself.
  - limited only to entry points used when $STDLIST or $STDIN are redirected
  - limited to a single alternate entry point, may not work well in jobs

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entry points (cont)

- generic approach:

```
PARM  p1 ...  entry=main          # default entry is "main"
if "!entry" = "main" then
    ... initialize etc...
    xeq !HPFILE !p1, ... entry=go  # run same script, different entry
    ...  cleanup etc...
    return
elseif "!entry" = "go"  then...
    # execute the GO subroutine ...
    return
elseif "!entry" =  ...
     ...
endif
```

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entry points (cont)

- i/o redirection specific approach:

```
PARM  p1 …            # no “entry” parm defined
if HPSTDIN = “$STDIN” then
    … (“main” entry -- initialize etc…)
    xeq !HPFILE !p1, …  <somefile
    …  (cleanup etc…)
   return
else                  # no elseif since only 1 alternate
    # execute the entry to read “somefile”
    setvar eof FINFO(hpstdin, “eof”)
    …
    return
endif
```

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CI variables

- 113 predefined “HP” variables
- user can create their own variables via :SETVAR
- variable types are: integer (signed 32 bits), Boolean and string (up 1024 characters)
- variable names can be up 255 alphanumeric alphanumeric and “_” (cannot start with number)
- predefined variable cannot be deleted, some allow write access
  - :SHOWVAR @ ; HP -- shows all predefined variables
- can see user defined variables for another job/session (need SM)
  - :SHOWVAR @ ; job=#S or Jnnn
- the bound() function returns true if the named variable exists
- variables deleted when job / session terminates
- :HELP variables and :HELP VariableName

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predefined variables

- HPAUTOCONT - set TRUE causes CI to behave as if each command is protected by a :continue.
- HPCMDTRACE - set TRUE causes UDC / scripts to echo each command line as long as OPTION NOHELP not specified. Useful for debugging.
- HPCPUMSECS - tracks the number of milliseconds of CPU time used by the process. useful for measuring script performance.
- HPCWD - current working directory in POSIX syntax.
- HPDATETIME - contains the date/time in CenturyYearMonthDateHourMinuteSecondMicrosecond format.
- HPDOY - the day number of the year from 1..365.
- HPFILE - the name of the executing script or UDC file.
- HPINTERACTIVE - TRUE means $STDIN and $STDLIST do not form an interactive pair, useful to test if it is ok to prompt the user.
- HPLASTJOB - the job ID of the job you most recently streamed, useful for a default parm value in UDCs that alter priority, show processes, etc.

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predefined variables (cont)

- HPLASTSPID - the $STDLIST spoolfile ID of the last job streamed, useful in
  :print !hplastspid.out.hpspool
- HPLOCIPADDR - IP address for your system.
- HPMAXPIN - the maximum number of processes supported on your system.
- HPPATH - list of group[.acct] or directory names used to search for script and program files
- HPPIN - the Process Identification Number (PIN) for the current process.
- HPPROMPT - the CI's command prompt, useful to contain other info like: !!HPCWD, !!HPCMDNUM, !!HPGROUP, etc.
- HPSPOOLID - the $STDLIST spoolfile ID -- if executing in a job.
- HPSTDIN - the filename for $STDIN, useful in script "subroutines" where input has been redirected to a disk file
- HPSTREAMEDBY - the "Jobname,User.Acct (jobIDnum)" of the job/session that streamed the current job.
- HPUSERCAPF - formatted user capabilities, useful to test if user has desired capability, e.g. if pos("SM",hpusercapf) > 0 then

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variable scoping

- all CI variables are job/session global, except the following: HPAUTOCONT, HPCMDTRACE, HPERRDUMP, HPERRSTOLIST, HPMSGFENCE, which are local to an instance of the CI
- thus it is easy to set “persistent” variables via a logon UDC
- need care in name of UDC and script “local” variables to not collide with existing job/session variables
  - _scriptName_varname -- for all script variable names. Use:deletevar _scriptName_@ at end of script
  - Can create unique variable names by using !HPPIN, !HPCIDEPTH, !HPUSERCMDEPTH as part of the name, e.g.
    :setvar _script_xyz_!hppin , value
- save original value of some “environment” variables
  - :setvar _script_savemsgfence hpmsgfence
    :setvar hpmsgfence 2

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variable referencing

- two ways to reference a variable:
  - explicit -- !varName
  - implicit -- varName
- some CI commands expect variables (and expressions) as their arguments, e.g.
  - :CALC, :IF, :ELSEIF, :SETVAR, :WHILE
  - use implicit referencing here, e.g.
    :if (HPUSER = "MANAGER") then
- most CI commands don't expect variable names (e.g. BUILD, ECHO, LISTF)
  - use explicit referencing here, e.g.
    :echo You are logged on as: !HPUSER.!HPACCOUNT
  - note: all UDC/script parameters must be explicitly referenced
- all CI functions accept variable names, thus implicit referencing works
  - :while JINFO (HPLASTJOB, "exists") do… better than …
    :while JINFO ("!HPLASTJOB", "exists") do

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explicit referencing -

!varname

- processed by the CI early, before command name is known
  - can cause hard-to-detect bugs in scripts - array example
- lose variable type -- strings need to be quoted, e.g..

  "!varName"
- **!!** (two exclamation marks) used to "escape" the meaning of "!", multiple "!'s" are folded 2 into 1
  - even number of "!" --> don't reference variable's value
  - odd number of "!" --> reference the variable's value
- useful to convert an ASCII number to an integer, e.g.

```
setvar int "123"                    or        input foo, "enter a
number"
 if  !int > 0 then ...                        if  !foo = 321 then ...
```

- the only way to reference UDC or script parameters
- the only way for most CI commands to reference variables

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implicit referencing -

just varname

- evaluated during the execution of the command -- later than explicit referencing
- makes for more readable scripts
- variable type is preserved -- no need for quotes, like: "!varname"
- only 5 commands accept implicit referencing: CALC, ELSEIF, IF, SETVAR, WHILE -- all others require explicit referencing
- all CI function parameters accept implicit referencing
- variables inside ![expression] may be implicitly referenced

