



IBM Software Group



CICS Interdependency Analyzer V2.2

Understanding CICS relationships

Resources are communicating, but to whom and how?

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Preface

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 - ▶ MVS/ESA
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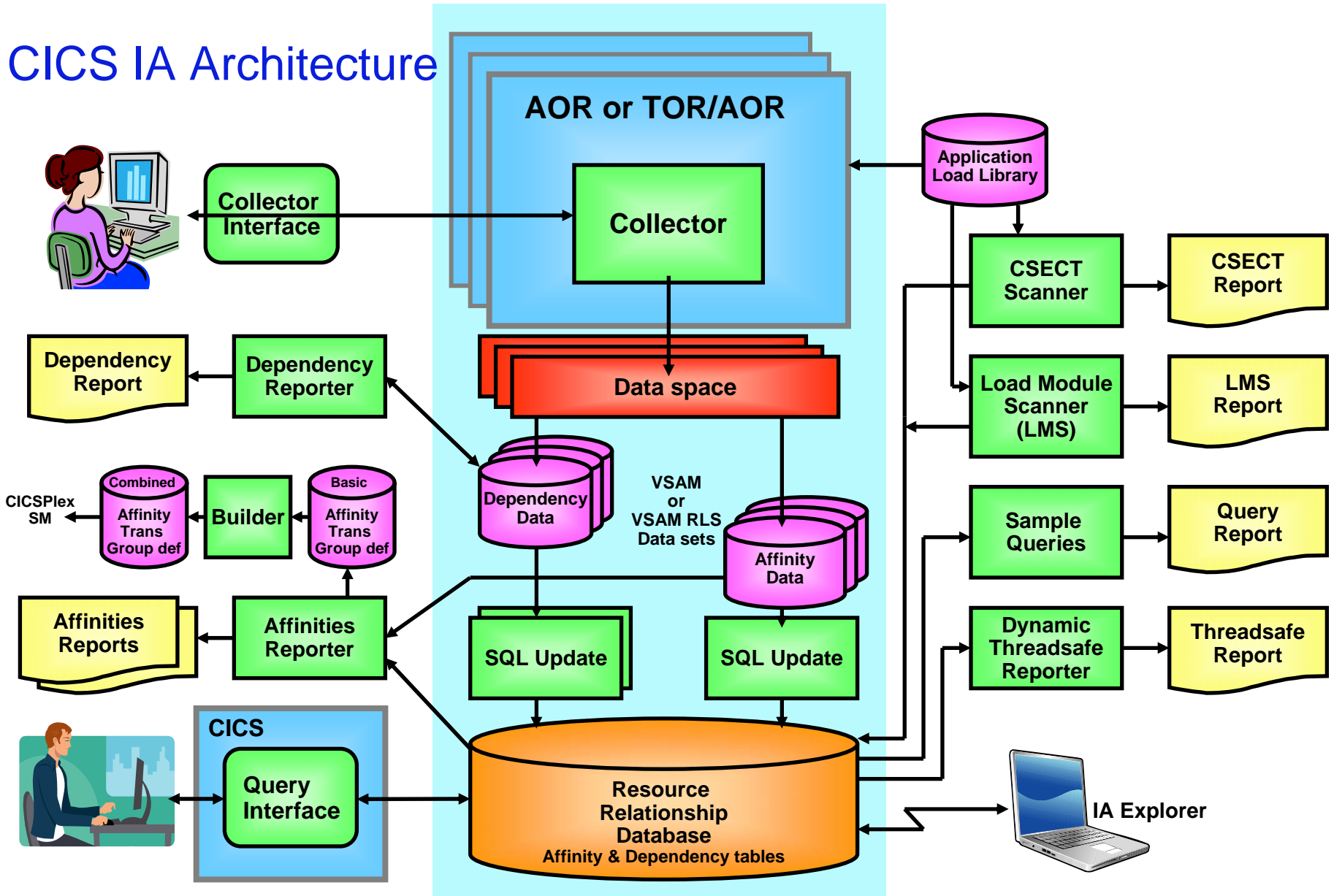


Agenda

- CICS Interdependency Analyzer Overview
- Finding Threadsafe Resources
- Managing CICSplex Affinities
- Exposing Reusable Assets
- Questions



CICS IA Architecture



CICS Interdependency Analyzer for z/OS (CICS IA)

■ Key features

- ▶ Captures CICS application relationships:
 - Resources used by a transaction - Programs, Files, TSQs, TDQs plus DB2, MQ, IMS plus Web services
 - **Identifies non-threadsafe programs**
 - Transactions with affinities and their type / lifetime
 - **API changes between CICS versions / releases**
 - Unused resources
 - Sequencing of transactions within an application
- ▶ Relationship data loaded onto a DB2 data base
- ▶ Query interface, SQL sample queries and Eclipse-based CICS IA Explorer
- ▶ Batch Reporting

