

IRRHFSU HFS UNLOAD UTILITY

Kentucky-Ohio-Indiana RACF Users Group - May 2011



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RSH PRESENTER



Robert S. Hansel is Lead RACF Specialist and founder of RSH Consulting, Inc., a firm he established in 1992 and dedicated to helping clients strengthen their IBM z/OS mainframe access controls by fully exploiting all the capabilities and latest innovations in RACF. He has worked with IBM mainframes since 1977 and in information systems security since 1981. Mr. Hansel began working with RACF in 1986 and has been a RACF administrator, manager, auditor, instructor, developer, and consultant. He has reviewed, implemented, and enhanced RACF controls for major insurance firms, financial institutions, utilities, payment card processors, universities, hospitals, and international retailers. Mr. Hansel is especially skilled at redesigning and refining large-scale implementations of RACF using role-based access control concepts. He has also created elaborate automated tools to assist clients with RACF administration, database merging, identity management, and quality assurance.

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IRRHFSU

Free utility provided by IBM in both source code and executable form

Extracts File Security Packets (FSPs) and status information (e.g., last used date) for files and directories in the z/OS Unix Hierarchical File System (HFS)

Generates a sequential text file with extracted information

Format of IRRHFSU output records is very similar to IRRDBU00

IRRHFSU output is suitable for browsing and processing with tools such as REXX, DFSORT, and ICETOOL

IBM provides SQL for loading output into DB2

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FILE SYSTEM SECURITY

Each directory and file has its own File Security Packet (FSP)

- Kept in the file system with directory or file
- Created and deleted along with the directory or file

FSP contains

- Owner & Group
- Permission bits - Owner, Group, & Other
- Access Control List (ACL)
- Audit bits

Access checking is based on user's UNIX identity as established in the User Security Packet (USP)

FILE SECURITY PACKET

File Security Packet - Base Access Control List (ACL) entries

Owner uid	Group gid	Extended Attributes						s	e	t	Permissions						Auditing			Access Control List
		A	P	R	L	s	e				Owner		Group		Other		Owner		Auditor	
											PF	ro	un	oad	uid	gid	Read	Write	Execute	
chown	chgrp	extattr				chmod						chaudit			setfacl					

Permissions

r read
w write
x execute (dir = search)
T sticky bit
t sticky bit + execute
S set uid / gid
s set uid / gid + execute

(sticky - load from MVS)

Audit

f failures
s successes
a all

Extended Attributes (only applies to programs)

a APF authorized
p enable program control
s run shared address space
l load from shared library region

All

- null

LIST FILE & DIRECTORY FSP - ls

ls -alEW /etc

```
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611          10 Sep 27 11:13 inetd.pid
-----  fff--- --s-  1  DMVSKERN  2611          2587 Oct 21  1999 init.options
lrwxrwxrwx  fff---          1  DMVSKERN  DMVSGRP          22 Oct 23  1999 ioepdcf -> ../
etc/dfs/etc/ioepdcf
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611        13573 May  3  2000 javelin.conf
drwxr-xr-x  fff---          2  2134      SYS1          8192 Jan 19  1999 ldap
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611          2042 May  3  2000 lgw_fcgi.conf
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611          2914 Sep 27 11:13 log
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611          5144 May  3  2000 mvsds.conf
-----  fff--- --s-  1  DMVSKERN  2611        19683 Dec 11  2001 profile
-----  fff--- --s-  1  DMVSKERN  2611          2093 Apr 27  2000 rc
drwxrwxrwx  fff---          2  DMVSKERN  2611          8192 Oct 21  1999 recover
-rwxr-x---  fff--- --s-  1  DMVSKERN  2611           168 Apr 27  2000 resolve.conf
drwxr-xr-x  fff---          2  2134      SYS1          8192 Jan 19  1999 security
-rwxr-xr-x  fff--- --s-  1  DMVSKERN  2611          4703 Apr 27  2000 services
-rw-r--r--  fff--- --s-  1  DMVSKERN  IMWEB          4189 May  3  2000 socks.conf
-rw-r--r--  fff--- --s-  1  WEBADM   IMWEB          4189 May  2  2000 socks.conf.exp
-rw-r--r--  fff--- --s-  1  DMVSKERN  2611           396 Oct  7 16:35 utmpx
drwxr-xr-x  fff---          2  2134      SYS1          8192 Jan 19  1999 zoneinfo
$
===>
```

