

Understand and efficiently react to
problems in the system to effectively
manage CICS in the enterprise

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Gaining insight into IBM CICS systems with events

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CICS icon of progress: <http://www.ibm.com/ibm100/us/en/icons/cics/>

Executive Summary

Increasing challenges have put an even greater demand on enterprises around the world. These challenges include requirements on business compliance, governance with financial transparency, information privacy, and process control. On the other hand, businesses continuously look for new opportunities to satisfy new consumer demands by reacting swiftly and effectively to maximize their full potential.

IBM® System z® is a premier platform, with CICS® Transaction Server for z/OS® running a huge number of critical business applications. Enterprises look to these business applications to get possible solutions for their challenges. CICS Transaction Server for z/OS Version 4.1 provides the ability to participate in event processing by capturing application events, which provide insight into the processing carried out in the enterprise's applications. CICS Transaction Server for z/OS Version 4.2 extends beyond that, and provides the ability to capture and emit system events, which provide insight into the state of the enterprise's CICS system and its resources.

The events are defined without the need to make any application or system changes. They can also be emitted in a number of standard formats, and thus easily consumed in many different ways, by a range of commercial software products. System events allow the business to gain insight into whether the systems are able to support and run the business workload required, and to respond immediately when problems occur. All of these new capabilities open up a way to satisfy the challenges faced by enterprises and, at the same time, inspire the potential for event-driven enterprise business.

Introduction

CICS Transaction Server for z/OS (CICS TS) handles billions of transactions a week. Companies around the world rely on their CICS systems in their daily operation. It is very important that the CICS systems are in a good state and that companies are fully aware of the operation of the CICS systems that their business relies on.

In CICS TS 4.1, IBM introduced application events that could assist the business community in gaining insight into how their business processes were performing. In CICS TS 4.2 IBM has built upon this capability and introduced system events that can help the technical community understand the health of their CICS systems. Whilst application events are generally related to higher-level business processes, system events result from system resources, and application execution. For example, a system event can occur when the total number of running tasks hits the maximum limit. By monitoring the number of times this event happens in a certain period of time, you can determine how busy your CICS system is, whether there is a resource bottleneck or any application abnormality.

As with application events, it is important to note that CICS system events can be implemented without adding new system programming code, by specifying event-enabled points in a non-invasive way, allowing swifter deployment and faster time to value.

This paper will help you to understand what CICS system events are and how to make use of them.

What are system events?

A CICS system event is a type of event that results from system activity and contains system data, while a CICS application event is a type of event that results from application program activity and contains application data. Using system events will help you to understand changes in the state of your system resources or system health. Using application events will help you to understand your business applications and business processing.

Event-enabled system points

To source or *capture* an event, you must have a point at which activity and relevant information is known for constructing the event. When the activity of interest is a change in the system, CICS TS 4.2 provides a number of system points where system events can be captured. The following system event capture points are available:

- DB2® connection status change
- FILE enable status change
- FILE open status change
- Percentage threshold of maximum tasks in system crossed
- Percentage threshold of maximum tasks in transaction class crossed

- Unhandled transaction abend

These system event capture points are built into the CICS system code, and the corresponding events are emitted (pushed) when the condition happens. Pushing events is much more efficient than polling CICS systems periodically for changes. Compared with a polling mechanism, pushing means that you can respond to these events more quickly as there is no need to wait for a polling cycle before an event is emitted.

Specifying system events

System events are specified using an Eclipse-based tool called the Event Binding Editor. This tool is provided for CICS TS 4.2 as part of the CICS Explorer™ and is also included in Rational® Developer for System z. The event binding is an XML definition that specifies events to CICS. Each event binding consists of one or more event specifications, and references or includes, one event processing (EP) adapter specification. The EP adapter specification describes the format of the event and the transport or destination for the emitted event.

Each event specification includes the business information to be emitted and one or more capture specifications. For system events, only related system information can be mapped to the emitted business information; unlike at application capture points, there is no application data to map to business information items.

In each capture specification, the CICS system programmer can choose a system capture point. Figure 1 shows the system capture points alongside the application capture points in the Event Binding Editor.

