Publication Changes for APAR OA68733

In this document, changes introduced for APAR OA68733 are highlighted in green (or blue for major section headings) and updates for editorial corrections or support missing from previous releases are highlighted in purple. Changes introduced for APAR OA65820 that were not included in a prior IBM publication continuous delivery refresh and are relevant to the non-disruptive structure copy support provided by OA68733 are highlighted in orange, Text in [brackets] is for orientation purposes, indicating where and what changes are made.

z/OS MVS Setting Up a Sysplex (SA23-1399)

Summary of changes:

- New section describing the overall behavior of non-disruptive structure copy
- Formatting the CFRM couple data set to support non-disruptive structure copy
- Updating the CFRM policy to exploit non-disruptive structure copy
- Editorial corrections

Non-Disruptive Structure Copy Overview

[In Chapter 4 “Managing Coupling Facility Resources,” the following new section is added after existing section “An Installation Guide to Duplexing Rebuild”.]

Exploiting Non-Disruptive Structure Copy

Non-disruptive structure copy is a modification of the structure copy protocol used during a system-managed process (rebuild or duplexing rebuild) that reduces the time during which the rebuilding structure is unavailable to structure connectors. For certain lock structures, it may improve application throughput and reduce the elapsed time required to complete a system-managed process.

During a system-managed process, the system allocates a secondary instance of the structure and copies the contents of the primary instance into the secondary. In the original copy protocol, z/OS systems read the objects to be copied from the primary instance and then write them to the secondary. This protocol requires that structure activity be quiesced for the duration of the system-managed process to ensure that structure contents do not change.

In contrast, the non-disruptive structure copy protocol permits structure activity to resume after an initial quiesced period, so that the rebuild process is less disruptive to applications. In this protocol, the coupling facility housing the primary structure instance is responsible for “pushing” object state change information to the secondary coupling facility, and the secondary facility applies the changes to the secondary structure. This push process can tolerate ongoing arrival of application requests while the copy process is in progress and therefore does not require that the structure remain quiesced during the copy. Moreover, it is generally faster than the original read/write protocol managed by z/OS.

Understanding Non-Disruptive Structure Copy Requirements

The non-disruptive structure copy protocol exploits the coupling facility and z/OS infrastructure associated with asynchronous duplexing, so its hardware and software requirements are similar to those described in section “Understanding System-Managed Duplexing Rebuild Requirements” for asynchronous duplexing.

Hardware Requirements

- **Coupling facility:** Non-disruptive structure copy requires that the primary coupling facility be at or above CFLEVEL 26 with a service level of 00.43. The secondary coupling facility must be at or above

CFLEVEL 21.

- **CF-to-CF links:** Non-disruptive structure copy places the structure in an interim state similar to asynchronous duplexing, even when the system-managed process itself is a non-duplexing rebuild. Therefore, it has the same CF-to-CF connectivity requirements as system-managed duplexing. The link connectivity between the coupling facilities must be bidirectional, and there should be more than one link providing CF-to-CF connectivity in each direction for highest availability.

- **Coupling capacity:** During non-disruptive structure copy, the primary and secondary coupling facilities are handling a higher-than-normal workload. They are processing both the application workload and the internal commands required to push the primary structure contents to the secondary. Any incoming application commands that change the structure are duplexed and must also be pushed to the secondary. Thus, there is both greater coupling facility processor consumption and greater CF-to-CF signal traffic. The installation must ensure that the coupling facility configuration is capable of handling this temporarily-increased workload.

Software Requirements

- **z/OS level:** All systems in the sysplex must have APAR OA68733 installed, either as a PTF or in the base. PTFs for OA68733 are available at z/OS 3.2, 3.1, and V2R5.

- **Application level:** Applications owning structures for which non-disruptive structure copy has been enabled by the installation may require updates to accommodate a changed connector event delivery sequence.

Deciding Whether to Exploit Non-Disruptive Structure Copy

Because non-disruptive structure copy exploits the asynchronous duplexing infrastructure, it applies only to lock structures. List and cache structures are not eligible and continue to use the original copy protocol.

Non-disruptive structure copy applies only during system-managed processes. If an application supports both user-managed rebuild and system-managed processes, a non-duplexing rebuild will exploit the user-managed protocol rather than the system-managed. Most IBM middleware products that create lock structures do support user-managed rebuild. That means that the system-managed protocol, and non-disruptive structure copy, would only come into play during duplexing rebuilds, or in the relatively uncommon case of non-duplexing rebuild with no active connectors.

The purpose of non-disruptive structure copy is to reduce the elapsed time during which the rebuilding structure is quiesced and therefore unavailable to structure connectors. It is expected to provide the most value for large, heavily-populated structures that would normally require longer times to copy, and for which the quiesced period enforced by the original copy protocol imposes a significant throughput penalty.

Non-disruptive structure copy applies to both duplexing and non-duplexing rebuild, so it can be of value even for structures that are not defined in the CFRM active policy as eligible for duplexing. While an installation may have concluded that a particular structure does not require the enhanced reliability provided by duplexing, the structure can still exploit non-disruptive structure copy as long as the coupling configuration and CFRM active policy preference list allow it to enter the intermediate duplexing-like state required for copying the structure.

Controlling the Use of Non-Disruptive Structure Copy

To exploit non-disruptive structure copy, all systems in the sysplex must be at a level that supports that protocol. That requirement is enforced by requiring the use of a new version of the CFRM couple data set. Format primary and alternate CFRM couple data sets to support non-disruptive structure copy by specifying ITEM NAME(VERSION) NUMBER(11) in the IXCL1DSU format utility input (see section

“CFRM Parameters for Format Utility”). Bring those data sets into service using the SETXCF COUPLE command. Once that is done, only systems with the function provided by OA68733 can exist in or join the sysplex.

The installation controls the use of non-disruptive structure copy on a structure-by-structure basis. To permit the use of non-disruptive structure copy for a specific structure, specify NDCOPY(YES) in that structure’s CFRM policy definition. See section “CFRM Parameters for Administrative Data Utility”.

Migration Steps

1. Ensure that all systems in the sysplex are z/OS V2R5 or higher and install OA68733 on all systems.

2. Ensure that the coupling configuration contains coupling facilities at the required CFLEVEL and service level and with sufficient capacity and CF-to-CF connectivity to support non-disruptive structure copy.

3. Format primary and alternate CFRM couple data sets to support non-disruptive structure copy as described in the previous section. Bring the new couple data sets into use with the following sequence of commands:

   SETXCF COUPLE,TYPE=CFRM,ACOUPLE=[dsname of version 11 new primary CFRM CDS]

   SETXCF COUPLE,TYPE=CFRM,PSWITCH

   SETXCF COUPLE,TYPE=CFRM,ACOUPLE=[dsname of version 11 new alternate CFRM CDS]

4. Evaluate the effectiveness of exploiting non-disruptive structure copy for each candidate structure.

   a. If the structure-owning application requires an update to support non-disruptive structure copy, migrate all instances of that application to the appropriate level.

   b. Use the IXCMIAPU utility to create or modify a CFRM policy that enables the structure to participate in non-disruptive structure copy.

