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IMS Tools Reorg Solution

High Performance Reorganization

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Abstract

This session will focus on how the IMS Parallel Reorganization (IPR) product integrates IBM High Performance Database Tools to improve administrative productivity for reorganization of IMS full-function databases.

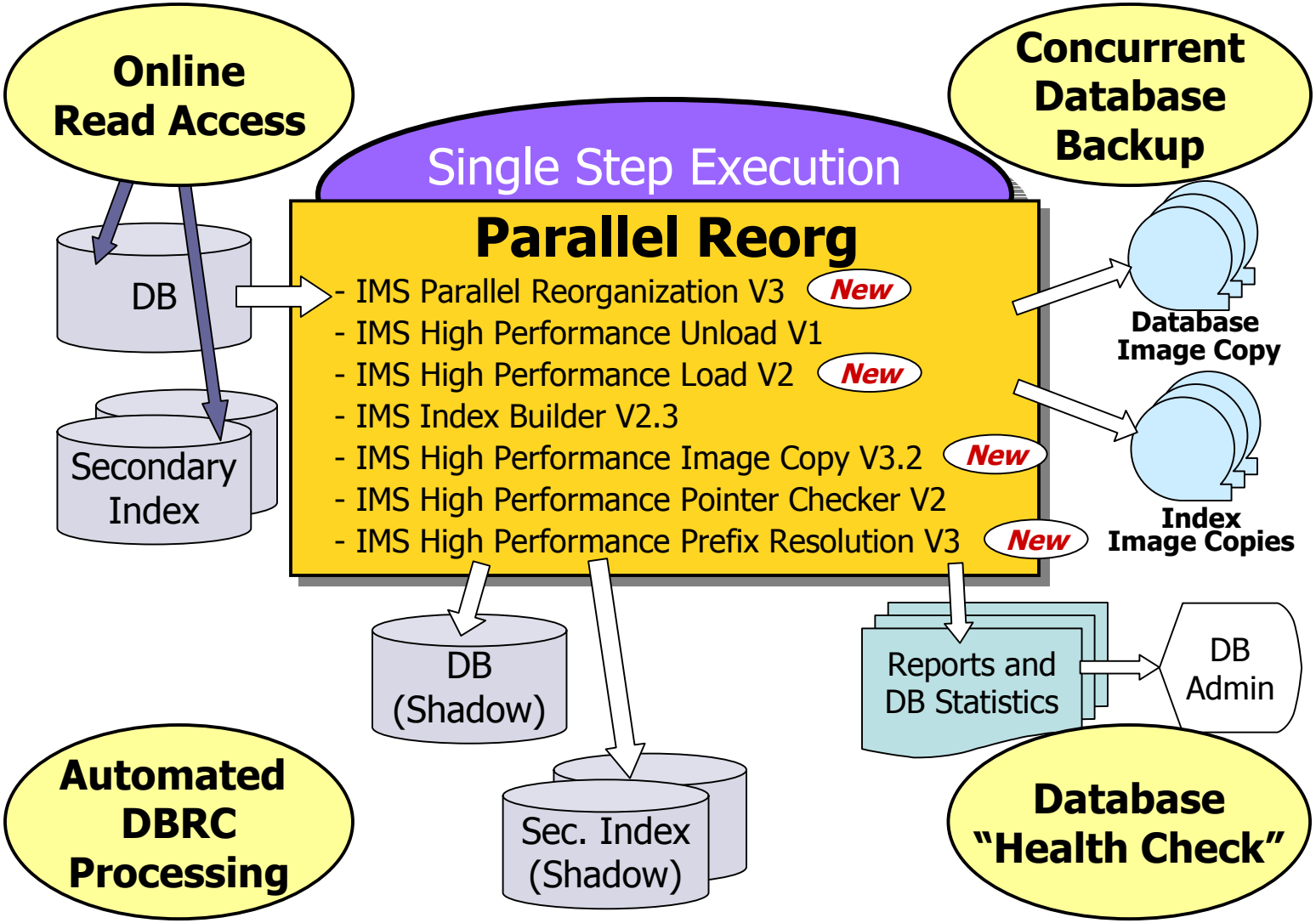
Reorganization is necessary to improve physical space utilization or to change the database structure. IMS High Performance Tools help improve the speed of numerous management tasks required for reorganization and IPR provides the infrastructure to operate some of these tools concurrently and to complete most of the reorganization tasks in a single job step.

The session will also cover the recent functional enhancements and performance improvements of these tools.

Agenda

- Introducing IMS Parallel Reorg (IPR) V3
- IPR Driver and High Performance Reorg Tools
  - Overview of Database Reorganization Process
  - How IPR Driver V3 makes reorganization easier
  - IMS High Performance Reorganization Tools
    - Performance Improvements
- Summary

IMS Parallel Reorganization V3



Purposes of DB Reorganization

- **Reorganization is necessary**
  - To change physical storage
    - Database becomes physically disorganized due to insert/delete processing and high update activity
  - To change database structure
- **Reorganization process includes**
  - Reclaiming and consolidating free space
  - Optimizing the grouping of the root segment and its dependent segments
  - Updating the indexes with the new locations of the target segments
  - Updating the segment prefixes with the new location of the logically related segments (for non-HALDB)

