
Rule WLM124: Significant transaction time was in Waiting for I/O state

Finding: A significant amount of the transaction response time for the service class missing its performance goal was spent in the Waiting for I/O state. This finding applies to service classes that are part of a subsystem (e.g., CICS transactions).

Impact: This finding has MEDIUM IMPACT or HIGH IMPACT on performance of the service class. The level of impact depends on the percent of transaction response time spent in the Waiting for I/O state.

Logic flow: The following rules cause this rule to be invoked:

- Rule WLM104: Subsystem Service Class did not achieve average response goal
- Rule WLM105: Subsystem Service Class did not achieve percentile response goal

Discussion: When CPExpert produces Rule WLM104 or Rule WLM105 to indicate that a subsystem service class did not achieve its performance goal, the logic of these rules tries to identify the cause of the delay. The cause of the delay initially is analyzed from the "served" service class view. The delays from the served service class are reported by CICS (with CICS/ESA Version 4.1 and later) or by IMS (with IMSVersion 5 or later). Interaction with the Workload Manager is accomplished using the Workload Management Services macros¹.

CICS reports two separate views of the transactions: the *begin_to_end phase* and the *execution phase*².

- **Begin_to_end phase.** The *begin_to_end phase* starts when CICS has classified the transaction³. This action normally is done in a CICS Terminal Owning Region (TOR).
- **Execution phase.** The *execution phase* starts when either CICS or IMS (Version 5 or later) has started an application task to process the

¹Please refer to Section 4 of this document for more detail about the Workload Management Services macros and how the subsystems use these macros to exchange information with the Workload Manager.

²IMS Version 5 reports only *execution phase* samples.

³Classifying the transaction into a service class is done by the Workload Manager when the subsystem manager issues the IWMCLSFY macro. Please refer to Section 4 for a more complete discussion of the subsystem work manager (e.g., CICS) interaction with the Workload Manager.

transaction. For CICS, this normally is done in a CICS Application Owning Region (AOR). For IMS, this is done in an IMS Message Processing Region (MPR).

Within each phase, CICS or IMS report the "state" of the transaction, from the view of CICS or IMS. The state of the transaction is reported in the following categories⁴:

- **Idle state.** (Both CICS and IMS report this state.
- **Ready state.** Only CICS reports this state.
- **Active state.** Both CICS and IMS report this state.
- **Wait state.** Both CICS and IMS report this state, but IMS provides only Wait for I/O state and Wait for Lock state.
- **Switched state.** Only CICS reports this state.

If the subsystem supports work manager delay reporting, the delay information is available in the "Work Manager/Resource Manger State Section" of SMF Type 72 (Subtype 3) records. When a transaction service class fails to achieve its performance goal, CPExpert analyzes the information to identify the primary and secondary causes of delay.

The Wait state indicates that a task in support of the transaction was waiting on some activity. The Wait state is broken into several categories: waiting for lock, waiting for I/O, waiting for conversation, waiting for distributed request, waiting for a session to be established (locally, somewhere in the network, or somewhere in the sysplex), waiting for a timer, waiting for another product, waiting for a new latch, waiting for SSL thread, waiting for regular thread, waiting for work table, or waiting for an unidentified resource.

CPExpert produces Rule WLM124 when the primary or secondary cause of delay was that the transaction service class was in the Waiting for I/O state for a significant percent of its response time. This is not necessarily time actually performing I/O, but could be any activity related to the I/O request. For CICS transactions, this time includes:

- File Control requests
- Terminal Control wait.

⁴Please refer to Section 4 of this document for a more comprehensive discussion of the transaction states and the interaction between the subsystem (CICS or IMS) and the Workload Manager.

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- Transient data requests.
 - Temporary storage requests.
 - Shared Temporary Storage I/O wait.
 - Journaling I/O requests.
 - Waiting for I/O buffers or VSAM strings.
 - Inbound or Outbound Socket I/O wait.
 - Coupling Facility data tables server I/O wait.

These tasks would be shown as "Suspended" by the CEMT INQUIRE TASK command.

The following example illustrates the output from Rule WLM124:

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RULE WLM124:  SIGNIFICANT TRANSACTION TIME WAS WAITING FOR I/O REQUEST

A significant amount of the transaction response time for CICUSRTX Service
Class was spent waiting for some I/O request.  This is not necessarily
time actually performing I/O, but could be any activity related to the
I/O request.  For CICS transactions, this time includes:
- File Control requests.
- Transient data requests.
- Temporary storage requests.
- Journaling I/O requests.
- Waiting for I/O buffers or VSAM strings.
- Shared Temporary Storage I/O wait.
- Waiting for I/O buffers or VSAM strings.
- Inbound or Outbound Socket I/O wait.
- Coupling Facility data tables server I/O wait.
These tasks would be shown as "Suspended" by the CEMT INQUIRE TASK
command.  You should execute the CPEXpert CICS Component against the
regions serving the Service Class transactions to identify the cause
of the large Wait on I/O time.
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Suggestion: CPEXpert suggests that you execute the CICS Component of CPEXpert against the CICS regions serving the service class missing its performance goal. The CICS Component of CPEXpert should identify problems in I/O-related areas.

Reference: CICS/ESA Version 4.1 Performance Guide
Section 2.7.1.1: The response time breakdown in percentage section
Section 2.7.1.2: The state section

CICS/TS Release 1.1 Performance Guide

Section 2.7.1.1: The response time breakdown in percentage section

Section 2.7.1.2: The state section

CICS/TS Release 1.2 Performance Guide

Section 2.7.1.1: The response time breakdown in percentage section

Section 2.7.1.2: The state section

CICS/TS Release 1.3 Performance Guide

Section 2.6.1.1: The response time breakdown in percentage section

Section 2.6.1.2: The state section

CICS/TS for z/OS Release 2.1 *Performance Guide*: Chapter 8 (Managing Workloads). |

CICS/TS for z/OS Release 2.2 *Problem Determination Guide*: Section 2.3.3.6.7 (The meanings of the WLM_WAIT_TYPE parameter) |

CICS/TS for z/OS Release 2.2 *Problem Determination Guide*: Section 2.3.3.7 (The resources on which tasks in a CICS system can wait) |