IMS Version 7

Rich Lewis and Suzie Wendler
IBM Dallas Systems Center

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Abstract

IMS, the recognized leader in database and transaction management, continues to evolve. IMS may be used to power e-business environments while preserving customers' investments in mission-critical applications and data.

IMS Version 7 introduces many enhancements to help its users provide increased availability, improved performance, and a more usable system. This presentation highlights the new system, database, and transaction manager capabilities. IMS V7 includes High Availability Large Database (HALDB) which supports databases with up to 1001 independently managed partitions, Online Recovery Service (ORS) which allows users to recover databases with online facilities, Rapid Network Restart which implements VTAM persistent sessions, Open Database Access (ODBA) which provides for IMS database access from DB2 stored procedures, DBRC usability and performance enhancements, improved DEDB availability, and many performance, usability, and availability enhancements.

This presentation will be of interest to both IMS TM and DBCTL users.

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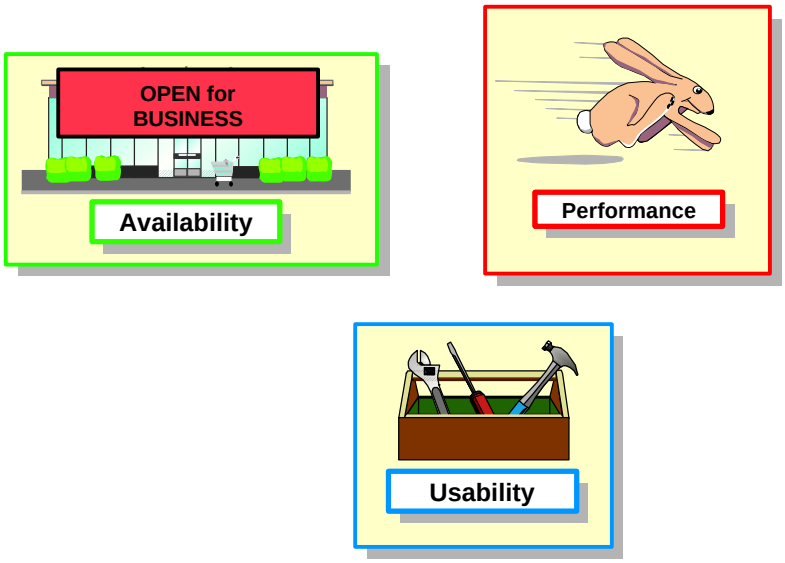

- IMS V7 delivers enhancements to IMS which allow users to increase their systems and data availability, improve their performance, and to enjoy greater usability. This presentation indicates the which of these characteristics each enhancement is designed to address.

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System Enhancements

- Install/IVP process
- System Parameters display
- CPLOG specification
- Concurrent upgrade of RECONs
- Online RECON access preference
- RECON loss notification
- ACBGEN processing and limits
- IMS Monitor and IMS PA enhancements

Database Enhancements

- High Availability Large DB (HALDB)
- Online Recovery Service (ORS)
- Change Accum enhancements
- Image Copy 2 compression
- DBRC GENMAX and RECOVPD
- DBRC PROCOPT=L|LS support
- I/O error handling for DEDBs
- DEDB Scan segment expansion
- Open DB Access (ODBA)

- The enhancements listed on this page and the next page are explained in this order in the rest of this presentation.

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Transaction Manager Enhancements

- CQS Enhancements for Shared Queues
- Asynchronous OTMA/APPC
- TM and MSC Message Routing and Control User Exit
- Deferred VTAM ACB open
- RACF PassTicket support
- USERID clarification
- SLUP/Finance Session Cold Termination
- Spool enhancement
- Queue Space Notification Exit enhancement
- SLU2 enhancement
- ETO Enhancements
- Callable Interface to OTMA
- VTAM Generic Resources enhancements
- Rapid Network Reconnect (RNR)
- IMS Connect

System Enhancements

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System Enhancements

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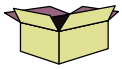
Install/IVP Enhancements

- **Style and format of Install/IVP panels standardized**
  - Same look and feel as other IBM products
    - Action Bar Pull-Downs
    - Pop-up windows
    - Standard command and message areas
- **Sample IVP jobs support DFSMS allocation parameters**
  - STORCLAS
  - MGMTCLAS



Usability

- IMS V7 changes the style of the panels displayed in the Install/IVP so that they have the same look and feel as other IBM products. In general, the changes are reflected in the colors shown and placement of the various panel areas.
-
- The IMS IVP dialogs build JCL to install IMS. DFSMS MGMTCLAS and STORCLAS class names may be specified in the variable gathering phase with IMS V7. They then will be used for the allocation of IVP data sets.
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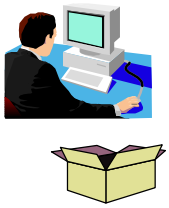
Install/IVP Enhancements

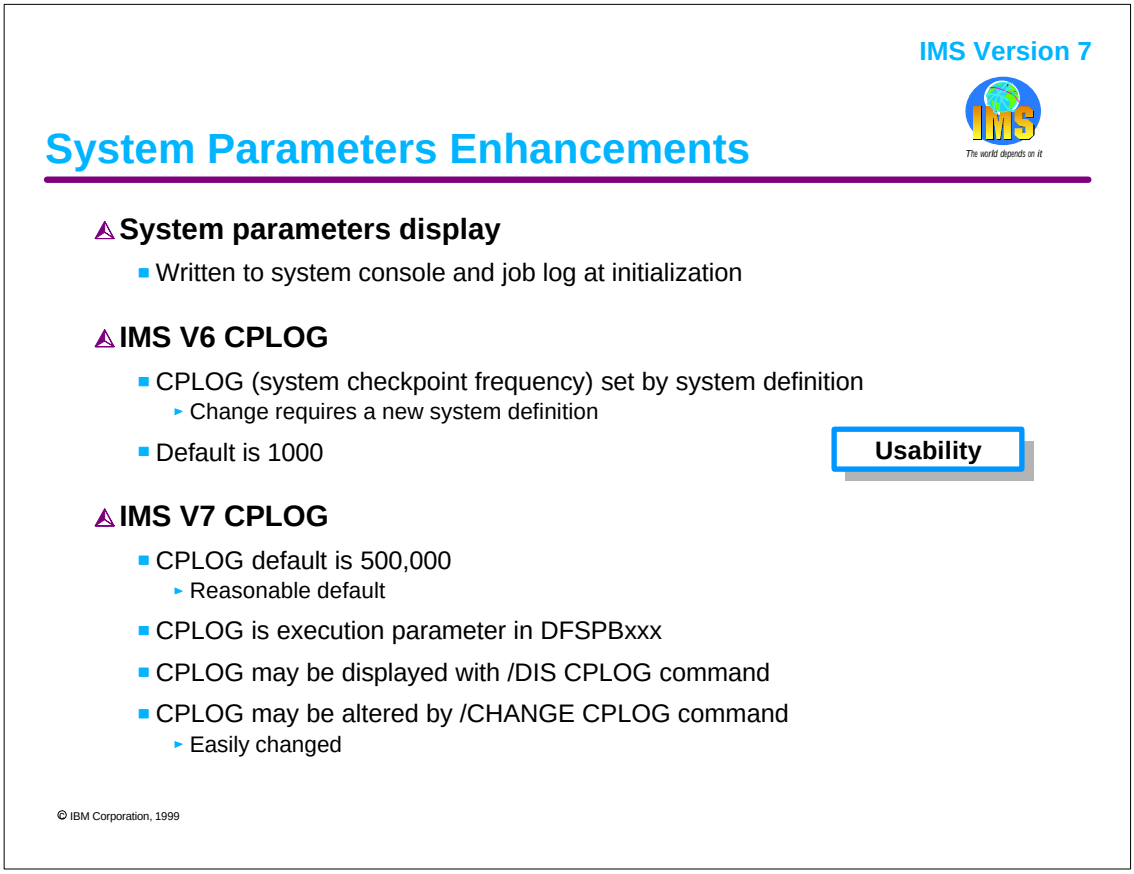


- **OS/390 Standards**
  - Data set names
    - Distribution libraries: ADFS prefix
    - Target libraries: SDFS prefix
  - Macro libraries
    - One distribution library: ADFSMAC
    - One target library: SDFSMAC

Usability

- **SYSGEN reduction**
  - More than 1000 modules moved from SYSGEN to DFSJCLIN

- IMS V7 has changed the standard data set names for its distribution and target libraries. Data set names include ADFS (distribution libraries) or SDFS (target libraries) prefixes. Macro libraries have ADFSMAC or SDFSMAC prefixes. This adheres to the OS/390 naming standards for these types of data sets. These naming standards are also used by other OS/390 products, such as CICS and DB2.
-
- IMS V7 has moved over 1000 modules from the system definition process to DFSJCLIN processing. This eliminates some system definition processing and allows SMP/E to track these modules when maintenance is applied to them. The exposure to installation errors has been lessened.



- A new IMS message displays the system parameter values that are in effect during IMS initialization. The values can come from the system generation (defaults), the overrides in the DFSPBxxx member of PROCLIB, or override specification in the EXEC statement. The information provides an easily-identifiable format to document the values that are actually in effect.
-
- IMS V7 has made the setting of CPLOG, which controls system checkpoint frequency, more dynamic.
-
- In IMS V6 the CPLOG was specified in the system definition and could not be overridden. The default value was 1000. This default specified that a system checkpoint should be taken after writing 1000 log records.
-
- The default for CPLOG in IS V7 is 500,000. This is a much more reasonable default value. The IMS V7 CPLOG specification may be overridden in the DFSPBxxx member. It also may be displayed and changed during IMS executions.
-
- This combination on enhancements eliminates a cause for some installations doing an additional system definition. Incorrect checkpoint frequencies are much less likely to occur and, if they do, will not require new system definitions.
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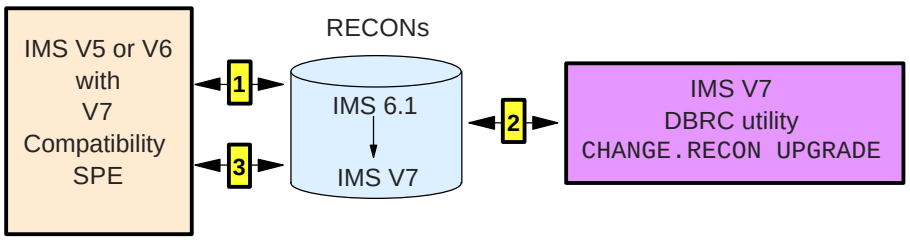
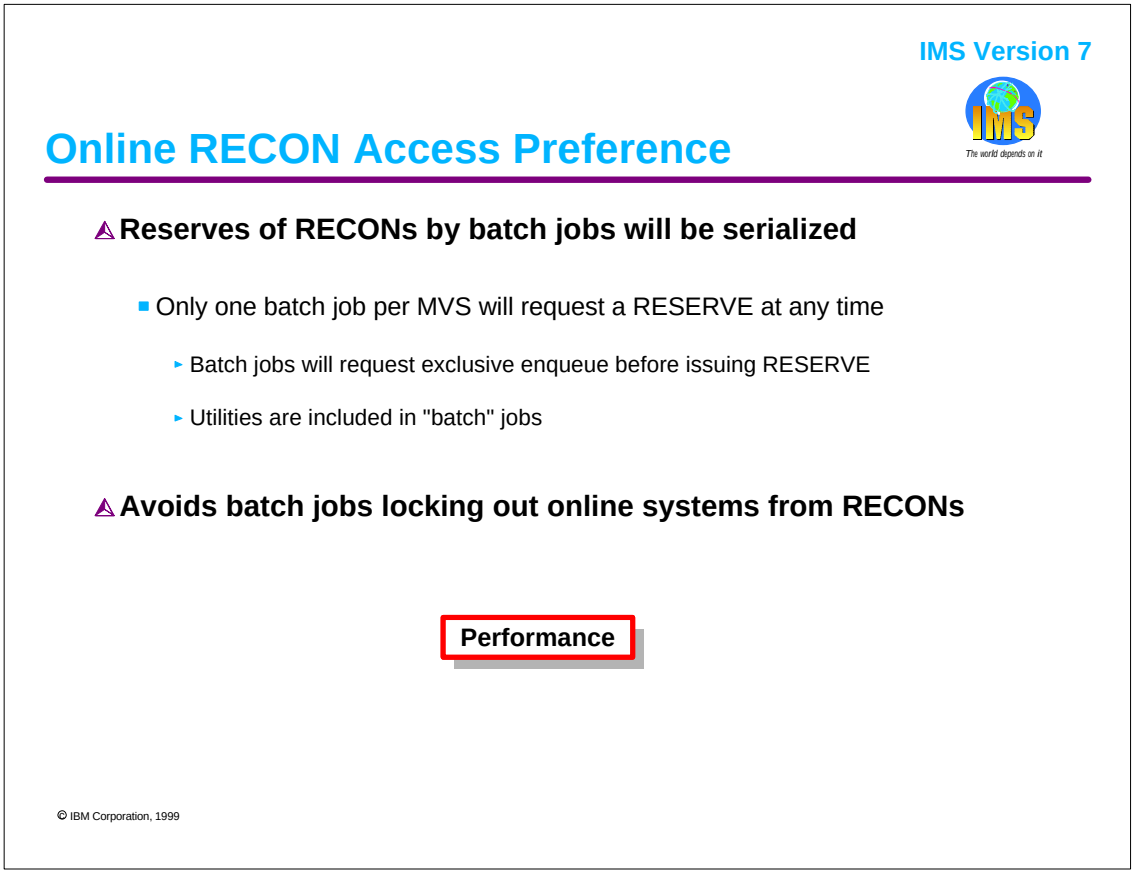
Concurrent Upgrade of RECONs

- **IMS 6.1 RECONs are upgraded to V7 without terminating IMS**
  - Upgraded by DBRC command
    - `CHANGE.RECON UPGRADE`

Availability



- RECONs may be upgraded from the IMS V6 format to the IMS V7 format while systems remain active and connected to them. IMS systems to do not have to be terminated to make this upgrade. This eliminates the outage that was required when upgrading the RECONs for previous releases.
- The RECON compatibility SPE (small programming enhancement) must be on any system which has the RECONs open during the upgrade process. This SPE allows the IMS system to use RECONs with either the IMS V6 or IMS V7 formats. There are SPEs for both IMS V5 and IMS V6 systems.
- The upgrade is done by the new CHANGE.RECON UPGRADE command using the DBRC utility. The command causes the utility to read the records in COPY1 and rewrite them in the IMS V7 format. When this completes, the records from COPY1 are written to COPY2. While these copies are being done, the RECONs are reserved by the DBRC utility. In this illustration, at step 1 the IMS system is accessing the RECONs. In step 2 the utility is upgrading the RECONs. In step 3 the IMS system is again accessing the RECONs.
- Upgrades from IMS V5 RECONs to IMS V7 RECONs are done by the DBRC RECON Upgrade utility. Concurrent upgrades are not supported for these upgrades.



- IMS V7 gives preference to online systems over batch jobs and utilities in accessing the RECONs. Only one batch job or utility on an MVS system will ever attempt to RESERVE the RECONs at any time. This is done by forcing the batch jobs and utilities to acquire an enqueue on a resource. The same resource is requested with exclusive access by each batch job and utility. The enqueues use SCOPE=SYSTEM to limit the enqueue to one MVS system.
-
- Online systems do not request this enqueue before issuing RESERVEs for the RECONs.
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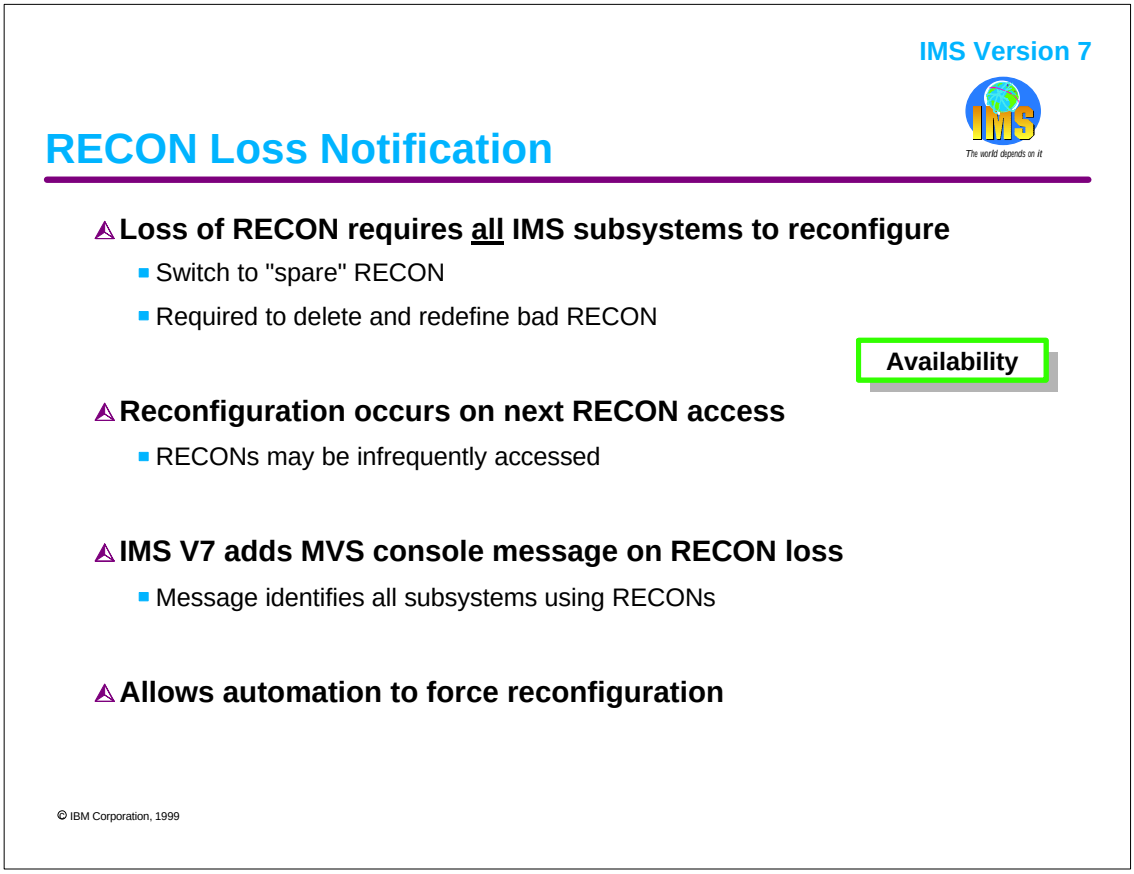
- The result of this new technique is to give access preference to online systems. They will not be forced to wait for the RESERVE requests on many batch jobs to be satisfied before their RESERVE requests are granted.



- The loss of a RECON data set requires that all IMS subsystems using the set of RECONs reconfigure. That is, they must all discontinue using the bad RECON and switch to using the data set that was the spare. This reconfiguration occurs automatically when a subsystem next accesses the RECONs. Each subsystem must go through the reconfiguration process to deallocate the bad RECON. This RECON needs to be deleted and redefined so that it will become the new spare.
-
- IMS V7 adds a new message when the loss of a RECON data set forces a reconfiguration of the RECONs. The message is designed to drive an installation's automation so that the reconfiguration may be done more expeditiously. This message identifies the IMS subsystems which have SUBSYS records in the RECONs and have not been abnormally terminated. This allows automation to know which subsystems need to access the RECONs to invoke the reconfiguration process which will deallocate the bad RECON. Automation could issue a /RMLIST DBRC='RECON STATUS' command to cause these accesses by online subsystems.
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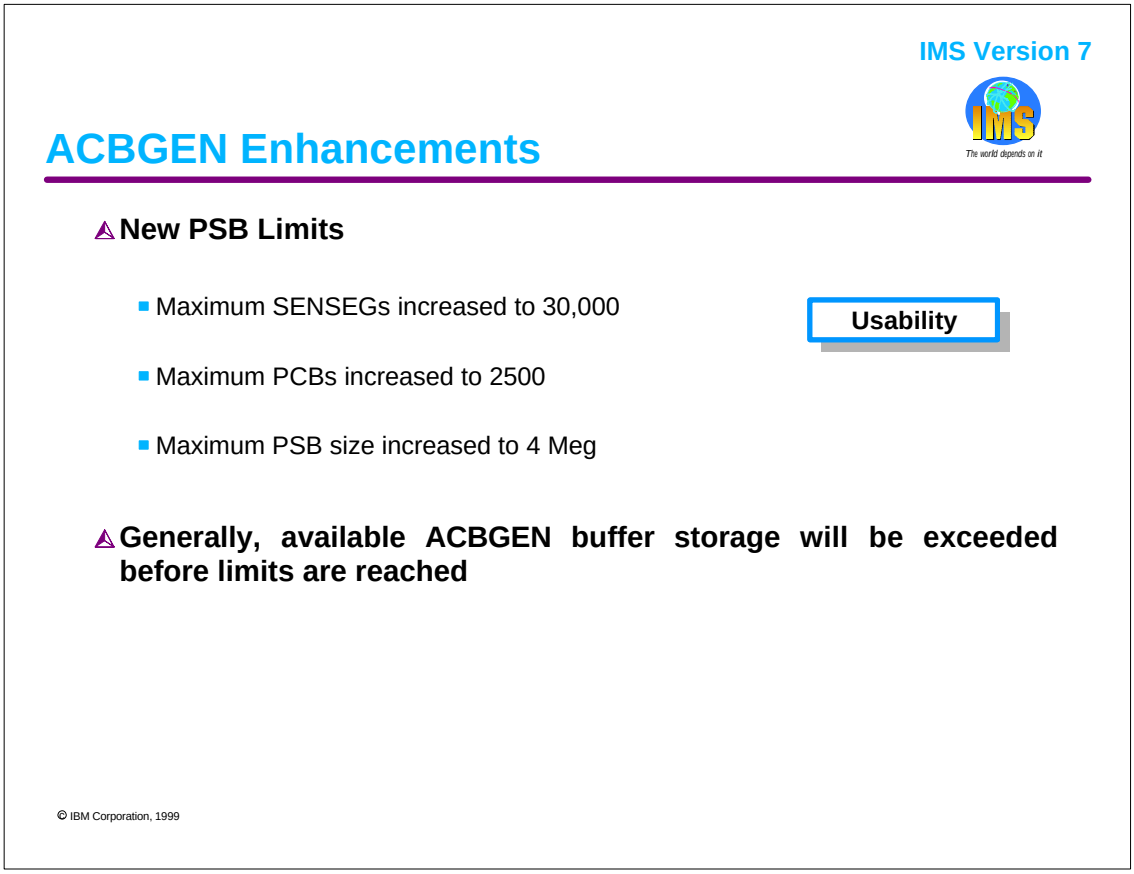

