



IBM Systems & Technology Group

VSAM & z/VSE 4.1

Stev Glodowski

IBM Deutschland Entwicklung GmbH



IBM z/VSE 4.1 WAVV 2007 Green Bay

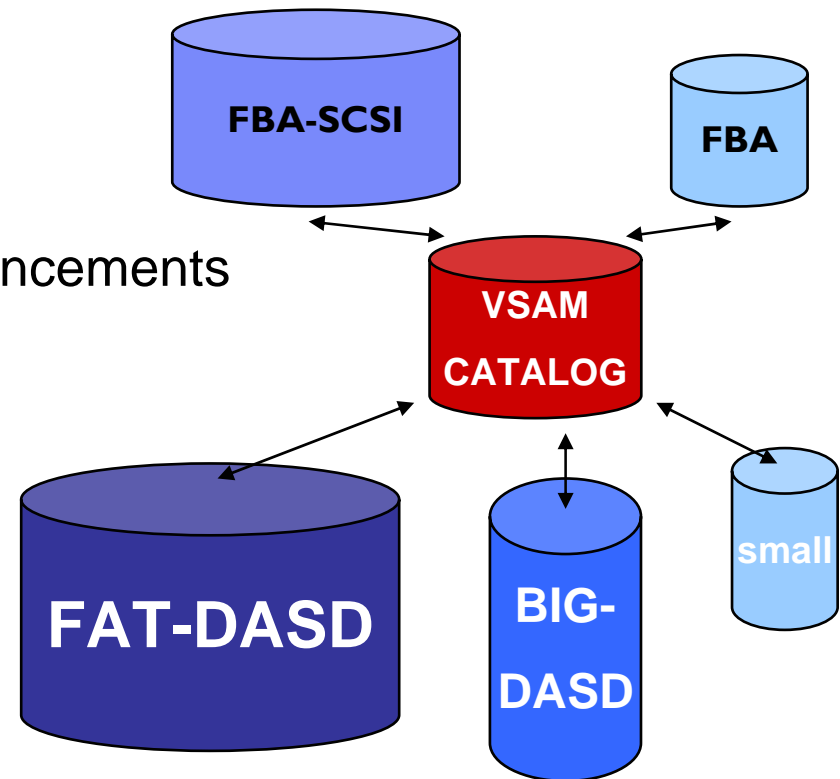
20/05/2007

© 2007 IBM Corporation



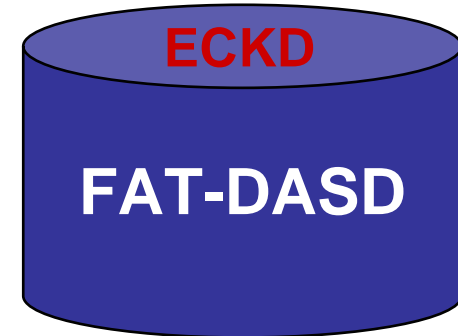
AGENDA

- **FAT-DASD**
- IDCAMS BACKUP/RESTORE Enhancements
- Return Codes & Limitations
- Latest Service



NEW DASD Support

FAT-DASD



What is FAT-DASD ?

- max **65520 cylinders** per DASD
- more then **280 gigabyte** per VSAM KSDS XXL Cluster
- IDCAMS FAT-DASD Support for
 - VSAM Catalogs
 - Space
 - Cluster (UNIQUE)
 - Alternateindex (UNIQUE)

FAT-DASD

Overview

ECKD

MODEL	VSAM Capacity	Bytes/Cylinder	VSAM Classification
3380	max 2655 cylinders	712140	Small DASD
3390 mod 3	max 3339 cylinders	849960	Small DASD
3390 mod 9	max 10017 cylinders	849960	BIG- or FAT-DASD
3390 mod 27 / DS8000	max 65520 cylinders	849960	BIG- or FAT-DASD

SCSI-FBA

MODEL	Capacity in Blocks	Capacity in Bytes	VSAM Classification
Generic FBA	491.520 FBA blocks	2 Gigabyte	FBA
FBA-SCSI	33.553.920 FBA blocks	16 Gigabyte	FBA-SCSI



FAT-DASD

- IDCAMS Parameter „**FATDASD**“
- Abbreviation. „**FAT**“ & „**FD**“
- New parm is available for the following IDCAMS Commands:
 - **DEFINE USERCATALOG**
 - **DEFINE MASTERCATALOG**
 - **DEFINE SPACE**
 - **DEFINE CLUSTER (UNIQUE)**
 - **DEFINE ALTERNATEINDEX (UNIQUE)**
- **FAT-DASD** can only be defined explicitly.