■ CICS support

- ▶ CICS Transaction Server for z/OS, V2 and V3
- ▶ CICS Transaction Server for OS/390 V1.3

New in CICS IA V2.2

- CICS TS V3.2 support
- CICS Version Migration Support
- Application performance support
 - Thread safety, Affinities
- Web service support
 - Detect, Identify, Capture
- Intuitive new CICS IA Explorer
 - Sample queries - rich query editor
- Software AG Natural 4GL support
- Optimized database schema



CICS IA – Business Value

- **Understand relationships between resources used by CICS and its applications**
 - ▶ See cross-system applications and dependencies
 - ▶ Know the resource topology within a particular CICS region
 - what resources a CICS region uses
 - what resources a transaction needs in order to run
 - which programs use which resources
 - which resources are no longer used, etc..
 - ▶ Know the last time a particular resource was used
 - ▶ Display transaction call paths in a graphical tree format



Finding Threadsafe Resources

- Why make applications Threadsafe?
 - ▶ Improve performance
 - CICS QR TCB is CPU constrained
 - Application tasks are waiting excessively for the QR TCB
 - The CICS region in general is CPU constrained
 - ▶ Reduce cost by reducing the instruction path length
 - Each TCB switch is approximately 2,000 instructions
 - In CICS V3.2, non-threadsafe DB2 and MQ transactions switch TCB's for each SQL statement or MQ command.
 - ▶ Bottom line is it can save you money!

