FOR INTERNAL USE

Introduction to Database analysis with ACS

COMMON PL 2026

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About the speaker

Bartlomiej Grabowski

- 20+ years of experience in IBM i, VIOS, performance and IBM storage
- IBM Redbooks® Platinum Author
- Member of IBM certificate development team
- Blogger – https://www.theibmi.org/
- X - @GIRA79



DB performance problems

- „Do something - my query runs slow...”
- ODBC jobs are killing performance
- Batch jobs take too much time
- Query runs slow on Monday (IPL over the weekend?)

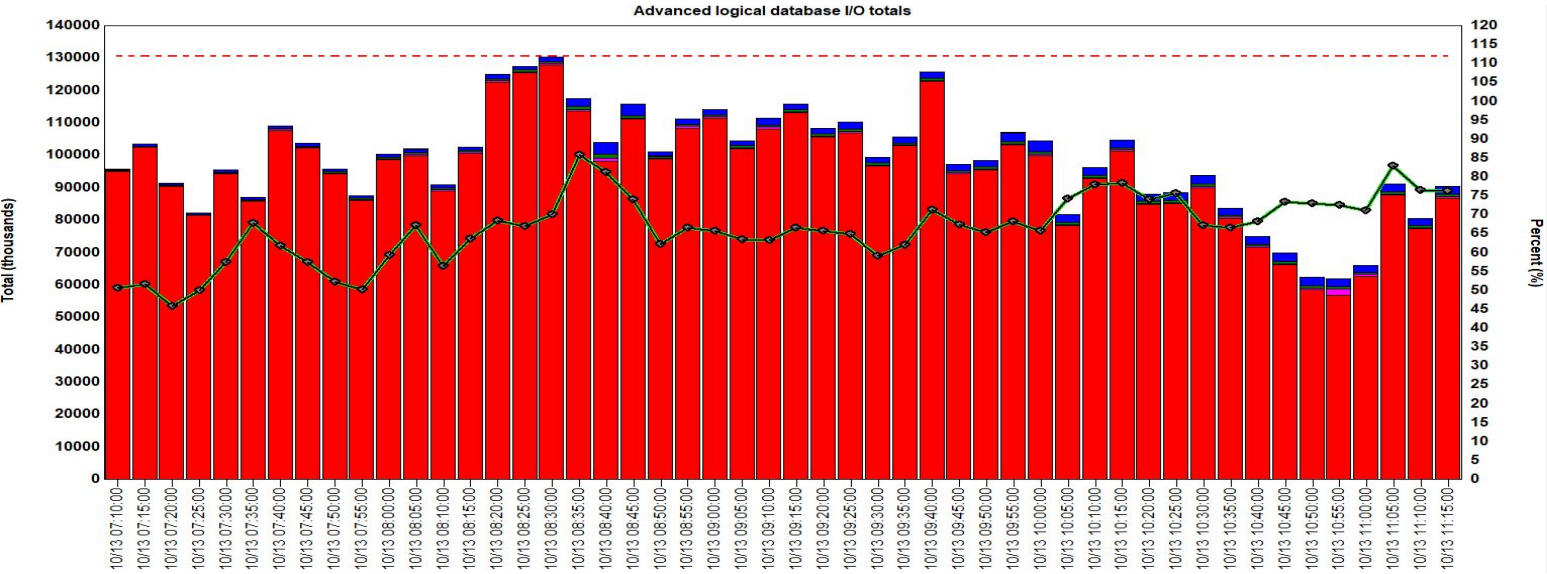
~~**AS400 does not need DB Admin**~~



- ✔ Add more CPU & MEM
- ✔ Buy faster storage
- ✔ Start DB investigation

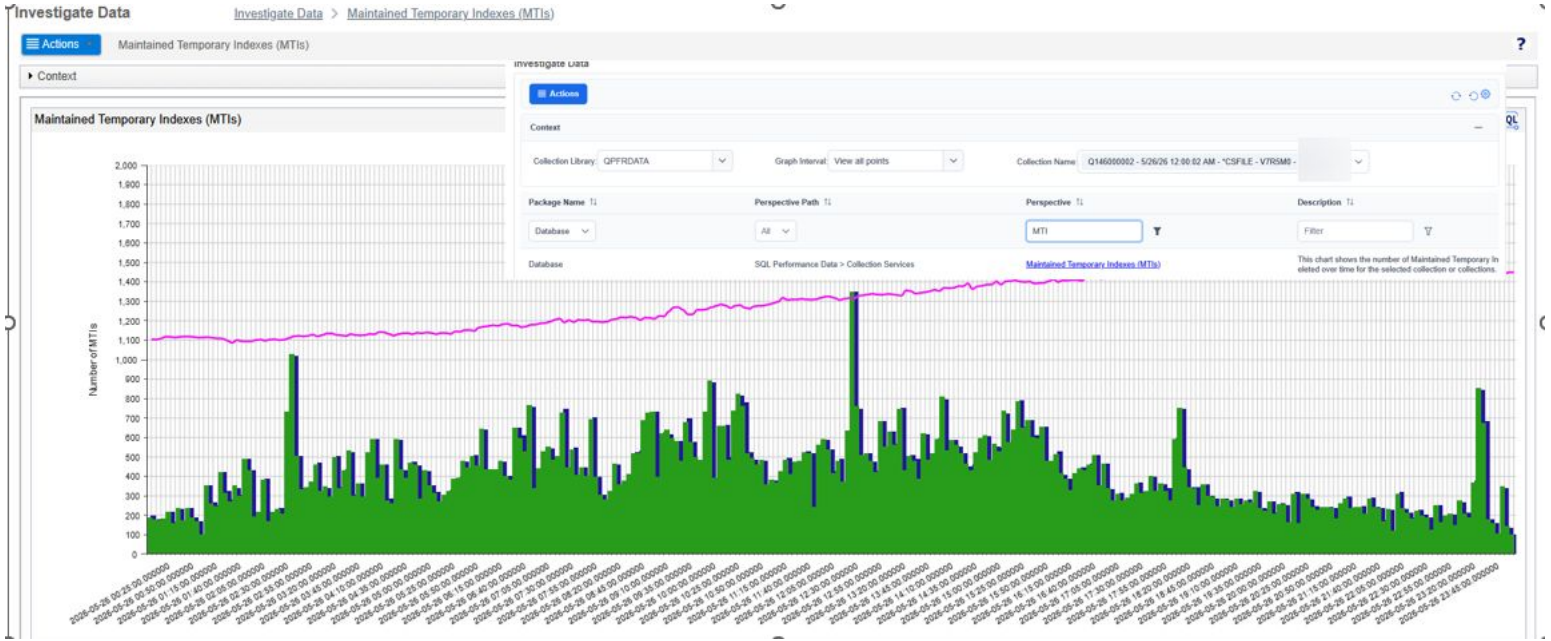
DB performance problems