FAT-DASD

- Min FAT-DASD = 64K Tracks
- Max FAT-DASD = ~64K Cylinders (**65520** Cylinders)
- LISTCAT
 - DeviceType: **FAT-3390**
 - SPACE-MAP of FAT-3390 shows cylinder values
 - Name of SPACE-MAP for FAT-3390 is **FAT-SPC-MAP**
- Min & Max CONTROL AREA(CA) Size for each FAT-DASD = 1 Cylinder
- Min allocation also 1 Cylinder

FAT-DASD Overview

- A FAT-DASD can be any CKD device with a **minimum of 64K tracks**
- FAT-DASD **space allocations** will be done **explicitly** every time a new VSAM dataspace is to be defined by any IDCAMS command on a CKD disk with more than 64K-1 tracks if parm „**FATDASD**“ is **specified**.
- Independent of the maximum dasd capacity (if at least 64k tracks), up to a **maximum of 65520** cylinders will be allocated by VSAM.
- The SPACE-BIT-MAP for a FAT-DASD is handled internally in cylinders
- The SPACE-BIT-MAP for a FAT-DASD displayed in a Listcat will be in cylinders with the name „**FAT-SPC-MAP**“
- Min and max CA value for FAT-DASD is 1 cylinder

BIG-DASD Overview

- A BIG-DASD can be any CKD device with a **minimum of 64K tracks**
- BIG-DASD **space allocations** will be done **implicitly** every time a new VSAM dataspace is to be defined by any IDCAMS command on a CKD disk with more than 64K-1 tracks if parm „**FATDASD**“ is **NOT** specified.
- Independent of the maximum dasd capacity (if at least 64k tracks), up to a **maximum of 10017 cylinders** will be allocated by VSAM.
- The SPACE-BIT-MAP for a BIG-DASD is handled internally in tracks
- The SPACE-BIT-MAP for a BIG-DASD displayed in a Listcat will be in **cylinders !!** with the name „**BIG-SPC-MAP**“
- Starting with z/VSE 3.1 the devicetype „BIG-3390“ is displayed in Listcat output

VSAM SPACE-MAP

- Space Map describes each track/cylinder on a volume as allocated to a VSAM object or unallocated
- The tracks/cylinders on a VSAM volume are allocated to a VSAM object, or are unallocated, as described by the Space Map.
Each bit position describes one track/cylinder as **allocated (bit=0)** or **unallocated (bit=1)**.
- **1 bit for 1 tracks** for **small and BIG-DASD**
- **1 bit for 1 cylinder** for **FAT-DASD**
- All tracks/cylinders on a volume are mapped.
- Any tracks/cylinders **not owned by VSAM** are **marked as 'allocated'** in order to ensure that they are not used by VSAM data sets.

Background for implementation

- Space Map is stored in a Space Map group occurrence in the VSAM catalog.
- Each volume catalog records points to all group occurrence records necessary to map a complete VSAM dataspace
- 1 group occurrence has 1 to 440 bytes out of 512 bytes for each catalog record available to describe 1 to 3520 tracks/cylinders on a volume as allocated or unallocated
- 1 volume catalog record can point to up to 43 space map group occurrences. (3520 tracks * 43 = 151360 tracks = 10090 cylinders max capacity)
- For FAT-DASD each bit is associated with 1 cylinder instead of 1 track. (3520 cylinders * 43 = 151360 cylinders new Space Map max capacity)

FAT-DASD SPACE-MAP sample

```

CYLINDERS-TOTAL-----65520
BEG-CCHH-----X'00010001'
FAT-SPC-MAP-----00FD2000FD0C5AFD00A6FD00700203FD002FFD02D90302
    FD01C2FD012CFD034889FD0283FD1671
    1EFD0F00FD02DFFD01FEFD01E069FD0FE1
    FD07443C7501022DFD0EC4FD01BC0501FD
    15BDFD0609FD0159FD042928133823.....
  