- performance differences:
  - "!HPUSER.!HPACCOUNT" = "OP.SYS" 4340 msec
  - HPUSER + "." + HPACCOUNT = "OP.SYS" 4370 msec
  - HPUSER = "OP" and HPACCOUNT = "SYS" 4455 msec*

    (*with user match true)

  I prefer the last choice since many times :IF will not need to evaluate the expression after the AND

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compound variables

- :setvar a “!!b” # B is not referenced, 2!’s fold to 1
- :setvar b “123”
- :showvar a, b A=“!b” B=123
- :echo b is !b, a is !a b is 123, a is 123
- :setvar a123 “xyz”
- :echo Compound var "a!!b": !"a!b” Compound var "a!b": xyz

- :setvar J 2
  :setvar VAL2 “bar”
  :setvar VAL3 “foo”
  - :calc VAL!J bar
  - :calc VAL![J] bar
  - :calc VAL![decimal(J)] bar
  - :calc VAL![setvar(J,J+1)] foo

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variables arrays

- simple convention using standard CI variables

- varname0 = number of elements in the array
  varname1…varnameN = array elements, 1 .. !varname0
  varname!J = name of element J
  !"varname!J" = value of element J

- :showvar buffer@

```
BUFFER0 = 6
BUFFER1 = aaa
BUFFER2 = bbb
BUFFER3 = ccc
BUFFER4 = ddd
BUFFER5 = eee
BUFFER6 = fff
```

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variable array example

- centering output:

"Center" script

```
PARM count=5
setvar cnt 0
while setvar(cnt,cnt+1) <= !count do
   setvar string!cnt,input("Enter string !cnt: ")
endwhile
setvar cnt 0
while setvar(cnt,cnt+1) <= !count do
   echo ![rpt(" ",39-len(string!cnt))]!"string!cnt"
endwhile
```

:center

```
Enter string 1: The great thing about Open Source
Enter string 2: software is that you can
Enter string 3: have any color
Enter string 4: "screen of death"
Enter string 5: that you want.

       The great thing about Open Source
           software is that you can
                have any color
              "screen of death"
                that you want.
```

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filling variables arrays -- wrong!

- example 1:

```
                                  # array name is “rec”
setvar j 0
setvar looping true
while looping do
    input name, “Enter name “
    if name = “” then
        setvar looping false
    else
        setvar j j+1
     setvar rec!j  name
    endif
endwhile
setvar rec0  j
```

- :xeq exmpl1
  - infinite loop!, won’t end until <break>

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filling variables arrays (cont)

- example 2:

```
setvar j 0
setvar looping true
while looping do
     setvar NAME  " "
    input name, "Enter name "
    if name = "" then
        setvar looping false
    else
        setvar j j+1
      setvar rec!j  name
    endif
endwhile
setvar rec0  j
```

- :xeq exmpl2 <datafile (datafile has 20 text records)

("enter name" prompt shown 20 times snipped…)

```
End of file on input. (CIERR 900)
 input name, "enter name "
Error executing commands in WHILE loop. (CIERR 10310)
```

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filling variables arrays (cont)

- example 3;

```
setvar j 0
if HPINTERACTIVE then
    setvar prompt  "'Name = '"
    setvar limit 2^30
     setvar test  'name= "" '
else
    setvar prompt ""
    setvar limit FINFO (HPSTDIN, "eof")
     setvar test "false"
endif
while (j < limit) do
    setvar name  ""
    input name , !prompt
    if  !test  then
        setvar limit 0                  # exit interactive input
    else
        setvar j j+1
        setvar rec!j  name
    endif
endwhile
setvar rec0  j
```

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filling variables arrays (cont)

- :xeq exmpl3 <datafile

- :showvar rec@

```
REC1 = line1
REC2 = line2
…
REC20 = line20
REC0 = 20
```

- performance:
  - Script as is: 100 records: 530 millisecs
  - Script modified for file input only (shown in notes):

    100 records: 380 millisecs

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filling variables arrays (cont)

- can we fill arrays (and read files) faster?
- example 4:

```
setvar rec0  0
setvar limit FINFO (HPSTDIN, ”eof”)
while setvar(rec0, rec0+1) <= limit and  &
        setvar(rec![rec0+1], input()) <> chr(1) do
endwhile
setvar rec0 rec0-1
```

- performance (:xeq expl4 <datafile):
  - 100 records: 185 millisecs (twice as fast!)

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CI expressions

- operators:
  - + (ints and strings), -, *, /, ^, (), <, <=, >, >=, =, AND, BAND, BNOT, BOR, BXOR, CSL, CSR, LSL, LSR, MOD, NOT, OR, XOR
- precedence (high to low):
  - 1) variable dereferencing
  - 2) unary + or -
  - 3) bit operators (csr, lsl…)
  - 4) exponentiation (^)
  - 5) *, /, mod
  - 6) +, -
  - 7) <, <=, =, >, >=
  - 8) logical operators (not, or…)
  - left to right evaluation, except exponentiation is r-to-l

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CI expressions

- what is an expression?
  - any variable, constant or function with or without an operator, e.g:
    MYVAR, “a”+”b”, x^10*y/(j mod 6), false, (x > lim) or (input() =“y”)
  - partial evaluation:
    if true or x # “x” side not evaluated
    if false and x # “x” side not evaluated
    if bound(z) and z > 10 then # if “z” not defined it won’t be referenced
    - problems when MPEX runs the script
- where can expressions be used?
  - 5 commands that accept implicit variable references:
    :calc, :if, :elseif, :setvar, :while
  - ![expression] can be used in any command:
    :build afile; rec=-80; disc= ![100+varX]
    :build bfile; disc= ![finfo(“afile”,”eof”)*3] # file b is 3 times bigger
- examples:
  - :print ![input(“File name? “)]
  - :setvar reply ups(rtrim(ltrim(reply)))

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CI functions

- functions are invoked by their name, accept zero or more parms and return a value in place of their name and arguments
- file oriented functions:
  - BASENAME, DIRNAME, FINFO, FSYNTAX, FQUALIFY
- string parsing functions:
  - ALPHA, ALPHANUM, DELIMPOS, DWNS, EDIT, LEN, LFT, LTRIM, NUMERIC, PMATCH, POS, REPL, RHT, RPT, RTRIM, STR, UPS, WORD, WORDCNT, XWORD
- conversion functions:
  - CHR, DECIMAL, HEX, OCTAL, ORD
- arithmetic functions
  - ABS, MAX, MIN, MOD, ODD
- job/process functions:
  - JINFO, JOBCNT, PINFO
- misc. functions:
  - ANYPARM, BOUND, INPUT, SETVAR, TYPEOF