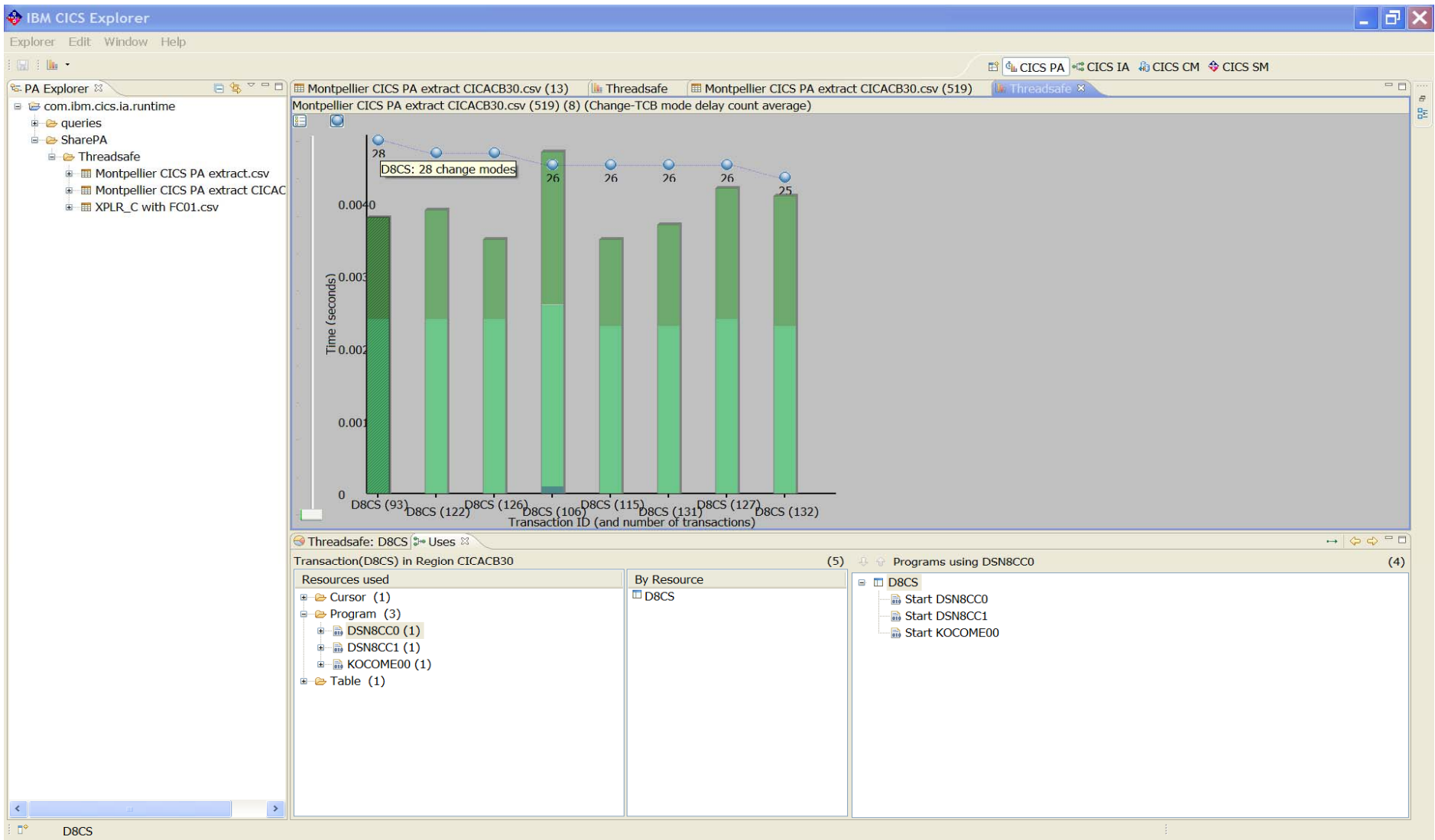


What is a Threadsafe program?

- Capable of being invoked on multiple TCBs concurrently
- Normally read-only, they do not in general overwrite themselves
 - ▶ Could overwrite themselves if updates are serialized correctly like shared stg
- Cannot rely on quasi-re-entrancy to serialize access to resources and storage
- Must use serialization techniques to access shared resources with integrity
 - ▶ Compare and swap (CS)
 - ▶ Enqueue/dequeue to access shared resources with integrity
- All programs accessing a shared resource must be made threadsafe
 - ▶ For example, existing program's reliance on quasi-re-entrancy to serialize access to the CWA is made invalid if just one other program can run concurrently on another TCB and access the same CWA field
- Sometimes referred to as fully MVS reentrant programs
 - ▶ MVS reentrant is often misunderstood to mean that programs do not overwrite themselves. We use the term threadsafe to avoid confusion



CICS Explorer – CICS PA/IA Integration



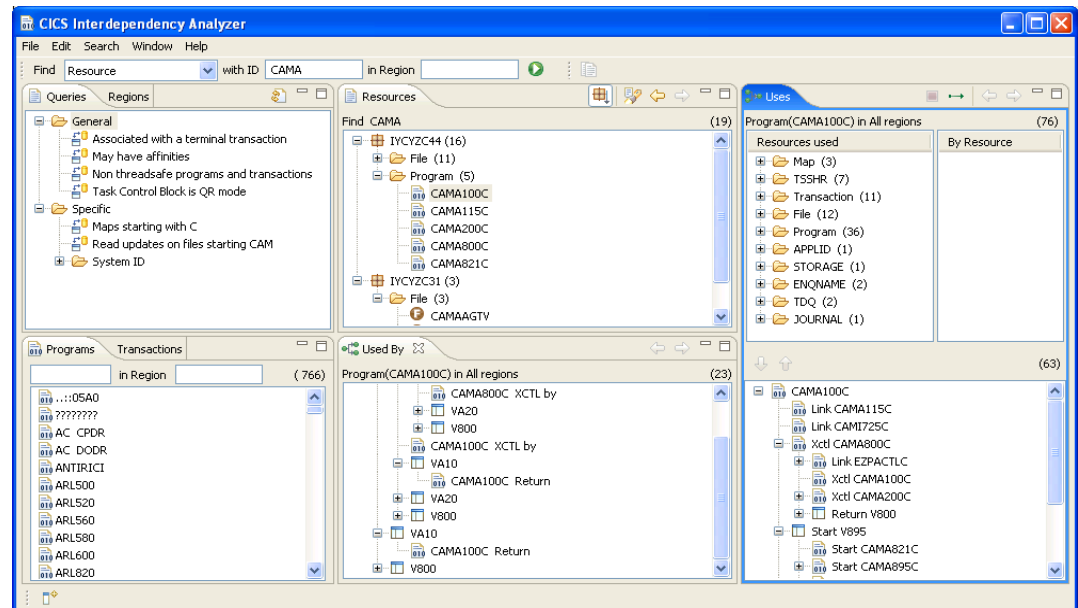
Finding Threadsafe Resources with CICS IA

Problem

- Transaction identified as having multiple TCB switches
 - How do you define as threadsafe and ensure data integrity?

Solution

- Supplied Explorer queries
 - Identify programs used by the transaction with high switches
 - Run threadsafe queries on the programs
 - Determine TCB used by command within the program
- Batch Report
 - Analyze the Threadsafe Dynamic Analysis report



Value

- Reduce risk of data integrity issues by analyzing the program for shared data access.
- Quickly convert programs to threadsafe with confidence.



