# Virtual IMS Users Group

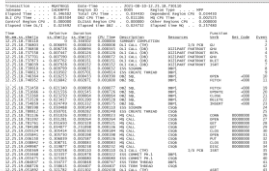## Simplifying IMS performance problem identification and determination

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IBM

# IMS Performance tools: Integration and modernization

❑ IMS Performance Solution Pack:

1. IMS Performance Analyzer: Log batch reporting

2. IMS Problem Investigator: Deep-dive log analysis

3. IMS Connect Extensions: Operations and monitoring

❑ IBM Transaction Analysis Workbench: Cross-subsystem deep-dive, plus log forwarding to analytics platforms (AIOPs)

❑ IBM OMEGAMON for IMS: Monitoring, Application Trace, Open Data (AIOPs)

Batch reporting

Investigation

Operational Analytics

splunk>

elastic

kafka

# IMS Connect and TM: Complete coverage

**Time in IMS Connect and Transaction Manager**

| IMS Connect | In | Today we will use the tools mentioned here to identify and diagnose problems in your IMS-TM-DB+Db2 transaction environment. Then we will see how simple it is to use analytics to visualize problems and monitor ongoing operations. | Out |

IMS

Input Queue

Dependent region

| Application processing | Syncpoint |

DLI   Db2   MQ

**OMEGAMON for IMS ATF**

**IMS Performance Analyzer**

**IMS Connect Extensions** with **IMS Performance Analyzer** and **Problem Investigator (**or **Transaction Analysis Workbench)**

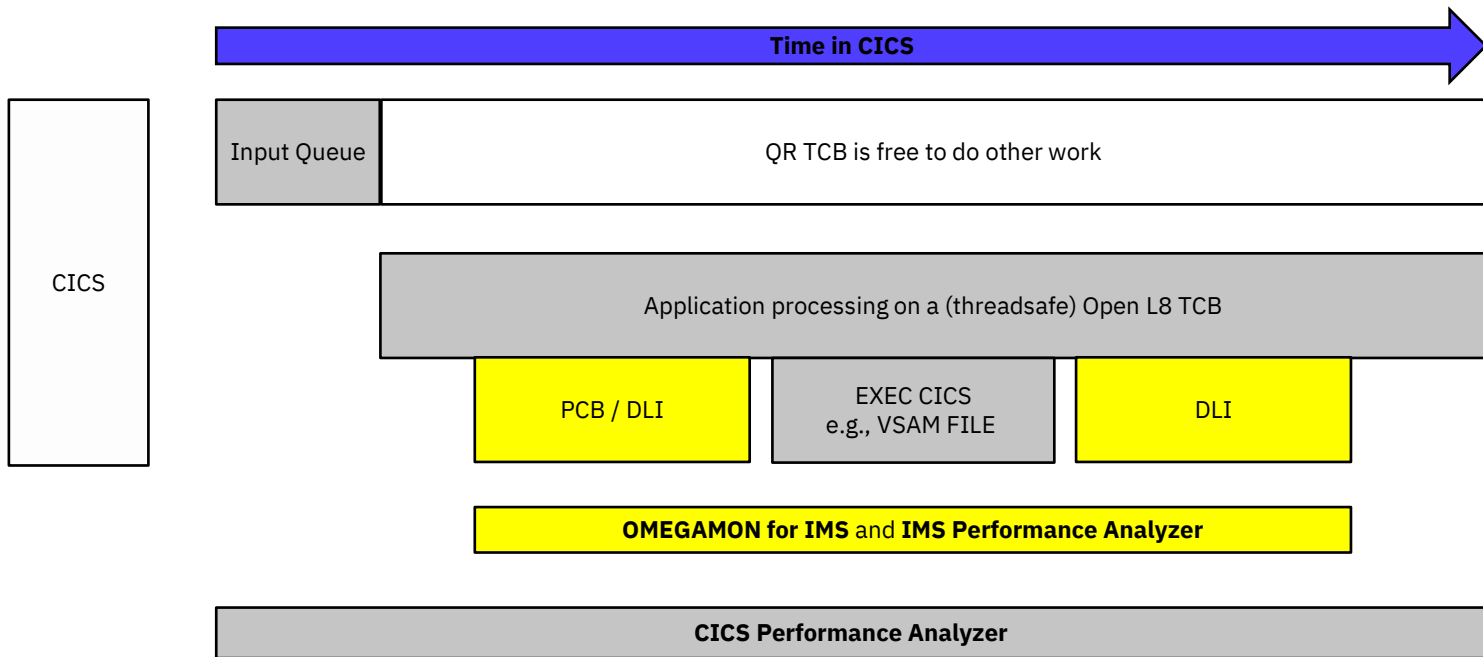Rocket software

# CICS-DBCTL: Complete coverage

The tools and techniques used to visualize and diagnose problems in IMS-TM apply also to CICS-DBCTL. First use [CICS Performance Analyzer](#) to identify the performance bottlenecks and problems in your CICS transaction environment.

**Time in CICS** →

**CICS**

| Input Queue | QR TCB is free to do other work |
| --- | --- |

Application processing on a (threadsafe) Open L8 TCB

| PCB / DLI | EXEC CICS e.g., VSAM FILE | DLI |
| --- | --- | --- |

**OMEGAMON for IMS** and **IMS Performance Analyzer**

**CICS Performance Analyzer**

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# IMS PA form-based reporting

Powerful and flexible alternative to fixed format reports – ask a question and get an answer

```
 File  Edit  Options  Help

EDIT                Summary Report Form - CPUHEAVY    Row 1 of 8  More: < >
Command ===> _____   Scroll ===> CSR

Description . . . CPU heavy hitters                 Page Width . . . 132
                                                   Precision  . . . 6
                                                   Digit Grouping  SEC
   Field    Sort              _____ Range _____
 / Name +   K O Func  Len  From +      To         Report
 __ PROGRAM K A         8  ____        ____       ____
 __ TRANCNT            10  ____        ____       ____
 __ CPUTIME    D TOTAL  8  ____        ____       ____
 __ CPUTIME      AVE    8  ____        ____       ____
 __ CPUTIME      RANGE  8  >0.2 Not good          PERCENT  Seconds
 __ CPUTIME      RANGE  8  >0.5 Bad               PERCENT  Seconds
 __ CPUTIME      RANGE  8  >2.0 Ugly!             PERCENT  Seconds
 __ EOR
 *********************** Bottom of data *************************** ******
```