- Check what method of accessing the database is in place. In this example the system use DDS (Data Description Specifications). Since release V5R3M0 no enhacements.



DB performance problems

- Check how many temporary indexes (MTIs) being created, compare with historic data, if the number is significant bigger probably some new „not well optimized” query was implemented.



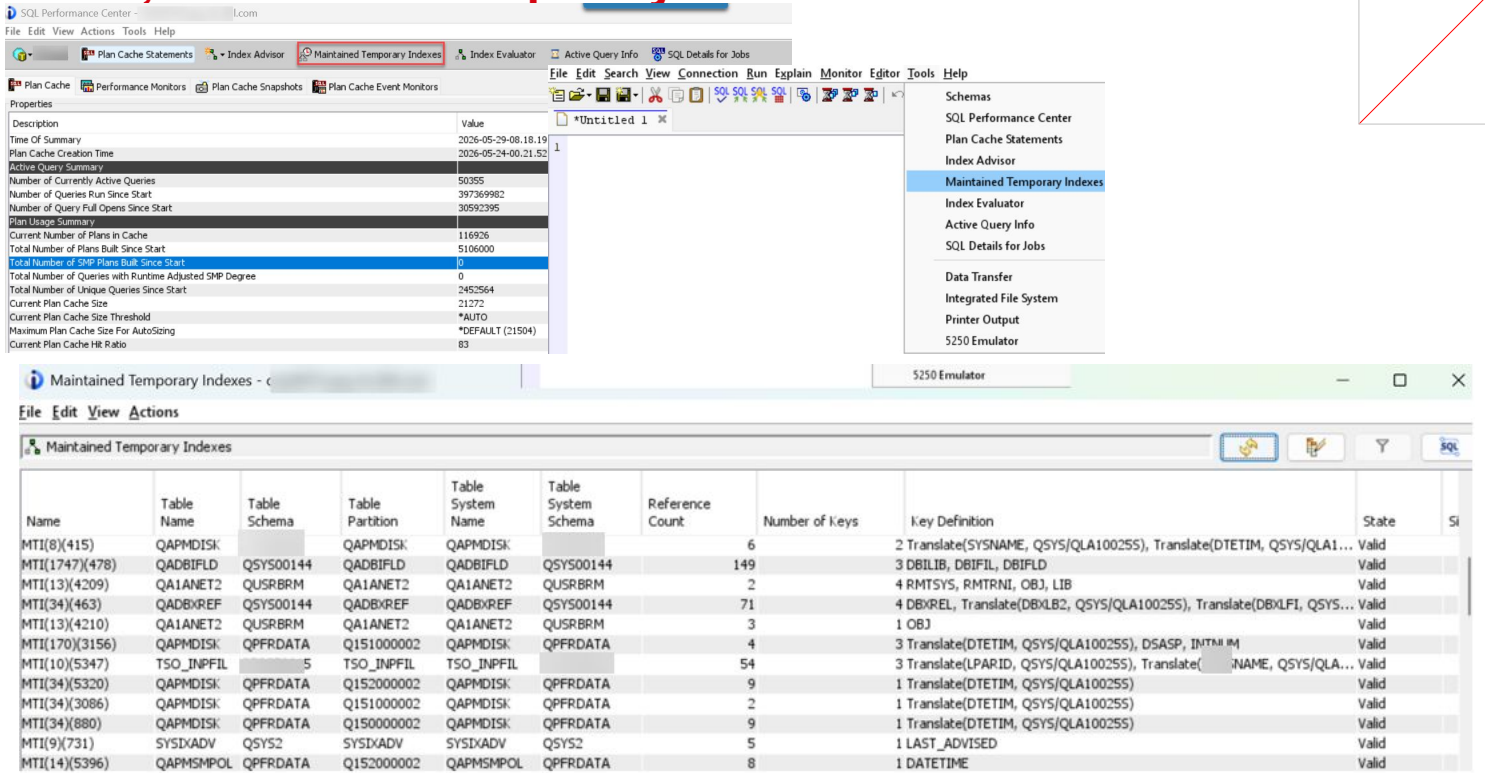
Maintained Temporary Indexes

- Maintained Temporary Indexes (MTIs) are indexes that the query optimizer creates without any user intervention
- Temporary vs permanent indexes
  - use temporary storage
  - managed entirely by the optimizer
  - not good idea to rely on MTIs for good performance
  - The initial execution of the query observes higher response time as the temporary index is being built
  - System resources are needed to build an MTI
  - The index is temporary and will go away at some point

