

E42

IMS/ESA From the RECON's Point of View

Karen Tischer



Anaheim, California

October 23 - 27, 2000

Table of Contents

■ PART 1

- ▶ Introduction
- ▶ Batch/Online Interfaces

■ PART 2

- ▶ Batch/Online Interfaces (cont.)
- ▶ Utility Interfaces
- ▶ Changes in IMS/ESA V6

■ APPENDIX - Reference Only

- ▶ RECON Initialization
- ▶ Database Registration
- ▶ RECON Records Usage Summary
- ▶ Diagnostics

Trademark acknowledgment

The following terms are trademarks of the IBM Corporation:

▲ **ACF/VTAM**

▲ **CICS**

▲ **CICS/ESA**

▲ **DB2**

▲ **DFSMS**

▲ **DFSMS/MVS**

▲ **ESA/390**

▲ **ESCON**

▲ **ES/9000**

▲ **IBM**

▲ **IMS**

▲ **IMS/ESA**

▲ **MVS/ESA**

▲ **Parallel Sysplex**

▲ **RACF**

▲ **S/390**

▲ **Sysplex Timer**

▲ **VTAM**

TOPIC 1: INTRODUCTION

- What are RECONs ?
- RECON Allocation
- RECON Initialization & Management
- DBRC Exit Processing
- Database Registration

What are the RECONs?

- **Fundamental data repository for IMS/ESA TM and DB system control information**
- **Crucial prerequisite for IMS/ESA management of**
 - ▶ **Data Sharing**
 - ▶ **IMS System access to IMS databases**
 - ▶ **IMS/ESA DB Integrity**
 - ▶ **IMS/ESA Logs**
- **Implemented as a set of VSAM KSDS data sets, the RECONs**
- **The RECON is managed by DBRC to ensure integrity and recoverability of the data required by DBRC**
 - ▶ **"Pair and a spare"**

RECON Allocation

- **Allow for smooth handling of RECON size limitation**
 - ▶ Make RECON2(backup) larger than RECON1 (active)
 - ▶ Make RECON3(spare) larger than RECON2
- **Remember that DBRC issues Hardware RESERVEs**
 - ▶ For the Catalog(s)
 - ▶ For the active RECONs
- **Configure**
 - ▶ to prevent possible deadlocks
 - ▶ to maximize availability
- **Catalog each RECONs in separate catalog on separate device & string**



**Beware of non-IMS
Catalogs on any
volume with RECONs
or CATALOGs**

RECON Initialization & management

● INIT.RECON command

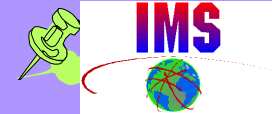
- ▶ Builds RECON Header & Header Extension records
 - Initialization time-stamp (DUI processing)

● Controls System options

- ▶ SHARECTL, FORCER
- ▶ Shared DASD control information (CI/CA splits, new extents)
- ▶ Error & update indicators

● Controls RECON management

- ▶ Pair and a spare defined in header



RECOVCTL is
no longer
supported in
IMS V6

RECON Header records



The diagram shows a white rounded rectangle containing two green boxes. The left box is labeled 'HEADER' and the right box is labeled 'HEADER EXT'. The entire structure is outlined in red.

HEADER

HEADER
EXT

Header and Header Extension Listing . . .

RECON

RECOVERY CONTROL DATA SET, IMS/ESA V6R1 **COEXISTENCE ENABLED**
DMB#=536 **INIT TOKEN=97352F1625030F**
NOFORCER LOG DSN CHECK=CHECK44 STARTNEW=NO
TAPE UNIT=CARTRIDG DASD UNIT=SYSDA TRACEOFF SSID=IMST
LIST DLOG=YES CA/IC/LOG DATA SETS CATALOGED=YES
LOG RETENTION PERIOD=00.014 00:00:00.0

TIME STAMP INFORMATION:

TIMEZIN = %SYS

-LABEL-	-OFFSET-
PST	-08:00
PDT	-07:00

OUTPUT FORMAT: DEFAULT = LOCORG NONE PUNC YY
CURRENT = LOCORG LABEL PUNC YYYY

Header and Header Extension Listing

-DDNAME-	-STATUS-	-DATA SET NAME-
RECON1	COPY1	IMS610.SAMPLE.RECON1
RECON2	COPY2	IMS610.SAMPLE.RECON2
RECON3	SPARE	IMS610.SAMPLE.RECON3

THT

-LOCAL START-	-OFFSET-
0000.000 00:00:00.0	-08:00
1998.295 02:00:00.0	-07:00
1999.094 04:00:00.0	-08:00

DBRC Exit Processing (Initial)

- Allocate RECON1, RECON2 and RECON3
- RESERVE all 3 RECON data sets
 - ▶ in DDNAME sequence, or MDA entry sequence
 - ▶ QNAME is DSPURI01
 - ▶ RNAME is RECON DSN
- Open RECONs
 - ▶ Note spares
- Perform VERIFY if necessary
 - ▶ (For prior system failure during some RECON activity)
... .. more

DBRC Exit Processing (Initial) . . .

- Read Header records, and Header Extensions
- Determine active pair
 - ▶ Restore duality if necessary, and possible
- Deallocate & release unused RECON data sets
- Perform partial update backouts if necessary
- Perform EXIT processing
- Release active RECONs

DBRC Exit Processing (subsequent)

- **RESERVE active RECON data sets**
 - ▶ in DDNAME sequence, or MDA entry sequence
 - ▶ QNAME is DSPURI01
 - ▶ RNAME is RECON DSN
- **Invalidate RECON buffers**
- **Read Header & Header Extensions**
- **Close and reopen RECONS if needed**
- **Issue VERIFY if needed**

... .. more

DBRC Exit Processing . . .

- If active pair has changed, allocate other RECONs and determine active pair
 - ▶ Restore duality if necessary and possible
- Deallocate unused RECON data sets
- Perform partial update backouts if necessary
- Perform exit processing
- If 'TERM' exit, close RECONs
- Release RECONs

Database Registration

● **INIT.DB**

- ▶ Builds Database (DB) Record
- ▶ DB record is used for control of database allocation and sharing

● **INIT.DBDS**

- ▶ Build Database Data Set (DBDS) records
- ▶ DBDS records are used for Recovery processes

● **INIT.DBDSGRP**

- ▶ Optionally can build Database Data Set Group (DBDSGRP) records
- ▶ DBDSGRP records are used for DBRC and IMS command processing

● **INIT.CAGRP**

- ▶ Builds Change Accumulation Group (CAGRP) records
- ▶ CAGRP records are used for change accum processing for Recovery processes

Full Function DB Record

DB

DBD=SAMPDBD1 IRLMID=*NULL DMB#=3 TYPE=IMS
SHARE LEVEL=3 GSGNAME=**NULL** USID=0000000001
AUTHORIZED USID=0000000000 RECEIVE USID=0000000000 HARD USID=0000000000
RECEIVE NEEDED USID=0000000000

FLAGS:

BACKOUT NEEDED =OFF
READ ONLY =OFF
PROHIBIT AUTHORIZATION =OFF
RECOVERABLE =YES

TRACKING SUSPENDED =NO
OFR REQUIRED =NO

COUNTERS:

RECOVERY NEEDED COUNT =0
IMAGE COPY NEEDED COUNT =0
AUTHORIZED SUBSYSTEMS =2
HELD AUTHORIZATION STATE =3
EEQE COUNT =0
RECEIVE REQUIRED COUNT =0

ASSOCIATED SUBSYSTEM INFORMATION:

		ENCODED	B/O NEEDED	
-SSID-	-ACCESS INTENT-	-STATE-	-COUNT-	-SS ROLE-
IMS3	UPDATE	3	0	ACTIVE
IMS1	UPDATE	3	0	ACTIVE

Full Function DBDS Record

DBDS

DSN=IMSPROD.SAMPDBD1.SAMPDDN1 TYPE=IMS

DBD=SAMPDBD1 DDN=SAMPDD1 DSID=001 DBORG=HDAM DSORG=OSAM

CAGRP=MYGRP GENMAX=2 IC AVAIL=0 IC USED=1 DSSN=00000000

NOREUSE RECOVPD=0

DEFLTJCL=**NULL** ICJCL=ICJCL OICJCL=OICJCL RECOVJCL=RECOVJCL

FLAGS:

IC NEEDED =OFF

RECOV NEEDED =OFF

RECEIVE NEEDED =OFF

COUNTERS:

EEQE COUNT =0

Fast Path DB Record

DB

DBD=SAMPDBD5

SHARE LEVEL=3

FLAGS:

PROHIBIT AUTHORIZATION=OFF

DMB#=217

TYPE=FP

COUNTERS:

RECOVERY NEEDED COUNT =0

IMAGE COPY NEEDED COUNT =0

AUTHORIZED AREAS =48

EEQE COUNT =0

Fast Path DBDS Record

DBDS

DBD=SAMPDBD5 AREA=AREA01 TYPE=FP
GSGNAME=**NULL** USID=0000000002
AUTHORIZED USID=0000000002 RECEIVE USID=0000000002 HARD USID=0000000002
RECEIVE NEEDED USID=0000000000
CAGRP=MYGRP GENMAX=3 IC AVAIL=0 IC USED=1 DSSN=00000001
NOREUSE RECOVPD=0 NOVSO NOPREOPEN NOPRELOAD
CFSTR1=**NULL** CFSTR2=**NULL** NOLKASID
DEFLTJCL=**NULL** ICJCL=ICJCL RECVJCL=RECVJCL RECOVJCL=RECOVJCL

FLAGS:

PROHIBIT AUTHORIZATION=OFF
IC NEEDED =OFF
RECOV NEEDED =NO
DATABASE LEVEL TRACK =NO
RECEIVE NEEDED =NO
OFR REQUIRED =NO
TRACKING SUSPENDED =NO
HSSP CIC IN PROGRESS =NO

COUNTERS:

AUTHORIZED SUBSYSTEMS =2
HELD AUTHORIZATION STATE =3
ADS AVAIL# =1
REGISTERED ADS # =1
EEQE COUNT =0

Fast Path DBDS Record

ADS LIST:

-ADS DDN-	-ADS DSN-	-STAT-	CREATE -RUNNING-
CUSTDD10	IMSSET.NOS.CUSTDB10	AVAIL	NO
CUSTDD11	IMSSET.NOS.CUSTDB11	UNAVAIL	YES

ASSOCIATED SUBSYSTEM INFORMATION:

-SSID-	-ACCESS INTENT-	ENCODED -STATE-	B/O NEEDED -COUNT-	-SS ROLE-
IMS3	UPDATE	3	0	ACTIVE
IMS1	UPDATE	3	0	ACTIVE

DBDSGRP Record Listing

DBDSGRP

GRPNAME=SMPLDBDS

#MEMBERS=3

-DBD-

-DDN/AREA-

SAMPDBD1

SAMPDDN1

SAMPDBD2

SAMPDDN2

SAMPDBD3

SAMPDDN3

DBDSGRP

GRPNAME=SMPLDB

#MEMBERS=3

-DBD-

-DDN/AREA-

SAMPDBD1

NULL

SAMPDBD2

NULL

SAMPDBD3

NULL

CAGRP Record listing

CAGRP

GRPNAME=SMPLCAGP GRPMAX=2 CA AVAIL=0 CA USED=1

NOREUSE CAJCL=CAJCL DEFLTJCL=**NULL**

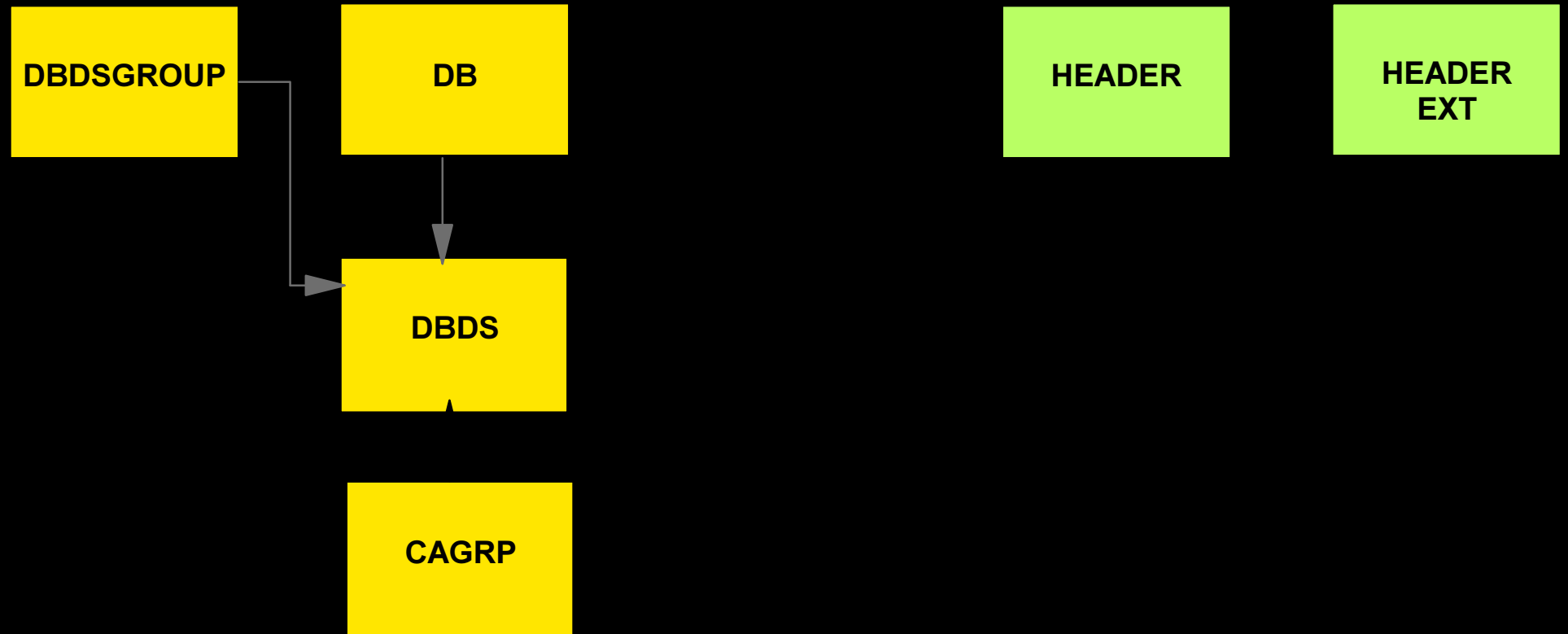
#MEMBERS=3 -DBD- -DDN-

SAMPDBD1 SAMPDDN1

SAMPDBD2 SAMPDDN2

SAMPDBD3 SAMPDDN3

RECON Records: Database



TOPIC 2: BATCH/ONLINE INTERFACES

Sign-on

Log Open

Authorization

DB Open

DB Update

DB I/O Error

Log Processing

Termination

Sign-on Processing (normal)

● Normal Sign-on

- ▶ Performed by DLI/DBB batch initialization
 - Subsystem name is the MVS Jobname
- ▶ or by /NRE online processing
 - Subsystem name is the IMSID
 - Cold start updates the BACKOUT record (if one exists)
- ▶ Builds a SUBSYS record if one does not already exist for the subsystem
- ▶ Fails if a SUBSYS record already exists

Sign-on Processing (abnormal)

● Abnormal Sign-on

▶ Recovery Start

- Turns on 'Recovery Started' bit if SUBSYS record already exists for the subsystem
- fails if a SUBSYS record does not exist for the subsystem

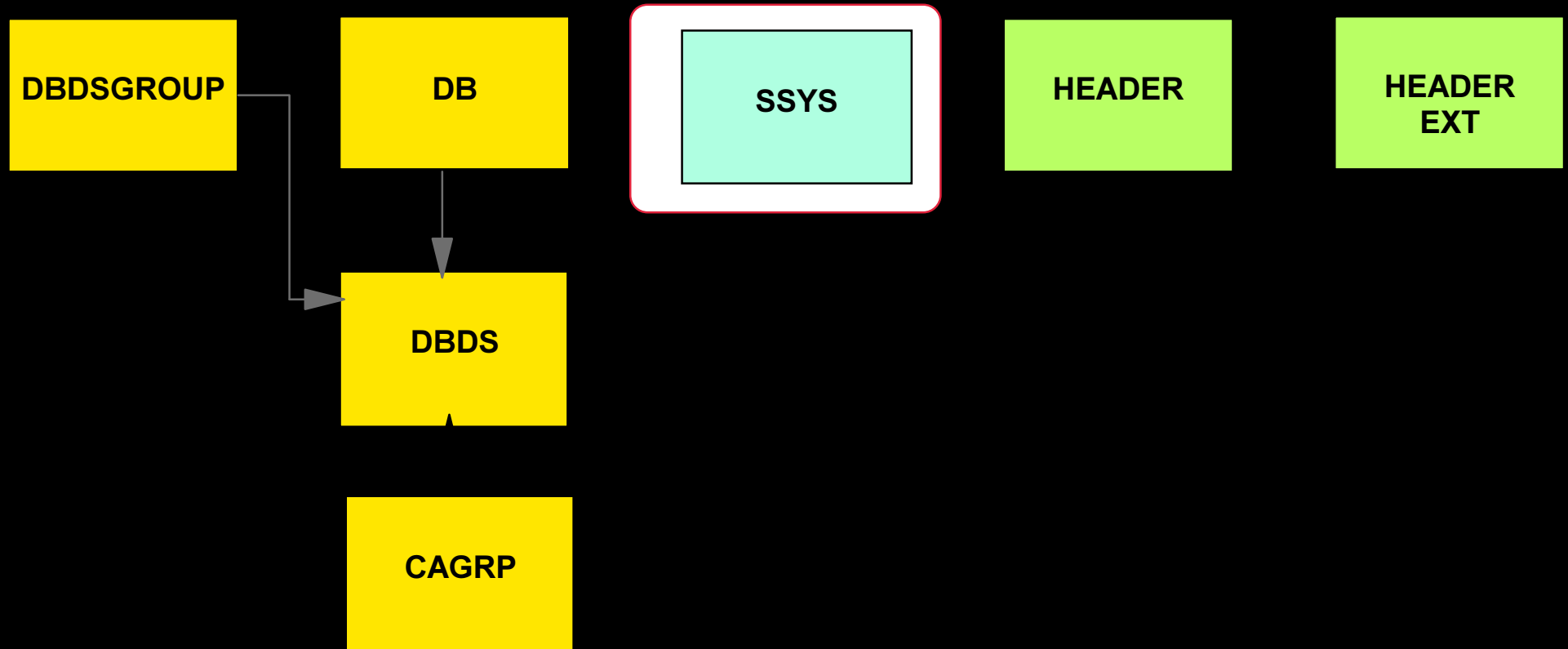
▶ Sign-on Recovery end

- Releases database authorizations
- When complete, environment looks like 'Sign-on normal'

▶ Sequence issued by:

- /ERE online processing
- Batch Backout Utility

RECON Records: Subsystems



Subsystem Record Listing

SSYS

SSID=IMS1 LOG START=1997.352 12:37:49.3 EST

SSTYPE=ONLINE ABNORMAL TERM=OFF RECOVERY STARTED=NO

BACKUP=NO

TRACKED=NO TRACKER TERM=OFF SHARING COVERED DBDS=NO

IRLMID=IRL1 IRLM STATUS=NORMAL GSGNAME=**NULL**

ASSOCIATED DATA BASES/AREAS=703

VERSION=6.1

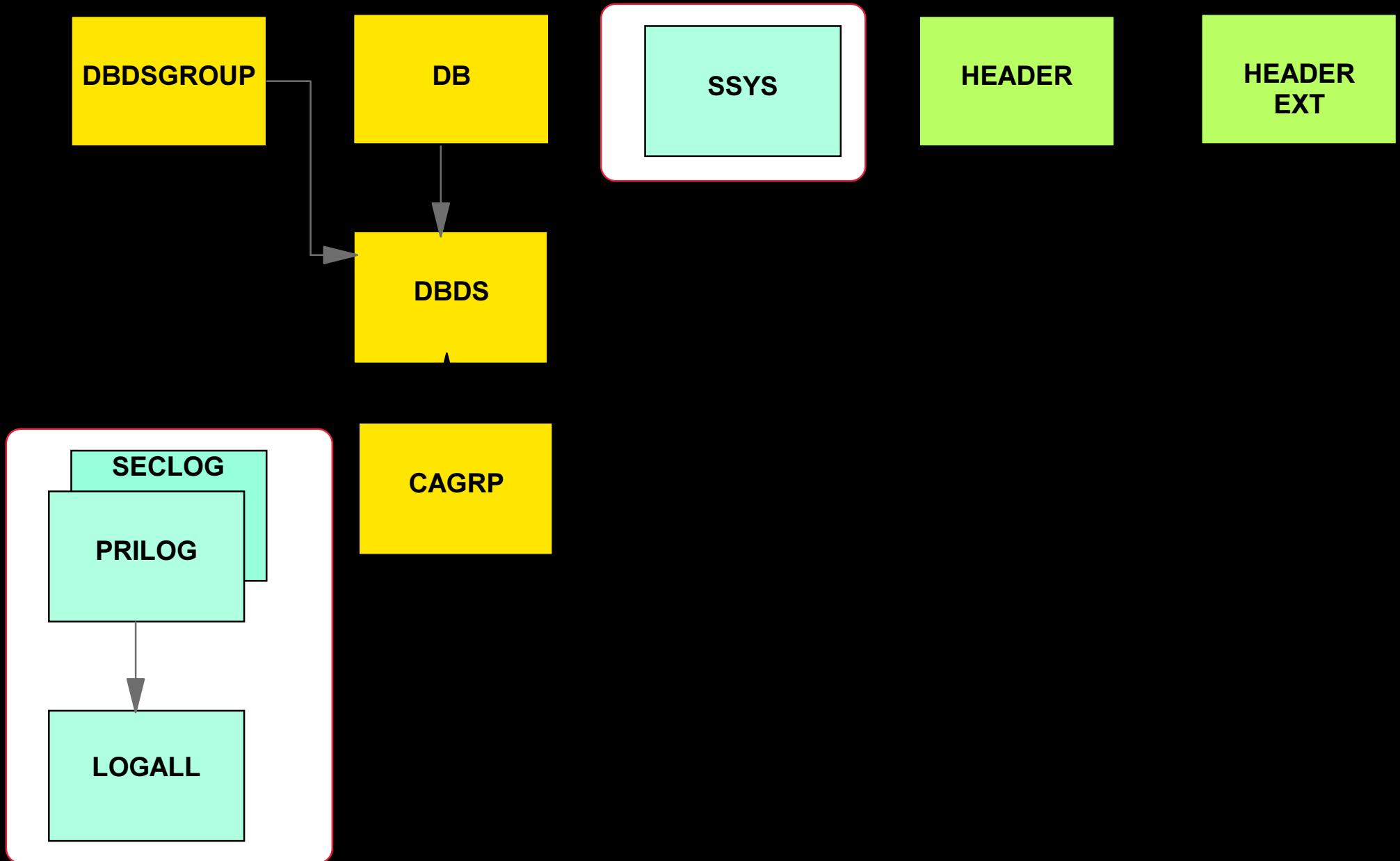
ENCODED

-DBD-	-AREA-	-LEVEL-	-ACCESS INTENT-	-STATE-
SAMPDBD01	**NULL**	3	UPDATE	3
SAMPDBD02	**NULL**	3	UPDATE	3
.				
.				
.				
SAMPDBD5	AREA240	3	UPDATE	3

Log Open processing (batch)

- **Build PRILOG [& SECLOG] records**
 - **One per subsystem execution**
- **Build empty LOGALL record**
- **Update SUBSYS record with log start time**

