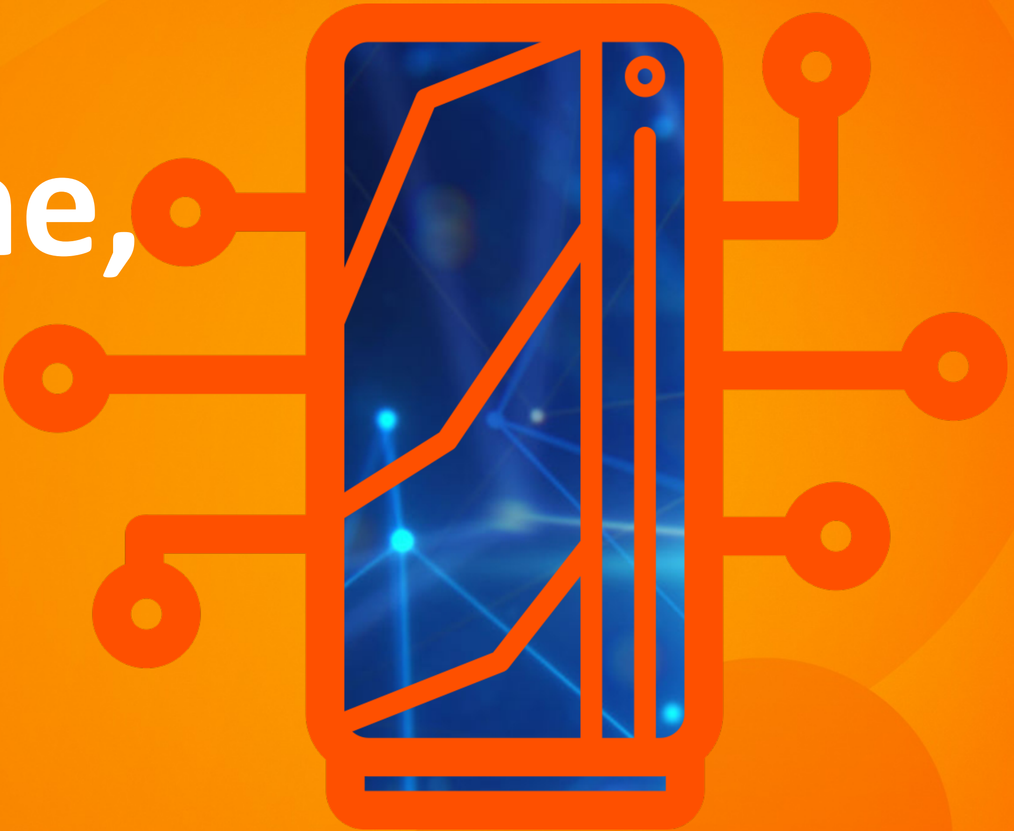
bmc AMI

Reached the IMS Database 4/8gig line, Now What?



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Agenda

Why is this an issue?

- Data Growth
- Skills shortage
- Understanding Database Space

Here are your alternatives

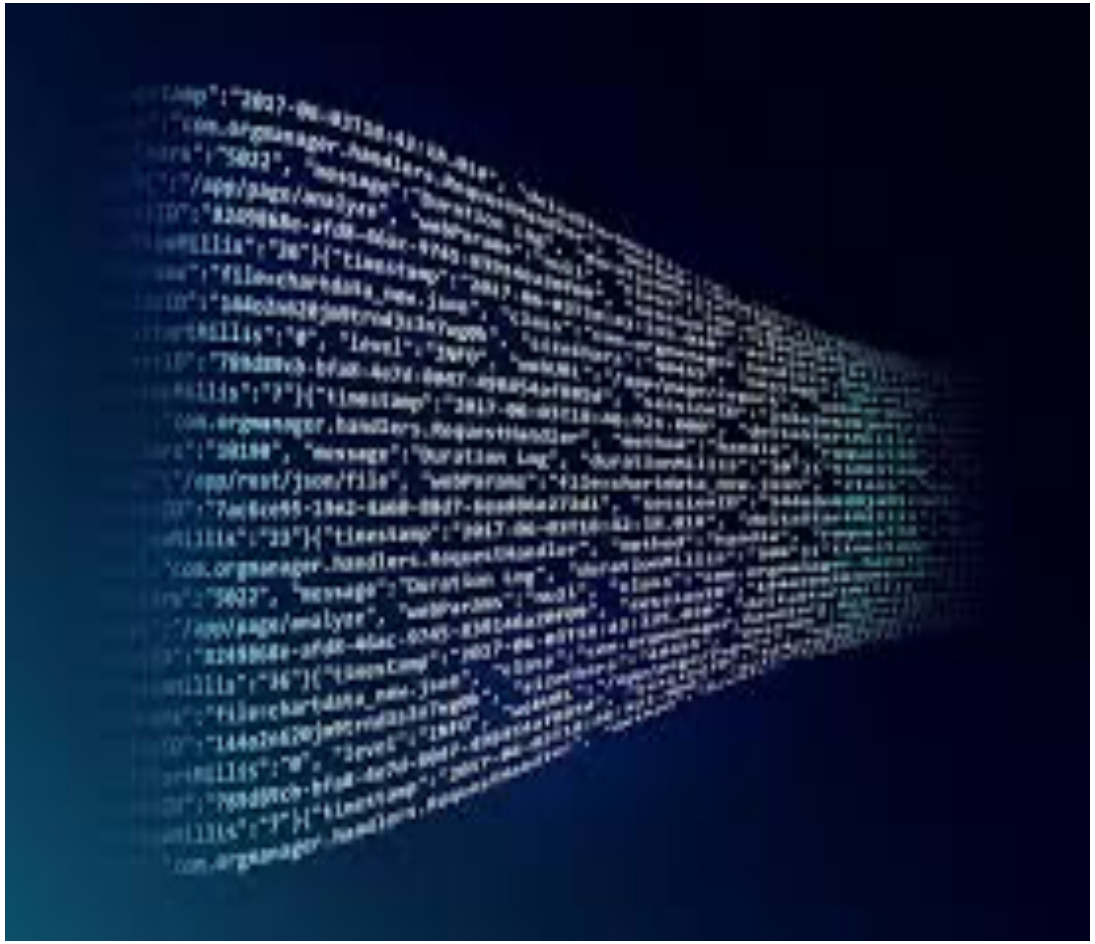
- Do nothing, well kind of
- HALDB - Config and migration
- Fast Path - Config and migration
- PDF - Config and migration
- Compression - Config and migration

Conclusion

SPACE

THE FINAL FRONTIER?

Data Generated in a Single Day



500 million tweets are sent

294 billion emails are sent

4 petabytes of data are created on Facebook

4 terabytes of data are created from each connected car

65 billion messages are sent on WhatsApp

5 billion searches are made

By 2025, it’s estimated that 463 exabytes of data will be created each day globally – that’s the equivalent of 212,765,957 DVDs per day!

