IBM Software Group

Exploring Black Holes in IMS Performance with IMSPA and IMSPI

Session 1215

Presenter: Jim Martin, Fundi Software

Session agenda

- **Introduction: what are IMS Problem Investigator and IMS Performance Analyzer?**
- **What is a performance “black-spot”?**
- **How new features in IMS Performance Analyzer (IMS PA) and IMS Problem Investigator (IMS PI) can help illuminate these black spots**
- **Case studies: performance analysis and problem determination in complex environments**

Disclaimer: this presentation discusses some features that represent “future directions”. These features may change or be removed before they are officially announced.

IMS Performance Analyser and IMS Problem Investigator

- **IMS Performance Analyser (IMS PA) is a tool that uses the IMS and related logs to create performance and throughput reports**
- **IMS Performance Analyzer remains the premier tool for:**
  - Service Levels and capacity planning
  - Response time analysis
  - Monitoring enterprise-wide indicators that can adversely affect IMS performance
- **IMS Problem Investigator is a log analysis tool that allows you to interactively browse IMS and other related logs**

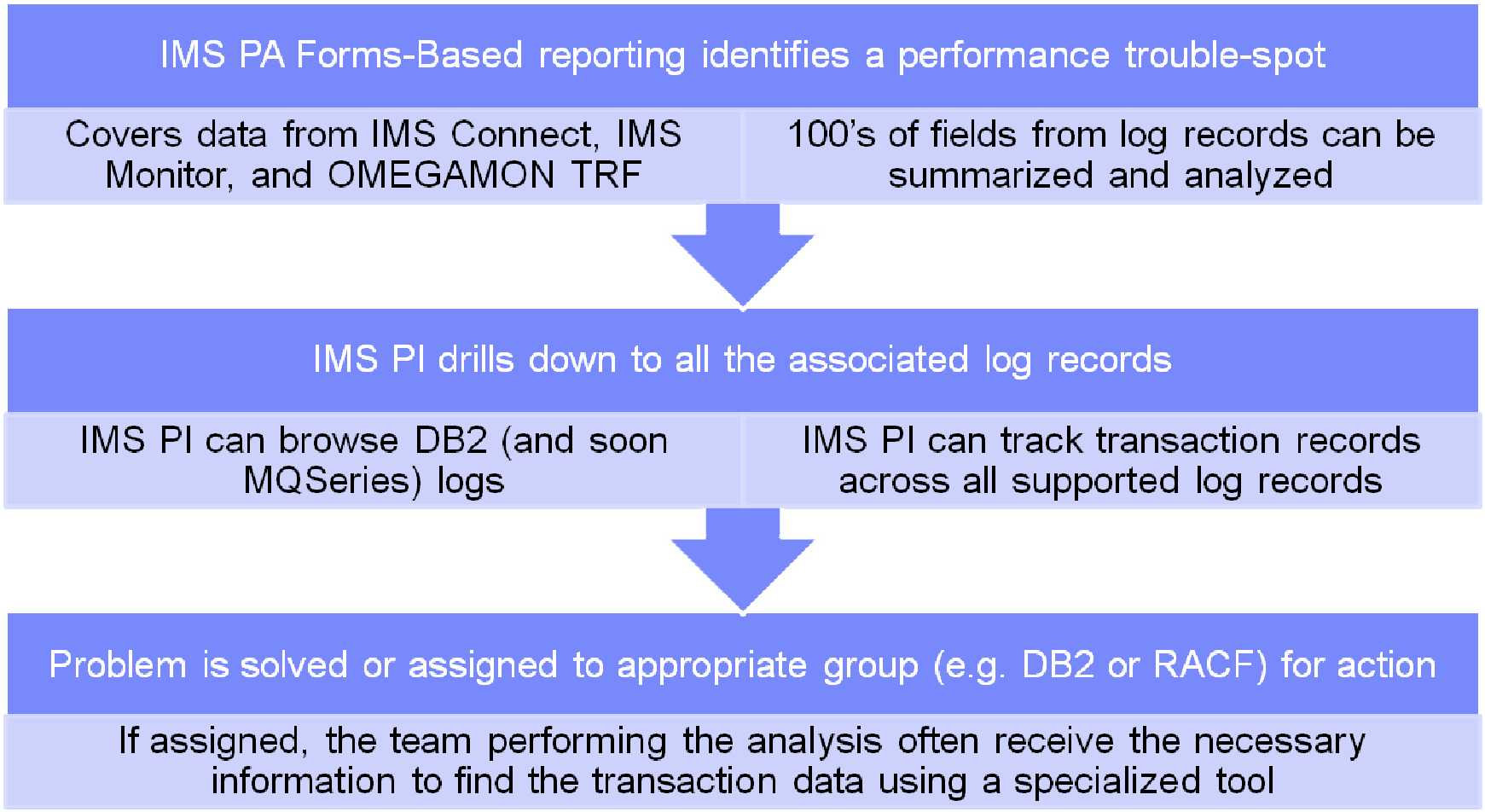
What is a performance black-spot?

