CICS Version 4 – Event Processing

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Agenda

- Changing landscape of technologies
- Event Processing in CICS TS V4.1
- Event Processing in CICS TS V4.1 Demo
- Event Processing in CICS TS V4.2
- Event Processing in CICS TS V4.2 Demo
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We are living in a new landscape...

People

Companies

Institutions

Industries

Man-made systems

Nature’s systems
"Today, there are 1 billion transistors for each person on the planet"¹

"There are 30 billion RFID tags embedded into our world and across entire ecosystems"¹

¹ Sam Palmisano speech, November 12, 2008
Interconnected

“The internet of people is nearly 2 billion strong. Almost one third of the world’s population”¹

“Over 4 billion mobile phone subscribers worldwide”²

¹ World Internet Users and Population Stats
² World Bank, World Development Indicators
“Every day, 15 petabytes of new information are being generated. This is 8x more than the information in all U.S. Libraries”¹

“An average company with 1,000 employees spends $5.3 million a year to find information stored on its servers”¹

¹ New Intelligence White Paper from ThinkForward website
Information is Everywhere and Consumable
What does this mean for businesses?

• If a business can become *instrumented* and *interconnected* then end to end process visibility can be achieved.

• This visibility allows *intelligent* decisions to be made which enables the business to...

Mitigate Risk and Identify Opportunities
React with Greater Agility
Deliver Faster Time to Value
What’s the problem?

- Clearly businesses need to keep up with the changing landscape of technologies...
- ...but struggle to do so because they can’t update the old applications that underpin their processes.
The computing environments on which business applications run must provide capabilities to non-invasively instrument them to take advantage of these technologies.¹

¹ Paraphrased from: Smarter Banking with CICS Transaction Server Redbook
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What are Business Events?

“As the pace of interactions increases, untapped potential exists in the business events flowing throughout our enterprises”

Large companies can experience up to 800 Billion business events daily

Nearly 4 Trillion RFID events are emitted each day

Over 30 Billion CICS transactions per day

“A business event is an action that has happened, or the absence of it happening, which has relevance to the business”
What is Business Event Processing?

"Turn insight into action"

**Event:** Pos Purchase

**Business Context:** 2nd purchase in a week and total purchases this year > $1000

**Action:** Offer loyalty program membership before customer leaves the store

---

**Event:** No meter signal

**Business Context:** Third consecutive period without signal

**Action:** Trigger automated troubleshooting process

---

**Event:** GPS Signal

**Business Context:** Calculated arrival > 30 min over SLA

**Action:** Phone customer to re-arrange delivery
The Path to Event Aware Enterprise

1990

Applications: ERP/CRM
Discrete, data oriented, processing for non-differentiating, transactional processes.

2000

Business Process Management
Provides a flexible architectural style in support of efficient process change, deployment and orchestration, empowering business and IT people to more effectively collaborate.

2010

Business Event Processing
Detect, correlate and respond to business situations for early and intelligent insight.
IBM Delivers Business Event Processing
CICS has a key part to play
CICS TS V4.1 Event Processing Support Overview

- Development and Deployment Tools
- Existing Business Logic
  - CODE
  - NOT CHANGED
- CICS Event Processing
  - Event Capture
  - Filtering
  - Enrichment
  - Formatting
  - Routing
  - Extensible
  - Secured
  - Monitored etc.
- Captured Events
- CICS TS for z/OS v4.1
- WebSphere Business Events
- WebSphere Business Monitor
- Events
- Other Event Consumers

Code Not Changed Captured Events
CICS TS V4.1 Event Processing Support Overview

Existing Business Logic

CICS Event Processing

- Event Capture
- Filtering
- Enrichment
- Formatting
- Routing
- Extensible
- Secured
- Monitored
- etc.

Events

CICS TS for z/OS v4.1

CODE
NOT
CHANGED

Development and Deployment Tools

WebSphere Business Events

WebSphere Business Monitor

Other Event Consumers

Captured Events

CODE NOT CHANGED
Where can events be captured?

• In CICS V4.1 events can be captured at...

