Analyzing Your RACF Database Using REXX

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Trademarks

Agenda

- **What is R_admin?**
  - Functions
  - Authorizations
- **What is IRRXUTIL?**
  - Relationship to R_admin
  - Invocation syntax
  - Sample invocation
  - Considerations
  - Return Codes
  - Returned data
  - Getting the “next” profile
  - Finding field names
  - References

What is R_admin?

What is R_admin?

- **The R_admin callable service (IRRSEQ00) is an assembler programming interface which allows for management of RACF profiles and system wide settings (SETROPTS).**
- **R_admin allows you to:**
  - Execute RACF commands
    - With the exception of RVARY, BLKUPD, RACLINK, RACF operator commands (TARGET, SET, SIGNOFF, etc.)
  - Update/Extract profile information into a tokenized format
    - USER, GROUP, user-to-group connections, general resources including access lists
    - Data set profiles (UPDATE only)
  - Set/Extract SETROPTS information
    - SMF Unload-like format
    - "Tokenized" format

  … and more!

Authorization for R_admin

- **R_admin may be invoked by authorized and unauthorized callers.**
  - Authorization is required to set or change the user ID under which the function is performed.
  - Non-authorized callers cannot use the R_admin update function codes.
  - Non-authorized callers must have READ authority to a function-specific resource in the FACILITY class.

    For example:
    - IRR.RADMIN.command for a RACF command

      i.e. IRR.RADMIN.LISTUSER for an LU command
    - IRR.RADMIN.SETROPTS.LIST to extract SETROPTS data

What is IRRXUTIL?

What is IRRXUTIL?

- **IRRXUTIL allows a REXX program to use the R_admin interface to extract RACF profile and SETROPTS Data.**
  - Supports the extraction of USER, GROUP, CONNECT, RESOURCE and SETROPTS data from RACF
  - Data set extraction not supported
  - Digital Certificate information not supported
- **IRRXUTIL places the returned data directly into REXX variables which can then be easily used simply by referencing the REXX variables.**
- **Since IRRXUTIL uses R_admin, you must authorize IRRXUTIL users to the underlying R_admin function.**

What IRRXUTIL is not

- **IRRXUTIL does not have any support for any of the other function codes supported by R_admin, such as those which update profile information**
- **However, it is relatively simple to create a command invocation and run it directly from REXX. Certainly simpler than attempting to create any sort of REXX data structure to map back the tokenized functions of R_admin.**
- **Because R_admin does not support the extraction of data from RACF DATASET profiles, IRRXUTIL does not support RACF DATASET profiles.**

9

IRRXUTIL Invocation Syntax

- myrc=**IRRXUTIL(***function,type,profile,stem,prefix,generic***)**
  - ***Function***
    "EXTRACT" or "EXTRACTN"
  - ***Type***
    "USER", "GROUP", "CONNECT", "_SETROPTS", general resource class.
    DATASET is not supported.
  - ***Profile***
    Profile to extract. Case sensitive.
    Specify '_SETROPTS' for SETROPTS data.
  - ***Stem***
    REXX stem variable name to populate with results.
    Do not put the '.' at the end.
  - ***Prefix***
    Optional prefix for returned variable name parts (more later)
  - ***Generic***
    Optional, 'TRUE' or 'FALSE' (uppercase).
    Applies to general resource profiles only.

10

A Quick Example

- Here is a simple program which retrieves a general resource profile and dumps the access list.

```
/* REXX */
myrc=IRRXUTIL("EXTRACT","FACILITY","BPX.DAEMON","RACF","","FALSE")
say "Owner: "RACF.BASE.OWNER.1
Say "ACL:"
do a=1 to RACF.BASE.ACLCNT.REPEATCOUNT
   Say "  "||RACF.BASE.ACLID.a||":"||RACF.BASE.ACLACS.a
end
```

```
READY
EX 'SAMPLE.CLIST(IRREXXRS)'
Owner: IBMUSER
ACL:
   IBMUSER:READ
   WEBSRVR:READ
   MEGA:READ
   LDAPSRVR:READ
   FTPD:READ
READY
```

- This simple example lacks some vital return code and other checking, but it shows how simple IRRXUTIL can be, compared to trying to parse command output.
- Don't try this example, it is too simple, and, because it doesn't check the return code, or if there are any access list entries, and, since you can forget to grant yourself access to the appropriate FACILITY class profile for R_admin, it will fail with no diagnostics.

