Cognitive Systems

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Db2 for i Business Architect

# What's New in Db2 for i

# Db2 for i

- **Standard compliant**
- **Secure**
- **Scalable**
- **Functionally Advanced**
- **Excellent Performance**
- **Easier to use**
- **Easier to maintain**

Value Proposition

*Continual Investment and Innovation*
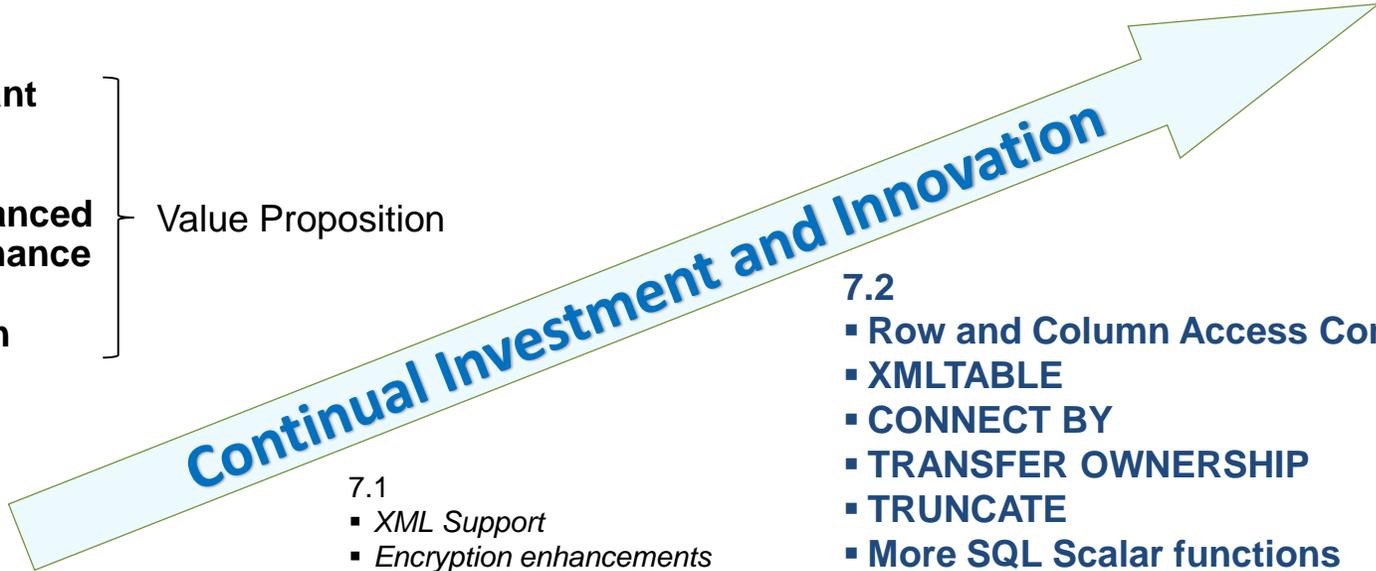
**6.1**
- Omnifind
- MySQL storage engine
- DECFLOAT
- *Grouping sets / super groups*
- INSERT in FROM
- VALUES in FROM
- Extended Indicator Variables
- Expression in Indexes
- ROW CHANGE TIMESTAMP
- *Statistics catalog views*
- CLIENT special registers
- *SQE Stage 6*
- *DDM and DRDA IPv6*
- *Deferred Restore of MQTs and Logicals*
- *Environmental limits*

**7.1**
- *XML Support*
- *Encryption enhancements (FIELDPROCs)*
- Result set support in embedded SQL
- *CURRENTLY COMMITTED*
- *MERGE*
- *Global variables*
- *Array support in procedures*
- Three-part names and aliases
- SQE Logical file support
- *SQE Adaptive Query Processing*
- *EVI enhancements*
- *Inline functions*
- CREATE OR REPLACE
- *Partition table enhancements*
- Expressions in CALL
- *TR-timed enhancements*

**7.2**
- **Row and Column Access Control**
- **XMLTABLE**
- **CONNECT BY**
- **TRANSFER OWNERSHIP**
- **TRUNCATE**
- **More SQL Scalar functions**
- **Named arguments and defaults for parameters**
- **Obfuscation of SQL routines**
- **Array support in UDFs**
- **Timestamp precision**
- **Multiple-action Triggers**
- **Built-in Global Variables**
- **1.7 Terabyte Indexes**
- **Navigator Graphs and Charts**
- **Regular Expressions**
- **SQL Dynamic Compound**
- **UPDATE ROW across partitions**
- **System Limits - IFS**

**7.3**
- **Temporal Tables**
- **Generated columns for auditing**
- **OLAP Extensions**
- **OFFSET and LIMIT**
- **Inline User-Defined Table Functions**
- **New Aggregate Functions**
- **Index Merge Ordering**
- **EVI Only Access**
- **More Built-in Global Variables**
- **More SQL Scalar functions**
- **Increased routine and view limits**
- **More IBM i Services**
- **CREATE OR REPLACE TABLE**
- **ATTACH & DETACH Partition**
- **Pipelined Table Functions**

# Prioritization Formula

We use **customer value**, **cost** and **risk**
to guide our decisions regarding enhancements

Enhancements explained here:
[www.ibm.com/developerworks/ibmi/techupdates/db2](www.ibm.com/developerworks/ibmi/techupdates/db2)

# Requests For Enhancement

Levy your requirement, vote on Open requirements:
## http://ibm.biz/IBMi_RFE

## How-to Article:
## https://www.ibm.com/developerworks/ibmi/library/i-ibm-rfe-trs/

***Most Popular Database RFEs***

116 votes

**Enhance the interface for Run SQL Script in IBM i ACS**

I would like to see the Run SQL Script interface support "." dot prompting for colu
typing in a select statement the user would use an alias s...

Under Consideration

113 votes

**DB2 service for IFS listing**

I'd like to be able to get a list of IFS files within a directory using a DB2 service.

For example, to get the root directory:
SELECT * FROM TABLE(QSYS2.GET_IFS('/')) A

# IBM i 7.1 – End of Support on April 30th, 2018

OMNI – September, 2017

# Which release should you choose?

**Enhancements in IBM i 7.2?**

- Database performance
  - ✓ SQE handles Native DB access
  - ✓ New I/O Costing Model
  - ✓ EVI Only Access

- Data-centric security
  - ✓ Row & Column Access Control for SQL and DDS file

- Developer productivity
  - ✓ Default parameters on functions
  - ✓ Built-in Global Variables
  - ✓ Many other improvements

- Workload insight
  - ✓ Improved SQL Plan Cache
  - ✓ Performance Data Perspectives

**Enhancements in IBM i 7.3?**

- Data-centric history
  - ✓ System-period Temporal table support for SQL tables and DDS created physical files

- Data-centric accountability
  - ✓ Generated columns for SQL and DDS files
  - ✓ Authority Collection to avoid excess authority

- On-Line Analytical Processing (OLAP)
  - ✓ New OLAP built-in functions
  - ✓ Improved capabilities for Db2 Web Query, Cognos Analytics and other BI tools

- Improved value from priced options
  - ✓ DB2 SMP – Parallel execution of OLAP
  - ✓ DB2 Multisystem – Attach/Detach partitions

# Data Security … an area of continuous investment

| 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |

**7.1 and earlier**

**7.2**

**7.3**

**i next**

- Field Procedures
- Guardium Database Activity Monitor
- Guardium Vulnerability Assessment
- Guardium Classifier

