

Don't Let ICIs... put your DB2 applications in the ICU!

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SEGUS & SOFTWARE ENGINEERING

Session Code: V8

On May 25, 2016 | at 10:30 | Platform: DB2 z/OS



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AGENDA

1. The what and why of ICIs
2. BiF problems
3. Ways to deal with incompatibilities
4. Some guidance
5. SEG Workload Expert to the rescue
6. Customer experiences and quotes

DB2 Version Incompatibilities

- In recent versions, IBM has modified the behavior of certain DB2 functionality
 - Built-in Functions (BiFs)
 - Reserved Words
 - SQL Return Codes
 - Deprecated Functionality
- It is important that you are aware of, and track, the incompatibilities that may cause issues/problems... why?
 - Applications no longer function
 - Applications function differently
 - The results of your SQL SELECT statements can change



DB2 Version Incompatibilities



- ICI =
 - Incompatibility Indicator
- DB2 can track when your applications use incompatible functionality
 - If you start the right traces/IFCIDs

How Many Incompatibilities Are There?

- 1: V9 version of CHAR(DEC) executed
- 2: V9 version of VARCHAR(DEC) executed
- 3: Unsupported character string representation of a TIMESTAMP
- 4: V10 default SQL path used instead of V11
- 7: SQLCODE -301 from a DB2 11 server
- 8: Stored procedure data types
- 9: TIMESTAMP TIMEZONE from DRDA
- 10: V9 version of LTRIM, RTRIM, STRIP executed
- 1101: INSERT into XML column w/o XMLDOCUMENT function
- 1102: XPATH evaluation resulted in error
- 1103: Dynamic SQL ASUTIME limit RLF issue
- 1104: CLIENT_ACCTNG longer than supported length pre-V11
- 1105: CLIENT_APPLNAME longer than supported length pre-V11
- 1106: CLIENT_USERID longer than supported length pre-V11
- 1107: CLIENT_WORKSTNNAME longer than supported length pre-V11
- 1108: CLIENT register longer than supported used for RLF
- 1109: CAST(String AS TIMESTAMP) using invalid string lengths as of V11
- 1110: Argument for SPACE function greater than 32764
- 1111: Optional integer argument of VARCHAR greater than 32764
- 1112: Empty XML element

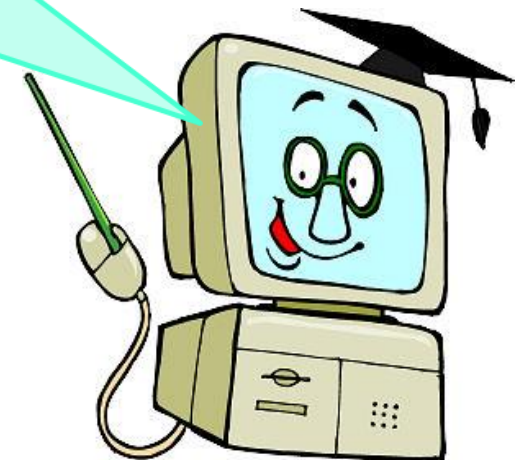
The turquoise ones are related to BIFs...

Why are incompatibilities being introduced?

- The first reaction from many is to question why IBM would change the way that DB2 works?
 - This is a reasonable question, but of course, there is a reasonable answer:

To be compatible with industry standards

- The ANSI SQL Standard
- Makes porting applications from Oracle and SQL Server to DB2 easier if they all work the same way and return the same results



Of Course...

- By changing sometimes long-standing functionality, users are forced to modify their applications or live with changed functionality
 - And nobody wants to change code, no matter how simple, when the code is working...
 - Should say ***was working***
- Fortunately, there is help
 - We'll look at ways to identify changed functionality
 - And Roy will talk to you about how SEG's Workload Expert can help!



First, Let's Look at an Example: BiFs

- Built-in Functions, or BiFs, are one area that will impact many shops
 - The output of several BiFs have changed... we'll take a look at how
 - Remember the blue ones from the long list of ICIs
 - slide 6



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- 1112: Empty XML element

The turquoise ones are related to BiFs...

- Before looking at the incompatibilities, a quick BiF review...

What are BiFs?

