MASS 11

Microsystems Engineering Corporation

VSG
DECUS
DISKCHARGE HANDOUTS
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DISKCHARGE - VA130

VMS Project-Based Disk Resource Accounting

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Our Environment

- Major defense contractor (lots of audits!)
- Many systems supported - 146 at last count
- Decentralized management
- Many different configurations - 11/730 to 6320
- Extended LAN, some closed systems

Why ?

- Disks, associated peripherals (controllers, HSCs, tape drives for backup) make up growing fraction of system cost
- Disks are always 90% full, no matter how much you have
- Configuration control increases disk space requirements
- Management wants assurance that we **need** what we **want** and that we **use** what we **get**!

Why Project-Based ?

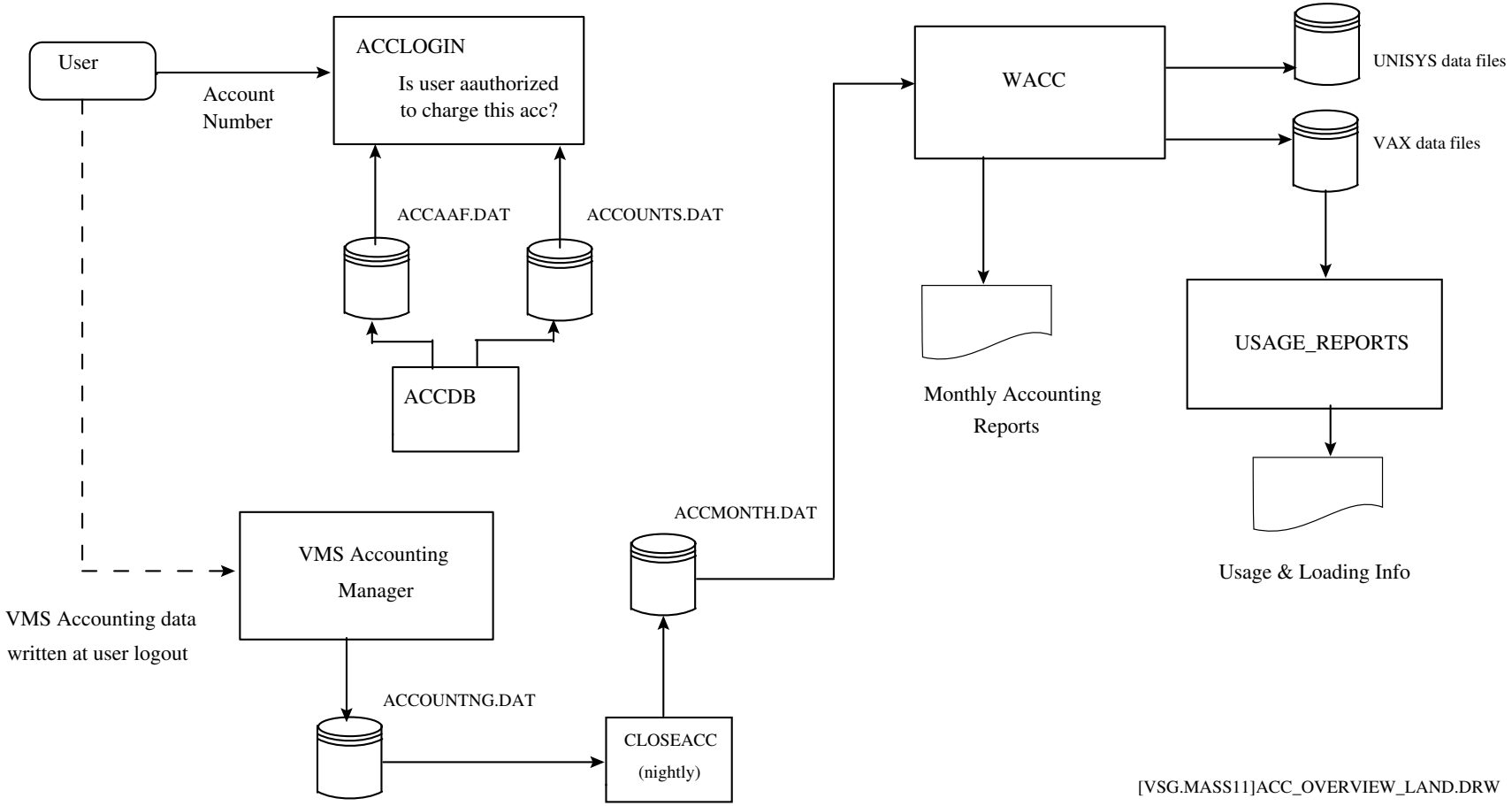
- DISKQUOTA can only track by UIC / Identifier
- A given user charges different accounts for different projects
- Need accountability for DoD project billing
- Projects want to pay only "their share" (or less!)