- IMS V7 relaxes the limits for numbers of some statements that may be specified in one PSB. Up to 30,000 SENSEG statements and 2500 PCB statements may be included in a PSB. A PSB requiring up to 4 Meg may be generated. Since a PSB with large numbers of SENSEG or PCB statements will also require large numbers of other statements, the new limitations for SENSEG or PCB statements may not be reached due to the exceeding of buffer storage available for ACBGEN.
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- The previous limit for SENSEG statements in one PSB was 3000. The previous limit for PCB statements was 500.
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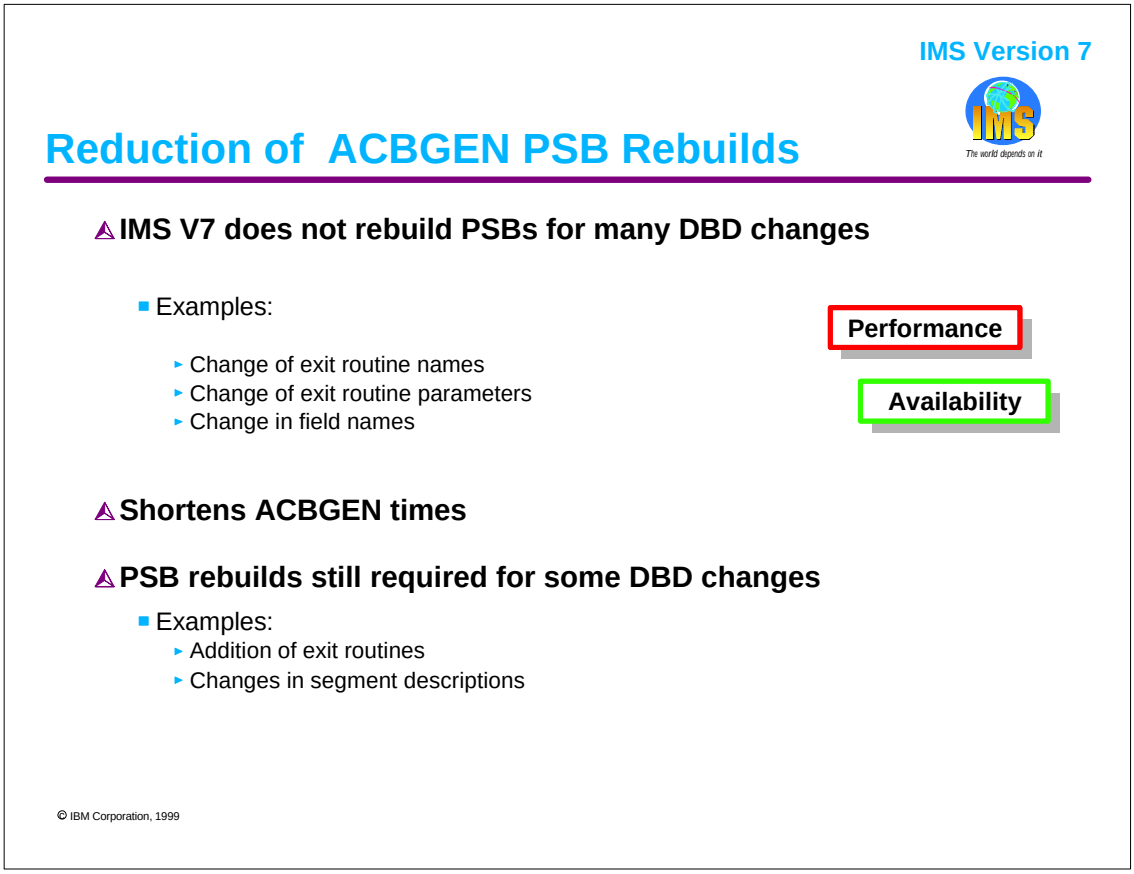
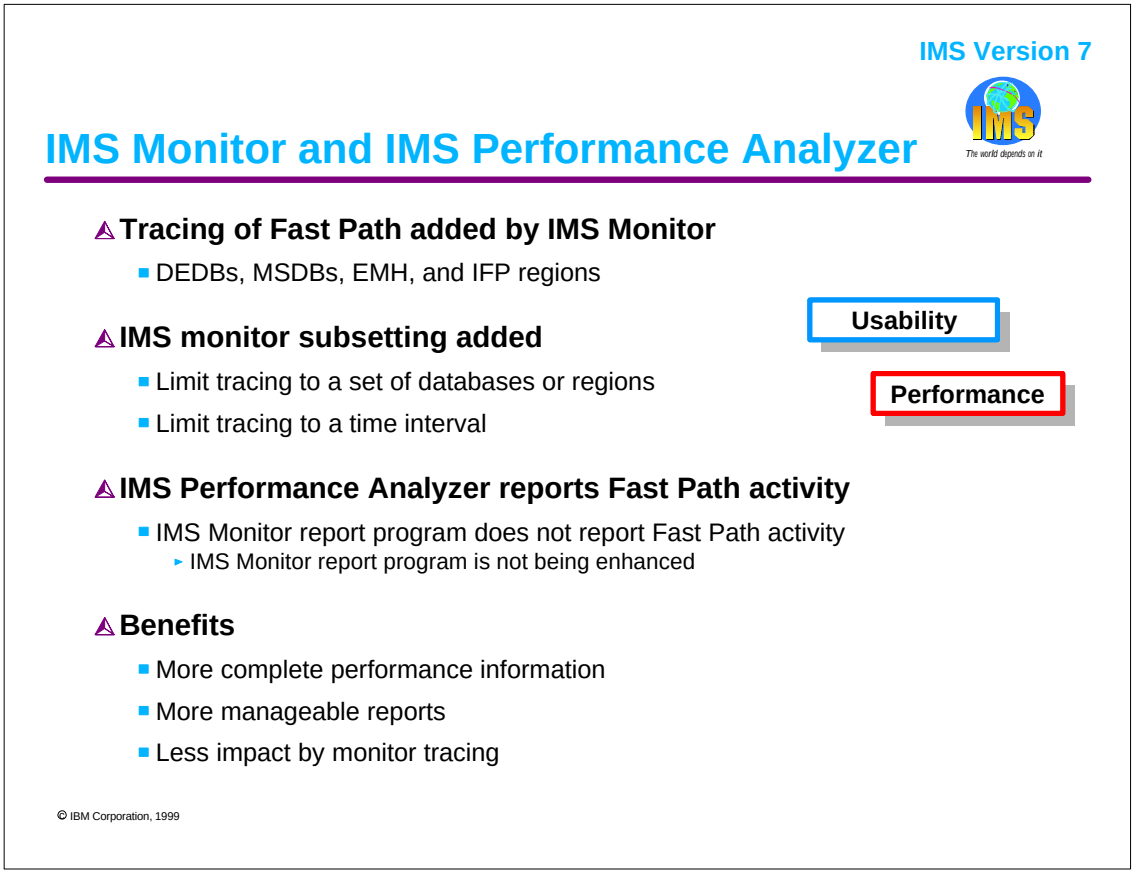
- The changes will allow some unusual PSB requirements to be met. For example, an application generator which requires access to many, if not all, of the databases in an installation might require such a PSB.



- IMS V7 has eliminated some processing done by ACBGEN. When some changes are made to DBDs, IMS V7 does not rebuild the PSBs which reference the databases. For example, one can change the segment/edit compression exit used to compress a segment without rebuilding all of the PSBs which reference the database. Similarly, one can change the randomizing parameters, such as the number of blocks in the root addressable area for an HDAM database without rebuilding PSBs. This will greatly reduce the time required for ACBGENs for these types of changes. Rebuilds of PSBs are still required for some DBD changes, such as the addition of an exit routine type or changes in segment descriptions.



- IMS monitoring has been enhanced in three ways.
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- First, tracing of Fast Path activity has been added. This includes calls and I/Os for DEDBs and MSDBs as well as EMH and IFP region activity.
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- Second, tracing subsetting has been added. Tracing can be limited to only a set of databases or regions. This may greatly reduce the size of reports generated by the monitor. For example, if an installation wants to address a problem with a BMP, it need only trace and report on the BMP. This could reduce the size of a report from 1,000 pages to a handful.
-
- Third, when starting a trace, the requesting command can include a time interval. At the end of the interval, tracing will be stopped.
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- The IMS Performance Analyzer product reports Fast Path activity. The IMS Monitor report program which comes with IMS will not report this activity. This report program has not been enhanced to process the new Fast Path trace records.

Database Enhancements

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Database Enhancements

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HALDB (High Availability Large Database)

- **Large Database**

  Up to 10,010 data sets per database!

  Greater than 40 terabytes

  - Databases are partitioned
    - Up to 1001 partitions per database
    - Partitions have up to 10 data set groups

- **High Availability Database**

  - Partition independence
    - Allocation, authorization, reorganization, and recovery are by partition
  - Self healing pointers
    - Reorganization of partition does not require changes to secondary indexes or logically related databases which point to it

- IMS V7 introduces a new capability for full function databases. This is High Availability Large Database (HALDB). HALDB databases have up to 1001 partitions. Each partition has up to 10 data set groups. This gives HALDB up to 10,010 data sets per database. Each of these data sets may be up to 4 gigabytes. So, the limit is 40 terabytes per database.
- HALDB provides two availability benefits. First, partitions are managed independently. Each partition in a database may be allocated, authorized, reorganized, and recovered independently. Second, the reorganization of a partition does not require utilities to update the pointers in secondary indexes and logically related databases which point to the reorganized data. Even though the reorganization moves segments, pointers to those segments are not updated by the reorganization process. Instead, these pointers are updated as needed. This is a "self healing" process. This combination of capabilities can greatly reduce the windows required for database maintenance. Multiple partitions allow users to reorganize and image copy smaller amounts of data. This takes less time. The reorganizations may be done in parallel as can the image copies. Since pointers are self healing, there is no need for utilities such as Prefix Resolution and Prefix Update to correct pointers. This also reduces the time required for reorganizations.
- The use of HALDB is optional. The non-HALDB databases of previous versions of IMS remain available with IMS V7.

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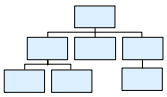
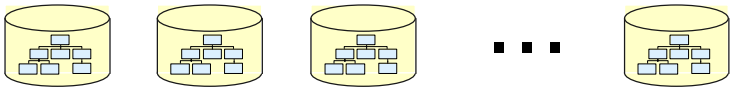
Highlights

- **New database types**
  - PHDAM - partitioned HDAM
  - PHIDAM - partitioned HIDAM
    - Index is also partitioned
  - PSINDEX - partitioned secondary index
- **Hierarchic structure is maintained**
  - A database record resides in one partition



- **Partition selection**
  - By key or by user exit routine



- HALDB introduces three new full function database types, partitioned HDAM (PHDAM), partitioned HIDAM (HIDAM), and partitioned secondary index (PSINDEX). As the names imply, these are partitioned versions of the corresponding database types for non-HALDB databases. PHIDAM includes its index which is also partitioned.
-
- HALDB databases have the same hierarchic structure that is used for other full function databases. With HALDB a database record, which is a root segment and all of its dependents, resides in one partition.
-
- Partitioning may be done either by key range or by a user written exit routine. Either method may be used with each of the three database types, PHDAM, PHIDAM, and PSINDEX.
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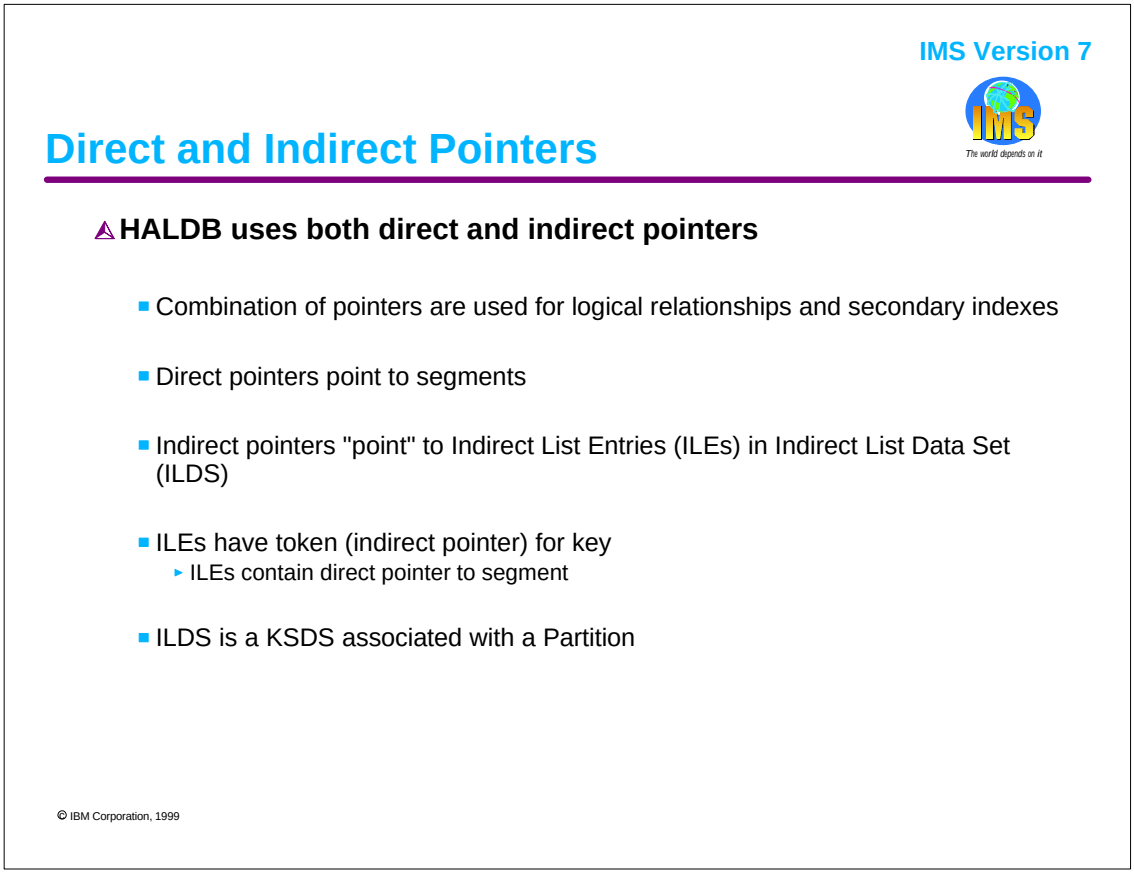
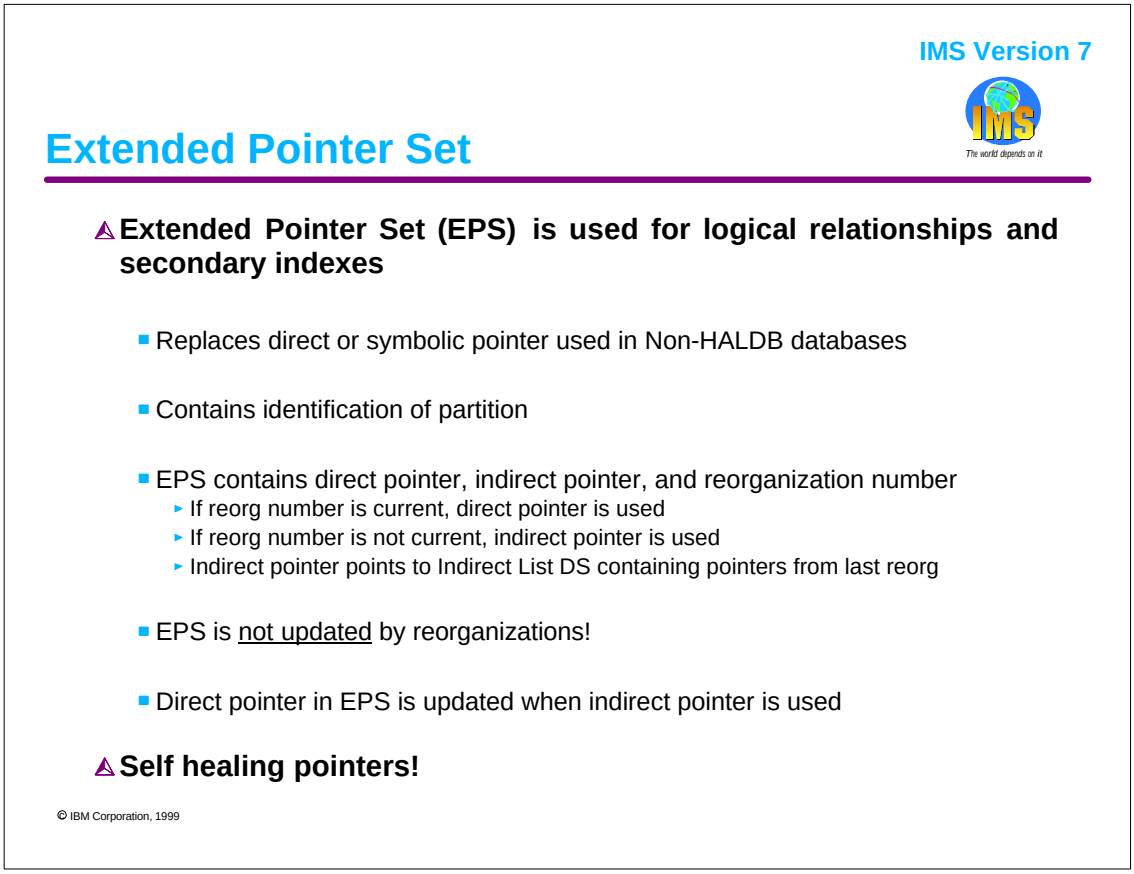
Highlights

- **Logical relationships and secondary indexes are supported**
  - Secondary indexes may be partitioned
- **OSAM and VSAM (ESDS and KSDS) are used**
- **DBRC is required**
  - Databases must be registered
  - Dynamic allocation from DBRC information, not DFSMDA
- **Minimal (or no) application changes required**
  - Initial load cannot insert logical children (must be added by update)
    - New status code for load programs
  - 'Data unavailable' conditions apply to partitions
    - Database may be available, but partition unavailable

- HALDB as complete full function database capabilities. This includes support for logical relationships and secondary indexes.
-
- Like non-HALDB databases, HALDB databases use OSAM, VSAM ESDS, and VSAM KSDS data sets.
-
- HALDB databases must be registered with DBRC. In fact, the definition process stores information about partitions in the RECONs. Since the information about HALDB data sets must be stored in the RECONs, this information is used for dynamic allocation. DFSMDA members cannot be used.
-
- Most users will be able to convert non-HALDB databases to HALDB without any application program changes. Initial loads of HALDB databases cannot insert logical children. There are two choices for handling these programs. Either the logical children may be added by update program which is run after the initial load or the "initial load" program may be executed with PROCOPT=I instead of PROCOPT=L. If an attempt to insert a logical child is made by initial load (PROCOPT=L), a status code 'LF' is returned for the call.



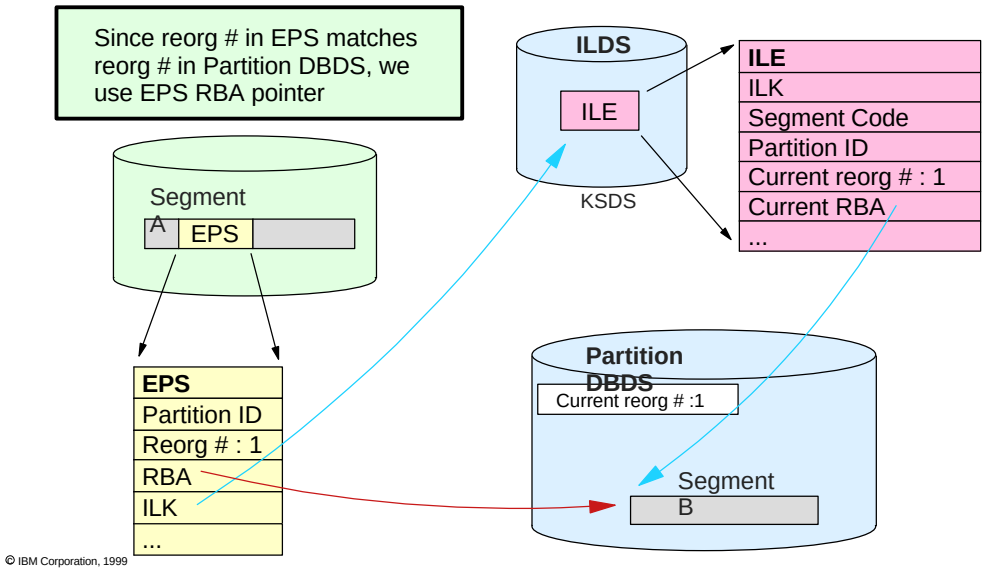
- HALDB uses a combination of direct and indirect pointers for logical relationships and secondary indexes. The direct pointers are relative byte addresses (RBA) which point to segments. Indirect pointers "point" to Indirect List Entries (ILEs). These indirect pointers are actually keys of these ILEs. The ILEs are stored in an Indirect List Data Set. These ILDSs are new with HALDB. Each partition has an ILDS. The ILDS is updated by reorganizations. It contains direct pointers to the new locations of the segments after the reorganization. The ILDS is a VSAM KSDS.



- An Extended Pointer Set (EPS) is used for logical relationship and secondary index pointers. It replaces the direct or symbolic pointer used with non-HALDB databases. The EPS contains an identification of the partition where the target segment resides, a direct pointer to its location, an indirect pointer which is the key of the Indirect List Entry for the target segment, and the reorganization number. This is the reorganization number associated with the direct pointer. It means that the direct pointer points to the location of the target segment after the reorganization associated with the reorganization number.
-
- The EPS is not updated by reorganizations. Reorganizations update the ILEs in the ILDS. The direct pointer in the EPS is updated when the EPS is used. We will see how this "self healing" process works in the example which follows.

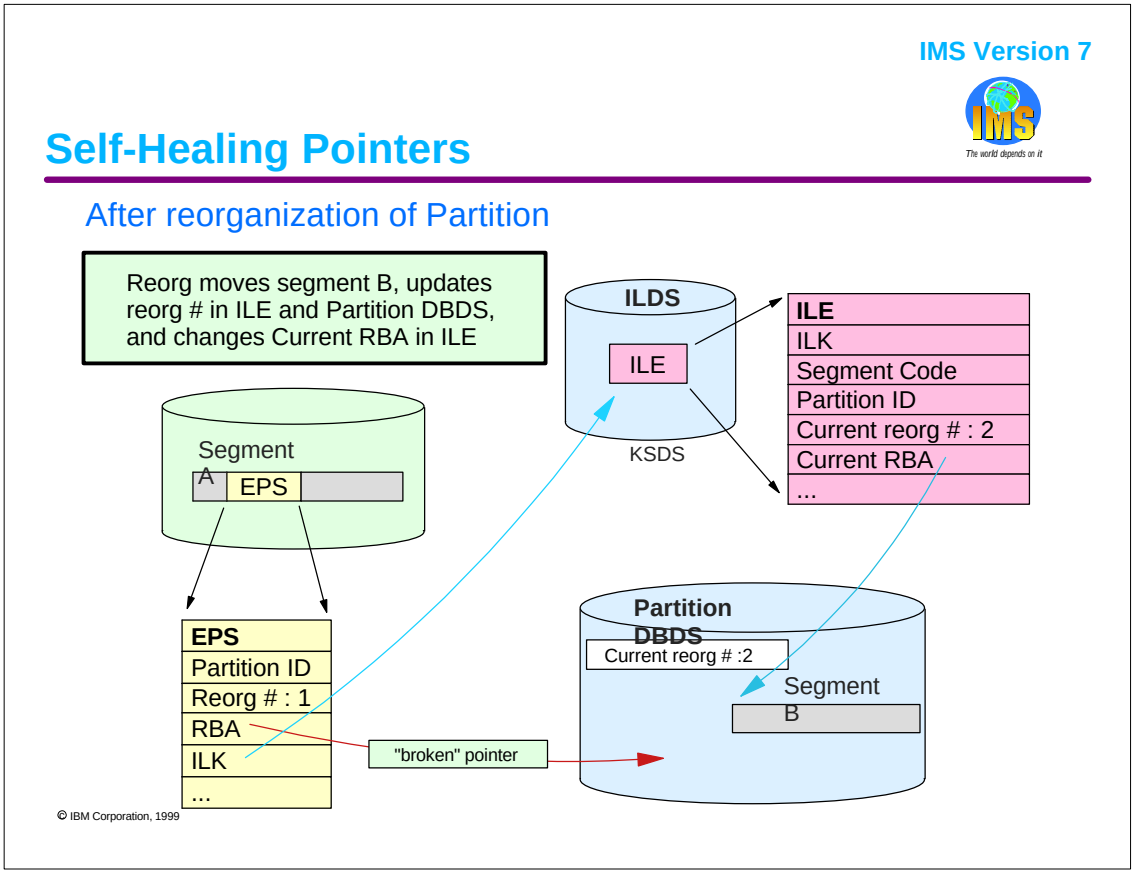
Self-Healing Pointers

Using an Extended Pointer Set (EPS)



- In this example segment A has a pointer to segment B. This pointer is either for a logical relationship or a secondary index. That is, segment A is either a logical child or a secondary index segment. Segment B is the target of the pointer. The Extended Pointer Set (EPS) is in the prefix of segment A.
-
- The EPS contains a direct pointer to segment B. The direct pointer is a Relative Byte Address (RBA). The EPS also contains the partition ID of the partition where segment B resides. The EPS contains a reorganization number for the partition where segment B resides. In this case it is 1. The reorganization number is also stored in the partition database data set. When IMS opens the partition, it keeps the reorg number in its control blocks for the partition. When the pointer from segment A to segment B is used, IMS checks the two reorg numbers, the one in the EPS and the one from the partition DBDS. If they are the same, the direct pointer (RBA) in the EPS is used to go directly to segment B and the ILDS is not used. In this case, the reorg numbers are both 1, so the direct pointer is used.

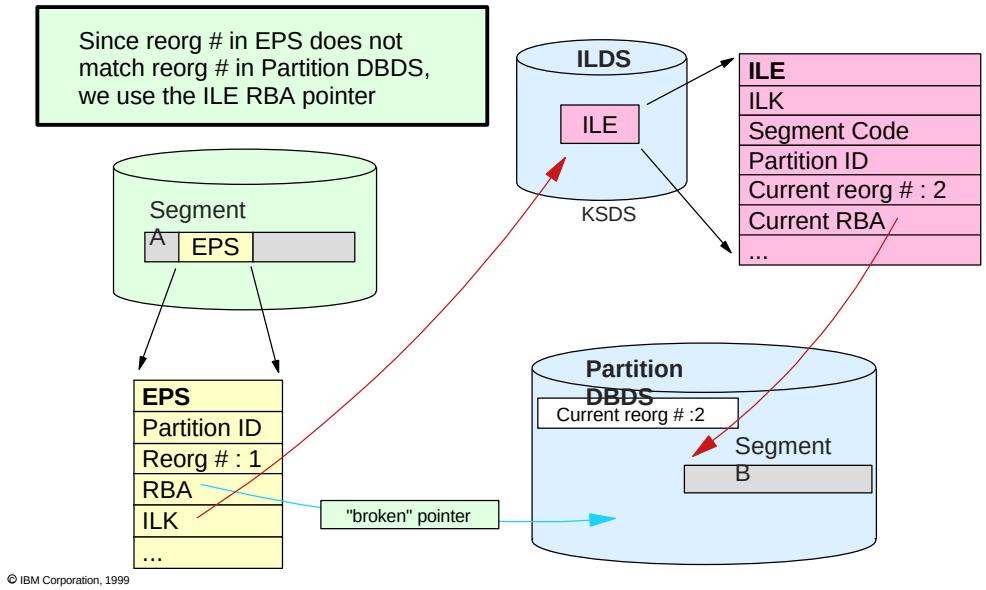
Self-Healing Pointers



- Reorganizing a partition changes the location of its segments. It also updates the ILEs for these segments in the ILDS and updates the reorg number stored in the partition DBDS. It does not update the pointers in EPSs.
-
- In this example, segment B is moved and its ILE is updated with an RBA which points to the new location of B. The reorg number in the partition DBDS is also updated.
-
- Since the EPS in segment A is not changed, its RBA does not point to the new location of segment B. It is now a "broken" pointer. The reorg number in the EPS remains 1.