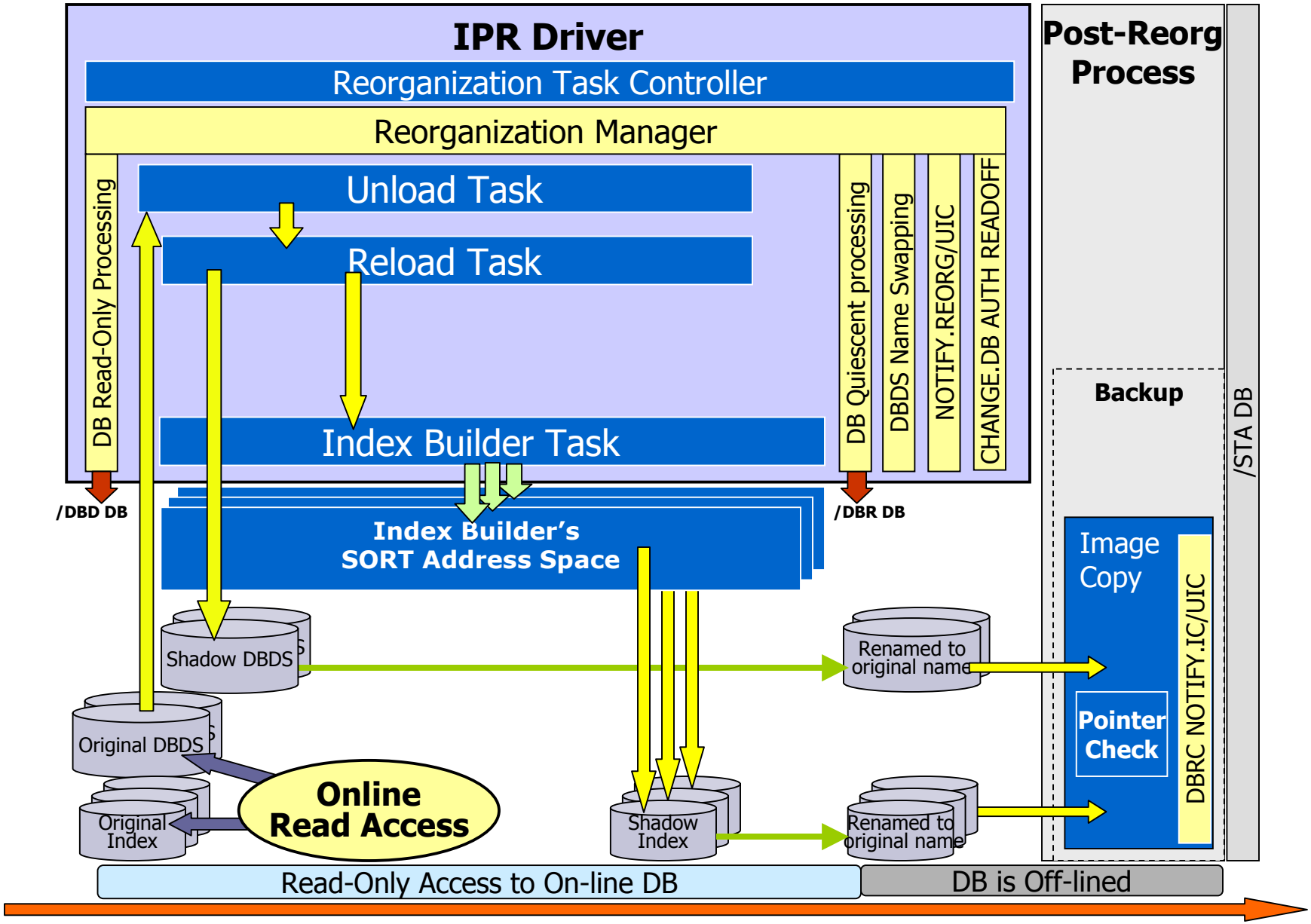
Tasks for DB Reorganization

- **Periodic DB "Health Check"**
  - Monitoring how well the DB data sets are organized
  - Checking the integrity of the DB
- **Pre-reorganization Process**
  - Making the DB off-line (/DBR DATABASE)
  - Taking "before" image copies
  - Running IMS Pre-Reorg utility (only for logically related non-HALDBs)
- **Data Set Reorganization Process**
  - Unloading and reloading DB segments in hierarchical order
  - Reorganizing or rebuilding secondary indexes for the reloaded DB
  - Notifying DBRC of the reorganization (NOTIFY.REORG)
- **Post-reorganization Process**
  - Reorganizing or scanning other logically related DBs (for non-HALDB that has external logical relationship)
  - Prefix resolution/update (for non-HALDB)
  - Taking "after" image copies
  - Checking the integrity of the reorganized DB (using Pointer Checker)
  - Notifying DBRC of the image copies (NOTIFY.IC)

IPR Driver Version 2

- Has implemented the Single Step Execution of the following processes:
  - **Making the Database Read-Only**
    - Issuing the IMS /DBD DB command
  - **Reorganizing Database Data Sets**
    - Running unload, reload, and index-builder concurrently
    - Reorganizing into “shadow” data sets
  - **Stopping the Database**
    - Issuing the IMS /DBR DB command
  - **Performing Post-Reorganization Process**
    - Swapping original and “shadow” data sets
    - Notifying DBRC of the reorganization completion

