IBM Data Server Manager for z/OS

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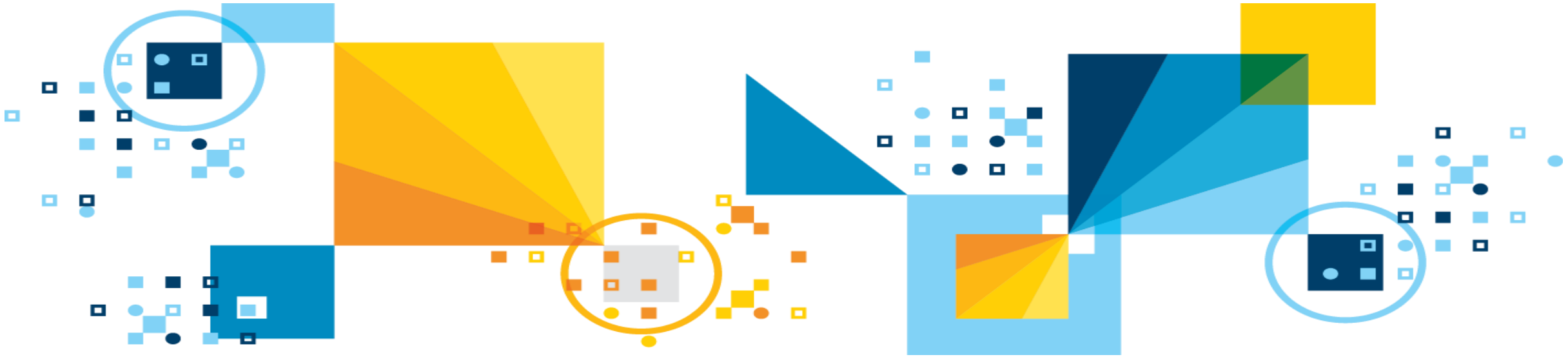

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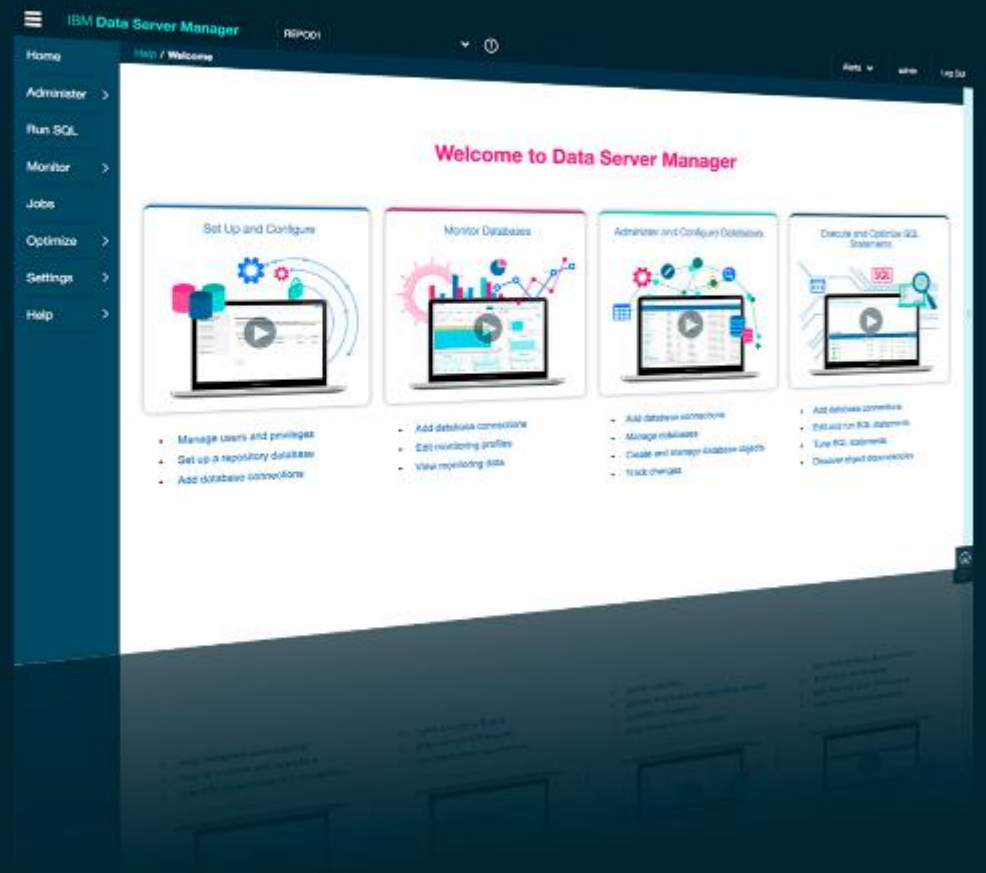

IBM Data Server Manager

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Password

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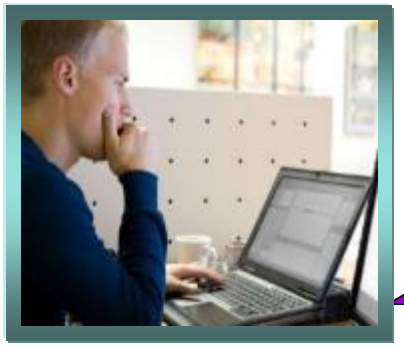
Performance tuning challenges across the organization



Application Developer

”I don’t have time to hone my SQL skills. I need to focus on developing core application functionality.”

IT Manager

“It is very challenging to aggregate performance data across our complex data environment.”

DBA

“I don’t understand why our developers aren’t focused on creating better performing SQL.”

LOB Manager

“I need to get my business results fast and accurate. What’s going on ?”

“Performance problems seem to appear without warning and deep technical skills are hard to find.”

QA Manager

“We can’t adequately test for peak workload since we don’t have enough human or IT resources.”

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Reactive vs. Proactive performance management

- Problems addressed after performance impact
- Measuring flashing light indicators
- Noticing either the very good or the very bad
- Takes longer to react to bad performance because of measuring lagging indicators

- Understanding what behavior is desired
- Measuring leading indicators
- Capture best practices and procedures
- Team responsible for creating the measurements understands the what and why

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What should you look for in a performance management solution?

- Cost reductions of Db2 and associated applications
- Faster identification and resolution
- Improved overall performance
- Replacing ad-hoc methods
- Faster Db2 and application migration

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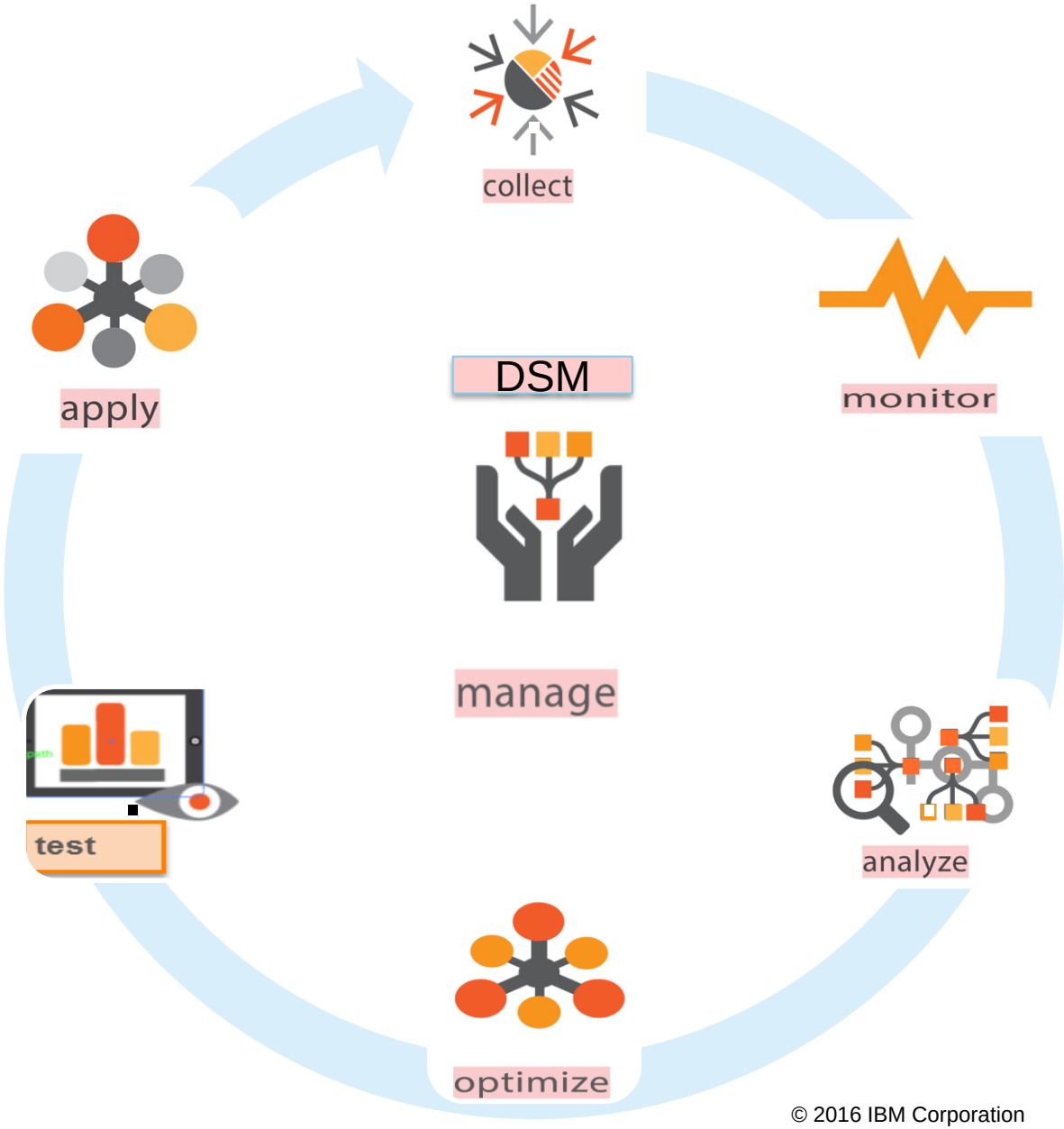
IBM Db2 Performance Management Solution provides:

- ✓ Fast identification with automated alerts, proactive notification and 24x7 monitoring
- ✓ Tuning of queries and workloads proactively
- ✓ Expert advice with built-in advisors
- ✓ Diverse set of capabilities managed via Data Server Manager (DSM)
  - ✓ Easy-to-use integrated view of overall Db2 performance management
  - ✓ Seamless navigation and movement via functional capabilities versus individual products



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IBM Data Server Manager | tpcds | Alerts | admin | Log Out

- Home
- Administer
- Run SQL
- Monitor
- Jobs
- Optimize
- Settings
- Help

Help / Welcome

Welcome to Data Server Manager

Set Up and Configure

- Manage DSM users and privileges
- Set up a repository database
- Add database connections

Monitor Databases

- Add database connections
- Edit monitoring profiles
- View monitoring data

Administer and Configure Databases

- Add database connections
- Manage databases
- Create and manage database objects
- Track changes

Execute and Optimize SQL Statements

- Add database connections
- Edit and run SQL statements
- Tune SQL statements
- Discover object dependencies

Data Server Manger – Where DBAs Spend Time

Administration

- helps you manage, and maintain complex database environments for increased productivity and optimized use of system resources

Performance Tuning

- helps you develop and implement a performance strategy including providing expert recommendations to improve query workload performance

Identifying Environment changes

- offers centralized management of database and client configuration

Troubleshooting

- capture production application workloads then compare capture and enforce configuration settings

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Features of the Data Server Manager z/OS Based Tools - At A Glance

NO CHARGE

Data Server Manager Base

- Connect to Db2 for z/OS V10/ V11/V12
- Database object navigation, viewing object detail, and linking to related objects.
- Database object dependency display.
- Data browsing and editing.
- Basic database object operations, such as creation of tables, indexes, constraints, and tablespaces; dropping of tables, indexes and constraints; altering tables.
- Show system privilege from the perspective of Group/User, Role, or SQL object. Choose:
  -"Group/User" to see the role and the relative object privilege for a user account;
  - "Role" to see the role a user account belongs to and its relative object privilege;
  - "SQL object" to see a specific object and users or roles that have the relative authority.
- Single query tuning
  - Statistics Advisor
  - Query Environment **Capture**
  - Access Path Graph

Db2 Performance Solution Pack

IBM Query Workload Tuner

- Launch of visual explain and tune query on the SQL editor
- Tuning wizard to capture SQL statements from multiple sources
- Tuning advisors provide recommendations for:
  - Statistics Advisor
  - Index Advisor
  - IDAA Advisor
- Problem analysis of query or workload
  - Access plan graph
  - Query formatting and annotation
  - Tuning Report
  - Test Candidate Index
  - Access Plan Comparison
  - Index Impact Analysis
  - Query and Workload Environment Capture
  - Selectivity Override

IBM Db2 Query Monitor

- Launching of DSM from Query Monitor Web UI for end to end performance analysis
- Host variable collection

OMEGAMON XE for Db2 PE

- Key Performance Indicators (KPIs) displayed in Data Server Manager on the Subsystems

Db2 Admin Solution Pack

Configuration Manager for z/OS V5.1

- Track configuration changes
- Configure zParm
- Compare and clone configurations
- Manage application profile
- Manage alias
- Manage and control clients

Db2 Utility Solution Pack V4.1

- Customizable profiles for performing conditional object evaluations and generating actions mapped to resolving utilities (reorg, copy, runstats, etc)
- Ability to control prioritization of objects, evaluation conditions and generated resolving actions.
- Ability to define maintenance windows for enabling autonomics, allowing Db2 to self manage utility runs
- Graphical trend analysis of historical RTS
- Capture of utility history, recording utility output, time, duration, etc.

