Agenda for Thursday, May 31, sessions before lunch

	BEFORE COFFEE BREAK
3.12	CA MAT OVERVIEW, ROADMAP
3.12	BEST PRACTICES OF MEASURING COBOL/DB2 APPLICATION
3.12	USING ECLIPSE GUI TO RESOLVE PERFORMANCE PROBLEMS
	AFTER COFFEE BREAK
3.13	AUTOMATED PERFORMANCE MEASUREMENTS WITH MAT PMA
3.01	CA MAT INTEGRATION WITH MAINFRAME OPERATIONAL INTELLIGENCE
	LUNCH

CA Mainframe Application Tuner
Strategy and Roadmap

Ekaterina Tumanova, Petr Klomfar – 31.05.2018 – 3.12

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CA Mainframe Application Tuner

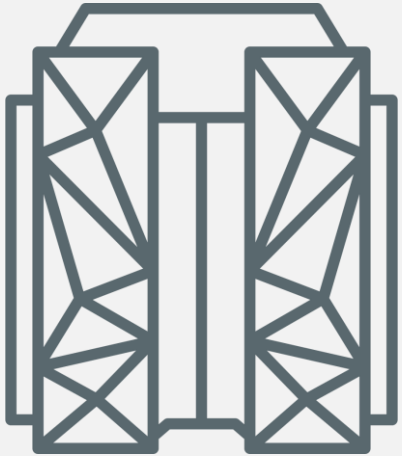
Why tune applications?

- Application tuning is the process of analyzing and adjusting the performance of an application with the goal of maximizing efficiency and effectiveness.
- By focusing on the major causes of delay associated with an application you can find the best solutions for your worst problems.

CA Mainframe Application Tuner

How is CA MAT Used?

CA MAT is used to improve the performance of applications by:



- Observing and sampling applications to identify high CPU usage, long wait times and slow transaction response times
- Providing data to identify the root causes of performance inefficiencies in z/OS based applications

Product Overview

Mainframe Application Tuner

Business Problems Addressed

- Identify performance opportunities in complex applications
- Help applications reduce CPU consumption and transaction response time
- Delay costly hardware upgrades
- Evaluate applications under development

Key Capabilities

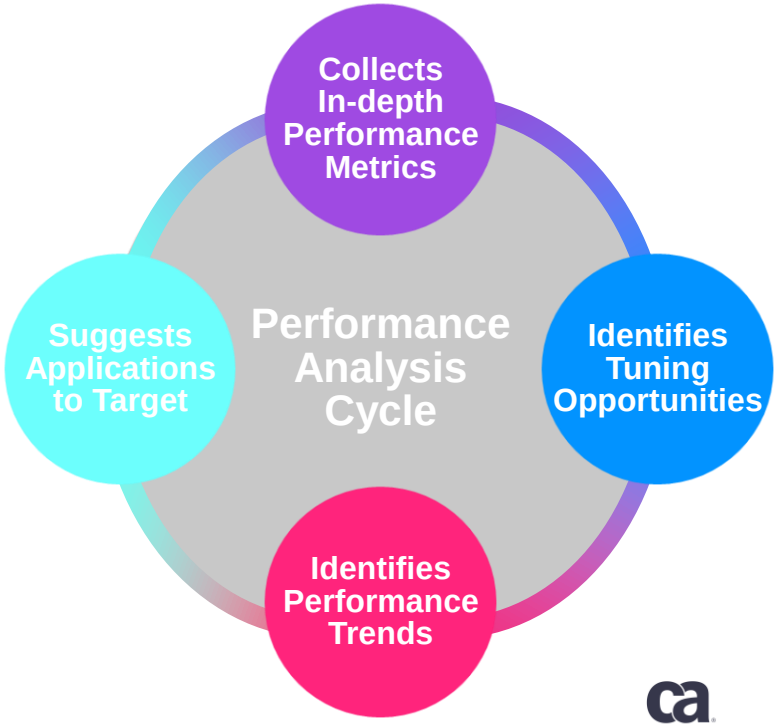
- Easily measure application performance
- Provide root cause analysis reporting
- Integration with CA SYSVIEW, CA Endevor, CA Mainframe Operational Intelligence (MOI)

Personas

- Performance Engineer
- Systems Programmer
- DBA
- Application Developer

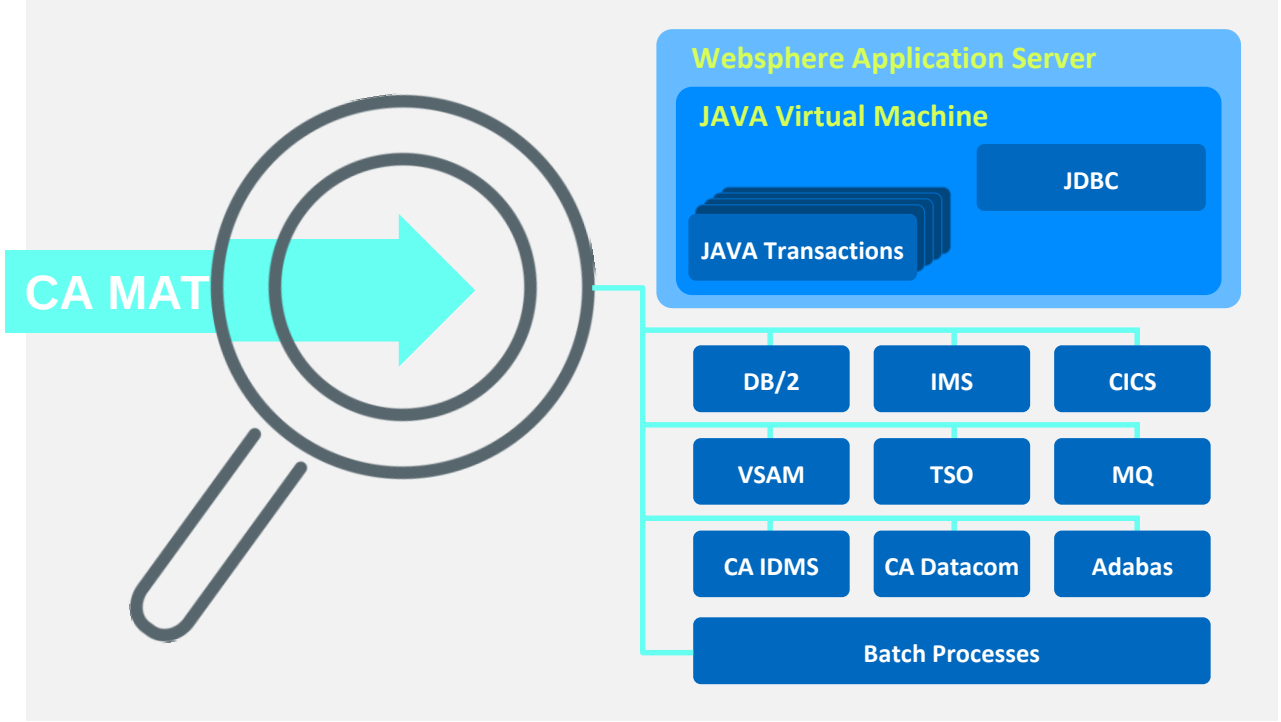
CA Mainframe Application Tuner
What Is CA MAT?