- There are 4 types of BiFs but the two most common are:
 - Aggregate Functions
 - Compute, from a group of rows, a single value for a designated column or expression.
 - This provides the capability to aggregate data, thereby enabling you to perform statistical calculations across many rows with one SQL statement.
 - Scalar Functions
 - Are applied to a column or expression and operate on a single value.
 - Contrast this with the column functions, which are applied to a set of data and return only a single result.
 - There are well over a hundred scalar functions.
 - SQL Reference Guide, Chapter 3

Aggregate vs. Scalar Functions

A G G R E G A T E

- ARRAY_AVG
- AVG
- CORRELATION
- COUNT / COUNT_BIG
- COVARIANCE /
COVARIANCE_SAMP
- GROUPING
- MAX
- MEDIAN
- MIN
- STDDEV / STDEV_SAMP
- SUM
- VARIANCE /
VARIANCE_SAMP
- XMLAGG

S C A L A R

- ABS
- ACOS
- ASCII
- CEILING
- CHAR
- COALESCE
- LOCATE
- LOWER / UPPER
- LPAD / RPAD
- LTRIM / RTRIM
- OVERLAY
- RAND
- TRUNCATE
- VARCHAR
- ARRAY_AVG

Example scalar functions;
there are almost 200 of them.

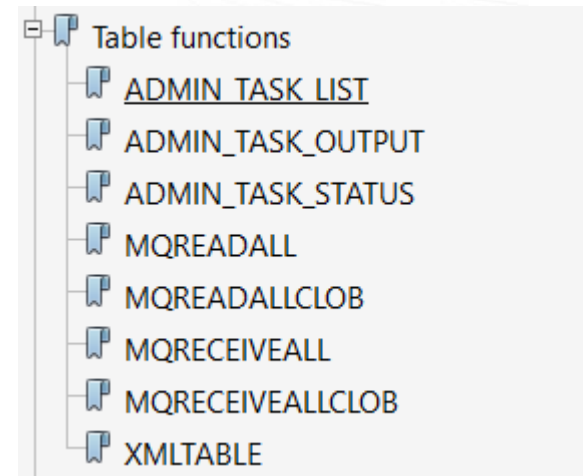
OK, What are the other two types of BiFs?

- **Table Functions**

- Table functions are used only in the FROM clause of an SQL statement.
- Table functions return columns just like your normal created tables.

- **Row Functions**

- Used in specific contexts
- There is only one row function as of DB2 11
 - The UNPACK function returns a row of values that are derived from unpacking a binary string.
 - Unpacks a string that was encoded according to the PACK function.
 - The PACK scalar function returns a binary string value that contains a data type array and a packed representation of each non-null *expression* argument.



User Defined Functions

- Of course, you can also create your own UDFs, or user-defined functions
 - UDFs can be EXTERNAL or SOURCED
 - EXTERNAL
 - You write the function program
 - SOURCED
 - The UDF is based on an existing BiF
- So, if the UDF is sourced using an existing BiF, and the BiF has incompatible functionality, the UDF will be impacted, too.

Why All the Fuss About BiFs?

- The way some of the most popular scalar BiFs work started changing with DB2 10 for z/OS. For example, CHAR:

```
SELECT CHAR(DEC_COL) FROM SYSIBM.SYSDUMMY1 ;
```

	CHAR(000.1)	CHAR(1000.)	CHAR(1.1)
V10+	'1'	'1000'	'1.1'
V9	' 000.1'	' 1000.'	' 1.1'

- CHAR on a DEC no longer returns:
 - Leading zeros.
 - The trailing decimal point character.
 - Leading blanks for positive decimal values. This change applies to the CHAR built-in function only.
- You can see how that might cause your application to work differently, right?

Other BiFs with “Similar” Incompatibilities

- VARCHAR
- TRIM / LTRIM / RTRIM
- STRIP
- TIMESTAMP



Customers Need a Way to Deal With all this!

- And nobody wants to change their code!
- Some help...
 - BIF_COMPATIBILITY
 - New schemas
 - APPLCOMPAT
 - New BiFs with V9 functionality



BIF_COMPATIBILITY

- IBM added a new DSNZPARM to help control the behavior of BiFs with incompatible functionality
 - Set on DSNTIPX panel
- BIF_COMPATIBILITY values
 - CURRENT
 - new functionality
 - V9
 - pre-V10 functionality for CHAR
 - V9_DECIMAL_VARCHAR
 - pre-V10 functionality for VARCHAR (and CHAR)
 - V9_TRIM
 - pre-V10 functionality for TRIM functions (and CHAR and VARCHAR)

```

DSNTIPX          INSTALL DB2 - ROUTINE PARAMETERS
====
Enter data below:

 1 WLM PROC NAME   ==> DSN1WLM   WLM-established stored procedure JCL PROC
 2 NUMBER OF TCBS  ==> 8         Number of concurrent TCBS (1-100)
 3 MAX ABEND COUNT ==> 0         Allowable ABENDs for a routine (0-255)
 4 TIMEOUT VALUE   ==> 180       Seconds to wait before SQL CALL or
                                   function invocation fails (5-1800,NOLIMIT)

 5 WLM ENVIRONMENT ==>          Default WLM environment name
 6 MAX OPEN CURSORS ==> 500       Maximum open cursors per thread
 7 MAX STORED PROCS ==> 2000      Maximum active stored procs per thread
 8 MAXIMUM LE TOKENS ==> 20       Maximum tokens at any time. 0-50
 9 BIF COMPATIBILITY ==> CURRENT  Compatibility level for DB2 built-in
                                   functions (V9, V9_DECIMAL_VARCHAR, or
                                   CURRENT)
10 ADMIN SCHEDULER ==> DSNADMT   Administrative scheduler task proc name

PRESS:  ENTER to continue  RETURN to exit  HELP for more information
  