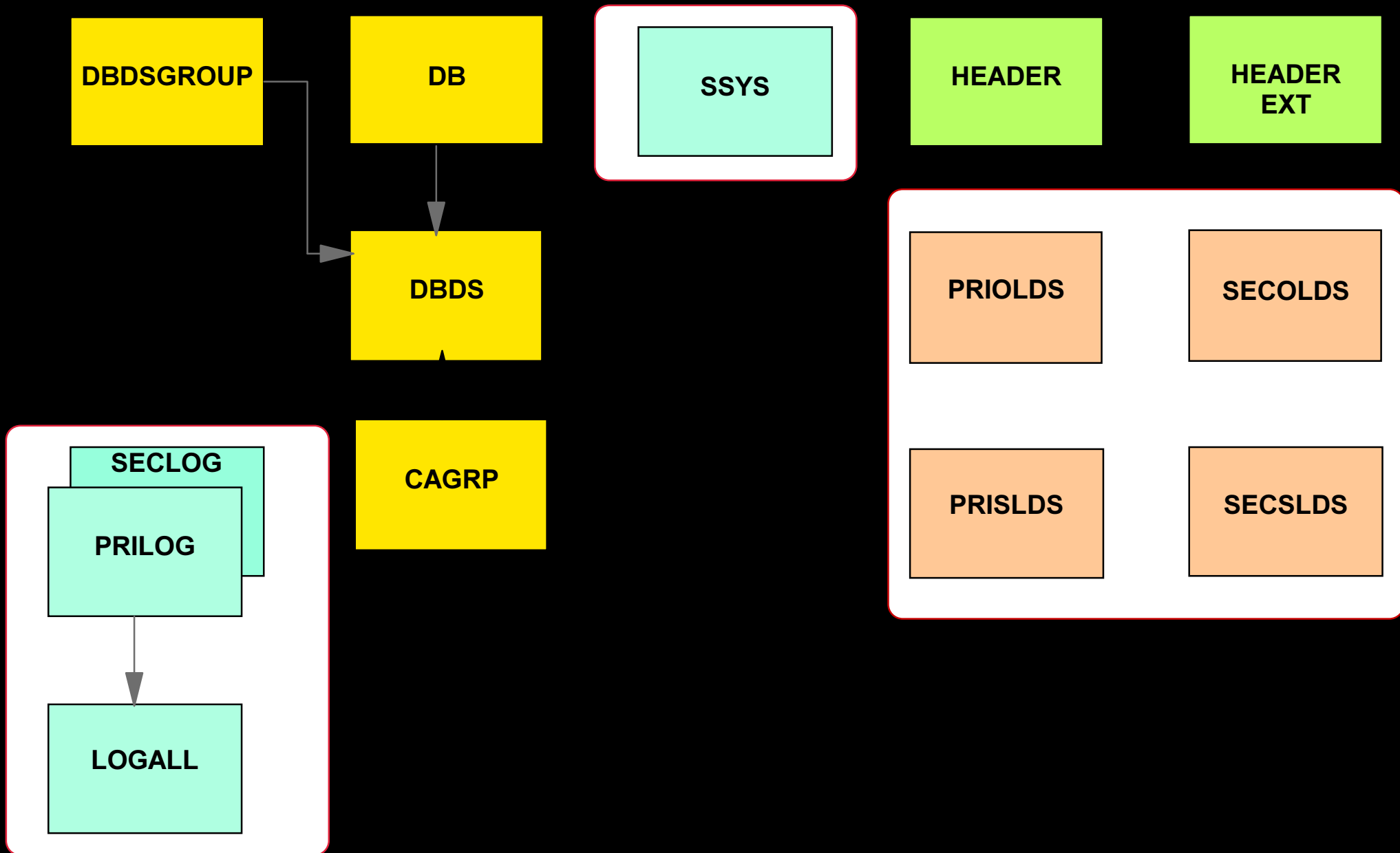
RECON Records: Batch Log Open



IMS TM & DBCTL Log Open processing

- **Build PRIOLDS & SECOLDS for subsystem**
 - if they do not exist
 - Note: There is one set of PRIOLDS-SECOLDS per subsystem
- **Build PRILOG record**
 - One per subsystem execution
- **Build PRISLDS record**
 - One per subsystem execution
- **Build empty LOGALL (log allocation) record**
- **Update SUBSYS record with log start time**

RECON Records: IMS TM & DBCTL Log Open



PRIOLDS Record listing

PRIOLD

SSID=IMS1 # DD ENTRIES=6
EARLIEST CHECKPOINT = 1997.352 12:38:16.9 EST

DDNAME=DFSOLP04 DSN=IMSPROD.IMS1.DFSOLP04
START = 1997.352 14:26:52.5 EST FIRST DS LSN=
000000009BDFEF9A
STOP = 1997.352 14:54:28.9 EST LAST DS LSN =
000000009BEC65DE
STATUS=ARC COMPLT FEOV=YES
AVAIL
PRILOG TIME=1997.352 12:37:49.3 EST ARCHIVE JOB NAME=IMS1AR
VERSION=6.1

DDNAME=DFSOLP05 DSN=IMSPROD.IMS1.DFSOLP05
START = 1997.352 14:54:28.9 EST FIRST DS LSN=
000000009BEC65DF
STOP = 1997.352 15:25:53.2 EST LAST DS LSN =
000000009C0112D2
STATUS=ARC COMPLT FEOV=YES
AVAIL
PRILOG TIME=1997.352 12:37:49.3 EST ARCHIVE JOB NAME=IMS1AR
VERSION=6.1

PRILOG/SECLOG

PRISLDS/SECSLDS

PRILOG

START = 1997.352 12:37:49.3 EST * SSID=IMS1 VERSION=6.1
STOP = 0000.000 00:00:00.0 +00:00 #DSN=14
GSGNAME=**NULL**
FIRST RECORD ID= 0000000000000001 PRILOG TOKEN= 0
EARLIEST CHECKPOINT =19 97.352 12:38:16.9 EST

DSN=IMSPROD.IMS1.PRIRLDS.D97352.T1237493.V00 UNIT=CARTRIDG
START =1997.352 12:37:49.3 EST FIRST DS LSN= 0000000000000001
STOP = 1997.352 13:23:53.9 EST LAST DS LSN= 000000000009F88D
FILE SEQ=0001 #VOLUMES=0001

VOLSER=190806 STOPTIME = 1997.352 13:23:53.9 EST
CKPTCT=1 CHKPT ID = 1997.352 12:38:16.9 EST

DSN=IMSPROD.IMS1.PRIRLDS.D97352.T1323539.V00 UNIT=CARTRIDG
START =1997.352 13:23:53;9 EST FIRST DS LSN= 000000000009F88D
STOP = 1997.352 13:32:36.9 EST LAST DS LSN= 000000000013EC0B
FILE SEQ=0001 #VOLUMES=0001

VOLSER=190806 STOPTIME = 1997.352 13:32:36.9 EST
CKPTCT=1 CHKPT ID = 1997.352 13:22:11.8 EST

LOGALL Record listing

LOGALL

START = 97.033 04:48:29.6*

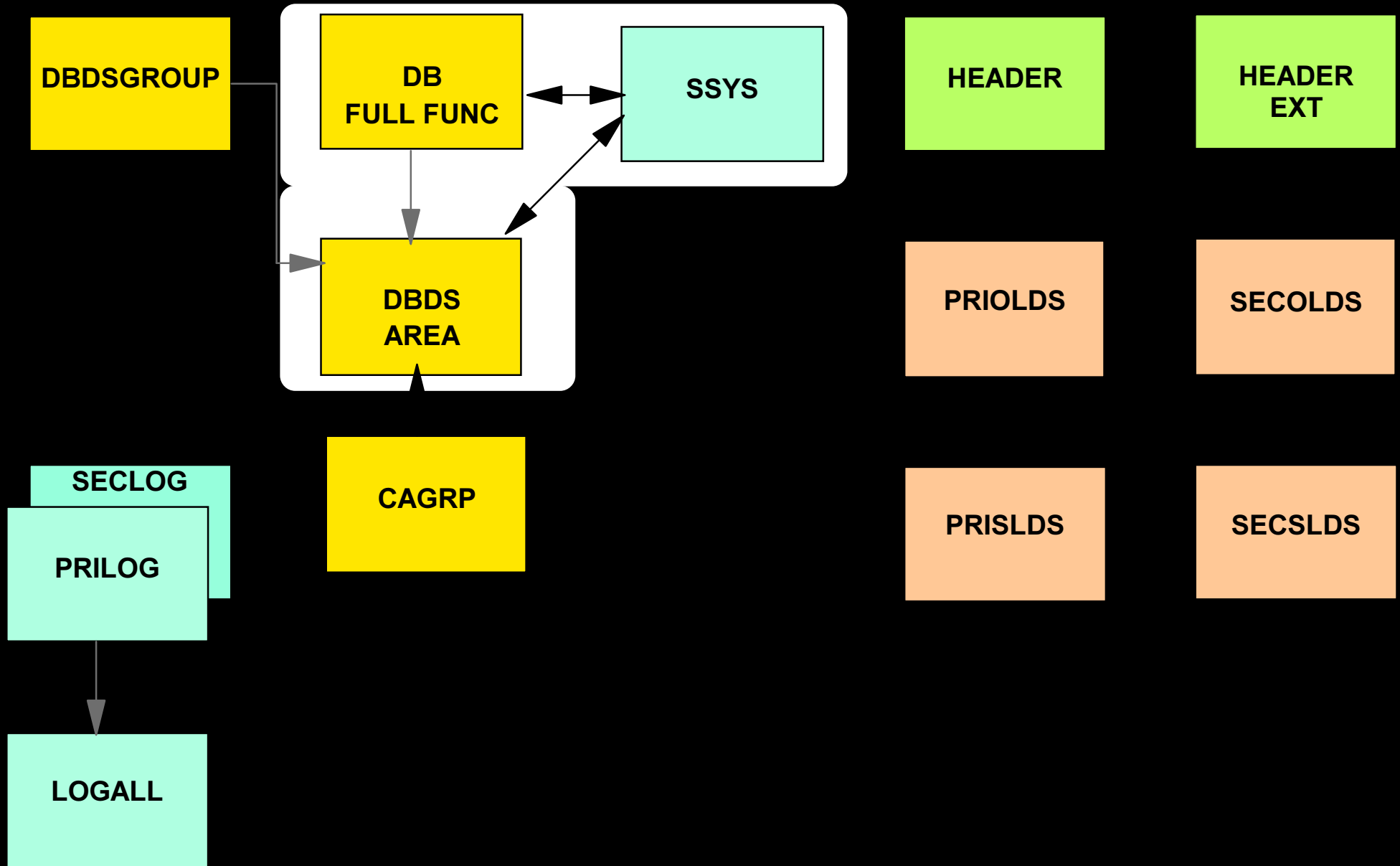
DBDS ALLOC=410

	-DBD-	-DDN-	-ALLOC-
	SAMPDBD3	SAMPDDN3	4
	SAMPDBD2	SAMPDDN2	4
	SAMPDBD1	SAMPDDN1	4
...	