      1) If necessary, update the structure SIZE specification to reflect the requirement for the coupling facility internal controls required for non-disruptive structure copy. The controls required are the same as those required for asynchronous duplexing, so if the policy specifies the duplexing options ASYNC or ASYNCONLY, then presumably the policy SIZE already reflects the requirement for those controls. Use the z/OSMF Sysplex Management service or the CFSizer tool (at https://www.ibm.com/support/pages/cfsizer) to determine the correct structure size.

      2) Add keyword NDCOPY(YES) to the policy specification for the structure.

      3) Update the structure preference list to specify coupling facilities with the required CFLEVEL and CF-to-CF connectivity.

      4) Start the policy to make it active in the sysplex. It will be necessary to rebuild the structure to activate the new policy if it either (1) changes the structure size or (2) introduces the first requirement for the internal controls used for non-disruptive structure copy (that is, the old policy did not specify the duplexing options that permit asynchronous duplexing), In the latter case, where the existing structure does not have the internal controls, the rebuild that activates the policy will not use non-disruptive structure copy.

   Continue this process on a structure-by-structure basis until all structures intended to be enabled for non-disruptive structure copy have been deployed.

Overview of Non-Disruptive Structure Copy Processing

CFRM does not determine whether a system-managed process will exploit non-disruptive structure copy processing until it prepares to allocate the new secondary structure, so the processing is unchanged up to that point. As in the original protocol, connectors are notified that the structure will be temporarily unavailable and the structure is quiesced when all connectors have responded. After allocating the secondary structure, the system places the primary and secondary structures in a copy-in-progress state resembling asynchronous duplexing. The primary coupling facility begins propagating structure object state information to the secondary facility, and the secondary facility applies those updates to the secondary structure instance.

Meanwhile, the system-managed process continues through the Attach phase to the Copy phase. At that point, the structure is unquiesced. The system presents the Structure Available event to connector event exits and connectors can resume initiating requests. The primary and secondary coupling facilities cooperate to apply the updates represented by the connector requests in parallel with the ongoing background copy activity. z/OS monitors copy progress by periodically querying the primary coupling facility.

When the coupling facility reports the background copy process to be complete, the system-managed process enters a synchronization subphase of the Copy phase. As in asynchronous duplexing, the secondary structure state lags the primary state, and the secondary must catch up before the system-managed process can continue. Connector activity is once again quiesced to prevent further state changes. No event is presented to connectors for this quiesce. z/OS monitors synchronization progress by periodically querying the secondary coupling facility.

When the two structure instances are observed to be in synchronization, the system transitions the pair of structures to the state appropriate to the type of system-managed process being executed. For a non-duplexing rebuild, the copy-in-progress state is terminated in the secondary structure instance and the primary structure is deallocated. For a synchronous duplexing rebuild, the copy-in-progress state is terminated in both primary and secondary structures, and they are placed in the synchronous duplexing state. For an asynchronous duplexing rebuild, the two structures are already in a suitable state and no additional action is required. Finally, connector structure access is restored and the system-managed process completes normally.

CFLEVEL Functionality – CFLEVEL 26

[In Chapter 4 “Managing Coupling Facility Resources” -
“Planning for a coupling facility” -
“Defining a coupling facility” -
“Understanding the coupling facility level (CFLEVEL)” -
“CFLEVEL and operating system level coexistence”]

Update the section with a brief summary of CFLEVEL 26 function.

After:

25
With a PTF for APAR OA60650, in conjunction with CFCC CFLEVEL 25…

Add:

26

With a PTF for APAR OA68733, in conjunction with CFCC CFLEVEL 26 service level 00.43:

- Non-Disruptive Structure Copy (NDSC)

  A new protocol for propagating the contents of the primary structure to the secondary structure during a system-managed rebuild or duplexing rebuild. With the standard system-managed copy protocol, structure activity is quiesced and the structure is not accessible to the owning application for the duration of the copy process. With NDSC, the structure remains accessible during copy and connectors can continue to drive requests to the coupling facility. NDSC applies only to lock structures.

Formatting the CFRM Couple Data Set To Support Non-Disruptive Structure Copy

[Chapter 11 “Format Utility for Couple Data Sets”
“Coding the Couple Data Set Format Utility”
“CFRM Parameters for Format Utility”

This APAR defines a new VERSION keyword for the CFRM input to the IXCL1DSU format utility.]

When formatting the couple data set to support CFRM policy data, the value that is specified for MAXSYSTEM should match the value that is specified for MAXSYSTEM when formatting the sysplex couple data sets. For a CFRM couple data set — i.e., DATA TYPE(CFRM) — valid data names are POLICY, CF, STR, CONNECT, SMREBLD, SMDUPLEX, MSGBASED, ASYNCDUPLEX, and VERSION.

. . .

ITEM NAME(ASYNCDUPLEX) NUMBER(1)

. . .

ITEM NAME(VERSION) NUMBER( )

Specifies the version of a CFRM couple data set to format.

When a version is specified, the couple data set is formatted for all functions associated with the specified version and all earlier functions regardless of whether the function keywords were explicitly specified to the format utility. For example, when the CFRM couple data set is formatted with NAME(VERSION) NUMBER(9), it implies specification of asynchronous duplexing rebuild (ASYNCDUPLEX), system-managed rebuild (SMREBLD), system-managed duplexing rebuild (SMDUPLEX), and message-based processing (MSGBASED), regardless of whether those functions were explicitly specified.

When VERSION is not specified, the format utility will determine the version from the format utility input parameters.

(Default=Version required by the function(s) for which the couple data set is being formatted, Minimum=1, Maximum=11)

Considerations for supporting CFRM functions

. . .

Table 26. Support for CFRM function

Function	Data Name	Notes

	(Note 2)	
Non-disruptive structure copy for system-managed rebuild or duplexing rebuild	VERSION(11)	Minimum release supported: z/OS V2R5 with APAR OA68733. A VERSION(11) or higher CFRM CDS is required to define a CFRM policy that specifies the NDCOPY keyword for any structure.
Version 10 of the CFRM couple data set has been deprecated. If VERSION(10) is explicitly coded, it will produce function equivalent to VERSION(9).		
System-managed asynchronous duplexing rebuild	ASYNCDUPLEX or VERSION(9)	
> 1024 structure definitions	STR or VERSION(8)	
Message-based processing	MSGBASED or VERSION(7)	
> 512 structure definitions	STR or VERSION(6)	
System-managed duplexing rebuild	SMDUPLEX or VERSION(5)	
System-managed rebuild	SMREBLD or VERSION(4)	
> 255 structure definitions	STR or VERSION(3)	

General notes:

1. A CFRM CDS is formatted at a specific version either by explicit specification of the VERSION keyword or by specification of a named data item implying that version. For example:

   a. Specifying either
   NAME(ASYNCDUPLEX) NUMBER(1)
   or
   NAME(VERSION) NUMBER(9)
   results in a version 9 CDS.

   b. Specifying either
   NAME(STR) NUMBER(600)
   or
   NAME(VERSION) NUMBER(6)
   results in a version 6 CDS.

   If the VERSION keyword specifies a value higher than required by other data items, the VERSION specification determines the effective CDS version number.

2. The VERSION(n) value specified in the table is shorthand for ITEM NAME(VERSION) NUMBER(n). It defines the minimum VERSION specification that provides the function described by the table row. All higher VERSION values also provide that function.