Self-Healing Pointers

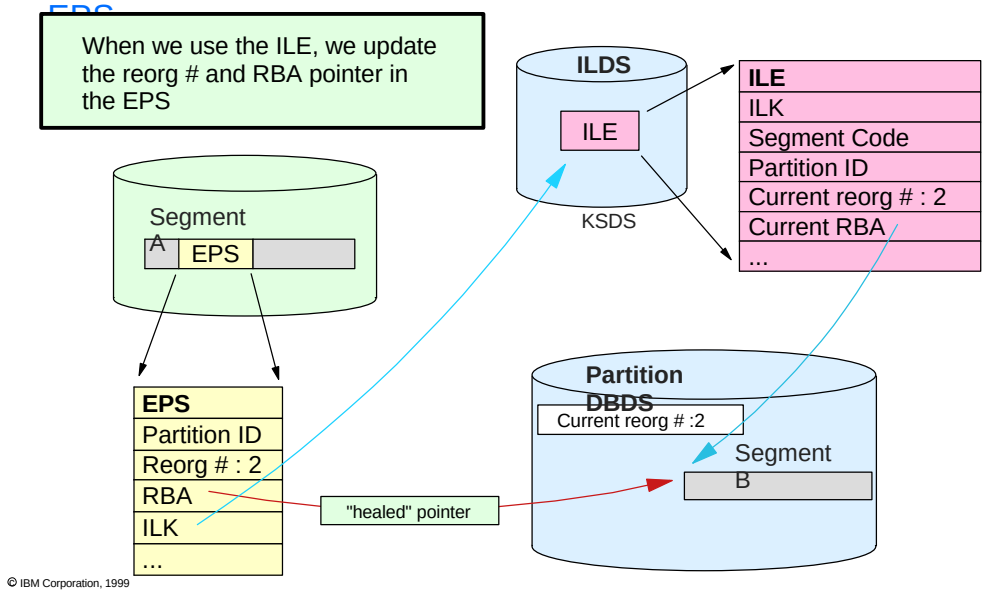
Using the EPS after the reorganization



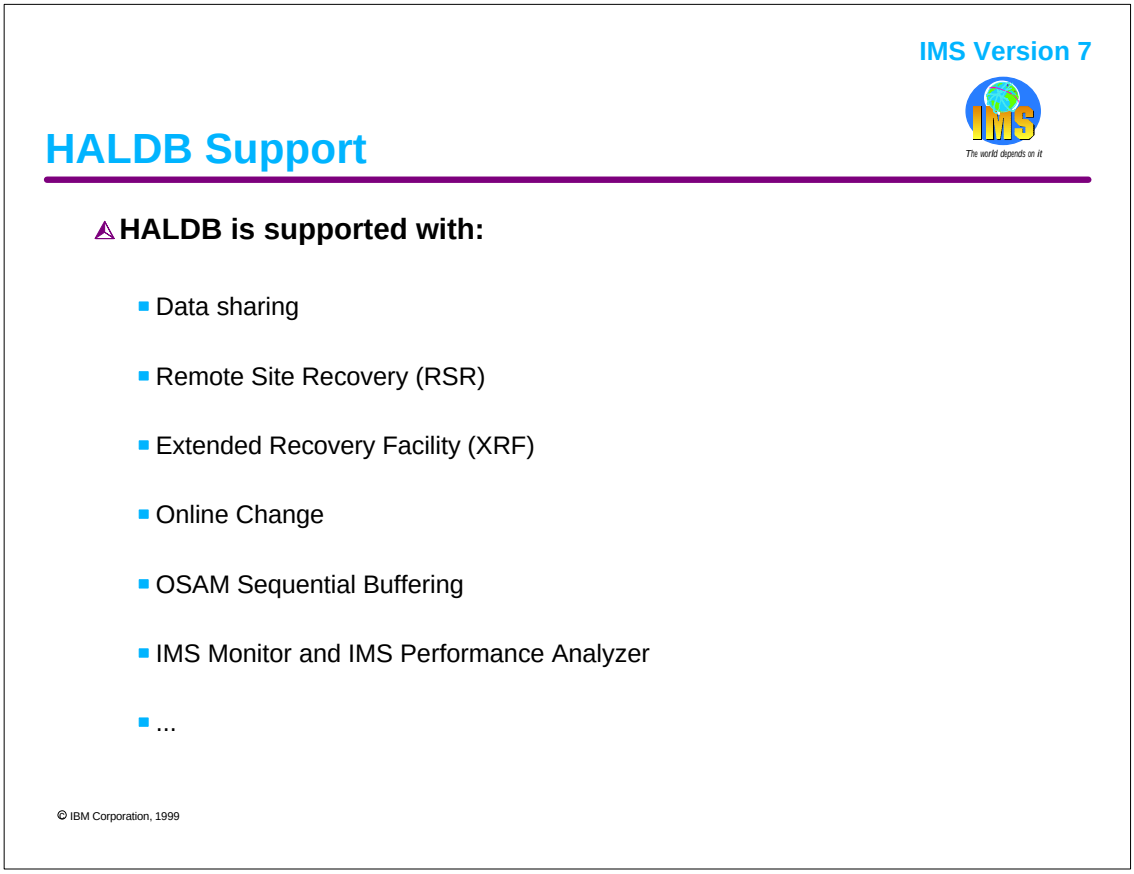
- An IMS call which needs to use the pointer from segment A to segment B will discover the "broken" pointer. IMS knows that the RBA pointer should not be used because the reorg number in the EPS does not match the reorg number in the partition DBDS. Instead of using the RBA, IMS will use the ILK in the EPS to find and read the ILE for segment B in the ILDS. The ILE contains a correct RBA pointer. It was updated by the reorganization.

Self-Healing Pointers

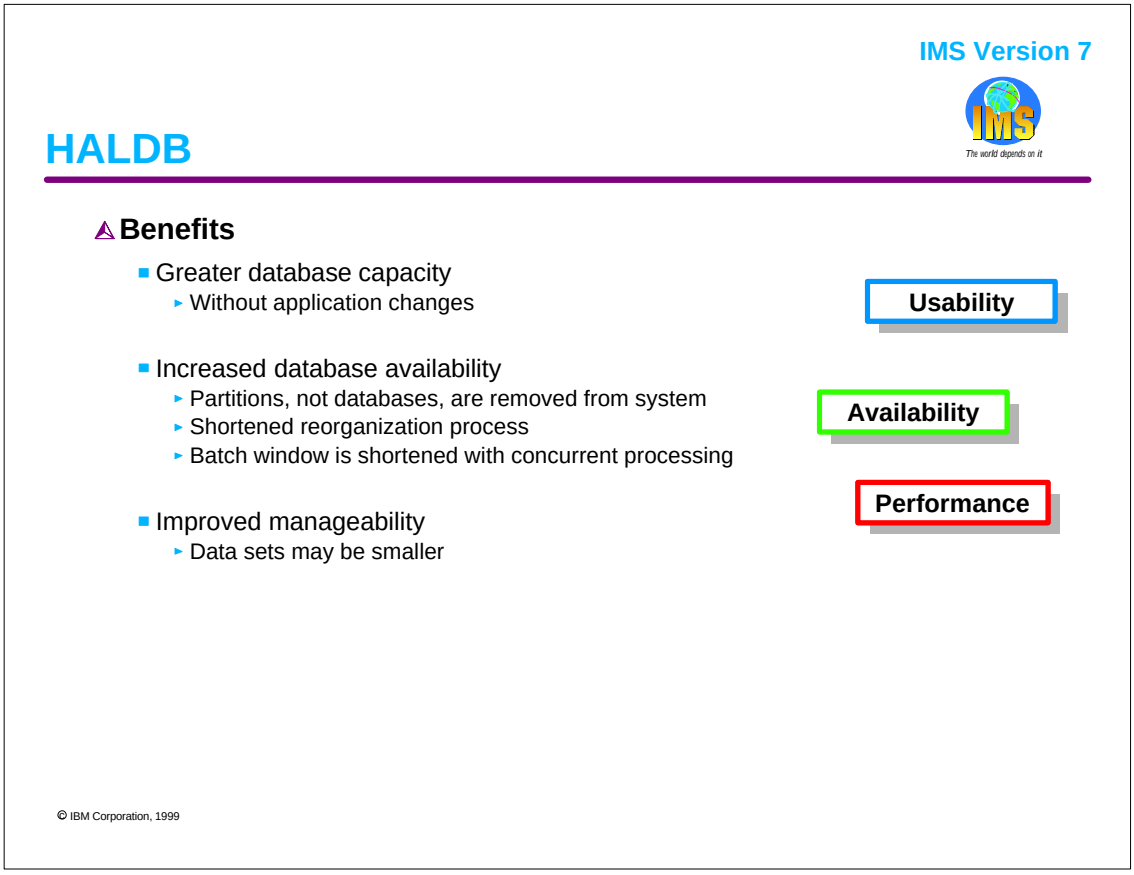
"Healing" the EPS



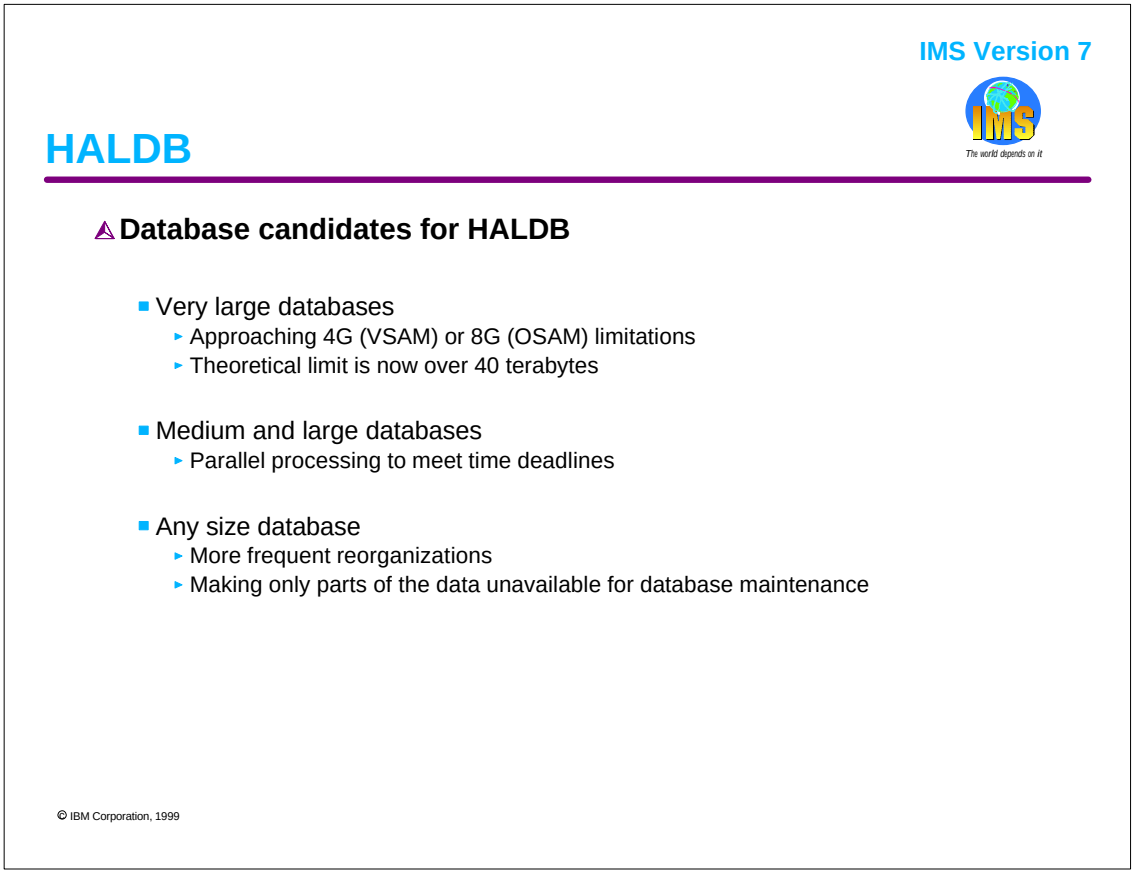
- When an ILE is used, IMS updates the direct pointer (RBA) and the reorg number in the EPS. This allows future uses of the EPS to avoid the overhead of referencing the ILDS. When this "healing" process completes, the EPS in segment A contains reorg number 2 and the RBA of segment B's new location. This update to the EPS is done for any reference by a program with an update PROCOPT for segment A.



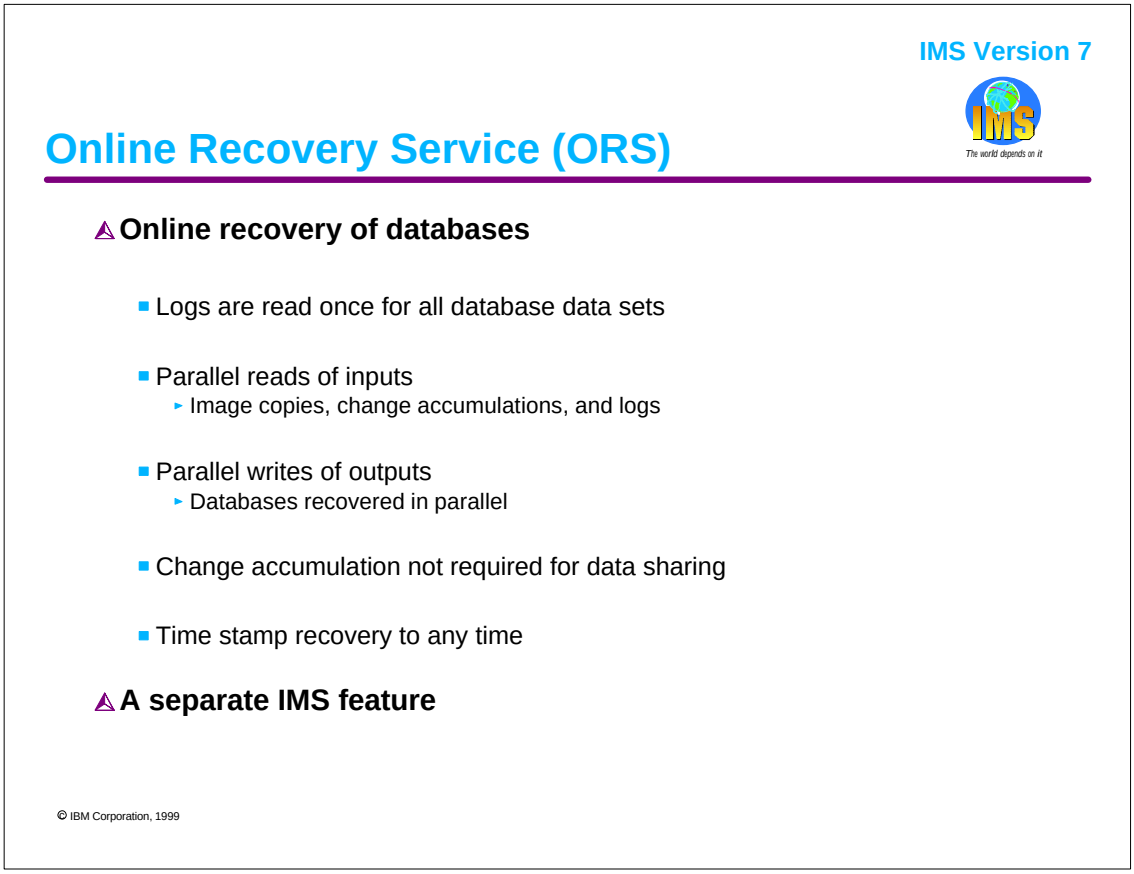
- HALDB has the same support that non-HALDB full function databases have. That is, they may participate in data sharing, RSR, XRF, and online change. HALDB database data sets may use OSAM sequential buffering and VSAM hiperspace buffers. HALDB activity is monitored by the IMS Monitor and reported by the IMS Monitor and the IMS Performance Analyzer product.



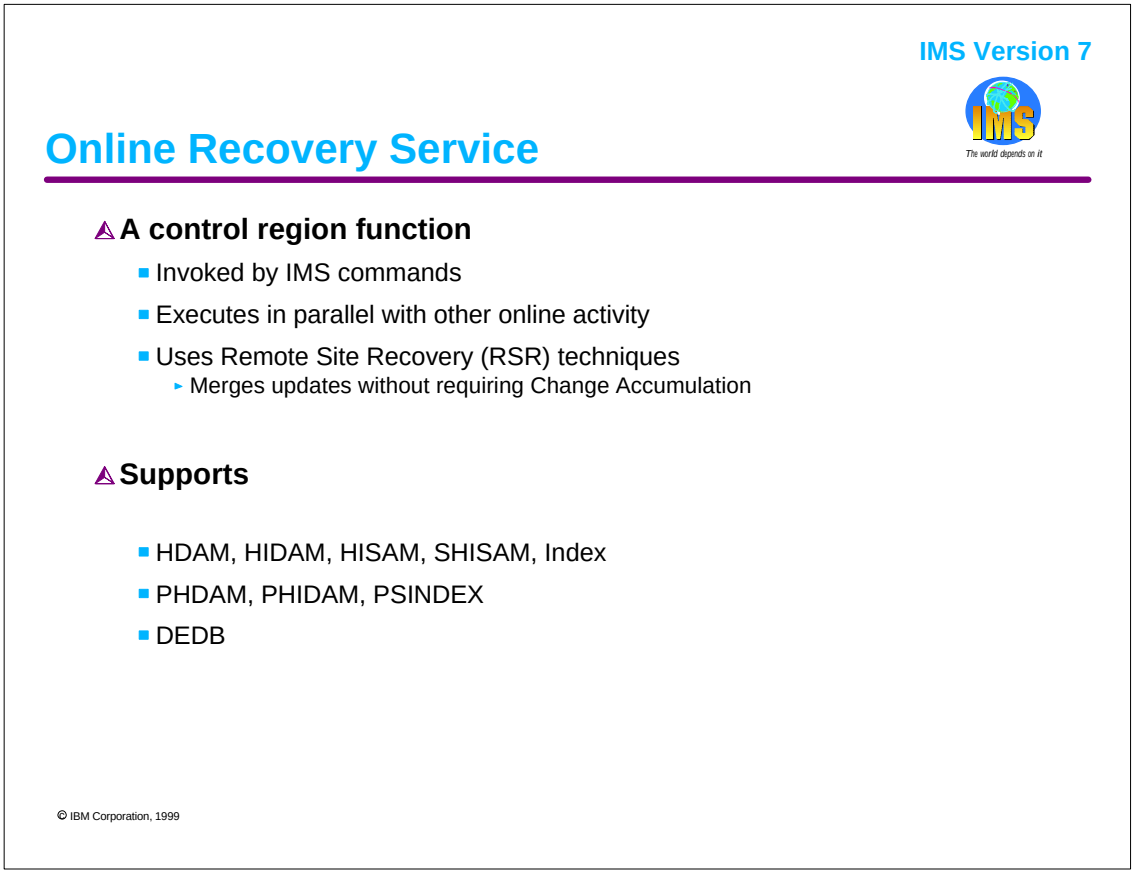
- HALDB benefits users in several ways. It allows databases to become larger without requiring changes to application programs. Availability is increased by multiple means. HALDB allows partitions, not entire databases to be removed from systems for database maintenance purposes. Reorganization times are shortened by providing for concurrent reorganizations of partitions and eliminating utility step requirements to update logical relationship and secondary index pointers. Since partitions may be processed in parallel, HALDB may reduce batch window time requirements. Finally, HALDB eliminates the need to have very large data sets. This improves their manageability.



- The most obvious candidates for HALDB are very large databases. Databases which are approaching the data set size limits of 4GB for VSAM or 8GB for OSAM have their size restrictions removed when they are converted to HALDB.
-
- Medium and large sized databases with time deadlines for batch executions may benefit from the use of parallel processing against multiple partitions.
-
- Even relatively small databases are candidates for HALDB. Since reorganizations may require less time, they may be done more frequently. Installations that can benefit from removing only parts of a database for maintenance processing, will take advantage of HALDB.



- Online Recovery Service (ORS) is a new feature in IMS V7. It is used to recover database data sets using an online system. ORS reads its inputs only one time. Logs and Change Accumulation data sets may be needed as inputs for the recovery of each of multiple database data sets. When ORS recovers these data sets, it reads these inputs only once. ORS reads inputs in parallel. That is, multiple read processes, such as the Image Copy and the Change Accumulation data set for a database recovery may be read at the same time. Similarly, the Image Copies for multiple data sets may be read concurrently. Databases data sets are also recovered in parallel. ORS does not require Change Accumulation input for recovering databases that have been updated with block level data sharing. It can merge log records from multiple IMS subsystems. This eliminates the Change Accum requirement. These techniques can greatly shorten the time needed to recover a set of IMS databases.
-
- ORS supports time stamp recovery to any time. It will recover all updates to the database that have been committed up to the specifies time. Quiescing the database with a /DBR command is not required.
-
- ORS is a separately priced feature.



- ORS is a control region function. It uses other address spaces, such as DLI SAS and DBRC, but is controlled by commands processed by the online control region. ORS recoveries execute in parallel with other online activity such as transactions and BMPs. ORS is based on Remote Site Recovery techniques. For example, it reads logs in parallel and merges records from them. Like RSR, it does not require Change Accum, even with input from data sharing subsystems.
-
- ORS recovers the same databases that the batch Database Recovery utility recovers. These are HDAM, HIDAM, HISAM, SHISAM, Index, and DEDB databases, as well as, the HALDB types of PHDAM, PHIDAM, and PSINDEX.

IMS Version 7

Online Recovery Service

- **Recovers a list of database data sets**
  - List is built by /RECOVER ADD xxx commands
    - Command may add a data set, a database, or a group
- **Recovery of list is started by command**
  - /RECOVER START command
  - Database, partition, or area must be deallocated (/DBR) before recovery
- **Option to /START database, partition, or area after recovery**
  - /START GLOBAL may be specified for data sharing

- ORS can recover multiple database data sets concurrently. The user builds a list of data sets to recover and starts the recovery of the list. These actions are done with the new /RECOVER command. The list is built with the /REC LIST command. The user may specify a data set, a database, a HALDB partition, or a group in this command. The group may be any of the groups defined to DBRC. These include database data set groups, database groups, Change Accum groups, and recovery groups. Recovery groups are new with IMS V7.
-
- The recovery is started with a /REC START command. The databases, partitions, or areas must be deallocated from all systems before recovery may begin. This includes the system on which the recovery is executing. ORS gets its own special authorization for recovery. It does not use the authorization for its online system.
-
- The user has the option of having ORS automatically issue a /START DB command for a database after the recovery completes. The /START DB may include the GLOBAL parameter which is used with data sharing.

