z390 VSAM User Guide v1.5.06

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1.0 Overview

z390 VSAM support enables z390 application assembler programs running on Windows or Linux to access fixed length or variable length record data files (data sets) in key sequence (KSDS) which is the default, relative record sequence (RRDS/VRRDS), entry sequence (ESDS), or linear (LDS) control interval access. z390 VSAM file access from assembler programs is performed using VSAM macros such as GENCB, OPEN, CLOSE, POINT, GET, PUT, MODCB, SHOWCB, or TESTCB referencing ACB and RPL control blocks which define the type of data access to be performed.

The advantages of z390 VSAM over QSAM and BSAM access methods are:

1. **Z390 VSAM supports random and skip sequential access to fixed and variable length records by key index fields, by relative record number, or by 32 bit or 64 bit relative byte address.**
2. **Z390 VSAM supports sequential and random access to both fixed length and variable length records up to 2 GB.**
3. **Z390 VSAM supports any number of alternate key indexes with offsets and lengths up to 2 GB. Note only random and skip sequential primary key browse currently supported.**
4. **VSAM maximizes performance by utilizing a VSAM Cache Buffering (VCB) option to buffer all I/O for records less than 4096. Writes are always performed immediately where as reads may come from file or cache. The cache buffers are reused on least recently used basis.**

Z390 VSAM files are defined in VSAM Catalog Definition Tables (VCDT's) which are defined using DEFINE macro calls to define any number of base clusters, alternate indexes, and paths. The macro calls are assembled and linked into loadable table. When an ACB is opened, the DDNAME points to the VCDT catalog to be accessed. An optional dot suffix defining the name of the catalog entry to open can be specified or the name of the ACB will be used as default entry name. The DEFINE macro checks all the entries for consistency and then passes global data to ZDEFINE macro to generate the table if no errors are found. See the copybook ZDEFINE.CPY for the global VCDT data definitions. For examples see vsam\demo\DEMOCAT.MLC which defines all the demo VSAM data sets, and see vsam\test\TESTCAT.MLC which defines all the regression test VSAM data sets.

IDCAMS type VSAM utilities

The IDCAMS utility on the mainframe is used to create VSAM catalog base cluster, alternate index, and path definitions. The following z390 tools are used in place of IDCAMS utility:

1. **DEFINE macro to define base cluster, alternate index, and path entries in a z390 VSAM Catalog Definition Table (VCDT)**
2. **REPRO assembler utility to load or unload z390 VSAM cluster files from or to QSAM file. When VSAM files are loaded or unloaded, deleted records are removed and the base cluster data records are stored in physical primary key sequence. Note inserts and updates can cause records to be added to the end of the base cluster leaving dead space and causing the file to grow so periodic reorganizations may be necessary.**

The following DEFINE macro calls can be used to create a z390 VSAM Catalog Definition Table:

```
      *
* DEFINE VCDT CATALOG FOR VSAM DEMOS IN vsam\demo
*
      DEFINE CATALOG,NAME=DEMOCAT
      DEFINE CLUSTER,NAME=ESF1,                                  X
          RECORDSIZE=80,INDEX=NONINDEXED
      DEFINE CLUSTER,NAME=ESV1,RECORDSIZE=(200,300),             X
          INDEX=NONINDEXED
      DEFINE CLUSTER,NAME=RRF1,                                  X
          RECORDSIZE=80,INDEX=NUMBERED
      DEFINE CLUSTER,NAME=RRV1,                                  X
          RECORDSIZE=(200,400),INDEX=NUMBERED
      DEFINE CLUSTER,NAME=KSF1NAME,                              X
          RECORDSIZE=70,KEYS=(20,0)
      DEFINE ALTERNATEINDEX,NAME=KSF1ADDR,                       X
          RELATE=KSF1NAME,KEYS=(20,20)
      DEFINE ALTERNATEINDEX,NAME=KSF1CITY,                       X
          RELATE=KSF1NAME,KEYS=(20,40)
      DEFINE ALTERNATEINDEX,NAME=KSF1STAT,                       X
          RELATE=KSF1NAME,KEYS=(5,60)
      DEFINE ALTERNATEINDEX,NAME=KSF1ZIP,                        X
          RELATE=KSF1NAME,KEYS=(5,65)
      DEFINE
PATH,NAME=NAMELIST,ENTRY=KSF1NAME,UPDATE=NOUPDATE
      DEFINE
PATH,NAME=ADDRLIST,ENTRY=KSF1ADDR,UPDATE=NOUPDATE
      DEFINE
PATH,NAME=CITYLIST,ENTRY=KSF1CITY,UPDATE=NOUPDATE
```

```
      DEFINE
PATH,NAME=STATLIST,ENTRY=KSF1STAT,UPDATE=NOUPDATE
      DEFINE PATH,NAME=ZIPLIST,ENTRY=KSF1ZIP,UPDATE=NOUPDATE
      DEFINE CLUSTER,NAME=ESF1CI2K,CONTROLINTERVALSIZE=2048,
          RECORDSIZE=200,INDEX=NONINDEXED
      DEFINE CLUSTER,NAME=LDS1CI2K,CONTROLINTERVALSIZE=2048,
          INDEX=LINEAR
      DEFINE END
      END
```

The above macros can be assembled and linked into loadable table that is referenced by the ACB DDNAME= parameter when opening a VSAM file. The file specification can have path and must have the file name DEMOCAT. Optionally a specific catalog entry can be specified such as DEMOCAT.ESF1. If no entry name is specified, the name of the ACB is used to search catalog for entry. At open time DCB's are dynamically allocated for the physical data file and any index files required.

