

Evolution of CICS for Application Programmers

Jani Katta

Westfield Group

August 14th

Share session # 13358



Agenda

- History
- Evolution
- Application developers
 - Languages supported
 - Features
 - Support for new technologies
 - What's new
- Development tools

History

- CICS – Customer Information Control System
- Designed to support BTAM terminals
- First release supported 50 odd terminals
- Online Transaction Processing System (OLTP)
- Released in 1968
- Macro commands

Evolution

- Terminal support
 - Hundreds of thousands of users/terminals
- Language support
 - From limited languages to 7 languages
 - Java, PHP support
- File / Databases – DB2, IMS, VSAM
 - MQ support
- Non-terminal transactions
- Web services support, Web 2.0

Application developers

- Languages supported
 - Assembler
 - COBOL
 - REXX
 - C
 - Java
 - PL/I
 - PHP
- All functions are invoked by “EXEC CICS” commands.

File / Database

- VSAM – read, browse, readnext, readprev, write, rewrite, delete
- DB2 SQL – select, insert, delete
- MQ – open, get, put, put1, close
- IMS DB - CBLTDLI

Ex: 1) EXEC SQL

```
SELECT EMPLOYEE_NUM, EMPLOYEE_NAME  
FROM EMPLOYEE  
WHERE DEPT_NUM = '1234'
```

END-EXEC.

2) EXEC CICS READ

```
DATASET(datasetname)  
INTO(storage-area)  
RIDFLD(key-info / rrr)
```

END-EXEC.

Passing data

- Passing data between programs
 - Temporary Storage queues
 - Transient Data queues
 - Transaction Work Area
 - Commarea
 - Channels/Containers
 - Files/Databases

Temporary Storage queues

- Used to store data temporarily
- Application can build their queues – as they are temporary
- CRUD – Create Read Update Delete
- Queue name – max of 8 bytes
- Application has to delete the queue or deleted during recycling CICS

EXEC CICS

WRITEQ TS QUEUE(queue-name)

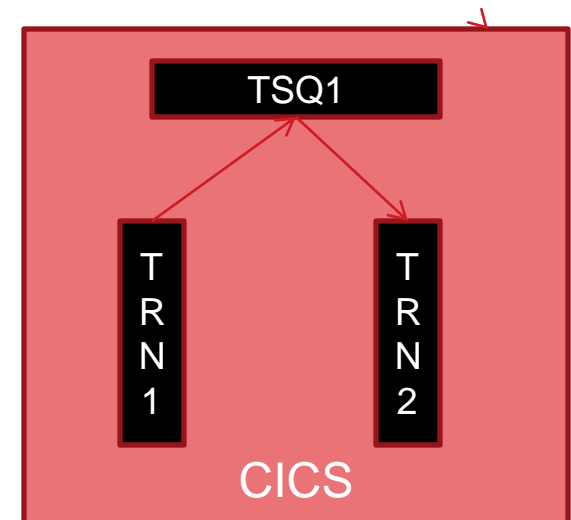
FROM (working-storage-variable)

LENGTH (queue-length)

ITEM(item-no)

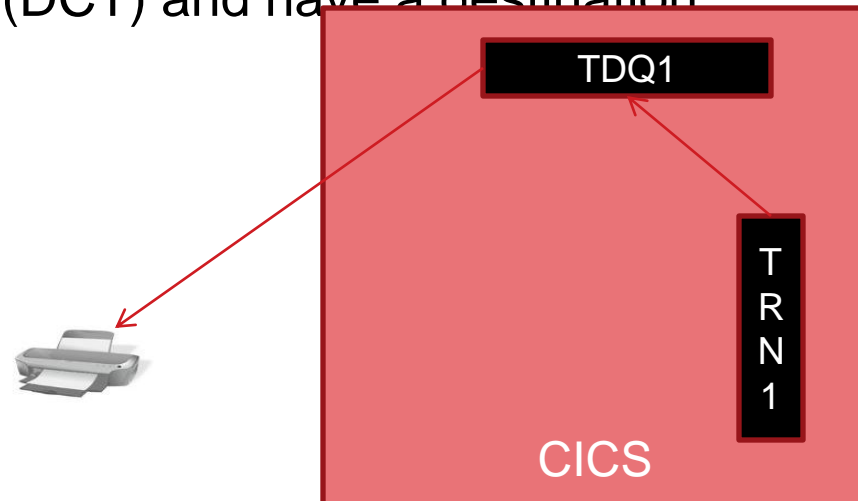
RESP(ws-resp)

END-EXEC.



Transient Data

- Simple way to pass data sequentially.
- Retrieved in the same sequence it is written. FIFO – first in first out
- Record gets deleted after you read – similar to MQ.
- Can not update the record after you write.
- TD queues need to be defined by System programmers in Destination Control Table (DCT) and have a destination



Transaction Work Area

- Defined at the transaction level.
- Each instance of the transaction gets the amount of storage defined in Transaction Control Table
- Application program can address it, modify the area
- The next program gets the updated info
- Should be defined in LINKAGE SECTION.