INPUT

```
ESC=¢    1=Help    2=SubCmd    3=HlpRetrn  4=Top    5=Bottom    6=TSO
          7=BackScr  8=Scroll   9=NextSess 10=Refresh 11=FwdRetr 12=Retrieve
```

EXTENDED ACCESS CONTROL LIST (ACL)

Extension to base (original) file and directory permissions

Activated by SETR CLASSACT(FSSEC)

Max entries - 1024

Supports inheritance of access controls - default ACLs

EXTENDED ACCESS CONTROL LIST (ACL)

```
$ ls -al rshtest
```

```
total 352
```

```
drwxr----x    4 RSH      SYS1          8192 Oct 29 23:13 .
drwxrwxrwt    3 OMVSKERN SYS1        24576 Oct 29 23:17 ..
drwxr-xr-x+   2 RSH      SYS1          8192 Oct 29 23:13 rshdirx
drwxrwxrwx    2 OMVSKERN SYS1          8192 Oct 29 02:47 rshtest2
-rwxr-xr-x+   1 RSH      SYS1       127910 Oct 29 22:48 sampfile
```

"+" indicates presences of extended ACL

EXTENDED ACL - getfacl

```
$ getfacl sampfile                (-a default)
#file:  sampfile
#owner: RSH
#group: SYS1
user::rwx
group::r-x
other::r-x
user:RLW:r-x
group:LEVEL1:--x
```

EXTENDED ACL - getfacl

```
$ getfacl -adf rshdirx
#file:  rshdirx/
#owner:  RSH
#group:  SYS1
user::rwx
group::r-x
other::r-x
user:RLW:rwx
user:$OEDFLU:--x
group:LEVEL1:r-x
fdefault:group:LEVEL1:--x
default:user:RLW:r-x
```

IRRHFSU RECORDS

0900 HFS File Basic Data record

- One record per file or directory
- Contains File Owner, Group, Permissions, Attributes, Status, Auditing

0901 HFS File Access record

- Each record is associated with a 0900 file or directory record
- One record per Extended ACL entry
- Contains User or Group and associated Permissions

0902 HFS File Default Access record

- Each record is associated with a 0900 file or directory record
- One record per Extended ACL File Default entry
- Contains User or Group and associated Permissions

0903 HFS Directory Default Access record

- Each record is associated with a 0900 file or directory record
- One record per Extended ACL Directory Default entry
- Contains User or Group and associated Permissions

IRRHFSU RECORDS

Basic format:

- 1 - 4** **Record Type (e.g., 0900)**
- 6 - 1028** **File/Directory (full path - \dir1\dir2\filex)**
- 1030 - 1039** **Inode (file serial number)**
- 1041 - 4096** **Record-specific fields (values or YES|NO)**

Output records provide a RACF USERID and Group ID associated with each uid and gid

- **First ID found is the one displayed**
- **No indication other IDs may share same uid or gid**
- **To find other IDs, cross-reference with IRRDBU00 output**
- **If uid or gid not defined to RACF, associated ID field is blank**

OBTAINING IRRHFSU

IBM RACF Downloads webpage

- www-03.ibm.com/servers/eserver/zseries/zos/racf/goodies.html

The screenshot shows the IBM RACF Downloads webpage. The page has a dark blue header with the IBM logo and a search bar. Below the header is a navigation menu with links for Home, Solutions, Services, Products, Support & downloads, and My IBM. A welcome message for Mr. Robert Hansel is displayed. The main content area is titled "RACF Downloads" and includes a sub-menu with Overview, What's New, z/VM, and Resources. A paragraph of text explains that the page provides sample utilities for RACF, but notes that IBM Support Center does not provide support for these programs. A list of utilities is provided, each with a brief description of its function.