```

Occupied RLC (run length code)

Free RLC

- First RLC gives the numbers of contiguous used tracks
- Second RLC gives the numbers of contiguous free tracks
- 1 byte for 0-249 contiguous tracks, 3 bytes if #of tracks > 249
- X'FD' as first byte of a 3 byte RLC to identified that more then 249 contiguous tracks are described within the following 2 bytes



LISTCAT

```

VOLUME ----- WAVVOL
HISTORY
  RELEASE-----2
CHARACTERISTICS
  BYTES/TRK-----58786  DEVTYPE-----FAT-3390  MAX-PHYREC-SZ-----56664  DATASETS-ON-VOL-----2
  TRKS/CYL-----15     VOLUME-TIMESTAMP:  MAX-EXT/ALLOC-----5     DATASPCS-ON-VOL-----1
  CYLS/VOL-----65520      2007.131   11:03:46
                          X'C0940016453928A0'
DATASPACE
  DATASETS-----1  FORMAT-1-LABEL:  ATTRIBUTES:
  EXTENTS-----1  CCHHR-----X'0000000303'  SUBALLOC
  SEC-ALLOC-----0  TIMESTAMP  EXPLICIT
  TYPE-----TRACK      2007.131   11:03:46
  CLASS-----0      X'C0940016453928A0'
EXTENT-DESCRIPTOR:
  CYL-TOTAL-----65518  BEG-CCHH-----X'00020000'  FAT-SPC-MAP-----FDFDE8FD0206
  CYL-USED-----65000
DATASET-DIRECTORY:
  DSN----TC9D1587.VSAMDSSET.DFD07131.TC094001.TC9D1587  ATTRIBUTES----- (NULL)  EXTENTS-----8
    
```

Sample

```
* Define VSAM USERCATALOG WAVVCAT and SPACE
// EXEC IDCAMS,SIZE=AUTO
DEFINE USERCATALOG (      -
      NAME (WAVVCAT)      -
      FATDASD              -
      CYLINDERS (100 50)  -
      VOLUME (VOLONE))
DEFINE SPACE ( DEDICATE          VOLUME (VOLONE)) CATALOG(WAVVCAT)
DEFINE SPACE ( DEDICATE FATDASD VOLUME (VOLONE)) CATALOG(WAVVCAT)
/*
```

- First define space will allocate up to 10017 cylinders
- Second define space dedicate will allocate everything from 10017 up to the full 64K cylinders.

FAT-DASD(only) Restrictions

- On ECKD devices, unique datasets (CLUSTER or AIX) must **not** allocate **mixed extents** of FAT-DASD and NON-FAT-DASD(BIG-DASD, Small-DASD).
- Every DEFINE CATALOG, SPACE, AIX(UNIQUE), CLUSTER(UNIQUE) without Parm **FATDASD** for a Volume with more than **10017 cylinders** will force VSAM to restrict the VSAM space usage on this Volume to 10017 cylinders max and define as BIG-DASD

FAT- & BIG-DASD Restrictions

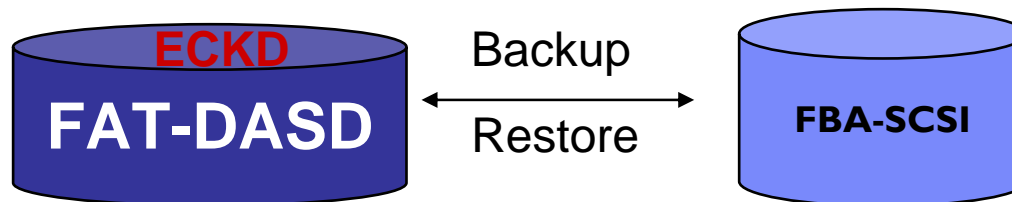
- Any **Define Catalog** with option **DEDICATE** on a **BIG-** or **FAT-DASD** will be rejected, if the define would result in more than one VSAM space EXTENT due to already existing VTOC entries.
 - This means e.g if the VTOC for a volume is not at the beginning or end
 - Or if a NonVSAM file or a dataspace from a different catalog is defined in the middle of the volume, then a DEFINE CATALOG DEDICATE would result in multiple EXTENTS and for that reason being rejected. (old restriction from BIG-DASD implementation)
- Min data CISIZE dependent on key length
 - Key length between **7-35** require min data CISIZE of **1024**
 - Key length between **36-55** require min data CISIZE of **2048**
 - Key length greater than **55** require min data CISIZE of **4096**
 - **CISIZE/KEYLENGTH** constrain for **BACKUP/RESTORE**
- **RECOVERABLE** or **IMBED** catalogs are **NOT** supported

