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Agenda

1. **The big picture of modern z/OS transactions**
2. **IBM Transaction Analysis Workbench for z/OS** (“Workbench”) covers IMS, DB2, CICS, and more…
3. Workbench and big data: identifying transaction “exceptions” in instrumentation data
4. How Workbench can help application development teams
5. Possible future Workbench features

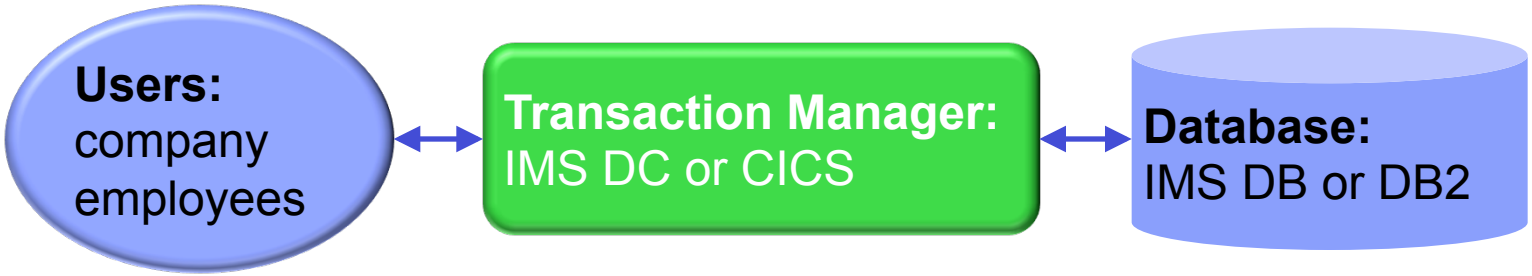
Additional slides (for reference; not presented)

5. Scenario: IMS-DB2 problem

Applications have evolved

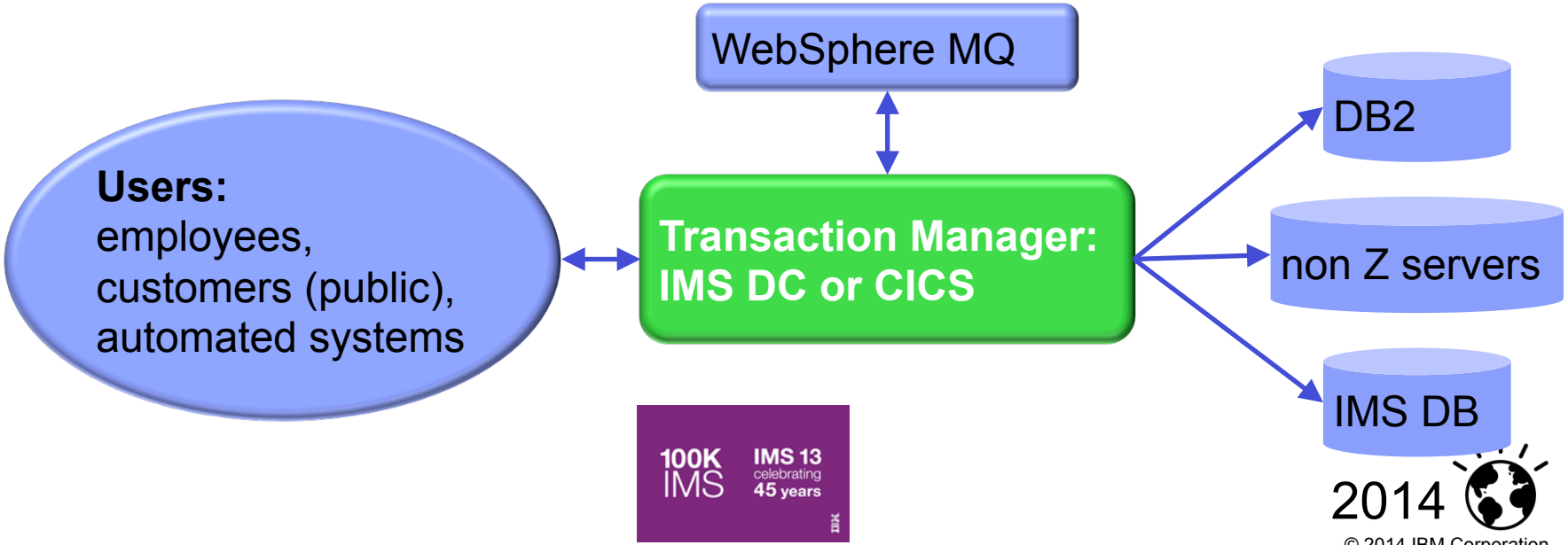
1980s application:

in-house users only; **simple** data, single data store



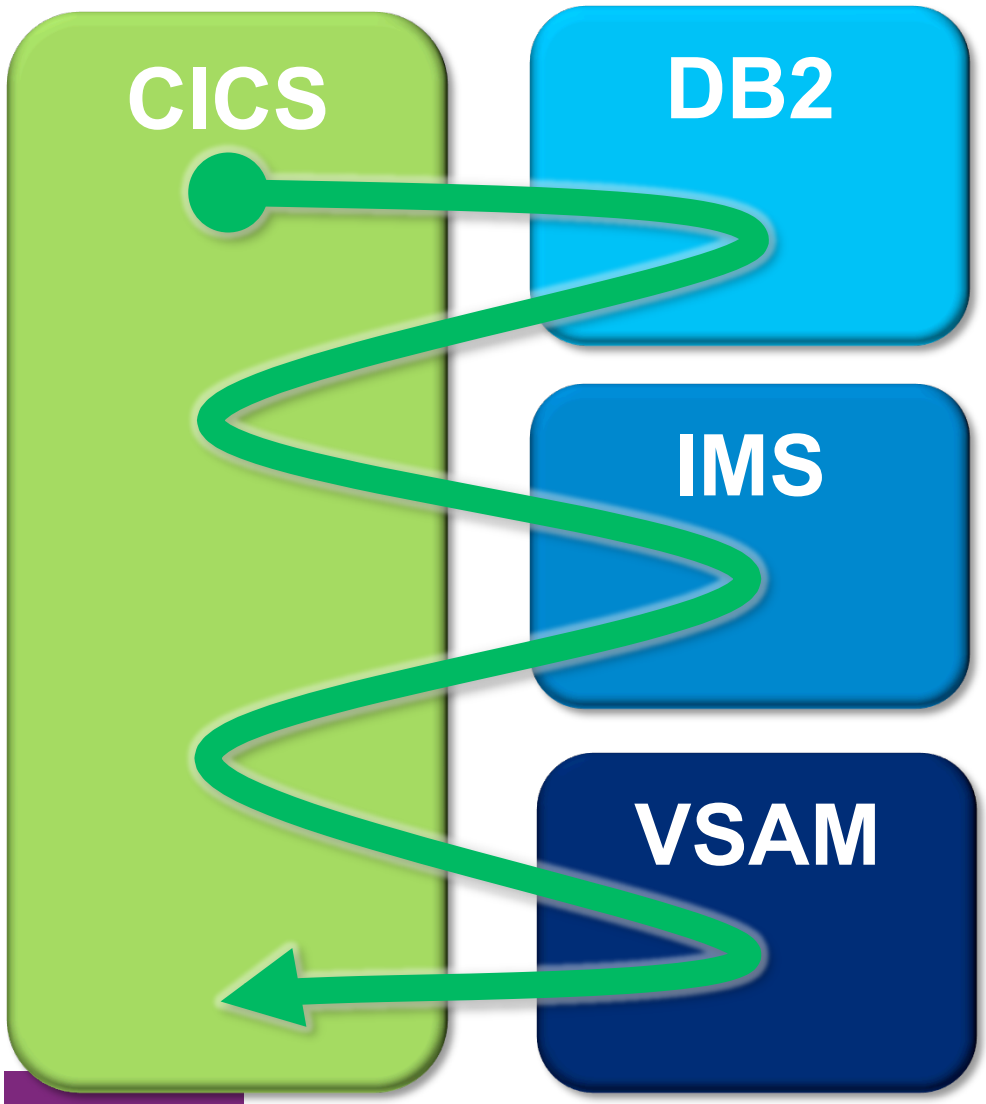
Today:

users are customers; data is **complex, heterogeneous**, often distributed



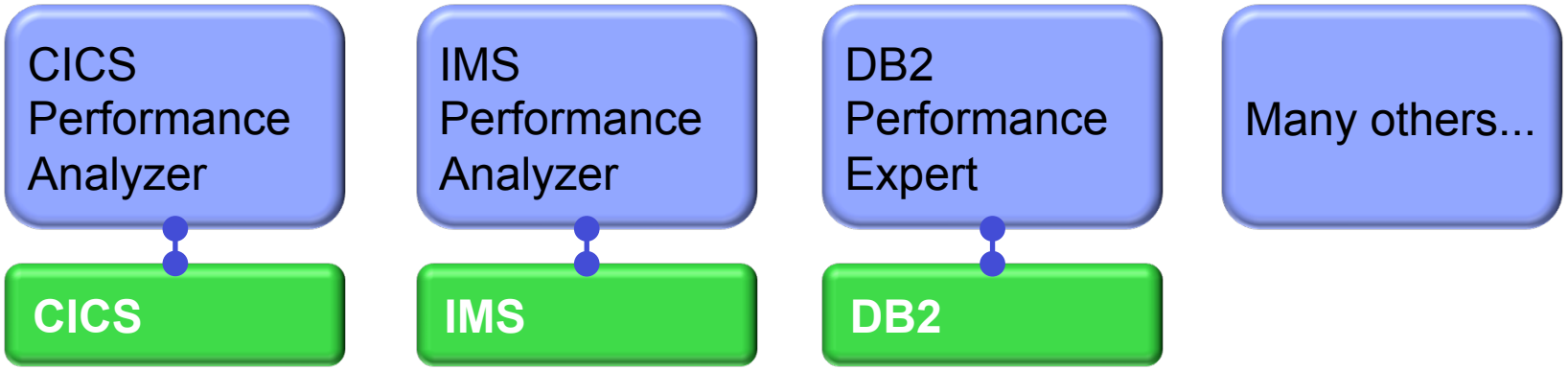
Where did the delay occur?

