



IBM® IMS™

Best practices

Managing IMS resources with online change

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Executive Summary

This article provides an overview and discussion of best practices for defining IBM Information Management System (IMS) resources using online change, including IMS database, DMB, MFS format, program, PSB, Fast Path routing code, and transaction resources. The purpose of these guidelines is to help you maximize the availability and ease of use of your IMS systems while minimizing the potential for errors and downtime.

Introduction

The direction for online change in IMS began in version 1.3 with the introduction of local online change. This feature was followed by Fast Path DEDB online change in IMS 6.1, global online change introduced in IMS 8.1, and ACBLIB member online change introduced in IMS 10.1. The purpose of online change is to allow you to modify your IMS system without first making it unavailable. However, there are number of factors that you should consider when you decide which method of online change to use and how best to implement a change-management policy.

Local online change

Local online change supports adding, changing, and deleting database, DMB, MFS format, program, PSB, routing code, transaction resources for one IMS system, without having to shut down IMS. Local online change consists of two phases initiated by command: the prepare phase (started with the /MODIFY PREPARE command) and the commit phase (started with the /MODIFY COMMIT command). In the prepare phase, IMS compares the active ACBLIB, FMTLIB, and MODBLKS data set with the inactive ACBLIB, FMTLIB, and MODBLKS data set, to determine what resources are to be added, changed, and deleted. The prepare phase also quiesces resources that are affected by the online change, which includes those that are actually being changed or deleted and those that are associated with a resource that is being changed. For example, if a DMB is being changed, the programs and transactions that reference that database are added to the list of resources that are affected by the online change. In the commit phase, IMS checks for work in progress for the resources affected by online change. If there is no work in progress, IMS commits the changes.

Online change is better for changing resource definitions than the IMS system definition process, because the IMS system is still up and available to do work. However, you still need to run some offline or batch utilities such as ACBGEN to generate the required resources prior to using online change. Also, the resources that are affected by the online change are quiesced during the online change. Modifying more resources increases the amount of time required for IMS to make the online change.

Global online change

Global online change is an IMS function that coordinates adding, changing and deleting database, DMB, MFS format, program, PSB, routing code, and transaction resources between all of the IMS systems in an IMSplex. Global online change eases the complexity of manually coordinating online changes between multiple IMS systems by providing the user with a way to issue a single command that is then propagated to all of the IMS systems in an IMSplex. Global online change consists of two phases initiated by commands. The prepare phase (started with the INITIATE OLC PHASE(PREPARE) command) and the commit phase (started with the INITIATE OLC PHASE(COMMIT) command).

The IMS type-2 commands that apply to global online change are:

- INITIATE OLC PHASE(PREPARE) TYPE(ACBLIB|FMTLIB|MODBLKS)
- INITIATE OLC PHASE(COMMIT)
- QUERY MEMBER TYPE(IMS)
- TERMINATE OLC

The global online change commands (INITIATE OLC and TERMINATE OLC) are defined to OM to be routed to only one IMS. That IMS becomes the global online change command master, and coordinates the online change with the other IMS systems in the IMSplex. The global online change command master is selected by SCI, and is usually the last IMS that came up and registered to SCI. If you want the command master to be a specific IMS, route the INITIATE OLC or TERMINATE OLC command to that specific IMS. The global online change command master can be any IMS in the IMSplex, even if the flavor of global online change does not apply to the command master IMS. For example, in a mixed configuration IMSplex, a DBCTL IMS can coordinate a global online change for FMTLIB, even though FMTLIB is not supported for DBCTL.

Global online change requires that the Common Service Layer (CSL) must be defined with SCI, OM, and RM. A resource structure is not required, but it is recommended in order to be able to bring up more than one RM in the IMSplex and avoid a single point of failure. If a resource structure is defined, CQS is also required. If a resource structure is not defined, only one RM may be brought up in the IMSplex.

ACB library member online change (ACBMBR OLC)

In an IMSplex environment, you can use the ACB library member online change (ACBMBR OLC) function to add or change individual members of the ACB library, or the entire ACB library, and bring these new or changed members online without quiescing the IMSplex or refreshing the active ACB library. The ACB library member online change function uses enhanced type-2 IMS commands and a combination of existing IMS processes including global online change, PSB definition, DBD definition, ACB definition, the ACB Maintenance utility, and the Online Change Copy utility (DFSUOCU0).

