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MVS update

Special edition

In this issue

A xephon PUBLICATION

MVS Update

Published by

Xephon Inc
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Dallas, Texas 75355
USA

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Subscriptions and back-issues

A year's subscription to *MVS Update*, comprising twelve monthly issues, costs $505.00 in the USA and Canada; £340.00 in the UK; £346.00 in Europe; £352.00 in Australasia and Japan; and £350.00 elsewhere. In all cases the price includes postage. Individual issues, starting with the January 2000 issue, are available separately to subscribers for £29.00 ($43.50) each including postage.

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Code from *MVS Update*, and complete issues in Acrobat PDF format, can be downloaded from our Web site at http://www.xephon.com/mvs; you will need to supply a word from the printed issue.

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Printed in England.

A simple ISPF productivity aid

We are always looking for ways to work smarter and quicker. In this short article we offer a simple REXX program that does just that. Three of the most common activities that most of us perform under TSO are browsing a dataset, editing a dataset, and submitting a job. Our REXX program will help us perform all three of these functions. There are two other components besides the REXX program that have to be put into place to enable this: command table entries and the EDPANEL.

COMMAND TABLE ENTRIES

These are the entries that you need to make in the ISPF SITECMDS table. You must make the following entries in that table:

```
ED        2  SELECT CMD(%ED ED &ZPARM) NEWAPPL(ISR)
BR        2  SELECT CMD(%ED BR &ZPARM) NEWAPPL(ISR)
SJ        2  SELECT CMD(%ED SJ &ZPARM) NEWAPPL(ISR)
```

Note that all three entries are pointing at the same command – %ED.

EDPANEL

The second item that needs to be placed in your local ISPF panel library is the EDPANEL, which is shown below:

```
)ATTR
% TYPE(TEXT) INTENS(HIGH) ATTN(OFF) SKIP(ON)
+ TYPE(TEXT) INTENS(LOW)  ATTN(OFF) SKIP(ON)
@ TYPE(INPUT) INTENS(HIGH) CAPS(ON) PADC(_) ATTN(OFF)
! TYPE(INPUT) INTENS(LOW)  CAPS(ON) PADC(_) ATTN(OFF) COLOR(TURQ)
{ TYPE(TEXT) COLOR(WHITE) HILITE(REVERSE) INTENS(HIGH)
)BODY EXPAND($$)
%${$<< Alias Settings for ED/BR/SJ Commands >> $+$ +
%OPTION===>_ZCMD                                                +
+
+ALIAS  FULLY QUALIFIED DATASET NAME  ALIAS FULLY QUALIFIED DATASET NAME
+
@A1    !D1                          + @A18   !D18
@A2    !D2                          + @A19   !D19
@A3    !D3                          + @A2Ø   !D2Ø
@A4    !D4                          + @A21   !D21
```

```
@A5    !D5                          + @A22   !D22
@A6    !D6                          + @A23   !D23
@A7    !D7                          + @A24   !D24
@A8    !D8                          + @A25   !D25
@A9    !D9                          + @A26   !D26
@A10   !D10                         + @A27   !D27
@A11   !D11                         + @A28   !D28
@A12   !D12                         + @A29   !D29
@A13   !D13                         + @A30   !D30
@A14   !D14                         + @A31   !D31
@A15   !D15                         + @A32   !D32
@A16   !D16                         + @A33   !D33
@A17   !D17                         + @A34   !D34
+
)INIT
 .CURSOR = ZCMD
)PROC
 VPUT(A1 A2 A3 A4 A5 A6 A7 A8 A9 A10) PROFILE
 VPUT(A11 A12 A13 A14 A15 A16 A17 A18 A19 A20) PROFILE
 VPUT(A21 A22 A23 A24 A25 A26 A27 A28 A29 A30) PROFILE
 VPUT(A31 A32 A33 A34) PROFILE
 VPUT(D1 D2 D3 D4 D5 D6 D7 D8 D9 D10) PROFILE
 VPUT(D11 D12 D13 D14 D15 D16 D17 D18 D19 D20) PROFILE
 VPUT(D21 D22 D23 D24 D25 D26 D27 D28 D29 D30) PROFILE
 VPUT(D31 D32 D33 D34) PROFILE
)END
```

This is a very straightforward panel that is used to create and maintain aliases for datasets. It allows us to associate a short name with a full dataset. Typical entries might look like the following:

```
JCL  hlq.my.jcl.library
SAS  hlq.my.sas.library
```

As implemented, up to 34 entries can be created. Note that this information is saved in your ISPF profile so that it will be preserved across TSO sessions.

ED REXX PROGRAM

The last item that we need to consider is the REXX program itself. We have kept the code very simple and straightforward. If you invoke the program by entering BR, ED, or SJ without any arguments or with ? being the only argument, the EDPANEL panel will be displayed, so that you can maintain the aliases and their associated datasets. If you invoke it with only a single passed parameter, it is treated as the alias. If you invoke the program with two arguments,

the second of the two arguments is treated as the member name. Several examples are given below. Once you have all of the pieces in their respective locations, you can invoke the ED REXX program from any command line in TSO.

```
/* REXX EXEC  */
parse upper arg FUNC NAME MBR
if NAME = "?" | NAME = "" then
  "ISPEXEC DISPLAY PANEL(EDPANEL)"
else
  do
    X = 1
    do until NAME = ALIAS | X > 34
      AL = "A"||X ; DS = "D"||X ; CN = "C"||X
      "ISPEXEC VGET ("AL DS CN") PROFILE"
      ALIAS = value('AL') ; ALIAS = value(ALIAS)
      X = X + 1
    end
    if X > 34 then
      do
        ZEDSMSG = "Invalid alias - "||NAME
        ZEDLMSG = "Alias does not exist, or you have a spelling error"
        "ISPEXEC SETMSG MSG(ISRZØØ1)"
        exit
      end
    else
    DS1 = value('DS') ; DSN = value(DS1)
    CT1 = value('CN') ; CNT = value(CT1)
    if CNT = "" then
      CNT = Ø
    else
    CNT = CNT + 1
    CNT_DATA = CT1 ; interpret CNT_DATA ' = CNT'
    "ISPEXEC VPUT ("CN") PROFILE"
    code = LISTDSI(DSN)
    if code > Ø then
      do
        ZEDSMSG = "Invalid Dsn - "||NAME
        ZEDLMSG = "Dataset name associated with alias does not exist"
        "ISPEXEC SETMSG MSG(ISRZØØ1)"
        exit
      end
    if FUNC = "ED" then
      do
        if MBR = "" then
          "ISPEXEC EDIT DATASET("DSN")"
        else
          "ISPEXEC EDIT DATASET("DSN"("MBR")"
        if lastcc > Ø then "ISPEXEC SETMSG MSG(ISRZØØ2)"
      end
```

```
    if FUNC = "BR" then
      do
        "ISPEXEC BROWSE DATASET("DSN")"
        if lastcc > 0 then "ISPEXEC SETMSG MSG(ISRZ002)"
      end
    if FUNC = "SJ" then
      do
        ADDRESS "TSO"
        "SUBMIT "DSN"("MBR")"
        if lastcc > 0 then "ISPEXEC SETMSG MSG(ISRZ002)"
      end
end
exit
```

Here are some examples:

- ED – display EDPANEL
- BR ? – display EDPANEL
- ED JCL – edit the dataset associated with JCL
- BR SAS – browse the dataset associated with SAS
- SJ JCL BR14 – submit the BR14 member of the JCL dataset.

Execute program with extended parameter

PROBLEM ADDRESSED

The EXEC parameter has always been a useful and simple means of passing parameters to a program; rather than processing a file, five instructions suffice to access the EXEC parameter. In particular for compilers, there has been a dramatic increase in the number and range of parameters. However, since time immemorial (with regard to z/OS and its predecessors), the maximum length of the EXEC parameter that can be specified by JCL has remained at 100 characters. This may have been appropriate when (real) memory was literally worth its weight in gold, but nowadays this restriction is purely artificial. No robust program should have any problem in

handling an EXEC parameter of any specified length (the infamous buffer overflow problem with the associated security risks known from the Windows world underscores the problems associated with non-robust programs). Indeed, even some programs which explicitly state that they can process only parameter lists with a maximum of 100 characters, when invoked dynamically can actually process longer EXEC parameter lists (eg some COBOL compilers). A second problem concerns the somewhat abstruse rules for the continuation of a JCL EXEC PARM when commas, parentheses, and apostrophes are involved.

Some, but not all, compilers solve these problems by allowing the use of an options file that can contain additional compiler options.

EXTDPARM, the program described in this article, allows an extended EXEC parameter, specified in the SYSPARM file, to be passed to a program invoked dynamically. The name of the program to receive control is specified in the EXTDPARM EXEC parameter. This program is loaded from the current load library (STEPLIB, LOADLIB, etc). Thus, EXTDPARM can be used to invoke any program with an extended parameter provided the invoked program correctly processes its EXEC parameter.

SOLUTION

EXTDPARM dynamically invokes the program specified in the EXEC parameter with the parameter formed from the input specified by the SYSPARM file. The trailing blanks in each line of the SYSPARM file are removed. The resulting parameter list is formed by concatenating each line of the SYSPARM file; any special characters and leading blanks are passed unchanged.

Example 1:

```
ALPHA BETA
  GAMMA
    DELTA
```

produces the parameter list:

```
ALPHA BETA  GAMMA    DELTA
```

Example 2:

```
ALPHA BETA,
  'GAMMA '
    DELTA
```

produces the parameter list:

```
ALPHA BETA,  'GAMMA '    DELTA
```

Invocation:

```
//         EXEC PGM=EXTDPATM,PARM=pgmname
//STEPLIB DD DSN=loadlib,DISP=SHR
//SYSPARM DD *
parm1
parm2
...
```

DD statements are:

- pgmname – the name of the program to be invoked.
- loadlib – the name of the load library that contains EXTDPATM and pgmname. If required, additional load libraries can be concatenated.
- parm1 ... parmn – the parameters to be passed to pgmname.

Note: although SYSPARM is shown here assigned to the input stream, it can be assigned to any PS dataset that has RECFM=FB and LRECL<256 as file attributes.

Unless EXTDPATM detects a processing error – eg no program name specified (or name too long), or specified parameter too long (> 32760 characters, program constant) – it sets its completion code to that returned from the invoked program.

Error returns:

- -1 – no external program name specified or name longer than eight characters.
- -2 – parameter overflow.

EXTDPATM

```
         TITLE 'Execute Program With Extended Parameter'
```

```
**
* EXTDPATM: Execute (load) program with extended parameter    **
Invocation:
*  //        EXEC EXTDPATM,PARM=execname
*  //SYSPARM DD * (RECFM=FB,LRECL<256)
*
*  DD:SYSPARM contains the parameters to be passed to the
*  specified program. Trailing blanks are removed from each
*  line. The processed lines are concatenated together (any
*  required delimiters must be specified explicitly, eg
*  commas, leading blanks).
*
* Return:
*   Return code from the executed program
* Error returns:
*   -1: no external program name specified or name longer than
*       8 characters.
*   -2: parameter overflow
**
         PRINT NOGEN
         SPACE 1
EXTDPARM CSECT
EXTDPARM AMODE 31
EXTDPARM RMODE 24
* initialise addressing
         STM   R14,R12,12(R13)        save registers
         BASR  R12,Ø                  base register
         USING *,R12
         LA    R15,SA                 A(save-area)
         ST    R13,4(R15)             backward ptr
         ST    R15,8(R13)             forward ptr
         LR    R13,R15                A(new save-area)
         SPACE 1
         LHI   R15,-1                 preload ReturnCode register
         L     R2,Ø(R1)               pointer to parameters
         SR    R1,R1                  zeroise R1
         ICM   R1,3,Ø(R2)             length of program name
         JZ    EXIT                   no exec name (=error)
         CHI   R1,L'EXECNAME          test length
         JH    EXIT                   too long (=error)
         BCTR  R1,Ø                   LengthCode(parm)
         EX    R1,EXMOVE              store program name
         SPACE 1
         OPEN  (SYSPARM,(INPUT))      open SYSPARM file
         LTR   R15,R15                test OPEN return code
         JNZ   NOPARM                 open error -> file does not exist
         LA    R2,EXECDATA
         LR    R3,R2
         AHI   R3,DATALEN             end of exec data
         USING IHADCB,SYSPARM
```

```
READLOOP LHI   R15,-2                preload ReturnCode
         CR    R2,R3                 test for buffer overflow
         JNL   EXIT                  buffer overflow
         GET   SYSPARM,(R2)          read logical record
* remove trailing blanks
         LH    R1,DCBLRECL           logical record length
         AR    R2,R1                 address of record-end +1
TESTLOOP BCTR  R2,Ø                  decrement address pointer
         CLI   Ø(R2),C' '            test for blank
         JNE   LOOPOUT               non-blank found
         JCT   R1,TESTLOOP           test next character
* empty record
LOOPOUT  LA    R2,1(R2)              correct address pointer
         J     READLOOP              read next record
         SPACE 1
FILEEOF  DS    ØH                    EOF(DD: SYSPARM)
         S     R2,=A(EXECDATA)       length of buffer data
         STH   R2,EXECLEN            save length
         CLOSE (SYSPARM)
         SPACE 1
NOPARM   DS    ØH                    load and invoke program
         LINK  EPLOC=EXECNAME,PARAM=(CALLPARM),VL=1
         SPACE 1
EXIT     DS    ØH                    job end
         L     R13,4(R13)            restore addr. of old save-area
         RETURN (14,12),RC=(15)
         SPACE 1
EXMOVE   MVC   EXECNAME(Ø),2(R2)
         SPACE 1
* symbolic register equates
RØ       EQU   Ø
R1       EQU   1
R2       EQU   2
R3       EQU   3
R4       EQU   4
R5       EQU   5
R6       EQU   6
R7       EQU   7
R8       EQU   8
R9       EQU   9
R1Ø      EQU   1Ø
R11      EQU   11
R12      EQU   12
R13      EQU   13
R14      EQU   14
R15      EQU   15
         TITLE 'Data Areas'
         LTORG
         SPACE 1
SYSPARM  DCB   DDNAME=SYSPARM,DSORG=PS,MACRF=GM,EODAD=FILEEOF
```

```
         SPACE 1
SA       DS    18F                    register save area
         SPACE 1
EXECNAME DC    CL8' '                 program name
         SPACE
DATALEN  EQU   32760
CALLPARM DS    0H
EXECLEN  DC    H'0'
EXECDATA DS    CL(DATALEN)
         DS    CL256                  padding
         SPACE 1
         DCBD  DSORG=PS,DEVD=DA
         END
```

SAMPLE PROGRAM

```
IDENTIFICATION DIVISION.
PROGRAM-ID. COBPARM.
ENVIRONMENT DIVISION.
DATA DIVISION.
WORKING-STORAGE SECTION.
LINKAGE SECTION.
01 EXECPARM.
 02 EXECPARM-LEN PIC 9(4) BINARY.
 02 EXECPARM-DATA PIC X(32760).
PROCEDURE DIVISION USING EXECPARM.
    DISPLAY 'EXECPARM:' EXECPARM-DATA
    DISPLAY 'EXECPARM-LEN:' EXECPARM-LEN
    STOP RUN.
```

SAMPLE INVOCATION

```
//        EXEC PGM=EXTDPATM,PARM=TESTPGM
//STEPLIB DD DSN=loadlib,DISP=SHR
//SYSPARM DD *
NOADATA  ADV
 NOANALYZE  APOST
  ARITH(COMPAT) NOAWO
  BUFSIZE(8192)
```

OUTPUT

```
EXECPARM:NOADATA  ADV NOANALYZE  APOST  ARITH(COMPAT) NOAWO
BUFSIZE(8192)
EXECPARM-LEN:0065
```

System layout verification tool

For quite some time now, a typical mainframe installation environment comprises multiple CPUs with many partitions active.

The frequency with which the core software needs to be maintained imposes a precise operating system design that needs to clearly reflect the division between 'target', 'distribution', and 'operational' dataset types.

Generally speaking, a 'target' or 'distribution' dataset is one that has a 'DDDEF' definition in its respective SMP/E zone, whereas 'operational' datasets are all those that contain the customizations of a particular product or feature.

Moreover, the contents of the 'target' and 'distribution' datasets may change completely with every upgrade of the operating system, whereas the 'operational' datasets would have minimal updates if any, and so are maintained intact with each and every release of the core software.

This differentiation of datasets isn't merely academic, but rather becomes almost obligatory if one intends to have an operating system and base software that must be easy to upgrade and maintain.

The fundamental characteristics of this software design are effectively summed up in the following technical documents:

- *OS/390 Maintenance Philosophy – An IBM View.*
- *SHARE SUMMER 2000 Technical Conference Session 2825, 26 July 2000.*

Even the Serverpac dialogs push the systems programmer to dedicate the RESVOL volumes only to the 'target' datasets, while the SMP/E and 'distribution' datasets have separate volumes.

It is desirable that those 'operational' datasets that define the 'image customization set' get allocated on a different volume from the ones that go to a new ServerPac or CBPDO – in this case, one is often advised to take advantage of indirect cataloguing through the use of

the system symbols that are defined in the member of SYS1.PARMLIB(IEASYM*xx*).

Each one of us is full of good intentions, but in the end even in a job well done the odd error can slip through and in time create problems.

To this end I have written EXAMSYS, a batch utility that will examine (one volume at a time) all those volumes intended for the operating system.

The end result for each selected volume is a printout listing every file, clearly pointing out the relating SMP/E zone, the type of cataloguing used as well as the correct type to be used, and also the quantity of 'operational' datasets on that volume.