```

Two New Schemas

- **SYSCOMPAT_V9 and SYSCURRENT**
 - For CHAR, VARCHAR, and all the TRIM functions
 - Must be added before SYSIBM in the path
 - Used in the current path
special register or
PATH bind option



DB2 11- APPLCOMPAT

- APPLCOMPAT DSNZPARM and BIND option
- Provides support for up to two back level releases of DB2
 - DB2 11 supports V10R1 and V11R1
 - DB2 Next will support 10, 11, and Next
 - Next+1... 10 support goes away
- So you can put things off until DB2 13
 - Disclaimer: : IBM has not stated that there will actually be a version 13, nor do I have any knowledge that there will be a DB2 13. But we can all count, right?



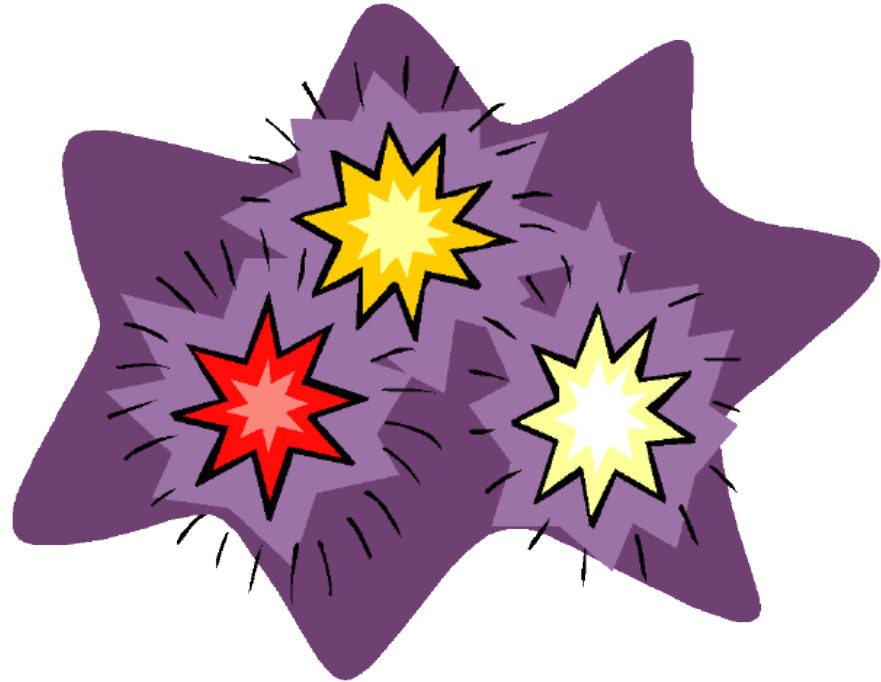
APPLCOMPAT

- The DSNZPARM value is the default value
- You can use the BIND option to control application compatibility on a program by program basis
- APPLCOMPAT does not control new function availability
 - Example: you can CREATE a GLOBAL VARIABLE using SPUFI even if the package was bound for V10R1
 - Note: Global variables are new in DB2 11
- APPLCOMPAT parameter is available on:
 - BIND PACKAGE
 - REBIND PACKAGE
 - REBIND TRIGGER
 - CREATE/ALTER PROCEDURE
 - CREATE/ALTER FUNCTION

```
>-----+-----+----->
      '----- APPLCOMPAT--- (--V10R1---) -----'
                          (---V11R1---)
```

DB2 11 – Two New BiFs

- These behave like they did for DB2 9 and prior releases, with the old functionality
 - CHAR9
 - VARCHAR9



Some Guidance

- Nobody likes to change application code, but really how hard would it be to just change:
 - CHAR → CHAR9
 - VARCHAR → VARCHAR9
- APPLCOMPAT is great because it buys us some time to make changes
 - Don't make the mistake of never moving forward your APPLCOMPAT version until IBM no longer supports it
 - Doing that just moves your mad scramble to some point in the future



IFCIDs 366 and 376

- IBM makes it easier for us to track when we use incompatible functionality via IFCID 366
- This IFCID is output whenever DB2 detects a *possible* change of behavior from the current release to the next release.
- Remember our list of ICIs from earlier?
- This IFCID tracks them by the numbers shown in that list
- Shops started to get many 366 records being cut
 - So IBM created IFCID 376 in DB2 11
 - This is an aggregated version of the 366.