CICS IA Threadsafe Support

- **CICS IA provides two ways to identify which EXEC CICS commands are threadsafe in a program**
 - ▶ **Query the threadsafe view**
 - A join between the detail table and the threadsafe table
 - Data from Load Module Scanner (LMS)
 - Sample queries are provided to detect non-threadsafe commands and indeterminate threadsafe commands
 - ▶ **Threadsafe Dynamic Analysis report**
 - Create a report that identifies which EXEC CICS commands are:
 - Threadsafe
 - Non-threadsafe
 - Indeterminate



Threadsafe sample view for transaction D8CS

The screenshot displays the IBM CICS Explorer interface. The left-hand pane shows a tree view of resources, with 'Threadsafe' expanded under 'CICS'. The bottom-left pane shows a list of programs, with 'D8CS' selected and a context menu open showing options like 'Used By Programs', 'Used By Transactions', and 'Uses Resources'. The central pane displays the properties for 'Transaction D8CS in CICACB30'.

Property	Value
Transaction D8CS in CICACB30	
Applid	CICACB30
Brexit	
Cmdsec	N
Dtimeout	0
Dump	Y
Dynamic	N
First run	2008-09-29 17:21:29.0
Homesysid	DM30
Indoubt	BACKOUT
Indoubt wait	Y
Indoubt wait time	0
Initial program	DSN8CC0
Isolate	Y
Last run	2008-09-29 17:36:11.0
Local queuing	N
Ottimeout	0
Partitionset	NONE
Partitionset name	
Primary transid	D8CS
Profile name	DFHCICST
Remote	N
Remote name	
Remote system	
Ressec	N
Restart	N
Routable status	NOTROUTABLE
Runaway limit	5000
Shutdown	DISABLED
Spurge	N
Storage clear	N
Storage freeze	N
System attach	N
System runaway	Y
Taskdatakey	USER
Taskdataloc	ANY
Tclass	N
Tclass name	
Tpurge	N

The right-hand pane shows 'Transaction(D8CS) in Region CICACB30' with a list of resources used: Program (3), DSN8CC0 (1), DSN8CC1 (1), KOCOME00 (1), Table (1), Cursor (1), and (3). Below this, it shows 'Programs using DSN8CC0' with a list: Start DSN8CC0, Start DSN8CC1, and Start KOCOME00.



CICS IA Explorer Threadsafe Queries

The screenshot displays the IBM CICS Explorer interface with several panes:

- Queries:** A tree view under 'Supplied Samples' with 'Threadsafe' expanded, showing various query filters like 'All programs that issue a GETMAIN' and 'CICS commands by TCB mode and programs DSN%'.
- *Resources:** A tree view showing 'CICS commands by TCB mode and programs DSN%' (11) with sub-items like 'PROGRAM (DSN8CC1) (1)', 'PROGRAM (DSN8CC0) (1)', and 'Task Control Block (TCB) (QR) (6)' containing commands like RETURN, RECEIVE, SEND MAP, LINK, SEND, and RECV MAP.
- Resources used:** A tree view for 'Program(DSN8CC0) in Region CICACB30' (12) listing resources such as Map (2), MAPSET (2), Program (4), Table (1), Transaction (1), Cursor (1), and STORAGE (1).
- By Resource:** A table listing resources used by the program: DSN8CC1, DSN8CC2, and DSN8CC0.
- Programs using:** A tree view for 'Programs using' (7) showing DSN8CC0 and its associated links and start programs like DSN8CC1, DSN8CC2, and KOCOME00.
- Used By / Properties:** A table showing properties for 'Program DSN8CC0 in CICACB30':

Property	Value
Access	CICS
Applid	CICACB30
Concurrency	QUASIRENT
Data location	BELOW
Dynamic status	NOTDYNAMIC
Execution key	USER
Execution set	FULLAPI
Exit point	
First run	2008-09-29 17:21:29.0
Hold status	TASKLIFE
Homesysid	DM30
Install type	GROUPLIST
Language deduced	COBOL2
Language defined	COBOL
Last run	
Lib dataset name	
Linkedit date	
Load status	LOADABLE
- Programs:** A list of DSNs: DSN8CC0, DSN8CC1, and DSN8CC2.



Dynamic Threadsafe Analysis Report

APPLID Program Linkedit Date Execution Key Concurrency APIST Storage Protect CICS Rel LIB Dataset Name