3. When a CFRM CDS is formatted at a specific version, the CDS also supports all function provided by earlier versions, regardless of whether keywords associated with the earlier versions were explicitly specified. For example, NAME(VERSION) NUMBER(9) or ASYNCDUPLEX implies support for all functions provided by NAME(VERSION) NUMBER(8) or below and for all functions provided by the MSGBASED, SMDUPLEX, and SMREBLD data items.

4. Specifying both a functional keyword such as ASYNCDUPLEX or MSGBASED, or a STR value that implies a particular version, in combination with an explicit VERSION value lower than the version implied by the keyword or STR value, is an error. For example, you cannot specify MSGBASED with NAME(VERSION) NUMBER(6), or STR(1025) with NAME(VERSION) NUMBER(7).

Updating the CFRM policy to exploit non-disruptive structure copy

[Chapter 12 "Administrative Data Utility"
"Coding the Administrative Data Utility"
"CFRM Parameters for Administrative Data Utility"

This APAR defines a new NDCOPY keyword for the CFRM input to the IXCM2APU administrative data utility.]

The CFRM policy information describes the coupling facilities (CF) and structures (STRUCTURE) that can be used in the sysplex once an administrative policy is activated.

The syntax of the CFRM parameters for the Administrative Date Utility is shown in Figure ... on page ....

```
DEFINE POLICY NAME(polname) REPLACE(NO | YES | timestring)
CF NAME(cfname)
   TYPE(tttttt)
   MFG(mmm)
   PLANT(pp)
   SEQUENCE(nnnnnnnnnnnn)
   PARTITION(h | hh)
  [SIDE(0 | 1)]
  [CPCID(nn)]
  [DUMPSPACE(size[u])]
  [SITE(SITE1 | SITE2)]
STRUCTURE NAME(strname)
   SIZE(size[u])
  [INITSIZE(initsize[u])]
  [MINSIZE(minsize[u])]
  [SCMMAXSIZE(scmmaxsize[u])]
  [SCMALGORITHM(algorithm)]
  [ALLOWAUTOALT(NO | YES)]
  [FULLTHRESHOLD(value)]
   PREFLIST(cfname1,cfname2,...,cfname8)
  [EXCLLIST(strname1,strname2,...,strname8)]
  [REBUILDPERCENT(value)]
  [DUPLEX(DISABLED | ALLOWED[,dupopts] | ENABLED[,dupopts])]
  [RECPRTY(value)]
  [SUBNOTIFYDELAY(delaytime)]
  [LISTNOTIFYDELAY(listnotifydelay)]
  [KEYRNOTIFYDELAY(keyrnotifydelay)]
  [ENFORCEORDER(NO | YES)]
  [ALLOWREALLOCATE(YES | NO)]
  [ENCRYPT(NO | YES)]
  [NDCOPY(NO | YES)
```

Figure xx. Syntax of CFRM Parameters for the Administrative Data Utility

The SETXCF START,POLICY,TYPE=CFRM operator command is used to activate an administrative policy. If no policy is active for CFRM, then the specified administrative policy is activated immediately. Otherwise, a transition to the newly activated policy is required. For an allocated structure, some subparameters can take effect immediately. STRUCTURE subparameters that take effect immediately include:

- ALLOWAUTOALT
- FULLTHRESHOLD
- REBUILDPERCENT
- DUPLEX (see the DUPLEX parameter for special conditions)
- ALLOWREALLOCATE
- RECPRTY
- SUBNOTIFYDELAY
- LISTNOTIFYDELAY
- KEYRNOTIFYDELAY
- NDCOPY (see the NDCOPY parameter for special conditions)

When running under z/VM ...

DEFINE POLICY NAME(polname)
. . .

STRUCTURE
Specifies the definition of a structure within the scope of the named policy. The limit for the number of structures that can be defined in a policy is established when the CFRM couple data set is formatted.

. . .

DUPLEX(DISABLED)
DUPLEX(ALLOWED[,dupopts])
DUPLEX(ENABLED[,dupopts])
Specifies the installation's request for duplexing rebuild of the structure.

. . .

DUPLEX(DISABLED) and the default dupmode of SYNCONLY both indicate that a structure will be allocated without the ability to participate in asynchronous duplexing. Other uses of dupmode indicate that a structure should be allocated with the ability to participate in asynchronous duplexing. The NDCOPY parameter also affects whether the structure is allocated with the internal controls that permit participation in asynchronous duplexing. A policy change that updates the **DUPLEX** parameter becomes pending if it changes the allocation requirements for a structure that is currently allocated:

- The combination of the dupopts and NDCOPY specifications requires the presence of the internal controls that support asynchronous duplexing, and the existing structure was allocated without them.

- The combination of the dupopts and NDCOPY specifications precludes the presence of the internal controls that support asynchronous duplexing, and the existing structure was allocated with them.

Otherwise, a change to the DUPLEX parameter takes effect immediately with policy activation.

. . .

ENCRYPT(YES)
ENCRYPT(NO)
Specifies whether list and cache structure entry data **. . .**

NDCOPY(NO)
NDCOPY(YES)
Indicates whether the structure is to support non-disruptive structure copy during system-managed rebuild or duplexing rebuild. In a standard system-managed process, the structure is inaccessible to connectors from the start of the process until the process completes. In non-disruptive structure copy, the structure is initially inaccessible, but becomes accessible during the copy phase of the process, and applications can resume initiating coupling facility requests during that time. The NDCOPY keyword applies only to lock structures and is ignored for other structure types.

The NDCOPY keyword can only be specified when defining a policy in a CFRM couple data set formatted to support the non-disruptive structure copy protocol (ITEM NAME(VERSION) NUMBER(11) or higher).

NO
System-managed processes involving this structure will always use the standard copy

protocol. The structure will be allocated without the internal controls that support non-disruptive structure copy unless the duplexing options include ASYNCONLY or ASYNC, indicating support for asynchronous duplexing. (The same controls support both asynchronous duplexing and non-disruptive structure copy.)

YES

System-managed processes involving this structure will use non-disruptive structure copy when all environmental conditions are satisfied. The structure will be allocated with the controls necessary to support non-disruptive structure copy if the CF in which it resides is at CFLEVEL 21 or higher, regardless of the duplexing options.

A policy change that updates the NDCOPY parameter becomes pending if it changes the allocation requirements for a structure that is currently allocated:

- The combination of the NDCOPY and DUPLEX specifications requires the presence of the non-disruptive structure copy internal controls, and the existing structure was allocated without them.

- The combination of the NDCOPY and DUPLEX specifications precludes the presence of the non-disruptive structure copy internal controls, and the existing structure was allocated with them.

If the new NDCOPY specification is consistent with the state of the allocated structure, the policy change takes effect immediately with policy activation.

Editorial corrections

[Chapter 16 “Sysplex Configurations”
“Under VM – Physical Configuration of Sysplex with MVS Guests”
“Setting Up a Coupling Environment Under z/VM”
“Understanding the Node Descriptor”

In the third sentence of the following paragraph, replace “DN” with “ND”]

Because z/VM Guest Coupling Simulation Support simulates a real coupling facility, the software must create a unique Node Descriptor (ND) for every CF Service Machine to be used. z/VM dynamically creates an architecturally correct unique ND when the message facility environment is created in the CF Service Machine. The method used to create the ND is documented so that the user can generate the administrative policy for CFRM in MVS. This will allow MVS's CFRM policy generator to be used and there is no need for the user to specify an ND. This is exactly how it works with the real hardware.

z/OS MVS Programming: Sysplex Services Guide (SA23-1400)

Summary of changes:

- Structure Available and Structure State Change Events can be delivered in either order.
- Considerations for allocation of the new structure during a system-managed process exploiting non-disruptive structure copy.
- In the description of the population of the new structure during a system-managed process, distinguish between the original system-managed copy protocol and the non-disruptive structure copy protocol.
- In the description of system-managed process completion or continuation, distinguish between the original system-managed copy protocol and the non-disruptive structure copy protocol.