Subsystem Authorization Processing

- **For Batch:** At initialization time
- **For Online TM system:** At first schedule
- **Unregistered databases - always granted**
 - ▶ (Unless 'FORCER' has been specified)
- **Database treated as registered**
 - ▶ if DBD, DD and DSN match RECON information
- **Processing flow:**
 - ▶ Check status flags in DB and DBDS records
 - ▶ Check current authorizations for compatibility
 - ▶ If all DB's requests can be granted
 - update SUBSYS and DB records

RECON Records: Database Authorization



Database Open Processing

- Performed at database open time
- Does not update RECONs
- Verifies that all data sets of a database are registered if the database is registered
- Performs Database Usage Intent (DUI) processing, with possible error messages:
 - ▶ **DFS0486W** THE RECON DATA SET WILL NOT BE UPDATED FOR [DATA BASE dbdname|AREA areaname]
 - ▶ **DFS0486W** THE RECON DATA SET WILL NOT BE UPDATED FOR [DATA BASE dbdname|AREA areaname]
 - ▶ **DFS0487W** THE RECON DATA SET USED FOR [DATA BASE dbdname|AREA areaname] HAS CHANGED
- Return EEQEs

At first DB update

- Performed when first update to a DBDS occurs following all *authorization*
- Checks to make sure database is registered by comparing DBD name, DD name, and DSN
- Build ALLOC (allocation) record
- Updates LOGALL record
- Returns data sharing information (DSSN)
- Returns RSR information Update Set Identifier (USID)

ALLOC Record Listing

ALLOC

ALLOC = 1997.352 12:57:43.8 EST * ALLOC LRID=0000000000000000
DSSN=0000000001 USID=0000000002 START = 1997.352 12:37.49.3 EST
DEALLOC = 1997.043 14:52:55.4 EST DEALLOC LRID=0000000000000000

ALLOC

ALLOC = 1997.352 13:00:24.0 EST * ALLOC LRID=0000000000000000
DSSN=0000000001 USID=0000000002 START = 1997.352 12:27.37.6 EST
DEALLOC = 1997.043 14:52:53.0 EST DEALLOC LRID=0000000000000000

... ..

Note: Deallocation information only shown if /DBR or /DBD performed

DATABASE I/O Error Processing

- Performed for read and write errors
- DB and DBDS records updated with EEQE (Extended Error Queue Element) information
- If write error - full function
 - ▶ "Recovery Needed" flag turned on in DBDS record
 - ▶ "Recovery Needed" counter incremented in DB record
- If severe error - fast path
 - ▶ "Recovery Needed" flag turned on in DBDS (area) record
 - ▶ "Recovery Needed" counter incremented in DB record

Backout Error Processing

- **Invoked for**

- ▶ **Dynamic backout failures**
- ▶ **/ERE backout failures**
- ▶ **/ERE NOBMP**

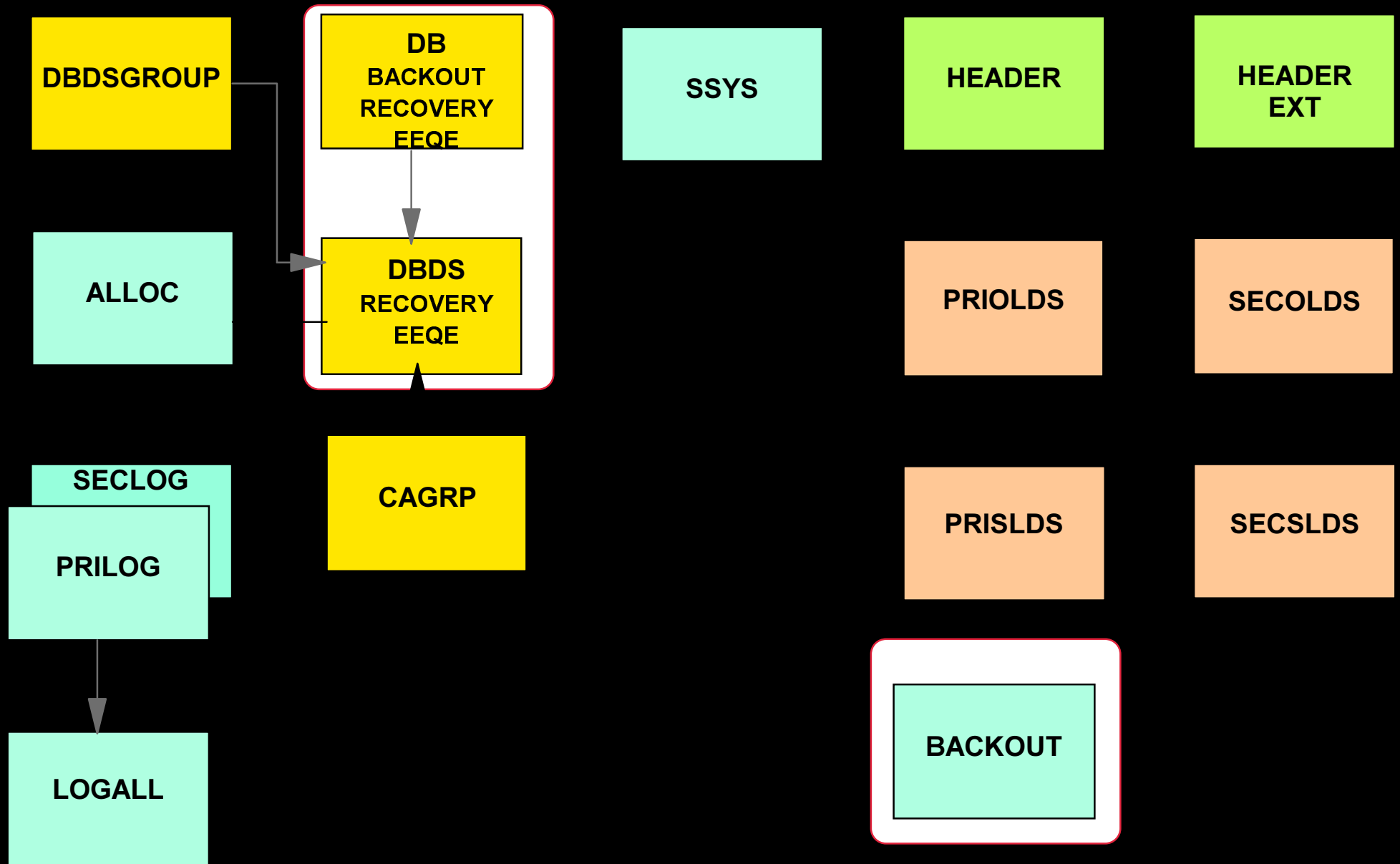
- **To prevent authorization prior to recovery**

- ▶ **"Backout Needed" counter incremented in DB record**
- ▶ **"Backout Needed" flag turned on in DB record**

- **BACKOUT record updated (created) with UOR (unit of recovery) information**

- **Not invoked for DLI/DBB batch abends**

RECON Records: I/O & Backout Errors



BACKOUT Record listing

BACKOUT

SSID=IMS1 #UORS=57

RECOVERY TOKEN=C9D4E2F1404040400000000300000002

TIME=1997.352 14:37:04.3 EST

PSB=PSB001

INFLT

ASSOCIATED DATA BASES=1

	BACKED	DYN BKOUT
-DBD-	-OUT -	-FAILURE-
SAMPDBD1	NO	YES

RECOVERY TOKEN=C9D4E2F1404040400000000200000003

TIME=1997.352 14:37:04.3 EST

PSB=PSB002

CANDIDATE INFLT

ASSOCIATED DATA BASES=3

	BACKED	DYN BKOUT
-DBD-	-OUT -	-FAILURE-
SAMPDBD1	NO	NO
SAMPDBD2	NO	NO
SAMPDBD3	NO	NO

Log processing: Batch

- **Updates PRILOG/SECLOG records**
- **Log EOVS**
 - ▶ **Add new volume serial number to current (only) RLDS entry**
 - ▶ **Set EOVS time stamp for prior volume in RLDS entry**
- **Log Close**
 - ▶ **Set EOVS time stamp for last volume in RLDS entry**
 - ▶ **Set data set stop time for RLDS entry**
 - ▶ **Set subsystem stop time for PRILOG/SECLOG record**

Log processing: TM & DBCTL

- Updates PRIOLDS/SECOLDS records

- OLDS switch

- ▶ For the Current OLDS:

- Set OLDS close time,
- turn off "In Use" flag, and
- set "Archive Needed" flag

- ▶ For the new OLDS:

- Set OLDS open time,
- subsystem start time, and
- turn on "In Use" flag

Log processing: TM & DBCTL ...

- To close an OLDS:

- ▶ For the current OLDS:
 - Set OLDS close time,
 - Turn off "In Use" flag, and
 - Set "Archive Needed"

Archive Processing (OLDS)

- Create **SECLOG/SECSLDS** records for subsystem execution
 - ▶ if they do not exist
- Add **SLDS** entry to **PRISLDS/SECSLDS** records
 - ▶ using time stamps from the archived OLDS
- Add **RLDS** entry to **PRILOG/SECLOG** records
 - ▶ using time stamps from the archived OLDS
- If archive did not create a separate **RLDS**,
 - ▶ use **SLDS** information for **RLDS** entry
- Set status of archived **OLDS** data sets to "Available"

Archive Processing (OLDS) ...

- **Place "checkpoint ID prior to oldest unit of work"**
 - ▶ in SLDS and RLDS data set entry
- **If all OLDS for subsystem execution archived,**
 - ▶ set subsystem stop time in
PRILOG/SECLOG/PRI SLDS/SEC SLDS records

Archive Processing: SLDS or RLDS

- Search RECONs for SLDS or RLDS being archived

- ▶ Match on data set name
file sequence number, and
volume serial numbers
- ▶ Look for "duplicates"
- ▶ Can be time consuming

- Upon completion,

- update data set entry with

- ▶ new data set name
- ▶ file sequence number
- ▶ unit type, and volume serial numbers

PRILOG Compression

● Invoked

- ▶ when new data set entry added to PRILOG family
- ▶ during DELETE.LOG INACTIVE command processed

● Deletes inactive data set entries from beginning of record

- ▶ if compression threshold reached

● Threshold is 50% of maximum record size

- ▶ if prior compression attempt was successful

● Threshold is 75% of maximum record size

- ▶ if prior compression attempt failed

● PRILOG compression is automatic

/DBRECOVER Processing

- Database data set update "span" terminated
 - ▶ ALLOC record updated with deallocation time (also occurs when database is closed)
- Database authorization released
 - ▶ DB and SUBSYS records updated
- "Prohibit Further Authorizations" flag in DB record
 - ▶ SET if /DBR GLOBAL
 - ▶ NOT SET in V6 if /DBR GLOBAL ... **NOPFA**

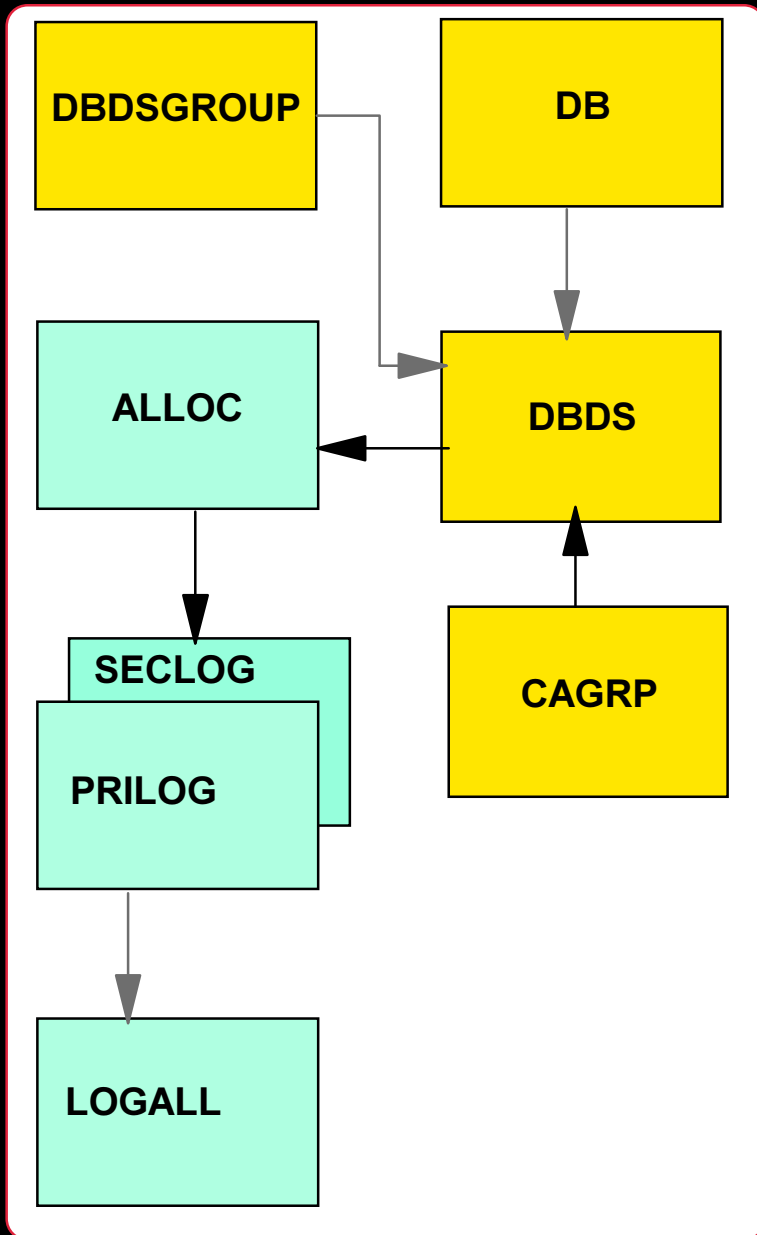
Normal Termination of Subsystem

- Sign-Off Normal
- Database Authorizations released
- DB Records updated
- SUBSYS record is deleted