Features:
- Individual transactions or summarization
- Important information always at the top
- Five statistical functions
- Service levels
- View in SDSF, Db2 or spreadsheet, analytics
- 100's of samples provided

Sample use cases:
- Programs – highest CPU consumers
- Databases – most I/O activity
- Regions – over and under utilized

### CPU heavy hitters

| Program | Tran Count | Tot CPU Time | Avg CPU Time | >0.2 CPU Time | >0.5 CPU Time | >2.0 CPU Time | Max CPU Time | Avg Process Time | >1.0 Process Time | >2.0 Process Time | Max Process Time |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BANKING | 143 | 66.22499 | 0.476439 | 43.88% | 20.14% | 0.00% | 1.758429 | 6.405757 | 32.17% | 27.97% | 187.6067 |
| FINANCE | 19 | 54.28877 | 2.857303 | 73.68% | 63.16% | 42.11% | 11.19808 | 10.10058 | 100.00% | 94.74% | 59.88424 |
| MOBILE | 16,132 | 35.17463 | 0.002180 | 0.00% | 0.00% | 0.00% | 0.014006 | 0.023198 | 0.00% | 0.00% | 0.519829 |
| ONLINE | 12 | 28.91666 | 2.628787 | 100.00% | 100.00% | 100.00% | 5.865392 | 25.13817 | 100.00% | 100.00% | 104.9229 |
| ORDERS | 77 | 21.79370 | 0.283035 | 90.91% | 0.00% | 0.00% | 0.313683 | 0.791294 | 22.08% | 10.39% | 5.615369 |
| INVENTRY | 70 | 17.12364 | 0.244623 | 7.14% | 5.71% | 2.86% | 7.029314 | 1.332807 | 35.71% | 7.14% | 20.97937 |
| CUSTOMER | 2,219 | 15.33635 | 0.006911 | 0.00% | 0.00% | 0.00% | 0.022029 | 0.063811 | 0.00% | 0.00% | 0.749206 |
| STOCK | 68 | 13.95261 | 0.205185 | 50.00% | 1.47% | 1.47% | 2.677944 | 2.321356 | 55.88% | 30.88% | 49.71441 |
| . | | | | | | | | | | | |
| . | | | | | | | | | | | |
| . | | | | | | | | | | | |
| Total | 44,290 | 438.5006 | 0.010333 | 0.59% | 0.19% | 0.08% | 12.05804 | 0.819255 | 5.92% | 0.50% | 3673.108 |

# IMS Transaction Index

The IMS Transaction Index is a specialized extract file created by IMS Performance Analyzer batch reporting.

Each record in the index represents an IMS transaction, containing the cumulative information from the IMS log about that transaction.

```
CA01  IMS Transaction                               11.07.11.055772
      TranCode=CEXRTRN1 Program=CEXRPGM1 Userid=IPI2 LTerm=IPI2
      Terminal=VAPIPI2B Region=0005 OrgUOWID=IFDE/D9869846E6C3AC47 SSID=DEMO
      IMSRel=152 RecToken=IFDE/0000003900000000
      CPU=0.014642 InputQ=0.001599 Process=0.442307
      TotalTm=0.443906 RegTyp=MPP DBCalls=88 FPCalls=3
```

Can be used for a variety of purposes:

1.  In IMS PA as log input when the SLDS to too large to reprocess, or no longer exists

2.  In IMS PI or TAW to make for quickly locating your problem transaction

3.  In TAW to stream transaction information to an analytics platform

Tip: The OMEGAMON ATF transaction summary records written to the log are a good substitute

# Transaction Analysis Workbench

Display is filtered to show IMS x'CA01' Transaction Index records with excessive processing times.

Enter TX to show records related to a transaction.

Like IMS Problem Investigator, plus:
- Cross-subsystem analysis into Db2, CICS, MQ, SMF, SYSLOG etc.
- Log forwarding of log records in CSV or JSON format to your analytics platform e.g., Splunk

```
BROWSE      FUW000.QADATA.FBOSP007.IMS.D131008.INDEX    Record 00000201 More: < >
Command ===> _____      Scroll ===> CSR
            Navigate < 00.00.01.000000 >        Date/Time 2021-10-05 17.10.09.284086
/  ─── Filtering ──────────────────────          Tuesday 2021-10-05 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
       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
       RecToken=IDDG/0000000600000000
       CPU=11.512388 InputQ=0.000354 Process=18.105197 OutputQ=0.000039
       TotalTm=18.105590 RegTyp=MPP
  ─────────────────────────────────────────────────────────────────────────────
```

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# Tracking the transaction across subsystems