ACB library member online change requires that the OLCSTAT data set be initialized with version 2. Run the global online change utility (DFSUOLC0) with VERS=2.

ACB library member online change cannot be used to delete ACB library members; instead a full global online change must be used to change to a different ACBLIB dataset that does not include the ACB library members that you want to remove.

ACBLIB members that are not affected by the member OLC are not quiesced.

The ACBLIB suffix is not swapped and modify id is not incremented in the OLCSTAT data set, because the ACBLIB is not swapped.

You can make online changes to the ACB library in the following types of IMSplex environments:

- An IMSplex that contains a single IMS system. In this configuration, IMS must use the OLCSTAT data set with a Common Service Layer (CSL) that consists of an OM and SCI. An RM address space is not required.
- An IMSplex that contains multiple IMS systems. In this configuration, if IMS is using RM services, each IMS system must use the same shared OLCSTAT data set. If IMS is not using RM services (RMENV=N), each IMS can use its own local OLCSTAT data set, in which case the INITIATE OLC or TERMINATE OLC command must be routed to each IMS. The CSL must consist of an OM, an SCI, and an RM. A resource structure is not required, but it is recommended in order to be able to bring up more than one RM in the IMSplex and avoid a single point of failure. If a resource structure is defined, CQS is also required. If a resource structure is not defined, only one RM may be brought up in the IMSplex.

The following IMS type-2 commands apply to ACB library member online change:

- INITIATE OLC PHASE(PREPARE) TYPE(ACBMBR)
- INITIATE OLC PHASE(COMMIT)
- QUERY MEMBER TYPE(IMS)
- QUERY OLC SHOW(RSCLIST)
- TERMINATE OLC

Planning for online change



Determine which type of online change best suits your IMS environment

In general, using the most modern method for online change (ACB library member online change or global online change) is recommended. However, there are specific circumstances related to your IMS environment that might make local online change more attractive. In addition, you can avoid some overhead in a single-system environment by using local online change.

If you want to change the FMTLIB and ACBLIB in a single local IMS system, and you never plan to increase the number of IMS systems in your IMSplex, and you are not interested in the benefits of type-2 commands, use local online change. Choose global online change instead if you have multiple IMS systems, want to coordinate your ACBLIB or FMTLIB resource definition changes across an IMSplex, don't want to have to shut down and restart IMS because of a MODSTAT data set error, or if you are also interested in using type-2 commands. Global change is also recommended and might be necessary if you use ACBLIB member online change, depending on whether you want to delete DMBs and PSBs from the ACBLIB.

Global online change is better to use than local online change, even if you are using only one IMS, because the OLCSTAT data set can be dynamically allocated. If you use local online change and the MODSTAT data set gets an I/O error, you have to shut down IMS and restart it after correcting the I/O error, in order to address the problem.

ACBLIB member online change is best for coordinating DMB and PSB changes in ACBLIB across an IMSplex.

Alternatively, you can use dynamic resource definition (DRD). DRD is a much more flexible and easy-to-use method for defining database, program, routing code, and transactions resources, rather than using online change to modify MODBLKS resources.



Back up resource definitions

Always create and store backups of resource definitions in case they are lost because of an error. The resources involved in online change are stored in the ACBLIB, MODBLKS, and FMTLIB datasets. When you run the system generation utility to create the resources in the dataset, it is a good idea to create a backup. One method is to save the stage-1 system definition source. Another method is to make a copy of the data set. For example, you can run the IEBCOPY utility to copy resources to a backup dataset. It is a best practice to create the backup as soon as the source or data set is created.