IPR Driver Version 2



IPR Driver Version 3

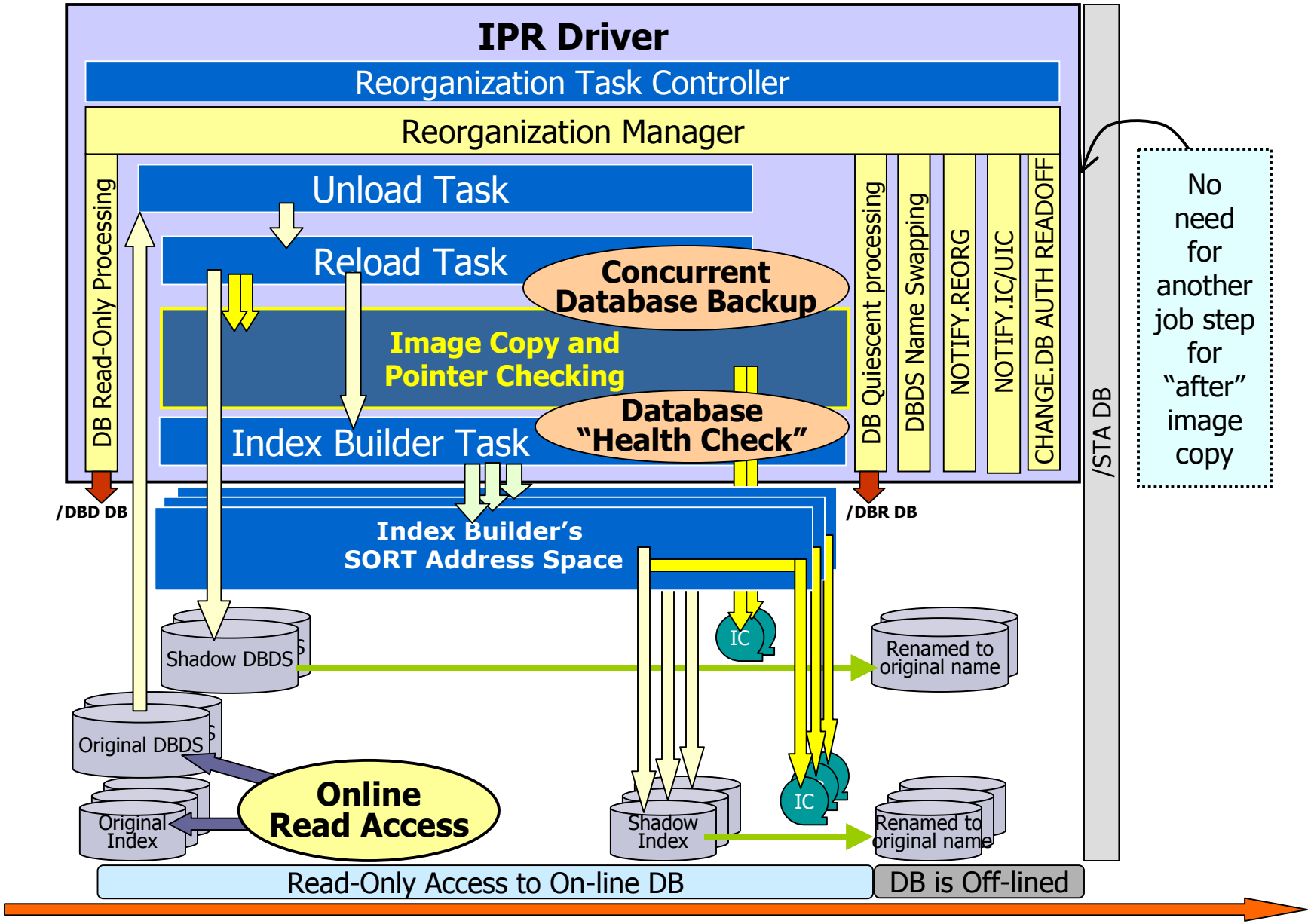
- Extends IPR Driver V2 functionality to support:
  - Concurrent execution of image copy with HASH pointer checking while reloading database and building secondary indexes

    → **Type-A Image Copy**
    (Concurrent Database Backup and "Health Check")
  - Prefix resolution/update and image copy of a database that has internal logical relationship

    → **Concurrent Prefix Update**

    → **Type-B Image Copy**
  - DBRC Notification of the image copies

IPR Driver V3 Type-A Image Copy



Simple JCL Statements

```
//IPR      EXEC PGM=HPSGMAIN,PARM='DBD=YOURDBD,DBRC=Y'
//STEPLIB  DD DISP=SHR,DSN=IBM.IMSTOOLS.LIBRARY
//         DD DISP=SHR,DSN=IMS.SDFSRESL
//IMS      DD DISP=SHR,DSN=IMS.DBDLIB
//IMSDALIB DD DISP=SHR,DSN=IMS.MDALIB
//HPSIN    DD *
(REORG)
  IC=YES
* ICTYPE=B
  INDEXBLD=YES
  NAMESWAP=YES
  PREFIXRES=YES
  DELOLDDS=YES
/*
//ICEIN    DD *
  GLOBAL   HDPC=(Y,HISTORY),ICHLQ=IMSICA
/*
//HISTORY  DD DISP=SHR,DSN=HDPC.HISTORY
```

JCL DD Statements

- **STEPLIB**
  - Specifies IMS RESLIB, IMS Tools Libraries, and user routine libraries
  - Must be APF-authorized
- **IMS**
  - Specifies the DBD library
- **IMSDALIB** (optional)
  - Specifies the dynamic allocation member library
- **HISTORY** (optional)
  - Specifies a HISTORY data set used by **IMS High Performance Pointer Checker (HPPC)**
  - Must be coded if IC=YES and HDPC=(Y,HISTORY)