Where do I start ?.....
Data Server Manager

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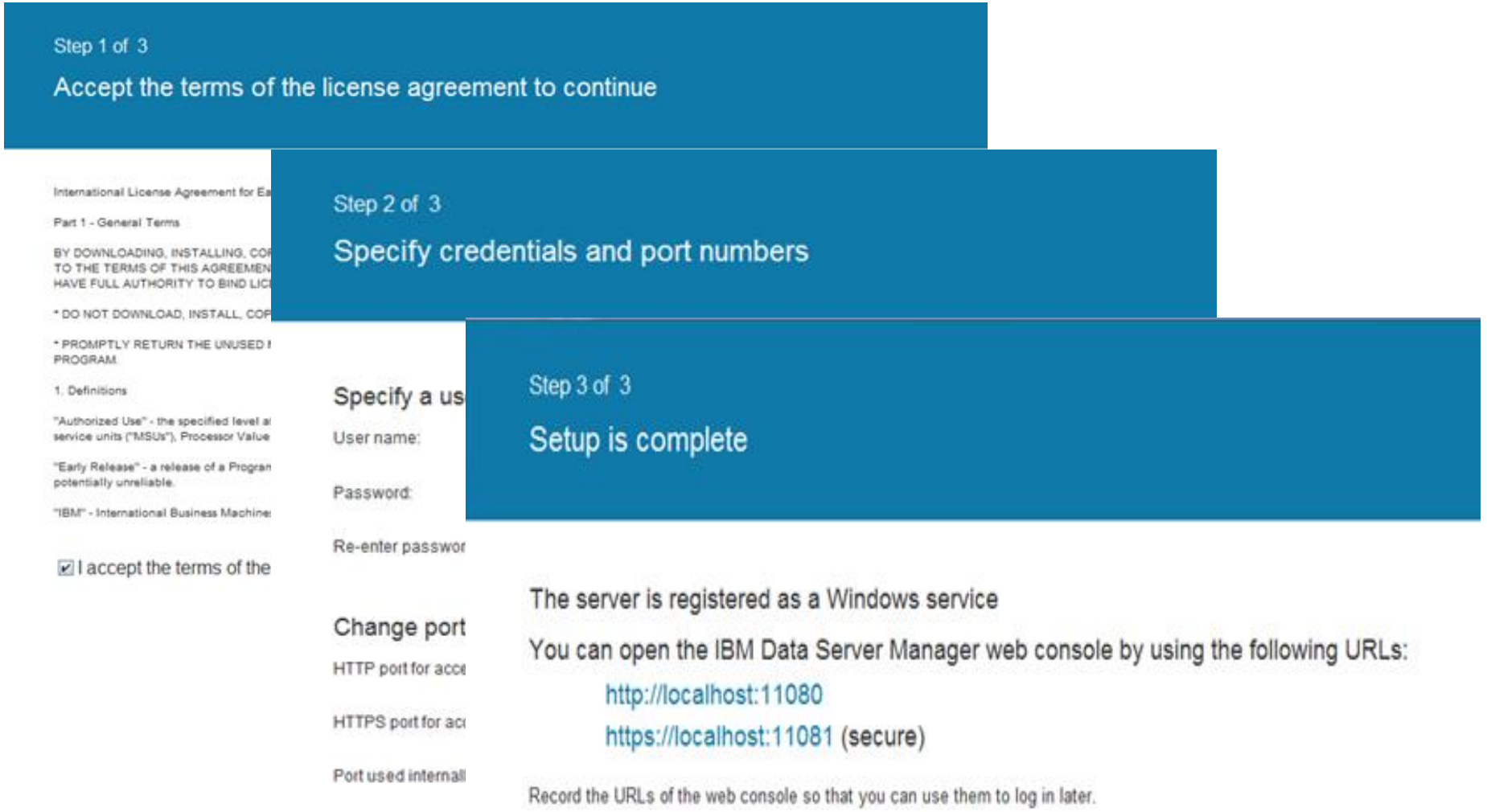
Simple 3-step setup



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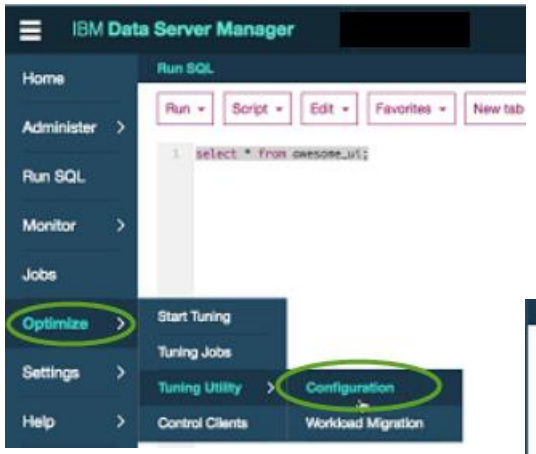

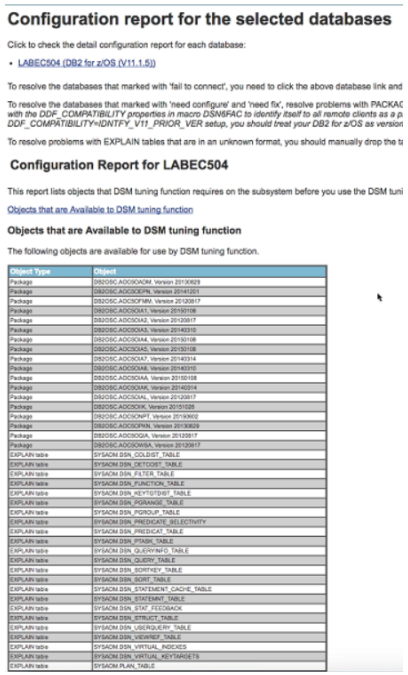

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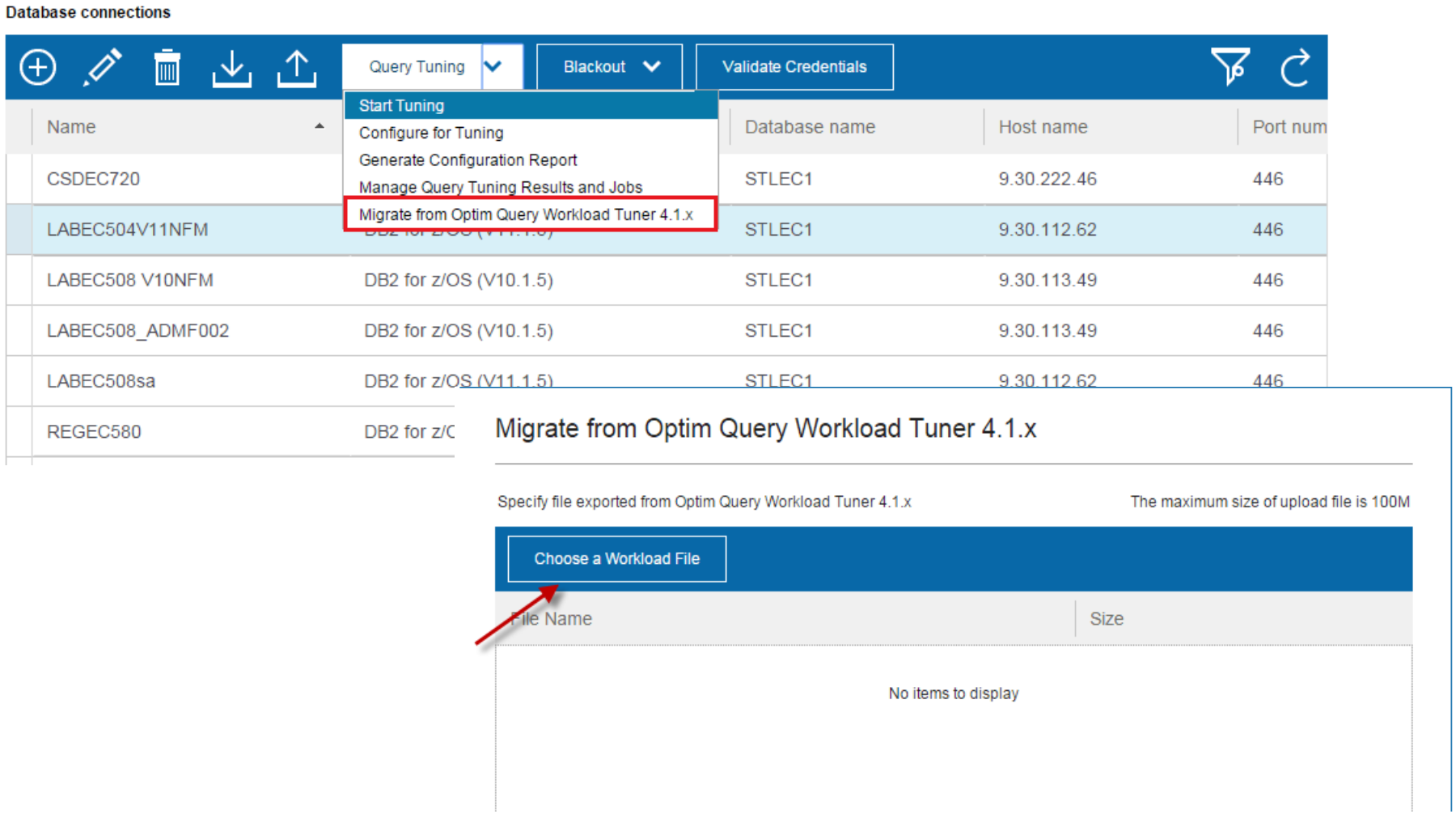
Migrating workloads from QWT 4.1.x to DSM