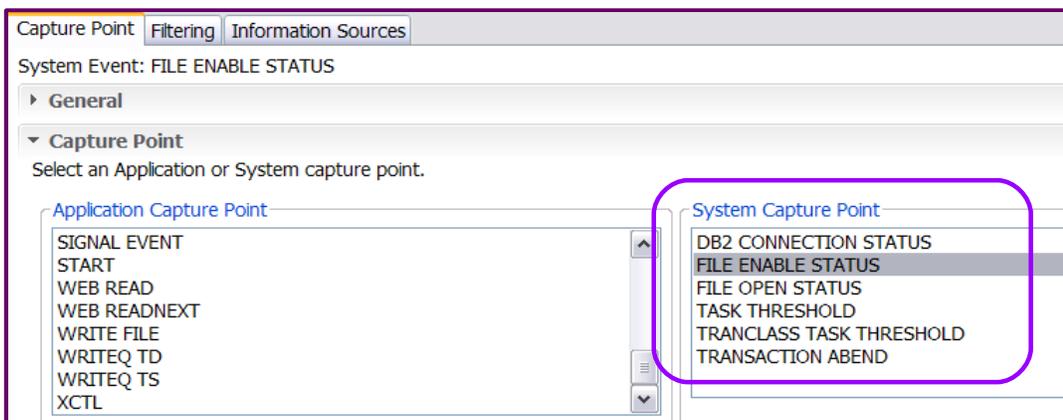


Figure 1. System event capture points

The CICS system programmer can also choose a specific filtering condition under which the event will be captured. These filtering conditions are called predicates and are matched at run time.

Figure 2 shows a filtering condition for the FILE enable status system event. The filter specifies an event is emitted if the enable status of the file TESTFILE changes from ENABLED while the file is open.

Name	Operator	Value
FILE*	Equals	TESTFILE
<input checked="" type="radio"/> FROM_ENABLESTATUS	Equals	ENABLED
<input type="radio"/> TO_ENABLESTATUS	All	DISABLED
OPENSTATUS	Equals	OPEN

Figure 2. Predicates for the FILE enable status system event

The more specific the filtering condition is, the more precise the condition under which the event will be emitted. Therefore, CICS will emit a smaller number of more specifically-targeted events.

Depending on the type of system event, the relevant information that can be captured in the event by CICS event processing varies. For example, for a FILE enable status change event, CICS can capture the file name, the dataset name, the status of the file before the event happened, the status of the file after the event happened, and whether the file was open when the event happened.

Figure 3 shows the data that can be captured for this type of system event. CICS can also capture the transaction ID and user ID that caused the status change, which may be useful in certain circumstances.

Figure 3. Capturing data for FILE enable status change event

Figure 4 shows the data that can be captured for a system event that crosses a threshold of the percentage of the maximum tasks limit in a CICS region. In this type of system event, you can also capture the transaction ID and user ID. However, the system event data is different. For this event, you can capture the number of tasks before and after the event occurred, the maximum tasks limit that is defined in the system, and the percentage of the maximum tasks limit that were in the system when the event occurred.

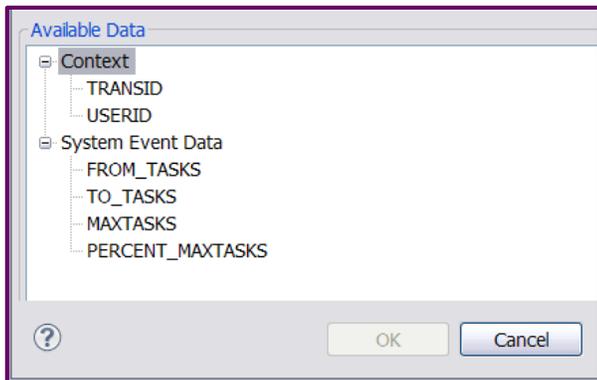


Figure 4. Capturing data for the event of crossing a threshold percentage of tasks in the system

Event bindings are packaged into bundle resources, which can be deployed into CICS using the CICS Explorer. For details on CICS event specifications, please see the white paper 'Gaining insight into critical enterprise applications with IBM CICS and business events' ¹. Exactly the same approach is used for both application and system events.

Advantages of using system events

There are a number of advantages of using system events with CICS. System events are captured in a “non-invasive” way in CICS TS 4.2. There is no need to change your CICS systems or to create new CICS programs to capture system events. The speed of implementation is fast, satisfying the business need to respond rapidly, and the process of accommodating changes is agile.

Using a push rather than a pull mechanism, the impact to the performance of the CICS system by running event processing is minimized. The emission of system events is asynchronous, which means that the emission processing is not under the thread in which the event was detected. Event processing is specifically designed so that emitting system events will not delay your business applications or the rest of your system.