  • ...any event enabled API call
    • Non invasive

  • ...program initialisation
    • Non invasive

  • ...an explicit EXEC CICS SIGNAL EVENT call
    • Small program change required
Filters

- There are 3 types of filter that can be used to determine that an event has happened at a particular capture point:
  - Context filters
  - Command option filters
  - Data filters
Context Filters

- Allow you to identify events based on context, for example:

  - **Current Transaction**
  - **Current Program**
  - **Current User ID**
Command Option Filters

- Allow you to identify events based on attribute values in the API command of the capture point, for example:
  
  - **File name on a WRITE FILE command**
  
  - **Channel name on LINK PROGRAM**
Data Filters

- Allow you to identify events based on data values in the application, for example:
  - Integer at offset 25 in the FROM field on a WRITE FILE command is greater than 500
  - Data in a certain container in the current channel
Capture Data

• Once an event point is identified, data can be captured from the application to populate the event
## The Performance Question…

<table>
<thead>
<tr>
<th>EP On/Off</th>
<th>API in spec</th>
<th>Primary Predicate Match</th>
<th>Other Predicate Match</th>
<th>Capture Process</th>
<th>Cost</th>
</tr>
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<td></td>
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<td></td>
<td></td>
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<tr>
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<tr>
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<td>YES</td>
<td>NO</td>
<td>+11 microseconds</td>
</tr>
</tbody>
</table>
The Performance Question…

![Bar chart showing CPU time per transaction for different test cases.](chart.png)
Event Emission

• Once an event is captured it is queued for emission via an Event Processing Adapter
  • EP Adapters format and emit events from CICS using a range of transports:
    • WebSphere Message Queue
    • Transaction Start
    • TS Queue
    • Custom
“But I don’t have MQ. How do I emit my events from CICS?”

• Once an event is captured it is queued for emission via an Event Processing Adapter
  • EP Adapters format and emit events from CICS using a range of transports:
    • WMQ
    • Transaction Start
    • TS Queue
    • Custom

![HTTP EP Adapter configuration](image-url)
Event Emission

- Event captured by Business Logic and sent to the Event Dispatcher.
- Event Dispatcher sends the CICS Event to one of the EP Adapters:
  - WebSphere MQ EP Adapter
  - 'HTTP' EP Adapter
  - CICS Transaction Start EP Adapter
  - TS Queue EP Adapter
  - Custom EP Adapter

- The EP Adapters handle the event and send it to the following transports and primary uses:
  - CBE: WebSphere Business Events
  - CBER: WebSphere Business Events
  - WBE: WebSphere Business Events
  - CCE: CICS Transaction
  - CFE: CICS TS Queue

- The primary uses are:
  - WebSphere Business Monitor
  - WebSphere Business Events
  - Any Consumer

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EP Adapters Advanced Options

- **Dispatcher Priority** – Normal or High
- **Transaction ID** – Run the EP adapter with a specific Transaction ID
- **User ID** – Run the EP adapter with a specific User ID
- **Events are Transactional**
  - When set, causes CICS to wait for sync point completion before either emitting or discarding event (depending on sync point outcome)
  - *Note:* Transactional events are not emitted until the UOW reaches sync point – for some transactions, this could mean the events are not very close to real-time
Event Bindings

• Tells CICS how to identify, capture, format and emit events

• Created using the CICS Explorer Event Binding Editor

• Installed via a Bundle and managed like any other CICS resource
Event Bindings

Bundle

Event Binding

Business Event Specification

Capture Specification

EP Adapter Configuration
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Event Processing in V4.x

• Event Processing in CICS TS V4.1 is a good foundation.

• Event Processing in CICS TS V4.2 builds on that foundation to enhance both capability and usability.

• Event Processing in CICS TS V4.2 aims to address customer questions arising from interest in the V4.1 capability.
Event Processing in V4.2 basic improvements

- More data types supported for filter and capture:
  - Sign leading/trailing Zoned Decimal
  - Hexadecimal floating point
  - Binary floating point
  - Decimal floating point (requires optional hardware facility)
  - Null terminated character
  - Null terminated hex

“We’ve started using events and we have many event bindings. All of our events are emitted using identical EP adapter specifications. What happens if need to change the EP adapter specification? We worry that it would be a lot of work to change it due the number of event bindings we have.”
Solution: Separate EP adapters

- In CICS TS V4.2 EP adapter specifications can be defined and managed separately to Event Bindings.
- Event Bindings can reference these EP adapters by name.
EP adapters in bundles

Bundle

Event Binding

Business Event Specification

Capture Specification

EP Adapter Reference

Separate EP Adapter Specification
“We emit events from a number of our applications. If we ever needed to make a change to any of those applications how would we know which event capture specifications could be affected and may need updating?”
Solution: EP Search

- Available in the CICS Explorer

- Enter the name of the thing you have changed and EP search will tell you which event bindings may be affected.