- CA MAT observes and samples program activity to show you the application view of performance.
- Detailed application-specific delay information is presented, allowing you to improve the performance of your application.
- From a single program monitoring session, CA MAT can answer questions for the application programmer, systems programmer, and database administrator. This ability saves time and reduces resources that are used in resolving program bottlenecks or delays.



CA Mainframe Application Tuner

Supports over 20 Sub-Systems and Languages

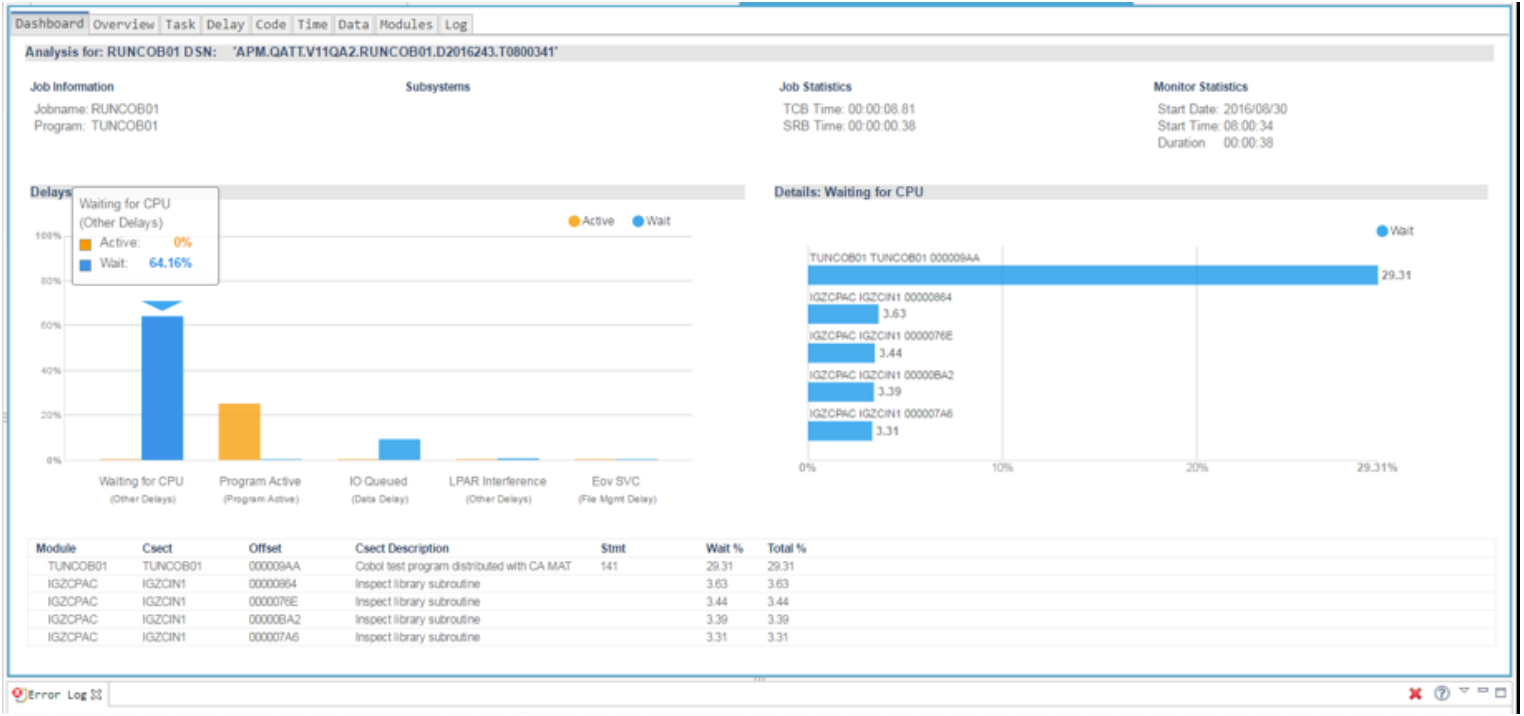


Supported Languages:

- COBOL
- PL/I
- Assembler
- C
- C++
- REXX
- CA Ideal™
- Natural

CA Mainframe Application Tuner

Multiple Interface Options



Technology and Product Architecture Goals

CA Endevor SCM

TECHNOLOGY GOALS

- Currency & exploitation – continuously provide support for all supported subsystems and languages
- Improve overall customer experience and ease of use by simplifying the install and GUI analysis reporting to encourage greater adoption by Application Developers
- Deliver customer requested enhancements

PRODUCT ARCHITECTURE GOALS

- Enhance current sampling methodology to provide maximum data to the users
- Simplify installation, deployment and configuration
- Provide the necessary artifacts and APIs for Integration with other CA solutions
- New functionality supplied with JAVA / Metal C coding
- Enhanced Eclipse UI
- Leverage common service integration opportunities
- Exploit z architectural components to improve TCO

Key capabilities in development/consideration

Massive enhancements in sampling architecture

#1 Complement sampling data with the data taken directly from CICS exits

#2 Explore new hardware capabilities to complement the sampling data

#3 Enhance the sampling methods

#4 Update the GUI to show the

Caller Stack

Currency

Stay on top of technology with

- Support of wide range of systems/subsystems and combinations

Explicit JAVA Support

Supporting Java on and off platform

- WAS Liberty support for
  - CICS
  - Batch
  - IMS
  - DB2
- Support of Java methods and classes
- Detailed garbage collection information
- Off-platform Java code traceability

PLEX support

Sampling of the transactions dispatched over

- IMS plex
- CICS plex
- DB2 plex

RESTful APIs

Provide new opportunities for automation and continuous testing with

- MAT RESTful APIs

Test automation changes

Stability and product quality with

- New MAT automated framework

GUI enhancements

Adding functional and usability enhancements to MAT web interface and Eclipse plugin

In Research/Preparation/Consideration | **In development**

Roadmap: CA Mainframe Application Tuner (MAT)

Timeline as of March 2018

	Delivered	Planned	Under Consideration
Product/ Releases	**CA MAT 11.0 & 12.0.0.1**	**CA MAT 12 INC 2 (12.0.0.2)**	**CA MAT Ongoing**

Marquee Features/ Business Value	• **VSAM RLS**
	• **DB2 IFI**
	• **DB2 Summarization Parameters**
	• **CICS data collection frequency**
	• **Caller ID Sys. modules->Appl. modules->LE Enhancement**
	• **Technical Currency:**
	  • MQ 9.0.1
	  • CA IDMS 19.0
	  • CA Datacom 15.0
	  • CA Ideal 15.0
	  • WAS 8.5
	  • CTS 5.4
	  • z/OS 2.3
	  • zNEXT (z14)
	  • IMS 15.1
	  • COBOL 6.2, PL1 5.2
	• **CA MAT/MOI Integration**
	• **RMODE 64 – 64b architecture exploitation**
		• **DB2 Explain on demand**
		• **WAS Liberty**
		  - Base support
		  - Liberty + CICS
		  - Liberty + IMS
		  - Liberty + DB2
		  - Liberty + batch mode
		• **MQ 9.0.4**
		• **ADABAS 8.4.3**
		• **Natural 8.2.7**
			• **CA MAT Caller ID, Caller Stack support for CICS**
			• **RESTful APIs for CA MAT**
			• **CICS PLEX**
			• **IMS PLEX**
			• **DB2 SHARED subsystems (DB2PLEX)**
			• **JAVA Agent Enhancements**
			• **DB2 intercept rework**
			• **Further enhancements to MOI integration**
			• **CTS 5.5 support**
			• **DB2 v13 support**