As with application events, CICS system events can be formatted in a number of standard formats to provide integration with other products. With the variety of formats, CICS events can support a wide range of consumers. The supplied formats are:

- Common base event (CBE) format, based on Common Base Event (CBE) version 1.0.1.
- Common base event REST (CBER) format, a basic XML representation of a CICS event. The CBER format can be consumed by any HTTP server that requires events in XML format.
- WebSphere® Business Event (WBE) format, an XML representation that is recognized by WebSphere Business Events. This format can also be used by any consumer that can recognize the WBE XML format.
- CICS flattened event (CFE) format, a CICS programming data structure.
- CICS container-based event (CCE) format, providing a CICS channel with

containers. The CCE format can be used to extend application behavior in an event-driven way by driving a new CICS transaction, which uses the information passed to it in the container-based event format.

As with application events, CICS system events can be transported through a number of popular mechanisms by the provided EP adapters. The formatted events can be sent to a WebSphere MQ® queue, to an HTTP server, to a CICS temporary storage queue, or to start a CICS transaction. You can also implement a user-written custom EP adapter for specific business requirements, making it possible to emit events in any format and over any transport.

Combining these rich capabilities, CICS system events have advantages which are welcomed by both event emitters and event consumers. For example, CICS system events can be consumed and combined with other events by WebSphere Business Events to derive follow-on processing after detecting patterns of these events.

Comparing CICS system events with system monitoring tools

The IBM Tivoli® family of products is IBM's solution for processing IT system events. In particular, IBM Tivoli OMEGAMON® XE for CICS on z/OS is a comprehensive CICS system monitoring product. It enables monitoring and management of CICS transactions and resources. In contrast, CICS TS 4.2 event processing provides a light-weight and smaller scale solution towards monitoring certain aspects of the CICS system. CICS system changes can be detected immediately by CICS event processing, and with the variety of EP adapters, these events can be sent out to a number of different consumers.

The real-time analysis component of CICSplex® System Manager (RTA) allows you to define and manage notification of exception conditions at your enterprise. For example, it can send out MVS™ operator notifications if CICS has reached the maximum tasks (MXT) limit. With CICS TS 4.2 event processing, you can easily request events when the CICS system tasks goes higher than 60%, 70%, 80%, 90% and 100% of MXT. This can give system administrators an understanding of how the system performs prior to reaching the maximum level, and therefore the ability to react to the condition earlier.

Both IBM Tivoli OMEGAMON XE for CICS on z/OS and RTA support a broad range of system conditions, but for some conditions use a polling mechanism to acquire the information needed, which implies a bigger impact on CICS system performance and a less timely reporting of events. CICS system events are a targeted set of events which particularly benefit from not using polling.

Business use cases with system events

IBM has a rich suite of software products that support business event processing. Two very important event processing products are IBM Business Monitor and WebSphere Business Events.

WebSphere Business Events is a business event processing engine, which can combine events from a number of event sources and which allows complex processing of the

events². Decisions about the actions to be taken when a particular pattern of events is detected can be derived using ILOG® JRules together with WebSphere Business Events when using the WebSphere Decision Server. WebSphere Business Events provides a friendly user interface for business users to manage events to achieve business goals.

CICS TS 4.2 can act as an event source to work with WebSphere Business Events. For example, for any CICS system which has a maximum tasks limit of 10 or above, you could define a TASK THRESHOLD system event such that events will be emitted when the percentage of the CICS tasks in the system goes over 80% of the MXT limit. These events can be consumed by WebSphere Business Events. In WebSphere Business Events, you can define that if three such events are received over a certain period of time, an email notification is sent to notify the system administrator to investigate the load on the system. You can also specify that a cloned stand-by CICS region is to be started to ease the workload of the other systems.

IBM Business Monitor (formerly IBM WebSphere Business Monitor) is a comprehensive business activity monitoring (BAM) software that provides business users and managers a real-time and end-to-end view of business processing, events and operations³. With IBM Business Monitor, you can quickly build a dashboard with the CICS events and other sources of events and gain insight into your CICS systems. You can also integrate other business applications based on the events.

For example, by specifying an FILE enable status change event with TO_ENABLESTATUS being UNENABLED and a context filter of TRANSID being CSFU, you can monitor whether a file defined with OPENTIME(STARTUP) failed to open during CICS initialization. If the file fails to open the file you will get an event, as the enable status will change from DISABLED to UNENABLED. Figure 5 shows the corresponding filtering configuration of the capture specification of this event.

The screenshot shows the configuration for a system event named 'FILE ENABLE STATUS'. The interface is divided into two main sections: 'Context' and 'Event Options'.