Dynamic Allocation

- Input database data sets can be allocated dynamically
- Shadow data sets can be allocated dynamically
  - Note: Spaces must be allocated in a preceding job step
- All SYSOUT streams for reports and statistics can be allocated dynamically
  - You do not need to know the DD names for various utility outputs
  - Some reports can be controlled by control statements

Control Statements

- **HPSIN** – The main control statement inputs

```
//HPSIN    DD *
(REORG)
  IC=YES
* ICTYPE=B
  INDEXBLD=YES
  NAMESWAP=YES
  PREFIXRES=YES
  DELOLDDS=YES
/*
```

- **ICEIN** – Specifies control statements for IMS High Performance Image Copy (HPIC) if IC=YES

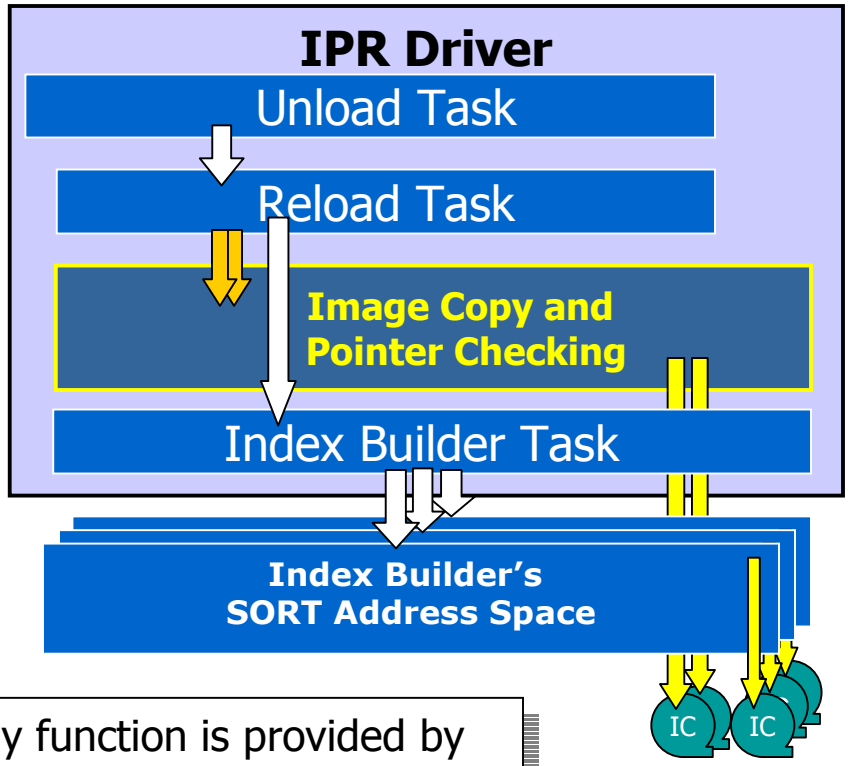
```
//ICEIN    DD *
  GLOBAL   ICHLQ=IMSICA
/*
```

REORG Options

- New statements:
  - **IC=YES and ICTYPE=A or B**
    - Runs IMS High Performance Image Copy with optional HASH pointer checking
  - **PREFIXRES=YES**
    - Updates segment prefixes of a database that has internal logical relationships
  - **DELOLDDS=YES**
    - Deletes input original database data sets at a successful completion of reorg
- Enhanced statement:
  - **PARTITION=(*partname*,*n*)**
    - *n* consecutive HALDB partitions can be reorganized

Concurrent Database Backup

- If **IC=YES** and the DB has no logical relationship, you can take image copies while reloading DB and building secondary indexes (**Type-A Image Copy**)
- Each index data set and its image copy are created in an Index Builder's SORT address space



• Type-A Image Copy function is provided by **IMS High Performance Image Copy V3.2**

ICEIN Control Statements

- Are the same as those used for standalone High Performance Image Copy (HPIC)
- But, you do not need to specify an IC or AIC control statement for each DBD
  - It is built internally
- Just code the GLOBAL statement
- Or, use the site default table FABJGLB0 of HPIC

ICEIN Control Statements…

- ICEIN for IPR Driver

```
//ICEIN    DD *
  GLOBAL ICHLQ=IMSICA
/*
```

- ICEIN for standalone HPIC (some typical examples):

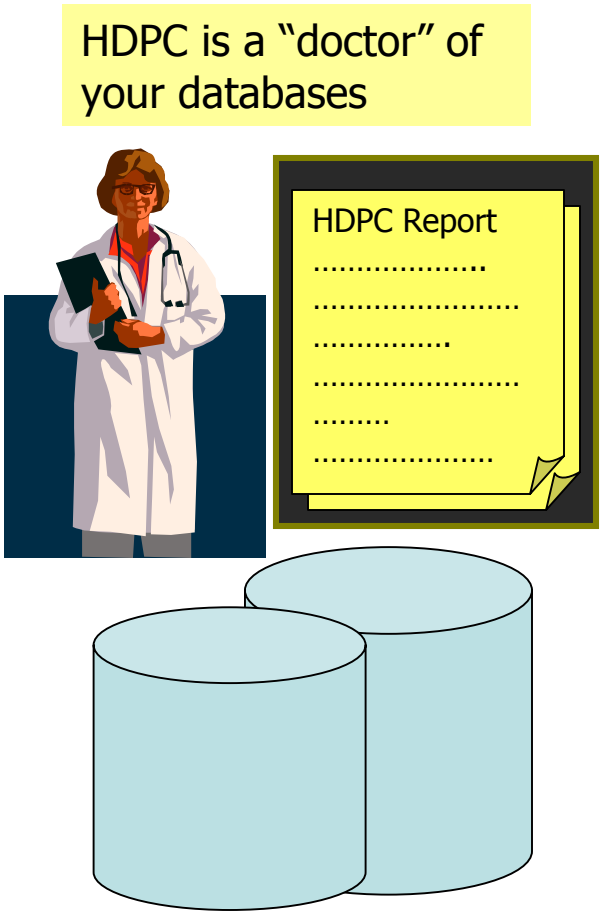
```
//ICEIN    DD *
  GLOBAL ICHLQ=IMSICA
  AIC    DBD=CUSTOMDB,ICOUT=*
  AIC    DBD=CUSTPIDX,DDN=CUSTPXDS,ICOUT=*
  AIC    DBD=CUSTIDX1,DDN=CUSTXDS1,ICOUT=*
    :
    :
  AIC    DBD=CUSTIDXn,DDN=CUSTXDSn,ICOUT=*
/*
```