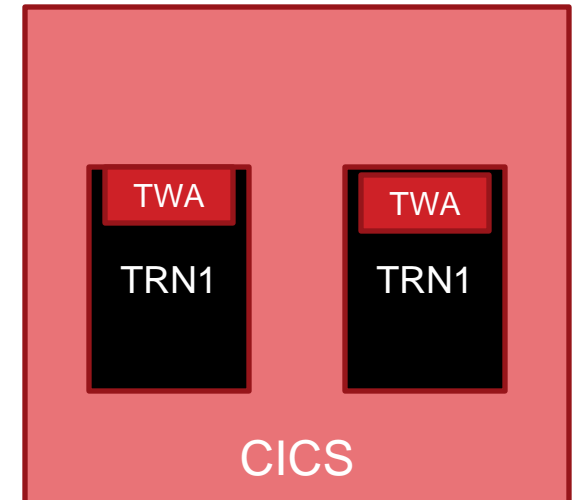
LINKAGE SECTION.
01 LN-TWA.

05 LN-TWA-EMP-NO	PIC X(10).
05 LN-TWA-EMP-FIRST-NAME	PIC X(50).
05 LN-TWA-EMP-LAST-NAME	PIC X(50).

..
PROCEDURE DIVISION.

...
EXEC CICS ADDRESS TWA(ADDRESS OF LN-TWA)
END-EXEC.

..
EXEC CICS READ DATASET('EMPDET') RIDFLD(LN-EMP-NO) INTO(LN-TWA)
END-EXEC.



Commarea

- Most commonly used way to pass data in CICS
- Max limit of 32k

EXEC CICS

LINK PROGRAM(program name)

COMMAREA (ls-comm-area)

LENGTH (ls-comm-area-length)

END-EXEC.

- Pass data between programs via LINK/XCTL
- Pass data between transaction using START/RETURN TRANID

Channels/Containers

- Channels/Containers
 - Container – blocks of data to pass between programs
 - Channels – grouping of containers
 - Supported for LINK/XCTL/START/RETURN
 - More structured way to pass data
 - No limit on the amount of data 😊

Channels / Containers (contd..)

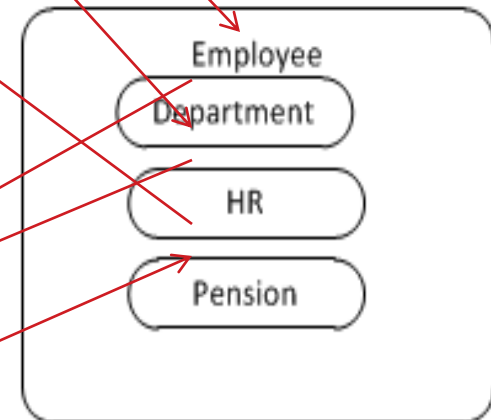
Channels/containers example

PROG1

```
PUT CONTAINER('Department') CHANNEL('Employee') FROM(dept-data)
PUT CONTAINER('HR') CHANNEL('Employee') FROM(hr-data)
LINK PROGRAM('PROG2') CHANNEL('Employee')
GET CONTAINER('Pension') CHANNEL('Employee') INTO(pension-data)
```

PROG2

```
GET CONTAINER('Department') INTO(dept-data)
GET CONTAINER('HR') INTO(hr-data)
...
PUT CONTAINER('Pension') FROM(pension-data)
```



MQ

- Guaranteed delivery
- API's are same across batch and CICS
- Can connect to a Queue Manager
- No need to connect to the queue manager
- Trigger CICS transactions based on queue depth
 - Trigger on every
 - Trigger on first

Other features

- Storage control
 - GETMAIN, FREEMAIN
- Program control
 - LINK, XCTL, CALL
- Interval control
 - WAIT

Transaction Control blocks

- TCB – transaction control blocks
- QR – quasi-reentrant
- Only one QR TCB per region
- Program need to be defined as quasi-reentrant
- QR makes sure that program is unaffected from previous runs
- Till 1989 - all user applications transactions ran under QR TCB