Example of Data Growth Issues – Stimulus Checks

Several banks across the US reported trouble with online and mobile banking Wednesday -- the same day that coronavirus IRS stimulus checks are expected to hit bank accounts of those eligible.

Banks including Chase, Capital One, PNC Bank, US Bank and Navy Federal, as well as the app Cash App, have all reported outages or access issues on Twitter support pages or their websites. Web outage monitoring site Down Detector also shows a spike in outages for these and other online banking services.

Understanding IMS Database Space

A full-function database consists of one or more data sets. As IMS data increases in the data set, the free space in the data set decreases. When all the free space is used up, IMS applications cannot insert new segments or replace existing segments. To prevent this situation, you must take appropriate actions to mitigate the potential problems before they become significant issues.

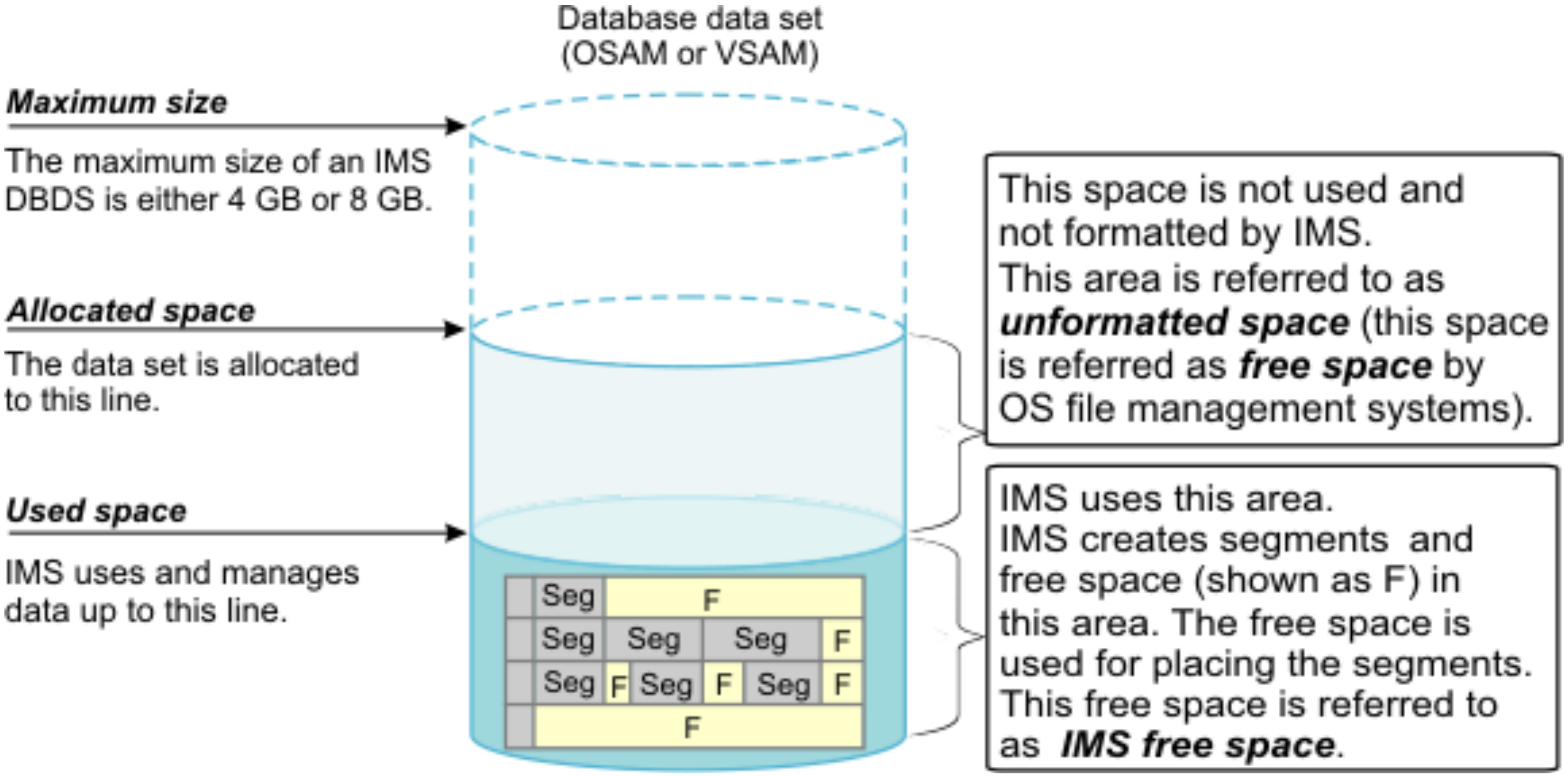
Out-of-space problems can be caused by one of the following three conditions:

- **Primary space is used up**
  - Primary allocation space is used up.
- **The data set is full**
  - Data set size has reached the maximum limit that is defined by IMS.
- **Extent resources are used up**
  - Data set cannot be expanded.

How IMS uses space in datasets

The following shows how IMS uses space in a full-function database data set.

VSAM = 4GB – OSAM=8GB



Maximum size

The maximum size of an IMS DBDS is either 4 GB or 8 GB.

Allocated space

The data set is allocated to this line.

Used space

IMS uses and manages data up to this line.

This space is not used and not formatted by IMS. This area is referred to as ***unformatted space*** (this space is referred as ***free space*** by OS file management systems).

IMS uses this area. IMS creates segments and free space (shown as F) in this area. The free space is used for placing the segments. This free space is referred to as ***IMS free space***.