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RACF Downloads

Overview | What's New | z/VM | Resources

Check out the [eserver/zseries/zos/racf/](#) directory on the [z/OS FTP Server](#) for the very useful sample utilities shown below. **Please note that the IBM Support Center does not provide support for any of these programs. Please direct all questions and reports of problems to [RACF-L](#).**

- [CDT2DYN](#), a utility to help change installation-defined RACF classes into dynamic classes.
- [CUTPWHIS](#), a utility which removes non-usable passwords from the RACF password history. Non-usable passwords are created when the password history (SETROPTS PASSWORD(HISTORY(xxx))) value is reduced.
- [DBSYNC](#), a utility which compares two RACF data bases and creates the commands to make them similar. Can also assist in merging RACF databases from different systems.
- [DBU2MSXL](#), a set of scripts which loads the output of the RACF Database Unload Utility (IRRDBU00) into Microsoft® Excel spreadsheet.
- [DBU2MSAC](#), a set of scripts which loads the output of the RACF Database Unload Utility (IRRDBU00) into Microsoft Access.
- [IRRHFSU](#), a utility which unloads the UNIX System Services Hierarchical File System file security information in a manner compatible with with IRRDBU00.
- [IRRXUTIL](#), a set of sample REXX programs which illustrate the power of IRRXUTIL, the new REXX interface to the R_admin callable service. IRRXUTIL allows you to extract profile and SETROPTS information from the RACF database using the REXX programming language.
- [KMIGRATE](#), a tool for migrating existing DCE and MVS users to a Kerberos registry managed by an OS/390 or z/OS Network Authentication Service server.

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The HFS Unload Utility

In the OS/390 UNIX environment, the Hierarchical File System (HFS) contains files and directories. The security information for these files and directories resides within the file system itself, not within the RACF database. Thus, the RACF Database Unload Utility (IRRDBU00) cannot be used to report on HFS security data.

The irrhfsu utility will report on the HFS security data in a manner consistent with IRRDBU00. For each file and directory in the currently mounted file system structure, a record will be created which contains security data: permissions bits, owner, audit settings, etc. The format of this record is documented the same way IRRDBU00 output is documented in the z/OS Security Server (RACF) Macros and Interfaces manual. Sample DB2 load and table statements are provided for this new record type.

The irrhfsu utility can be invoked as a UNIX command, or from batch using the BPXBATCH program. It can be run against the entire file system, or a list of subtrees within the file system. The output can be appended to your IRRDBU00 output so you can combine the data within a relational database for integrated queries.

The irrhfsu utility consists of these files:

- [Documentation for irrhfsu in PDF format \(54K\)](#)
- [C source code for the utility \(24K\)](#)
- [An executable version of the utility \(104K\)](#)
- [Sample DB2 load statement \(4K\)](#)
- [Sample DB2 table statements \(9K\)](#)

You can download these files either by using your browser or by using anonymous file transfer protocol (ftp). From your browser, select "file" and "save as". For anonymous ftp, use the site public.dhe.ibm.com. irrhfsu can be found in the directory /eserver/zseries/zos/racf/irrhfsu/. Full installation instructions are in the HFSUnloadReadMe.pdf file.

z/OS

Features and Functions

- z/OS HCD and HCM
- Language Environment
- Metal C
- Network File System
- Output management software
- Resource Access Control Facility

z/OS RMF

- SAP on IBM System z
- SMP/E
- Software
- System Automation
- System Display and Search Facility
- z/OS UNIX System Services
- z/OS Workload Manager (WLM)
- z/OS XML System Services
- Systems Management
- PKI
- z/OS Capacity Provisioning Manager (CPM)

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The irrhfsu utility consists of these files:

- [Documentation for irrhfsu in PDF format \(51K\)](#)
- [C source code for the utility](#)
- [An executable version of the utility](#)
- [Sample DB2 load statements](#)
- [Sample DB2 table statements](#)

