RSH CONSULTING

IRRHFSU

HFS Unload Utility

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RSH Consulting – Robyn E. Gilchrist

RSH Consulting, Inc. is an IT security professional services firm 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. RSH's services include RACF security reviews and audits, initial implementation of new controls, enhancement and remediation of existing controls, and training.

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IRRHFSU

- Free utility provided by IBM/GitHub in both source code and executable form
  - Developed by Bruce Wells of IBM
- 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)
  - Optionally extracts security information on mounted file systems
- 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

File System Security

- zFS Dataset Access
- File System Mount
- File and Directory Security

zFS Dataset Access

- Control whether users can access files and directories contained in a zFS dataset

- General Resource
  - Class - FSACCESS (Note: RACLIST-REQUIRED)
  - Resource - *zfs-dsname* (e.g., OMVS.APPL.PAYROLL.ZFS)
  - Access levels - UPDATE - access zFS file

- Supersedes all other file security permissions and authorities (e.g., Superuser)

- RACF System-AUDITOR and ROAUDIT grant UPDATE access

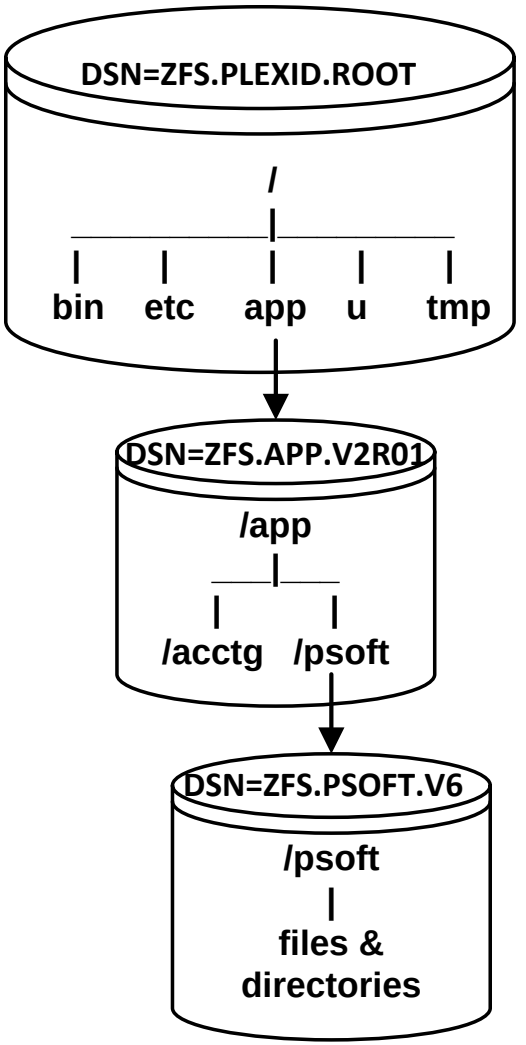
- Access is permitted if there is no protecting profile

- Root File System (/) is excluded from FSACCESS check

zFS Dataset Access

```
RLIST FSACCESS ZFS.APP.V2R01 AUTH
CLASS      NAME
-----      ----
FSACCESS   ZFS.APP.**

LEVEL  OWNER      UNIVERSAL ACCESS   YOUR ACCESS  WARNING
-----  --------   ----------------   ----------   -------
 00    PSOFTGRP        NONE            UPDATE      NO

INSTALLATION DATA
-------------------------------------------------
APPLICATION ZFS FILE SYSTEM

USER      ACCESS    ACCESS COUNT
----      ------    ------ -----
*         UPDATE
```

```
RLIST FSACCESS ZFS.PSOFT.V6 AUTH
CLASS      NAME
-----      ----
FSACCESS   ZFS.PSOFT.**

LEVEL  OWNER      UNIVERSAL ACCESS   YOUR ACCESS  WARNING
-----  --------   ----------------   ----------   -------
 00    PSOFTGRP        NONE            NONE        NO

INSTALLATION DATA
-------------------------------------------------
PEOPLESOFT ZFS FILE SYSTEM

USER      ACCESS    ACCESS COUNT
----      ------    ------ -----
PSOFTSVR  UPDATE
TECHSPTP  UPDATE
PSOFTDEV  UPDATE
```



File System Mount - Security Options

- MOUNT options determine whether users can write to a file system and whether setuid and security will be in effect

