204

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In this issue

3 DFHSM error report from daily SMF extract

7 Archival data warehousing designs

10 Locating strings in files

22 Calling the ANTRQST macro

33 Using Pretty Good Privacy (PGP) to encrypt/decrypt and sign your MVS data

54 Using TAR and JAR files on MVS

56 Finding CSECTs within LPA load modules in virtual storage

63 Reorganization of datasets

70 October 1999 – September 2003 index

73 MVS news

update

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Editor

Trevor Eddolls

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DFHSM error report from daily SMF extract

After publishing the article entitled *A simple DFHSM report writer* (*MVS Update*, issue 191, August 2002) I received several requests to make the code more applicable. The key point of these requests was that the code was written in the SAS language, which is not available at all mainframe sites.

What was really needed was a simple, flexible, and yet fast reporting tool that would quickly identify work that has not been completed by DFHSM.

In order to provide a simple and effective way to gather the data needed to monitor, analyse, and correct what went wrong during DFHSM activity, an easy-to-use reporting procedure has been created.

CODE

The code is a two-part stream. In the first part, COPYSMF, selected DFHSM SMF records of the FSR type are copied from the SMF dataset to a file that can be used as a base for the archived records. By default, DFHSM writes SMF id 241 for functional statistics records (FSR and WWFSR). A detailed description of the layout of FSR records and its fields can be obtained from the DFSMS manual *DFSMShsm Implementation and Customization Guide*.

In the second part of the code, HSMERR, the captured records are formatted and two reports are produced.

The first report (DFHSM Function Error Statistics report) shows the summary of DFHSM errors along with a breakdown of this summary data by DFHSM function (BACKUP, SPILL, Primary to Level 1, etc), date, and return/reason codes, as well as the totals of the numbers of each error. The second report is a detailed dataset-level activity, reporting *all* activity that failed.

Note: a non-zero return code indicates that the function did not

complete successfully. The meanings of the return codes are documented in *DFHSM Messages*, SH35-0094. Use this field along with the function field to find out what function was running. Then, see message ARC0734I to determine what the return code means.

```
//DEL EXEC PGM=IDCAMS
//SYSPRINT  DD SYSOUT=X
//SYSIN     DD *
     DELETE hlq.SMF241
     SET MAXCC=Ø
/*
//COPYSMF  EXEC PGM=IFASMFDP,REGION=ØM
//INDA1 DD DSN=sysid.SMFDUMPW,DISP=SHR       * weekly/daily SMF file
//OUTDA DD DSN=hlq.SMF241,DISP=(NEW,CATLG),UNIT=SYSDA,
//         SPACE=(CYL,(x,y),RLSE),
//         DCB=(sysid.SMFDUMPW)
//SYSPRINT DD SYSOUT=X
//SYSIN DD *
       INDD(INDA1,OPTIONS(DUMP))
       OUTDD(OUTDA,TYPE(241))
/*
//HSMERR   EXEC PGM=ICETOOL,REGION=ØM
//TOOLMSG  DD SYSOUT=X
//DFSMSG   DD SYSOUT=X
//FUNCERR  DD SYSOUT=X
//DETAIL   DD SYSOUT=X
//SMF      DD DSN=hlq.SMF241,DISP=SHR
//SHOW     DD DSN=&&TEMPD,SPACE=(CYL,(15,15)),UNIT=SYSDA
//SMFC     DD DSN=&&TEMPV,SPACE=(CYL,(15,15)),UNIT=SYSDA
//TOOLIN   DD *
  COPY FROM(SMF) TO(SMFC) USING(SMFI)
*
*  Print a summary report showing total number of errors
*
   OCCUR FROM(SHOW) LIST(FUNCERR)                        -
   TITLE('DFHSM Function Error Statistic Report') DATE TIME -
    HEADER('Function')                 ON(1,13,CH)      -
    HEADER('Total number of errors')   ON(VALCNT)       -
    BLANK
*
*  Print a summary report showing number of errors by RC/RS
*
   OCCUR FROM(SHOW) LIST(FUNCERR)                        -
   TITLE('DFHSM Function Error Report by RC & RS') DATE TIME -
    HEADER('Function')           ON(1,13,CH)            -
    HEADER('Ret.Code')           ON(26,4,BI)            -
    HEADER('Reas.Code')          ON(3Ø,4,BI)            -
```

```
    HEADER('Total number of errors')   ON(VALCNT)       -
    BLANK
*
*  Print a summary report showing number of function errors by date
*
   OCCUR FROM(SHOW) LIST(FUNCERR)                                  -
   TITLE('DFHSM Function Error Report by Function') DATE TIME      -
    HEADER('Function')           ON(1,13,CH)                       -
    HEADER('Date')               ON(18,4,DT1,E'9999/99/99')        -
    HEADER('Number of errors')   ON(VALCNT)                        -
    BLANK
*
*  Print a summary report showing number of function errors by date
*
   OCCUR FROM(SHOW) LIST(FUNCERR)                                   -
   TITLE('DFHSM Function Error Report by Date') DATE TIME           -
    HEADER('Date')               ON(18,4,DT1,E'9999/99/99')        -
    HEADER('Function')           ON(1,13,CH)                       -
    HEADER('Number of errors')   ON(VALCNT)                        -
    BLANK
*
*  Print a detailed report of function errors by date
*
    DISPLAY FROM(SHOW) LIST(DETAIL)                          -
    TITLE('DFHSM Function Error Report - Detailed') DATE TIME -
     HEADER('Sid')           ON(14,4,CH)                     -
     HEADER('Time')          ON(22,4,TM1,E'99:99:99')        -
     HEADER('Function')      ON(1,13,CH)                     -
     HEADER('RC')            ON(26,4,BI)                     -
     HEADER('REAS')          ON(30,4,BI)                     -
     HEADER('Last Ref.')     ON(34,4,DT1,E'9999/99/99')      -
     HEADER('Last Moved')    ON(38,4,DT1,E'9999/99/99')      -
     HEADER('DS Age')        ON(62,2,BI)                     -
     HEADER('Request by')    ON(42,8,CH)                     -
     HEADER('From Vol.')     ON(56,6,CH)                     -
     HEADER('To Vol.')       ON(50,6,CH)                     -
     HEADER('Dsorg ')        ON(116,4,CH)                    -
     HEADER('Data Set Name') ON(64,44,CH)                    -
     HEADER('Mclass')        ON(108,8,CH)                    -
     BREAK(18,4,DT1,E'9999/99/99')                           -
     BTITLE(': Daily Error Report')                          -
     BLANK
/*
//SMFICNTL DD *
   OPTION COPY,VLSHRT
   OUTFIL FNAMES=SHOW,CONVERT,      * Build a new output record
   INCLUDE=(6,1,BI,EQ,X'F1',AND,109,4,BI,GT,X'0000'),
    OUTREC=(43,1,CHANGE=(13,
           X'01',C'Migrate l0/l1',  * primary to level 1 migration
```

```
X'Ø2',C'Migrate l1/l2',  * level 1 to level 2 migration
X'Ø3',C'Migrate lØ/l2',  * primary to level 2 migration
X'Ø4',C'Recall l1/lØ ',  * recall from level 1 to primary
X'Ø5',C'Recall l2/lØ ',  * recall from level 2 to primary
X'Ø6',C'Delete mig.  ',  * delete migrated dataset
X'Ø7',C'Daily backup ',  * daily backup
X'Ø8',C'Spill backup ',  * spill backup
X'Ø9',C'Recovery     ',  * recovery from backup
X'ØA',C'Recycle bk.  ',  * recycle backup volume
X'ØB',C'Del by age   ',  * dataset deletion by age
X'ØC',C'Recycle ml2  ',  * recycle migration volume
X'ØD',C'Volume dump  ',  * full volume dump
X'ØE',C'Restore      ',  * volume or dataset restore
X'ØF',C'Abackup      ',  * abackup function
X'1Ø',C'Arecover     ',  * arecover function
X'11',C'Expire       ',  * expire primary or mig. dataset
X'12',C'Partrel      ',  * partial release
X'13',C'Expired bk.  ',  * expire incremental backup ver.
X'14',C'Delete bk.   '), * delete incremental backup ver.
  15,4,         * System identification
  11,4,         * Date of function being performed
  7,4,          * Time
  1Ø9,4,        * Return code from mwe
  113,4,        * Reason code from mwe
  157,4,        * Dataset last referenced date
  161,4,        * Dataset last moved date
  35,8,         * Id of the user requesting the function
  89,6,         * Receiving volume
  99,6,         * From volume
  185,2,        * Dataset age
  45,44,        * Dataset name
  215,8,        * Management class
177,2,CHANGE=(4,            * Dsorg (as char field)
       X'8ØØØ',C'IS  ',     * change to indexed seq
       X'4ØØØ',C'PS  ',     * change to physical seq
       X'2ØØØ',C'DA  ',     * change to direct
       X'ØØØ8',C'VSAM',     * change to vsam
       X'Ø2ØØ',C'PDS ',     * change to partitioned
       X'41ØØ',C'PSU ',     * change to ps unmoveable
       X'ØØ8Ø',C'GS  '),    * change to graphic
       NOMATCH=(C'UNDF'))   * change to undefined
/*
```

It is to be hoped that DASD/Storage Management personnel now have the ability to easily identify and analyse any action taken by DFHSM that failed.

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Archival data warehousing designs

The underlying objectives of data warehouse designs can be summarized as:

- Storing a large volume of data.
- The fastest and cheapest retrieval of data
- OLTP interface for user-friendly querying.
- Controlling system load.

Business applications running on legacy systems often need such a design to query archival/back-up data, without restrictions on size. *Ad hoc* reporting techniques available on MVS systems (see *Handling* ad hoc *reports querying large volumes of data – a case study*, *MVS Update*, issue 201, June 2003) can be used to build a primitive data warehouse that meets these underlying principles.

DATA ARCHIVAL DESIGN

Generation data groups can be used for taking back-ups daily. Because GDGs support a maximum of only 255 versions, we must collect data differently, based on a volume of data that we can browse sequentially. Below are two ways to do this.

- Monthly, appending data daily to the current version. We use a file layout with the date of archival as the file's key, which helps to search data by date. This is when a month's volume of data is suitable for sequentially browsing.
- Separate GDGs for each month with 28/29/30/31 versions based on month and year. We need two-tier JCL with INCLUDE groups (see previous article). First the JCL runs a program with built-in logic to read the date of the data archival/system date and converts it to a GDG version number. Thus the correct generation is located to store the back-up data. This information is passed to the second JCL

with the INCLUDE feature. The second JCL uses this INCLUDE member and stores the data. This pair runs daily to collect archival data. This JCL pair helps when a month's volume is too great for sequential browsing during data retreival. We can have as a file key the back-up hour too, for those applications where back-ups are taken hourly.

Thus the design of the data storage layer aims at zero maintenance by storing archival data in GDGs.

It directly influences the speed of data retrieval by:

- Using two-tier JCL with INCLUDE groups.
- Choosing a file key of date/hour.

Figure 1 shows a data archival design diagram.

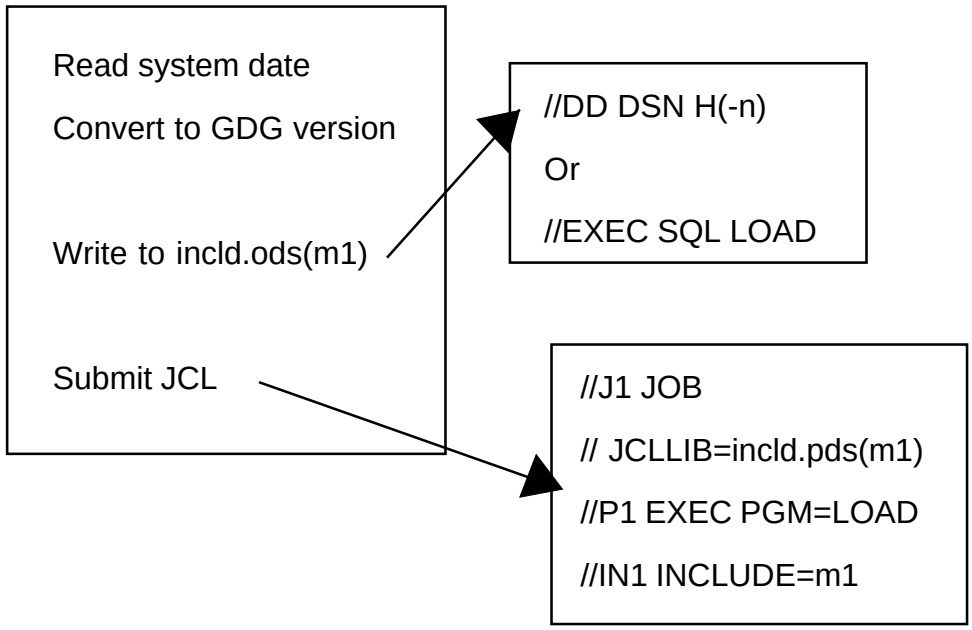

Figure 1: Data archival design diagram

DATA RETRIEVAL DESIGN

As discussed above, we can embed in an ISPF/CLIST front end, built-in date-version conversion logic, prepare INCLUDE

members, and trigger the JCL to run using the INCLUDE dataset group. Such an application runs queries single-threaded. Using a design with two-tier JCL, using job scheduler switches (see previous article), means that JCL waits in the MVS input queue until the preceding job pair completes. This multi-threads keying-in requests. Batch query jobs still run single-threaded. By preparing separate INCLUDE members instead, a common member query can be multi-threaded.

Queries can be made much more flexible by preparing INCLUDE members with DB2 load control statements instead of JCL DD statements. Thus data warehousing designs can be created with much more advanced front-end designs on top of layers of the fastest and cheapest archival/retrieval designs.