- Row Permissions
- Column Masks
- Query journals with SQL
- Function Usage

- Generated Columns for Auditing
- Authority Collection
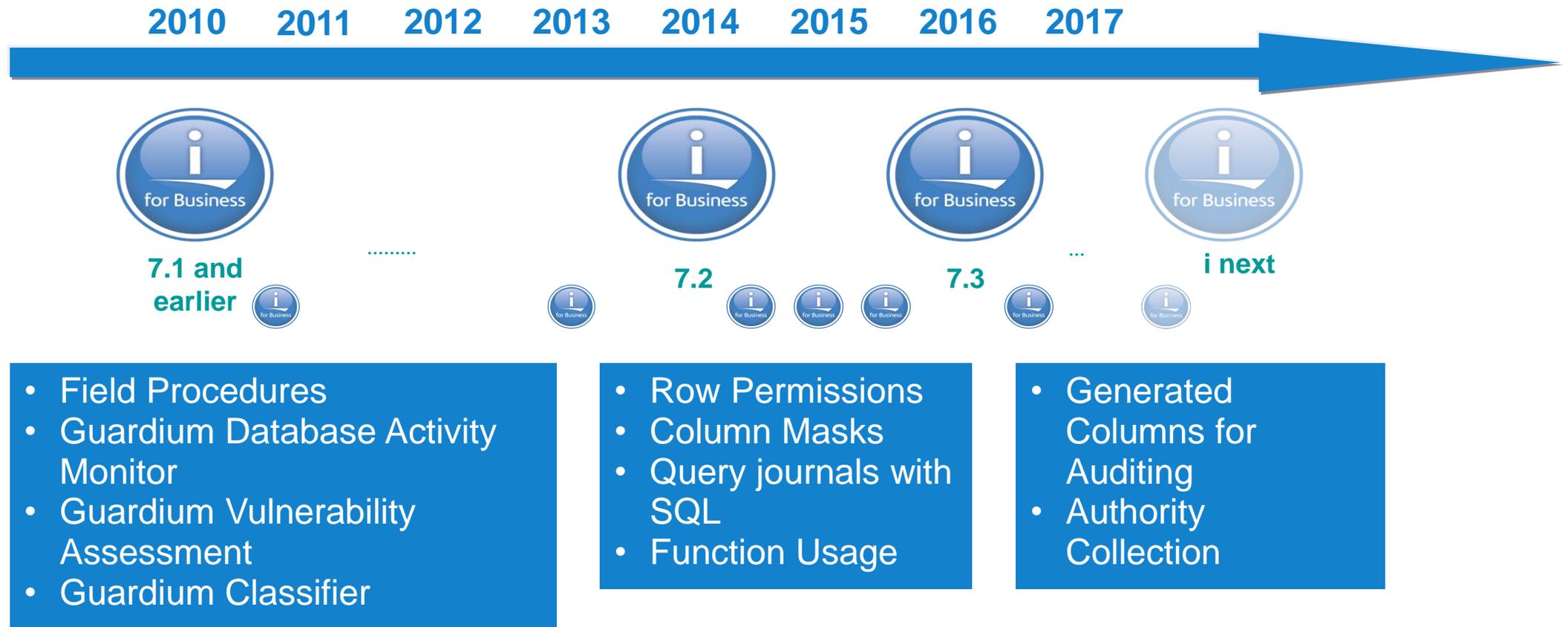
# Temporal Tables in IBM i 7.3

```
--
-- Who deleted this customer?
-- Get that row back!
--
SELECT USER_NAME, C.* FROM CUSTOMERS C
   FOR SYSTEM_TIME BETWEEN '0001-01-01' AND '9999-12-30'
      WHERE AUDIT_OP = 'D' AND CUSTNO = '102901'
```



| Temporal TABLE | RB | RE | TS | CHG | USR |
|---|---|---|---|---|---|
| | | | | U | Nick |
| | | | | I | Tom |
| | | | | I | Tom |
| | | | | | |
| | | | | | |

**Db2 Managed**

| History TABLE | RB | RE | TS | CHG | USR |
|---|---|---|---|---|---|
| | | | | I | Tom |
| | | | | U | Nick |
| | | | | D | Jim |
| | | | | I | Tom |
| | | | | D | Jim |

# DB2 Web Query – 3 EZ steps

1. **DB2 WQ EZ-Install**
   Read about it and how to acquire it at **ibm.biz/db2wqezinstall-info**

2. **Understand** how to build reports and more at **ibm.biz/db2wqezinstall**
   i.   Test drive the EZ-Install tutorial
   ii.  Try some of the Version 2.1 tutorials

3. **Read** the new Redbook:
   **"IBM DB2 Web Query for i: The Nuts and Bolts"**

   www.redbooks.ibm.com/abstracts/sg248379.html?Open
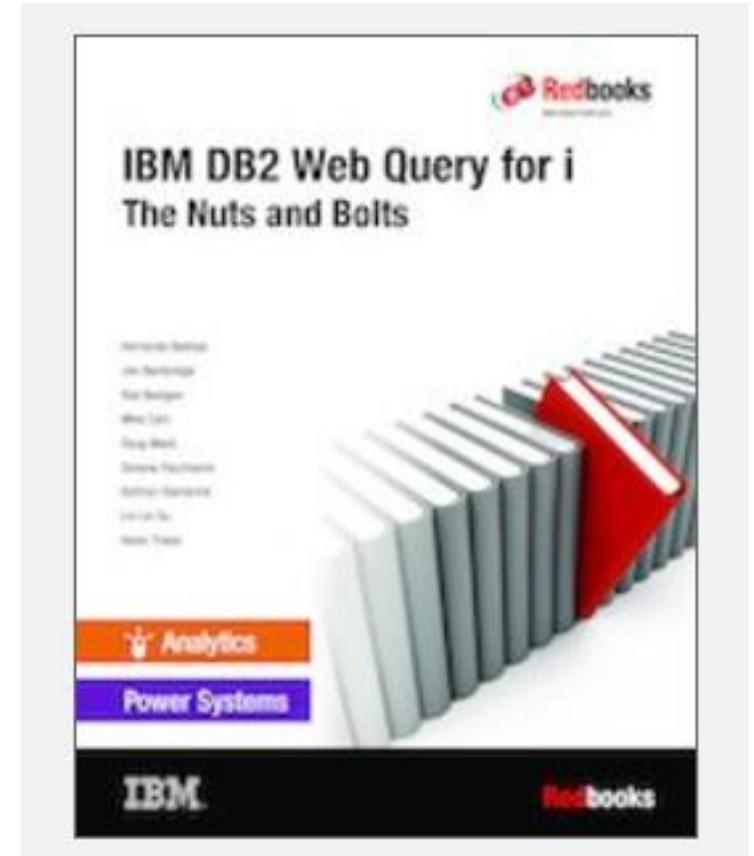
# Enhancements delivered via DB2 PTF Groups

**7.2 – TR4**
**7.3 – GA**

**7.2 – TR5**
**7.3 – TR1**

**7.2 – TR6**
**7.3 – TR2**

2016

2017

*SF99702 Level 11*
*SF99703 Level 1*

*SF99702 Level 14*
*SF99703 Level 3*

*SF99702 Level 16*
*SF99703 Level 4*
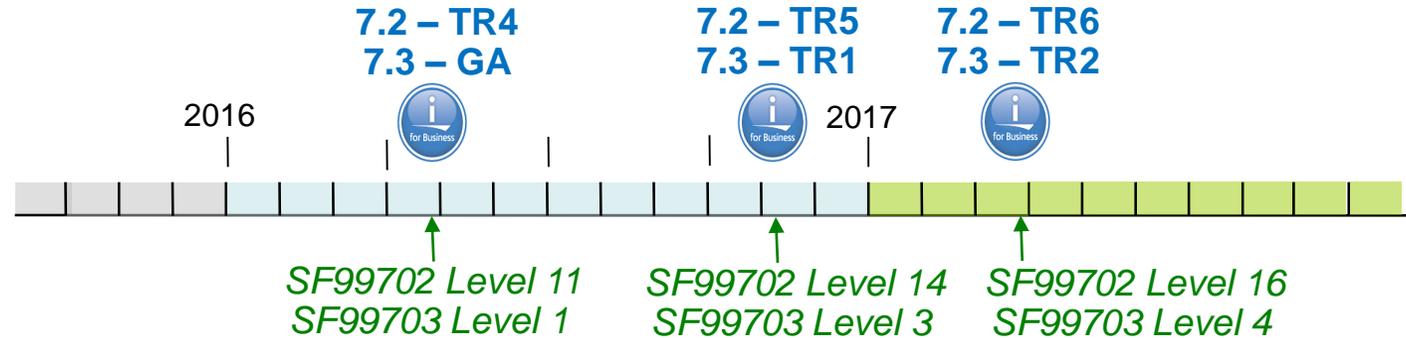
**Enhancements timed with TR4**
- Inlined UDTFs
- Trigger (re)deployment
- More IBM i Services
- New Db2 built-in Global Variables
- Enhanced SQL Scalar functions
- Evaluation option for DB2 SMP & DB2 Multisystem

**Enhancements timed with TR1 & TR5**
- **JSON_TABLE()**
- **INCLUDE for SQL Routines**
- **Database features in ACS**
- **Faster Scalar Functions**
- **More IBM i Services**
- **New Db2 for i Services**
- **And much more…**

**Enhancements timed with TR2 & TR6**
- **Performance Improvements**
- **JSON predicates**
- **Additional Database features in ACS**
- **New and enhanced SQL Scalar Functions**
- **New IBM i Services**
- **Enhanced Db2 for i Services**
- **And more…**