- **The IMS logs are a rich source of information about the activity within IMS**
- **IMS Performance Analyzer and IMS Problem Investigator have traditionally been the de-facto tools for interrogating the logs for troubleshooting and performance information**
- **But what if a problem in IMS is actually caused by DB2? Websphere MQ?**
- **Or what if the most valuable data about the transaction is in SMF, not the IMS log?**
- **Without tools that connect data from various subsystems and sources performance black-spots appear**

IMS Performance Analyser and IMS Problem Investigator

- **IMS PA and PI are rapidly evolving products**
- **The roadmap for IMS PA and PI is to:**
  - Connect transaction data from different subsystems and sources
  - Identify performance and tuning black spots and providing analytics that can illuminate them
- **They are moving from being focused primarily on evaluating system performance (“tree killers”) to being at the heart of system problem determination methodologies**

IMS Performance Analyser and IMS Problem Investigator



New capabilities:

- **IMS PA:**
  - Directions in 2008:

    Accounting index records for IMS PI

    Improved fast-path reporting

    IMS Connect Send-Only with Resume TPIPE programming model support (provides reporting for TIRKS and TIRKS-like transactions)
- **IMS PI**
  - DB2 log support (Apar PK56005 - PTF UK32909)
  - Direction in 2008:

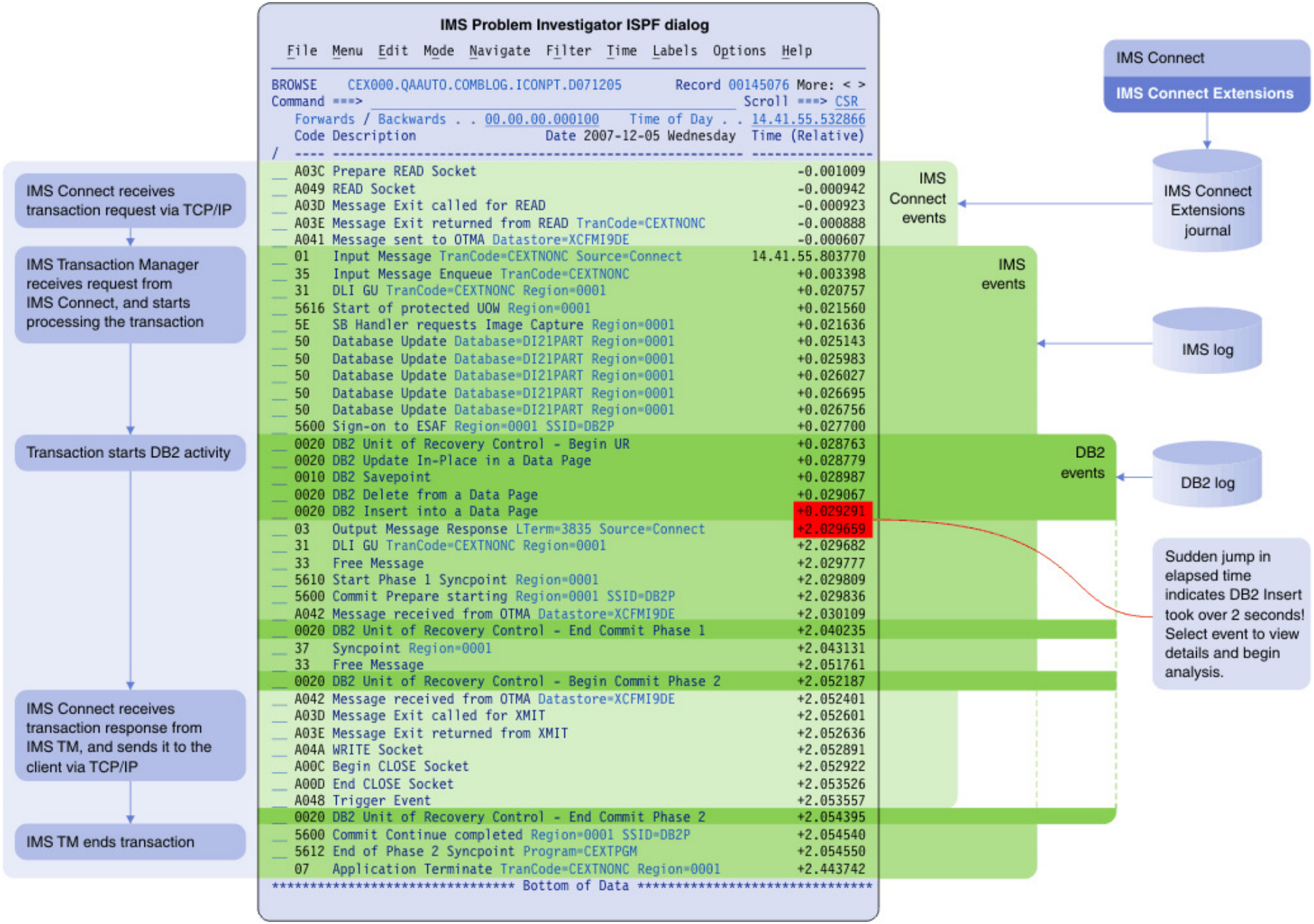
    WebSphere MQ log support

    SMF log support

    Intelligent log analysis with IMS PA accounting index

Track transaction records in heterogenous environments

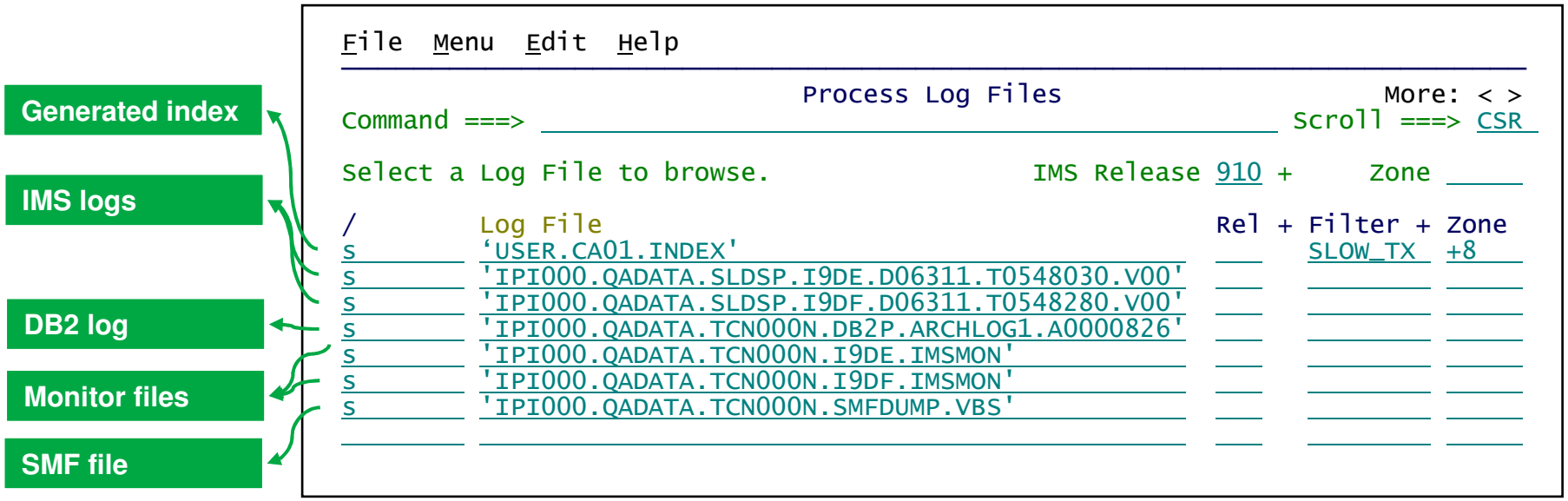
- **With IMS PI you can now select multiple IMS, DB2, and IMS Connect records and merge them into a single view.**
- **The TX line action will connect records associated with the same transaction across all logs.**
- **The action ‘tracks’ all records associated with the transaction and hides (potentially) thousands of records not related to the transaction.**
- **Example…**



IMS PA accounting index

- **In 2008, IMS PA and PI plan to introduce an accounting index**
- **IMS PA generates the accounting index**
- **You can use this index to intelligently navigate log files**
- **For example, you will be able to create filters that:**
  - Show records from all transactions where the end-to-end performance characteristics are above a given threshold
  - Show transaction records where particular parts of the transaction had poor performance characteristics (e.g. poor OTMA performance, poor I/O performance, etc)
  - Show the performance characteristics for complex transactions such as Send Only with Resume TPIPE or fast-path transactions
  - Track poor performing transactions across IMS, DB2, and WebSphere MQ using their logs and SMF log records