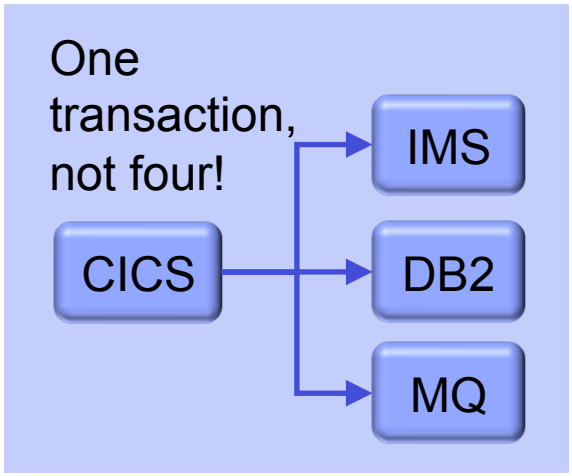
- A single transaction can have activity across many subsystems
- To quickly identify performance issues, you need to track the entire transaction
- Subsystem-specific approaches and tools offer a limited perspective
- Each subsystem has its own activity log and SMF records

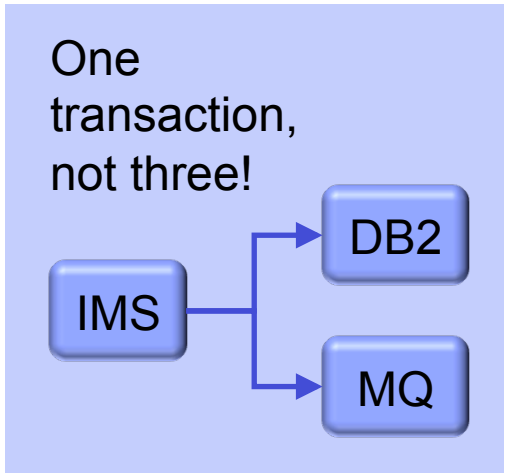


Traditional approaches and tools based on “silo” model

There are many tools to help analyze *individual* transaction environments on System z:







Each tool is well-suited to its environment, but SME uses their own tools

Cross support is key with fewer staff

- Why is support so difficult?
  - SME may be in silos
    - Cross training may be difficult
    - Takes too much time using current tools
    - Unable or unwilling to cooperate easily
- What does good cross-platform tool achieve?
  - Conservation of SMEs' time (a valuable, limited resource)
  - Transparency of information (everyone using the correct data from the same time period)
- SMEs need to see the big picture and the benefit of collaboration
  - Reduced time to resolution
  - More SME time focused on problem resolution
  - Cross-training of first responders and SMEs

Introducing Transaction Analysis Workbench for System Z

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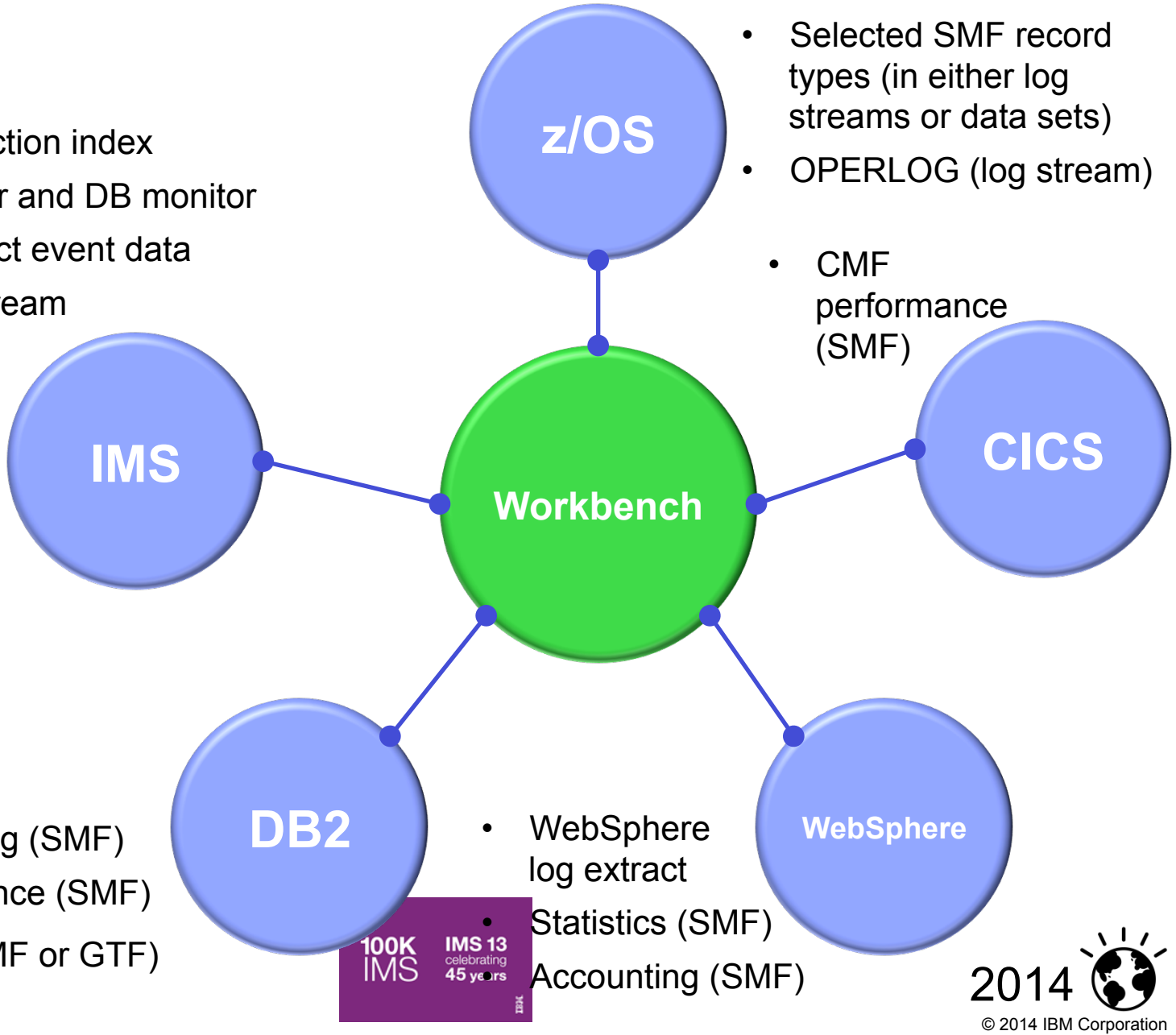
IBM Transaction Analysis Workbench for z/OS

- A tool for problems in the big picture:
  - For “first responders” and subject-matter experts (SMEs)
  - For SMEs in different areas
- Provides a life cycle view of transaction activity across subsystems
  - Changes the way problem resolution is performed
  - Ensures everyone is looking at the same transactional data
- Goes in-depth.
  - Uses SMF, trace, and log records to follow transaction flow
- Better assignment of problems to the correct group
  - Improved confidence in problems assigned to experts

Workbench is not just for IMS



- IMS log
- IMS transaction index
- IMS monitor and DB monitor
- IMS Connect event data
- CQS log stream

- Selected SMF record types (in either log streams or data sets)
- OPERLOG (log stream)

- CMF performance (SMF)

- DB2 log
- Accounting (SMF)
- Performance (SMF)

Trace (SMF or GTF)

- WebSphere log extract
- Statistics (SMF)

Accounting (SMF)

100K IMS IMS 13 celebrating 45 years

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Workbench is not just for IMS (cont.)

- Workbench merges logs from multiple subsystems to present a consolidated, cross-subsystem view of a transaction's life cycle
- Interactive ISPF dialog log browser provides a consistent interface to all log types from all subsystems (finding, navigating, filtering, formatting: when you know how to work with one log type, you know how to work with them all)
- Automated file selection for IMS logs, DB2 logs, and (soon) SMF
- Specific additional support for combined CICS-DBCTL reporting (other combinations coming soon: CICS-DB2, IMS-DB2)
- Various SMF record-type specific batch reports (aimed at transaction analysis)

Workbench and big data: identifying transaction "exceptions" in instrumentation data

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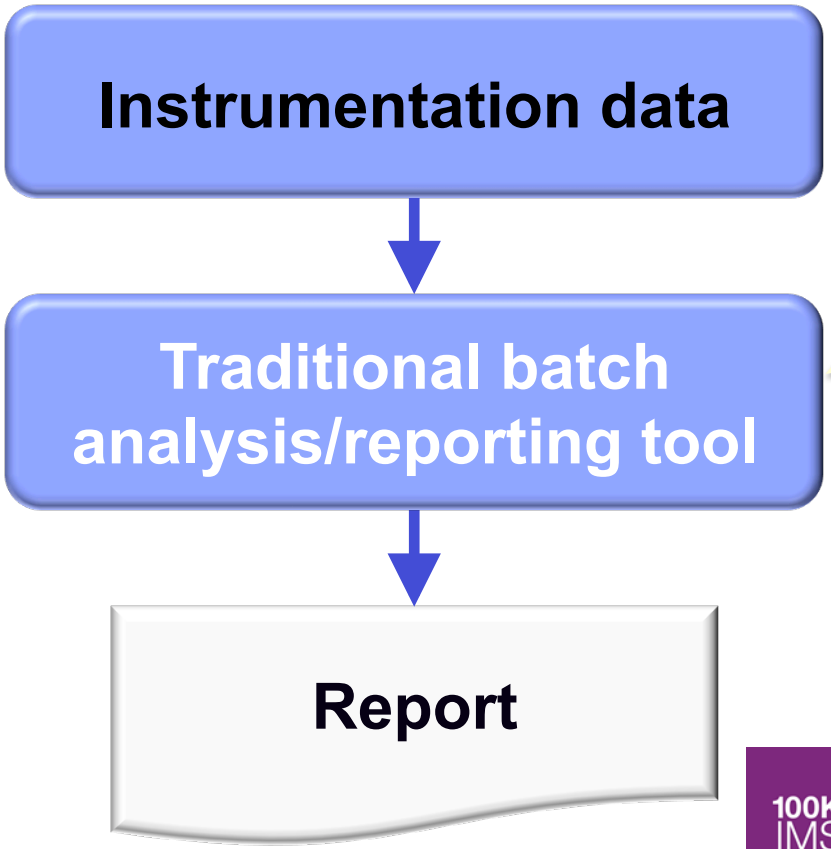
Problem: today's instrumentation data overwhelms traditional tools

- Good performance monitoring should identify possible performance issues before they become critical
- Today's systems create so much instrumentation data that existing techniques cannot keep up: **takes too long, costs too much!**



- Processes and reports on all records
- Processing time and cost grows with size of instrumentation data, beyond practical limits
- Reports can grow too long to be useful, and contain unwanted detail