- Options
  - MODE(RDWR | READ) - Allow READWRITE or READONLY access
  - SETUID | NOSETUID - Honor setuid, setgid, APF, program control
  - SECURITY | NOSECURITY - Perform security checking

File System Mount - Security Options

```
===> df -v

/VERSYSB/usr/lpp/cobol (IGY420.HFS)              3576/4320      4294967279 Avail
able
HFS, Read Only, Device:17, ACLS=Y
File System Owner : S0W1        Automove=Y      Client=N
Filetag : T=off   codeset=0

/S0W1          (OMVS.S0W1.SYSTEM.ZFS)    2564/2880      4294967283 Available
ZFS, Read/Write, Device:2, ACLS=Y
File System Owner : S0W1        Automove=N      Client=N
Filetag : T=off   codeset=0
Aggregate Name : OMVS.S0W1.SYSTEM.ZFS

/VERSYSB/usr/lpp/cicsts/cicsts42/samples (DFH420.SAMPLES.ZFS)      11408/17280
Available
ZFS, Read/Write, Device:61, ACLS=Y, No SUID, Exported, No Security
File System Owner : S0W1        Automove=N      Client=N
Filetag : T=off   codeset=0
Aggregate Name : DFH420.SAMPLES.ZFS
```

Directory and File Security

- Each directory and file has its own File Security Packet (FSP)
  - Stored in directory's or file's parent directory in the file system
  - Created and deleted along with the directory or file
- FSP contains
  - Owner UID and Group GID
  - Permission bits - Owner/User, Group, and Other
  - Extended Attributes (e.g., APF)
  - 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				setuid	setgid	stickybit	Permissions									Auditing						Access Control List
									Owner			Group			Other			Owner			Auditor			
		APF	ProgCntl	RunShr	LoadSLib				Read	Write	Execute	Read	Write	Execute	Read	Write	Execute	Read	Write	Execute	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

(file - sticky - load program from MVS)
(dir - sticky - only Owner or UID 0 can delete)

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 and Directory FSP - ls Command

```
$ ls -alEW rshtest

drwxr----x  fff--- --s-  4 RSH      SYS1        8192 Oct 15 10:31 .
drwxrwxrwt  fff--- --s-  3 BPXROOT  SYS1       24576 Oct 29  2011 ..
drwxr-xr-x+ fff--- --s-  2 RSH      SYS1        8192 Oct 29  2011 rshdirx
drwxrwxrwx  fff-s- --s-  2 BPXROOT  SYS1        8192 Oct 29  2011 rshtest2
-rwxr-xr-x+ fff--- --s-  1 RSH      SYS1      127910 Oct 15 10:31 sampfile
-rwxr-xrwx  fff--- --s-  1 6179050  SYS1      539070 Oct 29  2011 mastfile
-rwxr-xr-x+ fff--- --s-  1 RSH      9698211    12897 Oct 29  2011 testfile
```

"+" indicates presences of extended ACL

Extended Access Control List (ACL)

- Extension to base (original) file and directory permissions
- Activated by SETR CLASSACT(FSSEC)
- Maximum number of entries - 1024
- Supports inheritance of access controls - default ACLs