CA MAT Roadmap – Delivered

Feature	Description	Benefit
VSAM RLS	Dataset details in DataView is enhanced to include VSAM DS that use Record Lever Sharing (RLS)	Customers can now identify VSAM RLS data sets and report statistics in the same manner as for non-RLS VSAM data sets
DB2 IFI	Ideation / customer requested product enhancement. Utilization of DB2 Instrumentation facility and information about the SQL provided within IFCIDs	DB2 IFI provides an alternative to conventional collection of SQL data for DB2 applications using Intercept.
DB2 Summarization Parameters	To provide greater flexibility in DB2 measurements several parameters were moved from global definition in TUNSSP00 and they have been moved to individual monitor definitions.	Site specific settings for DB2 summarization parameters can be set in global parameters as well as individual
CICS Data Collection Frequency	Customer requested enhancement. The Summary statistic collection of CICS data has been to default of 0 (CICS collection was switched off)	Helps to eliminate the generation of specific SMF records by MAT and reduce CPU time used in the CICS region.
Caller ID Sys. modules-> Appl.modules ->LE Enhancement	Enhanced attribution of CallerID information for application modules (delivered in V11) and LE specifics (delivered in V12)	Ability to identify caller of the application and attribute the collected data to specific modules and statements within listing in order to provide more accurate delay attribution hence more accurate identification of tuning opportunity.

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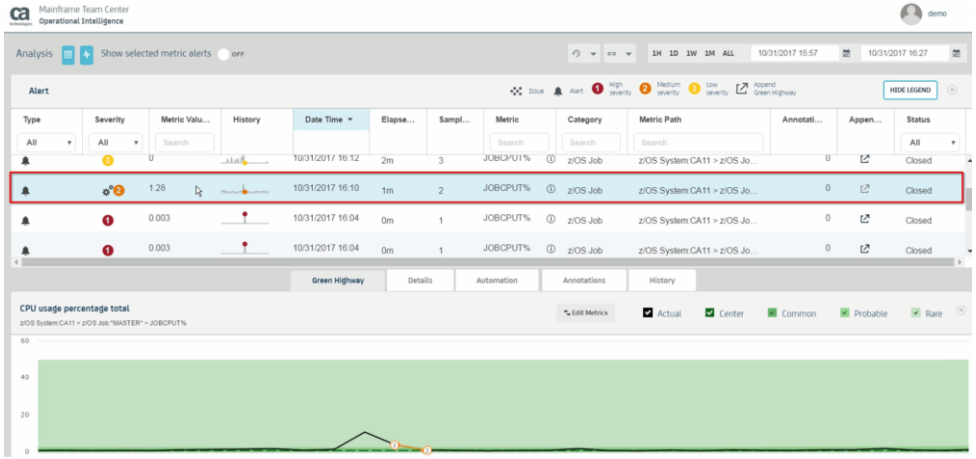
CA MAT Roadmap – Delivered – *continued*

Feature	Description	Benefit
Incremental Release 12.0.1	Maintenance and new functionality package in form of wrapper Incremental PTF.	Easy and fast way for our customers to adopt new currency items and functionality delivered in time frame between MAT V12 BASE and INC1 release.
MAT and MOI Integration	Enhancement PTF for MAT integration with MOI. This PTF is excluded from Incremental Release PTF. Planned for the end of CY17.	Deliverable of CA MAT and MOI functionality to customers that enables them to use provided functionality.
COBOL 6.2	Currency item, support of COBOL 6.2	Fast adoption of latest COBOL compiler. Ability to measure COBOL 6.2 applications.
PL1 5.2	Currency item, support of PL1 5.2	Fast adoption of latest Pl1 compiler. Ability to measure PL1 5.2 applications.
IMS 15.1	Currency / certification feature that enables users to measure workload related to IMS v 15.1 subsystems.	Identification of tuning opportunities for IMS v 15.1 workload.
RMODE64 – 64 bit Architecture	Exploitation of Residency mode that comes with z/OS 2.3 and overall enhancements to 64 bit architecture toleration throughout CA MAT code. This is phased delivery.	Measurements of applications that have executable code stored above the bar together with ability to measure display 64 bit entries with MAT client.

CA MAT and Mainframe Operational Intelligence



PAIN

Significant

- Manual problem discovery
- Issues detected too late in a cycle
- Multiple tools with no shared access point
- Skills gap for performance analyses

SOLUTION

- **CA MOI** monitors and learns your system behavior to create a baseline, know as ***green highway***
- Automated invocation of **CA MAT** measurement based on dynamic alerts
- **CA MOI** shows details for top 5 performance consumers.

BENEFIT

- Predict problems earlier
- Diagnose issues faster
- Automate your corrective actions
- Have one access point to collect data from multiple sources: **CA MAT**, CA Sysview, CA NetMaster, CA Vantage

CA MAT Roadmap – Planned

Feature	Description	Benefit
WAS Liberty	Support measurement of WebSphere Liberty server and application address space running under Liberty profile: • base WAS Liberty server support • WAS liberty and CICS • WAS liberty and batch application • WAS liberty and DB2 • WAS liberty and IMS	Ability to measure workload related to WebSphere Application Server Liberty. Enabler for tuning opportunities.
DB2 Explain on demand	Enabler for on demand analysis. As oppose to collection of SQL EXPLAIN data during the measurement this feature introduces on demand SQL EXPLAIN within analysis of monitored application obtaining most recent and actual data.	Latest and most recent EXPLAIN data are available to customers at the time of the analysis of the monitored file providing more relevant and accurate data for performance tuning opportunity assessment. Reduces overhead on MAT server. Explain will be changed to fully comply with new security features of DB2 which in turn will require more user set up.
MQ 9.0.4 support	Currency / certification feature that enables users to measure workload related to MQ 9.0.4 subsystems.	Identification of tuning opportunities for MQ 9.0.4
ADABAS 8.4.3/ Natural 8.2.7 support	Currency / certification feature that enables users to measure workload related to ADABAS 8.4.3 or Natural 8.2.6.	Identification of tuning opportunities for ADABAS 8.4.3 and Natural 8.2.6

CA MAT Roadmap – Under Consideration

Feature	Description	Benefit
RESTful APIs	Develop RESTful APIs for CA MAT as industry standard integration points to invoke measurement and gather results. Adopt MAT GUI to use RESTful API.	• Enable modern integrations with other CA and 3rd party products • Enable customers to easily script MAT invocation and results gathering and make it a part of the application lifecycle
Caller ID / Caller Stack support for CICS	• Enhance sampling methodology to get more Caller ID data • Improve the UI to show all caller ID info for all applications in an automatic fashion • Add the ability to view the full caller stack for an application	• Gather more CallerID data for CICS transactions to allow more precise tuning. • Improve User experience by enabling customer to get all the caller ID information in an automatic way. • Enable customers to trace back the full Caller Stack for the current code executable.
• **CICS PLEX** • **IMS PLEX** • **DB2 PLEX**	New value feature about utilization of CICS PLEX, IMS PLEX, DB2 PLEX (DB2 shared subsystems) capabilities. Application / transaction can be dispatched within CICS/IMS/DB2 PLEX with preference on performance or low utilization of CICS Transactional Servers (CPU load) that are registered to PLEX.	Ability to measure CICS/IMS/DB2 workloads regardless where it is dispatched e.g. running on different CICS/IMS/DB2 PLEX registered systems and provision of the data to single monitor dataset file without need to focus on location of the run of the app.
JAVA Agent Enhancements	Research followed by implementation phase. Utilization of mature JAVA agent used within CA and adapting it to CA MAT purpose. Aim to exchange / enhance our current JAVA agent exploiting enhanced capabilities	Ability for new CA MAT JAVA functionality (extent defined outcome of the research). Introducing more opportunities how to tune JAVA applications.
DB2 Intercept architecture rework	Rework of this functionality resides in utilization of stacking PC routines and externalizing intercept code outside of DB2 subsystems.	Functionality remains the same. Increased stability. Simplification of internal maintenance. Future enabler for stored procedures using executable code in 64b area.