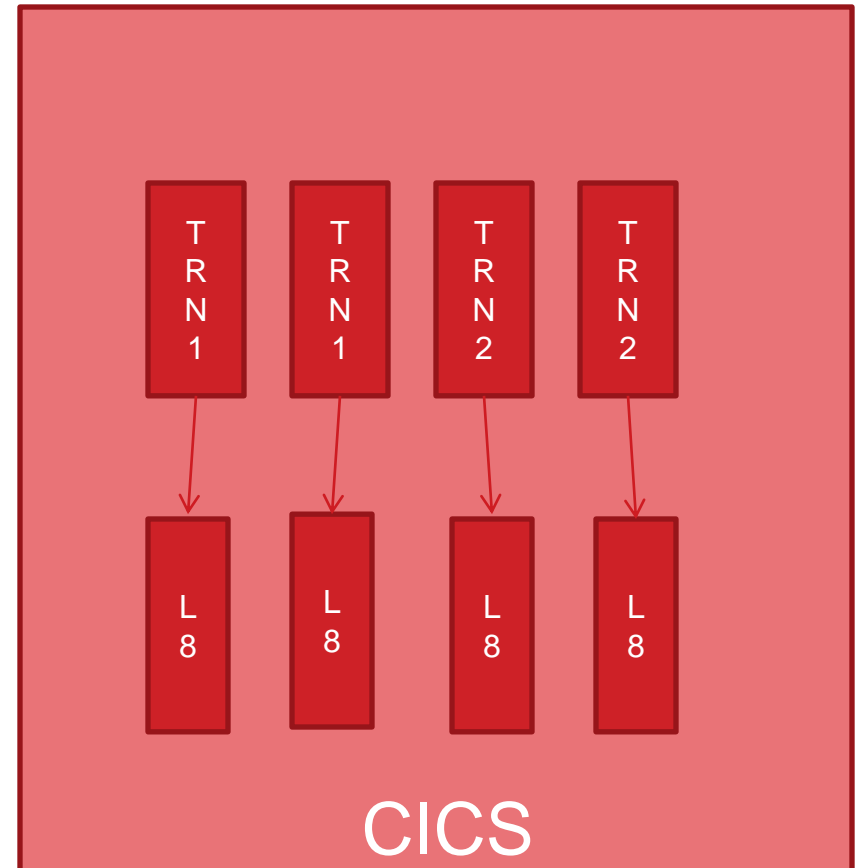
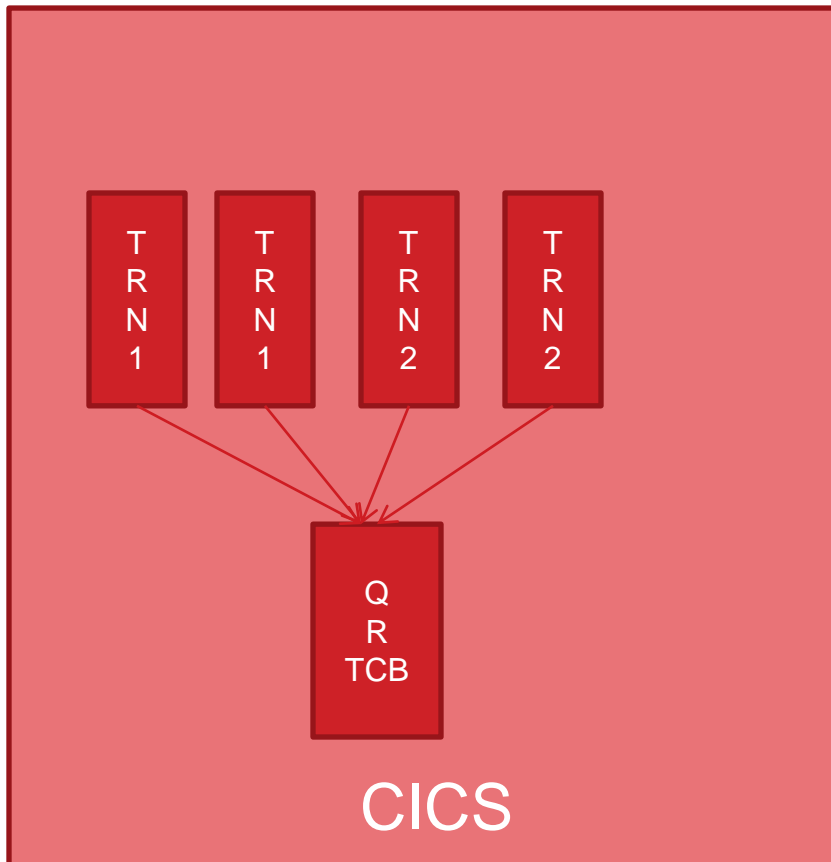
Transaction Control blocks (contd..)

- Open TCBs
 - Started in 1990's
 - Used to run thread safe applications in its own TCB
 - Application can share QR and open TCB
 - Multiple open TCBs can run at a time
 - J8, J9 for Java programs
 - L8, L9 for application programs (non-Java)
 - There are other TCBs available for different needs
 - Programs and transactions need to be thread-safe
 - MAXTCB parameter – to control the number of open TCBs

Thread safe

- Piece of code is **thread-safe** if it only manipulates shared data in a manner that guarantees safe execution by multiple threads at the same time.
- Few system and program settings
 - STGPROT
 - EXECKEY
 - CONCURRENCY
 - API
- Can achieve CPU savings for some applications
- DB2 applications have greater benefits
- With every release there are more and more application and system commands that are made thread safe.
- Caution: if you have non-thread safe API's you could result in decrease in performance due to TCB switching

Thread safe (contd..)



TRN1, TRN2 are thread safe transactions and CICS is configured for it.
A simple example.

Java support

- Support for 64 bit JVMs
- A JVM instance can support multiple transactions
 - Prior versions had a JVM instance for each transaction
- JCICS – Java talking to COBOL programs
- Open Service Gateway initiative (OSGi)
 - OSGi development and packaging now required to deploy CICS applications on a JVM server
 - Existing CICS Java applications using main() method linkage can run unchanged if wrapped in an OSGi bundle
 - All JVM server applications need to be thread-safe