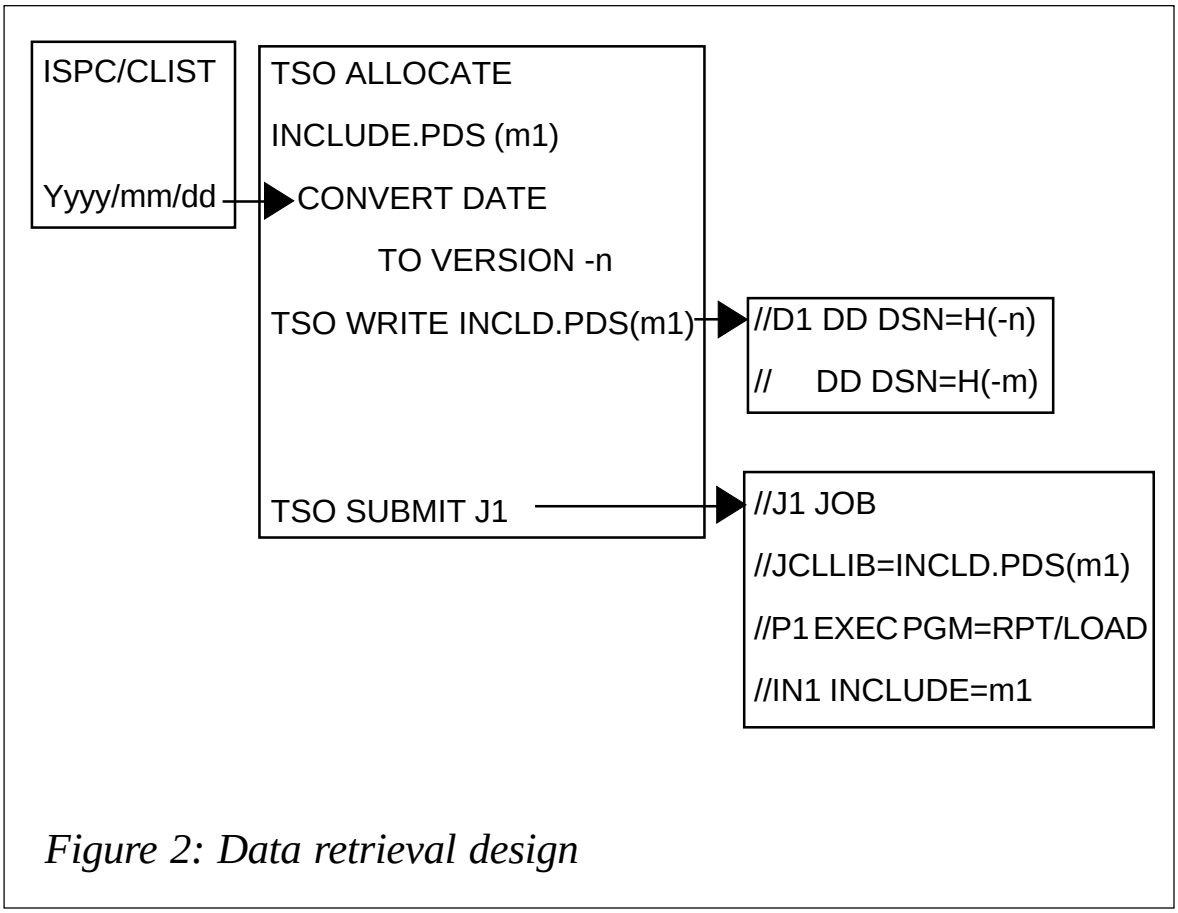

Figure 2: Data retrieval design

Data retrieval design is illustrated in Figure 2.

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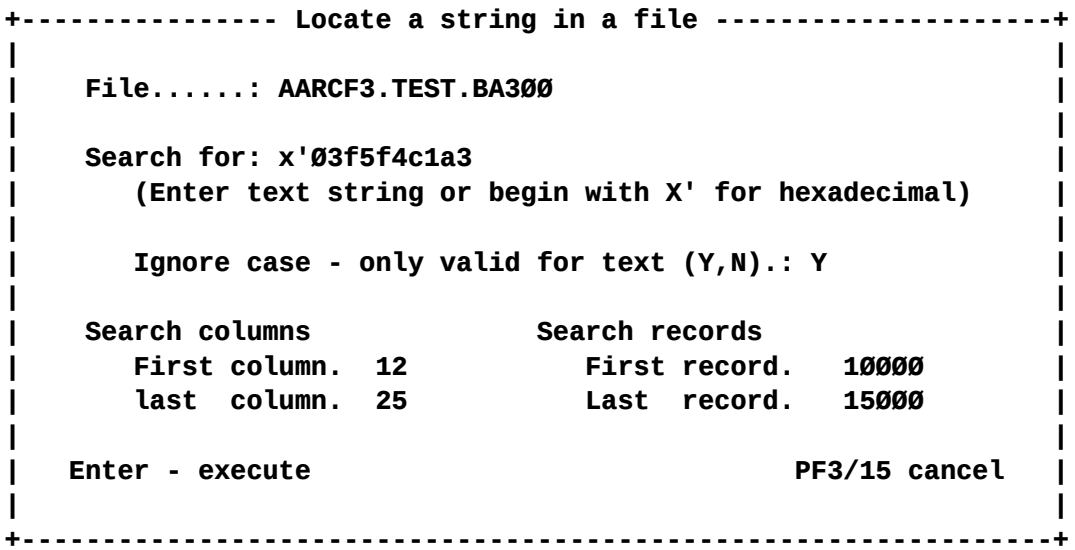
Locating strings in files

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:



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'ØØØA0B0C0D0E0F00000000000000000Ø' bits Ø1111 A thru F
         DC    X'ØØØ102030405060708090000000000000' bits 11111 Ø thru 9
*
TRTAB    DC    X'ØØØ102030405060708Ø90A0B0C0D0E0F' Uppercase
         DC    X'10111213141516171819 1A1B1C1D1E1F' 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 <> 0 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,"0") || right(col2,4,"0") ||,
          right(rec1,8,"0") || right(rec2,8,"0") ||,
          I || str"'"

xx = msg(off)
"free dd (temp1)"
"alloc da('"tempfile"') dd(temp1) new reuse blksize(8000),
   lrecl(80) recfm(f,b) dsorg(ps) space(1 1) tracks delete"
if rc <> 0 then do
   say "Error "rc" allocating" tempfile
   exit
end

queue "//"userid()"0 JOB LOCATE,MSGCLASS=X,CLASS=A"
queue "//STEP0  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
```

Calling the ANTRQST macro

The following program, CQPROG, is an example of how to call the ANTRQST macro. This macro issues calls to the System Data Mover API, and can be used to issue commands for XRC, PPRC, SNAPSHOT, and FLASHCOPY functions.

This particular program issues PPRC CQUERY commands. These can also be issued as TSO CQUERY commands (or alternatively ISMF can obtain the same information), but the program has several advantages over this:

- The TSO command can be quite slow if you are issuing a lot of commands.
- The TSO command mirrors all of its displays on the system console – this can be quite a problem if you are repeatedly issuing a lot of these commands.
- This program uses an easily-tailored input file to select the volumes you want to report on.

The program reads a list containing addresses (required) and volume names (optional) that you want to issue CQUERY commands against, while using PPRC to mirror DASD volumes. TSO variables are updated and displayed using a small piece of REXX. CQPROG will need to be authorized in the IKJTSO*x* member.

CQUERY PROGRAM

```
         TITLE 'CQPROG - ISSUE "CQUERY" COMMANDS VIA "ANTRQST" MACRO'
*********************************************************************
* CQPROG:   ISSUE CQUERY COMMANDS AGAINST SELECTED DEVICES, USING     *
*           THE 'ANTRQST' MACRO (SEE 'DFSMSDFP ADVANCED SERVICES').   *
*                                                                     *
*           THIS WILL PREVENT THE OUTPUT OF 'CQUERY' COMMANDS FROM    *
*           FLOODING THE SYSLOG.                                      *
*                                                                     *
*           THE CALLER WILL NEED READ ACCESS TO THE FACILITY CLASS    *
*           PROFILE 'STGADMIN.ANT.PPRC.COMMANDS'.                     *
```

```
*                                                                     *
*           THE 'ANTASØØØ' ADDRESS SPACE MUST BE ACTIVE.              *
*                                                                     *
* PARMS:    NONE                                                      *
*                                                                     *
* INPUT:    DATASET CONTAINING ADDRESSES OF DISKS TO BE 'CQUERY'ED.   *
*                                                                     *
* OUTPUT:   TSO 'PPRQNNN' VARIABLES, FOR PANEL OR REXX DISPLAY.       *
*           RETURN CODES -                                            *
*                                                                     *
*           Ø  -  SUCCESSFUL COMPLETION                               *
*           4  -  AT LEAST ONE NON-ZERO RETURN CODE FROM 'ANTRQST'    *
*           8  -  UNABLE TO OPEN INPUT FILE 'VOLIN'                   *
*           12 -  UNABLE TO UPDATE TSO VARIABLE                       *
***********************************************************************
         PRINT NOGEN
***********************************************************************
* HOUSEKEEPING...                                                     *
***********************************************************************
CQPROG   CSECT
CQPROG   AMODE 31
CQPROG   RMODE 24
         BAKR  R14,Ø                    SAVE CALLER DATA ON STACK
         LR    R12,R15                  GET ENTRY POINT
         USING CQPROG,R12               ADDRESSABILITY
*
         OPEN  (VOLIN,(INPUT))          OPEN LIST OF ADDRESSES
         LTR   R15,R15                  OK?
         BNZ   BADOPEN                  NO...GO AND SET RC=8
         LA    R7,VOLINREC              ADDRESSABILITY TO INPUT RECS
         USING VOLINDSC,R7
         LA    R6,QRYINFO
         USING ANTDATA,R6               ADDRESSABILITY TO RETURNED DATA
READLOOP DS    ØH
*
         GET   VOLIN,VOLINREC           READ LIST OF ADDRESSES
*
         AP    PPRTOT,PØ1               NUMBER OF INPUT RECORDS READ
         MVC   VALDEVN,VOLADDR          SAVE ADDRESS
         BAL   R9,CONVCUU               CONVERT EBCDIC ADDRESS TO HEX
*
         ANTRQST ILK=PPRC,              PPRC CALL                      X
               REQUEST=PQUERY,          CQUERY TYPE REQUEST            X
               DEVN=DEVN,               FIELD CONTAINING DEVICE ADDR.  X
               QRYSIZE=QRYSIZE,         LENGTH OF BUFFER FOR RESPONSE  X
               QRYINFO=QRYINFO,         BUFFER FOR RESPONSE            X
               RETINFO=RETINFO,         RETURNCODE INFO                X
               ALET=Ø,                                                 X
               ASYNCH=NO,                                              X
```

```
               ECB=NO_ECB,                                              X
               BITMAP=NOBITMAP,                                         X
               PATHS=NO,                                                X
               WAITTIME=Ø
*
         MVC   RETCD,RETINFO            SAVE RETURNCODE
         MVC   RSNCD,RETINFO+4          SAVE REASONCODE
         CLC   RETCD,=A(RQST_PQUERY_QRYSIZE_BIG_ENOUGH)    CALL OK?
         BE    CALLOK
*-------------------------------------------------------------------*
* CALL TO 'ANTRQST' GAVE NONZERO RETURN CODE. THERE WILL BE AN ERROR  *
* MESSAGE IN THE RESPONSE - DISPLAY THAT...                          *
*-------------------------------------------------------------------*
ANTFAIL  DS    ØH
         MVC   RETC,RC4                 SET RC=4
         MVC   VALDEVN+5(5),=C'ANTPØ'   SET UP MSG PREFIX
         XR    R2,R2                    CLEAR R2
         IC    R2,RETINFO+8             GET LENGTH OF FOLLOWING MSG
         C     R2,=F'56'                TOO LONG FOR MSG AREA?
         BL    MOVEIT                   NO...MOVE MSG
         LA    R2,56                    YES..TRUNCATE...
MOVEIT   DS    ØH
         EX    R2,EXMVC                 MOVE MSG TO VARIABLE AREA
         B     UPDATEIT                 NOW GO AND UPDATE
*-------------------------------------------------------------------*
* CALL TO 'ANTRQST' OK - UPDATE TSO VARIABLES...                     *
*-------------------------------------------------------------------*
CALLOK   DS    ØH
         CLC   ANTSTAT(6),=CL6'DUPLEX'  #VOLUMES IN DUPLEX STATE
         BE    UPDTDUPL
         CLC   ANTSTAT(7),=CL7'SIMPLEX' #VOLUMES IN SIMPLEX STATE
         BE    UPDTSIMP
         CLC   ANTSTAT(7),=CL7'SUSPEND' #VOLUMES IN SUSPEND STATE
         BE    UPDTSUSP
         CLC   ANTSTAT(7),=CL7'PENDING' #VOLUME IN SUSPEND STATE
         BE    UPDTPEND
         B     UPDTTSO                  UNKNOWN STATUS - SKIP COUNTS
UPDTDUPL DS    ØH
         MVC   VALASTER(3),=C'(*)'      HIGHLIGHT DUPLEX PAIRS
         AP    DUPLCT,PØ1               BUMP DUPLEX COUNT
         B     UPDTTSO
UPDTSIMP DS    ØH
         AP    SIMPCT,PØ1               BUMP SIMPLEX COUNT
         B     UPDTTSO
UPDTPEND DS    ØH
         AP    PENDCT,PØ1               BUMP PENDING COUNT
         B     UPDTTSO
UPDTSUSP DS    ØH
         AP    SUSPCT,PØ1               BUMP SUSPEND COUNT
```

```
UPDTTSO  DS    ØH
         MVC   VALDEVN,ANTDEVN
         MVC   VALLEVEL,ANTLEVEL
         MVC   VALSTAT,ANTSTAT
         MVC   VALVOLID,VOLVOLID
         BAL   R9,CHKPATHS              CHECK PATHS
UPDATEIT DS    ØH
         UNPK  NAMESTEM(3),PPRTOT
         OI    NAMESTEM+2,X'FØ'         SET CORRECT SIGN
         BAL   R9,UPDTVAR
         LTR   R15,R15                  OK?
         BNZ   SETRC12                  NO...SET RC=12
         MVI   VALDEVN,C' '             CLEAR OUT DETAIL AREA
         MVC   VALDEVN+1(VALUELN-1),VALDEVN
         B     READLOOP
*-------------------------------------------------------------------*
* CLOSE INPUT DATASET...                                            *
*-------------------------------------------------------------------*
CLOSE    DS    ØH
         CLOSE VOLIN
*-------------------------------------------------------------------*
* RETURN TO CALLER WITH RELEVANT RC...                              *
*-------------------------------------------------------------------*
RETURN   DS    ØH
         L     R15,RETC                 LOAD RETURN CODE
         PR    ,                        RESTORE CALLER DATA, RETURN
*-------------------------------------------------------------------*
* COULDN'T OPEN INPUT FILE 'VOLIN'...                               *
*-------------------------------------------------------------------*
BADOPEN  DS    ØH
         MVC   RETC,RC8                 SET RC=8
         B     RETURN
*-------------------------------------------------------------------*
* ERROR UPDATING TSO VARIABLE(S)... RC=12...                        *
*-------------------------------------------------------------------*
SETRC12  DS    ØH
         MVC   RETC,RC12                SET RC=12
         B     CLOSE
*-------------------------------------------------------------------*
* E-O-F ON INPUT - SET TSO VARIABLES FOR # IN SIMPLEX, # IN DUPLEX,  *
* # PENDING, # SUSPENDED AND TOTAL INPUT RECORDS READ...             *
*-------------------------------------------------------------------*
EOFVOLIN DS    ØH
         MVC   NAME(5),=C'PPSIM'
         MVC   NAMELEN,=A(5)
         UNPK  VALDEVN(3),SIMPCT
         OI    VALDEVN+2,X'FØ'
         MVC   VALUELEN,=A(3)
         BAL   R9,UPDTVAR               UPDATE PPSIM
```