Events and the Event Exit for System-Managed Processing

[Chapter 6 “Connection Services”
“Structure Rebuild Processing”
“Overview of System-Managed Rebuild Processing”
“Events and the Event Exit for System-Managed Processing”]

. . .

The following list summarizes the events . . .

Structure Temporarily Unavailable
Indicates the start of the system-managed process, during which the structure is unavailable for processing coupling facility requests. Response is required via IXLYEEPL or IXLEERSP.

Structure State Change
Describes changes to the structure or the coupling facility in which the structure resides. These changes might have occurred as a result of the system-managed process. Response is not required.

Structure Available
The structure is available for coupling facility requests. Response is not required.

The Structure State Change and Structure Available events can be delivered in either order, depending, for example, on whether the process is exploiting non-disruptive structure copy. The application should make no assumptions about the order of delivery of these two events.

In addition, if the structure connectors allow alter ...

System-Managed Allocation Considerations for Non-Disruptive Structure Copy

[Chapter 6 “Connection Services”
“Structure Rebuild Processing”
“Overview of System-Managed Rebuild Processing”
“Establishing the New Structure in System-Managed Process”

After subsection “Considerations for Cache Structures during System-Managed Processing”, the following new subsection is add at the same outline level:]

Considerations for Non-Disruptive Structure Copy

During system-managed allocation, z/OS determines whether the system-managed process can exploit non-disruptive structure copy. The eligibility requirements are:

- The structure being rebuilt must be a lock structure.
- The primary structure must have been allocated with the internal controls required to support non-disruptive structure copy.
- The primary coupling facility must be at a CFLEVEL greater than or equal to 26 with a service level sufficient for non-disruptive structure copy.
- The secondary coupling facility must be at a CFLEVEL greater than or equal to 21 with a service level sufficient for asynchronous duplexing.

- The primary and secondary coupling facilities must be connected by peer-to-peer links allowing bidirectional communication.

- The primary CFRM couple data set must be formatted to support non-disruptive structure copy (VERSION 11 or higher).

- The CFRM active policy must specify NDCOPY(YES) for the structure being rebuilt.

CFRM does not modify the selection criteria for the secondary coupling facility described in section "Allocating the New Structure" to accommodate non-disruptive structure copy. The system evaluates the eligibility requirements after the candidate facility is selected and the secondary structure is allocated.

If the CFRM active policy specifies NDCOPY(YES) and the secondary coupling facility is at least CFLEVEL 21, the system will allocate the secondary structure with the internal controls required to support non-disruptive structure copy regardless of whether the current system-managed process can exploit that protocol.

Populating the New Structure

[Chapter 6 "Connection Services"
"Structure Rebuild Processing"
"Overview of System-Managed Rebuild Processing"
"Populating the New Structure"

Replace the first paragraph with the following text:]

After the system has connected all active users to the new structure, the new structure is populated by copying data from the old structure to the new. Both the old and the new structure must remain viable during this copy phase.

- In the original system-managed copy protocol, one or more systems in the sysplex cooperate to copy the data. The two structures must remain accessible to the systems copying the data, but structure connectors remain quiesced during this period and cannot direct requests to the structures.

- In the non-disruptive structure copy protocol, the primary coupling facility propagates data directly to the secondary coupling facility, building on the same infrastructure used by asynchronous duplexing. Structure connectors are unquiesced during the copy process and may resume directing requests to the primary structure. z/OS monitors the progress of the copy process but is not otherwise involved in copying the data.

Once the new structure has been populated with the data from the old structure, and the system determines that the structure is viable, either the old structure can be deallocated and connected users can be notified of the new instance of the structure (for rebuild) or the old and new structure instances remain allocated and connected users enter the Duplex Established phase.

[The following new subheadings:]

Original System-Managed Copy Protocol

[Existing text goes here:]

The copy process is similar for both system-managed rebuild and duplexing rebuild. Major differences are noted in the following description of the data copied. The data copied includes: ...

. . .

- Lock structures
  - Lock table entries. Resource status (contention status, global management, resource queues, for example) remains unchanged across the rebuild.
  - Record data (if applicable), including the entry IDs associated with the record data

Non-Disruptive Structure Copy Protocol

Because non-disruptive structure copy exploits the asynchronous duplexing infrastructure, it applies only to lock structures. Only those lock structures designated in the CFRM active policy as eligible (NDCOPY(YES)) can use this protocol. List and cache structures always use the original copy protocol.

In non-disruptive structure copy, the primary coupling facility "pushes" structure state data to the secondary facility, which applies the updates to the secondary structure. This push process can tolerate ongoing arrival of connector requests while the copy process is in progress and therefore does not require that the structure remain quiesced during the copy. Connectors are unquiesced and receive the Structure Available event to notify them that they can resume structure operations. No response is required for this event. (It is possible for this phase of the copy process to complete so quickly that connectors are not unquiesced. In that case, the Structure Available event is presented during rebuild completion or attainment of the duplex-established state.)

The primary and secondary coupling facilities cooperate to apply the updates represented by the connector requests in parallel with the ongoing background copy activity. z/OS monitors copy progress by periodically querying the primary coupling facility, but is not otherwise involved in populating the new structure.

When the coupling facility reports the background copy process to be complete, the system-managed process enters a synchronization subphase of the copy phase. As in asynchronous duplexing, the secondary structure state lags the primary state, and the secondary must catch up before the system-managed process can continue. Connector activity is once again quiesced to prevent further structure changes, and z/OS monitors synchronization progress by periodically querying the secondary coupling facility. Since this second quiesce is of short duration, the system does not deliver another Structure Unavailable event.

When the two structure instances are observed to be in synchronization, the system transitions the pair of structures to the state appropriate to the type of system-managed process being executed. For a non-duplexing rebuild, the copy-in-progress state is terminated in the secondary structure instance and the primary structure is deallocated. For a synchronous duplexing rebuild, the copy-in-progress state is terminated in both primary and secondary structures, and they are placed in the synchronous duplexing state. For an asynchronous duplexing rebuild, the two structures are already in a suitable state and no additional action is required.

Completing or Continuing the System-Managed Process

[Chapter 6 "Connection Services"
"Structure Rebuild Processing"
"Overview of System-Managed Rebuild Processing"
"Completing or Continuing the System-Managed Process"

Update to state that the Structure Available event is not presented a second time during non-disruptive structure copy]

When the system-managed process commits to using the new structure, . . .
. . .
No response is required for the Structure State Change event. It simply provides an opportunity for

connected users to evaluate the new structure's attributes based on the coupling facility containing the structure and take any action deemed appropriate.

When the original structure copy protocol is used: To communicate the end of a system-managed rebuild or the beginning of the Duplex Established phase of system-managed duplexing rebuild, the system presents the Structure Available event to the event exits of the active connectors to the structure. No response is required for this event. Its purpose is to inform connectors that had previously quiesced their activity against the structure that they may now resume their coupling facility requests.