**www.ibm.com/developerworks/ibmi/techupdates/db2**

# SQL enhancements

- **LISTAGG –** Aggregates a set of string values for the group into one string by appending the string-expression

```
--   Produce a list of comma-separated names
SELECT workdept,
   LISTAGG(lastname, ',')
     WITHIN GROUP(ORDER BY lastname) AS
employees FROM employee GROUP BY workdept;
```

| WORKDEPT | EMPLOYEES |
|----------|-----------|
| A00 | HAAS,HEMMINGER,LUCCHESSI,O'CONNELL,ORLANDO |
| B01 | THOMPSON |
| C01 | KWAN,NATZ,NICHOLLS,QUINTANA |

# SQL enhancements

- **LISTAGG –** Aggregates a set of string values for the group into one string by appending the string-expression

```
--   Produce a list of comma-separated names
SELECT workdept,
```

*Read Simon Hutchinson's recent article...nice job Simon*

**Using SQL to aggregate columns into one returned result**
http://www.rpgpgm.com/2017/04/using-sql-to-aggregate-columns-into-one.html

| WORKDEPT | EMPLOYEES |
|----------|-----------|
| A00 | HAAS,HEMMINGER,LUCCHESSI,O'CONNELL,ORLANDO |
| B01 | THOMPSON |
| C01 | KWAN,NATZ,NICHOLLS,QUINTANA |

# SQL enhancements

- **LTRIM & RTRIM –** Add optional 2<sup>nd</sup> parameter (*trim-expression*)

```
--   Left Trim more than blanks
values LTRIM('  $ 10.40', '$ ');   ➔ '10.40'
```

```
--   Remove leading and trailing noise
values RTRIM(
       LTRIM('""Snazzy^--"', '"-^') ,
       '-"^');                    ➔ 'Snazzy'
```

# SQL Programmers Resource

- **2,000+ Pages of fun!**

- **Updated twice per year**

**Find it here:**

**http://ibm.biz/DB2fori_SQLreference**

IBM i
Version 7.3

Database
DB2 for i SQL Reference

IBM
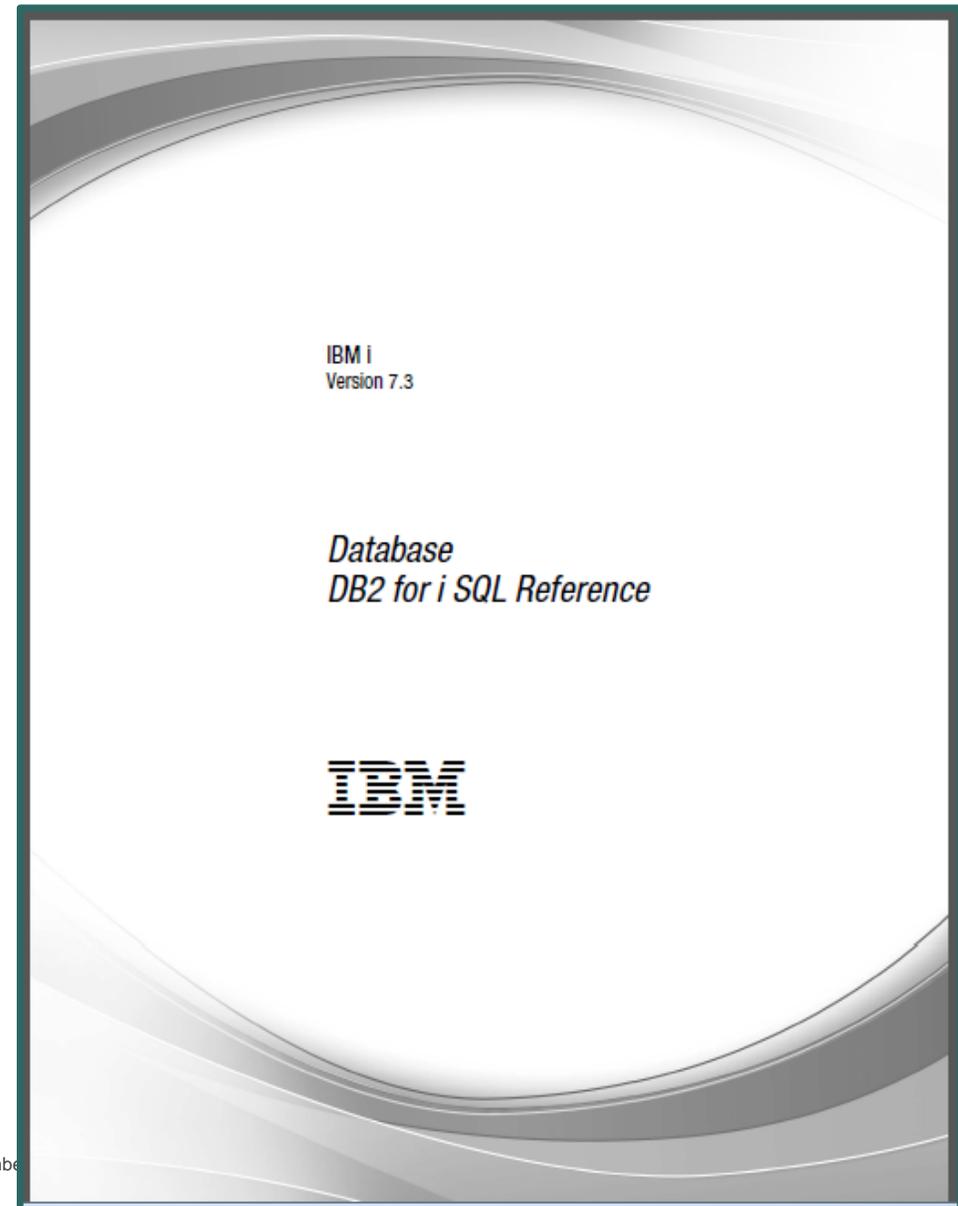
# IBM i Services – What happened in the last 2 TRs?

## IBM® i Services

### Security Services
QSYS2.AUTHORITY_COLLECTION – VIEW
**QSYS2.AUTHORIZATION_LIST_INFO – VIEW**
**QSYS2.AUTHORIZATION_LIST_USER_INFO – VIEW**
QSYS2.DRDA_AUTHENTICATION_ENTRY_INFO – VIEW
QSYS2.FUNCTION_INFO – VIEW
QSYS2.FUNCTION_USAGE – VIEW
QSYS2.GROUP_PROFILE_ENTRIES – VIEW
**QSYS2.OBJECT_PRIVILEGES – VIEW**
QSYS2.SQL_CHECK_AUTHORITY – UDF
QSYS2.USER_INFO – VIEW
SYSPROC.SET_COLUMN_ATTRIBUTE – PROCEDURE

### Communication Services
QSYS2.NETSTAT_INFO – VIEW
QSYS2.NETSTAT_INTERFACE_INFO – VIEW
QSYS2.NETSTAT_JOB_INFO – VIEW
QSYS2.NETSTAT_ROUTE_INFO – VIEW
QSYS2.SERVER_SBS_ROUTING – VIEW
QSYS2.SET_SERVER_SBS_ROUTING – PROCEDURE
QSYS2.TCPIP_INFO – VIEW
SYSIBMADM.ENV_SYS_INFO – VIEW

### Product Services
**QSYS2.LICENSE_INFO – VIEW**
**SYSTOOLS.LICENSE_EXPIRATION_CHECK – PROCEDURE**

### Application Services
QSYS2.ENVIRONMENT_VARIABLE_INFO – VIEW
QSYS2.QCMDEXC – PROCEDURE
QSYS2.SERVICES_INFO – TABLE
**QSYS2.SET_PASE_SHELL_INFO – PROCEDURE**

### Storage Services
QSYS2.MEDIA_LIBRARY_INFO – VIEW
QSYS2.SYSDISKSTAT – VIEW
QSYS2.SYSTMPSTG – VIEW
**QSYS2.USER_STORAGE – VIEW**