- JCICS example **Java support (contd..)**

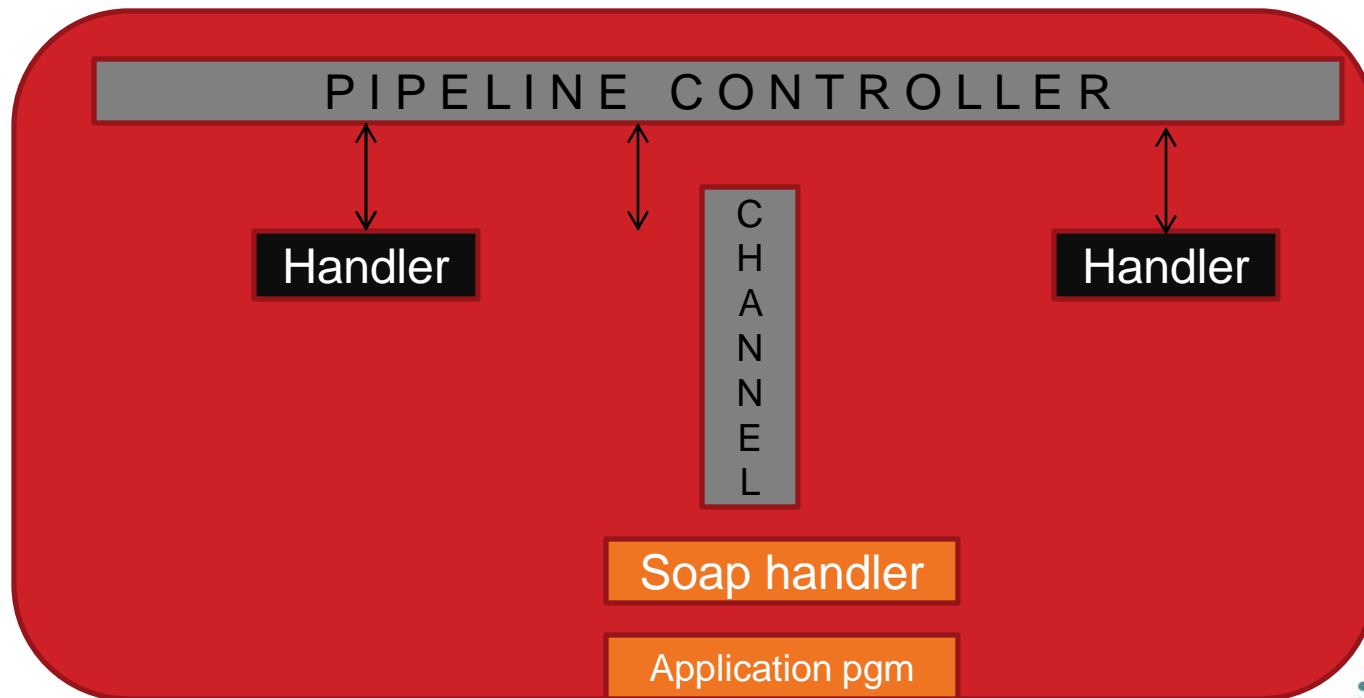
```
import com.ibm.cics.server.*;
public class Payroll {
...
Task t=Task.getTask();
// create the payroll_2004 channel
Channel payroll_2004 = t.createChannel("payroll-2004");
// create the employee container
Container employee = payroll_2004.createContainer("employee");
// put the employee name into the container
employee.put("John Doe");
// create the wage container
Container wage = payroll_2004.createContainer("wage");
// put the wage into the container
wage.put("2000");
// Link to the PAYROLL program, passing the payroll_2004 channel
Program p = new Program();
p.setName("PAYR");
p.link(payroll_2004);
// Get the status container which has been returned
Container status = payroll_2004.getContainer("status");
// Get the status information
byte[] payrollStatus = status.get();
... }
```

Web Services

- CICS applications can be a service provider and service requester
- Web service assistant
 - Batch utility that helps to transform existing CICS applications into Web Services and also enables to CICS applications to use Web Services provided outside of CICS environment.
 - DFHLS2WS – generates web service binding file from language structure
 - DFHWS2LS - web service binding file from WSDL and also language structure for your application
 - Can do for simpler structures, no nested or max/min boundary conditions

Web Services (contd..)

- Axis 2 support
 - Open source java based engine
 - Can offload some of the processing to specialty engine
 - Needs 4.2 or higher