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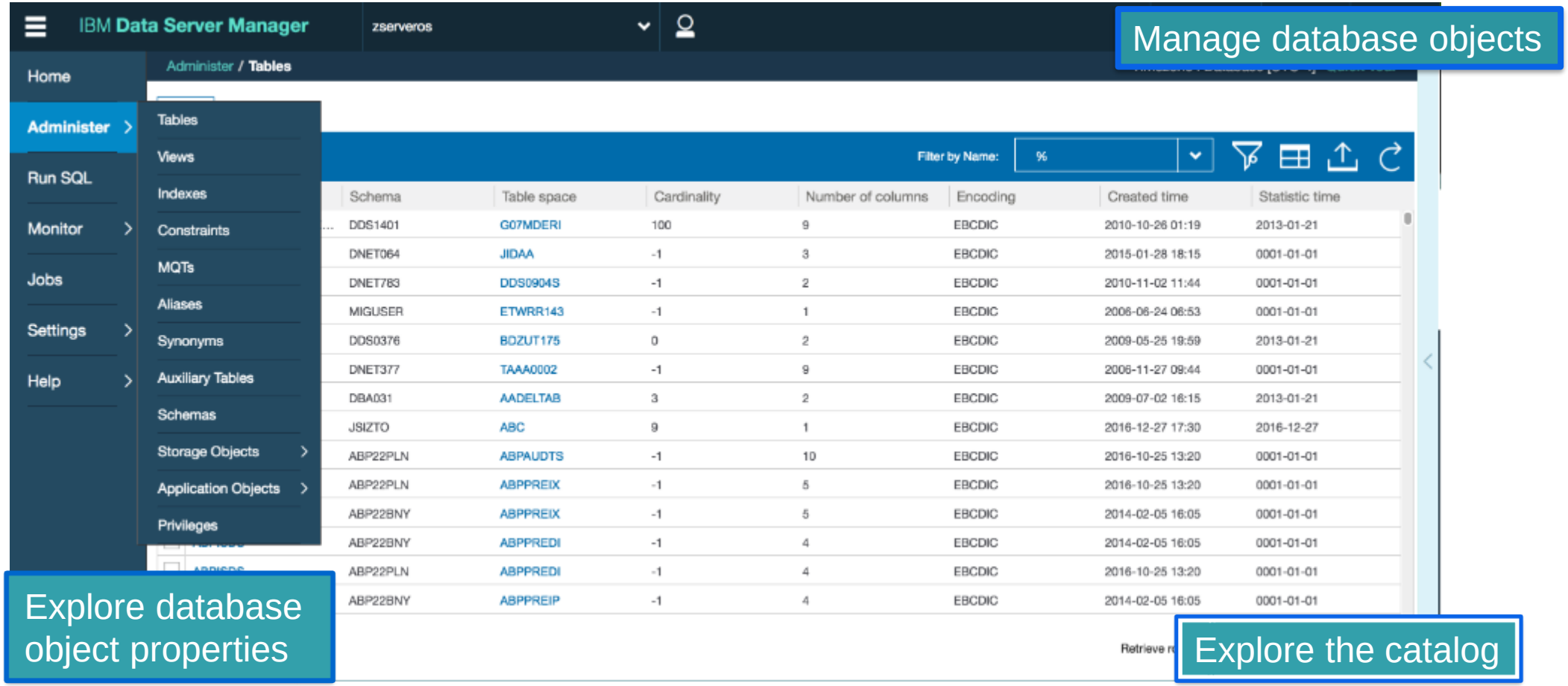
Manage Databases Using the Database Explorer



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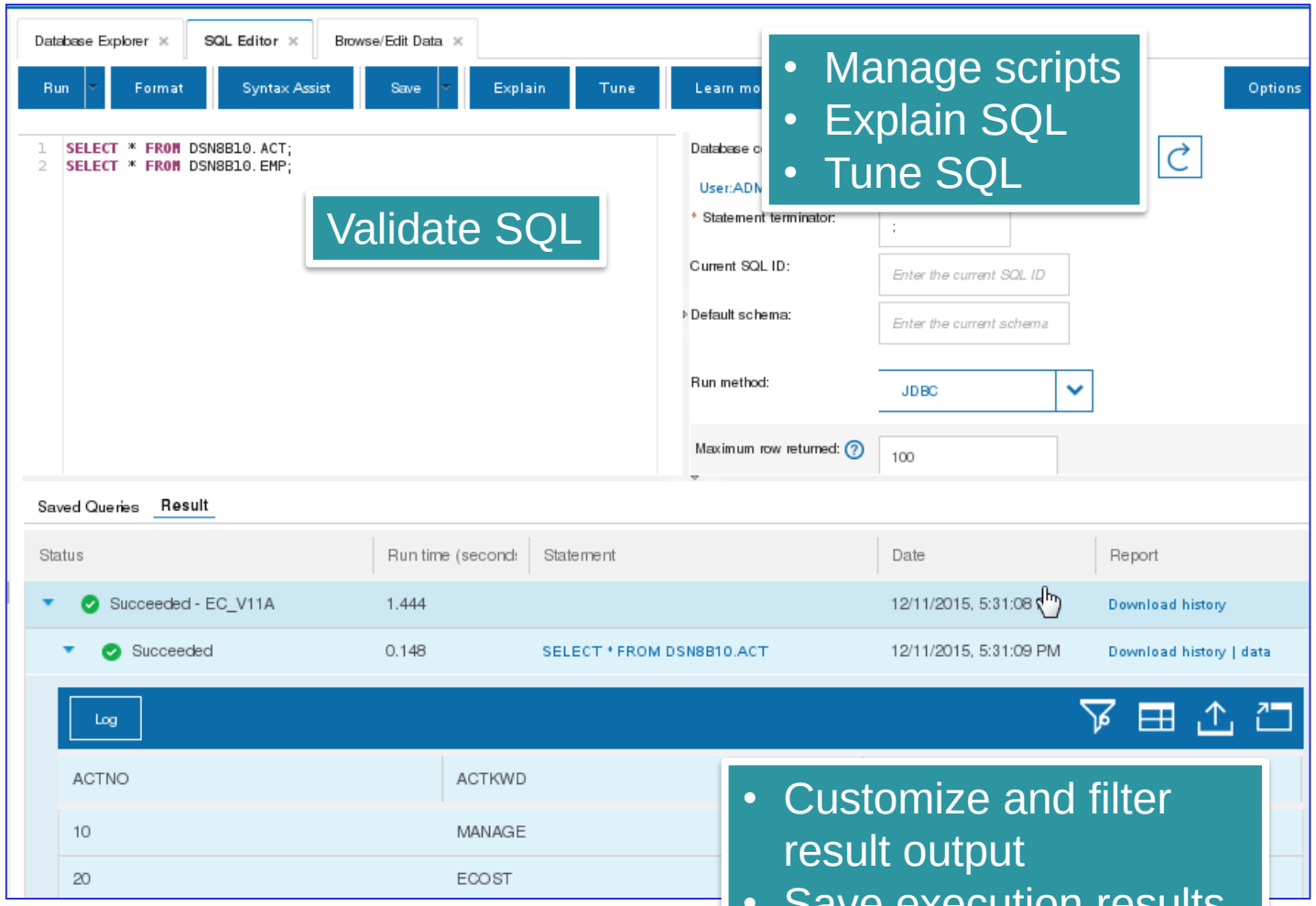
Develop and Run SQL Scripts



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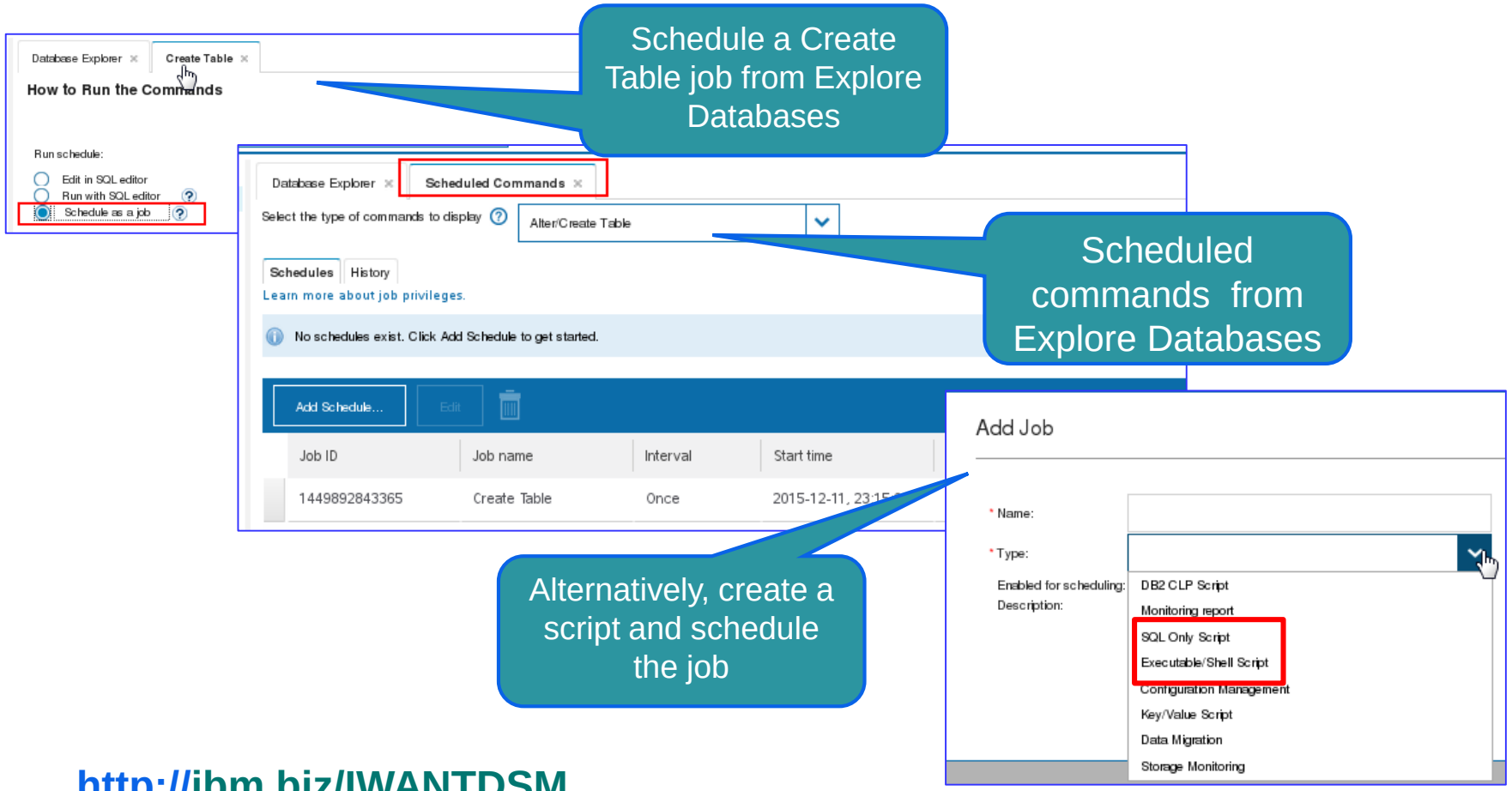
Create and schedule jobs



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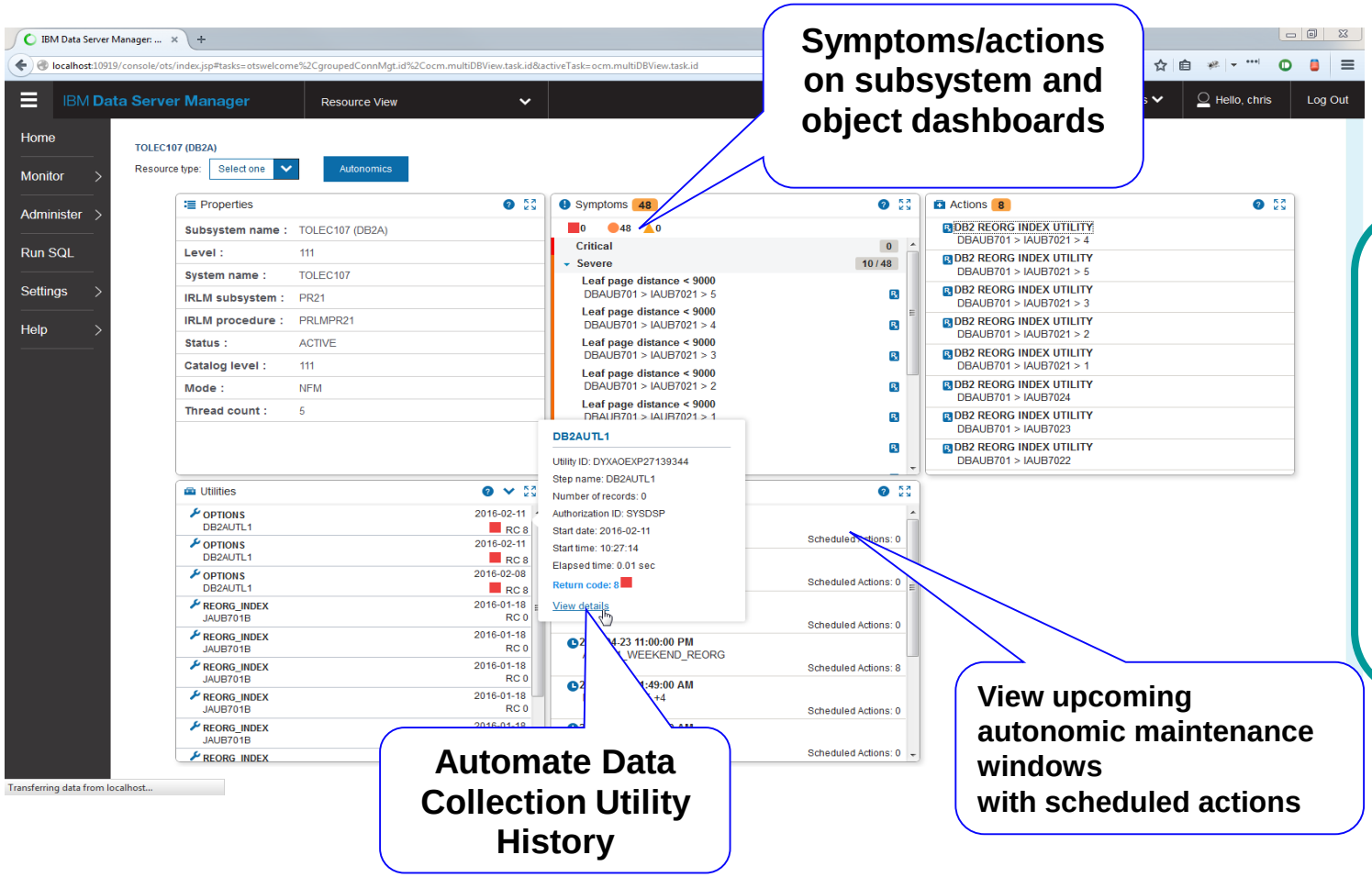
Db2 Utilities Solution Pack 2.2