### Journal Services
QSYS2.DISPLAY_JOURNAL – UDTF
QSYS2.JOURNAL_INFO – VIEW

### Java Services
QSYS2.JVM_INFO – VIEW
QSYS2.SET_JVM – PROCEDURE

### Spool Services
QSYS2.OUTPUT_QUEUE_ENTRIES – VIEW
QSYS2.OUTPUT_QUEUE_ENTRIES – UDTF
QSYS2.OUTPUT_QUEUE_INFO – VIEW

### Librarian Services
QSYS2.LIBRARY_LIST_INFO – VIEW
**QSYS2.OBJECT_STATISTICS – UDTF**

### System Health Services
QSYS2.SYSLIMITS – VIEW
QSYS2.SYSLIMTBL – TABLE

### Message Handling Services
**QSYS2.HISTORY_LOG_INFO – UDTF**
QSYS2.JOBLOG_INFO – UDTF
**QSYS2.MESSAGE_QUEUE_INFO – VIEW**
QSYS2.REPLY_LIST_INFO – VIEW

### PTF Services
QSYS2.GROUP_PTF_INFO – VIEW
QSYS2.PTF_INFO – VIEW
**SYSTOOLS.GROUP_PTF_CURRENCY – VIEW**
SYSTOOLS.GROUP_PTF_DETAILS – VIEW

### Work Management Services
QSYS2.ACTIVE_JOB_INFO – UDTF
**QSYS2.GET_JOB_INFO – UDTF**
**QSYS2.JOB_INFO – UDTF**
QSYS2.MEMORY_POOL – UDTF
QSYS2.MEMORY_POOL_INFO – VIEW
**QSYS2.OBJECT_LOCK_INFO – VIEW**
QSYS2.RECORD_LOCK_INFO – VIEW
QSYS2.SCHEDULED_JOB_INFO – VIEW
QSYS2.SYSTEM_STATUS – UDTF
QSYS2.SYSTEM_STATUS_INFO – VIEW
QSYS2.SYSTEM_VALUE_INFO – VIEW

# HISTORY_LOG_INFO – SQL's alternative to DSPLOG

```
-- Compute the 10 jobs with the longest time span
WITH new_jobs(JN, job_start, from_user, sbs)
   AS (SELECT from_job, message_timestamp, from_user,
                 substr(message_tokens, 59, 10)
          FROM TABLE(qsys2.history_log_info()) x
          WHERE message_id = 'CPF1124'),
    ended_jobs(JN, job_end, from_user)
   AS (SELECT from_job, message_timestamp, from_user
          FROM TABLE(qsys2.history_log_info()) x
          WHERE message_id = 'CPF1164'),
    top_10_jobs(SBS, JN, JLIFE)
   AS (SELECT n.sbs, n.JN,
          TIMESTAMPDIFF(4, CAST(job_end - job_start AS CHAR(22)))
          FROM new_jobs n INNER JOIN ended_jobs e ON n.JN = e.JN
          ORDER BY 2 DESC FETCH FIRST 10 ROWS ONLY)
SELECT A.* from top_10_jobs A ORDER BY JLIFE DESC;
```

# HISTORY_LOG_INFO – SQL's alternative to DSPLOG

WITH new_jobs(JN, job_start, from_user, sbs) AS (SELECT from_job, message_timestamp, from_user, subs...

File  Edit  View
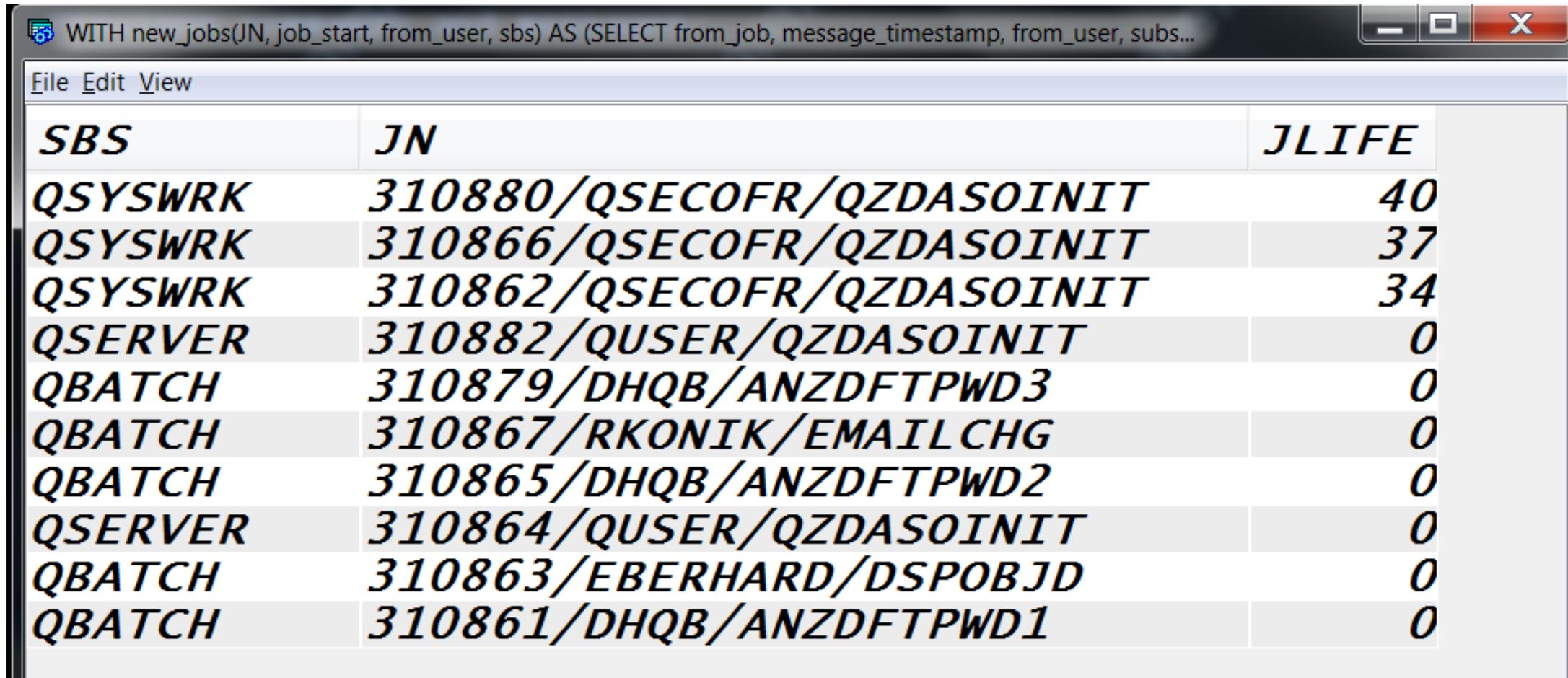
| SBS | JN | JLIFE |
|---|---|---|
| QSYSWRK | 310880/QSECOFR/QZDASOINIT | 40 |
| QSYSWRK | 310866/QSECOFR/QZDASOINIT | 37 |
| QSYSWRK | 310862/QSECOFR/QZDASOINIT | 34 |
| QSERVER | 310882/QUSER/QZDASOINIT | 0 |
| QBATCH | 310879/DHQB/ANZDFTPWD3 | 0 |
| QBATCH | 310867/RKONIK/EMAILCHG | 0 |
| QBATCH | 310865/DHQB/ANZDFTPWD2 | 0 |
| QSERVER | 310864/QUSER/QZDASOINIT | 0 |
| QBATCH | 310863/EBERHARD/DSPOBJD | 0 |
| QBATCH | 310861/DHQB/ANZDFTPWD1 | 0 |

# HISTORY_LOG_INFO – Predictive IPLs

```
-- Determine whether the next IPL will be abnormal
WITH last_ipl(ipl_time) AS (SELECT job_entered_system_time
 FROM TABLE(qsys2.job_info(job_status_filter => '*ACTIVE',
                           job_user_filter => 'QSYS')) x
              WHERE job_name = '000000/QSYS/SCPF'),
     abnormal(abnormal_count) AS (SELECT COUNT(*) FROM
     last_ipl, TABLE(qsys2.history_log_info(ipl_time,
     CURRENT TIMESTAMP)) x WHERE message_id IN ('CPC1225'))
SELECT CASE WHEN abnormal_count = 0
            THEN 'NORMAL'
            ELSE 'ABNORMAL – ' concat abnormal_count END
     AS ipl_indicator FROM abnormal ;
```

IPL_INDICATOR

NORMAL

IPL_INDICATOR

ABNORMAL – 2

# SCHEDULED_JOB_INFO

**http://patrickbehr.com/blog/**

Scott,

The QSYS2.SCHEDULED_JOB_INFO view has just saved me tons of searching line by line in WRKJOBSCDE.
You guys ROCK!
Just thought you would like to know.

