Implementing and Using Extended Addressing Volumes (EAV)

Session 17448

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Agenda

• What are EAV Volumes?
  – History and current status
  – Architecture and addressing

• z/OS changes for EAV
  – DSCBs, program support, DFSMS
  – SRS, ACC, and vendor support of EAV

• How to Create and Use EAV

• Advantages and Disadvantages
Why EAV?

• Running out of addressable disks
  - 4-digit device number limits total available devices

• Larger Volumes
  - More data under one roof
    • Fewer total volsers to manage
What is an EAV Volume?

- More than 65,520 (x'FFF0') cylinders on volume
  - IBM 3390-A (DS8000 lic 4.0) or equiv (UVM, VMAX, etc)
  - Introduced in z/OS 1.10 for up to 223 GB
  - Track format and tracks/cyl identical to current 3390
  - SMS or non-SMS
  - Volume divided into two areas:
    - Track-managed space
    - Cylinder-managed space

What Data Can Reside on an EAV?

- Almost everything! (depending upon z/OS release)
Maximum Volume Sizes

EAV introduced in z/OS R1.10

Theoretical max size of 268,434,453 cyls (225TB)

DSNTYPE=LARGE non-EF PS datasets limited by access methods to 16,777,215 trks/vol

- 3390-3: 3 GB, Max cyls: 3,339
- 3390-9: 9 GB, Max cyls: 10,017
- 3390-27: 27 GB, Max cyls: 32,760
- 3390-54: 54 GB, Max cyls: 65,520
- 3390-A “EAV”

223GB – 1TB Max Cyls 262,688 to 1,182,006
EAV Architecture Terms

- Multicylinder Unit (MCU/MAU) = 21 cylinders
- BreakPointValue (BPV)
- EAS-eligible – can reside anywhere on EAV

Cylinders
Beyond first
65,520
Cylinders

Extended-addressing space
(Cylinder-Managed space)

EAS

Cylinders
0 – 65,519

Base Addressing space
(Track-Managed Space)

65K 'line'
Changes due to EAV

• Changes in DSCBs
• Changes in size of VTOC, VTOCIX, VVDS
• Changes in track addressing format
• Changes in program parameters and processing
• Changes in report field sizes

• New LISTDSI REXX variables, changes to LSPACE, CVAF, and more
EAS-Eligible Datasets

2008

- E A S :  
  - V S A M objects
- Format 8 D S C B s
- Migration tracker

2009

- E A S :  
  - E x t e n s i o n f o r m a t t e r i a l
  - E A T T R attribute
  - A u t o m a t i c V T O C r e b u i l d

2010

- E A S :  
  - S e q u e n t i a l
  - P D S , P D S E
  - B D A M
  - B C S , V V D S
  - S p o o l d a t a s e t s

1 TB volume size

Complete your session evaluations online at www.SHARE.org/Orlando-Eval
Non-EAS-Eligible Data

• Must still reside in track-managed space
  – VTOC, VTOCIX, HFS, page datasets
  – Certain XRC (control) and SYS1
  – VSAM imbed/keyrange, or incompatible CA size (old alloc not 1,3,5,7,9,or 15)

• Just about all user data is now EAS-supported
  – Including DB2, IMS, CICS, zFS, NFS
  – FTP support (in 1.11 for EF, 1.13 for non-EF,cs)
DSCB Changes

• Format-4
  • EAV indicator, cylinder count, MAU

• Extended-Attribute DSCBs (EADSCBs)
  – Format-8
    • Similar to F1DSCB, chains to F9DSCB
  – Format-9
    • Similar to F3DSCB, but:
      – Can point to additional F3DSCB or F9DSCB
      – Direct pointers to F3DSCBs
      – Additional metadata: jobname, stepname, crtime, vendor.
DSCB Changes

Extended addressing space

Base addressing space

8K blocks

VVDS

VTOCIX

VTOC

EAV

Format-8

Format-3

Format-3

Format-3

Format-3

Format-3

Format-3

Format-1

Format-3

Format-3

Up to 10

Up to 10

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EAV Addressing

• Old 16-bit Cylinder Addressing Format
  - CC HH
  
  maximum value x'FF F0 00 0F'
  
  C C H H

• New 28-bit Cylinder Addressing Format
  - The '000' in the HH field becomes high order cylinder number
    • X'CCCCcccH' – as stored
    • X'cccCCCCH' – as used
    • cccCCCC:H – normalized (i.e, as printed)
28-bit Cylinder Addressing Format

- **Model 9**
  - 3 GB: 3339 Cyl
  - 9 GB: 10017 Cyl
  - 27 GB: 32760 Cyl
  - 54 GB: 65520 Cyl

- **Model A**
  - 100’s of TB

- Extended addressing space: xCCCCCCcccH
- Cylinder-managed space: CCHH (xCCCCC0000H)
- Track-managed space: Base addressing space

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EAV Addressing

• Track-managed space
  - The high-order cylinder no. is zero
  
  X'05 DC 00 0E' =0005DC0,E – cylinder 1500, track 14
  X'FF F0 00 0E' =000FFF0,E – cylinder 65520, track 14
  X'FF F0 00 FE' =000FFFF,E – cylinder 65535, track 14
  X'00 00 00 1E' =0010000,E – cylinder 65536, track 14
  X'49 F0 00 21' =00249F0,1 – cylinder 150000, track 1