Existing Resource Accounting

- Home-grown software manages accounts:
  - Define valid charge numbers, and who is allowed to use them
  - Ask for charge number at login & validate it
  - Stuff JIB$T_ACCOUNT & CTL$T_ACCOUNT

- Extraction and report software:
  - Reads VMS accounting file
  - Formats data for billing system
  - Transfers files across LAN/WAN to Sperry/IBM

Resource Accounting Overview



Design Goals

- ❒ No changes to distributed VMS
  - No mods to RMS
  - No stuffing reserved file header area
- ❒ Ease of installation & maintenance
  - No separate databases to maintain
  - No extensive manual initialization
  - No configuration by System Manager

Design Goals (Cont'd)

- ❒ Use DEC-supported interfaces
  - Minimize any special (kernel) code
  - Avoid future file structure problems
- ❒ Ease of use
  - DCL interface for user, manager
  - Allow flexibility, minimize required actions
  - User access to their disk usage
- ❒ Integration with existing software

A Solution

- Info ACE (Access Control Entry) on files
  - Relatively little documentation
  - SYS$CHANGE_ACL or QIOs thru ACP
- Uses RMS $PARSE & $SEARCH to handle wildcards
- Use VMS file protection to handle access
- Use existing account validation to handle charge to be applied

ACE Format

ACE$W_FLAGS = 701x		ACE$B_TYPE= ACE$C_INFO=7	ACE$B_SIZE=23
ACE$L_INFO_FLAGS = 56012E00x			
n	n	B	A
(blank)	(blank)	n	n
A	H	C	F
	E	G	R

701x = Hidden + Protected + Default + Customer

ACE Format (Cont'd)

```
$ DIR/SECURITY DISKCHARGE.FOR

DISKCHARGE.FOR;62    [VSG]              (RE,RWED,RWED,)

$ SET PROCESS/PRIV=SECURITY

$ DIR/SECURITY DISKCHARGE.FOR

DISKCHARGE.FOR;62    [VSG]              (RE,RWED,RWED,)
     (APPLICATION,SIZE=%D23,FLAGS=%X0701,
     ACCESS=%X56012E00,
     DATA=%X30304241,%X20203130,%X41484346,%X00454752)
```

"Messy ACE Buildup"

- Retrieve ACL buffer via SYS$CHANGE_ACL
- See if it contains one of "our" ACEs
  - Size=23
  - Flags=56012E00x
  - "FCHARGE"
- Same account as one being added? Then quit. Otherwise, must REMOVE old ACE or will have new ACE and old ones together
- Write new ACE using ACP QIO to file

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DCL Interface

DISKCHARGE [/options] filespec

Major options for users:

- /SET - Assign charge number to file(s)
- /SHOW - Show charge number on file(s)
- /REPLACE - Replace an existing charge with a new one
- /SUMMARY - Summary of disk space by disk, user, etc.

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DCL Format(Cont'd)

- File spec handles wildcard formats

- Additional privileged options:
  - /SCAN - Record usage for a volume
  - /REMOVE - Completely remove charge number

- Other common qualifiers:
  - /ACCOUNT=acc - Account number desired
  - /LOG [=file] - Log activity
  - /DEFAULT - Use "default" account - more later
  - /TRACE - Turn on debug by module

Installation & Setup

- Need to install on dozens of clusters with hundreds of volumes

  How to initialize all the files on all the disks *without* driving the System Manager crazy??

- "Default account" → SYSUAF ACCOUNT
  - Drawback - Once entered, never changed!
  - Solution - Check for validity at each interactive login & allow user to change at any time

Data Collection

DISKCHARGE / SCAN [/ REPAIR] ddcu:

- Needs to look at every file (header) for ACE
- LAVC - only run on node local to disk
- If no charge ACE found, and /REPAIR, add ACE for the default account of the file owner. If owned by identifier, look up identifier in account database.

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Data Collection (Cont'd)

- Update number of blocks for this account - uses B-tree
- When scan completed, write data file: SYS$MANAGER:DISKCHARGE_ACC.DAT
- Command procedure to find all suitable disks, kick off batch jobs to process them
- Runs once a week in batch

Data Collection (Cont'd)

Scan method tradeoff - TANSTAAFL

Read INDEXF.SYS:

✗ Undocumented, subject to change
✗ Problems with extension headers
✗ Problems with volume sets
✓ Faster than file-by-file

RMS$SEARCH file-by-file:

✓ Locality of owner & account saves lookups.
✓ Documented interface
✓ Works on volume sets.