Backup/Restore XXL

New with z/VSE 4.1

IDCAMS Backup/Restore from ECKD to SCSI for XXL datasets EXTRALARGEDATASET_s

- The so called „remapping“ enables VSAM to Backup a Cluster from a DASD with one architecture and Restore to DASD of different architecture
- Remapping now is also available supported for XXL KSDS Clusters
- Clusters > 4 Gigabyte can now be moved between SCSI and CKD using IDCAMS Backup/Restore



NEW VSAM Catalog allocation limit

- Starting with z/VSE 4.1 the primary & secondary allocation for a catalogs data and index portion have been limited.
- Max 5000 cylinders on ECKD ~ 4.20 gigabyte
- Max 8.388.096 blocks on FBA-SCSI (multiple of 512) ~ 4.29 gigabyte
- Any specified value will be rounded up to the next min/max CA multiple and then compared to the new limit
- Over all catalog limit is still 4.3 gigabyte
- Limits only apply to the catalog itself but NOT to the VSAM DATASPACE owned by the catalog

NEW & Updated Return Codes

- **UPDRC140/RSN24** The total amount of space specified as primary or secondary allocation on cluster and/or data-/index-level rounded to the next min-/max-CA multiple, exceeds 5000 cylinders on a CKD device or 8,388,096 blocks on a FBA-SCSI device for a DEFINE catalog.

SAMPLE :

```
DEFINE USERCATALOG (      -  
      NAME      (WAVVUCAT) -  
      CYLINDERS (5001 100) -  
      FATDASD   -  
      VOLUME    (VOLONE))
```

```
IDC3014I CATALOG ERROR
```

```
IDC3009I ** VSAM CATALOG RETURN CODE IS 140 - REASON CODE IS IGG0CLAP-24
```

```
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Return Codes

- **NEWRC58/RSN12 Explanation:** An attempt has been made to define a file with option NOALLOCATION, but in case of a subsequent space allocation the high allocated RBA (HALRBA-OR-CI) of the primary would exceed (X'FFFFFFFF') (4.3 billion bytes for a XXL KSDS). The file definition is rejected.

SAMPLE :

```
DEFINE CLUSTER          -
      (NAME      (KSDS   )  -
      INDEXED          -
      NOALLOCATION      -
      VOL          (VOLONE )  -
      KEY          ( 8 4   )  -
      RECSZ        (256 256 )  -
      CYLINDERS(8000 100) )  -
      CATALOG   (WAVVUCAT)
```

```
IDC3014I CATALOG ERROR
```

```
IDC3009I ** VSAM CATALOG RETURN CODE IS 58 - REASON CODE IS IGG0CLCY-12
```

```
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Return Codes

- **UPDRC68/RSN16** On a DEFINE SPACE command for FBA-SCSI devices the allocation in numbers of blocks exceeds 16,777,215 (X'FFFFFF'). This caused no data space to be allocated. (rounded up to next multiple of min/max CA 512)

SAMPLE:

```
DEFINE SPACE (BLK(16777215) VOLUME (GLOSC1)) CATALOG(WAVV2CAT)
```

```
IDC1293I BLOCKS PARAMETER IGNORED
```

```
IDC0511I SPACE ALLOCATION STATUS FOR VOLUME GLOSC1 IS 68
```

```
IDC3020I INSUFFICIENT SPACE ON USER VOLUME
```

```
IDC3009I ** VSAM CATALOG RETURN CODE IS 68 - REASON CODE IS IGG0CLAQ-16
```

```
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Return Codes

- **NEWRC220/RSN12 Explanation:** On ECKD devices, unique datasets (CLUSTER or AIX) must not allocate mixed extents of FAT-DASD and non-FAT-DASD. The mix of small and BIG-DASDs (3390 mod 9/27) (max. 10017 cylinders) is still allowed and not affected.

SAMPLE :