You can download these files either via anonymous file transfer protocol (ftp) or via the "save as" option in your browser. For anonymous ftp, use the user name "anonymous" and the password "anonymous". The instructions are in the HFSUnload.pdf file.

z/OS

Features and Functions

- z/OS HCD and HCM
- Language Environment
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- Network File System
- Output management software
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z/OS RMF

- SAP on IBM System z
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- z/OS UNIX System Services
- z/OS Workload Manager (WLM)
- z/OS XML System Services
- Systems Management
- PKI
- z/OS Capacity Provisioning Manager (CPM)

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Open

Open in New Window

Save Target As...

Print Target

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OBTAINING IRRHFSU

Items provided ...

- **HFSUnloadReadMe.pdf** **Documentation Manual**
- **irrhfsu.txt** **C source code (text)**
- **irrhfsu.o** **Executable object module (binary)**
- **RACHFSLD.txt** **Sample DB2 Load Statements**
- **RACHFSTB.txt** **Sample DB2 Table Statements**

INSTALLING IRRHFSU

PC - CMD window - upload file

```
cd \window-directory-where-irrhfsu.o-resides
FTP your-mainframe-ipaddress-or-dnsname
cd /
cd /your-home-directory
mkdir hfsu
cd hfsu
bin
put irrhfsu.o
quit
```

z/OS - OMVS command - set 'r-x' permission to execute

```
cd /your-home-directory
chmod 700 hfsu
cd hfsu
chmod 500 irrhfsu.o
```

EXECUTING IRRHFSU

Options

- Shell - OMVS
- Batch - BPXBATCH

Syntax

- Send output to Unix file:
`irrhfsu.o dir1 [dir2 dir3 ...] > unix-output-filename`
- Send output to z/OS dataset
`irrhfsu.o -f //OUTPUT.FILE.NAME dir1 [dir2 dir3 ...]`
- Send output of single file to display
`irrhfsu.o filename`

- Example: `irrhfsu.o -f //RSH.HFS.ALL /`

EXECUTING IRRHFSU - BATCH

```
//RSHHFSU JOB (0),'ROBERT HANSEL',NOTIFY=&SYSUID, ...  
//STEP0010 EXEC PGM=BPXBATCH,  
// PARM='PGM /u/rsh/hfsu/irrhfsu.o -f //RSH.HFSU.SYSA /'  
//STDERR DD PATH='/u/rsh/hfsuerr',  
// PATHOPTS=(OWRONLY,OCREAT,OTRUNC),  
// PATHMODE=SIRWXU
```

Note: Case-sensitive

REQUIRED UNIX / RACF AUTHORITY

Requires READ and SEARCH (r-x) authority to all directories to be unloaded and SEARCH (--x) to all parent directories

Alternative authorities

- **UID 0**
- **FACILITY BPX.SUPERUSER - READ - execute 'su' command**
- **UNIXPRIV SUPERUSER.FILESYS - READ**
- **RACF System-AUDITOR authority**

Requires access permissions to output file

- **Dataset - preallocated - UPDATE**
- **Dataset - to be created - ALTER**
- **Unix file - WRITE and SEARCH (-wx) to target directory and SEARCH (--x) to all parent directories**

EXECUTION TIPS

Do NOT execute with a RACF ID having UAUDIT

- Could generate an excessive number of SMF records and cause an SMF buffer overflow

Do NOT execute on a system where UNIXMAP is inactive and AIM Stage 2 or 3 has not been implemented

- uid and gid lookups may cause performance problems

If sending output to a dataset, pre-allocate it with sufficient space and DCB=(RECFM=VB,LRECL=4096) to facilitate concatenation with IRRDBU00 output

Output is not sorted - before processing, sort by directory/file and record type

SORT FIELDS=(10,1024,CH,A,5,4,CH,A)

IRRHFSU CLEANUP OPTION

Execution option to remove obsolete entries from Extended ACLs (uid or gid with no matching RACF ID)

irrhfsu -c ...

