Adabas Cluster Services

Operations

Version 8.5.4

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ADABAS & NATURAL

This document applies to Adabas Cluster Services Version 8.5.4 and all subsequent releases.

Specifications contained herein are subject to change and these changes will be reported in subsequent release notes or new editions.

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Preface

This documentation provides information about initialization, termination, backout, restart, and recovery processes in an Adabas cluster environment. It tells you how to plan an outage and how to use the utility functions that are provided specifically for cluster environments. Finally, it provides a sample of the session-end statistics produced for a clustered nucleus.

The Adabas Cluster Services Operations documentation is organized in the following topics:

Initialization	Describes topics related to Adabas Cluster Services initialization.
Termination	Describes topics related to Adabas Cluster Services termination.
Using Alert and Timeout Settings	Describes alert and timeout settings that can be specified to help you prevent or handle critical situations where system problems affect the availability of cluster members.
Collaboration Between Cluster Nuclei	Describes enhancements for making the nuclei in a cluster more independent of one another.
Backout Processing	Describes Adabas Cluster Services backout processing.
Restart/Recovery Processing	Describes Adabas Cluster Services restart and recovery processing.
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Switching Between Cluster and Noncluster Modes / PLOG Handling	Describes the process of switching between cluster and non-cluster modes and the PLOG handling associated with that process.
Performance and Tuning	Describes performance and tuning you can do for Adabas Cluster Services.
Estimating Entire Net-Work Storage Requirements	Provides tables to assist in estimating the storage requirements of Entire Net-Work.
Adabas SMF Records	Describes Adabas SMF records and how they can be produced.
Adabas Online System Cluster Environment Screens	Describes the Adabas Online System version 8.2 screens that apply to the Adabas Cluster Services cluster environment.

1 Conventions

Notation *vrs* or *vr*: When used in this documentation, the notation *vrs* or *vr* stands for the relevant version, release, and system maintenance level numbers. For further information on product versions, see *version* in the *Glossary*.

2 About this Documentation

Document Conventions

Convention	Description
Bold	Identifies elements on a screen.
`Monospace font`	Identifies service names and locations in the format *`folder.subfolder.service`*, APIs, Java classes, methods, properties.
`Italic`	Identifies: Variables for which you must supply values specific to your own situation or environment. New terms the first time they occur in the text. References to other documentation sources.
`Monospace font`	Identifies: Text you must type in. Messages displayed by the system. Program code.
{ }	Indicates a set of choices from which you must choose one. Type only the information inside the curly braces. Do not type the { } symbols.
|	Separates two mutually exclusive choices in a syntax line. Type one of these choices. Do not type the | symbol.
[ ]	Indicates one or more options. Type only the information inside the square brackets. Do not type the [ ] symbols.
...	Indicates that you can type multiple options of the same type. Type only the information. Do not type the ellipsis (...).

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3 Initialization

This section provides information about initialization in an Adabas cluster environment.

Sequence

Due to the interdependence among Entire Net-Work, ADACOM, and Adabas cluster nuclei, these programs have certain co-occurrence requirements.

- Whether currently running or not, ADACOM must have been executed in the local operating system image when there are cluster users but no cluster nuclei to set up the environment.
- Entire Net-Work can start before or after ADACOM or a nucleus is active.

Note that although ADACOM and several Adabas cluster nuclei could run without Entire Net-Work within a single operating system image, there could then be no Adabas Cluster Services programs for that database in any other operating system image.

- A nucleus will not start if another nucleus with the same NUCID (whether local or remote) is already active.

ADACOM Process

The ADACOM initialization process is recorded in PLI*nnn* messages.

All PLI*nnn* messages are printed to the console. PLI001-049 messages are specific to a particular SVC/DBID set and are written to the SYSOUT data set dynamically allocated for that set; starting with PLI050, the messages apply to ADACOM in general and are written to the COMPRINT data set.

A new Adabas Cluster Services control block is acquired if none yet exists.

Note: Prior to PLI050, the system default ADARUN parameter values for `MODE`, `DBID`, `DEVICE`, `SVC`, and `AMODE` are displayed. These are not the values for the current ADACOM.

```
PLI050 00161 INITIALIZING ADACOM
PLI002 00161 INITIALIZING DBID=dbid SVC=svc
             ACQUIRING NEW PLXCB
             PLXCB IS LOCATED AT address
PLI063 00161 PROCESSING: ADACOM SVC=svc,DBID=dbid,NU=users
             INITIALIZATION COMPLETE
```

Adabas Cluster Nucleus Process

Each Adabas cluster nucleus serializes during initialization by means of an enqueue. This is done because each nucleus puts information into the CSA nucleus table.

```
PLX050 00161 ADACLU INIT  DBID=00161  NUCID=00132
PLX006 00161 PLXCB LOCATED AT 0C893000
ADAN03 00161 INITIALIZING NUCID=132  INTNUCID=2
ADAX20 00161 XCF TRANSPORT INITIALIZATION COMPLETE
ADAX28 00161 IXCJOIN XCFTI     RET 00000004 RSN 00000004
ADAX28 00161 IXCQUERY XCFTI     RET 00000000 RSN 00000000
PLX059 00161 INITIALIZATION OF ADACLU COMPLETE
ADAN03 00161 ADABAS COMING UP
ADAX31 00161 OPENING WORK DATASET FOR NUCID=132
```

Access to the coupling facility lock structure is established and acknowledged by messages issued by the operating system:

```
IXL014I IXLCONN REQUEST FOR STRUCTURE ADA_LOCK11
WAS SUCCESSFUL.  JOBNAME: USADFM7 ASID: 00C0
CONNECTOR NAME: DB00006P00002N02 CFNAME: DCF1
IXL015I STRUCTURE ALLOCATION INFORMATION FOR
STRUCTURE ADA_LOCK11, CONNECTOR NAME DB00006P00002N02
  CFNAME     ALLOCATION STATUS/FAILURE REASON
  --------    --------------------------------
  DCF1          STRUCTURE ALLOCATED
  DCF2          PREFERRED CF ALREADY SELECTED
```

Adabas Cluster Services follows the operating system messages with lock structure statistics:

```
ADAX70 00161 CONNECTED TO LOCK STRUCTURE ADA_LOCK11
ADAX70 00161 NUMBER OF LOCK ENTRIES             32,768
ADAX70 00161 MAX NUMBER OF RECORD ELEMENTS      11,184
```

Access to the coupling facility cache structure is established and acknowledged by messages issued by the operating system:

```
IXL014I IXLCONN REQUEST FOR STRUCTURE ADA_CACHE11
WAS SUCCESSFUL.  JOBNAME: USADFM7 ASID: 00C0
CONNECTOR NAME: DB00006P00002N02 CFNAME: DCF1
IXL015I STRUCTURE ALLOCATION INFORMATION FOR
STRUCTURE ADA_CACHE11, CONNECTOR NAME DB00006P00002N02
  CFNAME     ALLOCATION STATUS/FAILURE REASON
  --------    --------------------------------
  DCF1          STRUCTURE ALLOCATED
  DCF2          PREFERRED CF ALREADY SELECTED
```

Adabas Cluster Services follows the operating system messages with cache structure statistics:

```
ADAX57 00161 CONNECTED TO CACHE STRUCTURE ADA_CACHE11
ADAX57 00161 DIRECTORY ELEMENTS          11,490
ADAX57 00161 DATA      ELEMENTS           2,872
ADAX57 00161 DATA ELEMENT SIZE            1,024
ADAN19 00161 BUFFER FLUSH IS  A S Y N C H R O N O U S
ADAN01 00161 A D A B A S  Vv.r.s  IS ACTIVE
ADAN01 00161 MODE = MULTI
ADAN01 00161 RUNNING WITHOUT RECOVERY LOG
```

PPT Processing

The parallel participant table (PPT), which exists for both cluster and noncluster nuclei, is used to determine if any PLOGs still need to be copied from previous sessions. If the PPT indicates that PLOGs remain to be copied, the PLOG data sets are read and, if necessary, the user exit (user exit 2 or user exit 12) is invoked.

First Sysplex Cluster Nucleus Starts

The Adabas sysplex cluster nucleus that is the first to initialize checks all the PLOG entries from the previous session for all nuclei and marks any that are "still being written" to completed status. In this way, the user exit (user exit 2 or user exit 12) need not be called each time a cluster nucleus autostarts. The first nucleus then calls the user exit but waits only if the PLOGs that need to be copied are for its own NUCID.

Subsequent Sysplex Cluster Nucleus Starts

A subsequent cluster nucleus checks only its own PLOGs and invokes user exit 2 or user exit 12 if the PLOGs are still not copied/merged. It waits if the user exit instructs it to. If there is no user exit 2 or user exit 12, it overwrites the PLOGs.

Noncluster Nucleus Starts

A noncluster nucleus checks whether the previous session was a sysplex cluster session and has a pending autorestart. If so, the noncluster nucleus is not allowed to start.

If PLOGs from a previous sysplex cluster session remain to be copied, ADARES invokes the merge or the PLCOPY as required. A noncluster nucleus always uses block 1 of the PPT and can only overwrite it when PLOGs from previous sessions have been processed to completion.

A user exit 2 or user exit 12 controls the copy/merge process. If there is no user exit 2 or user exit 12, the PLOG and PPT entry are overwritten.

Different PLOG Detected

If `PLOGRQ=FORCE` is specified and an uncopied PLOG is detected that does not match that specified in the last session, a parameter error occurs. If the PLOG has been copied, the PPT entry is overwritten and the nucleus starts.

4 Termination

This section provides information about termination in an Adabas cluster environment.

Normal Termination

Entire Net-Work

Entire Net-Work may be stopped while ADACOM and/or cluster nuclei are active.

If the local Entire Net-Work stops while remote nuclei are still active, the remote nuclei are effectively no longer active. That is, users in the local operating system image will receive response code 148 for commands that are to be routed to any of the remote nuclei.

When Entire Net-Work is restarted, the environment is reset by the ADACOM module on operating system images that have users but no cluster nuclei. If on such an image

- the ADACOM module remained operational after initialization, it automatically resets the environment
- the ADACOM was quiesced after initialization, you must rerun it to reset the environment.

In lieu of ADACOM, the environment is reset on operating system images that have one or more active nuclei when the first user issues a command.

ADACOM

If ADACOM is used only to initialize a sysplex cluster environment, it can subsequently be stopped ("quiesced") for batch operation or retained in operation as a command manager. ADACOM can be restarted at any time.

On operating system images that have users but no cluster nuclei, Software AG recommends that you keep ADACOM in operation as well so that it is available to reset the environment if Entire Net-Work goes down for any reason and comes back up.

Adabas Cluster Nuclei

If the Adabas operator command `ADAEND` or `HALT` is issued, the nucleus will stop with no pending autorestart. The other active nuclei in the cluster continue processing normally.

```
ADAN51 00006 2001-02-13 23:05:54 OPERATOR TYPE-IN: ADAEND
ADAN42 00006 2001-02-13 23:05:54 FUNCTION ACCEPTED
```

The operating system issues the following lock structure statistics:

```
IXL030I CONNECTOR STATISTICS FOR LOCK STRUCTURE ADA_LOCK11,
CONNECTOR DB00006P00132N02:
      00010019
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000001 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000002 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
      00000000 00000000 00000000 00000000
IXL031I CONNECTOR CLEANUP FOR LOCK STRUCTURE ADA_LOCK11,
CONNECTOR DB00006P00132N02, HAS COMPLETED.
INFO: 00010019 00000000 00000000 00000000 00000000 00000000
```

Adabas Cluster Services follows the operating system messages with

```
ADAX28 00161 IXCLEAVE XCFTT    RET 00000000 RSN 00000000
ADAM97 00132 THIS ASCB/INITIATOR WILL BE TERMINATED BY MVS AT EOJ
```

Abnormal Termination

Entire Net-Work

The description for Entire Net-Work normal termination in section *Normal Termination* also applies to an Entire Net-Work abnormal termination. Adabas Cluster Services makes no distinction.

ADACOM

If ADACOM terminates abnormally, a PLI*nnn* error message is produced to explain the problem.

Adabas Cluster Nuclei

When an Adabas sysplex cluster nucleus terminates abnormally, each surviving peer nucleus performs "online recovery". See the section ***Restart/Recovery Processing*** for more information.

The online recovery process synchronizes with a normal shut-down process that is already in progress for a failed peer nucleus. If the normal shut-down process has just begun, it is interrupted and canceled and the online recovery process replaces it. If the normal shut-down process is well underway, it proceeds and finishes; the online recovery process is not issued for the failed nucleus. The online recovery process

- synchronizes online recovery with a newly starting nucleus;
- waits three seconds for open transactions to complete before interrupting all open transactions;
- waits 0.3 seconds for active commands to complete before interrupting all active user commands;
- interrupts all activity going on in the nucleus;
- cleans up;
- disconnects from the lock and cache structures;
- performs session autorestart or waits for another nucleus to do it;
- reconnects to the lock and cache structures;
- prints messages when an online save, ADAEND, or HALT process is canceled; and
- resumes normal processing.

5 Using Alert and Timeout Settings

In a cluster environment, the Adabas nuclei working on the same cluster database must collaborate to keep the database physically and logically consistent while processing user commands. To do this, they issue intracluster commands to one another. If one cluster member does not respond to an intracluster command from another cluster member within a specified time period, the sending member cancels the unresponsive member.

Adabas Cluster Services provides alert and timeout settings that are designed to help you prevent or handle critical situations where system problems might cause the prolonged unavailability of one cluster member, thus endangering the ability of the cluster member (or in severe cases, the entire cluster) to provide service. These settings include:

- A cancel alert that generates an operator message can be invoked when a cluster member is unresponsive to an intracluster command for a specified period of time. If the cluster member does not respond before the message times out, it is canceled.
- Self-termination alerts that generate operator messages can be invoked when a canceled cluster member does not terminate as requested (in a specified period of time) and the other cluster members prepare to self-terminate.
- An operator query that prints an operator console message and requests a response from the operator. This can be invoked by cluster members that are preparing to self-terminate because a canceled peer member remains active.
- XCF system- and member-level status monitoring can be used to determine if a cluster member is unable to respond to internal intracluster requests. This monitoring process prints operator messages that provide early warning information about the cluster member.
- Messaging statistics provide information about the performance of message transmission events. These statistics can be used to determine the impact of messaging on system performance and to determine how to set the ADARUN parameters related to the alert and timeout settings.

Using Cancel Alerts

In cluster environments, the cluster members issue intracluster commands to one another to ensure that the database is kept physically and logically consistent. If one cluster member does not respond to an intracluster command from another cluster member within the time specified by the ADARUN `MXMSG` parameter, the sending member cancels the unresponsive member.

You can invoke a cancel alert before the unresponsive peer member is canceled. This alert generates an operator message that provides early warning information before the unresponsive cluster member is canceled.

The cancel alert is governed by the setting of the ADARUN `MXMSGWARN` parameter. This optional parameter specifies the number of seconds after which a cluster nucleus should generate an operator message warning about an outstanding intracluster response. If the cluster member does not respond within the time specified by ADARUN `MXMSGWARN`, message ADAX9C is issued. This

warning message can be used to notify you sometime before the unresponsive cluster member is canceled.

As complements to the ADARUN MXMSG and MXMSGWARN parameters, two operator commands, MXMSG and MXMSGWARN, are provided that allow you to change the corresponding ADARUN settings dynamically, while the database is running. In addition, the DPARM operator command's output information includes the settings of the ADARUN parameters related to cluster alert and timeout enhancements.

For more information about the MXMSG and MXMSGWARN parameters, read *MXMSG: Timeout Threshold for Internucleus Command Processing* and *MXMSGWARN : Timeout Threshold for Internucleus Command Processing Warning* , in *Adabas Cluster Services Reference* . For information about the DPARM, MXMSG, and MXMSGWARN operator commands, read *Adabas Cluster Nucleus Operator Commands* , in *Adabas Cluster Services Reference*.

Using Self-Termination Alerts

In cluster environments, if one cluster nucleus has issued a cancellation request for a second unresponsive cluster nucleus, but the canceled peer cluster nucleus does not terminate within the time specified by the ADARUN MXCANCEL parameter, the sending nucleus will either return response code 124, subcode 28 (if the intracluster communication occurred on behalf of an Adabas command) or terminate itself abnormally (if the intracluster communication occurred on behalf of an internal process that must not fail).

You can invoke a self-termination alert before a nucleus terminates itself because a canceled peer nucleus fails to terminate. This alert generates an operator message that provides early warning information regarding the pending self-termination.

Self-termination alerts are governed by the setting of the new ADARUN MXCANCELWARN parameter. This optional parameter specifies the number of seconds after which a requesting cluster nucleus should generate an operator message warning about the inability of a canceled peer nucleus to terminate quickly. If the canceled peer nucleus does not terminate within the time specified by ADARUN MXCANCELWARN, message ADAX9G is issued. This warning message can be used to notify you that the nucleus issuing the message is in danger of terminating itself.

As complements to the ADARUN MXCANCEL and MXCANCELWARN parameters, two operator commands, MXCANCEL and MXCANCELWARN, are provided that allow you to change the corresponding ADARUN settings dynamically, while the database is running. In addition, the DPARM operator command's output information has been enhanced to include the settings of ADARUN parameters related to Adabas Cluster Services alert and timeout enhancements.

For more information about the MXCANCEL and MXCANCELWARN parameters, read *MXCANCEL: Timeout Threshold for Canceled Peer Nucleus* and *MXCANCELWARN : Timeout Threshold for Canceled Peer Nucleus Warning* , in *Adabas Cluster Services Reference* . For information about the DPARM,

MXCANCEL, and MXCANCELWARN operator commands, read *Adabas Cluster Nucleus Operator Commands* , in *Adabas Cluster Services Reference*.

Using the Self-Termination Operator Query

You can invoke an operator query when a cluster member is in the process of self-terminating because a canceled peer nucleus fails to terminate. This gives you a chance to terminate the canceled cluster member manually, thus avoid the self-termination of the member that issued the ineffective cancel request.

This operator query prints a console message (message ADAX9J) explaining the situation and requesting instructions, waiting for a specified time for a response. The valid responses to message ADAX9J are:

- R (print the ADAX9J message again and continue to wait for resolution of this issue, but without setting a new wait period for the response)
- T (terminate the querying nucleus with message ADAX99 and user abend 79)
- W (continue to wait for another time period of length MXWTOR)

The amount of time the operator query waits for a response is governed by the setting of the ADARUN MXWTOR parameter. This optional parameter specifies the number of seconds the nucleus should wait for the operator response. If the operator does not respond in this timeframe and if the canceled peer nucleus still has not terminated, the requesting nucleus issues message ADAX99 and terminates itself.