IRRXUTIL Considerations

- **The caller needs access to use R_admin extract via the appropriate FACILITY class profile protecting the desired function.**
- **In addition, the caller must be allowed to retrieve the profile in question. The caller will only have fields they are allowed to view returned.**
- **This is all enforced by the R_admin extract function which IRRXUTIL calls.**

Profile Type	Required FACILITY profile
User, Connect	IRR.RADMIN.LISTUSER
Group	IRR.RADMIN.LISTGRP
General Resource	IRR.RADMIN.RLIST
Setropts	IRR.RADMIN.SETROPTS.LIST

IRRXUTIL return codes

myrc=IRRXUTIL(*function,type,profile,stem,prefix,generic*)

- MYRC is the return code from IRRXUTIL. It is a list of 5 numbers. If the first=0, IRRXUTIL was successful and data has been returned.

Description	RC1	RC2	RC3	RC4	RC5
Success	0	0	0	0	0
Warning, stem contained '.'	2	0	0	0	0
Bad number of parameters specified	4	Number of parameters specified	Minimum number allowed	0	0
Parameter Error	8	Index of bad parameter	1=Bad length 2=Bad value 3=Incompatible with other parameters		
R_admin failure	12	12	R_admin SAFRC	R_admin RACFRC	R_admin RACFRSN
Environmental error	16	0=REXX Error 4=R_admin error	For IBM support	For IBM support	0

13

Common Return Codes

- **0 0 0 0 0 = Success**
- **8 x y 0 0 = Error in IRRXUTIL invocation**
  - "x" - Number of the incorrect parameter
  - "y" - What's wrong
    - 1: Bad length
    - 2: Bad value
    - 3: Inconsistent with other parameters
- **12 12 4 4 4 = Profile not found**
- **12 12 8 8 24 = Not authorized to R_admin extract**

Note:

- The combination 12/12/8/8/24 does not distinguish between FACILITY or command processor authorization. A FACILITY error will probably result in an ICH408I message to the console. You can issue the corresponding TSO command to see if you are authorized to list the profile. For that matter, you can try to RLIST the FACILITY resource, and if you can't, then you do not have READ access.

14

Return Code Checking

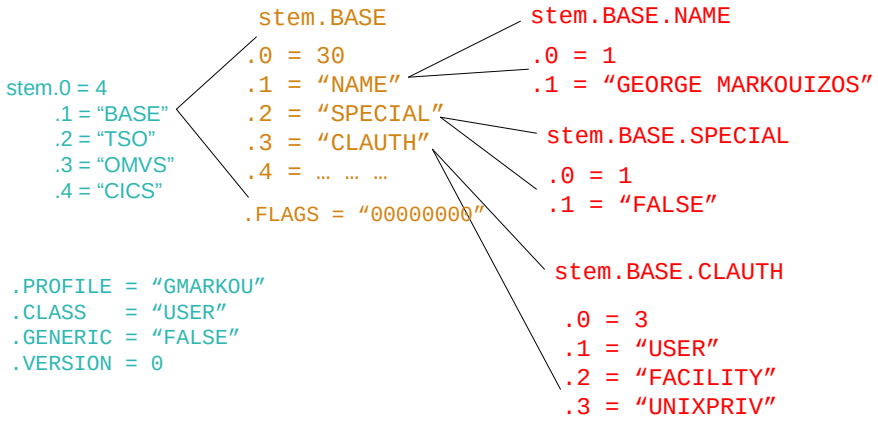
Check the first value in the return code string. If it is 0, the call was successful.

```
/* REXX */
myrc=IRRXUTIL("EXTRACT","FACILITY","BPX.DAEMON","RACF","","FALSE")
If (word(myrc,1)>0) then do
   say "Error calling IRRXUTIL "||myrc
   exit
end
say "Profile name: "||RACF.profile
do a=1 to RACF.BASE.ACLCNT.REPEATCOUNT
   Say "  "||RACF.BASE.ACLID.a||":"||RACF.BASE.ACLACS.a
end
```