Having read through the report, one ultimately understands whether or not that particular volume has been correctly assigned and if any datasets have been allocated on the wrong logical volume.

To do all this I have used the standard IBM utilities as well as a few lines of code using the REXX language.

Everything can be easily modified, should one so desire, including the structure of the final printout (see Step/JCL with ICETOOL).

EXAMDSN REXX SAMPLE

```
/* REXX ---------------------------------- */
/* REXX RECORD MANIPULATION OF PRINTOUT FILE */
/* REXX ---------------------------------- */
  TRACE OFF
  " PROF NOPREF "
   WK_FILEV  = 'START'
   WK_FILED  = 'START'
   WK_RCD = Ø
   WK_RCV = Ø
  "EXECIO Ø DISKR FILED (OPEN"
  "EXECIO Ø DISKR FILEV (OPEN"
  "EXECIO Ø DISKW FILEP (OPEN"
/* - EMPTY FILE ------------------------- */
  IF WK_FILED = 'START' THEN DO
      "EXECIO 1 DISKR FILED "
       WK_RCD = RC
           IF WK_RCD > Ø THEN EXIT(98)
       PULL WK_FILED
                           END
```

```
  IF WK_FILEV = 'START' THEN DO
      "EXECIO 1 DISKR FILEV "
       WK_RCV = RC
           IF WK_RCV > Ø THEN EXIT(99)
       PULL WK_FILEV
                               END
/* - EMPTY FILE ------------------------- */

     DO FOREVER

       SELECT

    WHEN WK_RCD > Ø
       THEN    DO
       CALL PROC_PRINT
      "EXECIO 1 DISKR FILEV "
       WK_RCV = RC
           IF WK_RCV > Ø THEN LEAVE
       PULL WK_FILEV
               END

    WHEN SUBSTR(WK_FILEV,Ø2,44) = SUBSTR(WK_FILED,3Ø,44)
       THEN    DO
        CALL PROC_PRINT
       "EXECIO 1 DISKR FILED "
        WK_RCD = RC
        PULL WK_FILED
       "EXECIO 1 DISKR FILEV "
        WK_RCV = RC
           IF WK_RCV > Ø THEN LEAVE
        PULL WK_FILEV
               END

    WHEN SUBSTR(WK_FILEV,Ø2,44) > SUBSTR(WK_FILED,3Ø,44)
       THEN    DO
      "EXECIO 1 DISKR FILED "
       WK_RCD = RC
       PULL WK_FILED
               END

    WHEN SUBSTR(WK_FILEV,Ø2,44) < SUBSTR(WK_FILED,3Ø,44)
       THEN    DO
       CALL PROC_PRINT
      "EXECIO 1 DISKR FILEV "
       WK_RCV = RC
           IF WK_RCV > Ø THEN LEAVE
       PULL WK_FILEV
               END

       OTHERWISE NOP
       END
```

```
     END

/* ------------------------------------ */
   "EXECIO Ø DISKR FILEV (FINIS"
   "EXECIO Ø DISKR FILED (FINIS"
   "EXECIO Ø DISKW FILEP (FINIS"

    EXIT(ØØ)

/* INTERNAL ROUTINE ---------------------- */
  PROC_PRINT:

    SELECT
    WHEN INDEX(WK_FILEV,'.VTOCIX.')   <> Ø THEN RETURN
    WHEN INDEX(WK_FILEV,'.VVDS.')     <> Ø THEN RETURN
    WHEN INDEX(WK_FILEV,'.DATA ')     <> Ø THEN RETURN
    WHEN INDEX(WK_FILEV,'.INDEX ')    <> Ø THEN RETURN
    WHEN INDEX(WK_FILEV,'.CATINDEX ') <> Ø THEN RETURN
    OTHERWISE NOP
    END

/* ------------------------------------ */
    WK_DSNP =  SUBSTR(WK_FILEV,Ø2,44)
    WK_ZON  =  'OPERATIONAL    '
    WK_DRC  =  ' NO  '
    WK_CAT  =  ' NO  '
    WK_FLG  =  '<<'
    WK_DDN  =  '        '

/* ------------------------------------ */
             LL = OUTTRAP(LINE.)
    "LISTC ENT("WK_DSNP") VOL"
    IF RC = Ø THEN DO
         WK_CAT = ' YES '
         I = 4
         DO UNTIL I = 9
           IF INDEX(LINE.I,"DEVTYPE------X'ØØØØØØØØ'") > Ø
           THEN WK_DRC = ' YES '
         I = I + 1
         END
                   END

    LL = OUTTRAP(OFF)

/* ------------------------------------ */
    SELECT
      WHEN  WK_RCD > Ø THEN NOP
      WHEN  SUBSTR(WK_FILEV,Ø2,44) = SUBSTR(WK_FILED,3Ø,44)
         THEN DO
              WK_ZON =  SUBSTR(WK_FILED,1Ø1,15)
              WK_DDN =  SUBSTR(WK_FILED,Ø2,Ø8)
```

```
              END
      OTHERWISE NOP
    END

/* ------------------------------------ */
    WK_FILEP = WK_DSNP WK_DDN WK_ZON WK_DRC WK_CAT WK_FLG
    PUSH WK_FILEP
   "EXECIO 1 DISKW FILEP "

/* ------------------------------------ */
    RETURN
```

EXAMOUT REXX SAMPLE

```
/* REXX ---------------------------------- */
/* REXX RECORD MANIPULATION OF OUTPUT FILE */
/* REXX ---------------------------------- */
  TRACE OFF
   WK_EMPTY = 'NOK'
   WK_ZONE  = ''
  "EXECIO Ø DISKR INPØØØ (OPEN"
  "EXECIO Ø DISKW SORTIN (OPEN"
/* ------------------------------------ */
  READØØ:

  DO FOREVER
   "EXECIO 1 DISKR INPØØØ "
    WK_RC = RC
    IF WK_RC > Ø THEN LEAVE

      PULL MY_INPØØØ

       IF INDEX(MY_INPØØØ,'DDDEF ENTRIES') = Ø
            THEN    DO
              WK_SORTIN = SUBSTR(MY_INPØØØ,Ø1,1ØØ)WK_ZONE
              PUSH WK_SORTIN
             "EXECIO 1 DISKW SORTIN "
                    END
            ELSE    DO
              WK_EMPTY = 'OK'
              WK_ZONE  =  SUBSTR(MY_INPØØØ,Ø2,Ø7)
                    END
  END

  ENDØØ:

  "EXECIO Ø DISKR INPØØØ (FINIS"
  "EXECIO Ø DISKW SORTIN (FINIS"
/* ------------------------------------ */
```

```
   IF WK_EMPTY = 'NOK' THEN EXIT(2Ø)
/* ------------------------------------ */
   IF WK_RC  <> 2      THEN EXIT(5Ø)
/* ------------------------------------ */
   ADDRESS  "LINKMVS" "ICEMAN"
   IF RC     <> Ø      THEN EXIT(4Ø)
/* ------------------------------------ */
  "EXECIO Ø DISKW WORKEND (OPEN"
  "EXECIO Ø DISKR SORTOUT (OPEN"
   WK_REC1 = '$$.START.$$'
   WK_REC2 = ''

   DO FOREVER
      SELECT
   WHEN WK_REC1 = '$$.END.$$'
       THEN  LEAVE

   WHEN WK_REC1 = '$$.START.$$'
       THEN CALL READ_ALL

   WHEN SUBSTR(WK_REC1,2,44) = SUBSTR(WK_REC2,2,44)
       THEN DO
       WK_ZON1   = SUBSTR(WK_REC1,1Ø1,7)
       WK_ZON2   = SUBSTR(WK_REC2,1Ø1,7)
       WK_WORKEND = SUBSTR(WK_REC1,Ø1,Ø99) WK_ZON1 WK_ZON2
       PUSH WK_WORKEND
       "EXECIO 1 DISKW WORKEND "
       CALL READ_ALL
            END

   WHEN SUBSTR(WK_REC1,2,44) <> SUBSTR(WK_REC2,2,44)
       THEN DO
       WK_WORKEND = WK_REC1
       PUSH WK_WORKEND
       "EXECIO 1 DISKW WORKEND "
       WK_REC1 = WK_REC2
       CALL READ_ONE
            END
   OTHERWISE NOP
      END
   END

  "EXECIO Ø DISKR SORTOUT (FINIS"
  "EXECIO Ø DISKW WORKEND (FINIS"
   EXIT(ØØ)

/* INTERNAL ROUTINE ---------------------- */
  READ_ALL:
  "EXECIO 1 DISKR SORTOUT"
     IF RC > Ø THEN WK_REC1 = '$$.END.$$'
```

```
        ELSE  PULL WK_REC1

  READ_ONE:
  IF WK_REC1 = '$$.END.$$' THEN RETURN

  "EXECIO 1 DISKR SORTOUT"
     IF RC > Ø THEN WK_REC2 = '$$.END.$$'
        ELSE  PULL WK_REC2

   RETURN
```

SAMPLE JCL TO RUN EXAMSYS

```
//......  JOB ......,......,CLASS=.,MSGCLASS=.,REGION=ØM,COND=(Ø,GT)
//** ------------------------------------------------------- **
//** BEFORE SUBMITTING THE JOB:                              **
//** > IN ST1ØØ INDICATE:                                    **
//**   . THE CORRECT CSI  NAME  ON THE 'SMPCSI'  DD CARD;    **
//**   . THE CORRECT ZONE NAMES ON THE 'SMPCNTL' DD CARD.    **
//** > IN ST4ØØ INDICATE:                                    **
//**   . THE NAME OF THE VOLUME TO BE EXAMINED IN 'SYSIN' CARD.**
//**   . THE CORRECT VOL=SER ON THE 'DISKØØ' DD CARD.        **
//** ------------------------------------------------------- **
//ST1ØØ    EXEC PGM=GIMSMP
//SMPCSI   DD   DISP=SHR,DSN='your_.GLOBAL.CSI'
//SMPLIST  DD   DSN=&&SMPLIST,DISP=(MOD,PASS),UNIT=VIO,
//   SPACE=(CYL,3),DCB=(LRECL=121,BLKSIZE=726Ø,RECFM=FBA)
//SYSOUT   DD   SYSOUT=*
//SMPLOG   DD   DUMMY
//SMPLOGA  DD   DUMMY
//SMPRPT   DD   DUMMY
//SMPOUT   DD   DUMMY
//SMPCNTL  DD   *
  SET BOUNDARY(GLOBAL).
      LIST DDDEF.
  SET BOUNDARY(your_target_zone).
      LIST DDDEF.
  SET BOUNDARY(your_distribution_zone).
      LIST DDDEF.
/*
//** ------------------------------------------------------- **
//ST2ØØ    EXEC PGM=ICEMAN
//SORTIN   DD   DSN=&&SMPLIST,DISP=(OLD,PASS)
//SORTOUT  DD   DSN=&&DDDEF1,DISP=(,PASS),UNIT=VIO,
//   SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//SYSOUT   DD   DUMMY
//SYSIN    DD   *
 SORT FIELDS=COPY
 INCLUDE COND=(12,17,CH,EQ,C'DATASET         =',                    *
```

```
           OR,1Ø,13,CH,EQ,C'DDDEF ENTRIES')
/*
//** --EXEC REXX - EXAMOUT -------------------------------- **
//ST3ØØ    EXEC PGM=IKJEFTØ1,PARM='%EXAMOUT'
//INPØØØ   DD   DSN=&&DDDEF1,DISP=(OLD,PASS)
//SORTIN   DD   DSN=&&DDDEF2,DISP=(,PASS),UNIT=VIO,
//  SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//SORTOUT  DD   DSN=&&DDDEF3,DISP=(,PASS),UNIT=VIO,
//  SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//WORKEND  DD   DSN=&&DDDEND,DISP=(,PASS),UNIT=VIO,
//  SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//SYSPROC  DD   DISP=SHR,DSN=your_sysproc
//SYSPRINT DD   SYSOUT=*
//SYSTSPRT DD   SYSOUT=*
//SYSOUT   DD   DUMMY
//SYSTSIN  DD   DUMMY
//SYSIN  DD *
  SORT FIELDS=(3Ø,44,CH,A)
/*
//** ------------------------------------------------------ **
//ST4ØØ    EXEC PGM=IEHLIST
//SYSPRINT DD   DSN=&&VTOCL,DISP=(,PASS),UNIT=VIO,
//   SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//DISKØØ   DD   UNIT=339Ø,VOL=SER=your_volser,DISP=SHR
//SYSIN    DD *
 LISTVTOC  VOL=339Ø=your_volser
/*
//** ------------------------------------------------------ **
//ST5ØØ    EXEC PGM=ICEMAN
//SORTIN   DD   DSN=&&VTOCL,DISP=(OLD,PASS)
//SORTOUT  DD   DSN=&&VTOCP,DISP=(,PASS),UNIT=VIO,
//  SPACE=(CYL,3),DCB=*.ST1ØØ.SMPLIST
//SYSOUT   DD   DUMMY
//SYSIN    DD   *
 SORT FIELDS=COPY
 OMIT    COND=(Ø2,Ø6,CH,EQ,C'DATE: ',                          *
           OR,Ø3,1Ø,CH,EQ,C'THERE ARE ',                       *
           OR,Ø5,12,CH,EQ,C'THERE IS A  ',                     *
           OR,Ø5,13,CH,EQ,C'DATA SETS ARE',                    *
           OR,15,17,CH,EQ,C'--DATA SET NAME--',                *
           OR,18,24,CH,EQ,C'CONTENTS OF VTOC ON VOL ',         *
           OR,32,25,CH,EQ,C'SYSTEMS SUPPORT UTILITIES')
/*
//** --EXEC REXX - EXAMDSN -------------------------------- **
//ST6ØØ    EXEC PGM=IKJEFTØ1,PARM='%EXAMDSN'
//FILEV    DD   DSN=&&VTOCP,DISP=(OLD,PASS)
//FILED    DD   DSN=&&DDDEND,DISP=(OLD,PASS)
//FILEP    DD   DSN=&&OUTPØ,DISP=(,PASS),UNIT=VIO,
//  SPACE=(CYL,3),DCB=(LRECL=9Ø,BLKSIZE=6Ø3Ø,RECFM=FB)
//SYSPRINT DD   DUMMY
```

```
//SYSTSPRT DD   DUMMY
//SYSPROC  DD   DISP=SHR,DSN=*.ST3Ø0.SYSPROC
//SYSTSIN  DD   DUMMY
//** ------------------------------------------------------ **
//ST7ØØ    EXEC PGM=ICETOOL
//TOOLMSG  DD   DUMMY
//DFSMSG   DD   DUMMY
//IN1      DD   DISP=(OLD,PASS),DSN=&&OUTPØ
//REPORT   DD   SYSOUT=*
//TOOLIN   DD *
 DISPLAY FROM(IN1) LIST(REPORT) DATE  TIME PAGE        -
       TITLE('         SYSTEM DESIGN CHECK         ')  -
      HEADER('DATASET NAME ')    ON(Ø1,44,CH)          -
      HEADER(' SMP/E DDDEF ')    ON(45,Ø8,CH)          -
      HEADER(' SMP/E ZONES ')    ON(54,16,CH)          -
      HEADER('INDIRECT/CAT ')    ON(7Ø,Ø5,CH)          -
      HEADER(' CATALOGUED ')     ON(76,Ø5,CH)          -
      BLANK   LINES(63)
/*
```

PRINTOUT RESULT

```
Ø1/28/Ø3        13:39:23        - 1 -                SYSTEM DESIGN CHECK

 DATASET NAME       SMP/E DDDEF  SMP/E ZONES   INDIRECT/CAT   CATALOGUED
 ---------------    ----------- ----------    ------------   ----------

 AOP.SAOPEXEC       SAOPEXE      TARGET_zone   YES             YES
 AOP.SAOPMENU       SAOPMEN      TARGET_zone   YES             YES
 AOP.SAOPPENU       SAOPPEN      TARGET_zone   YES             YES
 ..............................................................
 GLD.SGLDLNK.COPY                 OPERATIONAL  NO              NO
 GSK.SGSKLOAD       SGSKLOA      TARGET_zone   YES             YES
 ICA.SICALMOD       SICALMO      TARGET_zone   YES             YES
 ..............................................................
 IOE.SIOEPROC       SIOEPRO      TARGET_zone   YES             YES
 ISF.SISFEXEC       SISFEXE      TARGET_zone   YES             YES
 ISF.SISFLINK       SISFLIN      TARGET_zone   YES             YES
 ISF.SISFLOAD       SISFLOA      TARGET_zone   YES             YES
 ..............................................................
 SYS1.ADGTPLIB      ADGTPLI      DISTRIBUTION_zone    NO       YES
 SYS1.AERBPWSV      AERBPWS      DISTRIBUTION_zone    YES      YES
 SYS1.PARMLIB                    OPERATIONAL          NO       YES
 ..............................................................
 SYS1.VTAMLST                    OPERATIONAL   YES             YES
 TCPIP.SEZACMTX     SEZACMT      TARGET_zone   YES             YES
 ..............................................................
```

Comparing two files

The following program was written to check whether two files have identical contents. The files being compared can be KSDS, RRDS, ESDS, or non-VSAM. The files have DDnames INFILE1 and INFILE2. Each record is compared with the same record of the other file. If one of the records is shorter than the other, the shorter record is padded with the character indicated by variable PADCHAR within the program (space by default), and the rules of the CLCL (compare logical long) instruction apply. This is useful, for example, if you want to compare an ordinary 80-byte sequential file, but where only the first 50 bytes are meaningful and the remaining are spaces, with a 50-byte VSAM file.