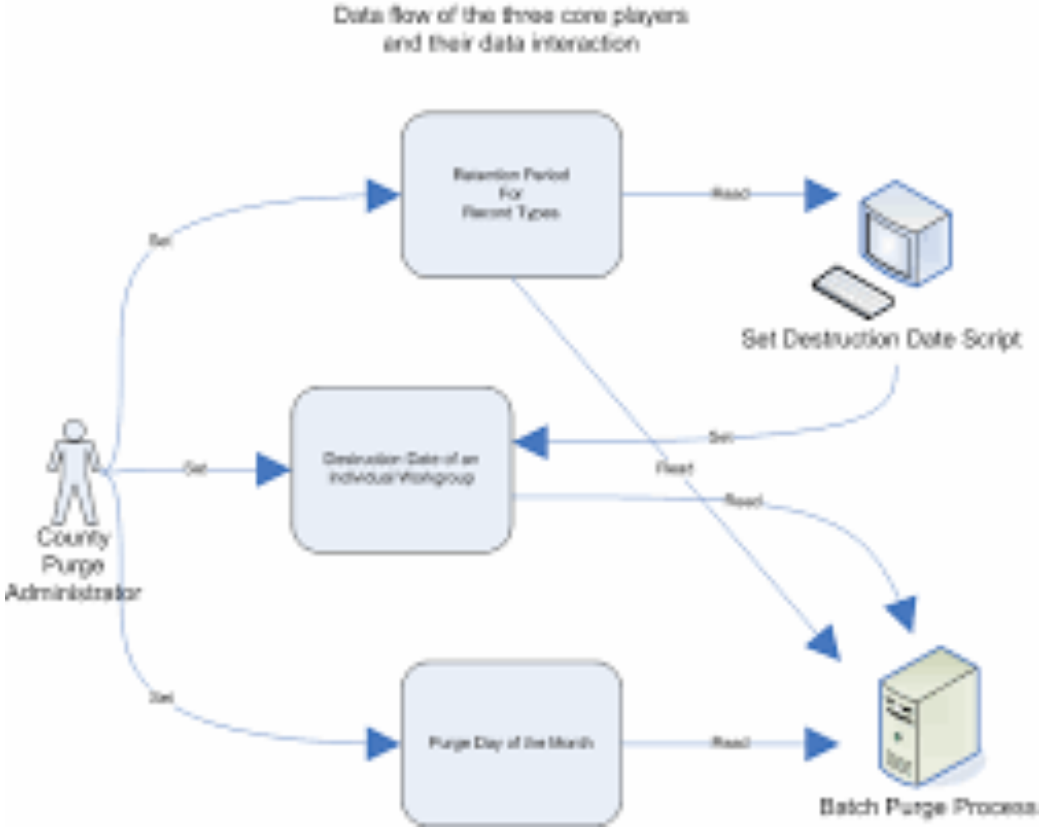
What are the alternatives

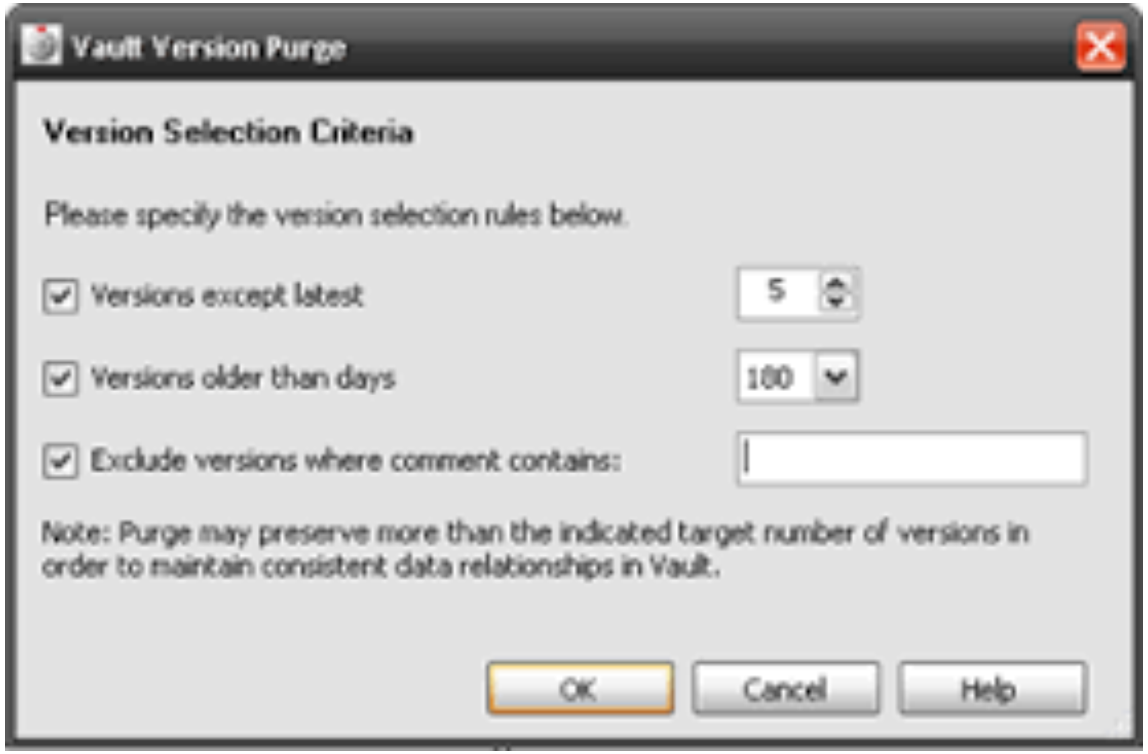
Do nothing, HALDB, Fast Path, PDF or compression?

Do nothing?

Do nothing?

Archive / Delete records





Version Selection Criteria

Please specify the version selection rules below.

☑ Versions except latest 5

☑ Versions older than days 180

☑ Exclude versions where comment contains:

Note: Purge may preserve more than the indicated target number of versions in order to maintain consistent data relationships in Vault.

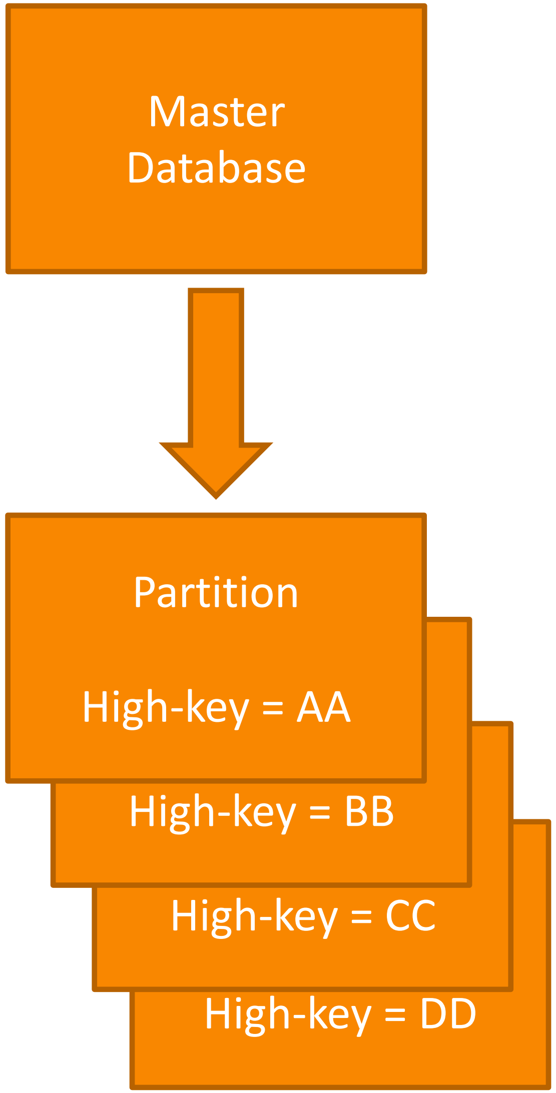
HALDB

Partitioning Options

HALDB

- Introduced in IMS v7 - August 1997
- Supports up to 1001+ partitions
  - Up to 10 Datasets (max 10,010)
  - 4+ Terabyte (@10 DSGs 40+ Terabyte)
- Partition size max of 4 GB for VSAM and 8 GB for OSAM
  - OLR does not support OSAM 8 GB
  - BMC Online Reorg Supports Both 4/8 GB
- Requires DBRC