"More integration, greater value"

Optimize, control manage & automate

Components:

Db2 Automation Tool

Db2 High Performance Unload for z/OS

Db2 Sort for z/OS

Db2 Utilities Enhancement Tool

Autonomics support

Data Server Manager

Db2 Utilities Solution

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Traditional Reactive Tuning

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What to do next …. Performance Tuning Using Data Server Manager : Query Workload Tuner 5.1

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Why is workload tuning important?

Workload: Multiple SQL statements defined by user

- The effort for tuning the whole application with good performance by evaluating every statement is overwhelming. Optimization decisions are based on trade offs:
  - Statistics – CPU costs vs. query savings
  - Indexing – query speed vs resource and transaction
- Sometimes performance improvement for one statement in an application may regress other statements in the application.
- When your application data grows, allows you to do proactive application health check periodically to find potential problems earlier before costly application outages
- Workload tuning speeds up analysis
  - Analyzes multiple queries at once
- Workload tuning consolidates and optimizes recommendation for overall workload
  - Statistics recommendations
  - Index recommendation

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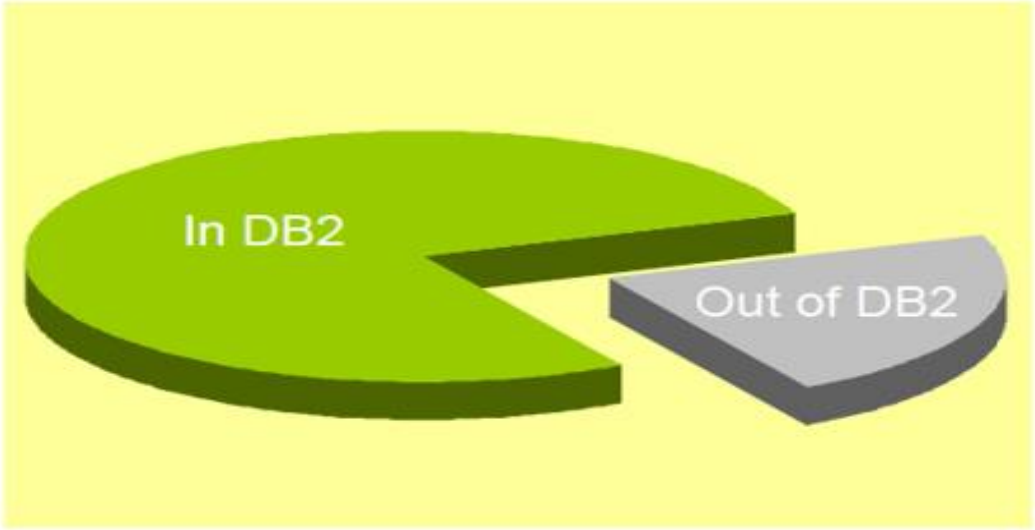
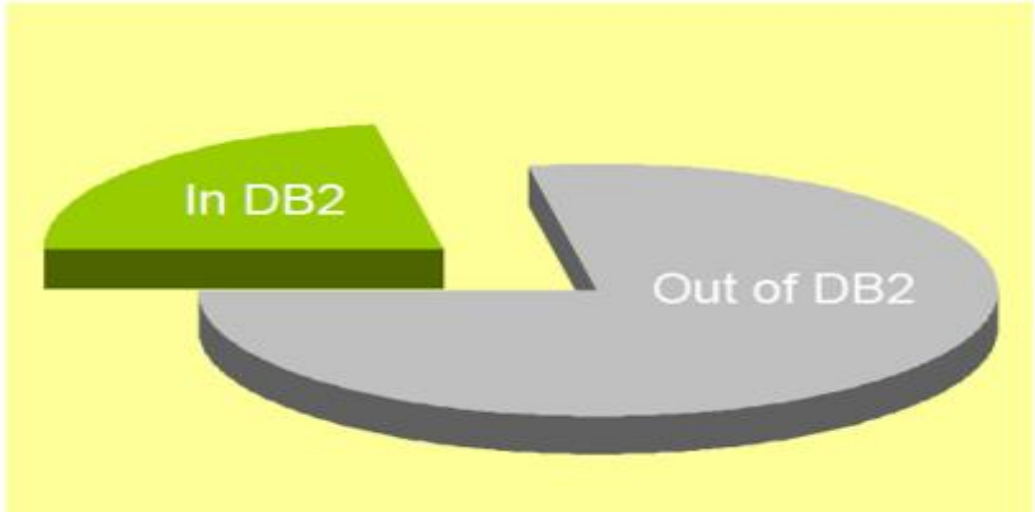
Where is the most time spent?



Need to analyze time distribution:
where is the time really spent?



- Application logic inefficiency
  - often combined with
    Class 2 CPU << Class 1 CPU
- Network problems
- Class 2 not active all the time

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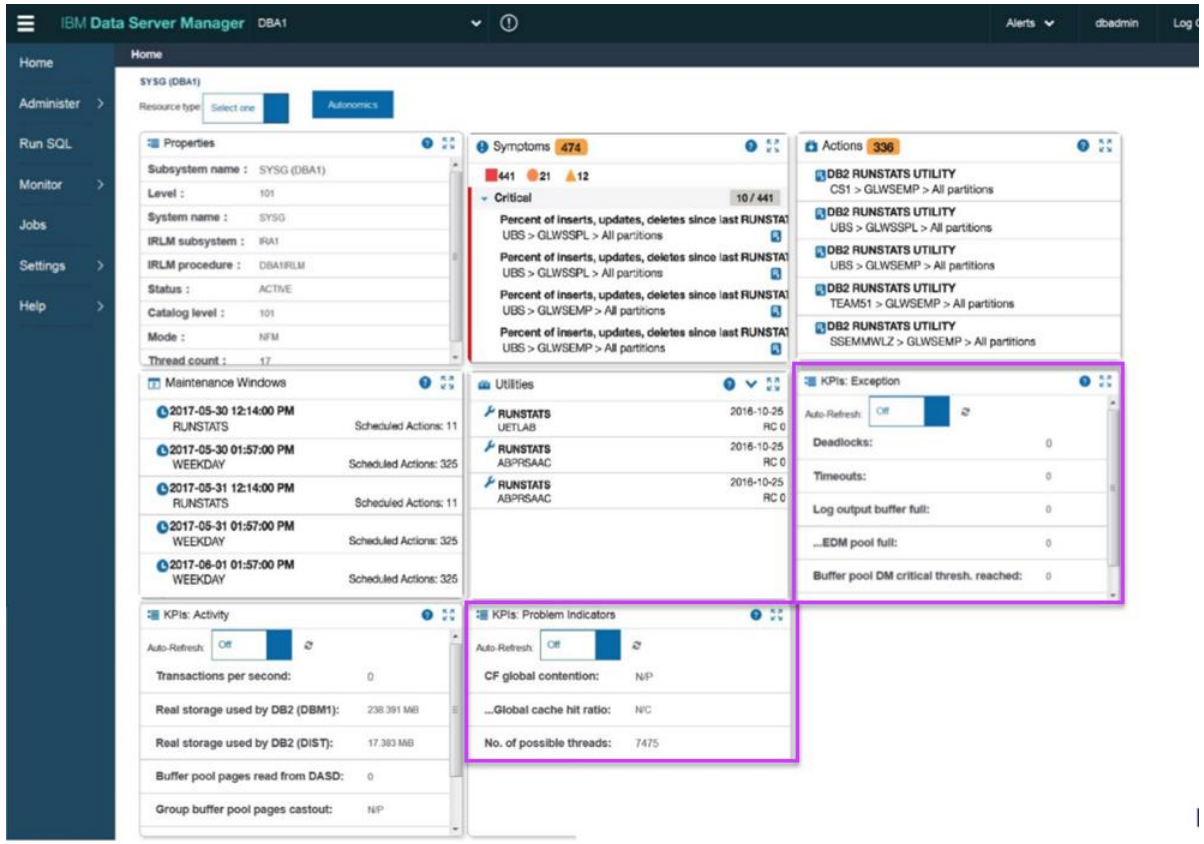
Improve Performance and Reduce Costs

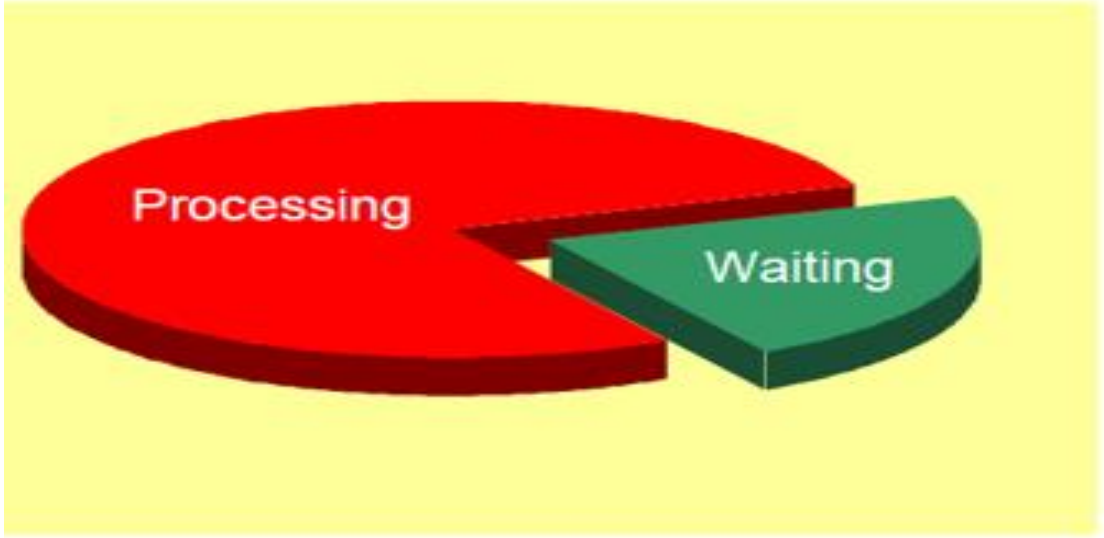
- Improve end-user experience of performance
  - Monitor KPIs that better reflect end-user experience
    - i.e., transaction response time
  - Get early warning of degrading performance before users are affected
  - Isolate problems to correct area for fast response
  - Get expert advice for improving query and workload performance
- Reduce costs
  - Improve performance and govern system utilization to defer upgrades
  - Save hours of staff time and stress
    - Isolate problems to the right layer of the application stack, database component, even the line of code
  - Enable developers and novice DBAs to tune like an expert



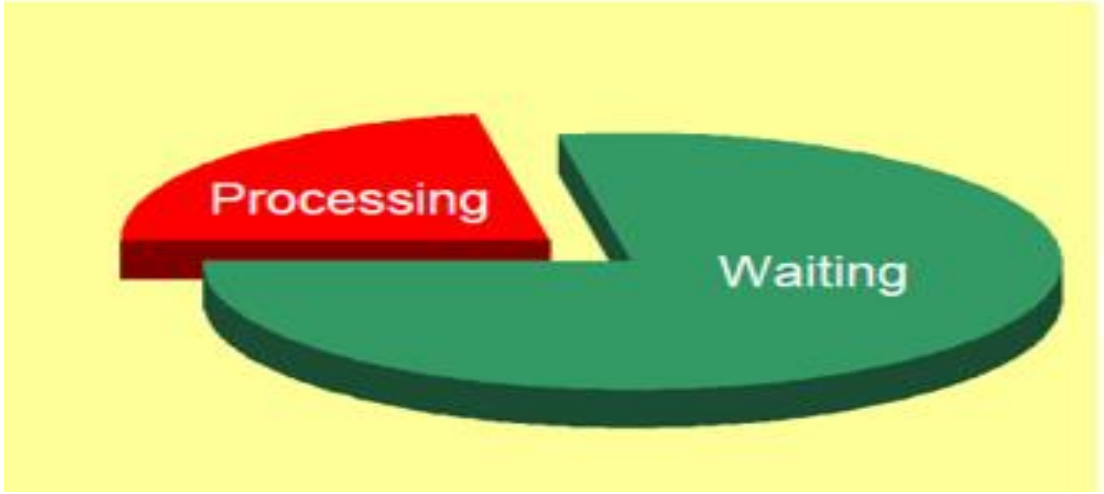
Accelerate analysis and reduce downtime for urgent situations

monitor

Where is the time spent within Db2?



