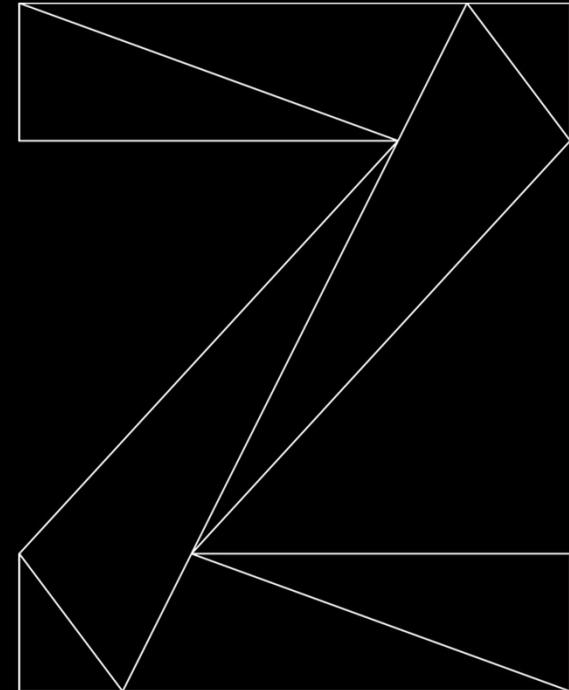


# CICS Event processing & CICS Policies

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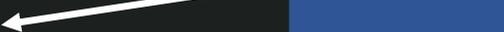
# Agenda

- Intro to CICS events
- Intro to CICS policy
- Demos

# What's Event processing in CICS?

- Business happens in your application, e.g.
  - Withdraw from bank account
  - Request for a loan created
  - Placing an order for some office supplies
- CICS can monitor and notify you that some kind of “business event” has happened
  - so that you can add extra value to it.
- You can extend your application using event processing in CICS **without modifying application source code.**

# Events correspond to your application source

```
CATALOG-INQUIRE.  
  MOVE 'EXCATMAN: CATALOG-INQUIRE' TO CA-RESPONSE-MESSAGE  
  EXEC CICS LINK      PROGRAM(WO-DATASTORE-PROG)  
                   COMMAREA(DFHCOMMAREA)  
  
  END-EXEC  
  EXIT.  
  
=====*  
* Procedure to link to Datastore program to place order,      *  
* send request to dispatcher and notify stock manager        *  
* an order has been placed                                   *  
=====*  
PLACE-ORDER.  
  MOVE 'EXCATMAN: PLACE-ORDER' TO CA-RESPONSE-MESSAGE  
  EXEC CICS LINK PROGRAM(WO-DATASTORE-PROG)  COMMAREA(DFHCOMMAREA)  
  
  END-EXEC  
  
  IF CA-RETURN-CODE EQUAL 00  
* Link to the Order dispatch program with details  
* Set up commarea for request  
  INITIALIZE WS-STOCK-COMMAREA  
  MOVE '01DSP0' TO CA-ORD-REQUEST-ID  
  MOVE CA-USERID TO CA-ORD-USERID  
  MOVE CA-CHARGE-DEPT TO CA-ORD-CHARGE-DEPT  
  MOVE CA-ITEM-REF-NUMBER TO CA-ORD-ITEM-REF-NUMBER  
  MOVE CA-QUANTITY-REQ TO CA-ORD-QUANTITY-REQ  
  EXEC CICS LINK PROGRAM (WO-DISPATCH-PROG)  
                   COMMAREA(WO-STOCK-COMMAREA)
```

If we run this line of code,  
an order is being placed  
from the catalog.

Events allow us to tell  
people that it has  
happened.

# Without modifying source code?

- Events in your source code are centered around usage of the EXEC CICS APIs
- You define which EXEC CICS calls correspond to your business events
- You also define the destination (who), format (how), content (what) of the event.
- CICS uses these definitions to monitor and capture your business events.