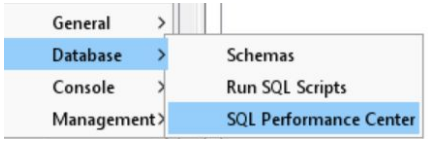
Maintained Temporary Indexes

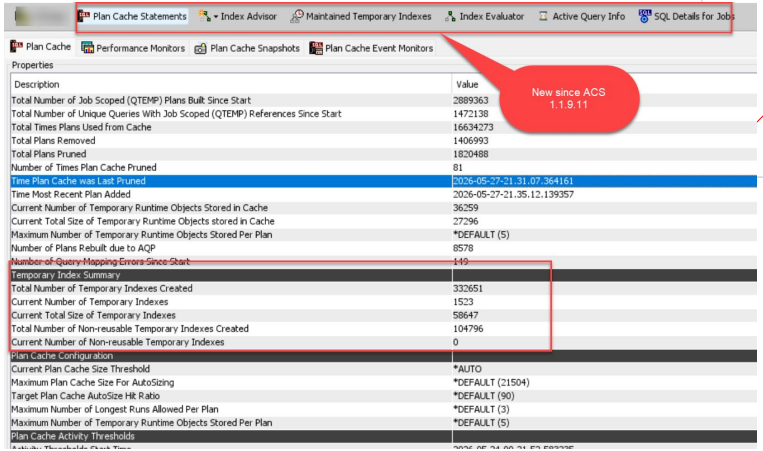
- The Db2 for IBM i Query optimizer makes its decision, to build an MTI, based on estimates and how many times a query is run.
- During the optimization phase, the optimizer might estimate the cost to build and use an MTI as too expensive.
- Deleted at IPL time or when all access plans, referencing the MTI, are purged from the plan cache.
- After an IPL, it takes time for queries to warm up as all access plans have to be recreated. It could also take time to repopulate the plan cache with temporary indexes.

ACS, Maintained Temporary Indexes



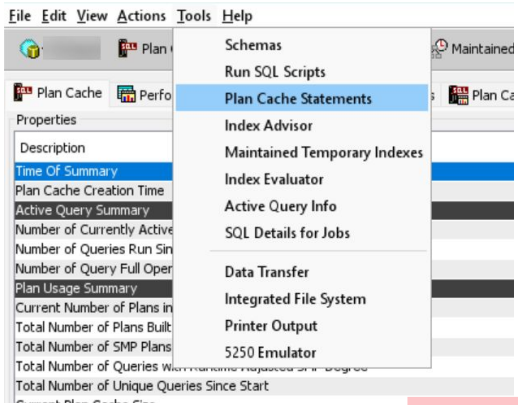
ACS, Plan cache

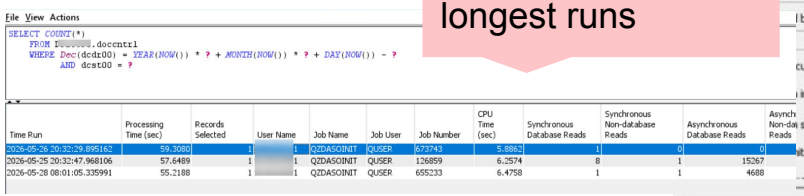




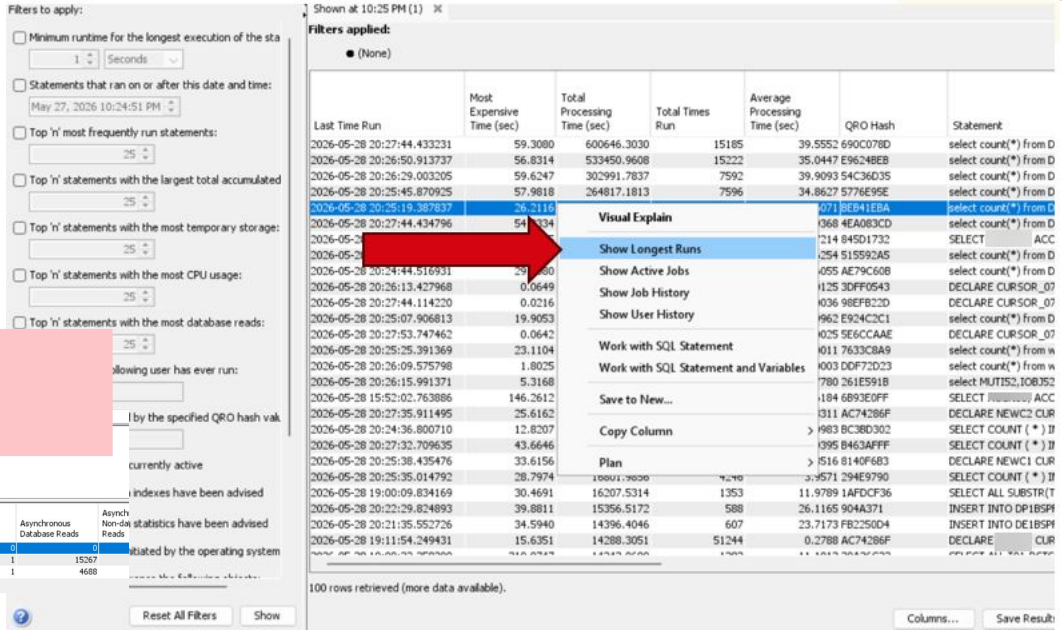
- **The plan cache** is a repository that contains the access plans for statements that have been optimized by the database engine.
- It is to facilitate the reuse of statement access plans when the same statement, or a similar statement, is executed at a later point in time.
- When an access plan is tuned, for example when an index is created, all statements can benefit from the updated access plan
- SQL Plan cache is live and changing
- Cleared at IPL