Basic Design



DBD NAME=MYDB,…

DATASET …

SEGMENT NAME=SEG1,…

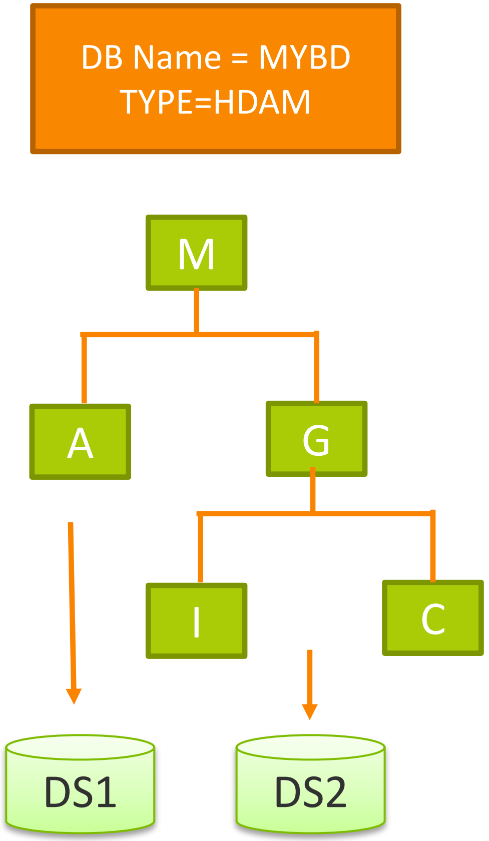
FIELD NAME=FIELD1,…

FIELD NAME=FIELD1,…

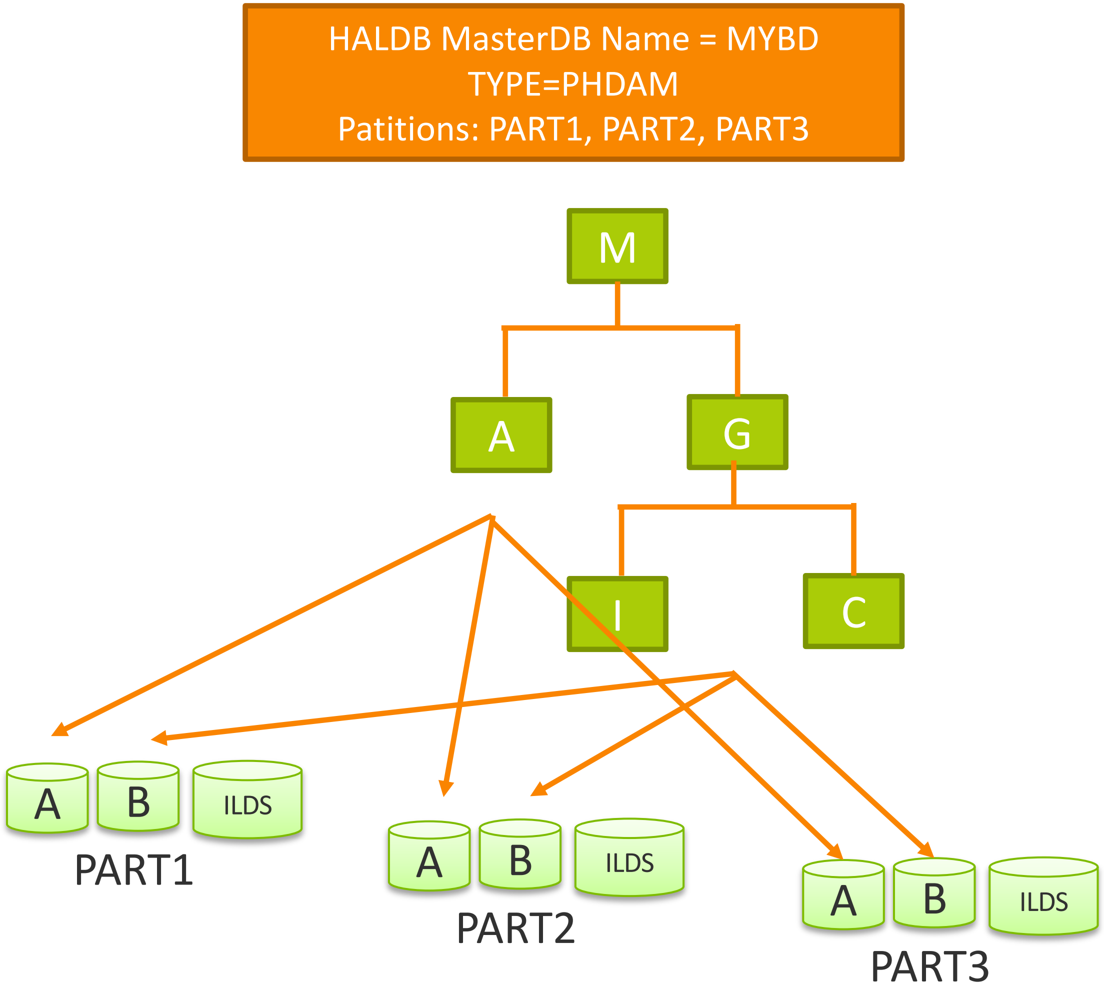
DATESET(s)

Attributes set by PDU utility stored in Recon

Basic Design



DB Name = MYBD
TYPE=HDAM



HALDB MasterDB Name = MYBD
TYPE=PHDAM
Patitions: PART1, PART2, PART3

HALDB Migration Process

1. Use a HALDB Migration Tool
2. Unload the full function database.
3. Save DBRC information for the full function database.
4. Delete full function database information.
5. Define the HALDB information to the RECON.
6. Initialize the partitions.
7. Load the HALDB.
8. Image copy the partitions.

Note: All logically related databases and their secondary indexes must be migrated to HALDB at the same time!

Also assumes that the database name remains the same.