```

DEFINE USERCATALOG ( NAME (WAVVUCAT) CYLINDER (5 5) FD VOLUME (VOLONE) )
// DLBL DATAFIL,,,VSAM
// EXTENT ,VOLONE,,,900,15
// DLBL INDXFIL,,,VSAM
// EXTENT ,VOLONE,,,915,15
// EXEC IDCAMS,SIZE=AUTO
  DEFINE CLUSTER ( -
    NAME (VSAM64.KSDS.FILE1 ) INDEXED KEYS (8 4) -
    SHAREOPTIONS (1) RECORDSIZE (00080 00080 ) VOLUMES (VOLONE ) )-
    DATA (NAME (VSAM64.KSDS.§D§) UNIQUE CYLINDERS(1 1 ) FILE(DATAFIL )) -
    INDEX (NAME (VSAM64.KSDS.§I§) UNIQUE CYLINDERS(1 1 ) FILE(INDXFIL )) -
    CATALOG (WAVVUCAT)
IDC3014I CATALOG ERROR
IDC3009I ** VSAM CATALOG RETURN CODE IS 220 - REASON CODE IS IGG0CLFZ-12
  
```

Return Codes

- **NEWRC220/RSN14 Explanation:** During DEFINE CLUSTER/AIX with option UNIQUE, one or more specified extents exceed the volume capacity. This is independent of any VSAM specific VOLUME type (e.g. FAT-DASD).

SAMPLE:

```

DEFINE USERCATALOG ( NAME (WAVVUCAT) CYLINDER (5 5) FD VOLUME (VOLONE) )
// DLBL DATAFIL,,,VSAM
// EXTENT ,VOLONE,,,900000,15
// DLBL INDXFIL,,,VSAM
// EXTENT ,VOLONE,,,915,15
// EXEC IDCAMS,SIZE=AUTO
  DEFINE CLUSTER ( -
    NAME (VSAM64.KSDS.FILE1) INDEXED KEYS (8 4) FATDASD -
    SHAREOPTIONS (1) RECORDSIZE (00080 00080 ) VOLUMES (VOLONE) )-
    DATA (NAME (VSAM64.KSDS.§D§) UNIQUE CYLINDERS(1 1 ) FILE(DATAFIL ) ) -
    INDEX (NAME (VSAM64.KSDS.§I§) UNIQUE CYLINDERS(1 1 ) FILE(INDXFIL ) ) -
    CATALOG (WAVVUCAT)
IDC3014I CATALOG ERROR
IDC3009I ** VSAM CATALOG RETURN CODE IS 220 - REASON CODE IS IGG0CLFQ-14
  
```

Return Codes

- **NEWRC156/RSN28 Explanation:** Any DEFINE CATALOG with option DEDICATE on a BIG- or FAT-DASD is rejected, in case the define would result in more than one VSAM space extent due to already existing VTOC entries. This does not apply to DEFINE SPACE DEDICATE, only to DEFINE CATALOG DEDICATE on BIG- or FAT-DASD.

SAMPLE:

```
// EXEC ICKDSF
  INIT SYSNAME(SYS000) NVFY PURGE VOLID(VOLONE) DEVTYP(3390) DOSVTOC(150,3,12)
...
DEFINE USERCATALOG (          -
  NAME (WAVVUCAT)             -
  DEDICATE                     -
  FATDASD                       -
  VOLUME (VOLONE) )
IDC3025I INSUFFICIENT SUBALLOCATION DATA SPACE
IDC3009I ** VSAM CATALOG RETURN CODE IS 156 - REASON CODE IS IGG0CLFE-28
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```

Return Codes

- **NEWRC212/RSN18 Explanation:** For DEFINE CATALOG or DEFINE SPACE, the sum of the specified number of blocks for primary allocation at **data- and “+” index-level** exceeds 16,777,215 (X'FFFFFF').

SAMPLE :

```
DEFINE USERCATALOG ( -  
    NAME (WAVV2CAT) -  
    DEDICATE          -  
    VOLUME (GLOSC1 ) )-  
    DATA (BLK(16775680 512))-  
    INDEX(BLK(160000 512))
```

```
IDC3014I CATALOG ERROR
```

```
IDC3009I ** VSAM CATALOG RETURN CODE IS 212 - REASON CODE IS IGG0CLAP-18
```

```
IDC3003I FUNCTION TERMINATED. CONDITION CODE IS 12
```