However, if the canceled cluster member terminates after all (whether due to operator intervention or another reason), the cluster nucleus that issued the operator query stays alive; it retracts the query and initiates an online recovery process.

As a complement to the ADARUN MXWTOR parameter, an operator command, MXWTOR, is provided that allows you to change the MXWTOR setting dynamically, while the database is running. In addition, the DPARM operator command's output information includes the settings of ADARUN parameters related to Adabas Cluster Services alert and timeout enhancements.

For more information about the MXWTOR parameter, read *MXWTOR : Self-Termination Operator Query Interval* , in *Adabas Cluster Services Reference*. For information about the DPARM and MXWTOR operator commands, read *Adabas Cluster Nucleus Operator Commands* , in *Adabas Cluster Services Reference*.

Using XCF Status Monitoring

XCF system- and member-level status monitoring on z/OS systems can be used to determine early if a cluster member may be unable to respond to internal intracluster requests. This monitoring process occurs by checking the activity (heartbeat) of each cluster nucleus and printing operator messages which provide early warning information about the cluster nuclei that show no heartbeat.

XCF status monitoring provides a second method by which Adabas Cluster Services can warn you that a cluster nucleus might be unable to respond in a timely way to intracluster commands. The first method is, of course, via the normal intracluster communication that occurs between cluster members. If a nucleus has heartbeat exceptions (as determined by XCF status monitoring), it most likely will be unable to process and respond to an intracluster command; if a nucleus is slow to respond to an intracluster command, it might or might not have a heartbeat monitor exception (a nucleus may appear to be active to XCF but be unable to respond to an intracluster command). If the ADARUN `MXMSGWARN` parameter for a cluster nucleus is nonzero (read ***Using Cancel Alerts***, elsewhere in this section), it produces warning messages (ADAX9B or ADAX9C) when intracluster communication with other nuclei in the cluster is too slow, Likewise, when XCF status monitoring determines that a nucleus is missing its heartbeat updates, it produces warning messages (ADAX22 and ADAX04). You can use an automated mechanism set up at installation to raise an alert or take other appropriate action based on the existence of these messages, as they identify existing or potential problems in the cluster.

XCF status monitoring uses an ADARUN parameter, `MXSTATUS`, to activate XCF member-level status monitoring and to specify the monitoring interval (in seconds). In addition, the `DMEMTB` operator command includes a flag in its member state table messages indicating whether a system or message-level status monitoring exception was encountered and whether a message was issued for the exception.

To complement the new ADARUN `MXSTATUS` parameter, an operator command, `MXSTATUS`, allows you to change the MXSTATUS setting dynamically, while the database is running. In addition, the `DPARM` operator command's output information includes the settings of ADARUN parameters related to Adabas Cluster Services alert and timeout enhancements.

Note: The `MXSTATUS` parameter and operator command are only used by Adabas Cluster Services and not by Adabas Parallel Services. Adabas Parallel Services does not use XCF and ignores this parameter and setting.

For more information about the `MXSTATUS` parameter, read *MXSTATUS : Member-Level XCF Status Monitoring Heartbeat Interval* , in *Adabas Cluster Services Reference*. For information about the updated `DPARM` and `DMEMTB`, and `MXSTATUS` operator commands, read *Adabas Cluster Nucleus Operator Commands* , in *Adabas Cluster Services Reference*.

Using Messaging Performance Statistics

Adabas Cluster Services messaging statistics provide information about the performance of message transmission events. These statistics can be used to determine the impact of messaging on system performance and to determine how to set the ADARUN `MXMSG` and `MXMSGWARN` parameters related to the other alert and timeout enhancements in Adabas Cluster Services.

The performance statistics are provided in the termination statistics of an Adabas nucleus as well as in response to the `DXMSG` operator command. The performance statistics are split into those that are subject to the ADARUN `MXMSG` parameter setting and those that are not; after each is reported separately in the output, a combined report is provided containing the summarization of the two for all messages.

For more information about the `DXMSG` operator command, read *Adabas Cluster Nucleus Operator Commands* , in *Adabas Cluster Services Reference*.

6 Collaboration Between Cluster Nuclei

The Adabas nuclei in a cluster frequently need to collaborate with one another to keep the database consistent while each of them reads and updates data in the database. The nuclei share recently used data in the global cache structure, synchronize their operations using locks in the global lock structure, and send messages to one another to perform joint actions that multiple or all nuclei must be informed about or participate in.

If a system hosting a cluster nucleus is temporarily unable to let that nucleus execute normally, for example because it is overloaded, a collaboration process in the cluster may stall if the nucleus cannot respond to intracluster messages in a timely fashion. In such cases, one unhealthy nucleus may impact the processing performed by the other nuclei in the cluster, an effect known as "sympathy sickness." Adabas Cluster Services has configuration options to eliminate this negative effect for two important collaboration processes.

Buffer Flush Independence

When cluster nuclei process update commands, they store the updated ASSO and DATA blocks in the global cache structure, either immediately (if the LRDP parameter equals zero) or by the end of the associated transaction (with **deferred publishing**, LRDP>0). Later, a buffer flush writes all updated blocks from the global cache to the database. Any nucleus in the cluster may perform a buffer flush when needed, but only one at a time.

Before a buffer flush writes updated ASSO and DATA blocks to the database, all protection data for the updates in those blocks must be written to the WORK data sets, so that at all times, in the event that one or more of the nuclei fail (terminate abnormally), the following session autorestart can use that protection data to back out any incomplete updates. In earlier versions of Adabas Cluster Services, when one nucleus performed a buffer flush, every other nucleus in the cluster needed to collaborate by writing its latest protection data to its WORK data set, in order to ensure the protection data is available if the nucleus fails during or after the buffer flush. If one nucleus was slow or unable to respond to the request from the buffer flush, the flush would stall. Without a functioning buffer flush, updated blocks waiting to be flushed out would over time fill up the global cache and then all update processing would stall, too.

Adabas Cluster Services Version 8.4 introduced the global parameter CLUPUBLPROT, which allows a buffer flush to complete even without the collaboration of the other nuclei in the cluster. When CLUPUBLPROT is set to YES, each cluster nucleus "publishes" its protection data before it writes related updated ASSO or DATA blocks to the global cache. A nucleus "publishes" protection data by writing it either to the WORK data set or to the global cache as well. This makes the protection data available to the other nuclei in the cluster. Then, if the nucleus is slow or unable to collaborate with a buffer flush performed by a peer nucleus, the buffer flush can read the latest protection data of the unresponsive nucleus from the cache and write it to WORK by itself. This way, the buffer flush is independent of the ability of the other nuclei to collaborate and can complete even without collaboration.

When CLUPUBLPROT is set to YES, cluster nuclei publish their protection data either in the global cache or on the WORK data set before they publish related updated ASSO or DATA blocks in the cache. There is a performance aspect to consider. All protection data must eventually be written to WORK, so writing it to the cache first is overhead. On the other hand, writing data to the cache structure is much faster than an I/O to disk; issuing a WORK I/O every time updated ASSO or DATA blocks are to be written to the cache can slow down the processing of update commands significantly.

The parameter CLUWORK1CACHE specifies how many different WORK blocks a cluster nucleus may keep in the global cache at the same time (when CLUPUBLPROT=YES). CLUWORK1CACHE limits the amount of cache space used for protection data and implicitly regulates the use of cache writes versus WORK I/Os for publishing protection data. If CLUWORK1CACHE is specified as zero, protection data is only written to the WORK data set and never to the global cache. This may lead to a significant number of additional WORK writes and is not recommended. A large number for CLUWORK1CACHE may lead to a significant number of additional cache writes for WORK blocks. A number in-between may lead to some additional WORK writes and some additional cache writes. Finding the best balance for overall performance may require trials with different CLUWORK1CACHE settings.

In summary, specifying CLUPUBLPROT=YES (with CLUWORK1CACHE set appropriately) is recommended to make the nuclei in a cluster more independent of one another when they perform buffer flushes.

Update Command Synchronization

If an Adabas nucleus fails (terminates abnormally), the following session autorestart recovers from the failure by undoing incomplete updates or transactions that may have been written to the database before the failure and redoing complete transactions that may not have been written to the database. This happens either during an online recovery process triggered by a nucleus failure in a cluster (if one or more nuclei in the cluster are still active) or when the next nucleus starts (if no nucleus stayed active).

Historically, the session autorestart logic relied on, and took advantage of, the presence of a point in time before the nucleus failure where none of the nuclei in the cluster was processing any update commands. During normal processing, the nuclei in a cluster took care to create such points in time by delaying the selection of new update commands for processing until all active update commands have finished. They did this regularly after every buffer flush. The process to get to a point where no update command is in progress in the entire cluster (called “update command synchronization”) requires the collaboration of all nuclei.

Adabas Version 8.4 introduced the global parameter UPDATECONTROL, which offers the choice to do without these update command synchronization processes. When UPDATECONTROL is set to NODELAY, the nuclei in the cluster do not delay the start of new update commands after buffer flushes. In the case of a nucleus failure, the following session autorestart does no longer

rely on the presence of points in time where no update processing was in progress. This eliminates the regular update command synchronization processes in which all nuclei in the cluster must collaborate.

In summary, specifying UPDATECONTROL=NODELAY (in conjunction with INDEXUPDATE=ADVANCED, which is a prerequisite) is recommended to make the nuclei in a cluster more independent of one another after each buffer flush.

7 Backout Processing

Normal backout processing includes

- `BT` command processing;
- backing out an update command that received a nonzero response code; and
- internal transaction backout due to, for example, a timeout.

Cluster nuclei perform normal Adabas backout processing. However, each cluster nucleus invokes backout logic from its own Work data set, ignoring the protection record timestamps.

8 Restart/Recovery Processing

Restart/recovery occurs if a cluster nucleus fails. Restart/recovery uses the Work data sets of all nuclei to recover the database. The Work data sets are dynamically allocated from the data set names recorded in the PPT. Adabas Cluster Services 8.2 supports offline and online recovery.

Offline Recovery (Session Autorestart)

- If a cluster nucleus session terminates, start one of the cluster nuclei to invoke autorestart.
- If a noncluster nucleus session terminates, restart the noncluster nucleus to invoke autorestart.

Offline recovery occurs if all active cluster nuclei in an Adabas sysplex cluster fail. Offline recovery relies only on information from the physical database and the Work data sets of each cluster nucleus. All information in the coupling facility is lost.

The first cluster nucleus to restart repairs any physical inconsistencies in the database and backs out all incomplete commands and transactions. The restarted nucleus obtains recovery information from blocks in the common database and from the Work data sets of all the failed nuclei.

The restarting nucleus retrieves the Work data set names from the PPT block for each terminated nucleus and opens these data sets using dynamic allocation. From that point, normal recovery processing occurs:

- the breakpoint on each Work data set is found;
- backward and forward repair is performed; and
- autobackout is performed.

While reading through the Work data sets, the restarting nucleus on the fly merges the protection records by their timestamps into chronological sequence.

Online Recovery

When one or more cluster nuclei have failed while one or more other nuclei in the same cluster remain active, online recovery processing is performed by collaboration of all surviving nuclei.

All surviving cluster nuclei quiesce their operations and reinitialize their working storage. Command processing is quiesced and the internal status variables, tables, and pools are repaired.

The peer nuclei compete for the recovery lock: when one of the nuclei obtains it, it invokes offline recovery processing. It repairs any physical inconsistencies in the database and backs out all incomplete command and transactions. Open transactions executed by the surviving nuclei are backed out as well. All information in the lock and cache structures is discarded. Please keep in mind that the nucleus performing online recovery may need additional LWP for the online recovery

procedures depending on other ADARUN parameters such as NU. We recommend the following formula for cluster nuclei to avoid work pool overflow in online recovery or auto restart:

- **With Adabas 8.3**

```
LWP ≥ (NU * 200) + 1,000,000
```

- **For nuclei running with UPDATECONTROL=NODELAY (with Adabas 8.4 or later)**

```
LWP ≥ (NU * 250) + 1,000,000
```

Once this recovery processing has completed, normal processing resumes.

Users are affected by online recovery as follows:

- users assigned to failed nuclei lose their commands, transactions, sequential processes, and search results. They may receive response codes 9, 21, 148, or 251, depending on the status of their session at the time of the failure.
- users assigned to surviving nuclei may or may not lose their commands/transactions, depending on whether they managed to complete them in the quiesce phase. They retain their sequential processes and search results, but they may experience an increased response time. Users that do lose their commands/transactions will subsequently receive response code 9 and might possibly get response code 21 as well.

Automatic Restart Management (ARM)

Automatic restart management (ARM) is a z/OS facility that can be used to automatically restart a nucleus when it ABENDs. Automatic restart is suppressed when the ABEND is intentional; for example, when it results from a parameter error.

ARM can be used for Adabas nuclei in both cluster and noncluster environments.

The ADARUN parameter `ARMNAME` is used to identify the element in the ARM 'policy' that is to be activated. Each element specifies when, where, and how often an automatic restart is to be attempted.

If an ARM policy has not been defined, the `ARMNAME` parameter has no effect.

Archive Recovery

Archive recovery occurs if the container data sets of the database are damaged or restart/recovery is not effective.

Archive recovery

- restores the database; and
- regenerates the updates from the protection logs.

The protection logs to be regenerated are the output of the ADARES PLCOPY protection log copy and merge process that occurs in sysplex cluster environments. The restore/regenerate process is the same in both cluster and noncluster environments.

9 Planning an Outage

The Adabas Cluster Services solution permits the database administrator to migrate an Adabas nucleus to another operating system image in the sysplex so that a planned outage due to system changes or preventive maintenance on one machine need not impact any other part of the system.

To migrate the nucleus to a different operating system image

1 Quiesce the nucleus using ADAEND.

2 Start the nucleus in a different operating system image.

The nucleus automatically accepts commands.

10 Utility Processing

Like normal users, utilities are assigned to a local nucleus, if available; to a remote nucleus, otherwise.

Adabas Cluster Services automatically synchronizes with database changes made by utilities.

See the *Adabas Utilities* documentation for specific information about utility functions used in an Adabas parallel sysplex cluster environment.

ADACHK PPTPRINT - Print/Dump Parallel Participant Table

The PPTPRINT function is included in the Adabas ADACHK utility to support Adabas cluster environments. It is used to dump/print the parallel participant table (PPT) for the Adabas cluster.

Each of the 32 blocks (RABNs) allocated for the PPT represents a single nucleus in the cluster and comprises

- a single header of fixed length; and
- multiple entries of variable length.

Note that in the dump/print, 'PPH' is the tag for the PPT header and 'PPE' is the tag for the PPT entries.

ADADBS OPERCOM Commands

Changes have been made for ADADBS OPERCOM command processing in an Adabas cluster nucleus environment.

Global Commands

The following ADADBS OPERCOM commands have a "GLOBAL" option for routing the following commands to all nuclei in an Adabas cluster:

`ADAEND`, `CANCEL`, `FEOFCL`, `FEOFPL`, `HALT`.

For example:

```
ADADBS OPERCOM ADAEND,GLOBAL
```

When "GLOBAL" is specified, a response code 148 is returned to ADADBS if any one of the nuclei is down. When "GLOBAL" is *not* specified, a specific NUCID from the cluster must be specified and the command is sent to that NUCID.

Routing a Command to a Specific Nucleus

The NUCID option allows you to direct the OPERCOM commands to a particular nucleus in the cluster for execution.

The OPERCOM function's NUCID option is specified in a manner similar to the ADARUN NUCID parameter.

For example:

```
ADADBS OPERCOM DSTAT,NUCID=3
```

sends the DSTAT command to the Adabas cluster nucleus designated with NUCID=3.

For inherently global commands, such as changing the setting of the TT parameter, the NUCID parameter is ignored.

Routing a Command to All Cluster Nuclei

When the NUCID option in the ADADBS OPERCOM function is not specified, the command is sent to all cluster nuclei and information is displayed for each nucleus in sequence.

ADADBS REFRESHSTATS - Refresh Statistical Values

The REFRESHSTATS function resets statistical values maintained by the Adabas nucleus for its current session. Parameters may be used to restrict the function to particular groups of statistical values.

In cluster environments, you must specify the specific nucleus (NUCID) for which statistical values are to be refreshed. If NUCID is not specified, statistical values will be refreshed for all active nuclei in the cluster.

ADAPLP IPLOGPRI - Print Sequential Intermediate Data Sets

The IPLOGPRI function is used to print the sequential intermediate data sets created from the PLOG merge process. Input to ADAPLP IPLOGPRI must be a MERGIN1/MERGIN2 data set created by the ADARES utility and specified in the JCL with DD name DDPLOG.

ADARAI - Adabas Recovery Aid

Adabas cluster products support the Adabas Recovery Aid (ADARAI).

ADARAI maintains a recovery log (RLOG) for each database; all nuclei in the cluster support a database write to the same RLOG and concurrent updates to the RLOG are controlled by a lock.

The ADARAI LIST function supports Adabas version 7 and above RLOGs; Adabas version 6 RLOGs are not supported.

ADAREP - Checkpoint Information Extended

Given that each cluster nucleus has its own PLOG data sets, checkpoints are no longer identified only by their name, PLOG number, and PLOG block number, but also by the ID of the nucleus that writes the checkpoint.

Several new parameters have been introduced for utilities that need to identify checkpoints on the PLOG.

ADARES CLCOPY - Copy/Merge Nucleus Cluster Command Logs

When the ADARUN parameter `CLOGMRG=YES`, the ADARES `CLCOPY` automatically merges the command logs for each cluster nucleus into a single log file for the cluster.

Sample JCL has been added for allocating the intermediate data sets MERGIN1 and MERGIN2 required for automated CLOG copy/merge processing in nucleus cluster environments.