An IDCAMS type utility REPRO.390 can be used to load or unload VSAM data files to or from QSAM using INFILE and OUTFILE DDNAME's. Note REPRO can only be used if the record length is less than 32760 due to QSAM limits. VSAM files must be periodically unloaded and reloaded to free dead space created by updating records with different lengths. Reloading also optimizes file structure by moving inserted KSDS records from insert balanced tree structures to direct access primary indexes structures.

3. VSAM macros for use within z390 assembler

1 **ACB – Access Control Block defining access method and VSAM cluster files**
2 **ACBD – ACB IHAACB DSECT**
3 **CLOSE – Close VSAM cluster files**
4 **DEFINE – define VSAM catalog entries and load global data tables**
5 **ENDREQ – end request to release record locking for update**
6 **ERASE – delete VSAM record (not supported yet)**
7 **GENCB – generate ACB or RPL control block (not supported yet)**
8 **GET – Get VSAM record**
9 **MODCB – modify ACB or RPL control block field. Currently AREA and RECLEN for RPL are supported. See linklib\REPRO.MLC for example.**
10 **OPEN – Open VSAM cluster files**
11 **POINT – Start sequential access at specified key position (not supported yet)**
12 **PUT – Put VSAM record**
13 **RPL – Request Processing List**
14 **RPLD – RPL IHARPL DSECT**
15 **SHOWCB – move ACB or RPL field to user area. Currently AREA, RECLEN, FDBK, RBA, and XRBA are supported for RPL. See linklib\REPRO.MLC and vsam\test regression test programs.**
16 **TESTCB – test value of field in ACB or RPL. Currently RECLEN and FDBK fields in RPL are supported. See linklib\REPRO.MLC for example usage of TESTCB to check FDBK reason code for logical end or data error.**
17 **VCDTD – VSAM Catalog Definition Table containing the following DSECTS:**
17.1 **IHAVCDT – VSAM Catalog DSECT with pointers to VCLR, VAIX, and VPTH (Applications should only use SHOWCB, TESTCB, and MODCB for compatibility. See linklib\REPRO.MLC for example VCDTD usage).**
17.2 **IHAVCLR – VSAM Base Cluster entry**
17.3 **IHAVAIX – VSAM Alternate Index entry**
17.4 **IHAVPTH – VSAM Path entry**
18 **ZDEFINE.MAC – generate VSAM catalog from global data tables**
19 **ZDEFINE.CPY – copybook with global data tables for catalog**
20 **ZGENACB – create ACB control block for GENCB or ACB**
21 **ZGENMACF – create ACB MACRF field for ZGENACB or MODCB**
22 **ZGENOPTD – create RPL OPTCD field for ZGENRPL or MODCB**
23 **ZGENRPL – create RPL control block for GENCB or RPL**
24 **ZMODCB – generate MODCB code**
25 **ZSHOWCB – generate SHOWCB code**
26 **ZTESTCB – generate TESTCB code**

4. VSAM Cluster Definition Table (VCDT) and Z390 VSAM physical files

A z390 VSAM catalog is created by assembling calls to DEFINE macro. When an ACB is opened, the DDNAME points to loadable catalog file and either user specified catalog entry name or ACB name is used to find specific VSAM cluster to be opened. The following DCB's for physical files are dynamically allocated at ACB open time using base cluster, alternate index, and path information from catalog:

1. **Base cluster NAME.VES – ESDS data file containing all data records. Variable length records are preceded by 4 byte length which is not included in logical record length. The individual fixed or variable length records can be up to 2 GB long. The maximum ESDS file size is 2**63 or about 10**18. The user can override default path and name of VES file using VESDSN= parm on DEFINE CLUSTER macro.**
2. **Base cluster NAME.VX0 – VRRDS/ESDS primary index file containing 8 byte RBA addresses to each record in the base cluster VES data file. ESDS, fixed RRDS, and fixed LDS file types do not use VX0. XRBA index values are +1 with 0 indicating not written yet. Negative values are KSDS pointers to inserted record structures. The user can override default path and name of VX0 file using VX0DSN= parm on DEFINE CLUSTER macro.**
3. **Alternate index NAME.VXN – KSDS alternate index files containing 8 byte RBA addresses plus alternate key field to each index entry in the VX0 primary index file. Any number of alternate keys can be defined with lengths and offsets up to 2 GB. The default UPGRADE mode for each alternate index can be changed either by UPGRADE parm on alternate index definition or by turning off all alternate index ugrades via use of DEFINE PATH with UPDATE=NOUPDATE option. The user can override the default path and name of VXN file using VXNDSN= parm on DEFINE ALTERNATEINDEX macro.**

5. References:

Visit the www.z390.org website VSAM Support page here for additional information and links to VSAM support references and examples:

z390_VSAM_Compatible_Assembler Support.htm