**CAMBRO**
TRUSTED FOR GENERATIONS®

**Patrick Behr** | Sr Developer
Cambro Manufacturing
5801 Skylab Road
Huntington Beach, CA 92647-2056

# SQL for Security Administration

| IBM i Service | Type of Service | IBM i 7.3 | IBM i 7.2 | IBM i 7.1 |
|---|---|---|---|---|
| **Security Services** | | | | |
| AUTHORITY_COLLECTION | View | Base | - | - |
| AUTHORIZATION_LIST_INFO | View | SF99703 Level 4 | SF99702 Level 16 | - |
| AUTHORIZATION_LIST_USER_INFO | View | SF99703 Level 4 | SF99702 Level 16 | - |
| USER_INFO | View | Enhanced in SF99703 Level 4 | Enhanced in SF99702 Level 16 | Enhanced in SF99701 Level 43 |
| FUNCTION_INFO | View | Base | Base | SF99701 Level 26 |
| FUNCTION_USAGE | View | Base | Base | SF99701 Level 26 |
| GROUP_PROFILE_ENTRIES | View | Base | Base | SF99701 Level 23 |
| OBJECT_PRIVILEGES | View | SF99703 Level 4 | SF99702 Level 16 | - |
| SQL_CHECK_AUTHORITY() | UDF | Base | Base | SF99701 Level 21 |
| SET_COLUMN_ATTRIBUTE() | Procedure | Base | Base | Base |
| DRDA_AUTHENTICATION_ENTRY_INFO | View | Base | SF99702 Level 5 | SF99701 Level 34 |

**http://ibm.biz/Db2foriServices**

# Built-in Security Examples

- Insert from Examples…
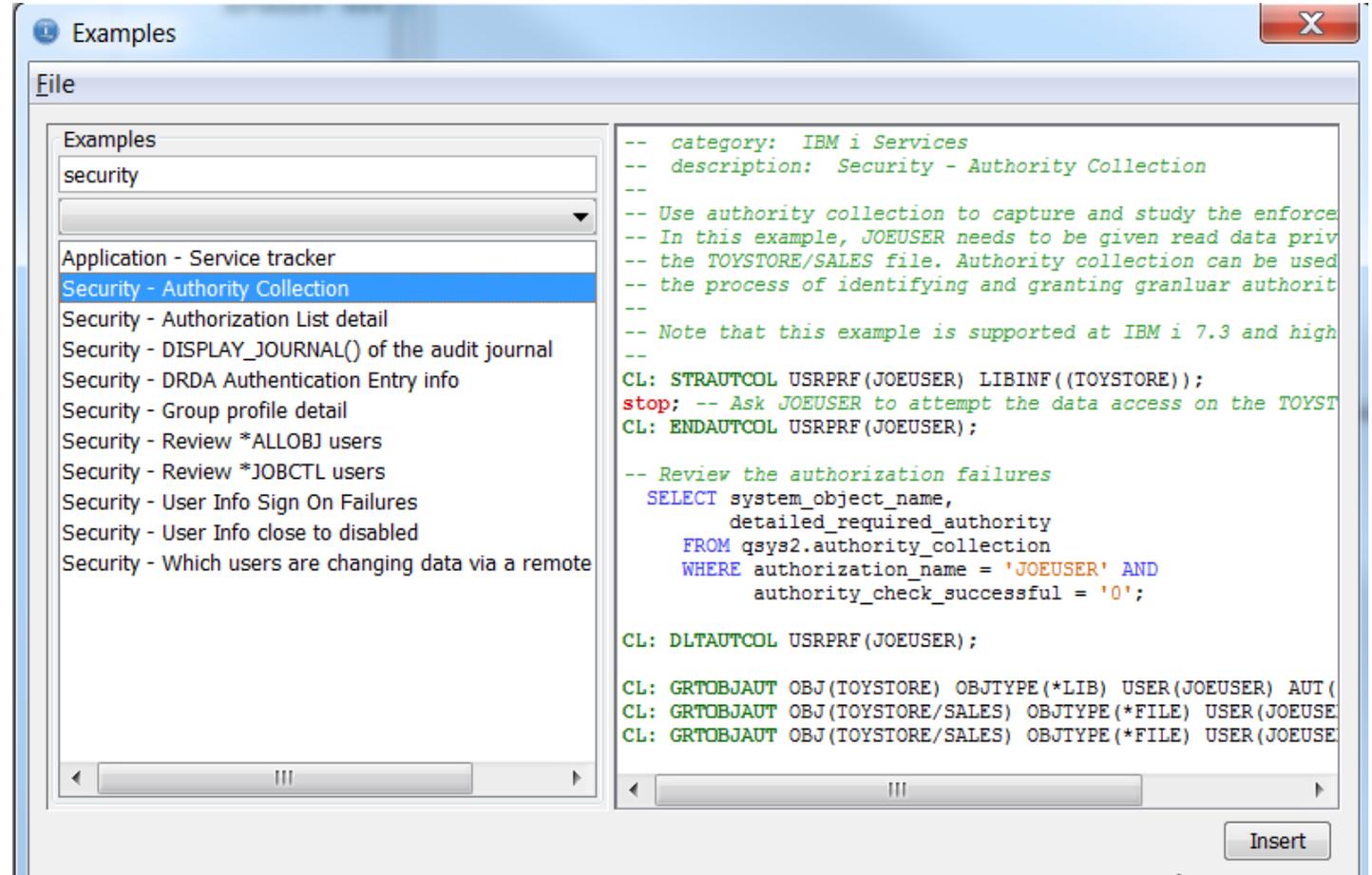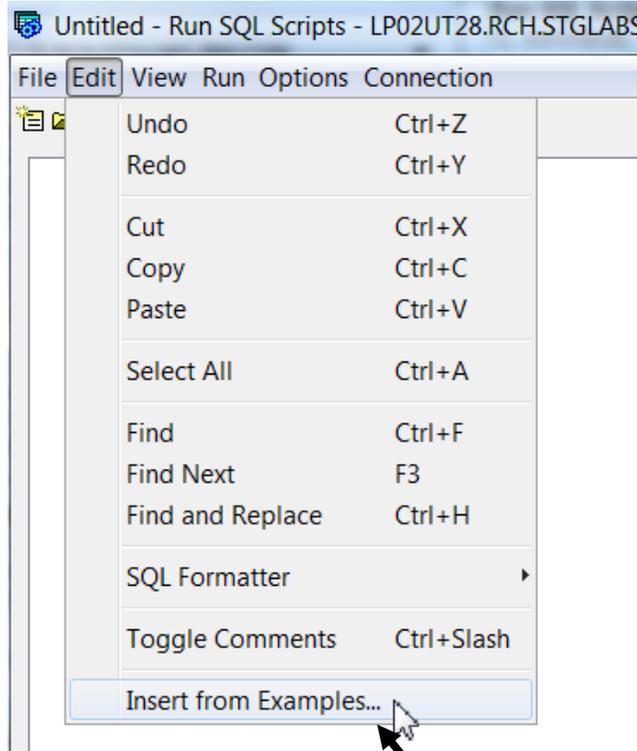


- **No need to start from scratch**

- **Save and reuse useful scripts**

OMNI – September, 2017

22

# SQL Disappearing Act

Db2 for i

# SQL Scalar Function (UDF) Inlining

- SQL Scalar functions now enjoy much of the same inline potential as SQL Table functions

```
CREATE OR REPLACE FUNCTION IMPROVE_IT(NAME VARCHAR(10))
RETURNS VARCHAR(20)
LANGUAGE SQL DETERMINISTIC
RETURN NAME CONCAT 'abulous!';
```
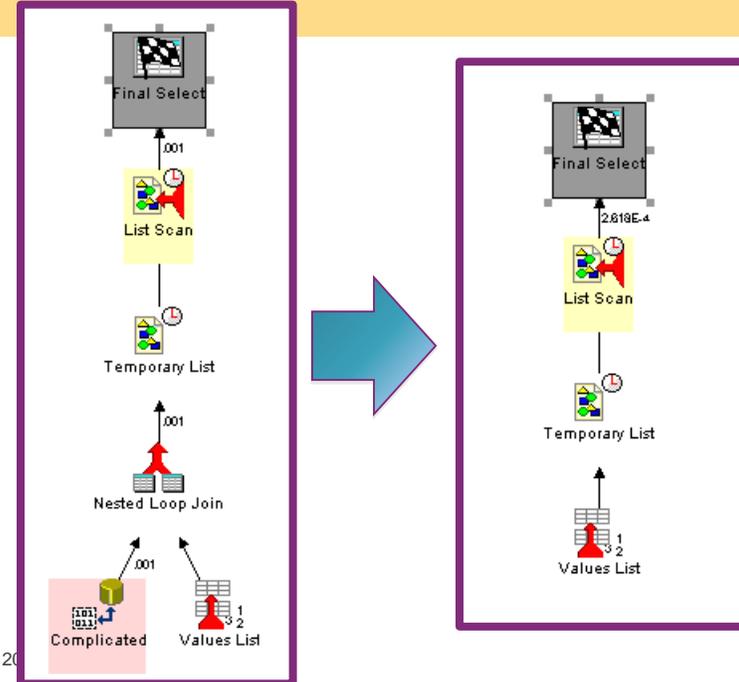
# SQL Scalar Function (UDF) Inlining