```
         MVC   NAME(5),=C'PPDUP'
         MVC   NAMELEN,=A(5)
         UNPK  VALDEVN(3),DUPLCT
         OI    VALDEVN+2,X'FØ'
         MVC   VALUELEN,=A(3)
         BAL   R9,UPDTVAR              UPDATE PPDUP
         MVC   NAME(5),=C'PPPND'
         MVC   NAMELEN,=A(5)
         UNPK  VALDEVN(3),PENDCT
         OI    VALDEVN+2,X'FØ'
         MVC   VALUELEN,=A(3)
         BAL   R9,UPDTVAR              UPDATE PPPND
         MVC   NAME(5),=C'PPSUS'
         MVC   NAMELEN,=A(5)
         UNPK  VALDEVN(3),SUSPCT
         OI    VALDEVN+2,X'FØ'
         MVC   VALUELEN,=A(3)
         BAL   R9,UPDTVAR              UPDATE PPSUS
         MVC   NAME(5),=C'PPTOT'
         MVC   NAMELEN,=A(5)
         UNPK  VALDEVN(3),PPRTOT
         OI    VALDEVN+2,X'FØ'
         MVC   VALUELEN,=A(3)
         BAL   R9,UPDTVAR              UPDATE PPTOT
         MVC   NAME(7),=C'PPRPATH'
         MVC   NAMELEN,=A(7)
         MVC   VALDEVN(1),PPRPATH
         MVC   VALUELEN,=A(1)
         BAL   R9,UPDTVAR              UPDATE PPRPATH
         B     CLOSE                   GO AND CLOSE VOLIN
*********************************************************************
*                  + + S U B R O U T I N E + + +                    *
* CONVERT CHARACTER CUU (EG 'Ø94F') INTO ITS BINARY EQUIVALENT, THEN  *
* PLACE IT IN THE 'DEVN' FIELD...                                     *
*********************************************************************
CONVCUU  DS    ØH
         TR    VOLADDR(4),TRTAB        CONV. C'A->F' INTO X'A->F'
         XC    DWORD,DWORD             CLEAR OUT WORKAREA
         PACK  DWORD+4(4),VOLADDR(5)   REMOVE ZONES
         L     R8,DWORD+4              LOAD 'ØØCCUUØØ'
         SRL   R8,8                    SHIFT OUT TRAILING 'ØØ'
         STH   R8,DEVN                 SAVE BINARY CUU VALUE
         BR    R9                      RETURN FROM SUBROUTINE
*********************************************************************
*                  + + S U B R O U T I N E + + +                    *
* CHECK THE PATHS' FILEDS IN CASE THERE IS A POTENTIAL PROBLEM. AS WE *
* ARE USING ONLY 2 PATHS WE'LL CHECK ONLY PATH1 AND PATH2...          *
*********************************************************************
CHKPATHS DS    ØH
```

```
         MVC   VALPATHS,=15C' '         RESET FIELD
         CLC   ANTSTAT1,=C'  '          STATUS1 = SPACES?
         BE    PATH1OK                  YES..GOOD
         CLC   ANTSTAT1,ESTABLISHED     STATUS1 = ESTABLISHED?
         BE    PATH1OK                  YES..GOOD
         MVC   VALPATHS,PATHCHEK        NO...SHOW POSSIBLE ERROR
         MVI   PPRPATH,C'Y'                  SHOW POSSIBLE ERROR
         BR    R9                       RETURN FROM SUBROUTINE
PATH1OK  DS    ØH
         CLC   ANTSTAT2,=C'  '          STATUS2 = SPACES?
         BER   R9                       YES..RETURN
         CLC   ANTSTAT2,ESTABLISHED     STATUS2 = ESTABLISHED?
         BER   R9                       YES..RETURN
         MVC   VALPATHS,PATHCHEK        NO...SHOW POSSIBLE ERROR
         MVI   PPRPATH,C'Y'                  SHOW POSSIBLE ERROR
         BR    R9                       RETURN FROM SUBROUTINE
*********************************************************************
*                  + + S U B R O U T I N E + + +                    *
* CALL 'IKJCT441' TO UPDATE TSO VARIABLES...                        *
*********************************************************************
UPDTVAR  DS    ØH
*
         LINK  EP=IKJCT441,             PUT VALUE INTO VARIABLE        X
               PARAM=(ECODE,                                           X
               NAMEPTR,                                                X
               NAMELEN,                                                X
               VALUEPTR,                                               X
               VALUELEN,                                               X
               TOKEN),                                                 X
               VL=1
*
         BR    R9                       RETURN
*-------------------------------------------------------------------*
*
         LTORG                          LITERAL POOL
*
*-------------------------------------------------------------------*
* REGISTERS EQUATES, ETC...                                         *
*-------------------------------------------------------------------*
EXMVC    MVC   VALDEVN+1Ø(Ø),RETINFO+9  EXECUTED MOVE
SIMPCT   DC    PL2'Ø'
DUPLCT   DC    PL2'Ø'
PENDCT   DC    PL2'Ø'
SUSPCT   DC    PL2'Ø'
PPRTOT   DC    PL2'Ø'
PØ1      DC    PL1'1'
DEVN     DC    XL2'ØØØØ'
NO       DC    CL3'NO '
RETCD    DS    F
```

```
RSNCD    DS    F
FWORD    DS    F
DWORD    DS    D
RETC     DC    F'Ø'
RC4      DC    F'4'
RC8      DC    F'8'
RC12     DC    F'12'
RETINFO  DS    XL1ØØ
QRYINFO  DS    XL19ØØ
QRYINFOL EQU   *-QRYINFO
QRYSIZE  DC    Y(QRYINFOL)
NOBITMAP DC    CL3'NO '
PATHCHEK DC    CL13'<CHECK PATHS>'
PPRPATH  DC    CL1'N'
ESTABLISHED DC CL2'Ø1'
*
*               Ø 1 2 3 4 5 6 7 8 9 A B C D E F
TRTAB    DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' Ø
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 1
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 2
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 3
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 4
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 5
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 6
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 7
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 8
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' 9
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' A
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' B
         DC    X'FF0A0B0C0D0E0FFFFFFFFFFFFFFFFFFF' C  (ABCDEF)
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' D
         DC    X'FFFFFFFFFFFFFFFFFFFFFFFFFFFFFFFF' E
         DC    X'000102030405060708090FFFFFFFFFFF' F  (0123456789)
*
*-------------------------------------------------------------------*
* IKJCT441 PARMLIST (TSO VARIABLE ACCESS ROUTINE)...                *
*-------------------------------------------------------------------*
NAME     DC    C'PPRQ'                 TSO VARIABLE NAME (FIXED)
NAMESTEM DS    CL3                     TSO VARIABLE NAME (VARIABLE)
NAMELN   EQU   *-NAME                  VARIABLE LENGTH
NAMELEN  DC    A(NAMELN)                  "        "
VALDEVN  DC    CL4' '                  DEVICE NUMBER (IE ADDRESS)
         DC    CL6' '
VALLEVEL DC    CL9' '                  LEVEL
         DC    CL5' '
VALSTAT  DC    CL7' '                  STATUS
         DC    CL3' '
VALASTER DC    CL3' '                  HIGHLIGHT IF DUPLEX
         DC    CL1Ø' '
```

```
VALVOLID DC    CL6' '                  VOLID
         DC    CL2' '
WHEREPAT EQU   *-VALDEVN               OFFSET TO VALPATHS FIELD
VALPATHS DC    CL13' '                 POSSIBLE PATH PROBLEM
VALUELN  EQU   *-VALDEVN               VALUE LENGTH
VALUELEN DC    A(VALUELN)                "      "
NAMEPTR  DC    A(NAME)                 POINTER TO VARIABLE NAME
VALUEPTR DC    A(VALDEVN)              POINTER TO VARIABLE VALUE
TOKEN    DC    F'Ø'                    TOKEN (UNUSED HERE)
ECODE    DC    A(TSVEUPDT)             ENTRY CODE FOR 'SET'
*-------------------------------------------------------------------*
* INPUT DCB AND BUFFER...                                           *
*-------------------------------------------------------------------*
VOLIN    DCB   DDNAME=VOLIN,                                         X
               RECFM=FB,                                           X
               DSORG=PS,                                           X
               MACRF=(GM),                                         X
               EODAD=EOFVOLIN
VOLINREC DS    CL8Ø
*-------------------------------------------------------------------*
* REGISTER EQUATES, DSECTS, ETC...                                  *
*-------------------------------------------------------------------*
*
         YREGS
*
         ANTRQSTL
*
         IKJTSVT
*
ANTDATA  DSECT
ANTDEVN  DS    CL4                     DEVICE NUMBER
         DS    CL1
ANTLEVEL DS    CL9                     LEVEL
         DS    CL1
ANTSTAT  DS    CL1Ø                    STATUS
         DS    CL1
ANTPTHST DS    CL8                     PATH STATUS
         DS    CL1
ANTPSSID DS    CL4                     PRIMARY SSID
         DS    CL1
ANTPCCA  DS    CL2                     PRIMARY CCA
         DS    CL1
ANTPSER# DS    CL12                    PRIMARY SERIAL NUMBER
         DS    CL1
ANTSSSID DS    CL4                     SECONDARY SSID
         DS    CL1
ANTSCCA  DS    CL2                     SECONDARY CCA
         DS    CL1
ANTSSER# DS    CL12                    SECONDARY SERIAL NUMBER
```

```
         DS    CL1                 ','
         DS    CL1
         DS    CL1                 ','
         DS    CL1
         DS    CL1                 ','
ANTPATHS DS    CL1                 NUMBER OF PATHS
         DS    CL1
ANTSADE1 DS    CL8                 SAID/DEST (1)
         DS    CL1
ANTSTAT1 DS    CL2                 PATH STATUS (1)
         DS    CL1
ANTSADE2 DS    CL8                 SAID/DEST (2)
         DS    CL1
ANTSTAT2 DS    CL2                 PATH STATUS (2)
         DS    CL1
ANTSADE3 DS    CL8                 SAID/DEST (3)
         DS    CL1
ANTSTAT3 DS    CL2                 PATH STATUS (3)
         DS    CL1
ANTSADE4 DS    CL8                 SAID/DEST (4)
         DS    CL1
ANTSTAT4 DS    CL2                 PATH STATUS (4)
*
VOLINDSC DSECT
         DS    CL1
VOLADDR  DS    CL4                 ADDRESS
         DS    CL1
VOLDEVT  DS    CL4                 DEVICETYPE
         DS    CL1
VOLALLOC DS    CL7                 ONLINE/ALLOC
         DS    CL1
VOLVOLID DS    CL6                 VOLID!
         DS    CL1
*
         END
```

PPRQ REXX

The following REXX code will execute the CQUERY program. It expects a sysid (from a valid list), which it then uses as a qualifier for a dataset name to hold the list of addresses that you want to issue the PPRC commands for.

```
/* Rexx tso issue CQUERY-type commands */
lastct = Ø

sys = "PRD1 PRD2 PRD3 TST1 TST2"
```

```
lin = "========================"

Parse Upper Arg dsn1 whatsthis
If whatsthis <> "" Then Do
  Say "Extraneous info passed: '"whatsthis"'"
  Return 8
End
If Length(dsn1) = 4 Then
  sysid = dsn1
Else
Parse Value dsn1 WITH pref '.' pprc '.' sysid '.' stuff

If Pos(sysid,sys) = Ø Then Do
  Say "==> Invalid SYSid passed: '"sysid"'"
  Return 8
End

Address "TSO"

x = Outtrap("null.",1Ø,"NOCONCAT")
"FREE FI(VOLIN)"
dsn = "'SYSG.PPRC."sysid".INPUT'"
"ALLOC FI(VOLIN) DA("dsn") SHR"         /* Alloc list of addresses */

Do Forever
  Address "TSO"
  "CALL 'SYSG.LINKLIB(CQPROG)'"
  cqrc = rc

  If cqrc = 8 Then
    pprqØØ1 = "Unable to open input dataset "dsn"..."

  If cqrc = 12 Then Do
    lin = "NB: Unable to update at least one TSO variable..."
    aa = pptot + 3
    aa = Right("ØØ"aa,3)
    Interpret "PPRQ"aa" = lin"
  End

  pprdt = Date('E')
  pprtm = Time()
  ppsy = sysid
  If cqrc = Ø Then Do
    ppch = ppdup¦¦" ("ppdup-lastct")" /* Calc change since last time */
    ppch = Strip(ppch,"L","Ø")                /* Remove leading Øs */
    lastct = ppdup
    aa = pptot + 1
    aa = Right("ØØ"aa,3)
    Interpret "PPRQ"aa" = lin"                /* Underline last one */
```

```
    ppsim = Strip(ppsim,"L","Ø")              /* Remove leading Øs */
    pppnd = Strip(pppnd,"L","Ø")
    ppsus = Strip(ppsus,"L","Ø")
    pptot = Strip(pptot,"L","Ø")
  End
  pathmsg = " "
  If pprpath = "Y" Then     /* If prog found path problem, flag this */
    pathmsg = "*** POSSIBLE PATH PROBLEMS - PLEASE CHECK ***"
  Address "ISPEXEC"
  "ISPEXEC DISPLAY PANEL(PPRCQPAN)"
  If rc = 8 Then Return                       /* PF3 = exit         */
End

Address "TSO"
x = Outtrap("null.",1Ø,"NOCONCAT")
"FREE FI(VOLIN)"

Return                                        /* That's it...       */
```

PPRCQPAN PANEL

```
)ATTR DEFAULT(%+_)
      ! TYPE(OUTPUT) INTENS(LOW) CAPS(OFF)
      ¬ TYPE(OUTPUT) INTENS(HIGH)
      $ TYPE(OUTPUT) INTENS(HIGH) COLOR(RED) HILITE(BLINK)
      # AREA(SCRL) EXTEND(ON)
)BODY WIDTH(8Ø) EXPAND(@@)
¬pprdt   %@-@ PPRC CQUERY DISPLAY (¬ppsy%) @-@¬pprtm   %
+              $pathmsg                                    +
+   SIMPLEX:¬ppsim+DUPLEX:¬ppch
+PENDING:¬pppnd+SUSPEND:¬ppsus+TOTAL:¬pptot
+
+       =DEVICE=    ==LEVEL==     ===STATUS====         =VOLSER=
#SCRLAREA                                                      #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
#                                                             #
+
+Press%PF3+to%End,%Enter+to Refresh...
)AREA SCRLAREA
+        ¬PPRQØØ1                                             +
```

```
+        ¬PPRQØØ2                                                    +
+        ¬PPRQØØ3                                                    +
+        ¬PPRQØØ4                                                    +
+        ¬PPRQØØ5                                                    +
         .                                                           +
         .                                                           +
         .                                                           +
     and so on up to                                                 +
         .                                                           +
         .                                                           +
         .                                                           +
+        ¬PPRQ398                                                    +
+        ¬PPRQ399                                                    +
+        ¬PPRQ4ØØ                                                    +
)INIT
)PROC
)END
```

INPUT

Format of the input dataset. The addresses start in column 2, the volids in column 20; all other information is ignored.