Extended ACL - getfacl

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

"-a" is the default

```
$ 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
fdefault:user:RLW:r-x
default: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, File System DSNAME, Links

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 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 directory record
- One record per Extended ACL Directory Default entry
- Contains User or Group and associated Permissions

0904 Mounted File System record (appear first in unload output)

- One record per mounted file system
- Contains DSNAME, Dataset Type (e.g., zFS), Mount Point, Mount Attributes - Mode, Security, SETUID

IRRHFSU Records

- Basic format - 0900-0903 records (position - contents):

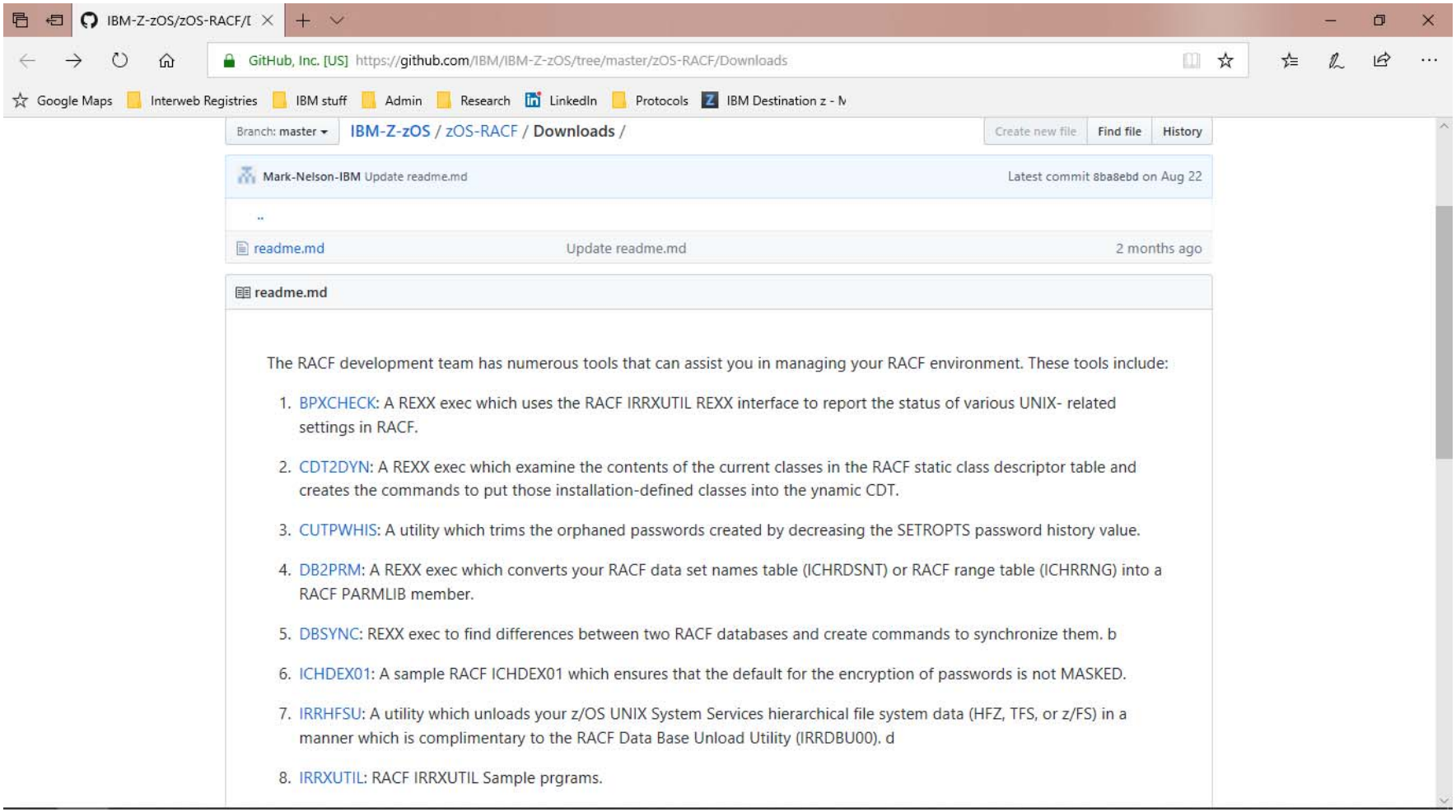
1 - 4	Record Type (e.g., 0900)
6 - 1028	File/Directory (full path - /dir1/dir2/filex)
1030 - 1039	Inode (file serial number)
1041 - 4096	Record-specific fields (values or YES|NO)

*** With DFSORT/ICETOOL, add 4 to starting position for variable blocked records

- Symbolic links show unresolved variable names (e.g., &SYSNAME/etc)
- Output records provide a RACF USERID and Group ID associated with each UID and GID
  - First RACF ID found is the one displayed
    - In z/OS 2.3, PARMLIB(BPXPRMxx) SUPERUSER user will be displayed for UID(0) USERID
  - No indication other RACF IDs may share same UID or GID
  - To find other RACF IDs, cross-reference with IRRDBU00 output
  - If UID or GID is not defined to RACF, the associated RACF ID field is blank
    - Warning - if the default group of the user assigned the UID does not have a GID, the USERID field will misleadingly be blank

Obtaining IRRHFSU - GitHub

https://github.com/IBM/IBM-Z-zOS/tree/master/zOS-RACF/Downloads



Obtaining IRRHFSU - IBM FTP Site

ftp://public.dhe.ibm.com/s390/zos/racf/

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

- To install as a Unix program
  - PC - CMD window - upload file

    cd \win-*directory-where-irrhfsu.o-resides*
    FTP *your-mainframe-ipaddress-or-dnsname*
    cd */your-home-directory*
    mkdir *hfsu-subdirectory*
    cd *hfsu-subdirectory*
    bin
    put irrhfsu.o
    quit
  - z/OS - OMVS command - set 'r-x' permission to allow OWNER to execute

    cd */your-home-directory*
    chmod 700 *hfsu-subdirectory*
    cd *hfsu-subdirectory*
    chmod 500 irrhfsu.o
  - Optionally rename irrhfsu.o

    mv irrhfsu.o hfsu
- To install as an MVS program
  - Allocate a PDSE library dataset