If an unequal record is found, the program sends out a message to SYSPRINT, indicating that record number, and continues the comparison. If a predefined number of unequal records is attained (as defined by variable DIFLIMIT), the program terminates. Otherwise, the program continues until it reaches the end of both files. If one of the files ends first, the program continues to read the other up to its end, but without performing any more comparisons, in order to find out how many records each file has. In the end, it sends a message with that information.

You can also compare just part of each record. For example, you have code in the first file which is 10 bytes long and occurs at offset 23, and you want to know if it matches the second file, where that code occurs at offset 175. For this, pass a parameter to the program, with two pairs of length-offset values, with each value separated by commas. The first pair relates to INFILE1 and the second pair to INFILE2:

```
//STEP1  EXEC PGM=VCOMPARE,PARM='1Ø,23,1Ø,175'
//INFILE1  DD DISP=SHR,DSN=first.file
//INFILE2  DD DISP=SHR,DSN=second.file
//SYSPRINT DD SYSOUT=*
```

This way, only the specified bytes are compared, and the rest of each record is ignored.

If no parameter is given, the entire records are compared, as initially explained. Parameters are positional, and can be partially omitted. For example, if you just want to compare the first 25 bytes of each record (that means, with the default offset zero), you can code either of these:

```
//EXEC PGM=VCOMPARE,PARM='25,Ø,25,Ø'
//EXEC PGM=VCOMPARE,PARM='25,,25'
```

This also is applicable if, as in the first example, you just want to compare the first 50 bytes of the sequential file against the entire 50-byte VSAM. Since this last value is the default, because it is the VSAM record length, you can omit it, and just specify the length for the first file:

```
//EXEC PGM=VCOMPARE,PARM='5Ø'
```

which, in this particular case, would be identical to:

```
//EXEC PGM=VCOMPARE,PARM='5Ø,Ø,5Ø,Ø'
//EXEC PGM=VCOMPARE,PARM='5Ø,,5Ø'
```

This way, the remaining 30 bytes of the seqential file would be ignored, and only the first 50 bytes would be considered.

VCOMPARE SOURCE CODE

```
*=================================================================*
*                                                                 *
* VCOMPARE - Compare two files. The files can be VSAM, sequential,  *
* or both, with fixed or variable length.                         *
* Files are assigned to DDnames INFILE1 and INFILE2.              *
* Records are compared in a parallel fashion. If two records do not  *
* have the same length, the smaller is considered to be padded with  *
* the character stored in variable PADCHAR (space by default).    *
* If inequal records are found, the program prints a message with   *
* the record number and increments a counter. If a certain number of *
* unequal records is attained, the program terminates.            *
* That number is set in variable DIFLIMIT.                        *
*                                                                 *
* The program also states how many records each file has. If a file  *
* ends sooner than the other, the program continues to read the     *
* longer file until it ends, to determine the number of records, but *
* no more comparisons take place.                                 *
*                                                                 *
* Records can be compared totally or in part. For partial comparison *
* specify a length-offset pair for each file, with each value     *
```

```
* separated by commas. Values are positional. If a value is not      *
* specified, the defaults are assumed (the full length of each       *
* record from offset zero). The first pair of values concerns file1  *
* and the second pair concerns file2.                                 *
*                                                                     *
*=====================================================================*
&PROGRAM SETC  'VCOMPARE'
&PROGRAM AMODE 31
&PROGRAM RMODE 24
&PROGRAM CSECT
         SAVE  (14,12)
         LR    R12,R15
         USING &PROGRAM,R12
         ST    R13,SAVEA+4
         LA    R11,SAVEA
         ST    R11,8(R13)
         LR    R13,R11
         B     GETPARMS
         DC    CL16' &PROGRAM 2.1'
         DC    CL8'&SYSDATE'
*
*=====================================================================*
* Separate input parameter into its components, convert them to
* binary form, and store them in fields PARM1 thru PARM4. If any of
* the parms does not exist, those fields will remain with low-values.
* For each parm specified, set the corresponding flag field to 1, in
* order to allow CLI comparisons later on.
*=====================================================================*
*
GETPARMS DS    ØH
         LR    R2,R1               Copy parameter pointer to R2.
         L     R2,Ø(Ø,R2)          Load parm address
         LH    R3,Ø(R2)            Load parm length in R3
         LTR   R3,R3               Any parm entered?
         BZ    OPENPRT             No
*
         LR    R6,R2
         AR    R6,R3               R6: point after end of parms
         LA    R6,2(Ø,R6)          Skip 2 bytes of parmlength
         LA    R2,2(Ø,R2)          Skip 2 bytes of parmlength
         LR    R4,R2               R4: Current char to ckeck
         LA    R11,PARM1           Area to keep parms in binary form
         XR    R9,R9               Clear length counter
*
LOOPARMS EQU   *
         CR    R4,R6               End of all parms?
         BNL   CONVERT             Yes, go convert the last one
         CLI   Ø(R4),C','          Comma found?
         BE    CONVERT             Yes, go convert parm
         LA    R9,1(Ø,R9)          Increment index (char counter)
```

```
         LA    R4,1(Ø,R4)          Increment pointer (current char)
         B     LOOPARMS            And continue
*
CONVERT  EQU   *
         LTR   R9,R9               Any chars in current parm?
         BZ    CONVERT2            No, skip pack and cvb instructions
         S     R9,=F'1'            Sub one for ex
         EX    R9,PACKEX           Execute pack
         LA    R9,1(Ø,R9)          Increment again
         CVB   R7,PARMPACK         Convert to binary into R7
         ST    R7,Ø(R11)           And store it in R11 (Parm1 to 4)
*
CONVERT2 EQU   *
         CR    R4,R6               End of all parms?
         BNL   SETFLAG1            Yes, move ahead
         AR    R2,R9               Add length to base pointer
         LA    R2,1(Ø,R2)          And skip comma
         XR    R9,R9               Reset length
         LR    R4,R2               R4: Current char
         LA    R11,4(Ø,R11)        Point next binary parm storarea
         B     LOOPARMS
*
SETFLAG1 CLC   PARM1,=F'Ø'         Parm1 specified?
         BE    SETFLAG2            No, try next
         MVI   P1FLAG,C'1'         Yes, set flag to 1
SETFLAG2 CLC   PARM2,=F'Ø'         Same for others
         BE    SETFLAG3
         MVI   P2FLAG,C'1'
SETFLAG3 CLC   PARM3,=F'Ø'
         BE    SETFLAG4
         MVI   P3FLAG,C'1'
SETFLAG4 CLC   PARM4,=F'Ø'
         BE    OPENPRT
         MVI   P4FLAG,C'1'
*
*====================================================================*
* Check what kind of files we have and try to open them.
* First attempt is to open as VSAM. If Error, assume non-VSAM file.
* If VSAM, test ACB for ESDS. If ESDS, modify RPL accordingly.
*====================================================================*
*
OPENPRT  DS    ØF                  Open sysprint
         OPEN  (SYSPRINT,OUTPUT)   for displaying messages
*
OPENACB1 EQU   *                   Open ACB for VSAM file
         OPEN  INFILEA1            If error, go open DCB for seq file
         LTR   R15,R15
         BNZ   OPENDCB1
         TESTCB ACB=INFILEA1,                                      X
               ATRB=ESDS           Check if VSAM ESDS
```

```
         BNE   OPENACB2            No, go open second file
*
ESDSFIL1 EQU   *
         MODCB RPL=INFILER1,                                          X
               OPTCD=ADR           Modify RPL for ESDS
         B     OPENACB2
*
OPENDCB1 EQU   *                   Open DCB (sequential file)
         OPEN  (INFILED1,INPUT)
         LTR   R15,R15
         BNZ   ERRMSG2
*
         MVI   FILETYP1,C'S'       Set flag sequential type (nonVSAM)
         LA    R2,INFILED1         Address IHADCB of input file1
         USING IHADCB,R2
         TM    DCBRECFM,DCBBIT1    Is recfm V or U (B'x1xxxxxx)
         BNO   OPENACB2            No, jump ahead
         MVI   FILEVAR1,C'U'       set recfm undefined
         TM    DCBRECFM,DCBBITØ    Is recfm U (B'11xxxxxx)
         BO    OPENACB2            Yes, jump ahead
         MVI   FILEVAR1,C'V'       set recfm variable
*
*
OPENACB2 EQU   *                   Open ACB for VSAM file
         OPEN  INFILEA2            If error, go open DCB for seq file
         LTR   R15,R15
         BNZ   OPENDCB2
         TESTCB ACB=INFILEA2,                                         X
               ATRB=ESDS           Check if VSAM ESDS
         BNE   READFILS            No, jump ahead
*
ESDSFIL2 EQU   *
         MODCB RPL=INFILER2,                                          X
               OPTCD=ADR           Modify RPL for ESDS
         B     READFILS
*
OPENDCB2 EQU   *                   Open DCB (sequential file)
         OPEN  (INFILED2,INPUT)
         LTR   R15,R15
         BNZ   ERRMSG2
*
         MVI   FILETYP2,C'S'       Set flag sequential type (nonVSAM)
         LA    R11,INFILED2        Address IHADCB of input file2
         DROP  R2
         USING IHADCB,R11
         TM    DCBRECFM,DCBBIT1    Is recfm V or U (B'x1xxxxxx)
         BNO   READFILS            No, jump ahead
         MVI   FILEVAR2,C'U'       set recfm undefined
         TM    DCBRECFM,DCBBITØ    Is recfm U (B'11xxxxxx)
         BO    READFILS            Yes, jump ahead
```

```
         MVI   FILEVAR2,C'V'       set recfm variable
*
*====================================================================*
* Now enter a loop where we read a pair of records and compare them
* If they are equal, continue reading another pair.
* If they are different, print a message with the record number within
* the file and continue. If the maximum limit of different records
* is attained, terminate the program.
*====================================================================*
*
READFILS EQU   *
         XR    R8,R8               Record count for file1
         XR    R9,R9               Record count for file2
READ1    EQU   *
         CLI   ENDF1,C'F'          End of file1 already happened?
         BE    READ2               Yes, just read file2
         LA    R8,1(Ø,R8)          Increment file1 record counter
         CLI   FILETYP1,C'V'
         BNE   READSEQ1
*
READVSA1 EQU   *
         GET   RPL=INFILER1        Read VSAM file
         LTR   R15,R15             End of file?
         BNZ   ENDFILE1
         L     R4,VAREA1           Get address of data in R4.
         SHOWCB RPL=INFILER1,                                        X
               AREA=LRECL1,                                          X
               LENGTH=4,                                             X
               FIELDS=RECLEN
         L     R5,LRECL1           Get record length in R5
         B     READ2
*
READSEQ1 EQU   *
         DROP  R11
         USING IHADCB,R2
         GET   INFILED1            Read sequential (locate method)
         LR    R4,R1               copy address of data to R4.
         LH    R5,DCBLRECL         Load R5 with record length.
         CLI   FILEVAR1,C'V'       Is recfm variable?
         BNZ   READ2               No, jump ahead.
         LA    R4,4(Ø,R4)          Yes, skip 4 bytes of RDW
         SH    R5,=H'4'            And reduce record length.
*
READ2    EQU   *
         CLI   ENDF2,C'F'          End of file2 already happened?
         BE    READ1               Yes, just read file1
         LA    R9,1(Ø,R9)          Increment file2 record counter
         CLI   FILETYP2,C'V'
         BNE   READSEQ2
*
```

```
READVSA2 EQU   *
         GET   RPL=INFILER2        Read VSAM file
         LTR   R15,R15             End of file?
         BNZ   ENDFILE2
         L     R6,VAREA2           Get address of data in R6
         SHOWCB RPL=INFILER2,                                          X
               AREA=LRECL2,                                            X
               LENGTH=4,                                               X
               FIELDS=RECLEN
         L     R7,LRECL2           Get record length in R7
         B     COMPARE
*
READSEQ2 EQU   *
         DROP  R2
         USING IHADCB,R11
         GET   INFILED2            Read sequential (locate method)
         LR    R6,R1               copy address of data to R6.
         LH    R7,DCBLRECL         Load R7 with record length.
         CLI   FILEVAR2,C'V'       Is recfm variable?
         BNZ   COMPARE             No, jump ahead.
         LA    R6,4(Ø,R6)          Yes, skip 4 bytes of RDW
         SH    R7,=H'4'            And reduce record length.
*
COMPARE  EQU   *
         CLI   ENDF1,C'F'          If any of the files already ended,
         BE    READ2               no comparison is necessary.
         CLI   ENDF2,C'F'          Just continue to read the other
         BE    READ1               until it ends also.
*
ASKFLAG1 CLI   P1FLAG,C'Ø'         If parm1 (length) not zero,
         BE    ASKFLAG2            assume parm1 length for file1
         L     R5,PARM1
ASKFLAG2 CLI   P2FLAG,C'Ø'         If parm2 (offset) not zero,
         BE    ASKFLAG3            add it to the record pointer
         A     R4,PARM2
ASKFLAG3 CLI   P3FLAG,C'Ø'         Same for file 2 parms.
         BE    ASKFLAG4
         L     R7,PARM3
ASKFLAG4 CLI   P4FLAG,C'Ø'
         BE    ASKNOMOR
         A     R6,PARM4
ASKNOMOR ICM   R7,B'1ØØØ',PADCHAR  Insert padchar in R7
*
COMPLOOP EQU   *
         CLCL  R4,R6               Compare strings
         BZ    READ1               Strings are equal
         BL    DIFERENT            Strings are different
         BH    DIFERENT            Strings are different
         B     COMPLOOP            Equal so far, continue
*
DIFERENT EQU   *
```

```
         XR    RØ,RØ
         AH    RØ,DIFCOUNT         Increment different record counter
         AH    RØ,=H'1'
         STH   RØ,DIFCOUNT
         CH    R8,DIFLIMIT         Different limit attained?
         BE    EXIT2               Yes, exit
         LR    RØ,R8               Prepare different recnum
         BAL   R1Ø,UNPACK          for display
         MVC   DIFNUM,OUT1Ø
         PUT   SYSPRINT,DIFMSG     Send message
         B     READ1               And continue with next record
*
ENDFILE1 EQU   *
         S     R8,=F'1'
         LR    RØ,R8               Prepare number of records
         BAL   R1Ø,UNPACK          for display
         MVC   ENDNUM1,OUT1Ø
         PUT   SYSPRINT,ENDMSG1    Send message
         MVI   ENDF1,C'F'
         CLI   ENDF2,C'F'
         BE    EXITØ
         B     READ2
*
ENDFILE2 EQU   *
         S     R9,=F'1'
         LR    RØ,R9
         BAL   R1Ø,UNPACK
         MVC   ENDNUM2,OUT1Ø
         PUT   SYSPRINT,ENDMSG2
         MVI   ENDF2,C'F'
         CLI   ENDF1,C'F'
         BE    EXITØ
         B     READ1
*
*=====================================================================*
*          Close files and exit
*=====================================================================*
*
EXITØ    EQU   *
         CLC   DIFCOUNT,=H'Ø'
         BNE   EXIT1
         PUT   SYSPRINT,NODIFMSG
         B     EXIT1
*
EXIT2    EQU   *
         PUT   SYSPRINT,LIMITMSG
*
EXIT1    EQU   *
         CLOSE INFILED1
         CLOSE INFILED2
         CLOSE INFILEA1
```

```
         CLOSE INFILEA2
         CLOSE SYSPRINT
         L     R13,SAVEA+4
         LM    R14,R12,12(R13)
         XR    R15,R15
         BR    R14
*
*=====================================================================*
*        Subroutines and work areas
*=====================================================================*
*
UNPACK   EQU   *                   Binary to display:
         CVD   RØ,REGDECIM         Convert binary to packed decimal
         UNPK  OUT12,REGDECIM      and unpack
         BR    R1Ø                 Return
*
ERRMSG1  EQU   *
         PUT   SYSPRINT,=CL8Ø'>>> Error opening input file INFILE1'
         B     EXIT1
ERRMSG2  EQU   *
         PUT   SYSPRINT,=CL8Ø'>>> Error opening input file INFILE2'
         B     EXIT1
*
INFILEA1 ACB   DDNAME=INFILE1       VSAM ACB
INFILER1 RPL   ACB=INFILEA1,        VSAM RPL                          X
               OPTCD=LOC,           Locate method                     X
               AREA=VAREA1,         Record buffer address             X
               ARG=CHAVE1           Only needed for rrds
*
INFILED1 DCB   DSORG=PS,MACRF=(GL), For sequential files              X
               EODAD=ENDFILE1,                                        X
               DDNAME=INFILE1
*
INFILEA2 ACB   DDNAME=INFILE2       VSAM ACB
INFILER2 RPL   ACB=INFILEA2,        VSAM RPL                          X
               OPTCD=LOC,           Locate method                     X
               AREA=VAREA2,         Record buffer address             X
               ARG=CHAVE2           Only needed for rrds
*
INFILED2 DCB   DSORG=PS,MACRF=(GL), For sequential files              X
               EODAD=ENDFILE2,                                        X
               DDNAME=INFILE2
*
SYSPRINT DCB   DSORG=PS,MACRF=(PM),                                   X
               LRECL=8Ø,                                              X
               DDNAME=SYSPRINT
*
         LTORG
SAVEA    DS    18F
VAREA1   DS    F                    Address of record buffer (VSAM)
CHAVE1   DS    F                    Record key (rrds - VSAM)
```

```
LRECL1   DS    F                    Record length (VSAM)
VAREA2   DS    F                    Address of record buffer (VSAM)
CHAVE2   DS    F                    Record key (rrds - VSAM)
LRECL2   DS    F                    Record length (VSAM)
FILETYP1 DC    C'V'                 Flag preset for VSAM
FILETYP2 DC    C'V'                 Flag preset for VSAM
FILEVAR1 DC    C'F'                 Flag preset to recfm F (if nonVSAM)
FILEVAR2 DC    C'F'                 Flag preset to recfm F (if nonVSAM)
ENDF1    DC    C' '                 Flag for end of file 1
ENDF2    DC    C' '                 Flag for end of file 2
PADCHAR  DC    C' '                 Fill char for different reclen
DIFLIMIT DC    H'2Ø'                Max different records
DIFCOUNT DC    H'Ø'                 Different record count area
*
PACKEX   PACK  PARMPACK,Ø(Ø,R2)     Pack from input parm to parmpack
PARMPACK DS   D                     Pack and convert to binary areas
PARM1    DC   F'Ø'                  for input parameters
PARM2    DC   F'Ø'
PARM3    DC   F'Ø'
PARM4    DC   F'Ø'
P1FLAG   DC   C'Ø'                  Flags are set to 1
P2FLAG   DC   C'Ø'                  if parms 1 to 4 have a value
P3FLAG   DC   C'Ø'                  other than the initial zero.
P4FLAG   DC   C'Ø'
*
         DS    ØD                   Convert to decimal and unpack
REGDECIM DS    CL9                  areas for output numbers
         DS    ØF
OUT12    DS    ØCL12
OUT1Ø    DS    CL1Ø
         DS    CL2
*
NODIFMSG DC    CL8Ø'** No differences found in compared records **'
LIMITMSG DC    CL8Ø'++ Max number of different records attained ++'
DIFMSG   DC    C'Differences found in record number :'
DIFNUM   DS    CL1Ø
         DC    CL4Ø' '
ENDMSG1  DC    C'Number of records of INFILE1 . . . :'
ENDNUM1  DS    CL1Ø
         DC    CL4Ø' '
ENDMSG2  DC    C'Number of records of INFILE2 . . . :'
ENDNUM2  DS    CL1Ø
         DC    CL4Ø' '
*
         DCBD  DSORG=PS             Ihadcb map (addressed by R2 for
         YREGS                      file1 and by R11 for file2)
         END
```

WLM postprocessing made easy

INTRODUCTION

As is commonly known, beginning with z/OS V1R3, compatibility-mode is no longer available and an IPLed system will run in WLM goal-mode only. This means that each installation will be required to have a service definition installed and a WLM policy activated. Once a service definition is in place and the system is running in goal-mode, performance analysts are faced with the task of trying to understand what is going on in the system.