1. Start tracking a transaction (here, an IMS transaction).

2. See the transaction lifecycle 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.

```
BROWSE      FUW000.QADATA.FBOSP007.IMS.D131008.INDEX      Record 00000201 More: < >
Command ===>                                                    Scroll ===> CSR
          Navigate < 00.00.01.000000 >        Date/Time 2021-10-05 17.10.09.284086
 /. — Tracking                                    Tuesday 2021-10-05 Time (Elapsed)
 E  CA01 IMS Transaction TranCode=FBOIAT41 Region=0002                  0.000000
 __ 01   Input Message TranCode=FBOIAT41                                0.000000
 __ 35   Input Message Enqueue TranCode=FBOIAT41                        0.000023
 __ 08   Application Start TranCode=FBOIAT41 Region=0002                0.000256
 __ 5607 Start of UOR Program=FBOIAP41 Region=0002                      0.000000
 __ 31   DLI GU TranCode=FBOIAT41 Region=0002                           0.000022
 __ 5616 Start of protected UOW Region=0002                             0.000189
 __ 5600 Sign-on to ESAF Region=0002                                    0.005896
 __ 5600 Thread created for ESAF                                        0.000012
 __ 112  Thread allocate FBOIAP41                        DBA6           0.000572
 __ 073  Create thread end                              DBA6           0.000068
 __ 177  Package allocation FBOIAP41                     DBA6           0.000227
 __ 233  SP entry FBOSP007                    STMT=001031 DBA6          0.000234
 __ 380  SP entry FBOSP007                    STMT=001031 DBA6          0.000023
 __ 177  Package allocation FBOSP007                     DBA6           0.000184
 __ 061  SQL UPDATE                           STMT=000001 DBA6          0.000141
 __ 0020 Begin UR                                                       0.001034
 __ 0600 Savepoint                                                      0.000000
 __ 0600 Update in-place in a data page                                 0.000000
 __ 058  SQL UPDATE                   SQLCODE=0 STMT=000001 DBA6         0.000338
 __ 065  SQL OPEN C1                            STMT=000001 DBA6         0.000090
 __ 058  SQL OPEN                     SQLCODE=0 STMT=000001 DBA6         0.000021
 __ 499  SP statement execution detail                   DBA6           0.000039
 __ 233  SP exit  FBOSP007            SQLCODE=0 STMT=001031 DBA6         0.000016
 __ 380  SP exit  FBOSP007            SQLCODE=0 STMT=001031 DBA6         0.000012
 __ 053  SQL request              SQLCODE=466 STMT=001031 DBA6          0.000083
 __ 053  SQL request                SQLCODE=0 STMT=001082 DBA6          0.000824
 __ 053  SQL request                SQLCODE=0 STMT=001085 DBA6          0.000119
 __ 059  SQL FETCH C1                           STMT=001090 DBA6         0.000107
 __ 0600 Savepoint           Coverage:                                  1.437546
 __ 0600 Savepoint            • IMSPI                                    0.257680
 __ 0600 Savepoint            • TAW                                     1.059456
```

# OMEGAMON for IMS ATF: IMS PA report

```
Transaction  . . . . WEBORDER    Date-Time  . . . . . 2021-08-10-12.25.18.730110
Jobname  . . . . . . IMSPROD1    Region ID  . . . . . 0005       Region Type  . . . . MPP
Elapsed Time . . . . 0.346502    Total CPU Time . . . 0.034430   Dependent Region CPU  0.034430
DLI CPU Time . . . . 0.003504    DB2 CPU Time . . . . 0.011106   MQ CPU Time  . . . . 0.002525
Control Region CPU . 0.000000    DLISAS Region CPU  . 0.000000   Other Regions CPU  . 0.000000
Elapsed time DL/I  . 0.023492    Elapsed time DB2 . . 0.024732   Elapsed time MQ  . . 0.257480
```

```
Time                 Relative   Duration                                            Function
hh.mm.ss.thmiju      ss.thmiju  ss.thmiju  CPU Time  Description       Resources      Verb      Ret Code    Event
12.25.18.730110              0  0.346502   0.000000  SUMMARY COMPLETION                                        1
12.25.18.736803  +   0.006693  0.000010   0.000008  DLI CALL (TM)               I/O PCB  GU                   2
12.25.18.736838  +   0.006728  0.000694   0.000345  DLI CALL (DB)     DI21PART PARTROOT  GHU                  3
12.25.18.737558  +   0.007447  0.000126   0.000126  DLI CALL (DB)     DI21PART PARTROOT  REPL                 4
12.25.18.737701  +   0.007590  0.000155   0.000072  DLI CALL (DB)     DI21PART PARTROOT  GHU                  5
12.25.18.737873  +   0.007762  0.000151   0.000151  DLI CALL (DB)     DI21PART PARTROOT  DLET                 6
12.25.18.738039  +   0.007928  0.000152   0.000152  DLI CALL (DB)     DI21PART PARTROOT  ISRT                 7
12.25.18.739910  +   0.009799  0.000651   0.000632  ESS SIGNON        DBP1                                    8
12.25.18.740613  +   0.010502  0.005701   0.004914  ESS CREATE THREAD DBP1                                    9
12.25.18.746364  +   0.016253  0.000433   0.000390  DB2 SQL           DBP1            OPEN        +000        10
12.25.18.746952  +   0.016842  0.002871   0.001600  DB2 SQL           DBP1            FETCH       +000        11
. . . .
12.25.18.751450  +   0.021340  0.000098   0.000077  DB2 SQL           DBP1            FETCH       +000        19
12.25.18.751666  +   0.021556  0.001545   0.000726  DB2 SQL           DBP1            UPDATE      +000        20
12.25.18.753360  +   0.023250  0.000064   0.000064  DB2 SQL           DBP1            CLOSE       +000        21
12.25.18.753528  +   0.023417  0.001190   0.000528  DB2 SQL           DBP1            DELETE      +000        22
12.25.18.754859  +   0.024749  0.001332   0.000575  DB2 SQL           DBP1            INSERT      +000        23
12.25.18.780598  +   0.050488  0.000149   0.000110  ESS SIGNON        CSQ6                                    24
12.25.18.780812  +   0.050701  0.000282   0.000248  ESS CREATE THREAD CSQ6                                    25
12.25.18.781136  +   0.051026  0.000023   0.000023  MQ CALL           CSQ6            CONN        00000000    26
12.25.18.781392  +   0.051281  0.000264   0.000264  MQ CALL           CSQ6            OPEN        00000000    27
12.25.18.781761  +   0.051650  0.002328   0.000521  MQ CALL           CSQ6            GET         00000000    28
12.25.18.784188  +   0.054077  0.251098   0.000136  MQ CALL           CSQ6            GET         00000002    29
12.25.19.035524  +   0.305414  0.000230   0.000184  MQ CALL           CSQ6            CLOS        00000000    30
```

SSA, KFBA, and IO area also available

- Three reporting levels show increasing levels of trace detail – refer to the docs for OMEGAMON and IMSPA

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# AIOPs for IMS: Live feed and log forwarding

## Live feed (near real-time)

- All OMEGAMON agents including IMS can use the OMEGAMON Data Provider to live-feed attribute groups – transaction workload and resource usage metrics that are cut at regular intervals. Elastic dashboards in GitHub