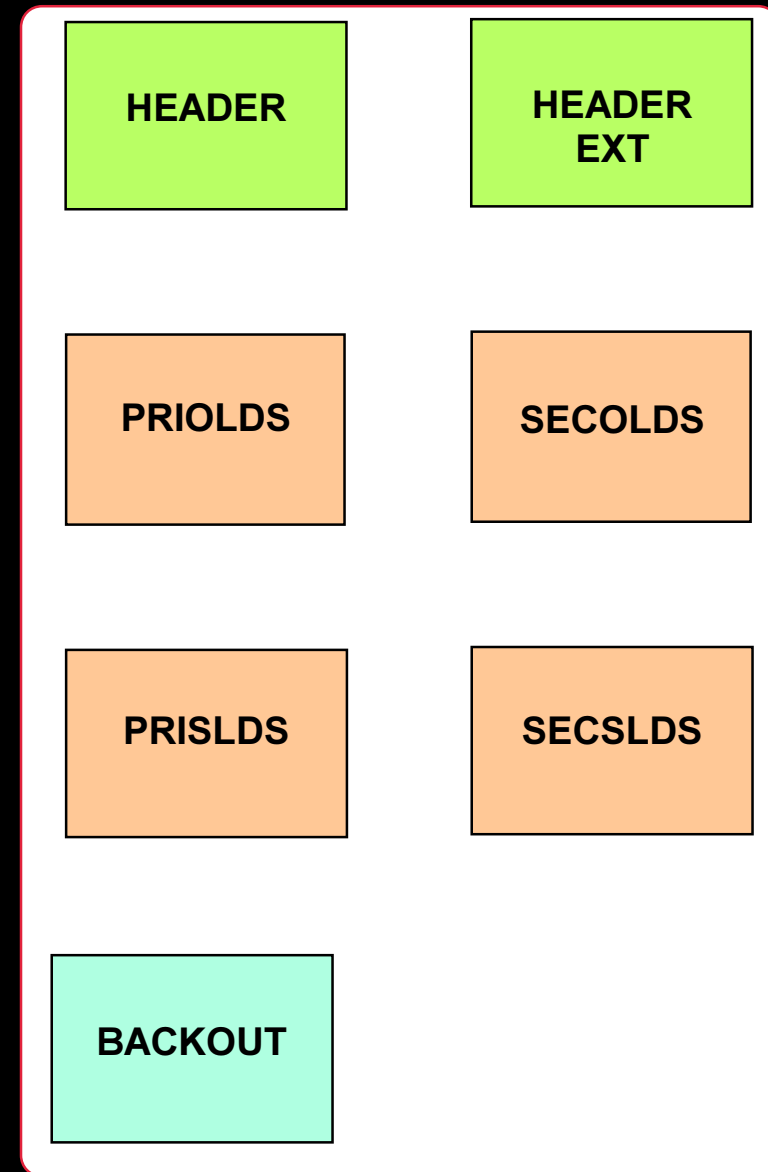
Abnormal Subsystem Termination

- **Sign-Off Abnormal (ESTAE)**
- **No Action (in case of MVS failure)**
- **Authorizations released**
 - ▶ **for databases that have NOT been updated**
- **SUBSYS record may be deleted,**
 - ▶ **ONLY if no databases* were updated**
 - * - registered or not registered databases
- **SUBSYS record will remain**
 - ▶ if **ANY** database(s) have been updated

RECON Record: Subsystem Termination



SSYS
ABNORMAL



TOPIC 3: UTILITY INTERFACES

- **Unload/Scan/Reload/Prefix Update**
- **Image Copy**
- **Change Accumulation**
- **Batch Backout**
- **DB Recovery**
- **DBDSGRP Considerations**

DB Unload and Scan Utilities

- **Participate in database level sharing**

- ▶ **ACCESS = RD**

- ▶ **"IC Needed" and "Prohibit Authorizations" flags are ignored**

- ▶ **"Recovery Needed" flag will fail authorization**

- **Database authorized as needed**

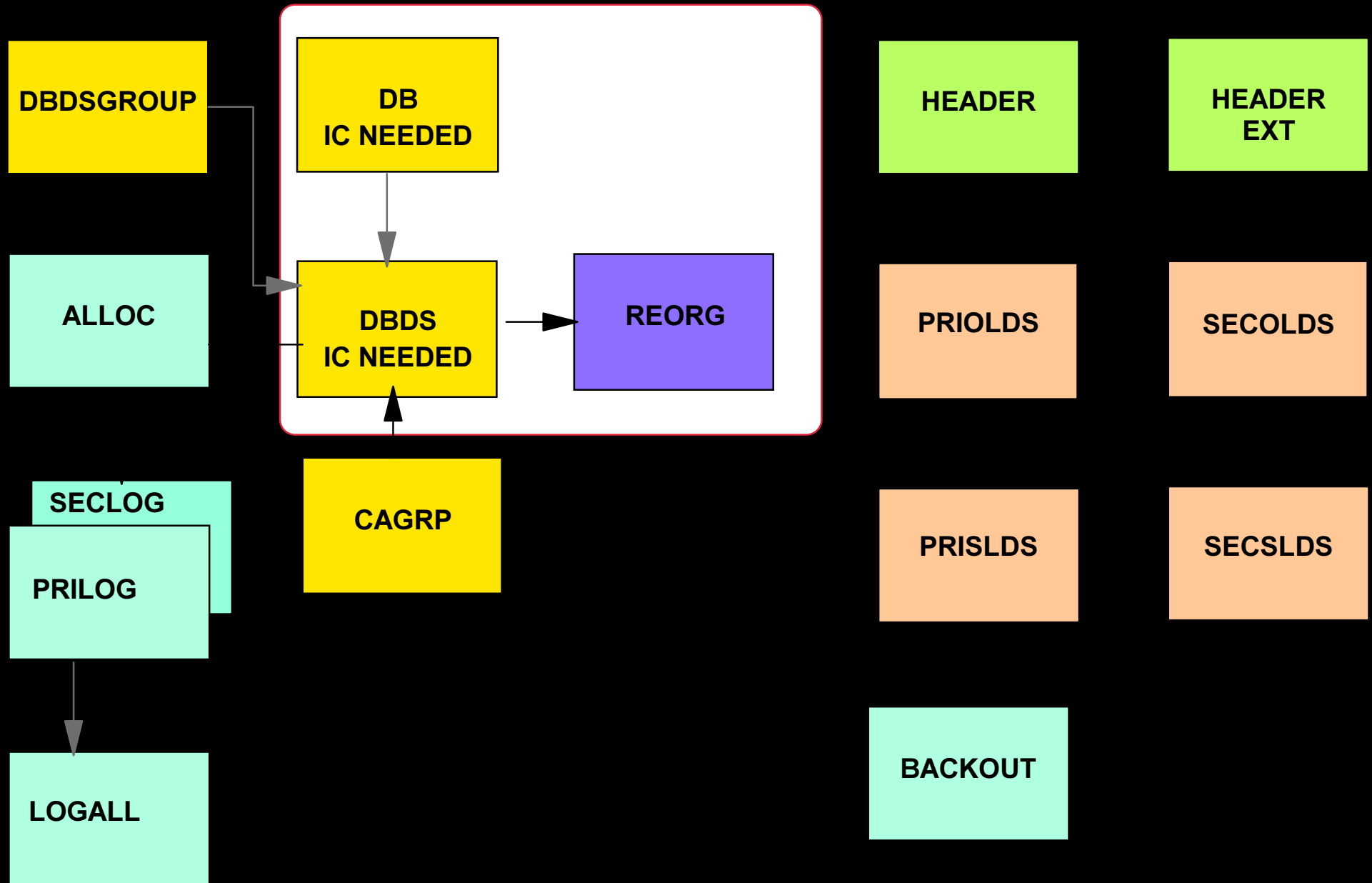
- **RECONs are not updated**

- ▶ **(These utilities do not alter the database)**

DB Reload Utilities

- **HISAM Reload and HD Reload**
- **Participates in database level sharing**
 - ▶ **ACCESS = EX**
 - ▶ **"IC Needed" and "Prohibit Authorizations" flags are ignored**
- **Create REORG record**

RECON Records: Reorganization



REORG Record Listing

REORG

RUN = 1997.349 01:39:17.4 EST * USID=0000000155

Reload Utility Differences

- **Authorization**

- ▶ HD occurs at initialization
- ▶ HS occurs as required

- **"IC Needed" Flag**

- ▶ HD always sets
- ▶ HS sets if IC REUSE

- **IC record**

- ▶ HD never creates
- ▶ HS creates if IC NOREUSE

Prefix update

- **Participates in database level sharing**
 - ▶ **ACCESS = EX**
 - ▶ **Authorization obtained as required**
 - ▶ **"IC Needed" and "Prohibit Authorizations" flags ignored**

- **If no logging, "IC Needed" flag is turned on**

- **If logging, acts like normal batch update job**
 - ▶ **ALLOC, PRILOG, and LOGALL records created**

Image Copy processing

- GENJCL
- Sign-On
- Validation
- Authorization
- Data set processing
- Data set completion
- Sign-Off

Image Copy GENJCL & Validation

- **Primary value of GENJCL is with *REUSE* option (pre-defined ICs)**
 - ▶ If "available" ICs exist, select first available
 - ▶ If no "available" ICs exist, select oldest IC for reuse
 - ▶ Might be useful with DBDSGRPs

- **Validation only effective with *REUSE* option**
 - ▶ Verifies that output data set is the same that GENJCL would have selected

Image Copy Authorization

- Participates in database level sharing
- Authorization obtained as required
 - ▶ ACCESS = RD (RO for CIC)
 - ▶ "IC Needed" and "Prohibit Authorizations" flags are ignored
 - ▶ Authorization will fail if "Recovery Needed" flag is on

Image Copy Completion

- **IC record created**

- ▶ If *REUSE* and "available" IC used, IC record describing "available" data set is deleted