Detailed versus Aggregated

- IFCID 366
 - Identifies any new type of incompatible application change
 - Makes it possible to find packages with incompatible behavior
- IDCID 376
 - Written once for each unique dynamic cached stmt
 - And static stmt if bound V10 NFM or later.
 - For static stmts bound before V10 NFM, once per unique combo of plan, pkg ID, statement number.

How can you be best prepared?

- A lot of new information and options
 - What is your strategy for attacking ICIs?
- Some shops have many, many instances of incompatible changes running
- Are you prepared to trace IFCID 366 / 376?
 - Could be a lot of data.
- SEG offers help...



Part 2 - Don't Let ICIs... put your DB2 applications in the ICU!

Roy Boxwell
SOFTWARE ENGINEERING

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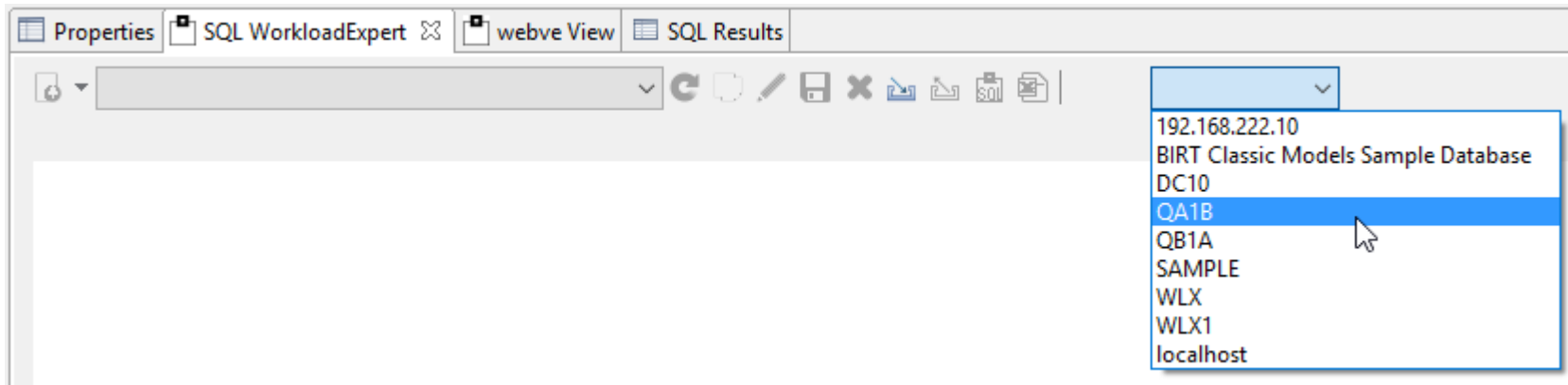


SQL WorkloadExpert (WLX) for DB2 z/OS

- The SQL WorkloadExpert architecture comes in two parts:
 - Mainframe DB2 fast Workload collector using Opx and processing engine
 - Workstation analysis and reporting engine
- DSC and SSC (EDMPOOL) are selected and the data is stored in WLX tables
- Processing and display of the data in Datastudio 4.1.1 or Eclipse on the workstation

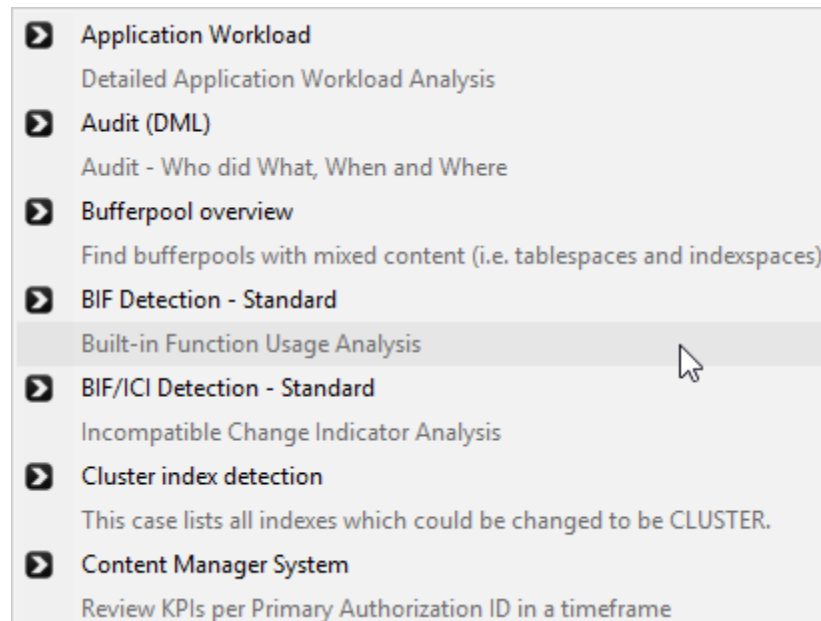
Evaluation with SQL WorkloadExpert

Here's how the WorkloadExpert looks in the GUI



Evaluation with SQL WorkloadExpert

After selecting a DB2 subsystem you select the desired Use Case:



Evaluation with SQL WorkloadExpert

Give it a name, check the columns of interest, the selection criteria and the initial sort. All done click **OK!**

 BIF/ICI Detection

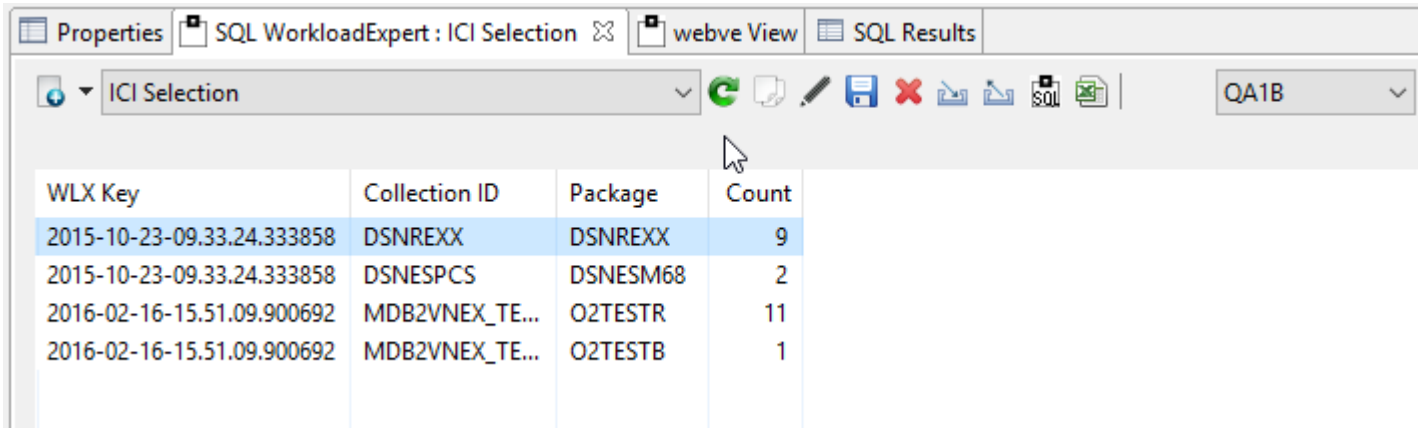
Description

Projection Selection Sorting

Label	Description
WLX Key	The WorkloadExpert key for this wor...
Collection ID	The Collection ID used by the state...
Package	The package used by the statement
Count	Count

Evaluation with SQL WorkloadExpert

Results at „standard“ first level look like this:

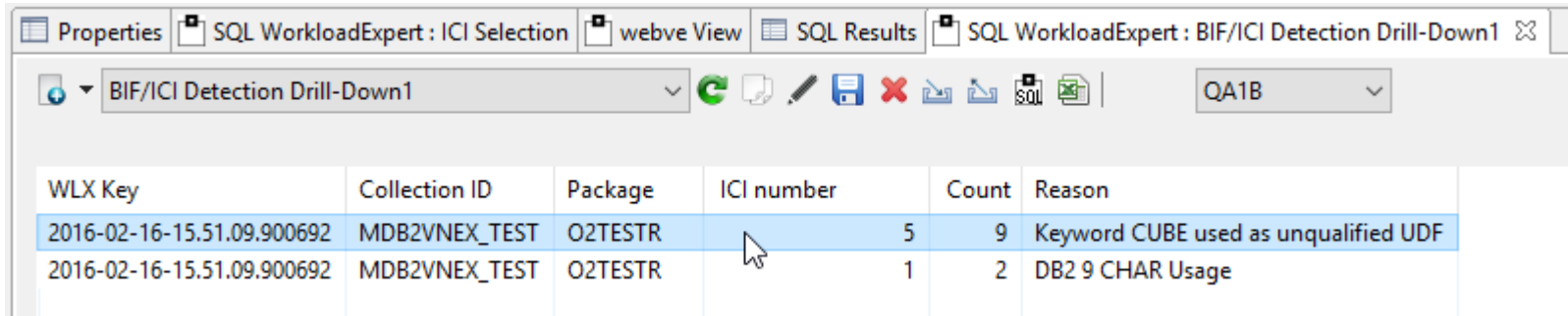


The screenshot shows the SQL WorkloadExpert webview interface. The top bar includes tabs for Properties, SQL WorkloadExpert : ICI Selection, webve View, and SQL Results. Below the tabs is a toolbar with various icons and a dropdown menu set to 'QA1B'. The main area displays a table with the following data:

WLX Key	Collection ID	Package	Count
2015-10-23-09.33.24.333858	DSNREXX	DSNREXX	9
2015-10-23-09.33.24.333858	DSNESPCS	DSNESM68	2
2016-02-16-15.51.09.900692	MDB2VNEX_TE...	O2TESTR	11
2016-02-16-15.51.09.900692	MDB2VNEX_TE...	O2TESTB	1

Evaluation with SQL WorkloadExpert

Drill on down to the next level which shows the split of the ICIs:

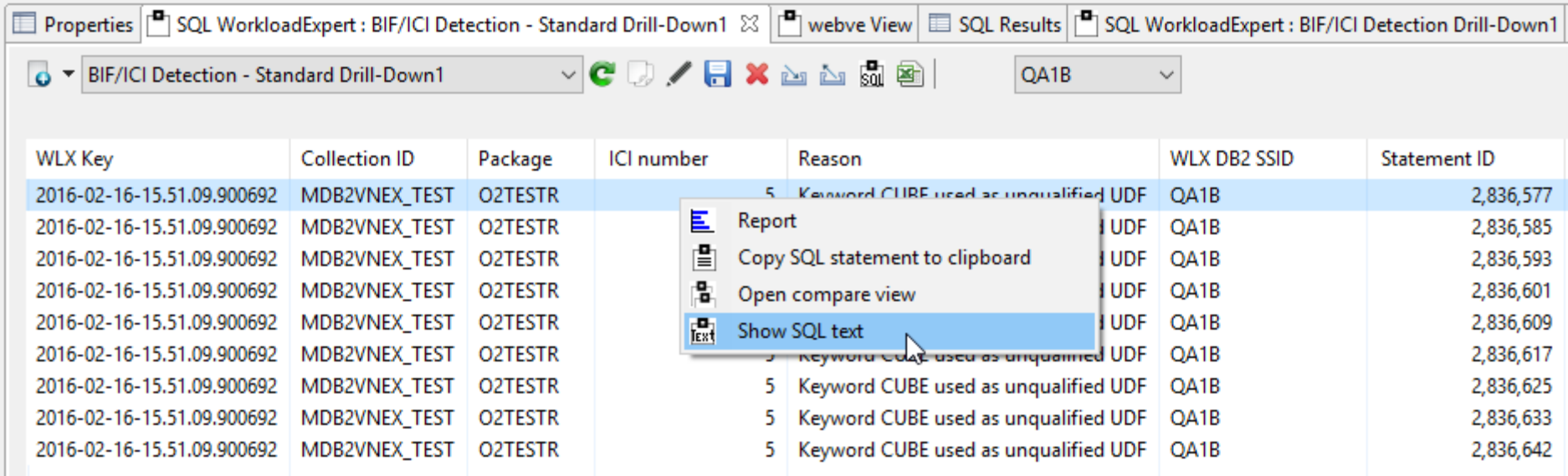


The screenshot shows the SQL WorkloadExpert application window. The 'BIF/ICI Detection Drill-Down1' tab is active, displaying a table of detected issues. The table has columns for WLX Key, Collection ID, Package, ICI number, Count, and Reason. Two rows are visible, both with a WLX Key of 2016-02-16-15.51.09.900692 and a Collection ID of MDB2VNEX_TEST. The first row has a Package of O2TESTR, ICI number 5, Count 9, and Reason 'Keyword CUBE used as unqualified UDF'. The second row has a Package of O2TESTR, ICI number 1, Count 2, and Reason 'DB2 9 CHAR Usage'. A mouse cursor is hovering over the ICI number 5 in the first row.

WLX Key	Collection ID	Package	ICI number	Count	Reason
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	9	Keyword CUBE used as unqualified UDF
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	1	2	DB2 9 CHAR Usage

Evaluation with SQL Workload Expert

Drilling on down again shows the details and now with a right-click you can see the SQL text:

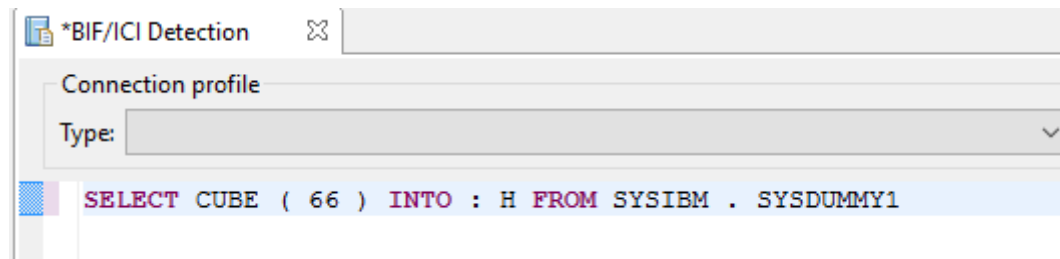


The screenshot shows the SQL Workload Expert application window. The title bar includes tabs for Properties, SQL WorkloadExpert : BIF/ICI Detection - Standard Drill-Down1, webve View, SQL Results, and SQL WorkloadExpert : BIF/ICI Detection Drill-Down1. The main window displays a table with the following columns: WLX Key, Collection ID, Package, ICI number, Reason, WLX DB2 SSID, and Statement ID. A right-click context menu is open over the 'Reason' column, showing options: Report, Copy SQL statement to clipboard, Open compare view, and Show SQL text (which is highlighted by the mouse cursor). The table contains 8 rows of data, all with the same WLX Key and Collection ID, and a reason of 'Keyword CUBE used as unqualified UDF'.

WLX Key	Collection ID	Package	ICI number	Reason	WLX DB2 SSID	Statement ID
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,577
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,585
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,593
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,601
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,609
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,617
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,625
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,633
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	5	Keyword CUBE used as unqualified UDF	QA1B	2,836,642

Evaluation with SQL WorkloadExpert

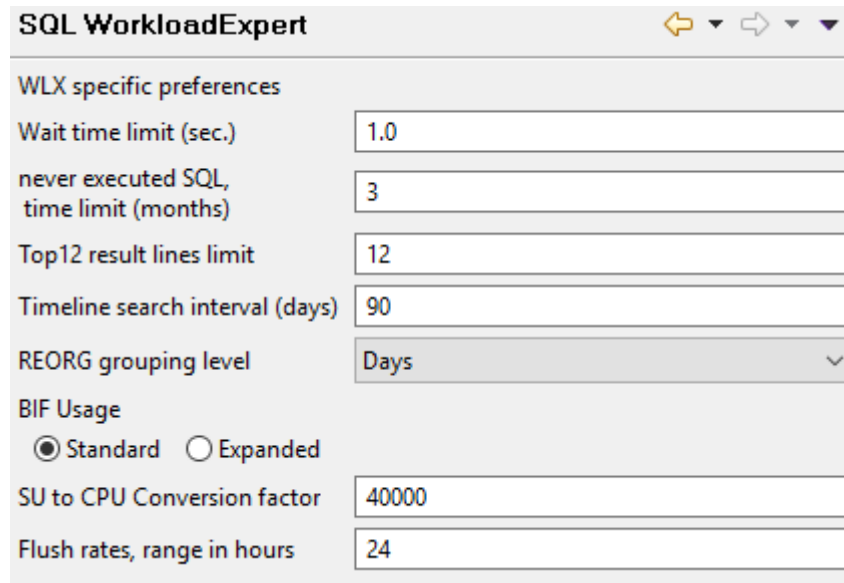
And the SQL text is:



There is also an „expanded“ view which reduces the click-load a little!

Evaluation with SQL WorkloadExpert

To get the „Expanded“ view change the BIF Usage setting in the properties:



The screenshot shows the 'SQL WorkloadExpert' configuration window. It has a title bar with navigation arrows. The main area is divided into sections. The 'WLX specific preferences' section contains several input fields: 'Wait time limit (sec.)' with value 1.0, 'never executed SQL, time limit (months)' with value 3, 'Top12 result lines limit' with value 12, 'Timeline search interval (days)' with value 90, and 'REORG grouping level' with a dropdown menu set to 'Days'. Below this is the 'BIF Usage' section, which has two radio buttons: 'Standard' (selected) and 'Expanded'. At the bottom are two more input fields: 'SU to CPU Conversion factor' with value 40000 and 'Flush rates, range in hours' with value 24.