- IMS Connect Extensions can be used to live feed IMS Connect transaction details, providing an enterprise view of the performance of IMS Connect, datastores and transactions. Splunk dashboards in Splunkbase

## Log forwarding (in batch)

- IBM Transaction Analysis Workbench (TAW) can forward all IMS related logs via a batch job – the IMS log, OMEGAMON ATF, and selected SMF for CICS, Db2, and z/OS are also supported. Elastic dashboards in Dockerhub

- IMS Problem Investigator can create CSVs for log and OMEGAMON data. Ask Tracy about the upgrade path to TAW

- IMS Performance Analyzer can create CSVs for most of its reporting. In plan are Elastic dashboards for form-based transaction performance reports, currently available resource usage (IRUR)

## Enterprise level

- Z Common Data Provider (CDP), now part of IBM Z Operational Log and Data Analytics, provides near real-time operational analytics covering all aspects of your enterprise; by streaming system logs including SMF and SYSLOG

- IBM zWIC and zWIN combine to provide visibility into interdependencies across z/OS workloads. Correlating system wide activity every few seconds can assist in problem determination

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# AIOPs for IMS : Operational Analytics done two ways

**1. Historical problem determination**

**Application performance problem**

**2. Near-real-time monitoring**

**IMS and system log reporting:**

✓ *IMS Performance Analyzer*

✓ *Transaction Analysis Workbench*

**Advantages of visualization:**

1. Ideal for investigating problems that occurred one hour or one day ago

2. Can quickly identify the problem

3. Reduces the complexity of relying solely on batch and green-screen tools

4. Share the results with managers, application developers and colleagues

**Advantages of IMS (and CICS) tools:**

1. Supports most popular analytics platforms with minimal configuration
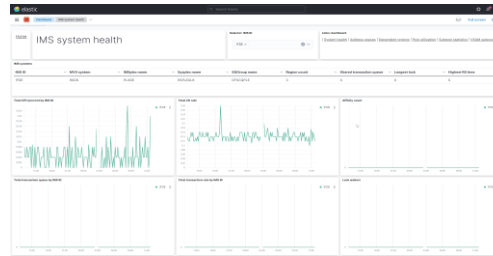


2. No prerequisites – every tool streams directly to the analytics platform

3. JSON format is friendly to work with and simple to change (add new metrics)

**IMS administration and monitoring:**

✓ *OMEGAMON suite* including *IMS*

✓ *IMS Connect Extensions*

**Advantages of visualization:**

1. IMS is contributing to a simple and concise enterprise-wide view – all of mainframe and distributed together

2. Ideal for ongoing system monitoring

3. Upwards trends and spikes can quickly identify an imminent problem

4. Application developers and managers get immediate feedback

5. Analytics tools such as Splunk and Elastic are probably commonplace and encouraged across your organization

6. Awareness and understanding of IMS will improve across your organization

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# OMEGAMON: Open Data Provider
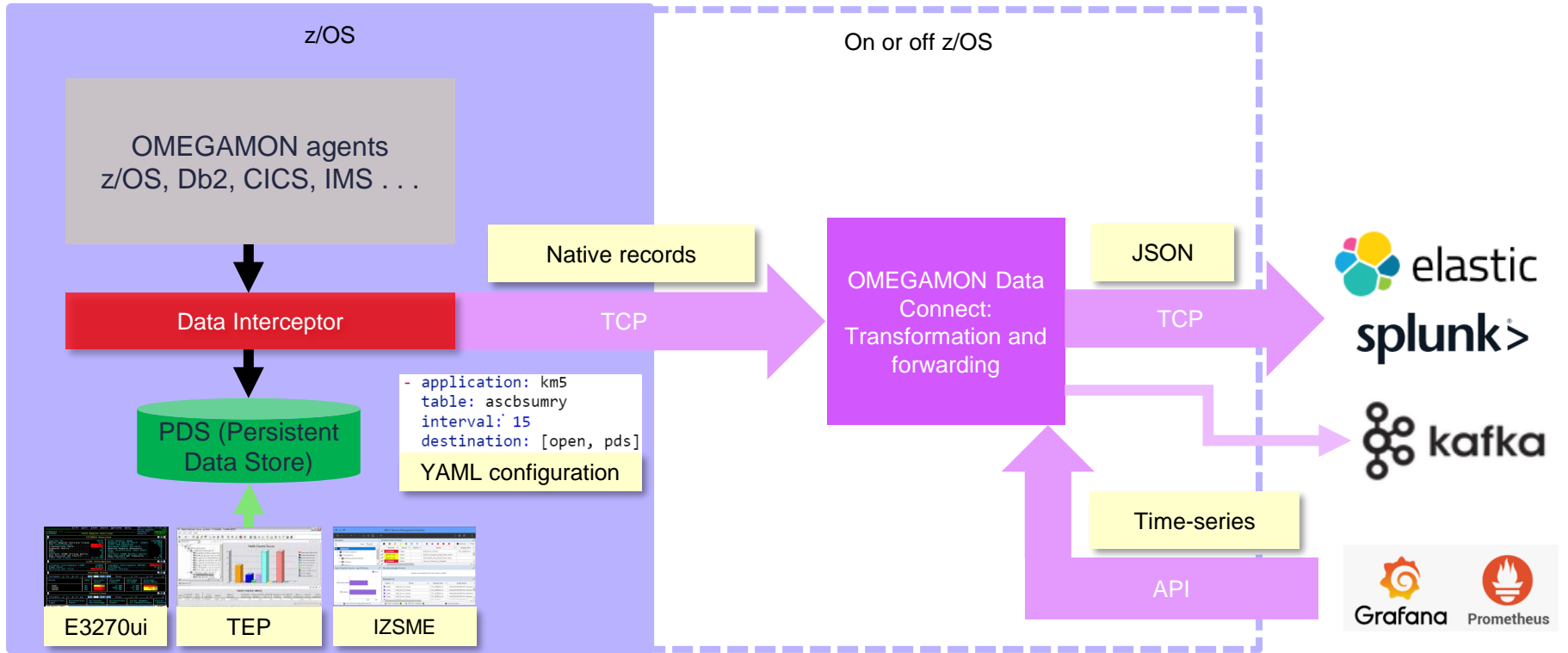
# OMEGAMON for IMS: Easy to roll your own