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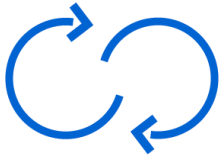
We know that

WINNING COMPANIES FOCUS ON FOUR KEY PRINCIPLES



Agility

Automation

Insights

Security

Are You Participating in Community Ideation?

CA Communities Ideation

- Submit your ideas on communities.ca.com
- Vote and comment on ideas that are important to you
- CA Product Management reviews ideas and updates status as they move through the lifecycle
- “Currently Planned” idea status indicates inclusion in Agile Backlog or Product Roadmap

Customer Validation

- Register to participate in:
  - Live Demos / End-of-Sprint Review meetings
  - Private - Members Only - Online Community
  - Pre-Complete Release Feature Testing and Support
  - Upgrade Support From SWAT Team
- How to register: **validate.ca.com**
- Contact your:

Product Manager ***Ekaterina.Tumanova@ca.com***
Product Owner ***Petr.Klomfar@ca.com***

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Questions?

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Using CA MAT to analyse
a poorly behaved Cobol/Db2 program

Ian Sergeant, Inna Dvorakova – 31.05.2018 – 3.12

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A very simple Cobol program:
What could go wrong?

```
IDENTIFICATION DIVISION.

PROGRAM-ID. TUNDOB.

ENVIRONMENT DIVISION.

DATA DIVISION.

FILE SECTION.

WORKING-STORAGE SECTION.

EXEC SQL INCLUDE SQLCA END-EXEC.
EXEC SQL INCLUDE TTUNDOB END-EXEC.
01  FNAME PIC X(20) VALUE 'JOHN'.
01  SNAME PIC X(20) VALUE 'SMITH'.

PROCEDURE DIVISION.

    EXEC SQL DECLARE C1 CURSOR FOR
        SELECT DOB FROM TTUNDOB WHERE FORENAME = :FNAME
        AND SURNAME = :SNAME
    END-EXEC.

    EXEC SQL OPEN C1 END-EXEC.
    EXEC SQL FETCH C1 INTO :DOB END-EXEC.
    EXEC SQL CLOSE C1 END-EXEC.

DISPLAY DOB.

STOP RUN.
```

Run takes 13 seconds…but there are several million rows on the table

```
12.51.28 JOB36654 ---- MONDAY,     26 MAR 2018 ----
12.51.28 JOB36654  TSS7000I SERIA01 Last-Used 26 Mar 18 03:46 System=CA31 Facili
12.51.28 JOB36654  TSS7001I Count=00012 Mode=Fail Locktime=None Name=SERGEANT, I
12.51.28 JOB36654  $HASP373 SERIA01A STARTED - WLM INIT   - SRVCLASS BATSTWLM - S
12.51.28 JOB36654  IEF403I SERIA01A - STARTED - TIME=12.51.28
12.51.28 JOB36654  TN0300I MONITORING STARTED FOR PROFILE COB2DEMO BY USER  KLOP
12.51.41 JOB36654  CAJR250I STEPNAME STEP    PGM=    CCODE  EST-COST    EXCPS      E
12.51.41 JOB36654  CAJR251I RUN          1 IKJEFT01 0000      $1.15       13 00:00
12.51.41 JOB36654  IEF404I SERIA01A - ENDED - TIME=12.51.41
12.51.41 JOB36654  CAJR252I JOB ENDED. TOTAL EST-COST        $1.15       TOTAL CP
12.51.41 JOB36654  $HASP395 SERIA01A ENDED - RC=0000
```

The output is one line of text, as we expect.

```
1963-03-04
```

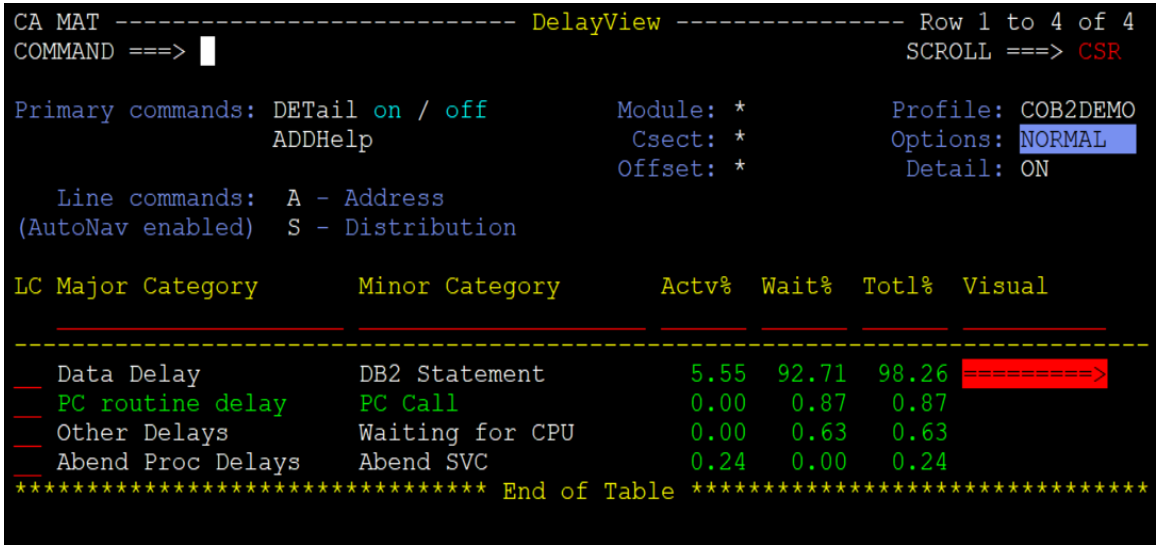
* The only exception being minimal use to color-code information.