ACS, Plan cache



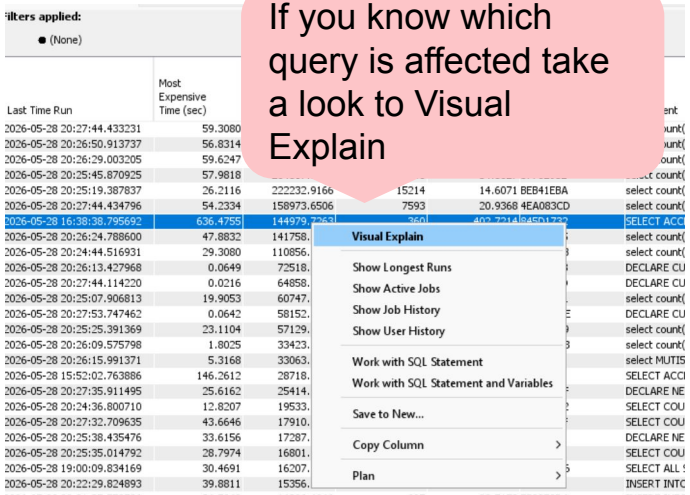


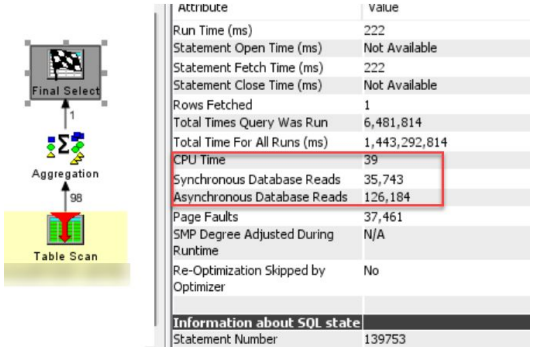
Shows up to 3 longest runs



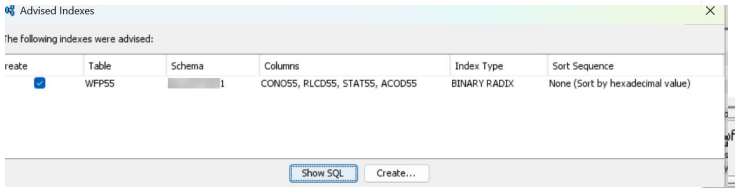
ACS, Plan cache

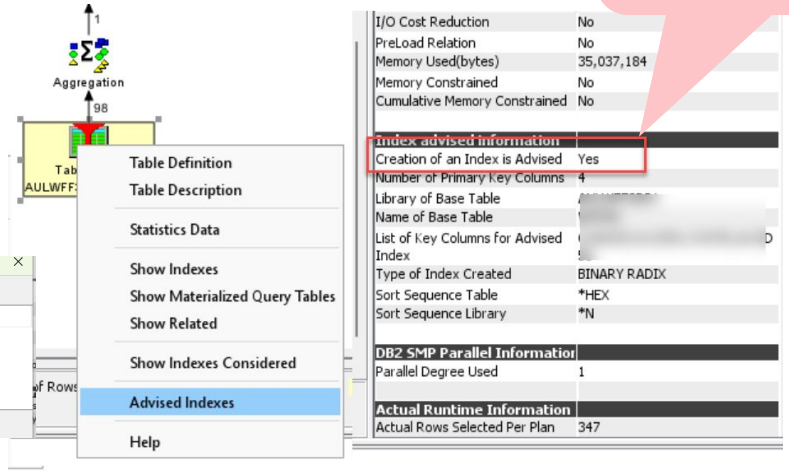
If you know which query is affected take a look to Visual Explain





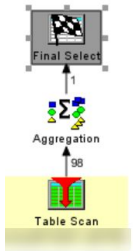
Index is advised





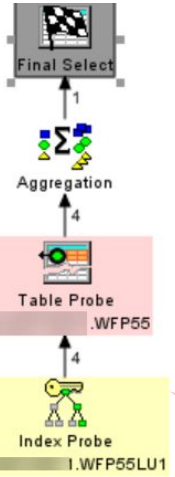
ACS, Plan cache

Before



Attribute	Value
Run Time (ms)	222
Statement Open Time (ms)	Not Available
Statement Fetch Time (ms)	222
Statement Close Time (ms)	Not Available
Rows Fetched	1
Total Times Query Was Run	6,481,814
Total Time For All Runs (ms)	1,443,292,814
CPU Time	39
Synchronous Database Reads	35,743
Asynchronous Database Reads	126,184
Page Faults	37,461
SMP Degree Adjusted During Runtime	N/A
Re-Optimization Skipped by Optimizer	No
Information about SQL state	
Statement Number	139753