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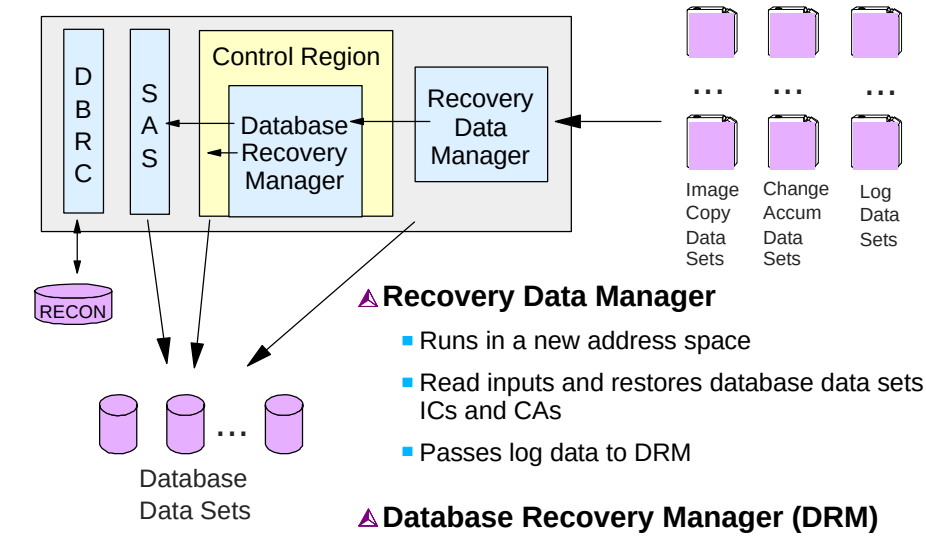
ORS Components and Flow



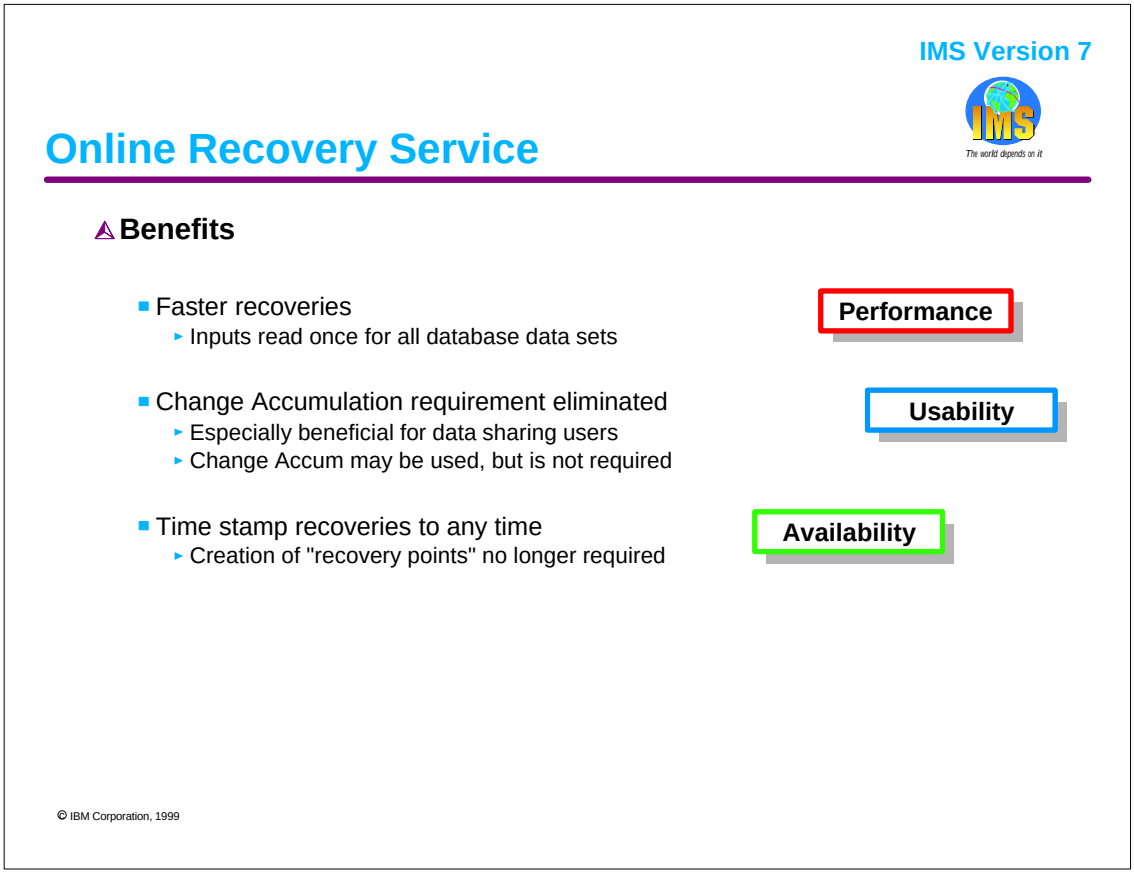
Recovery Data Manager

- Runs in a new address space
- Read inputs and restores database data sets from ICs and CAs
- Passes log data to DRM

Database Recovery Manager (DRM)

- Manages recovery in the control region and SAS address spaces

- This is an illustration of ORS components. When ORS is invoked, it starts the Recovery Data Manager (RDM) address space. RDM reads all inputs to the recoveries. It merges Image Copies with their Change Accum data and restores them to the database data sets.
-
- RDM passes log records to the Database Recovery Manger (DRM). DRM runs as part of the control region. DRM passes the log records to the full function tracker and the Fast Path tracker. The full function tracker runs in the DLI SAS address space. It uses the full function buffer pools to apply updates to the databases being recovered. The Fast Path tracker runs in the control region. It has its own buffers which it uses to apply updates to the areas being recovered.



- ORS has several benefits.
-
- It recovers sets of database data sets faster then multiple executions of the Database Recovery utility would do. When recoveries are done, they usually involve multiple databases. For time stamp recoveries, all related databases and their indexes must be restored to the same time. Since most recoveries involve multiple data sets and the same log and change accumulation inputs, ORS's reading of these inputs only once provides significant time savings.
-
- Change Accumulation may be used with ORS, but it is never required. Without ORS, data sharing users must run Change Accumulation before they can begin the Database Recovery utility. ORS eliminates this time consuming step.
-
- ORS allows databases to be recovered to any time. "Recovery points" do not have to be created to do these time stamp recoveries. A recovery point is created by quiescing all update activity to a database. This is done with either a /DBR or /DBD command. This make the database unavailable across the recovery point. ORS eliminates this need for deallocating the database from online systems.

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Change Accumulation Enhancements

- **Data sharing limits merging of logs in IMS V6**
  - Cannot merge incomplete log set
    - Merging requires /DBRs or termination of all IMS systems
    - "Spills" unmergable logs
- **IMS V7 eliminates this restriction**
  - Merges all records up to end of oldest log
  - "Spills" only later timed records

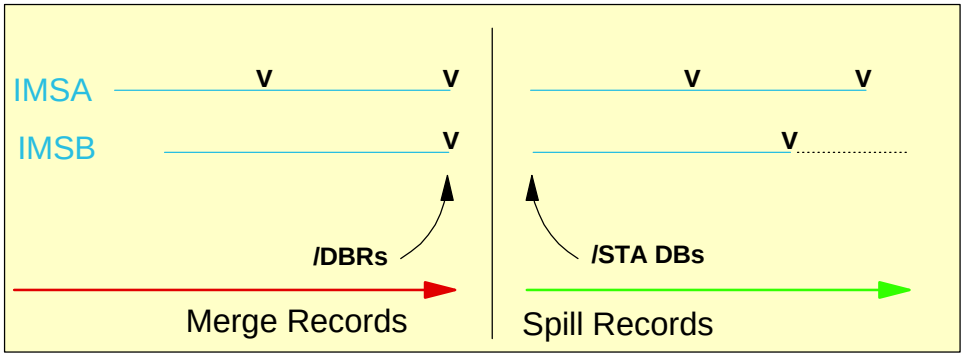
Usability

Availability

- IMS V7 improves the Change Accumulation utility. This utility is used to merge logs from different subsystems and to keep only the latest updates for a location in a data set. Data sharing users in previous releases had to use Change Accum before they could recover a database data set. ORS in IMS V7 makes the execution of Change Accum optional; however, it still may be desirable.
-
- Change Accum can either merge records for the same location or spill them. Merging records does not require that Change Accum keep track of when the various parts of the record were updated. Spilling records keeps only the latest updates, but also keeps the time a record is keeping only the latest update. Spilling also keeps track of these times. The Database Recovery utility will not accept as input any Change Accum data set which has spill records for the data set it is recovering. ORS will not use spill records for its recoveries.
-
- IMS V7 Change Accumulation makes its decision on which records to merge or spill based on different information than was used in previous releases. The result is that many more records will be merged for data sharing users. IMS V7 merges all records up to the end of the oldest log for which it has received. It spills only later timed records. The next pages contain examples which illustrate this change.

IMS V6 Change Accum Illustration

- /DBRs are used so that CA may merge records



V: end of volume

——— : log is input to Change Accumulation

..... : log is not input to Change Accumulation

- This shows a typical use of Change Accumulation with data sharing in IMS V6. IMSA and IMSB are producing log streams. To create a point to which logs may be merged, /DBRs are issued for both IMS systems. If logs from before and after the /DBR times are input to Change Accum, only the changes before the /DBRs are accumulated. Later change records become spill records. The /DBRs are done so that some of the records may be accumulated. Of course, these /DBRs make the database unavailable until the /START DB commands are processed.

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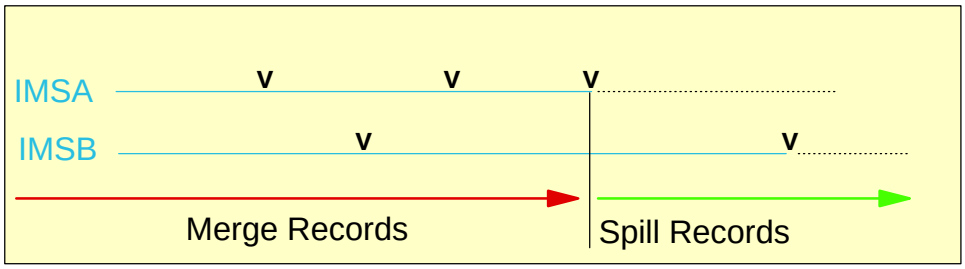
IMS V7 Change Accum Illustration

- **/DBRs are not needed**
  - Fewer spill records are created

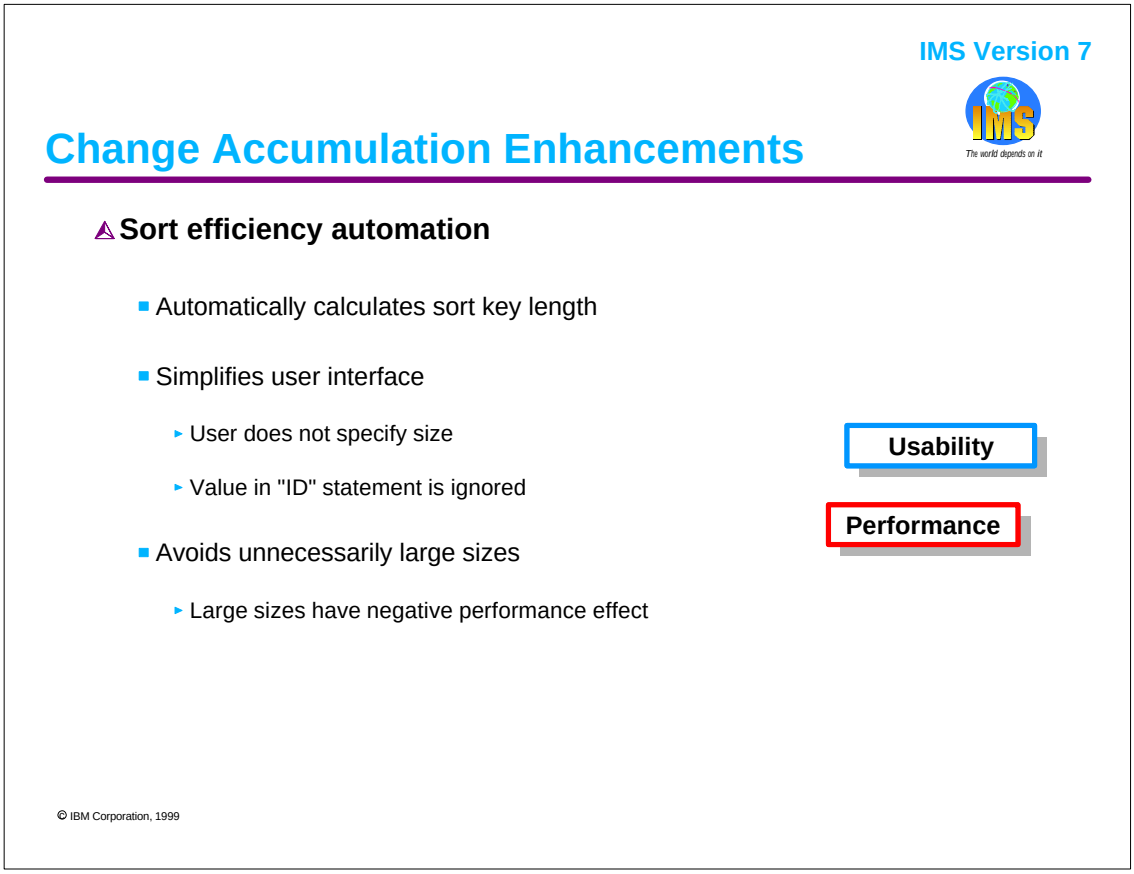


V: end of volume

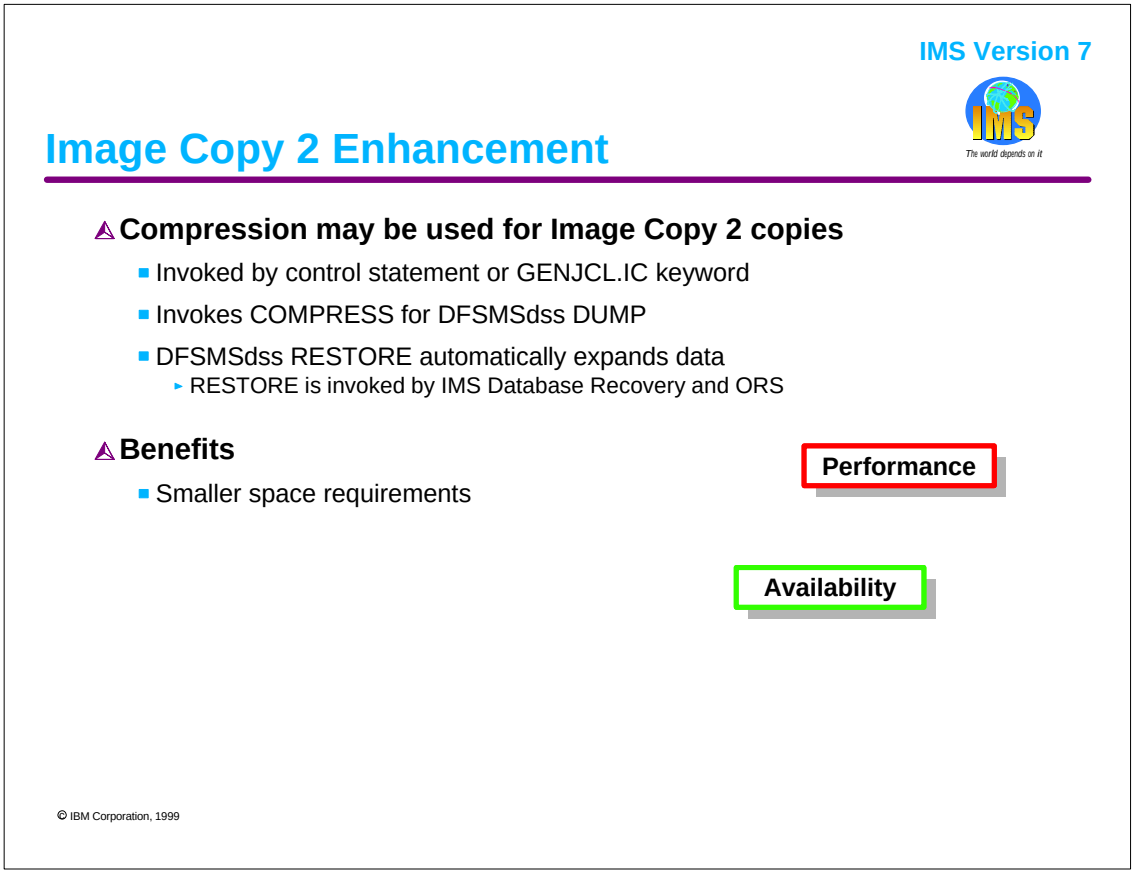
——— : log is input to Change Accumulation

..... : log is not input to Change Accumulation

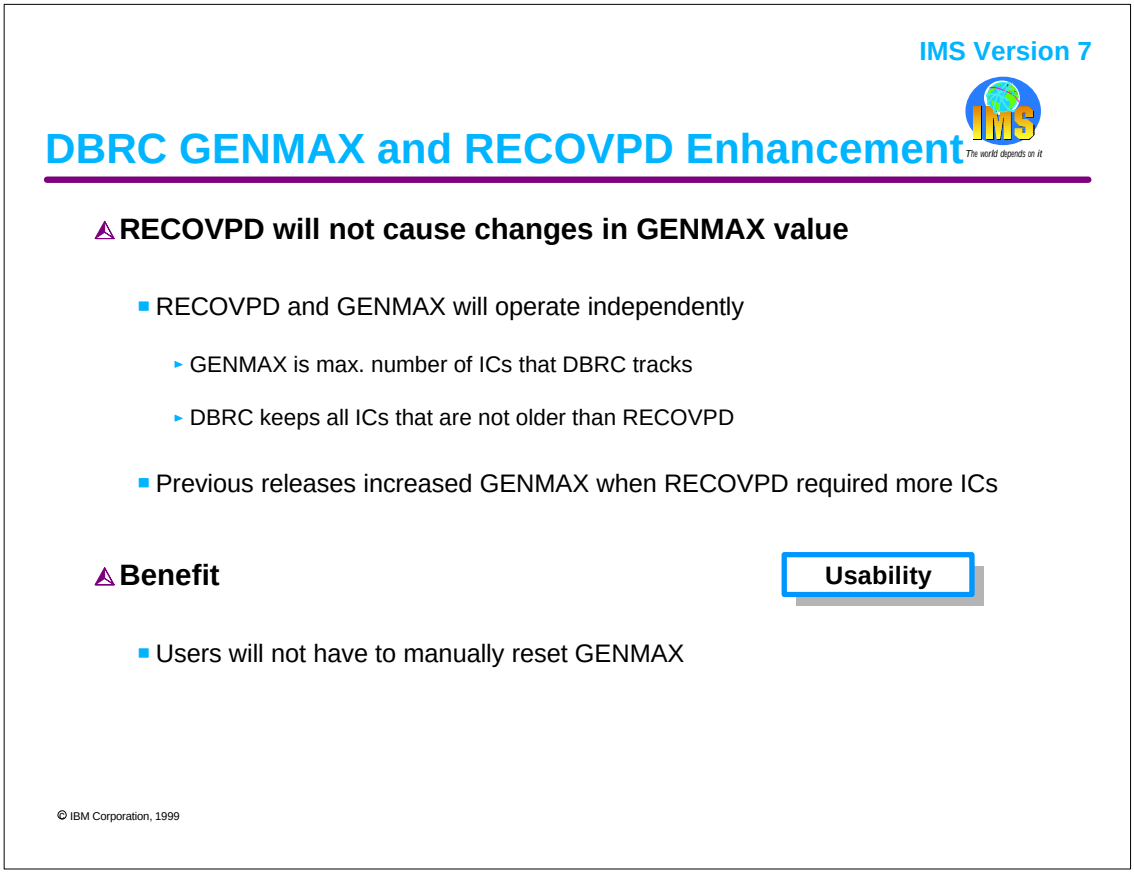
- IMS V7 eliminates the requirement for /DBRs for Change Accum purposes. Change Accum accumulates all of the change log records up to the time for which it has received all log records.
- In this illustration, the inputs to Change Accum include logs from IMSA and IMSB. The input logs from IMSA end before those from IMSB. All of the change records on the IMSA logs are accumulated. All of the change records from IMSB that were created up to the time of the end of the IMSA input logs are also accumulated. The only log records which become spill records are those from IMSB which were created after the time of the end of the IMSA log records.
- There are two benefits with this change. First, /DBRs for Change Accum purposes are no longer needed. Second, the size of Change Accum data sets is reduced. Many of the spill records are no longer needed.



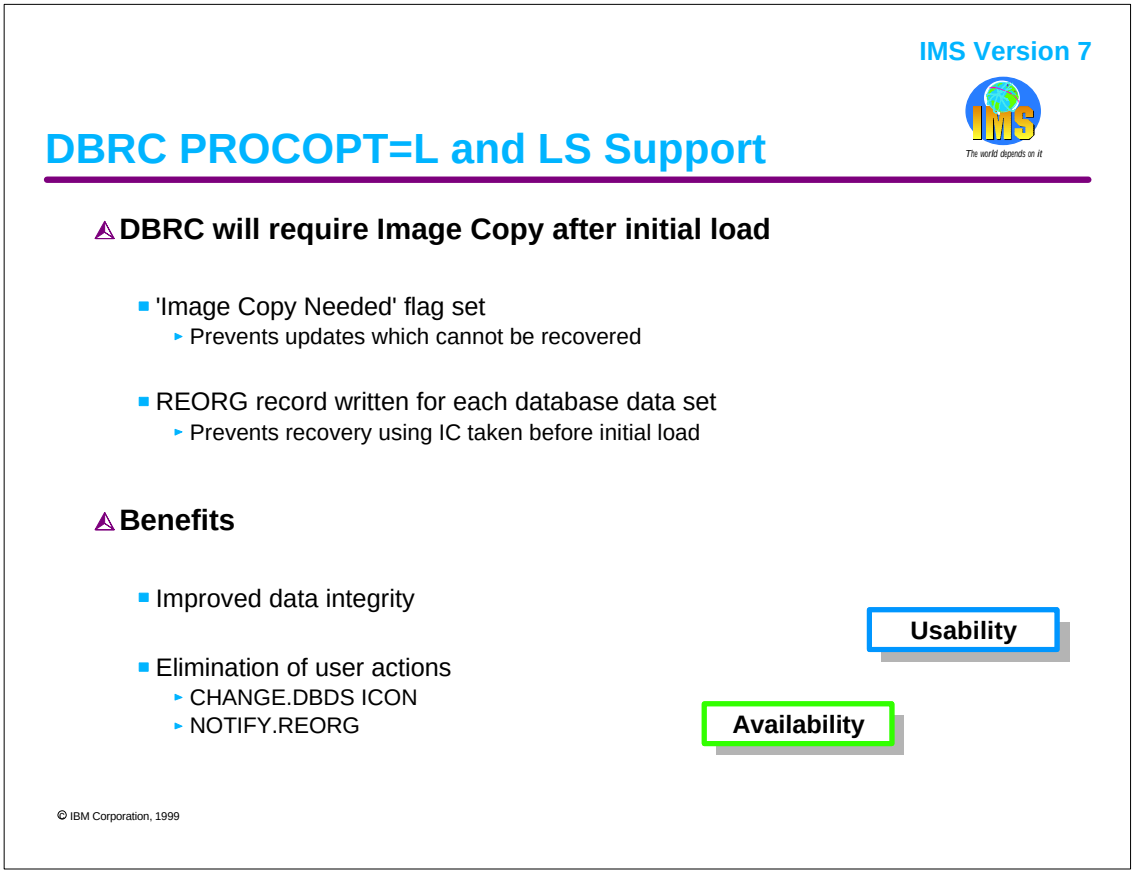
- Change accumulation sorts database change log records. The sort key for KSDS records is the record key. For other types of data sets, the sort key is the four byte relative block number. In previous releases, Change Accumulation assumed a 10 byte key size unless the user specified a size on the ID control statement. For keys greater than 10 bytes, this specification was required.
- If the key size specified (or defaulted) was greater than required, the sort had unnecessary overhead.
- IMS V7 eliminates these user considerations. It calculates the minimum required sort key size and uses it. The calculation is done by examining the DBD for KSDS data sets.
- These changes remove the user's responsibility for understanding and specifying the sort key size. In the past, some installations have specified the maximum size (255 bytes) for the sort key to avoid the discovering the minimum required size for each change accumulation group. For these installations, the change will result in improved performance.



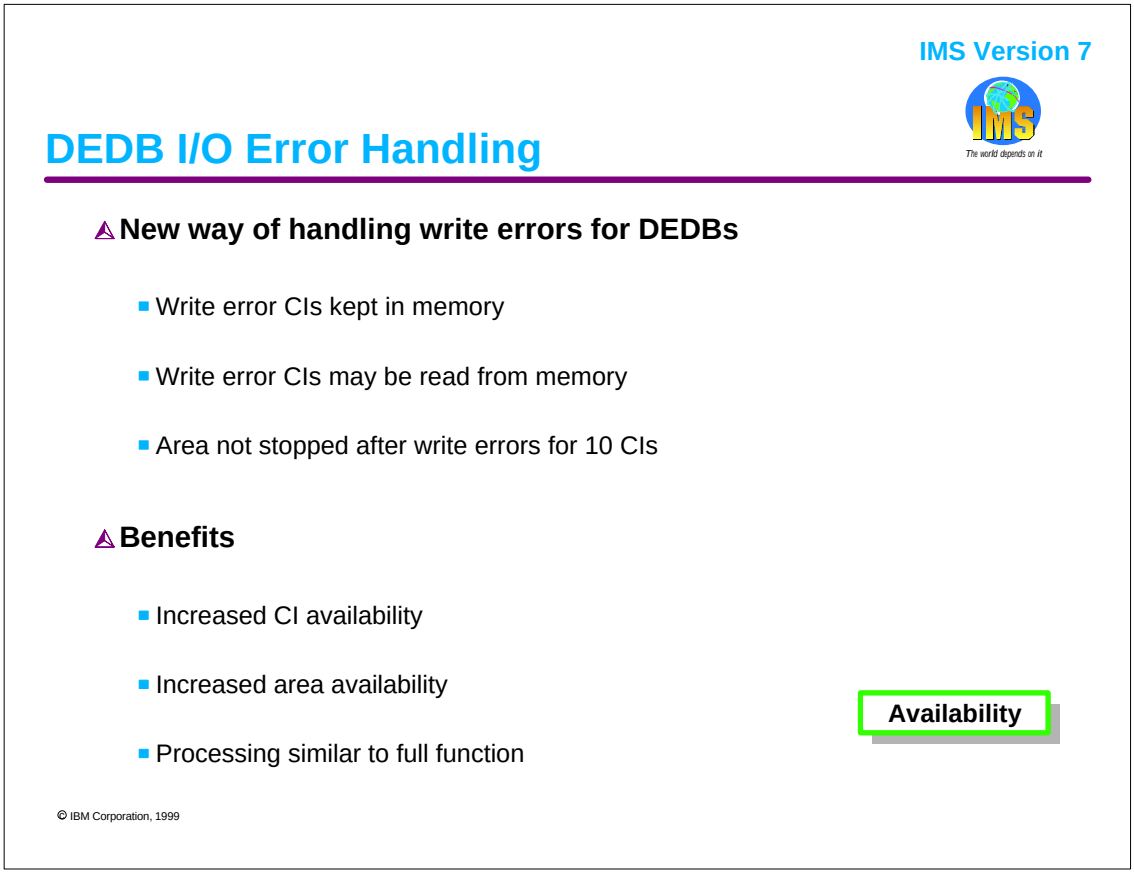
- The Image Copy 2 utility was introduced by IMS V6, It invokes DFSMSdss DUMP to copy an IMS database data set. IMS V7 adds the capability to specify that the copy should be compressed. This may be done either with a control statement for the utility or through a new keyword on the DBRC GENJCL.IC command. The Database Recovery utility and Online Recovery Service recognize that their input is a DFSMSdss dump and invoke DFSMSdss RESTORE for these data sets. Restore automatically expands compressed data sets.
-
- This compression capability creates smaller dump data sets.