Or, if an appropriate CA group is defined,

```
//ICEIN    DD *
  GLOBAL ICHLQ=IMSICA
  GROUP  CAGRP=GRP1,FUNC=AIC,ICOUT=*
/*
```

HASH Pointer Checking

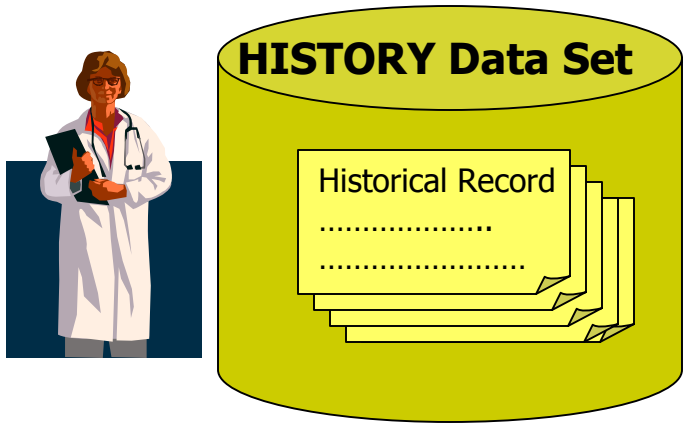
- Is activated automatically if IC=YES and HPPC is installed
- Is the fast pointer-checking capability provided by **HD Pointer Checker (HDPC)** of **IMS High Performance Pointer Checker (HPPC) V2**
- Produces many statistics reports
  - The reports provide a detailed description of the condition of the reorganized database



HISTORY Data Set

- **HISTORY Data Set:** is a repository of the result of an HDPC run
  - Results are stored as historical records
  - Records are stored if `HDPC=(Y,HISTORY)`
  - `//HISTORY DD` specifies the HISTORY data set

- Historical records can be printed by **Historical Data Analyzer** of HPPC



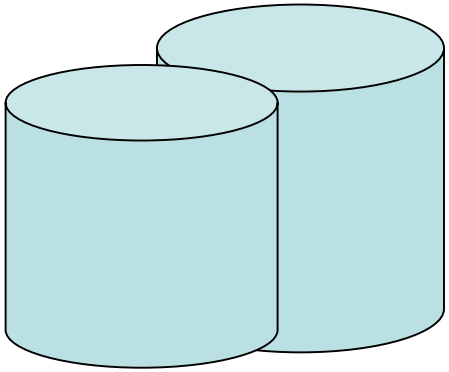


Image Copy of Indexes

- If image copies of indexes are not necessary, select one of two options:
  - Virtual Image Copy (VIC)
  - HDPC=O
- **VIC**
  - HASH check can be done unless HDPC=N is specified
  - Dummy ICDSN specified by the VICDSN parameter is notified to DBRC as UIC
- **HDPC=O**
  - HASH check is done
  - DBRC notification is not done