SQL WorkloadExpert	
WLX specific preferences	
Wait time limit (sec.)	1.0
never executed SQL, time limit (months)	3
Top12 result lines limit	12
Timeline search interval (days)	90
REORG grouping level	Days
BIF Usage	
☒ Standard	☐ Expanded
SU to CPU Conversion factor	40000
Flush rates, range in hours	24

Evaluation with SQL WorkloadExpert

Then run again and now you get everything in one loooong row:

Properties SQL WorkloadExpert : BIF/ICI Detection webve View SQL Results					
BIF/ICI Detection QA1B					
WLX Key	Collection ID	Package	ICI number	Reason	WLX DB2 SSID
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTB	1	DB2 9 CHAR Usage	QA1B
2016-02-16-15.51.09.900692	MDB2VNEX_TEST	O2TESTR	1	DB2 9 CHAR Usage	QA1B

Statement ID	Statement Origin	BIF Timestamp	Statement Type	Section number	Statement number
2,599,403	S	2016-02-19-10.21.14.813876	S	3	185
2,836,640	S	2016-02-19-13.38.18.914851	S	3	270

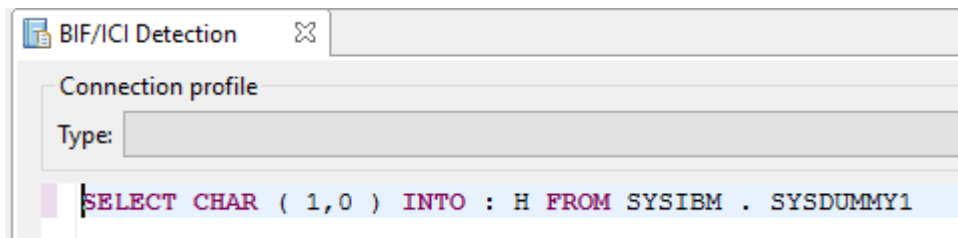
Plan name	Package CONTOKEN	Statement Timestamp	SQ...	Statement text short
MVNXPLAN	19F340EB05B24064	2016-02-19-10.21.14.813672	53	SELECT CHAR (1,0) INTO : H FROM SYSIBM . SYSDUMMY1
MVNXPLAN	1A0A616E0D9C7C3C	2016-02-19-13.38.18.914571	53	SELECT CHAR (1,0) INTO : H FROM SYSIBM . SYSDUMMY1

Authorization ID	Job name or logon ID	Connection name	Plan name	Initial authorization ID	Connection type
BOXWELL	BOXWELLX	DB2CALL	MVNXPLAN	BOXWELL	DB2 CALL ATTACH
BOXWELL	CORRELATIONZ	RRSAF	MVNXPLAN	BOXWELL	RRSAF ATTACH

And there are more columns!

Evaluation with SQL WorkloadExpert

Right-click and select Show SQL text to see the offending SQL statement:



Now just get the developers to validate and/or change the code – Easy!

Customer experiences and quotes

Our customers have added their own expertise into the mix as well! Here's an example of a REXX reading the BiF/ICI data and then transforming it into a CSV file for use by application development to check if it is a real problem or not!

	A	B	C	D	E	F	G	H
1	WLX_TIMESTAMP	PACKAGE	PROGRAM	ICI_NO	REASON	STMT_GRP	STMT_ID	STMT_OR
2	2016-04-12-00.01.13.744608	C00	PROGXY	1	DB2 9 CHAR Usage	DB29	938582	S
3	2016-04-12-00.01.13.744608	C00	PROGXY	1	DB2 9 CHAR Usage	DB29	938582	S
4	2016-04-12-00.01.13.744608	C00	PROGXY	1	DB2 9 CHAR Usage	DB29	938582	S

TRANSACTION	END_USER	WORKSTA	STMT_LEN	STMT_TEXT_SHORT
			487	DECLARE CR-NAMExyz CURSOR WITH HOLD FOR SELECT Collist
APPL.EXE	AUTHXXX	WS00L787	299	SELECT DISTINCT NR_KUNDEN , char (NR_P
APPL.EXE	AUTHXXX	WS00L787	335	SELECT DISTINCT char (NR_PARTNER) , N

To quote a customer:

„Due to the high number of DB2 systems, we use this through TWS. For Ad Hoc analysis, the GUI Plug-in is the normal choice“

Customer experiences and quotes

Some quotes from our customers:

The question: “Where’s the BiF?” Is answered immediately, and the SQL is categorized and displayed. The full SQL text is displayed - **even for dynamic SQL**.

Unlike the analyses we had previously conducted using **Omegamon**, it was not necessary, when using WLX, to collect **SMF data for more than 12 months** prior to the migration.

With WLX you **don’t even need SMF data**. The straight-forward approach that WLX takes **saves huge amounts** of time, manpower, and storage.

SQL WorkloadExpert Free Trial

The BiF/ICI detection Use Cases you have just seen are available for a 30 day free trial and are also separately licensable within the complete  SQL WorkloadExpert packet.

30 **Day
Free
Trial**

Where's the BiF?

After all, you do not want your application to end up looking like this:



Craig Mullins and Roy Boxwell

SEGUS & SOFTWARE ENGINEERING

r.boxwell@segus.com

*Please fill out your session
evaluation before leaving!*



Session: V8

**Don't Let ICIs... put your DB2 applications in the
ICU!**