Notes:

1. When intermediate data sets are used for both CLCOPY and PLCOPY, the data set names must be unique so that they are not overwritten.
2. The data set BLKSIZE used must be greater than or equal to the largest CLOG BLKSIZE plus eight. The LRECL must be set to the BLKSIZE minus four.
3. If ADARUN CLOGMRG=NO is specified, at the end of an ADARES CLCOPY job no additional invocations of the ADARES CLCOPY will occur. The additional invocations only occur in an ADARUN CLOGMRG=YES environment.

```
//ALLOC JOB
//*
//* Example to allocate the ADARES CLCOPY intermediate data sets
//*
//CM1 EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//OUTFIL DD DISP=(NEW,CATLG),SPACE=(CYL,(3,10)),UNIT=SYSDA,
// VOL=SER=volser,DCB=(RECFM=VB,LRECL=23472,BLKSIZE=23476),
// DSN=EXAMPLE.CLOG.MERGIN1
//INPFIL DD *
/*
//SYSIN DD *
REPRO INFILE(INPFIL) -
OUTFILE(OUTFIL)
/*
//*
//CM2 EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//OUTFIL DD DISP=(NEW,CATLG),SPACE=(CYL,(3,10)),UNIT=SYSDA,
// VOL=SER=volser,DCB=(RECFM=VB,LRECL=23472,BLKSIZE=23476),
// DSN=EXAMPLE.CLOG.MERGIN2
//INPFIL DD *
/*
//SYSIN DD *
REPRO INFILE(INPFIL) -
OUTFILE(OUTFIL)
/*
```

ADARES PLCOPY - Copy/Merge Nucleus Cluster Protection Logs

In an Adabas nucleus cluster environment, the protection logs (and optionally, the command logs) of all individual nuclei in the cluster must be merged into single log files in chronological order for the cluster database shared by all the nuclei as a whole. The chronological order is determined by timestamps on all individual nucleus log records, which are synchronized across systems in a parallel sysplex environment by the Sysplex Timer.

Protection logs are automatically merged when an ADARES PLCOPY is executed. In an Adabas cluster environment, the PLCOPY process accesses the parallel participant table (PPT) to determine which protection logs to copy and opens the appropriate data sets using dynamic allocation. PLCOPY copies/merges as much data as possible; if a nucleus is still writing to a protection log data set, PLCOPY 'partially' merges the data set.

The merge begins with the lowest timestamp from all protection logs being merged and ends with the lowest of the ending timestamps from all data sets. Records beyond this point are written to an 'intermediate' data set, which must be supplied as input to the subsequent merge. A cross-check ensures that the correct intermediate data set has been supplied.

The following sample JCL illustrates the allocation of the intermediate data sets MERGIN1 and MERGIN2 which are required for automated PLOG copy/merge processing in nucleus cluster environments.

Notes:

1. When intermediate data sets are used for both CLCOPY and PLCOPY, the data set names must be unique so that they are not overwritten.
2. The data set BLKSIZE used must be greater than or equal to the largest PLOG BLKSIZE plus eight. The LRECL must be set to the BLKSIZE minus four.

```
//ALLOC JOB
//*
//* Example to allocate the ADARES PLCOPY intermediate data sets
//*
//CM1 EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//OUTFIL DD DISP=(NEW,CATLG),SPACE=(CYL,(3,10)),UNIT=SYSDA,
// VOL=SER=volser,DCB=(RECFM=VB,LRECL=23472,BLKSIZE=23476),
// DSN=EXAMPLE.PLOG.MERGIN1
//INPFIL DD *
/*
//SYSIN DD *
REPRO INFILE(INPFIL) -
OUTFILE(OUTFIL)
/*
//*
//CM2 EXEC PGM=IDCAMS
//SYSPRINT DD SYSOUT=*
//OUTFIL DD DISP=(NEW,CATLG),SPACE=(CYL,(3,10)),UNIT=SYSDA,
// VOL=SER=volser,DCB=(RECFM=VB,LRECL=23472,BLKSIZE=23476),
// DSN=EXAMPLE.PLOG.MERGIN2
//INPFIL DD *
/*
//SYSIN DD *
REPRO INFILE(INPFIL) -
OUTFILE(OUTFIL)
/*
```

ADARES expects that at least one of the protection logs being merged is at 'completed' status. If this is not the case, ADARES reports that there is no data to be copied.

Sample user exits (USEREX2P and UEX12) are provided to illustrate the necessary change for the intermediate data set.

A sample job ADARESPM is provided on the MVSJOBS data set to illustrate the manual execution of the PLCOPY merge function. Two intermediate data sets must be supplied. ADARES analyzes the data sets to determine which is to be used as input and which for output. Specific cross-checks determine whether the correct intermediate data set has been supplied; if not, ADARES will not

continue. Continuing without the correct input can result in lost updates and inconsistencies if the output is used for REGENERATE or BACKOUT functions.

Caution: Sample user exits and programs and are not supported under any maintenance contract agreement.

Once DD statements for the PLOG data sets have been supplied on the session startup JCL, you do not need to supply them again for ADARES as these are opened using dynamic allocation. If the DD statements are supplied, they are ignored.

ADARESPM Job

The following sample JCL illustrates the ADARES PLCOPY merge function:

```
//ADARESPM JOB
//*
//* ADARES : COPY/MERGE DUAL/MULTIPLE PROTECTION LOG
//* TWO COPIES OF OUTPUT ARE TO BE CREATED
//* FOR USE WITH AN ADABAS NUCLEUS CLUSTER
//*
//RES EXEC PGM=ADARUN
//STEPLIB DD DISP=SHR,DSN=ADABAS.Vvrs.LOAD
//*
//DDASSOR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.ASSOR1
//DDDATAR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.DATAR1
//MERGIN1  DD DISP=SHR,DSN=EXAMPLE.PLOG.MERGIN1
//MERGIN2  DD DISP=SHR,DSN=EXAMPLE.PLOG.MERGIN2
//DDSIAUS1 DD DSN=EXAMPLE.DByyyyy.PLOG1(+1),
// VOL=SER=ADAxxx,UNIT=TAPE,DISP=(NEW,CATLG)
//DDSIAUS2 DD DSN=EXAMPLE.DByyyyy.PLOG2(+1),
// VOL=SER=ADAxxx,UNIT=TAPE,DISP=(NEW,CATLG)
//DDDRUCK DD SYSOUT=X
//DDPRINT DD SYSOUT=X
//SYSUDUMP DD SYSOUT=X
//DDCARD DD *
ADARUN PROG=ADARES,MODE=MULTI,SVC=svc,DEVICE=3380,DBID=yyyyy
/*
//DDKARTE DD *
ADARES PLCOPY TWOCOPIES
/*
```

ADARES PLCOPY NOPPT - Ignore PPT

NOPPT is for emergency use when the PPT has been overwritten. It specifies that the PPT is to be ignored and that the PLOG data sets of all cluster nuclei are being supplied with DD names DDPLOGnn in the JCL.

Caution: Use this parameter cautiously since it ignores the PPT and all control-type information typically coming from the PPT.

When you use this parameter, you must supply

- the correct intermediate data set; and
- the correct input protection logs from all nuclei with DD names DDPLOG01-nn.

The optional parameter `SBLKNUM` can be used to specify the starting block number for the sequential merge output.

Caution: Without the PPT, ADARES cannot perform any extensive validations on the input data sets.

ADARESIP Job

The following sample JCL illustrates the ADARES PLCOPY NOPPT merge function:

```
//ADARESIP JOB
//*
//* ADARES : COPY/MERGE DUAL/MULTIPLE PROTECTION LOGS FROM ALL
//* NUCLEI IN AN ADABAS NUCLEUS CLUSTER
//* PPT IS TO BE IGNORED
//* THIS IS ONLY FOR EMERGENCY USE WHEN THE PPT HAS BEEN
//* OVER-WRITTEN - USE CAUTION WHEN SUBMITTING
//*
//RES EXEC PGM=ADARUN
//STEPLIB DD DISP=SHR,DSN=ADABAS.Vvrs.LOAD <=== ADABAS LOAD
//*
//DDASSOR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.ASSOR1 <=== ASSO
//DDDATAR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.DATAR1 <=== DATA
//DDPLOG01 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR1.NUC1 <=== PLOG1
NUC1
//DDPLOG02 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR2.NUC1 <=== PLOG2
NUC1
//DDPLOG03 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR1.NUC2 <=== PLOG1
NUC2
//DDPLOG04 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR2.NUC2 <=== PLOG2
NUC2
//DDPLOG05 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR1.NUC3 <=== PLOG1
```

```
NUC3
//DDPLOG06 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.PLOGR2.NUC3 <=== PLOG2
NUC3
//MERGIN1  DD DISP=SHR,DSN=EXAMPLE.PLOG.MERGIN1 <=== INTERMEDIATE 1
//MERGIN2  DD DISP=SHR,DSN=EXAMPLE.PLOG.MERGIN2 <=== INTERMEDIATE 2
//DDSIAUS1 DD DSN=EXAMPLE.DByyyyy.PLOG1(+1), <=== PLOG COPY
// VOL=SER=ADAxxx,UNIT=TAPE,DISP=(NEW,CATLG)
//DDDRUCK DD SYSOUT=X
//DDPRINT DD SYSOUT=X
//SYSUDUMP DD SYSOUT=X
//DDCARD DD *
ADARUN PROG=ADARES,MODE=MULTI,SVC=svc,DEVICE=3380,DBID=yyyyy
/*
//DDKARTE DD *
ADARES PLCOPY NOPPT
/*
```

ADARES MERGE CLOG - Merge Nucleus Cluster Command Logs

In an Adabas cluster environment, command logs (CLOGs) from the cluster nuclei may be manually merged using the ADARES MERGE CLOG `NUMLOG=nn` function.

The `NUMLOG` parameter is required: it specifies the number of command log data sets to be included in the merge process. The maximum number is 32.

Sequential data sets are expected as input to the MERGE CLOG function; therefore, the ADARES CLCOPY function (with ADARUN `CLOGMRG=NO`, the default) must be executed prior to the ADARES MERGE function.

The timestamp contained in the `CLOGLAYOUT=8` format of the CLOG is required for the proper merging of command logs records.

ADARESCM Job

The following sample job ADARESCM (see the JOBS data set) illustrates the execution of the ADARES MERGE CLOG function:

```
//ADARESCM JOB
//*
//* ADARES : MERGE SEQUENTIAL COMMAND LOGS
//* FOR USE WITH AN ADABAS NUCLEUS CLUSTER
//*
//RES EXEC PGM=ADARUN
//STEPLIB DD DISP=SHR,DSN=ADABAS.V vrs.LOAD <=== ADABAS LOAD
//*
//DDASSOR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.ASSOR1 <=== ASSO
//DDDATAR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.DATAR1 <=== DATA
```

```
//DDWORKR1 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.WORKR1 <=== WORK
//DDCLOG01 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.CLOGR1.NUC1 <=== CLOG1
NUC1
//DDCLOG02 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.CLOGR1.NUC2 <=== CLOG1
NUC2
//DDCLOG03 DD DISP=SHR,DSN=EXAMPLE.DByyyyy.CLOGR2.NUC3 <=== CLOG2
NUC3
//DDSIAUS1 DD DSN=EXAMPLE.DByyyyy.CLOGM, <=== OUTPUT OF
// VOL=SER=ADAxxx,UNIT=TAPE,DISP=(NEW,CATLG) CLOG MERGE
//DDDRUCK DD SYSOUT=X
//DDPRINT DD SYSOUT=X
//SYSUDUMP DD SYSOUT=X
//DDCARD DD *
ADARUN PROG=ADARES,MODE=MULTI,SVC=svc,DEVICE=3380,DBID=yyyyy
/*
//DDKARTE DD *
ADARES MERGE CLOG,NUMLOG=3
/*
```

ADARES BACKOUT and REGENERATE - Uniquely Identifying Checkpoints

After the protection log merge process, the block number will not necessarily be the same. To uniquely identify the checkpoint in this situation, it is necessary to also specify the `NUCID` for all ADARES functions that can specify a `TOBLK` / `FROMBLK` parameter; that is, BACKOUT and REGENERATE.

Notes:

1. BACKOUT DPLOG and BACKOUT MPLOG are not allowed for a cluster database. The PLOG must be merged before the BACKOUT can be performed.
2. The merge process ensures that there is at most one checkpoint per block. It records the (old) block number prior to the merge and the `NUCID` that wrote the checkpoint. When you then specify the block number and NUCID as reported in ADAREP, ADARES is able to uniquely identify the block.
3. In an Adabas nucleus cluster environment, ADAREP includes the NUCID when printing all checkpoint information.

The additional parameters that are required in an Adabas nucleus cluster environment are `NUCID`, `TONUCID`,`FROMNUCID`.

If the NUCID is the same for the starting and ending checkpoint, only the NUCID needs to be specified.

Note: An ADAREP CPEXLIST function can be used to determine the original block number and NUCID that wrote the checkpoint. This is the block number prior to the merge and the one that ADARES REGENERATE and BACKOUT expects.

ADASAV Processing Change

Sample JCL is located in the ADASAVRW member of the JOBS data set.

For the RESTONL (database), RESTONL GCB, RESTORE (database), and RESTORE GCB ADASAV functions, the Work data sets and files of all cluster (or noncluster) nuclei for the database that may have been active at the time of the ABEND must be reset. This can be done:

- manually (e.g., by using ADAFRM WORKRESET FROMRABN=1,SIZE=1B); or
- by specifying the Work data sets and files with DD names/link names DD/WORKRn (n=1-9) or DD/WORKnn (nn=10-32) in the JCL for the RESTONL/RESTORE function.

Otherwise, the nuclei that did not have their Work data sets and files reset will give parm-error 42 when started.

The DD/PLOGRn and DD/CLOGRn data sets are not reset in the restore process. They must be either copied/merged by ADARES PLCOPY/CLCOPY or reset by ADAFRM.

ADASAV RESTPLOG -- Uniquely Identifying Checkpoints

After the protection log merge process, the block number will not necessarily be the same. To uniquely identify the checkpoint in this situation, it is necessary to also specify the NUCID parameter for the ADASAV RESTPLOG function when specifying the SYN1 or SYN4 parameter.

Note: An ADAREP CPEXLIST function can be used to determine the original block number and NUCID that wrote the checkpoint. This is the block number prior to the merge and the one that ADASAV RESTPLOG expects.

11 Cluster Nucleus Session End Statistics

In addition to the end-of-session statistics printed by every Adabas nucleus, the statistics for a cluster nucleus also include external cache and lock statistics.

If you are running the selectable unit Adabas Online System (AOS), all of the statistics shown in the following sample output are displayed.

If you are running only the demo version of AOS delivered with Adabas, the statistics displayed are limited as follows:

Section	Displays statistics only for...
External Cache Statistics	totals, DS, and NI
External Lock Statistics	buffer flush, hold ISN, new data RABN, and global update command sync locks

General Nucleus Information

```
A d a b a s  nucleus session statistics

From 2014-03-11 10:56:39 to 2014-03-11 14:46:57


Duration            3:50:18
Wait-time           3:50:13
CPU time            0:00:02
```

Input/Output Statistics

I/O Counts (Including Initialization)

```
Container            Reads                Writes
-----------------------------------------------

ASSO                   107                    72
DATA                    27                    14
WORK                     3                   397
PLOG                     0                     0
CLOG                     0                     0

-----------------------------------------------
Total                  137                   483
```

Work and PLOG I/Os and Blocks

```
PLOG  protection blocks                  32
PLOG  different blocks                   24
PLOG  protection I/Os                    14
WORK1 protection blocks                  42
WORK1 different blocks                   23
WORK1 protection I/Os                    22

WORK1 publishing blocks                  21
WORK1 publishing I/Os                     5
WORK1 publishing waits                    6
```

- "WORK1 protection blocks" shows the total number of blocks written to WORK Part 1. Some blocks may have been written more than once (with increasing amounts of data).
- "WORK1 different blocks" shows the number of different blocks written to WORK Part 1 - that is, counting each block once if it was written multiple times in a row. This number correlates with the actual amount of protection data written to WORK.
- "WORK1 protection I/Os" shows the number of I/Os performed to write the protection data to WORK Part 1. Where possible, Adabas writes multiple consecutive blocks in a single I/O operation, if sufficient I/O buffers are available (based on the NWORK1BUFFERS parameter).
- The "PLOG protection blocks", "PLOG different blocks" and "PLOG protection I/Os" statistics are similar.
- The "WORK1 publishing" statistics report on extra WORK writes induced by the CLUPUBLPROT=YES setting in a cluster. They show the number of blocks written, the number of I/O operations performed for those writes, and the number of waits incurred for writing protection data to WORK before ASSO and DATA blocks containing related updates could be written to the global cache. They are printed only if at least one of the numbers is nonzero.

Log Reads and Buffer Efficiency

```
Logical reads                   12,778
Buffer efficiency                 95.3
```

Distribution of ASSO/DATA I/Os by Volser Number (Excluding Initialization)

```
 VOLSER     High RABN                Reads                Writes
-------------------------------------------------------------------
ASSO:
 SMSZ10         6,286                  107                    72
-------------------------------------------------------------------
ASSO total                            107                    72

DATA:
 SMSZ10         5,992                   27                    14
```

```
-----------------------------------------------------------------
DATA total                              27                   14
-----------------------------------------------------------------
Total                                  134                   86
```

Command Statistics

Distribution of Commands by Source

```
Source               Commands
-----------------------------
Remote                      0
Local                     579
Internal                  289
Operator                    3
-----------------------------
Total                     871
```

Distribution of Commands by Thread

```
  Thread             Commands
-----------------------------
       1                  852
       2                   19
       3                    0
       4                    0
       5                    0
       6                    0
       7                    0
       8                    0
       9                    0
      10                    0
      11                    0
      12                    0
      13                    0
      14                    0
      15                    0
      16                    0
      17                    0
      18                    0
      19                    0
      20                    0
-----------------------------
  Total                   871
```

Distribution of Commands by File

```
    File             Commands
-----------------------------
       0                  324
       1                  400
      19                  147
-----------------------------
   Total                  871
```

Distribution of Commands by Type

```
    Type             Commands
-----------------------------
    A1/4                400
    CL                   12
    LF                    2
    L1/4                147
    OP                   10
    REST                288
    UC                   12
-----------------------------
   Total                871
```

User Sessions

```
User sessions                   nnn

Most calls (nnn)              initiated by: User   userid
                                            Job    jobname
                                            SECUID secuid

Most I/Os  (nnn)                initiated by: User   'userid'
                                            Job    jobname
                                            SECUID secuid

Most thread time (hh:mm:ss)         used by: User   'userid'
                                            Job    jobname
```

Efficiency Statistics

```
Format translations                          157
Format overwrites                              0
Auto-restarts                                  0
Throw-backs due to ISN                         0
Throw-backs due to space                       0
```

Buffer Flush Information

```
Buffer flushes                                20
Flush phases                                  20
Blocks flushed                                81
Flush I/Os                                    73

Flush requests:
 Return immediately                            0
 Return after logical flush                    0
 Return after entire  flush                   29

Buffer flush V2 timeouts                       4
```

Note: The "Buffer flush V2 timeouts" statistic is printed only if it is nonzero or the CLUPUBLPROT parameter is set to YES.

