Adabas System Coordinator

Adabas System Coordinator for zIIP

Version 8.6.1

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This document applies to Adabas System Coordinator Version 8.6.1 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 document provides information on Adabas System Coordinator for zIIP, an option of the Adabas System Coordinator that enables the Adabas System Coordinator Daemon to make use of IBM's zIIP engine.

Adabas System Coordinator for zIIP enables the Daemon on z/OS to offload part of the Daemon workload from the mainframe's general processors (GP) to System z Integrated Information Processors (zIIP).

Offloading work from the GPs will free up some of their capacity. This helps decrease the total cost of operation (TCO) of the GPs and makes room for running additional workload on them. Furthermore, the use of Adabas System Coordinator for zIIP may result in performance benefits by increasing the throughput for certain workloads.

Adabas System Coordinator for zIIP supports other selectable units that are integrated into the Daemon:

- Adabas Fastpath
- Adabas Transaction Manager
- Adabas Vista
- Adabas SAF Security

This documentation is organized under the following topics:

Implementation	Implementation information (including prerequisites).
General Information on zIIP Processing	Brief description of zIIP processing.
Adabas System Coordinator for zIIP Processing: Concepts	Explanations of the TCB and SRB processes and the WLM enclaves Adabas System Coordinator requires for zIIP processing.
Monitoring zIIP Usage	System information, reports and statistics available for controlling and evaluating zIIP-enabled Daemon sessions.

1 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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2 Implementation

All implementation information (including prerequisites) is described in *Implementing Adabas System Coordinator for zIIP* in the *z/OS Installation* documentation.

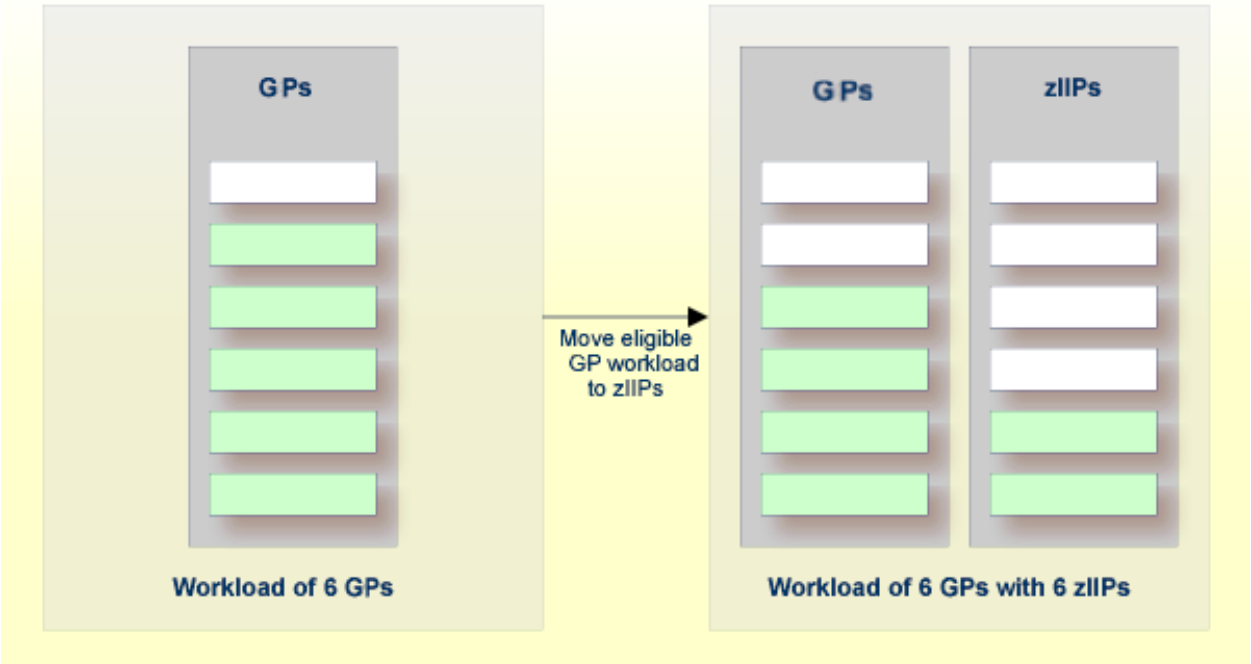
3 General Information on zIIP Processing

The IBM System z Integrated Information Processor (zIIP) is a specialty engine designed to offload eligible workload from a GP (general processor) to a zIIP.