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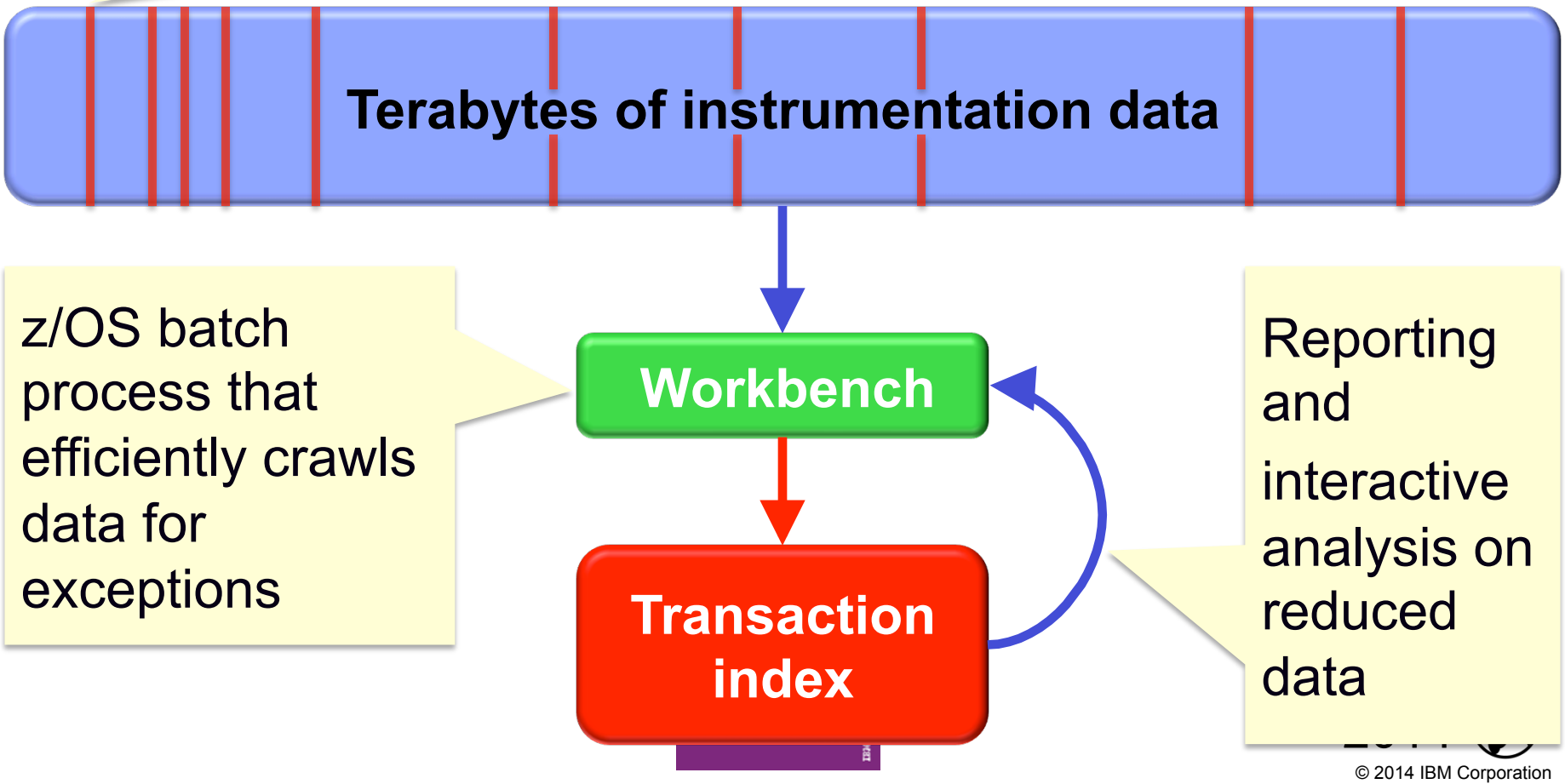
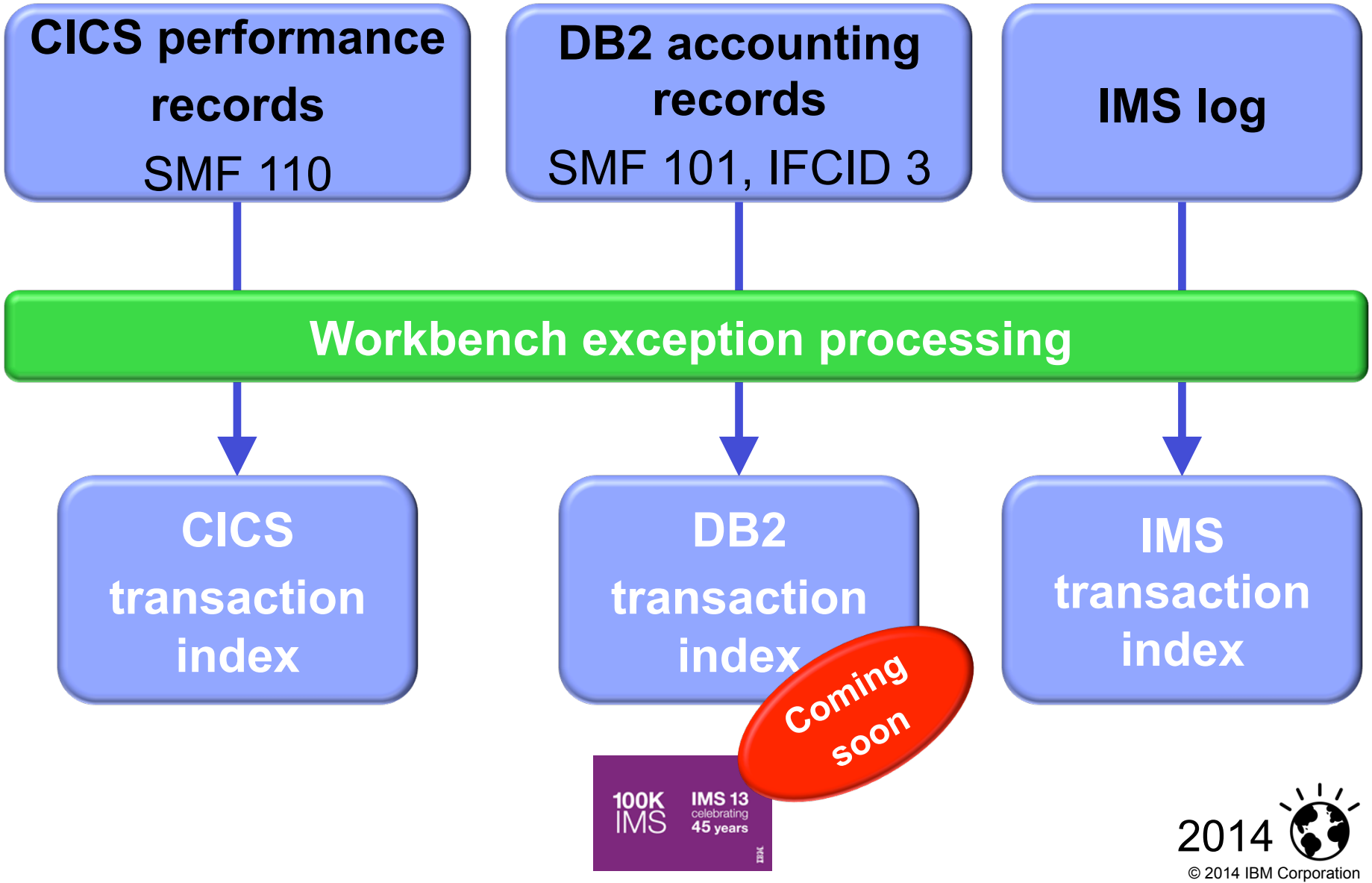
Solution: Workbench exception processing

Exception: a transaction that matches specific *exception criteria*, such as long response time or an abend



Exception processing for CICS, DB2, and IMS



How Transaction Analysis Workbench for System Z can help application development teams

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Application releases must work and perform when deployed

- Application teams perform validation testing during roll-out
  - Is performance a part of validation testing?
  - If performance validation is done, who does the validation?
  - What criteria are used?
- Does the evaluation occur at the transaction level?
- What is the cost of performance validation testing?
- What is the cost of a failed roll-out due to poor performance?
- Does system programming have time to help?

Application Team instrumentation data usage Inhibitors

- Value of instrumentation data not known
  - May not know what is available and how to use it
  - Not a traditional development tool
- Do not know how to obtain the data or data access not allowed
  - May not have access to system parts
- Limited or no knowledge of tools that use instrumentation data
- Limited access to system programmers' time
  - Reluctant to bother system programmers to get help

How Workbench helps

- Automates the collection of instrumentation data
  - Application development teams do not have to acquire those skills
- Performs automated reporting of validation testing
  - Includes reporting via CICS PA and/or IMS PA, in addition to its own reports
- Analyses instrumentation data for performance exceptions
  - Provides easy recognition of validation testing against expected results
- Provides transaction life cycle views of transaction exceptions
  - Identify what part of transaction is causing problem
- Saves results of each validation testing run
- Facilitates collaboration with system programmers and/or DBAs for help with transaction exception diagnosis

Summary of application team benefits

- Automate tasks often unfamiliar to application teams
  - Data acquisition – get the data needed for problem analysis
  - Autonomics – automated transaction analysis (life cycle)
  - Reporting – basic reporting without tool-specific knowledge
- Enables collaboration with other experts
  - Shared data approach
    - DBA, system programmer provide assistance when needed
  - Fewer SMEs may need to be involved
- Analysis of applications performance testing
  - Exceptions process provides evaluation of validation runs
  - Deeper transaction evaluation if exceptions reported

Possible Workbench Futures:

- **CICS-DB2 and IMS-DB2 transaction exception processing**
  Was the problem in CICS or DB2? IMS or DB2? (CICS-DBCTL already supported in V1.1.)
- **Enhanced support for DB2 trace records**
  Detailed field-by-field formatting for more than 60 IFCIDs.
- **Workflows and session templates**
  Subject-matter experts (SMEs) can define a workflow (a sequence of analysis tasks) and save it in a session template. When creating a new session, users can select the session template that best matches the report problem.
- **Eclipse-based rich client platform (RCP) user interface**
  Implements a subset of the ISPF dialog: create a session; run a workflow; assign to appropriate SME.
- **Automated SMF file selection**
- **SMF 42.6 DASD Data Set I/O report**