Two Ways to Process IRRXUTIL Output

- **The variables returned by IRRXUTIL can be used in 2 ways:**
  - Known data can be retrieved directly by simply referencing REXX variables by segment and field.
  - Programs with no knowledge of what segments and fields exist are given enough information to find all of the segments and fields returned by IRRXUTIL.
    - But, there is no mechanism to find out all *potential* segments/field which could exist. It only returns what exists for a given profile.

Retrieving Unknown Data Example

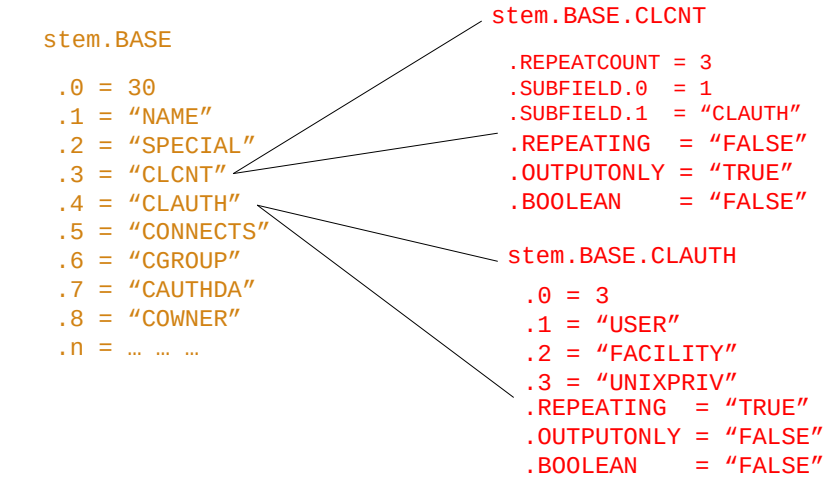


Retrieving Repeating Data

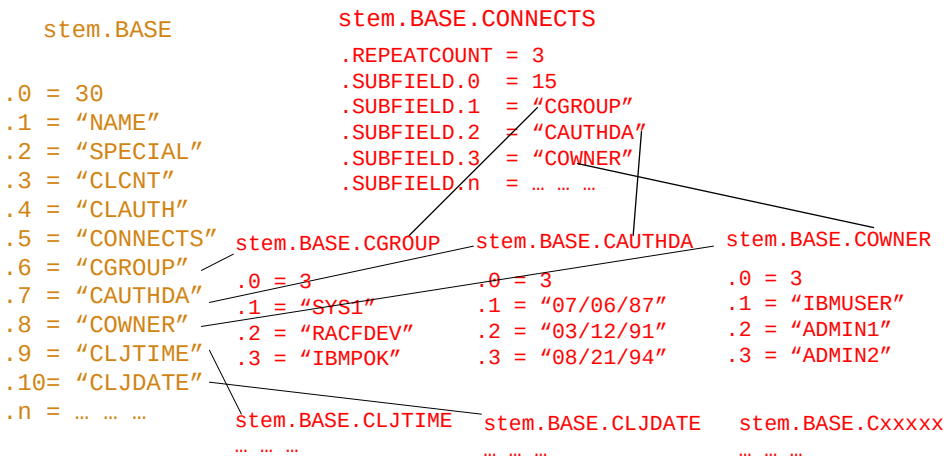
- **Repeating fields have some additional control information stored in the 'repeat header' field.**
  - **Stem.segment.field.repeatCount**
    Non-zero value indicates field is a repeat header.
    This is the number of repeat groups for this field.
  - **Stem.segment.field.subfield.0**
    Number of subfields in this repeat group.
  - **Stem.segment.field.subfield.1-n**
    Subfield names
  - **Stem.segment.subfieldname.0:**
    Same as Stem.segment.field.repeatCount. Number of values.
  - **Stem.segment.subfieldname.1-n:**
    Subfield names