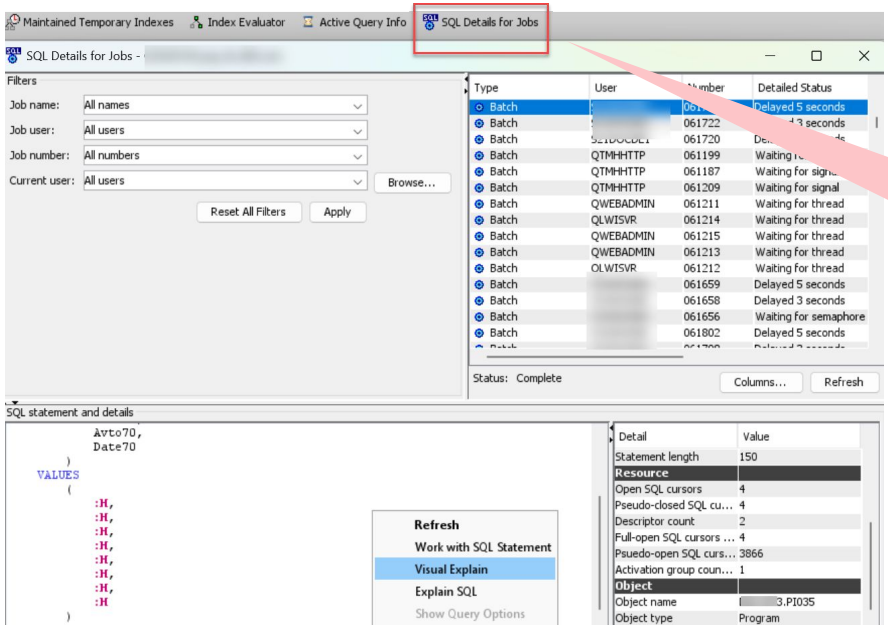
After



Attribute	Value
Run Time (ms)	1
Statement Open Time (ms)	Not Available
Statement Fetch Time (ms)	1
Statement Close Time (ms)	Not Available
Rows Fetched	1
Total Times Query Was Run	8,770,371
Total Time For All Runs (ms)	6,326,435
CPU Time	1
Synchronous Database Reads	10,644
Asynchronous Database Reads	8,182
Page Faults	11,386
ee Adjusted	N/A

Index created, usage of resources dramatically dropped

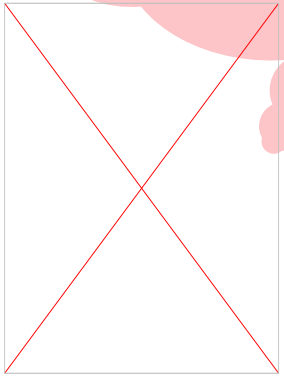
ACS menu to identify specific SQL job



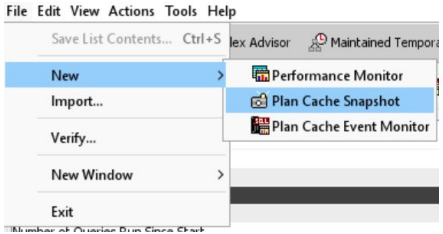
Use SQL details for Jobs to quickly identify a job

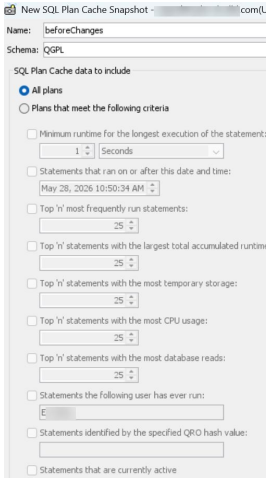
ACS, Plan cache snapshots

I would like to implement some indexes. How can I measure whether they improve the performance?