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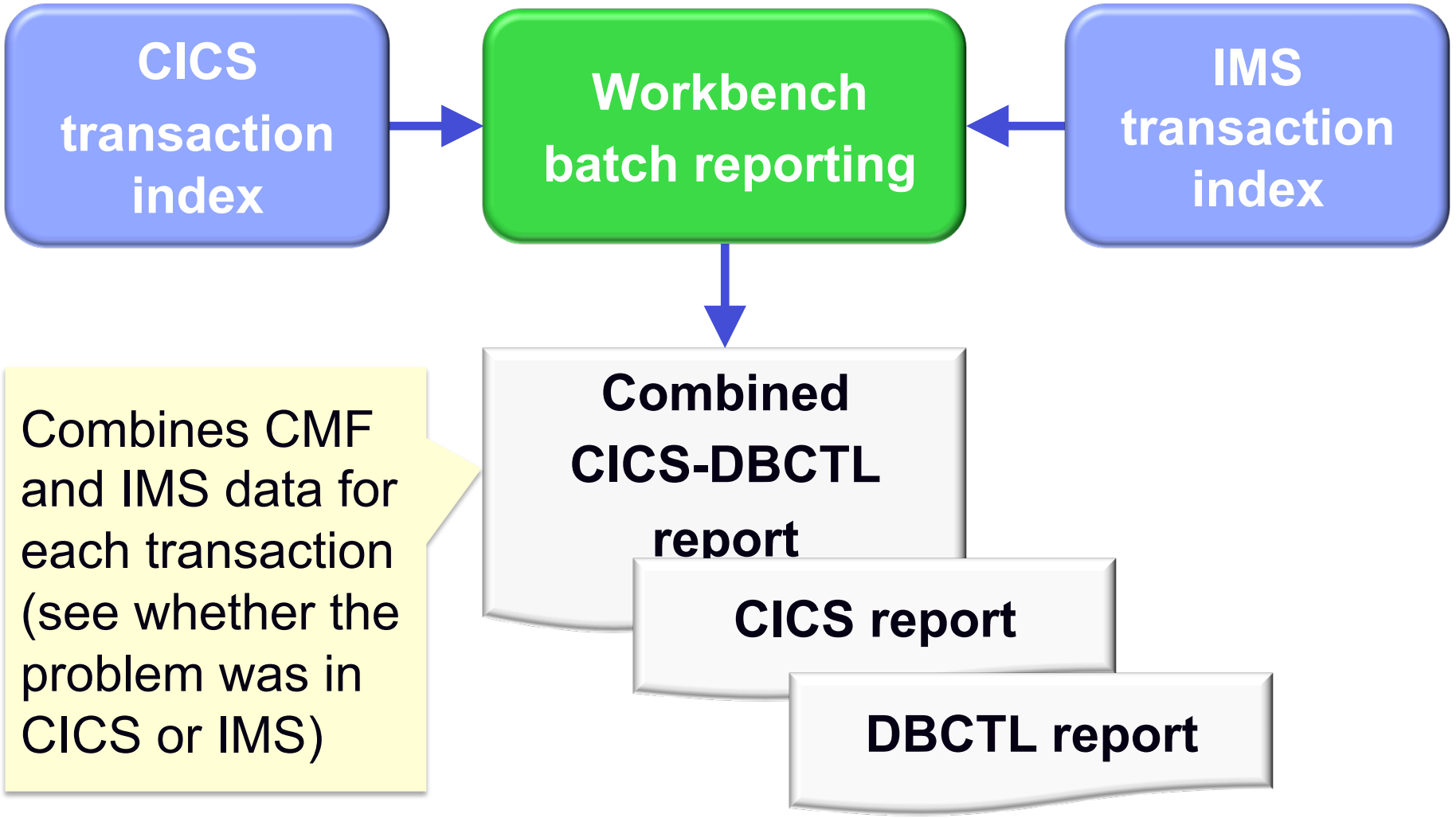
Combined CICS-DBCTL exception reporting



Example CICS-DBCTL summary report

CICS-DBCTL Summary

CICS

Tran	APPLID	CMF Count	Response	CPU Time	IMS Reqs	IMS Wait	ABEND	Rate/Sec
BANK	CICSP1	60	11.12982	0.008967	35	4.256977	10	0

IMS

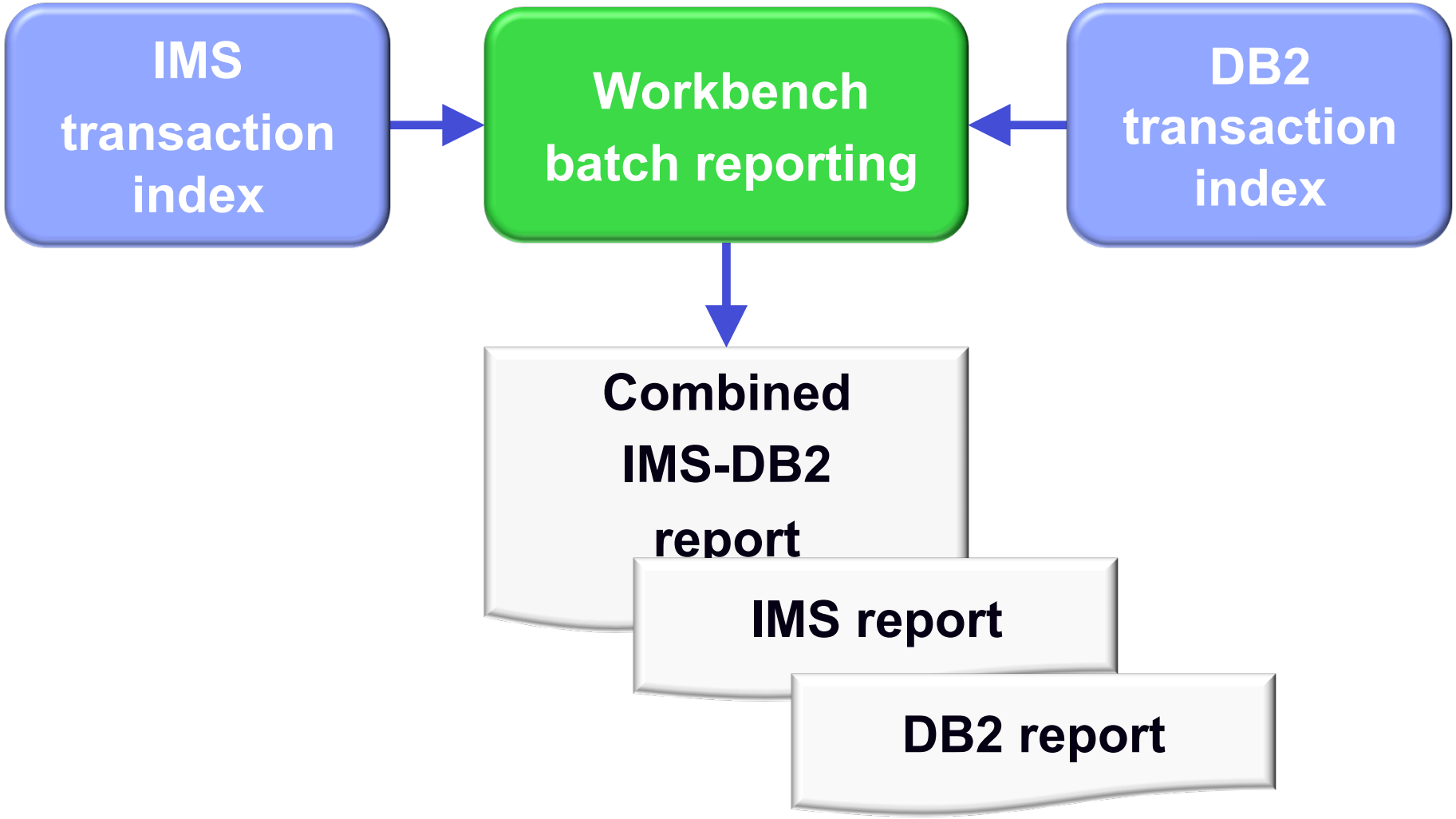
08 Count	Elapsed	CPU Time	StaDelay	Schedule	IC Wait	PS Wait
42	10.94999	0.004092	0.011668	0.000183	0	0

07 Count	DB call	DB Gets	DB Upds	IO Count	IO Time	LockWait
41	33	13	19	4	0.003438	3.980170

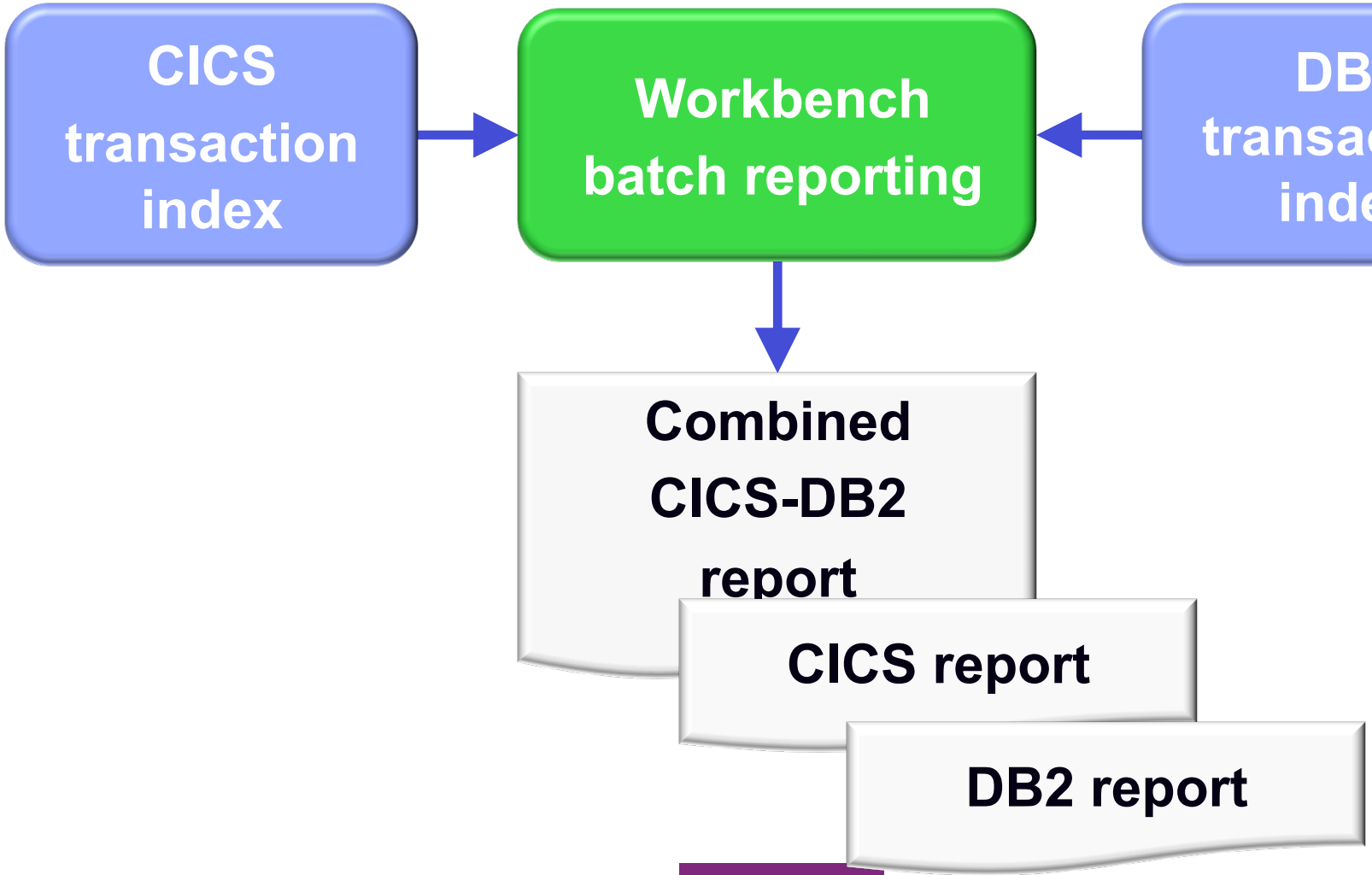
FP Count	FP call	FP Gets	FP Upds	FP Wait	FP Fail
41	19	7	11	0	7

Synctime	Phase 1	Phase 2	FP PH2	OTHREAD
0.011938	0.006555	0.005383	0.002232	0.017659