We use MAT to analyse the measurement (1)

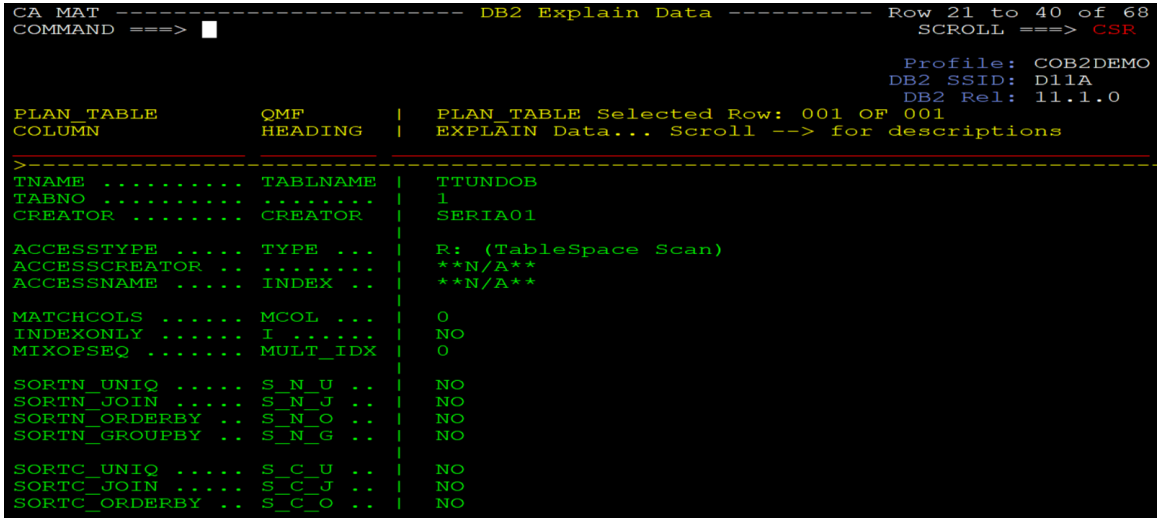
- Option 0

We use MAT to analyse the measurement (2)

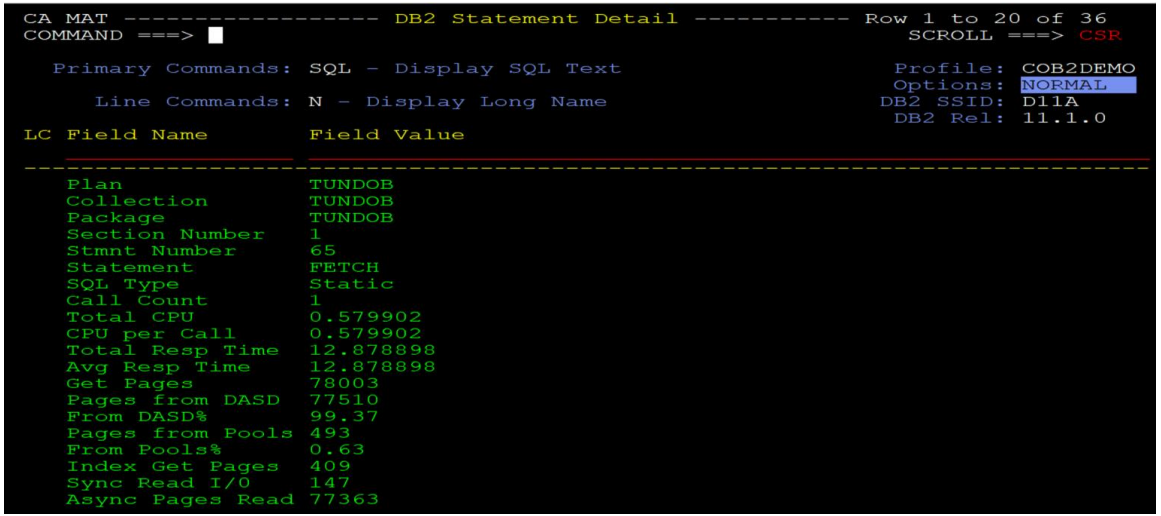
- Option 2 – almost all the time in Db2



We use MAT to analyse the measurement (3)



We use MAT to analyse the measurement (4)



Tablespace scan plus high number of GETPAGES

MAT allows us to fix the job (1)

```
//SERIA01B JOB 124300000,CLASS=A,MSGCLASS=A,NOTIFY=&SYSUID
/*JOBPARM S=CA31
//CREATEIX EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=*
//SYSPRINT DD SYSOUT=*
//SYSTSIN  DD *
 DSN S(D11A)
 RUN PROGRAM(DSNTIAD) PLAN(DSNTIA11) LIB('D11A.RUNLIB.LOAD')
//SYSIN    DD *
 CREATE UNIQUE INDEX ITUNDOB ON TTUNDOB
  (FORENAME ASC, SURNAME ASC)
 USING STOGROUP SYSDEFLT PRIQTY 400000 SECQTY 40000;
 COMMIT;
/*
```

Create an index on FORENAME and SURNAME

MAT allows us to fix the job (2)

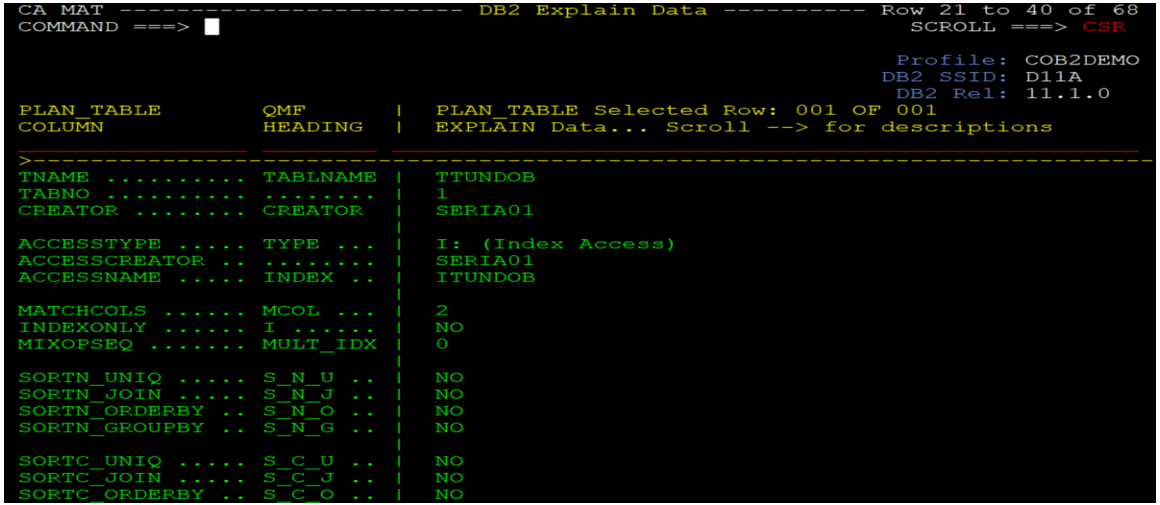
```
//SERIA01B JOB 124300000,CLASS=A,MSGCLASS=A,NOTIFY=&SYSUID
/*JOBPARM S=CA31
//BIND    EXEC PGM=IKJEFT01
//SYSTSPRT DD SYSOUT=*
//SYSTSIN  DD *
 DSN S(D11A)
 REBIND PACKAGE(TUNDOB.TUNDOB)
********************************* Bottom of Data ********************
```

Rebind the package

Rerun – all is well

```
13.10.17 JOB37041 ---- MONDAY,     26 MAR 2018 ----
13.10.17 JOB37041  TSS7000I SERIA01 Last-Used 26 Mar 18 03:46 System=CA31 Facili
13.10.17 JOB37041  TSS7001I Count=00012 Mode=Fail Locktime=None Name=SERGEANT, I
13.10.17 JOB37041  $HASP373 SERIA01A STARTED - WLM INIT  - SRVCLASS BATSTWLM - S
13.10.17 JOB37041  IEF403I SERIA01A - STARTED - TIME=13.10.17
13.10.17 JOB37041  TN0300I MONITORING STARTED FOR PROFILE COB2DEMO BY USER  KLOP
13.10.17 JOB37041  CAJR250I STEPNAME STEP    PGM=    CCODE  EST-COST    EXCPS      E
13.10.17 JOB37041  CAJR251I RUN          1 IKJEFT01 0000      $ .10       13 00:00
13.10.18 JOB37041  IEF404I SERIA01A - ENDED - TIME=13.10.18
13.10.18 JOB37041  CAJR252I JOB ENDED. TOTAL EST-COST        $ .10       TOTAL CP
13.10.18 JOB37041  $HASP395 SERIA01A ENDED - RC=0000
```