```
//jobname  JOB job-card-parameters
//         EXEC PGM=IEFBR14
//HFSU     DD  DSN=pdse.library,
//             DISP=(NEW,CATLG,DELETE),
//             SPACE=(TRK,(10,5,3)),
//             UNIT=SYSDA,
//             DSNTYPE=LIBRARY,
//             DCB=(RECFM=U,
//             BLKSIZE=32760)
```

  - Install as a Unix program and then copy to MVS PDSE library

    cp irrhfsu.o "//'*pdse.library*(IRRHFSU)'"

Executing IRRHFSU - Command Syntax

irrhfsu.o [-c] [-m] [-M] [-f *output-file*] *path1* [*path2* ...]

path File or Directory (e.g., /u)
- includes all subdirectories

-c Clean up orphaned ACL entries

-m Create 0904 records along with other 0900-series records
- Creates records for all mounted file systems, not just that of target directory

-M Create only 0904 records (ignores any specified *path*)

-f Name of output Unix file or dataset *(//dsname*)
- Opens in append mode

Executing IRRHFSU - OMVS Shell

- Enter irrhfsu.o with options at the ===> command line prompt

- Send output to Unix file (two options):

  irrhfsu.o -f *unix-output-filename* *path1* [*path2* ...]

  irrhfsu.o *path1* [*path2* ...] > *unix-output-filename*

  - Using redirect ">" overwrites existing file's contents

- Send output to z/OS dataset

  irrhfsu.o -f *//OUTPUT.FILE.NAME* *path1* [*path2* ...]

- Send output to display

  irrhfsu.o *path1* [*path2* ...]

  irrhfsu.o -M

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

Executing IRRHFSU - BPXBATCH Batch

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

```
//RSHHFSU  JOB (0),'ROBERT HANSEL',NOTIFY=&SYSUID, ...
//STEP0010 EXEC PGM=BPXBATCH
//STDPARM  DD *                                    (Note: Use NUM OFF)
PGM /u/RSH/hfsu/irrhfsu.o -m
 -f //RSH.HFSU.SYSA   /
//STDERR   DD PATH='/u/RSH/hfsuerr',
//            PATHOPTS=(OWRONLY,OCREAT,OTRUNC),
//            PATHMODE=SIRWXU
```

Note: Unix file and directory names and program options are case-sensitive

Executing IRRHFSU - MVS Program Batch