Select records with the accounting index



One index file can refer to multiple logs on different subsystems

Create a record filter

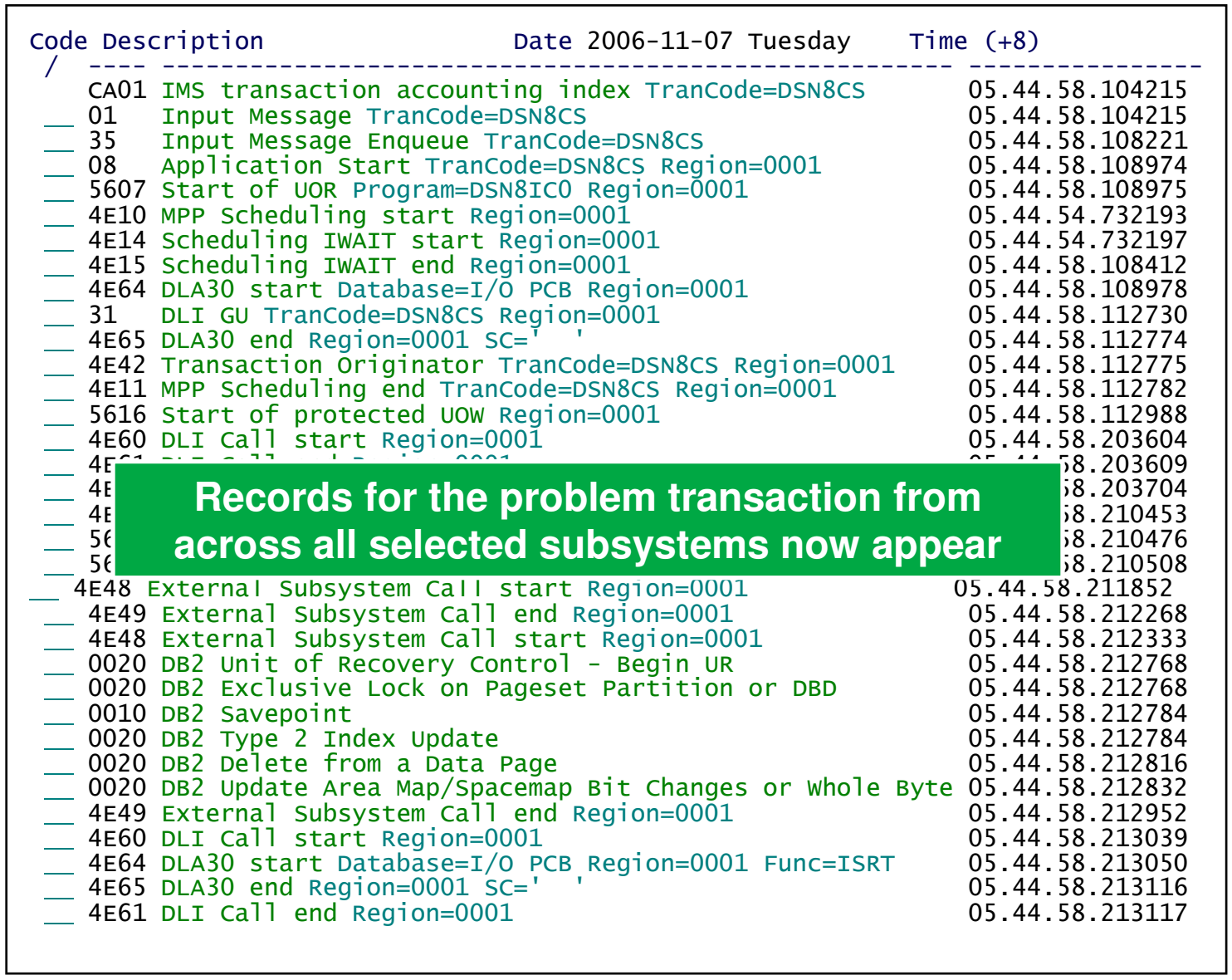
```
File  Menu  Edit  Object Lists  Help
                                  Conditions                    Row 1 to 1 of 1
Command ===> ____________________________________________________ Scroll ===> CSR

Code: CA01 IMS transaction accounting index

/  Field Name +                    Oper Value +
   TRANSACTION_PROCESSING_TIME     GT   0.3
******************************** Bottom of data ********************************
```

“Show accounting records with processing time greater than 0.3 seconds”