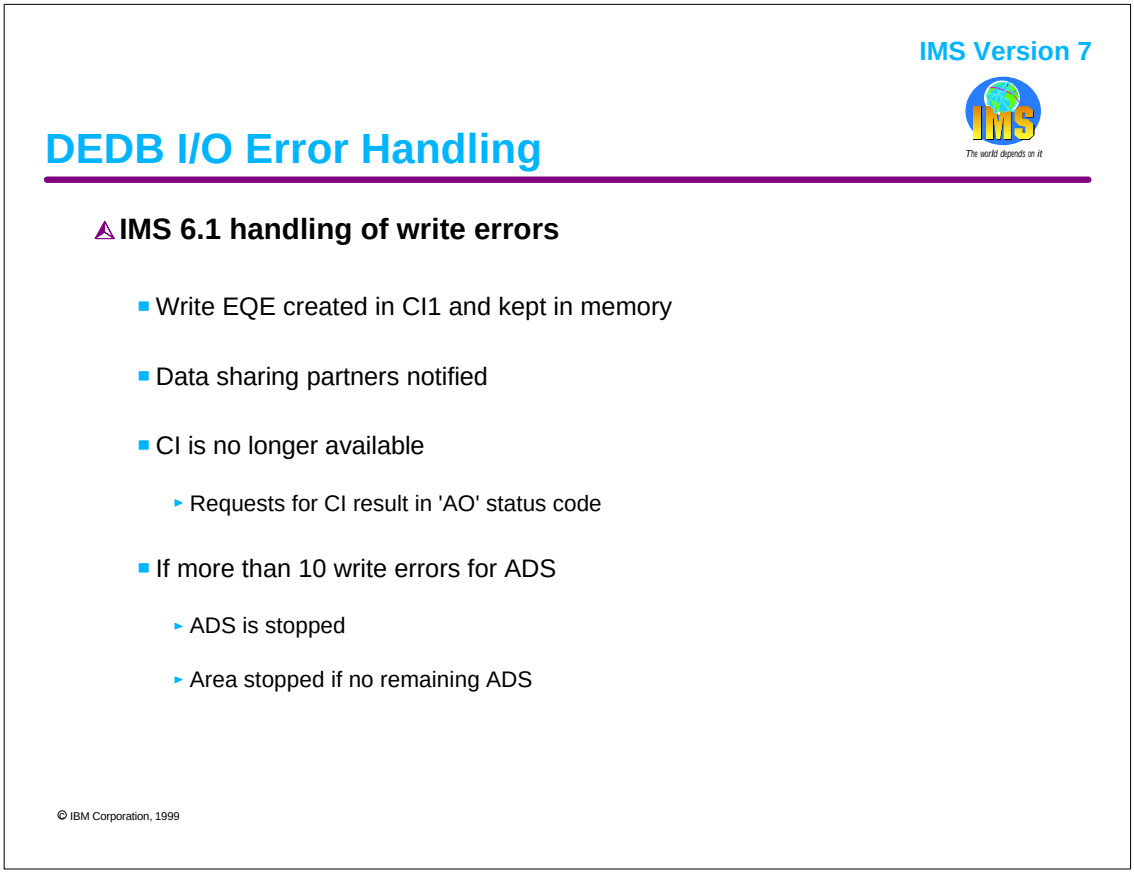
- RECOVPD specifies the minimum number days which Image Copies for a database data set should be kept. GENMAX specifies the minimum number of Image Copies that should be kept. DBRC keeps a record of an Image Copy if either RECOVPD or GENMAX require it.
-
- In previous releases of IMS, the user specified value for GENMAX may be changed due to the processing for RECOVPD. This made it necessary for users to reset the GENMAX value when the requirements of the RECOVPD processing allowed it.
-
- IMS V7 makes the two parameters independent. Users do not have to reset GENMAX due to RECOVPD processing.



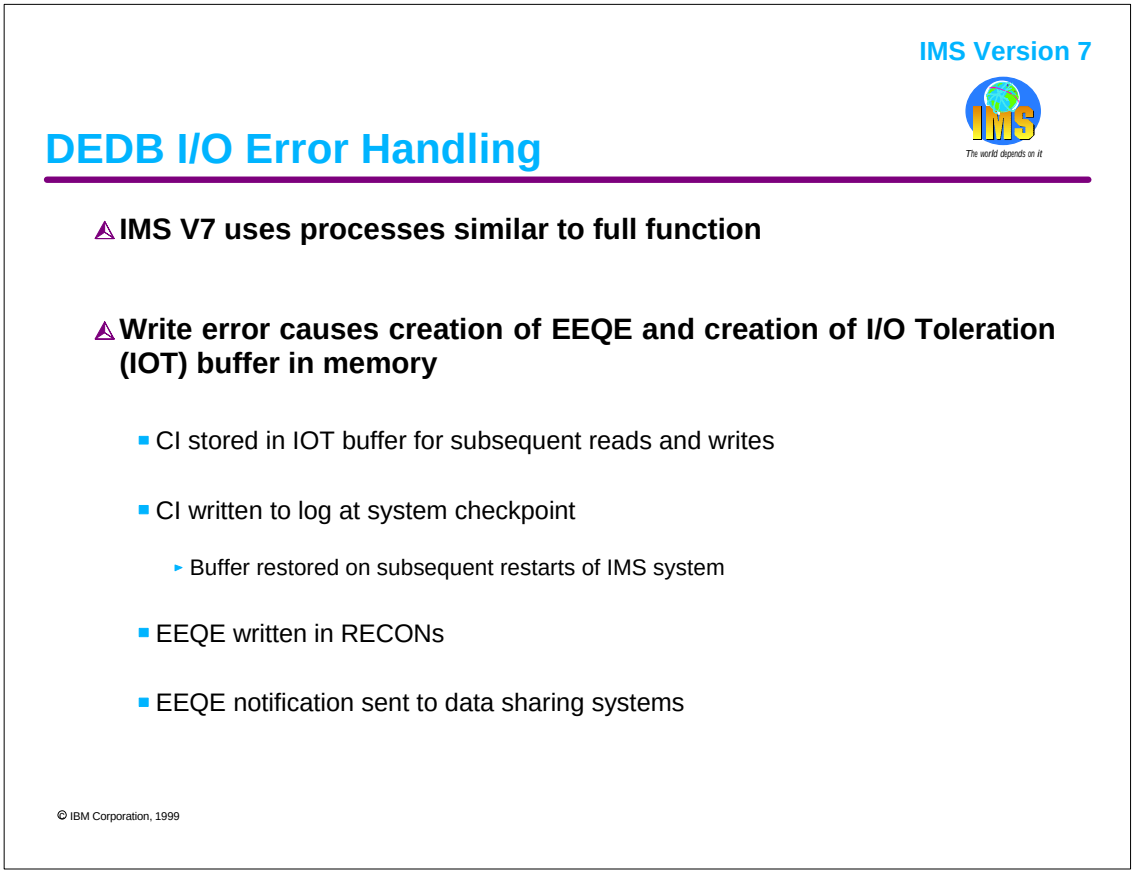
- IMS V7 increases data integrity by setting the DBRC 'Image Copy Needed' flag and writing a REORG record for each data set when a database is initially loaded.
-
- The 'IC Needed' flag prevents updates which cannot be recovered by a subsequent database recovery. If an Image Copy is not taken before updates are done, a subsequent recovery may not be possible since it would require a copy of the data as it appeared at the time of the initial load.
-
- Reorg records prevent an invalid recoveries from being executed. The REORG record tells DBRC not to allow a recovery with IC or log inputs before the REORG record time and log inputs after the REORG record time. Databases which are initially loaded (using PROCOPT=L or LS) on a regular basis are subject to an integrity exposure without this REORG record.
-
- With previous releases of IMS, users often added the Image Copy Needed flags and Reorg records to provide increased database integrity. These user actions are not required with IMS V7.
-
-



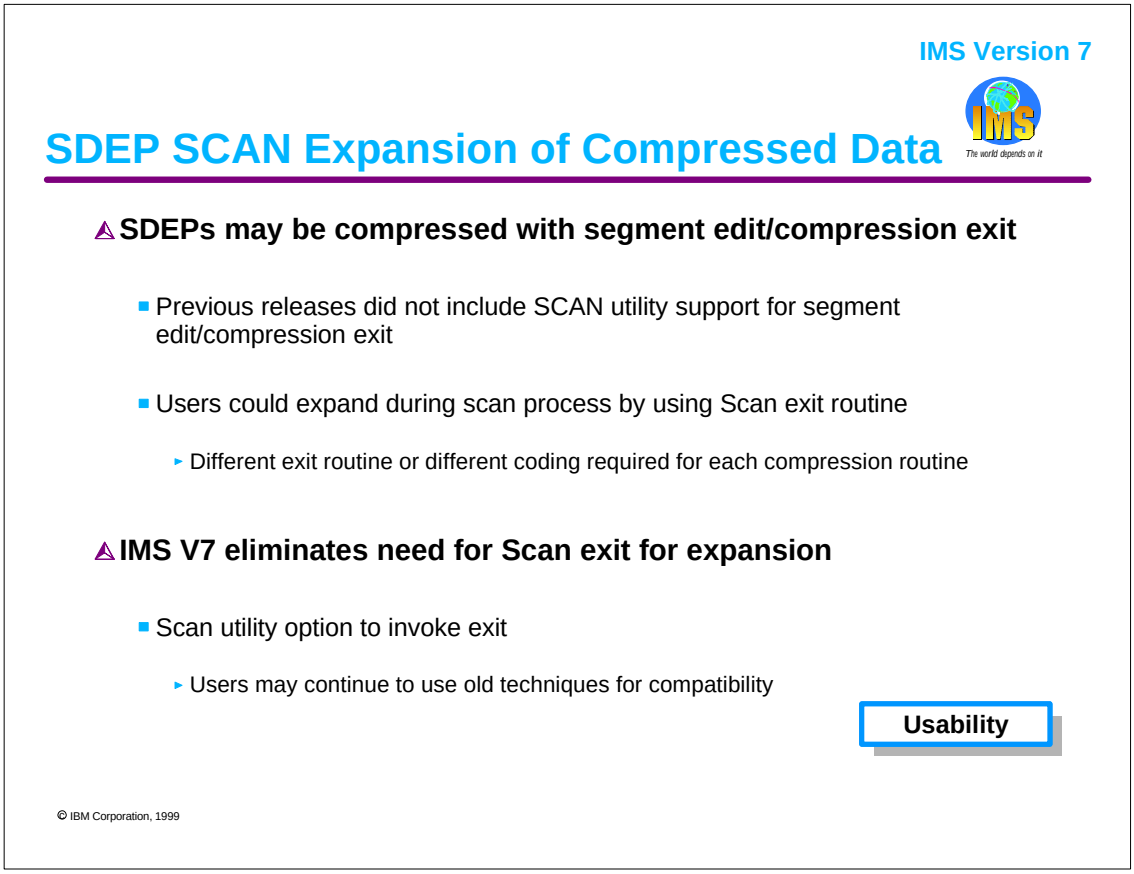
- IMS V7 introduces a new way of handling write errors for DEDBs. When a write error occurs, a copy of the CI is kept in memory. This copy may be used to satisfy later read requests. Unlike previous releases of IMS, IMS V7 does not stop an area when more than 10 write errors occur for the last area data set.
-
- A CI for which a write error occurs is not lost to later processing. It remains available to the subsystem. More than 10 write errors does not cause an area to be lost to processing. It remains available. These changes make the handling of DEDB write errors similar to the handling for full function databases.



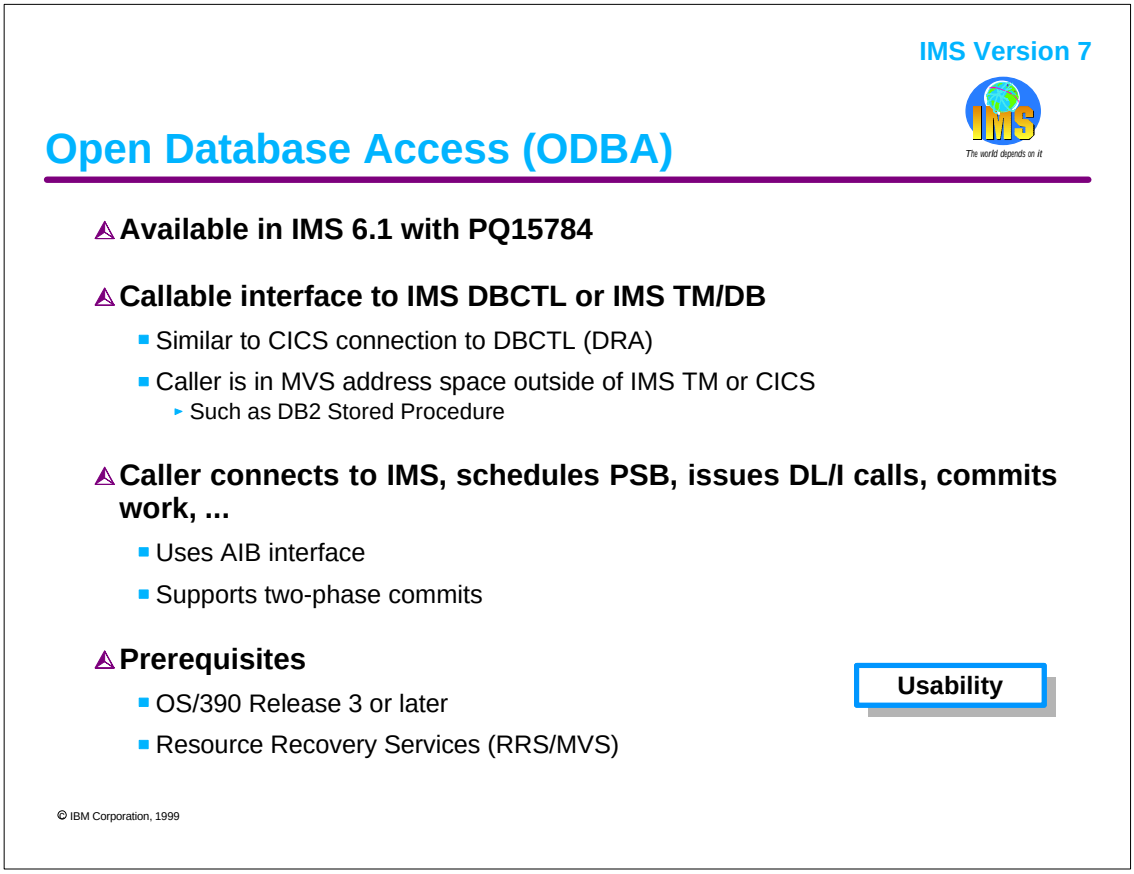
- This is a review of the way that write errors are held in releases prior to IMS V7. A write error would create an error queue element (EQE). This EQE was stored in CI1 and kept in memory. When data sharing was in use, a notification of the error was sent to data sharing partners. After the write error, the CI was not available to any subsystem, including the one that experienced the error. Any call which required the CI would receive an 'AO' status code. Since there is only room for 10 EQEs in CI1, more than 10 write errors would result in the area data set (ADS) being stopped. If this was the last ADS, the area was stopped.



- IMS V7 introduces processes similar to those used for full function databases.
-
- In IMS V7 a write error causes the creation of an extended error queue element (EEQE). This EEQE is kept in memory and written in the RECONs. If data sharing is being used for the DEDB, the EEQE is sent to data sharing partners via an IRLM notification. These partners create a copy of the EEQE in their memory. New users of the area get a copy of the EEQE from DBRC when they get authorization for the area.
-
- IMS V7 also creates a IO toleration (IOT) buffer containing a copy of the CI when a write error occurs. Later requests for the CI are honored from this buffer. A copy of the CI is logged at system checkpoints. Restarts of the system restore the CI to an IOT buffer. This means that the CI remains available to the system experiencing the write error. The recovery of the area data set may be delayed until a convenient time.
-
- These actions allow IMS V7 to increase data availability.
-



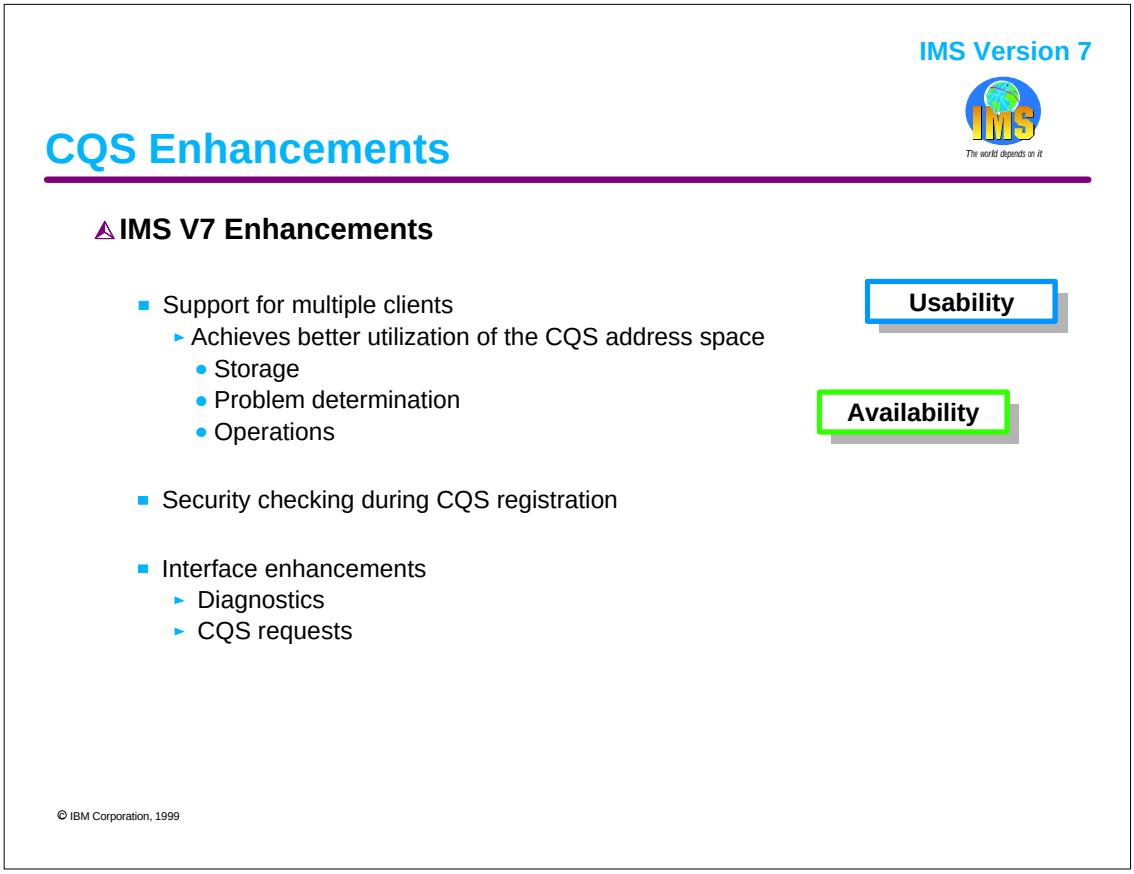
- Previous releases of IMS support compression of DEDB sequential dependent segments (SDEPs). The Scan utility for those releases does not include explicit support for expanding these segments. Users could expand these segments during Scan processing by specifying a Scan exit routine. This routine would then invoke the expansion function of the segment's edit compression/expansion routine. Since each segment might have a different edit compression/expansion routine, each invocation of the Scan utility might require a different exit routine. This implementation was unnecessarily complex. IMS V7 eliminates the need for invoking the Scan exit. Instead, the user may simply ask for expansion of the scanned segments. The utility will then invoke the expansion function of the segment edit/compression exit routine specified in the DBD. This simplifies the use of compressed SDEPs.
-
- For compatibility reasons, the old technique may still be used.



- Open Database Access (ODBA) was introduced in IMS 6.1 by PQ15784.
-
- ODBA provides a callable interface to IMS from an MVS address space other than CICS or IMS TM. The interface uses the Database Resource Adapter (DRA) as CICS does when using DBCTL services. Like CICS, ODBA may use either a DBCTL subsystem or an IMS TM system with IMS DB.
-
- ODBA is designed for use with DB2 Stored Procedures but is also applicable to other uses.
-
- When using ODBA the caller connects to IMS, schedules PSBs, issues DL/I calls, and commits its work. The interface supports multiple threads. That is, one address space may have multiple concurrent units of recovery is execution. Callers must use an AIB interface. ODBA supports two-phase commit processing. Callers may access other resource managers, such as DB2.
-
- ODBA requires at least release 3 of OS/390 and the use of Resource Recovery Services (RRS/MVS) with the MVS System Logger.
-
- ODBA makes it easier for installations to access IMS database information. Its use is not limited to DB2 Stored Procedures. It may also be used with OS/390 server address spaces, such as Web servers.

Transaction Manager Enhancements

IMS V7
Transaction Manager
Enhancements



IMS V7 enhances the Shared Queues support that was introduced in IMS/ESA V6 by allowing a single CQS (Common Queue Server) address space to support multiple clients, e.g., IMS systems, that reside on the same CEC as CQS. CQS continues to be the component that accesses the coupling facility structures. The multiple client support improves storage utilization and simplifies problem determination (e.g., only one CQS address space to analyze) as well as operational procedures (fewer address spaces to monitor).

The ability to use RACF or another security product to control CQS registration is also being added. This prevents an unauthorized client from accessing CQS and issuing commands that could prevent other clients from connecting to a structure.

CQS also provides several interface enhancements in the area of diagnostics and in the CQS requests. IMS does not take advantage of these but they are available for new clients, e.g., vendor monitors, to use.

IMS Version 7

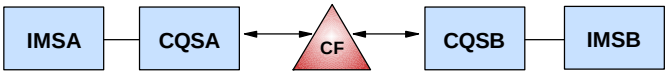
CQS Background

Shared Queues were introduced in IMS/ESA V6

- A set of input and output message queues (*Shared Queue Structures in a Coupling Facility)* that can be shared by multiple IMSs in a Parallel Sysplex.
  - Replace individual IMS message queues
  - Allow messages in the Shared Queue Structures to be available to all IMSs

Common Queue Server (CQS)

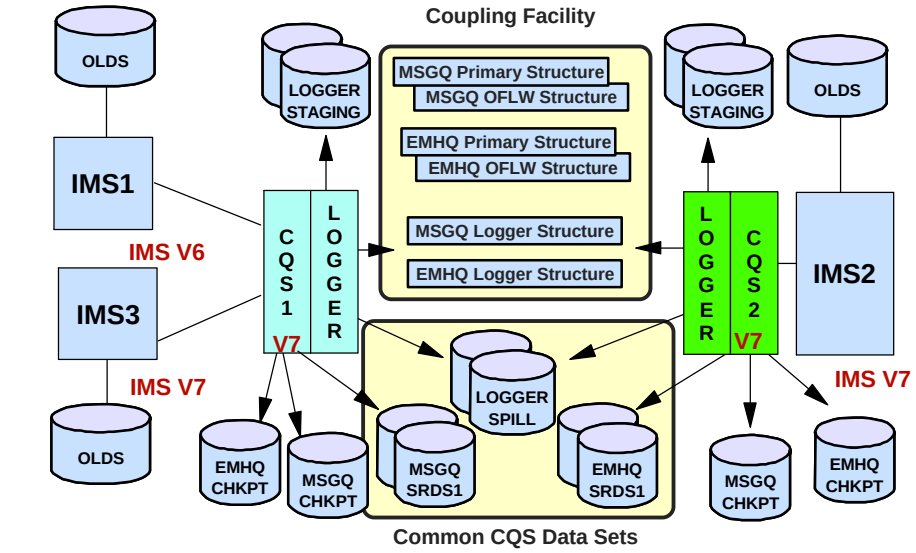
- Component that manages the shared queue structures on the CF
  - Connects to the shared queue structures
- Runs in separate address space connected to IMS
- Acts as ***server*** for IMS control region
  - V6 - One client (IMS) per CQS



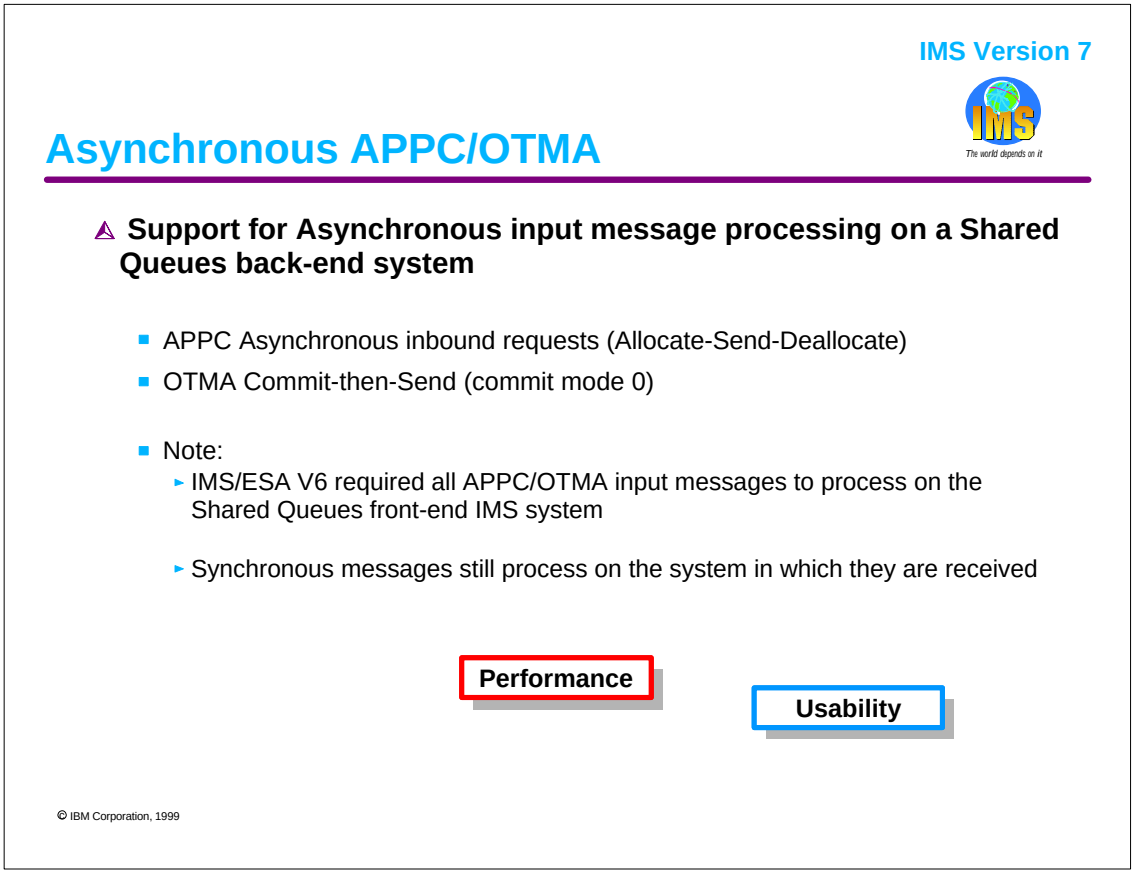
- To better understand the IMS V7 enhancement, a little background information is provided on this page.
-
- Shared queues are exactly what the name implies. They are a set of IMS message queues and EMH queues which can be shared between multiple IMS systems in a Parallel Sysplex environment. The queues physically reside in list structures in Coupling Facilities (CF) where they are accessible to any IMS in the same "shared queues group". IMS does not directly access the shared queues structures in the CF. To do this, IMS interfaces with a subsystem running in a separate address space called the Common Queue Server, or CQS. All queue manager activity such as putting messages on the queue or reading them off the queue is done through CQS.
-
- In IMS/ESA V6, each IMS in the shared queue group is served by its own dedicated CQS.
-

IMS Version 7

V7 CQS - Multiple Client Support



- The multiple client support in IMS V7 opens up the CQS address space to allow up to 32 clients on an MVS system to use the same CQS address space.
-
- The CQS Clients can be a mix of IMS control regions and other clients. Some details include:
  - IMS clients can be at different release levels
  - IMS V6 and IMS V7 can attach to the same CQS
  - IMS starts CQS if it is not active, otherwise, IMS registers with the active CQS
  - CQS registration is controlled via RACF or an equivalent product
- For migration purposes, both V6 and V7 CQSs can connect to the same CF structures and both releases can run on the same CEC.