Much needed example on next page

Stem Structure for a Simple Repeating Field



Stem Structure for a Complex Repeating Field



Sample Code to Get Field Names

- Here's a code fragment which shows how to extract all of the field names for a profile.

```
/* REXX */
 RACF.profile='IBMUSER'
 myrc=IRRXUTIL("EXTRACT","USER",RACF.profile,"RACF")
    If (Word(myrc,1) <> 0) Then Do
       Say myrc
       exit
       end

 say "The USER profile" RACF.profile " has " racf.0
"segments“

/* Continued on the next page */
```


Sample Code to Get Field Names …

```
do i=1 to RACF.0       /* get the segment names */
  segment=RACF.i
  say "====" segment "===="
  do j=1 to RACF.segment.0
     field=RACF.segment.j
     say "   FIELD="LEFT(Field,8,' ')
   end
 end
```

- **The Result:**

```
The USER profile IBMUSER  has  2  segments
==== BASE ====
   FIELD=CREATDAT
   FIELD=OWNER
   FIELD=ADSP
   FIELD=SPECIAL
   FIELD=OPER
   FIELD=REVOKEFL
   FIELD=GRPACC
   …
```

The Importance of Prefixing

- **Consider the following program which determines if the OMVS UID of the supplied user id matches a supplied UID value.**

```
/* REXX */
arg user idNum
myrc=IRRXUTIL("EXTRACT","USER",user,"RACF")
uid=idNum
if (RACF.OMVS.UID.1=uid) then
   say "Uid matches"
else
   say "No match"
```

- **The problem is that the REXX variable UID is overused. It is used as a variable, and also set by IRRXUTIL as part of a variable. The uses conflict. Because we cannot expect REXX programs to anticipate all possible future segment and field names, IRRXUTIL has a 'prefix' option.**

The Importance of Prefixing …

- **Let's fix the program using prefix.**

```
/* REXX */
arg user idNum
myrc=IRRXUTIL("EXTRACT","USER",user,"RACF","R_")
uid=idNum
if (RACF.R_OMVS.R_UID.1=uid) then
   say "Uid matches"
else
   say "No match"
```

- **The specified prefix is added to all variable name parts as the REXX variables are created. Specifying a prefix which you know will never be used in your program variables guarantees that there will be no name collisions. As long as the above program does not use any variables starting with 'R_', it is safe.**

Extract Next

- The extract next function returns the profile following the specified profile.
- To return the user following 'BOB', issue the following:

```
myrc=IRRXUTIL("EXTRACTN","USER","BOB","RACF")
```

- Repeatedly calling IRRXUTIL(EXTRACTN…) with the previously retrieved profile is a way to iterate through all profiles in a class.

Extract NEXT for General Resource Profiles

- When extracting General Resources with EXTRACTN, start out with non generic profiles, by specifying 'FALSE' for the GENERIC parameter.
- Every time IRRXUTIL(EXTRACTN…) is called, pass in the returned 'generic' indicator (stem.GENERIC), along with the returned profile name.
- IRRXUTIL(EXTRACTN..) will automatically switch over to GENERIC profiles when it has gone through all discrete profiles.

Extract NEXT for General Resource Profiles …

- When extracting General Resources with EXTRACTN, start out with non generic profiles, by specifying 'FALSE' for the GENERIC parameter.

```
/* REXX */
class = 'FACILITY'
RACF.R_PROFILE = ' '
RACF.R_GENERIC= 'FALSE'
Do Forever
   myrc=IRRXUTIL("EXTRACTN",class,RACF.R_PROFILE,"RACF","R_",RACF.R_GENERIC)
   If (Word(myrc,1) <> 0) Then Do
      Say myrc
      Leave
   End
   Say RACF.R_PROFILE     /* print profile name */
End
```


Specifying '.' as a Part of Stem Name

- IRRXUTIL resets the entire supplied stem to '' (null) before populating any values. This means that each call to IRRXUTIL has new data and no residual data is left over from previous calls.
- If the stem variable contains a '.' (period) character, this is not possible, and IRRXUTIL does not clean anything. Return code '2' is returned as a warning that residual data has not been cleared.
- However, this quirk can be useful, as long as the REXX programmer is careful.