MAT now shows matching index scan on two columns



The number of GETPAGES is dramatically reduced

```
CA MAT ------------------ DB2 Statement Detail ----------- Row 1 to 20 of 32
COMMAND ===>                                                SCROLL ===> CSR

  Primary Commands: SQL - Display SQL Text                   Profile: COB2DEMO
                                                             Options: NORMAL
     Line Commands: N - Display Long Name                  DB2 SSID: D11A
                                                            DB2 Rel: 11.1.0
LC Field Name        Field Value
-- ----------------- ------------------------------------------------------------
   Plan              TUNDOB
   Collection        TUNDOB
   Package           TUNDOB
   Section Number    1
   Stmnt Number      65
   Statement         FETCH
   SQL Type          Static
   Call Count        1
   Total CPU         0.000813
   CPU per Call      0.000813
   Total Resp Time   0.171756
   Avg Resp Time     0.171756
   Get Pages         8
   Pages from DASD   7
   From DASD%        87.50
   Pages from Pools  1
   From Pools%       12.50
   Index Get Pages   7
   Sync Read I/O     7
   Rows Ret/Changed  1
```

We use MAT to analyse the job (1) GUI Overview

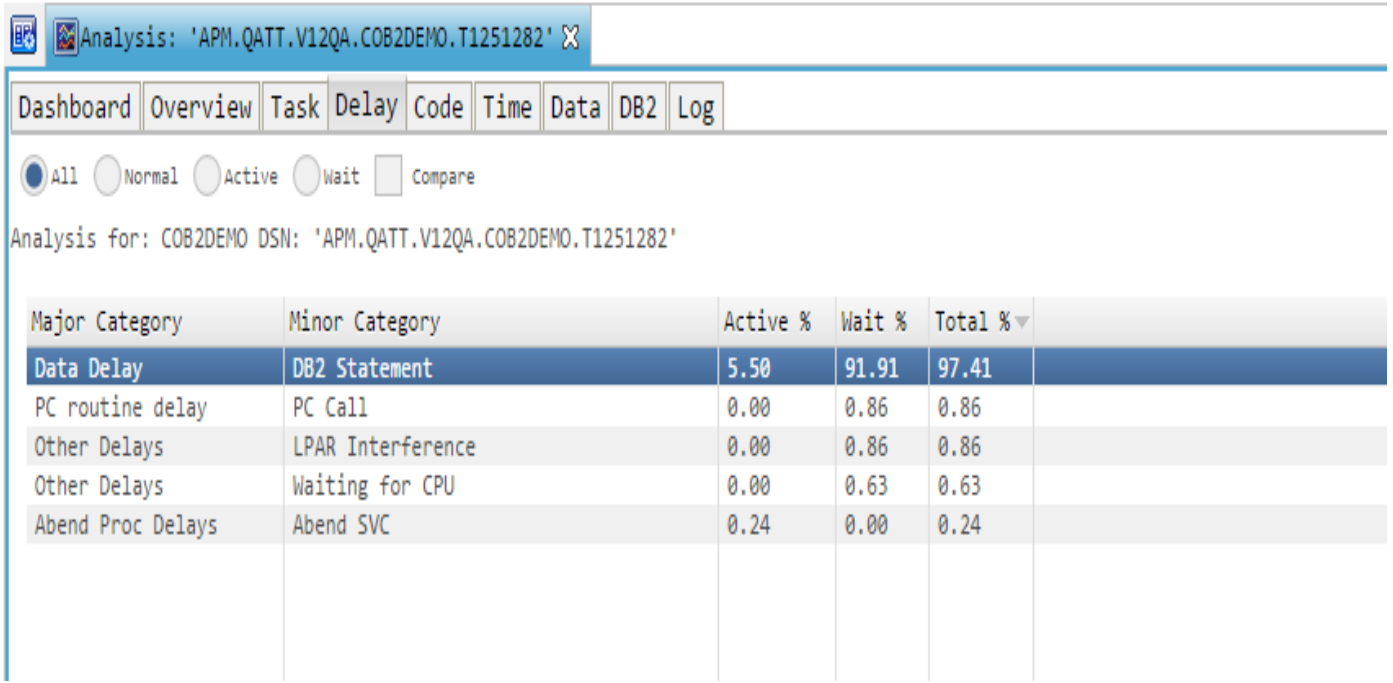
Dashboard | Overview | Task | Delay | Code | Time | Data | DB2 | Log

(●) All ( ) Normal ( ) Active ( ) Wait [ ] Compare

Analysis for: COB2DEMO DSN: 'APM.QATT.V12QA.COB2DEMO.T1251282'