When the non-disruptive structure copy protocol is used: The system will usually have presented the Structure Available event when connectors were unquiesced at the start of the copy phase. In that case, it did not notify connectors of the short quiesced period required for synchronization of the old and new structures, and it therefore does not notify them with another Structure Available event when that period ends. Only in the case when connectors were not unquiesced would the system present the Structure Available event at this time.

For duplexing rebuild, operations which were originally intended to be sent to a single coupling facility structure while in simplex mode are now converted into duplex operations and sent to both structures.

z/OS MVS Programming: Sysplex Services Reference (SA38-0658)

Summary of changes:
- IXLCSP updates for non-disruptive structure copy

IXLCSP updates for non-disruptive structure copy

[Chapter "IXLCSP – XES Structure Computation Service"]

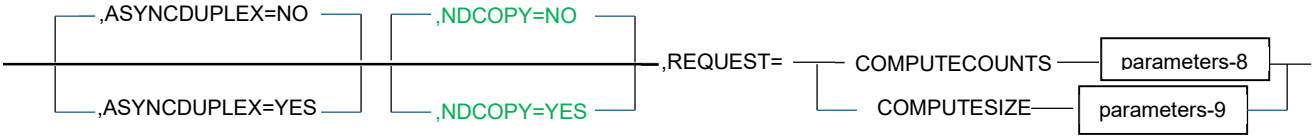
Understanding IXLCSP Version Support

[Change the fourth bullet (for version 3 keywords) to read]

- The following keywords are supported by version 3 and subsequent versions of the IXLCSP macro.
  - ASYNCDUPLEX
  - NDCOPY

Syntax Diagram

[In the box marked “parameters-3” (for TYPE=LOCK), change the second line to appear as follows:]



Parameter Descriptions

[Between the NAMECLASS and NUMCOCLASS parameter descriptions, add the following:]

,NDCOPY=NO
,NDCOPY=YES
Use this optional input parameter to indicate whether the lock structure is expected to exploit the non-

disruptive structure copy protocol during system-managed rebuild or duplexing rebuild, and thus requires the additional control structures necessary to support that protocol. The value selected should correspond to the NDCOPY specification in the CFRM policy structure definition.

NDCOPY=YES is valid when the target coupling facility is at a CFLEVEL >= 21. If specified for a CF at a lower CFLEVEL, the request will complete with return code 4 reason code IxlRsnCodeWarningCFLevel and will not consider non-disruptive structure copy in performing the computations. (Note that CFLEVEL >= 26 is required to exploit the non-disruptive structure copy protocol, but CFLEVEL 21 is sufficient to perform the necessary calculations.)

z/OS MVS System Messages, Vol 10 (IXC-IZP) (SA38-0677)

Summary of changes:

- IXC291I (couple data set format utility error)
- IXC347I (DISPLAY XCF,REALLOCATE output)
- IXC358I (DISPLAY XCF,COUPLE output)
- IXC360I (DISPLAY XCF,STRUCTURE output)
- IXC522I (Rebuild stop)
- IXC572I (System-managed process subphase transition)
- IXC574I (Stucture allocation information)
- IXC584I (Structure allocated without requested support)
- IXC745I (CFRM policy definition error)
- IXC750I (Format or policy utility maintenance level discrepancy – new message)

Message IXC291I

IXC291I ***text***

Explanation
The XCF couple data set format utility program encountered an error in the DEFINEDS statement in the JCL for the program. The data set might not have been formatted.

In the message text:
. . .
ITEM NAME(MEMBER) VALUE OVERRIDES MAXMEMBER VALUE
The value specified for ITEM NAME(MEMBER) has overridden the value specified for MAXMEMBER. The data set will still be formatted.

ITEM NAME(VERSION) NUMBER VALUE NOT VALID FOR INPUT PARAMETERS
ITEM NAME(VERSION) is lower than the CFRM CDS version required to support the specified input parameters. Either specify ITEM NAME(VERSION) with a NUMBER value greater than or equal to the CDS version required to support the function(s) for which the CDS is being formatted, or remove the VERSION input parameter and allow the format utility to determine the version of the couple data set based on the input parameters.
. . .

Message IXC347I

IXC347I ***hh.mm.ss*** **DISPLAY XCF** ***text***

. . .
In the message text:
. . .
ACTIVE POLICY ASYNC DUPLEX SUPPORT CONFLICT DETECTED.
The current active policy definition conflicts with the state of the allocated structure's internal controls required to support asynchronous duplexing and non-disruptive structure copy. This may occur when the structure was reconciled into the policy or if the structure was allocated by a system without support for non-disruptive structure copy. Structure rebuild is needed to resolve the conflict.

Message IXC358I

IXC358I (XCF message)

. . .
In the message text:
. . .
typeinfo
Additional information provided by the component owning the couple data set. It may describe, for example, the level of specialized function for which the couple data set is formatted.
. . .

- **If *cdstype* is CFRM,** *typeinfo* has the following format:

```
FORMAT DATA
 POLICY(n)   CF(n)   STR(n)   CONNECT(n)
 [SMREBLD(1)   [SMDUPLEX(1)   [MSGBASED(1)   [ASYNCDUPLEX(1)]]]]
 VERSION(n)
```

The FORMAT DATA lines ...

Message IXC360I

IXC360I *hh.mm.ss* DISPLAY XCF *text*

. . .
In the message, *text* is:

```
[CF LOSSCONN RECOVERY MANAGEMENT IS IN PROGRESS]
...
POLICY INFORMATION:
  POLICY SIZE: policysize u
  POLICY INITSIZE: policyinitsize u
  POLICY MINSIZE: policyminsize u
 [SCMMAXSIZE: policyscmmaxsize u]
 [SCMALGORITHM: scmalgorithm]
 [POLICY RECPRTY: recprty]
  FULLTHRESHOLD: fullthreshold
  ...
  EXCLUSION LIST: excl-str excl-str excl-str
 [SUBNOTIFYDELAY: subnotifydelay]
 [LISTNOTIFYDELAY: listnotifydelay]
 [KEYRNOTIFYDELAY: keyrnotifydelay]
 [ENCRYPT:         encrypt]
 [NDCOPY:          ndcopy]
```

```
[PENDING POLICY INFORMATION]

. . .
```

A DISPLAY XCF, STRUCTURE command was entered to display detailed information about the structures defined in the CFRM active policy in use by this sysplex. ...

In the message text:

. . .

status

One or more of the following:

. . .

XES INITIATED REBUILD STOP:

XES has stopped the structure rebuild for the following reason:

. . .

ASYNC DUPLEXING PROCESSING STALLED

The system is stopping the rebuild process because request processing is stalled. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

CF-TO-CF CONNECTIVITY LOST

The system is stopping the rebuild process because connectivity between the CF containing the old structure and the CF containing the new structure has been lost. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

ASYNC DUPLEXING INACTIVE

The system is stopping the rebuild process because the coupling facility reported that duplexing is no longer active. Duplexing may be deactivated by the coupling facility when a problem is encountered. Duplexing may be deactivated by z/OS when gaining ownership of a coupling facility. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

DUPLEXING PREVENTING A CHANGE IN THE SET OF CONNECTORS

A duplexing rebuild was stopped because a request to connect did not support the duplexing configuration.