☞ **File-by-file wins, but it's *s l o w***

Data Collection (Cont'd)

Timing - 3 concurrent jobs (780 with UDA50):

- 2 Vol RA82 — 2:06:41 CPU, 6:54:06 Elapsed
- 1 RA82 — 0:58:44 CPU, 3:19:12 Elapsed
- System RA82 — 2:15:42 CPU, 6:42:00 Elapsed

Types of Reports (/SUMMARY)

- Specified User and Specified Account
- Specified User and All Authorized Accounts
- All Users and Specified Account
- All Users and All Authorized Accounts

Privileges Needed

- Group privilege needed to view usage of a user in the same group.
- World privilege needed to view usage of other users.
- Oper privilege needed to view usage of account numbers you are not authorized to charge.

History Data

- Current Data file :
  SYS$MANAGER:DISKCHARGE_ACC.DAT

- Rollup Data File :
  SYS$MANAGER:DISKCHARGE_ACC.HISTORY
  - Use /BEFORE and /SINCE to access history data.

User and Account

```
$    diskcharge/summary/user=spock/account=ab1234

Summary of disk space usage for SPOCK on AB1234 From 15-JUL-1989
To 29-SEP-1989

     USER$DISK                                  8716
     CAS$DISK                                     31
                                             ---------
                         Grand Total =          8747    Block Month
```

User and Wild Account

```
$    diskcharge/summary/user=spock/account=*

Summary of disk space usage for SPOCK From 15-JUL-1989 To
29-SEP-1989

  Account:       AB1234
     USER$DISK                                  8716
     CAS$DISK                                     31
                                             ---------
                                  Total =       8747    Block Month
  Account:       AB1235
     USER$DISK                                  1639
                                             ---------
                                  Total =       1639    Block Month
                            Grand Total =      10386    Block Month
```

Wild User and Account

```
$    diskcharge/summary/user=*/account=AB1234

Summary of disk space usage for AB1234 From 15-JUL-1989 To
29-SEP-1989

  User:          SPOCK
     USER$DISK                                  8716
     CAS$DISK                                     31
                                             ---------
                                  Total =       8747    Block Month
  User:          KIRK
     USER$DISK                                  1659
                                             ---------
                                  Total =       1659    Block Month
                            Grand Total =      10406    Block Month
```

Wild User and Wild Account

```
$    diskcharge/summary/user=*/account=*

Summary of disk space usage From 15-JUL-1989 To 29-SEP-1989

  User:          SPOCK                          Account:    AB1234
     USER$DISK                                            8716
     CAS$DISK                                               31
                                   Total =                8747     Block Month

  User:          KIRK                           Account:    AB1234
     USER$DISK                                            1659
                                   Total =                1659     Block Month

  User:          SPOCK                          Account:    AB1235
     USER$DISK                                            1639
                                   Total =                1639     Block Month

                             Grand Total =               12045     Block Month
```

History Data

```
$    diskcharge/summary/since=6-JUN-1989

Summary of disk space usage for SPOCK on AB1234 From  8-JUN-1989
To  6-JUL-1989

     USER$DISK                                  8631
                         Grand Total =          8631     Block Month

Summary of disk space usage for SPOCK on AB1234 From 15-JUL-1989
To 29-SEP-1989

     USER$DISK                                  8716
                         Grand Total =          8716     Block Month
```

History Data

```
$    diskcharge/summary/before=YESTERDAY

Summary of disk space usage for SPOCK on AB1234 From  8-JUN-1989
To  6-JUL-1989

     USER$DISK                                  8631
                         Grand Total =          8631     Block Month

Summary of disk space usage for SPOCK on AB1234 From 15-JUL-1989
To 29-SEP-1989

     USER$DISK                                  8716
                         Grand Total =          8716     Block Month
```

DECUS Tape? YES!

- FVALIDATE_ACCOUNT status:
  - +1 OK - Charge is valid, user allowed
  - +2 OK - Had privilege to override
  - -1 OOPS
  - -2 Charge OK, user not authorized
  - -3 Bad charge number
  - -4 Unable to open account user auth file
  - -5 Unable to open accounts file

- Has a "generic" FVALIDATE_ACCOUNT function in FVALIDATE_DUMMY for account/user validation - always returns +1.

DECUS Tape? YES!

- Several dummy routines in MISC_DUMMY.FOR
- Probably change DISKCHARGE.MSG, ACC_ERRORS
- Several refs to logical ACC$, WUTIL$
- Must link /NODEBUG /NOTRACE
- Needs to be INSTALLed with SYSPRV