On the other hand, it may happen that, even though an installation is running in goal-mode for quite some time and everything is performing quite well, there are still changes, such as workload, software, or hardware changes, that should cause one to review, re-evaluate, and perhaps to modify WLM goals. This is where using a performance reporter product can be useful.

One of the best ways to review the WLM performance metrics is through the use of both real-time monitors (RMF Monitor III SYSSUM report, for example) and a postprocessor.

There are several areas one will want to look at to quickly gain knowledge of how a given workload is performing in relation to the goals that have been set in the service policy. One should keep in mind the fact that WLM uses three primary metrics to define how it should manage workloads – importance levels, service objectives, and performance index (PI):

- Importance level identifies the service classes according to the order in which WLM is to try to satisfy stated objectives, ie the order they should receive/donate resources. Since WLM dynamically adjusts the resources, the importance level determines how those adjustments are to be made and in what order. It was noticed that there is a strong temptation to place too many units of work into the upper importance levels and thus to overload WLM's decision-making capability. The consequence

of this is that a high importance-level workload that fails to meet its objectives will invariably prevent lower importance level work from being examined.

- The defined service objectives categories (response time, response time percentile, velocity, discretionary) are telling WLM what the standard of measure will be.
- Performance index (PI) is used to evaluate how well the stated objectives are being met. WLM uses performance index in conjunction with importance level to determine what action (if any) should be taken. Most people are aware that a PI greater than 1 indicates that goals are not being met, while a PI of less than 1 indicates they are being exceeded.

Once the work has been classified into service classes with defined goals, the performance index tells us whether the workload on the system is meeting its WLM policy-defined goals, or that nothing is acting in the way we thought it would. Besides the obvious point that a service class is missing its objectives, this may also indicate that a particular objective is simply too aggressive for WLM to ever satisfy. What if you have noticed that a service class isn't performing well because of a WLM-managed resource such as CPU, or that a Sysplex performance index is significantly less than a local performance index? For those performance analysts who have a grasp of Workload Manager concepts, constraints, and analysis techniques, the WLM postprocessor can significantly reduce the time required to perform daily analysis of system performance.

COLLECTING WLM DATA

As mentioned above, Workload Manager periodically assesses the performance of each service class period by comparing the performance achieved by the service class period against the performance goals defined for the service class period. WLM does this by sampling the state of the service class four times per second. This assessment is done at each goal importance level. In this way, WLM can determine whether the service class is using resources or whether the service class is being delayed in a manner that may be

adjustable. These sorts of delay, over which WLM can exert no control, are discarded in this assessment and do not contribute directly to WLM's decision making. Idle time periods are excluded from the samples collection.

In order to document its decisions, WLM creates several SMF records (type 99) for each policy interval, or approximately once every 10 seconds. They can be useful in analysing and understanding the performance characteristics of a site's workload. The records contain performance data for each service class period, a trace of SRM actions, the data SRM used to decide which actions to take, and the internal controls SRM uses to manage work. This can help the performance analyst to determine in detail what SRM is doing to meet workload goals defined with respect to other work, and the types of delays the work is experiencing.

Before proceeding any further it might be helpful to clarify the difference between SMF record type 72 (RMF Workload Activity) subtype 3 and record type 99 (System Resource Manager Decisions) subtype 6 since these two do overlap in some of their content. However, they have two significant differences.

Record type 99(6) contains local and Sysplex-level performance index values as calculated at policy adjustment time (in fact, this subtype contains no new data – everything in it is already in other subtypes of the type 99, but the new record compacts the needed data in one subtype so that one can afford to write that subtype 6 record and can suppress all other subtypes to reduce data volume).

The record type 72(3) does not include a PI value but does contain all the data needed to calculate an average PI for the RMF recording interval. Furthermore, type 99(6) provides the data on WLM's internally-used dynamic service classes, but it is only type 72(3) that contains resource consumption data.

A detailed description of the layout of SMF type 99 record and its subtypes can be obtained from the *MVS System Management Facilities (SMF)* - SA22-7630-03 manual.

For information about how to use type 99, see *z/OS MVS Programming: Workload Management Services*.

For information about workload management, see *z/OS MVS Planning: Workload Management*.

The mapping macro, IRASMF99, for this record is supplied in SYS1.AMODGEN.

Because SMF type 99 records are written approximately every 10 seconds, one should write them only for certain time periods and define them (in SMFPRM*xx* member) like:

```
SYS(NOTYPE(99))
SYS(TYPE(99(6))
```

CODE

In order to provide a starting point from which one can begin to gather information about the system, an example of the WLM postprocessor JCL statements is included below.

The code is a three-part stream. In the first part (COPY996) selected SMF records (selection being defined by INCLUDE's condition) are copied from the SMF dataset to a VB file, which can be used as a base of archived records. In the second part (WLM99), the captured records are being formatted by invoking REXX EXEC (WLMPP). In the last part (RPT996), the formatted records are being read and a report produced. The field reformatting capability of DFSORT's ICETOOL was used to produce a report from the WLMPP output. For each service class, related information is produced – class name, period, local and Sysplex performance index, goal type defined and goal value measured, period importance, goal percentile, dispatching and I/O priority.

This job stream can be used to create a flexible report of those metrics that can quickly provide us, at a glance, with data about service classes which are and are not meeting specified goals, local and Sysplex-level PI. From a WLM perspective, a daily or weekly review of the reports should be used to provide a set of measurements to track and provide information for trend analysis. One should choose a busy time frame (1-3 hours) to use as a measurement period for this purpose.

```
//COPY996  EXEC PGM=ICETOOL
```

```
//TOOLMSG  DD SYSOUT=*
//DFSMSG   DD SYSOUT=*
//RAWSMF   DD DSN=hlq.SMFDUMPW,DISP=SHR
//SMF99    DD DSN=your.copied.by.sort.to.VB.smf.dataset,
//         SPACE=(CYL,(1)),UNIT=SYSDA,
//         DISP=(NEW,PASS),
//         DCB=(RECFM=VB,LRECL=32756,BLKSIZE=32760)
//TOOLIN   DD *
  COPY FROM(RAWSMF) TO(SMF99) USING(SMFI)
//SMFICNTL DD *
  OPTION SPANINC=RC4,VLSHRT
  INCLUDE COND=(6,1,BI,EQ,99,AND,23,2,BI,EQ,6)
/*
//WLM99  EXEC PGM=IKJEFT01,REGION=0M,DYNAMNBR=50,PARM='%WLMPP'
//SYSEXEC  DD DISP=SHR,DSN=your.rexx.library
//SMF      DD DISP=(SHR,PASS),DSN=your.copied.by.sort.to.VB.smf.dataset
//OUT99    DD DSN=sysuid.output.dataset,
//         SPACE=(CYL,(30,15)),UNIT=SYSDA,
//         DISP=(NEW,PASS),
//         DCB=(RECFM=FB,LRECL=140)
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
/*
//RPT996   EXEC PGM=ICETOOL,REGION=0M
//TOOLMSG  DD SYSOUT=X
//DFSMSG   DD SYSOUT=X
//REPORT   DD SYSOUT=X
//OUT99    DD DISP=(SHR,KEEP),DSN=sysuid.output.dataset
//TEMP     DD DSN=&&TEMPV,SPACE=(CYL,(15,15)),UNIT=SYSDA
//TOOLIN   DD *
  COPY FROM(OUT99) TO(TEMP) USING(SMFI)
  DISPLAY FROM(TEMP) LIST(REPORT)    -
  TITLE('WLM POSTPROCESSOR REPORT') DATE TIME -
   HEADER('TIME')       ON(13,8,CH)    -
   HEADER('SID')        ON(23,4,CH)    -
   HEADER('S.CLASS')    ON(46,8,CH)    -
   HEADER('PERIOD.')    ON(55,1,CH)    -
   HEADER('LOCAL PI')   ON(57,3,CH)    -
   HEADER('SYSPLEX PI') ON(62,3,CH)    -
   HEADER('GOAL TYPE')  ON(67,15,CH)   -
   HEADER('GOAL VALUE') ON(83,3,CH)    -
   HEADER('IMP')        ON(87,1,CH)    -
   HEADER('PERC.')      ON(90,2,CH)    -
   HEADER('CPU DP')     ON(93,3,CH)    -
   HEADER('IO DP')      ON(97,3,CH)    -
   BREAK(1,11,CH)                      -
   BTITLE('DAILY REPORT')              -
   BLANK
/*
```

```
//SMFICNTL DD *
* Example: select only peak period (ie 1Ø am - 2.pm)
* In a similar fashion one may construct customized INCLUDE statement
* and select other fields (ie LPI > 1, LPI > SPI…)
   OPTION COPY
    INCLUDE COND=(13,5,CH,GT,C'1Ø:ØØ',AND,13,5,CH,LT,C'13:59')
/*
```

WLMPP EXEC

```
/* REXX EXEC to read and format SMF records  */
ADDRESS TSO

 'EXECIO * DISKR SMF ( STEM x. FINIS'
    do i = 1 to x.Ø

  smftype  = c2d(SUBSTR(x.i,2,1))               /* SMF record type */
  smfstype = c2d(SUBSTR(x.i,19,2))              /* Record subtype  */
   /*-------------------------------------------------------------*/
  /* Check SMF record type & subtype (ie 99.6)                   */
   /*-------------------------------------------------------------*/
  IF smftype = '99' & smfstype = '6' THEN
  DO
    offset   = c2d(SUBSTR(x.i,69,4))  /* Offset to period section  */
    len      = c2d(SUBSTR(x.i,73,2))  /* Length of period section  */
    cpon     = c2d(SUBSTR(x.i,75,2))  /* Number of period sections */
   /*-------------------------------------------------------------*/
  /* Unpack SMF date & decode SMF time                            */
   /*-------------------------------------------------------------*/
    smfdate  = SUBSTR(c2x(SUBSTR(x.i,7,4)),3,5) /* unpack SMF date */
    time     = c2d(SUBSTR(x.i,3,4))             /* decode SMF time */
    time1    = time % 1ØØ
    hh       = time1 % 36ØØ
    hh       = RIGHT("Ø"||hh,2)
    mm       = (time1 % 6Ø) - (hh * 6Ø)
    mm       = RIGHT("Ø"||mm,2)
    ss       = time1 - (hh * 36ØØ) - (mm * 6Ø)
    ss       = RIGHT("Ø"||ss,2)
    smftime  = hh||":"||mm||":"||ss             /* Compose SMF time*/
   /*-------------------------------------------------------------*/
  /* Process all class periods                                    */
   /*-------------------------------------------------------------*/
     do j = Ø to cpon
       incr = (offset + (j*len)) - 3      /* Incremental position  */
       sclass = SUBSTR(x.i,incr,8)        /* Class name            */
       period = c2d(SUBSTR(x.i,incr+8,2)) /* Class period number   */

        if period >  'Ø' then do
         sysid    = SUBSTR(x.i,11,4)      /* System identification */
```

```
       syslvl   = SUBSTR(x.i,53,8)      /* System level          */
       sysname  = SUBSTR(x.i,61,8)      /* System name           */
       gt       = c2d(SUBSTR(x.i,incr+10,1)) /* Goal type        */
       pct      = c2d(SUBSTR(x.i,incr+11,1)) /* Goal percentile  */
/*-------------------------------------------------------------*/
/* Reformat goal type values into goal description            */
/*-------------------------------------------------------------*/
        SELECT
          when gt=0 then goal='System/STC/Srv '
          when gt=1 then goal='Shr.Resp (sec.)'
          when gt=2 then goal='Lng.Resp (sec.)'
          when gt=3 then goal='Velocity (%)   '
          when gt=4 then goal='Discretionary  '
        END

       gval  = c2d(SUBSTR(x.i,incr+20,4)) /* Goal value          */
       imp   = c2d(SUBSTR(x.i,incr+24,2)) /* Period importance   */
       dp    = c2d(SUBSTR(x.i,incr+26,1)) /* Dispatching prty.   */
       iodp  = c2d(SUBSTR(x.i,incr+27,1)) /* I/O priority        */
       mpli  = c2d(SUBSTR(x.i,incr+28,2)) /* MPL in-target       */
       mplo  = c2d(SUBSTR(x.i,incr+30,2)) /* MPL out-target      */
       rua   = c2d(SUBSTR(x.i,incr+32,4)) /* Number of ready ASIDs*/
       pspt  = c2d(SUBSTR(x.i,incr+36,4)) /* Time swapped out    */
       psitar= c2d(SUBSTR(x.i,incr+40,4)) /* Storage isolation   */
       lpi   = c2d(SUBSTR(x.i,incr+44,4)) / 100 /* Local PI      */
       spi   = c2d(SUBSTR(x.i,incr+48,4)) / 100 /* Sysplex PI    */
       sdata = c2d(SUBSTR(x.i,incr+52,4)) /* Offset to server sec.*/
       slen  = c2d(SUBSTR(x.i,incr+56,2)) /* Length of server sec.*/
       snum  = c2d(SUBSTR(x.i,incr+58,2)) /* Number of server ent.*/
/*-- -------------------------------------------------------------*/
/* Reformat goal value according to the goal type                */
/*-------------------------------------------------------------*/
        SELECT
          when gt=0 then gvvv='n/a'
          when gt=1 then gvvv=gval/1000
          when gt=2 then gvvv=gval/1000
          otherwise gvvv=gval
        END

rec99 = left(Date('N',smfdate,'J'),11) left(smftime,9),
        left(sysid,4)  left(syslvl,8)  left(sysname,8),
        left(sclass,8) left(period,1)  left(lpi,4),
        left(spi,4)    right(goal,15)  right(gvvv,3),
        left(imp,2)    right(pct,2)    left(dp,3),
        left(iodp,3)   right(mpli,2)   right(mplo,2),
        right(rua,4)   right(pspt,4)   right(psitar,4),
        right(sdata,4) right(slen,2)   right(snum,2)

 PUSH rec99
   "EXECIO 1 DISKW OUT99"
```

```
        end
      end
    end
  end
exit
```

It is strongly recommended that this report be used in conjunction with the RMF postprocessor service class reports, which allow us to look further into those workloads that are not performing as expected. These reports provide more detailed information about specific service classes. The RMF service class period report is created using the SYSRPTS(WLMGL(SCPER)) control card with the RMF postprocessor. Another way to gain a quick glance at service class performance and various types of resource delays is by using the RMF postprocessor overview record control statements. In the example below, the service class TSO period 1 is being examined. One would need to add control cards to specify other periods (ie second and third period if applicable and identical control cards for any other service classes one wants to report on).