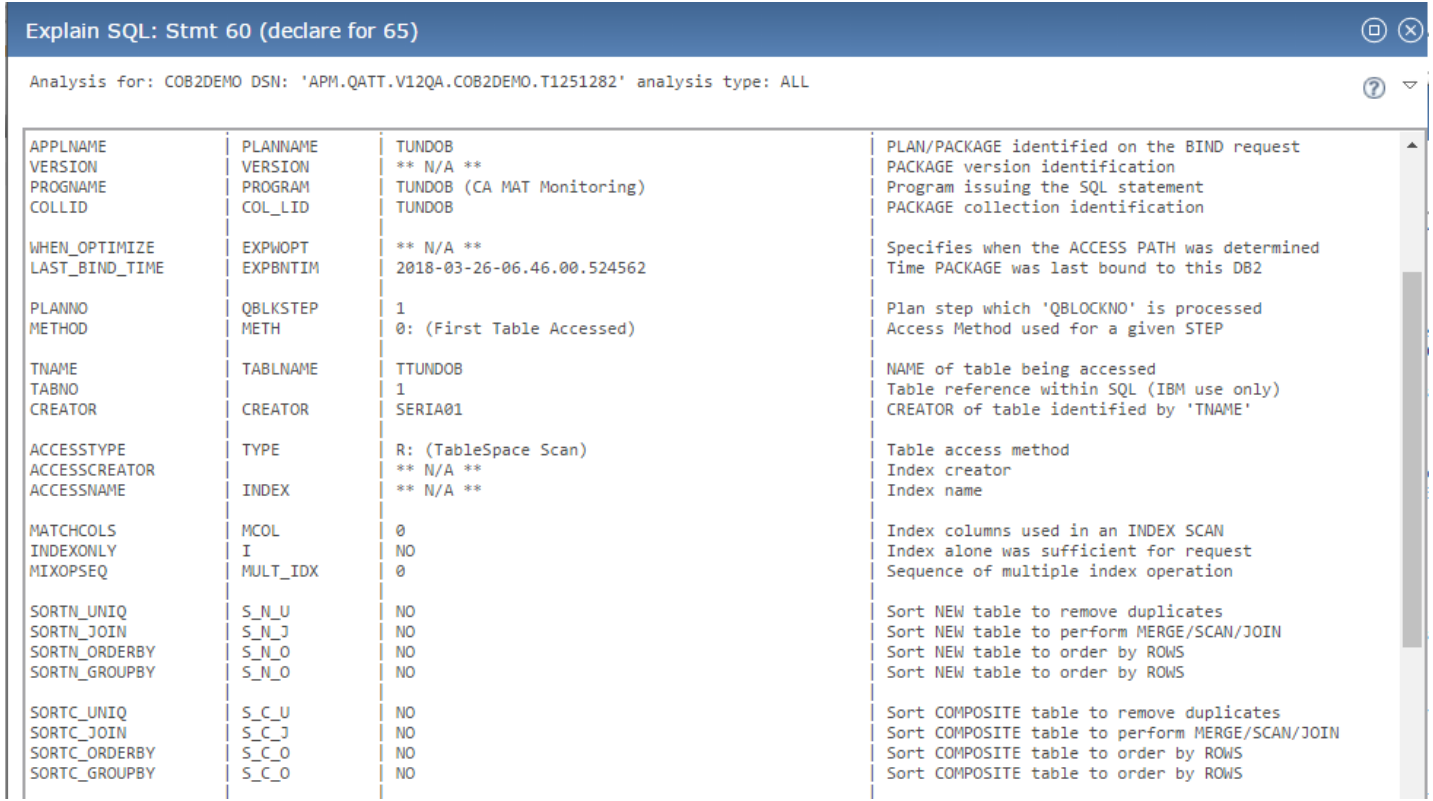
```
-- Job Information --  ------ Job Statistics ------  --- Monitor Statistics ---

Jobname  . . SERIA01A  TCB Time . . . . 00:00:00.61  Start Date . . 2018/03/26
Stepname . . RUN       SRB Time . . . . 00:00:00.28  Start Time . . 12:51:28
Procstep . .                                         Duration . . . 00:00:13
Program  . . IKJEFT01  ECPU Time  . . . 00:00:00.89
ASID . . . . 1003      zAAP Time  . . .     **N/A**  Observations:
(HEX)  . . . 03EB      Elig zAAP Time .     **N/A**  Final rate . . 10Msec
User ID  . . KLOPE01   zIIP Time  . . . 00:00:00.00  Requested  . . 6000
Job ID . . . JOB36654  Elig zIIP Time . 00:00:00.00  Used . . . . . 1269

DB2 Lvl  . . 11.1.0    Swapped Out  . . 00:00:00.00  Samples:
                       Non Disp . . . . 00:00:00.00  Used . . . . . 1273
                       LPAR/DIS Delay . 00:00:00.11  % Active . . . 5.73
                       Wait . . . . . 00:00:12.24  % Wait . . . . 94.27
                       CPU Svc Units  . 31282

                       EXCP count . . . 9            Avg TCBs Act . 1.00
                       EXCP rate  . . . 0.66

DB2 Name . . D11A

< Rgn Lim  . 7656K     < Rgn Used HWM . 452K         CMN HWM Used . 273K
> Rgn Lim  . 256M      > Rgn Used HWM . 2888K        Page-ins . . . 0
Rgn Request  256M                                   Page-in Rate . 0.00
Dynamic Linklist:
LNKLST00

Monitor Data Set  . APM.QATT.V12QA.COB2DEMO.T1251282
```

We use MAT to analyse the job (2) GUI – Delay View



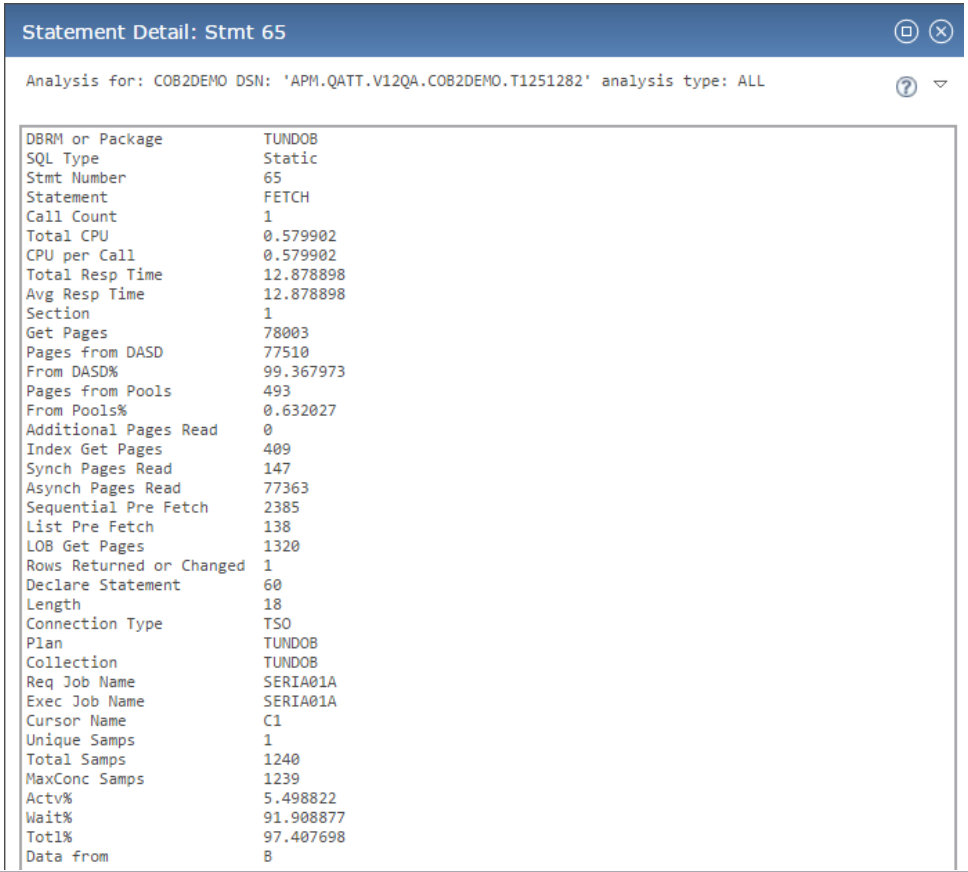
Major Category	Minor Category	Active %	Wait %	Total %
Data Delay	DB2 Statement	5.50	91.91	97.41
PC routine delay	PC Call	0.00	0.86	0.86
Other Delays	LPAR Interference	0.00	0.86	0.86
Other Delays	Waiting for CPU	0.00	0.63	0.63
Abend Proc Delays	Abend SVC	0.24	0.00	0.24