POLICY CHANGE PENDING — CHANGE

There is an administrative policy change pending for this structure. . . .

. . .

METHOD: *method*

The method used to manage the current process (for example, rebuilding, rebuild stopping, or duplexing rebuild) is one of the following:

SYSTEM-MANAGED

The system is managing the process.

AUTO VERSION: procid1 procid2

The version number of the system-managed process. Used to correlate messages and XCF
component trace records associated with the current system-managed process. procid1 is the first half of the auto version and procid2 is the second half.

[USING NON-DISRUPTIVE STRUCTURE COPY]

The connected users can continue to access the structure during the copy phase of the system-managed process.

USER-MANAGED

The connected users are managing the process.

PHASE: *phase*

The phase of the current process (for example, rebuilding, rebuild stopping, or duplexing rebuild) is one of the following:

WAITING FOR QUIESCE

The structure rebuild process is in the quiesce phase.

. . .
COPY
The structure rebuild process is in the copy phase. This line is followed by additional text:
COPY SUBPHASE: *subphase*
where subphase is one of the following:
INITIALIZATION
Phase initialization.
. . .
EVENT QUEUE
Copying list structure event and monitoring event queue data.
NON-DISRUPTIVE COPY
The coupling facility is copying information from the primary structure instance to the secondary.
COPY QUIESCE
Reestablishing structure quiesce in preparation for copy synchronization.
COPY SYNCHRONIZATION
Waiting until all structure contents have been propagated from the primary structure instance to the secondary structure instance.
COPY EXIT
Transitioning from non-disruptive structure copy to the final rebuild state.
NOT AVAILABLE
Subphase information not available.
UNKNOWN
Unknown subphase.
COPY STOP
The structure rebuild process is in the copy stop phase.
. . .
ASYNC DUPLEX SWITCHING
The structure rebuild process is in the async duplex switching phase. The structure is switching out of system-managed asynchronous duplexing.
START ALTER NOT PERMITTED
CF structure alter processing has been disabled; start alter is not permitted.
EVENT MANAGEMENT:
The CFRM event management protocol according to the CFRM active policy. Except for XCF signaling structures, message-based processing can be used for any allocated structure. When the CFRM event management protocol is message-based, message-based processing is enabled for an allocated structure during event processing. When the CFRM event management protocol is policy-based, event processing is policy-based for all allocated structures.
. . .
enforceorder
One of the following:
YES
The order of the preference list is to be enforced.
NO
The system may reorder the preference list.
excl-str
The name of a structure in the exclusion list. Additional lines may be used to list more names. If the list is empty, the message EXCLUSION LIST IS EMPTY will be displayed instead.
subnotifydelay
The SUBNOTIFYDELAY value for the structure as specified in the policy, expressed in microseconds.
listnotifydelay
The LISTNOTIFYDELAY value for the structure as specified in the policy, expressed in microseconds.
keyrnotifydelay
The KEYRNOTIFYDELAY value for the structure as specified in the policy, expressed in microseconds.
encrypt

One of the following:

YES
Encryption of user data is requested. For more information on the requirements necessary to encrypt
data in coupling facility structures please see the section on encrypting structure data in z/OS MVS
Setting Up a Sysplex.

NO
Encryption of user data is not requested.

[blank]
The CFRM administrative policy does not specify the ENCRYPT keyword for this structure, causing encryption of user data to not be requested.

ndcopy
One of the following:

YES
This structure is permitted to exploit non-disruptive structure copy during system-managed processes.

NO
This structure is not permitted to exploit non-disruptive structure copy during system-managed processes.

[blank]
The CFRM active policy does not specify the NDCOPY keyword for this structure, causing it to default to NO.

header
One of the following:

. . .

sysname
The name of the system participating in the system-managed process.

systoken
The token of the system participating in the system-managed process.

processstate
One of the following:

ALLOCATING
The system is in the process of allocating the new structure during the allocate phase of a system-managed process (for example, rebuild).

. . .

COPY STOPPED
The system was participating in the copy phase of a system-managed process (for example, rebuild), but has stopped.

COPY EXIT
The system is responsible for transitioning out of the Copy phase of a system-managed process when non-disruptive structure copy is in use.

processcopyid
Identifier assigned to this system while participating in the copy phase of a system-managed process. Applicable only when the phase is COPY or COPY STOP.

. . .

Message IXC522I

IXC522I ***rebuildtype*** **FOR STRUCTURE** ***strname*** **IS BEING STOPPED** ***action*** **DUE TO** ***reason*** **[*codetype stopcode*]**

. . .
In the message text:
. . .

reason

One of the following:

. . .

ASYNC DUPLEXING PROCESSING STALLED

The system is stopping the rebuild process because request processing is stalled. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

CF-TO-CF CONNECTIVITY LOST

The system is stopping the rebuild process because connectivity between the CF containing the old structure and the CF containing the new structure has been lost. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

ASYNC DUPLEXING INACTIVE

The system is stopping the rebuild process because the coupling facility reported that duplexing is no longer active. This can occur for a system-managed asynchronous duplexing rebuild or for any system-managed rebuild or duplexing rebuild exploiting non-disruptive structure copy.

Message IXC572I

IXC572I **SYSTEM-MANAGED *process* FOR STRUCTURE *strname* HAS COMPLETED THE *subphase1* SUBPHASE OF THE *phase* PHASE AND IS ENTERING THE *subphase2* SUBPHASE.**
TIME: *subphasetime* AUTO VERSION: *procid1 procid2*

. . .

In the message text:

. . .

subphase1

One of the following:

. . .

EVENT QUEUE

Copying list structure event monitoring event queue data.

NON-DISRUPTIVE COPY

The primary coupling facility (CF) is pushing data asynchronously to the secondary CF.

COPY QUIESCE

Quiescing structure access to permit synchronization of the primary and secondary structure instances.

COPY SYNCHRONIZATION

Monitoring synchronization of the primary and secondary structure instances.

COPY EXIT

Establishing the required relationship between primary and secondary structure instances.

subphase2

One of the following:

. . .

EVENT QUEUE

Copying list structure event monitoring event queue data.

NON-DISRUPTIVE COPY
The primary coupling facility (CF) is pushing data asynchronously to the secondary CF.

COPY QUIESCE
Quiescing structure access to permit synchronization of the primary and secondary structure instances.

COPY SYNCHRONIZATION
Monitoring synchronization of the primary and secondary structure instances.

COPY EXIT
Establishing the required relationship between primary and secondary structure instances.

EXIT
Phase completion.

Message IXC574I

IXC574I ***text*** **OF STRUCTURE** ***strname*** **. . .**

. . .
In the message text:
. . .
ACTIVE POLICY ASYNC DUPLEX SUPPORT CONFLICT DETECTED.
The current active policy definition conflicts with the state of the allocated structure's internal controls required to support asynchronous duplexing and non-disruptive structure copy. This may occur when the structure was reconciled into the policy or if the structure was allocated by a system without support for non-disruptive structure copy. Structure rebuild is needed to resolve the conflict.

Message IXC584I

IXC584I **STRUCTURE** ***strname*** **IN COUPLING FACILITY** ***cfname***
PHYSICAL STRUCTURE VERSION: ***physver1 physver2***
ALLOCATED WITHOUT SUPPORT FOR ***function***
REASON: ***reason***

In the message text:

. . .

function
One of the following:

STORAGE-CLASS MEMORY
Storage-class (flash) memory provides additional or overflow capacity for structure objects.