Dynamically allocate the OLCSTAT data set

Global online change requires an OLCSTAT data set. The OLCSTAT data set contains information about the online change status for all of the IMS systems in the IMSplex, and it must be defined to use the global online change function. Dynamically allocating the OLCSTAT data set minimizes the possibility that a long running, multi-step batch job can result in JES allocating all of the data sets before the operation, including the OLCSTAT data set, which effectively prevents global online change operations from occurring. The global online change operation fails in this case because it attempts to allocate the OLCSTAT data set with DISP=OLD. When you dynamically allocate the OLCSTAT data set, it is allocated only while it is being used and is not allocated for the duration of the batch job.



Dynamically allocate ACBLIB data sets

Dynamically allocating data sets is a best practice, because it allows you to change data set characteristics without shutting down IMS. Use the dynamic allocation macro (DFSMDA) macro to create DFSMDA members to dynamically allocate the ACBLIB data sets (IMSACB, IMSACBA, IMSACBB). DFSMDA members provide the following benefits:

- You can increase the size of the ACBLIB data sets without stopping and restarting IMS.
- You can correct errors with the inactive ACBLIB without stopping and restarting IMS.
- You can add additional data sets to the ACBLIB concatenation without stopping and restarting IMS.



Manage online change with type-2 commands

Type-2 commands have many benefits, such as more information provided by type-2 QUERY commands than by type-1 /DISPLAY commands, more information provided by type-2 INITIATE command than by type-1 /MODIFY commands, more informational completion codes, completion code text, and error text, and support of the SPOC for automation, scrolling, retrieving the last command, and sorting output.

Consider using global online change even for a simple monoplex (one IMS only) because of the advantages of the type-2 command support for the INITIATE OLC and TERMINATE OLC commands, and the advantages of using ACBLIB member online change. The output from these commands contains much more information, especially if the online change command fails. If commit fails due to work in progress, IMS displays the resource name, type, and description of the work in progress that caused commit to fail. A type-1 /MODIFY COMMIT command that fails with work in progress returns the DFS3542 WORK IN PROGRESS FOR RESOURCE TO BE CHANGED/DELETED, without identifying the resource type and name that caused the failure.

Global online change and ACBLIB member online change require that OM and type-2 commands be enabled. OM and type-2 commands are not required for local online change. However, it is a best practice to enable OM so that you can use type-2 commands that return more information and help you ensure that the INITIATE OLC PHASE(COMMIT) or /MODIFY COMMIT command will succeed.



Use commands to identify conflicts that could halt an online change before starting the change process

For all types of online change (local and global, which includes ACB library member online change), there are several commands that are a good practice to issue after the PREPARE command, either with automation or manually, to help improve the chances that the COMMIT command will succeed.

Issue the /DISPLAY MODIFY ALL command to look for work in progress for affected resources. You can then quiesce the work in progress so that the COMMIT command will succeed for that resource. Quiescing work sometimes involves issuing commands, such as stopping transactions, stopping programs, allowing scheduled work to complete, and stopping databases. The /DISPLAY MODIFY ALL command output includes “NO WORK PENDING” on the last line, if there is no work in progress that would cause the COMMIT command to fail and there is nothing to quiesce at the time that the command is issued. However, this does not guarantee that the COMMIT command will succeed. It is still possible that new work could start after the /DISPLAY MODIFY ALL command is issued that causes commit to fail, notably a program-to-program switch.

Issue the /DISPLAY MODIFY MODS command after the PREPARE command, to see what resources are being modified. Capture this output (manually or with the OM audit log) in case there are problems with resources after the global online change. This information can be useful for diagnostics if problems occur. You can also use the information to verify that the resources slated for change are correct.

Issue the QUERY MEMBER TYPE(IMS) SHOW(STATUS) command after an error to see the online change state of all the IMS systems in the IMSplex. The output from the command includes information such as the online change phase (in progress or completed) for each system.

Issue the QUERY OLC LIBRARY(OLCSTAT) SHOW(ACTVLIB,MODID,MBRLIST) command before and after the global online change, to make sure the modify ID and active libraries are correct.

Issue the QUERY OLC LIBRARY(OLCSTAT) command to see which IMS systems are up to date with the online change libraries and which must participate in the global online change (except if OPTION(FRCABND) or OPTION(FRCNRML) are specified).