• TRKADDR macro or IECTRKAD routine
  - Converts, compares, calculates normalizes track addr
  - “possible” for programs to do 28-bit calculations
EAV Free Space

Two sets of free space statistics

- Track-managed free space (all volumes)
- Cylinder+track-managed free space (EAV only)
- Affects many programs
  - LSPACE, ISMF, IEHDLIST, DITTO, SMF19
  - DCOLLECT 'VL' and 'V' records

Two sets of DFSMSHsm Thresholds

- SMS Track-managed free space threshold
- SMS Volume free space threshold
- ADDVOL TRACKMANAGEDTHRESHOLD(hi lo)
EAV Space

Idle Space Release
- Down to MAU boundary (21 cyls)

Dataset Extents
- Can span Cyl and Trk managed space
- Multivolume can extend between EAV / nonEAV
EAS Attribute

- **EATTR= NO/OPT/blank**
  - Added in z/OS 1.11, recorded in F1DSCB
  - Use to prevent downlevel (1.10, 1.11) systems from failing when restoring EAS datasets
    - by forcing non-EAS alloc if EATTR=NO
  - Available via
    - JCL, dataclas
    - Dynalloc
    - IDCAMS DEFINE / ALTER

2.1 new ACS r/o variable available &EATTR=
EAS Dataset Allocation

EAS-eligible type of dataset?
- Yes
  - EATTR=OPT?
    - Yes
      - Space req > BPV?
        - Yes
          - Allocate in CYL-managed space
        - No
          - Allocate in TRK-managed space
    - No
      - Allocate in TRK-managed space
  - No
    - Allocate in TRK-managed space
EAV Programming Support

• Changes for new DSCBs, cylinder addressing
• EADSCB=OK keyword
  – Indicates program understands F8/F9/28-bit cyls
  – OBTAIN, CVAF macros (CVAFDIR/FILT/SEQ, etc.)
  – DCBE (for EXCP open, VTOC open)

LISTDSI variables
  • SYSCREATETIME/STEP/JOB
  • SYSEATTR, SYSEADSCB
  • (also multivolume info!)
EAV Programming Support

• Other programs
  – Any channel program without OPEN
    • Usually, VTOC readers
  – Size calculations or track addresses with CCHHR
  – LSPACE, DEVTYPE – new keywords and plists
  – Any readers of VVDS, or DEB extents

z/OS 2.1 IEC190I message if DCBE incomplete at OPEN
EAV Programming Support

• New SMF fields
  - SMF14EADSCB → EADSCB=OK on DCBE
  - SMF14EXCPBPAM → BSAM/QSAM and EXCP
  - SMF19 → LSPACE statistics expanded
  - SMF6x → VSAM cylinder numbers expanded
  - SMF74-1 → new RMF device capacity field
Migration Assistance Tracker

• Uses Console ID tracking facility (APAR II113752)
  – SETCON and D OPTDATA, TRACKING commands
• Or in 2.1, The Generic Tracker, GTZ
  – EXCLUDE, STATUS, DEBUG, and more

• Identify VTOC access errors needing EADSCB=OK
  • OBTAIN, CVAFxxx, OPEN VTOC, OPEN EXCP
• Identify programs that may need new services
  • LSPACE, DEVTYPE, IDCAMS DCOLLECT
• Warn of possible errors parsing 28-bit cyls
  • IEHLIST LISTVTOC, IDCAMS LISTCAT, LISTDATA PINNED
Setting Up EAV

- SYS1.PARMLIB(IGDSMSxx)
  - USEEAV = YES/NO
  - BreakPointValue=cyls
    - May be specified in SG definition
- ICKDSF INIT volume or use Dynamic Volume Expansion
  - DEVSUPxx REFVTOC=ENABLE automatically expands VTOC for DVE
- Set dataclas EATTR=OPT if needed
- Allocate and copy/move data
Vendor Products and EAV

- Allocation Control Center
  - Dataset allocation management
    - SET EATTR
    - Device selection and pooling

- Storage Control Center MONitor
  - Dataset and device reporting and monitoring
Cautions

- Insure sufficient DSCBs when INITializing EAV
  - max DSNs = EAV cyls / (VTOC trks * 50)
  - ICKDSF REFORMAT EXTVTOC or NEWVTOC
  - IGGCATxx VVDSSPACE sets VVDS size
  - Max VVDS size 5460 trk → 5825 cyl

- Enable HyperPAV to prevent queuing on 1 UCB

- Use EATTR=NO to prevent restore problems with EAS datasets restored to pre-z/OS 1.12 systems
Further Reading and Documentation

• Redbooks
  - z/OS V1.13 / V2.1 Technical Update SG24-8190
  - z/OS V1.11 / 1.12 /1.13 Implementation SG24-7229

• Manuals
  - DFSMSdfp Advanced Services SC26-7400
    • Chapter 7.6 – TRKADDR macro
    • Appendix C – Using the EAV Migration Assistance Tracker
    • or Tools and Service Aids (Generic Tracker Facility)
  - DFSMS Using the New Functions SC26-7473
Questions?

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