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CI i/o redirection

- > name - redirect output from $STDLIST to “name”
  - “name” will be overwritten if it already exists
  - file will be saved as “name”;rec=-256,,v,ascii;disc=10000;TEMP
  - file name can be MPE or POSIX syntax
- >> name - redirect, append output from $STDLIST to “name”
  - same file attributes for “name” if it is created
- < name - redirect input from $STDIN to “name”
  - “name” must exist (TEMP files looked for before PERM files)

- I/O redirection has no meaning if the command does not do I/O to $STDIN or $STDLIST
- available on all commands, except:
  - IF, ELSEIF, SETVAR, CALC, WHILE, COMMENT, SETJCW, TELL, TELLOP, WARN.

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CI i/o redirection (cont)

- how it works:
  - CI ensures the command is not one of the excluded commands
  - CI scans the command line looking for <, >, >> followed by a possible filename (after explicit variable resolution has already occurred)
    - text inside quotes is excluded from this scan
    - text inside square brackets is excluded from the scan
  - filename is opened and "exchanged" for the $STDIN or $STDLIST
  - after the command completes the redirection is undone

- examples:
  - INPUT varname < filename
  - ECHO The next answer is: !result >>filename
  - LISTFILE ./@,6 > filename
  - PURGEACCT myacct <Yesfile
  - PURGE foo@ ;temp ;noconfirm >$null
  - ECHO You need to include !<THIS!> too!

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file i/o

- why not use INPUT in WHILE to read a flat file?, e.g.:

```
while not eof do
    input varname  < filename
endwhile
```

- answer: the CI opens and closes “filename” each iteration, thus you will be reading the 1st record over and over…

- three main alternatives:
  - write to (create) and read from a MSG file via I/O redirection
  - use :PRINT and I/O redirection to read file 1 record at a time
  - use entry points and I/O redirection
- MSG file works because each read is destructive, so next INPUT reads next record

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file i/o - MSG file

- PARM fileset=./@

```
# This script reads LISTFILE,6 output and measures CPU millisecs
# using a MSG file
setvar savecpu hpcpumsecs
errclear
file msg=/tmp/LISTFILE.msg; MSG
continue
listfile !fileset,6 >*msg
if hpcierr = 0 then
    # read listfile names into a variable
    setvar cntr setvar(eof, finfo('*msg', "eof"))
    while setvar(cntr, cntr-1) >= 0 do
        input rec <*msg
    endwhile
endif
echo ![hpcpumsecs - savecpu] msecs to read !eof records.
deletevar cntr, eof, rec
```

```
:readmsg
259 msecs to read 22 records

:readmsg @.pub.sys
15845 msecs to read 1515
```

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strategy

file i/o - :print

- PARM fileset=./@

```
# This script reads a file produced by LISTFILE,6 and measures CPU msecs
# using PRINT as an intermediate step
setvar savecpu hpcpumsecs
errclear                                    :readprnt
continue
listfile !fileset,6 > lftemp
if hpcierr = 0 then
   # read listfile names into a variable
   setvar cntr 0
   setvar eof finfo('lftemp',"eof")
   while setvar(cntr, cntr+1) <= eof do
        print lftemp;start=!cntr;end=!cntr > lftemp1
        input rec <lftemp1
   endwhile
endif
echo ![hpcpumsecs - savecpu] msecs to read !eof records.
deletevar cntr,eof,rec
```

735 msecs to read 22 records
3 times slower than MSG files

:readprnt @.pub.sys
74478 msecs to read 1515 recs
over 4 times slower than MSG files!

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strategy

file i/o - entry points

- PARM fileset=./@, **entry="main"”**

```
# This script reads a file produced by LISTFILE,6 and measures CPU
msecs
# using entry points and script redirection
if "!entry" = "main" then
   setvar savecpu hpcpumsecs
   errclear
   continue
   listfile !fileset,6 > lftemp
   if hpcierr = 0 then
      xeq !hpfile !fileset entry=read <lftemp
   endif
   echo ![hpcpumsecs - savecpu] msecs to read !eof records.
   deletevar cntr,eof,rec
   purge lftemp;temp
   return
```

. . . (continued on next slide)

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strategy

file i/o - entry points (cont)

```
else
    # read listfile names into a variable
    setvar cntr setvar(eof, finfo(hpstdin, "eof"))
    while setvar(cntr,cntr-1) >= 0 and setvar(rec, input()) <>
chr(1) do
    endwhile
    return
endif
```

:readntry
90 msecs to read 24 records.
---> Almost 3 times faster than MSG files
---> 8 times faster than the PRINT method!

:readntry @.pub.sys
2400 msecs to read 1515 records.
---> Over 6 times faster than MSG files
---> 31 times faster than using PRINT!

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strategy

error handling

- use HPAUTOCONT variable judiciously :
  - better --
    continue
    command
    if hpcierr > 0 then …
- if error-condition then
  echo something…
  return -- or -- escape
  endif …
- RETURN vs. ESCAPE
  - :return goes back ONE level
  - :escape goes back to the CI level in a session, to an active CONTINUE, or can abort a job
- HPCIERRMSG - variable contains the error text for the value of CIERROR JCW / variable
- :ERRCLEAR - sets HPCIERR, CIERROR, HPFSERR, HPCIERRCOL variables to zero

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strategy

cleanup

- delete variables “local” to the UDC / script
  - :deletevar _”prefix”_@
- purge scratch files
- reset “local” file equations
- don’t do the above if still debugging!
- better, build in a way to preserve files, variables, etc. on the fly
  - use a central cleanup “entry” routine
  - use a variable to control the cleanup related commands