```
1Ø33 339Ø ALLOC   PFPP3Ø   ( 3,339)  PRIVATE
1Ø34 339Ø ALLOC   PFPP31   ( 3,339)  PRIVATE
1Ø35 339Ø ALLOC   PFPP1Ø   ( 3,339)  PRIVATE
1Ø36 339Ø ALLOC   PFPP11   ( 3,339)  PRIVATE
```

Grant Carson
Systems Programmer (UK)

Using Pretty Good Privacy (PGP) to encrypt/decrypt and sign your MVS data

INTRODUCTION TO CRYPTOGRAPHY

Pretty Good Privacy (PGP) is a freeware public key cryptography program developed by Phillip Zimmerman (1991) under the GNU licence, which is now available for z/OS.

Cryptography is the science of using mathematics to encrypt and decrypt data. Cryptography enables you to store sensitive information or transmit it across insecure networks (like the Internet) so that it cannot be read by anyone except the intended recipient.

A cryptographic algorithm, or cipher, is a mathematical function used in the encryption and decryption process. A cryptographic algorithm works in combination with a key (a word, number, or phrase) to encrypt the plaintext. The same plaintext encrypts to different ciphertext with different keys. The security of encrypted data is entirely dependent on two things – the strength of the cryptographic algorithm and the secrecy of the key.

Cryptanalysis is the science of analysing and breaking secure communication.

Encryption

Symmetric-key encryption

In conventional cryptography, also called secret-key or symmetric-key encryption, one key is used both for encryption and decryption.

The Data Encryption Standard (DES) in an example of a conventional cryptosystem that has been widely deployed by the US Government and the banking industry.

An extremely simple example of conventional cryptography is a substitution cipher. A substitution cipher substitutes one piece of information for another. This is most frequently done by offsetting letters of the alphabet.

So, starting with ABCDEFGHIJKLMNOPQRSTUVWXYZ and sliding everything up by three, you get DEFGHIJKLMNOPQRSTU VWXYZABC – where D=A, E=B, F=C, and so on.

Using this scheme, the plaintext SECRET encrypts as VHFUHW.

To allow someone else to read the ciphertext, you tell them that the key is 3.

Conventional encryption has benefits – it is quite simple and very fast.

But it has some major limitations – for a sender and recipient to communicate securely using conventional encryption, they must agree on a key and keep it secret between themselves. If they are in different physical locations, they must trust a courier, the phone, or some other secure communications medium to prevent the disclosure of the secret key during transmission. Anyone who overhears or intercepts the key in transit can later read, modify, and forge all information encrypted or authenticated with that key.

The persistent problem with conventional encryption is key distribution – how do you get the key to the recipient without someone intercepting it?

Asymmetric-key encryption

The problems of key distribution are solved by public-key cryptography, the concept of which was introduced by Whitfield Diffie and Martin Hellman in 1975.

Public-key cryptography uses a pair of keys – a public key, which encrypts data, and a corresponding private key, for decryption.

Because it uses two keys, it is also called asymmetric cryptography. You publish your public key to the world while keeping your private key secret. Anyone with a copy of your public key can then encrypt information that only you can read.

It is computationally infeasible to deduce the private key from the public key.

Anyone who has a public key can encrypt information but cannot decrypt it. Only the person who has the corresponding private key can decrypt the information.

The main benefit of public-key cryptography is that it allows people who have no pre-existing security arrangement to exchange messages securely.

The need for sender and receiver to share secret keys via some secure channel is eliminated; all communications involve only public keys, and no private key is ever transmitted or shared.

Some examples of public-key cryptosystems are :

- Elgamal (named for its inventor, Taher Elgamal).
- RSA (named for its inventors, Ron Rivest, Adi Shamir, and Leonard Adleman).
- Diffie-Hellman (named, you guessed it, for its inventors).
- DSA, the Digital Signature Algorithm (invented by David Kravitz).

How PGP works

PGP combines some of the best features of both conventional and public-key cryptography – PGP is a hybrid cryptosystem.

When a user encrypts plaintext with PGP, PGP first compresses the plaintext.

Data compression saves transmission time and disk space and, more importantly, strengthens cryptographic security. Most cryptanalysis techniques exploit patterns found in the plaintext to crack the cipher. Compression reduces these patterns in the plaintext, thereby greatly enhancing resistance to cryptanalysis.

Because the public key encryption algorithm is much slower than conventional single-key encryption, encryption is better accomplished by using a high-quality fast conventional single-key encryption algorithm to encipher the message.

In a process invisible to the user, PGP creates a temporary random key (the session key, which is a one-time-only secret key) just for this ‘session’, which is used to conventionally encipher the plaintext file.

The session key works with a very secure, fast, conventional encryption algorithm to encrypt the plaintext; the result is ciphertext.

Once the data is encrypted, the session key is then encrypted to the recipient's public key. This public key-encrypted session key is transmitted along with the ciphertext to the recipient.

Decryption works in the reverse. The recipient's copy of PGP uses his or her private key to recover the session key, which PGP then uses to decrypt the conventionally encrypted ciphertext.

The combination of the two encryption methods combines the convenience of public-key encryption with the speed of conventional encryption.

Conventional encryption is about 10,000 times faster than public-key encryption. Public-key encryption in turn provides a solution to key distribution and data transmission issues. Used together, performance and key distribution are improved without any sacrifice in security.

Digital signatures

A major benefit of public key cryptography is that it provides a method for employing digital signatures.

Digital signatures let the recipient of information verify the authenticity of the information's origin, and also verify that the information was not altered while in transit.

Thus, public key digital signatures provide authentication and data integrity.

The basic manner in which digital signatures are created is:

- The signature algorithm uses your private key to create the signature and the public key to verify it.
- If the information can be decrypted with your public key, then it must have originated from you.

This system has some problems. It is slow, and it produces an enormous volume of data – at least double the size of the original information.

An improvement on this scheme is the addition of a one-way hash function in the process.

A one-way hash function takes variable-length input and produces a fixed-length output. The hash function ensures that, if the information is changed in any way (even by just one bit) an entirely different output value is produced.

How PGP works

PGP uses a cryptographically strong hash function on the plaintext the user is signing. This generates a fixed-length data item known as a message digest.

Then PGP uses the digest and the private key to create the 'signature'. PGP transmits the signature and the plaintext together. PGP can also encrypt the plaintext using the recipient's public key.

Upon receipt of the message, the recipient uses PGP to recompute the digest, thus verifying the signature.

PGP INSTALLATION ON Z/OS

Downloading PGP for OS/390 from the Web

PGP for OS/390 and MVS is freeware which can be downloaded from the Alan Nichols Web site at http://s390.nichols.de/pgp/index.html.

The current version of PGP for OS/390 (in June 2003) is 2.6.3is.

You have to download a PAX file (pgp263is.pax.Z – 1.16 MB) on your PC.

Allocating and mounting an HFS file on z/OS

At this point, you should allocate and mount an HFS file on your z/OS system to upload PGP:

```
//STEPØ1   EXEC PGM=IEFBR14
//*
//MKFS     DD DISP=(,CATLG),DSN=SYS2.OMVS.U.PGP.HFS,
//            SPACE=(CYL,(ØØ5,Ø1,1)),UNIT=SYSALLDA,
//            DSNTYPE=HFS
//*
```

```
//STEPØ2    EXEC PGM=IKJEFTØ1
//SYSPROC  DD DISP=SHR,DSN=SYS1.SBPXEXEC
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
  oshell mkdir /u/pgp
  mount filesystem('SYS2.OMVS.U.PGP.HFS') type(HFS) +
        mode(rdwr) mountpoint('/u/pgp')
//*
```

Uploading the PAX file to z/OS

Now you have to use FTP to tranfer the PAX file to your z/OS system:

```
D:\Migration\Dustbin>ftp 126.9.41.65
Connect to 126.9.41.65.
22Ø-FTPD1 IBM FTP CS V1R4 at smvs.ctrcempl.caisse-epargne.fr, 11:33:38
on 2ØØ3-Ø
6-13.
22Ø Connection will close if idle for more than 5 minutes.
Utilisateur (126.9.41.65:(none)) : SXSPØØ1
331 Send password please.
Mot de passe :
23Ø SXSPØØ1 is logged on.  Working directory is "SXSPØØ1.".
ftp> cd /u/pgp
25Ø HFS directory /u/pgp is the current working directory
ftp> bin
2ØØ Representation type is Image
ftp> put pgp263is.pax.Z
2ØØ Port request OK.
125 Storing dataset /u/pgp/pgp263is.pax.Z
25Ø Transfer completed successfully.
ftp : 1217601 octets sent in 21,16 seconds at 57,55 Ko/sec.
ftp> quit
221 Quit command received. Goodbye.

D:\Migration\Dustbin>
```

Uncompressing the PAX file

You should now use a Telnet session to log on to your USS system and uncompress the PAX file:

```
EZYTE27I login: SXSPØØ1
EZYTE28I SXSPØØ1 Password:
IBM
Licensed Material - Property of IBM
5694-AØ1 (C) Copyright IBM Corp. 1993, 2ØØ1
```

```
(C) Copyright Mortice Kern Systems, Inc., 1985, 1996.
(C) Copyright Software Development Group, University of Waterloo, 1989.

All Rights Reserved.

U.S. Government users - RESTRICTED RIGHTS - Use, Duplication, or
Disclosure restricted by GSA-ADP schedule contract with IBM Corp.

IBM is a registered trademark of the IBM Corp.

SXSP001:/: >cd /u/pgp
SXSP001:/u/pgp: >uncompress pgp263is.pax.Z
SXSP001:/u/pgp: >pax -rf pgp263is.pax
SXSP001:/u/pgp: >ls -al
total 5912
drwx------   3 SXSP001  OMVSGRP     8192 Jun 13 12:45 .
drwx------   8 SXSP001  OMVSGRP     8192 Jun  5 18:04 ..
drwxrwxrwx   5 SXSP001  OMVSGRP     8192 Sep  4  2002 pgp
-rw-r----   1 SXSP001  OMVSGRP  2999808 Jun 13 12:34 pgp263is.pax
SXSP001:/u/pgp: >
SXSP001:/u/pgp: >cd pgp
SXSP001:/u/pgp/pgp: >ls -al
total 512
drwxrwxrwx   5 SXSP001  OMVSGRP     8192 Sep  4  2002 .
drwx------   3 SXSP001  OMVSGRP     8192 Jun 13 12:45 ..
-r--------   1 SXSP001  OMVSGRP     5024 Oct  6  1998 config.txt
drwxrwxrwx   6 SXSP001  OMVSGRP     8192 Oct  6  1998 contrib
-r--------   1 SXSP001  OMVSGRP     5597 Jan  2  1996 de.hlp
drwxrwxrwx   2 SXSP001  OMVSGRP     8192 May 29  2001 doc
-r--------   1 SXSP001  OMVSGRP     4152 Jan  2  1996 en.hlp
-r--------   1 SXSP001  OMVSGRP     4526 Jan  2  1996 es.hlp
-r--------   1 SXSP001  OMVSGRP     4651 Jan  2  1996 fr.hlp
-r--------   1 SXSP001  OMVSGRP    14274 Jan 15  1996 keys.asc
-r--------   1 SXSP001  OMVSGRP   105573 Jan 18  1996 language.txt
-r--------   1 SXSP001  OMVSGRP     2035 Jan 12  1996 pgp.hlp
-r--------   1 SXSP001  OMVSGRP    19651 Jan 18  1996 readme.1st
-rwx------   1 SXSP001  OMVSGRP      734 Sep  4  2002 readme.mvs
-r--------   1 SXSP001  OMVSGRP     2526 Jan 18  1996 readme.usa
-r--------   1 SXSP001  OMVSGRP    13453 Jan 11  1996 setup.doc
drwxrwxrwx   2 SXSP001  OMVSGRP    16384 Sep  4  2002 src
SXSP001:/u/pgp/pgp: >
```

Compiling PGP C/C++ source

First, you should check the value of several USS environment variables in your /etc/profile:

```
export _CC_CNAME=CBCDRVR              - The OS/390 C/C++ driver program
export _CC_PLIB_PREFIX=SYS1           - prefix for SYS1.SCEELKEX
```

Then, you should compile the PGP C/C++ sources:

```
SXSP001:/u/pgp/pgp/src: >make clean
rm -f *.o pgp core a.out tags *.err CEEDUMP*
SXSP001:/u/pgp/pgp/src: >make os390
make all CPP=/lib/cpp OBJS_EXT="c370.o"  CFLAGS=" -O -DC370 -DHIGHFIRST"
cc -O -DC370 -DHIGHFIRST -DHIGHFIRST pgp.c
cc -O -DC370 -DHIGHFIRST -DHIGHFIRST crypto.c
cc -O -DC370 -DHIGHFIRST keymgmt.c
cc -O -DC370 -DHIGHFIRST fileio.c
WARNING CBC3236 ./c370.h:114   Macro name ENOENT has been redefined.
FSUM3065 The COMPILE step ended with return code 4.
cc -O -DC370 -DHIGHFIRST mdfile.c
cc -O -DC370 -DHIGHFIRST more.c
cc -O -DC370 -DHIGHFIRST armor.c
cc -O -DC370 -DHIGHFIRST mpilib.c
cc -O -DC370 -DHIGHFIRST mpiio.c
cc -O -DC370 -DHIGHFIRST genprime.c
cc -O -DC370 -DHIGHFIRST rsagen.c
cc -O -DC370 -DHIGHFIRST random.c
cc -O -DC370 -DHIGHFIRST idea.c
cc -O -DC370 -DHIGHFIRST passwd.c
cc -O -DC370 -DHIGHFIRST md5.c
cc -O -DC370 -DHIGHFIRST system.c
cc -O -DC370 -DHIGHFIRST language.c
cc -O -DC370 -DHIGHFIRST getopt.c
cc -O -DC370 -DHIGHFIRST keyadd.c
cc -O -DC370 -DHIGHFIRST config.c
cc -O -DC370 -DHIGHFIRST keymaint.c
cc -O -DC370 -DHIGHFIRST keymaint.c
cc -O -DC370 -DHIGHFIRST charset.c
cc -O -DC370 -DHIGHFIRST randpool.c
cc -O -DC370 -DHIGHFIRST noise.c
cc -O -DC370 -DHIGHFIRST zbits.c
cc -O -DC370 -DHIGHFIRST zdeflate.c
cc -O -DC370 -DHIGHFIRST zfile_io.c
cc -O -DC370 -DHIGHFIRST zglobals.c
cc -O -DC370 -DHIGHFIRST zinflate.c
cc -O -DC370 -DHIGHFIRST zip.c
cc -O -DC370 -DHIGHFIRST zipup.c
cc -O -DC370 -DHIGHFIRST ztrees.c
cc -O -DC370 -DHIGHFIRST zunzip.c
cc -O -DC370 -DHIGHFIRST rsaglue1.c
cc -O -DC370 -DHIGHFIRST c370.c
cc -o pgp pgp.o crypto.o keymgmt.o fileio.o  mdfile.o more.o armor.o
mpilib.o mp
iio.o  genprime.o rsagen.o random.o idea.o passwd.o  md5.o system.o
language.o g
etopt.o keyadd.o  config.o keymaint.o charset.o  randpool.o noise.o
```

```
zbits.o zdef
late.o zfile_io.o zglobals.o  zinflate.o zip.o zipup.o ztrees.o zunzip.o
rsaglue
1.o c37Ø.o
SXSPØØ1:/u/pgp/pgp: >
```

This step produces the PGP module:

```
SXSPØØ1:/u/pgp/pgp/src: >ls -al pgp
-rwxrwxrwx   1 SXSPØØ1  OMVSGRP   765952 Jun 13 18:Ø6 pgp
SXSPØØ1:/u/pgp/pgp/src: >
```

You can now call PGP:

```
SXSPØØ1:/u/pgp/pgp/src: >pgp -h
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 199Ø-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-Ø1-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2ØØ3/Ø6/13 17:Ø9 GMT

Usage summary:
To encrypt a plaintext file with recipent's public key, type:
   pgp -e textfile her_userid [other userids] (produces textfile.pgp)
To sign a plaintext file with your secret key:
   pgp -s textfile [-u your_userid]           (produces textfile.pgp)
To sign a plaintext file with your secret key, and then encrypt it
   with recipent's public key, producing a .pgp file:
   pgp -es textfile her_userid [other userids] [-u your_userid]
To encrypt with conventional encryption only:
   pgp -c textfile
To decrypt or check a signature for a ciphertext (.pgp) file:
   pgp ciphertextfile [-o plaintextfile]
To produce output in ASCII for email, add the -a option to other
options.
To generate your own unique public/secret key pair:  pgp -kg
For help on other key management functions, type:   pgp -k
SXSPØØ1:/u/pgp/pgp/src: >
```

For ease of use, you should have the PGP directory to the PATH environment variable in /etc/profile:

```
export PATH=$PATH:/u/pgp/pgp/src
```

If do not have a C/C++ compiler

If you have no C/C++ compiler, the executable PGP module is included in the src directory.

So omit the **make clean** and **make os390** commands.

PGP online documentation

PGP documentation can be found in the directory */u/pgp/pgp/doc/*.

PGP KEYS MANAGEMENT

Now that PGP is installed on your z/OS system, in order to use it, you need to:

- Create your own keypair – PGP requires a keypair: a private key and a public key.
- Exchange your public keys with other PGP users.

Create your private/public keypair

You have to create you own private/public keypair, which will be stored in two ‘keyrings’.

A keyring is a file that stores keys.

Each user has two keyrings – one public and one private:

- The private keyring (secring.pgp) stores your private key.
- The public keyring (pubring.pgp) stores public keys; yours, and those that you receive from other PGP users.

To generate your own unique public/secret key pair, you should use the following command from the USS prompt:

```
SXSP00:/u/SXSP00: >pgp +nomanual -kg
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/16 10:17 GMT

Pick your RSA key size:
    1)   512 bits- Low commercial grade, fast but less secure
    2)   768 bits- High commercial grade, medium speed, good security
    3)  1024 bits- "Military" grade, slow, highest security
```

```
Choose 1, 2, or 3, or enter desired number of bits: 2048
2048

Generating an RSA key with a 2048-bit modulus.

You need a user ID for your public key.  The desired form for this
user ID is your name, followed by your E-mail address enclosed in
<angle brackets>, if you have an E-mail address.
For example:  John Q Smith 12345.6789@compuserve.com
Enter a user ID for your public key:
MyOrg Site1
MyOrg Site1

You need a pass phrase to protect your RSA secret key.
Your pass phrase can be any sentence or phrase and may have many
words, spaces, punctuation, or any other printable characters.

Enter pass phrase: pass phrase for MyOrg Site1

Enter same pass phrase again: pass phrase for MyOrg Site1

Note that key generation is a lengthy process.

We need to generate 1536 random bits.  This is done by measuring the
time intervals between your keystrokes.  Please enter some random text
on your keyboard until you hear the beep:
1536
1528 ff
1504 fffgeez
1448 ehptyptp
1376 fptoto
1320 ftppepep
1248 rprprp
1192 totptp
1136 tptptp
1080 tptptpp
1016 tpppp
 984 evstcy
 928 tptptp
 872 toprp
 824 rtpvm
 776 tpbpbp
 720 ptptp
 672 fpfpfp
 616 rprpr
 568 dptptp
 512 vpvpvp
 456 rprprp
 400 yyoy
```

```
 360 dpdpf
 312 rprp
 272 dpdp
 232 vpvp
 192 vmvpeeer
 128 vmerpe
  72 cpfpf
  24 epep
   Ø * -Enough, thank you.
...**** ........................................****
Pass phrase is good.  Just a moment....
Key signature certificate added.
Key generation completed.
SXSPØØ1:/u/SXSPØØ1: >
```

The 'pass phrase' is a kind of password to protect your secret key. Each time you need to use your secret key (to decrypt a file, to sign a message…), you will have to specify your pass phrase.

This command produces the public and the private keyrings:

```
SXSPØØ1:/u/SXSPØØ1: >ls -al *.pgp
-rw-rw-rw-   1 SXSPØØ1  OMVSGRP      963 Jun 16 11:22 pubring.pgp
-rw-rw-rw-   1 SXSPØØ1  OMVSGRP     1489 Jun 16 11:22 secring.pgp
SXSPØØ1:/u/SXSPØØ1: >
```

Exchange your public keys with other PGP users

After you have created a keypair, you can begin corresponding with other PGP users.

But first, you will need to:

- Extract and send a copy of your public key to other PGP users.
- Add other PGP users' public keys to your public keyring.

Extracting your public key

To extract your public key from your public ring, you should enter:

```
SXSPØØ1:/u/SXSPØØ1: >pgp -kx MyOrg Site1
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 199Ø-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-Ø1-18
International version - RSA Patent Expired.     Does not use RSAREF.
```

```
Current time: 2003/06/16 10:52 GMT

Extracting from key ring: 'pubring.pgp', userid "MyOrg".

Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16

Key extracted to file 'Site1.pgp'.
SXSP001:/u/SXSP001: >
```

This command produces a copy of your public key (Site1.pgp), which can be sent (in binary) to other PGP users.

Adding a public key to your public keyring

When you receive a public key from another PGP user, you have to use the following command to add it to your public keyring:

```
SXSP001:/u/SXSP001: >pgp -ka Site1.pgp
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/16 09:00 GMT

Looking for new keys...
pub  2048/E59DA965 2003/06/16  MyOrg Site1

Checking signatures...
pub  2048/E59DA965 2003/06/16 MyOrg Site1
sig!      E59DA965 2003/06/16  MyOrg Site1


Keyfile contains:
   1 new key(s)

One or more of the new keys are not fully certified.
Do you want to certify any of these keys yourself (y/N)? y
y

Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16
Key fingerprint = 70 CF C1 A4 8E F6 28 01  D8 65 4A E7 90 B5 90 EC
This key/userID association is not certified.
  Questionable certification from:
  MyOrg Site1

Do you want to certify this key yourself (y/N)? y
```

```
y

Looking for key for user 'MyOrg Site1':

Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16
      Key fingerprint = 70 CF C1 A4 8E F6 28 01  D8 65 4A E7 90 B5 90 EC


READ CAREFULLY:  Based on your own direct first-hand knowledge, are
you absolutely certain that you are prepared to solemnly certify that
the above public key actually belongs to the user specified by the
above user ID (y/N)? y
y

You need a pass phrase to unlock your RSA secret key.
Key for user ID: MyOrg Site2
512-bit key, key ID 3EFAE341, created 2003/06/11

Enter pass phrase: MyOrg Site2
Pass phrase is good.  Just a moment....
Key signature certificate added.

Make a determination in your own mind whether this key actually
belongs to the person whom you think it belongs to, based on available
evidence.  If you think it does, then based on your estimate of
that person's integrity and competence in key management, answer
the following question:

Would you trust "MyOrg Site1"
to act as an introducer and certify other people's public keys to you?
(1=I don't know. 2=No. 3=Usually. 4=Yes, always.) ? 4
4
SXSP001:/u/SXSP001: >
```

PGP USAGE

You can use PGP to:

- Exchange an encrypted file from Site2 to Site1.
- Sign a message to send it from Site2 to Site1.

In order to use PGP, the users must have their PGP ring files in their home directory.

On Site2, we will use the following sample message file to send it to Site1:

```
BROWSE -- /u/SXSP001/text_msg.txt ----------- Line 00000000 Col 001 025
 Command ===>                                          Scroll ===> PAGE
****************************** Top of Data ******************************
line 01 from MyOrg Site2
line 02 from MyOrg Site2
line 03 from MyOrg Site2
line 04 from MyOrg Site2
line 05 from MyOrg Site2
line 06 from MyOrg Site2
line 07 from MyOrg Site2
line 08 from MyOrg Site2
line 09 from MyOrg Site2
line 10 from MyOrg Site2
line 11 from MyOrg Site2
****************************** Bottom of Data ******************************
```

Exchanging an encrypted file

Encrypting a file on Site2

To encrypt a plaintext file with the recipient's Site1 public key, you should enter:

```
SXSP001:/u/SXSP001: >pgp -e text_msg.txt MyOrg Site1
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/16 09:21 GMT


Recipients' public key(s) will be used to encrypt.
Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16

Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16
.
Ciphertext file: text_msg.txt.pgp
SXSP001:/u/SXSP001: >
```

This command produces the encrypted file, which is not readable!

```
BROWSE -- /u/SXSP001/text_msg.txt.pgp -------- Line 00000000 Col 001 080
 Command ===>                                          Scroll ===> PAGE
****************************** Top of Data ******************************
e...¤...V.z......LL..?b..r..X.e..¬/
7..E$..;i.g.....e........rB~..6.....eL...)J".
```

```
....P.J...//w. n.¦.X.)....X....r.)..6.v..m..Z..'V..*...../...\.¬..lB.-
\gs \&..eb
***************************** Bottom of Data ****************************
```

Decrypting a file on Site1

To decrypt the message, the recipient on Site1 should use the following command:

```
SXSP001:/u/SXSP001: >pgp -d text_msg.txt.pgp
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/16 11:51 GMT

File is encrypted.  Secret key is required to read it.
Key for user ID: MyOrg Site1
2048-bit key, key ID E59DA965, created 2003/06/16

You need a pass phrase to unlock your RSA secret key.
Enter pass phrase: pass phrase for MyOrg Site1
Pass phrase is good.  Just a moment......
Plaintext filename: text_msg.txt
SXSP001:/u/SXSP001: >
```

The result is the ‘clear’ file:

```
BROWSE -- /u/SXSP001/text_msg.txt ------------ Line 00000000 Col 001 025
 Command ===>                                          Scroll ===> PAGE
***************************** Top of Data ******************************
line 01 from MyOrg Site2
line 02 from MyOrg Site2
line 03 from MyOrg Site2
line 04 from MyOrg Site2
line 05 from MyOrg Site2
line 06 from MyOrg Site2
line 07 from MyOrg Site2
line 08 from MyOrg Site2
line 09 from MyOrg Site2
line 10 from MyOrg Site2
line 11 from MyOrg Site2
***************************** Bottom of Data ****************************
```

Using PGP in batch

You can also use PGP as a batch job using BPXBATCH:

```
//INET   EXEC PGM=BPXBATCH,REGION=4Ø96K,
// PARM='SH pgp -z ''pass phrase fo MyOrg Site1''          - pass phrase
//            -d /u/SXSPØØ1/text_msg.txt.pgp'
//SYSERR   DD PATH='/tmp/pgpbatch.syserr',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//STDOUT   DD PATH='/tmp/pgpbatch.stdout',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//STDERR   DD PATH='/tmp/pgpbatch.stderr',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//SYSOUT   DD PATH='/tmp/pgpbatch.sysout',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
```

This first example shows how to specify the pass phrase using the –z parameter.

The next example will use the PGPPASS environment variable:

```
//INET   EXEC PGM=BPXBATCH,REGION=4Ø96K,
// PARM='SH pgp -d /u/SXSPØØ1/text_msg.txt.pgp'
//SYSERR   DD PATH='/tmp/pgpbatch.syserr',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//STDOUT   DD PATH='/tmp/pgpbatch.stdout',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//STDERR   DD PATH='/tmp/pgpbatch.stderr',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//SYSOUT   DD PATH='/tmp/pgpbatch.sysout',
//         PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//         PATHMODE=SIRWXU
//STDENV   DD *
PGPPASS=pass phrase fo MyOrg Site1                  - pass phrase
/*
```

Signing a message

Signing a ‘clear’ message on Site2

To sign a plaintext file with your secret key and have the output readable to people:

```
SXSPØØ1:/u/SXSPØØ1: >pgp -sta text_msg.txt -u MyOrg Site2
No configuration file found.
```