Payload is **JSON** with field names identical to the IBM OMEGAMON for IMS Docs

| Time ▼ | Document |
|---|---|
| Feb 25, 2022 @ 17:18:00.000 | @timestamp: Feb 25, 2022 @ 17:18:00.000  @version: 1 address_space_id: 49  common_page_in_rate: 0  common_page_ins: 2 cpu_percentage: 0.01  cpu_time: 160.52  excp_count: 0  excp_count_64: 0 excp_rate: 0.1  host: 10-244-3-105.connect.default.svc.cluster.local ims_id: IFD3  imsplex_name: PLXDV  interval_seconds: 60 |

IBM OMEGAMON for IMS on z/OS / 5.5.0 /                                      ✉ Feedback

## Address Spaces attributes

Use the Address Spaces attributes to view all address spaces associated with the monitored IMS subsystem.

**Address Space ID** The z/OS address space ID. Valid format is hexadecimal.

**Common Page-In Rate** Page-in rate of common area storage in pages per second for address space.

**Common Page-Ins** Page-in count of common area storage for address space.

**CPU Percentage** Percentage of CPU time consumed by this address space.

**CPU Time** Total amount of CPU time consumed by this address space.

**EXCP Count Extended Precision** The number of EXCPs that this address space runs.

**EXCP Rate** EXCP rate for this address space in EXCPs per second.

**IMS ID** The IMS Subsystem identifier. Valid format is a text string of up to 4 alphanumeric characters, for example, IMSA.

**IMSplex Name** The name of the IMSplex that this address space belongs to. If no name is indicated, the IMS is not a member of an IMSplex.

**Job Name** The job name of the subject IMS address space. Valid format is a text string of up to 8 alphanumeric characters.

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# OMEGAMON for IMS: System health

**IMS system health**
provides the individual IMS
subsystem view, showing:

- CPU and I/O
- Message queue
- Transaction processing rate
- Response time
- Locks
- Address space
- Dependent regions
- Buffer Pools
- Subpools

- Build your own charts
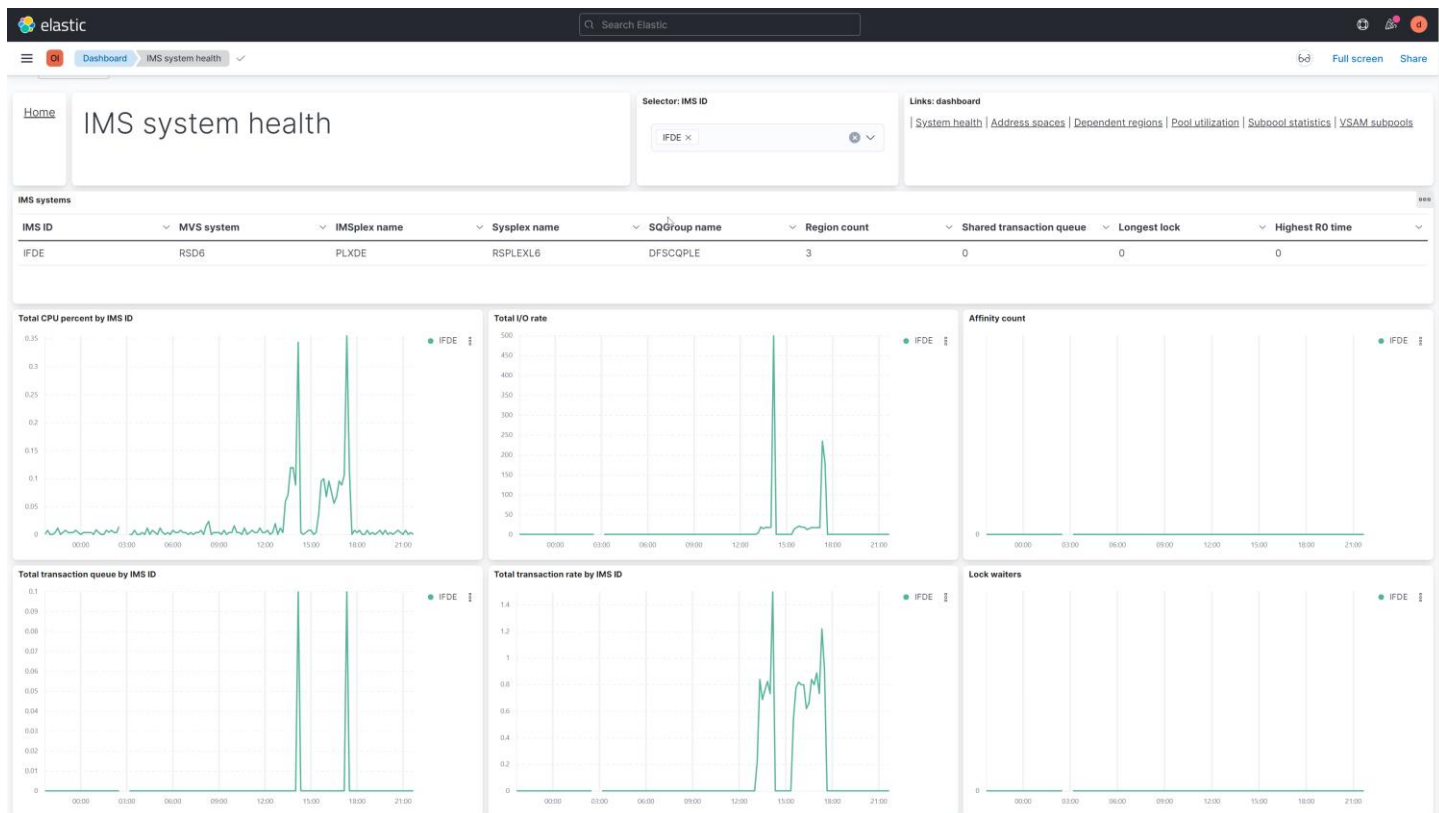
# IMS Performance Analyzer: IRUR