CMD Type	Function	Type	Resource	Offset	Program Length	Use Count	Threadsafe
CICACB30	DSN8CC0	----- USER	QUASIRENT	CICSAPI INACTIVE 0650	CICSCFG.CICSDM.DEMO.LOADLIB		
	CICS RECEIVE	MAP	DSN8CCD	994	2728	31	N
	CICS RECV MAP	MAPSET	DSN8CCD	994	2728	31	N
	CICS SEND	MAP	DSN8CCD	11D8	2728	7	N
	CICS SEND MAP	MAPSET	DSN8CCD	11D8	2728	7	N
	CICS SEND	MAP	DSN8CCD	1270	2728	26	N
	CICS SEND MAP	MAPSET	DSN8CCD	1270	2728	26	N
	CICS RECEIVE	MAP	DSN8CCG	ACE	2728	75	N
	CICS RECV MAP	MAPSET	DSN8CCG	ACE	2728	75	N
	CICS SEND	MAP	DSN8CCG	F36	2728	14	N
	CICS SEND MAP	MAPSET	DSN8CCG	F36	2728	14	N
	CICS SEND	MAP	DSN8CCG	FCE	2728	62	N
	CICS SEND MAP	MAPSET	DSN8CCG	FCE	2728	62	N
	CICS LINK	PROGRAM	DSN8CC1	D38	2728	111	I
	CICS RETURN	TRANSID	D8CS	12BA	2728	32	Y
	CICS RETURN	TRANSID	D8CS	1018	2728	75	Y
	DB2 SELECT	TABLE		FFFFFFFF	2728	111	Y

Total CICS calls: 15 Threadsafe: 2 Non-Threadsafe: 12 Indeterminate Threadsafe: 1
 DB2 calls: 1 MQ calls: 0 IMS calls: 0
 Dynamic Calls: 0 Threadsafe Inhibitor calls: 0

- 'Threadsafe' calls are EXEC CALLS commands that do not cause a TCB swap.
- 'Non-Threadsafe' calls are EXEC CALLS commands that cause a TCB swap.
- 'Indeterminate Threadsafe' calls are EXEC CALLS commands where it cannot be determined if the call causes a TCB swap.
- 'Dynamic calls' are calls to modules at execution time. Programs that are called dynamically take on the same environment as the calling program.
- 'Threadsafe Inhibitor calls' are EXEC CICS commands that need to be investigated further because they may prevent you from defining your program as threadsafe. These commands are: ADDRESS CWA, EXTRACT EXIT, GETMAIN SHARED, and LOAD.

Managing CICSplex Affinities

- **Why should you consider moving to a DTR environment?**
 - ▶ Facilitate the need to balance CICS work across regions
 - ▶ Improve throughput
 - ▶ Quickly identify resource relationships for change to run anywhere
 - ▶ Assist in rapidly cloning CICS regions



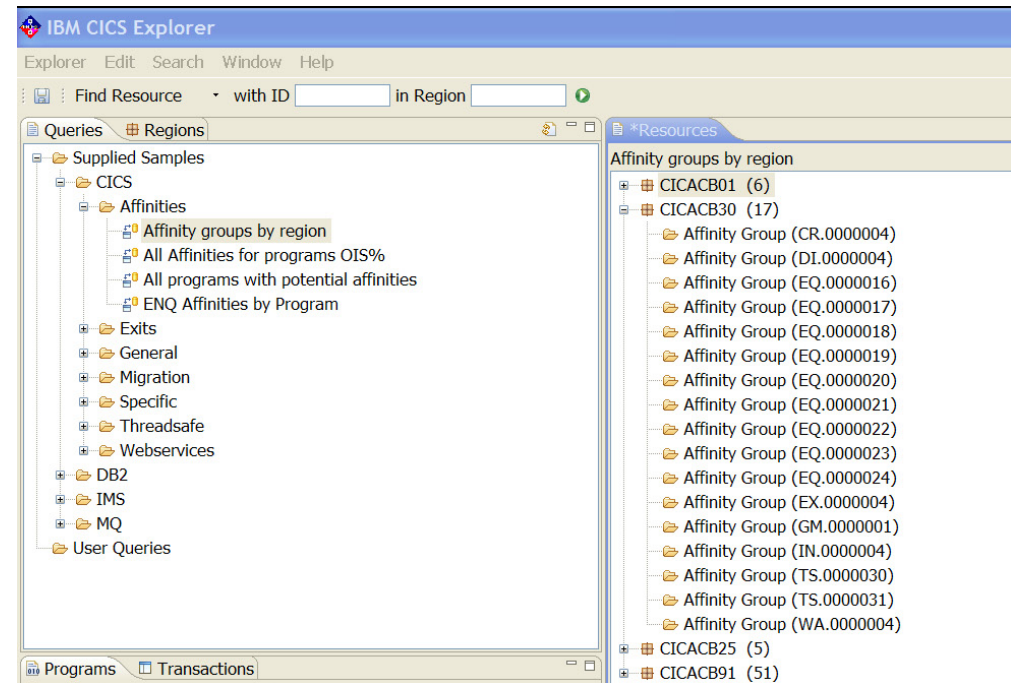
Managing CICSplex Affinities

Problem

- Dynamically route transactions with affinities
 - ▶ How do you determine if a transaction has affinities?