HALDB Migration Tool

- Analyzes Full Function Databases
- Helps decide partition high keys based on either
  - Number of desired partitions
  - Desired size of each partition
  - Count of records
  - Subset of root key
- Capability to merge multiple datasets
- Can factor in a user specified growth percentage
- Generates DBRC statements for HALDB definition
- Generates IDCAMs statements for HALDB partitions
- GUI-based workflow

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HALDB – What changes to expect

Database size grows after converting to HALDB – especially for secondary indexes

- Pointers grow from 4 to 28 bytes (EPS)
- RKSIZE keyword adds the root key to each secondary index record
- SX fields grow from 4 to 8 bytes
- ILK (8 bytes) assigned to each segment

Primary Index database is substituted by a dataset (one for each partition)

New dataset (Indirect List Dataset) (one for each partition)

Things not available in the HALDB world

- Shared secondary indexes
- Non unique keys
- Symbolic pointers
- Virtual logical relationships

HALDB – Pro’s and Con’s

Pro’s

- Storage capacity in increased dramatically
- Availability of the database can be held to only a single partition.
- Secondary index databases with direct pointers do not have to be rebuilt when their indexed databases are reorganized.
- Logical relationships can update pointers in related databases when a database is reorganized.
- Reorganization of a single partition to increase the size of a database.
- Will be required for the **IMS Catalog**

- **Con’s**
  - Requires application resources to implement apps changes
  - HALDB requires DBRC in every IMS environment
  - HALDB does not support Root only HISAM or SHISAM databases
  - HALDB primary index (PSINDEX) and ILDS must be non-recoverable and cannot be image copied by IMS.
  - HALDB does not update secondary indexes during reload.

Fast Path

Partitioning Options

Fast path - Term used in computer science to describe a path with shorter instruction path length through a program compared to the 'normal' path.

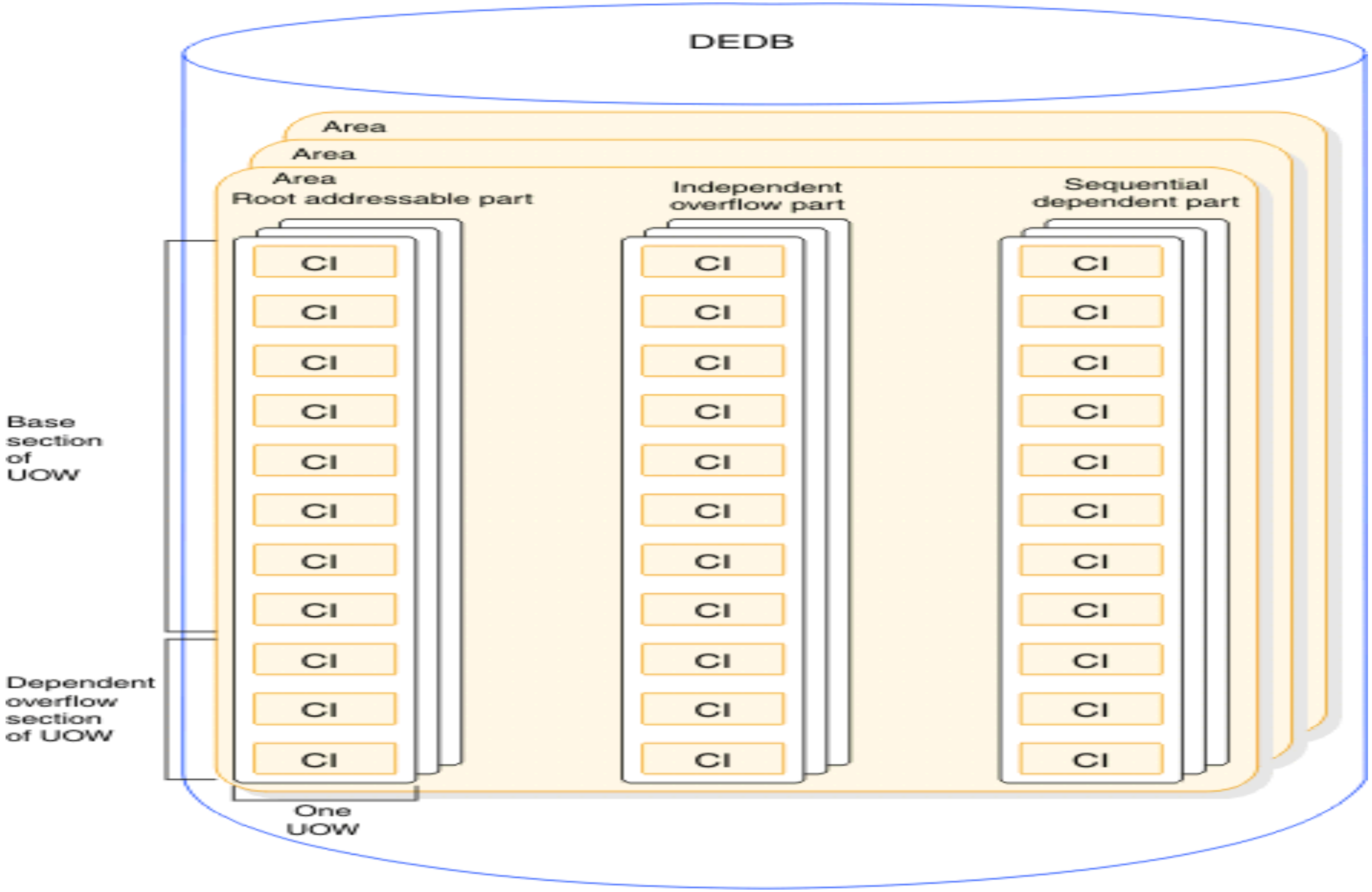
- Introduced in IMS 1.1.4 GA 1977
- Supports 2048 areas 8+ Terabyte
  - Soon to be 9999 areas ~40 Terabyte
- Area size max of 4 gig
- DBRC not required, but RECOMMENDED
- Support full online reorganization with concurrent update capability. No outage is required unless you are doing restructuring. DEDBs were designed with online reorganization in mind.

DEDBs Achieve High Performance

The performance-related aspects of DEDB are these:

- Path length
- I/O elimination and parallelism
- Sequential dependent segments (SDEPs)
- High-speed sequential processing(HSSP)
- Subset pointers
- Virtual Storage option (VSO)
- Main Storage Databases
- Expedited Message Handler
- DEDB Areas / Randomizer
- Log reduction

Parts of a DEDB area in storage


DEDB
Area
Area
Area
Root addressable part
Independent overflow part
Sequential dependent part
CI
Base section of UOW
Dependent overflow section of UOW
One UOW

Designing a DEDB

1. Calculating the Average Database Record Length
2. Picking a CI Size
3. Picking a Unit of Work Size
4. Designing an Area
5. Defining Your DEDB to DBRC
6. Initializing a DEDB
7. Your DEDB is now ready for you to add the data. You do not need a load mode PSB to add data to a DEDB.