We use MAT to analyse the job(3) GUI-DB2 Explain SQL

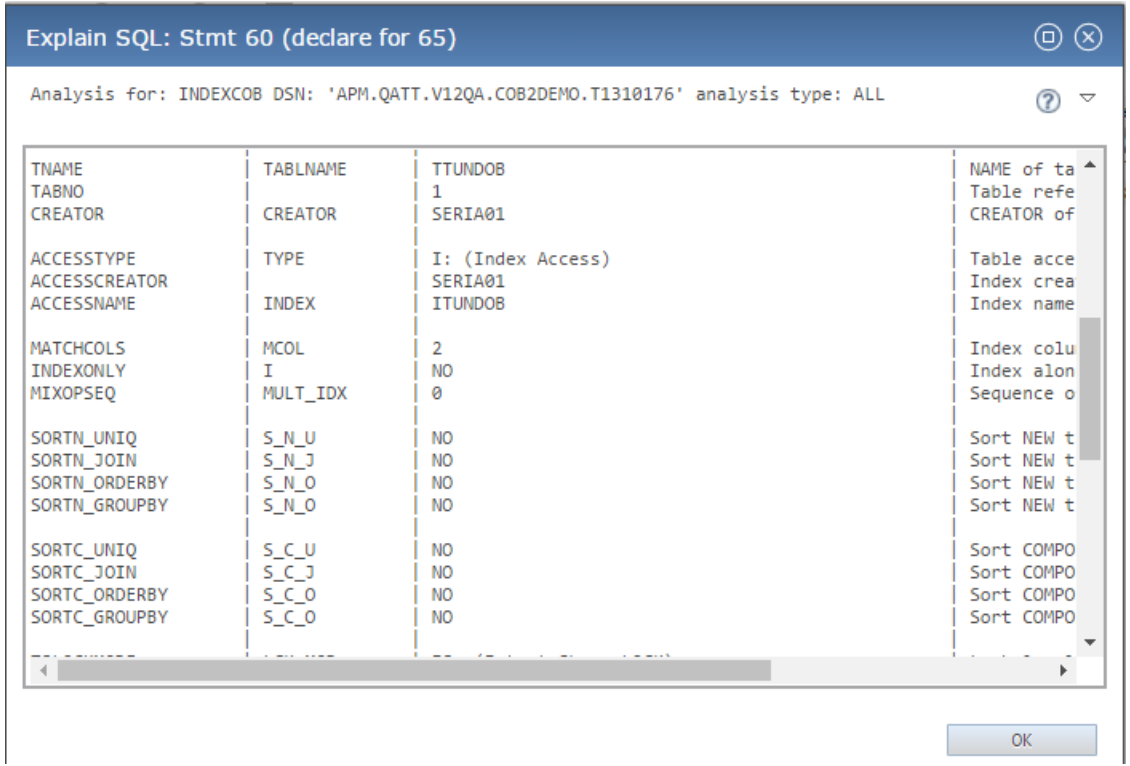


APPLNAME	PLANNAME	TUNDOB	PLAN/PACKAGE identified on the BIND request
VERSION	VERSION	** N/A **	PACKAGE version identification
PROGNAME	PROGRAM	TUNDOB (CA MAT Monitoring)	Program issuing the SQL statement
COLLID	COL_LID	TUNDOB	PACKAGE collection identification
WHEN_OPTIMIZE	EXPWOPT	** N/A **	Specifies when the ACCESS PATH was determined
LAST_BIND_TIME	EXPBNTIM	2018-03-26-06.46.00.524562	Time PACKAGE was last bound to this DB2
PLANNO	QBLKSTEP	1	Plan step which 'QBLOCKNO' is processed
METHOD	METH	0: (First Table Accessed)	Access Method used for a given STEP
TNAME	TABLNAME	TTUNDOB	NAME of table being accessed
TABNO		1	Table reference within SQL (IBM use only)
CREATOR	CREATOR	SERIA01	CREATOR of table identified by 'TNAME'
ACCESSTYPE	TYPE	R: (TableSpace Scan)	Table access method
ACCESSCREATOR		** N/A **	Index creator
ACCESSNAME	INDEX	** N/A **	Index name
MATCHCOLS	MCOL	0	Index columns used in an INDEX SCAN
INDEXONLY	I	NO	Index alone was sufficient for request
MIXOPSEQ	MULT_IDX	0	Sequence of multiple index operation
SORTN_UNIQ	S_N_U	NO	Sort NEW table to remove duplicates
SORTN_JOIN	S_N_J	NO	Sort NEW table to perform MERGE/SCAN/JOIN
SORTN_ORDERBY	S_N_O	NO	Sort NEW table to order by ROWS
SORTN_GROUPBY	S_N_O	NO	Sort NEW table to order by ROWS
SORTC_UNIQ	S_C_U	NO	Sort COMPOSITE table to remove duplicates
SORTC_JOIN	S_C_J	NO	Sort COMPOSITE table to perform MERGE/SCAN/JOIN
SORTC_ORDERBY	S_C_O	NO	Sort COMPOSITE table to order by ROWS
SORTC_GROUPBY	S_C_O	NO	Sort COMPOSITE table to order by ROWS

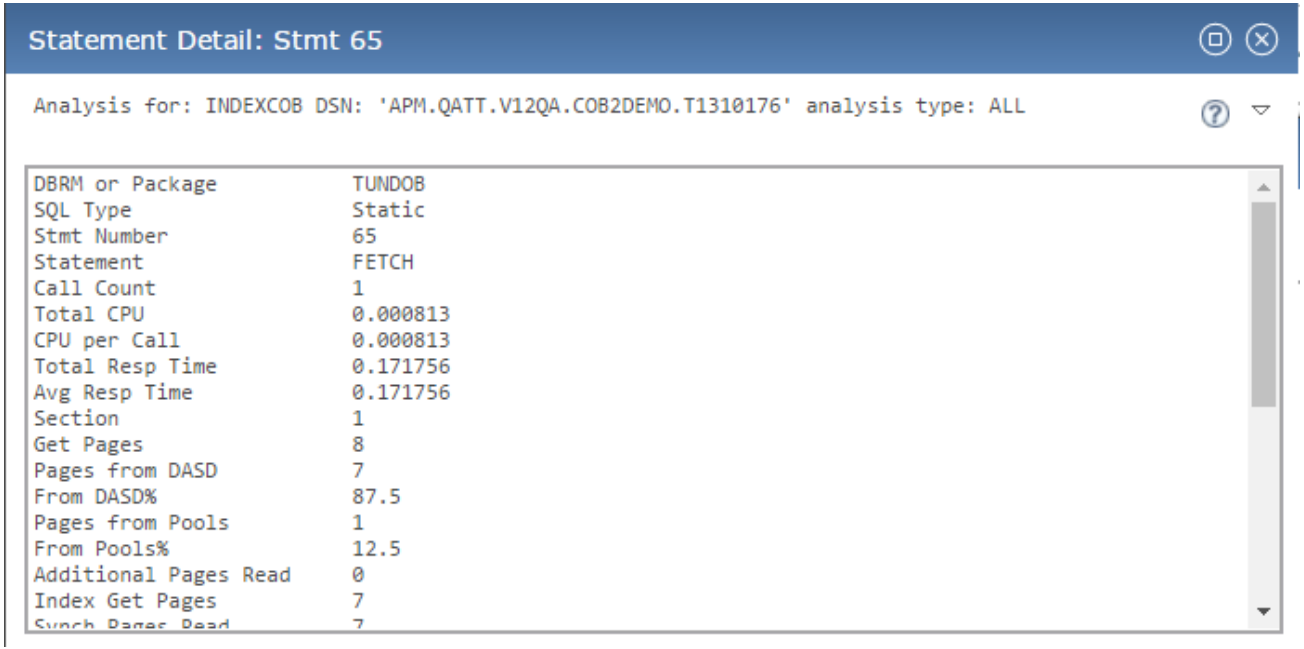
We use MAT to analyse the job(4) GUI - Statement detail



MAT shows matching index scan on two columns –GUI Db2 Explain SQL



The number of GETPAGES is dramatically reduced – GUI Statement detail



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Thank You.