Actual High-water Marks for Major Pools (Except the Buffer Pool)

```
Pool          ADARUN parm       High watermark
-----------------------------------------------

AB  -POOL    NAB=       300      16896 (  1 %)
CQ  -POOL    NC =       500        192 (  0 %)
DUQ -POOL    LDE=      7000          0 (  0 %)
FI  -POOL    LFP=    100000        160 (  0 %)
HQ  -POOL    NH =      8000       5200 (  1 %)
Redo-POOL   LRDP=    300000        112 (  0 %)
SC  -POOL    LCP=     10000          0 (  0 %)
TBI -POOL    LI =      4000          0 (  0 %)
TBS -POOL    LQ =     30000          0 (  0 %)
UQ  -POOL    NU =       500       1820 (  0 %)
UQF -POOL    NU =       500        216 (  0 %)
Wrk1-IO B NWORK1=         1          1 (100 %)
WORK-POOL    LWP=    500000      73112 ( 14 %)
Work Part1   LP =       500          6 (  1 %)
Work Part2 LWKP2=       200          0 (  0 %)
Work Part3  --  =       794          0 (  0 %)
XID -POOL    XID=                    (  0 %)
```

Messaging Statistics

```
Message Control Block statistics
Allocated                        768
Used                               0
Total requests                     0

Statistics for ACMD-type messages
Messages sent                      0
Messages arrived                   0
Messages accepted                  0
Replies sent                       0
```

External Cache Statistics (Cluster Nucleus Only)

Publishing requests by type and total cache statistics are presented first:

```
Update sync    :                20
BT or CL or ET :               316
Redo threshold :                 0
Full bufferpool:                 0
All blocks     :                28
Specific RABN  :                 0
File DS blocks :                 0
DSST blocks    :                13
File NI blocks :                 0

Totals:

Cast-out dir   :                40
 Synchronous   :                 0
 Asynchronous  :                40

Unlock cast-out:                20
 Synchronous   :                 0
 Asynchronous  :                20

Directory reads:                 3
 Synchronous   :                 0
 Asynchronous  :                 3


Reads          :                51
 Synchronous   :                51
 Asynchronous  :                 0
```

```
 In cache      :               0
 Not in cache  :              51
 Structure full:               0

Writes         :           3,007
 Synchronous   :           3,007
 Asynchronous  :               0

 Written       :           3,007
 Not written   :               0
 Structure full:               0

Validates      :          19,302
 Block invalid :               0

Cast-out reads :              81
 Synchronous   :              81
 Asynchronous  :               0

Deletes        :               6
 Timeouts      :               0

Redo processes :               0
```

After this, specific cache statistics in the following format are presented for the Address Converter (AC), Data Storage (DS), the Data Storage Space Table (DSST), File Control Block (FCB), normal index (NI), upper index (UI), WORK blocks (if at least one of the statistics is nonzero), and for every file in the database:

```
Reads          :               4
 Synchronous   :               4
 Asynchronous  :               0

 In cache      :               0
 Not in cache  :               4
 Structure full:               0

Writes         :              13
 Synchronous   :              13
 Asynchronous  :               0

 Written       :              13
 Not written   :               0
 Structure full:               0

Validates      :           2,118
 Block invalid :               0

Cast-out reads :              13
 Synchronous   :              13
 Asynchronous  :               0
```

```
Deletes        :               0
 Timeouts      :               0

Redo processes :               0
```

External Lock Statistics (Cluster Nucleus Only)

Lock statistics are displayed in a format similar to the following sample:

```
Obtains
 Conditional   :               0
  Granted      :               0
  Rejected     :               0
 Unconditional :              12
 Synchronous   :              10
 Asynchronous  :               2
Releases       :              12
 Synchronous   :               5
 Asynchronous  :               7
```

Statistics are displayed for many of the following kinds of locks, as appropriate for your database session:

- Buffer flush locks;
- Cancel locks;
- Checkpoint locks;
- Container locks;
- DBID target assignment locks;
- Delta Save Facility (DSF) locks;
- ETID locks;
- File/ISN read locks;
- File Space Table (FST) locks;
- File-lock-table locks;
- Format AC/AC1 locks;
- General Control Block (GCB) locks;
- Global update command sync locks;
- Global ET sync locks;
- Hold ISN locks;
- LOB tracker locks;

- New data RABN locks;
- Online save locks;
- Parameter locks;
- PETU table locks;
- Recovery locks;
- Recovery Log (RLOG) locks;
- Replication handshake locks;
- (Re)usable NI space locks;
- (Re)usable UI space locks;
- Security locks;
- Stored Procedures and Triggers (Spats) locks;
- TBWK4 table locks;
- Unique descriptor locks;
- User locks; and
- XIDE locks.

WORK Data Set I/O Statistics (Cluster Nucleus Only)

```
Internal NUCID :               2
External NUCID :           10002
 Reads         :               3
 Writes        :               0

Internal NUCID :               3
External NUCID :           10001
 Reads         :               1
 Writes        :               0
```

These statistics include the I/O operations of a cluster nucleus to all WORK datasets in a cluster for the following purposes:

- Initialization and validation of the access to a WORK dataset
- Writing of protection data for an unresponsive peer nucleus
- Reading of protection data during online and offline recovery (session autorestart)

Any I/Os to the own WORK dataset of the nucleus during normal processing (writing of protection data for updates, reading of protection data for backout operations, writing and reading of search

results) are not included. These are covered by the **Input/Output Statistics** displayed near the top of the end-of-session statistics.

Data Set Activity Statistics

```
14:46:58 ADAIO3 00035 DDWORKR1                          3 reads
14:46:58 ADAIO3 00035 DDWORKR1                        397 writes
14:46:58 ADAIO3 00035 DDDATAR1                         27 reads
14:46:58 ADAIO3 00035 DDDATAR1                         14 writes
14:46:58 ADAIO3 00035 DDASSOR1                        107 reads
14:46:58 ADAIO3 00035 DDASSOR1                         72 writes
```

12 Switching Between Cluster and Noncluster Modes / PLOG Handling

Switching from cluster to noncluster mode (or vice versa) is possible only after normal termination. A starting nucleus checks in the PPT whether the previous session ended abnormally with a pending autorestart. If this is the case and the previous nucleus ran in the same mode as the starting nucleus, the session autorestart logic will be executed. If the previous nucleus ran in a different mode than the starting nucleus, the session start will terminate with an error.

The following sections illustrate a few scenarios where a cluster nucleus starts after the normal termination of a noncluster nucleus. PLOGRQ is not set to FORCE. These scenarios apply to two PLOGs as well as up to eight PLOGs.

Scenario 1

The previous session was noncluster mode, there are remaining PLOGs to be copied, there is no UEX2/12 in use, and the PLOG data sets are different from what was used in the previous session. The results of this scenario are as follows:

- The information in the PPT entry of the noncluster nucleus remains, and the new entry of the cluster nucleus is written.
- Initialization continues.

Scenario 2

The previous session was noncluster mode, there are remaining PLOGs to be copied, there is no UEX2/12 in use, and the PLOG data sets are the same as what was used in the previous session of a noncluster nucleus. The results of this scenario are as follows:

- A warning that the PLOG is being overwritten will occur and the PLOG flag in the previously used PPT block will be reset or the PPT entry will be overwritten (whichever is appropriate).
- Initialization continues.

Scenario 3

The previous session was noncluster mode, there are remaining PLOGs to be copied, UEX2/12 is in use, and the PLOG data sets are different from what was used in the previous session of a noncluster nucleus. The results of this scenario are as follows:

- UEX2/12 is called to submit a PLCOPY job that will copy and merge the PLOGs. The information in the PPT entry of the noncluster nucleus remains, and the new entry of the cluster nucleus is written.

- Initialization continues.

Note: If ADARES detects that there is data to be copied both from a cluster nuclei and from a noncluster nucleus (different PLOGs), it will copy the oldest data first.

13 Performance and Tuning

This chapter describes performance and tuning issues.

ADARUN Parameter Settings

Software AG recommends that you use the default settings (or the existing values of your Adabas ADARUN parameters) for each nucleus in an Adabas cluster, and then tune the values after analyzing the performance of the cluster.

Session statistics can be used to determine the best settings for each parameter. The statistics can be displayed using ADACOM operator commands during the session; the statistics are also printed automatically at the end of a session.

Allocating Work Data Set Space

Each Adabas cluster nucleus requires its own Work data set to hold its temporary data. However, the Work data sets may not need to be as large as for Adabas noncluster data sets because the workload is spread over several nuclei.

The individual sizes of the different Work parts (1, 2, and 3) as specified by ADARUN parameters such as LP and LWKP2 can be different among the nuclei; however, the overall size of each Work data set must be the same. Software AG recommends that you use the same LP and LWKP2 values on each nucleus active for the same database. The total Work size is stored in the Adabas general control block (GCB).

For each nucleus, you need to specify `DISP=SHR` for DDWORKR1. During an offline or online restart/recovery, a nucleus may access the Work data sets belonging to other nuclei in the cluster.

Using Close (CL) Commands

Users are assigned to a nucleus for their entire sessions and should therefore issue Adabas close (`CL`) commands as appropriate. The close command ends the user's session, making the user eligible for reassignment to another nucleus when the user again issues an Adabas open (`OP`) command. This allows Adabas Cluster Services to rebalance the workload over the participating nuclei.

Timeout Values

The Adabas ADARUN parameter timeout values (TT, TNAA, TNAE, TNAX) should be reevaluated, since there is a greater chance of contention for records, blocks, etc., in a multiprocessing environment.

Deferred Publishing

Publication of updated blocks to the cache structure can now be deferred until just before the end of the associated transaction. Multiple updates to a block may produce only a single write of the block to the cache rather than a cache write for each update.

The greater the number of database updates in parallel transactions, the greater the expected improvement in performance.

Note: Deferred publishing creates an asymmetry between users on the update nucleus, who see uncommitted updates, and users on other cluster nuclei, who may or may not see uncommitted updates (unless they read with hold).

This section covers the following topics:

- Redo Pool
- ADARUN Parameter LRDP

Redo Pool

Since the write of updated blocks to the cache may fail due to conflicting updates to the same blocks by other nuclei in the cluster, every cluster nucleus must be capable of redoing the updates it has not yet written to the cache. The nucleus maintains information about these updates in the "redo pool".

ADARUN Parameter LRDP

The size of the redo pool is specified by the new ADARUN parameter LRDP. The LRDP parameter is effective only in a cluster nucleus; that is, when a nonzero NUCID is specified.

If LRDP is not specified, the nucleus takes as default the value of the LFIOP parameter. If LRDP is explicitly set to zero, the nucleus writes each update immediately to the cache.

Different nuclei in the same cluster can have different settings of LRDP. It is also possible, although not recommended, to run one nucleus with LRDP=0 and a peer nucleus with LRDP>0.

Note: If one nucleus runs with `LRDP=0` and a peer nucleus runs with `LRDP>0` and the different cluster nuclei concurrently update the same Data Storage blocks, incorrect DSST entries may be produced. These are reported by ADADCK. Such errors are harmless and do not affect the results of the application programs.

The nucleus reports on the use (high watermark) of the redo pool in a shutdown statistic and in the response to the `DRES` command from the operator console or from ADADBS `OPERCOM`.

Tuning Buffer Flushes

When the update load on the database is so high that the buffer flush becomes the bottleneck, you can improve performance by reducing the duration of buffer flushes.

Instead of starting one I/O per volume, a buffer flush can initially start a predetermined number of I/Os on each volume and then starts a new one once another I/O on the same volume finishes. This occurs independently on each volume.

This section covers the following topics:

Meaning of ADARUN FMXIO Parameter Changed

The meaning of the `FMXIO` parameter has changed for the new buffer flush method. See the *Adabas Operations* documentation.

When `ASYTVS=YES` (buffer flushes occur by volume), `FMXIO` now specifies the number of I/Os to be started in parallel *on each volume*. The minimum and default number is 1; the maximum number is 16. If you specify a number greater than 16, it is reduced to 16 without returning a message.

When `ASYTVS=NO` (buffer flushes occur in ascending RABN sequence without regard to the distribution of the blocks over volumes), the minimum, default, and maximum values continue to be 1, 60, and 100, respectively.

Dynamically Modifying the FMXIO Parameter Setting

The setting of `FMXIO` can be modified dynamically using the FMXIO=nn command from the operator console or the Modify Parameter function of Adabas Online System.

Optimizing Lock and Cache Structures in the Coupling Facility

As a user, you must allocate and define sizes that are appropriate to your application needs for the lock structure and a cache structure in the coupling facility (CF).

This section provides guidelines for determining optimal sizes for these structures based on current experience.

Note: There may be sites for which these guidelines are not appropriate.

This section covers the following topics:

Cache Structure Size in the Coupling Facility

The coupling facility cache structure must be large enough to retain

- "directory elements" for all blocks that reside in all the buffer pools; and
- enough "data elements" to keep changed blocks between buffer flushes (cast-outs).

Directory elements are used to keep track of the cluster members that have a particular block in their buffer pools so that the block can be invalidated should any member modify it.

If the number of directory elements is insufficient, the coupling facility reuses existing directory elements and invalidates the blocks associated with those directory elements, because they can no longer be tracked. These blocks must then be reread from the database and registered again the next time they are referenced and validated, even though they did not change.

It is generally better to reassign storage for data elements to keep more ASSO and DATA blocks in the coupling facility than to define too many directory elements in the cache structure. More data elements than necessary can be used to keep additional blocks to improve the local buffer efficiency.

The number of directory elements need not be greater than the sum of the sizes of all buffer pools divided by the smallest block size in use for ASSO and DATA.

When connecting to the cache structure during startup, the ADAX57 message reports the number of directory elements and data elements. The ADARUN parameters DIRRATIO and ELEMENTRATIO determine the ratio between the number of directory and data elements.

Lock Structure Size in the Coupling Facility

All nuclei in a database cluster share the lock structure.

The coupling facility uses a lock table (organized as a hash table) to allocate and find a specific lock entry. It uses lock record entries to maintain data associated with lock instances.

When the coupling facility receives a lock request (for example, to put an ISN of a file into hold status), it allocates specific lock table and lock record entries unless another member of the cluster has already made a conflicting allocation.

- another member holds the same lock (real contention); or
- another lock name hashes to the same lock table entry (false contention).

False contention is eventually detected and resolved by the lock manager. However, since contention resolution is much more expensive than a lock request (there is a difference of about two orders of magnitude), false contention should be avoided.

False contention depends on the number of lock table entries compared to the number of concurrent lock requests. The likelihood (and therefore the frequency) of false contention decreases if the number of lock table entries allocated in the lock structure is increased.

Locks are held for a variety of entities, for example unique descriptor values. These lock types tend to occur with very different frequencies. The amount of lock activity during a session for each lock type is displayed in a shutdown statistic.

It is often the case that ISN locks show the greatest activity. The sum of high-water marks for NH yields an upper limit for the number of ISN locks that were held concurrently during the session.

Since lock contention is significantly more expensive than lock requests without contention, the lock table should be made large enough so that only a very small percentage of all lock requests cause false contention. As a rule of thumb, the number of lock table entries should be at least 1,000 times higher than the maximum number of ISN locks held concurrently.

RMF-I and RMF-III have reports that indicate how many instances of false contention occurred within a monitoring interval.

The minimum lock structure size can be roughly estimated as:

```
(NU*3 + NH + NT + LDEUQP/15 + MAXFILES*6 + 100) * 400 + 1,000,000 bytes
```

where `MAXFILES` is the maximum number of files in the database (set in ADADEF or ADAORD) and `NU`, `NH`, `NT`, and `LDEUQP` are the ADARUN parameters of the cluster nuclei. The formula in parentheses `(NU*3 + NH + NT + LDEUQP/15 + MAXFILES*6 + 100)` is used to calculate the minimum number of lock record entries that the cluster nuclei expect to have available.

Minimizing Communication with the Coupling Facility

Most of the additional processing required for Adabas sysplex environments compared to a single Adabas nucleus involves communication with the coupling facility (CF).

For this reason, optimizing the performance of an Adabas sysplex environment means minimizing the need to communicate with the CF. It is also important to keep the time required for each communication as short as possible.

This section covers the following topics:

Avoiding the Hold Option

Lock requests usually depend on application requirements. Under data-sharing, the hold option is more expensive and access with the hold option should be avoided unless records will in fact be updated or must be protected from concurrent updates.

Reducing Direct Interaction with the Coupling Facility

Cache requests occur when blocks

- that are referenced do not exist in a local buffer pool;
- exist in the local buffer pool but have become invalid due to concurrent updates from other cluster members or from directory reuse; or
- are updated.

The first and second situation require registering and (re)reading the blocks from the cache. This is much more expensive than validating blocks, which does not require direct interaction with the CF.

The first situation is related to the buffer efficiency in a noncluster environment. In a cluster environment, the buffer efficiency represents the combined effect of the local buffer pool and the cache structure. In order to reduce the interaction with the cache structure, the local buffer pool (LBP) should not be decreased from what would be used in a noncluster nucleus. A large LBP parameter

and the usage of forward index compression are recommended to improve the buffer efficiency in the local buffer pool.

Tuning measures to avoid I/Os and cache requests are even more important under data-sharing. Very large LBP and the use of forward index compression are recommended to improve the buffer efficiency in the local buffer pools.

Optimizing Block Sizes

The time for moving or reading blocks into or out of the cache structure depends on the device type (block size) in use:

- Small block sizes are moved synchronously to and from the cache structure.
- Larger block sizes may be moved asynchronously. Asynchronous moves take much longer and always require more CPU time than synchronous requests.

Although earlier versions of Adabas often worked well with large block sizes, the buffer pool manager and forward index compression feature introduced with Adabas version 7 make smaller block sizes more attractive, especially in data-sharing mode.

Use the following guidelines when selecting an optimal block size for ASSO and DATA:

Note: Only general recommendations can be given.

1. Avoid 4-byte RABNs

   If the database is not extremely large, avoid 4-byte RABNs as this increases the number of AC blocks by 33%. When growth considerations are taken into account, this may require larger block sizes or limit reductions in block size. The same holds true for the maximum compressed record length.

2. Use forward index compression

   Forward index compression can significantly reduce the number of index blocks in a database. Apply forward index compression to all frequently accessed files (or to all files, regardless of their frequency of use). Choose the ASSO block size that is as small as possible but large enough to keep the number of index levels down to 3 or 4.