```
//RSHHFSU  JOB (0),'ROBERT HANSEL',NOTIFY=&SYSUID, ...
//HFSUNLD  EXEC PGM=IRRHFSU,PARM=('/-m /')          (Start parm with / )
//STEPLIB  DD DSN=RSH.IRRHFSU.LOAD,DISP=SHR
//SYSPRINT DD DSN=RSH.HFSU.SYSA,                    (Alternative to -f )
//            DISP=(,CATLG,DELETE),UNIT=TAPE,
//            DCB=(RECFM=VB,LRECL=4096,BLKSIZE=0)
```

Note: (1) Unix file and directory names and program options are case-sensitive

(2) The / at the beginning of the PARM indicates to LE that the LE parameters have ended

Required Authority to Execute

- To unload a directory
  - FSACCESS *zfs-dataset* - UPDATE (except if System-AUDITOR or ROAUDIT)
    ... plus either of the following ...
  - READ and SEARCH (r-x) to the parent directory and all subdirectories, and SEARCH (--x) to all directories in the path
  - UID 0
  - FACILITY BPX.SUPERUSER - READ - execute 'su' command
  - RACF System-AUDITOR or ROAUDIT authority
  - UNIXPRIV SUPERUSER.FILESYS - READ
  - UNIXPRIV SUPERUSER.FILESYS.DIRSRCH - READ

- To create or write to the output file
  - Dataset - pre-allocated - UPDATE
  - Dataset - to be created - ALTER
  - FSACCESS *zfs-dataset* - UPDATE (except if System-AUDITOR or ROAUDIT)
    ... plus either of the following ...
  - Unix file already created - WRITE (-w-) to the file and SEARCH (--x) to all directories in the path
  - Unix file to be created - WRITE and SEARCH (-wx) to parent directory of the file and SEARCH (--x) to all directories in the path

Execution Tips

- Do NOT execute with a RACF ID having UAUDIT
  - Could generate an excessive number of SMF records causing an SMF buffer overflow
- Do NOT execute on a system where (a) UNIXMAP is inactive, (b) AIM Stage 2 or 3 has not been implemented, and (c) VLF is not caching UID and GID mappings
  - UID and GID lookups may cause performance problems
  - To improve performance, irrhfsu locally caches last 10 UID and GID mappings
- If sending output to a dataset …
  - IRRHFSU creates dataset with RECFM=VB, LRECL=4096, and SPACE=(6144, (8,24))
  - Recommend pre-allocating dataset with substantial space
- Output is not sorted - sort 0900-0903 records by directory/file and record type

  SORT FIELDS=(10,1023,CH,A,5,4,CH,A)
- Last access date of a directory is updated when unloaded by IRRHFSU

Execution Tips

- Analyzing Unix security for the entire z/OS environment requires unloading the file system on every individual z/OS system image (a.k.a., LPAR)
  - If the file system is shared by multiple images (BPXPRMxx parameter SYSPLEX=YES), and these images also share a RACF database, only need to unload the file system on one of the sharing systems
- Contents of unmounted file system datasets will not appear in the unload
- Contents of automounted file system datasets (e.g., user file systems) will not appear in the unload if not currently mounted
  - Can cause automounted file systems to be mounted temporarily by listing their contents with an ls command prior to executing IRRHFSU (e.g., ls -al /u/userid)
  - Can unload automounted file systems by specifying directory as IRRHFSU input
- RSH has found it helpful to …
  - Convert YES/NO fields into Unix permission and attribute display symbols (e.g., r-x)
  - Add tabs between fields to facilitate importation into Excel

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 ACL entries
  - Assumes no matching USERID or Group ID means UID or GID is not assigned

- Authority to execute
  - FSACCESS *zfs-dataset* - UPDATE (except if System-AUDITOR or ROAUDIT)

    ... plus either of the following ...
  - UID 0
  - FACILITY BPX.SUPERUSER - READ - execute 'su' command
  - UNIXPRIV SUPERUSER.FILESYS.CHANGEPERMS - READ - plus any of the following
    - READ and SEARCH (r-x) to all directories to be cleaned and SEARCH (--x) to all directories in the path
    - RACF System-AUDITOR or ROAUDIT
    - UNIXPRIV SUPERUSER.FILESYS - READ
    - UNIXPRIV SUPERUSER.FILESYS.DIRSRCH - READ
  - Access to the output file and directories

Execution Errors

- If problems are 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

- The following slides provide sample Batch Job JCL statements, TOOLIN DD ICETOOL commands, and xxxxCNTL DD DFSORT commands to generate reports from IRRHFSU output

- Sample ICETOOL reports include ...
  - Find OWNER and GROUP with no matching RACF ID
  - Find files with SETUID or SETGID
  - Find files and directories where OTHER has WRITE (-w-) permission

- The jobs have not been tested with SYNCSORT or any other sort programs and may require modifications to successfully run them with other products

Sample ICETOOL Report - Orphaned IDs

Find OWNER and GROUP with no matching RACF ID

```
//          JOB  ...
//S010URPT EXEC PGM=ICETOOL
//SYSOUT   DD  SYSOUT=*
//TOOLMSG  DD  SYSOUT=*
//DFSMSG   DD  SYSOUT=*
//HFSUFILE DD  DISP=SHR,DSN=irrhfsu.output.file
//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)
//TOOLIN   DD  *
    - see next slide -
//UDIDCNTL DD  *
    - see slide after next -
```

Sample ICETOOL Report - Orphaned IDs

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 - Orphaned IDs

Find OWNER and GROUP with no matching RACF ID

```
//UDIDCNTL 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 - SETUID or SETGID