- Turn off expensive traces
- Inefficient access paths
  - Explain



- What is the largest contributor
  - Class 3 and 8 analysis

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What is your query tuning objective ……..

reduced CPU usage or reduced elapsed time ?

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Common Scenarios & Collection

- Most expensive SQL statement in your Db2 subsystem
- Most expensive SQL within a PLAN
- All of the PLANS where a specific package is used
- All of the “exceptional SQL for a given plan”
- All of the objects accessed by a specific package
- All of the SQL which access a specific object
- Unnecessary negative SQLCODES

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1 Determine what data needs to be collected

- Data available to be collected or viewed
  - SQL metrics
  - Db2 object access
  - SQL text and host variables
  - Db2 commands
  - Negative SQLCODES
  - Expanded and grouped Information about exceptions
  - Buffer Pool Statistics
  - Delays

- Three types of data
  - **Summary** – data summarized for each unique SQL statement executed in a particular interval of time
    - Plan + Program + Section + Statement # + Statement type
    - SQL Codes are not collected by default
  - **Exceptions** – individual SQL calls that have exceeded user defined thresholds
  - **Alerts** – events that require immediate attention; can be classified as exceptions

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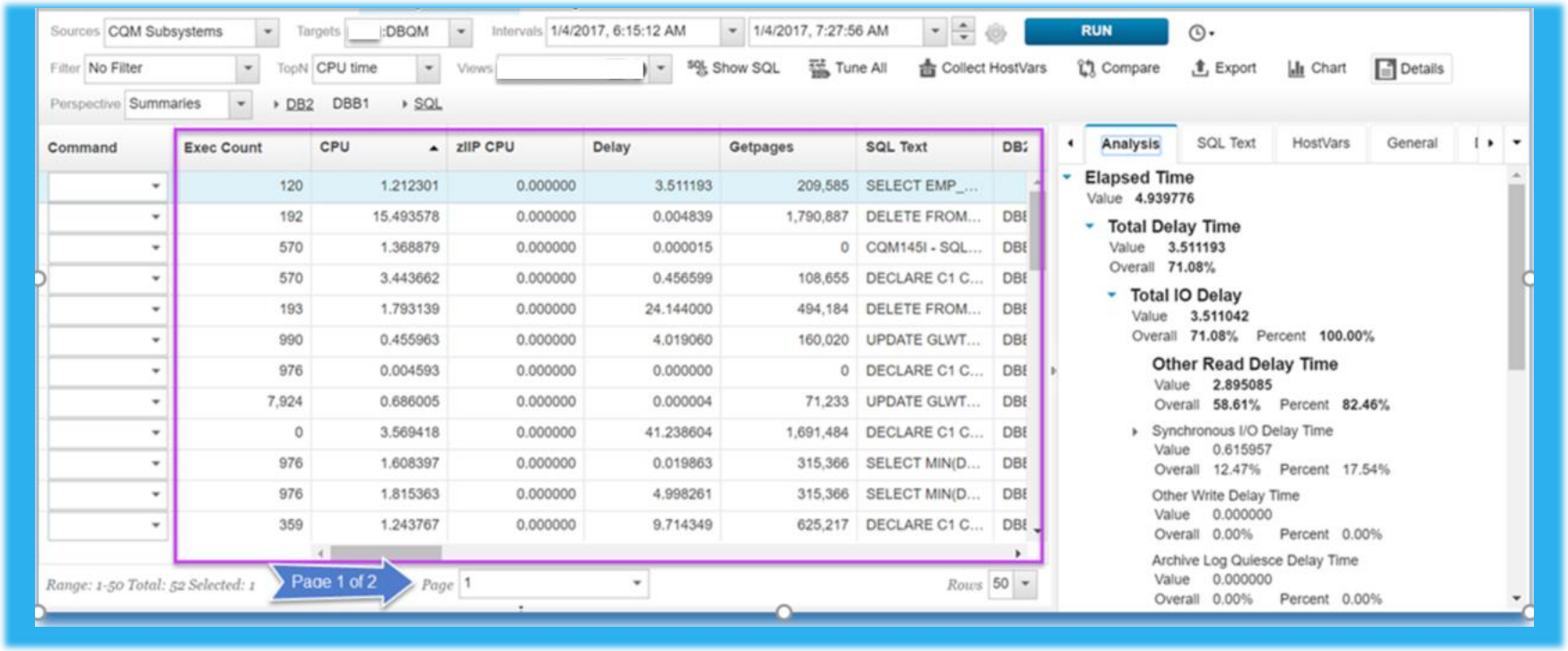
2 Identify workload for proactive tuning

- Identify the topN (50 , 200 , 250 …….) most expensive queries
- Drill down into results
- Save workload and/or start tuning



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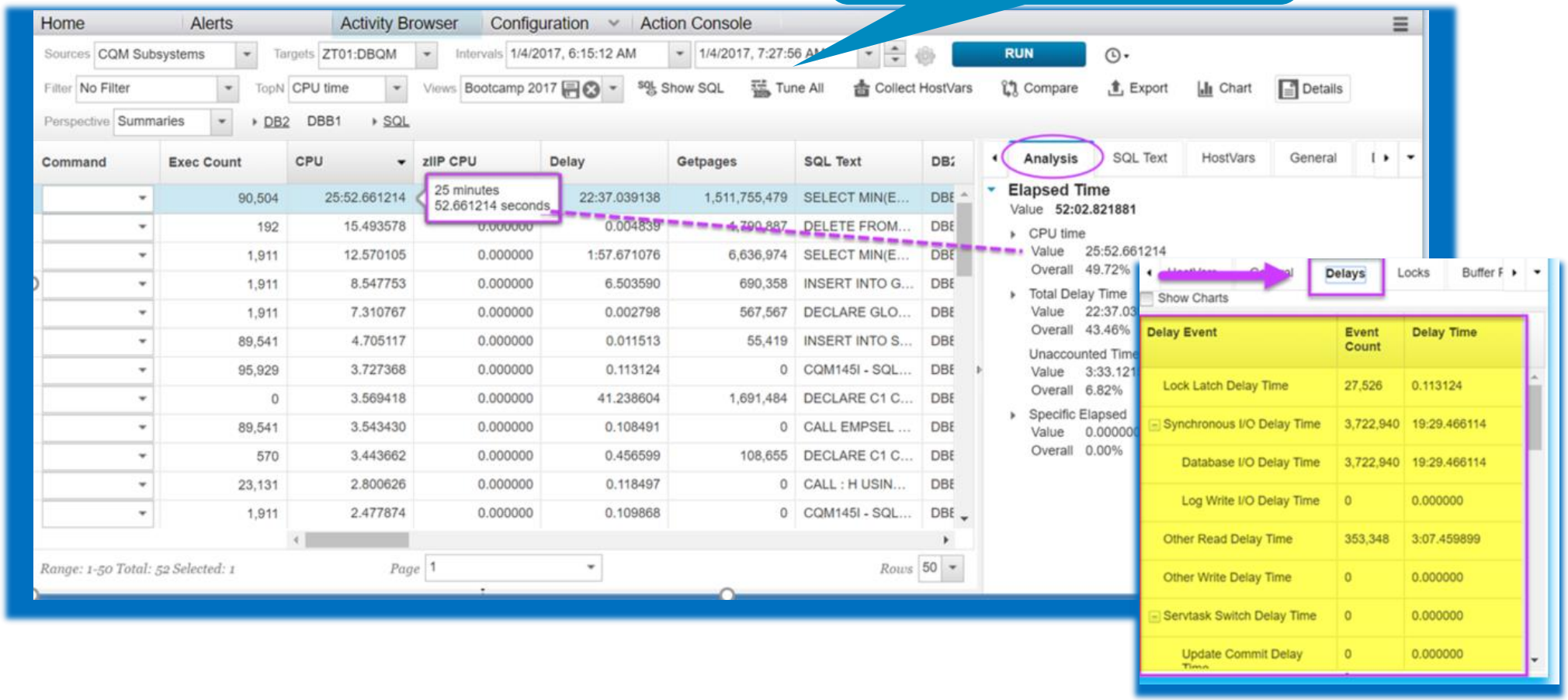
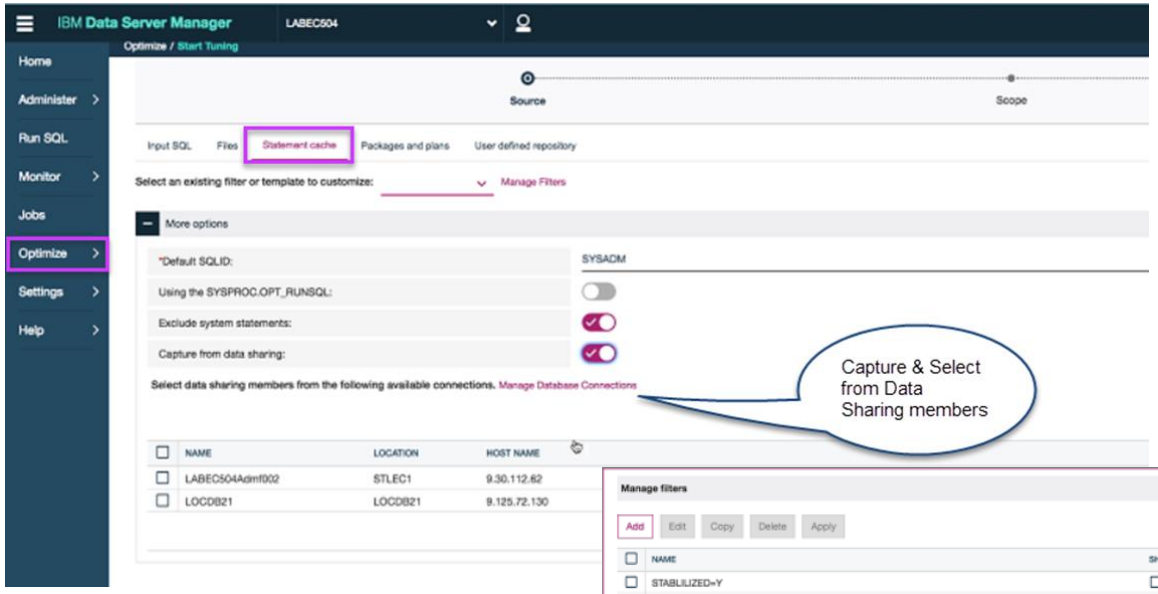
2 Drill down into results