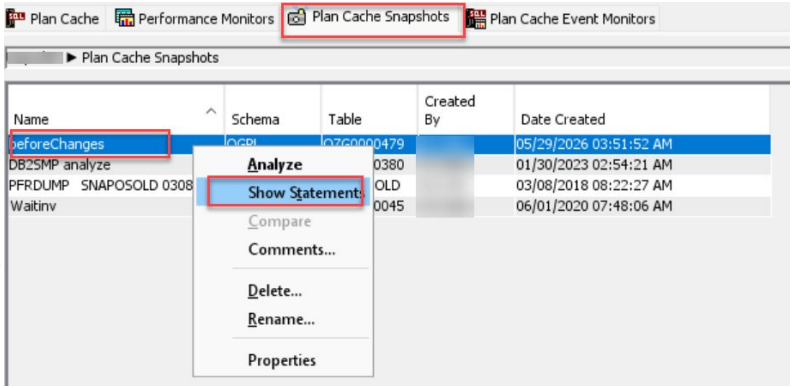


ACS, Plan cache snapshots

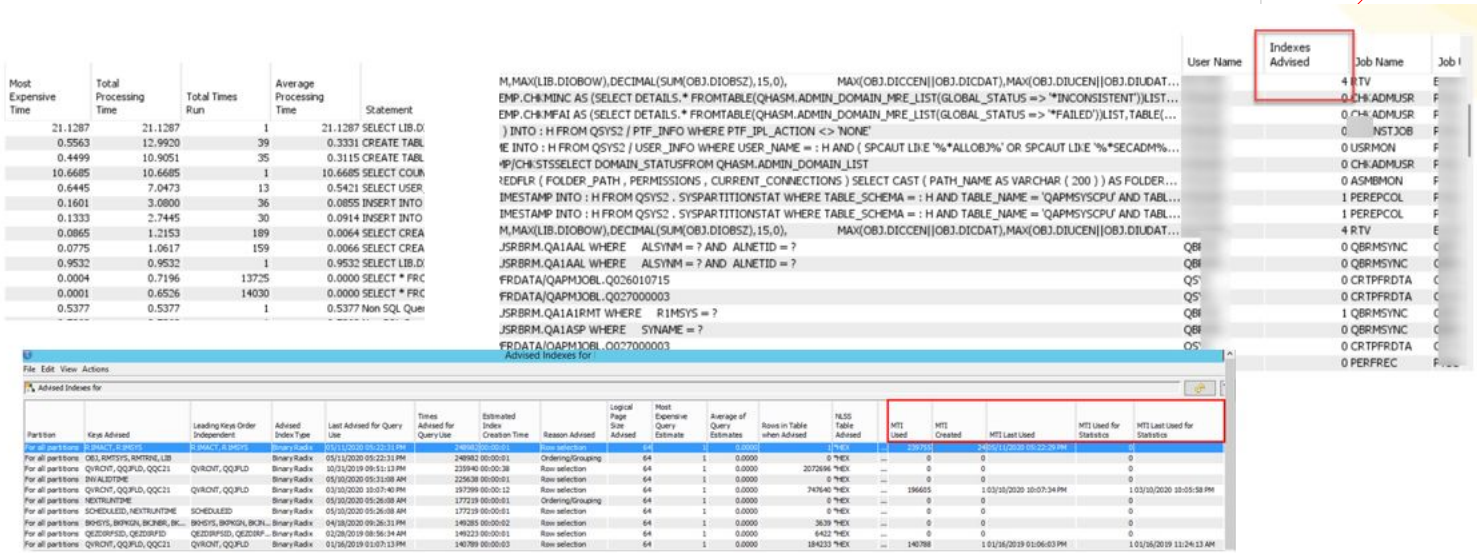




It creates a PF



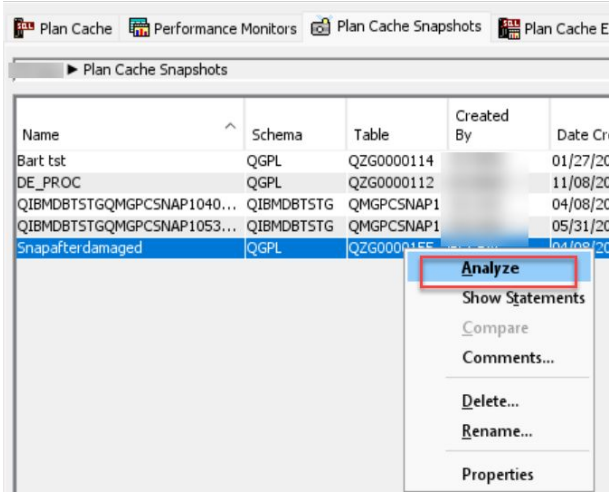
ACS, Plan cache snapshots

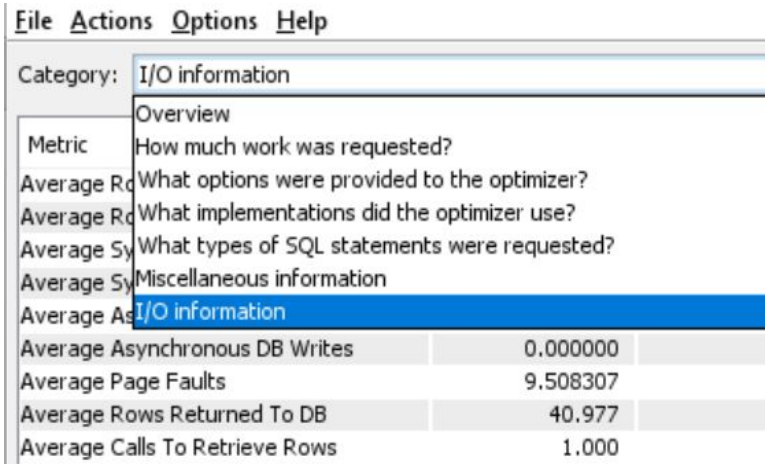


- The Index Advisor has columns that indicate whether an MTI was used for the index being advised
- Indexes aren't free. They require storage and CPU (to maintain them) do not create them blindly

ACS, Plan cache snapshots – analysis

- Presents a summarized overview of the information from an SQL performance data collection
- It is very helpful to group I/O intersive queries