Solution

- Supplied Explorer queries
 - ▶ Show CPSM affinity groups
 - ▶ Show affinities for particular program set
 - ▶ Show affinities by specific command
- Batch Report
 - ▶ Analyze the Affinities Reporter
 - ▶ Run the Affinities builder to create CPSM rules



Value

- Manage affinities to quickly implement Dynamic Transaction Routing
- Maintain affinities for application release migrations



CICS IA Explorer – Affinities View

The screenshot displays the IBM CICS Explorer interface with the following panels:

- Queries:** A tree view showing categories like Supplied Samples, Affinities, Exits, General, Migration, Specific, Threadsafe, Webservises, DB2, IMS, MQ, and User Queries.
- *Resources:** A tree view titled "All Affinities for programs OIS%" showing programs like OISA1000 and OISA1010, along with their commands and group types.
- Uses:** A tree view titled "Program(OISA1010) in Region CICACB30" showing resources used such as Map, File, OISDDM30, TSAUX, MAPSET, Program, Transaction, DT01, EXIT, and STORAGE.
- Programs:** A list of programs including OISA1000, OISA1010, OISA1020, OISA2000, and OISDM30.
- Transactions:** A list of transactions.
- Used By:** A tree view titled "Programs using TSAUX(OISD+TE+) in Region CICACB30" showing the usage of OISD+TE+ by OISA1010, OISA1000, and OISA1010.



CICS IA Affinity Reporter

```

Trangroup   : TS.00000002
Affinity    : LUNAME
Lifetime    : PCONV
Queue       : OISDZ041          (D6C9E2C4E9F0F4F140404040404040)
Recoverable : No                (AUX )
Terminal Id : Z041              (E9F0F4F1)
    
```

Tranid	Program	Offset	Usage	Command	Terminal	CBTS Task	Link3270
DT01	OISA1010	000000F8	1	DELETEQ TS	Yes	No	No
DT01	OISA1010	0000036E	31	WRITEQ TS	Yes	No	No
DT01	OISA1010	00000480	15	READQ TS	Yes	No	No
Total Transactions			:	1			
Total Programs			:	1			

TRANSACTION-SYSTEM AFFINITIES REPORT FOR APPLID: CICACB30 - INQUIRE/BROWSE/SET COMMANDS

Tranid	Program	Offset	Usage	Command
DT01	OISA1000	0000032A	2	INQUIRE SYSTEM
DT01	OISA1010	000002A0	1	INQUIRE TERMINAL
DT01	OISA1010	0000069E	15	INQUIRE SYSTEM



CICS IA Affinities Builder

```
* HEADER APPLID(BUILDER )  SAVEDATE(20081103)  SAVETIME(190211  );
*
* Generated by CICS IA Transaction Affinities (Builder) on 2008/11/05
* Note: Suitable for input to CICSplex SM
*
* REMOVE TRANGRP NAME(CEDAGRP );
CREATE TRANGRP NAME(CEDAGRP ) AFFINITY(GLOBAL ) AFFLIFE(SYSTEM  )
      AFFAUTO(YES) MATCH(LUNAME) STATE(ACTIVE );
      CREATE DTRINGRP TRANGRP(CEDAGRP ) TRANID(CEDA);
*
* REMOVE TRANGRP NAME(DT01GRP );
CREATE TRANGRP NAME(DT01GRP ) AFFINITY(LUNAME ) AFFLIFE(PCONV  )
      AFFAUTO(YES) MATCH(LUNAME) STATE(ACTIVE );
      CREATE DTRINGRP TRANGRP(DT01GRP ) TRANID(DT01);
```



Finding Reusable Resources

- **Maintain or enhance applications more quickly and efficiently**
 - ▶ Identify the scope of a change
 - ▶ What resources are affected directly and indirectly
 - *Transactions, programs, data elements: files, queues, screens ...*
 - ▶ What to change, what to build, what to test, what needs to be communicated to the various roles involved
 - ▶ Look across boundaries, including shared data
 - ▶ Provide documentation of unknown systems
- **Auditing and tracking capability**
 - ▶ Time stamped entries
 - ▶ Query capable database
 - ▶ Electronic documentation from real time capture



Finding Reusable Resources

- **Web enablement**
 - ▶ Expose presentation and business logic
 - build stereotypical web services
 - ▶ Build workflow-based applications

- **Assist the process choreographer for SOA conformance**
 - ▶ Reveal appropriate invocation and interaction patterns
 - ▶ Manage life cycle of business processes
 - ▶ Provide quality-of-service (QoS) characteristics
 - maintain a certain response time
 - ensure particular security constraints