# Get it started

What we need:

- CICS Explorer – this is where you create event binding (.evbind file)
- CICS region – this is where event binding will be deployed
- Optionally application source code including copybooks as a reference

What artifacts need to be defined?

- CICS bundle project – this is where .evbind file resides
- Event binding (.evbind file)
  - Capture specification
  - Define which EXEC CICS commands to monitor
  - Define filtering to capture at the desired point
  - Define the event's destination, format, what's in it

CICS Explorer

CICS bundle

Event binding A

Capture specifications

EP adapter/  
adapterset

Export

zFS

Install

Trigger

CICS region

## Specifications

- order\_placed
  - order\_to\_XVDS
- item\_inquired
  - inquire\_to\_XVDS

Capture Point Filtering Information Sources

Application Event: LINK PROGRAM

### General

Identify and describe the capture specification.

Name order\_to\_XVDS

Description

Delete Capture Specification Copy Capture Specification To...

### Capture Point

Select an Application or System capture point.

Application Capture Point

- INVOKE SERVICE
- LINK PROGRAM
- PROGRAM INIT
- PUT CONTAINER
- PUT64 CONTAINER
- READ
- READNEXT
- READPREV
- READQ TD

Capture before or after command runs

Before  After

# Catalog Manager Sample Application

```
CICS EXAMPLE CATALOG APPLICATION - Inquire Catalog
Select a single item to order with /, then press ENTER

Item      Description                                Cost      Order
-----
0010      Ball Pens Black 24pk                          2.90      -
0020      Ball Pens Blue 24pk                            2.90      -
0030      Ball Pens Red 24pk                             2.90      -
0040      Ball Pens Green 24pk                           2.90      -
0050      Highlighters Orange 100pk                       1.78      -
0060      Highlighters Assorted 5pk                       3.89      -
0070      Laser Paper 28-lb 108 Bright 500/ream           7.44      -
0080      Laser Paper 28-lb 108 Bright 2500/case          33.54     -
0090      Blue Laser Paper 20lb 500/ream                   5.35      -
0100      Green Laser Paper 20lb 500/ream                   5.35      -
0110      IBM Network Printer 24 - Toner cart             169.56     -
0120      Standard Diary: Week to view 8 1/4x5 3/4        25.99     -
0130      Wall Planner: Eraseable 36x24                   18.85     -
0140      70 Sheet Hard Back wire bound notepad           5.89      -
0150      Sticky Notes 3x3 Assorted Colors 5pk            5.35      -

F3=EXIT   F7=BACK   F8=FORWARD  F12=CANCEL
Mâ a                                           07/063
```

# Catalog Manager Architecture

(Link to DFH0XVDS to inquire items and place order)



# Event binding demo

# Application event capture points

- CONVERSE
- DELETE FILE
- DELETEQ TD
- DELETEQ TS
- INVOKE SERVICE
- LINK PROGRAM
- PROGRAM INIT
- PUT CONTAINER
- PUT64 CONTAINER
- READ
- READNEXT
- READPREV
- READQ TD
- READQ TS
- RECEIVE
- RECEIVE MAP
- RETRIEVE
- RETURN
- REWRITE
- SEND
- SEND MAP
- SEND TEXT
- START
- WEB READ
- WEB READNEXT
- WRITE FILE
- WRITE OPERATOR
- WRITEQ TD
- WRITEQ TS
- XCTL
- SIGNAL EVENT

# EP Adapters

- Provided EP Adapters
  - IBM MQ
  - HTTP POST
  - Transaction START
  - TS queue
  - TD queue
- You can write your own custom EP adapters if none of the provided suit your purposes
- EP Adapters (and sets of) can be defined independently and shared between multiple event bindings (i.e. send all events to MQ)

# Event dispatching – how do I want the event being emitted in relation to the capturing task?

- Do I want the **task UOW roll back** if the event is not emitted successfully?
  - Scenario: the event is captured when my transaction increased a credit card's limit. The event is sent to approver. If the approver is not available (i.e. emission fails), do I want to roll back the increase and abend the task with ASP7?
  - Yes: use Sync emission mode.
  - No: use Async emission mode.