```
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 199Ø-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-Ø1-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2ØØ3/Ø6/2Ø 15:19 GMT

A secret key is required to make a signature.
You need a pass phrase to unlock your RSA secret key.
Key for user ID: MyOrg Site2
2Ø48-bit key, key ID E59DA965, created 2ØØ3/Ø6/16

Enter pass phrase: pass phrase for MyOrg Site2
Pass phrase is good.  Just a moment....
Clear signature file: text_msg.txt.asc
SXSPØØ1:/u/SXSPØØ1: >
```

The result of this command is the following ‘signed message’:

```
BROWSE -- /u/SXSPØØ1/text_msg.txt.asc -------- Line ØØØØØØØØ Col ØØ1 Ø64
 Command ===>                                          Scroll ===> HALF
****************************** Top of Data ******************************
----BEGIN PGP SIGNED MESSAGE----

line Ø1 from MyOrg Site2
line Ø2 from MyOrg Site2
line Ø3 from MyOrg Site2
line Ø4 from MyOrg Site2
line Ø5 from MyOrg Site2
line Ø6 from MyOrg Site2
line Ø7 from MyOrg Site2
line Ø8 from MyOrg Site2
line Ø9 from MyOrg Site2
line 1Ø from MyOrg Site2
line 11 from MyOrg Site2

----BEGIN PGP SIGNATURE----
Version: 2.6.3i
Charset: noconv

iQEVAwUBPvMl1J+cDqrlnallAQEdSgf/XK52JiIu3zØGFVJpvnbqc7MOllfhs7XD
b1f3VUr8GO9B1/z3xHa7aRqaVePZZbdcIyrhBOtQ3oLRZtanPDV1Y9o6IEXbazhI
xla/5XxGJzqSM9sDfjhr7TYiWC2hpyAtoYcirØ3HFVØØ88BqhLP/QZUVbzE5FNB+
EG+bIOkYAxaNØ1CVk2lOexQYtE27DahqRxvQ7qZOrIEmvTjØSl43UPJXnjHO9dR2
h51c4IEHLS4h7CPYyQvKpw1oQgVF9taUHJAcvKJlrxUzuZLD18z6NØOgQrjmIBVQ
3BDD95ZPOMKJkW5eCEwvaXzVYGXCØNkZpTGJa3VHuvFn2Rb2nSjBUg==
=24Fu
----END PGP SIGNATURE----
*************************** Bottom of Data ***************************
```

Verifying the signature of the 'clear' message from Site2 on Site1

To check the signature integrity of a signed file:

```
SXSP001:/u/SXSP001: >pgp text_msg.txt.pgp
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/20 12:43 GMT
.
File has signature.  Public key is required to check signature.
.
Good signature from user "MyOrg Site2".
Signature made 2003/06/20 14:35 GMT using 2048-bit key, key ID E59DA965

Plaintext filename: text_msg.txt
SXSP001:/u/SXSP001: >
```

Signing an 'encrypted' message on Site2

To sign a plaintext file with your secret key, and then encrypt it with the recipient's public key:

```
SXSP001:/u/SXSP001: >pgp -es text_msg.txt MyOrg Site1 -u MyOrg Site2
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/20 16:01 GMT

A secret key is required to make a signature.
You need a pass phrase to unlock your RSA secret key.
Key for user ID: MyOrg Site2
2048-bit key, key ID E59DA965, created 2003/06/16

Enter pass phrase: pass phrase for MyOrg Site2
Pass phrase is good.  Just a moment....

Recipients' public key(s) will be used to encrypt.
Key for user ID: MyOrg Site1
2048-bit key, key ID 5A0B2D55, created 2003/06/20

Key for user ID: MyOrg Site1
2048-bit key, key ID 5A0B2D55, created 2003/06/20

Key for user ID: MyOrg Site2
2048-bit key, key ID E59DA965, created 2003/06/16
.
```

```
Ciphertext file: text_msg.txt.pgp
SXSP001:/u/SXSP001: >
```

Verifying the signature of the 'encrypted' message from Site2 on Site1

To decrypt an encrypted file and to check the signature integrity of a signed file:

```
SXSP001:/u/SXSP001: >pgp text_msg.txt.pgp
No configuration file found.
Pretty Good Privacy(tm) 2.6.3i - Public-key encryption for the masses.
(c) 1990-96 Philip Zimmermann, Phil's Pretty Good Software. 1996-01-18
International version - RSA Patent Expired.     Does not use RSAREF.
Current time: 2003/06/20 14:03 GMT

File is encrypted.  Secret key is required to read it.
Key for user ID: MyOrg Site1
2048-bit key, key ID 5A0B2D55, created 2003/06/20

You need a pass phrase to unlock your RSA secret key.
Enter pass phrase: pass phrase for MyOrg Site1
Pass phrase is good.  Just a moment......
File has signature.  Public key is required to check signature.
.
Good signature from user "MyOrg Site2".
Signature made 2003/06/20 16:01 GMT using 2048-bit key, key ID E59DA965

Plaintext filename: text_msg.txt
SXSP001:/u/SXSP001: >
```

PGP LINKS

Alan Nichols' OS/390 PGP page: http://s390.nichols.de/pgp/index.html.

International PGP Home page: http://www.pgpi.org/.

Using TAR and JAR files on MVS

I recently needed to transmit a large number of TIF images (held in MVS datasets) to a server running a Windows environment. The Unix TAR command can be used under Unix System Services on MVS to create an archive file that can then be transmitted to the server and expanded using the familiar Windows ZIP utility.

In the following example the images are first copied from a PDS to an HFS directory using the OPUTX EXEC.

```
//*
//* use the OPUTX exec to copy each member of the
//* PDS into the HFS directory
//*
//OPUTX EXEC PGM=IKJEFT01
//SYSEXEC  DD DSN=SYS1.SBPXEXEC,DISP=SHR
//SYSPROC  DD DISP=SHR,DSN=SYS1.SISPCLIB
//ISPPLIB  DD DISP=SHR,DSN=SYS1.SISPPENU
//         DD DISP=SHR,DSN=SYS1.SISFPLIB
//ISPMLIB  DD DISP=SHR,DSN=SYS1.SISPMENU
//         DD DISP=SHR,DSN=SYS1.SISFMLIB
//         DD DISP=SHR,DSN=SYS1.SBPXMENU
//ISPSLIB  DD DISP=SHR,DSN=SYS1.SISPSENU
//         DD DISP=SHR,DSN=SYS1.SISPSLIB
//ISPTLIB  DD DISP=SHR,DSN=SYS1.SISPTENU
//         DD DISP=SHR,DSN=SYS1.SISFTLIB
//ISPPROF  DD DSN=&&ISPPROF,SPACE=(TRK,(5,1,2)),LIKE=&userid.ISPPROF,
//         DISP=(NEW,PASS)
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
  OPUTX 'your-PDS-of-images' '/your-dir' ASIS BINARY CONVERT(NO) +
        MODE(644) SUFFIX(tif)
/*
```

The TAR command is then used to create the archive dataset – note that in this particular case the compression flag is not used because TIF images are already in a compressed format.

```
//*
//* use Unix System Services TAR command
//* to create an archive dataset
//*
//TAR    EXEC PGM=BPXBATCH,
```

```
//         PARM='sh tar -cUvf //tiffs.tar /your-dir'
//STDOUT  DD PATH='/tmp/stdout',
//          PATHOPTS=(OCREAT,OWRONLY),PATHMODE=SIRWXU,
//          PATHDISP=KEEP
//STDERT  DD PATH='/tmp/stderr',
//          PATHOPTS=(OCREAT,OWRONLY),PATHMODE=SIRWXU,
//          PATHDISP=KEEP
//*
```

The resulting MVS dataset, &userid.TIFFS.TAR, can be sent (obviously as a binary transmit) to the server and unzipped to restore the individual image files. Note that the Windows ZIP program will recognize files with an extension of .tar.

If you want to include text files in your archive, there is a slight problem in that we are using a binary transfer – somewhere along the line the data will need to be translated into ASCII. The following job will take an MVS text file (ie EBCDIC character data) and convert it to ASCII. The TEXT option in this case will result in the addition of an LF character being added to delimit the end of each record. This will be OK for a Unix system; however, the standard Windows text file expects CR LF or X'0D0A' as the delimiter.

```
//OCOPY  EXEC PGM=IKJEFT01
//INDD     DD DSN=your-text-file,DISP=OLD
//OUTHFS   DD PATH='/your-dir/myfile.txt',
//            PATHDISP=(KEEP,DELETE),
//            PATHOPTS=(OWRONLY,OCREAT),PATHMODE=SIRWXU
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
  OCOPY INDD(INDD) OUTDD(OUTHFS) TEXT CONVERT((BPXFX311)) +
        FROM1047
/*
```

While the Windows ZIP utility is quite happy to work with Unix TAR files created on MVS, the reverse is not true. To cater for the situation where you may want to package up some files on a Windows environment and upload them to MVS as a single dataset, you can make use of the Java archive utility, which provides a similar ZIP functionality, and, being Java, provides platform-independence. Further information about Java archive files can be found on the Internet (see the Sun Java tutorial pages).

Assuming that you have made Java available on your MVS system (mounting the HFS containing the Java software and setting the environment variables), the following JCL illustrates the use of the JAR command to expand a Java archive file that was created on a Windows PC:

```
//* use JAR to unload the archive
//*
//JAR    EXEC PGM=BPXBATCH,
//    PARM='sh cd work;jar xf /work/fixes.jar'
//STDOUT  DD PATH='/tmp/stdout',
//          PATHOPTS=(OCREAT,OWRONLY),PATHMODE=SIRWXU,
//          PATHDISP=KEEP
//STDERT  DD PATH='/tmp/stderr',
//          PATHOPTS=(OCREAT,OWRONLY),PATHMODE=SIRWXU,
//          PATHDISP=KEEP
//*
```

The OGETX EXEC can then be used to move files into a standard MVS PDS:

```
OGETX /work '&userid.MVS.PDS' LC SUFFIX(bin) BINARY
```

With many vendors providing fixes over the Internet as downloads, one possible use for this kind of job would be to move a number of fixes from a directory on your PC up to an MVS dataset.

Dave Welch (New Zealand)

Finding CSECTs within LPA load modules in virtual storage

In the course of development of certain types of system application, the ability to programmatically locate CSECT addresses within LPA-resident modules can sometimes prove useful. Unfortunately, the information to facilitate such location, ie the displacement of a given CSECT within the load module, while present in the linkage editor control information for the module, is not retained in virtual storage when the module is

actually loaded. Thus, it becomes necessary to refer back to the linkage editor CESD (Composite External Symbol Dictionary) control records, which form a portion of the load module's contents in its LPALST library on DASD. From these, the desired CSECT can be located, and its load module displacement extracted. This value, when added to the output of a system service call (which identifies the module's virtual storage load address), precisely identifies the virtual storage address of the aforesaid CSECT.

FNDCSCT is a statically or dynamically called routine which performs the above function. It is passed the load module and CSECT names as parameters, and, upon completion of a successful location operation, returns the associated virtual storage address in register 0 and a return code of 0 in register 15. WTO-type error messages and a non-zero return code in register 15 are generated upon recognition of any conditions which preclude successful completion. Note that the location technique employed will result in the appearance of one or more IEC141I 013-18 exception messages if the desired module is not found in the first of two or more LPALST libraries. These do not signal error conditions if the module is found in a subsequent LPALST library. If the module is not found in any LPALST library, then IEC141I 013-18 messages will appear for all such libraries, and a further 'FNDCSCT007E Load module loadmodulename was not found' message will signal the error condition.

FNDCSCT should be linkedited as a stand-alone load module into any desired load library. No specific linkage editor attributes need be assigned.

The calling sequences for FNDCSCT are as follows:

Static call:

```
         call   FNDCSCT,(loadmod,csect)
         ltr    r15,r15
         bnz    errorrtn
loadmod  dc     cl8'loadmodulename'
csect    dc     cl8'CSectname'
```

Dynamic call:

```
         link   ep=FNDCSCT,(loadmod,csect)
         ltr    r15,r15
         bnz    errorrtn
loadmod  dc     cl8'loadmodulename'
csect    dc     cl8'CSectname'
```

FNDCSCT

```
fndcsct  amode 31
fndcsct  rmode 24
fndcsct  csect
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
          stm   r14,r12,12(r13)            entry linkage
          lr    r12,r15
          using fndcsct,r12
          st    r13,savearea+4
          la    r15,savearea
          st    r15,8(r13)
          lr    r13,r15
          b     fcsc0020                   branch to start
return   ds    Øh
          xr    r15,r15                    exit linkage
          l     r13,4(r13)
          l     r14,12(r13)
          lm    r1,r12,24(r13)
          br    r14                        return
fcsc0020 ds    Øh
          lr    r9,r1                      save pal pointer
          l     r3,cvtptr                  CVT pointer
          icm   r3,15,cvtsmext-cvt(r3)     CVT extension
          bnz   fcsc0050                   it's there
```

```
          wto   'FNDCSCT001E No CVTX address found'
          la    r15,8
          b     return+2
fcsc0050 ds    0h
          icm   r3,15,cvteplps-cvtvstgx(r3) LPAT address
          bnz   fcsc0100                    it's there
          wto   'FNDCSCT002E No LPAT address found'
          la    r15,8
          b     return+2
fcsc0100 ds    0h
          clc   =cl4'LPAT',0(r3)            really the
LPAT?               00490000
          be    fcsc0150                    YES
          wto   'FNDCSCT003E LPAT ID check failed'
          la    r15,8
          b     return+2
fcsc0150 ds    0h
          icm   r4,15,4(r3)                 number of LPAT entries
          bnz   fcsc0200                    more than none
          wto   'FNDCSCT004E No LPAT entries present'
          la    r15,8
          b     return+2
fcsc0200 ds    0h
          l     r2,0(,r9)                   get member name address
          mvc   membrtu+6(8),0(r2)          move member name to txt unit
          la    r3,9(,r3)                   point to first LPAT entry
fcsc0250 ds    0h
          cli   0(r3),0                     end of entries?
          be    fcsc0900                    yes, module not found
          mvc   dsnamtu+6(44),0(r3)         no, move dsname to text unit
          mvi   alcverb,s99vrbal            prime dynalloc fields
          la    r0,dsnamtu
          st    r0,alctua1
          la    r0,membrtu
          st    r0,alctua2
          la    r0,statstu
          st    r0,alctua3
          la    r0,rtddntu
          st    r0,alctua4
          oi    alctua4,x'80'
          la    r1,alcrbptr
          dynalloc
          ltr   r15,r15                     allocation ok?
          bz    fcsc0400                    yes
          st    r15,allocrc
          mvc   wto00250+37(44),dsnamtu+6   move dataset name
          trt   wto00250+37(44),trtable     search for terminating blank
          mvi   0(r1),c'('                  member name preparation
          lr    r5,r1                       retain address of blank
```