**Recent RFE:** The IMS PA Internal Resource Utilization Report (IMS log type 45 statistics) in an Elastic dashboard

# Transaction Analysis Workbench: Elastic Mashup

This dashboard of six charts provides an IMS and Db2 perspective of transaction (and thread) activity:

1. Identifies a problem in IMS transaction processing
2. Provides the Db2 perspective, identifying Db2 as the probable cause
3. Identifies the root cause in Db2

This dashboard is a **mashup** of IMS log and Db2 accounting (SMF 101) for our IMS-Db2 workload
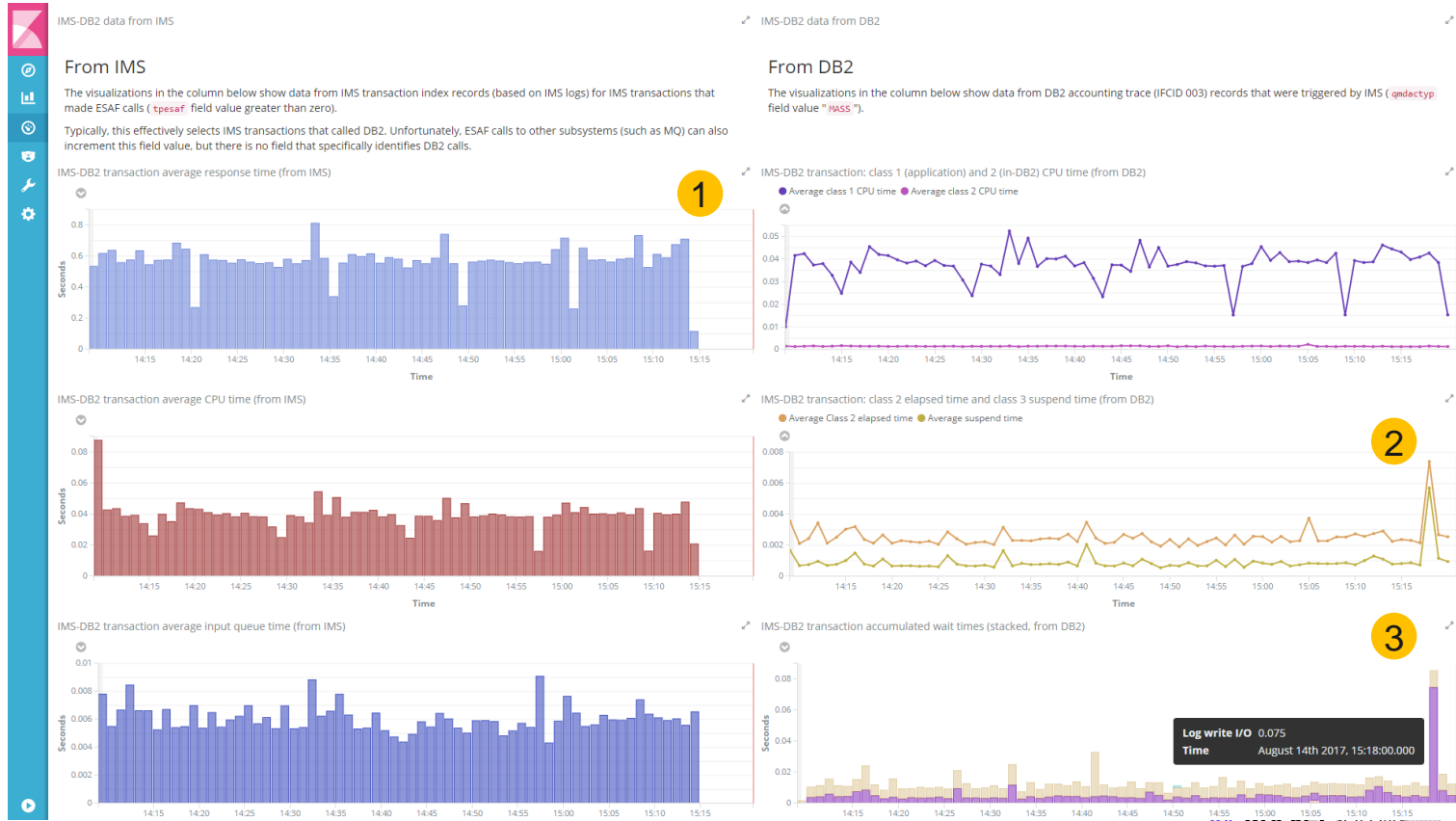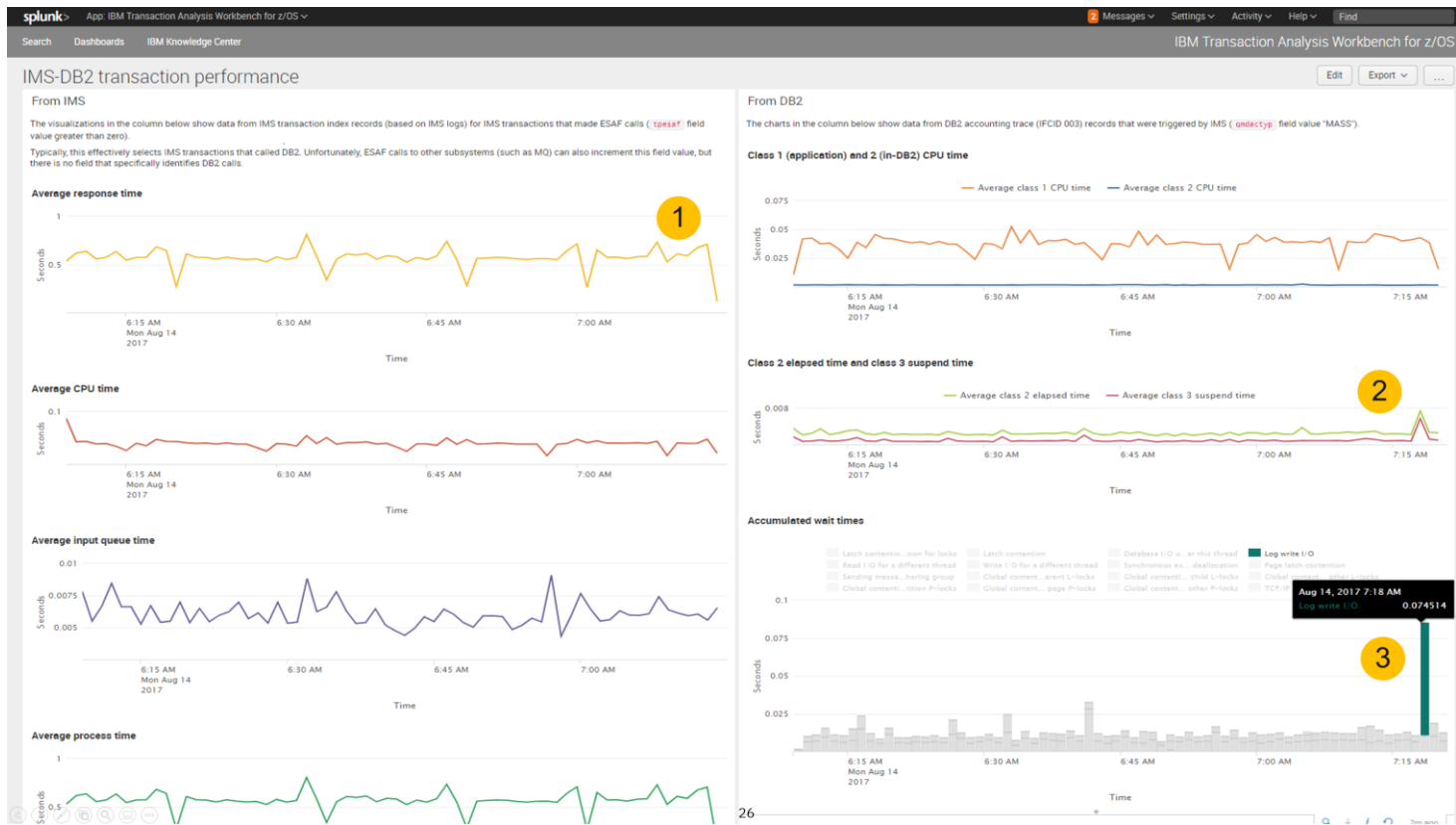
# OMEGAMON for IMS ATF

