configuration, the amount of fixed storage required for the coupling facility is based on configuration-dependent factors. This “fixed overhead” may be associated with the coupling facility's code areas or fixed controls and must be considered in addition to the storage needed for structure allocation.

Important!

IBM recommends that you review the sizes of all your coupling facility structures using the CF Structure Sizer (CFSizer) tool before migrating to a coupling facility at a higher CFLEVEL.

After reviewing your coupling facility structures with CF Structure Sizer (CFSizer), modify your CFRM policy INITSIZE and SIZE values appropriately for the structures that changed. Then activate the modified CFRM policy before bringing the coupling facility at the new CFLEVEL into active use.

In general, IBM recommends that coupling facility structures be sized generously, erring on the side of too-large rather than too-small, because sizing structures too-small is a major factor in many different kinds of structure-related problems and outages. Be careful to re-plan so that:

- The physical coupling facility LPARs in the configuration have enough storage to accommodate the structures with their new sizes, in aggregate.
- There is enough unused space in the coupling facilities so that if a coupling facility failure occurs, the re-sized structures are still recoverable into other CF(s) in the configuration.

Make physical coupling facility LPAR storage changes if necessary to accommodate this.

See also “Requesting structure size” on page 49.

PR/SM Planning Guide provides information about the functions available with each CFLEVEL of a coupling facility, model-dependent limits, and other characteristics such as performance, storage allocation, and operations.

Base coupling facility function is available with coupling facility control code (CFCC) level 0 (CFLEVEL=0). Additional function and enhancements are provided by follow-on CFLEVEL versions. For the most accurate list of CFLEVEL functions with associated hardware and software corequisites, see Coupling Facility Level (CFLEVEL) Considerations (www.ibm.com/systems/z/advantages/pso/cftable.html).

An application might require that its structure be allocated in a coupling facility at a minimum coupling facility level. Or, an application might have a requirement for a particular CFLEVEL, but if a coupling facility of that level is not available, might allow its connectors to connect and run, bypassing the architected function provided by the higher CFLEVEL that was unavailable. To ensure that the structure allocation is successful, you must provide a preference list containing coupling facilities that meet or exceed the minimum level in your CFRM policy.

“CFLEVEL and operating system level coexistence” on page 43 provides a summary of these functions and some exploiting products.

CFLEVEL and operating system level coexistence

Table 2 on page 44 shows which operating systems can use coupling facilities at different CFLEVELs, either to exploit the function provided by the CFLEVEL or to coexist with the CFLEVEL function without exploiting it.

- An operating system release “coexistence” support row of the table with an APAR number indicates required service in addition to the operating system product code to allow the operating system to use existing operating system and CF functions, but not exploit new functions that are contained in a particular CFLEVEL.
  - For a given z/OS release / CFLEVEL combination, APARs listed in the corresponding cell and all cells to the left of that cell are required for coexistence.
  - A blank area in an operating system coexistence row indicates no additional service is required for the operating system product code to use the CFLEVEL except as noted by the preceding bullet.
  - Example: A system at z/OS V2R1 can coexist with a coupling facility up to and including CFLEVEL 21 without additional service, but it requires the service provided by APAR OA52058 to coexist with

CFLEVEL 22 and all higher CFLEVELs. Higher CFLEVELs may require additional service as noted in the table. In particular, although there is no service specifically listed for CFLEVEL 23, all APARs listed in corresponding cells to the left of the blank cell are required for coexistence.

- An operating system release "exploitation" support row of the table with text (an 'X' or an APAR number) indicates exploitation of the functions contained in a particular CFLEVEL by the operating system release.
  - A blank area in an exploitation row indicates that the z/OS release does not exploit functions provided by that CFLEVEL.
  - Example: A system at z/OS V2R1 can exploit all function provided by CFLEVELs up to and including CFLEVEL 18, requires additional service to exploit CFLEVEL 19 function, and cannot exploit functions provided by CFLEVELs above 19.

Fix categories (FIXCATs) are used to identify whether an APAR and its related fixing PTF is required by a z/OS system to coexist with a CFLEVEL associated with a hardware server device, or required to exploit function provided by the CFLEVEL. For example, APAR OA56345 is required by the operating system to run with CFLEVEL 24 in a sysplex configuration, whereas OA56774 is required to exploit a particular CFLEVEL 24 function.