```
          mvc   1(8,r5),membrtu+6           move member name
          trt   1(8,r5),trtable             search for terminating blank
          mvi   Ø(r1),c')'                  end of member name
          cnop  Ø,4
wto00250 wto   'FNDCSCT005E Error allocating                          *
                                            '
          mvc   dfdaplp,=a(alcrb)           initialize DAIRFAIL parms
          mvc   dfrcp,=a(allocrc)
          la    r1,=a(Ø)
          st    r1,dfjeff02
          la    r1,=x'4032'
          st    r1,dfidp
          xc    dfcpplp,dfcpplp
          mvc   dfbufp,=a(dfbufs)
          la    r1,dfparms
          link  ep=IKJEFF18                 invoke DAIRFAIL
          ltr   r2,r15                      ok?
          bz    fcsc0300                    yes
         wto   'FNDCSCT006E DAIRFAIL error - return code set to DAIRFAI*
               L return code'
          lr    r15,r2
          b     return+2
fcsc0300 ds    Øh
          lh    r5,dfbufl1                  extract the DAIRFAIL message
          sh    r5,=h'5'                    set/check message length
          ch    r5,=h'112'
          bnh   fcsc0320
          lh    r5,=h'112'
fcsc0320 ds    Øh
          ex    r5,exmvc1                   move it to the wto
          cnop  Ø,4
wto00300
wto   'FNDCSCT006E                                                    *
                                                                      *
                               '            issue it
          clc   dfbufl2,=a(Ø)               any second level message?
          be    fcsc0340                    no
          lh    r5,dfbufl2                  yes, extract as well
          sh    r5,=h'5'                    set/check message length
          ch    r5,=h'112'
          bnh   fcsc0330
          lh    r5,=h'112'
fcsc0330 ds    Øh
          ex    r5,exmvc2                   move it to wto
          cnop  Ø,4
wto00330
wto   'FNDCSCT006E                                                    *
                                                                      *
                              '
```

```
fcsc0340 ds    0h
          l     r15,allocrc
          b     return+2
fcsc0400 ds    0h
          mvc   library+dcbddnam-ihadcb(8),rtddntu+6 move ddname
          open  (library,(INPUT)),mode=31   open the library
          tm    library+(dcboflgs-ihadcb),dcbofopn ok?
          bo    fcsc1000                   yes, module has been located
          la    r3,45(,r3)                  no, next LPAT library
          b     fcsc0250                    recycle
fcsc0900 ds    0h
          l     r3,0(,r9)                   get load module name addr
          mvc   wto00900+32(8),0(r3)        move load module name
          cnop  0,4
wto00900 wto   'FNDCSCT007E Load module xxxxxxxx was not found'
          la    r15,8
          b     return+2
fcsc1000 ds    0h
          get   library                     get a load module record
          lr    r3,r1                       retain its address
          cli   0(r3),x'20'                 CESD record?
          bne   fcsc1000                    no, get another one
          la    r4,0
          icm   r4,3,6(r3)                  get record length
          la    r3,8(,r3)
          la    r4,0(r3,r4)                 point past last byte
          sh    r4,=h'8'                    back off sufficiently
          l     r5,4(,r9)                   get passed CSECT name addr
fcsc1150 ds    0h
          clr   r3,r4                       past upper search limit?
          bnl   fcsc1000                    yes, go get another record
          clc   0(8,r3),0(r5)               no, CSECT names match?
          bne   fcsc1500                    no
          tm    8(r3),x'0f'                 yes, type=SD?
          bz    fcsc2000                    yes, what we're looking for
fcsc1500 ds    0h
          la    r3,1(,r3)                   next byte
          b     fcsc1150                    reiterate
fcsc2000 ds    0h
          la    r4,0
          icm   r4,b'0111',9(r3)            load the displacement
          l     r8,0(,r9)                   point to load module name
          csvquery inepname=(r8),search=LPA,outloadpt=loadpt look for it
          ltr   r2,r15                      find it?
          bz    fcsc2050                    yes
          ch    r2,=h'8'                    module not found?
          be    fcsc2020                    yes
         wto   'FNDCSCT008E CSVQUERY error - return code set to CSVQUER*
               Y return code'
```

```
          lr    r15,r2
          b     return+2
fcsc2020 ds    0h
          wto   'FNDCSCT009E CSVQUERY could not find the requested load*
                module'
          la    r15,8
          b     return+2
fcsc2050 ds    0h
          l     r0,loadpt                  load module load point
          alr   r0,r4                      add CSECT
displacement       01960013
          b     return                     return
******************
* DCB ABEND exit *
******************
fcsc8000 ds    0h
          lr    r3,r1                      retain parameter list addr
          lr    r4,r14                     retain  return addr
          mvi   3(r3),4                    ignore the abend
          lr    r14,R4                     restore return addr
          br    r14                        return
**********************
* DCB EODAD routine *
**********************
fcsc9000 ds    0h
          l     r2,4(,r9)                  load CSECT name address
          mvc   wto09000+51(8),0(r2)       move CSECT name
          cnop  0,4
wto09000 wto   'FNDCSCT010E No CESD record found for CSECT xxxxxxxx  '
          la    r15,8
          b     return+2
*************************
* Executed instructions *
*************************
exmvc1   mvc   wto00300+20(0),dfbuft1
exmvc2   mvc   wto00330+20(0),dfbuft2
*************
* Data Area *
*************
savearea dc    18f'0'
dsnamtu  dc    al2(daldsnam),al2(1),al2(44),cl44' '
membrtu  dc    al2(dalmembr),al2(1),al2(08),cl08' '
statstu  dc    al2(dalstats),al2(1),al2(01),xl01'8'
rtddntu  dc    al2(dalrtddn),al2(1),al2(08),cl08' '
library  dcb   ddname=dummy,macrf=GL,dsorg=PS,recfm=U,lrecl=0,         *
                blksize=32760,devd=DA,eodad=fcsc9000,exlst=exlst
exlst    dc    0f'0',x'11',al3(fcsc8000)
loadpt   dc    a(0)                       module load point
allocrc  dc    f'0'                       allocation return code
```

```
alcrbptr dc    x'8Ø',al3(alcrb)          request block pointer
alcrb    ds    Øf                        request block
alcrbln  dc    al1(2Ø)                   request block length
alcVERB  dc    al1(Ø)                    verb code
alcFLAG1 ds    Øal2                      flags
alcflg11 dc    al1(Ø)                    first flags byte
alcflg12 dc    al1(Ø)                    second flags byte
alcrsc   ds    Øal4                      reason code fields
alcerror dc    al2(Ø)                    error reason code
alcinfo  dc    al2(Ø)                    information reason code
alctxtpp dc    a(alctupl)                tupl address
alcrsvØ1 ds    f                         reserved
alcflag2 ds    Øal4                      authorized functions flags
alcflg21 dc    al1(Ø)                    first flags byte
alcflg22 dc    al1(Ø)                    second flags byte
alcflg23 dc    al1(Ø)                    third flags byte
alcflg24 dc    al1(Ø)                    fourth flags byte
alctupl  ds    Øf                        text unit pointer list
alctua1  dc    a(Ø)                      text unit address 1
alctua2  dc    a(Ø)                      text unit address 2
alctua3  dc    a(Ø)                      text unit address 3
alctua4  dc    a(Ø)                      text unit address 4
         ikjeffdf
trtable  dc    256x'Ø'
         org   trtable+c' '
         dc    c' '
         org   ,
**********
* DSects *
**********
         cvt   dsect=YES,list=NO
         dcbd  dsorg=PS,devd=DA
         iefzb4dØ
         iefzb4d2
         end
```

Joel Riemeer
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Reorganization of datasets

KSDS datasets with a lot of activity tend to get split. In practice, CI splits are more frequent than CA splits, and when a CA split happens the number of CI splits is normally already large.

Datasets that tend to get split should be periodically reorganized, in order to avoid performance degradation.

The program presented here reads a LISTCAT output, searching for KSDS files whose number of CI splits is greater than a specified limit. When it finds one, it writes out a five-step JCL to reorganize that file.

The steps are as follows:

- Create VSAM temp file (similar to the original)
- Repro original to the temp
- Delete and define the original file
- Repro from temp to the new file
- Delete the temp.

The volume where the new file is allocated is the same as the one where the original file was. I made no provision for multi-volume files because I felt files with such dimensions should be treated separately. This program should be used only for single volume datasets.

All the JCL is written to a single file that can later be submitted, or modified if necessary before being submitted. The program also writes to SYSTSPRT a list of the files considered for reorganization, showing how many there are.

This EXEC should be run in a two-step batch job, where the first step issues a LISTCAT ALL for a given catalog, writing the output to a file, and the second step runs the EXEC, reading the output and writing out the JCL to another file.

SAMPLE JOB

```
//STEP1    EXEC PGM=IDCAMS
//SYSPRINT DD DISP=(NEW,PASS),DSN=&&TEMP1,UNIT=VIO,
//            DCB=(LRECL=121,RECFM=FB,BLKSIZE=2420),
//            SPACE=(TRK,(30,30))
//SYSOUT   DD SYSOUT=*
//SYSIN    DD *
```

```
  LISTCAT ALL CATALOG(my.catalog)
/*
//STEP2    EXEC PGM=IRXJCL,PARM='VSREORG'
//SYSEXEC  DD DISP=SHR,DSN=where.is.the.exec
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//FILEIN   DD DISP=(OLD,DELETE),DSN=&&TEMP1
//FILEOUT  DD DISP=SHR,DSN=jcl.file
```

VSREORG REXX

```
/*= REXX ============================================================*/
/*  VSREORG - Reads a "LISTCAT ALL" listing allocated to FILEIN and */
/*            generates JCL for the reorganization of KSDS datasets */
/*            whose CI split number is greater than a certain       */
/*            threshold. The JCL is written to DDname FILEOUT.      */
/*            Threshold value is indicated by variable  splitsci.   */
/*====================================================================*/
splitsci = 1Ø              /* minimum number of CI splits for reorg */
suf = "TP"                 /* suffix for temporary datasets         */
execio 1 diskr filein
if rc <>Ø then do
   say "Error reading filein"
   exit
end
pull linha
cc = left(linha,1)
data_flag = Ø
c = Ø
do alpha = Ø
   execio 1 diskr filein
   if rc <>Ø then leave
   pull linha
   if cc = 1 then linha = substr(linha,2)
   call check_line_type
   if data_flag = 1 then do
      call extract_values
   end
end
call write_fileout
say
say total "datasets were considered for reorganization"
exit
/*====================================================================*/
/*                 search for a DATA component                        */
/*====================================================================*/
check_line_type:
 select
```

```
    when substr(linha,1,7)="CLUSTER" then do
       c = c + 1
       cluster.c = word(linha,3)
       data_flag = Ø
       aix = Ø
    end
    when substr(linha,4,4)="DATA" & aix = Ø then do
       data.c = word(linha,3)
       data_flag = 1
    end
    when substr(linha,1,3)="AIX" then do
       data_flag = Ø
       aix = 1
    end
    when substr(linha,4,5)="INDEX" & data_flag=1 & aix=Ø then do
       index.c = word(linha,3)
       data_flag = Ø
    end
    when substr(linha,1,7)="NONVSAM" then do
       data_flag = Ø
    end
    otherwise nop
 end
return
/*====================================================================*/
/*                    extract values from line                        */
/*====================================================================*/
extract_values:
 select
   when substr(linha,8,7)="REC-TOT" & data_flag = 1 then do
      linha = translate(linha," ","-")
      rectot.c = right(word(linha,3),11)
      splici.c = right(word(linha,6),5)
      if splici.c < splitsci then do
         c = c - 1
         data_flag = Ø
      end
   end
   when substr(linha,8,8)="SHROPTNS" & data_flag = 1 then do
      shropt.c = substr(linha,17,3)
      if word(linha,5) <> "INDEXED" then do
         c = c - 1
         data_flag = Ø
      end
   end
   when substr(linha,8,7)="REC-INS" then do
      linha = translate(linha," ","-")
      freeci.c = right(word(linha,6),2)
   end
```

```
   when substr(linha,8,7)="REC-UPD" then do
      linha = translate(linha," ","-")
      freeca.c = right(word(linha,6),2)
   end
   when substr(linha,8,7)="REC-DEL" then do
      linha = translate(linha," ","-")
      splica.c = right(word(linha,6),3)
   end
   when substr(linha,8,6)="KEYLEN" then do
      linha = translate(linha," ","-")
      keylen.c = right(word(linha,2),2)
      alrecl.c = right(word(linha,4),5)
      alrecl.c = space(alrecl.c,0)
      cisize.c = right(word(linha,8),5)
      cisize.c = space(cisize.c,0)
   end
   when substr(linha,8,3)="RKP" then do
      linha = translate(linha," ","-")
      keypos.c = right(word(linha,2),2)
      mlrecl.c = right(word(linha,4),5)
      mlrecl.c = space( mlrecl.c,0)
   end
   when substr(linha,8,7)="SPACE-T" then do
      linha = translate(linha," ","-")
      sptype.c = left(word(linha,3),3)
      if sptype.c = "CYL" then sptype.c = "CYLINDERS"
      if sptype.c = "TRA" then sptype.c = "TRACKS"
      if sptype.c = "REC" then sptype.c = "RECORDS"
   end
   when substr(linha,8,7)="SPACE-P" then do
      linha = translate(linha," ","-")
      spprim.c = right(word(linha,3),5)
      spprim.c = space(spprim.c,0)
   end
   when substr(linha,8,7)="SPACE-S" then do
      linha = translate(linha," ","-")
      spseco.c = right(word(linha,3),4)
      spseco.c = space(spseco.c,0)
   end
   when substr(linha,8,6)="VOLSER" then do
      linha = translate(linha," ","-")
      volume.c = word(linha,2)
   end
   otherwise nop
 end
return
/*====================================================================*/
/*                       Write fileout                                */
/*====================================================================*/
```