Offloading workload to a zIIP helps optimize resource capacities and free up part of the GPs for new workloads, while lowering the mainframe TCO (total cost of ownership). GPs are more expensive than zIIPs, both in their direct cost and in their impact on software license costs. Also, GPs may run throttled, whereas zIIPs always run at full speed.

For detailed information on the zIIP, refer to the appropriate IBM literature.

The simple graphic below illustrates the purpose of the zIIP:



4 Adabas System Coordinator for zIIP Processing: Concepts

This document provides information on how Adabas System Coordinator enables zIIP support.

In general, a z/OS application runs as a dispatchable unit managed using a TCB (task control block). It is said to run “under a TCB” or “in TCB mode”. Running an application on a zIIP requires a dispatchable unit managed using an SRB (service request block). SRB code is said to run “under a SRB” or “in SRB mode”.

To become eligible for running on a zIIP, an SRB must be assigned to an “enclave” managed by the z/OS Workload Manager (WLM). An enclave is a WLM transaction that can span multiple dispatchable units (TCBs and SRBs) in one or more address spaces and that WLM reports on and manages as a unit. When Adabas System Coordinator for zIIP starts, it creates an enclave consisting of its main TCB and an SRB and configures the SRB to be eligible for running on a zIIP. Generally, Adabas System Coordinator for zIIP runs in SRB mode (eligible for execution on a zIIP) whenever possible and in TCB mode whenever necessary.

The WLM enclave created and used by Adabas System Coordinator for zIIP processing is bound to the Daemon address space. It is deleted when the Daemon job step terminates.

TCB/SRB Switches

When a Daemon session is started with the Daemon runtime parameter ZIIP=YES, the Daemon starts an SRB in parallel to its main TCB, places the TCB in a wait state, and continues processing in the SRB. The SRB may run on a zIIP, as directed by the Workload Manager, and executes the bulk of the Daemon logic. The SRB cannot perform all operations that the TCB can do, though. Broadly, there are two categories of operations that Adabas System Coordinator for zIIP cannot perform in SRB mode:

- Certain system services, in particular those that perform input/output operations
- Code not owned by Software GmbH (supplied by the installation or a third party)

Whenever the SRB cannot perform an operation, it may “pass the baton” to the TCB by taking the TCB out of its wait and putting itself into a wait state. The TCB then proceeds at the point where the SRB left off and performs the operation. When the operation has finished, the TCB takes the SRB out of its wait and puts itself into a wait state again. These steps are called “switch to TCB mode” and “switch to SRB mode”, respectively.

Adabas System Coordinator for zIIP performs an operation in TCB mode either by switching to TCB mode before and back to SRB mode after the operation or by issuing a request to the TCB to perform the operation in parallel while the SRB continues other processing (see also **Parallel Requests** below).

Parallel Requests

As described in **TCB/SRB Switches** above, Adabas System Coordinator for zIIP may switch to TCB mode to perform an operation that it cannot do in SRB mode, and switch back to SRB mode after the operation. Alternatively, the SRB may issue a request to the TCB to perform the operation in parallel while the SRB continues processing other work. Roughly, the procedure to use parallel requests functions as follows:

1. The SRB needs to perform an operation that requires TCB mode.
2. The SRB issues a request to the TCB to perform the operation in parallel and takes the TCB out of its wait state.
3. If necessary, the SRB puts the current Daemon thread into a wait state.
4. The SRB looks for other work to do - other threads or new commands.
5. At the same time, the TCB, coming out of its wait state, processes the parallel request given to it.
6. When the TCB has finished processing a parallel request, it checks whether the SRB has meanwhile issued another request. If so, it processes that request too, and repeats this step.
7. When the TCB has processed all parallel requests and the SRB has not requested a switch to TCB mode, the TCB enters a wait state again.

Whether Adabas System Coordinator performs a TCB-mode operation via a mode switch or a parallel request depends on the type of operation. Generally, operations that may occur very frequently are performed via parallel requests. This is more efficient than mode switches if (and only if) the workload given to Adabas System Coordinator is high and allows for sufficient parallelism in its processing. The choice between mode switches and parallel requests is made by Adabas System Coordinator; it cannot be controlled via configuration parameters.