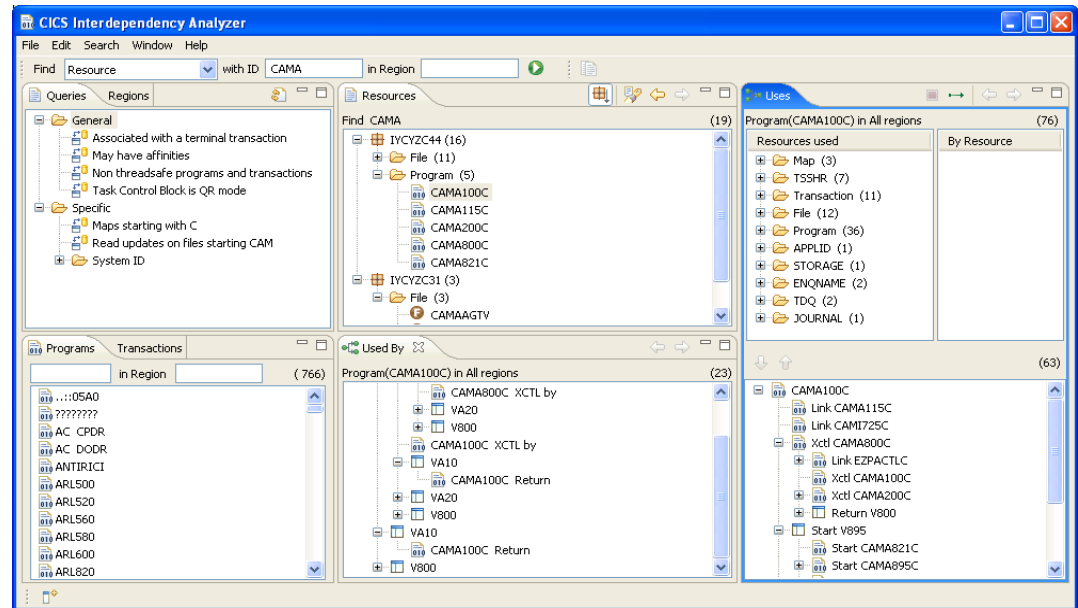
Find reusable assets with CICS Interdependency Analyzer

Problem

- Need to find good starting points to build Web services
 - Understand target application relationships and dependencies

Solution

- Supplied Explorer queries
 - Identify candidates to wrap as Web services
 - Identify all programs that issue send commands to a particular map
 - Expose VSAM files for DB2 conversion
 - Identify all programs that access a particular file



Value

- Reduced risk of problems when changing complex applications under time pressure or without deep CICS skills
- Speed time to delivery by understanding scope of change



CICS Webservices Support

The screenshot displays the IBM CICS Explorer application interface, which is used for managing and analyzing CICS resources. The interface is divided into several main panels:

- Queries and Regions:** A tree view on the left showing categories like 'Supplied Samples', 'CICS', 'Affinities', 'Exits', 'General', 'Migration', 'Specific', 'Threadsafe', 'Webservices', 'DB2', 'IMS', 'MQ', and 'User Queries'. Under 'Webservices', 'Programs that INVOKE a webservice' and 'Programs that contain presentation logic' are highlighted.
- *Resources:** A central panel titled 'Programs that contain presentation logic (94)'. It lists various CICS programs such as IYCYZC32 (6), CICACB95 (2), IYCYZC33 (4), CICACB96 (3), CICACB97 (1), IYCYZC31 (7), CICACB91 (29), IYCYZC39 (9), IYCYZC38 (3), IYCYZC37 (6), IYCYZC36 (4), IYCYZC34 (7), IYCYZC3C (4), IYCYZC3A (6), and CICACB30 (3). Below this list, it shows 'PROGRAM (DSN8CC0)', 'PROGRAM (OISA1000)', and 'PROGRAM (OISA1010)'.
- Uses:** A panel on the right titled 'Program(OISA1000) in Region CICACB30 (15)'. It shows a hierarchical view of resources used by the program, including 'Map (2)', 'OISM100 (1)', 'SEND', 'OISM110 (1)', 'TEXT (1)', 'SEND TEXT (1)', 'MAPSET (2)', 'OISM100 (1)', 'SEND MAP', 'OISM110 (1)', 'SEND MAP', 'Program (3)', 'Transaction (1)', '(2)', 'File (1)', 'TSAUX (1)', and 'EXIT (1)'. A 'By Resource' table on the right lists 'OISA1000'.
- Programs:** A panel at the bottom left titled 'OI%' in Region, showing a list of OI% programs: OISA1000, OISA1010, OISA1020, OISA2000, and OISDM30.
- Used By:** A panel at the bottom center titled 'Programs using Map(OISM100) in All regions (6)'. It shows a tree view for 'OISM100' with sub-items: 'OISA1000 Send', 'OISA1000 XCTL by', 'OISA1010 XCTL by', 'OISA1000 XCTL by', and 'OISA1020 XCTL by'.
- Properties:** A panel at the bottom right titled 'Programs using OISM100 (16)'. It shows a tree view for 'OISA1000' with sub-items: 'Xctl OISA1000', 'Return DT01', 'Start KOCOME00', 'Start OISA1000', 'Start OISA1010', 'Xctl OISA1010', 'Xctl OISA1000', 'Return DT01', 'Start KOCOME00', 'Start OISA1000', 'Start OISA1010', 'Return DT01', 'Start KOCOME00', 'Start OISA1000', and 'Start OISA1010'.