Latest VSAM Service for z/VSE 3.1

- [UD53191/DY46731](#) Invalid VERIFY of KEYRANGE Datasets
- [UD53095/DY46602](#) -MSG0S24I, MSG0S30I SDUMP Issued by VSAMIKQCIR, Followed by CICS
-Transaction CANCEL with VSAM RC X'34' (INTERNAL LOGIC ERROR)
DY46629 -Transaction WAIT Under CICS/VSE After EXCLUSIVE CONTROL CONFLICT
DY46684 -ILLOGIC ERROR From VSAM Under CICS/TS After EXCLUSIVE CONTROL ERROR
- [UD53145/DY46670](#) LISTCAT Mismatch between Number of EXTENTS Listed for DATA COMP,
- [UD53138/DY46666](#) User Storage Overlaid when Number of STRINGS exceeded

Latest VSAM Service for z/VSE 4.1

- HOTNEWS

"IDC2950I INVALID FORMAT STRUCTURE" on MASTERCATALOG LISTCAT:

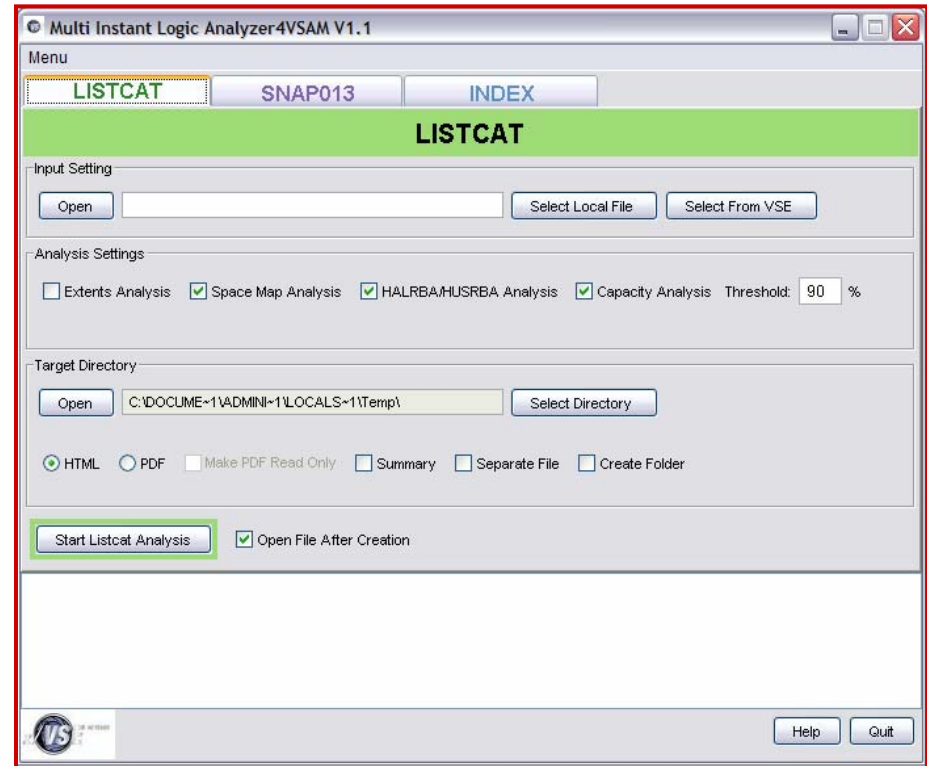
- This message is presented because of a LISTCAT printing problem regarding USERCATALOGs.
- **NO data, clusters or files in all MASTER- and USERCATALOGs are affected !**
- To prevent the "IDC2950I INVALID FORMAT STRUCTURE" problem to appear for any new USERCATALOGs created, **APAR DY46687 / PTF UD53149** will be available soon.
- z/VSE Homepage/HOTNEWS provides detailed steps as local fix to easily correct the LISTCAT error.

<http://www-03.ibm.com/servers/eserver/zseries/zvse/support/>

- **UD53149/DY46687** „Invalid Format Structure“ during LISTCAT of MasterCatalog
- **UD53195/DY46735** Invalid VERIFY of KEYRANGE datasets

Multi Instant Logic Analyzer4VSAM v1.1

- What is the **Multi Instant Logic Analyzer4VSAM** ?
 - A collection of multiple tools to analyze VSAM data instantly
 - LISTCAT, SNAP013 and INDEX analysis included
 - VSE Connector integration
 - Helps identifying & solving potential problems early
 - HTML / PDF output
 - First Version released Oct. 2006



VSAM & z/VSE 4.1



QUESTIONS ?

Stev Glodowski
glodowsk@de.ibm.com