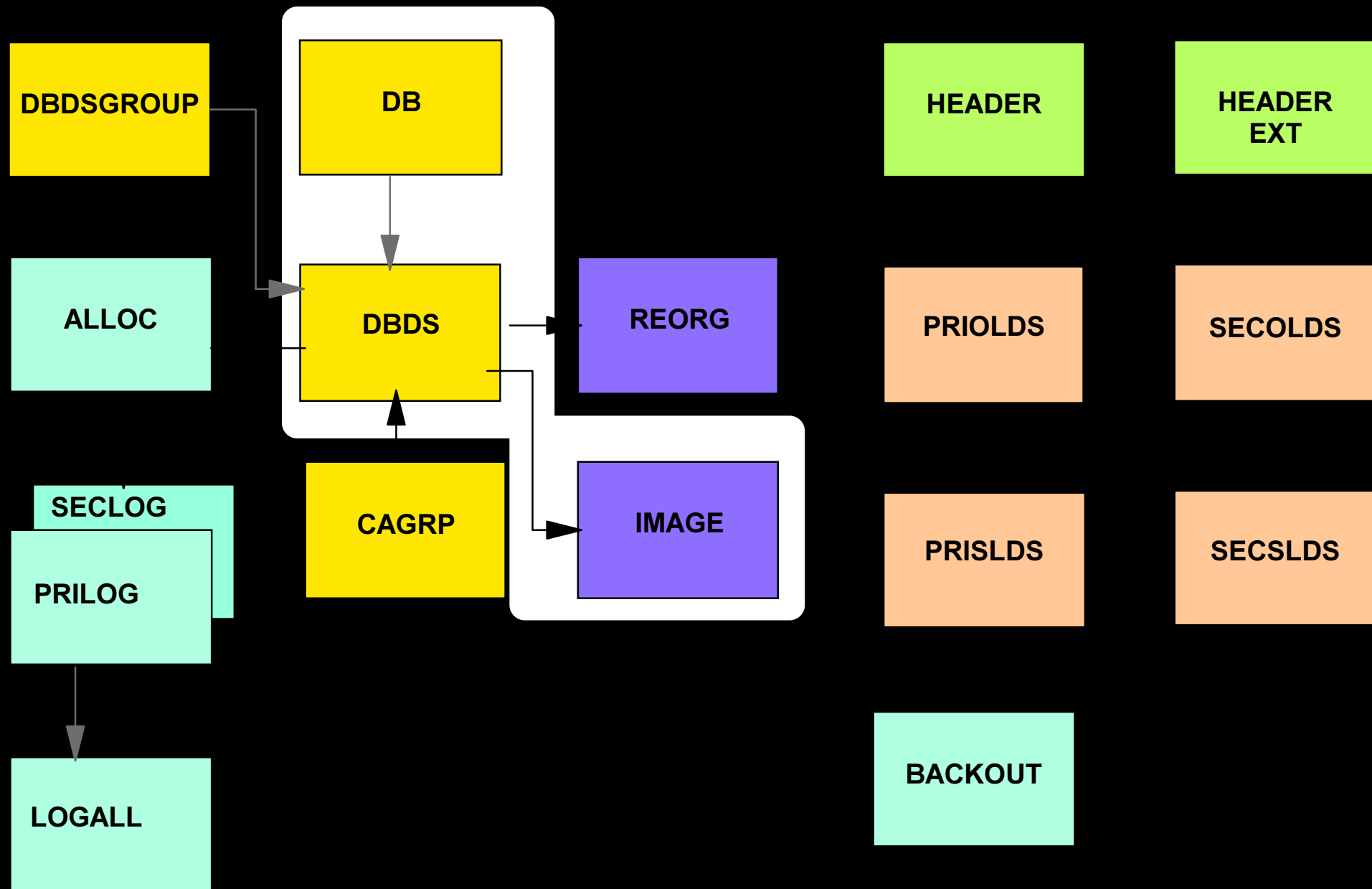
- **If GENMAX is exceeded and RECOVPD exceeded**

- ▶ delete oldest IC record

IMAGE Record Deletion

- REORG and RECOV records created prior to oldest IC record are *deleted*
- ALLOC records created prior to oldest IC record and not needed for recovery are *deleted* (OLIC and CIC implications)
- ALLOC records created prior to oldest IC and needed for recovery are *updated*
 - ▶ ALLOC timestamp set to IC timestamp
 - ▶ START timestamp set to starting log volume (PRILOG compression implications)
 - ▶ If ALLOC records are deleted, the associated LOGALL records are updated

RECON Records: Image Copy



IC Record Listing

IMAGE

RUN = 1977.351 22:17:04.4 EST * RECORD COUNT =180000
STOP = 1997.351 22:31:33.0 EST CONCUR USID=0000000572

IC1

DSN=IMSPROD.SAMPDBD5.SAMPDDN5.G0313V00 FILE SEQ=0001
UNIT=CARTRIDG VOLS DEF=0001 VOLS USED=0001
VOLSER=188300

IC2

DSN=DISASTER.SAMPDBD4.SAMPDDN4.G0313V00 FILE SEQ=0001
UNIT=CARTRIDG VOLS DEF=0001 VOLS USED=0001
VOLSER=S05672

IC Types: BATCH | ONLINE | CONCUR | **SMSCIC (V6)** | **SMSNOCIC (V6)**

Change Accumulation processing

- GENJCL
- Validation
- Completion

Change Accumulation GENJCL

- If REUSE option

- ▶ Set first "available" CA as new accum file
- ▶ If no "available" CAs exist, select oldest CA for reuse

- Select latest valid CA for old accum file

- Select all needed log volumes (next foil)

- Create DB0 control cards for all members of CAGRP

- ▶ Purge time stamp = latest valid image copy time stamp
 - Will be earlier for CIC

Change Accumulation Log Selection

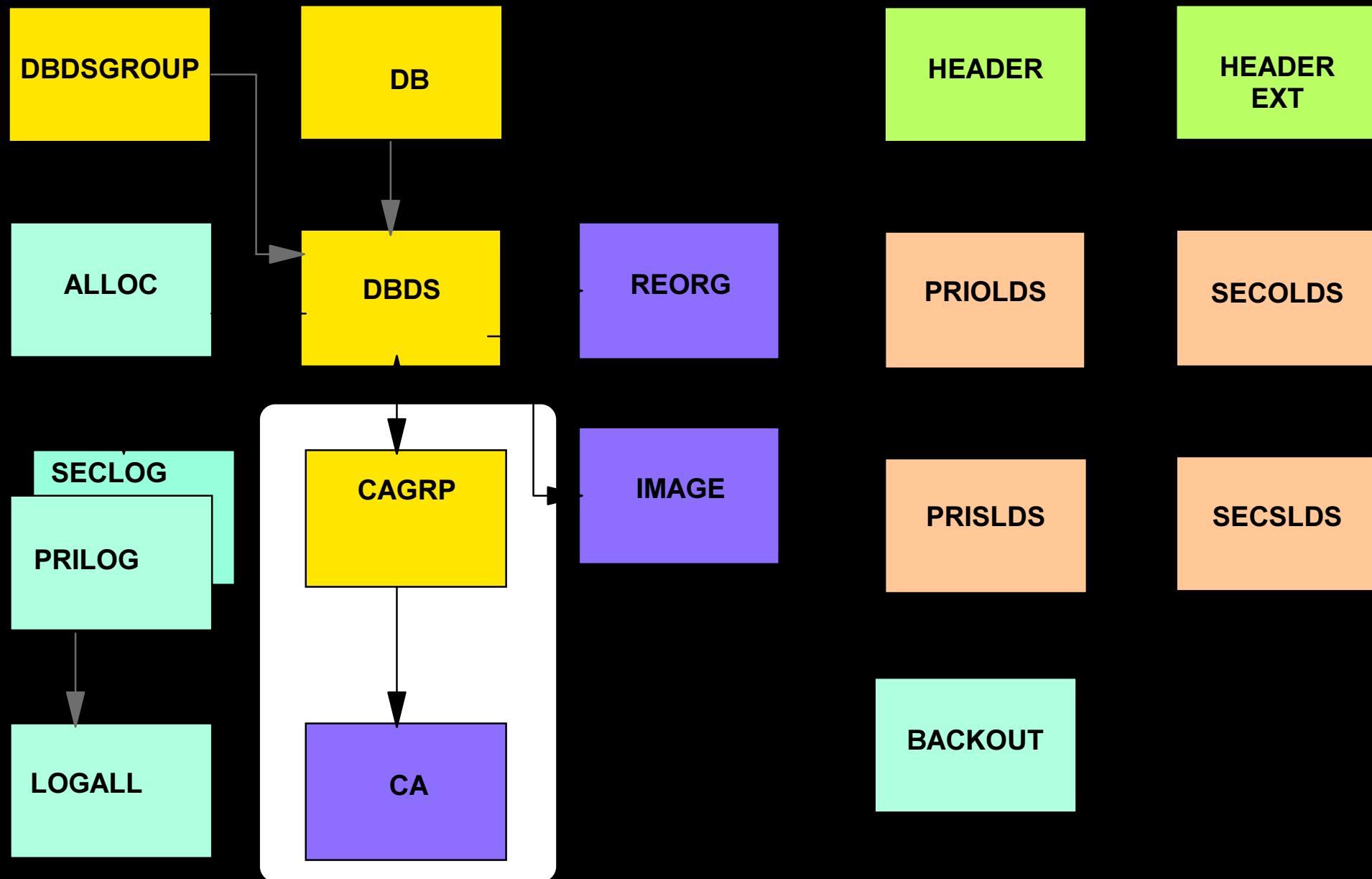
- For each database data set in the CAGRP, select all log volumes that
 - ▶ Contain change records for the DBDS (ALLOC records) and
 - ▶ Are available (log volume has stop time in PRILOG record) and
 - ▶ Have a stop time greater than the computed purge time and
 - ▶ Have not been processed in the old accum file and
 - ▶ Do not follow an archiving "gap"
- Merge resulting list of log volumes and order in log volume start sequence
- Log selection ignores impacts of time stamp recoveries

Change Accumulation Completion

- CA record created

- ▶ If REUSE and "available" CA used
 - CA record describing "available" data set is deleted
- ▶ If GRPMAX exceeded, delete oldest CA

RECON Record: Change Accum.



Batch BACKOUT processing

- **DBRC validates input log to ensure that**
 - ▶ **For Batch:**
 - log is last non-backout generated log for the subsystem
 - no "volume gaps" exist
 - ▶ **For Online**
 - no "volume gaps" exist
- **DBRC returns UOWs that need backing out**

... .. more

Batch BACKOUT processing ...

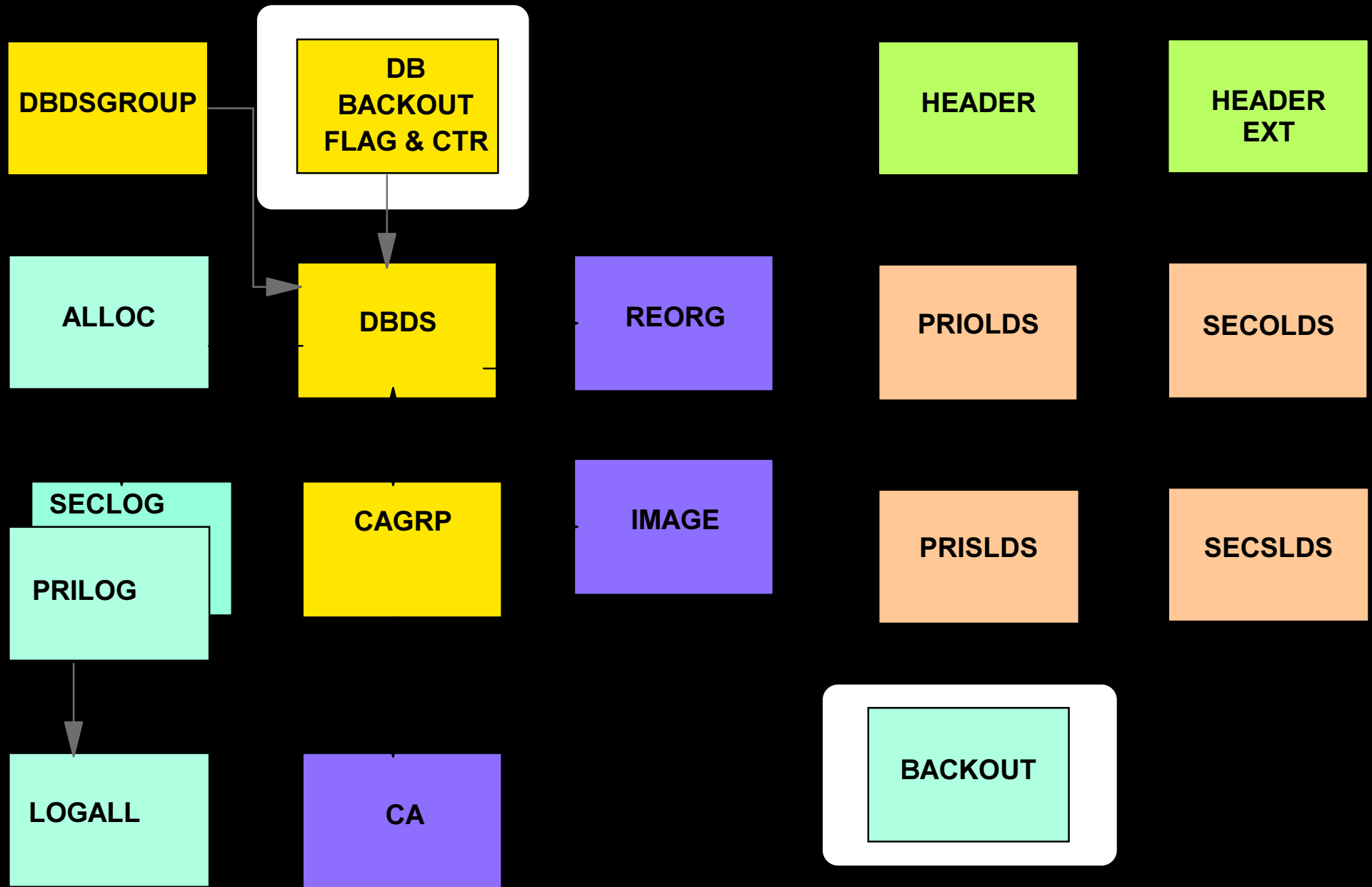
- If COLDSTART or ACTIVE,

- ▶ batch backout will return all UOWs that need backing out to DBRC
- ▶ DBRC will add UOWs to the BACKOUT record if they do not already exist