Find files with SETUID or SETGID

```
//          JOB  ...
//S010URPT EXEC PGM=ICETOOL
//SYSOUT   DD  SYSOUT=*
//TOOLMSG  DD  SYSOUT=*
//DFSMSG   DD  SYSOUT=*
//HFSUFILE DD  DISP=SHR,DSN=irrhfsu.output.file
//SELDATA  DD  DSN=&&TEMP,DISP=(NEW,PASS,DELETE),UNIT=SYSDA,
//             SPACE=(CYL,(1,1),RLSE),DCB=(RECFM=VB,LRECL=4096)
//HFSUSET  DD  DSN=hfsuset.report.file,DISP=(NEW,CATLG,DELETE),
//             UNIT=SYSDA,SPACE=(TRK,(1,1),RLSE)
//TOOLIN   DD  *
    - see next slide -
//USETCNTL DD  *
    - see slide after next -
```

Sample ICETOOL Report - SETUID or SETGID

Find files with SETUID or SETGID

```
//TOOLIN   DD  *
 SORT FROM(HFSUFILE) TO(SELDATA) USING(USET)
 DISPLAY FROM(SELDATA) LIST(HFSUSET) -
         PAGE TITLE('HFS FILES WITH SETUID OR SETGID') -
         DATE TIME -
         LINES(999) -
         BLANK -
         ON(1036,8,CH)    HEADER('USERID') -
         ON(1044,10,CH)   HEADER('OWNER-UID') -
         ON(1054,3,CH)    HEADER('SETUID') -
         ON(1057,8,CH)    HEADER('GROUP') -
         ON(1065,10,CH)   HEADER('GROUP-GID') -
         ON(1075,3,CH)    HEADER('SETGID') -
         ON(1078,10,CH)   HEADER('CREATED') -
         ON(1088,10,CH)   HEADER('LAST-MOD') -
         ON(1098,10,CH)   HEADER('STATUS-CHGD') -
         ON(1108,10,CH)   HEADER('LAST-ACC') -
         ON(1028,8,CH)    HEADER('FILETYPE') -
         ON(5,1023,CH)    HEADER('PATH+FILE/DIRECTORY-NAME')
```

Sample ICETOOL Report - SETUID or SETGID

Find files with SETUID or SETGID

```
//USETCNTL DD  *
 OPTION VLSHRT,VLSCMP,DYNALLOC=(3390,4)
  INCLUDE COND=(5,4,CH,EQ,C'0900',AND,
                (1094,3,CH,EQ,C'YES',OR,
                 1099,3,CH,EQ,C'YES'),AND,
                 1045,8,CH,EQ,C'FILE    ')
  INREC FIELDS=(1,4,10,1023,1045,8,1065,8,1054,10,1094,3,1085,8,
                 1074,10,1099,3,1273,10,1333,10,1313,10,1293,10)
  SORT FIELDS=(5,1023,CH,A)
```

Sample ICETOOL Report - OTHER WRITE Access

Find files and directories where OTHER has WRITE (-w-) permission

```
//         JOB  ...
//S010URPT EXEC PGM=ICETOOL
//SYSOUT   DD  SYSOUT=*
//TOOLMSG  DD  SYSOUT=*
//DFSMSG   DD  SYSOUT=*
//HFSUFILE DD  DISP=SHR,DSN=RSH.HFSU.OUT
//SELDATA  DD  DSN=&&TEMP,DISP=(NEW,PASS,DELETE),UNIT=SYSDA,
//             SPACE=(CYL,(20,5),RLSE),DCB=(RECFM=VB,LRECL=4096)
//HFSUOTW  DD  DSN=RSH.HFSUOTW.REPORT.FILE,DISP=(NEW,CATLG,DELETE),
//             UNIT=SYSDA,SPACE=(CYL,(20,5),RLSE)
//TOOLIN   DD  *
- see next slide -
//UOTWCNTL DD  *
    - see slide after next -
```

Sample ICETOOL Report - OTHER WRITE Access

Find files and directories where OTHER has WRITE (-w-) permission

```
//TOOLIN   DD  *
SORT FROM(HFSUFILE) TO(SELDATA) USING(UOTW)
DISPLAY FROM(SELDATA) LIST(HFSUOTW) -
        PAGE TITLE('HFS OBJECTS WITH OTHER WRITE PERMISSION') -
        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 - OTHER WRITE Access

Find files and directories where OTHER has WRITE (-w-) permission

```
//UOTWCNTL DD  *
 OPTION VLSHRT,VLSCMP,DYNALLOC=(3390,4)
 INCLUDE COND=(5,4,CH,EQ,C'0900',AND,
               1144,3,CH,EQ,C'YES',AND,
              (1045,8,CH,EQ,C'FILE    ',OR,
               1045,8,CH,EQ,C'DIR     '))
 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)
```