Define at least one DMB in your ACBLIB

If you are using IMS DB/TM or DBCTL and you are not using DRD, you must define at least one DMB in ACBLIB. If you fail to do this, IMS fails during cold start with the message DFS3402W NO DMBS IN THE INACTIVE LIBRARY FOR IMS DB/TM. This requirement also applies if you modify the ACBLIB or concatenation and then cold start IMS later. If IMS is using DRD and is at IMS version 13 or later, IMS can restart with no DMBs in ACBLIB.



*Specify as many ACB members as possible on a single
INITIATE OLC PHASE(PREPARE) TYPE(ACBMBR)
command*

Only one local online change, global online change, or ACB library member online change operation can run at a time. If you submit one or more subsequent online change commands while the first one is still in progress, the subsequent online change commands are rejected. For ACB library member online change, specify as many members as possible on the **INITIATE OLC PHASE(PREPARE) TYPE(ACBMBR)** command. Submitting a single command eliminates the possibility that sequential commands will be rejected.



Use rolling migration

Rolling migration is the practice of migrating to a new IMS release or service level incrementally across the IMSplex by upgrading one or more (but not all) of the participating IMS systems at a time. If there are problems with the new IMS release, work can still be done with the IMS systems that are at the older IMS level.

ACBLIB, FMTLIB, and MODBLKS global online change can be done during rolling migration, where some of the IMS systems are at one IMS release level, and the others at a newer IMS release level.

Here is one way to migrate IMS systems to a new IMS release level one IMS at a time. IBM recommends that all of the CSL address spaces, including Structured Call Interface (SCI), Operations Manager (OM), and Resource Manager (RM) be migrated to the new IMS release first.

1. Run the ACBGEN utility to generate IMSACBA and IMSACBB datasets at the new IMS release level.
2. Change ACBLIB data set definitions to the new IMS release level datasets. If the ACBLIB datasets are defined in the IMS start-up procedure, change the IMS procedure IMSACBA and IMSACBB DD cards to reference the new IMS release level ACBLIB datasets. If the ACBLIB datasets are dynamically allocated, change the DFSMDA member to reference the new IMS release level ACBLIB datasets.
3. Generate the MODBLKSA and MODBLKSB datasets at the new IMS release level, if dynamic resource definition is not enabled (DFSDFxxx proclib member does not define MODBLKS=DYN), change MODBLKS data set definitions to the new IMS release level datasets. If the MODBLKS datasets are defined in the IMS procedure, change the IMS procedure MODBLKSA and MODBLKSB DD cards to reference the new IMS release level MODBLKS data sets.
4. Run the MFS format utilities to generate the FMTLIBA and FMTLIBB datasets at the new IMS release level.
5. Change your FMTLIB data set definitions to the new IMS release level datasets by changing the IMS procedure FORMATA and FORMATB DD statements to reference the new IMS release level MFS format datasets.
6. Cold start the IMS. This updates the IMS version to the new IMS release level in the OLCSTAT data set, but its ACBLIB, FMTLIB, and MODBLKS suffixes remains the same as the other IMS systems in the IMSplex.

When global online change is done, each IMS system will simply switch the ACBLIB, FMTLIB, or MODBLKS libraries that were specified on the command, regardless of their IMS release level. If data sharing with ACBLIB, all of the IMS systems at the old IMS release level share the old IMS release level ACBLIB, and all of the systems at the new IMS release level share the new IMS release level ACBLIB. The ACBLIB data set names

can be different or the same. The IMS systems participating in a global online change do not compare their ACBLIB data set names with each other.

Requirements for global online change during a rolling migration

- All of the IMS systems have the same active ACBLIB suffix (IMSACBA or IMSACBB), FMTLIB suffix (FMTLIBA or FMTLIBB), and MODBLKS suffix (MODBLKSA or MODBLKSB).
- All of the IMS systems define the same ACBSHR value, if it is defined. This value is set with the ACBSHR parameter of the DFSCGxxx or DFSDFxxx member of the IMS PROCLIB data set. It is alright to have ACBSHR=Y defined to all the IMS systems in the IMSplex, as long as ACB library member online change is not attempted during the migration.