See the IBM Fix Category (FIXCAT) values https://www.ibm.com/support/pages/ibm-fix-category-values-and-descriptions that identify fixes that provide z/OS software support for the specific hardware server device associated with the CFLEVEL.

See the *PR/SM Planning Guide* for information on hardware server device model support for CFLEVELs.

Table 2. CFLEVEL summary table

Release		**CFLEVEL**						
	Support	**15-18**	**19**	**20**	**21**	**22**	**23**	**24**
z/OS V2R1	Coexistence					OA52058		OA56345
	Exploitation	X	OA44439					
z/OS V2R2	Coexistence					OA52058		OA56345
	Exploitation	X	X	X	OA47796	OA51862	OA54688	OA56774
z/OS V2R3	Coexistence							OA56345
	Exploitation	X	X	X	X	X	OA54688	OA56774
z/OS V2R4	Coexistence							
	Exploitation	X	X	X	X	X	X	OA56774

Notes:

1. There is significant growth in CFLEVEL 15 coupling facilities for the storage that is required for the CFCC code itself, the storage required for the individual structures that get allocated in the CF, and the storage increment size of the CF. See Washington Systems Center Flash 10572 for more detailed information about the amount of growth that can be expected for various types of CF structures.
2. When migrating to CFLEVEL 16, the CFCC storage increment size increases to 1M. Also the storage that is required for the individual structures might increase. This adjustment in structure size can have an impact when the system allocates structures or copy structures from one coupling facility to another with different CF levels.

The functions that are provided by each CFLEVEL are described briefly. For detailed information, see *PR/SM Planning Guide*.

0
Base coupling facility support

1
Structure alter support

2

New cache and lock structure functions for improved performance by allowing operations on lists of cache entries (batched registration) and lock entries (batched unlock), rather than on individual entries. These functions were intended for initial exploitation by DB2® and IRLM.

3

List monitoring enhancements for keyed list structures ("event monitoring"). The enhancements provide monitoring at a finer level of granularity than was available previously. These functions were intended for initial exploitation by IMS shared message queue.

4

Alter and dump support for list structures that use event monitoring.

5

User-managed duplexing of DB2 group buffer pools for added availability. This function was intended for initial exploitation by DB2.

6

Function that is provided for the TPF operating system. There is no new function for OS/390 exploitation, but all previous CFLEVEL function remains available.

7

Cache structure name class queue support that allows entries to be deleted more efficiently. This function was intended for initial exploitation by DB2.

8

System-managed rebuild support.

9

Support for list structure exploitation by WebSphere® MQ.

10

CF-to-CF connectivity support (required for CF Duplexing).

11

System-managed duplexing support for all coupling facility structure types.

12

Performance enhancements for cache structures by allowing batching of write requests, cross-invalidate requests, and castout requests. These functions were intended for initial exploitation by DB2.

13

Performance enhancements for cache structures for IXLCACHE REQUEST=READ_COCLASS requests. This function was intended for initial exploitation by DB2.

14

Performance enhancements for coupling facility dispatching and latching.

15

Performance enhancements for CF duplexing to suppress RTE signals.

Note: This RTE suppression function is not enabled by z/OS.

Granular CF CP Utilization reporting by structure.

CF multitasking enhancements (increased number of CF tasks).

16

CF duplexing enhancements and shared message queue list notification enhancements.

17

Dumping support for CFCC non-disruptive coupling facility. Increased the maximum number of coupling facility structure instances per coupling facility image from 1023 to 2047 and provided support for greater than 32 connectors to a coupling facility list or lock structure. Installations should not deploy more than 32 instances of the application until the following recommendations are met.

- Upgrade all relevant application instances to a level that supports greater than 32 connectors.
- Ensure that the sysplex contains at least two coupling facilities that are CFLEVEL=17 or higher.

Failure to implement the recommendations that were previously stated might result in an unsafe migration path to greater-than-32-connector support for a structure and can lead to failed connection attempts, failure to rebuild the structure, or failure to duplex the structure.

18

Functions include:

- Cache performance and reliability improvements.
- Coupling-related adapter interrupt exploitation.
- Enhanced serviceability information for coupling channels.

19

Storage-class memory.

21

Asynchronous duplexing support.

22

Improvements to the efficiency of scheduling and processing work targeted to system-managed synchronous duplexed CF structures.

To take advantage of this improvement without sacrificing duplexing reliability, you must run z/OS V2R3 or a lower release with a PTF for APAR OA52058 when a CFLEVEL=22 CF is involved in duplexing.