Example:

```
//RMFSTEP1 EXEC PGM=ERBRMFPP,REGION=ØM
//MFPINPUT DD DISP=SHR,DSN=SMF.SORTED,DATASET
//MFPMSGDS DD SYSOUT=*
//*******************************************************************
//*GOAL MODE INDICATORS for TSO class - PI, USING AND DELAY SAMPLES *
//*******************************************************************
//SYSIN DD *
SYSOUT(O)
NOSUMMARY
OVERVIEW(REPORT)
DATE(MMDDYYYY,MMDDYYYY)
ETOD(Ø8ØØ,15ØØ)
OVW(PI(PI(S.TSO.1)),NOSYSTEMS)            /* PERFORMANCE INDEX,
SC.PERIOD 1 */
OVW(ENDEDTRX(TRANSTOT(S.TSO.1)),NOSYSTEMS)/* ENDED TRANSACTIONS */
OVW(VELOCITY(EXVEL(S.TSO.1)),NOSYSTEMS)   /* ACTUAL VELOCITY */
OVW(CPUUSING(CPUUSGP(S.TSO.1)),NOSYSTEMS) /* CPU USING % */
OVW(CPUDELAY(CPUDLYP(S.TSO.1)),NOSYSTEMS) /* CPU DELAY % */
OVW(IOUSING(IOUSGP(S.TSO.1)),NOSYSTEMS)   /* I/O USING % */
OVW(IODELAY(IODLYP(S.TSO.1)),NOSYSTEMS)   /* I/O DELAY % */
OVW(APPLPCT(APPLPER(S.TSO.1)),NOSYSTEMS)  /* APPLICATION % */
OVW(UNKNOWN(UNKP(S.TSO.1)),NOSYSTEMS)     /* UNKNOWN STATE % */
OVW(IDLE(IDLEP(S.TSO.1)),NOSYSTEMS)       /* IDLE STATE % */
```

```
OVW(SWPDELAY(SWINP(S.TSO.1)),NOSYSTEMS)   /* SWAP IN DELAY % */
OVW(MPLDELAY(MPLP(S.TSO.1)),NOSYSTEMS)    /* MPL DELAY % */
OVW(CAPDELAY(CAPP(S.TSO.1)),NOSYSTEMS)    /* CAPPING DELAY % */
OVW(DASDDISC(DISC(S.TSO.1)),NOSYSTEMS)    /* DASD DISCONNECT TIME */
OVW(DASDIOSQ(IOSQ(S.TSO.1)),NOSYSTEMS)    /* DASD IOSQ TIME */ /*
/*
```

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Locating strings in files

For most purposes, the Searchfor utility is an acceptable way to search for strings within files. However, it lacks support for VSAM files and a way to limit the scope of the search. For example, I need to search for a name that should exist in a *name* field, but eventually might also exist in other fields, like *address*, etc. If I know the position of the field I want to search within each record, then I may wish to restrict my search to that area. Or I may choose to search only a limited set of records, and not the entire file.

To satisfy these needs, I wrote a search program that accepts both sequential and VSAM files, allows the search zone to be limited to a range of columns within each record or to a range of records, permits the search string to be specified in hexadecimal, and also permits case to be ignored when performing comparisons (this applies only to strings specified as characters and to standard a-z characters, but you can change the translation table within the program, if you like).

The application consists of an Assembler program and a front-end formed by a REXX EXEC and an ISPF panel. It looks like this:

```
 +---------------- Locate a string in a file --------------------+
 |                                                               |
 |    File......: AARCF3.TEST.BA300                              |
 |                                                               |
 |    Search for: x'03f5f4c1a3                                   |
 |       (Enter text string or begin with X' for hexadecimal)    |
 |                                                               |
 |       Ignore case - only valid for text (Y,N).: Y             |
```

```
|                                                                |
|    Search columns              Search records                  |
|       First column.  12           First record.   10000        |
|       last  column.  25           Last  record.   15000        |
|                                                                |
|   Enter - execute                                PF3/15 cancel |
|                                                                |
 +---------------------------------------------------------------+
```

In this example, we search for a hexadecimal string (since it begins with x', the ending quote is optional and can be omitted) with column boundaries 12 through to 25 and record boundaries 10,000 through to 15,000.

Since the string is hexadecimal, the *ignore case* field has no meaning. The program launches a job, and the result of the search can be found in sysprint: it states the record numbers where a match was found, the total number of record matches, and the total number of records searched:

```
String found in record number  0000012034
String found in record number  0000012035
String found in record number  0000012036
Number of records where string found: 0000000003
Number of records searched. . . . . : 0000005001
```

LOCATE ASSEMBLER PROGRAM

```
*=================================================================*
* LOCATE - Locates and counts the number of record matches of a   *
*          string in a file. The file can be sequential or VSAM.  *
*                                                                 *
* Format of the parameter received:                              *
* Offset Name and meaning                                        *
*    0   Col1 initial position within records                    *
*    4   Col2 final position within records                      *
*    8   Rec1 initial search record                              *
*   16   Rec2 final search record                                *
*   24   Flag X-Hexa string  Y-ignore case   otherwise respect case *
*   25   String to search.                                       *
*                                                                 *
* DDnames: Infile, Sysprint                                      *
*                                                                 *
* This program reads an input file and searches for a string in each *
* record. The search can be limited to a column range within each  *
* record (Col1 to Col2) or to a set of records (Rec1 to Rec2).     *
* If flag = 'X', string is represented in hexadecimal.           *
* If flag = 'Y', string and searched areas are uppercased before  *
```

```
* comparison takes place (case is ignored). This applies only to     *
* a-z standard EBCDIC characters.                                    *
*====================================================================*
&PROGRAM SETC  'LOCATE'
&PROGRAM AMODE 31
&PROGRAM RMODE 24
&PROGRAM CSECT
         SAVE  (14,12)
         LR    R12,R15
         USING &PROGRAM,R12
         ST    R13,SAVEA+4
         LA    R11,SAVEA
         ST    R11,8(R13)
         LR    R13,R11
         B     GETPARMS
         DC    CL16' &PROGRAM 1.1'
         DC    CL8'&SYSDATE'
*
*====================================================================*
* Check and validate parameters                                      *
*====================================================================*
*
GETPARMS DS    ØH
         LR    R2,R1               Copy parm pointer to R2.
         L     R2,Ø(Ø,R2)          Load parm address
         LH    R3,Ø(R2)            Load parm length in R3
         OPEN  (SYSPRINT,OUTPUT)   Open sysprint (for error msgs)
         LTR   R3,R3               Any parm entered?
         BZ    EXIT1               No, error
*
         LR    R6,R2
         AR    R6,R3               R6: point after end of parms
         LA    R6,2(Ø,R6)          Skip 2 bytes of parmlength
         LA    R2,2(Ø,R2)
         XR    R9,R9               Clear length counter
*
CONVERT  EQU   *
         LA    R9,3                4 byte length parms
         EX    R9,EXPACK           Execute pack
         CVB   R7,PARMPACK         Convert to binary into R7
         S     R7,=F'1'            Turn limit to offset
         ST    R7,PARM1            And store it
*
         LA    R2,4(Ø,R2)          Inc parm pointer
         EX    R9,EXPACK           Execute pack
         CVB   R7,PARMPACK         Convert to binary into R7
         ST    R7,PARM2            And store it
*
         LA    R2,4(Ø,R2)          Inc parm pointer
         LA    R9,7                8 byte length parms
         EX    R9,EXPACK           Execute pack
```

```
         CVB   R7,PARMPACK         Convert to binary into R7
         ST    R7,PARM3            And store it
*
         LA    R2,8(Ø,R2)          Inc parm pointer
         EX    R9,EXPACK           Execute pack
         CVB   R7,PARMPACK         Convert to binary into R7
         ST    R7,PARM4            And store it
*
         LA    R2,8(Ø,R2)          Inc parm pointer
         MVC   FLAG,Ø(R2)          Store flag parameter
*
         LA    R2,1(Ø,R2)          Inc parm pointer to string
         SR    R6,R2               Length of string to search
         SH    R6,=H'1'            Length of string to search
         EX    R6,EXMOVE           Move to string
         STH   R6,STRINGL          Keep string length ( - 1)
         CLI   FLAG,C'X'           Hexadecimal string?
         BNE   VALIDPR             No, jump ahead
*
         MVC   STR1,STRING1        Convert string to real hexadecimal
         MVC   STR2,STRING2        characters in three 12 byte parts
         MVC   STR3,STRING3
         NC    STR1,XAND
         TR    STR1,XTRN
         NC    STR2,XAND
         TR    STR2,XTRN
         NC    STR3,XAND
         TR    STR3,XTRN
         PACK  STRP1,STR1(13)
         PACK  STRP2,STR2(13)
         PACK  STRP3,STR3(13)
         MVC   STRING(6),STRP1
         MVC   STRING+6(6),STRP2
         MVC   STRING+12(6),STRP3
*
         LH    R6,STRINGL          Get original length (-1)
         LA    R6,1(Ø,R6)          Add 1
         SRL   R6,1                Divide length by two
         SH    R6,=H'1'            Ready for comparisons (-1)
         STH   R6,STRINGL          Store it
*
VALIDPR  EQU   *                   Validate parameters
         CLC   PARM1,PARM2
         BH    ERRMSG1
         CLC   PARM3,PARM4
         BH    ERRMSG2
         L     R7,PARM2
         S     R7,PARM1
         CR    R6,R7
         BH    ERRMSG3
```

```
*
         CLI   FLAG,C'Y'           Ignore case specified?
         BNE   OPENACB1            No, jump ahead
         LH    R1Ø,STRINGL         Load string length (-1)
         LA    R1Ø,1(Ø,R1Ø)        Reset correct length
         LA    R5,STRING
         EX    R5,EXTRAN           Execute uppercase translation
*
*=====================================================================*
* Check whether file is VSAM or sequential. If VSAM, check for ESDS  *
*=====================================================================*
*
OPENACB1 EQU   *                   Open ACB for VSAM input file
         OPEN  INFILEA             If error, go open the file as
         LTR   R15,R15             sequential.
         BNZ   OPENDCB1
         TESTCB ACB=INFILEA,       File is VSAM, check for ESDS        X
               ATRB=ESDS
         BNE   READFILE
*
ESDSFIL1 EQU   *
         MODCB RPL=INFILER,                                            X
               OPTCD=ADR           Set RPL for ESDS
         B     READFILE
*
OPENDCB1 EQU   *                   Open sequential file
         OPEN  (INFILED,INPUT)
         LTR   R15,R15
         BNZ   ERRMSG4
         MVI   FILETYP1,C'S'       Set flag sequential
         LA    R2,INFILED          R2: IHADCB of input file
         USING IHADCB,R2
*
*=====================================================================*
* Read loops (VSAM loop or sequential loop) and compare subroutine   *
*=====================================================================*
*
READFILE EQU   *
         XR    R7,R7               Record counter
         L     R8,PARM3            First record
         L     R9,PARM4            Last record
         CLI   FILETYP1,C'V'       VSAM file?
         BNE   LOOPSEQ             No, go to sequential
*
LOOPVSA  EQU   *                   VSAM loop
         LA    R7,1(Ø,R7)          Increment record counter
         GET   RPL=INFILER         Read VSAM file
         LTR   R15,R15             End of file?
         BNZ   EXITØ
         CR    R7,R8               First record attained?
```

```
         BL    LOOPVSA            No, read again
         CR    R7,R9              Last record attained?
         BH    EXITØ              Yes, exit
*
         L     R4,VAREA1          Get address of data in R4.
         SHOWCB RPL=INFILER,                                          X
               AREA=LRECL1,                                           X
               LENGTH=4,                                              X
               FIELDS=RECLEN
         L     R3,LRECL1          Get record length in R3
         BAL   R1Ø,COMPARE        Call compare
         B     LOOPVSA
*
LOOPSEQ  EQU   *                  Sequential loop
         LA    R7,1(Ø,R7)         Increment record counter
         GET   INFILED            Read sequential
         LR    R4,R1              R4: address of record
         CR    R7,R8              First record attained?
         BL    LOOPSEQ            No, read again
         CR    R7,R9              Last record attained?
         BH    EXITØ              Yes, exit
         LH    R3,DCBLRECL        Load R3 with record length.
         BAL   R1Ø,COMPARE        Call compare
         B     LOOPSEQ
*
COMPARE  EQU   *                  Compare subroutine
         L     R5,PARM1           Left limit (offset)
         L     R6,PARM2           Right limit
         CR    R3,R6              Record smaller than last position?
         BNL   COMPAREØ           No, continue.
         LR    R6,R3              Yes, switch limit to record limit
*
COMPAREØ EQU   *
         SR    R6,R5              R6: length of searchable area
         AR    R5,R4              R6: position to compare
         CLI   FLAG,C'Y'          Ignore case specified?
         BNE   COMPARE9           No, jump ahead
         EX    R6,EXTRAN          Execute uppercase translation
*
COMPARE9 EQU   *
         SH    R6,STRINGL         R6: number of searches in the line
         C     R6,=F'Ø'           If R6<Ø, string is greater than
         BNH   COMPARE3           search area, so skip this record
*
COMPARE1 EQU   *
         LH    R11,STRINGL        length of search string
         EX    R11,EXCOMPAR       Execute compare
         BNE   COMPARE2           If strings not equal, exit
         LR    RØ,R7
         BAL   R11,UNPACK
```

```
         MVC   MSGFND2,OUT1Ø
         LR    RØ,R9
         PUT   SYSPRINT,MSGFND     String found, send message
         L     R11,TOTFOUND        Inc rec found counter
         LA    R11,1(Ø,R11)
         ST    R11,TOTFOUND
         B     COMPARE3            And return
*
COMPARE2 EQU   *
         LA    R5,1(Ø,R5)          Increment compare position
         BCT   R6,COMPARE1         Loop to next
*
COMPARE3 EQU   *
         BR    R1Ø                 return
*
*=====================================================================*
* Send final messages, close files, and exit                          *
*=====================================================================*
*
EXITØ    EQU   *
         L     RØ,TOTFOUND
         BAL   R11,UNPACK
         MVC   MSGTOT2,OUT1Ø
         PUT   SYSPRINT,MSGTOT
         SR    R7,R8
         LR    RØ,R7
         BAL   R11,UNPACK
         MVC   MSGFIM2,OUT1Ø
         PUT   SYSPRINT,MSGFIM
*
EXIT1    EQU   *
         CLOSE INFILED
         CLOSE INFILEA
         CLOSE SYSPRINT
         L     R13,SAVEA+4
         LM    R14,R12,12(R13)
         XR    R15,R15
         BR    R14
*
*=====================================================================*
* Other subroutines, execute instructions and work areas              *
*=====================================================================*
*
EXCOMPAR EQU   *
         CLC   Ø(Ø,R5),STRING
*
EXMOVE   EQU   *
         MVC   STRING,Ø(R2)
*
EXPACK   EQU   *
```

```
         PACK  PARMPACK,Ø(Ø,R2)
*
EXTRAN   EQU   *
         TR    Ø(Ø,R5),TRTAB
*
UNPACK   EQU   *
         CVD   RØ,REGDECIM
         UNPK  OUT12,REGDECIM
         BR    R11
*
ERRMSG1  EQU   *
         PUT   SYSPRINT,MSG1
         B     EXITØ
*
ERRMSG2  EQU   *
         PUT   SYSPRINT,MSG2
         B     EXITØ
*
ERRMSG3  EQU   *
         PUT   SYSPRINT,MSG3
         B     EXITØ
*
ERRMSG4  EQU   *
         PUT   SYSPRINT,MSG4
         B     EXITØ
*
MSG1     DC    CL8Ø'Error: Parm2 smaller than parm1'
MSG2     DC    CL8Ø'Error: Parm3 smaller than parm4'
MSG3     DC    CL8Ø'Error: String length smaller than search interval'
MSG4     DC    CL8Ø'Error opening input file'
MSG5     DC    CL8Ø'Record smaller than compare position'
MSGFND   DS    ØCL8Ø
MSGFND1  DC    C'String found in record number  '
MSGFND2  DC    CL5Ø' '
MSGTOT   DS    ØCL8Ø
MSGTOT1  DC    C'Number of records where string found: '
MSGTOT2  DC    CL5Ø' '
MSGFIM   DS    ØCL8Ø
MSGFIM1  DC    C'Number of records searched. . . . . : '
MSGFIM2  DC    CL5Ø' '
*
STRINGL  DS    H
         DS    CL2
STRING   DS    ØCL36
STRING1  DS    CL12
STRING2  DS    CL12
STRING3  DS    CL12
         DS    CL4
STR1     DS    CL12
         DC    C' '
```

```
STR2     DS    CL12
         DC    C' '
STR3     DS    CL12
         DC    C' '
STRP1    DS    CL7
STRP2    DS    CL7
STRP3    DS    CL7
STRP16   DS    CL6
STRP26   DS    CL6
STRP36   DS    CL6
*
         DS    ØF
XAND     DC    X'1F1F1F1F1F1F1F1F1F1F1F1F1F1F1F1F' leave bits ØØØ11111
XTRN     DC    X'ØØØA0B0C0D0E0F00000000000000000000' bits Ø1111 A thru F
         DC    X'00010203040506070809000000000000' bits 11111 Ø thru 9
*
TRTAB    DC    X'000102030405060708090A0B0C0D0E0F' Uppercase
         DC    X'101112131415161718191A1B1C1D1E1F' translation
         DC    X'202122232425262728292A2B2C2D2E2F' table
         DC    X'303132333435363738393A3B3C3D3E3F'
         DC    X'404142434445464748494A4B4C4D4E4F'
         DC    X'505152535455565758595A5B5C5D5E5F'
         DC    X'606162636465666768696A6B6C6D6E6F'
         DC    X'707172737475767778797A7B7C7D7E7F'
         DC    X'80C1C2C3C4C5C6C7C8C98A8B8C8D8E8F'
         DC    X'90D1D2D3D4D5D6D7D8D99A9B9C9D9E9F'
         DC    X'A0A1E2E3E4E5E6E7E8E9AAABACADAEAF'
         DC    X'B0B1B2B3B4B5B6B7B8B9BABBBCBDBEBF'
         DC    X'C0C1C2C3C4C5C6C7C8C9CACBCCCDCECF'
         DC    X'D0D1D2D3D4D5D6D7D8D9DADBDCDDDEDF'
         DC    X'E0E1E2E3E4E5E6E7E8E9EAEBECEDEEEF'
         DC    X'F0F1F2F3F4F5F6F7F8F9FAFBFCFDFEFF'
*
INFILEA  ACB   DDNAME=INFILE
INFILER  RPL   ACB=INFILEA,                                          X
               OPTCD=LOC,                                            X
               AREA=VAREA1,                                          X
               ARG=CHAVE1
INFILED  DCB   DSORG=PS,MACRF=(GL),                                  X
               EODAD=EXIT0,                                          X
               DDNAME=INFILE
SYSPRINT DCB   DSORG=PS,MACRF=(PM),                                  X
               LRECL=80,                                             X
               DDNAME=SYSPRINT
*
SAVEA    DS    18F
VAREA1   DS    F
CHAVE1   DS    F
LRECL1   DS    F
TOTFOUND DC    F'0'
```

```
FILETYP1 DC    C'V'
FLAG     DS    C
PARMPACK DS    D
PARM1    DS    F
PARM2    DS    F
PARM3    DS    F
PARM4    DS    F
         DS    ØD
REGDECIM DS    CL9
         DS    ØF
OUT12    DS    ØCL12
OUT1Ø    DS    CL1Ø
         DS    CL2
*
         LTORG
         DCBD  DSORG=PS
         YREGS
         END
```