- Following successful backout,

- ▶ UOWs will be removed from backout record
- ▶ if no more UOWs
 - backout record will be deleted
- ▶ Backout Counter in DB record will be decremented
 - If all counters in record are zero, Backout Needed flag will be turned off

RECON Records: Batch Backout



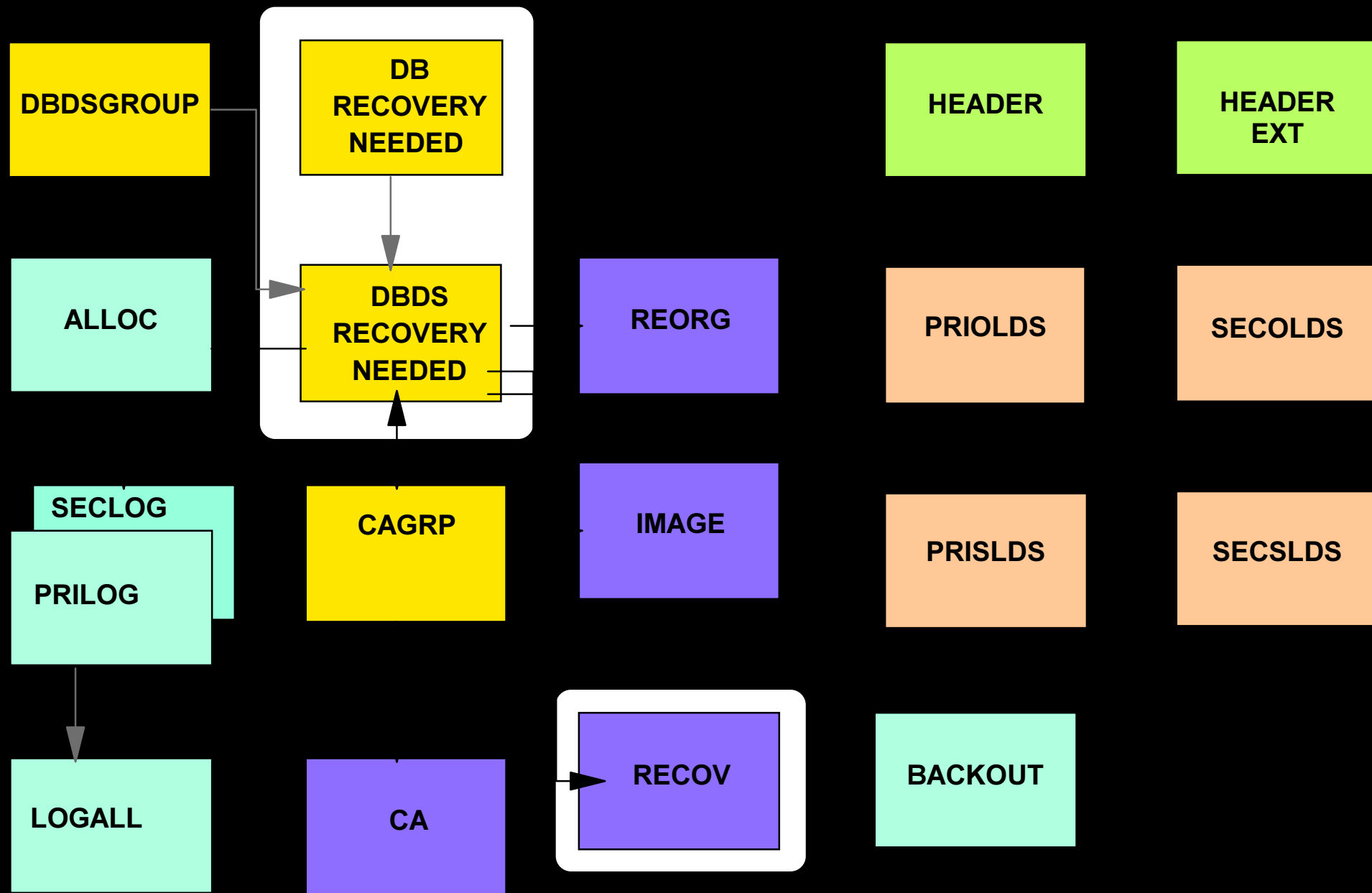
Database Recovery Utility Processing

- GENJCL
- Sign-on
- Validation
- Authorization
- Recovery Processing
- Sign-off

DB Recovery Authorization & Termination

- Participates in database level sharing
 - ▶ ACCESS = EX
- Special authorization logic
 - ▶ All currently authorized subsystems must be marked as abnormally terminated
- List of valid USIDs passed at execution time
- "Recovery Needed" flags and counters set at beginning of execution for full function
- "Recovery Needed" flags and counters must already be set at beginning of execution for fast path
- "Recovery Needed" flags and counters reset at end of execution

RECON Records: DB Recovery



Recovery Record listing

RECOV

RUN = 1997.042 06:14:46.9 EST
RECOV TO= 1997.042 02:39:56.1 EST

* RUN USID = 0000000129
RECOV TO USID = 0000000128

Database Recovery (Full)

- **GENJCL.RECOV DBD(name) DDN(name)**
- **Determine "gaps" caused by prior time stamp recoveries**
- **Select latest valid IC that does not include changes from a "gap"**
- **Select latest valid CA that**
 - ▶ **Has same purge time stamp as selected IC**
 - ▶ **Does not include changes associated with a "gap"**
 - ▶ **Does not span a REORG**
 - ▶ **Contains changes**

... .. **more**

Database Recovery (Full)

- **Select log volumes that**
 - ▶ **Contain changes (updates)**
 - ▶ **Have a stop time greater than the IC "purge" time**
 - ▶ **Not included in selected CA**
 - ▶ **Not created in a "gap"**
- **If logs cross a REORG boundary,**
 - ▶ **fail request**
- **Order logs in EOVS time sequence**
- **If logs need merging,**
 - ▶ **then fail with "Merged Needed" message**

Time Stamp Recovery

- **Used to recover a database data set to an earlier state**
 - ▶ "as at a point in time"
 - ▶ Cannot ensure application or multi-database system integrity
 - ▶ Is sometimes used as a substitute for application error-recovery
- **GENJCL.RECOV DBD(name) DDN(name) RCVTIME(time stamp)**
- **Determine "gaps" caused by prior time stamp recoveries**
- **Validate RCVTIME**
 - ▶ **Must not be within "span" of an ALLOC record**

Time Stamp Recovery

- **Select latest valid IC that**

- ▶ Does not include changes from a "gap"
- ▶ Run time is less than or equal to RCVTIME
- ▶ Stop time (OLIC) is less than or equal to RCVTIME

- **Select latest valid CA that**

- ▶ Has same purge time stamp as selected IC
- ▶ Does not include changes associated with a "gap"
- ▶ Does not span a REORG
- ▶ Contains changes within recovery window and
- ▶ Contains no changes beyond that window

... .. **more**

Time Stamp Recovery

- **Select log volumes that**
 - ▶ **Contain changes within recovery window**
 - ▶ **Have a stop time greater than the IC "purge" time**
 - ▶ **Not included in selected CA**
 - ▶ **Not created in a "gap"**
- **If logs cross a REORG boundary,**
 - ▶ **fail request**
- **Order logs in EOV time sequence**
- **If logs need merging,**
 - ▶ **then fail with "Merge Needed" message**

Non-recoverable DB Considerations

- **Registration**

- ▶ **INIT.DB ... NONRECOV**

- **Operation**

- ▶ **No ALLOC records created**

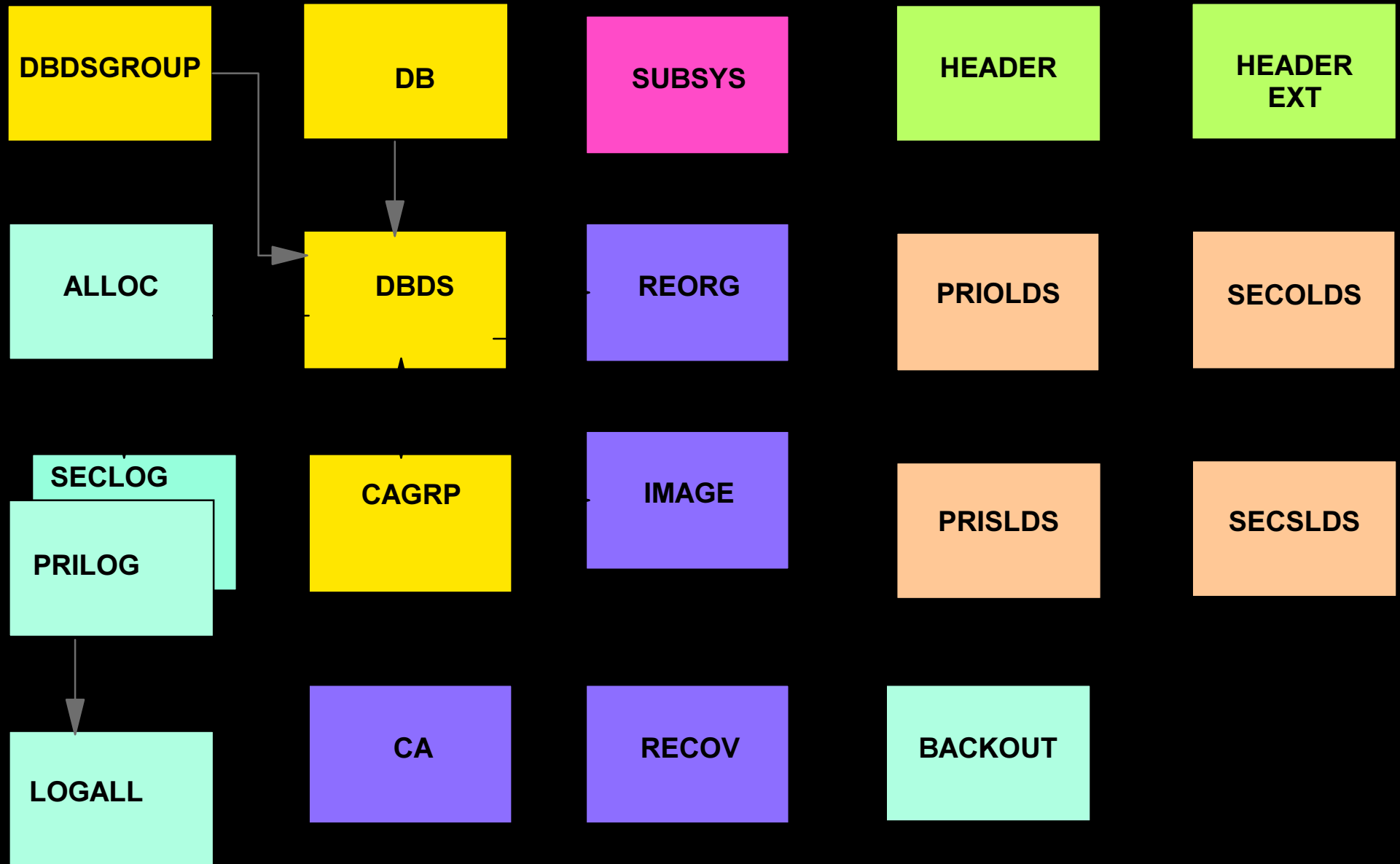
- **Recovery**

- ▶ **GENJCL.RECOV DBD(name) DDN(name) RESTORE**

DBDSGRP Considerations

- Used with **GENJCL.IC**, **GENJCL.OIC**, **GENJCL.RECOV**, and **GENJCL.USER** commands
 - ▶ Result is equivalent to issuing multiple identical **GENJCL** commands
 - for each member of the **DBDSGRP**
 - ▶ **DBD** is an implied group that contains all the **DBDS** in the **DBD**
 - ▶ **CAGRP** is treated as a valid **DBDSGRP**
- Used with **LIST.DBDS** and **LIST.HISTORY** commands
 - ▶ Same comments as above