3. Minimize frequently updated descriptors

   When files are updated frequently, the number of blocks that are modified and need to be written to the cache structure often depends on the number of descriptors that have been defined and modified during update processing. Support for additional keys whose descriptor values are subject to frequent modifications becomes even more expensive in a data-sharing environment.

14 Estimating Entire Net-Work Storage Requirements

Given the complexity of today's data processing environments, it is almost impossible to provide methods to predict the exact storage requirements of a software product.

The following tables provides rough estimates about the fixed storage requirements of Entire Net-Work and its various components, ignoring operating system-related storage requirements, which typically vary from installation to installation.

Table 1 contains the amounts of storage obtained from the operating system based on parameter specification or appropriate defaults. It does not include storage areas that are directly related to the operating system, such as operating system control blocks, I/O-related buffers, and control blocks (except where they are part of Entire Net-Work program modules or data areas).

Table 2 contains the amounts of storage obtained from the Entire Net-Work buffer pools by the control module and the various line drivers.

Table 1: Storage Areas Obtained from System

Storage Area		Platform
		z/OS
Request queue: (NC parameter+1)*192		AS(X)
Attached buffers: (NAB parameter*4112)		AS(X)
Entire Net-Work buffer pools*	Asynchronous buffers	AS(X)
	Long-term buffers	AS
	Short-term buffers	AS(X)
	Page-fixed buffers	AS
Entire Net-Work trace table		AS(X)
Entire Net-Work control blocks	general	AS
	Node	48
	Target	32
	Path	32
	CTCA DRIVER	544
	DCAM DRIVER	---
	IUCV DRIVER	---
	TCPI DRIVER	4KB
	TCPX DRIVER	4KB
	VTAM DRIVER	4KB
	XCF DRIVER	2048

Storage Area		Platform
		z/OS
	CTCA LINK	992
	DCAM LINK	---
	IUCV LINK	---
	TCPI LINK	1KB
	TCPX LINK	1KB
	VTAM LINK	256
	XCF LINK	2048
ADAIOR data areas	general	AS
	(for trace table, ECB list, etc.)	about 2KB

Abbreviation	Meaning
AS	from address space (private, below 16MB if XA or XS)
AS(X)	from address space (private, above 16MB if XA or XS)

Table 2: Storage Obtained from Entire Net-Work Buffer Pools

Statistic	Buffer Pool Types			
	Asynch	Long-term	Short-term	Page-fixed
Segment size	64	64	512	2KB or 4KB
Control module buffer pool usage		UB	MSG RPLY	
Queue manager buffer pool usage			BLK	BLK

Abbreviation	Meaning
BLK	Storage for outgoing transmission blocks (after compression and blocking), from short-term pool or page-fixed pool, depending on line driver requirements. Storage requirements for one transmission block include, in addition to the messages contained, 48 bytes for a transmission block header.
MSG	All messages sent or received; output messages kept until acknowledged by the access method, input messages kept until processed.
	The size of a message can be computed in the following way: 56 bytes for a message header + maxpath * 2 bytes for a node stack + 128 bytes for UB, ACB, etc. + size of FB, RB, SB, VB, IB to send or receive

Abbreviation	Meaning
RPLY	A reply buffer for each user request for a target on this node if the information returned by the target will not fit into the original message buffer (that is, if a large record buffer or ISN buffer is to be returned to the user).
UB	(only if 31-bit mode:) 64 bytes per user request for a target on this node, for the duration of the Adabas call.

15 Adabas SMF Records

On z/OS, Adabas supports the recording of database activity via SMF records when ADARUN parameter SMF=YES is specified.

SMF recording is supported on z/OS only.

All Adabas SMF records have a common structure, with some sections appearing in all records and others generated according to specific events and parameters specified through ADARUN or operator commands. The ASMFREC macro provides mapping DSECTs for all parts of the SMF record.

Record Structure

Adabas follows the modern convention for SMF record formats. A single record has:

- A standard IBM-type header
- A self-defining section that describes a variable number of detail sections
- A product ID detail section
- User-selected detail sections

Each detail section is described by an eight-byte entry in the self-defining section containing three fields. An entry is also called a *triplet*.

- A 4-byte offset from the beginning of the record to the detail section
- A 2-byte count of the number of instances of the detail section
- A 2-byte length of each detail section instance. If there are no detail section instances of a given type, the triplet is all zeros.

Field `ASNumD` in the **product ID section** specifies the number of triplets in the self-defining section.

Record Size Limits

SMF records are z/OS V-format records with a system-imposed maximum length of 32,756 bytes. Most Adabas SMF records fit within this limit for most reasonable types of ADARUN nucleus specifications. However, detail sections such as **File Activity** could potentially have several thousand detail section instances.

If the entire set of instances will not fit in the space remaining in the record, Adabas will include only as many as there are room for and write the record. The SMF record is reset by clearing the triplets for all detail sections except the product ID section and then adding as many of the remaining instances as will fit, repeating until all detail sections are processed. Field `ASSegNo` in the

product ID section will start at 1 and be incremented with each additional record, and field ASSegL will be set to zero for the last (or only) record for an interval or event.

If any detail section is so large that even one instance would cause the record size limit to be exceeded after resetting the SMF record, that detail type is deactivated.

Record Subtypes

The header section field ASSTy identifies a record subtype.

Subtype 1 (ASStI) - Adabas Nucleus Initialization

A record of this subtype is generated during nucleus initialization. In addition to the header, self-defining and product ID sections, it contains ADARUN parameter and user sections if these have been selected by SMFDETAIL ADARUN parameter or operator commands.

Subtype 2 (ASStT) - Adabas Nucleus Termination

A record of this subtype is generated during nucleus termination. In addition to the header, self-defining and product ID sections, it contains all detail sections specified by the SMFDETAIL ADARUN parameter or operator commands except for the ADARUN parameter section. Statistics in Adabas detail sections reflect totals for the entire nucleus session.

Subtype 3 (ASStI) - Adabas Interval Statistics

If interval recording has been specified by the SMFINTERVAL ADARUN parameter or operator command, a record of this subtype is generated at the expiration of each interval. In addition to the header, self-defining and product ID sections, it contains all detail sections specified by the SMFDETAIL ADARUN parameter or operator commands except for the ADARUN parameter section. Statistics in Adabas detail sections reflect activity since the previous interval ended, except where noted. This is also called a delta value.

Subtype 4 (ASStP) - Adabas Parameter Change

If the Adabas ADARUN parameter detail section has been specified by the SMFDETAIL ADARUN parameter or operator commands, a record of this subtype is generated whenever an ADARUN parameter value is changed after nucleus initialization. In addition to the header, self-defining, product ID and ADARUN parameter sections, it may also contain a user section if that has been selected by SMFDETAIL ADARUN parameter or operator commands.

Statistical Recording

The nucleus accumulates usage statistics on the resources it uses to accomplish its tasks. These statistics may be recorded at user or system-defined intervals (see ADARUN parameter SMFINTERVAL) and at termination.

Interval recording (Adabas SMF record subtype 3) provides the usage since the last interval ended for each detail section. Adabas SMF record intervals may be synchronized with one of the system-level intervals specified by PARMLIB member SMFPRM*xx* entries. This allows straightforward analysis of the usage by allowing direct comparison with other record interval data. For example, you can compare the Adabas interval record with RMF data for the same interval to better understand system performance.

Statistics at termination (Adabas SMF record subtype 2) will have cumulative statistics that reflect activity for the entire nucleus session in each specified detail section.

Record Sections

Every Adabas SMF record contains header, self-defining and product ID sections. You can select additional detail sections through the SMFDETAIL ADARUN parameter or operator commands. Each section is mapped by a DSECT generated by the ASMFREC mapping macro.

The following table summarizes the Adabas SMF record sections:

Detail Section Description	ASMFREC Macro or ADARUN Parameter Specification	Self-Defining Section Triplet Label Base	ASMFREC DSECT Name Produced by the ASMFREC Macro
Header and self-defining section	---	---	**ASBase**
Adabas command activity	CMD	ASTCmd	**ASCmd**
Adabas global cache activity by block type[1]	CSHB	ASTChB	**ASChB**
Adabas global cache activity by Adabas file number[1]	CSHF	ASTChF	**ASChF**

Detail Section Description	ASMFREC Macro or ADARUN Parameter Specification	Self-Defining Section Triplet Label Base	ASMFREC DSECT Name Produced by the ASMFREC Macro
Adabas global cache activity [1]	CSHG	ASTChG	**ASChG**
Adabas Parallel Services cache activity[2]	CSHP	ASTChP	**ASChP**
Adabas file activity	FILE	ASTFile	**ASFile**
Adabas global lock activity[1]	LOCK	ASTLok	**ASLok**
Adabas internucleus messaging control block activity	MSGB	ASTMsgB	**ASMsgB**
Adabas internucleus messaging counts	MSGC	ASTMsgC	**ASMsgC**
Adabas internucleus messaging service time histogram	MSGH	ASTMsgH	**ASMsgH**
ADARUN parameter values	PARM	ASTParm	**ASParm**
I/O by DD name	IODD	ASTIODD	**ASIODD**
Product ID[3]	ID	ASTPID	**ASPID**
Session Statistics	SESS	ASTSess	**ASSess**
Storage pool	STG	ASTStg	**ASStg**
Thread activity	THRD	ASTThrd	**ASThrd**
zIIP statistics	ZIIP	ASTzIIP	**ASzIIP**
User-defined	USER	ASTUsr	user-defined

1. The detail section is available only in cluster environments when either Adabas Cluster Services or Adabas Parallel Services are installed.
2. The detail section is available only in cluster environments when Adabas Parallel Services is installed.
3. The product ID section is always included in every SMF record. It may not be specified in the SMFDETAIL ADARUN parameter or in operator commands.

This section describes the different detail record sections:

Note: The DSECTs provided in the following sections may not be the most current. To see the most current versions of the DSECTs, generate them using the **ASMFREC macro**.

- Header Section
- Self-Defining Section
- Product ID Section: ID
- Adabas Command Activity Section: CMD
- Adabas File Activity Section: FILE
- Adabas Global Cache Activity by Block Type Section: CSHB
- Adabas Global Cache Activity by Adabas File Number Section: CSHF
- Adabas Global Cache Activity Section: CSHG
- Adabas Global Lock Activity Section: LOCK

Header Section

IBM has defined a standard format for the initial part of all SMF records in *z/OS MVS System Management Facilities (SMF), IBM document SA22-7630*. This section begins every Adabas SMF record.

```
ASBase   DSect ,                  Base segment
*
*                     Standard SMF Header
*
ASRDW    DS    0Bl4               Record descriptor word
ASLen    DS     Bl2                Record length
ASSeg    DS     Bl2                Segment descriptor
ASFlg    DS    Bl.8               System indicator flags
ASFStV   Equ    x'40'              Subtypes are valid
ASFV4    Equ    x'10'              MVS/SP V4 and above
ASFV3    Equ    x'08'              MVS/SP V3 and above
ASFV2    Equ    x'04'              MVS/SP V2 and above
ASFVS2   Equ    x'02'              VS2
ASRTy    DS    Bl1                Adabas record type
ASTme    DS    Bl4                Time since midnight when record was +
                                    moved into SMF buffer in 1/100 sec
ASDte    DS    Pl4                Date when record was moved into SMF +
                                     buffer as 0cyydddF
ASSID    DS    Cl4                System identifier (SMFPRMxx SID)
ASSSI    DS    Cl4                Subsystem identifier
ASSty    DS    Bl2                Subtype
ASStI    Equ     1                 Adabas initialization
ASStT    Equ     2                 Adabas termination
ASStS    Equ     3                 Interval statistics
ASStP    Equ     4                 Parameter change
ASStA    Equ     9                 Ad hoc record
*
ASBaseL  Equ   *-ASBase            Length of standard header
```

Self-Defining Section

The self-defining section follows immediately after the header section. It is part of the header section DSECT.

Each detail section triplet is identified by a base label as shown in the **table at the beginning of this section**. The base label begins with the prefix specified in the ASMFREC invocation followed by the letter T (for triplet), and then followed by a mnemonic detail section identifier. The base label with suffix O is the offset, with suffix L is the length, and with suffix N is the number of instances.

Here is an example of some triplets.

```
*
*                     Self-Defining Section
*
ASSDS    DS    0B                 Self-defining section
*                                 Map of typical section triplet
ASSDSO   DS     B14                Offset to section from start of    +
                                      record
ASSDSL   DS     B12                Length of section
ASSDSN   DS     B12                Number of section(s)
         Org    ASSDS
*
ASTID    DS    0B18               ID Section (always present)
ASTIDO   DS     B14                Offset to ID section from start    +
                                      of record
ASTIDL   DS     B12                Length of ID section
ASTIDN   DS     B12                Number of ID section(s)
*
ASTUser  DS    0B18               User-Defined Section
ASTUserO DS     B14                Offset to User-Defined section from+
                                      start of record
ASTUserL DS     B12                Length of User-Defined section
ASTUserN DS     B12                Number of User-Defined section(s)
*
ASTParm  DS    0B18               ADARUN Parameter Section
ASTParmO DS     B14                Offset to detail section from start+
                                      of record
ASTParmL DS     B12                Length of each detail section
ASTParmN DS     B12                Number of detail section(s)
*
 . . .
*
ASSDSLn  Equ   *-ASSDS            Length of self-defining section
ASSDSNT  Equ   ASSDSLn/8          Number of triplets
```

Product ID Section: ID

The product ID section is always present in every Adabas SMF record with one instance. It describes the nucleus generating the SMF record and provides information about the record's contents.

The 2-byte version code consists of a major version and a minor version. A change, such as adding a new triplet or extending a detail section, will increment the minor version. All existing programs should continue to operate as no existing displacements have changed. A more disruptive change will increment the major version and require existing programs to (at least) be reassembled.

```
ASPID    DSect ,                  Product ID Detail Section          +
                                    (always present in SMF record)
ASSMFV   DS    0Bl2               SMF record version
ASSMFVM  DS     Bl1                SMF record major version
ASSMFVN  DS     Bl1                SMF record minor version
ASSMFVC  Equ   ASSMFV14           Current version: 1.4
ASSMFV11 Equ     x'0101'           Version 1.1 - Initial release
ASSMFV12 Equ     x'0102'           Version 1.2 - Added ALS/ASM
ASSMFV13 Equ     x'0103'           Version 1.3 - ADARUN parms V8.3
ASSMFV14 Equ     x'0104'           Version 1.4 - ADARUN parms V8.4
*                                    in coll. seq., new section SESS
ASSegNo  DS    Bl1                Record segment number
ASSegL   DS    Bl1                Last segment when = 0
ASNumD   DS    Bl2                Number of detail type triplets
ASPNm    DS    Cl8                Product name (ADABAS)
ASVRSC   DS    Cl8                Product ver/rlse/SM/cum: vvrrsscc
ASSysN   DS    Cl8                System name
ASSypN   DS    Cl8                Sysplex name
ASVMN    DS    Cl8                Virtual machine name
ASJbN    DS    Cl8                Job name
ASStN    DS    Cl16               ProcStep/Step name
ASJNm    DS    Cl8                JES job identifier
ASPgm    DS    Cl8                Program name
ASGrp    DS    Cl8                Cluster messaging group name
ASST     DS    Bl8                Nucleus start time in STCK format
ASIST    DS    Bl8                Interval start time in STCK format
ASIET    DS    Bl8                Interval end time in STCK format
ASDBID   DS    Bl4                Database ID
ASNucX   DS    Bl2                External nucleus ID
ASNucI   DS    Bl1                Internal nucleus ID
ASSVC    DS    Bl1                Adabas SVC number
ASASID   DS    Bl2                Address space ID
ASASIDI  DS    Bl4                Reusable address space ID instance
ASComp   DS    Bl2                Completion code                    +
                                    x'0ccc' System ABEND code ccc     +
                                    x'8ccc' User ABEND code ccc
ASARC    DS    Bl4                ABEND reason code
*
ASPIDL   Equ    *-ASPID
```

Adabas Command Activity Section: CMD

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Adabas command activity data is derived from data presented at nucleus shutdown.