LOCATE REXX EXEC

```
/* REXX MVS *=========================================================*/
/*  LOCATE - Locates a string within a file.                         */
/*           Optional argument: file to search.                      */
/*                                                                   */
/*  This application consists of this EXEC, LOCATE ISPF panel,       */
/*  and LOCATE Assembler program. The load module should reside      */
/*  in the library indicated by the loablib variable below.          */
/*===================================================================*/
arg file .
file = strip(file,,"'")
loadlib  = "loadlib.with.locate.module"
tempfile = userid()||".TEMP.FILE"
I = "Y"
do forever
   address ispexec
    'addpop row(1) column(1)'
    'display panel(locate)'
    if rc = 8 then exit
    'rempop'
   address tso
   msg = ""
   hexastring = Ø
   if col1 = "" then col1 = 1
   if col2 = "" then col2 = 9999
   if rec1 = "" then rec1 = 1
   if rec2 = "" then rec2 = 99999999
   if col2 < col1 then do
      msg="Column2 cannot be smaller than column1"
```

```
      iterate
   end
   if rec2 < rec1 then do
      msg="Record2 cannot be smaller than record1"
      iterate
   end
   str = strip(stri)
   lstr= length(str)
   if left(str,2) = "x'" | left(str,2) = "X'" then do
      hexastring = 1
      str = strip(str,"T","'")
      str = translate(substr(str,3))
      lstr= length(str)
      if datatype(str,"X") <> 1 then do
         msg="Invalid hexadecimal string"
         iterate
      end
      lok = lstr // 2
      if lok <> Ø then do
         msg="Odd number of characters in hexadecimal string"
         iterate
      end
      lstr = lstr / 2
   end
   if lstr > col2 - col1 + 1 then do
      msg="String is longer than column search zone"
      iterate
   end
   if msg = "" then leave
end

if hexastring = 1 then I = 'X'
parm = "'"right(col1,4,"Ø") || right(col2,4,"Ø") ||,
          right(rec1,8,"Ø") || right(rec2,8,"Ø") ||,
          I || str"'"

xx = msg(off)
"free dd (temp1)"
"alloc da('"tempfile"') dd(temp1) new reuse blksize(8ØØØ),
   lrecl(8Ø) recfm(f,b) dsorg(ps) space(1 1) tracks delete"
if rc <> Ø then do
   say "Error "rc" allocating" tempfile
   exit
end

queue "//"userid()"Ø JOB LOCATE,MSGCLASS=X,CLASS=A"
queue "//STEPØ  EXEC PGM=LOCATE,"
queue "// PARM="parm
queue "//STEPLIB  DD DISP=SHR,DSN="loadlib
queue "//INFILE   DD DISP=SHR,DSN="file
```

```
queue "//SYSPRINT DD SYSOUT=*"
queue ""

"execio * diskw temp1 (finis"
"submit '"tempfile"'"
"free dd (temp1)"
say "Job" userid()"Ø submitted"
exit
```

LOCATE ISPF PANEL

```
)ATTR
  _ TYPE(INPUT) CAPS(ON)  JUST(LEFT)  COLOR(RED)
  $ TYPE(INPUT) CAPS(OFF) JUST(LEFT)  COLOR(RED)
  # TYPE(INPUT) CAPS(ON)  JUST(RIGHT) COLOR(RED)
  ? TYPE(TEXT) INTENS(HIGH) SKIP(ON) COLOR(PINK)
  % TYPE(TEXT) INTENS(HIGH) SKIP(ON) COLOR(YELLOW)
  + TYPE(TEXT) INTENS(LOW)  SKIP(ON) COLOR(GREEN)
  ! TYPE(OUTPUT) CAPS(OFF)  SKIP(ON) COLOR(WHITE)
)BODY WINDOW(7Ø,17)
+
?     File......:_FILE                                        +
+
?     Search for:$STRI                                  +
?        (Enter text string or begin with X' for hexadecimal)
+
+        Ignore case - only valid for text (Y,N).:_I
+
%     Search columns              Search records
+        First column.#COL1+         First record.#REC1    +
+        last  column.#COL2+         Last  record.#REC2    +
+
!MSG
+   Enter - execute                                 PF3/15 cancel
)INIT
&ZWINTTL = 'Locate a string in a file'
)PROC
&ver='Y,N'
VER(&FILE,nonblank,dsname)
VER(&STRI,nonblank)
VER(&STRI,nonblank)
VER(&I,NONBLANK,listv,&ver)
VER(&COL1,num)
VER(&COL2,num)
VER(&REC1,num)
VER(&REC2,num)
)END
```

Boosting VSAM performance with SMB

Ever since its introduction some 30 years ago, VSAM has been a popular and reliable data storage construct on MVS systems. VSAM is still the cornerstone of on-line applications such as IMS and CICS, and is widely used in ISV packages and in-house-written batch applications. However, with 24x7 operation becoming a necessity, batch windows must shrink in order to lessen their impact on on-line systems. The most effective way to cut down the batch window is to optimize I/O, and this article examines the results of a sample tuning exercise. Of course, it is a well-known fact that the fastest I/O is the one that is never issued. That is to say, an application that is having I/O performance problems will perform better if we can cut down on the number of I/Os. The whole concept of SMS automatic blocksizes according to DASD device was to reduce the number of I/Os for that specific DASD device type. Similarly, for VSAM data, automatic effective buffering can significantly reduce the number of I/Os, response time, and elapsed job time, thereby improving application performance.

It is well known that VSAM is very important to most installations, yet it is rarely utilized optimally. One consequence of this is that jobs accessing VSAM files almost always run longer than necessary. Thus, tuning native VSAM datasets is still an important part of the overall tuning process at many installations. Almost certainly, the largest performance gains can be achieved with good VSAM buffering – it is in fact the single most important aspect of VSAM tuning and will achieve the biggest performance boost. If implemented correctly, these buffering methodologies will greatly reduce disk I/Os, reduce CPU time, and lead to better job turnaround time. Now, with the advent of System Managed Buffering (SMB), high performance can be achieved through standard OS/390 system interfaces, with virtually no application programmer effort, and with no JCL changes. System Managed Buffering is a feature of DFSMSdfp, directed at support for batch application processing, and is intended as a means of achieving two things. The first one is to update the current defaults for processing VSAM datasets. This is necessary in order to utilize

current hardware technology to effect the processing of VSAM data. The second one is to initiate a buffering technique, other than that specified by the application program, that would improve application performance.

SYSTEM MANAGED BUFFERING

Before we see how SMB works and how you can take advantage of it, it might be useful to understand the overall buffering picture for VSAM files. There are two ways of addressing buffering of VSAM data offered by OS/390 and z/OS. The first method uses Non-Shared Resources (NSR), where buffers are dedicated to the processing of a single VSAM file. NSR means that each VSAM file in a task will have its own dedicated buffers assigned within the program address space, and, hence, will not share them with any other VSAM file that is open within the task. NSR is also the automatic default type of VSAM buffering logic. On the other hand, using Logically Shared Resources (LSR) allows the sharing of buffer pools among multiple VSAM files. While both NSR and LSR can be defined within an application, there is a significant difference when it comes to how an application maximizes its use of these buffer pools to process data – sequential processing of data works best using NSR and random data processing works best using LSR. Does this mean that applications need to be changed? Sometimes they need changing. Moreover, sometimes it is necessary to understand the type, access method, format, and options of the file. For example, do dataset options call for key access (KEY), sequential access (SEQ), addresses access (ADR), or access to CI (CNV)?

System Managed Buffering (SMB) for VSAM datasets is a fairly new facility introduced with DFSMS Version 1.4 for KSDS files only. This was enhanced with DFSMS 1.5 to include all types of VSAM file. Basically, the system decides how many buffers to use for data and index portions (the case of NSR) or buffer pools size (the case of LSR), with four basic buffer allocation algorithms that can be chosen or specified:

- Direct Optimized (DO) – SMB optimizes for totally random record access. This is appropriate for applications that access

records in a dataset in totally random order. This technique will override the user specification for using NSR buffering with an LSR buffering implementation. Random-access VSAM processing is automatically directed to use LSR, which will eliminate buffer stealing, exploit look-aside processing, ESA hiperspaces, and in-core indexes. The DO technique is elected if the ACB specifies only the MACRF=(DIR) option for accessing the dataset. If either SEQ or SKP are specified, in combination with DIR or independently, DO is not selected. The selection can be overridden by the user specification of ACCBIAS=DO on the AMP=parameter of the associated DD statement. Note should be taken of the fact that the MACRF type of access is just an intention. The real type of access is declared per I/O operation in the RPL.

- Direct Weighted (DW) – SMB optimizes for mixed-mode processing (both direct and sequential), but 'weights' the buffer allocations for key-direct. This will provide minimum read-ahead buffers for sequential retrieval and maximum index buffers for direct requests. The size of the dataset is a minor factor in the storage that is required for buffering. This technique requires approximately 100KB of processor storage for buffers, with a default of 16MB.
- Sequential Optimized (SO) – SMB optimizes for sequential processing. It is appropriate for applications reading the entire dataset from the first to last record or a large percentage in sequential order. The size of the dataset is not a factor in the processor virtual storage that is required for buffering. Approximately 500KB of processor virtual storage, defaulted to above the 16MB line, is required for buffers for this technique.
- Sequential Weighted (SW) – SMB optimizes for mixed-mode processing (both direct and sequential), but 'weights' the buffer allocations for sequential. It will use read-ahead buffers for sequential and provide additional index buffers for direct requests. The read-ahead will not be the large amount of data transferred as with SO. The size of the dataset is a minor factor in the amount of processor virtual storage that buffering requires.

This technique requires approximately 100KB of processor virtual storage for buffers, with the default above 6MB.

General discussion and guidelines related to processing with each technique are fully documented in *VSAM Demystified* (SG24-6105).

The change-over to SMB is easy enough – it can be simply done by defining an extended format dataset through an SMS data class with RECORD_ACCESS_BIAS=SYSTEM/USER. Or, if you prefer JCL changes, it can be invoked in a specific job stream by specifying ACCBIAS on the AMP parameter for the dataset's DD statement.

In the first case, the technique that will be defaulted to by the system is based on the application specification for the type of access intention ACB MACRF=(DIR,SEQ,SKP) and influenced by the specifications in the associated Storage Class (SC) for direct millisecond response, direct bias, sequential millisecond response, and sequential bias.

In the second case, the technique is externally specified by using the ACCBIAS JCL subparameters of the AMP DD parameter – probably the easiest and best option is the ACCBIAS=SYSTEM option. You can specify ACCBIAS equal to one of the following values:

- USER – bypass SMB. This is the default if you code no specification for the ACCBIAS subparameter. This default is not used when the data class specifies RECORD_ACCESS_BIAS.
- SYSTEM – force the system to determine the buffering technique.

One can also explicitly request a specific buffer allocation algorithm by specify the SMB buffer processing as SO/SW/DO/DW. One of the problems with SMB arises in situations where you have a batch program that does skip-sequential, sequential, and random processing all in the same run. In many such cases, that we have seen it's often been a good compromise just to default to ACCBIAS=SYSTEM. For a detailed description of each AMP option see *MVS: JCL Reference* (SA22-7597).

During a testing phase we turned on Systems Managed Buffering (through DATACLASS) for a large VSAM file, but in order to see how SMB works, as well as to prevent production problems, we decided to bypass SMB processing by specifying RECORD_ACCESS_BIAS=USER and later on we used JCL's AMP parameter ACCBIAS=SO (see below):

```
                    VSAM file buffers & buffering management

                                                                  # of
Records        Access:         Buffers
Job    Run date    Elapsed time   Cluster/Component name   Records
ret'ved   Excp mode bias SMB   used   Format   Restriction
-------------------------------------------------------------------------
-------------------------------------------------------------------------
-----
MYJOB  17 Oct 2003 00:49:24:46    PROD.HISTFILE.DATA      68171123
68171123 365207  seq none none     4   Standard Extended format required
(1)
MYJOB  17 Oct 2003 00:49:24:46    PROD.HISTFILE.INDEX        12030
0  11868  seq none none     2   Standard Extended format required
MYJOB  18 Oct 2003 00:42:45:09    PROD.HISTFILE.DATA      68379107
68379107 366613  seq none none     4   Standard Extended format required
MYJOB  18 Oct 2003 00:42:45:09    PROD.HISTFILE.INDEX        11757
0  11596  seq none none     2   Standard Extended format required
MYJOB  19 Oct 2003 00:50:07:19    PROD.HISTFILE.DATA      68430562
68430562 367646  seq none none     4   Extended none
(2)
MYJOB  19 Oct 2003 00:50:07:19    PROD.HISTFILE.INDEX        10857
0  10696  seq none none     2   Extended none
MYJOB  21 Oct 2003 00:50:57:52    PROD.HISTFILE.DATA      68667511
68667511 368038  seq none none     4   Extended none
MYJOB  21 Oct 2003 00:50:57:52    PROD.HISTFILE.INDEX        11940
0  11779  seq none none     2   Extended none
MYJOB  22 Oct 2003 00:26:22:79    PROD.HISTFILE.DATA      68931080
68931080  21714  seq so   jcl     49   Extended none
(3)
MYJOB  22 Oct 2003 00:26:22:79    PROD.HISTFILE.INDEX        12234
0  12073  seq so   jcl      4   Extended none
MYJOB  23 Oct 2003 00:26:41:31    PROD.HISTFILE.DATA      69104677
69104677  21406  seq so   jcl     49   Extended none
MYJOB  23 Oct 2003 00:26:41:31    PROD.HISTFILE.INDEX        11683
0  11522  seq so   jcl      4   Extended none
```

Notes:

(1) Job access statistics before converting dataset to extended format.

(2) Dataset converted to extended format with Rec_Acc_Bias=USER (bypass SMB).

(3) JCL AMP parameter override of data class definition (ACCBIAS=SO).

The order of precedence for specifying values that decide if and how SMB will be invoked is this: JCL specifications, then the data class Record_Access_Bias parameter, then the storage class parameters, then the MACRF values. That is, whatever is specified in the JCL will always take precedence. This also means that one may wish to tell a lie to VSAM about intent (for example direct versus sequential processing) and SMB will be fooled. Because SMB is not taking any sample of behaviour, it relies on the access intent of the OPEN. However, telling a lie is not a wise thing to do: incorrect use of a buffering strategy will result in a significant increase in I/O, thus causing long-running batch jobs and poor performance (see below):

Buffering	EXCPs	Clock time (min)	CPU time (sec)	CONN (k)	Buffers (D/I)	
NSR - Default	402472	41.4	251.16	1099	4	2
ACCBIAS=SO	34991	26.0	233.66	918	49	4
ACCBIAS=DO	793868	45.0	294.28	1342	0	0
Gain using SMB (%):	91.3	37.19	9.96	13.73		
(DO vs. Default) :	- 97.2	- 8.7	- 17.16	- 22.11		

SMB RESTRICTIONS AND POTENTIAL PROBLEMS

There are two main restrictions to SMB. The first one is that SMB support is currently limited to extended format VSAM files that use NSR buffering. To be in extended format, the dataset must be system managed (SMS) and use a data class defined with DSNTYPE=EXT. On the other hand, SMB will get involved only when NSR buffering is specified by the application program, ACB MACRF=(NSR). It will not get involved with the MACRF parameters RST (ACB reset option), UBF (USER buffering), GSR (Global Shared Resources), LSR (Local Shared Resources), RLS (Record Level Sharing), or ICI (Improved Control Interval processing). For releases prior to z/OS 1.3 DFSMS, processing the dataset through the alternate index of

the path specified in the DDname is not supported. When the conditions above are not satisfied, the job does not abend, but the SMB services are not used and no messages are issued.

The second restriction is that SMB is invoked at dataset open processing only: after the initial decision is made during that process, SMB has no further involvement.