ACB library member online change for an IMSplex defined with ACBSHR=Y is not supported during rolling migration and should not be attempted, because it would lead to unpredictable results. When ACBSHR=Y is defined, the ACBLIB is shared, so only IMS systems at the same IMS release level may access it.

We recommend that you use ACBLIB global online change instead of ACB library member online change if ACBLIB changes are required during rolling migration. Once all of the IMS systems have been migrated to the new IMS release, ACB library member online changes can be resumed.

It may be possible to do ACB library member online change during rolling migration, but it would likely require many more complex actions than just doing an ACBLIB global online change. For example, you could define each IMS with ACBSHR=N and define a local, non-shared ACBLIB, then cold start each IMS to cause these changes to take effect. When ACB library member online change is done for IMS systems defined with ACBSHR=N, each IMS updates its own, local, active ACBLIB, whatever IMS release that happens to be. Once the migration is complete, you would then have to define ACBSHR=Y and define a shared ACBLIB and cold start each IMS again, to cause these IMS systems to switch back to using the shared ACBLIB at the new IMS release level.

Recovering from problems



Prepare automation to deal with common errors before they happen

Think about what kinds of online change resource errors can happen, and plan for them before they happen. Establish automated procedures or manual checklists for handling error situations. For an overview, read the following topics:

[INITIATE OLC error handling](#)

[Handling errors for global online change commands](#)

For example, you can write an automation program using REXX SPOC, Batch SPOC, or your own that issues the INITIATE OLC PHASE(PREPARE) and INITIATE OLC PHASE(COMMIT) commands; checks the command return code, reason code, IMS completion codes; and takes action on non-zero reason codes and completion codes.

One of the most common causes of an OLC error is an insufficient timeout value. If an INITIATE OLC PHASE(COMMIT) command fails because one or more of the IMS systems failed to return a response in time, it results in a completion code of 91 (TIMEOUT ERROR). The commit command may have succeeded, but the IMS system was unable to return a response within the timeout value specified by the user. Before trying the command again, follow the instructions in [INITIATE OLC error handling](#) to determine whether the global online change was committed. If it was committed, simply issue the INITIATE OLC PHASE(COMMIT) command again with a longer timeout value to complete the commit on all of the affected IMS systems and get their responses.

There are many error reason codes that you can pre-plan to address. Some of the most common reason codes that apply to global online change commands are shown in the following table.

Command reason code	Meaning	Action
100C	Some IMS systems are down.	One or more of the IMS systems defined in the OLCSTAT data set are down, so the online change PREPARE command is rejected. Either bring those IMS systems back up or issue the INITIATE OLC PHASE(PREPARE) command with OPTION(FRCABND) if the stopped IMS is abended or OPTION(FRCNRML) if the IMS was shut down normally.
3000	At least one request was successful.	Check the completion code from each IMS system to determine what action to take.
3004	None of the requests were successful.	Check the completion code from each IMS system to determine what action to take.
4004	No CQS.	Bring CQS back up.
4100	Resource structure is full.	Increase the resource structure size.
4104	No RM address space.	Bring RM back up.
4108	No SCI address space.	Bring SCI back up.
4120	Online change phase in progress.	Wait for the current online change phase to complete, then try the online change command again.
4124	Same type process in progress.	Wait for the current online change that is in progress to complete, then try the new online change command again.
41F0	IMS checkpoint is in progress.	Wait for the IMS checkpoint to complete, then try the online change command again.

If an XRF alternate or FDBR region abends shortly after an ACB library member online change is performed on the active IMS system where ACBSHR=Y is defined, no action is needed other than restarting the XRF alternate or FDBR region, because the active and XRF alternate or FDBR region are sharing ACBLIB and the changes are committed. If an XRF alternate or FDBR region abends shortly after an ACBLIB, FMTLIB, or MODBLKS online change is performed on the active IMS system, issue the /CHECKPOINT command on the active IMS system until the restart checkpoint time is after the online change time. If this is not done, and if the online change X'70' records are applied after the XRF alternate or FDBR IMS comes back up with the most current MODSTAT or OLCSTAT data set and is already in the correct state, the XRF alternate or FDBR may abend with an ABENDU3000 when you bring it back up. The online change messages include DFS3499 MODBLKSA IMSACBB FORMATC, where A is the current MODBLKS data set suffix, B is the current ACBLIB data set suffix, and C is the current FMTLIB data set suffix. One message is issued for a successful prepare command, and one for a successful commit command. The checkpoint messages include the DFS994I CHKPT message and the DFS3804I LATEST RESTART CHKPT message. The DFS3804I message contains the restart checkpoint timestamp.