There is one instance for each command group: A1/4, BT, CL, ET, E1/4, L1/4, L2/5, L3/6, L9, LF, N1/2, OP, UC, RC, RE, REST, S1/4, S2, S5, S8, S9, YA, YB, YF, YP, YCAL, V1, V2, V3, V4, U0, U1, U2 and U3. There are 34 possible instances but this is subject to change in future releases.

```
ASCmd    DSect ,                  Adabas Command Activity
ASCmdNm  DS     Cl4               Command name
ASCmdCt  DS     Bl8               Number of times this command type   +
                                    was executed
ASCmdTm  DS     Bl8               Sum of this command type durations  +
                                    in microseconds
*
ASCmdL   Equ   *-ASCmd
```

Adabas File Activity Section: FILE

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Adabas file activity data is derived from data presented at nucleus shutdown or in response to a DFILUSE operator command. There is one instance for each file possible in the database as specified by ADADEF MAXFILES up to the highest file number with a non-zero use count. The file number is implied by the sequence number of the instance, starting with zero, which reflects commands such as OP that are not associated with a specific file.

```
ASFile   DSect ,                  Adabas File Activity
ASFileCt DS     Bl8               Number of commands executed against +
                                    this file
*
ASFileL  Equ   *-ASFile
```

Adabas Global Cache Activity by Block Type Section: CSHB

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Global cache statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DX-CACHE operator command. There is one detail section instance for each type of block. Users should examine the block type and not rely on any observed order of the instances. The following block types are reported:

- AC: Address Converter
- DS: Data Storage
- DSST: Data Storage Space Table
- FCB: File Control Block

- NI: Normal Index
- UI: Upper Index
- WORK: Protection Data
- OTHR: Any other block type

```
ASChB     DSect ,                  Global Cache Activity by Block
ASCBCN    DS    Bl2                Cache Number
ASCBRsv1  DS    Bl2                Unused
ASCBBT    DS    Cl4                Block type
ASCBRT    DS    Bl8                Reads - Total
ASCBRCS   DS    Bl8                Reads - Completed synchronous
ASCBRCA   DS    Bl8                Reads - Completed asynchronous
ASCBRIC   DS    Bl8                Reads - Data in cache
ASCBRNI   DS    Bl8                Reads - Data not in cache
ASCBRFS   DS    Bl8                Reads - Failed - Structure
ASCBRO    DS    Bl8                Reads - For cast-out
ASCBROS   DS    Bl8                Reads - For cast-out synchronous
ASCBROA   DS    Bl8                Reads - For cast-out asynchronous
ASCBWT    DS    Bl8                Writes - Total
ASCBWCS   DS    Bl8                Writes - Completed synchronous
ASCBWCA   DS    Bl8                Writes - Completed asynchronous
ASCBWDR   DS    Bl8                Writes - Data written
ASCBWNR   DS    Bl8                Writes - Data not written
ASCBWSF   DS    Bl8                Writes - Structure full
ASCBVI    DS    Bl8                Validates issued
ASCBVF    DS    Bl8                Validates failed
ASCBBD    DS    Bl8                Block deletes issued
ASCBDR    DS    Bl8                Deletes reissued due to timeout
ASCBUR    DS    Bl8                Number of times updates redone
*
ASChBL    Equ  *-ASChB
```

Adabas Global Cache Activity by Adabas File Number Section: CSHF

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Global cache statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DX-CACHE operator command. There is potentially one instance for each file possible in the database as specified by ADADEF MAXFILES. The size of this detail section precludes the ability to generate it for every possible file, so there is one detail section instance for each file that has non-zero usage. Users should examine the file number and not rely on any observed order of the instances.

```
ASChF     DSect ,                  Global Cache Activity by File
ASCFCn    DS    Bl2                Cache Number
ASCFRsv1  DS    Bl2                Unused
ASCFNum   DS    Bl4                File number
ASCFRT    DS    Bl8                Reads - Total
ASCFRCS   DS    Bl8                Reads - Completed synchronous
ASCFRCA   DS    Bl8                Reads - Completed a synchronous
ASCFRIC   DS    Bl8                Reads - Data in cache
ASCFRNI   DS    Bl8                Reads - Data not in cache
ASCFRFS   DS    Bl8                Reads - Failed - Structure
ASCFRO    DS    Bl8                Reads - For cast-out
ASCFROS   DS    Bl8                Reads - For cast-out synchronous
ASCFROA   DS    Bl8                Reads - For cast-out asynchronous
ASCFWT    DS    Bl8                Writes - Total
ASCFWCS   DS    Bl8                Writes - Completed synchronous
ASCFWCA   DS    Bl8                Writes - Completed a synchronous
ASCFWDR   DS    Bl8                Writes - Data written
ASCFWNR   DS    Bl8                Writes - Data not written
ASCFWSF   DS    Bl8                Writes - Structure full
ASCFVI    DS    Bl8                Validates issued
ASCFVF    DS    Bl8                Validates failed
ASCFBD    DS    Bl8                Block deletes issued
ASCFDR    DS    Bl8                Deletes reissued due to timeout
ASCFUR    DS    Bl8                Number of times updates redone
*
ASChFL    Equ   *-ASChF
```

Adabas Global Cache Activity Section: CSHG

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Global cache statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DX-CACHE operator command. This detail section appears with one instance.

```
ASChG     DSect ,                  Global Cache Activity Section
ASCGCN    DS    Bl2                Cache Number
ASCGRsv1  DS    Bl2                Unused
ASCGCOD   DS    Bl8                Cast-out directory reads issued
ASCGCODA  DS    Bl8                Cast-out directory - async
ASCGCODS  DS    Bl8                Cast-out directory - sync
ASCGCOU   DS    Bl8                Unlock cast-out locks issued
ASCGCOUA  DS    Bl8                Unlock cast-out locks - async
ASCGCOUS  DS    Bl8                Unlock cast-out locks - sync
ASCGDR    DS    Bl8                Directory reads issued
ASCGDRA   DS    Bl8                Directory reads issued - sync
ASCGDRS   DS    Bl8                Directory reads issued - async
ASCGPub   DS    (0*9)Bl8           Publishing requests
ASCGSync  DS     Bl8                 Update sync
ASCGXEnd  DS     Bl8                 BT/CL/ET transaction end
ASCGRedo  DS     Bl8                 Redo threshold
ASCGFull  DS     Bl8                 Full buffer pool
```

```
ASCGAll   DS     Bl8                 All blocks
ASCGRABN  DS     Bl8                 Specific RABN
ASCGDS    DS     Bl8                 File DS blocks
ASCGDSST  DS     Bl8                 DSST blocks
ASCGNI    DS     Bl8                 File NI blocks
*
ASChGL    Equ  *-ASChG
```

Adabas Global Lock Activity Section: LOCK

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Global lock statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DXLOCK operator command. There is one detail section instance for each lock type. The lock type is implied by the sequence number of the instance, starting with one.

```
ASLok     DSect ,                 Global Lock Section
*                                 Lock Types
ASLokGC   Equ     1                 GCB
ASLokSE   Equ     2                 Security
ASLokFS   Equ     3                 FST
ASLokUF   Equ     4                 UFT
ASLokSO   Equ     5                 Save Online
ASLokFL   Equ     6                 Flush
ASLokES   Equ     7                 Global ET Synchronization
ASLokRC   Equ     8                 Recovery
ASLokUT   Equ     9                 UFT-File
ASLokIU   Equ    10                 Index Update
ASLokHI   Equ    11                 Hold ISN
ASLokUD   Equ    12                 Unique DE
ASLokET   Equ    13                 ETID
ASLokLT   Equ    14                 LOB Tracker
ASLokCM   Equ    15                 Command Manager User
ASLokDI   Equ    16                 Data Increment
ASLokCP   Equ    17                 Checkpoint
ASLokDT   Equ    18                 Net-Work DBID Target Assignment
ASLokGU   Equ    19                 Global Update Commmand Sync
ASLokPM   Equ    20                 Parameter
ASLokDS   Equ    21                 DSF
ASLokRG   Equ    22                 RLOG
ASLokSP   Equ    23                 SPATS
ASLokCA   Equ    24                 Cancel
ASLokWR   Equ    25                 TBWK4A/E Table
ASLokWU   Equ    26                 PUTUA/E Table
ASLokXI   Equ    27                 XIDE
ASLokRH   Equ    28                 Replication Handshake
ASLokRI   Equ    29                 Read file/ISN
ASLokFA   Equ    30                 Format AC/AC1
ASLokOC   DS    Bl8                Obtains  - Conditional
ASLokOG   DS    Bl8                Obtains  - Granted
```

```
ASLokOR   DS    Bl8                Obtains  - Rejected
ASLokOU   DS    Bl8                Obtains  - Unconditional
ASLokOS   DS    Bl8                Obtains  - Synchronous
ASLokOA   DS    Bl8                Obtains  - Asynchronous
ASLokAC   DS    Bl8                Alters   - Conditional
ASLokAG   DS    Bl8                Alters   - Granted
ASLokAR   DS    Bl8                Alters   - Rejected
ASLokAU   DS    Bl8                Alters   - Unconditional
ASLokAD   DS    Bl8                Alters   - Deadlock/Rejected
ASLokAS   DS    Bl8                Alters   - Synchronous
ASLokAA   DS    Bl8                Alters   - Asynchronous
ASLokRL   DS    Bl8                Releases
ASLokRS   DS    Bl8                Releases - Synchronous
ASLokRA   DS    Bl8                Releases - Asynchronous
*
ASLokL    Equ   *-ASLok                                              ↩
```

Adabas Internucleus Messaging Control Block Activity Section: MSGB

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Internucleus messaging statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DXMSG operator command. This detail section appears with one instance. The number of blocks allocated (`ASMsgBBA`) and the high water mark (`ASMsgBBH`) reflect the entire nucleus session in interval records.

```
ASMsgB    DSect ,                 Inter-Nucleus Messaging Counts
ASMsgBBA  DS    Bl8               Message control blocks allocated
ASMsgBBH  DS    Bl8               Message control blocks used        +
                                   (high water mark)
ASMsgBBR  DS    Bl8               Message control block requests
*
ASMsgBL   Equ  *-ASMsgB
```

Adabas Internucleus Messaging Counts Section: MSGC

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Internucleus messaging statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DXMSG operator command. This detail section appears with one instance. Adabas Parallel Services nuclei report only the count of messages sent.

```
ASMsgC    DSect ,                  Inter-Nucleus Messaging Counts
ASMsgCMT  DS    Cl4                Message type
ASMsgCMS  DS    Bl8                Messages sent
ASMsgCMI  DS    Bl8                Messages incoming (arrived)
ASMsgCMA  DS    Bl8                Messages accepted
ASMsgCRS  DS    Bl8                Replies sent
*
ASMsgCL   Equ  *-ASMsgC
```

Adabas Internucleus Messaging Service Time Histogram Section: MSGH

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Internucleus messaging statistics are available only for Adabas Cluster Services and Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DXMSG operator command. This detail section appears with two instances:

1. The first represents messages subject to the MXMSG timeout parameter.
2. The second represents certain control messages not subject to MXMSG.

The two instances may be summed for a single representation of all messages. All message times are in microseconds. The minimum and maximum durations (`ASMsgHMn` and `ASMsgHMx`) reflect the entire nucleus session in interval records. Field `ASMsgMD2` is an extended (16-byte) floating point sum of the squares of all message durations. It may be used to compute a standard deviation.

```
ASMsgH    DSect ,                  Inter-Nucleus Messaging Histogram
ASMsgHXP  DS    Cl4                Transport service
ASMsgHMM  DS    Bl4                MXMSG or zero for messages not      +
                                    subject to MXMSG
ASMsgHMC  DS    Bl8                Message count
ASMsgHMD  DS    Bl8                Sum of all message durations
ASMsgHMS  DS    Bl16               Sum of squares, all msg durations   +
                                     (extended hex floating point)
ASMsgHMn  DS    Bl4                Minimum duration (us)
ASMsgHMx  DS    Bl4                Maximum duration (us)
ASMsgHCt  Equ   9                  Number of histogram buckets
ASMsgHG   DS    (0*ASMsgHCt)Bl8    Histogram buckets
ASMsgH10  DS     Bl8                 > 1000  s
ASMsgH09  DS     Bl8                 >  100  s, <= 1000  s
ASMsgH08  DS     Bl8                 >   10  s, <=  100  s
ASMsgH07  DS     Bl8                 >    1  s, <=   10  s
ASMsgH06  DS     Bl8                 >  100 ms, <=    1  s
ASMsgH05  DS     Bl8                 >   10 ms, <=  100 ms
ASMsgH04  DS     Bl8                 >    1 ms, <=   10 ms
ASMsgH03  DS     Bl8                 >  100 us, <=    1 ms
ASMsgH02  DS     Bl8                 <= 100 us
*
ASMsgHL   Equ  *-ASMsgH
```

Adabas Parallel Services Cache Activity Section: CSHP

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Parallel services cache statistics are available only for Adabas Parallel Services nuclei. They are derived from the ones presented at nucleus shutdown or in response to a DXCACHE operator command. This detail section appears with one instance. The directory high water mark `ASCPDHiN` and in-use count `ASCPDirI` reflect the entire nucleus session in interval records.

```
ASChP     DSect ,                  Parallel Services Cache Activity
ASCPCN    DS    Bl2                Cache Number
ASCPRsv1  DS    Bl2                Unused
ASCPNDir  DS    Bl8                Number of directory elements
ASCPNDiI  DS    Bl8                Number of directory index elements
*                                  Directory Statistics
*                                    General
ASCPDHiN  DS    Bl8                  High-water mark, this nucleus
ASCPDirI  DS    Bl8                  In-use, this nucleus
*                                    Read
ASCPDRA   DS    Bl8                  Located active
ASCPDRF   DS    Bl8                  Obtained from free pool
ASCPDRC   DS    (0*4)Bl8             Reclaim criteria categories
ASCPDNN   DS     Bl8                   First choice criteria
ASCPDND   DS     Bl8                   Second choice criteria
ASCPDIN   DS     Bl8                   Third choice criteria
ASCPDID   DS     Bl8                   Fourth choice criteria
ASCPDCF   DS    Bl8                  Unable to obtain (cache full)
ASCPDRT   DS    Bl8                  Tested for reclaim
*                                    Write
ASCPDWF   DS    Bl8                  Obtained from free pool
*                                  Space Management Statistics
*                                     Request Statistics
ASCPSRP   DS    Bl8                    Sufficient preallocated space
ASCPSRF   DS    Bl8                    Free space allocated
ASCPSRN   DS    Bl8                    Reclaim space, first choice
ASCPSRI   DS    Bl8                    Reclaim space, second choice
ASCPSRU   DS    Bl8                    Space unavailable (cache full)
ASCPSSP   DS    Bl8                    Searched part of space chain
ASCPSSF   DS    Bl8                    Searched entire  space chain
ASCPSST   DS    Bl8                    Number of space seqs tested
*                                     Element Reclaim Statistics
ASCPSEN   DS    Bl8                    First choice criteria
ASCPSEI   DS    Bl8                    Second choice criteria
*                                     Latch management statistics
*                                      Cache Space Chain
ASCPSPGE  DS    Bl8                      Get     Exclusive
ASCPSPWF  DS    Bl8                      WaitFor Exclusive
ASCPSPRE  DS    Bl8                      Release Exclusive
*                                      Cache Directory Index
ASCPDIGE  DS    Bl8                      Get     Exclusive
ASCPDIGS  DS    Bl8                      Get     Shared
ASCPDIUE  DS    Bl8                      Upgrade Exclusive
```

```
ASCPDIWE  DS    Bl8                       WaitFor Exclusive
ASCPDIWS  DS    Bl8                       WaitFor Shared
ASCPDIWU  DS    Bl8                       WaitFor Upgrade
ASCPDIRE  DS    Bl8                       Release Exclusive
ASCPDIRS  DS    Bl8                       Release Shared
*                                       Cache Directory
ASCPDRGE  DS    Bl8                       Get     Exclusive
ASCPDRGS  DS    Bl8                       Get     Shared
ASCPDRUE  DS    Bl8                       Upgrade Exclusive
ASCPDRWE  DS    Bl8                       WaitFor Exclusive
ASCPDRWS  DS    Bl8                       WaitFor Shared
ASCPDRRE  DS    Bl8                       Release Exclusive
ASCPDRRS  DS    Bl8                       Release Shared
*                                       Cast-Out Class
ASCPCOGE  DS    Bl8                       Get     Exclusive
ASCPCOGS  DS    Bl8                       Get     Shared
ASCPCOWE  DS    Bl8                       WaitFor Exclusive
ASCPCOWS  DS    Bl8                       WaitFor Shared
ASCPCORE  DS    Bl8                       Release Exclusive
ASCPCORS  DS    Bl8                       Release Shared
*
ASChPL    Equ  *-ASChP
```

ADARUN Parameter Value Section: PARM

This selectable detail section may appear in initialization records or whenever an ADARUN parameter is changed while the nucleus is running (subtypes 1 and 4 in the header section). It will not be generated for interval or termination records (subtypes 2 and 3). This section has a fixed-length portion containing most parameters, followed by variable-length areas for parameters capable of multiple values or lists of values.

Where possible, the individual field names are formed by prefixing the shortest allowable form of the parameter with ASP. In general, the SMF record will report character parameters in EBCDIC and numeric parameters in binary.

Parameters with limited enumerated values (YES or NO, for example) are reported in 1-byte fields if the possible values are unambiguous. Otherwise, the field length is that used by the nucleus, usually 4 bytes.

Here are some sample entries:

```
ASParm   DSect ,
ASPAO    DS    Cl1      AOslog
ASPARE   DS    Bl4      ARExclude
                           Offset to file table
ASPARMN  DS    Cl16     ARMname
ASPASS   DS    Cl1      ASSocache
ASPASY   DS    Cl1      ASYtvs
 . . .
```

```
ASPVI    DS    Cl1      Vista
ASPV64B  DS    Cl1      V64Bit
ASPWO    DS    Cl1      Workcache
ASParmV  DS    0B       Begin variable part
ASParmL  Equ   *-ASParm Length of ID section ↩
```

```
ASParm   DSect ,                  ADARUN Parameters
*
*         Adabas Nucleus Parameters
*
ASPAO    DS    Cl1                AOslog
ASPARE   DS    Bl4                ARExclude       Offset to file table
ASPARMN  DS    Cl16               ARMname
ASPASS   DS    Cl1                ASSocache
ASPASY   DS    Cl1                ASYtvs
 . . .

ASPVI    DS    Cl1                VIsta
```

The ADARUN AREXCLUDE parameter is a variable length list of values. The base parameter entry will be an offset from the beginning of the detail section to the table of values. The table is a 4-byte inclusive field followed by 4-byte file numbers. A separate DSECT maps the AREXCLUDE file exclusion table:

```
ASPAFE   DSect ,                  ARM File Exclusion Table
ASPAFEN  DS    Bl4                Inclusive length of table
ASPAFEF  DS    0Bl4               First file number entry
```

I/O by DD Name Section: IODD

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). I/O by DD data is derived from data presented at nucleus shutdown. There is one instance for each DD statement administered by the nucleus. You should examine the DD name and not rely on any observed order of the instances. An Adabas nucleus may open and close the same DD name multiple times. Multiple uses of a DD name are summed.

You might see this many DD statement entries in a single nucleus:

Statement Type	Number of DD Statements
ADC	248
ADP	248
ADW	62
ASSO	99
CLOG	8
DATA	99
ECS	1

Statement Type	Number of DD Statements
PLOG	8
RLOG	1
WORK	2

DD names beginning with "AD" represent files that were dynamically allocated, such as during Cluster or Parallel Services recovery, after another nucleus failed.

ADC and ADP represent CLOGs and PLOGs from other nuclei. There may be one set of 8 for each of the 31 possible other nuclei up to a maximum of 248.

Similarly, ADW represents a WORK data set from another nucleus. There may be two for each of the 31 possible other nuclei up to a maximum of 62.

```
ASIODD   DSect ,                    I/O Activity by DD
ASIODDNm DS    Cl8                  DD Name
ASIODDRd DS    Bl8                  Reads
ASIODDWt DS    Bl8                  Writes
*
ASIODDL  Equ   *-ASIODD
```

Session Statistics Section: SESS

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Session statistics data is similar to the data presented at nucleus shutdown or at the DSTAT operator command.

There is one single instance per record. The section has a fixed-length.

Here is a shortened sample of the SESS section:

```
ASSess   DSect ,                    Nucleus session statistics
*
ASSDURA  DS    BL8                  Nucleus Session Duration
ASSWAIT  DS    BL8                  Nucleus Wait Time
ASSCPU   DS    BL8                  Nucleus CPU Time

ASSASR   DS    BL8                  ASSO Reads
ASSASW   DS    BL8                  ASSO Writes

...

ASSBFFE  DS    BL4                  Buffer efficiency .x precision
ASSessL  Equ  *-ASSess             Length of the session section
```

Storage Pool Section: STG

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Storage pool statistics are derived from statistics presented at nucleus shutdown or in response to a DRES operator command. There is one instance for each storage pool with a non-zero size. Be sure to examine the pool name and not rely on any observed order of the instances.