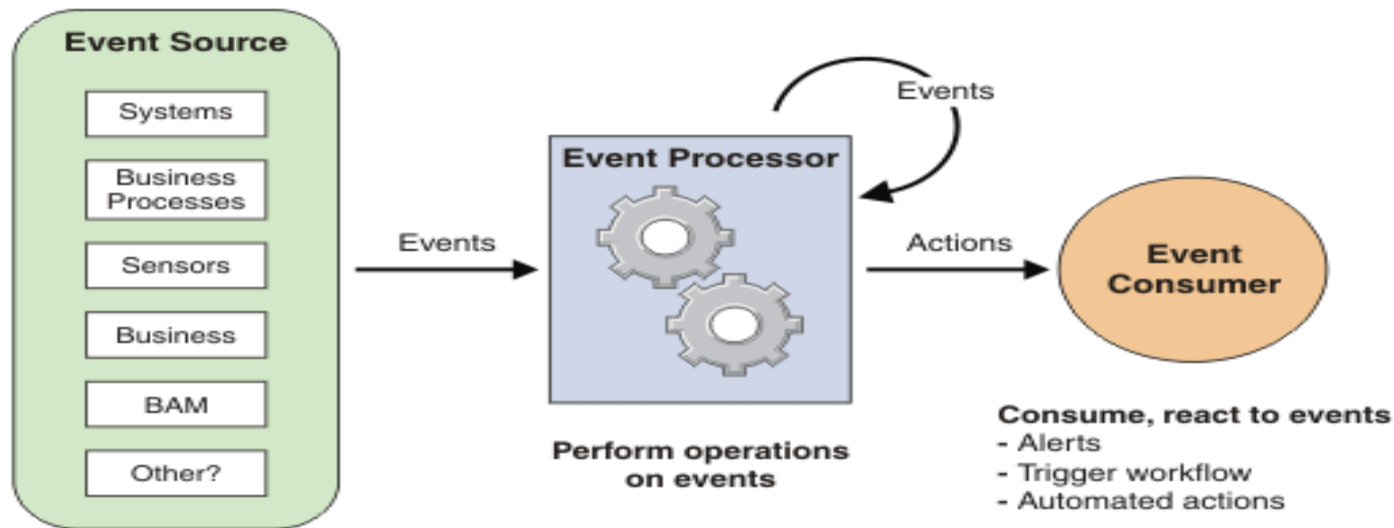


Event Processing

- Can produce events for new and existing applications
- Define and control outside the application code
- Supports events for every user
 - Business user – generate if the order > \$20000
 - Application Analyst – Send a message to dashboard when the stock level for an item < 50
 - System programmer – Monitor and optimize performance of system/application

Event Processing (contd..)

- Architecture of EP
- Event sources: CICS applications, RFID sensors
- Event consumers : Dashboards, start new piece of application work



Event Processing (contd..)

- Event adapters support emission of events to the following interfaces:
 - MQ message
 - HTTP message
 - Start another transaction and send information in a channel
 - Start another program
 - Write to a temporary storage
- You need CICS explorer to create EP

Development tools

- CICS Explorer
 - Eclipse plug-in
 - Most of the CEMT, CEDA functions can be accomplished
 - More real-estate
 - Multiple perspectives at a time
 - Few Application development tools that can connect are Debug, File Manager and Fault Analyzer
 - The best thing is FREE!!

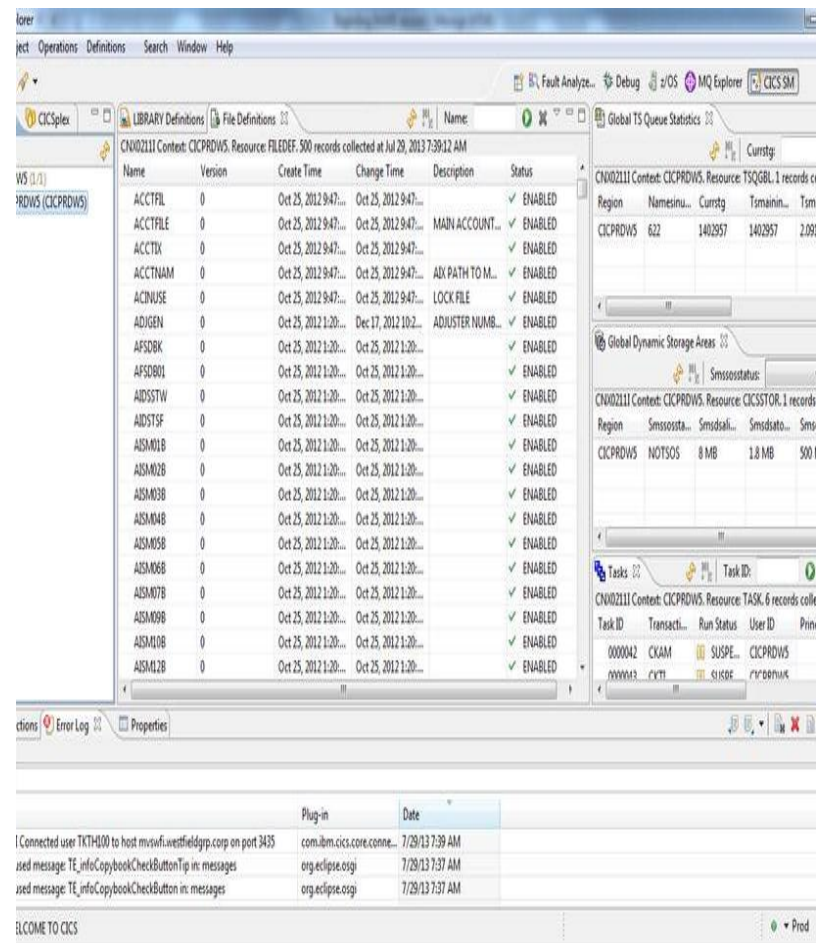
Development tools (CICS Explorer)

```

I FI(*)
STATUS: RESULTS - OVERTYPE TO MODIFY
Fil(ADJGEN) Vsa Clo Ena Rea Upd Add Bro Sha
      Dsn( LOSO.M010W.ADJGEN )
Fil(AFSDBK) Vsa Ope Ena Rea Upd Add Bro Del Sha
      Dsn( WICP.M001D.CICSAFSK )
Fil(AFSDB01) Vsa Ope Ena Rea Upd Add Bro Sha
      Dsn( WICP.M002D.CICSAFSD )
Fil(AIDSSTW) Vsa Ope Ena Rea Upd Add Bro Del Sha
      Dsn( WESO.M004D.AIDSSTW )
Fil(AIDSTSF) Vsa Ope Ena Rea Upd Add Bro Del Sha
      Dsn( WESO.M003D.AIDSTRAN )
Fil(AISM01B) Vsa Clo Une Rea Upd Add Bro Del Sha
      Dsn( AISO.M001D.LICENSE )
Fil(AISM02B) Vsa Clo Une Rea Upd Add Bro Del Sha
      Dsn( AISO.M002D.ACCOUNT )
Fil(AISM03B) Vsa Ope Ena Rea Upd Add Bro Del Sha
      Dsn( AISO.M094D.PRODUCR2 )
+ Fil(AISM04B) Vsa Clo Une Rea Upd Add Bro Del Sha
      Dsn( AISO.H004M.HISTORY )

SYSID=PW53 APPLID=CICPRDWS
RESPONSE: NORMAL TIME: 21.48.47 DATE: 07/29/13
PF 1 HELP 3 END 5 VAR 7 SBH 9 SFH 10 MSG 11 SF

01/011
  