When to Use HALDB/FF Databases vs DEDBs

- Logical Relationships and Secondary Indexes
- Roots in Key Sequence
- Fast Path Database Buffer Pool Saturation
- Short Database Records

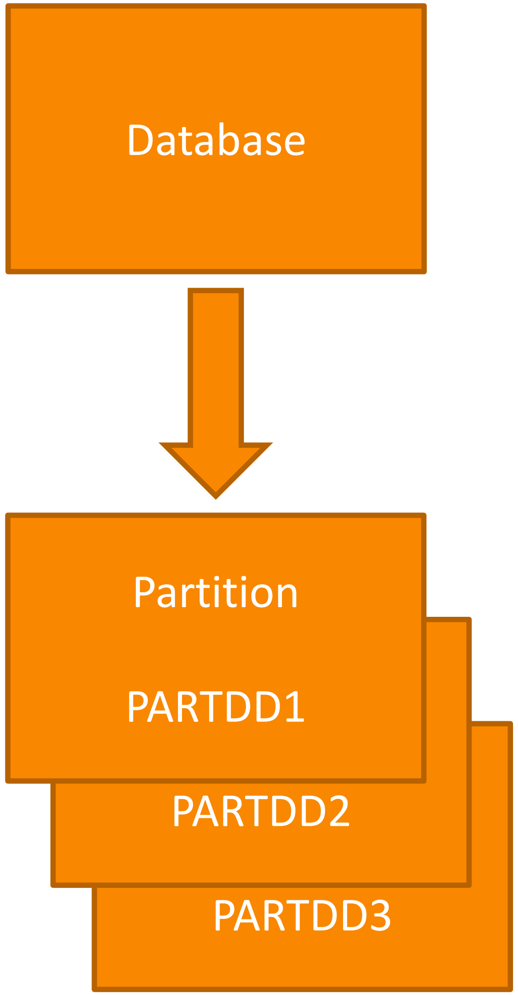
Partitioning Option

Partitioning Options

Partitioned Database Facility for IMS (PDF)

- Delivered to market in 1997
  - IMS/ESA® Partition Support Product (PDB)
    - created by Neon
- Supports 127 partitions 1+ Terabyte
- Includes support for HISAM, SHISAM and OSAM 8GB
- DBRC not required
- Minimal to NO application change

Basic Design



DBD
NAME=PARTDBD,ACCESS=HIDAM,

PARTDBD PSNAME=PDFPSEL

PART DD1=PARTDD1,....

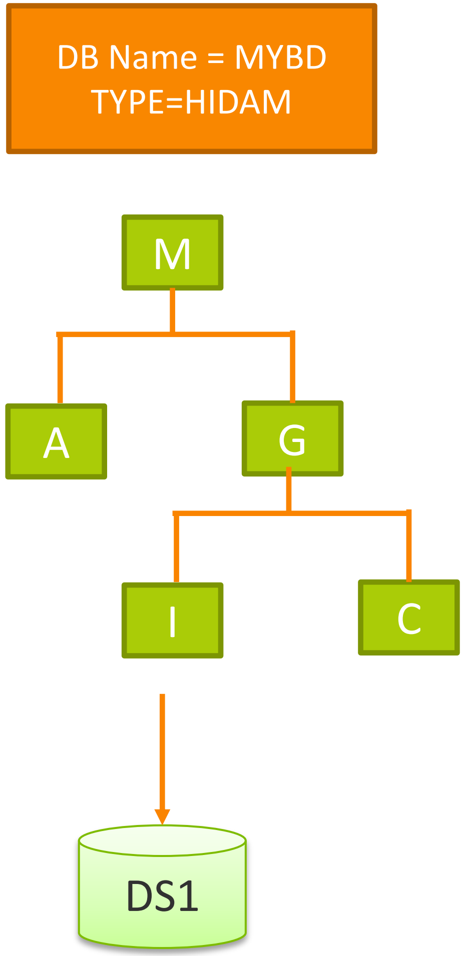
PART DD1=PARTDD2....

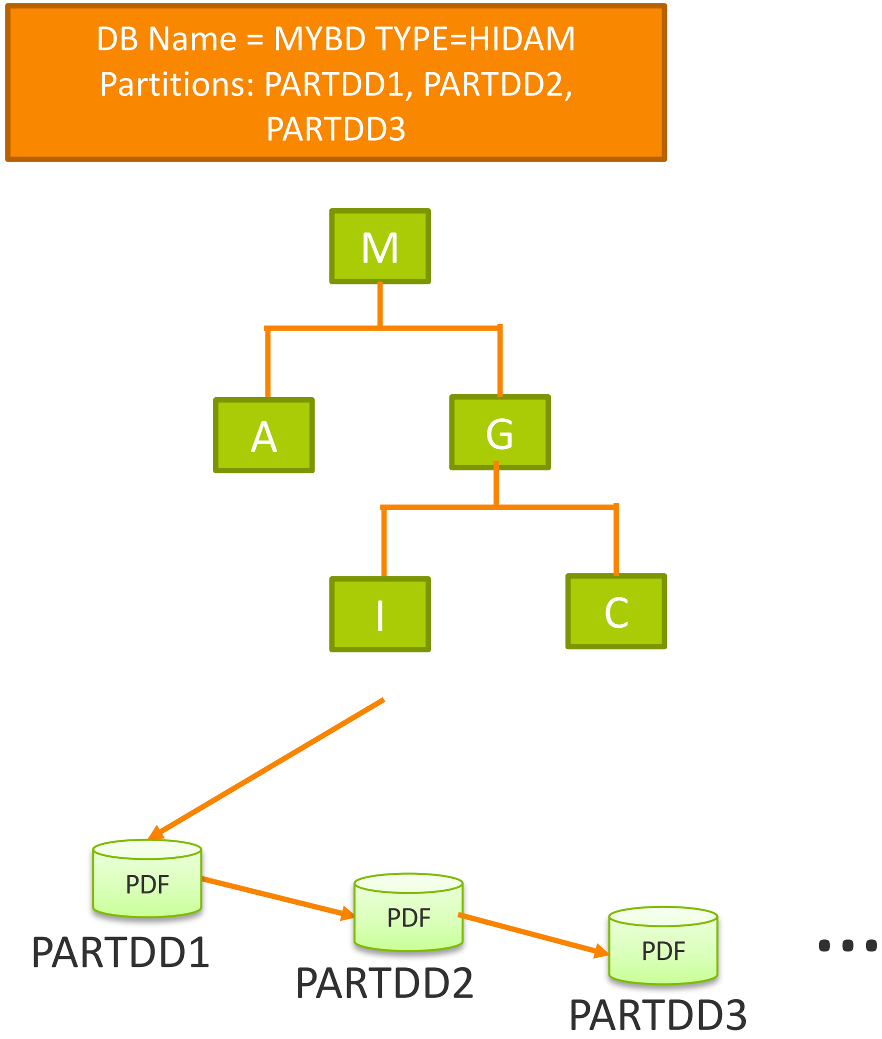
PART DD1=PARTDD3,...