```
write_fileout:
 total = Ø
 do k = 1 to c
    dropbuf
    if length(cluster.k"."suf) > 42 then do
       say ">>> Temporary name exceeds 42 characteres"
       say ">>> for dataset " cluster.k"."suf
       say ">>> Dataset skipped"
       iterate k
    end
    queue "//STEP"k"1 EXEC PGM=IDCAMS,COND=(Ø,LT)"
    queue "//SYSPRINT DD SYSOUT=*"
    queue "//SYSIN    DD *"
    queue " DEFINE CLUSTER( -"
    queue "   NAME("cluster.k"."suf") -"
    queue "         "sptype.k"("spprim.k spseco.k") -"
    queue "         RECSZ("alrecl.k mlrecl.k") -"
    queue "         KEYS("keylen.k keypos.k")) -"
    queue "   DATA( -"
    queue "        NAME("cluster.k"."suf".D)) -"
    queue "   INDEX( -"
    queue "        NAME("cluster.k"."suf".I))"
    queue "/*"
    queue "//STEP"k"2 EXEC PGM=IDCAMS,COND=(Ø,LT)"
    queue "//INF      DD DISP=SHR,"
    queue "//         DSN="cluster.k
    queue "//OUTF     DD DISP=SHR,"
    queue "//         DSN="cluster.k"."suf""
    queue "//SYSPRINT DD SYSOUT=*"
    queue "//SYSIN    DD *"
    queue " REPRO INFILE(INF) OUTFILE(OUTF)"
    queue "/*"
    queue "//STEP"k"3 EXEC PGM=IDCAMS,COND=(Ø,LT)"
    queue "//SYSPRINT DD SYSOUT=*"
    queue "//SYSIN    DD *"
    queue " DELETE ("cluster.k") CL PURGE"
    queue " DEFINE CLUSTER( -"
    queue "   NAME("cluster.k") -"
    queue "         "sptype.k"("spprim.k spseco.k") -"
    queue "         VOLUME("volume.k") -"
    queue "         RECSZ("alrecl.k mlrecl.k") -"
    queue "         FSPC("freeci.k freeca.k") -"
    queue "         KEYS("keylen.k keypos.k")) -"
    queue "   DATA( -"
    queue "        NAME("data.k") -"
    queue "        CISZ("cisize.k")) -"
    queue "   INDEX( -"
    queue "        NAME("index.k"))"
    queue "/*"
```

```
    queue "//STEP"k"4 EXEC PGM=IDCAMS,COND=(Ø,LT)"
    queue "//INF      DD DISP=SHR,"
    queue "//         DSN="cluster.k"."suf""
    queue "//OUTF     DD DISP=SHR,"
    queue "//         DSN="cluster.k
    queue "//SYSPRINT DD SYSOUT=*"
    queue "//SYSIN    DD *"
    queue " REPRO INFILE(INF) OUTFILE(OUTF)"
    queue "/*"
    queue "//STEP"k"5 EXEC PGM=IDCAMS,COND=(Ø,LT)"
    queue "//SYSPRINT DD SYSOUT=*"
    queue "//SYSIN    DD *"
    queue " DELETE ("cluster.k"."suf") CL PURGE"
    queue "/*"
    queue "//*"
    queue "//*============================================="
    queue "//*"
    execio queued() diskw fileout
    total = total + 1
    say "JCL generated for dataset " cluster.k
 end
 execio Ø diskw fileout "(finis"
return
```

Systems Engineer
(Portugal)

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October 1999 – September 2003 index

Items below are references to articles that have appeared in *MVS Update* since October 1999. References show the issue number followed by the page number(s). Subscribers can download copies of all issues in Acrobat PDF format from Xephon's Web site.

64-bit real storage 198.13-26
AES algorithm 176.3-9
Alias 184.3-8
Allocating cartridges 174.15-23
ANTRQST 204.22-33
APF 193.3-5
Archiving 187.8-14
ASCII 192.64-69
ASIDs 195.8-17
Assembler 190.17-31, 193.50-57
ASVT 182.49-68
Automation 182.26-31
Auxiliary Storage Monitor 182.13-24
Back-up 193.27-49, 194.30-60, 194.64-71, 195.31-60
Bar code 201.56-71
Batch 183.15-19
Bimodal Migration Accommodation 201.3-5
BIND 197.23-32
BPXMTEXT 202.70-71
Browse 188.39-71, 189.56-69
C functions 192.22-32
C 183.29-32, 190.17-31, 193.50-57
CA 1 TMC 157.3-5
CA 1 168.9-52
Cache status management 160.11-17
Calculating length 196.8-13
Cartridge drives 193.5-14, 195.19-30
Change 184.14-23
Channel information 165.12-27
Checkpoint 185.16-23
CI size 200.9-15
Cleaning volumes 172.27-42
COBOL 186.62, 194.10-26, 204.56-63
COBOL coding efficiency 161.3-15
COBOL II 157.5-7
COBOL Unit Tester 181.69-70
COBOL variables 161.64-65
COBOL Version 2 Release 2 171.8-13
Comparing files 203.25-34
Comparison 190.31-37
Compression 184.24-51
Concurrent copy 166.3-8
COPY 187.3-8
CPP 194.3-7
CPSM/SPOC 202.27-40
Cross memory mapping 159.49-57
CSECTs 200.64-71, 204.56-63
CSI 203.69-71
Cursor-sensitive ISPF 158.56-71, 160.50-71, 161.65-71
DASD 145.40-43, 146.3-9, 151.3-11, 170.44-63, 180.48-64, 187.38-71, 189.37-40
DASD information 189.6-20
DASD initialization 182.32-47, 183.33-48
DASD space monitor 177.3-12
DASD tuning 160.17-27
DASD volume display 170.12-17
Data warehousing 204.7-9
Dataset creation date 175.55-58
Dataset information 185.9-16, 189.41-55
Dataset names 202.50-55
Dataset ownership 194.7-10
Date and time 202.8-9
Debug 194.10-26
Defrag 180.3-9, 196.62-71, 197.32-47
Delete 200.7-9
DES algorithm 162.12-31
DFHSM 191.33-57, 193.27-49, 194.64-71, 204.3-6, 202.19-27
Dialog Manager 189.21-37

Disaster recovery 162.63-70
Disaster recovery testing 158.34-43
Dynamic allocation 183.48-67
Dynamic Channel-path management 183.68-70, 184.68-69
Dynamic dataset allocation 172.10-15
Dynamic dump datasets 171.27-48
EBCDIC 192.64-69
EDIF 193.58-66
EDIT 193.58-66, 198.27-29
Editing 191.3
edit macro 197.3-4
E-mail 172.3-6, 183.19-28, 194.60-64
Enterprise PL/I 203.45-57
Error report 204.3-6
ESS 179.8-40
EVALUATE 187.3-8
Extended parameter 202.3-8
File allocation 195.3-8
Filename 191.28-33
Freeware 182.12
FTP 176.39-41, 184.51-67, 185.53-69
GDG 184.8-13
GDG transfer 172.68-71
GIMZIP 193.15-26
HFS 191.57-65
High Level Assembler 158.50-52
Hints and tips 192.7-22
HiperSockets 186.23-24
HLASM 199.9-16
HOLDDATA 182.25
HSM 187.15-24, 190.3-6
HTML 174.3-9
Identify version 191.4-5
IFL 182.48
IMS 200.49-64
In-stream data 186.10-22
Internet 163.3-12, 169.65-71
Invoking MVS commands 165.37-42
IPA 192.32-64
IPCS 199.24-48
IPL 192.3-7, 203.3-7
IRD 183.68-70
ISPF 188.4-18, 189.21-37, 193.67-71, 201.24-47
JAR 204.54-56
Java 181.18, 189.3-6
Java client/server application 165.45-71
JCL 198.53-71
JES 201.12-24
JES2 recovery 157.7-9
JES output 171.3-4
Level 88 condition codes 158.13-17
Library search facility 158.17-28
Linkage editor 197.23-32
Linux 168.65-71, 180.64-72, 182.48
LLA 173.3-15, 186.3-10
Load module changes 166.27-48
Load REXX 187.25-37
LPA 200.64-71
LPA module mapping 182.3-12
LPAR 201.56
Machine instructions 180.31-48
Mail 193.67-71
Master catalog 196.20-27
Memory mapping 181.49-67
Messages 199.3-8, 200.3-6
MFS 196.13-20
Module design 201.5-9, 203.57-68
Monitoring 185.3-9, 197.4-10
Msys 182.69-71
MVS I/O performance 163.6-28
MVS system monitor 158.32-34
NetREXX 180.12-13
Online batch 191.66-71
On-line messages 174.35-64
Open MVS 159.8-18
Organizing Assembler 178.3-9
Orphaned DCBs 148.9-14
OS/390 strategy 167.3-9
OS/390 system messages 153.43-51
OS/390 Unix 157.30-59
OS/390 Version 2 Release 10 166.70-71
OS/390 Version 2 Release 6 145.3-6
OS/390 Version 2 Release 8 157.11-14
OS/390 Version 2 Release 9 163.3-11
Panel access 177.28-29
Parsing strings 199.49-71, 200.16-38
Pattern matching 191.28-33, 197.67-
PDF 191.57-65
PDF line commands 157.10-11, 162.60-62
PDS 166.48-49, 190.31-37, 200.38-48
PDSE 170.63-71, 180.13-31, 184.3-8, 198.3-5
Performance 183.3-14

PF keys 162.70
PF Keys 199.21-23
PGP 204.33-53
PL/I 184.70-71
POST macro 177.54-70
Prefixes 203.8-9
PROCLIB 189.69-71
PROFILE 163.64-71
PROG*xx* 179.3-5
PUTLINEs 161.27-31
Queries 201.9-12
Query 199.17-20
Reconstructing source code 177.19-54
Record tailoring 175.28-55
Recovery 194.30-60, 195.31-60
Redbooks 181.67-69
Re-entrant programming 172.63-68
Register contents 194.27-29
REORG 203.35-45
REPLACE 187.3-8
Return code special register 166.8-10
REXX 163.3-6,167.49-52, 168.7-9,173.3-9, 188.3-4
REXX over IP 168.52-65, 169.52-65
RMF Spreadsheet Reporter 168.3-7
Rounding errors 203.10-15
SCRT 202.41-49
Search 188.18-27, 188.28-39
Search engine 190.7-17
Searching with COBOL 165.42-45
SELCOPY 169.3-4
SELCOPY and BASE 64 176.41-53
SMP/E 160.15-27, 182.25, 193.15-26
SMP/E SMPPTS 181.3-18
SMP/E SYSMODS 173.9-15
SMS 162.32-48, 185.23-53, 186.25-61, 187.15-24, 189.6-20, 201.47-56
Snapshot copy 183.15-19, 184.71
Software changes 196.3-7
Sorting hexadecimal data 157.3-8
Sorting stem variables 163.51-71
SORT SYMNAMES 199.9-16
Spool offload facility 175.6-28
Spreadsheet 190.37-71
STC 186.10-22
Storage tables 198.29-44
Strings 160.47-49, 184.14-23, 204.10-21
SUBMIT 195.17-19
SVC screening 176.18-39
SYS1.PARMLIB members 172.22-27
SYSADATA 199.9-16
SYSLOG identification 160.3-11
Syslogs 187.8-14
SYSMODS 193.15-26
SYSOUT API 191.6-27
System layout 202.10-18
System trace table entries 176.53-71, 177.29-71
Tape 159.49-57, 161.3-12
TAR 204.54-56
Testing 188.3-4, 188.4-18
Translation 185.69-71, 186.63-71
Tuning 183.15-19
Unblocking commands 157.14-30
Unix 183.3-14
UNSTRING 160.47-49
Using overlays 158.52-56
USS 183.3-14
VARY commands 172.22-27
Virtual storage map 172.42-52
virtual storage memory leaks 196.49-62
VLF statistics 180.9-12
VOLSER 172.52-63
VSAM 188.39-71, 189.56-69, 197.47-67, 198.45-52, 200.9-15, 202.55-70, 203.35-45, 203.69-71, 204.63-69
Wait function 173.15-21
WAIT macro 177.54-71
WLC 202.41-49
WLM 198.6-12, 203.16-24
WLM information 163.8-41
WTORS 169.8-9,172.15-22
Year 2000 compliance 154.3
z900 170.3-12, 183.72
z/Architecture 195.60-71, 196.28-49
zFS 197.11-23
z/OS 170.3-12, 179.68-71, 183.72, 186.24, 186.62, 189.69-71
Z/OS migration 183.28
z/OS Version 1 Release 1 175.69-71
zSeries 175.3-6
Z/VM 182.71

Information Builders has announced availability of WebFOCUS for Mainframe Linux BI tool, allowing secure data access and integration over Linux, across 35 other platforms, including MVS and OS/390, VM/CMS, Unisys, Unix, and NT, and more than 85 applications.

Additionally, mainframe Linux customers can also exploit WebFOCUS's data access capabilities and securely access any data set under MVS or OS390, including DB2, IMS, and VSAM.

Features include reporting, query, and analysis facilities with support for standard reports to *ad hoc* queries and in-depth OLAP analysis.

Data visualization, such as GIS mapping and advanced graphical components, allows users at all levels to perform graphical analysis to help discover relationships and spot trends.

Information delivery and management features let users schedule, distribute, share, and archive corporate information, while data access, integration, and ETL allow companies to access virtually any type of information source or build data marts and data warehouses to exploit their information.

For further information contact:
Information Builders, Two Penn Plaza, New York, NY 10121-2898, USA.
Tel: (212) 736 4433.
URL: http://www.informationbuilders.com/products/webfocus/index.html.

* * *

IIBM has announced WebSphere Business Integration Adapters V2.3.0 and V2.3.1, which introduce 11 new adapters and provide connectivity to WebSphere Application Server.

The WebSphere Business Integration Adapter portfolio has been expanded to support industry applications. This release contains new adapters to provide connectivity to IndusConnect Framework, Maximo MEA, and QAD MFG/PRO.

New technology adapters in this release provide support for healthcare industry standards, such as Health Level Seven (HL7), as well as providing connectivity to iSeries, Lotus Domino, Exchange, COM, and CORBA.

Two new mainframe adapters are also being introduced. The first provides connectivity to a Natural application by executing the Natural program and retrieving the data returned from the execution. The adapter uses JDBC connectivity to the OS/390 platform. Standard operations on the applications are executed using stored procedure calls. The second is the adapter for IDMS, which provides access to IDMS data on mainframe systems using JDBC connectivity and host RPC. Standard operations on the applications are executed using stored procedure calls.

Both mainframe adapters use the NEON Shadow client and server to achieve connectivity. These adapters are available on AIX, HP-UX, Solaris, and Windows.

For further information contact your local IBM representative.
URL: http://www.ibm.com/websphere/integration/wbiadapters.

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