```



The screenshot shows the CICS Explorer interface with the following components:

- Library Definitions:** A table listing various CICS libraries and their status.
- Global TS Queue Statistics:** A table showing statistics for the TSQBL queue.
- Global Dynamic Storage Areas:** A table showing storage area details for NOTSOS.
- Tasks:** A table showing task details for the TASK resource.
- Log:** A log of system messages and events.

Name	Version	Create Time	Change Time	Description	Status
ACCTFIL	0	Oct 25, 2012 9:47...	Oct 25, 2012 9:47...		ENABLED
ACCTFILE	0	Oct 25, 2012 9:47...	Oct 25, 2012 9:47...	MAIN ACCOUNT...	ENABLED
ACCTX	0	Oct 25, 2012 9:47...	Oct 25, 2012 9:47...		ENABLED
ACCTNAM	0	Oct 25, 2012 9:47...	Oct 25, 2012 9:47...	AD PATH TO M...	ENABLED
ACINUSE	0	Oct 25, 2012 9:47...	Oct 25, 2012 9:47...	LOCK FILE	ENABLED
ADJGEN	0	Oct 25, 2012 1:20...	Dec 17, 2012 10:2...	ADJUSTER NUMB...	ENABLED
AFSDBK	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AFSDB01	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AIDSSTW	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AIDSTSF	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM01B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM02B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM03B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM04B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM05B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM06B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM07B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM09B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM10B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED
AISM12B	0	Oct 25, 2012 1:20...	Oct 25, 2012 1:20...		ENABLED

Region	Namesin...	Curstg	Tsmainin...	Tsm
CICPRDWS	622	1402957	1402957	2.091

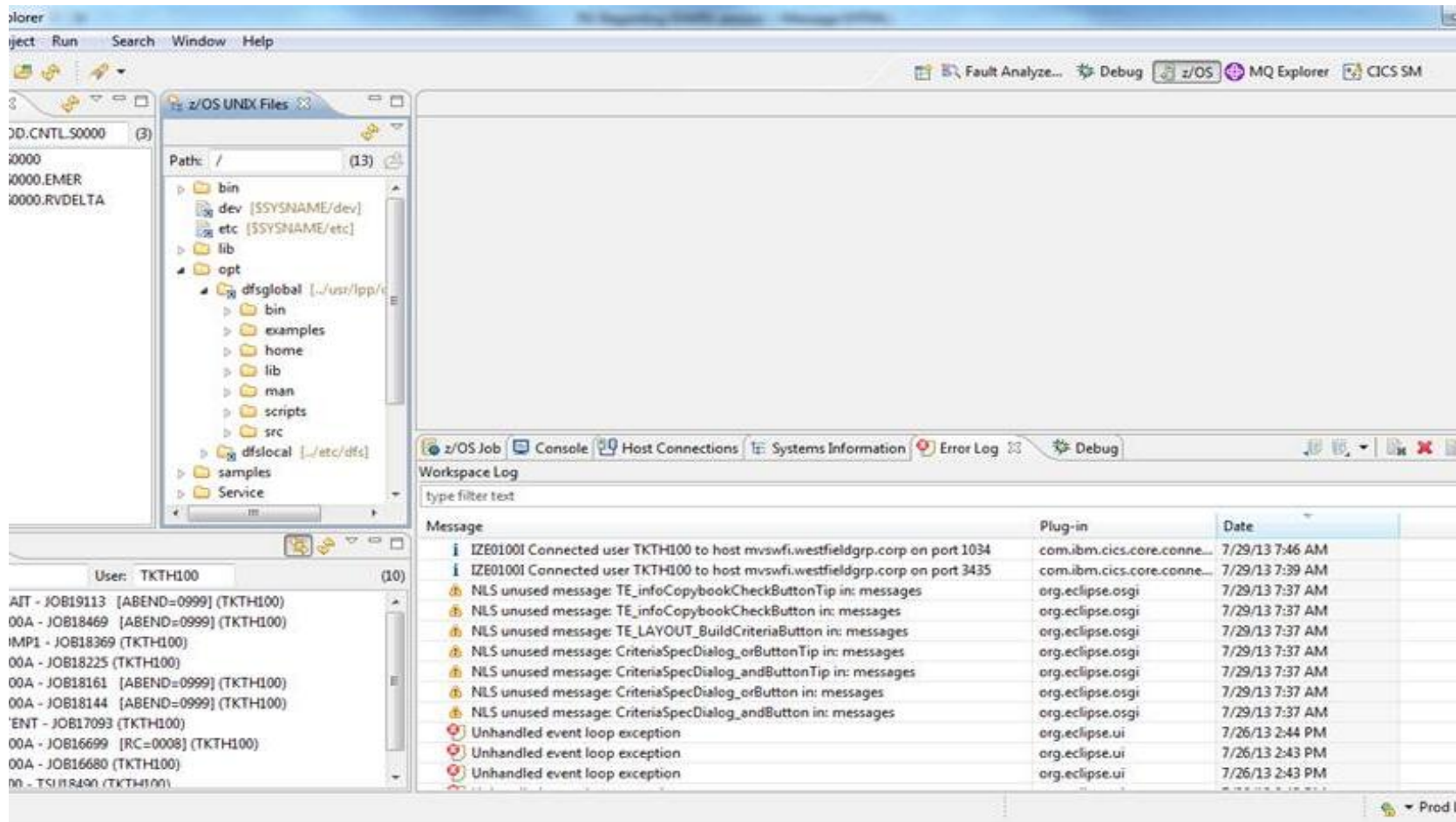
Region	Smsossta...	Smsdca...	Smsdstat...	Sms
CICPRDWS	NOTSOS	8 MB	1.8 MB	500