5 Monitoring zIIP Usage

The purpose of Adabas System Coordinator for zIIP is to reduce the Adabas System Coordinator Daemon CPU consumption on general processors (GP) by offloading part of the Daemon processing to System z Integrated Information Processors (zIIP). Adabas System Coordinator for zIIP offers statistics about how much CPU time it has consumed on GPs and zIIPs and for which reasons it has executed on GPs. This document provides information on how to view and understand these zIIP-related statistics.

zIIP-Related Statistics

Adabas System Coordinator for zIIP shows zIIP-related statistics

- in the Adabas System Coordinator session statistics that are printed when the Daemon terminates, and
- when the Adabas System Coordinator Daemon operator command DZSTAT is given from an operator console.

See **Understanding the zIIP-Related Statistics** below for information on how to interpret these statistics.

Understanding the zIIP-Related Statistics

Adabas System Coordinator for zIIP prints the full set of zIIP-related statistics in the Adabas System Coordinator session statistics when the Daemon terminates. The same statistics are displayed at other occasions, as described in section **zIIP-Related Statistics** above.

An Adabas System Coordinator Daemon started with the Daemon runtime parameter ZIIP=YES prints the zIIP-related statistics during termination at the end of its session statistics. They show the following information:

Statistic	Description
Total enclave CPU time (*note-2)	The total CPU time consumed by the Workload Manager enclave created by the Adabas System Coordinator Daemon for its entire session, comprising the CPU times consumed on GPs and on zIIPs.
Enclave GP time	The CPU time of the enclave that the Adabas System Coordinator Daemon consumed on GPs.
Enclave zIIP time	The CPU time of the enclave that the Adabas System Coordinator Daemon consumed on zIIPs.
Enclave zIIP time (%) (*note-1)	The percentage of the enclave CPU time that the Adabas System Coordinator Daemon consumed on zIIPs, calculated as: Enclave zIIP time / Total enclave time * 100

Statistic	Description
Eligible zIIP CPU time	The CPU time that the Adabas System Coordinator Daemon was eligible to execute on zIIPs, comprising the actual Enclave zIIP time and the Eligible zIIP CPU time on GP.
Enclave zIIP time	The CPU time of the enclave that the Adabas System Coordinator Daemon consumed on zIIPs (same as the 'Enclave zIIP time' under 'Total enclave CPU time').
Eligible zIIP time on GP	The CPU time of the enclave that the Adabas System Coordinator Daemon was eligible to execute on zIIPs but instead consumed on GPs because no zIIP was available.
Eligible zIIP time on GP (%) (*note-4)	The percentage of the eligible zIIP CPU time that the Adabas System Coordinator Daemon instead consumed on GPs, calculated as: Eligible zIIP time on GP / Eligible zIIP CPU time * 100
Mode switches (*note-7)	The number of mode switches performed by the Adabas System Coordinator Daemon comprising the number of switches into SRB mode to become eligible for execution on a zIIP and the number of switches into TCB mode to perform operations that were incompatible with SRB mode.
Parallel requests (*note-7)	The number of times the Adabas System Coordinator Daemon requested that the TCB perform an operation in parallel to its own processing in SRB mode.
No free element for request	The number of times the SRB had to wait for a free request element until it could issue a parallel request to the TCB.
Parallel requests per TCB pause (*note-5)	The average number of parallel requests processed by the TCB until it had to pause and wait for more work, calculated as: Parallel requests / Pause TCB (below).
Extended statistics	The following extended statistics were introduced for internal reporting and may be changed or removed in future releases.
Pause SRB	The number of times the SRB was waiting for work.
Release SRB	The number of times the SRB was released to continue processing.
Pause TCB	The number of times the TCB was waiting for work.
Release TCB	The number of times the TCB was released to continue processing .
Pause for wait (*note-6)	The number of times the Adabas System Coordinator Daemon had no work to do (i.e., was waiting for I/Os, new commands, or other events).
Release from wait	The number of times the Adabas System Coordinator Daemon was released to continue processing after an event had occurred.
SRB/TCB scheduling by type of work	The following statistics "by type of work" show why the processing mode (SRB or TCB mode) was switched or a parallel request was issued. They indicate the reasons for the "Mode switches" and "Parallel requests" reported above. Only categories with nonzero counts are shown. A selection of typical categories follows:

Statistic	Description
EXCPs	The number of direct-access input/output operations to any Adabas System Coordinator Daemon datasets (COLAT, TMRFI, etc.), in most cases issued via parallel requests to the TCB.
Fastpath services	The number of times that Adabas Fastpath required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
Operator commands	The number of operator commands whose processing required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
Sequential writes	The number of writes to a sequential dataset (e.g., DDPRINT), in most cases issued via parallel requests to the TCB.
Daemon services	The number of times that the Adabas System Coordinator Daemon required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
Timer services	The number of timer operations that required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
Transaction Manager services	The number of times that Adabas Transaction Manager required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
SRB/TCB scheduling (more)	The following statistics "(more)" provide greater granularity to those mode switches reported in "by type of work". They are provided for internal reporting and may be changed or removed in future releases. A selection of typical categories follows:
Serialization	The number of serialization requests whose processing required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
Miscellaneous	The number of other, infrequent operations that required execution in TCB mode, performed via switches to TCB mode and back to SRB mode.
…	(Other types of work that must be performed in TCB mode are reported if they occurred in the Adabas System Coordinator Daemon session.).
Enclave GP service units	The GP CPU service units accumulated by the enclave created by the Adabas System Coordinator Daemon.
Enclave zIIP service units	The zIIP CPU service units accumulated by the enclave created by the Adabas System Coordinator Daemon, normalized to GP speed.
GPs	The number of general processors (GP) managed by the operating system.
zIIPs	The number of System z Integrated Information Processors (zIIP) managed by the operating system.
zIIP SMT threads	The number of simultaneous multithreading (SMT) threads per zIIP core.
zIIP normalization factor	The factor by which zIIP CPU times have been multiplied by z/OS to be comparable with the CPU times of the GPs, if the GPs are throttled.

Notes:

1. The "Enclave zIIP time (%)" shows in a nutshell how much of the CPU consumption in the Workload Manager enclave created by the Adabas System Coordinator Daemon was actually offloaded to zIIPs.

2. To assess the zIIP CPU percentage properly, take into account that this number covers only the CPU time consumed by dispatchable units belonging to the enclave created by Adabas System Coordinator for zIIP - that is, by the Adabas System Coordinator Daemon main task TCB and its companion SRB. It does not cover CPU time consumed by dispatchable units that belong to other enclaves or to no enclave at all - such as system SRBs used for asynchronous event processing (I/O completion, cross-memory posts, XCF/XES exits, etc.). Therefore, the percentage of CPU time consumed on zIIPs relative to the total CPU time consumed by all dispatchable units in the the Adabas System Coordinator Daemon address space tends to be lower than the percentage relative to the enclave CPU time.
3. Also take into account that the TCB/SRB mode switches and parallel requests generate overhead that is also attributed to the GP and zIIP CPU times of Adabas System Coordinator for zIIP. For a more accurate assessment how much CPU time Adabas System Coordinator for zIIP saves on GPs, run the same, representative test workload both with ZIIP=YES and ZIIP=NO and compare the GP CPU times consumed in both scenarios. The GP CPU time savings will typically depend on the type of workload processed by the Adabas System Coordinator Daemon, particularly the speed and level of parallelism with which messages arrive.
4. If the “Eligible zIIP time on GP (%)” is non-negligible, it suggests that the available zIIPs in the host system are over-allocated. If their free capacity was higher, Adabas System Coordinator for zIIP could offload more of its work to the zIIPs.
5. The number of “Parallel requests per TCB pause” indicates the level of parallelism that Adabas System Coordinator for zIIP could utilize by stringing TCB-mode operations together. A number close to 1 indicates low parallelism; a greater number, higher parallelism and a greater reduction of overhead.
6. The “Pause for wait” count, relative to the number of I/Os (reported in the zIIP-related statistics under “EXCPs”) and Adabas System Coordinator Daemon commands (reported higher up in the session statistics), indicates the level of parallelism that the Adabas System Coordinator Daemon could utilize to process multiple commands concurrently. The higher the ratio of commands plus I/Os over "pauses for wait", the more work the Adabas System Coordinator Daemon was able to do without pause (such as waiting for I/O completion or for the arrival of a new command).
7. The counts of mode switches and parallel requests depend on the workload processed by the Adabas System Coordinator Daemon - in particular, the number of system service calls that require TCB mode and the inherent parallelism of the workload. Aside from changing these aspects, little can be done in the configuration of Adabas System Coordinator for zIIP to influence the interplay between the SRB and the TCB.
8. If the ZIIP Daemon runtime parameter is changed to NO during an Adabas System Coordinator Daemon session, requesting that the Daemon continue to run in TCB mode and not use zIIPs anymore, the then following processing will be charged to the TCB and counted under “Enclave GP time”. The proportion of “Enclave zIIP time (%)” will decrease correspondingly. This percentage shows how much of the Adabas workload was actually executed on zIIPs, not how much could have been executed on zIIPs under other circumstances.