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strategy

debugging

- some common problems:
  - syntax error (unmatched parenthesis), variable name typo, reliance on a var that has not been initialized, hitting eof, using an HFS file for IO redirection and then referencing FINFO(hpstdin) -- CI bug!, entry name typo (case sensitive!), off-by-one on loop counters, unexpected user input, re-using the same var in two places that are executed together (e.g., 2 eof counters), reading from terminal but $stdin is already redirected to a file
- trickier problems to find:
  - echoing a literal “>” without escaping,word() by index but index out of bounds, “array” index increment and reference in same loop, unmatched endwhile or endif, creating files that could contain CI metachars, date calculations that cross day, month, year boundaries,

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strategy

examples

- some simple examples to get started
- string manipulation and parsing examples
- dealing with quotes
- … and much more

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strategy

simple examples

display last N records of a file (no process creation)

- PARM file, last=12
  print !file; start= -!last
  "Tail" script

display CI error text for a CI error number

- PARM cierr= !cierror
  setvar save_err cierror
  setvar cierror !cierr
  showvar HPCIERRMSG
  setvar cierror save_err
  deletevar save_err
  "Cierr" script

alter priority of job just streamed -- great for online compiles ;-)

- PARM job=!HPLASTJOB; pri=CS
  altproc job=!job; pri=!pri
  "Altp" script

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strategy

brief file, group, user, dir listings

- PARM fileset=./@ "LF"
  listfile !fileset,6

- PARM group=@ "LG"
  listgroup !group; format=brief

- PARM user=@ "LU"
  listuser !user; format=brief

- PARM dir=./@ "LD"
  setvar _dir "!dir"
  if delimpos(_dir, "./") <> 1 then
  # convert MPE name to POSIX name
  setvar _dir dirname(fqualify(_dir)) + "/" + basename(_dir)
  endif
  listfile !_dir, 6; seleq=[object=HFSDIR]; tree

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strategy

string manipulations

1) parse out all tokens in a string var
2) extract the first N tokens from a string var
3) extract the last N tokens from a string var
4) test for “hi” somewhere in a string var (or “LOGON” vs. “NOLOGON”)
5) count tokens in a string var
6) remove Nth token from a string var
7) remove N consecutive tokens from a string var

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strategy

printing spoolfiles

- PRINTSP script:

```
PARM  job=!HPLASTJOB
# Prints spoolfile for a job, default is the last job you streamed
if  "!job" = "" then
    echo No job to print
     return
endif
setvar hplastjob "!job"
if hplastspid  = "" then
    echo No $STDLIST spoolfile to print for "!job".
    return
endif
print !HPLASTSPID.out.hpspool
```

- :stream scopejob

```
#J324
:printsp
:JOB SCOPEJOB,MANAGER.SYS,SCOPE.
 Priority = DS; Inpri = 8; Time = UNLIMITED seconds . . .
```

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strategy

customize jobs using variables

```
PARM p1="my value", p2="something“
# create a simple job passing parms and variables to the job
setvar testvar1 true
setvar testvar2 46
setvar testvar3 "abc“
echo !!job jeff.vance;outclass=,2          >tmpjob
echo !!setvar myP1 "!p1"                   >>tmpjob
echo !!setvar myP2 "!p2"                   >>tmpjob
echo !!setvar myVar1 !testvar1             >>tmpjob
echo !!setvar myVar2 !testvar2             >>tmpjob
echo !!setvar myVar3 "!testvar3"           >>tmpjob
echo !!showvar my@                         >>tmpjob
echo !!eoj                                    >>tmpjob
stream tmpjob
```

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strategy

new location (group, CWD)

- CD script

```
PARM dir=""
setvar d  "!dir"
# "-" means go to prior CWD
if d = '-' and bound(save_chdir) then
   setvar d  save_chdir
elseif fsyntax(d) = "MPE"  then                  # MPE syntax?
   if finfo("./"+d, "exists") then               # HFS dir?
      setvar d  "./" + d
   elseif finfo("../"+ups(d), "exists") then     # MPE group?
      setvar d  "../" + ups(d)
   elseif finfo(ups(d), "exists") then           # MPE dir name?
      setvar d  ups(d)
   endif
endif
setvar save_chdir HPCWD
chdir !d
```

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strategy

powerfail script

- UPS configuration file, UPSCNFIG.PUB.SYS):

  Contents:

```
powerfail_message_routing = all_terminals
powerfail_low_battery     = keep_running
powerfail_command_file    = prodshut.opsys.sys
powerfail_grace_period    = 300
```

- PRODSHUT.OPSYS.SYS script example:

```
warn @; Powerfail detected by UPS. Orderly shutdown BEGIN…
warn @; ***** Please logoff immediately! *****
if jobcnt("prod1J,usr.acct", jobID) > 0 then
    stream hipriJ
    pause 60; job=!hplastjob
    abortjob !jobID
endif
errclear
pause 180; job=@s
if cierror = 9032 then
    warn @;System going down in 2 minutes!
    pause 120
endif
shutdown
```

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strategy

columnar output

- before:

```
setvar j 0
while setvar(j,j+1) < 4 do
    setvar a rpt("a", j)
    setvar b rpt("b", (4-j)*2)
    echo !a xx !b xx
endwhile
```

output:

```
a xx bbbbbb xx
aa xx bbbb xx
aaa xx bb xx
```

- after:

```
while ...
   setvar a ; setvar b...same way...
   echo !a ![rpt(" ", 3-len(a))]xx &
           ![rpt(" ", 6-len(b))] !b xx
endwhile
```

```
a    xx bbbbbb xx
aa   xx   bbbb xx
aaa  xx     bb xx
```

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strategy

MPE version

- PARM vers_parm=!hprelversion

“Vers” script

```
# react to MPE version string
setvar vers "!vers_parm”
# convert to integer, e.g.. "C.65.02" => 6502
setvar vers str(vers,3,2) + rht(vers,2)
setvar vers !vers
if vers >= 7000 then
    echo  On 7.0!
elseif vers >= 6500 then
    echo On 6.5!
elseif vers >= 6000 then
    echo On 6.0!
endif
```