Task ID	Transacti...	Run Status	User ID	Prim
0000042	CKAM	SUSPE...	CICPRDWS	

Plug-in	Date
Connected user TKM100 to host mvwfi.westfieldgrp.cop on port 3435	7/29/13 7:39 AM
used message TE_infoCopybookCheckButtonTip in: messages	org.eclipse.org
used message TE_infoCopybookCheckButton in: messages	org.eclipse.org

Development tool(CICS Explorer)

- PDS, Unix files, job log at the same time



The screenshot displays the CICS Explorer application interface. The top menu bar includes 'ject', 'Run', 'Search', 'Window', and 'Help'. The toolbar contains icons for 'Fault Analyze...', 'Debug', 'z/OS', 'MQ Explorer', and 'CICS SM'. The main workspace is divided into several panes:

- z/OS UNIX Files:** A file explorer showing a directory tree with folders like 'bin', 'dev', 'etc', 'lib', 'opt', 'dfslocal', 'samples', and 'Service'.
- Job Log:** A table listing messages with columns for 'Message', 'Plug-in', and 'Date'. The messages include connection logs and NLS unused messages.
- Console:** A text area for job logs, showing a list of jobs with their status and user information.

Message	Plug-in	Date
IZE01001 Connected user TKTH100 to host mvswfi.westfieldgrp.corp on port 1034	com.ibm.cics.core.conne...	7/29/13 7:46 AM
IZE01001 Connected user TKTH100 to host mvswfi.westfieldgrp.corp on port 3435	com.ibm.cics.core.conne...	7/29/13 7:39 AM
NLS unused message: TE_infoCopybookCheckButtonTip in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: TE_infoCopybookCheckButton in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: TE_LAYOUT_BuildCriteriaButton in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: CriteriaSpecDialog_orButtonTip in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: CriteriaSpecDialog_andButtonTip in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: CriteriaSpecDialog_orButton in: messages	org.eclipse.osgi	7/29/13 7:37 AM
NLS unused message: CriteriaSpecDialog_andButton in: messages	org.eclipse.osgi	7/29/13 7:37 AM
Unhandled event loop exception	org.eclipse.ui	7/26/13 2:44 PM
Unhandled event loop exception	org.eclipse.ui	7/26/13 2:43 PM
Unhandled event loop exception	org.eclipse.ui	7/26/13 2:43 PM

The bottom pane shows a list of jobs with columns for 'User', 'Job ID', 'Status', and 'User'. The jobs listed include:

- AIT - JOB19113 [ABEND=0999] (TKTH100)
- 00A - JOB18469 [ABEND=0999] (TKTH100)
- HMP1 - JOB18369 (TKTH100)
- 00A - JOB18225 (TKTH100)
- 00A - JOB18161 [ABEND=0999] (TKTH100)
- 00A - JOB18144 [ABEND=0999] (TKTH100)
- 'ENT - JOB17093 (TKTH100)
- 00A - JOB16699 [RC=0008] (TKTH100)
- 00A - JOB16680 (TKTH100)
- NO - TSI118400 (TKTH100)