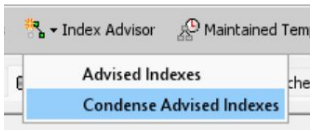


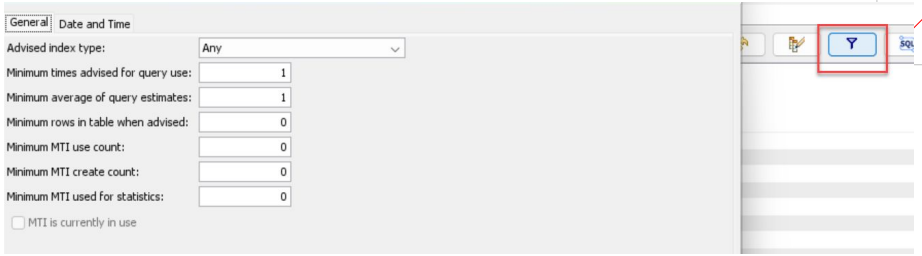
ACS, Plan cache snapshots – analysis

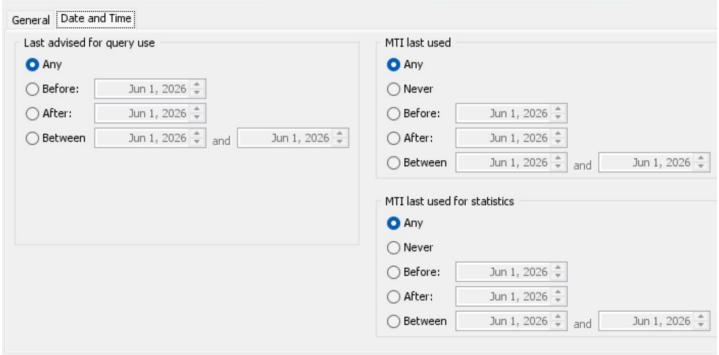
Most Expensive Use	Row Retrieval CPU Time	Row Retrieval Clock Time	Synchronous Database Reads	Synchronous Database Writes	Asynchronous Database Reads	Asynchronous Database Writes	Page Faults	Rows Returned	Calls To Retrieve Rows	Skip Locked Row Count	CURRENTLY COMMITTED Searches
2025-01-27 04:04:12.853946	23.401	391.762	11500.000	0.000	308931.000	0.000	386918.000	230.000	2.000	0.000	0.00
2025-01-27 11:01:43.035836	7.322	101.370	24.000	0.000	2.000	0.000	83128.000	0.000	1.000	0.000	0.00
2025-01-27 04:01:40.451987	5.994	48.647	0.000	0.000	0.000	0.000	854.000	11960.000	1.000	0.000	0.00
2025-01-27 13:58:32.857492	78.494	409.121	111.000	0.000	0.000	0.000	153813.000	0.000	36.000	0.000	0.00
2025-01-27 05:48:02.691766	4.247	21.128	0.000	0.000	0.000	0.000	0.000	1655.000	1.000	0.000	0.00
2025-01-26 01:08:49.074152	3.235	10.668	508.000	0.000	0.000	0.000	505.000	1.000	1.000	0.000	0.00
2025-01-27 14:02:02.183948	7.111	55.461	1704.000	0.000	0.000	0.000	34772.000	146.000	30.000	0.000	0.00
2025-01-27 13:59:33.110481	29.947	584.156	20.000	0.000	0.000	0.000	6397.000	350.000	350.000	0.000	0.00
2025-01-27 05:51:34.361531	0.208	0.953	0.000	0.000	0.000	0.000	0.000	122.000	1.000	0.000	0.00
2025-01-27 04:01:32.463886	0.867	7.047	0.000	0.000	0.000	0.000	23.000	3.000	13.000	0.000	0.00
2025-01-27 13:58:32.857493	2.354	12.992	84.000	0.000	0.000	0.000	343.000	3.000	39.000	0.000	0.00
2025-01-26 01:50:05.002908	0.028	0.132	0.791	0.000	47.026	0.000	0.800	6201.626	1.000	0.000	0.00