Context Section:

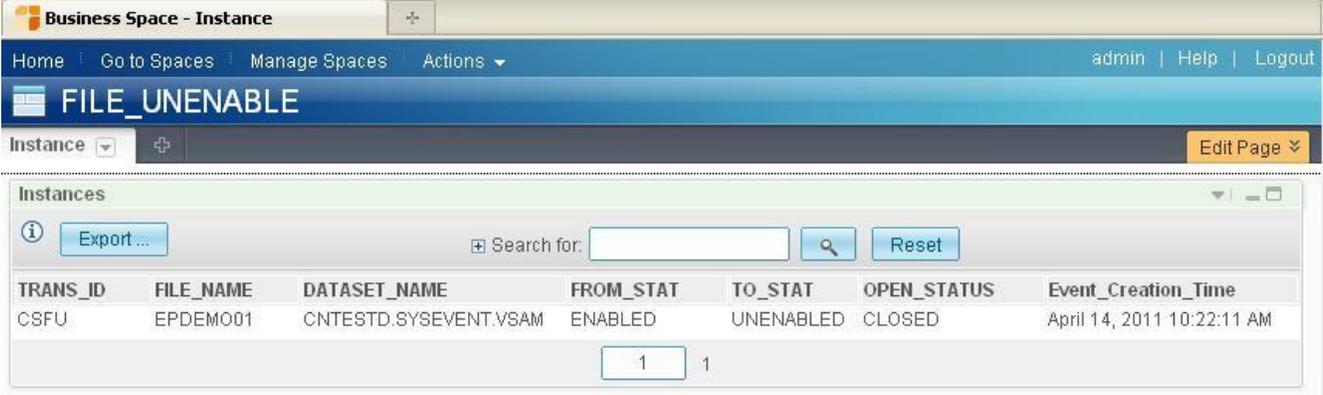
Context	Operator	Value
Transaction ID	Equals	CSFU
User ID	All	

Event Options Section:

Name	Operator	Value
FILE*	Equals	EPDEMO01
<input type="radio"/> FROM_ENABLESTATUS	All	DISABLED
<input checked="" type="radio"/> TO_ENABLESTATUS	Equals	UNENABLED
OPENSTATUS	All	CLOSED

Figure 5. FILE enable status system event predicates

Figure 6 shows one of such event being displayed on a IBM Business Monitor dashboard. By monitoring this kind of event, you can be aware of the failure as soon as it happens.



The screenshot shows the IBM Business Monitor dashboard for a 'Business Space - Instance'. The main heading is 'FILE_UNENABLE'. Below the heading, there is a table with the following data:

TRANS_ID	FILE_NAME	DATASET_NAME	FROM_STAT	TO_STAT	OPEN_STATUS	Event_Creation_Time
CSFU	EPDEMO01	CNTESTD.SYSEVENT.VSAM	ENABLED	UNENABLED	CLOSED	April 14, 2011 10:22:11 AM

Below the table, there are two input fields, both containing the number '1', likely for pagination or filtering.

Figure 6. IBM Business Monitor dashboard showing an event when FILE enable status becomes UNENABLED

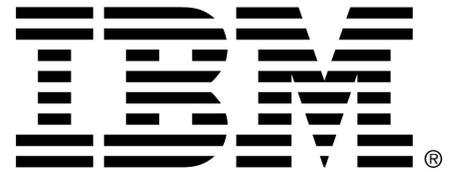
Another example is to use an unhandled transaction abend event to monitor how often unhandled transaction abends happen in the system. Unhandled transaction abends often indicate problems with the coding of the business application. By monitoring this event, you have a view of how well the business application is written and whether the application needs re-engineering.

Conclusion

In conclusion, with the system event capability provided by CICS Transaction Server for z/OS for Version 4.2, you can gain a pro-active view of your CICS systems with minimal performance impact and development overhead. Together with other IBM business processing products, you can build event-driven business processes to manage your enterprise system.

Further reading

1. "Gaining insight into critical enterprise applications with IBM CICS and business events," IBM, July 2009:
<http://public.dhe.ibm.com/common/ssi/ecm/en/zsw03120usen/ZSW03120USEN.PDF>
2. "Empowering the business to sense and respond: delivering business event processing with IBM WebSphere Business Events", IBM, July 2008:
ftp://ftp.boulder.ibm.com/software/integration/wbe/Delivering_Business_Event_Processing_with_WebSphere_Business_Events.pdf
3. IBM Business Monitor: <http://www.ibm.com/software/integration/business-monitor/>



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