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strategy

testing remote command execution

```
ANYPARM cmd
# Script that executes a command in a remote session and returns the
# CIERROR and HPCIERR values for that command back to the local
# environment.
purge rmstatus >$null
build rmstatus;rec=-80,,f,ascii
remote file rmstatus=rmstatus:$back,old
continue
remote !cmd
remote echo setvar cierror !!cierror    >*rmstatus
remote echo setvar hpcierr !!hpcierr >>*rmstatus
xeq rmstatus
echo remote CIERROR=!cierror, remote HPCIERR=!hpcierr
```

```
:rem  listfile 4abc,2
First character in file name not alphabetic. (CIERR 530)
remote CIERROR=530, remote HPCIERR=530
```

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strategy

synchronize jobs

```
!JOB job0…
!limit +2
!stream job1
!pause job=!hplastjob
!stream job2
!errclear
!pause  600, !hplastjob
!if hpcierr = -9032 then
!    tellop Job "!hplastjob" has exceeded the 10 minute limit
!    eoj
!endif
!stream job3
!pause job=!hplastjob; WAIT
!input  reply, "'Reply 'Y' for !hplastjob";  readcnt=1; CONSOLE
!if dwns(reply) = "y" then
   . . .
```

INFO= example

- ANYPARM info=!["**"**] # "**anyrun**" script
  run volutil.pub.sys; info="**:!info"**
  - :anyrun echo "Hi there!"

```
run volutil.pub.sys;info="":echo "Hi there!""
                                ^
Expected semicolon or carriage return. (CIERR 687)
```

- ANYPARM info=!["**"**]
  setvar _inf repl('!info', '"', '""') # double up quotes in :RUN
  run volutil.pub.sys;info="**:!_inf "**
  - :anyrun echo "Hi there!"

```
Volume Utility A.02.00, (C) Hewlett-Packard Co.,
1987. All Rights...
volutil: :echo "Hi there!"
"Hi there!"
```

- is this correct now?

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strategy

INFO= example (cont)

- ANYPARM info=![""]
  setvar _inf anyparm(!info) # note info parm is **not** quoted
  setvar _inf repl(_inf, '"', '"')
  run volutil.pub.sys;info=":_!inf "

- :anyrun echo "Hi there, ‘buddy’!”

```
Volume Utility A.02.00, (C) Hewlett-Packard Co., 1987.
All Rights...
volutil: :echo "Hi there, ‘buddy’!”
"Hi there, ‘buddy’!”
```

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strategy

random names

- PARM varname, minlen=4, maxlen=8
  # This script returns in the variable specified as "varname" a `random'
  # name consisting of letters and numbers - cannot start with a number.
  # At least "minlen" characters long and not more than "maxlen" chars.

  ## expression for a `random' letter:
  setvar letter "chr((hpcpumsecs mod 26) + ord('A'))"

  ## expression for a `random' number:
  setvar number "chr((hpcpumsecs mod 10) + ord('0'))"
  ## first character must be a letter
  setvar !varname !letter

  ## now fill in the rest, must have at least "minlen" chars , up to "maxlen"
  setvar i 1
  setvar limit min((hpcpumsecs mod !maxlen) + !minlen, !maxlen)
  while setvar(i,i+1) <= limit do
  if odd(hpcpumsecs) then
  setvar !varname !varname + !letter
  else
  setvar !varname !varname + !number
  endif
  endwhile

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strategy

parsing HPPATH

```
setvar x 0
while setvar(token, &
                word("!hppath",",; ",setvar(x, x+1))) <> "" do
   if delimpos(token,"/.") = 1 then
      # we have a POSIX path element

   else
      # we have an MPE path element

   endif
endwhile
```

- Why did I explicitly reference HPPATH?

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strategy

PRNT - print file based on HPPATH

```
PARM filename
# This command file prints the first MPE filename found in HPPATH.
setvar _prnt_i 0
setvar _prnt_match false
while not (_prnt_match) and &
     setvar(_prnt_tok,word(“!hppath”,',; ',setvar(_prnt_i,_prnt_i+1)))<>””do
     if delimpos(_prnt_tok,'./') <> 1 then
          # skip HFS path elements, we have an MPE syntax element
          setvar _prnt_match (finfo("!filename.!_prnt_tok",'exists'))
     endif
endwhile
if _prnt_match then
     setvar _prnt_f fqualify("!filename.!_prnt_tok")
     echo !_prnt_f
     continue
     print !_prnt_f,!out ;page=22
else
     echo ![ups("!filename")] was not found in your HPPATH.
endif
```

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strategy

scan history (redo) stack

```
PARM cmdstr entry=main
# Script scans the redo stack, from top-of-stack (TOS), backwards towards the
# begining, searching for the 1st cmd line that contains "cmdstr“ anywhere.
if '!entry' = 'main' then
    listredo ;unn >lrtmp
    # create variables for each command line in the redo stack
    xeq !hpfile "!cmdstr" entry='listredo' <lrtmp
    # scan above variables for first match on "cmdstr“
    xeq !hpfile "!cmdstr" entry='match‘
    # match or not?
    if _rdo_line = "" then
        echo "!cmdstr" not found in history stack.
     else
        # do an interactive command redo feature
        echo Edit command line for REDO:
        echo !_rdo_line
        setvar _rdo_edit input()
        while _rdo_edit <> "" do
            setvar _rdo_line edit(_rdo_line,_rdo_edit)
            echo !_rdo_line
            setvar _rdo_edit input()
         endwhile
        # execute the command
        continue
        !_rdo_line
    endif
    deletevar _rdo_@
    return
```

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strategy

scan history stack (cont)

```
elseif '!entry' = 'listredo' then
    # Fill variable "array" so redo stack can be searched from TOS down.
    # Input comes from output of LISTREDO ;unn command.
    # Skip TOS redo line since it invoked this script!
    setvar _rdo_x 0
    setvar _rdo_size finfo(hpstdin,'eof')-1
    while setvar(_rdo_x,_rdo_x+1) <= _rdo_size do
        setvar _rdo_!_rdo_x input()
    endwhile
    return
elseif '!entry' = 'match' then
    # Find redo entry (now in variable "array") that matches user's string.
    # Search from last array element down to the first. Return _rdo_line as
    # "" for no match, or the matching cmd.
    setvar _rdo_txt dwns("!cmdstr")
    setvar _rdo_x _rdo_size+1
    while setvar(_rdo_x,_rdo_x-1) > 0 and &
            pos(_rdo_txt,dwns(_rdo_![_rdo_x-1])) = 0 do
    endwhile
    if _rdo_x > 0 then
        # match
        setvar _rdo_line _rdo_!_rdo_x
    else
        setvar _rdo_line ""
    endif
    return
endif
```