ASYNC DUPLEXING
A structure must be allocated with asynchronous duplexing controls to provide the capability for the structure to participate in system-managed asynchronous duplexing.

ENCRYPTION
Encryption ensures list and cache structure entry data and entry adjunct data transferred to/from the

structure and residing in the structure are encrypted.

NON-DISRUPTIVE STRUCTURE COPY
A structure must be allocated with the same internal controls required for asynchronous duplexing in order to use the non-disruptive structure copy protocol during a system-managed process.

. . .

System Programmer Response
If operation without the specified function is undesirable, correct the issue identified by the REASON text.

When the reason is NOT SUPPORTED FOR STRUCTURE TYPE or INAPPROPRIATE STRUCTURE ATTRIBUTES, correct the CFRM policy to remove the request for the specified function.

When the reason is NOT SUPPORTED BY CONNECTORS, upgrade z/OS or the affected application, as appropriate, to a level that supports the requested function.

When the reason is INVALID TARGET STRUCTURE COUNTS, use the CF Sizer tool, available on the Parallel Sysplex website Coupling Facility sizer (www.ibm.com/support/docview.wss?uid=isg3T1027062), for help in determining structure SIZE, INITSIZE, and SCMMAXSIZE attributes.

When the reason is INSUFFICIENT CFLEVEL, ensure that coupling facilities at the required level are defined in the CFRM active policy, listed in the structure's preference list, and accessible to all systems requiring access to the structure. Table [reference] lists the required CFLEVELs for the various functions.

Function	Required CFLEVEL
STORAGE-CLASS MEMORY	19
ASYNC DUPLEXING	21
ENCRYPTION	N/A
NON-DISRUPTIVE STRUCTURE COPY	21 (Note 1)

Notes:
1. CFLEVEL 21 is required to allocate the structure with the controls required to support non-disruptive structure copy. However, the primary structure must reside in a CF at CFLEVEL 26 to exploit the function.

After correcting the problem, take the steps necessary to deallocate and reallocate the structure (for cases where the issue is not a CFRM policy error).

Message IXC745I

IXC745I **ERROR DETECTED IN *keyword* FOR STRUCTURE *strname* IN POLICY *polname*. *error_text***

In the message text:
. . .
error_text
A description of the error that occurred. *error_text* is one of the following:
. . .
THE CFRM CDS DOES NOT SUPPORT ASYNCDUPLEX
A duplex option that indicates a structure should be allocated with the ability to participate in asynchronous duplexing has been specified, but the CFRM CDS was not formatted with ASYNCDUPLEX. A CFRM CDS formatted with ASYNCDUPLEX is required for a policy to contain a duplex option that indicates a structure should be allocated with the ability to participate in asynchronous duplexing.

MULTIPLE DUPLEX MODE OPTIONS WERE SPECIFIED
The duplexing mode options specify the type of system-managed duplexing protocol (synchronous or asynchronous) that can be used when the structure is duplexed between two CFs at the same site or across two sites. Only a single value or single pair of values may be specified for a given structure.

MULTIPLE DUPLEX SITE OPTIONS WERE SPECIFIED
The duplexing site option specifies whether CF selection for duplexing should prefer CFs within the same site, prefer CFs in different sites, or allocate without regard for CF location. The option may be specified only once for a given structure.

THE CFRM CDS VERSION IS INSUFFICIENT
The specified keyword requires a CDS version higher than the one for which the target CDS was formatted. The CDS version is specified in the IXCL1DSU utility input at format time, either explicitly by the VERSION keyword or implicitly by function-specific keywords, as described in the instructions for formatting a CFRM CDS in “Setting Up a Sysplex”. Minimum required versions are as follows:

Keyword	Minimum Version
NDCOPY	11

Message IXC750I (new message)

IXC750I COUPLE DATA SET *utility* UTILITY MAINTENANCE LEVEL INCONSISTENCY FOR *type.*
text.

Explanation

The specified couple data set (CDS) utility encountered an error caused by an inconsistency in maintenance levels between the utility routine itself and a type-specific utility extension.

In the message text:

utility
One of the following:

DATA
The administrative data utility (also called the policy utility) IXCMIAPU or a type-specific extension has encountered an error.

FORMAT
The format utility IXCL1DSU or a type-specific extension has encountered an error.

type
The type of data in the CDS being processed (SYSPLEX, CFRM, ARM, etc.).

text
One of the following:

POLICY DATA REPORT COMPLETE

The report presented by the policy utility is complete.

POLICY DATA REPORT INCOMPLETE
The report presented by the policy utility is missing information because the utility does not provide a function required by the type-specific utility extension. If *type* is CFRM, the section of the CFRM administrative policy data utility report that contains the XCF Format Utility Control Cards does not contain the CDS format version number.

System action

The utility completes execution but may report error status, depending on the problem created by the inconsistency.

Operator response

Not applicable.

System programmer response

Update program libraries to ensure that the utility and the load modules containing its type-specific extensions, as identified in the following table, are at consistent maintenance levels.

Utility / Type	IXCL1DSU	IXCM2APU (IXCMIAPU)
ARM	IXCA3FDP	IXCA3FDX
BPXMCDS	BPXMCDSP	N/A
CFRM	IXCL2FDP	IXCL2PPI
LOGR, LOGRY, LOGRZ	IXGINVP	IXGI1PPI
SFM	IXCA2FDP	IXCA2FDX
SYSPLEX	IXCL1MDP	N/A
WLM	IWMPMFDP	N/A

Source

Cross System Coupling Facility (SCXCF)

Module
IXCL2PPR

Routing code
1, 2

Descriptor code
5

z/OS MVS Data Areas Volume 3 (ITK - RQE) (GA32-0937)

Summary of changes:

- IXCYQUAA (IXCQUERY answer area mapping)
- IXLYAMDA (IXLMG answer area mapping)

IXCQUERY answer area mapping IXCYQUAA

QUASTR

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	312	QUASTR	QUAA data for structures. QUAHSGOF points to this record when general or specific data for a structure is requested.
0	(0)	BITSTRING	1	QUASTRTYP	X'20' Structure record, X'A0' Last structure record.
...	...	...	...	...	...
112	(70)	BITSTRING	4	QUASTRREBLDPHASE(0)	Phase for the rebuild structure process. Valid when QuaStrStRebld is on. Note that not all phases are applicable to all rebuild types or methods. Type (duplexed or not duplexed) is indicated by QuastrRebldDuplex. Method (user- or system-managed) is indicated by QuaStrProcessMethod.
...	...	...	...	...	...
115	(73)	BITSTRING	1	QUASTRREBLDPHASE4(0)	4th byte of phase indicators
		1		QUASTRREBLDCOPYQUIESCE	"X'01' QUIESCE FOR COPY - A system-managed process is in the quiesce for copy subphase. Valid when QuaStrRebldCopy or QuaStrRebldCopyStop is on.
...	...	...	...	...	...
272	(110)	BITSTRING	1	QUASTRREBLDFLAGS (0)	Rebuild flags
		1...		QUASTRREBLDDUPLEX	"X'80'" Indicates whether or not the in-progress rebuild is a duplexing rebuild
		.1..		QUASTRREBLDSWITCHINPROGRESS	"X'40'" Indicates whether or not a switch to simplex mode using the new structure has been initiated for a duplexing rebuild that was in the rebuild duplex established phase.
		..1.		QUASTRUSINGNDC	"X'20'" Structure is exploiting non-disruptive structure copy. Meaningful when QuaStrProcessMethod is on and one of QuaStrRebldAttach, QuaStrRebldCopy, or QuaStrRebldCopyStop is on.
		.... ..1.		QUASTRASYNCDUPLEX	"X'02'" ON => duplexing is active using system-managed asynchronous duplexing
		1		QUASTRPROCESSMETHOD	"X'01'" ON => the process in progress is system-managed. OFF=> the process in progress is user-managed. The process type is identified by the QuaStrStRebld and QuaStrRebldDuplex flags.
273	(111)	CHARACTER	1	QUASTRDUPLEXOPTIONS (0)	Additional duplexing options
...	...	...	...	...	...
274	(112)	BITSTRING	1	QUASTRFLG2	More structure flags
		1...		QUASTRNDCOPY	"X'80'" NDCOPY(YES) was specified in the CFRM active policy
		.1..		QUASTRNDCOPYBYPOL	"X'40'" NDCOPY keyword was specified when the active policy was defined
275	(113)	BITSTRING	1	QUASTRFULLTHRESHOLD	FULLTHRESHOLD for a structure as specified or defaulted to in the