Combined IMS-DB2 exception reporting: TAW Futures



Combined CICS-DB2 exception reporting: TAW Futures



Enhanced support for DB2 trace records

- New DB2 trace (“DTR”) log type for IFCID records (from SMF record types 100, 101, 102, or GTF data set records)

```
  File  Mode  Filter  Time  Labels  Options  Help
BROWSE    FUW000.QADATA.FBOSPM4C.SMF.D130703.FULL    Record 00000927 More: < >
Command ===> ____________________________________________ Scroll ===> CSR
        Navigate < 00.05.00.000000 >      Date/Time 2013-07-03 16.39.00.000000
/  ——— Tracking ——————————————————— Wednesday 2013-07-03 Time (LOCAL)
__ 112  Thread allocate                                    DBA6 16.39.36.459771
__ 073  Create thread end                                  DBA6 16.39.36.459816
__ 122  Thread level exit from DB2                         DBA6 16.39.36.459831
__ 121  Thread level entry into DB2                        DBA6 16.39.36.459880
__ 177  Successful package allocation                      DBA6 16.39.36.465465
__ 380  SP entry FBOSPM4C                                  DBA6 16.39.36.465827
__ 177  Successful package allocation                      DBA6 16.39.36.465969
__ 060  SQL SELECT                          STMT=000009    DBA6 16.39.36.466073
s  058  SQL call completion      SQLCODE=0  STMT=000009    DBA6 16.39.36.474645
__ 060  SQL SELECT                          STMT=000010    DBA6 16.39.36.474704
__ 058  SQL call completion      SQLCODE=0  STMT=000010    DBA6 16.39.36.474912
__ 061  SQL DELETE                          STMT=000011    DBA6 16.39.36.474952
__ 325  Trigger entry USERDEL               STMT=000011    DBA6 16.39.36.479901
__ 177  Successful package allocation                      DBA6 16.39.36.479978
__ 061  SQL INSERT                          STMT=000002    DBA6 16.39.36.480037
__ 058  SQL call completion      SQLCODE=0  STMT=000002    DBA6 16.39.36.483035
__ 061  SQL DELETE                          STMT=000003    DBA6 16.39.36.483086
__ 058  SQL call completion      SQLCODE=0  STMT=000003    DBA6 16.39.36.497707
__ 325  Trigger exit             SQLCODE=0                 DBA6 16.39.36.497722
```

Enhanced support for DB2 trace records (cont.)

- Detailed formatting of IFCID-specific fields

```
+0120  QW0058ID... Scan information
+0120  Scan type.... 'SEQD'      Rows processed... +24069
+0130  Rows examined.... +24069
+0138  Rows qualified after stage 1... +24069
+0140  Rows qualified after stage 2... +1
+0148  Rows inserted.... +0
+0150  Rows updated... +0
+0158  Rows deleted... +0
+0160  Pages scanned.... +428
+0164  Pages scanned (RI)... +
+0168  Rows deleted (RI).... +
+0170  Pages scanned (LOB).... +0
+0174  Pages updated (LOB).... +0

+01A0  QW0058TY... Statement-level information
+01A0  SQL statement type... 4000
+01A8  Statement ID... +28917
+01B0  Sync reads... +0        Getpages... +428
+01C0  Rows examined.... +24069
+01C8  Rows processed... +0                    Sorts..... +0
+01D8  Index scans.... +0
+01E0  Table space scans.... +1
+01E8  Buffer writes.... +0
+01F0  Parallel groups.... +0
+01F8  In-DB2 elapsed... 0.008537
```

```
+0120  QW0058ID... 'SEQD'   Scan type

 Off   QW0058IX... 'INDX'   Index
 On    QW0058SD... 'SEQD'   Sequential data
 Off   QW0058SW... 'SEQW'   Sequential data workfile
```

Enhanced support for DB2 trace records (cont.)

- Investigating DB2 trace records can be expensive, and can result in very large log files: you might *not* want to start by analysing all traces.
- Workbench introduces the concept of trace "levels" (1 - 4) that categorize IFCIDs based on their usefulness (for transaction analysis) and cost overhead:
  - Program invocation
  - SQL
  - I/O
  - All (caution: may result in high volumes of data)
- In the ISPF dialog, enter the command:

TRACE ***n***

(*n*: 1 - 4) to show progressively more detail. TRACE 4 shows all available trace records.

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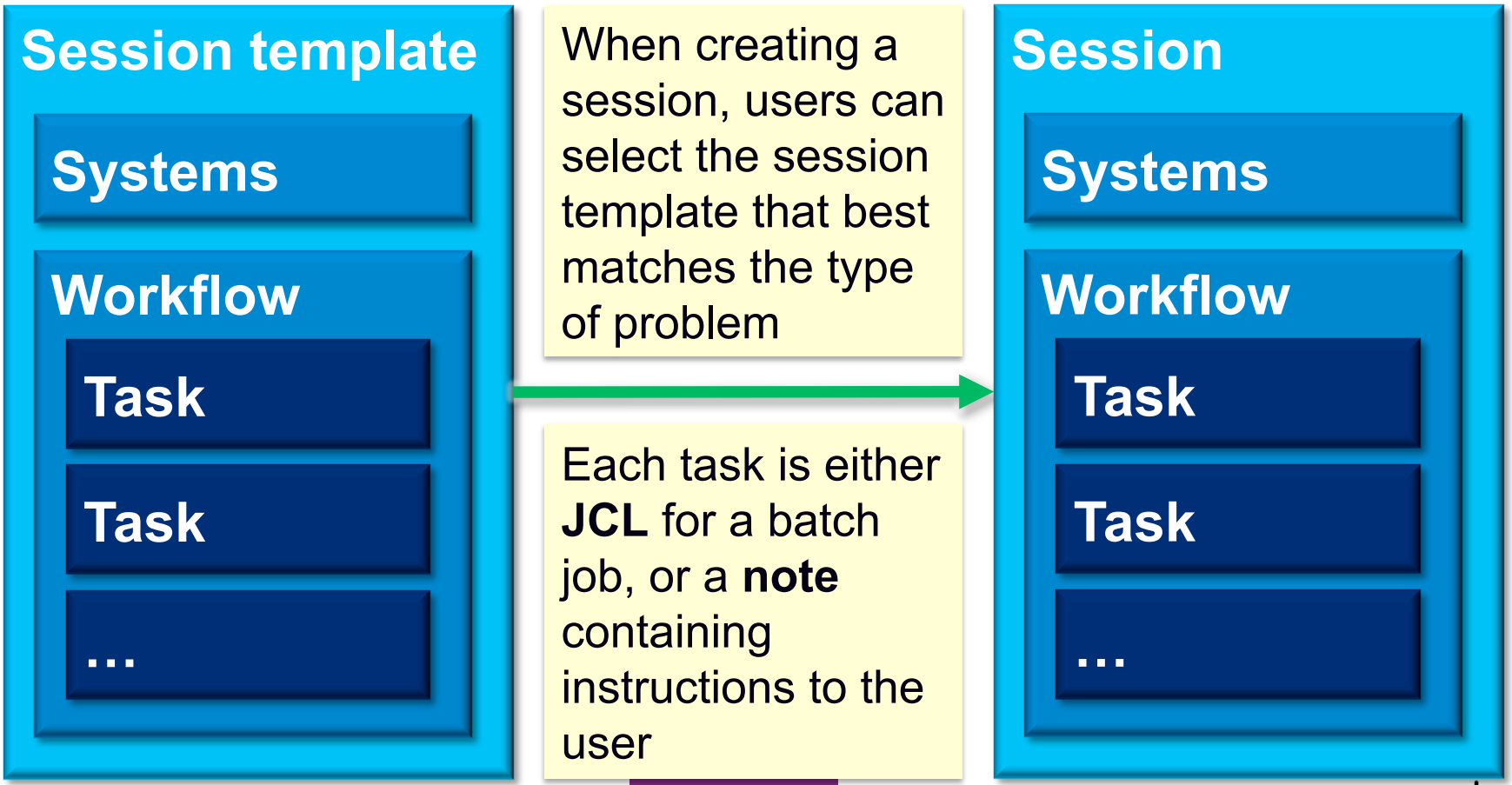
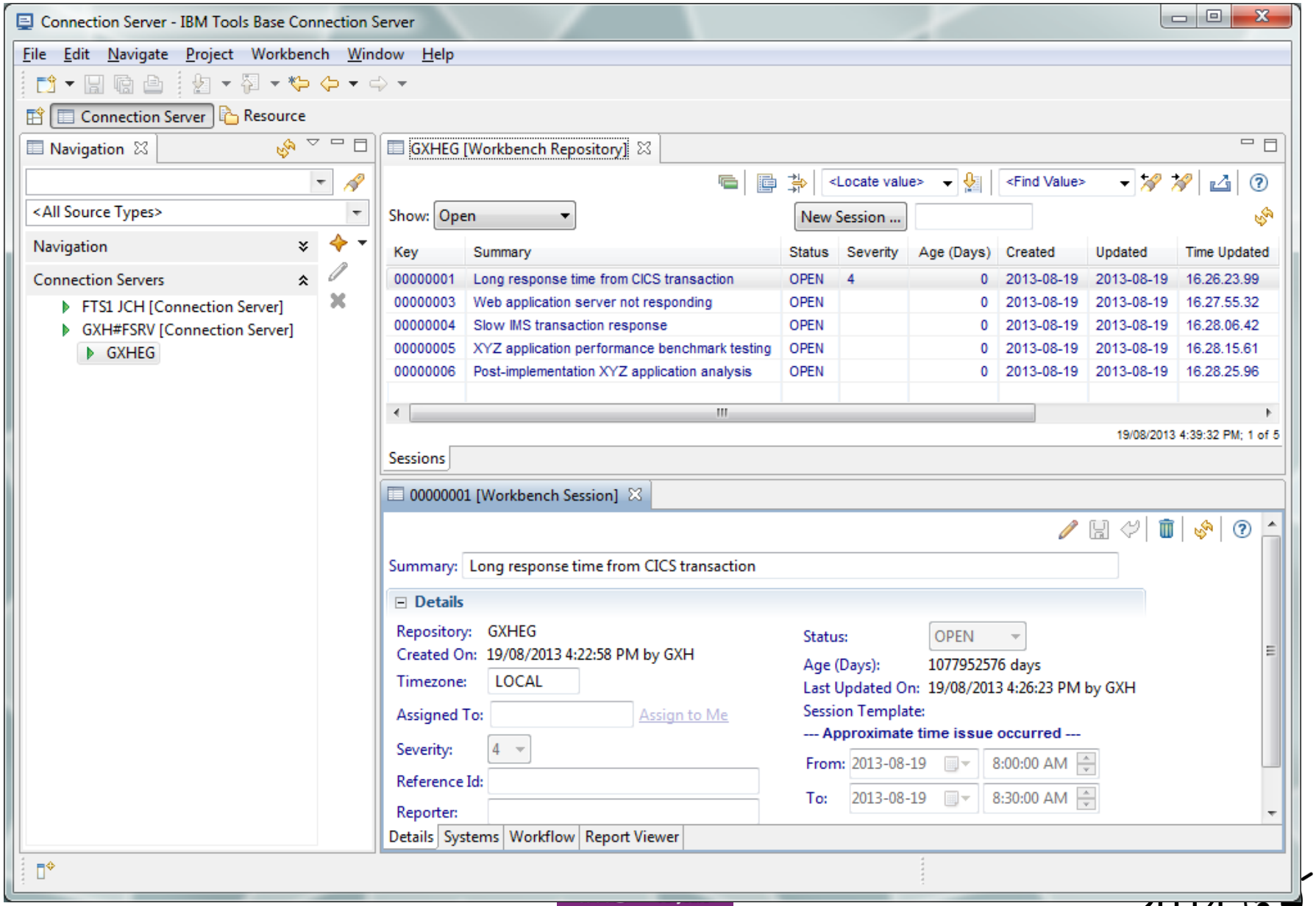
Workflows and session templates