Transaction processing CPU and elapsed (response) time broken down into its components:

- IMS regions
- Application (code)
- DLI database
- Db2
- MQ

Filter results by:

- IMSplex
- Region
- Transaction Code

This dashboard does **not** require a **mashup** because OM-ATF provides IMS and Db2 metrics in a single record

# IMS Connect transaction activity

Use the **IMS Connect Extensions feed** to forward activity metrics to analytics platforms such as Splunk

- Distribution of workload across IMS Connect systems to IMS DATASTORE connections
- Transaction counts and response times
- Input, OTMA, and output elapsed times
- SAF elapsed time
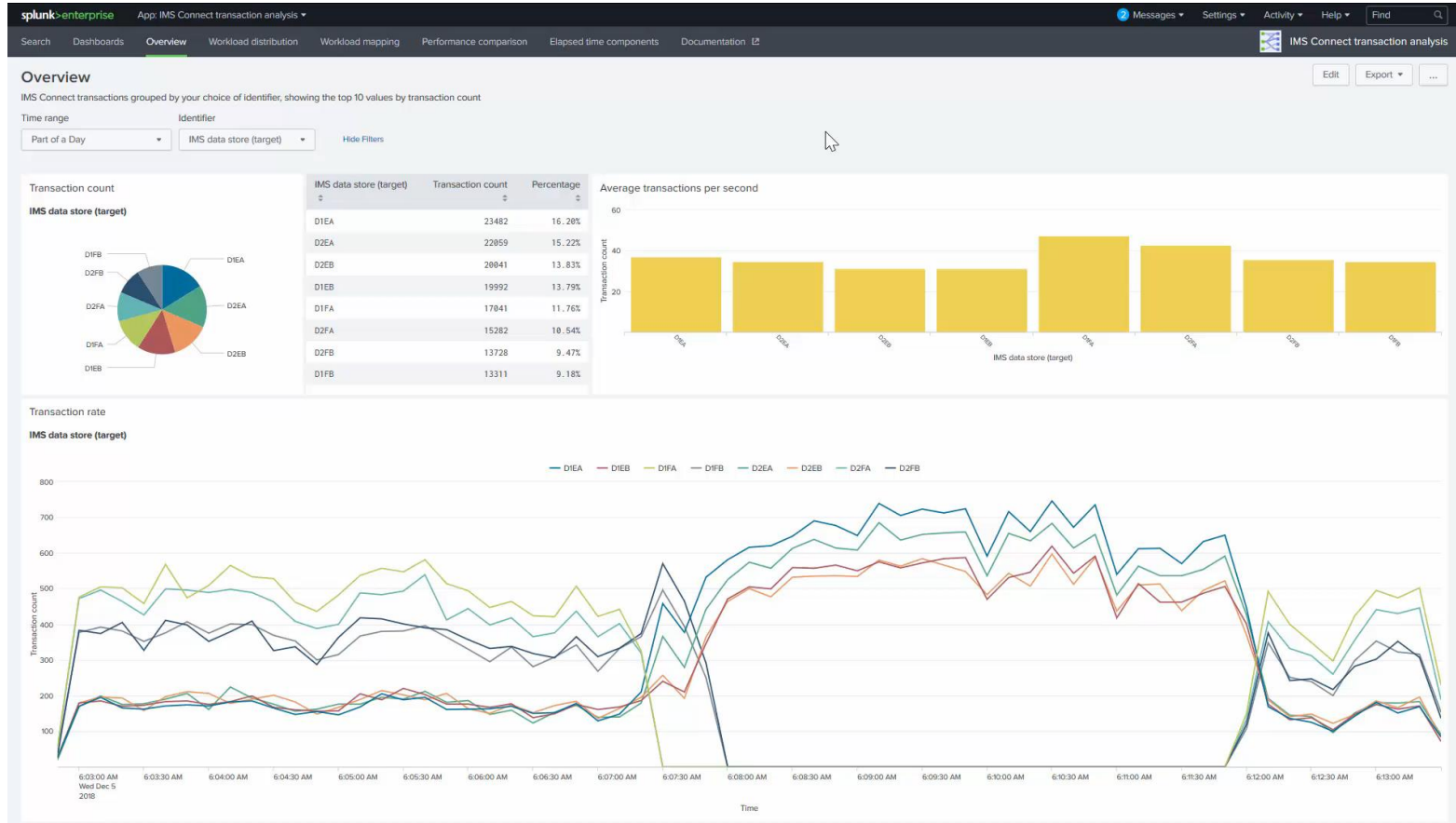
# CICS Performance Analyzer