Storage pool statistics are reported two ways: in bytes and also in units such as a user might specify as an ADARUN parameter, for example, NC. When the units are bytes, the two sets of statistics are the same.

Normally an interval record would show the change from the previous interval, but that isn't meaningful for storage pools. Thus the interval and termination record subtypes all reflect total usage for the nucleus session.

```
ASStg    DSect ,                  Storage Pool Usage
ASStgNm  DS    Cl4                Storage pool name
ASStgBSz DS    Bl8                Size in bytes
ASStgBHW DS    Bl8                High water mark in bytes
ASStgUSz DS    Bl8                Size in units from ADARUN parameter
ASStgUHW DS    Bl8                High water mark in ADARUN units
*
ASStgL   Equ   *-ASStg             Length of Storage Pool section
```

These are the possible storage pools:

Storage Pools		
Pool Name	**ADARUN Parameter**	**Description**
AB	NAB	Attached buffers
CQ	NC	Command queue
DUQ	LDEUQP	Unique descriptor
FI	LFP	Internal format buffers
HQ	NH	Hold queue
PLIO	NPLOGBUFFERS	PLOG I/O buffers
REDO	LRDP	Deferred publishing
RPL	LRPL	Replication pool
SC	LCP	Security information
TBI	LI	ISN table
TBS	NQ	Sequential command table
UQ	NU	User queue element
UQF	NU	User queue file elements
WKIO	NWORK1BUFFERS	Work I/O buffers
WORK	LWP	Work

Storage Pools		
Pool Name	**ADARUN Parameter**	**Description**
WKP1	LP	Work part 1
WK1B	CLUWORK1CACHE	Work part 1b
WKP2	LWKP2	Work part 2
WKP3	--	Work part 3
XID	NU	Transaction ID

Thread Activity Section: THRD

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). Thread activity data is derived from data presented at nucleus shutdown or in response to a DTH operator command. The ADARUN parameter NTHREAD defines the number of user threads for the nucleus session. There is one instance for each defined user thread. The thread number is implied by the sequence number of the instance.

```
AShrd   DSect ,                  Thread Activity
AShrdCt DS     Bl8               Number of commands executed in this +
                                   thread
*
AShrdL  Equ   *-AShrd
```

zIIP Statistics Section: ZIIP

This selectable detail section may appear in interval or termination records (subtypes 2 and 3). zIIP activity data is derived from data presented at nucleus shutdown or in response to a DZSTAT operator command. There is one instance for each zIIP-enabled nucleus product.

```
ASzIIP    DSect ,                Nucleus session statistics
*
ASzProd   DS    Cl4              Sub-product name
ASzPNuc    Equ   c'ANUC'          Adabas nucleus main task
ASzPRevL   Equ   c'REVL'          Review local
ASzRsv1   DS    Bl4              Unused
*
ASz2SRB   DS    Bl8              Count of switches to SRB mode
ASz2TCB   DS    Bl8              Count of switches to TCB mode
ASzPAUT   DS    Bl8              Count of pause TCB requests
ASzRLST   DS    Bl8              Count of release TCB requests
ASzPAUS   DS    Bl8              Count of pause SRB requests
ASzRLSS   DS    Bl8              Count of release SRB requests
ASzQPRQ   DS    Bl8              Count of queue parallel requests
ASzXRQE   DS    Bl8              Count of no free RQE for requests
*
ASzNCtr   Equ   64               Number of event counters
ASzCtr    DS    (ASzNCtr)Bl8     Event counters
```

```
*
ASzCPUT   DS    Bl8               CPU time             (STCK format)
ASzZTim   DS    Bl8               zIIP time            (STCK format)
ASzSCPU   DS    Bl8               SRB-on-CPU time      (STCK format)
ASzZQCP   DS    Bl8               zIIP-qualified time  (STCK format)
*
ASzIWait  DS    Bl8               ADAIOR general WAITs
ASzIRlse  DS    Bl8               ADAIOR releases
*
ASzIIPL   Equ  *-ASzIIP           Length of the zIIP section
```

ASMFREC Mapping Macro

Use the ASMFREC macro to generate the latest SMF record DSECTs. The ASMFREC macro will always generate the header and self-defining section DSECT. Detail section DSECTs will be generated as specified. The header and self-defining sections are mapped by a single DSECT. Each detail section is mapped by its own DSECT. The syntax of the ASMFREC macro is:

```
label    ASMFREC   Prefix={AS | prefix},
                                Detail={All | (type [,type]...)},
                                Title = {'Adabas SMF Records' | 'string'}
```

Prefix

Specify a character string to be used as the initial characters for all DSECT and field names. The default is Prefix=AS.

Detail

Identify which detail section DSECTs are to be included in the expansion. "All" is the default and will include all detail sections. Alternatively, a comma-delimited list of types (enclosed in parentheses) can be specified; only the types specified will be included. The valid types are shown in the following table. A null value (Detail=) will inhibit all detail section DSECTs.

ASMFREC Macro Specification	Detail Section Description	ASMFREC DSECT Name Produced by the ASMFREC Macro[1]
CMD	Adabas command activity	*xx*Cmd
CSHB	Adabas global cache activity by block type	*xx*ChB
CSHF	Adabas global cache activity by Adabas file number	*xx*ChF
CSHG	Adabas global cache activity	*xx*ChG
CSHP	Adabas Parallel Services cache activity	*xx*ChP
FILE	Adabas file activity	*xx*File

ASMFREC Macro Specification	Detail Section Description	ASMFREC DSECT Name Produced by the ASMFREC Macro[1]
LOCK	Adabas global lock activity	*xx*Lok
MSGB	Adabas internucleus messaging control block activity	*xx*MsgB
MSGC	Adabas internucleus messaging counts	*xx*MsgC
MSGH	Adabas internucleus messaging service time histogram	*xx*MsgH
PARM	ADARUN parameter values	*xx*Parm
IODD	I/O by DD name	*xx*IODD
SESS	Nucleus session statistics	*xx*Sess
STG	Storage pool	*xx*Stg
THRD	Thread activity	*xx*Thrd
ZIIP	zIIP statistics	*xx*zIIP
USER	User-defined	user-defined

1. Where *xx* is the prefix specified in the ASMFREC macro.

Title

If the Title default "Adabas SMF Record " or another quoted string is specified, an assembler Title statement is generated before the header section DSECT. A null value (Title=) for this operand will inhibit a title in the DSECT.

SMF User Exit

You can provide a user exit if you want to add a detail section to the Adabas SMF record. The user exit is a separate load module whose name must be provided in the ADARUN UEXSMF parameter. For complete information about the user exit, read *SMF User Exit*, in the *Adabas User, Hyperdescriptor, Collation Descriptor, and SMF Exits Manual*.

IBM Type 89 SMF Records

An Adabas nucleus can register with z/OS to have CPU usage statistics included in IBM type 89 SMF records. These records are described in *z/OS MVS System Management Facilities (SMF), IBM document SA22-7630*.

To activate type 89 recording for Adabas, specify ADARUN parameters SMF=YES and SMF89=YES. During initialization Adabas will register the nucleus address space with z/OS SMF and have its CPU statistics included in subtype 1 of the type 89 records. The address space is deregistered at nucleus termination. Each Adabas nucleus appears as a separate type 89 entry.

The type 89 entries include CPU usage and a number of descriptive registration parameters. Adabas nuclei use these descriptive fields in type 89 entries as follows:

SMF Type 89 Descriptive Fields				
Name	**Length**	**Format**	**Description**	**Value**
SMF89UPO	16	EBCDIC	Product owner or vendor name	SOFTWARE AG
SMF89UPN	16	EBCDIC	Product name	ADABAS
SMF89UPV	8	EBCDIC	Product version	The eight-byte product version has two-byte numeric values for the Adabas version, release, SM level, and cumulative level.
SMF89UPQ	8	Binary	Product qualifier	The product qualifier is a seven-byte string that may be used to distinguish among several nucleus instances. It contains a series of binary fields: **SVC** (1 byte) **DBID** (4 bytes) **NucID** (2 bytes) Use both the SVC and DBID to identify instances of Adabas Cluster or Parallel Service nuclei for the same database on any one system.
SMF89UPI	8	EBCDIC	Product ID	The product ID is a string of up to eight single characters to show what add-on products are being used. The characters may appear in any order: **C** (Adabas Cluster Services) **D** (Adabas Delta Save) **F** (Adabas Fastpath) **M** (Adabas Review) **P** (Adabas Parallel Services) **R** (Event Replicator for Adabas) **S** (Adabas Cache Facility) **T** (Adabas Transaction Manager)

SMF Type 89 Descriptive Fields				
Name	**Length**	**Format**	**Description**	**Value**
				U (Adabas Security) **V** (Adabas Vista) The following applies: C, D, P, and R are mutually exclusive. D, F, M, T and V are exclusive with A.

16 Adabas Online System Cluster Environment Screens

This chapter describes the Adabas Online System screens that apply to a cluster environment.

Scrolling through Nucleus IDs in a Cluster

You can use the PF2 key (function key 2) on some cluster environment screens in Adabas Online System (AOS) to scroll through the nuclei in a cluster. This allows you to review the same sets of statistics for each of the nuclei in a cluster.

When you press PF2 on such an AOS screen (or enter the `NextNucid` command), the same screen appears, but with data pertaining to the nucleus with the next highest nucleus ID in the cluster. If there is no higher nucleus ID, AOS cycles back to the beginning and displays the same screen, with data pertaining to the nucleus with the lowest ID in the cluster.

The screens on which this functionality is provided are:

- **Session Monitoring** menu
- **Display Parameters** screen
- **Modify Parameters** screen
- **Queue Displays** menu
- **Display User Queue** screen
- **Resource Utilization** menu

Once the nucleus ID is incremented on any of these screens, it remains in use on all AOS screens until it is changed.

Displaying Cluster Members

From the **Session Monitoring** menu, a new function *Display cluster members* (option A) produces the following screen:

```
14:02:39          *****  A D A B A S   BASIC  SERVICES  *****        2014-05-02
DBID 105                   -  Display Cluster Members  -                PACA002

Total number of nuclei in the cluster: 4
I Sel I Nuc ID I Image ID  I Jobname  I Status   I  Available Plex Services  I
-------------------------------------------------------------------------------
I  _  I  1     I DAEMVS    I ADANUC01 I Active   I  All                       I
I  _  I  2     I DAEMVS    I ADANUC02 I Inactive I  Lock                      I
I  _  I  3     I DDZMVS    I ADANUC03 I Active   I  All                       I
I  _  I  4     I DDZMVS    I ADANUC04 I Active   I  All                       I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I
I     I        I           I          I          I                            I

PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit      Refresh                           Menu
```

The screen includes a list of nuclei participating in the cluster and information about the current status of each nucleus.

To select a nucleus for additional processing

- Type "S" in the Sel column opposite that nucleus.

To display additional information about a nucleus

- Type "D" in the Sel column opposite that nucleus.

For an Adabas cluster nucleus that has a nonzero nucleus ID, its entry in the parallel participant table (PPT) is displayed in a screen similar to the following:

```
14:04:00          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955                    - Display PPT Entry -                    MACA012

NucID ... 1021    Active Nucleus, PLOG(s) not copied, CLOG(s) not copied


 Name    Dataset Status              DataSet Name
 ------  --------------------------  ----------------------------------------
 WORK1                               RD.USAXXX.DB1955.WORKR1
 PLOGR1                              RD.USAXXX.DB1955.PLOGR1
 PLOGR2                              RD.USAXXX.DB1955.PLOGR2
 CLOGR1                              RD.USAXXX.DB1955.CLOGR1
 CLOGR2                              RD.USAXXX.DB1955.CLOGR2









Press 'ENTER', PF3 or PF12 to continue
PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit                                          Menu        ↩
```

Nucleus File Status

From the **Interval Utilization** menu, the *Nucleus file status* (option N) can be used to determine the status of nucleus files. This is the equivalent of the DNFV operator command.

```
14:05:09          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                  - Nucleus File Status -                  PACUN02
NucID 1021

            Locking
      File   NucID  Access count   Update count   State
      -----  -----  -------------  -------------  ----------------------
      29                        0              0  Access
      39                        0              0  Access
      40                        0              0  Access
      41                        0              0  Access
      90                        0              0  Update









 Last page
PF1----- PF2----- PF3----- PF4----- PF7----- PF8----- PF9-------  PF12-----
Help     Repos    Exit     Refresh   -        +                  Menu        ↩
```

In an Adabas cluster environment, the file may be locked for exclusive use by another cluster nucleus. If this is the case and the file is in the nucleus file status table, the Locking NucID column for the file shows the ID of the nucleus that has exclusive control.

The Access count / Update count fields display the number of access or update users, respectively, that refer to the specified file in their user queue elements (UQEs). These users either have specified the file in an OP command with R-option or are using the file in an as yet incomplete transaction.

A State field indicates when the file is used for access only or for access and update. The State field indicates to what extent a nucleus can use a file on its own. If the requested use exceeds the given state, the nucleus must first communicate with the other nuclei in the cluster in order to upgrade the state.

Nucleus Status Flags

From the **Interval Utilization** menu, a second screen , *System status* (option S), displays I/O counts for the ASSO, DATA, WORK, and PLOG data sets; remote and local call distribution; and other current session status information.

```
14:07:19          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955                      -  System Status  -                   PACUS12
NucID: 1021

 Physical    Reads          Writes               Call Distribution
        ------------------------------  ---------------------------------------
 ASSO         7,529             280    No. of HQEs active .........          0
 DATA         4,946              90    No. of UQEs in User Queue ..          1
 WORK             2             379    No. of CQEs waiting in CQ ..          0
 PLOG            15             274    No. of PLOG switches .......          0
 CLOG            29              10    No. of CLOGs ...............          2
                                       No. of PLOGs ...............          2
 PLOG protection blks .         273
 PLOG protection I/Os .         273    Format translations .....         577
 WORK1 protection blks.         379    Format overwrites .......           0
 WORK1 protection I/Os.         379    Auto-restarts ...........          13
                                       Throw-backs for ISN .....           0
 Logical reads ........      35,163    Throw-backs for Space....           0
 Buffer efficiency ....         2.8
                                                                  page 1 of 3

PF1---- PF2---- PF3----- PF4----- PF6----- PF7----- PF8----- PF9----- PF12----
Help            Exit     Refresh                    +        FullView Menu    ↩
```

Pressing PF8 displays another screen of system status information.

```
14:07:19          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955                      -  System Status  -                   PACUS12
NucID: 1021

         Call Distribution                        Commands
-------------------------------------      -----------------------------
User sessions ........          67         Remote ........            0
Buffer flushes .......          91         Local .........        8,573
Flush phases .........          91         Internal ......        6,122
Blocks flushed .......         360         Operator ......            0
Flush I/Os ...........         360         Total .........       14,695


       Flush Requests Returned                    Time Elapsed
-------------------------------------      ---------------------------------
Immediately ..........           1         Duration .... 3 days, 17:33:36
After logical flush ..           0         Wait-time ... 3 days, 17:33:25
After entire flush ...          98         CPU time .... 0 day, 00:00:39

                                                                  page 2 of 3

PF1---- PF2---- PF3----- PF4----- PF6----- PF7----- PF8----- PF9----- PF12----
Help            Exit     Refresh             -        +        FullView Menu    ↩
```

Pressing PF8 again displays an additional screen that indicates if one or more of the following are in progress:

- Online database save running;
- ADAEND in progress;
- Online file save running;
- READONLY/UTIONLY transition;
- READONLY status;
- Update processing suspended;
- ET-sync in progress;
- UTIONLY status; and
- Exclusive-DB-control utility running.

Otherwise, "Adabas operation normal" is displayed.

```
14:07:19          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955                      -  System Status  -                  PACUS12
NucID: 1021

                            Nucleus Status Flags
                        -----------------------------------
                        Adabas operation normal

                                                                    page 3 of 3

PF1---- PF2---- PF3----- PF4----- PF6----- PF7----- PF8----- PF9----- PF12----
Help            Exit     Refresh           -                FullView Menu    ↩
```

Cluster Usage

From the **Session Monitoring** menu, *Cluster usage* (option X) displays nucleus cluster statistics that are equivalent of those displayed using the DXCACHE, DXLOCK, and DXFILE operator commands.

The equivalent direct command is:

```
DISPLAY CLUSTERSTATUS
```

```
14:09:48          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
                              -  Cluster Usage -                    PACUX02

                       Code    Service
                       ----    ----------------
                        C      Cache statistics
                        F      File statistics
                        L      Lock statistics
                        ?      Help
                        .      Exit
                       ----    ----------------
          Code ......... _
          File Number .. 29
          Database ID .. 1955   (WIS1955)            NucID .. 1021




Command ==>
PF1----- PF2----- PF3------ PF4------ PF6----- PF9----- PF10----- PF12-----
Help             Exit                         Fuse     Flist     Menu       ↩
```

This section covers the following topics:

- Cache Statistics
- File Statistics

- Lock Statistics

Cache Statistics

Choosing *cache statistics* (option C) from the Cluster Usage menu displays the following menu:

```
14:10:10          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
                            - Cache Statistics -                   PACUX12

                  Code   Service
                  ----   ----------------------
                    K    Cast-out / Directory
                    P    Publishing requests
                    X    Individual cache blocks
                    .    Exit
                    ?    Help
                  ----   ----------------------

     Code ......... _
     Database ID .. 1955   (WIS1955)            NucID .. 1021









PF1----- PF2----- PF3----- PF4------ PF6----- PF7----- PF8-----  PF12-----
Help              Exit     Refresh                               Menu         ↩
```

The rest of this section describes each of the options on this screen.

- Cast-out / Directory
- Publishing Requests
- All Cache Blocks

Cast-out / Directory

Choosing *cast-out / directory* (option K) from the Cache Statistics menu display the following:

```
14:10:10          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                  - Cast-out / Directory -                  PACUX12
NucID 1021

        Cast-out Directory Reads          Directory Reads
        --------------------------        --------------------------
        Total .......         182         Total .......          10
           Sync .....         107            Sync .....           0
           Async ....          75            Async ....          10

        Unlock Cast-out Calls
        --------------------------
        Total .......          91
           Sync .....           0
           Async ....          91




PF1----- PF2----- PF3----- PF4----- PF7----- PF8----- PF9-------  PF12-----
Help             Exit     Refresh                   Detail      Menu        ↩
```

Counters have a multiplier column with the following values:

Value	The total shown is in . . .
blank	(factor of 1)
K	kilo (factor of 1,000)
M	mega (factor of 1,000,000)
G	giga (factor of 1,000,000,000)

If a number has a multiplier shown, it has been divided by the multiplier, showing the significant digits to 9 places with no decimal point.