RECON Record Types



TOPIC 4: IMS/ESA V6.1 CHANGES

- **Daylight Savings time and Y2000 support**
 - **New Time Stamp format**
 - **Internal changes**
 - **Impact on users**
- **DFSMS Concurrent Copy**
- **Functional changes to DBRC**
- **Performance changes to DBRC**

Daylight Savings time and Y2000

● Concepts are simple

- ▶ Support 4-digit years
- ▶ Use UTC (GMT) times internally
- ▶ Allow for 'daylight savings time' changes during operation
- ▶ Increase precision of times to micro-second level
- ▶ Support cross time-zone IMS operation (Data Sharing & RSR)

● Many internal changes to IMS and DBRC

- ▶ Log records
 - ▶ Control blocks
 - ▶ Messages
 - ▶ DBRC formats and commands
- more

Daylight Savings time and Y2000

● Impact on users

- ▶ New display and command formats
 - Automated Operations applications may need alteration
- ▶ Changes in utility control cards wherever date/time occurs
- ▶ Applications which access logs or RECONs
 - RECON record formats have changed
 - IMS log records have changed
- ▶ DBRC command formats have changed wherever date/time occurs
- ▶ DBRC outputs e.g. LIST.RECON have changed wherever date/time occurs

DFSMS Concurrent copy

- V6 provides support for this function of DFSMS

- ▶ New Database Image Copy 2 Utility
- ▶ DBRC support for new image copy type
- ▶ IMS Database Recovery Utility (DFSURDB0) runs without changes
 - Must run with DBRC

- DFSUDMT0 - Database Image Copy 2 Utility

- ▶ Invokes DFSMSdss DUMP (using the DFSMSdss API) to create copy of data set
- ▶ Can produce consistent (*clean*) or concurrent (*fuzzy*) image copy
- ▶ May request 1-4 copies
- ▶ *Registers 2 copies* with DBRC at completion of DUMP

DBRC Performance Enhancements

- **General RECON performance issues have been raised for**
 - opening,
 - authorizing,
 - closing and
 - unauthorizing databases
- **V6 enhancements reduce the impact of these functions by**
 - ▶ Reducing the **number of calls to DBRC**; and by
 - ▶ Reducing the **number of RECON records accessed** when calls are made
 - ▶ Reducing **pathlength (CPU cycles)** required for DBRC functions
 - ▶ There are no externals to these improvements, but they may change the way the user chooses to manage the resources

DBRC Changes - DEDB access

- **Fast Path DEDB databases with large numbers of AREAs can suffer performance problems:**
 - ▶ **FP Pre-opening many Areas**
 - **Can impact IMS Restart times significantly**
 - ▶ **FP Area close**
- **DBRC processing has been changed**
 - ▶ **to substantially reduce the number of IMS calls to DBRC**
 - ▶ **to reduce pathlength and RECON I/Os**

Other DBRC Changes

- **RECOVCTL support has been removed**
- **Functional enhancements support new IMS facilities such as**
 - ▶ **Shared DEDBs with VSO**
 - ▶ **CA/DBD/DB Groups**
 - ▶ **Log retention Period**
 - ▶ **NOTIFY.RECOV timestamp**
 - ▶ **Identify batch backout logs**
 - ▶ **List deleted log data sets**
 - ▶ **LIST.RECON output**
 - ▶ **Support for DST/2000**
 - ▶ **Support for DFSMS CC**

DBRC Summary

● Functional enhancements in IMS/ESA V6

- ▶ Dropped support for RECOVCTL
- ▶ Functional enhancements
- ▶ Shared DEDBs with VSO
- ▶ CA/DBDS/DB groups
- ▶ NOTIFY.RECOV timestamp
- ▶ Identify batch backout logs
- ▶ Log retention period
- ▶ List deleted log data sets
- ▶ LIST.RECON output

E42

IMS/ESA From the RECON's Point of View

Thank you for your evaluation, Karen



Anaheim, California

October 23 - 27, 2000

E42: APPENDIX

IMS/ESA From the RECON's Point of View

Recon Initialization
Database Registration
Diagnostic Information
RECON Records Summary



Anaheim, California

October 23 - 27, 2000

RECON Initialization: INIT.RECON

- NOCATDS | CATDS
- COEX | NOCOEX
- DASDUNIT(3400 | unittype)
- NOFORCER | FORCER
- CHECK17 | CHECK44 | NOCHECK
- NOLISTDL | LISTDL
- LOGRET('001' | 'time interval')
- SSID(name)
- NONEW | STARTNEW
- TAPEUNIT(3400 | unittype)
- UPGRADE

Database Registration

- INIT.DB
 - INIT.DBDS
 - INIT.ADS

- [INIT.IC]

- INIT.CAGRP
 - [INIT.CA]

- INIT.DBDSGRP

INIT.DB

- DBD(name)
- RECOVABL | NONRECOV
- SHARELVL(0 | 1 | 2 | 3)
- TYPEIMS | TYPEFP
- GSGNAME(gsgname)
- DBTRACK | RCVTRACK

INIT.DBDS

- DBD(name)
- DDN(name) | AREA(name)
- DSN(name)
- GENMAX(2 | value)
- DBTRACK | RCVTRACK
- DEFLTJCL(member)
- GSGNAME(name)
- ICJCL(ICJCL | member)
- NOREUSE | REUSE
- OICJCL(OICJCL | member)
- NOPREO | PREOPEN
- RECOVJCL(RECOVJCL | member)
- RECOVPD(0 | value)
- RECVJCL(RECVJCL | member)
- NOVSO | VSO
 - ▶ CFSTR1(name)
 - ▶ CFSTR2(name)
 - ▶ NOLKASID | LKASID
 - ▶ NOPREL | PRELOAD

INIT.ADS

- DBD(name)
- AREA(name)
- ADDN(name)
- ADSN(name)
- UNAVAIL | AVAIL

INIT.IC

- DBD(name)
- DDN(name) | AREA(name)
- ICDSN(name)
- ICDSN2(name)
- VOLLIST(volser, volser, ...)
- VOLLIST2(volser, volser, ...)
- FILESEQ(1 | value)
- FILESEQ2(1 | value)
- UNIT(3400 | unittype)
- UNIT2(3400 | unittype)

INIT.CAGRP

- GRPNAME (name)
- GRPMAX (value)
- CAJCL (CAJCL | member)
- DEFLTJCL (member)
- NOREUSE | REUSE
- GRPMEM ((dbdname,ddname) , (dbdname,ddname) , ...)

NOTE: 2000 members as of V6, else 1024 members

INIT.CA

- GRPNAME(name)
- CADSN(name)
- VOLLIST(volser,volser, ...)
- FILESEQ(1 | value)
- UNIT(3400 | unittype)

INIT.DBDSGRP

■ For DBRC Command Processing (DBDSGROUP)

- ▶ GRPNAME(name)
- ▶ MEMBERS((dbdname,ddname), ... (dbdname,ddname))

■ For IMS Command Processing (DATAGROUP)

- ▶ GRPNAME(name)
- ▶ DBGRP(dbdname,areaname, ... areaname,dbdname)

NOTE: 2000 members as of V6, else 1024 members

Diagnostic Information

- **RECON record formats are documented in the DSECTS**
 - ▶ **Generate IMS with MACLIB=ALL then**
 - ▶ **DSECTS found in GENLIBB and MACLIB**
 - **IMS/ESA V6 DBRC Guide & Reference, Appendix B**

- **The format of the key fields for RECON records is documented in**
 - **IMS/ESA V6 Diagnosis Guide & Reference Chapter 3.7.2 and Table 64.**

Diagnostic Information

■ DBRC internal trace

- ▶ is a useful diagnostic tool when problems are suspected in DBRC.
- ▶ It is always enabled.

■ The DBRC trace can help diagnose many different types of problems, such as:

- ▶ RECON data set contention
- ▶ RECON errors that are indicated by messages
- ▶ System abends in which the PSW is pointing to DBRC
- ▶ Whether DBRC or some other IMS component is causing the problem

■ DBRC Trace is usually used in conjunction with advice from an IBM Support representative

RECON Records: Usage summary

Record	Created	Updated	Deleted	Notes
Header	INIT.RECON	- Initial DBRC Exit - VERIFY process		
Header Extension	INIT.RECON	- Initial DBRC Exit - VERIFY process		
DB	INIT.DB	SUBSYS Authorization Subsys Unauthorization DB I/O Error Backout failure /ERE NOBMP /DBR deallocation Normal Subsys Termination Abnormal Term (if no Updates)		
DBDS	INIT.DBDS	Image Copy Change Accum RSR Tracking DB Recovery DB I/O Error		

RECON Records:

Usage summary... ..

Record	Created	Updated	Deleted	Notes
DBDSGRP	INIT.DBDSGRP			
SUBSYS	Batch Initialization /NRE Online	<ul style="list-style-type: none"> - Log Open - Abend ESTAE - Signon Recovery Start - Signon Recovery end - Batch Backout - DB Allocation/Dealloc. Log Open (Begin Batch Job) TM - First log Open Subsys Authorization Subsys Unauthorization /DBR deallocation 	<p>Normal Subsys Termination</p> <p>Abnormal Subsys Termination - if no Updates.</p>	

RECON Records:

Usage summary

Record	Created	Updated	Deleted
ALLOC	TM - First DB Update	/DBR deallocation ALLOC recs prior to oldest IC will be updated - if needed for recovery	At IC record deletion, ALLOC recs prior to oldest IC will be deleted - if not needed for recovery
PRIOLDS SECOLDS	* First Online Log Open	OLDS Switch OLDS Close	
PRILOG SECLOG	Log Open (Begin Batch Job) TM - first Log Open	Log EOVS (Batch) Log Close (Batch) Archive Begin Archive End PRILOG Compression	
LOGALL	Log Open (Begin Batch Job) TM - First log Open	Subsys Authorization Subsys Unauthorization TM - First DB Update Dealloc /DBR Dealloc TM Close If ALLOC recs deleted	
CA	INIT.CA CA Completion - if CA rec. for REUSE of available CA data set exists	CA Completion - if CA rec. for REUSE of available CA data set exists	At CA Completion If GRPMAX exceeded

RECON Records:

Usage summary

Record	Created	Updated	Deleted
PRISLDS SECSLDS	TM - First log Open		
Archive OLDS (if it does not exist)	Archive Begin		
Archive Open RLDS/SLDS	Image Copy DB Reload (HS with IC NOREUSE)		IC Completion - if GENMAX & RECOVPD exceeded
Archive End			Records prior to oldest IC deleted when an IC record is deleted
RECOV			As for REORG recs.
BACKOUT			Successful BACKOUT of all UOWs