				CFRM active policy
...	...	...	... ...	...

QUASTR1

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	440	QUASTR1	STR record data format for QUAA level 1.
0	(0)	STRUCTURE	312		Mapped by QUASTR
312	(138)	CHARACTER	16	QUASTRUSYNCINFO2(0)	Additional USYNC info
...	...	...	...	...	...
356	(164)	CHARACTER	44	QUASTRPPINFO(0)	Detail info for pending policy changes. Valid only when QUASTRSTTOBECHANGED and QUASTRPPVALID are on. Returned only for QUAALEVEL=2 or higher.
356	(164)	BITSTRING	4	QUASTRPPFLAGS(0)	Pending policy flags
		...		...	...
		.... .1..		QUASTRPPENCRYPTKEYCHG	"X'04'" Pending policy Encryption key change
		.... ..1.		QUASTRPPNDCOPY	"X'02'" NDCOPY(YES) specified in pending policy
~~356~~	~~(164)~~	~~BITSTRING~~	~~3~~		~~Reserved~~
360	(168)	SIGNED	4	QUASTRPPSIZE	Pending policy SIZE
...	...	...	...	...	...

QUASTRSYS

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	64	QUASTRSYS	QUAA data for system-specific information for specified structure
...	...	...	...	...	...
16	(10)	BITSTRING	4	QUASTRSYSFLAGS(0)	System-related flags
16	(10)	BITSTRING	1	QUASTRSYSFLAGS1(0)	First byte of flags
		1...		QUASTRSYSALLOCATING	"X'80'" This system is in the process of allocating the new structure during the allocate phase of a system-managed process (e.g., rebuild)
		...		...	...
		..1.		QUASTRSYSCOPYSTOPPED	"X'02'" This system was participating in the copy stop phase of a system-managed process (e.g., rebuild), and has now stopped.
		...1		QUASTRSYSCOPYEXIT	"X'01'" This system is responsible for transitioning out of the Copy phase of a system-managed process when non-disruptive structure copy is in use
17	(11)	BITSTRING	1	QUASTRSYSFLAGS2	Second byte of flags
18	(12)	BITSTRING	1	QUASTRSYSFLAGS3	Third byte of flags
...	...	...	...	...	...

IXLMG answer area mapping IXLYAMDA

IXLYAMDSTRL1

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	392	IXLYAMDSTRL1	Structure entry for a list structure (STRL), AMDALEVEL >= 1
0	(0)	CHARACTER	264		Mapped by IXLYAMDSTRL
Begin fields whose validity is indicated by the IXLYAMDSTRL_Valid flag					
264	(108)	SIGNED	2	IXLYAMDSTRL_TEMCSTGPCT	Pending percent of structure storage to be used as EMCs, expressed in hundredths of a percent (ie. Range is 0 to 10000)
266	(10A)	BITSTRING	1	IXLYAMDSTRL1_FLAGS	
Bit definitions:					
		1...		IXLYAMDSTRL1_WRTCLI	X'80' Wait on ready to complete ...
		.1..		IXLYAMDSTRL1_PCQC	X'40' Asynchronous duplexing ...
		..1.		IXLYAMDSTRL1_DPLXST	X'20' Duplexing state. ...
		...1		IXLYAMDSTRL1_MI	X'10' Designated controlling structure. Indicates that RTC signal will always be sent first. (LEVEL24)
		.... 1...		IXLYAMDSTRL1_NDSC	X'08' Non-disruptive structure copy indicator. Indicates that the non-disruptive structure copy process has been initiated. Remains on after completion of the copy process if the structure transitions to asynchronous duplexing, reset otherwise. (LEVEL 26)
		11		IXLYAMDSTRL1_DPLXT	X'03' Duplexing type. ...
...	...	...	...	...	...

IXLYAMDSTRL2

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	456	IXLYAMDSTRL2	Structure entry for a list structure (STRL), AMDALEVEL >= 2
0	(0)	CHARACTER	392		Mapped by IXLYAMDSTRL1
392	(188)	ADDRESS	4	IXLYAMDSTRL2_ADUPADDR	Address of the structure asynchronous duplexing record ...
392	(188)	SIGNED	4	IXLYAMDSTRL2_ADUP_OFF	Offset of the structure asynchronous duplexing record ...
Begin fields whose validity is indicated by the IXLYAMDSTRL_AMValid flag					
396	(18C)	SIGNED	4	IXLYAMDSTRL2_ADUPDELAYOPCOUNT	Count of asynchronously-duplexed CF operations that were delayed because the primary CF was unable to accept new requests, either because it could not push requests to the secondary CF or because the secondary CF could not process incoming requests. Applicable only if IxlyamdStrL2_AsynchDupPri or IxlyamdStrL1_NDSC is on.
400	(190)	SIGNED	4	IXLYAMDSTRL2_ADUPDELAYREQCOUNT	Count of asynchronously-duplexed requests that ever experienced a delayed operation because the primary CF was unable to accept new requests. Applicable only if IxlyamdStrL2_AsynchDupPri or IxlyamdStrL1_NDSC is on.
...	...	...	...	...	...
Begin fields whose validity is indicated by the IXLYAMDSTRL_Valid2 flag					
429	(1AD)	BITSTRING	1	IXLYAMDSTRL2_PCTENTRYRSV	Composite percent entry reserve ...
430	(1AE)	BITSTRING	1	IXLYAMDSTRL2_COPYPCTCOMP	Non-disruptive structure copy percent completed. Valid when IXLYAMDSTRL1_NDSC is on.
Begin fields whose validity is indicated by the IXLYAMDSTRL_Valid2 flag					
431	(1AF)	CHARACTER	25		Reserved

...	... ...	... ...	...

IXLYAMDADUP

Offset Dec	Offset Hex	Type	Len	Name (Dim)	Description
0	(0)	STRUCTURE	256	IXLYAMDADUP	Structure asynchronous duplexing record. Information in this record reflects requests issued to asynchronously-duplexed structures and to structures being rebuilt or duplexed by a system-managed process using the non-disruptive structure copy protocol.
...	... ...	... ...			...