- SQL Table functions can also be inlined
    i.  SQL function with a single query on the RETURN statement
    ii. NO EXTERNAL ACTION
    iii. Function appears as INLINE = YES in QSYS2/SYSFUNCS

# SQL Scalar Function (UDF) Inlining

```
CREATE OR REPLACE FUNCTION LICCHK(EXPIRATION_DATE_TO_CHECK
DATE)
RETURNS TABLE(RTN_PRODUCT_ID VARCHAR(7), RTN_LICENSE_TERM
VARCHAR(6), RTN_RELEASE_LEVEL VARCHAR(6),
RTN_LICENSE_EXPIRATION DATE, RTN_PRODUCT_TEXT VARGRAPHIC(50)
CCSID 1200)
LANGUAGE SQL
NO EXTERNAL ACTION
NOT DETERMINISTIC
RETURN SELECT PRODUCT_ID, LICENSE_TERM, RELEASE_LEVEL,
PRODUCT_TEXT, LICENSE_EXPIRATION FROM QSYS2.LICENSE_INFO
WHERE LICENSE_EXPIRATION <= EXPIRATION_DATE_TO_CHECK;
```

# SQL Table Function (UDF) Inlining

- **Before**… the *SRVPGM is invoked, per every reference

| Start Time ▲ | Program | Cursor | Operation | Statement Text |
|---|---|---|---|---|
| 2016-03-11 1... | QZDASRV | | PREPARE...DESCRIBE | select a.*, x.* from table(scottf.licchk(current date + ? days - ? month)) xleft outer join qsys2.lic... |
| 2016-03-11 1... | QZDASRV | CRSR0005 | OPEN | select a.*, x.* from table(scottf.licchk(current date + ? days - ? month)) xleft outer join qsys2.lic... |
| 2016-03-11 1.. | QZDASRV | CRSR0005 | FETCH | |
| 2016-03-11 1.. | LICCHK | SQL_TABLE_CURSOR | OPEN | DECLARE SQL_TABLE_CURSOR CURSOR FOR SELECT PRODUCT_ID , LICENSE_TERM ... |
| 1.. | LICCHK | | GET DIAGNOSTICS | GET DIAGNOSTICS EXCEPTION 1 : H = MESSAGE_LENGTH , : H = MESSAGE_TEXT |
| 1.. | LICCHK | SQL_TABLE_CURSOR | CLOSE | CLOSE SQL_TABLE_CURSOR |
| 1.. | LICCHK | SQL_TABLE_CURSOR | FETCH | FETCH SQL_TABLE_CURSOR INTO : H : H , : H : H , : H : H , : H : H , : H : H |
| 2016-03-11 1.. | | SQL_TABLE_CURSOR | CLOSE (Hard) | HARD CLOSE    1 CURSORS |

**UDTF**

- **After inlining**… the highlighted steps disappear!

| Start Time ▲ | Program | Operation | Statement Text |
|---|---|---|---|
| 2016-03-11 11:46:37.265206 | QZDASRV | PREPARE...DESCRIBE | select a.*, x.* from table(scottf.licchk(current date + ? days - ? month)) xleft outer join qsys2.license_in... |
| 2016-03-11 11:46:37.384255 | QZDASRV | OPEN | select a.*, x.* from table(scottf.licchk(current date + ? days - ? month)) xleft outer join qsys2.license_in... |
| 2016-03-11 11:46:37.399820 | QZDASRV | FETCH | |
| 2016-03-11 11:46:37.415292 | QZDASRV | CLOSE | CLOSE CRSR0005 |

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# JSON Support in Db2 for i

| DB2 JSON Store | JSON_TABLE() | JSON Query support:<br>Predicates:<br>• IS JSON<br>• JSON_EXISTS |



June
2015

November
2016

March
2017

IBM i 7.1
and higher

IBM i 7.2 & 7.3

IBM i 7.2 & 7.3
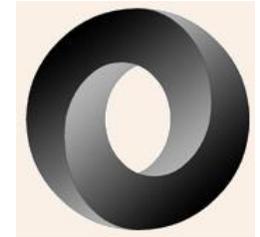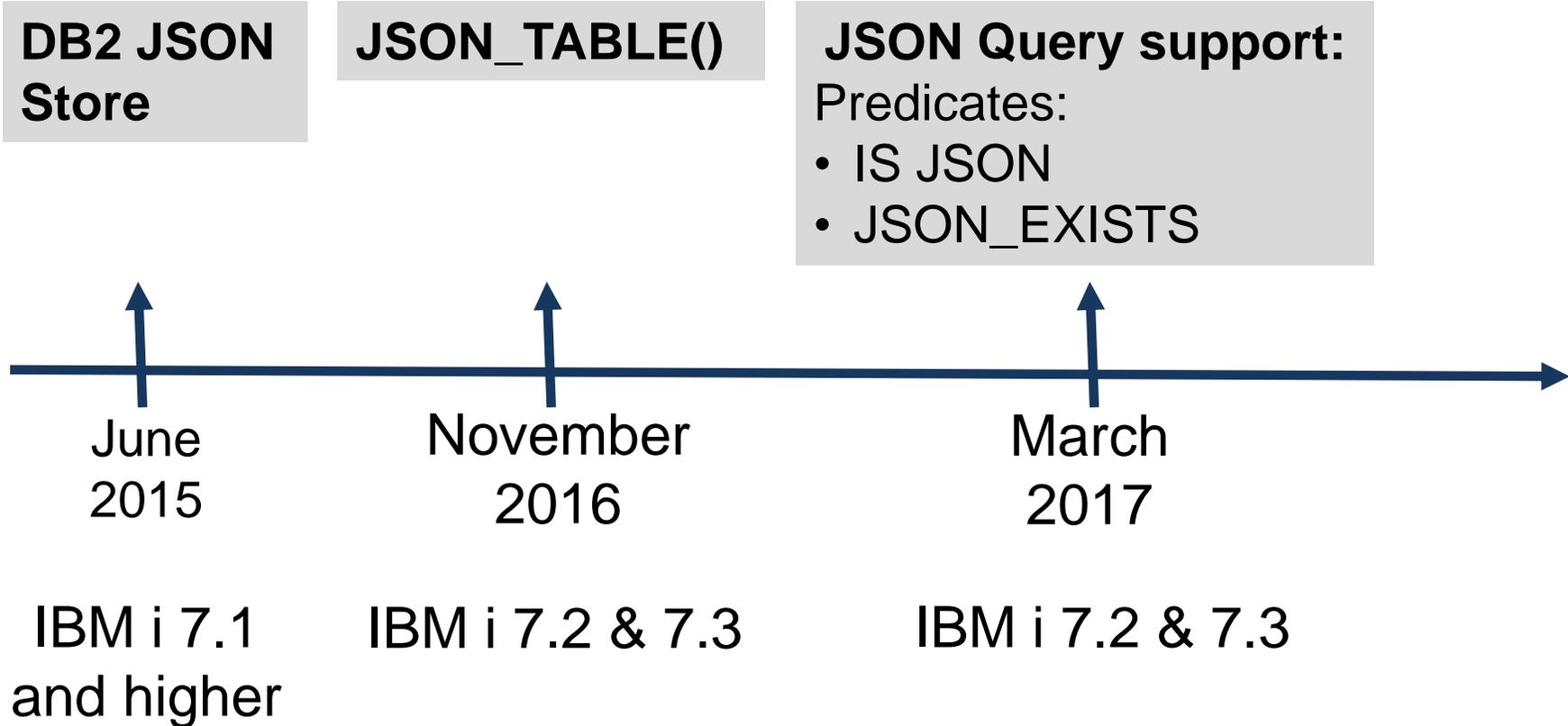
# JSON and the City of Chicago
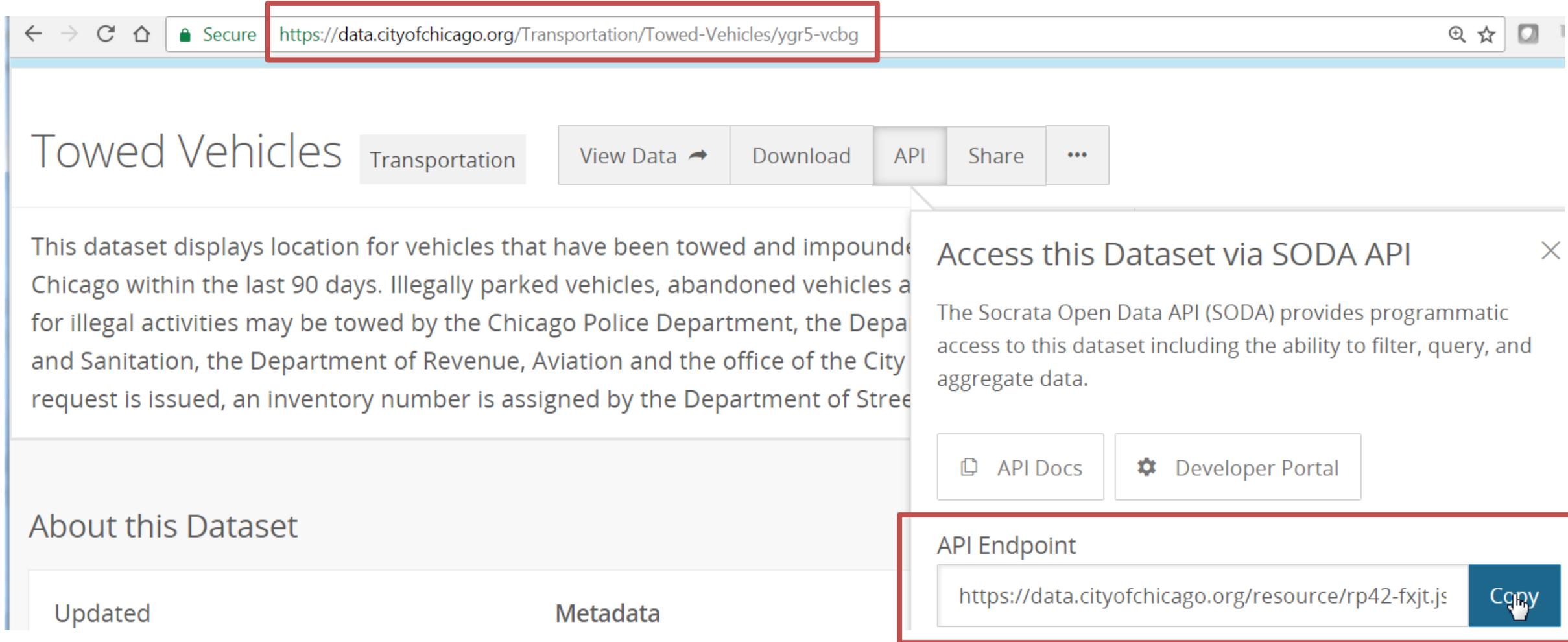
Secure | https://data.cityofchicago.org/Transportation/Towed-Vehicles/ygr5-vcbg