The status bar at the bottom right of the application window shows the file path: `zt01.pssc.mod.fr.ibm.com`.



CICS IA File Support

The screenshot displays the IBM CICS Explorer application interface. The main window is divided into several panes:

- Queries / Regions:** A tree view on the left showing categories like Supplied Samples, CICS, Affinities, Exits, General, Migration, Specific, Threadsafe, Webservices, DB2, IMS, MQ, and User Queries.
- *Resources:** A list of 87 programs using files, including PROGRAM (CCVMSCD), PROGRAM (HCEXIT), PROGRAM (HCREGID), PROGRAM (FMN3CICS), PROGRAM (CCVIINIT), PROGRAM (OISA1020), PROGRAM (HCINITA), PROGRAM (HCARRIV), PROGRAM (HCOFPRC), PROGRAM (EZPACTLC), PROGRAM (CBKFSX65), PROGRAM (TSAFEVWQ), PROGRAM (TSAFEVWT), PROGRAM (CCVSWASH), PROGRAM (LAB3POT), PROGRAM (HCOFPRQ), PROGRAM (OISA1010), PROGRAM (HCEXITQ), and PROGRAM (EMSTESTS).
- Uses:** A view for Program(OISA1010) in Region CICACB30, showing 15 resources used, including File (1), OISDDM30 (3), TSAUX (1), MAPSET (2), Program (3), Transaction (1), EXIT (1), (2), TEXT (1), and STORAGE (1).
- Programs:** A list of programs in the OI% region, including OISA1000, OISA1010, OISA1020, OISA2000, and OISDM30.
- Used By / Properties:** A view showing programs using File(OISDDM30) in all regions (6), including OISA1010, OISA1000, OISA1010, OISA1020, and OISA1000.
- Programs using OISDDM30:** A view showing 16 programs using OISDDM30, including OISA1010, Xctl OISA1000, Xctl OISA1000, Return DT01, Xctl OISA1010, Return DT01, and Return DT01.

The status bar at the bottom right shows the URL: zt01.pssc.mod.fr.ibm.com.



Questions?



Reference Information

- CICS Tools Web site: <http://www.ibm.com/cics/tools>
- Redbooks:
 - ▶ Threadsafe Considerations for CICS, SG24-6351-02
<http://www.redbooks.ibm.com/abstracts/sg246351.html?Open>
 - ▶ CICS Interdependency Analyzer
<http://www.redbooks.ibm.com/abstracts/sg246458.html?Open>
- Support Pac:
 - ▶ IBM CICS Explorer for Windows SupportPac –New Face of CICS
<http://tinyurl.com/6o6n9v>
- Running OMEGAMON XE for CICS as threadsafe
<http://www-01.ibm.com/software/tivoli/features/ccr2/ccr2-2004-06/features-cics.html>
- Try CICS tools for free for 60 days
www.ibm.com/software/os/zseries/trials/cicstools
- Contact your Local IBM Representative
- Program numbers (license):
 - 5697-J23: CICS Interdependency Analyzer



Bibliography

CICS Interdependency Analyzer

- ▶ CICS Interdependency Analyzer for z/OS V2.1 User Guide and Reference SC34-6685
- ▶ CICS Interdependency Analyzer for z/OS V2.1 Program Directory GI10-2598
- ▶ DB2 Application Programming and SQL Guide, SC26-4377
- ▶ DB2 Administration Guide, SC26-4374
- ▶ Redbook: CICS Interdependency Analyzer, SG24 -6458-00
- ▶ Redbook: Migration Considerations for CICS Using CICS CM, CICS PA, and CICS IA, SG24-7294-00
- ▶ White paper: CICS Interdependency Analyzer for z/OS V1.3 - Discovering resource relationships and affinities within your CICS environment, G224-9129



CICS Explorer - Community Ecosystem

- CICS Explorer home page
 - ▶ <http://ibm.com/cics/explorer>
- [CICS Explorer Forum](http://ibm.com/cics/explorer)
 - <http://tinyurl.com/68bndw>
 - ▶ FAQs, Links and resources, ISV Contributions, Ask questions, suggest improvements, report problems, dialogue
- Twitter
 - ▶ CICS Explorer news flashes on the [IBM_System_z channel](https://twitter.com/IBM_System_z)
- Blog
 - ▶ Comment and opinion at TheMasterTerminal.com
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