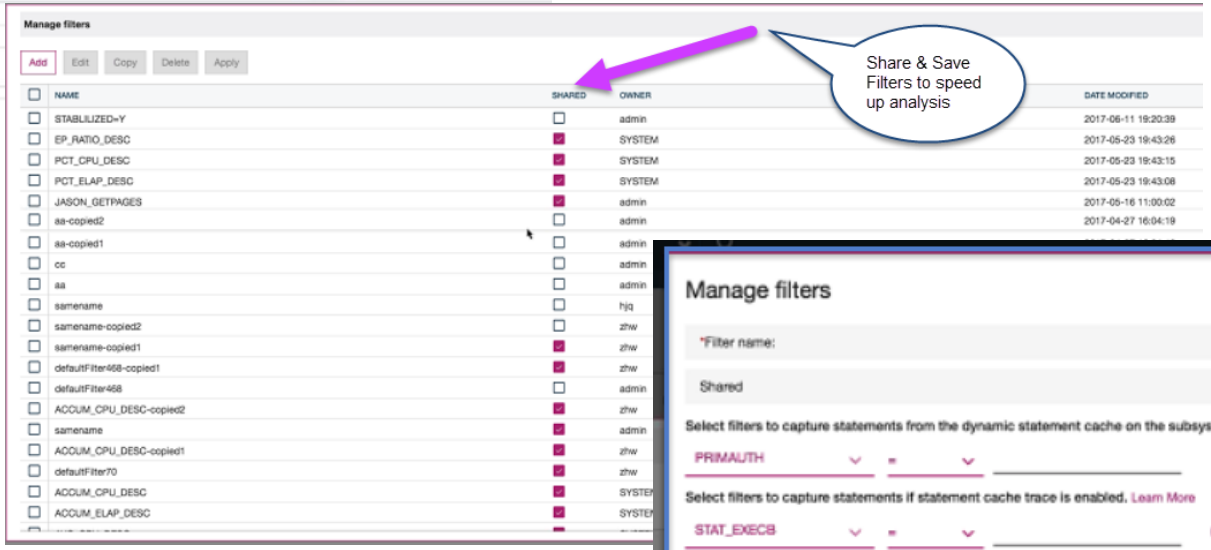
Tune or Tune all

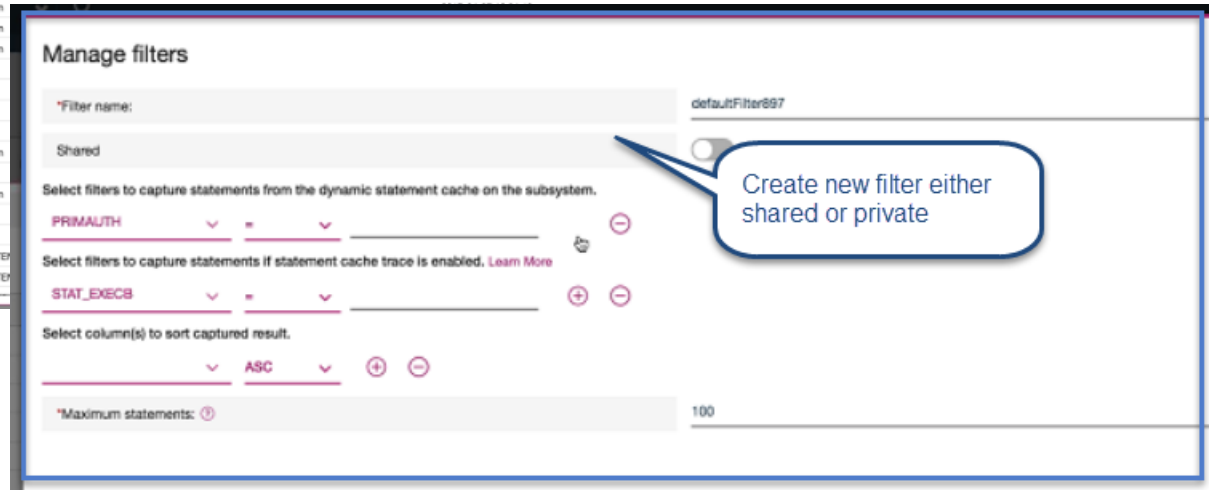


analyze

Capture from Statement Cache & customize collection



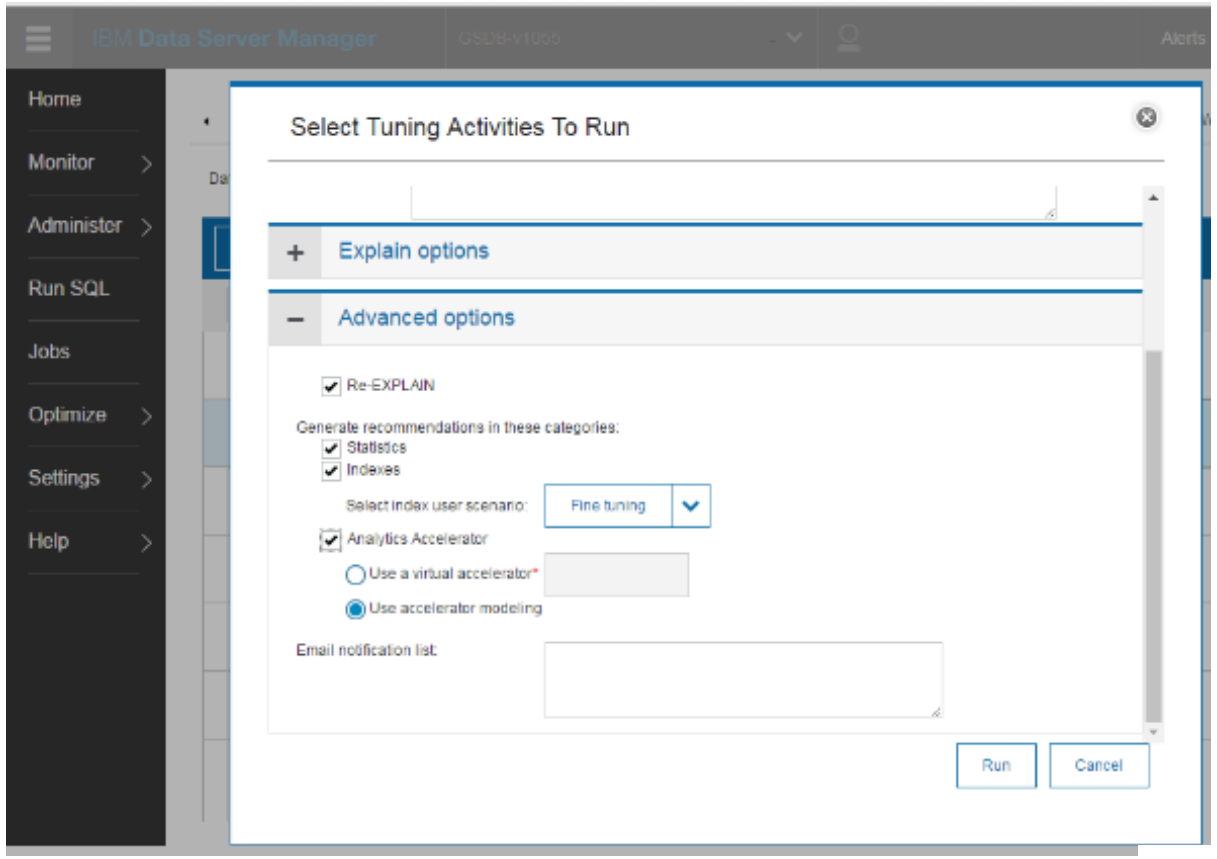




- Accelerate analysis, reduce downtime

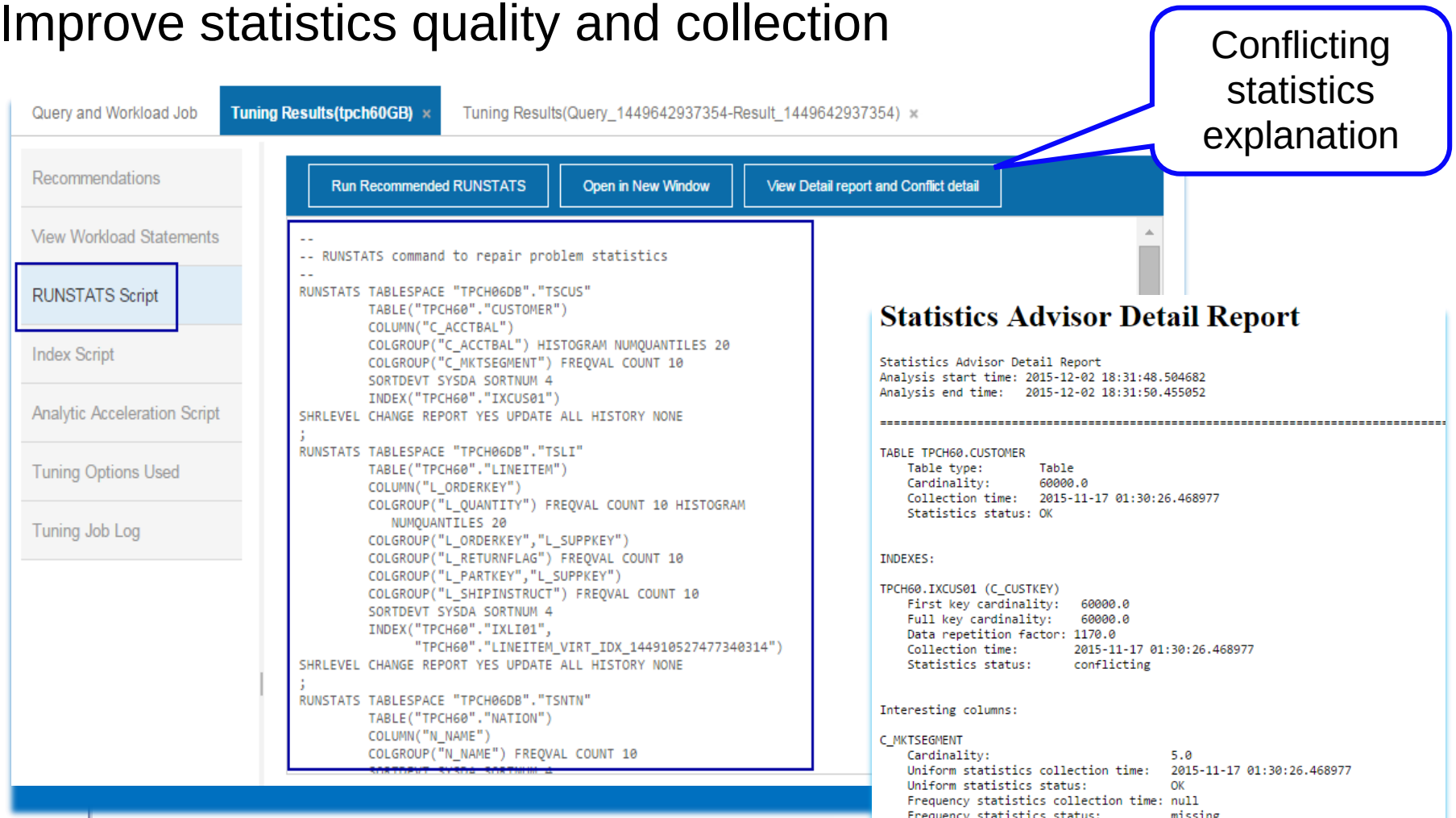
3 Execute Advisors

- Statistics
  - Get recommendations on the best statistics to capture to influence access path selection
- Index
  - Get recommendations on indexes changes that can reduce database scans
- Analytics Accelerator
  - Get recommendations on optimizing and managing accelerated analytic queries and applications



optimize

Improve statistics quality and collection



Conflicting statistics explanation

"80 % of access path PMRs could be resolved by statistics advisor before calling IBM support." – IBM Support