Transaction accounting records matching filter

Track all records from transaction

```
File  Menu  Edit  Mode  Navigate  Filter  Time  Labels  Options  Help
BROWSE    JCH.CA01.INDEX                          Record 00002488 More: < >
Command ===>                                                Scroll ===> CSR
   Forwards / Backwards . . 00.00.00.000100    Time of Day . . 14.41.55.532866
   Code Description                 Date 2006-11-07 Tuesday    Time (+8)
/  ---- ------------------------------------------------------ ---------------
TX CA01 IMS transaction accounting index TranCode=DSN8PP        05.33.51.461511
__ CA01 IMS transaction accounting index TranCode=DSN8PP        05.34.12.744752
__ CA01 IMS transaction accounting index TranCode=DSN8PP        05.34.32.058505
__ CA01 IMS transaction accounting index TranCode=DSN8PP        05.34.51.741893
__ CA01 IMS transaction accounting index TranCode=DSN8PP        05.35.09.250895
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.36.21.228573
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.36.50.751332
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.37.49.038430
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.37.55.082883
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.38.03.562376
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.38.08.273151
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.38.11.009607
__ CA01 IMS transaction accounting index TranCode=DSN8PT        05.38.55.350488
__ CA01 IMS transaction accounting index TranCode=DSN8PT        05.39.02.144529
__ CA01 IMS transaction accounting index TranCode=DSN8PT        05.39.11.703720
__ CA01 IMS transaction accounting index TranCode=DSN8CS        05.42.59.634801
__ CA01 IMS transaction accounting index TranCode=DSN8CS        05.44.52.678102
__ CA01 IMS transaction accounting index TranCode=DSN8CS        05.44.58.104215
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.45.13.821636
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.45.16.253392
__ CA01 IMS transaction accounting index TranCode=DSN8PS        05.45.18.786698
******************************** Bottom of Data ********************************
```



Some of the fields that could be used in filters

InputQ time

Processing time

Switch time

DLI Call Count

CPU time

VSAM writes

Field Name	
T_INQ	Input Queue time
T_PROC	Processing time
T_OUTQ	Output Queue time
T_OUTL	SMQ Out Queue time Local component
T_OUTG	SMQ Out Queue time Global component
T_TOTL	Total elapsed time
T_RESP	Response time, Total Transit time
T_SWIT	Program Switch Time
T_SCHED	Program Schedule Time
T_SYNPT	Syncpoint time
T_UOR	Unit-of-Recovery elasped time
T_CM1DL	Commit Mode=1 Delay time
T_SQ6	SUBQ6 Wait for Input time (10ths secs)
T_RASEC	Transaction Resource Accounting section
T_DBCAL	FF DB DLI call count
T_DBGET	FF DB DLI Get call count
T_DBUPD	FF DB DLI Update call count
T_DCCAL	FF DC DLI call count
T_DBWT	FF DB wait count
T_CPU	CPU time (micro-seconds)
T_FPCAL	FP DB DLI call count
T_FPGET	FP DB DLI Get call count
T_FPUPD	FP DB DLI Update call count
T_FPWT	FP DB (DEDB) wait count
T_DBIO	DB IO elapsed time (microseconds)
T_DBPL	DB Locking elapsed time (microsec)
T_VSAMR	VSAM IO count (Reads)
T_VSAMW	VSAM IO count (Writes)
T_OSAMR	OSAM IO count (Reads)
T_OSAMW	OSAM IO count (Writes)
T_TOTIO	Total DLI IO count (OSAM+VSAM)
T_ESAF	Total ESAF calls

Usage scenarios

- **In an enterprise environment, when a performance problem is identified, it could be caused by any of these subsystems:**
  - IMS Connect
  - OTMA
  - Shared queues
  - IMS TM
  - IMS DB
  - DB2
  - WebSphere MQ
  - RACF
  - Etc…

Example scenario: TCP/IP client reports a problem

IMS Connect clients report poor transaction performance but online tools showing IMS performance ‘perfect’

How do we know if IMS Connect is the problem?

Data collected by Connect Extensions holds the key

IMS PA shows IMS Connect performance

IMS PI tracks the source of the problem

Scenario

- **To analyze the problem we need to use IMS Connect Extensions, IMS Performance Analyzer, and IMS Problem Investigator**
- **The combination of these tools can help isolate a performance problem to a particular system and often identify the underlying cause of the problem**
- **All three tools are needed because:**
  - Without IMS Connect Extensions you will not be able to identify if OTMA or IMS Connect is causing the problem
  - Without IMS Problem Investigator:

    You will not be able to drill-down and see exactly what events are associated with the problem

    You will not be able to correlate the transaction records with data in WebSphere MQ and DB2 logs