Advanced Options  
These optional dispatcher settings are for advanced users.

Emission Mode	<input type="radio"/> Async <input checked="" type="radio"/> Sync
Dispatch Priority	Normal
Transaction ID	
User ID	
Events are Transactional	<input checked="" type="checkbox"/>

Event Binding | Specification | Adapter

- Do I want the **event discarded** if the task UOW fails the commit?
  - Scenario: the event is captured when my transaction has reduced a bank account's balance. If this transaction is rolled back, I want to ignore this event so don't emit it.
  - Yes: use transactional event. The event is held within CICS until the outcome of UOW is clear.
  - No: The event is emitted as soon as it is captured.

# Event dispatching – how do I want the event being emitted in relation to other events?

- Do I want this event **in preference** to other events that are queueing for being dispatched by CICS?
  - Scenario: the event is captured from a very important business application.
  - Yes: use HIGH dispatch priority.
  - No: use NORMAL dispatch priority.
  - This choice is only relevant for Async emission mode

▼ **Advanced Options**  
These optional dispatcher settings are for advanced users.

Emission Mode	<input checked="" type="radio"/> Async <input type="radio"/> Sync
Dispatch Priority	High
Transaction ID	<input type="text"/>
User ID	<input type="text"/>
Events are Transactional	<input checked="" type="checkbox"/>

< Adapter

# SPIs and statistics for event processing

- EXEC CICS INQUIRE/SET:
  - EPADAPTER
  - EVENTBINDING
  - EVENTPROCESS
  - etc.
- Event processing statistics shows:
  - Number of events captured
  - Number of events queuing to be emitted
  - Number of async and synchronous events
  - Failed events
  - Emitted events to different types of EP adapter
  - Event bindings/EP adapters/Capture specifications
  - etc.

# CICS policy

# Policy rule – when to use?

- CICS Policy is a modern way to provide real time monitoring of the status of CICS region and CICS tasks.
- Two types of policy rules
  - **Task rules**: Monitor and action when:
    - A CICS user task makes excessive use of system resources
    - e.g. a user task has consumed x amount of storage or issued x number of certain requests
  - **System rules**: Monitor and action when:
    - The state of a system resource changes, e.g. a FILE is closed
    - The overall system health changes, e.g. the number of active tasks exceeds 80% of MXT
- No polling!
- CICS system events are deprecated and replaced by CICS policies.
- CPSM RTA is deprecated. Migrate to CICS policies.

CICS Explorer

## CICS bundle

CICS policy A

Rule 1 –  
MQ status change

Rule 2 –  
DB2 status change

CICS policy B

Rule 1 –  
CPU time

Rule 2 –  
SQL commands

Export

zFS

Install

Trigger

CICS region

## Rules

Rules

type filter text

- cont1 (Container storage)
- storage (Storage allocation)

### General Information

Rule type: Storage allocation

Perform an action when the amount of storage that is allocated by a user task exceeds a threshold. The threshold applies to a specific storage class and is not a cumulative count of all storage requests.

Description:

### Condition

This rule will trigger when the following condition is met:

All storage allocated greater than 1 gigabytes

Limit this rule to specific transaction IDs and user IDs:

Transaction ID: all

User ID: all

This rule requires CICS TS 6.1 or later

### Action

What action should be taken when the threshold is exceeded?

- Issue a message
- Emit an event

EP Adapter

Event name:

Static Data (0 items)

Abend the task with abend code: AMPB

# CICS policy demo

# Policy task rule types

- ASYNC requests
- Database requests
- EXEC CICS requests
- File requests
- IBM MQ requests
- Named counter requests
- Program requests
- Start requests
- Storage requests
- Syncpoint requests
- TD queue requests
- TS queue requests
- Storage allocation
- Container storage
- TS queue bytes
- Time (CPU, elapsed)