Specifying '.' as a Part of Stem Name

- **This small program creates a small 'database' of user profile data, which is easily referenced by user id.**

```
/* REXX */
arg IDS
USERS.=""                      /* only init to "", never 0                 */
do i=1 to words(IDS)           /* populate specified users into USERS. stem */
  ID=word(IDS,i)               /* Get next user                            */
  myrc=IRRXUTIL("EXTRACT","USER",ID,"USERS."||ID)
end
/* We now have all specified users saved, process them                     */
do i=1 to words(IDS)           /* Retrieve data from multiple users without */
  ID=word(IDS,i)               /*  extracting them again                   */
  say ID||" Owner="||USERS.ID.BASE.OWNER.1
end
```

```
EX 'SAMPLE(IRREXXDS)' 'ibmuser mega elvis'
 IBMUSER OWNER=IBMUSER
 MEGA Owner=SYS1
 ELVIS Owner=MEGA
 READY
```

- **A silly example, but it does illustrate extracting multiple users and indexing them nicely by user id. By placing the user id as part of the stem, we can organize all extracted data by user id. In this example, myrc is set to '2 0 0 0 0' when successful.**

Specifying '.' as part of stem name, be careful

- **This small program shows the wrong way to use a '.' in the stem.**

```
/* REXX */
say "Extract users with no '.' in stem"
myrc=IRRXUTIL("EXTRACT","USER","MEGA","RACF","")
say "MEGA UID is "RACF.OMVS.UID.1
myrc=IRRXUTIL("EXTRACT","USER","ELVIS","RACF","")
say "ELVIS UID is "RACF.OMVS.UID.1
say "Extract users with '.' in stem to demonstrate error"
myrc=IRRXUTIL("EXTRACT","USER","MEGA","RACF.A","")
say "MEGA UID is "RACF.A.OMVS.UID.1
myrc=IRRXUTIL("EXTRACT","USER","ELVIS","RACF.A","")
say "ELVIS UID is "RACF.A.OMVS.UID.1
```

```
EX 'SAMPLE(IRREXXSR)'
Extract users with no '.' in stem.
MEGA UID is 8
ELVIS UID is
Extract users with '.' in stem to demonstrate error
MEGA UID is 8
ELVIS UID is
READY
```

- **This example demonstrates how specification of a '.' in the STEM allows residual data to remain after an new extract operation.**

Where Do You Find Field Names?

- **z/OS Security Server RACF Callable Services contains tables which document every segment and field name supported by R_admin in appendix A.2**
- **Fields which are 'Returned on Extract Requests' are supported by IRRXUTIL.**

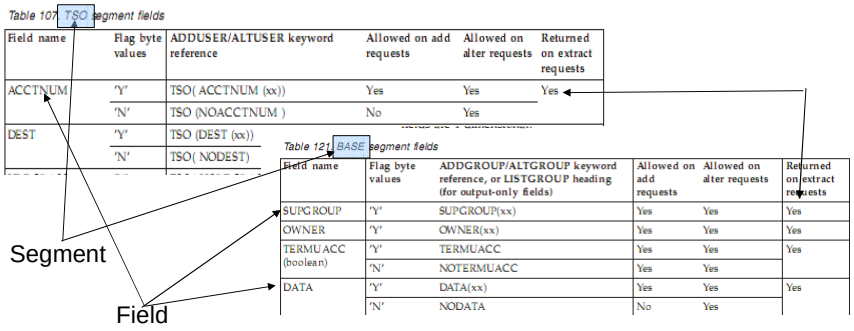


Table 107. TSO segment fields

Field name	Flag byte values	ADDUSER/ALTUSER keyword reference	Allowed on add requests	Allowed on alter requests	Returned on extract requests
ACCTNUM	'Y'	TSO(ACCTNUM (xx))	Yes	Yes	Yes
	'N'	TSO (NOACCTNUM)	No	Yes	
DEST	'Y'	TSO (DEST (xx))			
	'N'	TSO(NODEST)			