IMS Performance Analyzer report

IMS is showing millisecond response times

IMS Connect is also processing at sub-second levels

IMS Performance Analyzer 4.1
combined tran list

0LIST0001 Printed at 19:33:38 12Dec2007 Data from 13.57.52 12Dec2007

CON Tran Start	Trancode	OTMA	CON Resp Time	PreOTMA Time	OTMAproc Time	IMS Tran Start	InputQ Time	Process Time	Total IMS Time	PostOTMA Time
13.57.52.714	IMSTRANS	CONNECT	1.810	0.000	1.803	13.57.54.517	0.000	0.001	0.001	0.006
13.57.52.964	IMSTRANS	CONNECT	1.575	0.000	1.574	13.57.54.538	0.000	0.001	0.001	0.000
13.57.52.972	IMSTRANS	CONNECT	1.588	0.000	1.588	13.57.54.548	0.009	0.002	0.011	0.000
13.57.53.091	IMSTRANS	CONNECT	1.716	0.002	1.714	13.57.54.806	0.000	0.001	0.001	0.000
13.57.53.567	IMSTRANS	CONNECT	1.839	0.000	1.839	13.57.55.403	0.000	0		
13.57.54.044	IMSTRANS	CONNECT	1.800	0.000	1.799	13.57.55.836	0.006	0		
13.57.53.800	IMSTRANS	CONNECT	1.879	0.000	1.878	13.57.55.677	0.000	0		
13.57.54.120	IMSTRANS	CONNECT	1.851	0.000	1.850	13.57.55.903	0.006	0.001	0.007	0.000
13.57.54.213	IMSTRANS	CONNECT	1.904	0.000	1.903	13.57.56.116	0.000	0.001	0.001	0.000
13.57.54.251	IMSTRANS	CONNECT	1.931	0.000	1.930	13.57.56.180	0.000	0.001	0.001	0.000
13.57.54.713	IMSTRANS	CONNECT	2.007	0.001	2.005	13.57.56.718	0.000	0.001	0.001	0.000
13.57.55.461	IMSTRANS	CONNECT	2.207	0.000	2.206	13.57.57.665	0.000	0.002	0.002	0.000
13.57.55.632	IMSTRANS	CONNECT	2.070	0.001	2.069	13.57.57.700	0.000	0.001	0.001	0.001
13.57.55.890	IMSTRANS	CONNECT	2.061	0.002	2.055	13.57.57.946	0.000	0.001	0.001	0.003
13.57.56.147	IMSTRANS	CONNECT	2.171	0.002	2.169	13.57.58.314	0.000	0.003	0.003	0.000
13.57.56.190	IMSTRANS	CONNECT	2.158	0.001	2.157	13.57.58.347	0.000	0.001	0.001	0.000
13.57.56.559	IMSTRANS	CONNECT	2.222	0.000	2.222	13.57.58.780	0.000	0.001	0.001	0.000
13.57.56.909	IMSTRANS	CONNECT	2.048	0.002	2.045	13.57.58.955	0.000	0.002	0.002	0.000
13.57.56.934	IMSTRANS	CONNECT	2.033	0.001	2.03					000

OTMA is the source of the problem

Without IMS Connect Extensions, IMS Connect and OTMA performance cannot be obtained

IMS PI View of the problem

IMS Connect sends to IMS OTMA

```
A03C Prepare READ Socket                                          13.57.58.037571
A049 READ Socket                                                        +0.000048
A03D Message Exit called for READ                                       +0.000063
A03E Message Exit returned from READ TranCode=XXXXXXXXX                 +0.000082
A03F Begin SAF call                                                     +0.000097
A040 End SAF call                                                       +0.000539
A03F Begin SAF call                                                     +0.000548
A040 End SAF call                                                       +0.000658
A041 Message sent to OTMA Datastore=MMMMMM                              +0.000707
01   Input Message TranCode=XXXXXXXXX Source=Connect                    +2.485621
35   Input Message Enqueue TranCode=XXXXXXXXX                           +2.485636
08   Application Start TranCode=XXXXXXXXX Region=0184                   +2.485709
5607 Start of UOR Program=XXXXXXXX Region=0184                          +2.485710
31   DLI GU TranCode=XXXXXXXXX Region=0184                              +2.4857
03   Output Message Response LTerm=9999 Source=Connect                  +2.4887
31   DLI GU TranCode=XXXXXXXXX Region=0184                              +2.4887
33   Free Message                                                       +2.4887
5610 Start Phase 1 Syncpoint Region=0184                                +2.488784
37   Syncpoint Region=0184                                              +2.488807
33   Free Message                                                       +2.488849
5600 Commit found no work to do Region=0184 SSID=AAAA                   +2.488859
5612 End of Phase 2 Syncpoint Program=YYYYYYY                           +2.488864
A042 Message received from OTMA Datastore=MMMMMM                        +2.488917
A042 Message received from OTMA Datastore=MMMMMM                        +2.489037
A03D Message Exit called for XMIT                                       +2.489926
A03E Message Exit returned from XMIT                                    +2.489943
A04A WRITE Socket                                                       +2.489999
A048 Trigger Event                                                      +2.490032
```

OTMA finally logs the 01 record

Scenario 2: DB2 and MQ problems

IMS PA daily reporting flags a high-percentage of transactions falling below SLA

IMS PA form-based reporting is used to gain better insight into the problem

IMS PI identifies the cause of the problem

IMS PI merges IMS, DB2, and SMF log records	All of these logs are required to complete the analysis