- SMEs can use **session templates** to populate new sessions with the tasks needed to prepare the problem for evaluation
  - Created sessions include: systems involved and a sequence of tasks (workflow) for analyzing the problem

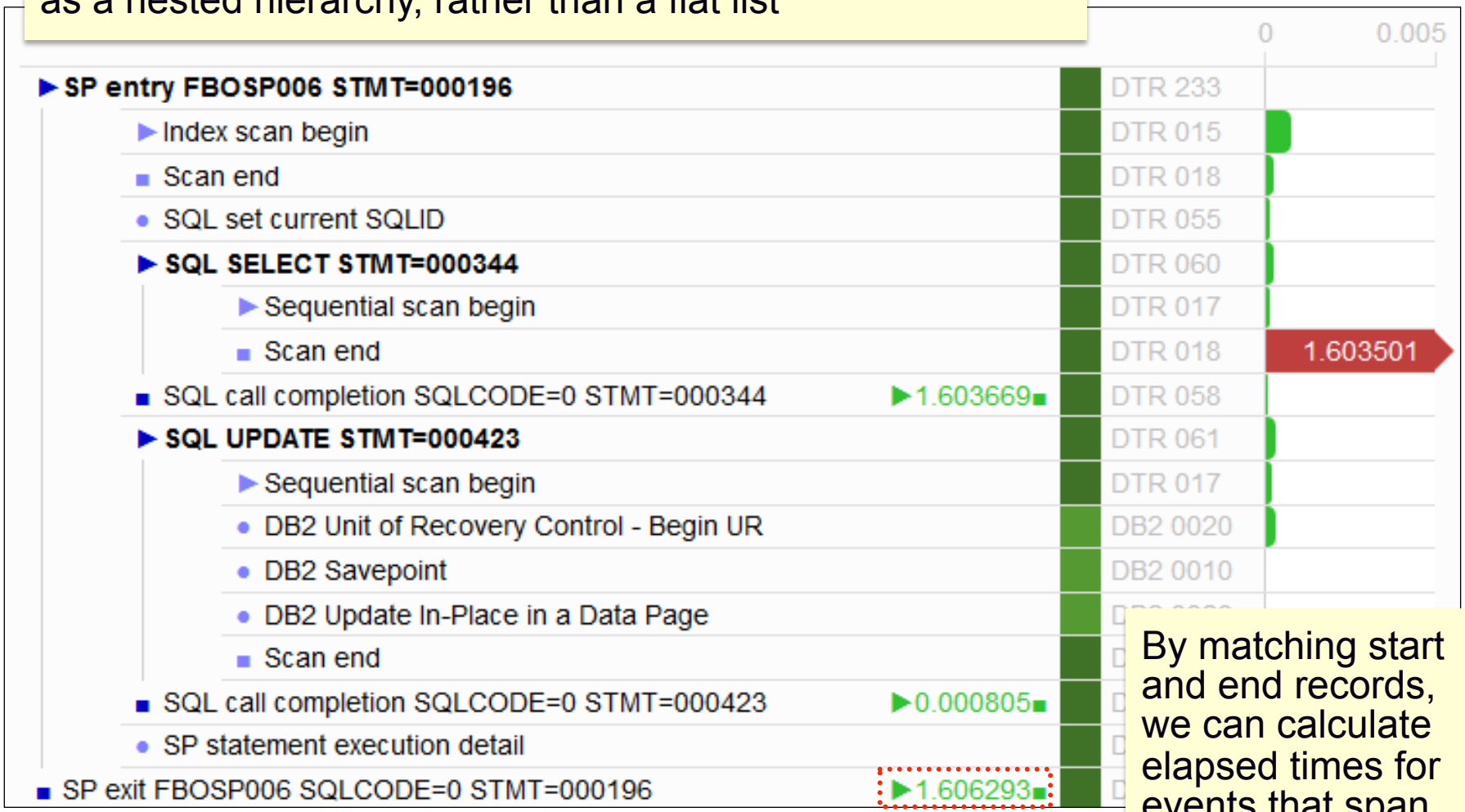


Eclipse-based rich client platform (RCP) UI



Enhanced support for DB2 trace records (cont.)

Possible future: TAW GUI could present DB2 trace records as a nested hierarchy, rather than a flat list



By matching start and end records, we can calculate elapsed times for events that span records (such as stored procedures)

More information

- IBM DB2 and IMS Tools website:
  www.ibm.com/software/data/db2imstools/
- IBM Transaction Analysis Workbench for z/OS:
  www.ibm.com/software/data/db2imstools/imstools/trans-analysis/
- Jim Martin, US Representative, Fundi Software:
  jim_martin@fundi.com.au
- James Martin, US Representative, Fundi Software:
  james_martin@fundi.com.au

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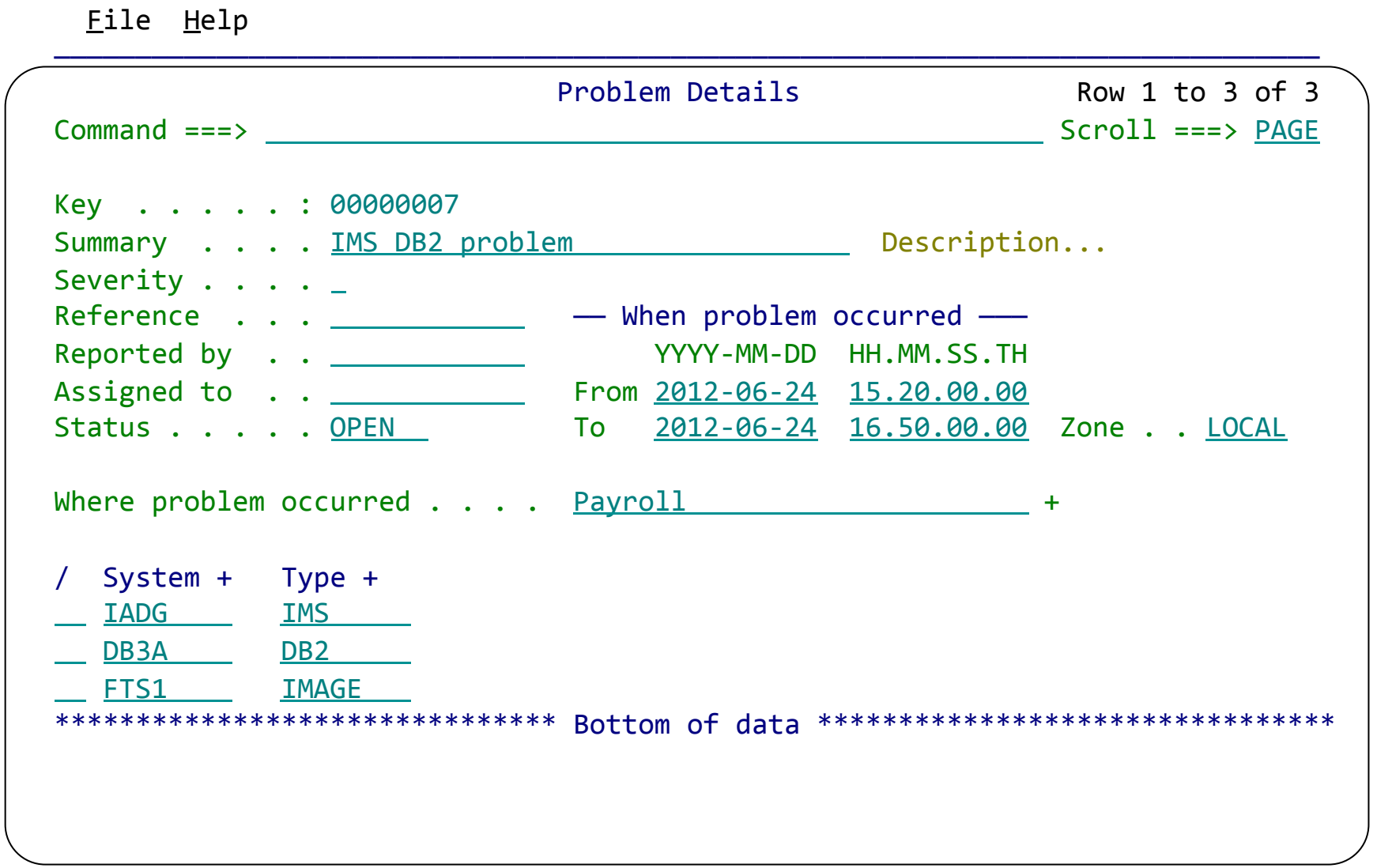
Scenario: IMS-DB2 problem

Scenario: IMS DB2 problem

1. On the following slides, we present an example scenario: a user has reported a long transaction response time for an IMS transaction performing DB2 updates

- The analysis is divided into two parts:
  1. The **first responder**:
     - Registers the problem in the Workbench session manager and collects the log files
     - Follows a process orientated script to assign problem to initial expert
       - Based on what is found
  2. The **subject-matter expert** performs a “deep dive” on the problem: reviewing the reports, and using interactive analysis to identify the specific log records for the cause of the problem

First responder: Creating a session



Create a session (main menu ► option 1 **Sessions** ► **NEW**).