	Statement Text	Variable Values
2	DECLARE COBJECT CURSOR FOR SELECT SUBSTR (OBJLONGSCHEMA , 1 , 10) AS LIBRARY , SUM (OBJSIZE) AS SIZE FROM TABLE (QSYS2 . OBJECT...	-
1	select e.usrexp, e.usrmail, e.usrtxt, char(date(k.PWDEXPDAT), iso) from chkusrexp e, qsys2/user_info k where current_date + e.usrwrn days >= date(...	-
1	DECLARE CUSRPRF CURSOR FOR SELECT USER_NAME , PRVSIGNON , USRCLS , SPCAUT , GRPPRF , SUPGRPLIST , TEXT , SUPGRPCNT , STATUS , USE...	-
36	CREATE TABLE LSTMPRF AS(SELECT USRPRF.OBJNAME AS UNMONITORED_RESOURCE FROM TABLE(QSYS2.OBJECT_STATISTICS('QSYS','*USRPRF','...	-
1	SELECT LIB.DIOBNM,MAX(LIB.DIOBOW),DECIMAL(SUM(OBJ.DIOBSZ),15,0), MAX(OBJ.DICCEN||OBJ.DICDAT),MAX(OBJ.DIUCEN||OBJ.DIUDAT...	'LIB ', 'QSYS
1	SELECT COUNT (*) INTO : H FROM QSYS2 / PTF_INFO WHERE PTF_IPL_ACTION <> 'NONE'	-
30	INSERT INTO SMBCONN (REMOTE_ADDRESS , LOCAL_PORT , TCP_STATE) SELECT DISTINCT REMOTE_ADDRESS , LOCAL_PORT , TCP_STATE FROM ...	-
350	SELECT CURRENT_CPU_CAPACITY INTO : H FROM QSYS2 . SYSTEM_STATUS_INFO	-
1	SELECT LIB.DIOBNM,MAX(LIB.DIOBOW),DECIMAL(SUM(OBJ.DIOBSZ),15,0), MAX(OBJ.DICCEN||OBJ.DICDAT),MAX(OBJ.DIUCEN||OBJ.DIUDAT...	'LIB ', 'QSYS
13	SELECT USER_NAME INTO : H FROM QSYS2 / USER_INFO WHERE USER_NAME = : H AND (SPCAUT LIKE '%*ALLOBJ%' OR SPCAUT LIKE '%*SECADM%...	'S21DEBUG '
39	CREATE TABLE QTEMP.CHKMINC AS (SELECT DETAILS.* FROMTABLE(QHASM.ADMIN_DOMAIN_MRE_LIST(GLOBAL_STATUS => '*INCONSISTENT'))LIST...	-
230	Non SQL Query QPFRDATA/QAPMJOBL.Q026010715	-
168	Non SQL Query QPFRDATA/QAPMJOBL.Q027000003	-
35	CREATE TABLE QTEMP.CHKMFAI AS (SELECT DETAILS.* FROMTABLE(QHASM.ADMIN_DOMAIN_MRE_LIST(GLOBAL_STATUS => '*FAILED'))LIST,TABLE(...	-
1	UPDATE QUSRBRM.QA1AHS SET BKSFMT = ? WHERE BKTMFN = ?	X'F0', 1
5	DECLARE SST CURSOR FOR SELECT TRIM (REPLACE (@DST , 'LOCAL ADDRESS:' , ' ')) FROM QTEMP / @DST WHERE RRN (@DST) > (SELECT RRN (...	-

ACS, Plan cache and MTIs

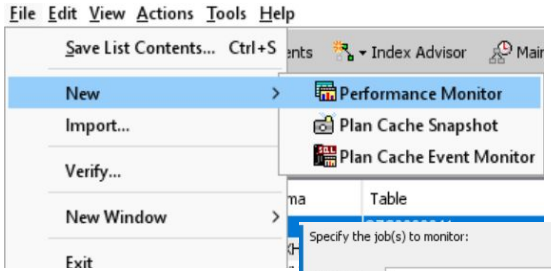


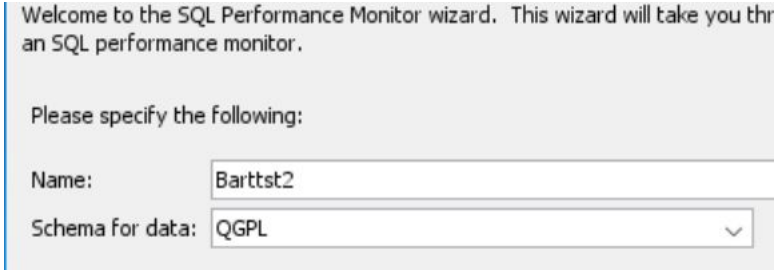


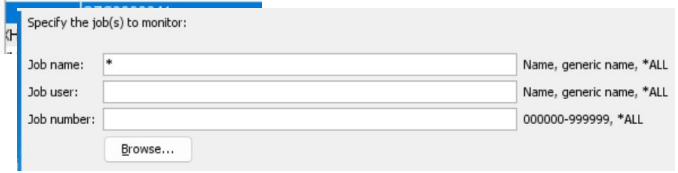


ACS, Performance Monitors

- To investigate a specific job, use Performance Monitors – It gathers real-time information about all SQL statements and non-SQL queries. The collection information includes details about optimization and runtime behavior.
- It must be started and then turned off







ACS, Performance Monitors

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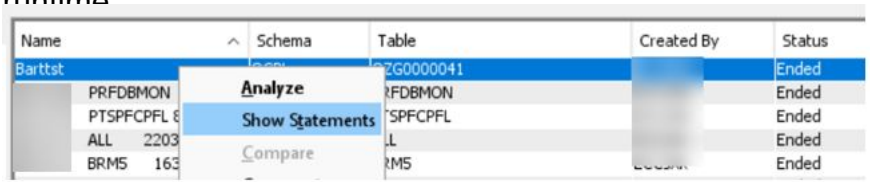
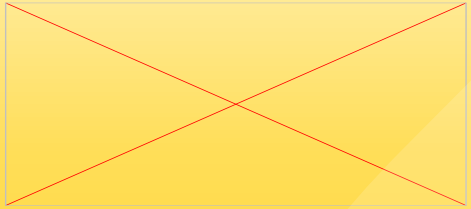


ACS, Performance Monitors helpful documentation

- IBM i on Power - Performance FAQ - https://public.dhe.ibm.com/services/us/igsc/idoctor/IBM-i-FAQ-Spring-2024-Final.pdf
- IBM Db2 for i indexing methods and strategies - https://www.ibm.com/support/pages/system/files/inline-files/Indexing%20and%20Statistics_3.pdf
- Watch Scott Forstie video (COMMON members only) - https://learn.common.org/products/manage-your-ifs-with-ibm-i-services-and-acs#tab-product_tab_contents__4



QUESTIONS ?