VIC

```
//ICEIN  DD *
  GLOBAL ICHLQ=IMSICA,
         VIC=Y,VICDSN=IPR
/*
```

HDPC=O

```
//ICEIN  DD *
  GLOBAL ICHLQ=IMSICA,
         HDPC=O
/*
```

• These functions are provided by **IMS High Performance Image Copy**

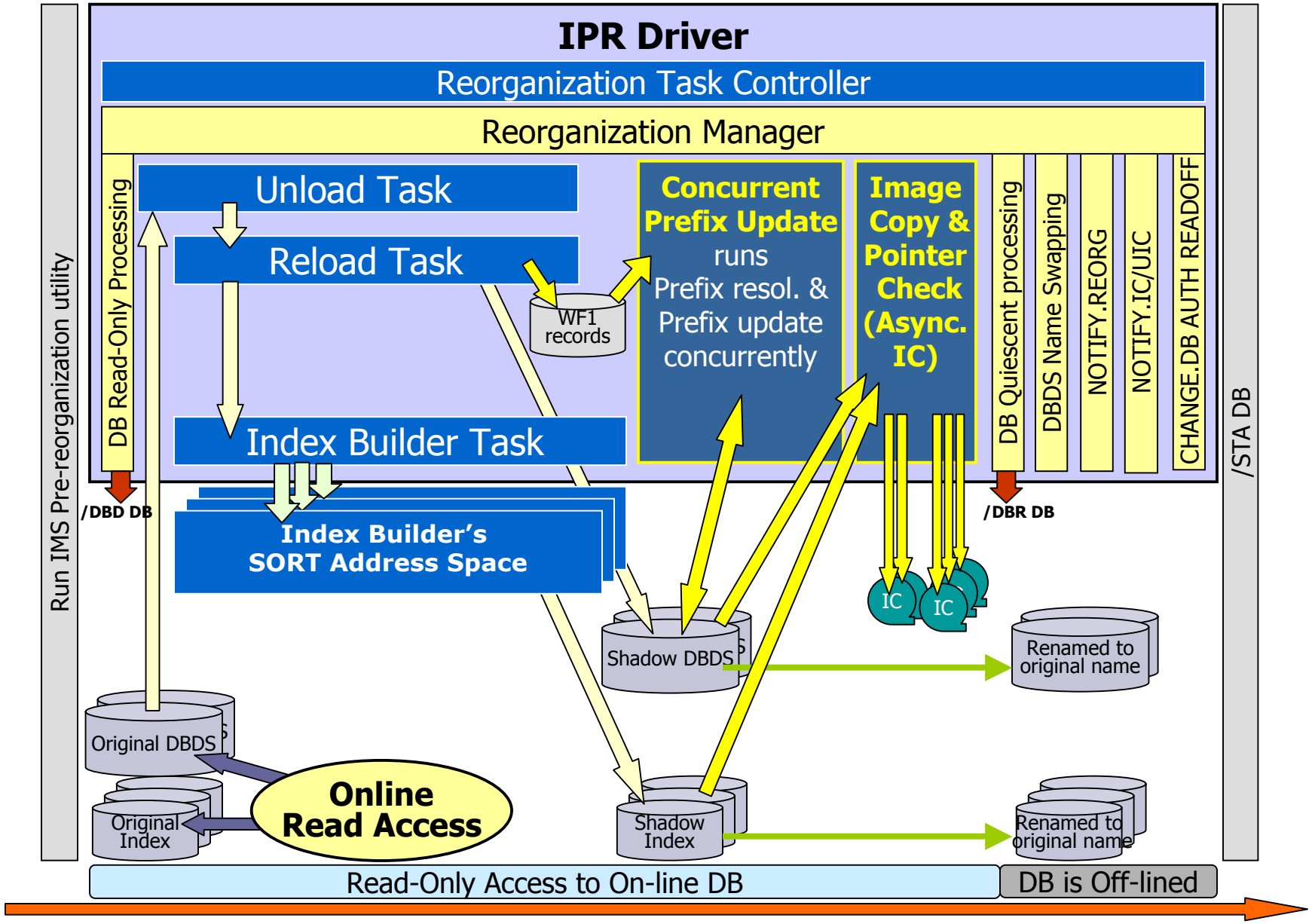
Image Copy Stacking

- Stacked image copy is not supported in Type-A Image Copy
- Run a **Create-Image-Copy (CRC)** job with the STACK option to create a stacked image copy or copies from the image copies created in Type-A Image Copy
  - The CRC function and the stacked image copy function are provided by IMS High Performance Image Copy
- Or, use **Type-B Image Copy** with the STACK option

Type-B Image Copy

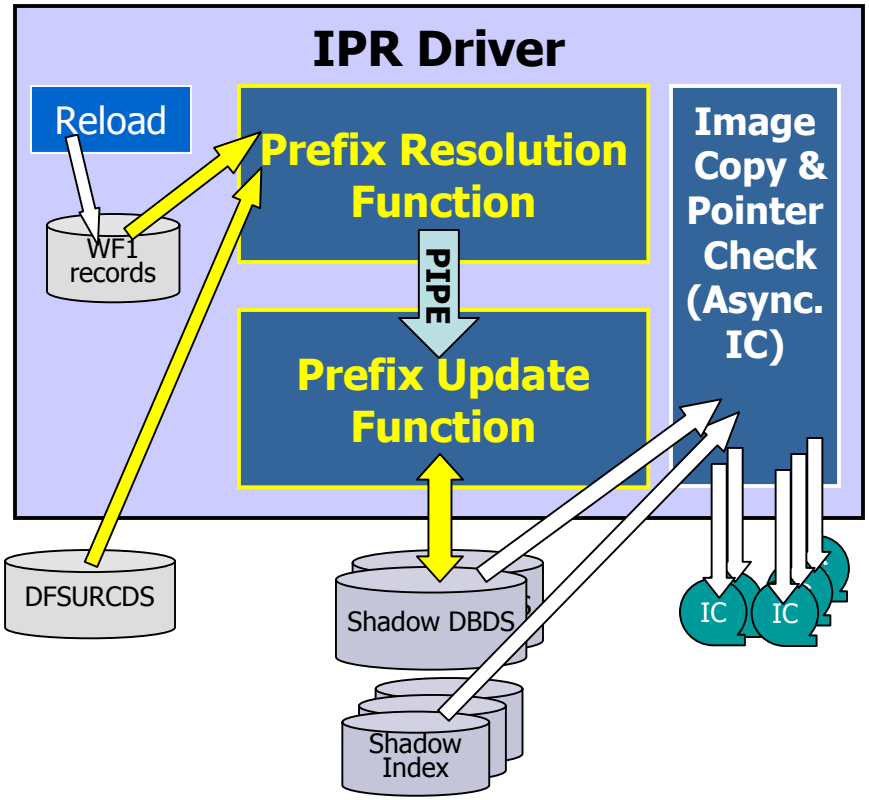
- Can be used if you want to stack multiple image copies on a tape or a set of tapes
  - The STACK option of HPIC is used
- Must be used if the database has internal logical relationship
  - Type-B Image Copy runs after **Concurrent Prefix Update** processing