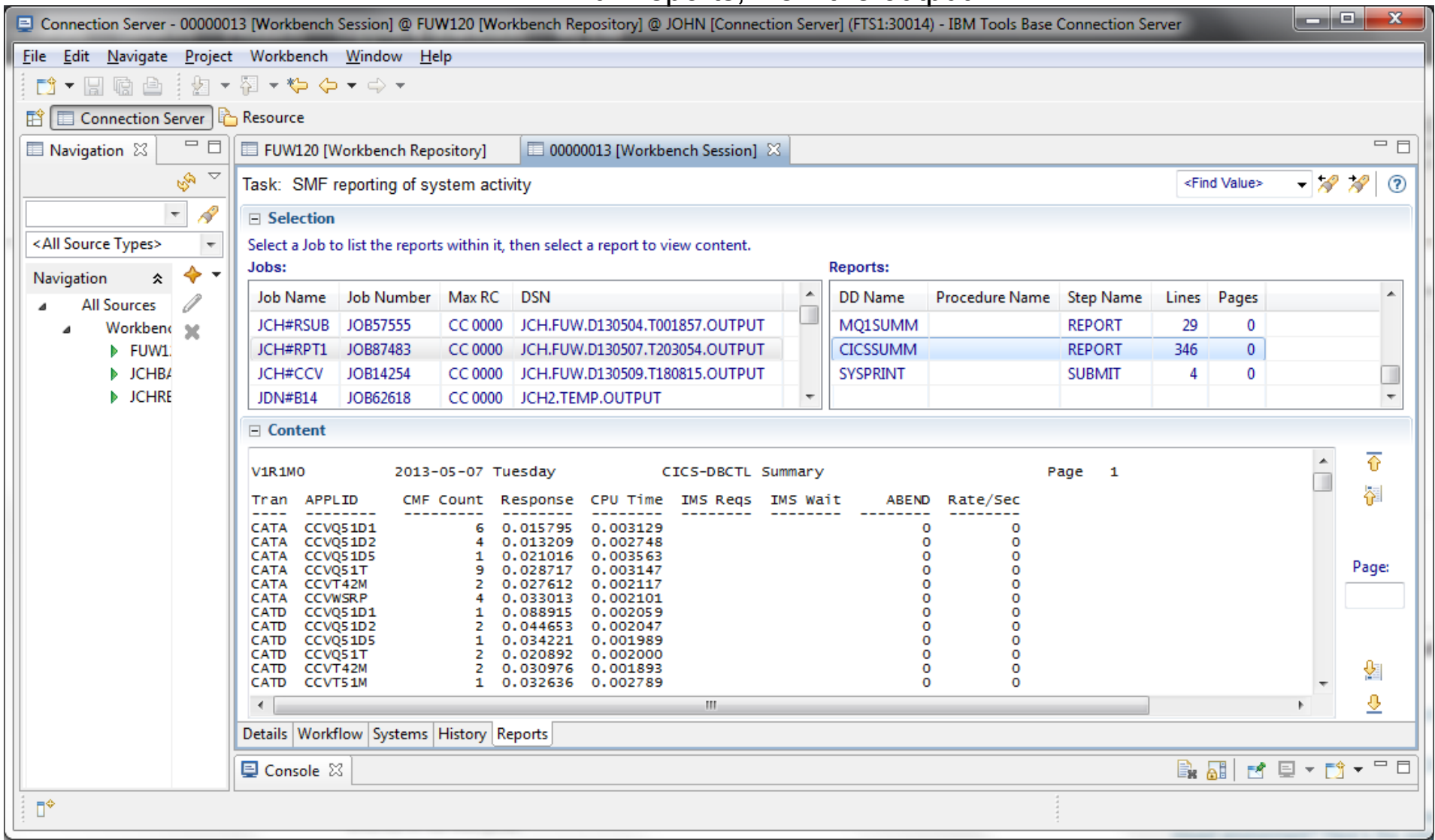
Select the environment where the problem occurred. This populates the system list.

Eclipse-based GUI

Register a new problem; work on an existing problem

Execute the workflow to locate the required diagnostic data

Run reports; view the output



Subject-matter expert: Exception candidate investigation

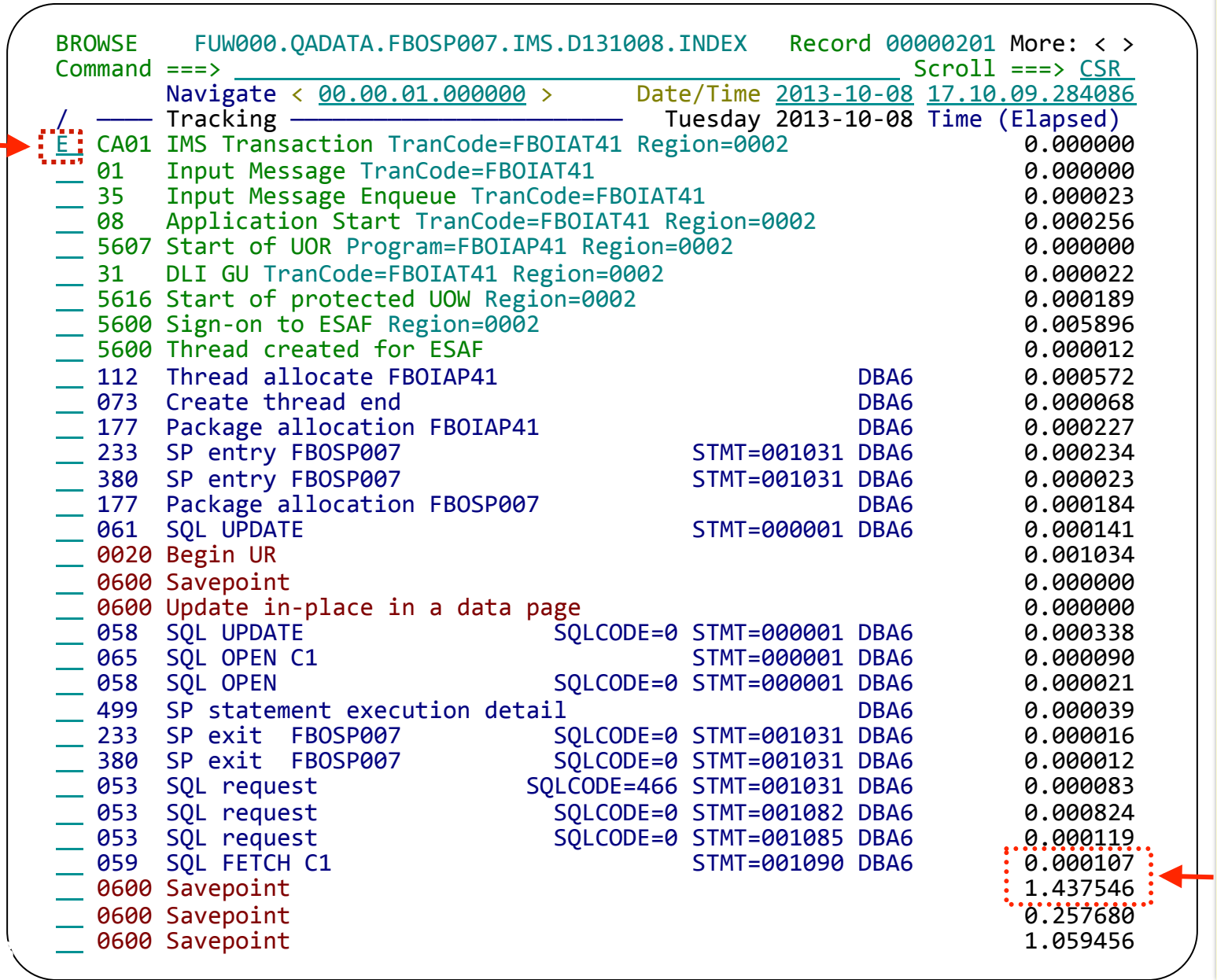
```
BROWSE    FUW000.QADATA.FBOSP007.IMS.D131008.INDEX   Record 00000201 More: < >
Command ===> ____________________________________________ Scroll ===> CSR
        Navigate < 00.00.01.000000 >      Date/Time 2013-10-08 17.10.09.284086
/  ——— Filtering ————————————————————    Tuesday 2013-10-08 LSN
```

→ TX CA01 IMS Transaction IMS-000000000021
UTC=17.10.09.284078 TranCode=FBOIAT41 Program=FBOIAP41 Userid=FUNTRM10
LTerm=FUNTRM10 Terminal=SC0TCP10 Region=0002
OrgUOWID=IDDG/CC1476B6713CB884 IMSRel=131
RecToken=IDDG/0000000400000000
CPU=45.699549 InputQ=0.000309 Process=72.612278 OutputQ=0.000356
TotalTm=72.612943 RegTyp=MPP

__ CA01 IMS Transaction IMS-000000000025
UTC=17.15.19.060177 TranCode=FBOIAT41 Program=FBOIAP41 Userid=FUNTRM10
LTerm=FUNTRM10 Terminal=SC0TCP10 Region=0002
OrgUOWID=IDDG/CC1477DDDE2AF104 IMSRel=131
RecToken=IDDG/0000000600000000
CPU=11.512388 InputQ=0.000354 Process=18.105197 OutputQ=0.000039
TotalTm=18.105590 RegTyp=MPP

This display has been filtered to show **IMS x'CA01' Exception index records** with excessive processing times. Use TX line command to show records related to a transaction

IMS/DB2 Transaction life cycle investigation



1. Start tracking a transaction (here, a IMS transaction)
2. See the transaction life cycle events from the related logs (here, an IMS Index and log, SMF file, and a DB2 log), merged together with no preparation required
3. Notice the jump in elapsed time
4. In this case, the problem was caused by an inefficient table scan initiated by a DB2 stored procedure.

   A drill down of the DB2 trace was able to determine this.

Detail DB2 event data view using forms view

```
+029C  Code... 058   SQL FETCH                    SQLCODE=0 STMT=001090 DBA6
+02A8  STCK... CC1476FBAF617906      LSN.... 0000000000000049
       Date... 2013-10-08 Tuesday    Time... 17.11.21.890327.563

+0000  SM102LEN... 03A6        SM102FLG... 1E          SM102RTY... 66
+0006  SM102TME... 005E6C9D    SM102DTE... 0113281F    SM102SID... 'FTS3'
+0012  SM102SSI... 'DBA6'      SM102STF... 0000

+0034  QW0058..... IFCID data
       Package
+0034  Location... 'DB2ALOC'   Collection ID.... 'FUNBOX'
+0056  Package name... 'FBOSP007'
+0068  Consistency token.... 19718A5F136E9A24

+0072  SQLCA...... SQL communication area (SQLCA)
+0072  SQLCAID.... 'SQLCA   '  SQLCABC.... +136        SQLCODE.... +0
+0082  SQLERRML... +0          SQLERRM.... '        '
+00CA  SQLERRP.... 'DSN     '  SQLERRD1... +0          SQLERRD2... +0
+00DA  SQLERRD3... +0          SQLERRD4... +4294967295
+00E2  SQLERRD5... +0          SQLERRD6... +0          SQLWARN0... ' '
+00EB  SQLWARN1... ' '         SQLWARN2... ' '         SQLWARN3... ' '
+00EE  SQLWARN4... ' '         SQLWARN5... ' '         SQLWARN6... ' '
+00F1  SQLWARN7... ' '         SQLWARN8... ' '         SQLWARN9...
+00F4  SQLWARNA... ' '         SQLSTATE... '00000'

+00FC  Statement number... +1090
+0106  Query command ID... 00000000
+010E  Query instance ID.... 00000000
+0116  Type of SQL request.... 01

+0118  QW0058ID... Scan information
+0118  Scan type.... 'INDX'    Rows processed... +1280799
+0128  Rows examined.... +1595
+0130  Rows qualified after stage 1... +1275908
+0138  Rows qualified after stage 2... +1275908
+0140  Rows inserted.... +0
```