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strategy

scan history stack (cont)

:listredo

1) listf,6
2) Showtime
3) run editor
4) run edit.pub.sys
5) hpedit rem
6) listredo ;unn
7) showjob
8) me
9) spme
10) showproc 0
11) listredo

:rdo sys

```
Edit command line for REDO:
run edit.pub.sys
    ihp
run hpedit.pub.sys
HP EDIT  HP32656A.02.33 (c) COPYRIGHT Hewlett-Packard Co. …
FRI, FEB 28, 2003,  5:21 PM
```

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strategy

CI grep

- PARM pattern, file, entry=main
  # This script implements unix $grep -in <pattern> <file>.
  setvar savecpu hpcpumsecs
  if '!entry' = 'main' then
  errclear
  setvar _grep_matches 0
  if not finfo('!file','exists') then
  echo File "!file" not found.
  return
  endif
  continue
  xeq !HPFILE !pattern !file entry=read_match <!file
  echo ![hpcpumsecs-savecpu] msecs …
  echo !_grep_eof records read -- !_grep_matches lines match "!pattern"
  deletevar _grep_@
  return
  . . . (continued on next slide)

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strategy

CI grep (cont)

```
elseif '!entry' = 'read_match' then
   # finds each "pattern" in "file" and echoes the record + line num
   # input redirected to "!file"
   setvar _grep_eof finfo("!file","eof")
   setvar _grep_recno 0
   setvar _grep_pat ups("!pattern")
   while setvar(_grep_recno,_grep_recno+1) <= _grep_eof  and &
         setvar(_grep_rec, rtrim(input())) <> chr(1) do
      if pos(_grep_pat,ups(_grep_rec)) > 0 then
         echo !_grep_recno) !_grep_rec
         setvar _grep_matches _grep_matches+1
      endif
   endwhile
   return
endif
```

- 4667 msecs …
  1669 records read -- 18 lines match "version"
- 4627 msecs …
  1669 records read -- 0 lines match "foo"

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strategy

where is a “cmd”?

```
PARM cmd="", entry=main
# This script finds all occurrences of "cmd" as a UDC, script or program in
# HPPATH.  Wildcards are supported for UDC, program and command file names.
# Note: a cmd name like "foo.sh" is treated as a POSIX name, not a qualified
#         MPE name.
if "!entry" = "main" then
  errclear
  setvar _wh_cmd "!cmd"
  if delimpos(_wh_cmd,"/.") = 1 then
     echo WHERE requires the POSIX cmd to be unqualified.
     return
  endif

  # see if the command could be a UDC (wildcards are supported)
  setvar _wh_udc_ok (delimpos(_wh_cmd,'._') = 0)
  # see if the command could be an MPE filename (wildcards ok, and
  #  MPE names cannot be qualified at all)
  setvar _wh_mpe_ok (delimpos(_wh_cmd,'._') = 0)
  ## All command values are assumed to be ok as a POSIX filename.
  ## The dash (-) char is excluded above since it could be in a [a-z] pattern
```

. . . continued . . .

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strategy

where (cont)

```
. . .
  # check for UDCs first
  if _wh_udc_ok then
     continue
     showcatalog >whereudc
     if cierror = 0 then
        xeq !hpfile !_wh_cmd entry=process_udcs <whereudc
     endif
  endif

  # Now check for command/program files
  if word(setvar(_wh_syn,fsyntax("./"+_wh_cmd))) = "ERROR" then
     # illegal name, could be a longer UDC name, in any event there
     # no need to check for command/program files.
     deletevar _wh_@
     return
  endif
  setvar _wh_wild pos("WILD",_wh_syn) > 0
```

. . . continued . . .

where (cont)

```
. . .
  # loop through hppath
  setvar _wh_i 0
  while setvar(_wh_tok,word(hppath,",; ",setvar(_wh_i,_wh_i+1)))<>"" do
    if delimpos(_wh_tok,"/.") = 1 then
      # we have a POSIX path element
      setvar _wh_tok "!_wh_tok/!_wh_cmd"
    elseif _wh_mpe_ok then
      # we have an MPE syntax HPPATH element with an unqualified _tok
      setvar _wh_tok "!_wh_cmd.!_wh_tok"
    endif
    errclear
    if _wh_wild then
      continue
      listfile !_wh_tok,6 >prntlf
    elseif finfo(_wh_tok,'exists') then
      # write to same output file as listfile uses above
      echo ![fqualify(_wh_tok)] >prntlf
    else
      setvar hpcierr -1
    endif
    if hpcierr = 0 then
      xeq !hpfile !_wh_tok entry=process_listf <prntlf
    endif
  endwhile
  deletevar _wh_@
  return
```

. . . continued. . .

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strategy

where (cont)

```
...
elseif "!entry" = "process_udcs" then
  # input redirected from the output of showcatalog
  setvar _wh_udcf rtrim(input())
  setvar _wh_eof finfo(hpstdin,"eof") -1
  while setvar(_wh_eof,_wh_eof-1) >= 0 do
    if lft(setvar(_wh_rec,rtrim(input())),1) = " " then
      # a UDC command name line
      if pmatch(ups(_wh_cmd),setvar(_wh_tok,word(_wh_rec))) then
        # display: UDC_command_name    UDC_level    UDC_filename
        echo !_wh_tok ![rpt(" ",26-len(_wh_tok))] &
                ![setvar(_wh_tok2,word(_wh_rec,,-1))+rpt(" ",7-len(_wh_tok2))] &
                UDC in !_wh_udcf
      endif
    else
      # a UDC filename line
      setvar _wh_udcf _wh_rec
    endif
  endwhile
  return
```