Unloads and then automatically deletes obsolete entries

Authority to execute ...

- **READ, WRITE, and SEARCH (rwx) authority to all directories to be cleaned and SEARCH (--x) to all parent directories**
- **SUPERUSER (UID 0 or FACILITY BPX.SUPERUSER - READ)**
- **UNIXPRIV SUPERUSER.FILESYS - UPDATE**
- **UNIXPRIV SUPERUSER.FILESYS.CHANGEPERMS - READ - plus**
 - **READ and SEARCH (r-x) to all directories to be cleaned and SEARCH (--x) to all parent directories, or**
 - **RACF System-AUDITOR, or**
 - **UNIXPRIV SUPERUSER.FILESYS - READ**

EXECUTION ERRORS

If problems encountered, browse file hfsuerr for error messages (specified in STDERR DD)

See IRRHFSU documentation for most error messages

If output dataset not pre-allocated with sufficient space, may get a B37 abend or fprint() error

IRRHFSU will fail if it hits a corrupted directory

SAMPLE ICETOOL REPORTS

Pre-ICETOOL SORT step for all jobs

```
//          JOB    ...
//S010HFSS EXEC PGM=SORT
//SYSOUT    DD  SYSOUT=*
//SORTIN    DD  DISP=SHR,DSN=irrhfsu.output.file
//SORTOUT   DD  DSN=&&HFS,DISP=(NEW,PASS,DELETE),UNIT=SYSDA,
//          SPACE=(CYL,(50,50),RLSE),DCB=*.SORTIN
//SYSIN     DD  *
           SORT FIELDS=(10,1024,CH,A,5,4,CH,A)
```

SAMPLE ICETOOL REPORT

Find OWNER and GROUP with no matching RACF ID

```
//S020URPT EXEC PGM=ICETOOL,COND=(4,LT)
//SYSOUT DD SYSOUT=*
//TOOLMSG DD SYSOUT=*
//DFSMSG DD SYSOUT=*
//HFSUFILE DD DSN=&&HFS,DISP=(OLD,DELETE,DELETE)
//SELDATA DD DSN=&&TEMP,DISP=(NEW,PASS,DELETE),UNIT=SYSDA,
//          SPACE=(CYL,(1,1),RLSE),DCB=(RECFM=VB,LRECL=4096)
//HFSUDID DD DSN=hfsudid.report.file,DISP=(NEW,CATLG,DELETE),
//          UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//          DCB=(RECFM=VB,LRECL=4096)
//TOOLIN DD *
- see next slide -
//UDIDCNTRL DD *
- see next slide -
```

SAMPLE ICETOOL REPORT

Find OWNER and GROUP with no matching RACF ID

```
//TOOLIN DD *
SORT FROM(HFSUFILE) TO(SELDATA) USING(UDID)
DISPLAY FROM(SELDATA) LIST(HFSUDID) -
    PAGE TITLE('HFS OBJECTS WITH UNDEFINED UID OR GID') -
    DATE TIME -
    LINES(999) -
    BLANK -
    ON(1036,10,CH)  HEADER('OWNER-UID') -
    ON(1046,8,CH)   HEADER('USERID') -
    ON(1054,10,CH)  HEADER('GROUP-GID') -
    ON(1064,8,CH)   HEADER('GROUP') -
    ON(1112,3,CH)   HEADER('ACL') -
    ON(1115,3,CH)   HEADER('DDACL') -
    ON(1118,3,CH)   HEADER('FDACL') -
    ON(1072,10,CH)  HEADER('CREATED') -
    ON(1082,10,CH)  HEADER('LAST-MOD') -
    ON(1092,10,CH)  HEADER('STATUS-CHGD') -
    ON(1102,10,CH)  HEADER('LAST-ACC') -
    ON(1028,8,CH)   HEADER('FILETYPE') -
    ON(5,1023,CH)   HEADER('PATH+FILE/DIRECTORY-NAME')
```