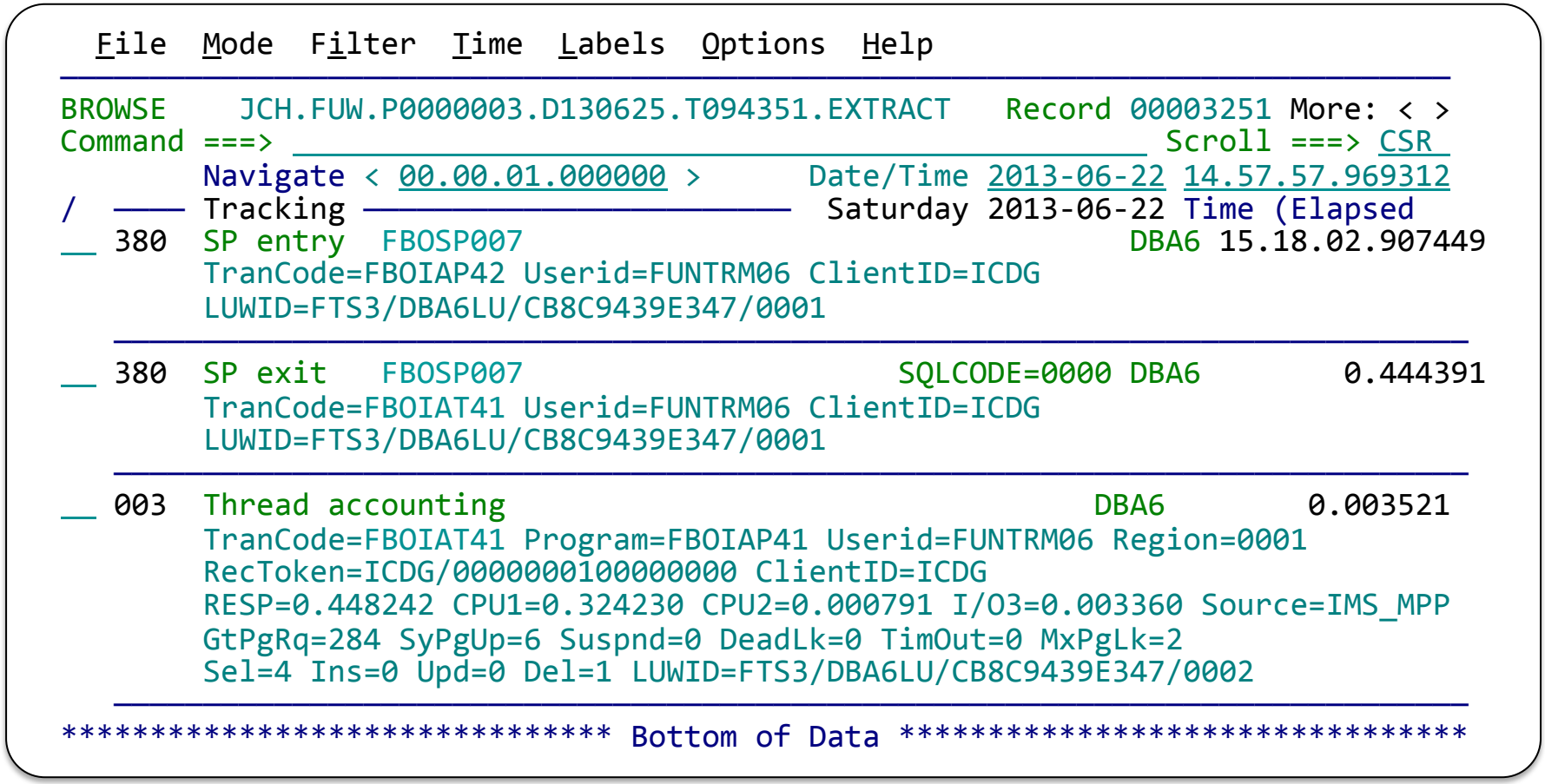
Program statement number 1090 caused an index scan that processed 1,280,799 rows in the table

Zoom to see more detail about log record fields

```
Field Zoom
  File  Menu  Help
BROWSE    FUW000.QADATA.FBOSP007.IMS.D131008.INDEX +         Line 00000000
Command ===> _____________________________________ Scroll ===> CSR
******************************* Top of data ********************************
+0116  QW0058TOS.... 01   Type of SQL request

 On    QW005801... 01   FETCH
 Off   QW005810... 10   INSERT
 Off   QW005811... 11   SELECT
 Off   QW005820... 20   UPDATE
 Off   QW005821... 21   UPDATE CURSOR
 Off   QW005830... 30   MERGE
 Off   QW005840... 40   DELETE
 Off   QW005841... 41   DELETE CURSOR
 Off   QW005850... 50   TRUNCATE
 Off   QW005880... 80   PREPARE
 Off   QW005881... 81   PREPARE CURSOR
 Off   QW005891... 91   OPEN
 Off   QW0058A1... A1   CLOSE
 Off   QW0058A0... A0   ALTER SEQUENCES
 Off   QW0058A2... A2   ALTER JAR
```

```
+00E2  SQLERRD5...  +0          SQLERRD6... +0          SQLWARN0... ' '
+00EB  SQLWARN1...  ' '         SQLWARN2... ' '         SQLWARN3... ' '
+00EE  SQLWARN4...  ' '         SQLWARN5... ' '         SQLWARN6... ' '
+00F1  SQLWARN7...  ' '         SQLWARN8... ' '         SQLWARN9... ' '
+00F4  SQLWARNA...  ' '         SQLSTATE... '00000'

+00FC  StateLength... +1090
+0106  QueryLength... 00000000
+010E  QueryInstanceID... 00000000
+0116  Type of SQL request.... 01

+0118  QW0058ID... Scan information
+0118  Scan type.... 'INDX'    Rows processed... +1280799
+0128  Rows examined.... +1595
+0130  Rows qualified after stage 1... +1275908
+0138  Rows qualified after stage 2... +1275908
+0140  Rows inserted.... +0
```

Life cycle events: expanded summary view

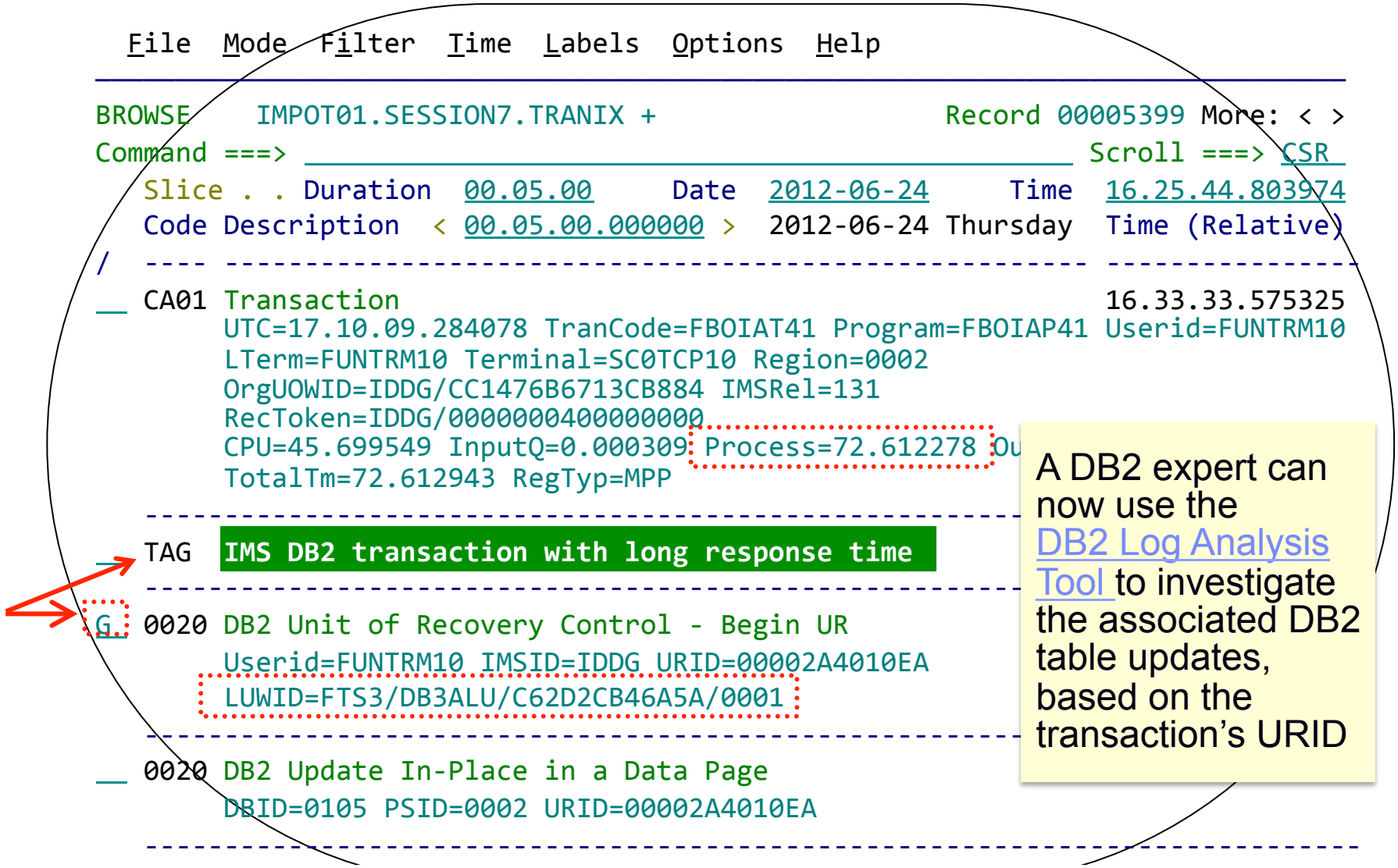


Scroll right to show the records in expanded view with elapsed or relative times:

Elapsed – time between log record events

Relative – time since start of transaction (or other selected event)

Identifying events for review or collaboration



A DB2 expert can now use the DB2 Log Analysis Tool to investigate the associated DB2 table updates, based on the transaction's URID

Enter **FIND LUWID** on the command line.

Enter **G** to "tag" (bookmark) this DB2 record.

DB2 Expert Help using DB2 Log Analysis Tool

```
RECORD IDENTIFIER: 1

ACTION DATE       TIME     TABLE OWNER  TABLE NAME                URID
------ ---------- -------- ------------ ------------------------ ------------
INSERT 2012-06-24 16.33.34 JOHN         HR                       00002A4010EA

DATABASE TABLESPACE DBID  PSID  OBID  AUTHID   PLAN     CONNTYPE LRSN
-------- ---------- ----- ----- ----- -------- -------- -------- ------------
HR_DB    HR_SPACE   00456 00002 00003 FUNTRM10 HR_PLAN  IMS      C62D2CB46CB3

MEMID CORRID       CONNID   LUW=NETID/LUNAME/UNIQUE/COMMIT      PAGE/RID
----- ------------ -------- ----------------------------------- -----------
00000 0004MQATPGM  IMS      FTS3    /DB3ALU  /C62D2CB46A5A/0001 00000002/02

ROW STATUS   EMP_ID EMP_NAME   EMP_PHONE       EMP_YEAR   EMP_SALARY
------------ ------ ---------- --------------- ---------- -----------
CURRENT      +330   JIM MARTIN 475-712-9508    2009-06-24 +0041000.00
POST-CHANGE  +330   JIM MARTIN 475-712-9508    2009-06-24 +0042000.00
```

Problem resolution: end of scenario

- The cause of the IMS transaction problem has been narrowed down to a slowdown in DB2
- Sufficient information about the DB2 update activity has been collected and can be passed on to the DB2 DBA for further investigation
- Automatically locates log files for the problem time range for supported subsystems
  - SMF
  - IMS logs
  - DB2 recovery log
- Enables a collaborative problem analysis:
  - Between first responders and subject-matter experts
  - Between experts in different areas