Thus far two basic storage-related problems have emerged, especially regarding the use of the ACCBIAS=DO option. SMB ACCBIAS=DO is in fact equivalent to BLSR in that, in both cases, VSAM LSR buffer pools are built for each dataset opened with this technique in a single application program. The size of the pool is based on the actual dataset size at the time the pool is created. A separate pool is built for both data and index components, if applicable, for each dataset. There is no capability for a single pool to be shared by multiple datasets. The index pool is sized to accommodate all records in the index component. The data pool is sized to accommodate approximately 20% of the user records in the dataset. This also means that the processor virtual storage requirement will increase with each OPEN after records have been added and the dataset has been extended beyond its previous size. Thus, for very large VSAM KSDS files, a program or job step might abend with ACCBIAS=DO because of storage problems unless SMB's default options regarding buffer pool allocations are overridden.

Again, two options are available to tackle this problem. Increasing the job's region size to support the buffers (think multiple megabytes just for the buffers) might avoid abends. Then again, it might not help, as was the case with a very large VSAM KSDS file we were testing, even though we had increased the job's region size to the maximum possible.

On the other hand, the use of the SMBVSP parameter on the AMP=parameter (not present in the data class specification) can alleviate the storage impact since it restricts the amount of virtual storage to be obtained for buffers when opening the dataset. It is used to override the default buffer space to be obtained, which is calculated assuming that 20% of the data accounts for 80% of the accesses. The buffer space acquired is split across two LSR pools –

one for the index and one for the data.

There is also an additional AMP parameter that can be used in conjunction with the SMBVSP parameter, and it can help to reduce the storage problems. The SMBHWT parameter can be used to provide buffering in hiperspace in combination with virtual buffers for the data component. These buffers may be allocated for the base data component of the sphere. If the CI size of the data component is not a multiple of 4KB, both virtual space and hiperspace are wasted. It can be specified as an integer from 0 to 99. The value specified acts as a weighting factor for the number of hiperspace buffers to be established. This can reduce the size required for an application region, but does have implications related to processor cycle requirements. That is, all application requests must orient to a virtual buffer address. If the required data is in a hiperspace buffer, the data must be moved to a virtual buffer after 'stealing' a virtual buffer and moving that buffer to a Least Recently Used (LRU) hiperspace buffer.

Finally, if the optimum amount of storage required for this option is not available, SMB will reduce the number of buffers and retry the request. The retry capability for the DO technique was added in z/OS 1.3 DFSMS. For data, SMB will make two attempts, with a reduced amount and a minimum amount. For an index, SMB reduces the amount of storage only once, to a minimum amount. If all attempts fail, the DW technique is used. The system issues an IEC161I message to advise that this has happened.

If you are running a 24-bit program (amode=rmode=24) be aware that the storage for buffers for SMB techniques are obtained above 16 megabytes (above the line), and in order to prevent problems IBM recommends that RMODE31=NONE be specified on the AMP= parameter for those datasets using SMB.

IDENTIFYING JOBS THAT MIGHT BENEFIT FROM SMB

The jobs that might benefit from SMB are those with certain application characteristics, most important of which are a data reference pattern and options specified by the application program

(ACB MACRF). The best candidates are long-running jobs as well as jobs with a high execute channel program (EXCP) count.

SMF type 64 records are probably used more frequently than any other data source for tuning VSAM applications. Using these records you can identify the programs with the highest amount of VSAM activity (such as number of EXCPs, retrievals, inserts, deletes, CI and CA splits, insert strategy), analyse the effectiveness of buffer usage, and determine whether the dataset is being used concurrently by other jobs or tasks. To determine candidates for SMB, we have used SMF type 64 records to obtain information about the SMB candidate's processing characteristics, including jobname, cluster/component name, change in number of EXCPs, and ACB MACRF fields. In addition, SMF type 64 records indicate whether a reduced or minimum amount of resource is being used for a data pool and whether DW is used. Bits 5–7 of SMF64RSC, which were previously reserved, are used to give more information about Direct Optimization (DO).

A detailed description of the layout of the SMF type 64 record can be obtained from the *MVS System Management Facilities (SMF)* (SA22-7630) manual. One can also find the type 64 subtype descriptions in macro IDASMF64 in SYS1.MACLIB.

CODE

Based on record descriptions obtained from the above mentioned manual, a sample SMB report writer was written. The code is a two-part stream. In the first part (COPYSMF) selected SMF records (selection being defined by INCLUDE's condition) are copied from the SMF dataset to a file that can be used as a base of archived records. In the second part, SMB64, the captured records are formatted by invoking SMB EXEC and two reports are produced.

Each report consists of two sets of variables. The first set is a fixed one consisting of the variables that uniquely identify the VSAM file or job being monitored. This set is meant to be used across all reports. The pool of variables in this set contains generated observation number, job name, date stamp, dataset allocation elapsed

time, cluster/component name, total number of records, number of records retrieved in a job run, and number of EXCPs. The second set of printed variables is area specific and pertains only to the VSAM file performance domain being monitored. Note should be taken of the fact that elapsed time in these reports is not the execution clock time (wall time) that we are accustomed to thinking of. This 'elapsed' time in fact represents the length of time the file was kept open (for details see APAR OW43854).

The first report shows standard VSAM file attributes and processing activity as well as the type of access to the record – key, rba (relative byte addresses) or cnv(access the dataset by control interval), dataset addressability, and format. As already stated, there are some restrictions when considering the use of SMB. This report shows whether there are any restrictions – user buffering, ICI processing, alternate index, NSR required, and/or if extended format is required.

The second report is a VSAM file buffer management report and it provides buffering-related information such as number of buffers used per component (system determined or user defined), buffer space, addressing mode for buffers (24/31 mode), as well as whether or not the buffers have been fixed in real storage. The more interesting part of the report provides answers to questions like: Is there any method to find out whether SMB gets invoked at all? Wouldn't it be nice not only to know that SMB is invoked but also how much (and what) it does to the job (or datasets). This report provides the answer to these two questions by means of SMB-related information. Was SMB invoked at all? (no, yes: by JCL or SYSTEM); which optimization technique was used? (DO, DW, SO, SW, or none); and in conjunction with that, what data reference pattern was used: sequential access (records were requested in either ascending or descending sequence), direct access (records were randomly requested), skip sequential (records were processed in sequence but some records may have been skipped), or a combination of these? In the case of the Direct Optimized (DO) technique, additional indicators are available, such as the amount of virtual storage set by the SMBVSP parameter, whether hiperspace buffers were used, whether insufficient virtual storage problems occurred, indicators of whether a reduced or minimum amount of resource is

being used for a data pool, and whether DW is used (the case of retry technique).

SMBJOB

```
//DEL       EXEC PGM=IDCAMS
//SYSPRINT  DD SYSOUT=X
//SYSIN     DD *
    DELETE hlq.SMF64.DATA
    SET MAXCC=Ø
/*
//COPYSMF  EXEC PGM=ICETOOL
//TOOLMSG  DD SYSOUT=*
//DFSMSG   DD SYSOUT=*
//RAWSMF   DD DSN=your.smf.dataset,DISP=SHR
//SMF64    DD DSN=hlq.SMF64.DATA,
//         SPACE=(CYL,(x,y)),UNIT=SYSDA,
//         DISP=(NEW,CATLG,KEEP),
//         DCB=(RECFM=VB,LRECL=32756,BLKSIZE=3276Ø)
//TOOLIN   DD *
  COPY FROM(RAWSMF) TO(SMF64) USING(SMFI)
//SMFICNTL DD *
  OPTION SPANINC=RC4,VLSHRT
  INCLUDE COND=(6,1,BI,EQ,64,AND,43,1,BI,NE,X'2Ø') * copy SMF 64
/*
//SMB64    EXEC PGM=IKJEFTØ1,REGION=ØM
//SYSEXEC  DD DISP=SHR,DSN=your.rexx.library
//SMF64    DD DISP=SHR,DSN=hlq.SMF64.DATA
//SYSPRINT DD SYSOUT=*
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
prof nopref
%SMB
/*
```