- Results
  - Accurate estimated costs
  - Better query performance
  - Less CPU consumption
  - Improved maintenance window throughput

optimize

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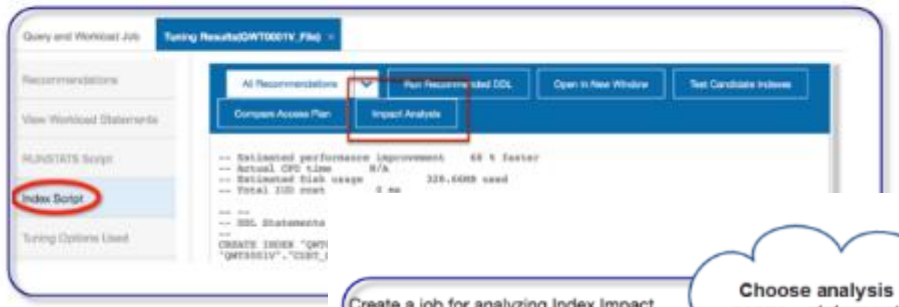
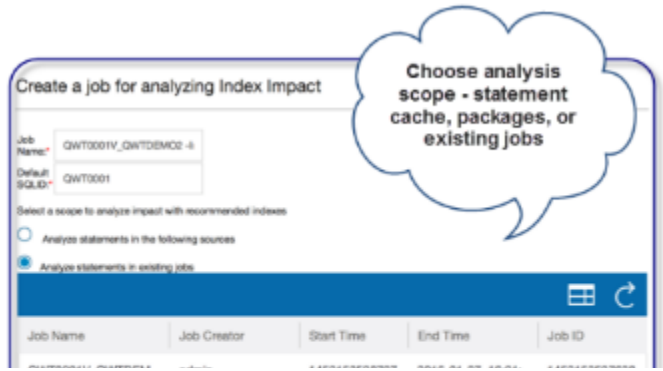
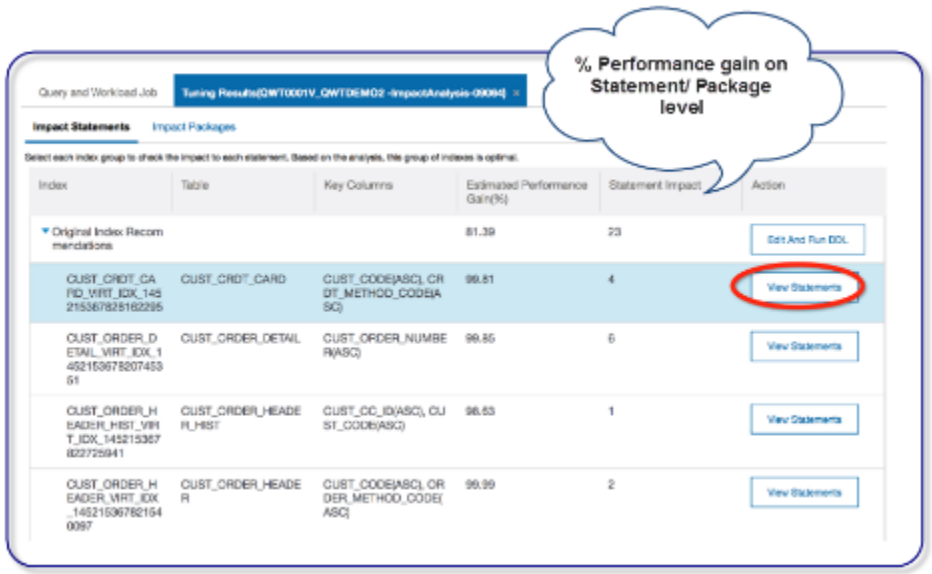
Indexing advice to improve database design

Workload Index Impact Analysis

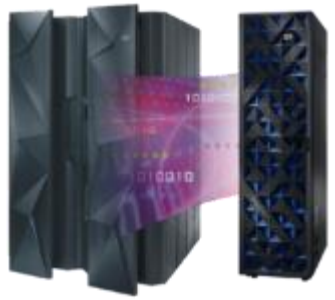
- Indexes are decided at design stage
  - Lot of effort is spent making SQL to use the provided indexes
  - But what if the SQL is "right" and it's the indexes that are "wrong“
  - Cost resources to maintain
  - ***How do you simply test your hypotheses without impacting production?***
- Removing obsolete indexes simplify use
  - Consolidate indexes and provide a single recommendation
  - Enables what-if analysis
  - Provides DDL to create indexes
  - Run immediately or save
- Test before deployment
  - Use virtual index capabilities built into the Db2 engine



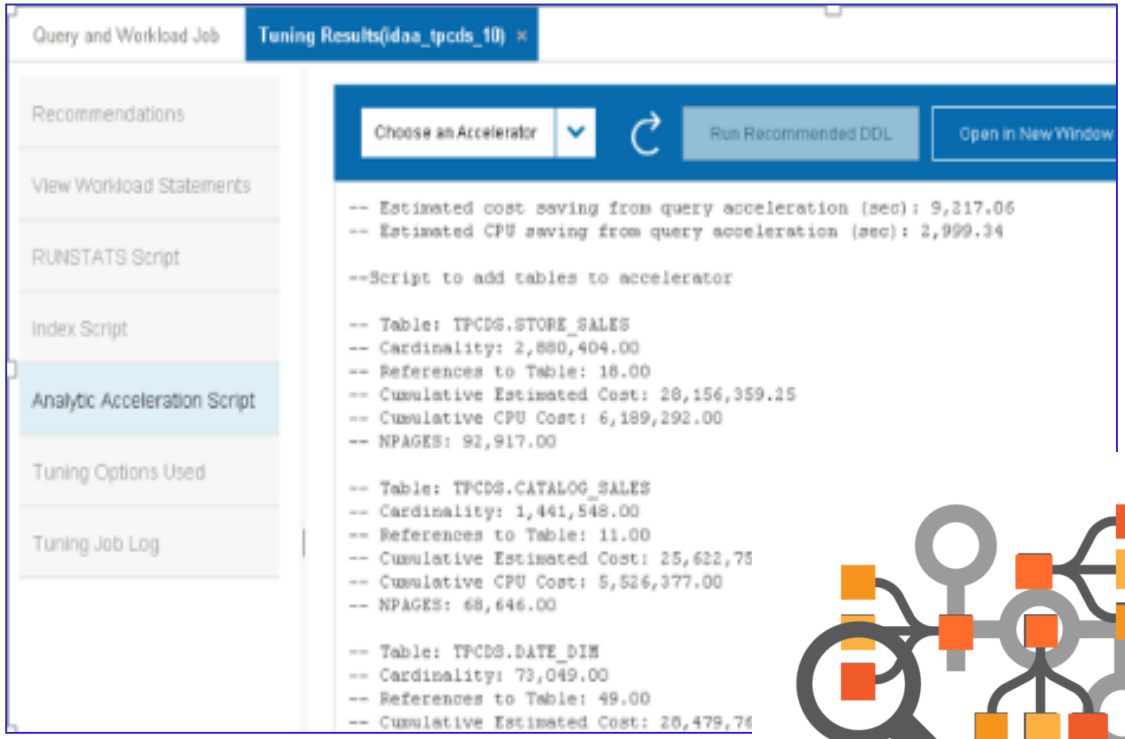




Optimizing the selection and tuning of accelerated workloads



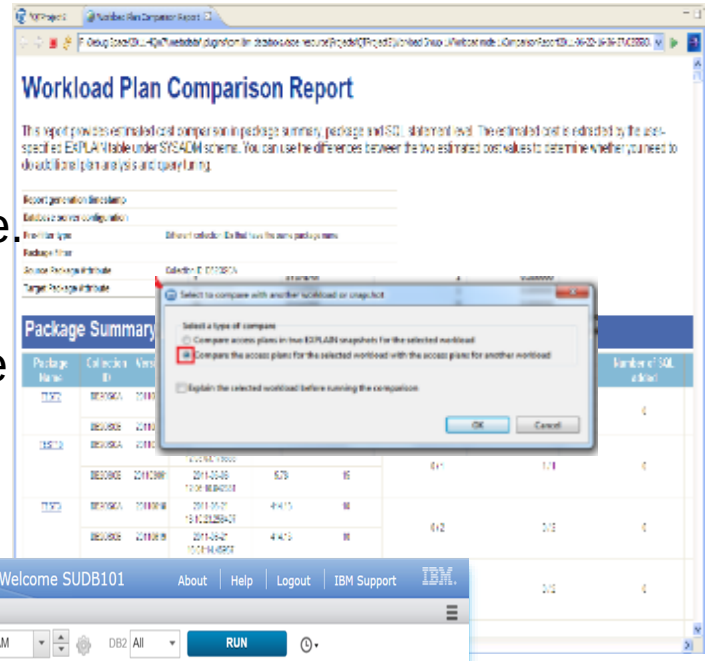
- Workload Analytics Accelerator Advisor
  - Identify candidate queries and tables to be routed to the Accelerator
  - Identify candidate tables to be routed to the accelerator
  - Implement advisor-based tuning recommendations for mixed workloads of accelerated and un-accelerated queries
  - Diagram accelerated queries in Access Plan Graphs
  - Integrates with Query Monitor and OMPE for capturing query workloads for complete analysis
  - Enable “what if” analysis



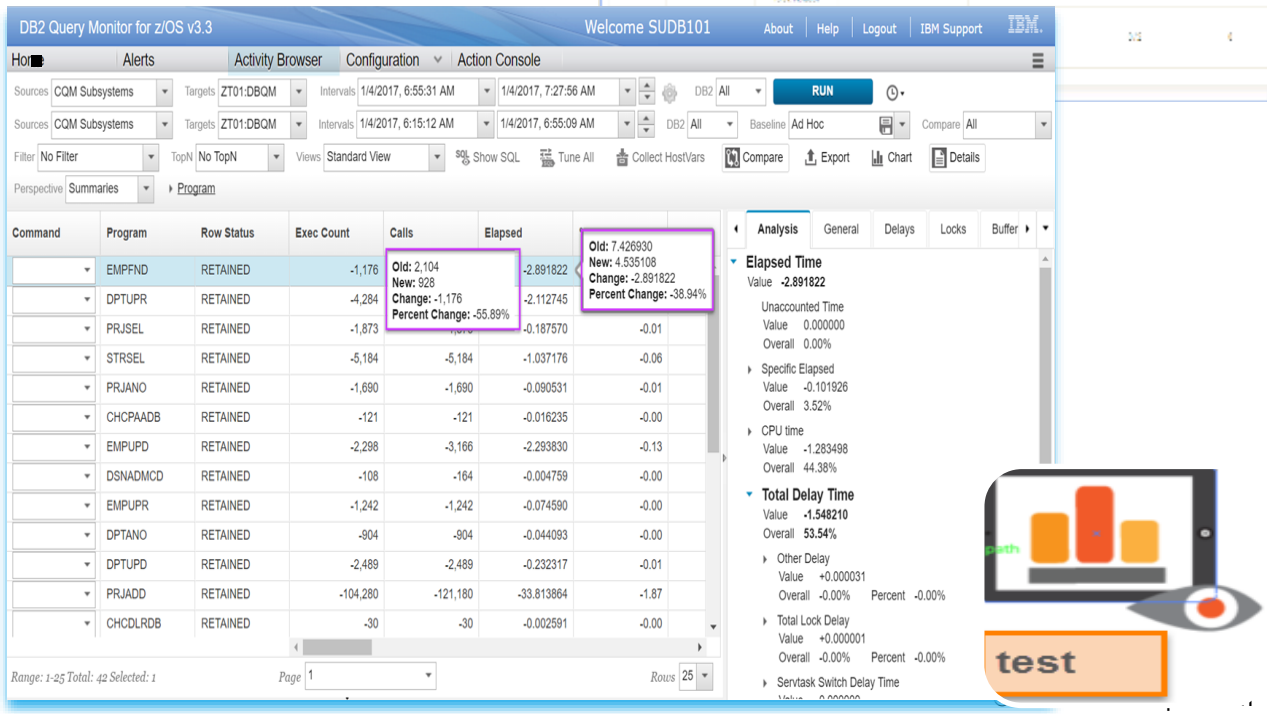
- Benefits
  - Shorten the process of selecting tables to be accelerated
  - Visualize access paths of accelerated queries
  - Increase productivity by working with accelerated queries through a unified interface
  - Increase overall system capacity

4 Prevent problems before they impact the business

- Optimize beyond the prior level of service
  - Determine whether the later version of the collection has degraded performance.
  - Determine whether any packages have errors.
  - Identify which packages have SQL statements that have degraded performance
- Available Actions
  - Apply filters and review Comparison result
  - Review comparison result
  - Generate HTML comparison report or in csv
  - Generate new query workload for tuning & perform analysis
- Enhancements
  - **Compare two different workloads**