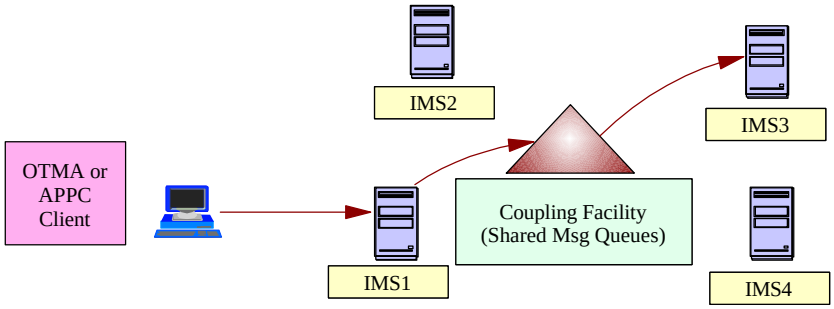


- Another enhancement in IMS V7 affects the Shared Queues environment. Asynchronous APPC and OTMA input messages can now be processed on any IMS system in the shared queues group.
-
- Synchronous transactions will continue to be processed on the front-end system.
-
- Note that the "asynchronous" nature of a message is still the same as it was in previous releases. APPC asynchronous messages are initiated by an LU 6.2 program issuing an Allocate-Send-Deallocate sequence for a non-conversational, non-Fast Path, non-response mode transaction. For OTMA, the message is sent in with a request of commit-then-send (commit mode 0) for a non-conversational, non-Fast Path transaction.

IMS Version 7

IMS V7 Enhancement

- ***Asynchronous*** **OTMA/APPC input messages are allowed to process on any IMS system in the shared queues group**
  - **Assumes** APPC/OTMA are enabled on all back-end systems



  - IOPCB messages are delivered by the system which receives the input message
  - ALTPCB messages are delivered by the system that processes the transaction

- In IMS/ESA V6, an input message arriving from APPC or OTMA can be scheduled only on the IMS where it arrived. In an IMS V7 environment, asynchronous input messages from OTMA/APPC can be processed on any back-end system in the shared queues group that has interest in the transaction.
-
- IOPCB output messages
- IOPCB responses must be delivered by the front-end system that receives the message from the client. A special internal "notify" message has been implemented as part of the enhancement. It informs the front-end that the back-end has placed an OTMA/APPC IOPCB response on the shared queues. The front-end then knows to retrieve the message from the queues and send the response to the appropriate OTMA/APPC destination.
-
- ALTPCB - program-to-program switches
- If the asynchronous input invokes a transaction which subsequently issues a program-to-program switch then IMS copies the input message prefix to the prefix for the new message. This allows the subsequent transaction's IOPCB reply to be correctly delivered by the front-end. IMS queues the spawned message to the shared queue to allow the message to be processed by any back-end IMS.
-
- ALTPCB output messages - OTMA/APPC destination
- Alternate TP PCB output is delivered by the system on which the application inserting the output is processing. This assumes that OTMA and APPC support have been enabled on every back-end system in the shared queues group that is capable of processing the application. If a back-end system does not have the appropriate support enabled, any asynchronous OTMA/APPC output inserted to the ALTPCB is queued and remains queued until such time that the support is enabled (/STA OTMA or /STA APPC). If the transaction abends, any DFS messages, such as DFS555I, are delivered asynchronously by the system on which the transaction processes.
-

IMS Version 7

DFSMSCE0

TM and MSC Message Routing and Control User Exit (DFSMSCE0)

Usability

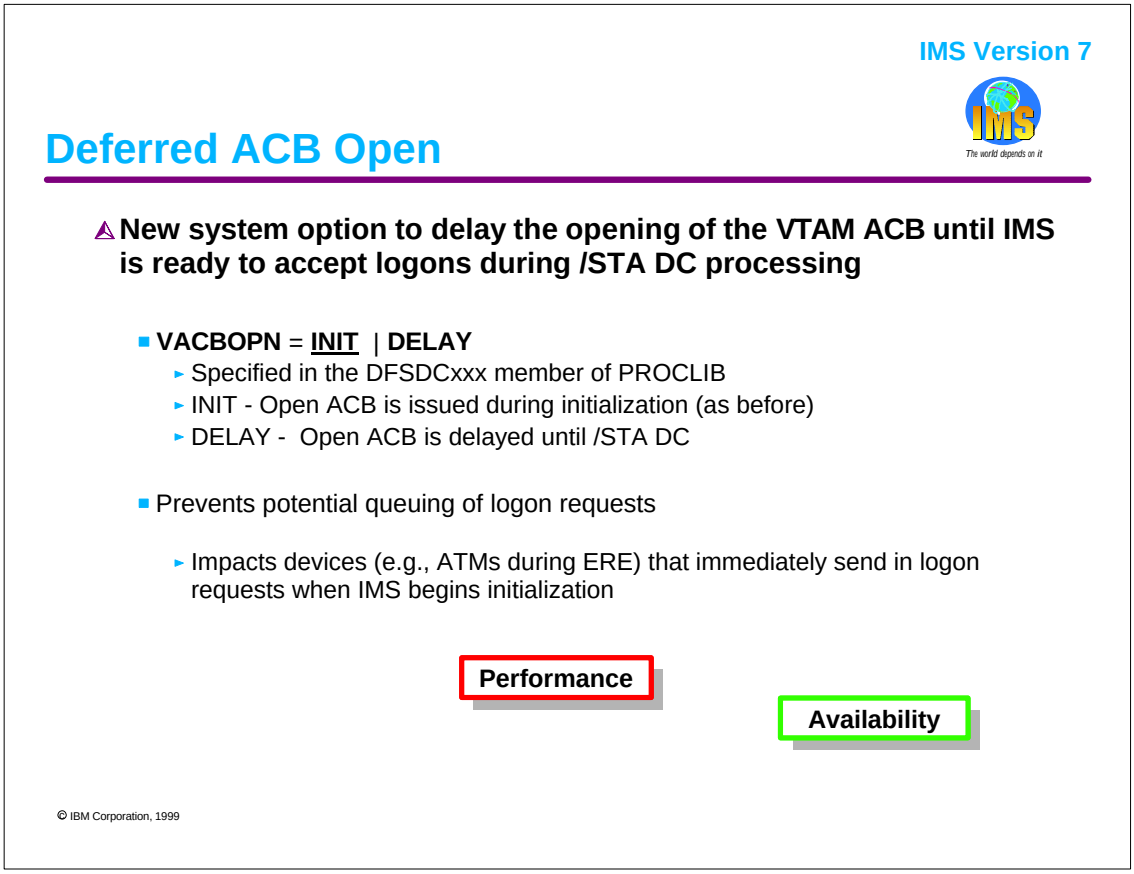
- New exit that combines and replaces:

  Terminal Routing Exit (DFSCMTR0)
  Input Message Routing Exit (DFSNPRT0)
  Link Receive Routing Exit routines (DFSCMLR0/DFSCMLR1)
  Program Routing Exit (DFSCMPR0)

  - Eases coding and maintenance by reducing the number of exit routines
  - Supports a consistent set of routing capabilities for all types of messages

- Provides the ability to attach a user prefix that follows the message and is passed to each exit interface
  - Allows the message to be customized for accounting, statistics, security, etc.

- The new TM and MSC Message Routing and Control User Exit (DFSMSCE0) combines, replaces, and enhances several of the existing message routing exits. As a consolidated exit, it is invoked at different entry points (terminal routing, link receive routing and program routing) and provides a variety of options such as the ability to: change the destination name, route messages to remote IMSs, keep the message on a local shared queues IMS system, reject the message, override directed routing and add a user prefix. The user prefix can be passed to each of the entry points and can be used to contain any data. This data could include accounting, statistical, or auditing information.
-
- DFSMSCE0 works with both MSC and non-MSC messages and lifts many of the restrictions of the previous routing exits. For example,
  - the terminal routing entry point enhances the capabilities provided by DFSCMTRO/DFSNPRT0 by being given control at the same points as the previous exits as well as now being called for: ISC messages where the destination name is specified in the FMH headers, messages from terminals in preset destination mode, and any Front End Switch (FES) messages.
  - the link receive routing entry point enhances the capabilities of DFSCMLR0/DFSCMLR1 by also being called for: intermediate messages, reply messages, and conversational transactions.
  - the program routing entry point enhances the capabilities of DFSCMPR0 by receiving control for: ISRTs of both non-modifiable and modifiable ALT PCB messages, IOPCB messages, and conversational transactions.



- A new system option is provided that delays the queuing of the VTAM logon requests until IMS is ready to start accepting logons. This change delays the opening of the VTAM ACB until the processing of the /START DC command. With the use of the new option, VTAM logon requests are rejected by VTAM until the processing of the /STA DC command.
-
- This is of value particularly in situations such as emergency restart where there might exist elongated times between the opening of the VTAM ACB (when IMS comes up and when devices can begin sending in logon requests) and the actual time when the /STA DC command is entered (the time that IMS can begin processing the logon requests). These elongated times can result in network problems because the remote devices could time out, unbind, relogon, possibly time out again, etc. until the logons are actually accepted.
-
- The VACBOPN option is specified in the DFSDCxxx member of PROCLIB. Valid values are INIT (default) and DELAY. INIT specifies that processing should continue as in previous releases. DELAY invokes the new support.
-

Security Enhancements

- **Enhanced PassTicket Support (uses RACF or equivalent)**
  - New keyword parameter on the /SIGN ON command
    /SIGN ON userid PassTicket APPL applname
  - Provides greater flexibility for the end-user/program
    - PassTicket creation can use IMSID (same as before)
    - PassTicket creation can use the IMS application name
  - Allows the creator of PassTickets to specify the value by which it knows IMS
- **New system-wide default SAPPLID=applid in DFSDCxxx**
  - Enables the use of PassTickets for VGR connections to IMS

Usability

- The RACF PassTicket is a one-time-only password that is generated by a requesting product or function. It is an alternative to a password and removes the need to send passwords across the network in clear text. It makes it possible to move the authentication of a mainframe user ID from RACF (or equivalent) to: (a) another authorized function executing on the host system or, (b) to the workstation environment. In prior IMS releases, when a /SIGN ON command was received by IMS that contained a PassTicket instead of a password, the signon process failed unless the PassTicket was created using the IMSID as the application name. Since the IMSID may not be known to other systems that might enter the signon command, more flexibility has been needed in the IMS processing of the PassTicket. The new keyword APPL in the /SIGN ON command allows the end-user or program to specify a name, e.g., the IMS VTAM application name, rather than the IMSID when creating the PassTicket.
-
- In a VGR environment, the remote end user does not know which IMS will be chosen for the connection. The DFSDCxxx PROCLIB member provides a system-wide default name SAPPLID that can be used for all the IMSs in the generic group.
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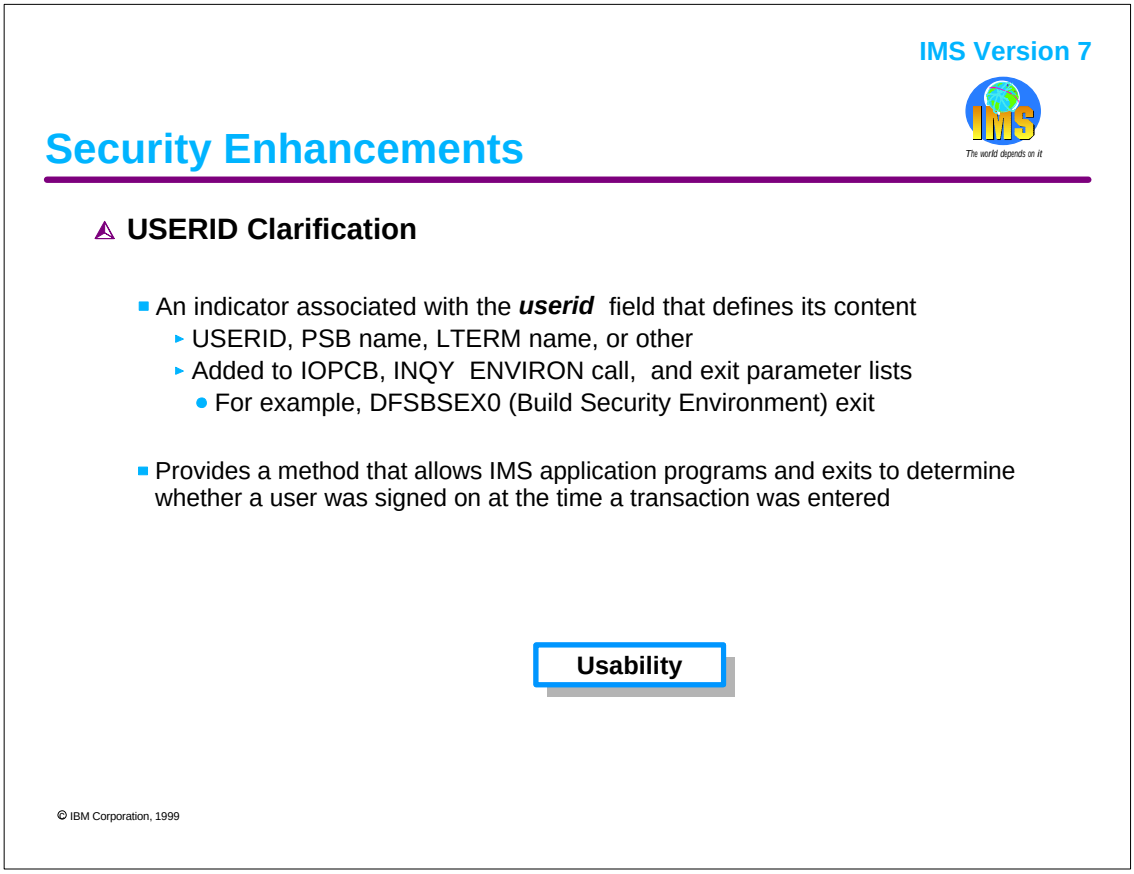
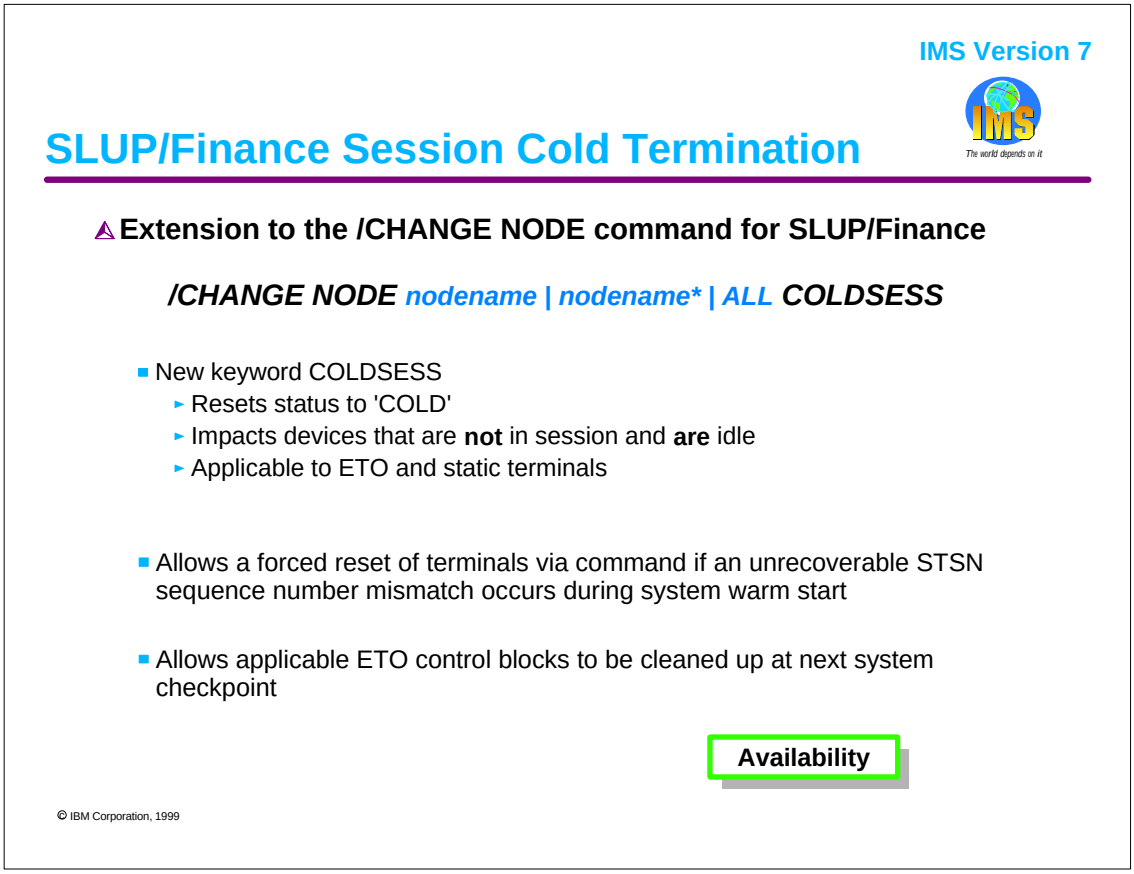
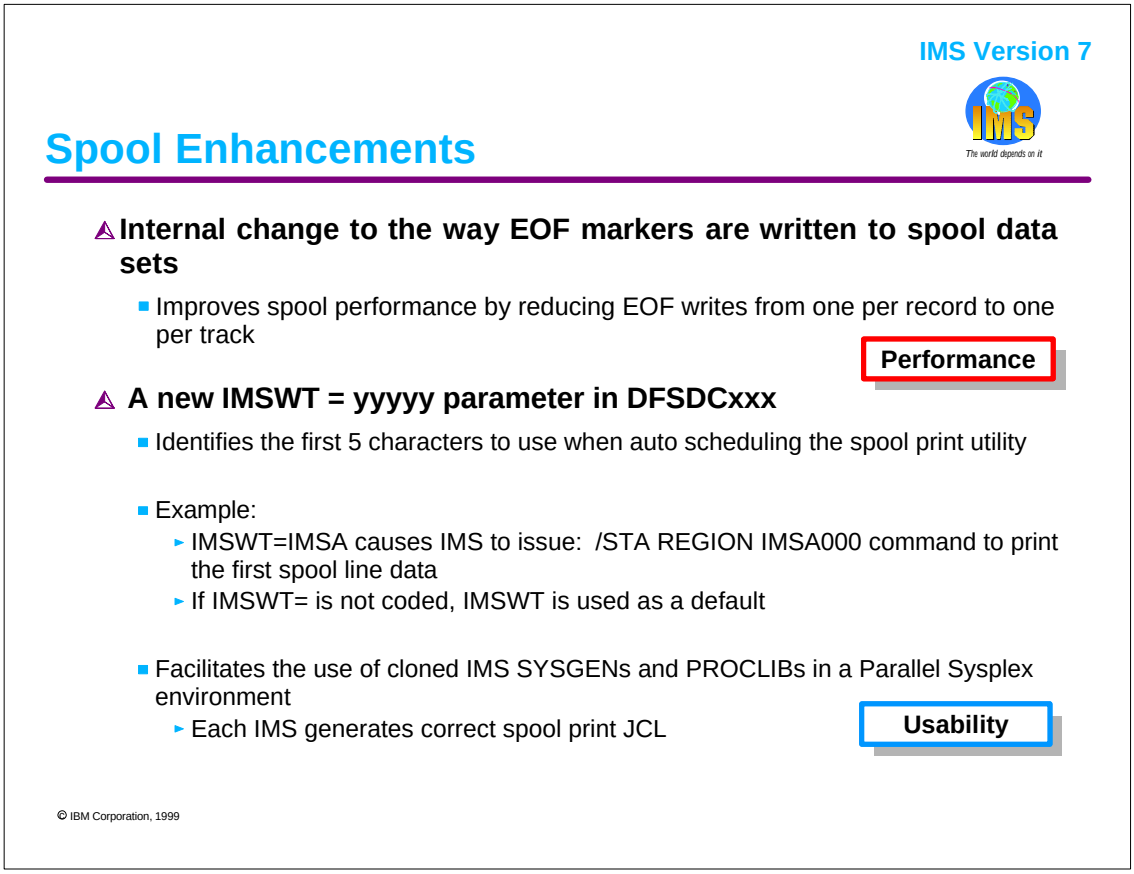


- When signon security is active in an IMS system, the userid field can contain: the user's identification from the source terminal during signon, the LTERM name of the source terminal if signon is not active, or the PSB name of a source BMP or transaction. Many IMS applications depend on knowing whether or not the value reflects a userid in order to perform different application functions. A common method to determine this is to check for the equality of the values in the USERID and LTERM fields. If the USERID is equal to the LTERM, it is assumed that this is not a true USERID. With ETO support, however, the method of equality of these values cannot be used in situations where the LTERM and USER structures are created based on the userid name. In this case, the LTERM is always equal to the USERID.
-
- The USERID clarification enhancement provides a method by which IMS application programs, either by querying the IOPCB or by issuing an INQY call, can determine the nature of the value passed in the USERID field. The information is also provided to several user exits.



- IMS starts a SLUP or Finance session 'COLD' after every IMS cold start. All subsequent sessions for the same device are restarted 'WARM' until IMS is again cold started. Warm restarts synchronize SNA STSN sequence numbers. In the case of an unrecoverable STSN sequence number mismatch during a session 'WARM' restart, the device will be unable to connect.
-
- The /CHA NODE ... COLDSESS command enhancement allows IMS to force a cold session initiation without also requiring an IMS cold start when the terminal and IMS experience a non-recoverable attempt to 'warm' start.
-
- For ETO environments, the enhancement further enables IMS to cleanup control blocks that were dynamically created from an incorrect ETO session initiation request, e.g., incorrect LU name. In the situation where the control blocks are incorrect and the command enhancement is NOT used to reset the state to 'COLD', the control blocks remain in the system and are recovered across IMS checkpoints. In these cases, the associated storage and IMS checkpoint/restart times for the 'dead' blocks could affect IMS performance.