CICS PA is the CICS companion to the IMS Performance Analyzer:

- ISPF dialog to request reports

- Batch reporting

- Splunk and Elastic dashboards

For all CICS workloads including IMS DBCTL and Db2, CICS PA is the best place to start – it can tell you whether there is a performance problem in CICS, IMS or Db2
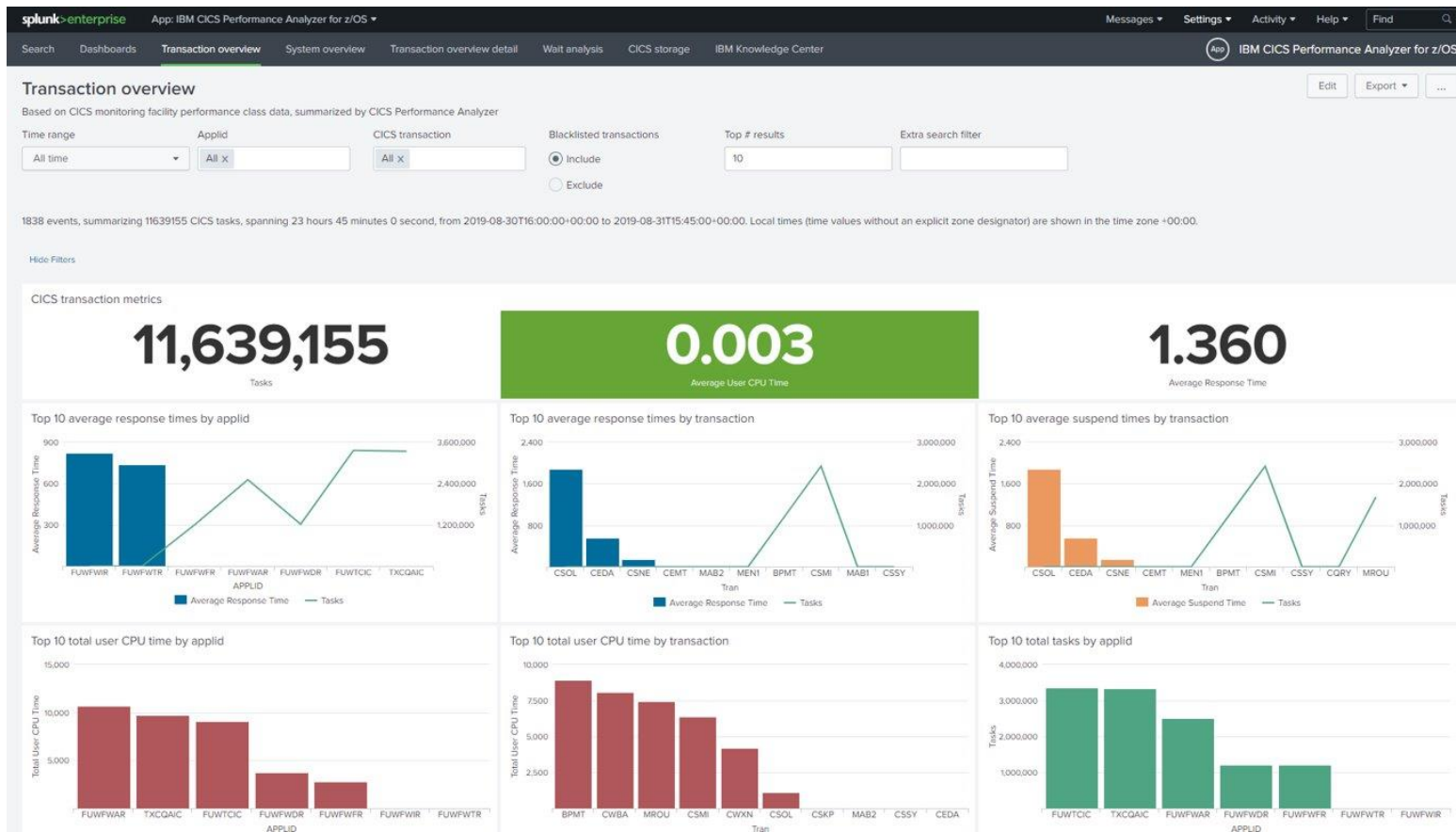
# Thank you

- **Summary**
- IMS performance tools can help you **modernize**
- Sending IMS performance metrics to your **analytics** platform of choice is easy
- IMS performance information is now available to everyone in your organization; including **managers** and **application developers** on and off the mainframe
- Don't use old fixed batch reports. Instead use [report forms](report forms) to ask questions of your data
- IBM [Transaction Analysis Workbench](Transaction Analysis Workbench) gives you the power of the IMS Problem Investigator, across all the subsystems. A pathway to upgrade from PI to TAW is available – please reach out to Tracy.

- **More information**
- If you would like more information about the three topics discussed today, then please contact Tracy Dean [tld1@us.ibm.com](mailto:tld1@us.ibm.com) or me James Martin [jamesm@rocketsoftware.com](mailto:jamesm@rocketsoftware.com) so we can arrange more targeted and in-depth sessions