Press PF9 to see the entire value. This value is the exact count up to 20 digits in length.

Publishing Requests

Choosing *publishing requests* (option P) from the Cache Statistics menu display the following:

```
14:11:14          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                  - Publishing Requests -                  PACUX12
NucID 1021

                     Publishing Request Category
                     ---------------------------------
                     Update sync .......          91
                     BT or CL or ET ....           3
                     Redo threshold ....           0
                     Full bufferpool ...           0
                     All blocks ........          97
                     Specific RABN .....           0
                     File DS blocks ....           0
                     All DSST blocks ...          90
                     File NI blocks ....           0









PF1----- PF2----- PF3----- PF4----- PF7----- PF8----- PF9-------  PF12-----
Help              Exit     Refresh                   Detail      Menu        ↩
```

All Cache Blocks

Choosing *all cache blocks* (option X) from the Cache Statistics menu display the following:

```
14:11:54          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                   - All Cache Blocks -                    PACUX12
NucID 1021
  Reads                                Writes
  ---------------------------------    ---------------------------------
  Total ............       7,460       Total ..............         373
     Sync ..........       1,241          Sync ............         179
     Async .........       6,219          Async ...........         194

     In cache ......         105          Written .........         373
     Not in cache ..       7,355          Not written .....           0
     Struc. full ...           0          Struc. full .....           0

  Cast-out Reads                       Other
  ---------------------------------    ---------------------------------
  Total ............         360       Validates ..........      44,877
     Sync ..........         360          Invalid .........           0
     Async .........           0       Deletes ............           0
                                          Timeouts ........           0
                                       Redo processes .....           0

PF1----- PF2----- PF3----- PF4----- PF7----- PF8----- PF9-------  PF12-----
Help     Repos    Exit     Refresh  PrevBlk  NxtBlk   Detail      Menu        ↩
```

Use PF7 and PF8 to scroll through the cache blocks; use PF2 to reposition.

Statistics are displayed for the following:

- All cache blocks
- Address converter (AC) cache blocks
- Data Storage (DS) cache blocks
- Data Storage space table (DSST) cache blocks
- File control block (FCB) cache blocks
- Normal index (NI) cache blocks
- Upper index (UI) cache blocks

Press PF9 from the above screen to display the following detail screen:

```
14:11:54          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                  - All Cache Blocks -                    PACUX12
NucID 1021
Reads                                Writes
------------------------------------ ----------------------------------------
Total ......                  7,460 Total .......                         373
  Sync .....                  1,241   Sync ......                         179
  Async ....                  6,219   Async .....                         194

  In cache..                    105   Written ...                         373
  Not in ...                  7,355   Not writ ..                           0
  Stru.full.                      0   Stru.full .                           0

Cast-out Reads                       Other
------------------------------------ ----------------------------------------
Total ......                    360 Validates ...                      44,877
  Sync .....                    360   Invalid ...                           0
  Async ....                      0 Deletes .....                           0
                                      Timeouts ..                           0
                                    Redo procs ..                           0


                                  Press Enter to continue                ↩
```

File Statistics

Choosing *file statistics* (option F) from the Cluster Usage menu for file 25 displays the following menu:

```
14:12:42          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                - File 29 Statistics -                    PACUX22
NucID 1021
  Reads                                 Writes
  --------------------------------      ------------------------------------
  Total ............           5        Total ..............           0
     Sync ..........           0           Sync ............           0
     Async .........           5           Async ...........           0

     In cache ......           0           Written .........           0
     Not in cache ..           5           Not written .....           0
     Struc. full ...           0           Struc. full .....           0

  Cast-out Reads                        Other
  --------------------------------      ------------------------------------
  Total ............           0        Validates ..........          12
     Sync ..........           0           Invalid .........           0
     Async .........           0        Deletes ............           0
                                           Timeouts ........           0
                                        Redo processes .....           0

PF1-----  PF2-----  PF3-----  PF4-----  PF7-----  PF8-----  PF9-------  PF12-----
Help      Repos     Exit      Refresh                       Detail      Menu        ↩
```

Lock Statistics

Choosing *lock statistics* (option L) from the Cluster Usage menu displays the following menu:

```
14:13:03          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
                             - Lock Statistics -                   PACUX39

Code  Service              Code  Service              Code  Service
----  -------------------  ----  -------------------  ----  -------------------
  A   Buffer flush           L   Global ET sync         W   Replicat handshake
  B   Cancel                 M   Glbl upd cmd sync      X   Security
  C   Checkpoint             N   Hold ISN               Y   Spats
  D   Container              O   LOB tracker            Z   Unique descriptor
  E   Delta Save (DSF)       P   Net-wrk DBID asgmt     1   User
  F   Distributed tranID     Q   New-Data-RABN          2   Wkpt4 RABN index
  G   ETID                   R   Online save            3   Wkpt4 PET user tbl
  H   File-lock-table        S   Parameter              .   Exit
  I   Format-addr-conver     T   Record read            ?   Help
  J   Free space table       U   Recovery (online)
  K   GCB                    V   Recovery log(RLOG)
----  -------------------  ----  -------------------  ----  -------------------
             Code ......... _
             Database ID .. 1955   (WIS1955)             NucID .. 1021


PF1----- PF2----- PF3------ PF4------ PF6----- PF7------ PF8----- PF12-----
Help             Exit      Refresh                              Menu
Û                                                               19,031      ↩
```

Each of the options on the Lock Statistics menu displays statistics for a particular lock. For each lock, the screen displays obtain and release information about the various types of that lock that are currently in use by a cluster nucleus:

- The system may obtain locks conditionally or unconditionally, synchronously or asynchronously. A conditional request for a lock may be granted or rejected.
- Releases may be performed synchronously or asynchronously.

Hold ISN Lock

Choosing *hold ISN lock* (option J) from the Lock Statistics menu displays the following:

```
14:13:03          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID  1955                    - Hold ISN Lock -                     PACUX39
NucID 1021

     Obtains                                Alters
     ------------------------------         ------------------------------------
     Conditional ....            91         Conditional ..........             0
        Granted .....            91           Granted ............             0
        Rejected ....             0           Rejected ...........             0
     Unconditional ..             0         Unconditional ........             0
                                              Rejected-deadlock ..             0
     Sync ...........             3
     Async ..........            88         Sync .................             0
                                            Async ................             0
     Releases
     ------------------------------
     Issued .........            91
        Sync ........             8
        Async .......            83


PF1----- PF2----- PF3------ PF4------ PF6----- PF7------ PF8----- PF12-----
Help     Repos    Exit      Refresh            PrevLok   NxtLok   Menu        ↩
```

Use PF7 and PF8 to scroll through the locks; use PF2 to reposition.

Estimating Sizes for the Cache Structure in a Cluster Environment

These instructions describe how to use the structure size calculator to estimate the size for the cache structure in a cluster environment. The cache structure should be made large enough to provide sufficient space for:

- Tracking all blocks kept in the buffer pools of all connected cluster nuclei (directory elements) and
- Keeping all changed blocks until they are written to the database (data elements).

The assignment of total cache space into directory and data elements is done via the `DIRRATIO` and `ELEMENTRATIO` ADARUN parameters.

The actual cache structure size value is dependent on coupling facility internals and may vary across different coupling facility levels. If the estimates by this structure size calculator are too far off the real allocations reported by cluster nuclei, you can tweak the directory element size value to bring the calculator more in line with the actual coupling facility being used.

To access and use the space calculator for the cache structure in a cluster environment

1 Select option **S** on the **Basic Services Main Menu** in AOS.

The **Space Calculation** menu appears.

```
14:15:27          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
                            -  Space Calculation  -                PSP0002

                             Code    Service
                             ----    ------------------
                              A      ASSO
                              C      Cluster-Cache/Lock
                              D      DATA
                              F      DDFILEA
                              S      SORT
                              T      TEMP
                              W      WORK
                              ?      Help
                              .      Exit
                             ----    ------------------
                Code .......... _
                Database ID ... 1955   (WIS1955)



Command ==>
PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit                                        Menu       ↩
```

2 Select option **C** on the **Space Calculation** menu.

The **Cache Structure Calculator** panel appears.

```
14:17:34          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955              -  Cache Structure Calculator  -              PSPC002

Smallest block size in DB ....... 2544
Largest block size in DB ........ 5724
Buffer pool size (LBP) .......... 80896_______
Size proper for caching blocks .. 100000______
Max nuclei in cluster ........... 3
Directory element size .......... 400
Cache structure size (in KB) .... _________

For minimum calculation, leave cache structure size field empty.
Modify values, press Enter to provide estimates below.

Cache CFRM SIZE/INITSIZE ........ 2650        ( 2.5        MB)
ADARUN DIRRATIO ................. 67
ADARUN ELEMENTRATIO ............. 48
Cache directory elements ........ 135
Cache data elements ............. 97
Cache data element size ......... 1024

PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit      Lock                               Menu        ↩
```

3 Specify values for the following fields on the **Cache Structure Calculator** panel.

Field	Description	Default
Smallest block size	Specify a value between 1024 and 32768 bytes.	The smallest block size of the current Adabas Online System database ID.
Largest block size	Specify a value between 1024 and 32768 bytes. If the value of the **Smallest block size** field exceeds this value, then the **Smallest block size** value is swapped in.	The largest block size of the current Adabas Online System database ID.
Buffer pool size	Specify a value between 80,000 and 999,999,999,999 bytes.	The value of the `LBP` parameter setting for the current Adabas Online System database ID.
Size proper for caching blocks	Specify a value between 100000 - 999,999,999,999 bytes.	The `LBP` parameter of the current Adabas Online System database ID, rounded down to nearest 100000. "Size proper" means that this does not include the overhead in the cache structure required for administering these blocks. Thus, this value specifies how much space should be available in the cache structure for keeping changed blocks between buffer flushes and for buffering blocks so that the cluster nuclei do not have to read them from the database.

Field	Description	Default
Max Nuclei in cluster	Specify a value between 2 and 32.	3
Directory element size	Specify a value between 100 and 999 bytes. This value specifies how much space (including the overhead for the access paths) will be used in the cache structure by each directory element.	400
Cache Structure size	Specify a blank for the minimum calculation or specify a value between 100 and 999,999,999 (KB). Although this value is given as an output field, you may want to propose a cache structure size, to see how to allocate the cache space (directory and data elements).	blank

4 Press Enter after all values in the previous step are specified.

The following output fields on the screen are filled.

Field	Description
Cache CFRM SIZE/INITSIZE	The recommended cache structure `SIZE` or `INITSIZE` specification in the coupling facility resource management policy.
ADARUN DIRRATIO	The recommended ADARUN `DIRRATIO` parameter settings for the cluster nuclei.
ADARUN ELEMENTRATIO	The recommended ADARUN `ELEMENTRATIO` parameter settings for the cluster nuclei.
Cache directory	The estimated directory and data element counts resulting from the `SIZE/INITSIZE` and `DIRRATIO` settings.
Cache data elements	The estimated directory and data element counts resulting from the `SIZE/INITSIZE` and `ELEMENTRATIO` settings.
Cache data element size	This (accurate) value depends only on the largest Asso/Data/Work block size in the database.

Estimating Sizes for the Lock Structure in a Cluster Environment

These instructions describe how to use the structure size calculator to estimate the size for the lock structure in a cluster environment. The lock structure should be made large enough to provide sufficient space for:

- Keeping the lock record elements for all locks held at the same time, and
- Avoiding too much false contention between locks on different resources.

The number of lock table entries and record elements are shown in the results for comparison with the related cluster nucleus message (ADAX70) and to aid your own calculations.

The actual lock structure size value is dependent on coupling facility internals and may vary across different coupling facility levels. If the estimates by this structure size calculator are too far off the real allocations reported by cluster nuclei, you can tweak the lock record element size value to bring the calculator more in line with the actual coupling facility being used.

To access and use the space calculator for the lock structure in a cluster environment

1 Select option **S** on the **Basic Services Main Menu** in AOS.

The **Space Calculation** menu appears.

2 Select option **C** on the **Space Calculation** menu.

The **Cache Structure Calculator** panel appears.

```
14:17:34          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955              -  Cache Structure Calculator  -              PSPC002

Smallest block size in DB ....... 2544
Largest block size in DB ........ 5724
Buffer pool size (LBP) .......... 80896_______
Size proper for caching blocks .. 100000______
Max nuclei in cluster ........... 3
Directory element size .......... 400
Cache structure size (in KB) .... _________

For minimum calculation, leave cache structure size field empty.
Modify values, press Enter to provide estimates below.

Cache CFRM SIZE/INITSIZE ........ 2650        ( 2.5        MB)
ADARUN DIRRATIO ................. 67
ADARUN ELEMENTRATIO ............. 48
Cache directory elements ........ 135
Cache data elements ............. 97
Cache data element size ......... 1024

PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit      Lock                                Menu       ↩
```

3 Press PF4 to access the **Lock Structure Calculator** panel:

```
14:16:57          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
DBID 1955              -  Lock Structure Calculator  -              PSPL002

Max files in database (MAXFILES) ...... 1000
Max number of parallel users (NU) ..... 200_____
Number of hold queue elements (NH) .... 800
Number of threads (NT) ................ 25
Unique descriptor pool size (LDEUQP) .. 50000
Lock record element size .............. 260
Lock structure size (in KB) ...........

For minimum calculation, leave lock structure size field empty.
Modify values, press Enter to provide estimates below.

Lock CFRM SIZE/INITSIZE ............... 1478786   ( 1444.1    MB)
Number of lock table entries .......... 16777216
Number of lock record elements ........ 5305996    Required min .. 5240000




PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit      Cache                               Menu       ↩
```

4 Specify values for the following fields on the **Lock Structure Calculator** panel.

Field	Description	Default
Max files in database	Specify a value between 3 and 5000. This is the same as the MAXFILES parameter of the ADADEF and ADAORD utilities.	The MAXFILES parameter setting of the current AOS database ID.
Max number of parallel users	Specify a value between 20 and 16,777,215.	The NU parameter setting of the current AOS database ID.
Number of hold queue elements	Specify a value between 20 and 16,777.215. .	The NH parameter setting of the current AOS database ID.
Unique descriptor pool size	Specify a value between 1 and 999,999,999.	The LDEUQP parameter setting of the current AOS database ID.
Lock record element size	Specify a value between 100 and 999. This parameter specifies how much space (including the overhead for the access paths) will be used by each lock record element in the lock structure.	260
Lock structure size	Specify a blank for the minimum calculation or specify a value between 100 and 999,999,999 (KB). Although this value is given as an output field, you may want to propose a lock structure size, to see how to allocate the lock table entries and lock table elements.	blank

5 Press Enter after all values in the previous step are specified.

The following output fields on the screen are filled.

Field	Description
Lock CFRM SIZE/INITSIZE	The recommended lock structure SIZE or INITSIZE specification in the coupling facility resource management policy.
Number of lock table entries	The calculated count of lock table entries resulting from the SIZE/INITSIZE setting.
Number of lock record elements	The estimated count of lock record elements resulting from the SIZE/INITSIZE setting. You must actually start a cluster nucleus with the specified parameters to see how many lock record elements it gets from the lock structure. The number on the right side is the minimum number of lock record elements required to be available by the starting cluster nuclei.

Maintain the User Table

Note: This option is available in Adabas nucleus cluster environments only.

A new function has been added to the **Session Opercoms** menu to support the CLUFREEUSER command. When option V (User Table Maintenance) is selected, the following screen is displayed:

```
15:10:47          ***** A D A B A S  BASIC  SERVICES *****          2014-05-02
                        - User Table Maintenance -                 PACIV02

                     Code    Service
                     ----    -------------------------
                      C      Begin CLUFREEUSER process
                      ?      Help
                      .      Exit
                     ----    -------------------------

         Code ......... _
         TNA .......... 0______
         UID .......... ____________________
         Force ........ _
         Global ....... _

         Database ID .. 1955  (WIS1955)              NucID .. 1021




Command ==>
PF1----- PF2------ PF3------ PF4------ PF6----- PF7----- PF8----- PF12-----
Help               Exit                                        Menu       ↩
```

The CLUFREEUSER command is only valid in cluster environments. It can be issued against the local nucleus only or, with the Global option, against all active and inactive nuclei in the cluster.

The command is used to delete leftover user table elements (UTEs) in common storage that are no longer associated with user queue elements (UQEs) in a nucleus where

TNA	is a decimal number specifying the timeout value in seconds. UTEs that are not used during the time specified may be deleted if other conditions are fulfilled. If TNA is not specified, UTEs may be deleted without regard to their recent use.	
UID	is a character string or hexadecimal byte string as follows:	
	cccccccc	where the argument is 1-8 letters, digits, or embedded '-' signs without surrounding apostrophes.
	'cccccccc'	where the argument is 1-8 characters with surrounding apostrophes.

	X'xxxxxxxxxxxxxxxx'	where the argument is an even number of 2-16 hexadecimal digits enclosed by X' '.
	A character string must be enclosed in apostrophes if it contains characters other than letter, digits, or embedded '-' signs. If a specified character string is less than 8 characters long, it is implicitly padded with blanks. If a specified hexadecimal string is shorter than 16 hexadecimal digits, it is implicitly padded with binary zeros. If the last 8 bytes of a user's 28-byte communication ID match a specific user ID or user ID prefix, that user's UTE may be deleted if other conditions are fulfilled. If UID not specified, UTEs may be deleted regardless of their user IDs.	
FORCE	Delete leftover UTEs even if the users are due a response code 9 (ADARSP009), subcode 20. If FORCE is not specified, such UTEs are not deleted. Before using the `FORCE` parameter, ensure that the users owning the UTEs to be deleted will not expect any of their transactions to remain open. Specify FORCE on this screen by marking the Force field with any character.	
GLOBAL	Delete leftover UTEs throughout the Adabas cluster if they are no longer associated with UQEs and are eligible according to the other specified parameters. Additionally and subject to the other rules, delete leftover UTEs if their assigned nuclei have terminated since their last use. If GLOBAL is not specified, only UTEs assigned to the local nucleus and used since the nucleus start are eligible for deletion. Specify GLOBAL on this screen by marking the Global field with any character.	

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