IMS PA daily performance summary report

IMS Performance Analyzer
Transaction Resource Usage

Data from 05.30.49 07Nov2006 to 05.45.18 07Nov2006 Page 1

Trancode	Tran Count	Avg InputQ Time	Avg Process Time	Avg OutputQ Time	Avg Total IMS Time	<=1.0 Total IMS Time	1.0-2.0 Total IMS Time	>2.0 Total IMS Time	Avg CPU Time	Avg DB Call Count
DSN8CS	7	0.011024	0.930524	0.000000	0.941549	71.43%	0.00%	28.57%	0.024617	0
DSN8PP	7	0.009017	0.627191	0.000000	0.636208	85.71%	14.29%	0.00%	0.018776	0
DSN8PS	21	0.011219	0.427845	0.007012	0.446075	100.00%	0.00%	0.00%	0.017876	0
DSN8PT	6	0.010506	0.373590	0.035327	0.419423	100.00%	0.00%	0.00%	0.018377	0
Total	41	0.010705	0.539763	0.008761	0.559229	92.68%	2.44%	4.88%	0.019254	0

Daily report flags that 28% of DSN8CS transaction were above the 2 second SLA

IMS PA Forms-based list report

This form lists all the transactions that ran on the day

```
 IMS Performance Analyzer
                                  Transaction Transit Log

                             Data from 05.30.49 07Nov2006                    Page      1

Org                  DB Call IMS Tran                  CPU     InputQ  Process  OutputQ     Total
LTERM     Trancode     Count Start                     Time      Time     Time     Time IMS Time
. . .
FUNTRM69 DSN8PT            0 05.39.50.738060 0.023359  0.007564 0.199647 0.121131 0.328342
FUNTRM69 DSN8PS            0 05.43.38.400003 0.014557  0.020709 0.287724 0.000000 0.308433
FUNTRM69 DSN8CS            0 05.44.52.678102 0.046589  0.013049 2.037216 0.000000 2.050265
. . .
```

We can see an offending transaction from the approximate time of day

Note: IMS PA accounting index simplifies identifying this kind of information in IMS PI

Gather the data required for the analysis

- **Transaction DSN8CS uses DB2, which may be the cause of the problem**
- **We need to gather the IMS log, DB2 log and SMF file for time period around when the problem occurred**
- **IMS PI will merge all the log records and allow us to track the transaction across all these log files**

This is a DB2 start of UOR: uniquely identifying the transaction so that we can use DB2 analytical tools should they be required

This is an SMF accounting record. It shows high page fetch and update activity, as well as high CPU usage

The IMS log termination event shows that most of the CPU time was spent in DB2

```
    Forwards / Backwards . . 00.00.00.000100    Time of Day . . 05.44.52.678102
    Code Description                 Date 2006-11-07 Tuesday    Time (Elapsed)
/   ---- ------------------------------------------------------- ---------------
E   01   Input Message TranCode=DSN8CS                           05.44.52.678102
    35   Input Message Enqueue TranCode=DSN8CS                          0.007919
    08   Application Start TranCode=DSN8CS Region=0001                  0.000807
    5607 Start of UOR Program=DSN8IC0 Region=0001                       0.000000
    31   DLI GU TranCode=DSN8CS Region=0001                             0.004315
    5616 Start of protected UOW Region=0001                             0.000262
    5600 Sign-on to ESAF Region=0001 SSID=DB2P                          0.165798
    5600 Thread created for ESAF SSID=DB2P                              0.000041
    ------------------------------------------------------------------------------
    0020 DB2 Unit of Recovery Control - Begin UR                        1.651871
         Userid=MKR IMSID=I9DE LUW=FTS1    /DB2PLU  /BFAAB47AF91B/0001
         URID=0003EC74CC34
    ------------------------------------------------------------------------------
    0020 DB2 Exclusive Lock on Pageset Partition or DBD                 0.000016
    0020 DB2 Insert into a Data Page                                    0.000000
    0020 DB2 Update Area Map/Spacemap Bit Changes or Whole Byte         0.000032
    0020 DB2 Type 2 Index Update                                        0.001952
    5600 Commit Prepare starting Region=0001 SSID=DB2P                  0.009863
    0020 DB2 Unit of Recovery Control - End Commit Phase 1              0.014200
    03   Output Message Response LTerm=FUNTRM69                         0.004067
    …
    36   Output Message Dequeue LTerm=FUNTRM69                          0.034227
    33   Free Message                                                   0.001001
    ------------------------------------------------------------------------------
    101  DB2 Accounting                                                 0.132925
         RecToken=I9DE/0000001900000000
         CPU1=00.030586 CPU2=00.000000 I/O3=00.000000 SSID=DB2P SYSID=FTS1
         GtPgRq=152 SyPgUp=11 Suspnd=0 DeadLk=0 TimOut=0 MxPgLk=6
         Des=0 Pre=0 Ope=1 Fet=12 Clo=1
    ------------------------------------------------------------------------------
    33   Free Message                                                   0.002256
    0020 DB2 Unit of Recovery Control - Begin Commit Phase 2            0.000127
    0020 DB2 Unit of Recovery Control - End Commit Phase 2              0.002016
    5600 Commit Continue completed Region=0001 SSID=DB2P                0.003950
    5612 End of Phase 2 Syncpoint Program=DSN8IC0                       0.000008
    ------------------------------------------------------------------------------
    07   Application Terminate                                          0.000529
         UTC=05.44.54.728881 TranCode=DSN8CS Program=DSN8IC0 Region=0001
         RecToken=I9DE/0000001900000000
         RegTyp=MPP MCNT=1 DBDLI=0 DCDLI=2 CPU=00.046589
    ------------------------------------------------------------------------------
```