## Towed Vehicles | Transportation

View Data ➔ | Download | API | Share | •••

This dataset displays location for vehicles that have been towed and impounde
Chicago within the last 90 days. Illegally parked vehicles, abandoned vehicles a
for illegal activities may be towed by the Chicago Police Department, the Depa
and Sanitation, the Department of Revenue, Aviation and the office of the City
request is issued, an inventory number is assigned by the Department of Stree

### Access this Dataset via SODA API ✕

The Socrata Open Data API (SODA) provides programmatic access to this dataset including the ability to filter, query, and aggregate data.

API Docs | ⚙ Developer Portal

### API Endpoint

https://data.cityofchicago.org/resource/rp42-fxjt.js | Copy

## About this Dataset

Updated | Metadata

# JSON and the City of Chicago

← → C ⟳  🔒 Secure | https://data.cityofchicago.org/resource/rp42-fxjt.json    🔍 ☆ 🗔 📌

[{"color":"BLK","inventory_number":"965569","make":"ACUR","plate":"Y733803","state":"IL","style":"4D","tow_date":
"2017-04-25T00:00:00.000","tow_facility_phone":"(312) 744-7550","towed_to_address":"400 E. Lower Wacker"}
,
{"color":"SIL","inventory_number":"6884576","make":"BMW","plate":"Q915038","state":"IL","style":"SLL","tow_date":"
2017-04-25T00:00:00.000","tow_facility_phone":"(773) 265-7605","towed_to_address":"701 N. Sacramento"}
,
{"color":"BLK","inventory_number":"2820720","make":"BUIC","plate":"968XPC","state":"WI","style":"4D","tow_date":"
2017-04-25T00:00:00.000","tow_facility_phone":"(773) 568-8495","towed_to_address":"10300 S. Doty"}
,
{"color":"GRY","inventory_number":"965570","make":"BUIC","plate":"N768966","state":"IL","style":"4D","tow_date":"
2017-04-25T00:00:00.000","tow_facility_phone":"(312) 744-7550","towed_to_address":"400 E. Lower Wacker"}
,
{"color":"MAR","inventory_number":"2820738","make":"CADI","plate":"Q716098","state":"IL","style":"4D","tow_date":
"2017-04-25T00:00:00.000","tow_facility_phone":"(773) 568-8495","towed_to_address":"10300 S. Doty"}
,
{"color":"RED","inventory_number":"6884578","make":"CHEV","plate":"Y865623","state":"IL","style":"2D","tow_date":
"2017-04-25T00:00:00.000","tow_facility_phone":"(773) 265-7605","towed_to_address":"701 N. Sacramento"}

# JSON and the City of Chicago

- Once the feed is discovered, consumption is simple
- JSON_TABLE() requires a valid JSON object

```
CREATE OR REPLACE VARIABLE towed_vehicles
    CLOB(1G) CCSID 1208 ;


SET towed_vehicles = '{ "stuff" :' concat
    systools.HTTPGETCLOB(
    'https://data.cityofchicago.org/resource/rp42-fxjt.json',
    '')
    concat '}';
```

# Most frequent tow days

```
select TOW_DATE, DAYNAME(TOW_DATE) AS DAYNAME,
       COUNT(*) AS TOW_COUNT
from JSON_TABLE(towed_vehicles, 'lax $.stuff[*]' COLUMNS(
TOW_DATE DATE   PATH '$."tow_date"'
)) x
group by TOW_DATE ORDER BY TOW_COUNT DESC;
```

| TOW_DATE | DAYNAME | TOW_COUNT |
|---|---|---|
| 2017-04-23 | Sunday | 120 |
| 2017-04-15 | Saturday | 109 |
| 2017-04-21 | Friday | 104 |
| 2017-04-22 | Saturday | 100 |
| 2017-04-20 | Thursday | 97 |

# Correlate Car towing to Sporting events

```
WITH tow_data(tow_date, tow_day, tow_count) AS (
  SELECT tow_date, DAYNAME(tow_date) AS dayname, COUNT(*) AS tow_count
    FROM json_table(mygov.towed_vehicles,'lax $.stuff[*]'
      columns(tow_date DATE PATH '$."tow_date"')) x GROUP BY tow_date
) SELECT t.*, c.opponent, c.outcome
    FROM tow_data t LEFT OUTER
      JOIN mygov.cubs_games c ON t.tow_date = c.game_day ORDER BY tow_date;
```

| TOW_DATE | TOW_DAY | TOW_COUNT | OPPONENT | OUTCOME |
|---|---|---|---|---|
| 2017-05-19 | Friday | 77 | - | - |
| 2017-05-20 | Saturday | 108 | - | - |
| 2017-05-21 | Sunday | 90 | - | - |
| 2017-05-22 | Monday | 70 | Giants | Loss |
| 2017-05-23 | Tuesday | 97 | Giants | Win |
| 2017-05-24 | Wednesday | 176 | Giants | Win |
| 2017-05-25 | Thursday | 176 | - | - |
| 2017-05-26 | Friday | 206 | - | - |

# Programmer's Resources

- **HTTP functions & Db2 for i – Whitepaper**
  ibm.biz/Db2foriHTTPfunctions

- **XML on Db2 for i – Whitepaper**
  ibm.biz/XMLandDB2fori

- **SYSTOOLS.GROUP_PTF_CURRENCY view**
  ibm.biz/IBMiGroupPTFcurrency

- **The Powerful JSON_TABLE()**
  www.ibm.com/developerworks/ibmi/library/i-json-table-trs/index.html