- ‘Things’ include:
  - CICS resource names
  - Language Structure names
  - Language Structure field names

- Searches event bindings in the CICS Explorer workspace and those installed in CICS regions that Explorer is connected to.
EP Search Interface

Search

- Search string: EPDEMO
- Case sensitive: Off
- Search for resource type: URIMAP
- in context: On
- in event options: On
- in adapters: On
- Ignore predicates with operator "All": Off
- Search for source information: in application data: On, in information sources: On, in file names: On
- Variable names: On, Structure names: On
- Search scope: Workspace
- CICS resources installed in: Not connected

Search for: System_event_demo, HTTP_TEST_SERVER.epadapter, Test, EPDevUnitTest.evbind, InvokeServiceCap, InvokeServiceFilter, InvokeMyService, Vegetable_event_bind, Vegetable_events.evbind, WTC2010_EPDemo, Vegetable_order_events.evbind, HTTP Adapter.
“I can see how events can be used for non critical functions like monitoring and analytics, but how can I reliably use events to extend my applications if an application can complete successfully even if an event captured from it fails to be emitted?”
Solution: Synchronous emission mode

- New Synchronous emission mode option on the EP adapter. When Synchronous emission is used event emission is Assured.

- Causes events to be formatted and emitted as part of the capturing UOW.

- If the event fails to be emitted the capturing UOW will be backed out at syncpoint and its transaction is abended with ASP7.

- Not available for the Transaction Start adapter.
Synchronous Transactional Event Emission

- Use Synchronous Emission with a Transactional EP adapter

- Capturing UOW is backed out if the event emission fails
- Event is backed out if the capturing UOW fails.

- Event must be emitted to a recoverable resource.

- Adapter options
  - WMQ adapter – where the queue is recoverable
  - TSQ adapter – where the queue is recoverable
  - Custom adapter – where all actions are recoverable if the EPAP_RECOVER flag is set in the DFHEP.ADAPTPARM container.
Let’s see that in action...
“Can I capture events when something happens in my system, e.g. when a transaction abends or the system load goes over 80% of MAXTASKS?”
Solution: System event capture points

- 6 new system event capture points

Capture events when:
- DB2 connection status changes
- FILE enable status changes
- FILE open status changes
- Unhandled transaction abends
- Current active tasks for a TRANCLASS goes above or below a certain percentage of MAXACTIVE.
- Current active task in a region goes above or below a certain percentage of MAXTASKs.
System event capture points

- **Business Logic Capture Point**: Event captured and sent to Synchroous Event Dispatcher.
- **System Activity Capture Point**: Event captured and sent to Custom EP Adapter.

**EP Adapter Interface**
- **WebSphere MQ EP Adapter**: CBE, CBE, CBE.
- **HTTP EP Adapter**: CBER, WBE.
- **CICS Transaction Start EP Adapter**: CCE, CBER, WBE, CBE, CFE.
- **TS Queue EP Adapter**: CBER, WBE, CBE, CFE.

**Event Format**
- WebSphere Business Monitor
- WebSphere Business Events
- Any Consumer
System event capture point details

- No Polling - Events are captured and emitted when the system condition of interest occurs.

- Configured, managed and deployed using the Event Binding Editor just like application events in CICS V4.1.

- Emitted using EP adapters

- Do NOT support synchronous or transactional EP adapters.
Task Threshold capture point details

- TASK_THRESHOLD and TRANCLASS_TASK_THRESHOLD

- Can capture an event when current active tasks for a region or a TRANCLASS
  - Goes above 60%, 70%, 80%, 90%, 100%*
  - Goes below 50%, 60%, 70%, 80%, 90%*
  *of MAXTASKs or MAXACTIVE.

- Need to consider the effect of tasks attached as a result of event emission e.g. some EP adapters are run under a new task

- Cannot capture task threshold events for MAXACTIVE or MAXTASKS less than 10.
Preventing task threshold event flooding

- Events can be captured only when the number of active tasks crosses a new threshold boundary.

- This prevents event flooding when workloads flip flop across a threshold.

![Graph showing active tasks and event opportunities over time](image)
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Summary

- **Changing landscape of technologies**
  - Information everywhere and consumable.
  - Need to instrument applications…
  - …through functionality provided by the computing environment.

- **Event Processing in CICS V4.1**
  - Business event processing
  - CICS 4.1 event processing capabilities
  - Concepts and configuration

- **Event Processing in CICS V4.1 Demo**

- **Event Processing in CICS V4.2**
  - Separate EP adapters
  - EP Search
  - Synchronous Emission Mode and Assured Events
  - System Events

- **Event Processing in CICS V4.2 Demo**
Want to know more?

Session TAC-2264: CICS Events Usage Patterns and Implementation Scenarios

Wednesday 1:30pm
Venetian - Murano 3203
Thank you for listening.

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