- The spool data set support allows users to browse a spool data set via TSO as it is being written by IMS. Prior to IMS V7, an end of file (EOF) mark is written after each message to delineate the end of the current data. The EOF marks are overwritten by each write of a new record. This is done by using BSAM and issuing a 'Close Type=T' macro. This can cause extra writes to the VTOC to update the Format 1 DSCB. Up to 7 I/Os may be required to complete writing a single record. The enhancement in V7 improves the performance of the EOF writes by using a more efficient EXCP call to write the EOF mark and by only writing one per track.
-
- The second enhancement implements a new option, IMSWT=, in the DFSDCxxx member of PROCLIB. This parameter is of value in a Parallel Sysplex environment. When auto scheduling of the spool print utility takes place in a cloned IMS using a shared PROCLIB, there is no guarantee that the correct JCL will be generated. The generated JCL depends only on the spool line number and the member of PROCLIB. To overcome this problem in the past, many customers came up with different bypass solutions. Some applied usermods to the spool device dependent module DFSDN155. Others generated as many spool lines in each cloned IMS as existed in the entire sysplex. With IMS V7, the new parameter IMSWT= allows the automatic generation of a unique jobnames (members in IMS.JOBS) for each cloned IMS system.
-

Queue Space Notification Exit (DFSQSPC0)

- **Enhancement to the existing exit interface**
  - Allows IMS to pass a stopped status to DFSQSPC0 for conversational transaction destinations
- **Benefit**
  - Prevent looping applications from impacting the message queue for stopped conversational transaction destinations

- IMS V7 provides an enhancement to the existing DFSQSPC0 exit interface to address stopped conversational transaction destinations. Prior to this enhancement when a conversational program inserted a SPA, the insert was always accepted even if the SPA destination was stopped. In V7 DFSQSPC0 provides a mechanism to detect and address the stopped condition for both situations where:
-
- The SPA is inserted to another conversational transaction.
- The SPA is inserted back to the input device via the IOPCB.

The exit routine may cause an 'A7' status code to be returned to the application program's ISRT call. This indicates that the SPA was not inserted to its destination.

IMS Version 7

SLU2 Enhancement

- **New DFSDCxxx option:** SLU2=EXR/NOEXR
  - Specifies whether or not to suppress the SNA exception response prior to sending a DFS error message during error recovery processing
  - Addresses Program check/keyboard lock for SLU2 devices that implement DFT (Distributed Function Terminal) architecture
    - Applies to static and ETO terminals

Usability

- A Distributed Function Terminal (DFT) is a programmable 3270 terminal that can perform operations previously performed by the control unit. These terminals can directly interpret the 3270 data stream. Devices that implement the DFT architecture include 327x hardware, such as 3192-G and 3194-F/H devices, and emulation products such as CM/2 and PC3270. Due to a SNA deviation that was implemented by this architecture, DFT devices can suffer from PROG726 errors and keyboard locks when IMS sends out SNA exception responses that precede DFS error messages.
-
- The option SLU2= allows an installation to specify whether or not to suppress the SNA exception response prior to sending a DFS error message. When it is used, DFT terminals will not be the PROG726 errors or keyboard locks when DFS error messages are sent.
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-
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IMS Version 7

ETO Enhancements

- **Descriptor Limitation (50 records per descriptor) has been removed**
- **Associated Print Support enhancements**
  - Allows more timely delivery of output messages for Associated Printers regardless of where the transaction is processed in a Shared Queues environment
- **Autologon**
  - Enhancements for Associated Printers
  - Dynamic terminals activated via /OPNDST
  - New keywords in the /CHANGE command
    - Update autologon information, e.g., Mode
    - SAVE|NOSAVE across restarts

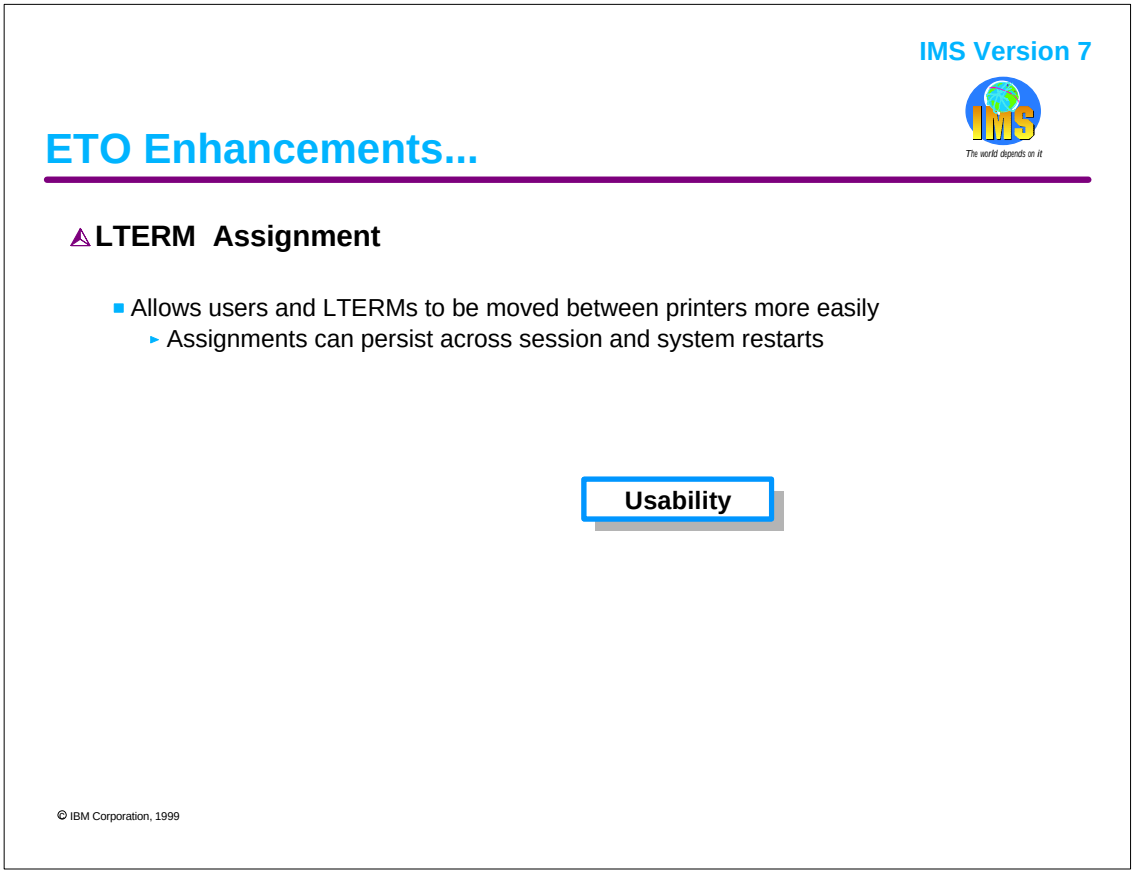
Usability

Prior to IMS V7, a descriptor that contained more than 50 records was ignored and an error message issued. This limited, for example, the number of remote LTERMs that could be defined on a single MSC link in an environment that used ETO MSC descriptors. In IMS V7, a new algorithm is used to remove the limit on the number of records that can be defined for a descriptor.

►

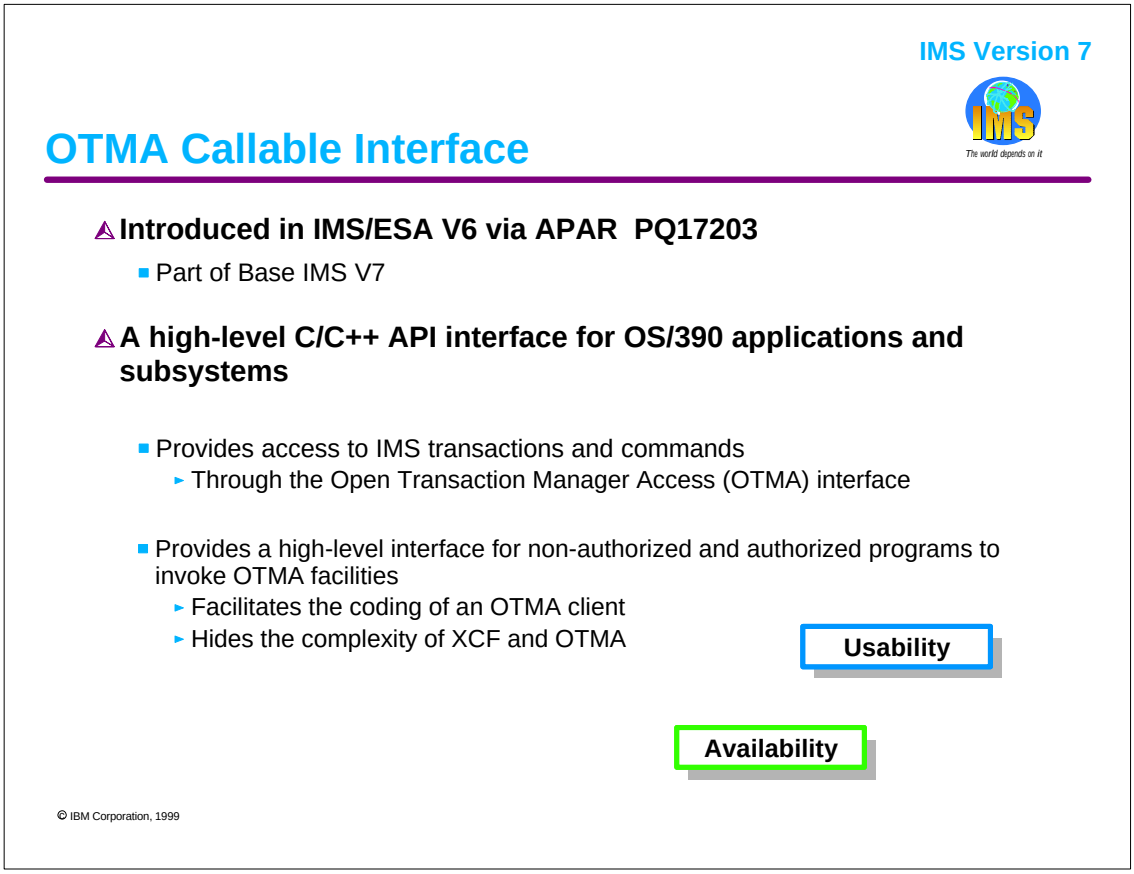
The ETO Associated Printer support is a technique that allows an end-user (at signon) to specify or associate a specific printer or printers for output messages. When an end-user signs on to an IMS system, the Associated Print (ASP) user structures, if specified, are created. For a Shared Queues environment, this IMS is considered the front-end for the end-user. The programs that process the input messages, however, may run in either the front-end IMS or in a back-end IMS system. IMS V7 enhances the associated printer support in a Shared Queues environment to ensure more timely delivery of the printer output. This is done by increasing the number of times when interest is registered in the associated printer LTERMs.

The autologon capability in ETO allows IMS to dynamically acquire a NODE as a result of queued output. It is applicable to all terminal types but primarily used for printers. Autologon processing in IMS V7 has been improved to be more compatible with associated printers as well as with printers that have been started interactively. In prior releases, the /OPNDST command to start a printer disabled the automatic autologon processing for the printer. IMS V7 does not disable this capability. Additionally, the autologon parameters can be modified using the /CHA command and saved across a subsequent restart.



The enhancements for ETO LTERM processing in IMS V7 include:

- the ability to assign LTERMs between users regardless of whether or not the target user structure exists.
- the capability to maintain persistence and remember the assignments across: session failure and restart, system failure and restart, and CLSDST due to printer sharing.



- The Open Transaction Manager Access (OTMA) interface was introduced in IMS/ESA V5 to provide a standardized access mechanism (XCF services) from MVS address spaces into the IMS TM component. The applications or subsystems that use this interface invoke IMS services to access transactions and commands and are called OTMA clients.
-
- XCF (Cross System Coupling Facility) is an MVS service which provides a high speed connection capability between two MVS address spaces and requires the calling programs (IMS OTMA and the OTMA client) to be authorized. Additionally, the direct use of XCF services requires portions of the OTMA client to be written in assembler to allow execution in both TCB and SRB mode. This imposes a degree of coding complexity beyond the scope of the average application or system programmer. Most of the OTMA clients that are available today are provided by vendors. Examples of existing clients are the MQSeries Bridge for IMS and the IMS TCP/IP OTMA Connection (ITOC).
-
- The OTMA Callable Interface simplifies this development environment by providing a high-level C/C++ interface to invoke the XCF services. It can be used by non-authorized as well as by authorized programs. The support was initially introduced by APAR in IMS/ESA V6 and is now delivered as part of base IMS V7.
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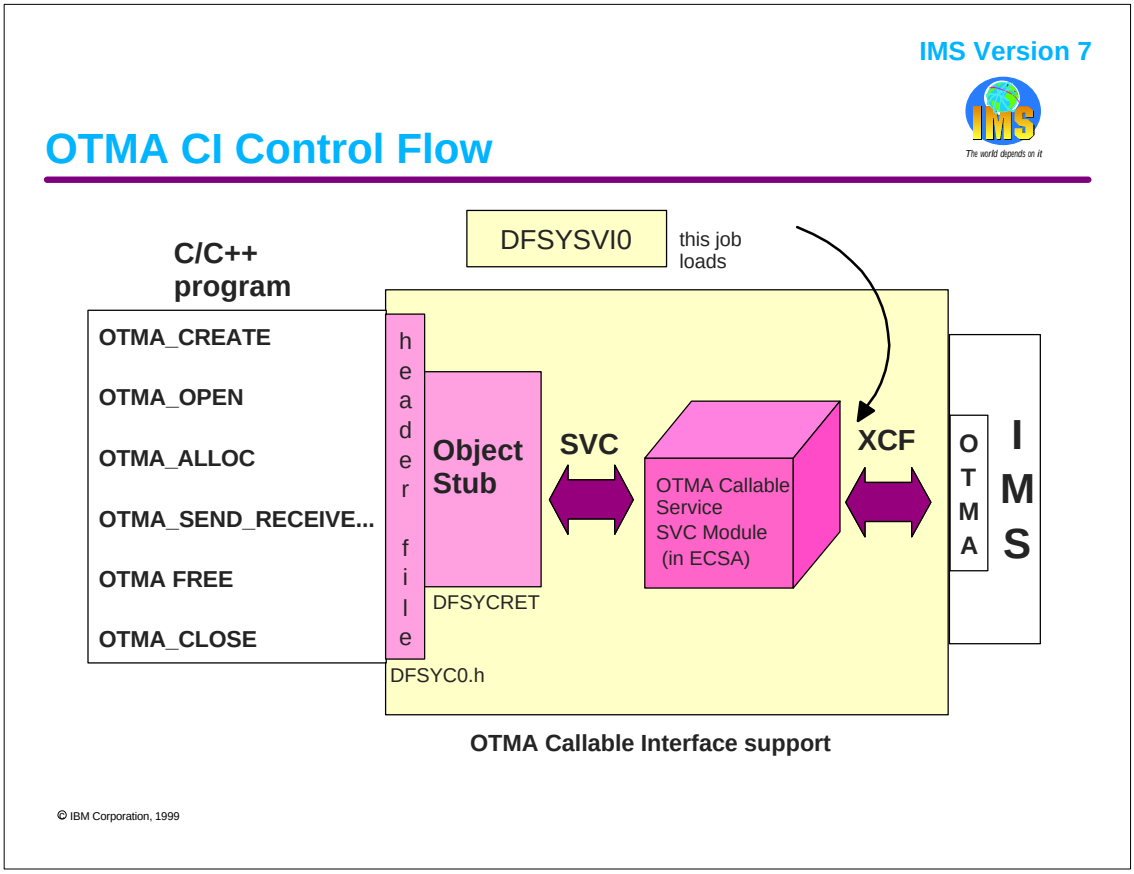


The OTMA CI environment consists of header files in the C/C++ program, object stubs and several interface modules:

- The header file DFSYC0.h defines the OTMA API for the programs and has to be included with the C/C++ program. This is delivered in the IMS ADFSMAC data set.
- The object stub, DFSYCRET, provides the underlying support for the API calls and issues an SVC 146 which passes control to the OTMA SVC interface module. This stub must be provided to the program during the bind process. It is delivered in the IMS ADFSLOAD data set.

  Note: IMS provides basic systems services to new address spaces through a component called Base Primitive Environment (BPE). MVS has assigned SVC 146 to BPE. The SVC allows callers to register a name and associate that name with an SVC interface routine.
- The OTMA Callable Services SVC interface module is the module that is called in supervisor state when the SVC is invoked with the registered name.

  Setup: This module needs to be loaded and registered to the BPE SVC services by an authorized address space. A stand-alone program, DFSYSVI0, is provided to do this. The program must be run after an MVS IPL. Once the OTMA SVC module is registered with BPE, it is available for use by authorized or non-authorized programs.

Flow:
When a C/C++ program issues an OTMA CI request, the object stub DFSYCRET that is linked with the program issues a BPE SVC (146) request which passes the OTMA function name. When the OTMA Callable Services SVC module receives the request, security and validity checking is performed and an input request is built for OTMA/IMS.

VTAM Generic Resources Enhancements

IMS DFSDCxxx options: GRAFFIN and GRESTAE

Availability

- Delivered via APAR PQ18590 in IMS/ESA V6
- Part of Base IMS V7
- Greater control over access availability to any IMS when failures occur

- **GRAFFIN = IMS | VTAM**
  - System option that specifies which component is to manage the Generic Resource affinities

- **GRESTAE = Y | N**
  - System option that defines whether or not IMS should reset affinities (CLSDSTs) during ESTAE processing
  - Applies to GRAFFIN=IMS

Usability

Note: MSC does not use VGR (sessions specify APPLID)

APAR PQ18590 delivered two new VTAM Generic Resources (VGR) options, GRAFFIN and GRESTAE, in IMS/ESA V6. They are included as part of the IMS V7 base support for VGR. Both options are specified at a system level and have no provision to provide different options at a terminal level. These enhancements address availability issues that were raised as a result of the original implementation of VGR in IMS/ESA V6.

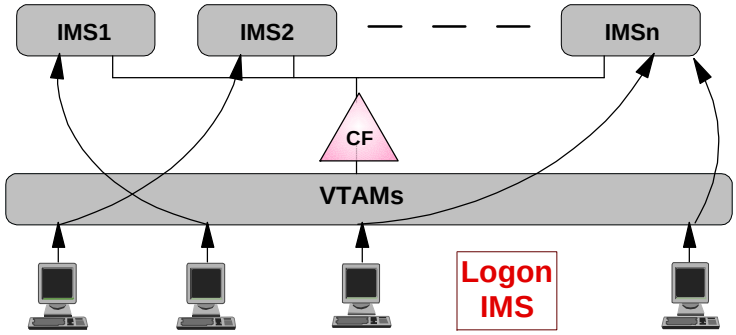
The GRAFFIN option provides the ability to choose whether IMS or VTAM is to manage the generic resource affinities. This is described in more detail in the following pages.

The GRESTAE option which applies to GRAFFIN=IMS environments, further provides the capability to choose whether or not IMS should issue VTAM CLSDSTs during ESTAE processing.

- Specifying GRESTAE=Y tells IMS to issue CLSDSTs which releases affinities if no terminal-related status conditions, such as response mode or conversational mode, exist. The CLSDSTs are issued synchronously and can result in delaying IMS termination. Under normal conditions, the time this action takes is not significant. On the other hand, problems might occur. An example is I/O time-outs that are commonly associated with cross-domain terminals.
- Specifying GRESTAE=N tells IMS to bypass the VGR CLSDSTs during ESTAE processing. This results in a fast termination of IMS but retains the terminal affinities to the failed IMS system.

IMS Version 7

Background - VGR ...



- All IMSs in the Sysplex join a **Generic Resource Group**
- IMS user logs on to a **Generic Resource Name** for the IMS Sysplex
- VTAM connects the user to one of '**n**' IMS **Members** of the Group

To better understand the enhancements to the VGR support, some background information is provided.

VGR is a service provided by VTAM to minimize the knowledge that an end user needs to logon to one of several like instances of an application, such as IMS, in a Parallel Sysplex. To the end user, there is a common name, called the Generic Resource Name (GRSNAME) which is used by VTAM to refer to any of the members of a Generic Resource Group (GRG). VTAM decides which member to use when processing an end user LU's session request.

This service provides a number of benefits including network load balancing across all the instances of IMS in the GRG. Were it not for VGR, the user, through system definition and special logon instructions, would have to perform the work of trying to balance these sessions. It also allows for easy changes in the number of IMSs in the sysplex. When a new IMS is added to the GRG, logons will be directed there without the end user ever knowing that a new IMS has been added. Likewise, IMSs can be removed with minimum impact on the end user. Obviously, there is some impact since the users would have to log off and then log back on to the GRSNAME to get connected to another IMS.

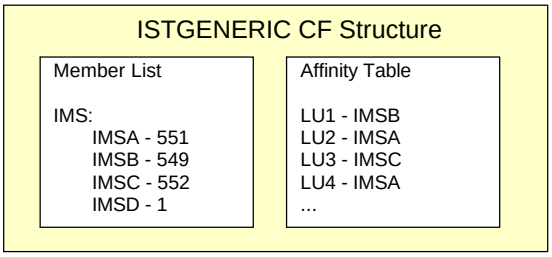
Note that there is a list structure in the CF called ISTGENERIC. This is where VTAM keeps track of which applications belong to which group, and which member each LU is logged onto. If an LU is logged onto a specific member, it is said to have an "affinity" for that member.

IMS Version 7

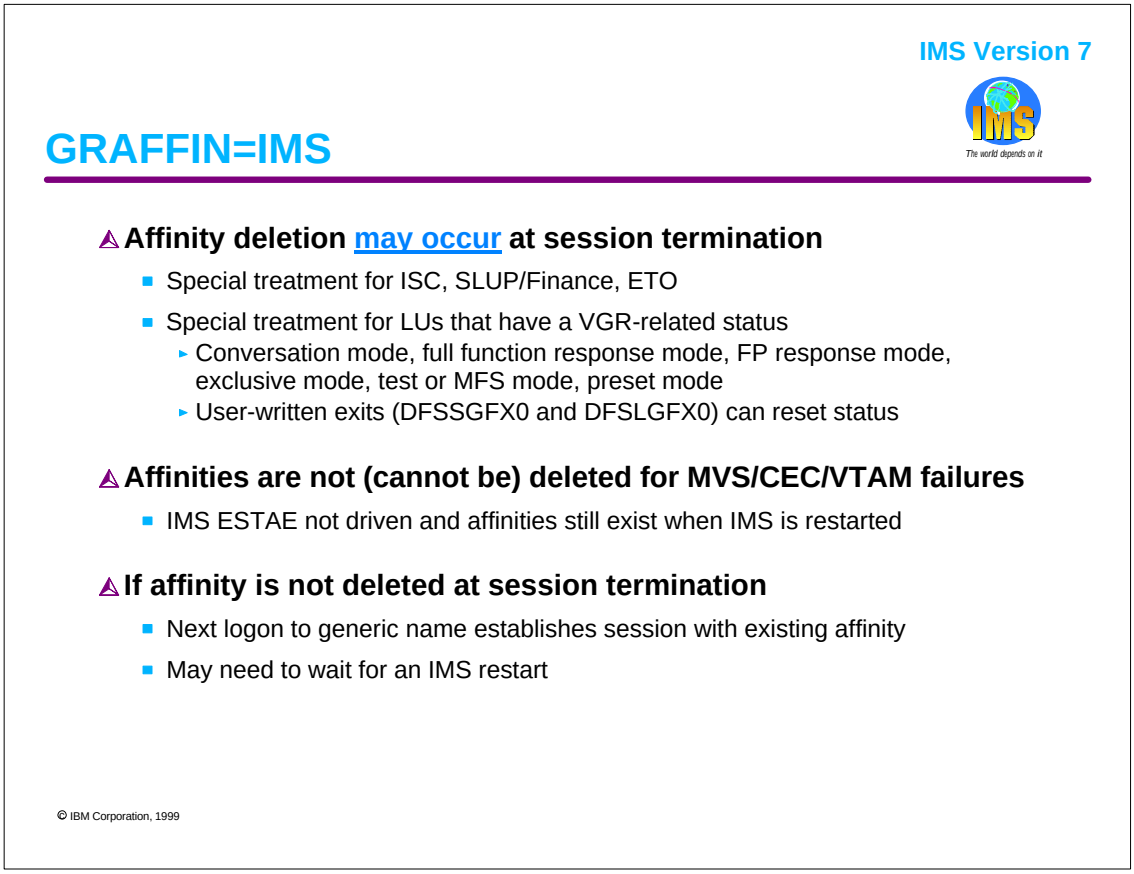
Background - VGR ...