# Using SQL to ask Watson a question

```
SELECT q.*,
systools.translate_english_to_French(q.quote) AS
"QUOTE_IN_French"
  FROM session.famous_quotes q;
```

# Using SQL to ask Watson a question

```
set v_encoded_string = trim(systools.urlencode(input_string, ''));

set v_translate_URL =
    'https://watson-api-explorer.mybluemix.net/language-translator/api/v2/translate?model_id='
    CONCAT input_language  CONCAT '-'
    CONCAT output_language CONCAT
    '&text=' CONCAT v_encoded_string;

set output_string =
    (CLOB(systools.httpgetclob(v_translate_URL, ''), 1048576));
```

# Using SQL to ask Watson a question

```
CREATE OR REPLACE FUNCTION systools.translate_english_to_french
(input_string CLOB(1M) CCSID 37)
   RETURNS CLOB(1M) CCSID 297
   MODIFIES SQL DATA
   DETERMINISTIC
BEGIN
   DECLARE output_string CLOB(1M) CCSID 297;
   CALL systools . translate_text (
      input_string,
      output_string,
      'en',
      'fr');
RETURN output_string;
END;
```

# Using SQL to ask Watson a question

**SQL**

IBM Watson

Language Translator
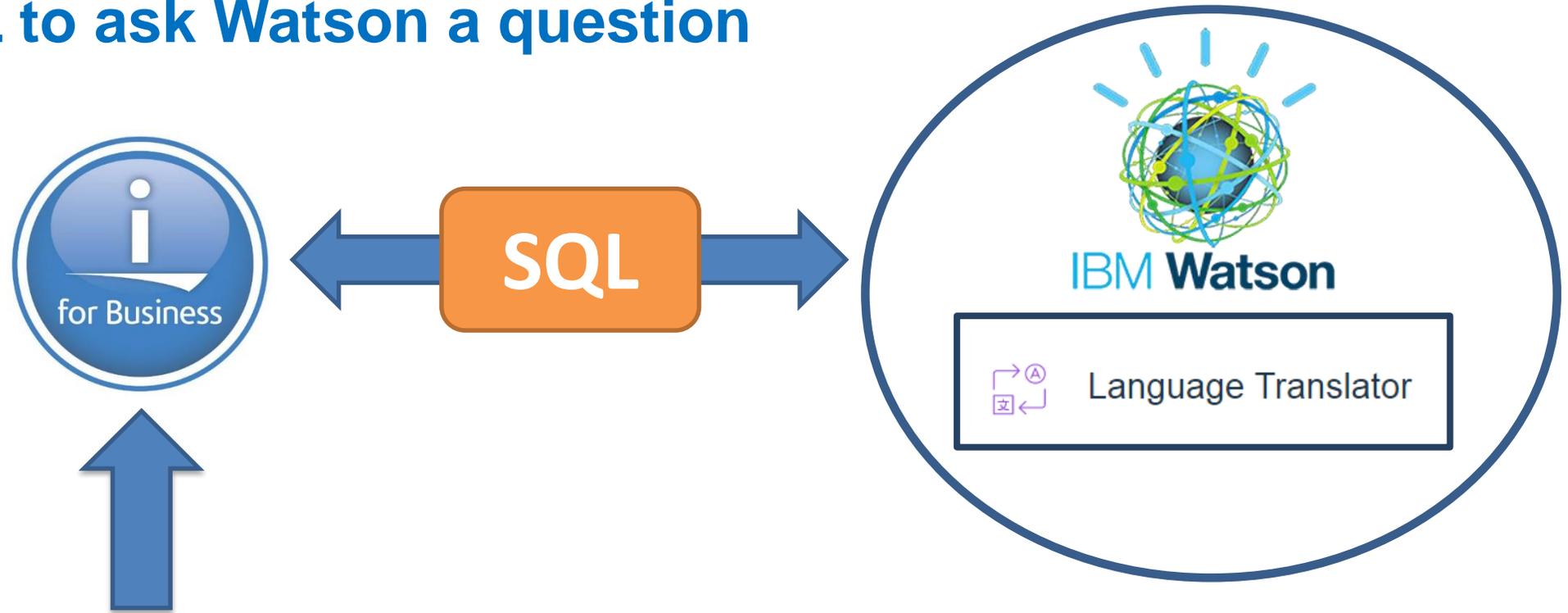
QUOTE
If you want to increase your success rate, double your failure rate.
The great accomplishments of man have resulted from the transmissio.
Nothing so conclusively proves a man's ability to lead others as wh.
Think

# Using SQL to ask Watson a question

**SQL**

**IBM Watson**

Language Translator
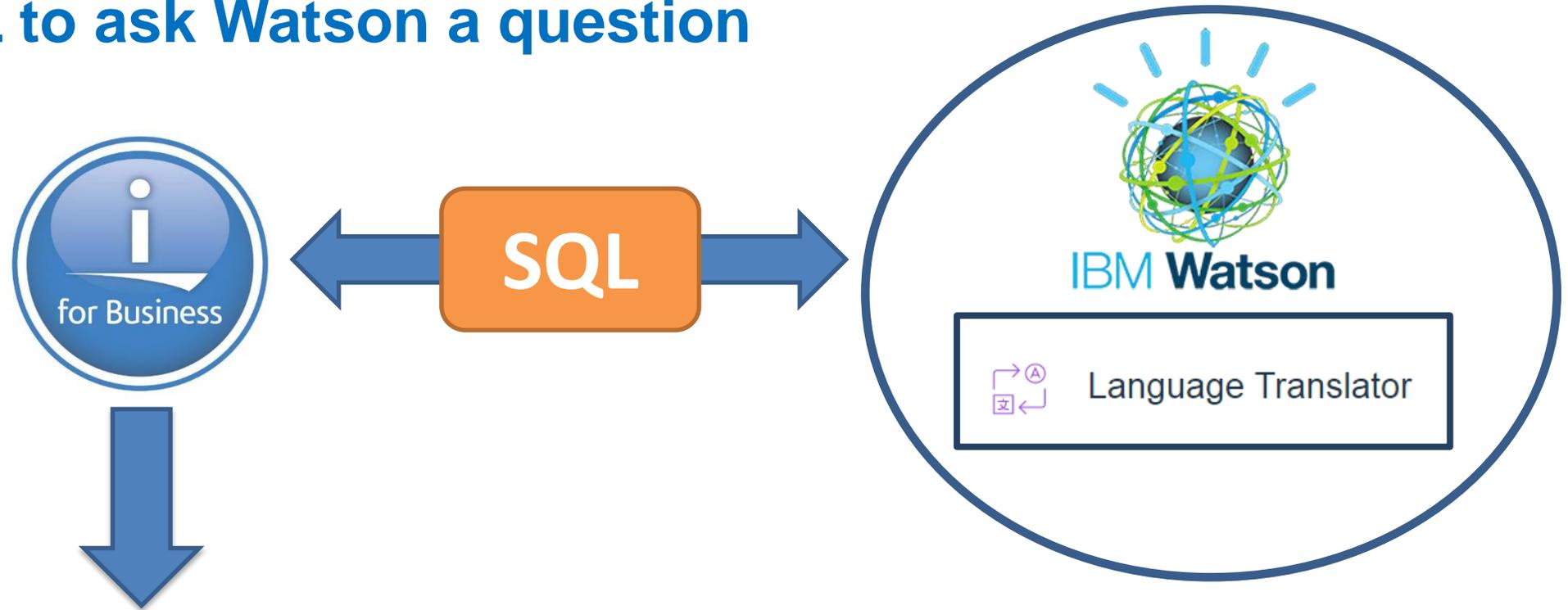
```
QUOTE_IN_French
Si vous souhaitez augmenter votre taux de réussite, doubler votre taux d'échec.
Les grandes réalisations de l'homme ont résulté de la transmission des idées et
Rien ne le prouve de façon concluante la capacité d'un homme à diriger les autr
Think
```

**www.ibm.com/power/i**

# References

# Database Resources

- **Db2 PTF Group schedule**
  **https://www.ibm.com/developerworks/ibmi/techupdates/db2/groupptf**

- **IBM i Services (brought to you by Db2 for i)**
  **http://ibm.biz/DB2foriServices**

- **Db2 for i Enhancements**
  **www.ibm.com/developerworks/ibmi/techupdates/db2**

- **IBM i – RFE's**
  **http://ibm.biz/IBMi_RFE**

- **Forstie on Twitter**
  **https://twitter.com/Forstie_IBMi**