where (cont)

```
...
elseif "!entry" = "process_listf" then
  # input redirected from the output of listfile,6 or a simple filename
  setvar _wh_eof finfo(hpstdin,'eof')
  while setvar(_wh_eof,_wh_eof-1) >= 0 do
    setvar _wh_fc ""
    if setvar(_wh_fc, finfo(setvar(_wh_tok,ltrim(rtrim(input()))),'fmtfcode')) = ""
      setvar _wh_fc 'script'
    elseif _wh_fc <> 'NMPRG' and _wh_fc <> 'PROG' then
      setvar _wh_fc ""
    endif
    if _wh_fc <> "" and finfo(_wh_tok,'eof') > 0 then
      setvar _wh_lnk ""
      if _wh_fc = "script" and finfo(_wh_tok,'filetype') = 'SYMLINK' then
        setvar _wh_fc 'symlink'
        # get target of the symlink
        file lf7tmp;msg
        continue
        listfile !_wh_tok,7 >*lf7tmp
        if hpcierr = 0 then
          # discard first 4 records
          input _wh_lnk <*lf7tmp
          input _wh_lnk <*lf7tmp
          input _wh_lnk <*lf7tmp
          input _wh_lnk <*lf7tmp
          input _wh_lnk <*lf7tmp
          setvar _wh_lnk "--!> " + word(_wh_lnk,,-1)
        endif
      endif
```

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strategy

where (cont)

```
...
        # display: qualified_filename file_code or "script" and link if any
        echo !_wh_tok ![rpt(" ",max(0,26-len(_wh_tok)))] !_wh_fc &
                ![rpt(" ",7-len(_wh_fc))] !_wh_lnk
        endif
    endwhile
    return
    endif
```

- :where @sh@

```
SHOWME                  USER    UDC in SYS52801.UDC.SYS
SH                      SYSTEM  UDC in HPPXUDC.PUB.SYS
SH.PUB.VANCE            NMPRG
SHOWVOL.PUB.VANCE       script
BASHELP.PUB.SYS         PROG
HSHELL.PUB.SYS          script
PUSH.SCRIPTS.SYS        script
RSH.HPBIN.SYS           NMPRG
SH.HPBIN.SYS            NMPRG
/bin/csh                NMPRG
/bin/ksh                symlink  --> /SYS/HPBIN/SH
/bin/remsh              symlink  --> /ENM/PUB/REMSH
/bin/rsh                symlink  --> /SYS/HPBIN/RSH
/bin/sh                 symlink  --> /SYS/HPBIN/SH
```

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strategy

stream UDC - overview

- STREAM
  ANYPARM streamparms = ![" "]
  OPTION nohelp, recursion
  . . .
  if main entry point then
  # initialize …
  - if "jobq=" not specified then read job file for job "card"
  - if still no "jobq=" then read config file matching "[jobname,]user.acct"
  - stream job in HPSYSJQ (default) or derived job queue
  - clean up
  else
  # alternate entries
  separate entry name from remaining arguments
  . . .
  if entry is read_jobcard then read job file looking for ":JOB", concatenate continuation lines (&) and remove user.acct passwords
  . . .
  elseif entry is read_config then
  read config file, match on "[jobname,]user.acct"
  . . .
  endif

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strategy

stream UDC - “main”

```
# comments ...
if "!streamparms" = "" or pos("entry=","!streamparms") = 0 then
    # main entry point of UDC
    setvar _str_jobfile word("!streamparms")                # extract 1st arg
    . . .
    # extract remaining stream parameters
    setvar _str_parms ups( &
                repl(rht("!streamparms",-delimpos("!streamparms")),” ”,””))
    if setvar(_str_pos, pos(“;JOBQ=“,_str_parms)) > 0 then
        setvar _str_jobq  word(_str_parms,,2,,_str_pos+5)
    endif
    if _str_jobq = “” then
        # no jobq=name in stream command so look at JOB “card”
        STREAM _str_jobcard entry=read_jobcard <!_str_jobfile
        if setvar(_str_pos,pos(";JOBQ=",_str_jobcard)) > 0 then
            setvar _str_jobq word(_str_jobcard,,2,,_str_pos+5)
        endif
    endif
```

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strategy

stream UDC - “main” (cont)

```
if _str_jobq = '' and finfo(_str_config_file,'exists') then
   # No jobq=name specified so far so use the config file.
   STREAM ![word(_str_jobcard,";")]  _str_jobq  entry=read_config &
                <!_str_config_file
   if _str_jobq <> '' then
      # found a match in config file, append jobq name to stream command line
      setvar _str_parms _str_parms + ";jobq=!_str_jobq"
   endif
endif
. . .
# now finally stream the job.
if _str_jobq = '' then
    echo Job file "!_str_jobfile" streamed in default "HPSYSJQ" job queue.
else
    echo Job file "!_str_jobfile" streamed in "!_str_jobq" job queue.
endif
option norecursion
continue
stream !_str_jobfile !_str_parms
. . .
```

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strategy

stream UDC - “read_jobcard”

```
else
  # alternate entry points for UDC.
  setvar _str_entry word("!streamparms",,-1)
  # remove entry=name from parm line
  setvar _str_entry_parms lft('!streamparms',pos('entry=','!streamparms')-1)

  if _str_entry = "read_jobcard" then
    # Arg 1 is the *name* of the var to hold all of the JOB card right of "JOB".
    # Input redirected to the target job file being streamed
    # Read file until JOB card is found.  Return, via arg1, this record,
    # including continuation lines, but less the "JOB" token itself.  Remove
    # all passwords, if any. Skip leading comments in job file.
   setvar _str_arg1 word(_str_entry_parms)
   while str(setvar(!_str_arg1,ups(input())),2,4) <> "JOB " do
   endwhile
   # remove line numbers, if appropriate
   if setvar(_str_numbered, numeric(rht(!_str_arg1,8))) then
      setvar !_str_arg1 lft(!_str_arg1,len(!_str_arg1)-8)
   endif
   ...
```

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strategy

stream UDC - “read_jobcard” (cont)

```
...
# concatenate continuation (&) lines
while rht(setvar(!_str_arg1,rtrim(!_str_arg1)),1) = '&' do
    # remove & and read next input record
    setvar !_str_arg1 lft(!_str_arg1,len(!_str_arg1)-1)+ltrim(rht(input(), -2))
    if _str_numbered then
        setvar !_str_arg1 lft(!_str_arg1,len(!_str_arg1)-8
    endif
endwhile
# remove passwords, if any
while setvar(_str_pos,pos('/',!_str_arg1)) > 0 do
    setvar !_str_arg1   repl(!_str_arg1,"/"+word(!_str_arg1,'.;',,,_str_pos+1),"")
endwhile
# return, upshifted, all args right of "JOB", and strip all blanks.
setvar !_str_arg1 ups(repl(xword(!_str_arg1)," ",""))
return
```