AFFINITY: A mapping of an LU to a specific member (IMS)

- **Affinity is set when a session is first established**
  - VTAM maintains the **affinity table** in ISTGENERIC
- **When an LU requests a session using the GRSNAME**
  - VTAM checks to see if an affinity exists
    - If one exists, the session request is routed to that member
    - Otherwise, VTAM chooses one of the members
      - Special considerations for ISC



- The concept of affinities is important in VGR, and is particularly important to IMS. When an LU logs on to IMS, VTAM checks to see if an affinity exists. If one exists, the session request is routed to that IMS. Otherwise, VTAM chooses one of the members of the GRG.
-
- There are special considerations for ISC affinities:
- The first request for an ISC parallel session establishes the guidelines for subsequent parallel session requests:
  - If the first parallel session request specifies the GRSNAME then subsequent requests using the GRSNAME will be routed to the same member IMS.
  - If the first parallel session request is for a specific IMS APPLID then a subsequent request using a generic name is interpreted by VTAM as a request for a session different from the specific IMS. VTAM will select an IMS from the Generic Resource Group excluding the specific IMS. This request will fail because all parallel sessions have to be established with the same IMS.
- For all parallel sessions to be established with the same IMS, all must request the generic resource name, or all must request the specific APPLID
-



With the GRAFFIN=IMS option, IMS takes the full responsibility of deleting the affinity. At session termination, which may occur for a number of reasons (e.g., user logoff, VTAM LOSTERM / NSEXIT, IMS normal shutdown, IMS failure, MVS, VTAM or CEC failure), IMS decides whether or not to delete the affinity. Some types of sessions, however, get special treatment from IMS:

- ISC parallel session affinities are deleted when all sessions are quiesced or cold. An ISC single session affinity is deleted if the session is quiesced.
- SLUTYPEP and FINANCE terminals require resynchronization using STSN (set and test sequence number). Only the IMS they were in session with has the necessary information to resynchronize a session when it is reconnected. Affinities are not deleted at session termination, except when IMS shuts down with the LEAVEGR option. LEAVEGR indicates that IMS is leaving the GRG.
- All affinities are retained for LUs with significant status. Significant statuses are response mode, conversational mode, exclusive (/EXC), test (/TEST), preset destination (/SET xxxxxxxx), and MFS test (/TEST MFS).
- When an ETO user signs off, significant status is moved from the terminal to the user structure. When logoff occurs, the affinity is deleted because there is no significant status on the terminal. When the ETO user logs on again to the GRSNAME, if VTAM selects the same IMS where the significant status was held and the Signon Exit selects the same User Structure, significant status will be restored. For example, the terminal may be returned to its conversation. If VTAM selects a different IMS with no existing user structure there will be no significant status. The next time the ETO user logs on and VTAM selects the original IMS, the original significant status is restored. This could be confusing and is, therefore, a good reason to use the SIGNOFF exit to reset significant status for ETO terminals.

Note that if MVS or VTAM or the CEC fails, IMS ESTAE is not driven and IMS cannot delete any affinities. If a user were to log on again immediately, he would be directed back to the IMS which just failed and the logon request would fail.

If the affinity does not get deleted, then the next time the user logs on the session request is directed back to the same IMS. If the IMS is still active, the logon succeeds. If it is not, the logon request fails.

GRAFFIN=VTAM

- **Non-ISC affinities are reset at failure:**
  - CEC, MVS, IMS/ESA, VTAM, and Network/Session terminations
  - VGR-related status conditions are automatically reset by IMS
  - Terminal sessions can be reestablished immediately with any surviving IMS in group
- **ISC affinities continue to be managed by IMS regardless of GRAFFIN**

In a GRAFFIN=VTAM environment the affinities are deleted regardless of the type of failure. IMS has been enhanced to reset any significant terminal-related status conditions. The conditions are reset by IMS at signoff/logoff if possible. Otherwise, they are reset at a terminal's subsequent attempt to logon/signon to the same IMS.

ISC affinities continue to be managed by IMS and not by VTAM.

IMS Version 7

Rapid Network Reconnect (RNR)

Availability

- **RNR implements VTAM persistent session support**
  - Higher availability and reduced overhead
    - Quickly reestablishes VTAM sessions following system outages (IMS, MVS, CEC or VTAM)
  - Eliminates session cleanup/restart following an outage
- **New IMS option PSTIMER**
  - Specifies time VTAM waits for recovery of the persistent session before terminating sessions
- **New IMS option RNR = NRNR | ARNR**
  - ARNR - automatic session reconnect
  - NRNR - no reconnect
- **Prerequisite -** OS/390 V2R5, ACF/VTAM V4R4.1 (HVT4411)

Rapid Network Reconnect (RNR) support in IMS V7 implements the first step towards VTAM persistent session (single node and multinode) support in IMS. This function provides the ability for sessions to be maintained across a failure (e.g., IMS) and automatically reconnected when the failed component has been restarted. Additionally, an option called PSTIMER is provided to specify how long IMS is willing to wait from the time of the failure to the reopening of the ACB. The use of RNR in IMS requires OS/390 V2R5 and the associated VTAM V4R4.1.

Some benefits for this support include:
- higher availability since the sessions are maintained and therefore already available for the application after restart.
- less CPU overhead during restart, since the significant work of cleanup/restart of sessions is eliminated.

RNR=ARNR is required to get the benefits of persistent sessions.

IMS Version 7

Background

Persistent Sessions

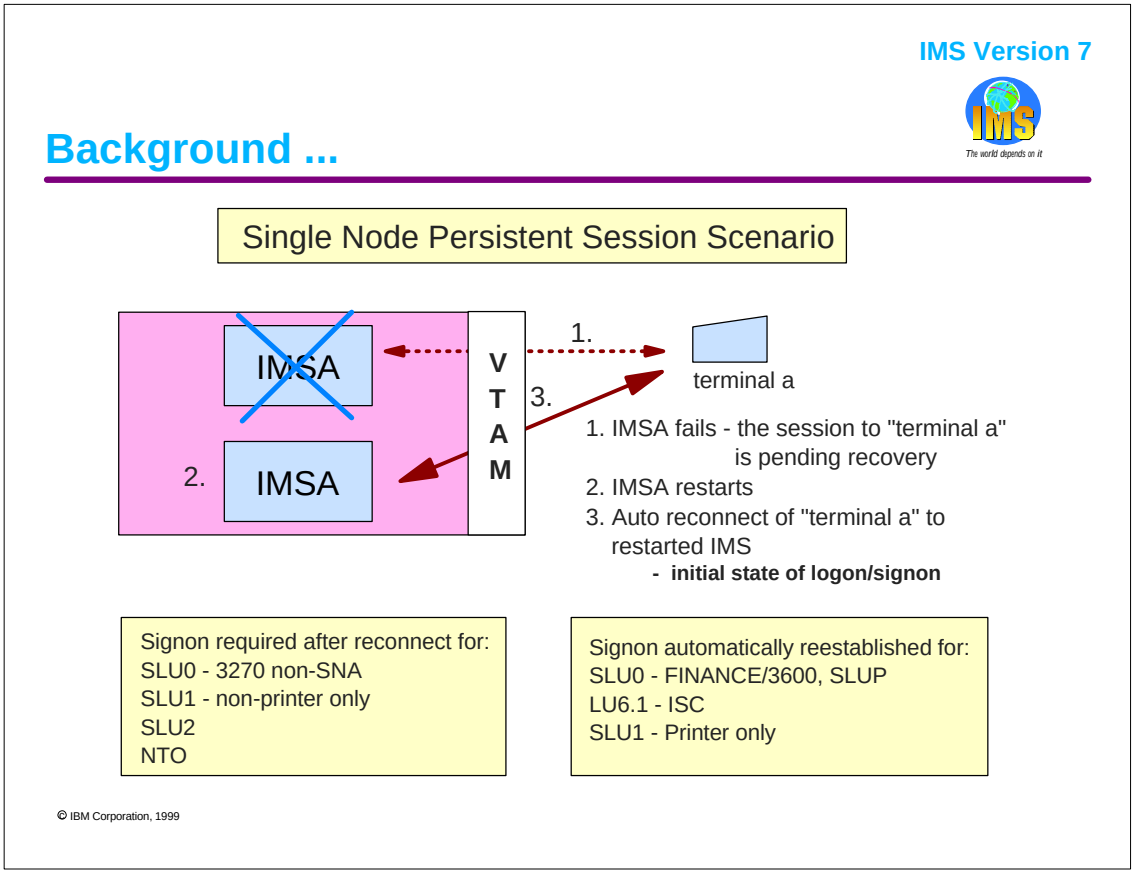
- VTAM Single-Node Persistent Session (SNPS)
  - Reconnect must be on same CEC as original IMS
  - Supports only application (IMS) failure/reconnect
- VTAM Multinode Persistent Session (MNPS)
  - Reconnect may be on another CEC in a sysplex
  - Supports failures/reconnects, including IMS, VTAM, MVS, and CEC failures
- Applies to VTAM nodes supported except MSC
  - Persistent session support for APPC is provided by APPC/MVS

VTAM persistent session support was introduced in VTAM V3R4. This capability allowed sessions to survive application failures and then be restored as soon as the application was restarted. The value of this capability consisted primarily in the elimination of the overhead associated with session termination and re-establishment. The support, however, as initially implemented in VTAM V3R4, was limited to application failures/restarts on the same CEC (single node).

Persistent session support was further enhanced in VTAM V4R4 to provide nondisruptive session recovery from any failure including network, application, VTAM, MVS, or CEC in a parallel sysplex environment. This enhancement allowed the failed application (IMS) to be restarted on a different VTAM system in the sysplex (multinode support). As a result of this added capability, the terminology associated with persistent sessions was expanded to include: single node persistent sessions (SNPS), and multinode persistent sessions (MNPS).

Although RNR support in IMS requires VTAM persistent session capability, the installation can select the use of either single or multinode persistent sessions.

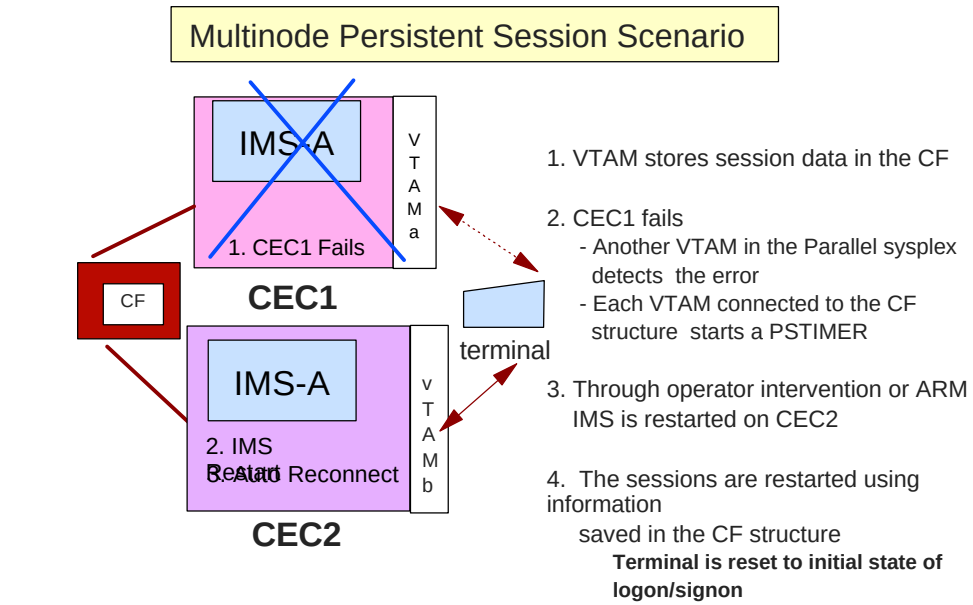
Note that RNR does not apply to APPC. The support for APPC persistent sessions is provided by APPC/MVS.



- Single Node Persistent Sessions (SNPS):
-
- When a persistence-enabled application program (i.e., IMS with RNR=ARNR specified) fails, VTAM closes the ACB on IMS's behalf but retains the LU-LU sessions, saves the allocated resources and control blocks in a data space, and shields the network from knowledge of the application program failure. VTAM stores the incoming data so that the network views the session as active but not currently responding. When the failed IMS restarts, VTAM reconnects the sessions. If the PSTIMER option is not specified, the session can remain pending recovery for an indefinite period. In this case, a VTAM "VARY NET INACT" command can be issued to close the session.
-

IMS Version 7

Background ...



Multinode Persistent Sessions (MNPS):

In an MNPS environment with IMS and RNR=ARNR specified, session data is stored by VTAM in the MNPS structure of a Coupling Facility.

In this example CEC1 fails. When VTAMa fails, VTAMb in the same sysplex detects the error and IMSA is marked pending recovery. VTAMb which is connected to the same MNPS structure in the CF starts a timer (PSTIMER value). If the PSTIMER expires before IMSA recovery is successful, VTAMb will perform cleanup of the failed IMS's session information in the CF structure. Otherwise, if IMSA is restarted on CEC2 either by operator intervention or by the Automatic Restart Manager (ARM), then IMSA's sessions are restored using the information from the MNPS structure in the CF.

Background - Requirements

- **VTAM V4R4**
  - VTAM APPL definition

```
IMSPROD    APPL    ACBNAME=IMSPROD
                   ...
                   PERSIST= SINGLE | MULTI
                   ...
```

- **If VTAM MNPS is used:**
  - VTAM end nodes must be running with APPN/HPR
    - HPR (High Performance Routing) network environment
  - All VTAMs must be connected to a coupling facility
    - Parallel Sysplex environment
    - Coupling Facility structure - ISTMNPS

MNPS requirements:

VTAM V4R4 - This release provides the VTAM code for MNPS support. Applications that choose to establish persistent sessions, must specify the PERSIST option in the APPL definition.

- PERSIST=SINGLE indicates that only single-node persistence is allowed.
- PERSIST=MULTI indicates multinode persistence is allowed in addition to single-node persistence support. If PERSIST=MULTI is coded and the application program is activated in an environment that does not support multinode persistent sessions then VTAM will issue an error message.

High Performance Routing (HPR) - HPR is an extension to APPN that provides nondisruptive path switching which can switch sessions around failed links or nodes. HPR connections are required to dynamically reroute session paths during failures in an MNPS environment.

Parallel Sysplex environment - VTAM uses the coupling facility in the MVS sysplex to maintain session and connection information for all multinode persistent session application programs.

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RNR - Highlights...

- **IMS Rapid Network Reconnect (RNR=)**
  - If specified, **always** establishes persistent sessions
  - **/START DC** following IMS restart initiates RNR action

Two IMS levels of RNR support on a terminal level:

RNR=ARNR
Automated session reconnect

RNR=NRNR
CLSDST scheduled
Forced for MSC/VTAM

- When the RNR option is specified in an IMS system, the associated sessions automatically become persistent. Persistence is maintained across an IMS, VTAM, MVS, or CEC failure.
-
- On a subsequent /START DC process to activate the IMS network, the persistent sessions are either:
  - terminated (NRNR), or
  - automatically reconnected (ARNR) to a data traffic reset point equivalent to a logon without user signon data. This results in either a DFS3649 signon message if appropriate for the terminal type, or a terminal connected DFS3650 message.
-
- VTAM MNPS support allows terminals to be defined with either session initiation/termination level of persistence or with a full active session send/receive level of persistence. IMS RNR takes advantage of the VTAM capability (introduced with UW50802) which allows IMS to request only session initiation/termination tracking (ARNR, NRNR options) rather than full session tracking (not supported by IMS RNR). This minimizes the number of accesses to the CF structure and the amount of data kept in the structure.

IMS Version 7

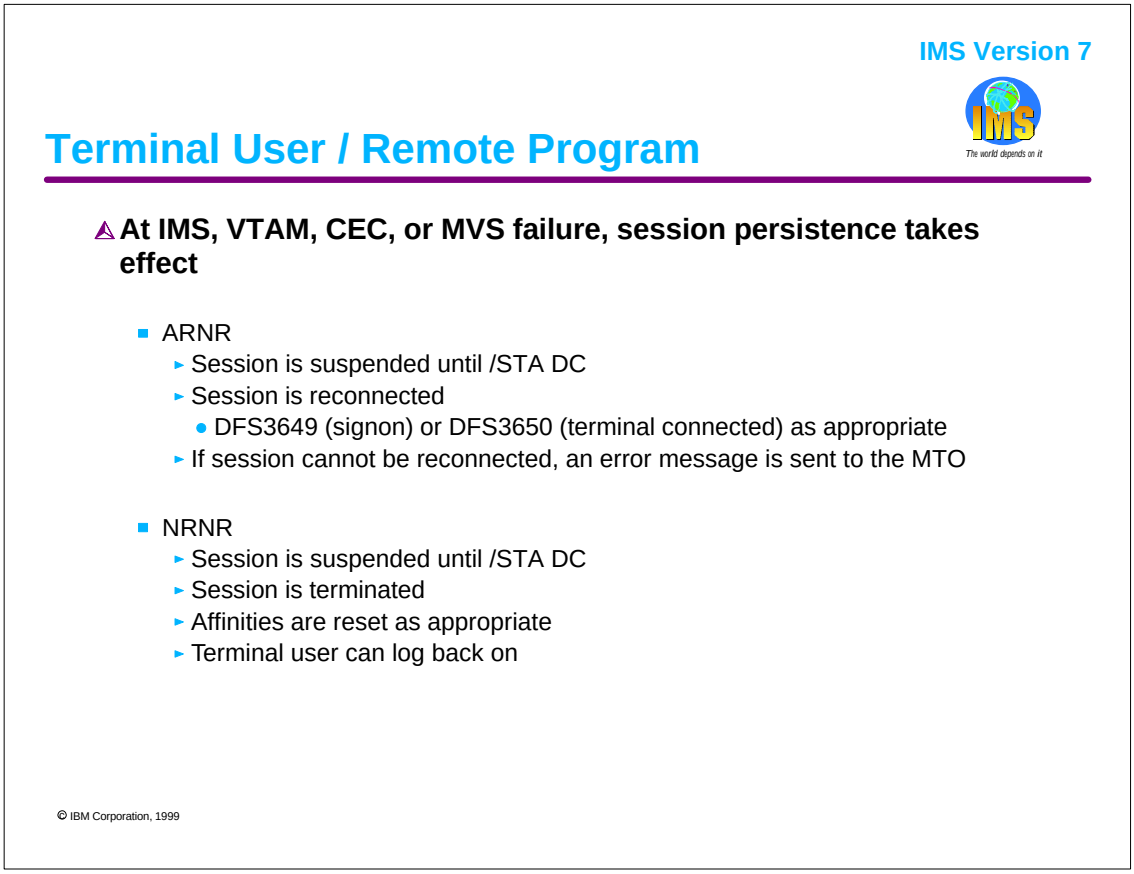
PSTIMER

- **DFSDCxxx execution option: PSTIMER= 0/86400**
  - Specifies time VTAM waits for recovery of the persistent session before terminating sessions
    - 0 = no timer used (24 hours)
    - 1-84600 seconds (up to 24 hours)
    - IMS default = 3600 seconds (1 hour)
    - Null or invalid value = IMS default

    VTAM start option (HPRPST) for MNPS will override PSTIMER if HPRPST is less than PSTIMER

The PSTIMER option specifies a 1-5 digit number of seconds. IMS tells VTAM to keep persistent sessions in pending recovery state for this amount of time after a failure. The timer is started by a failure (IMS, VTAM, MVS, or CEC) and continues until either the time limit expires or IMS issues the OPEN ACB. If the time expires prior to the OPEN ACB, VTAM terminates the sessions and releases the held resources.

Note the warning. If the VTAM value of HPRPST is set, then the lower of PSTIMER or HPRPST takes effect. The maximum value for HPRPST is 24 hours.



- The end user impact of RNR is based upon the option that has been specified for the device by the DFSDCxxx system default or by any overrides in the ETO logon descriptor or the DFSLGNX0 exit.
-
- Note that with RNR, if a failure occurs (IMS, VTAM, CEC, or MVS), the devices are suspended until the /STA DC can be issued. If IMS, MVS, or the CEC has failed, then the suspension also includes the time for an IMS restart. Depending on the RNR option, the sessions are then terminated (NRNR) or a session reconnect (ARNR) is attempted. If a session reconnect is unsuccessful, IMS sends an error message to the MTO.

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APPC Persistent Sessions

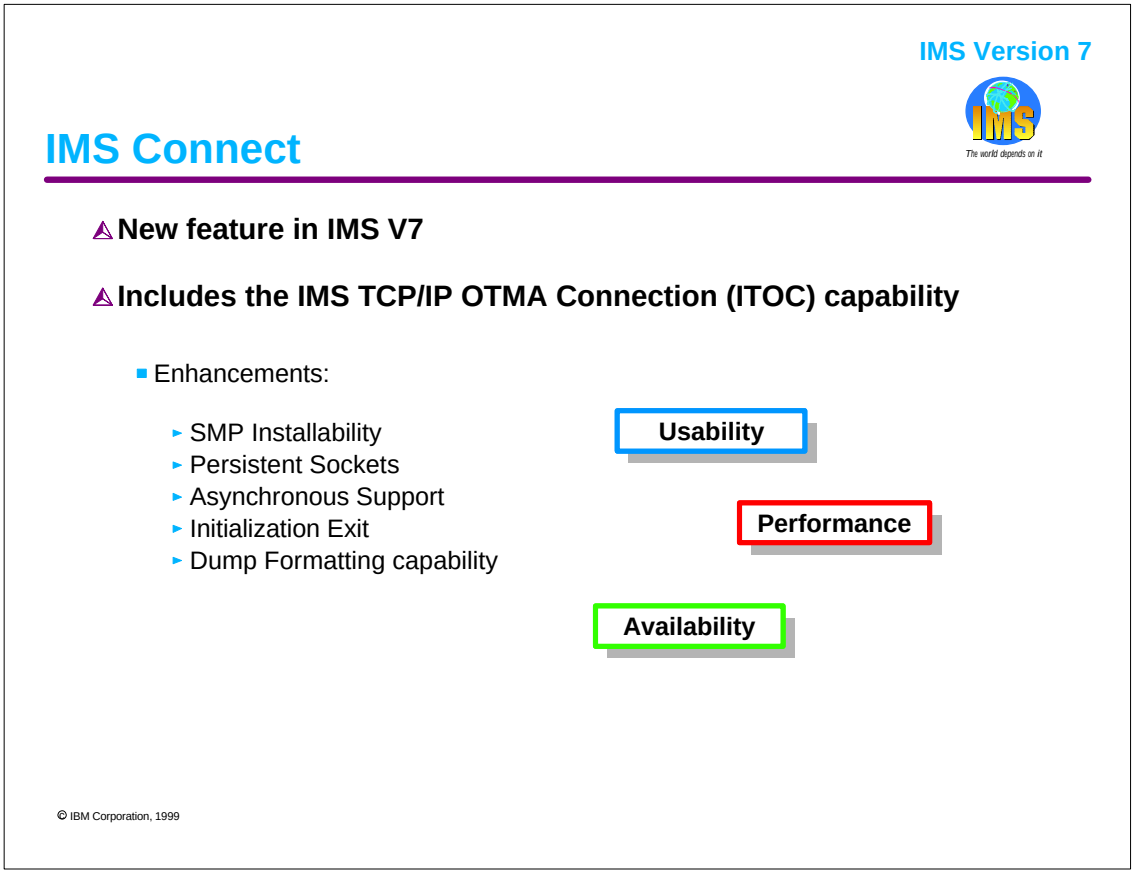
Persistent session support is provided by APPC/MVS

- Sessions are persistent, conversations are not
- SYS1.Parmlib (APPCPMxx)

```
LUADD
    ACBNAME (IMSLUA)
    SCHED (IMSA)
    BASE
    TPDATA (SYS1.APPCTP)
    PSTIMER (3600)
```

PSTIMER indicates the length of time that the sessions persist.
The VTAM definition for IMSLUA has PERSIST=SINGLE | MULTI.

- APPC sessions are managed by APPC/MVS and VTAM. Support for persistent APPC sessions is, therefore, provided by APPC/MVS and not IMS. This is an example of an LUADD statement that defines an LU named IMSLUA with persistent session support. The specification of PSTIMER= as well as the definition of PERSIST=SINGLE or MULTI in the VTAM definitions enables the support for APPC/MVS.



IMS Connect is a new separately priced feature in IMS V7. It incorporates and enhances the TCP/IP socket connection support that was originally called the IMS TCP/IP OTMA Connection (ITOC).

IMS Connect provides:
- SMP installability and maintenance.
- Persistent sockets support to allow a TCP/IP connection to remain active across multiple transaction iterations.
- Support for asynchronous output messages that originate from the IMS environment and are destined for a remote TCP/IP client.
- An initialization exit which is passed the status (active or not active) of the IMS systems to which it can connect. This information may be used to route a message to one of multiple candidate systems.
- Dump formatting capability to assist in problem determination.

IMS Version 7

System Enhancements

- Install/IVP process
- System Parameters display
- CPLOG specification
- Concurrent upgrade of RECONs
- Online RECON access preference
- RECON loss notification
- IMS Monitor and IMS PA enhancements
- ACBGEN processing and limits

Database Enhancements

- High Availability Large DB (HALDB)
- Online Recovery Service (ORS)
- Change Accum enhancements
- Image Copy 2 compression
- DBRC GENMAX and RECOVPD
- DBRC PROCOPT=L|LS support
- I/O error handling for DEDBs
- DEDB Scan segment expansion
- Open DB Access (ODBA)

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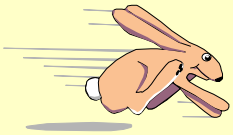
Transaction Manager Enhancements

- CQS Enhancements for Shared Queues
- Asynchronous OTMA/APPC
- TM and MSC Message Routing and Control User Exit
- Deferred VTAM ACB open
- RACF PassTicket support
- USERID clarification
- SLUP/Finance Session Cold Termination
- Spool enhancement
- Queue Space Notification Exit enhancement
- SLU2 enhancement
- ETO Enhancements
- Callable Interface to OTMA
- VTAM Generic Resources enhancements
- Rapid Network Reconnect (RNR)
- IMS Connect

IMS Version 7

Availability

- HALDB
- ORS
- RNR
- VTAM Gen. Resources
- DBRC
- Change Accum
- IC2
- DEDB I/O error handling
- SLUP/Finance Session Cold Termination
- ...



Performance

- HALDB
- ORS
- DBRC
- Change Accum
- ACBGEN
- Async OTMA/APPC
- Deferred ACB Open
- ...

Usability

- HALDB
- ORS
- ODBA
- Install/IVP
- IMS Connect
- DBRC
- ACBGEN
- Change Accum
- RACF PassTicket
- ...