One method for handling problems with DMBs and PSBs after member online change is to fall back to the previous version of the changed resource by performing a full ACBLIB online change process to switch back to the previous ACBLIB. You can use this option by setting a copy of the pre-change ACBLIB as the inactive ACBLIB for the system. If there are problems with the resources, do a global online change for ACBLIB to switch to the inactive (old) ACBLIB.

If you want to keep the inactive and active ACBLIB in sync after a successful member online change, run the Online Change Copy utility (DFSUOCU0) with the parameters (ACTVACB,S,G) to create an identical copy of all of the active ACB members. Using these options with the utility copies all of the active ACB members to the inactive ACBLIB with the staging library as the input and the inactive ACBLIB as the target as defined by the OLCSTAT data set.

Terminate a failed global online change to unlock the OLCSTAT data set before attempting another change

If one or more (but not all) of the participating IMS systems fail during a global online change, terminate the global online change with the TERMINATE OLC command, then start the IMS systems again before re-attempting the global online change. The global online change cannot succeed (unless you use OPTION(FRCNRML) or OPTION(FRCABND)) if one or more of the IMS systems are down.

If all of the IMS systems fail during global online change, the OLCSTAT data set remains locked, which will prevent any IMS systems from starting up. To unlock the OLCSTAT data set so that systems can restart, run the Global Online Change utility DFSUOLC0 with the unlock function.

Don't start IMS systems while a global online change is in progress

IMS abends with ABENDU2800 SUBCODE0010 if you attempt to start a system while a global online change is in progress. IMS restart must read the OLCSTAT data set to determine if it is current with the other IMS systems in the IMSplex. If a global online change is in progress, the OLCSTAT data set is locked and can't be read so a restart attempt will abend. Try restarting IMS again after the global online change is complete.



Create a recovery procedure for the OLCSTAT data set

The OLCSTAT data set contains the global online change status, which includes the modify ID, the active online change libraries, a lock field, the last online change, and a list of IMS systems that are current with the online change libraries. After every successful global online change, either create a copy the OLCSTAT data set, or record the following data in order to be able to recreate the OLCSTAT data set:

- The modify ID
- The active online change library suffixes
- The list of IMS systems that are current with the online change libraries

The Global Online Change utility (DFSUOLC0) can initialize, recreate, or unlock the OLCSTAT data set. If the OLCSTAT data set is destroyed (for example, due to an I/O error), or unavailable because all of the IMS systems failed after it was locked for global online change, use DFSUOLC0 to recreate or unlock the OLCSTAT data set. Global online change and initialization of additional IMS systems fail until the OLCSTAT data set is re-initialized.

Important: Use the recreate and unlock functions with extreme caution. Use the unlock function only if a series of errors has left the OLCSTAT data set locked, no online change is in progress, and no IMS systems can start because the OLCSTAT data set is locked.



Best practices

- Use global online change unless your IMS environment consists of a single IMS system and you are not interested in type-2 commands
- Back up resource definitions before starting an online change
- Dynamically allocate the OLCSTAT data set
- Dynamically allocate ACBLIB data sets
- Issue QUERY and DISPLAY commands to ensure that an online change operation will not be blocked by work in progress
- Use rolling migration
- Write automation to recover from common OLC errors
- Create a recovery procedure for the OLCSTAT data set

Conclusion

Online change is an important tool that you can use to make your IMS systems more flexible and responsive to development and business needs. Implement best practices to improve how you use online change and get the best results for your environment.

Further reading

- [*Best practices: Creating, storing, and managing definitions for DOPT PSB and GPSB resources*](#)
- Information Management best practices:
<http://www.ibm.com/developerworks/data/bestpractices/>

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