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strategy

stream UDC - “read_config”

```
elseif _str_entry = "read_config" then
    # Arg 1 is the "[jobname,]user.acct" name from the job card.
    # Arg 2 is the *name* of the var to return the jobQ name if the acct name
    # Input redirected to the jobQ config file.
    setvar _str_arg1 word(_str_entry_parms," ")
    setvar _str_arg2 word(_str_entry_parms," ",2)
    setvar _str_eof finfo (hpstdin, “eof”)
    …
    # read config file and find [jobname,]user.acct match (wildcards are ok)
    while setvar(_str_eof ,_str_eof-1)  >=  0                              and &
            (setvar(_str_rec,ltrim(rtrim(input())))  = “”                  or &
              lft(_str_rec,1) = '#'                                        or &
              not pmatch(ups(word(_str_rec,,-2)),_str_ua)                  or &
              (pos(',',_str_rec) > 0 and lft(_str_rec,2) <> '@,'  and &
               not pmatch(ups(word(_str_rec)),_str_jname)) )               do
    endwhile
    if _str_eof >= 0 then
       # [jobname,]user.acct match, return jobq name
       setvar !_str_arg2 word(_str_rec,,-1)
    endif
return
```

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strategy

appendix

- recent CI enhancements
- redo/do features
- CI limits
- COMMAND and HPCICOMMAND inrtrinsics
- JINFO, JOBCNT, and PINFO CI functions

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strategy

“recent” CI enhancements

- extended POSIX filename characters
- new CI functions: anyparm, basename, dirname, fqualify, fsyntax, jobcnt, jinfo, pinfo, wordcnt, xword
- new CI variables: hpdatetime, hpdoy, hphhmmssmmm, hpleapyear, hpmaxpin, hpyyyymmdd
- new CI commands: abortproc, newci, newjobq, purgejobq, shutdown
- enhanced commands: INPUT from console, FOS store-to-disk, :showvar to see another job/sessions’ variables, :copy to= a directory, :altjob HIPRI and jobq=, :limit +-N
- :HELP shows all CI variables, functions, ONLINEINFO, NEW

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strategy

redo

- delete a word
  - dw, >dw, dwddw, dwiXYZ
- delete up to a special character
  - d., d/, d*, d/iXYZ, d.d
- delete to end-of-line
  - d>
- delete two or more non-adjacent characters
  - d d
- upshift/downshift a character or word
  - ^, ^w, v, vw, >^, >v, ^>, v>
- append to end-of-line
  - >XYZ
- replace starting at end of line
  - >rXYZ
- change one string to another
  - c/ABCD/XYZ, c:123::
- undo last or all edits
  - u or u twice in a row
- available in CI, VOLUTIL, STAGEMAN, DEBUG others...

CI limits

- command buffer 511 bytes
  - applies to interactive, batch, UDCs, scripts, COMMAND and HPCICOMMAND intrinsics, NM and CM
  - CM command parms limited to 255 bytes due to MYCOMMAND intrinsic, eg. info= string
- nested IFs and WHILEs 100
- nested UDCs and scripts 30 each
- length of string variable value 1024 bytes
- length of CI variable name 255 bytes
- max number of CI variables 10,800 (approx)
- typical number of CI variables 8,300 (approx)
- length of UDC name 16 bytes
- length of script name 255 bytes
- max number of UDC/script parms 255

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strategy

COMMAND intrinsic

- COMMAND is a programmatic system call (intrinsic)
  syntax: COMMAND (cmdimage, error, parm)
- implemented in native mode (NM, PA-RISC mode)
- use COMMAND for system level services, like:
  - building, altering, copying purging a file
- no UDC search (a UDC cannot intercept “cmdimage”)
- no command file or implied program file search
- returns command error number and error location
  (for positive parmnum), or file system error number for negative parmnum

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strategy

HPCICOMMAND intrinsic

- HPCICOMMAND is an intrinsic
  syntax: HPCICOMMAND (cmdimage,error,parm
  [,msglevel])
- implemented in native mode (NM, PA-RISC mode)
- use HPCICOMMAND for a “window” to the CI, e.g.:
  - providing a command interface to a program, “:cmdname”
- UDCs searched first
- command file and implied program files searched
- returns command error number and error location or file system error number.
- Msglevel controls CI errors/warnings -- similar to the HPMSGFENCE variable

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strategy

JINFO function

syntax: JINFO ("[#]S|Jnnnn", "item" [,status])
where jobID can be "[#]J|Snnn" or "0", meaning "me"

- 63 unique items: Exists, CPUSec, IPAddr, JobQ, Command, JobUserAcctGroup, JobState, StreamedBy, Waiting ...
- status parm is a variable name. If passed, CI sets status to JINFO error return -- normal CI error handling bypassed
- can see non-sensitive data for any job on system
- can see sensitive data on: "you"; on other jobs w/ same user.acct if jobsecurity is LOW; on other jobs in same acct if AM cap; on any job if SM or OP cap

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strategy

JOBCNT function

syntax: JOBCNT ("job_spec" [,joblist_var])

- "Job_Spec" can be:
  - "user.account"
  - "jobname,user.account"
  - "@J", "@S", "@"
  - "@J:[jobname,]user.acct" or "@S:[jobname,]user.acct"
  - wildcarding is supported
  - use empty jobname (",") to select jobs without jobnames
  - omit jobname to match any jobname

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strategy

PINFO function

syntax: PINFO (pin, "item" [,status])

where PIN can be a string, "[#P]nnn[.tin]", or a simple integer, "0" is "me"

- 66 unique items: Alive, IPAddr, Parent, Child, Children, Proctype, WorkGroup, SecondaryThreads, NumOpenFiles, ProgramName, etc.
- status parm is a variable name. If passed, CI sets status to PINFO error return -- normal CI error handling bypassed
- can see non-sensitive data for any user process on system
- follows SHOWPROC's rules for sensitive data