Table 121. BASE segment fields

Field name	Flag byte values	ADDGROUP/ALTGROUP keyword reference, or LISTGROUP heading (for output-only fields)	Allowed on add requests	Allowed on alter requests	Returned on extract requests
SUPGROUP	'Y'	SUPGROUP(xx)	Yes	Yes	Yes
OWNER	'Y'	OWNER(xx)	Yes	Yes	Yes
TERMUACC (boolean)	'Y'	TERMUACC	Yes	Yes	Yes
	'N'	NOTERMUACC	Yes	Yes	
DATA	'Y'	DATA(xx)	Yes	Yes	Yes
	'N'	NODATA	No	Yes	

Gotchas

- **IRRXUTIL sets the entire stem to "" (null) before setting new data. Fields which do not exist in the extracted profile remain null.**
  - This can cause problem in fields which are usually returned as numeric fields because they also remain "", and not 0. So, care must be taken before referencing numeric fields as numbers.

```
/* REXX */
arg group
myrc=IRRXUTIL("EXTRACT","GROUP",group,"RACF","")
do i=1 to RACF.BASE.SUBGROUP.0
   say "Subgroup: "RACF.BASE.SUBGROUP.i
end
```

- This program fails if the specified group has no SUBGROUPs because RACF.BASE.SUBGROUP.0="" which is not a number.

Gotchas …

- **Universal Groups.**
  - Remember that a universal group profile does not contain a list of the users who are connected to the group with USE authority.
- **Discrete profiles which contain generic characters will cause the underlying R_admin service to fail if they are encountered during an EXTRACTN call.**
  - IRRXUTIL fails also
  - The only solution is to RDELETE these erroneous profiles.
  - There are few cases where discrete profiles are expected to contain generic characters and R_admin handles these properly.
- **Do not beat on the RACF database. For example, do not EXTRACT-NEXT all users in an attempt to find all users which belong to a given Universal Group.**

References

- **RACF Callable Services – R_admin documentation**
- **Command Language Reference**
  - http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/Shelves/ICHZBKA0
- **Macros and Interfaces – IRRXUTIL, including an exhaustive list of all REXX variables set by IRRXUTIL.**
  - http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/ichza3a0/14.0?SHELF=EZ2ZBK0H.bks&DT=20090610215513
- **RACF Downloads page – Sample R_admin extract program (RACSEQ)**
  - http://www.ibm.com/servers/eserver/zseries/zos/racf/downloads/racseq.html
- **RACF Downloads page – IRRXUTIL examples.**
  - http://www-03.ibm.com/servers/eserver/zseries/zos/racf/downloads/irrxutil.html

IRRXUTIL Samples, from the RACF Downloads Page

- **XDUPACL.txt**
  A program which looks for user ACL entries which may be redundant with existing group ACL entries
- **XLGRES.txt**
  A program which resumes the group connection of every member of a group
- **XLISTGRP.txt**
  A program which displays a group's connected users in alphabetic order, with each user's name and connect authority
- **XLISTUSR.txt**
  A program which displays a user's connect groups in alphabetic order
- **XRACSEQ.txt**
  A program which re-implements the RACSEQ download to demonstrate features of IRRXUTIL
- **XRLIST.txt**
  A program which displays the standard access list of a general resource profile with the users listed first, in alphabetic order, with the user's name, followed by the groups, in alphabetic order
- **XSETRPWD.txt**
  A program which displays only the password-related SETROPTS options, and indicates whether password and password phrase enveloping is active
- **XWHOCAN.txt**
  A program which displays certain users who can modify the specified profile