Development tools

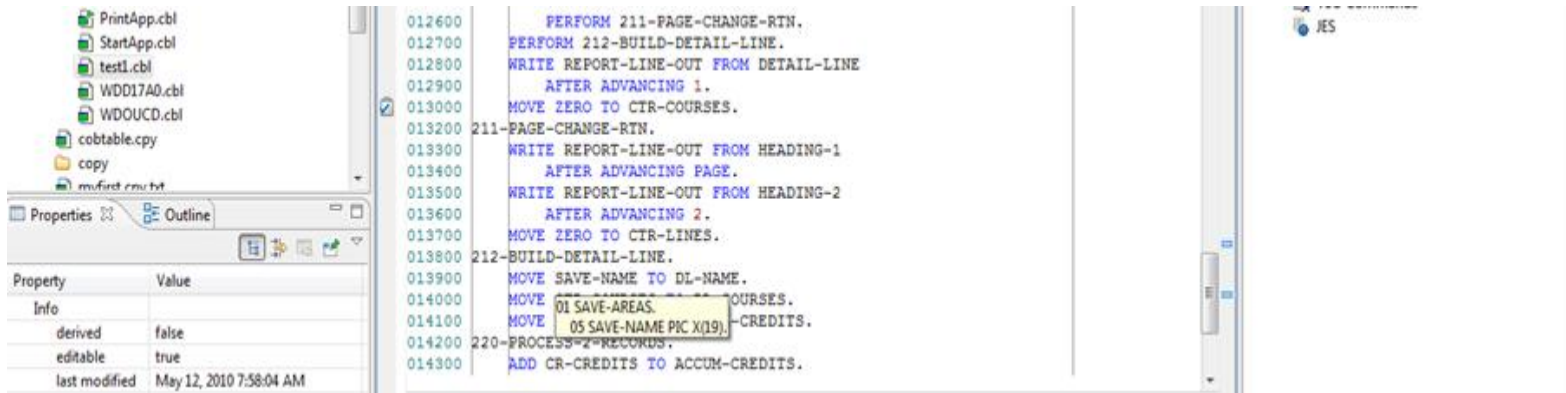
- There are multiple development tools available in the market
- Eclipse plug-in
- Support for most of the languages
- Context menus
- Multiple perspectives at a time
- Integrate with your application development tools

Development tools (contd..)

- Can use same development platform as distributed
- Easy to learn
- Context menus
- Connects to development tools
- Syntax validation
- Remote compilation
- Program flow

Development tools (contd..)

- Mouse over to see definition of field



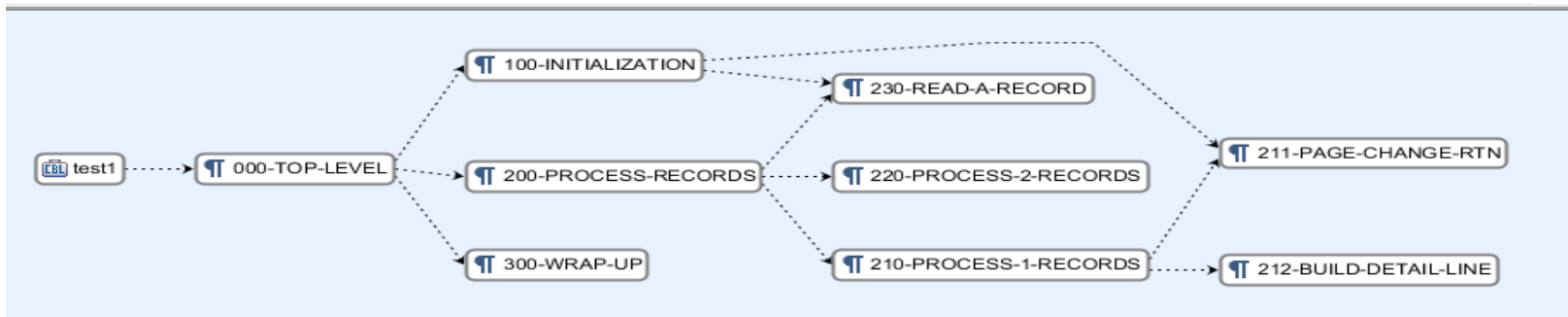
The screenshot shows a development environment with three main panes:

- File Explorer:** Lists files such as PrintApp.cbl, StartApp.cbl, test1.cbl, WDD17A0.cbl, WDOUCD.cbl, cobtable.cpy, copy, and mufirst.cpy.txt.
- Code Editor:** Displays COBOL code with line numbers. A mouse-over tooltip is visible over the code:


```
MOVE 05 SAVE-NAME PIC X(19) -CREDITS.
```
- Properties Window:** Shows a table of properties for the selected file.

Property	Value
Info	
derived	false
editable	true
last modified	May 12, 2010 7:58:04 AM

- Program flow



Development tools (contd..)

- Contextual help

013000	MOVE ZERO TO CTR-COURSES.	
013200	211-PAGE-CHANGE-RTN.	
013300	WRITE R	<ul style="list-style-type: none"> REPORT-LINE-OUT REPORT-LINE-OUT IN CREDITS-REPORT
013400	AFT	
013500	WRITE R	
013600	AFT	

CREDITS-REPORT
 01 REPORT-LINE-OUT PIC X(60).

What's new?

- CICS 5.1
 - Application bundling
 - Bundle all resources of an application
 - *Programs, files, transaction definitions*
 - Can apply policies on the application
 - Helps developers and system admin to check the application status

Additional resources

- Share sessions
 - 13341 – CICS what's in for Application Programmers
 - 13377, 13376 – Modernizing CICS Hands on Lab
 - 13361 – CICS and Java
- CICS TS4.2 Application programming reference
 - http://pic.dhe.ibm.com/infocenter/cicsts/v4r2/topic/com.ibm.cics.ts.applicationprogramming.doc/dfhp4_pdf.pdf
- Event processing
 - <http://www.redbooks.ibm.com/redbooks/pdfs/sg247792.pdf>
 - http://pic.dhe.ibm.com/infocenter/cicsts/v4r1/index.jsp?topic=%2Fcom.ibm.cics.ts.eventprocessing.doc%2Fconcepts%2Fdfhep_support.html
- Webcasts for CICS products
 - <http://www.ibm.com/support/docview.wss?uid=swg27007244>

Feedback

- Please provide your feedback.