Concurrent Prefix Update and Type-B Image Copy



Concurrent Prefix Update

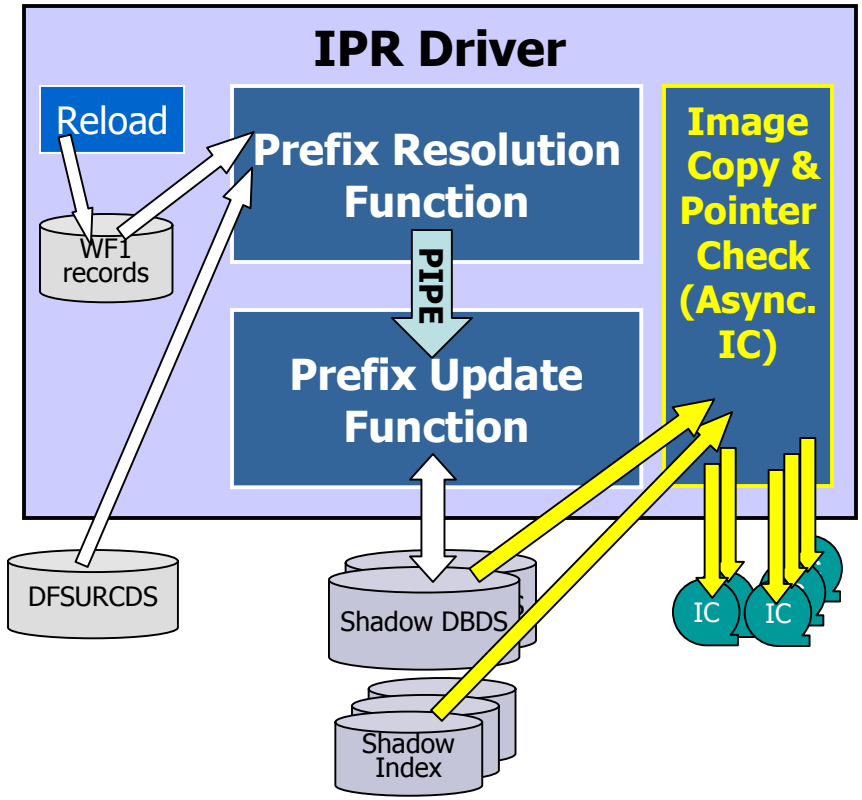
- If **PREFIXRES=YES** and the database has only internal logical relationship, the **Concurrent Prefix Update** will be run
- The Concurrent Prefix Update updates the prefix of each segment that is affected by the reorg
- Intermediate records are passed through pipes, which eliminates the intermediate work files (WF2 and WF3 files)
  - This speeds up the prefix update task



• The Concurrent Prefix Update function is provided by **IMS High Performance Prefix Resolution V3**

Type-B Image Copy

- If **IC=YES** and **ICTYPE=B** are specified, image copies are taken after database is reloaded and prefixes are updated (**Type-B Image Copy**)
- Each data set or index is image copied asynchronously by default
- "Shadow" data sets are image copied as the reorganized data sets



• Type-B Image Copy function is provided by **IMS High Performance Image Copy V3.2**

Deleting Old Data Sets

- In IPR Driver V2, …
  - Original database data sets are renamed to "*original_name*.T"
  - Must be deleted manually after the job result is checked

- In IPR Driver V3, …
  - If DELOLDDS=YES, the ".T" data sets are deleted when all of the following have succeeded:
    - Reload
    - Prefix Resolution and Update (if PREFIXRES=YES)
    - Image Copy (if IC=YES)
    - Name Swapping
    - DBRC Notifications
  - DELOLDDS=YES is valid only when DBRC=Y and NAMESWAP=YES

Prerequisite IBM IMS Tools

- High Performance Database Tools
  - **IMS High Performance Unload V1** (required)
  - **IMS High Performance Load V2** (required)
  - **IMS Index Builder V2.3** (required if INDEXBLD=YES)
  - **IMS High Performance Prefix Resolution V3** (required if PREFIXRES=YES)
  - **IMS High Performance Image Copy V3.2** (required if IC=YES)
  - **IMS High Performance Pointer Checker V2** (required if IC=YES and HASH pointer checking is needed)
- Other database management tools
  - **IMS Library Integrity Utilities V1** (required if DECODEDBD=YES or DECODESXD=YES)

Supported IMS Versions

- IPR Driver and the High Performance Database Tools running under IPR Driver support the following IMS versions:
  - **IMS V7**
  - **IMS V8**
  - **IMS V9** – supported by following APARs:
    - High Performance Unload V1
      - PQ80191 and PQ83387
    - IMS Index Builder V2.3
      - PQ80216
    - High Performance Pointer Checker V2
      - PQ86664

Support of HALDB

- HALDB is supported
  - including online-reorganization-capable (OLRCAP) HALDB partitions of IMS V9
- PARTITION statement specifies a partition or partitions to reorganize
  - PARTITION=*ALL (default)
    - Specifies all partitions
  - PARTITION=*partname*
    - Specifies a partition
  - PARTITION=(*partname*,*n*)
    - Specifies *n* consecutive partitions starting from the partition *partname*

```
//HPSIN  DD *
(REORG)
   .
   .
   .
  PARTITION=PARTA
   .
   .
   .
/*
```

```
//HPSIN  DD *
(REORG)
   .
   .
   .
  PARTITION=(PARTA,3)
   .
   .
   .
/*
```