New CF structure list monitoring functions include:

- List full/not-full monitoring
- Aggressive list and key range monitoring notification when entries are added to lists and key ranges
- List and key range monitoring notification delays.

The list monitoring functions are available to list structure connectors running on z/OS V2R3 or on z/OS V2R2 with APAR OA51862 when a structure is allocated in a CFLEVEL=22 or higher CF.

23

Asynchronous Cache Cross-Invalidation (XI) for Coupling Facility Cache Structures

Asynchronous Cache XI is a communication protocol that notifies connectors of the completion of data invalidation asynchronously with respect to the IXLCACHE request.

The Asynchronous Cache XI function is available to cache structure connectors running on z/OS V2R4 or a lower release with a PTF for APAR OA54688 when a cache structure is allocated in a CF at CFLEVEL 23 or higher.

24

- CFCC Fair Latch Manager

  Provides improvements to the efficiency of scheduling and processing work targeted to system-managed synchronous duplexed coupling facility structures. z/OS must provide new information to the CF to permit exploitation of system-managed synchronous structure duplexing when either structure instance resides in a CF at CFLEVEL 24.

- CFCC Message Path Resiliency Enhancement

  When z/OS recognizes an inconsistency in the system identification information associated with a message path to a CF, z/OS will initiate the capturing of diagnostic information from the CF, channel subsystem, and connected z/OS images, and will then take immediate action to transparently correct the inconsistent information dynamically

- Monopolization Avoidance for CF Tasks

  A PTF for APAR OA56774, in conjunction with CFCC CFLEVEL 24 provides new function to prevent a runaway sysplex application from monopolizing a disproportionate share of CF resources

The DISPLAY CF command will always display the actual CFLEVEL of the coupling facility. This might differ from what the application understands to be the operational level of the coupling facility. The

operational level refers to the architectural level required to perform the necessary operations against the structure.

Specifying coupling facility non-volatility

An application that is using the coupling facility might require non-volatility of the coupling facility storage. Depending on the processor on which the coupling facility is defined, you might have to provide a backup power supply to make the contents of coupling facility storage nonvolatile across utility power failures.

PR/SM Planning Guide describes the processor requirements for coupling facility non-volatility and the coupling facility control code MODE command. The MODE command must be set so that applications using the coupling facility can monitor its non-volatility status.

Planning for coupling facility failure-independence

An application might require that its structure be placed in a failure-independent environment. To accomplish this, you must ensure that the coupling facility is not in the same configuration as the MVS systems that access it. For example, placing the coupling facility in an LPAR in a processor with one or more additional LPARs that are running MVS to access the coupling facility would not provide a failure-independent environment.

Determining your coupling facility requirements

PR/SM Planning Guide provides information for use in determining the level of hardware and CFCC required for your installation:

- CPC model numbers that support a coupling facility
- CFCC EC levels
- Software corequisites
- Correspondence between CFCC levels and CFLEVELs
- Explanation of the functions provided by CFLEVEL

Managing a coupling facility

Storage in a coupling facility is divided up into distinct objects called structures. Structures are used by authorized programs to implement data sharing and high-speed serialization. Structure types are cache, list, and lock, each providing a specific function to the application. Some storage in the coupling facility can also be allocated as a dedicated dump space for capturing structure information for diagnostic purposes.

You manage a coupling facility through a policy, the coupling facility resource management (CFRM) policy. CFRM allows you to specify how a coupling facility and its resources are to be used in your installation. In a CFRM policy, you supply information about each coupling facility and each coupling facility structure that you plan to use.

Your installation can define several CFRM policies, to be used at different times depending on the workload running on the sysplex. Each of these *administrative* policies has its own name by which you identify it when you want to make it the *active* policy. Only one policy can be active in a sysplex at a time.

You create the administrative CFRM policies with an IBM utility program, IXCMIAPU, provided in SYS1.MIGLIB. Once created, the policies reside in a CFRM couple data set. MVS and the authorized application use the definitions in the CFRM policy when managing the coupling facility storage.

Two ways to start a CFRM policy

There are two ways to start using a CFRM policy in your sysplex:

- You can specify the name of the CFRM policy to be activated at IPL-time in the COUPLExx parmlib member that is used to initialize the sysplex. The system uses the CFRM policy name specified by the CFRMPOL keyword on the COUPLE statement to identify the policy to be started if there is no other