# Limiting task rules' scope

- Task rule can be limited to certain transaction ID and/or user ID
- Task rule can also be limited by policy scope on entry point:
  - PROGRAM, TRANSACTION, or URIMAP entry point
  - Policy scope can be used with or without CICS Cloud.
  - CICS Explorer KC describe how to define it:
    - [https://www.ibm.com/support/knowledgecenter/SSSQ3W\\_5.5.0/com.ibm.cics.core.help/topics/tasks/task\\_add\\_policy\\_scope.html](https://www.ibm.com/support/knowledgecenter/SSSQ3W_5.5.0/com.ibm.cics.core.help/topics/tasks/task_add_policy_scope.html)

# Policy task rules – how counting is done by CICS?

- Requests are counted regardless the request is successful or not
  - Except storage and TS queue byte counts
- Storage requests
  - Counts all explicit and implicit GETMAIN requests for task storage.
  - Counts decremented on FREEMAIN (except SHARED)
- Time (CPU or Elapsed)
  - Checked on every EXEC CICS command or when TRUE invoked
    - but the time only incremented when the task gives up control

# Policy task rule actions

- Choice of 3 automated actions:
  - Issue a message
  - Emit an event
  - Abend the current task

# Policy task rule action - message

- Issue a message (DFHMP3001)
  - Can be used with existing automation products
- All policy message (DFHMPnnnn) are output to CMPO TDQ
  - Its default TDQ definition redirects this to CSSL destination
- Example message:

DFHMP3001 06/16/2020 13:07:47 IYK2Z3B1 Task 00178(CECI) exceeded a policy threshold.  
BundleId=rbs\_demo, PolicyName=rbs\_demo\_policy, RuleName=more\_han\_5\_FILEA\_reads,  
RuleType=filerequest, Category=read, Threshold=5 (Value=5, Unit=), CurrentCount=6.

# Policy task rule action - emit event

- Emit a CICS policy event
  - All EP adapter types and event formats supported
  - Policy names the EP adapter or EP adapter set to consume event
    - MQ, HTTP, transaction start, TDQ, TSQ, or custom EP adapter.
    - Policy events can be emitted only to asynchronous and non-transactional EP adapters.
  - Event capture data is pre-canned and cannot be changed.
    - See CICS doc for full details on data captured for a policy event  
<https://www.ibm.com/docs/en/cics-ts/6.1?topic=actions-data-captured-policy-event>

# Policy task rule action - abend

- Abend the CICS task
  - Default abend code is AMPB but can be user-defined
  - Message DFHMP3002 is issued too

DFHMP3002 06/16/2020 13:09:02 IYK2Z3B1 Task 00178(CECI) exceeded a policy threshold and is abended with abend code AMPB. BundleId=demo, PolicyName=demo\_policy, RuleName=more\_han\_10\_FILEA\_reads, RuleType=filerequest, Category=read, Threshold=10 (Value=10, Unit=), CurrentCount=11.

# Task rules doesn't apply to ...

- All CICS system tasks
  - Includes CPLT at systems initialization
- All terminal initiated CICS supplied transactions, e.g. CEDA, CEMT, CESN etc.
  - Except CECI
- All user tasks started by event processing
- All non-terminal CICS supplied transactions.
  - Except:
    - ✓ All web interface tasks
    - ✓ All CICS MQ bridge tasks
    - ✓ All CICS mirror transactions
    - ✓ All Liberty initiated transactions
    - ✓ All CICS pipeline tasks

# How to decide the threshold for task rules?

- Performance Analyzer
  - Sample forms to produce reports you can use to identify suitable threshold values to set in task rules

Policy rule type	Sample CICS PA Version 5.4 form	Title	Description
Async request	ASSUM	Asynchronous API Activity	Provides details of EXEC CICS asynchronous API requests by transaction.
Database request	MPRMIRQ	Platform - RMI Requests Summary	Provides details of DB2®, IMS (DBCTL), and IBM® MQ requests by transaction.
EXEC CICS request	MPMISC3	Platform – Misc Requests Summary	Provides details of EXEC CICS requests, named counter requests, program link requests, start requests, and syncpoint requests by transaction.