SMB EXEC

```
/* REXX EXEC to read SMF 64 records - VSAM Component/Cluster Status  */
signal ON ERROR
/*-------------------------------------------------------------------*/
/* Part 1: Handle file allocation & dataset existence and            */
/*         print report header and labels                            */
/*-------------------------------------------------------------------*/
Address TSO
  userid=SYSVAR(SYSUID)
  r64fa  =userid||'.r64fa.rep'          /* File processing/attribute*/
  r64bf  =userid||'.r64bf.rep'          /* Buffering report         */
x = MSG('OFF')
```

```
IF SYSDSN(r64fa) = 'OK'
THEN "DELETE "r64fa" PURGE"
IF SYSDSN(r64bf) = 'OK'
THEN "DELETE "r64bf" PURGE"
"ALLOC FILE(S64FA) DA("R64FA")",
   " UNIT(SYSALLDA) NEW TRACKS SPACE(90,30) CATALOG",
   " REUSE RELEASE LRECL(245) RECFM(F B)"
"ALLOC FILE(S64BF) DA("R64BF")",
   " UNIT(SYSALLDA) NEW TRACKS SPACE(90,30) CATALOG",
   " REUSE RELEASE LRECL(205) RECFM(F B)"
 fi.1  =left(' ',8,' '),
        ||'VSAM file processing & attribute report'||left(' ',15,' ')
 fi.2  ='  '
 fi.3  =left(' ',8,' ')||'Report produced on',
        ||left(' ',1,' ')||left(date(),11),
        ||left(' ',1,' ')||left('at ',3,' ')||left(time(),10)
 fi.4 = '  '
 fi.5 = left(' ',83,' ')||left('# of',4)||left(' ',2,' '),
        ||left('Records in this run:',20)||left(' ',10,' '),
        ||left('Access by:',10)||left(' ',16,' ')||left('CI',2),
        ||left(' ',5,' ')||left('Index',5),
        ||left(' ',6,' ')||left('-- Split -- Insert',20),
        ||left(' ',8,' ')||left('Data set:',9),
        ||left(' ',9,' ')||left('Res.',4)
 fi.6 = left('obs',3) right('Job name',8) left('Run date',11),
        left('Elapsed time',14) left('Cluster/Component name',30),
        right('Excp',6)        right('Records',9) right("ret'ved",8),
        left('delete  insert update',21)          right('Key',3),
        right('Rba',3)         right('Cnv',3)     right('ICI',3),
        left('Recl',4)         right('kl',3)      right('size',4),
        right('level',8)       right('CI',7)      right('CA',9),
        center('strategy',8)   right('ext.',5),
        left('Address.',8)     left('Format',8)   left('sharing',7),
        left('Restriction',12)
 fi.7 = left('-',242,'-')
     "EXECIO * DISKW s64fa (STEM fi.)"
 bf.1  =left(' ',8,' '),
        ||'VSAM file buffers & buffering management'||left(' ',15,' ')
 bf.2  ='  '
 bf.3  =left(' ',8,' ')||'Report produced on',
        ||left(' ',1,' ')||left(date(),11),
        ||left(' ',1,' ')||left('at ',3,' ')||left(time(),10)
 bf.4 = left(' ',76,' ')||left('# of  Records',13),
        ||left(' ',8,' ')||left('Access:',8)||left(' ',8,' '),
        ||left('Buffers:',8)||left(' ',30,' ')||left('RS',2),
        ||left(' ',5,' ')||left("Direct Optimized (DO) SMB parms:",32)
 bf.5 = left('obs',3) right('Job name',8) left('Run date',11),
        left('Elapsed time',14) left('Cluster/Component name',30),
        right('Records',9)      right("ret'ved",8),
        right('Excp',6)         left('mode',4),
```

```
        left('bias',4)          left('SMB',5),
        left('used  user  space  data index',31),
        left('bit fixed',10)    right('vsp',5),
        right('hwt',5)          right('b31',5),
        right('cb31',5)         right('ivs',5),
        right('rer',5)          right('mer',5) right('hyp',5)
 bf.6 = left('-',205,'-')
     "EXECIO * DISKW s64bf (STEM bf.)"
/*-------------------------------------------------------------------*/
/* Part 2: read and decode SMF 64 records                            */
/*-------------------------------------------------------------------*/
'EXECIO * DISKR SMF64 ( STEM x. FINIS'
numeric digits 10
do i = 1   to x.0
/*-------------------------------------------------------------------*/
/* Header/Self-defining Section                                      */
/*-------------------------------------------------------------------*/
   rty = c2d(substr(x.i,2,1))
   if rty <> '40'x then do                    /* record type         */
   smfdate = substr(c2x(substr(x.i,7,4)),3,5) /* unpack smf date     */
   smftime = smf(c2d(substr(x.i,3,4)))        /* decode smf time     */
   term= c2d(substr(x.i,3,4))                 /* termination time    */
   jbn = substr(x.i,15,8)                     /* jobname             */
   rst = smf(c2d(substr(x.i,23,4)))           /* decode rst time     */
   init= c2d(substr(x.i,23,4))                /* initiate time       */
   rsd = substr(c2x(substr(x.i,27,4)),3,5)    /* unpack rsd date     */
/*-------------------------------------------------------------------*/
/* Situation indicator                                               */
/*-------------------------------------------------------------------*/
   rin = x2b(c2x(substr(x.i,39,1)))
    z1 =  substr(rin,1,1)
    z2 =  substr(rin,2,1)
    z3 =  substr(rin,3,1)
    z4 =  substr(rin,4,1)
    z5 =  substr(rin,5,1)
    z6 =  substr(rin,6,1)
    z7 =  substr(rin,7,1)
    if  z1 =1 & z6 =1 then sit='Close on Abend  '
    else if z1 =1     then sit='Component closed'
    else if z2 =1     then sit='Vol switched    '
    else if z3 =1     then sit='No space avail  '
    else if z4 =1     then sit='Cat or CRA rec  '
    else if z5 =1     then sit='Closed type=t   '
    else if z6 =1     then sit='Abend process   '
    else if z7 =1     then sit='Close VVDS or ICF'
    else                   sit='logic error'
/*-------------------------------------------------------------------*/
/* Indicator of component being processed                            */
/*-------------------------------------------------------------------*/
   dty = x2b(c2x(substr(x.i,40,1)))          /* dataset attributes  */
```

```
    w1 =  substr(dty,1,1)                    /* component type      */
    w2 =  substr(dty,2,1)                    /* component type      */
    w3 =  substr(dty,3,1)                    /* file format         */
    w4 =  substr(dty,4,1)                    /* file compession     */
    w5 =  substr(dty,5,1)                    /* rls                 */
    w6 =  substr(dty,6,1)                    /* rls : mmf           */
    w7 =  substr(dty,7,1)                    /* file addressibility */
  select
   when w1 =1 then comp = 'Data'
   when w2 =1 then comp = 'Index'
  end
  select
   when w3 =1 then form = 'Extended format'
   otherwise       form = 'Standard format'
  end
  select
   when w4 =1 then com  = 'Compressed   '
   otherwise       com  = 'Non compressed'
  end
  select
   when w5 =1 then rls  = 'RLS in effect             '
   when w6 =1 then rls  = 'RLS in effect MMF disabled'
   otherwise       rls  = 'Non rls       '
  end
  select
   when w7 =1 then addr = 'Extended addressable ds'
   otherwise       addr = 'Standard addressibility'
  end
   dnm = strip(substr(x.i,85,44))            /* dataset name         */
   hlq = substr(dnm,1,3)                     /* ds hlq construct     */
   hlqt= substr(dnm,1,11)                    /* test  ds hlq         */
   chr = c2d(substr(x.i,131,4))              /* current high rba/ci  */
   esl = c2d(substr(x.i,135,2))              /* extent segment length*/
   #extents = esl / 26                       /* no. of extents       */
   offset = 135 + 2 + esl
   sln = c2d(substr(x.i,offset,4))           /*  stat.segment length */
/*-------------------------------------------------------------------*/
/*  Selection filtering by: dsn or job name (sample)                 */
/*-------------------------------------------------------------------*/
/*  IF (hlq ¬= "SYS") & (hlq ¬= "DFH") & (hlq ¬= "BET") & ,
   (hlq ¬= "QMF") & (hlq ¬= "CIC") & ,
   (hlq ¬= "CAT") & (hlq ¬= "BK.") & ,
   (jbn ¬= "CICSPROD") &  (jbn ¬= "CICSTEST") & ,
   (jbn ¬= "CICSDEV")  &  (comp = 'Data')                           */
/*-------------------------------------------------------------------*/
/* Figure 1 selection filters used: dsn, job name, close status     */
/*-------------------------------------------------------------------*/
   IF hlqt="PROD.HISTFI" &  jbn = "MYJOB   "  & (z1 =1)
Then do
select ;
```

```
 when sln > 280
            then do ;
/*-------------------------------------------------------------------*/
/*  Statistics Section at OPEN Time                                  */
/*-------------------------------------------------------------------*/
     nil = c2d(substr(x.i,offset+4,4))    /* # of index levels       */
     nex = c2d(substr(x.i,offset+8,4))    /* # of extents            */
     nlr = c2d(substr(x.i,offset+12,4))   /* # of records            */
     nde = c2d(substr(x.i,offset+16,4))   /* # of deletes            */
     nin = c2d(substr(x.i,offset+20,4))   /* # of inserts            */
     nup = c2d(substr(x.i,offset+24,4))   /* # of updates            */
     nre = c2d(substr(x.i,offset+28,4))   /* # of retrieves          */
     ncs = c2d(substr(x.i,offset+36,4))   /* # of ci splits          */
     nas = c2d(substr(x.i,offset+40,4))   /* # of ca splits          */
     nep = c2d(substr(x.i,offset+44,4))   /* # of excp count         */
/*-------------------------------------------------------------------*/
/* Change in Statistics from OPEN to time of EOV and CLOSE           */
/*-------------------------------------------------------------------*/
     dil = c2d(substr(x.i,offset+48,4))   /* # of index levels chg.  */
     dex = c2d(substr(x.i,offset+52,4))   /* # of extents chg.       */
     drl = c2d(substr(x.i,offset+56,4))   /* # of records chg.       */
     dde = c2d(substr(x.i,offset+60,4))   /* # of deleted chg.       */
     din = c2d(substr(x.i,offset+64,4))   /* # of insert  chg.       */
     dup = c2d(substr(x.i,offset+68,4))   /* # of update  chg.       */
     dre = c2d(substr(x.i,offset+72,4))   /* # of retrieve chg.      */
     dcs = c2d(substr(x.i,offset+80,4))   /* # of ci splits chg.     */
     das = c2d(substr(x.i,offset+84,4))   /* # of ca splits chg.     */
     dep = c2d(substr(x.i,offset+88,4))   /* # of excp chg.          */
/*-------------------------------------------------------------------*/
/*  Dataset Characteristics Section                                  */
/*-------------------------------------------------------------------*/
     dbs = c2d(substr(x.i,offset+92,4))   /* physical blocksize      */
     dci = c2d(substr(x.i,offset+96,4))   /* control interval size   */
     dls = c2d(substr(x.i,offset+100,4))  /* max. logical rec length */
     dkl = c2d(substr(x.i,offset+104,2))  /* key length              */
     ddn = substr(x.i,offset+106,8)       /* dd name                 */
     str = c2d(substr(x.i,offset+114,1))  /* string number           */
     plh = c2d(substr(x.i,offset+168,2))  /* # of concurrent strings */
     bno = c2d(substr(x.i,offset+115,1))  /* # of buffers requested  */
     bsp = c2d(substr(x.i,offset+116,4))  /* buffer space            */
     bfd = c2d(substr(x.i,offset+120,2))  /* data buffers            */
     bfi = c2d(substr(x.i,offset+122,2))  /* index buffers           */
/*-------------------------------------------------------------------*/
/* First ACB MACRF flag byte                                         */
/*-------------------------------------------------------------------*/
mc1 = x2b(c2x(substr(x.i,offset+170,1)))
  acbkey =  substr(mc1,1,1)    /* access data via index? key_access  */
  acbadr =  substr(mc1,2,1)    /* access without index?' rba_access  */
  acbcnv =  substr(mc1,3,1)    /* control interval processing?       */
  acbseq =  substr(mc1,4,1)    /* sequential processing?             */
```

```
  acbdir =  substr(mc1,5,1)    /* direct processing?                */
  acbin  =  substr(mc1,6,1)    /* input/get/read ?                  */
  acbout =  substr(mc1,7,1)    /* output/put/write ?                */
  acbubf =  substr(mc1,8,1)    /* user buffers?                     */
if (acbout= 1)  & (acbin= 1)   then open='inout '
   else if acbout= 1           then open='output'
   else                        open='input '
/*-------------------------------------------------------------------*/
/* Second ACB MACRF flag byte                                        */
/*-------------------------------------------------------------------*/
mc2 = x2b(c2x(substr(x.i,offset+171,1)))
  acbskp  = substr(mc2,4,1)            /* skip sequential processing */
  acblogon= substr(mc2,5,1)            /* logon indicator            */
  acbrst  = substr(mc2,6,1)            /* dataset to empty state     */
  acbdsn  = substr(mc2,7,1)            /* shared_control_blocks'     */
  acbaix  = substr(mc2,8,1)            /* path_aix                   */
if (acbdir= 1)  & (acbseq= 1)  then mode='mix'
   else if acbdir= 1           then mode='dir'
   else if acbskp= 1           then mode='skp'
   else                        mode='seq'
/*-------------------------------------------------------------------*/
/* Third ACB MACRF flag byte                                         */
/*-------------------------------------------------------------------*/
mc3 = x2b(c2x(substr(x.i,offset+172,1)))
  acblsr  = substr(mc3,2,1)            /* local shared resource      */
  acbgsr  = substr(mc3,3,1)            /* global shared resource     */
  acbici  = substr(mc3,4,1)            /* improved ci processing     */
  acbdfr  = substr(mc3,5,1)            /* deferred write             */
  acbsis  = substr(mc3,6,1)            /* sequential insert strategy */
  acbncfx = substr(mc3,7,1)            /* fixed_control_blocks       */
  acbmode = substr(mc3,8,1)            /* vsam 31 bit addressing     */
select
  when acblsr = 1 then shr='lsr'
  when acbgsr = 1 then shr='gsr'
  otherwise            shr='nsr'
end
select
  when acbncfx= 1 then fix='yes'         /* cont. blocks & buffers   */
  otherwise            fix='no '         /* fixed in real storage    */
end
select
 when acbmode = 1 then bufa='31'         /*   buffer addressing mode */
  otherwise            bufa='24'
end
select
 when ACBSIS = '1' then ins='SIS'        /* insert strategy used     */
  otherwise             ins='nis'
end
/*-------------------------------------------------------------------*/
/* Fourth ACB MACRF flag byte                                        */
```

```
/*-------------------------------------------------------------------*/
mc4 = x2b(c2x(substr(x.i,offset+173,1)))
  acbrls  = substr(mc4,1,1)           /*  rls processing           */
  acbsnp  = substr(mc4,2,1)           /*  snp option               */
  mc43    = substr(mc4,3,1)           /*  reserved                 */
  mc44    = substr(mc4,4,1)           /*  reserved                 */
  mc45    = SUBSTR(mc4,5,1)           /*  reserved                 */
  mc46    = SUBSTR(mc4,6,1)           /*  reserved                 */
  mc47    = SUBSTR(mc4,7,1)           /*  reserved                 */
  mc48    = SUBSTR(mc4,8,1)           /*  reserved                 */
/*-------------------------------------------------------------------*/
/* SMB Restrictions                                                  */
/* MACRF parameters not supported are:                               */
/* UBF(USER buffering), ICI(Improved Control Interval processing),   */
/* GSR(Global Shared Resources), LSR(Local Shared Resources),        */
/* RLS(Record Level Sharing), AIX(Alternate Index)- pre z/OS 1.3 rel.*/
/* non-extended format VSAM files.                                   */
/*-------------------------------------------------------------------*/
  if acbubf = 1            then note='USER buffering'
     else if  acbici = 1   then note='ICI processing'
     else if  acbaix = 1   then note='Alternate Index'
     else if shr ¬= 'nsr'  then note='NSR required'
     else if acbrls =1     then note='RLS processing'
     else if w3 =Ø         then note='Extended format required'
     else                  note='none'
/*-------------------------------------------------------------------*/
/* SMB ACCESS BIAS Information                                       */
/*-------------------------------------------------------------------*/
smb = x2b(c2x(substr(x.i,offset+174,1)))
  s1 = substr(smb,1,1)                          /* accbias via jcl*/
  s2 = substr(smb,2,1)                          /* accbias via smb*/
  s3 = substr(smb,3,1)                          /* bias=do used   */
  s4 = substr(smb,4,1)                          /* bias=so used   */
  s5 = substr(smb,5,1)                          /* bias=sw used   */
  s6 = substr(smb,6,1)                          /* bias=dw used   */
  s7 = substr(smb,7,1)                          /* bias=co used   */
  s8 = substr(smb,8,1)                          /* bias=cr used   */
/*-------------------------------------------------------------------*/
/* The way of SMB invocation  ?                                      */
/*-------------------------------------------------------------------*/
select
  when s1 ='1' then smb='jcl'
  when s2 ='1' then smb='sys'
  otherwise         smb='none'
end
/*-------------------------------------------------------------------*/
/* Kind of SMB optimization technique used ?                        */
/*-------------------------------------------------------------------*/
select
  when s3 ='1' then bia='do'
```

```
  when s4 ='1' then bia='so'
  when s5 ='1' then bia='sw'
  when s6 ='1' then bia='dw'
  when s7 ='1' then bia='co'
  when s8 ='1' then bia='cr'
  otherwise         bia='none'
end
/*-------------------------------------------------------------------*/
/* SMB DO Information                                                */
/*-------------------------------------------------------------------*/
rsc = x2b(c2x(substr(x.i,offset+175,1)))
 vsp = substr(rsc,1,1)                    /* do with smbvsp         */
 hwt = substr(rsc,2,1)                    /* do with smbhwt         */
 b31 = substr(rsc,3,1)                    /* remode31=buff used     */
 cb31= substr(rsc,4,1)                    /* rmode31=cb used        */
 ivs = substr(rsc,5,1)                    /* do: insufficient vs    */
 rer = substr(rsc,6,1)                    /* do: reduced resource   */
 mer = substr(rsc,7,1)                    /* do: minimum resource   */
 hyp = substr(rsc,8,1)           /* do:some or all hyperspace buffers*/
 if comp="Index"  then buf  =bfi
   else if compont="Data" then buf  =bfd
  elapstm = smf(term-init)
/*-------------------------------------------------------------------*/
/* File processing & attribute report                                */
/*-------------------------------------------------------------------*/
fa=right(i,3,'Ø')    right(jbn,8)    right(date('n',rsd,'j'),11),
   left(elapstm,14)  left(dnm,3Ø)    right(DEP,6),
   right(nlr,9)      right(dre,8)    right(dde,6),
   right(din,6)      right(dup,6)    right(acbkey,3),
   right(acbadr,3)   right(acbcnv,3) right(acbici,3),
   right(dls,5)      right(dkl,3)    right(DCI,5),
   right((nil + dil),4),           /* index levels at the end of run */
   right((ncs + dcs),1Ø),          /* ci splits at the end of run    */
   right((nas + das),1Ø),          /* ca splits at the end of run    */
   right(ins,5),
   right((nex + dex),5),           /* extents at the end of run      */
   left(' ',1' ')    left(addr,8)    left(form,8)   right(shr,4),
   left(' ',2' ')    left(note,24)
 PUSH fa
   "EXECIO 1 DISKW s64fa"
/*-------------------------------------------------------------------*/
/* File buffers & & buffering management report                      */
/*-------------------------------------------------------------------*/
bff= right(i,3,'Ø')   right(jbn,8)    right(date('n',rsd,'j'),11),
     left(elapstm,14) left(dnm,3Ø)    right(nlr,9),
     right(dre,8)     right(dep,6)    right(mode,4),
     left(bia,4)      left(smb,4),
     right(bno,5)     right(acbubf,5) right(bsp,6),
     right(bfd,5)     right(bfi,5)    right(bufa,5),
     right(fix,5)     right(vsp,5)    right(hwt,5),
```

```
     right(b31,5)     right(cb31,5)   right(ivs,5),
     right(rer,5)     right(mer,5)    right(hyp,5)
 PUSH bff
   "EXECIO 1 DISKW s64bf"
        end
    otherwise do ;
    say 'REXX program logic in error !'
    exit
       end
      end
     end
    end
  end
drop x.
/* Close & free all allocated files  */
 "EXECIO Ø DISKW s64fa(FINIS "
 "EXECIO Ø DISKW s64bf(FINIS "
 say
 say 'VSAM file processing & attribute report dsn ...:'r64fa
 say 'VSAM file buffers & buffering management dsn ..:'r64bf
 say
 "free FILE(SMF64 s64fa s64bf)"
exit
/*-------------------------------------------------------------------*/
/* Error exit routine                                                */
/*-------------------------------------------------------------------*/
ERROR: say 'The following command produced non-zero RC =' RC
       say SOURCELINE(SIGL)
       exit
SMF: procedure
/* REXX - convert an SMF time to hh:mm:ss:hd format   */
arg time
    time1    = time % 1ØØ
    hh       = time1 % 36ØØ
    hh       = RIGHT("Ø"||hh,2)
    mm       = (time1 % 6Ø) - (hh * 6Ø)
    mm       = RIGHT("Ø"||mm,2)
    ss       = time1 - (hh * 36ØØ) - (mm * 6Ø)
    ss       = RIGHT("Ø"||ss,2)
    fr       = time //  1ØØØ
    fr       = RIGHT("Ø"||fr,2)
    rtime  = hh||":"||mm||":"||ss||":"||fr
    return rtime
```

CONCLUSION

It is true that SMB may not be the answer to all application program buffering requirements. Its main purpose is to provide a system

capability for improving performance buffering options for batch application processing beyond those provided by the standard defaults. However, if you haven't implemented System Managed Buffering yet, the recommendations in this article can be applied to any VSAM file type, and the performance improvements for batch processing will be remarkable. If your datasets are currently in EXTENDED format, or will be converted to EXTENDED in the near future, you should be able to implement System Managed Buffering, and you will be able to achieve even better performance than is available with NSR buffering. As in all other cases, one shouldn't make significant changes in a production dataset's allocation unless they have been thoroughly tested.

REFERENCES

z/OS DFSMS: Using Data Sets (SC26-7410)

z/OS V1R3: DFSMS Technical Guide (SG24-6569-00)

VSAM Demystified (September 2003 edition) (SG24-6105)

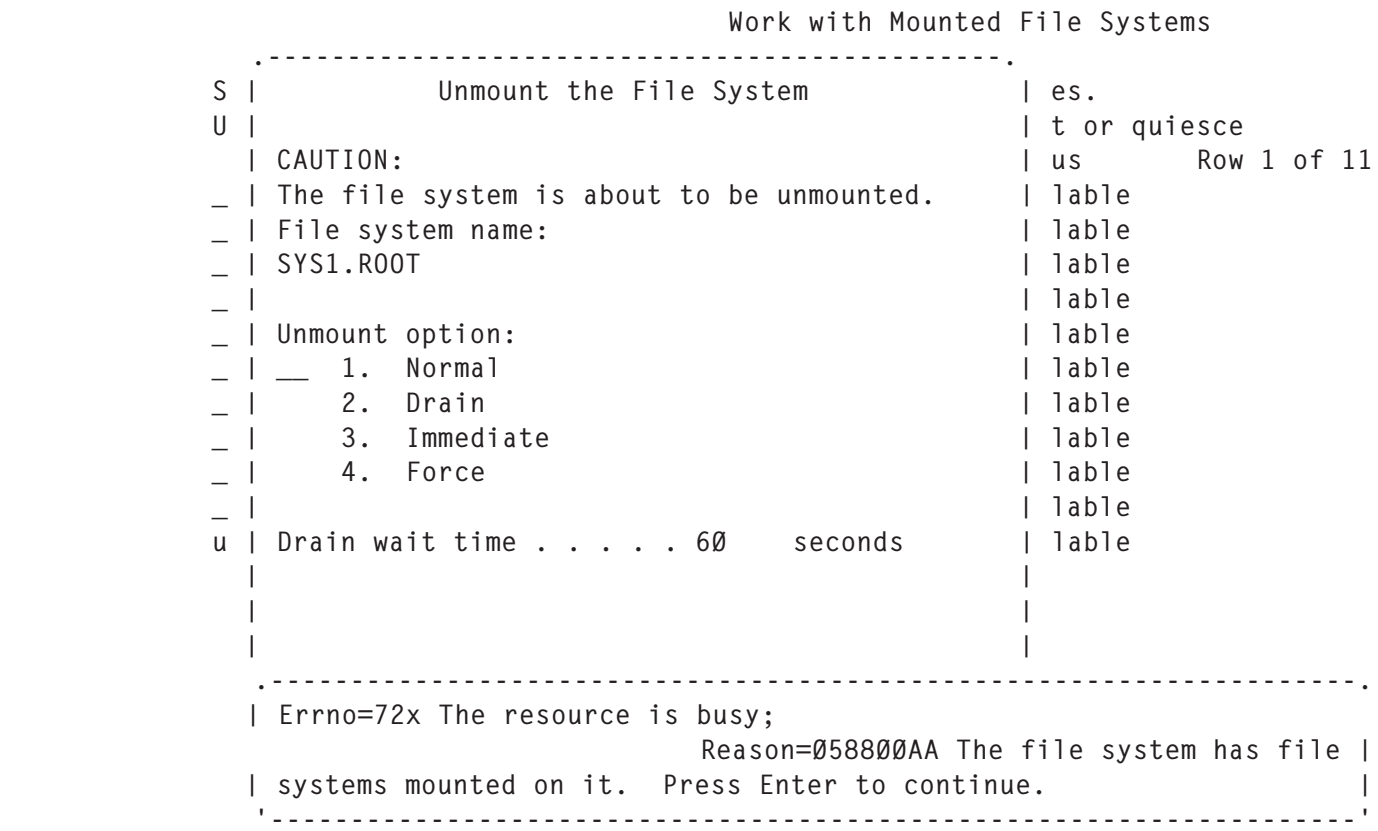
Mile Pekic
Systems Programmer (Serbia)

BPXMTEXT utility

As non-Unix users, we are constantly challenged by the new USS world and make lots of stupid errors! Deciphering the resultant error messages is not really intuitive. No message numbers, eight digit error codes, etc.

But IBM has delivered a 'goody' to help us! SYS1.SBPXEXEC(BPXMTEXT) contains an EXEC that displays short explanation messages.

For example, if you try to dismount SYS1.ROOT using ISHELL, you get the following message, which is not very clear:



Ouch! What is the meaning of the reason code 058800AA?

With BPXMTEXT, it is easy to get the answer. You only have to enter the following command on the ISPF command line:

```
BPXMTEXT 058800AA
```

And you get the answer!

```
MT       BPXMTEXT msg: 058800AA
BPXFSUMT 06/05/02
JRFsParentFs: The file system has file systems mounted on it

Action: An unmount request can be honoured only if there are no file
systems mounted anywhere on the requested file system.
Use the D OMVS,FILE command
from the system console to find out which file systems are mounted on
the requested file system.  Unmount them before retrying this request.
***
```

Often this is enough information to determine the real error; if not, well there is always the ‘friendly’ manual!

Systems Programmer
(France)

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