DATESET(s)

Attributes set by Part Selection Routine (PSR), register in the Recon

Basic Design




DB Name = MYBD TYPE=HIDAM Partitions: PARTDD1, PARTDD2, PARTDD3
M
A
G
I
C
PDF
PARTDD1
PDF
PARTDD2
PDF
PARTDD3
…

PDF Migration

1. Unload database (a single HD unload file)
2. Add PART statement(s) to DBD
3. Run DBD and ACB GENs for new DBD
4. Notify DBRC (optional)
5. Update MDALIB
6. Load partitioned database
7. Build secondary index(es)
8. Image Copy database
9. Alter any JCL

PDF Partitioning Pro’s / Con’s

- Significantly expands database size by distributing records across multiple partitions
- Transparent to applications and PSBs
- No performance hit; can improve performance
  - Reduced contention
  - Improves utility performance due to parallelism
  - Allows for parallel batch processes
- May improve database manageability and recoverability
- Supports partitioning of indexes as well

PDF Summary

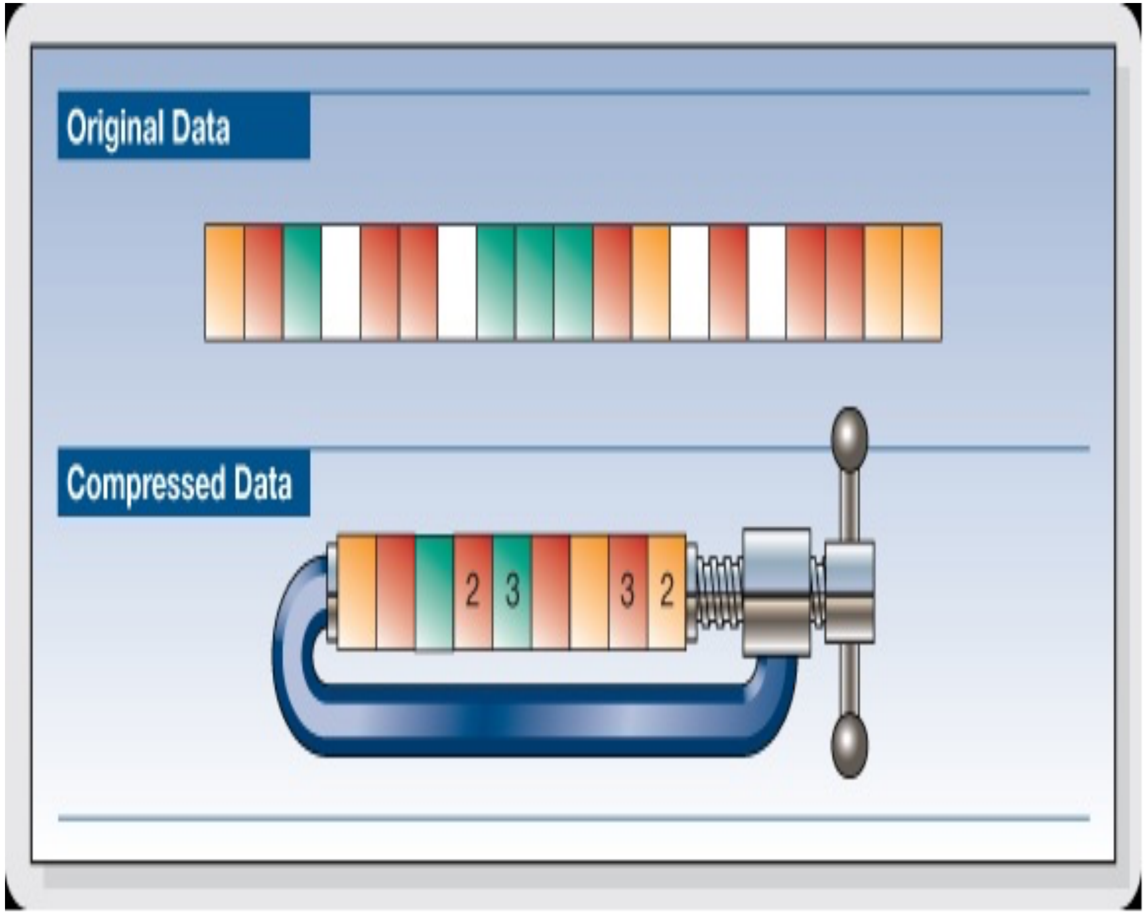
Simple, straightforward solution that minimizes complexity, risks, and costs

- Business as usual
  - Program testing environment and processes are unchanged
  - Operationally consistent – little or no change to production procedures
- Minimal learning curve
- Installs quickly
  - Nominal effort to migrate
    - Implements in as little as a week
    - No application changes
    - No PSB changes
- Testing process for applications is unchanged

Database Compression

Why use compression?

- Less DASD space, image copy and IMS Log volume used
- Better buffer hit ratios for online transactions
- Improved performance during utility execution
- Minimal to NO application change



Data Packer/IMS Features

8 Compression Techniques

IMS Space Management

- MSL – Minimum Segment Length
- FPS – Fixed Pad Size
- FSS – Free Space Segment Size

Trial Utility

DPK DBD implementation

Full Function example

- SEGM NAME=ROOT,BYTES=500,PARENT=0, COMPRTN=(DPIEXIT,DATA,INIT)
- DPIEXIT - is the compression routine used for Full Function Databases