WebSphere MQ problems

- **The process is similar for WebSphere MQ problems**

IMS, MQ, and DB2 transaction

Large number of MQ calls may be the cause of the problem

```
    01   Input Message TranCode=MQATREQ1                          09.49.26.679852
__  35   Input Message Enqueue TranCode=MQATREQ1                        +0.000023
__  31   DLI GU TranCode=MQATREQ1 Region=0001                        +0.000137
__  5E   SB Handler requests Image Capture Region=0001              +0.000262
__  50   Database Update Database=DI21PART Region=0001              +0.000643
__  50   Database Update Database=DI21PART Region=0001              +0.000720
__  50   Database Update Database=DI21PART Region=0001              +0.000771
__  5600 Sign-on to ESAF Region=0001 SSID=DB3A                      +0.001604
__  0020 DB2 Unit of Recovery Control - Begin UR                    +0.023043
__  0020 DB2 Update In-Place in a Data Page                         +0.023059
__  0010 DB2 Savepoint                                              +0.023347
__  0020 DB2 Delete from a Data Page                                +0.023459
__  0020 DB2 Insert into a Data Page                                +0.023683
__  5600 Sign-on to ESAF Region=0001 SSID=CSQ6                      +0.145085
__  0002 MQ Get Region=0001                                         +0.145870
__  0006 MQ Commit Phase 1 Region=0001                              +0.145870
__  0007 MQ Commit Phase 2 Region=0001                              +0.145870
__  0002 MQ Get Region=0001                                         +0.148405
__  0007 MQ Commit Phase 2 Region=0001                              +0.154640
__  0002 MQ Get Region=0001                                         +0.156635

[Multiple additional MQ calls]

 ------------------------------------------------------------------------
    07   Application Terminate                                      +1.073791
         UTC=10.37.00.753639 TranCode=MQATREQ1 Program=MQATPGM Region=0001
         RecToken=IADG/0000000700000005
         RegTyp=MPP MCNT=5 DBDLI=10 DCDLI=10 CPU=00.129896
------------------------------------------------------------------------
    74   WebSphere MQ Accounting Class 3                            +1.230147
         Program=MQATPGM Userid=FUNTRM78 Region=0001
         RecToken=IADG/0000000700000004 UOWType=IMS SSID=CSQ6 SYSID=FTS3
         COMMIT=(Count=0 Elapsed=00.000000 CPU=00.000000)
         Calls=(Count=2 Elapsed=00.000042 CPU=00.000041)
    ------------------------------------------------------------------------
    74   WebSphere MQ Accounting Class 1                            +1.230147
         Program=MQATPGM Region=0001 RecToken=IADG/0000000700000004
         UOWType=IMS CPU=00.000158 Puts=0 Gets=0 SSID=CSQ6 SYSID=FTS3
    ------------------------------------------------------------------------
```

Summary: Significance of the new features

- **New features position PA and PI at the center of problem determination and optimization. You can:**
  - Rapidly isolate problems and bottlenecks across: IMS Connect, OTMA, shared queues, IMS DB, WebSphere MQ, DB2, and IMS TM
  - Eliminate IMS as a source of performance problems
  - Enable less experienced staff to perform advanced analysis
  - Map the life-cycle of individual transactions to gain a better understanding of the IMS environment and to preemptively eliminate problems

More information

- **IBM DB2 and IMS Tools website:**

  http://www.ibm.com/software/data/db2imstools/

- **Feel free to contact Jim Martin (Fundi Software) for more information, including pre-sales assistance:**

  Jim_Martin@fundi.com.au