SAMPLE ICETOOL REPORT

Find OWNER and GROUP with no matching RACF ID

```
//UDIDCNL DD *  
OPTION VLSHRT,VLSCMP,DYNALLOC=(3390,4)  
INCLUDE COND=(5,4,CH,EQ,C'0900',AND,  
              (1065,8,CH,EQ,C'          ',OR,  
              1085,8,CH,EQ,C'          '))  
INREC FIELDS=(1,4,10,1023,1045,8,1054,10,1065,8,1074,10,1085,8,  
              1273,10,1333,10,1313,10,1293,10,1369,3,1374,3,1379,3)  
SORT FIELDS=(5,1023,CH,A)
```

SAMPLE ICETOOL REPORT

Find OWNER or GROUP assigned to default user or group

```
//S020URPT EXEC PGM=ICETOOL,COND=(4,LT)
//SYSOUT DD SYSOUT=*
//TOOLMSG DD SYSOUT=*
//DFSMSG DD SYSOUT=*
//HFSUFILE DD DSN=&&HFS,DISP=(OLD,DELETE,DELETE)
//SELDATA DD DSN=&&TEMP,DISP=(NEW,PASS,DELETE),UNIT=SYSDA,
//          SPACE=(CYL,(1,1),RLSE),DCB=(RECFM=VB,LRECL=4096)
//HFSUDUO DD DSN=hfsuduo.report.file,DISP=(NEW,CATLG,DELETE),
//          UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE),
//          DCB=(RECFM=VB,LRECL=4096)
//TOOLIN DD *
- see next slide -
//UDIDCNTRL DD *
- see next slide -
```

SAMPLE ICETOOL REPORT

Find OWNER or GROUP assigned to default user or group

```
//TOOLIN DD *
SORT FROM(HFSUFILE) TO(SELDATA) USING(UDUO)
DISPLAY FROM(SELDATA) LIST(HFSUDUO) -
    PAGE TITLE('HFS OBJECTS WITH DEFAULT UID/GID AS OWNER/GROUP') -
    DATE TIME -
    LINES(999) -
    BLANK -
    ON(1036,10,CH)  HEADER('OWNER-UID') -
    ON(1046,8,CH)   HEADER('USERID') -
    ON(1054,10,CH)  HEADER('GROUP-GID') -
    ON(1064,8,CH)   HEADER('GROUP') -
    ON(1112,3,CH)   HEADER('ACL') -
    ON(1115,3,CH)   HEADER('DDACL') -
    ON(1118,3,CH)   HEADER('FDACL') -
    ON(1072,10,CH)  HEADER('CREATED') -
    ON(1082,10,CH)  HEADER('LAST-MOD') -
    ON(1092,10,CH)  HEADER('STATUS-CHGD') -
    ON(1102,10,CH)  HEADER('LAST-ACC') -
    ON(1028,8,CH)   HEADER('FILETYPE') -
    ON(5,1023,CH)   HEADER('PATH+FILE/DIRECTORY-NAME')
```

SAMPLE ICETOOL REPORT

Find OWNER or GROUP assigned to default user or group

```
//UDUOCTL DD *
OPTION VLSHRT,VLSCMP,DYNALLOC=(3390,4)
INCLUDE COND=(5,4,CH,EQ,C'0900',AND,
              (1054,10,CH,EQ,C'uuuuuuuuuuu',OR,
              1074,10,CH,EQ,C'ggggggggggg'))
INREC FIELDS=(1,4,10,1023,1045,8,1054,10,1065,8,1074,10,1085,8,
              1273,10,1333,10,1313,10,1293,10,1369,3,1374,3,1379,3)
SORT FIELDS=(5,1023,CH,A)
```

'u...u' and 'g...g' are the uid and gid assigned to the default user and default group, respectively, specified in the APPLDATA field of the FACILITY class profile BPX.DEFAULT.USER, padded to the left with 0s to 10 digits in length

GO FORTH AND RACF