Performance Improvements

- IPR Unload Utility of IPR V3
  - Optimization for VSAM KSDS buffers
  - CPU time reduction for VSAM
- IPR Reload Utility of IPR V3 and High Performance Load V2
  - Performance improvement of the database write process for both OSAM and VSAM by using a background write technique
  - Performance improvement of ILDS write process
    - ILDSBLD=YES activates this function
  - CPU time reduction for VSAM

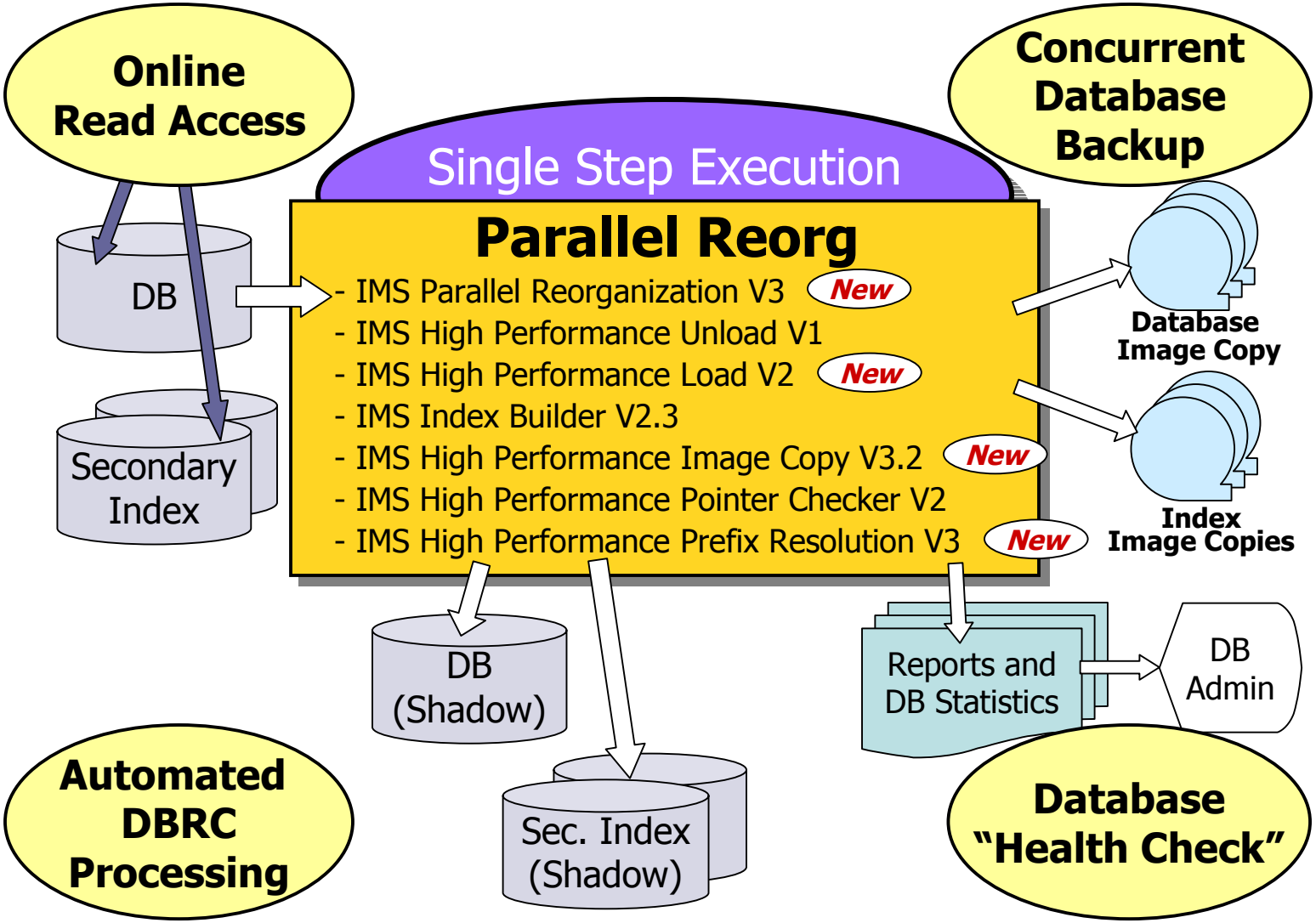
Performance Improvements…

- IMS High Performance Pointer Checker V2
  - CPU time reduction in HASH Check under High Performance Image Copy
    - Provided by APAR PQ89106
    - The CPU time in HASH Check has been reduced significantly when HDPC runs under HPIC
    - The CPU time reduction has effect on HDAM, HIDAM, HISAM, HIDAM primary index, secondary index, PHDAM, and PHIDAM

Summary

- **IBM IMS High Performance Database Tools**
  - Speed up reorganization tasks
  - Provides rich functions not available in classic IMS reorg utilities
- **IBM IMS Parallel Reorganization (IPR)**
  - Integrates IMS High Performance DB Tools
    - Runs them concurrently as possible as they can
  - Provides simple JCL interface – easy to code and modify
  - Reorganizes a database in a single job step
  - Automates reorganization process, including
    - Online database command processing
    - DBRC notification processing

IMS Parallel Reorganization V3



Product Information

DB2 and IMS Tools

http://www.ibm.com/software/data/db2imstools/

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