Fast Path example

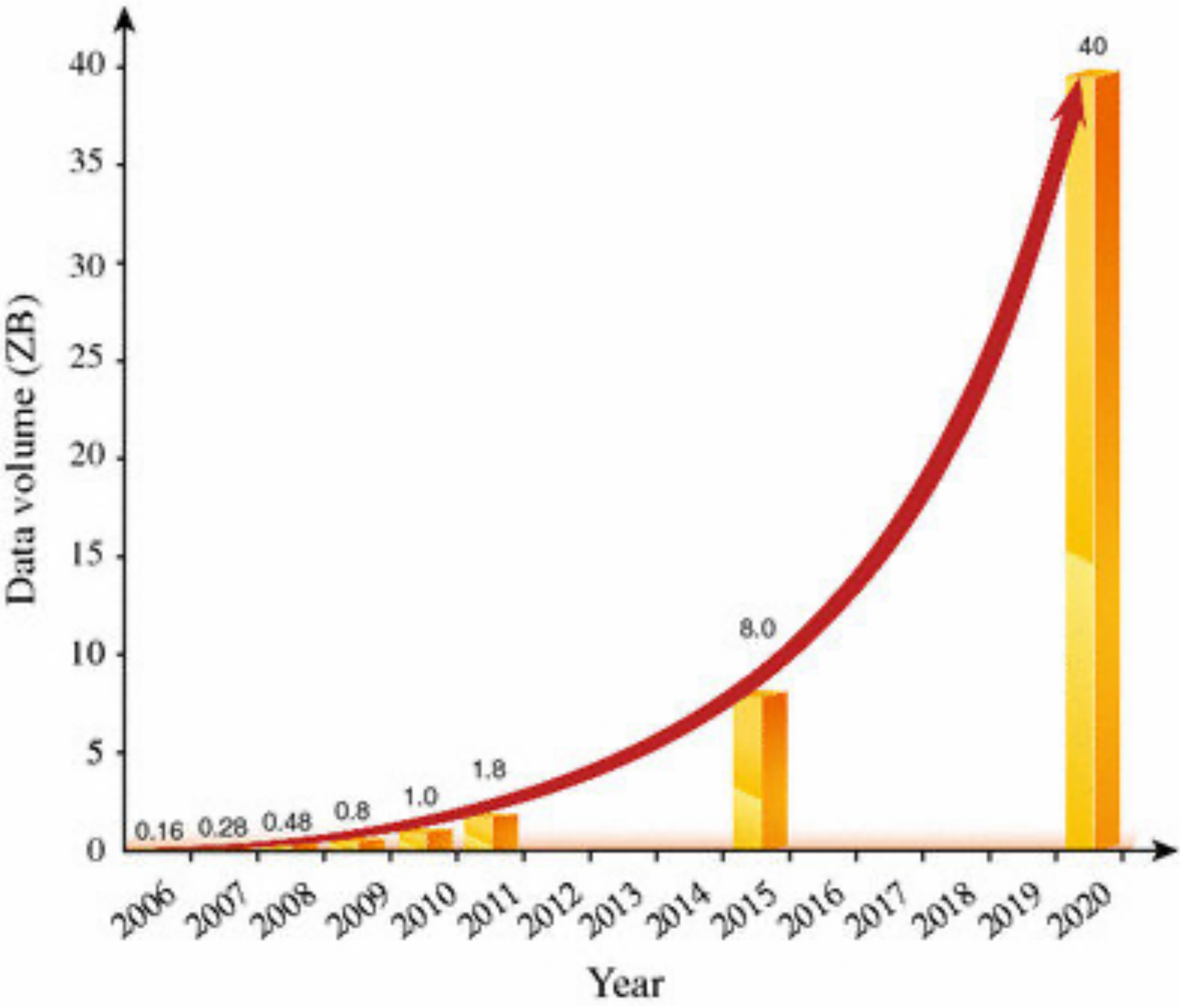
- SEGM NAME=ROOT2,BYTES=500,PARENT=0, COMPRTN=(DPIFPRTN,DATA,INIT)
- DPIFPRTN - is the compression routine used for Fast Path Databases.

- DATA - is used to compress the data in the segment.
  - KEY - can be used if you want to compress the key also (not recommended)
  - IMS does not allow key compression for Fast Path databases.
- INIT - IMS will call the compression routine when the database is opened.

Data Packer/IMS Benefits

- Extensive data integrity checks
  - Will NOT double compress
- Plain-text tolerance
  - Tolerates non-compressed data
  - Segment inserted ASIS
- Easily administered
  - No registration required; can use all Product defaults
  - 2 ways to for administrative tasks: ISPF and Batch JCL

Which way to go?

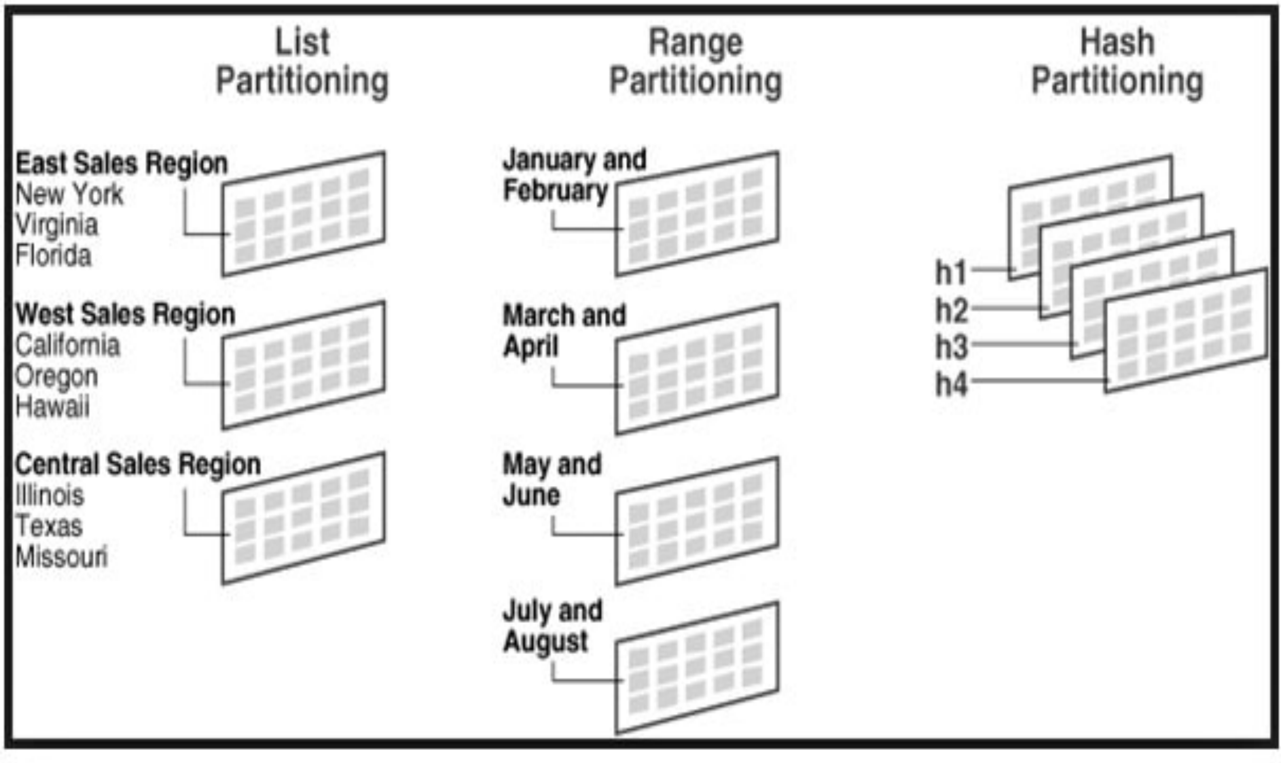


- Do nothing
- HALDB
- Fast Path
- PDF
- Compression

Depends on amount of time and resources available

Conclusion

Huge amount of data available to applications



Reference materials

- The Complete IMS HALDB Guide
    - https://www.redbooks.ibm.com/redbooks/pdfs/sg246945.pdf
- IMS Fast Path Solutions Guide
    - https://docuri.com/download/fast-path-db_59c1d0c0f581710b28647b8c_pdf
- BMC Partitioned Database Facility
    - https://docs.bmc.com/docs/partitioneddatabasefacilityims/home-669653019.html
- BMC Data Packer for IMS
    - https://docs.bmc.com/docs/dpackerims/31/overview-783036919.html
- IMS Primer
    - https://www.redbooks.ibm.com/redbooks/pdfs/sg245352.pdf
- Best Practices for HALDB – Peter Armstrong (2010)
    - Contact nick_griffin@bmc.com for a copy.

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