- Complete list of CICS PA forms:

<https://www.ibm.com/docs/en/cics-ts/6.1?topic=policies-cics-pa>

# Policy system rules

- Introduced in CICS TS 5.4 to provide equivalent function to CICS system events
  - CICS System events support is now deprecated and may be removed in a future release of CICS.
- Further new system rules introduced in CICS TS 5.5 and CICS TS 5.6 to address user requirements
  - PI92806 backported new CICS TS 5.5 rules to CICS TS 5.4
  - PH07632 backported new CICS TS 5.6 rules to CICS TS 5.5

# Policy system rule types

- Bundle available status
- Bundle enable status
- DB2 connection status
- DBCTL connection status
- File enable status
- File open status
- IBM MQ Connection status
- IPIC connection status
- MRO connection status
- Pipeline enable status
- Program enable status
- Compound condition
- AID threshold
- Transaction dump threshold
- Message
- User Tasks
- Transaction abend (unhandled)
- Transaction class tasks
- Transaction class queued tasks (CICS TS 6.2 open beta)

# Scope of system rules

- Most system rules can monitor certain state change of a resource.
- For example a FILE ENABLE system rule can be limit to
  - Only specific status changes, e.g. status changes to DISABLED
  - Only for FILE's whose name equal or not equal to a given name, e.g. "FILEA"
  - Or only for FILE's whose names start with or don't start with a given string, e.g. "FIL"
- You can also limit rule to specific TRANSACTION id's or USER id's for most rule types

# Policy system rule actions

- Issue a message (DFHMP3009)
- Emit a CICS event
  - The event is pre-canned.
- For AID threshold rule only, fail the EXEC CICS START request with INVREQ.
- Set WLM health status
  - Set z/OS WLM health OPEN, CLOSED or IMM CLOSE
  - Optionally set WLM health interval (from CICS TS 6.1 APAR PH58295).

Set z/OS WLM open status to:

CLOSED



Set interval to



10

seconds

# Policy messages for system rules

- For MESSAGE action:

DFHMP3009 06/16/2020 13:16:51 IYK2Z3B1 Task 00191 (CEMT) has triggered a fileEnable system rule filea\_is\_disabled  
(FILE=FILEA, FROM=DISABLING, TO=DISABLED) defined by policy demo\_policy in bundle demo.

- The portion of message in brackets varies depending on the rule, e.g.
  - User task rule: (FROM=90, TO=91)
  - DB2 connection rule (FROM=CONNECTED, TO=DISCONNECTING)
  - MRO connection (CONNECTION=MRO1, FROM=ACQUIRED, TO=RELEASED)

# Policy SPIs and statistics

- Resource statistics collected for each rule:
  - Policy and bundle names
  - Rule name
  - Action type, count and last time occurred
  - Data is also available in “Policy Rules” view in CICS Explorer 5.5
- EXEC CICS INQUIRE POLICY/POLICYRULE
  - Available from CICS TS 6.1

# Monitoring fields related to rules

- Performance class group, DFHCICS
  - MPPRTXCD: the number of task rule thresholds that this task has exceeded and triggered an action.
  - MPSRACT: The number of times that policy system rules that have been evaluated true and have triggered an action.

# Performance overhead of CICS Policy

- CICS region runs with and without a set of 1000 policy task rules.
- Transaction rate of ~4,000 per second.
- Task runs 1,000 EXEC CICS ASSIGN commands.
- ~5 micro-second overhead is measured.
  - This is insignificant, even with high API usage and policy rule numbers.
- CICS performance report: <https://www.ibm.com/docs/en/cics-ts/6.1?topic=report-cics-policy-rules>

# CICS policies vs. CICS application events

## CICS policies

- Use rules to monitor system resource status, the amount of resource usage and unusual system states
- Action can be a message, a CICS event, abending task, changing z/OS WLM status, or reject EXEC CICS request

## CICS application events

- Use capture specifications to filter on application data on selected EXEC CICS API calls
- Action is a CICS event

Thank you for joining the session.

Any questions?