Workload Comparison



Workload Access Plan Comparison

4

Prevent problems before they impact the business

migration comparison

	A	B	C	D
1				
2	General information		Run A	Run B
3	DB2 Group name		0	0
4	DB2 Subsystem name		0	0
5	Workload description		???	???
6	DB2 Version, Mode		V10 NFM ???	V11 CM ???
7	DB2 code level		PUTxxxx	PUTxxxx
8	z/OS level		z/OS V1R13	z/OS V1R13
9	Processor Model (RMF CPU)		??? 2097-E64	??? 2097-E64
10	Statistics with ZOSMETRICS (or RMF report)			
11	Number processor (AVG per Interval)	QWOSLNCP	#DIV/0!	#DIV/0!
12	CPU utillization (AVG per Interval and per processor)	QWOSLPRU	#DIV/0!	#DIV/0!
13	Aggregated Accounting for each CONN TYPE or ACCOUNTING TRACE			
14	CONNTYPE		0	0
15	CL1 Elapsed / QUANTITY		#DIV/0!	#DIV/0!
16	CL1 CPU / QUANTITY		#DIV/0!	#DIV/0!
17	CL1 SE CPU / QUANTITY		#DIV/0!	#DIV/0!
18	CL2 Elapsed / QUANTITY		#DIV/0!	#DIV/0!
19	CL2 CPU / QUANTITY		#DIV/0!	#DIV/0!
20	CL2 SE CPU / QUANTITY		#DIV/0!	#DIV/0!
21	CL3 SUSP / QUANTITY		#DIV/0!	#DIV/0!
22	CL2 NOT ACCOUNT / QUANTITY		#DIV/0!	#DIV/0!
23	QUANTITY (Number of transaction aggregated for the connection type)		0	0
24	COMMIT / Rollback			
25	COMMIT		0	0
26	ROLLBACK		0	0
27	DML per COMMIT			
28	SELECT		#DIV/0!	#DIV/0!
29	INSERT		#DIV/0!	#DIV/0!
30	NUMBER OF ROWS		#DIV/0!	#DIV/0!
31	UPDATE		#DIV/0!	#DIV/0!
32	NUMBER OF ROWS		#DIV/0!	#DIV/0!
33	MERGE		#DIV/0!	#DIV/0!
34	DELETE		#DIV/0!	#DIV/0!
35	NUMBER OF ROWS		#DIV/0!	#DIV/0!

DB2 11 ESP measurement result | Input A Stats | Input A plan | Input A BP | Input B Stats | Input B plan | Input B BP

Derived Worksheet with V11⇔V12 comparison

Import generated CSV data from V11 and V12 execution into the provided several worksheets

Host variable Collection & Selectivity Override

IBM Solution Exclusive!

- Why did the Db2 Optimizer choose that path?
- Helps users improve query access plans for dynamic queries with parameter markers
- The selectivity override feature utilizes parameter marker information
- Users can deploy a selectivity profile generated by this function to create better access plans.

```
SELECT * FROM
EMPLOYEES WHERE
SALARY BETWEEN ?
AND ?
```

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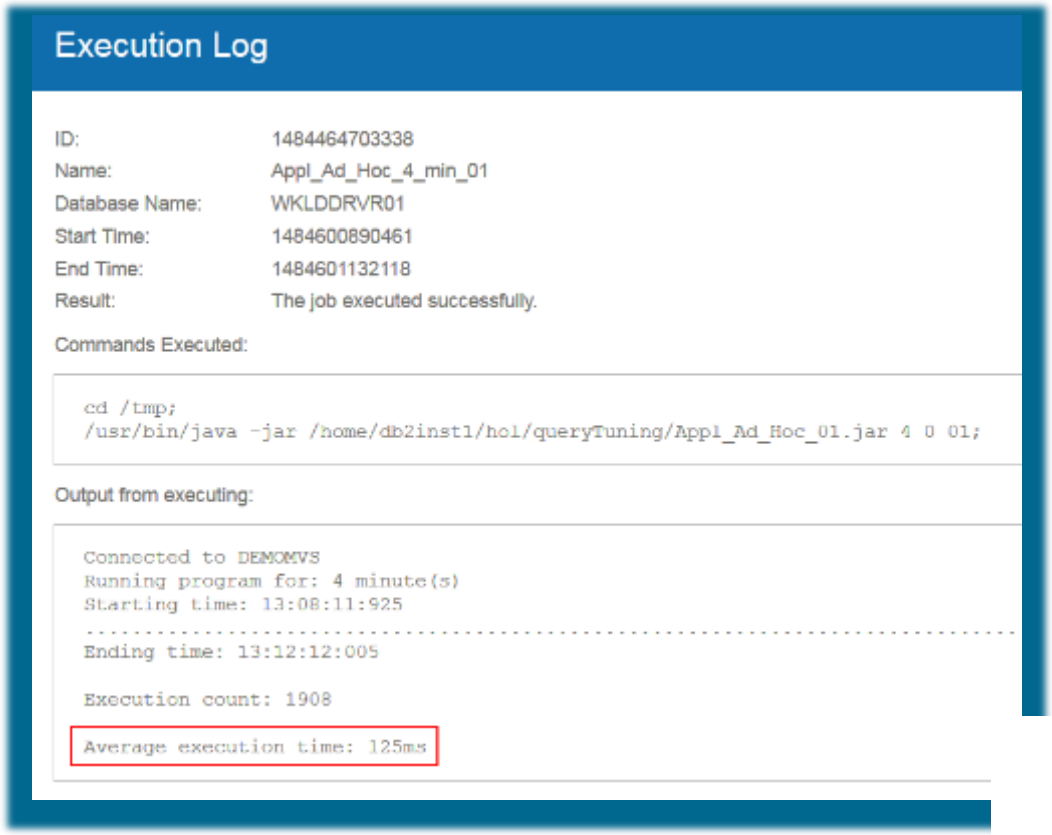
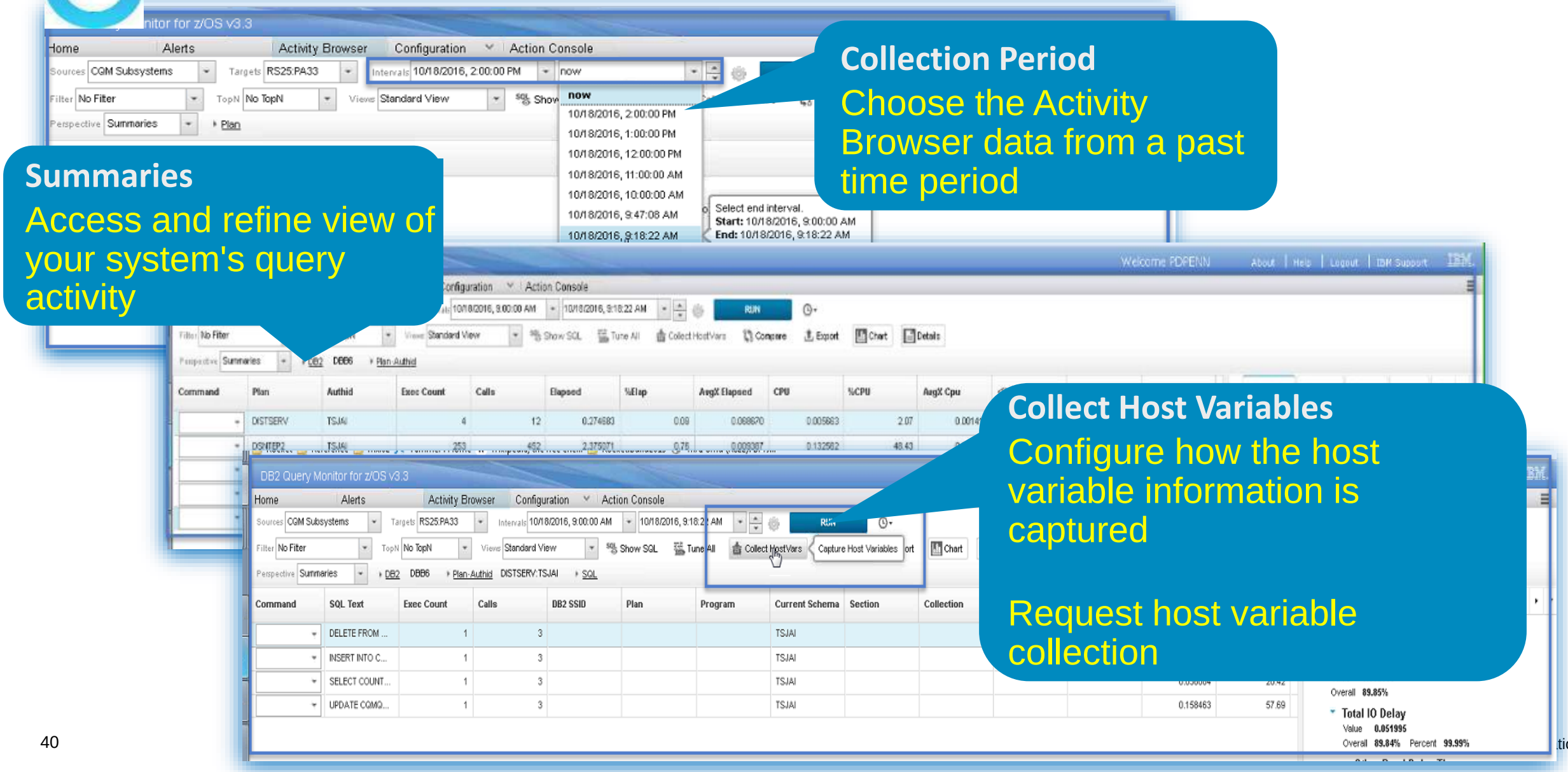
1 Create a Baseline

- Run a test application now to get a baseline.
- Average execution time for this application is: 125ms
- *Note this query is well tune before selectivity override analysis*
- Remember this number



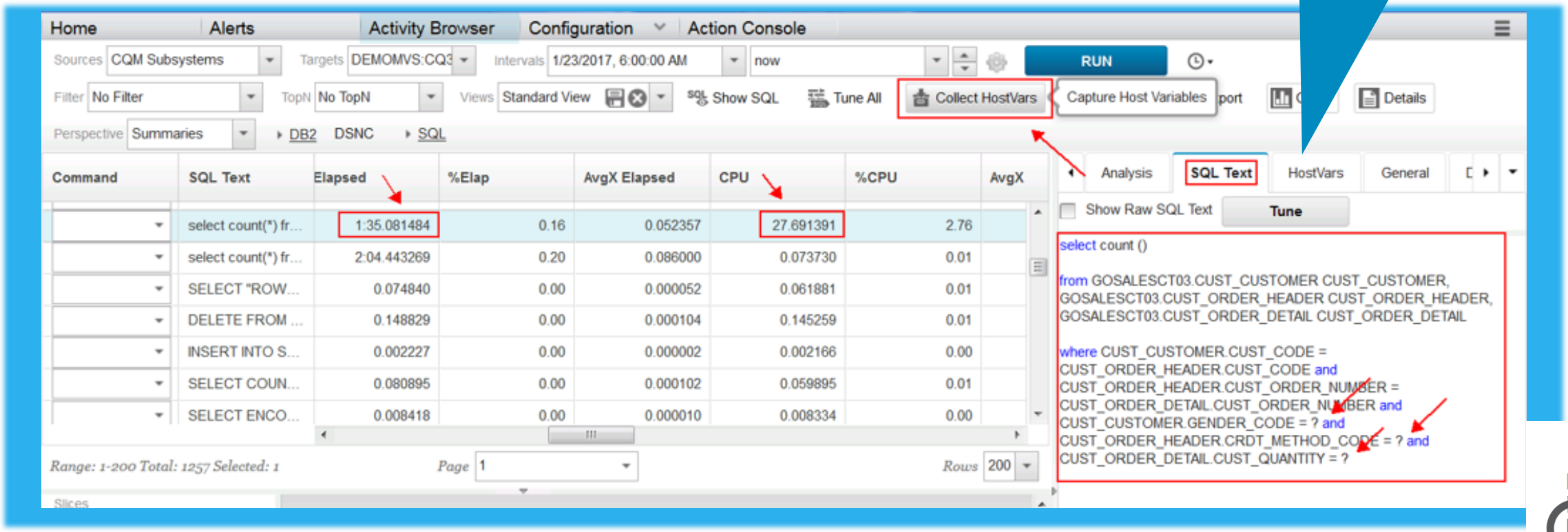
2 Collect Activity



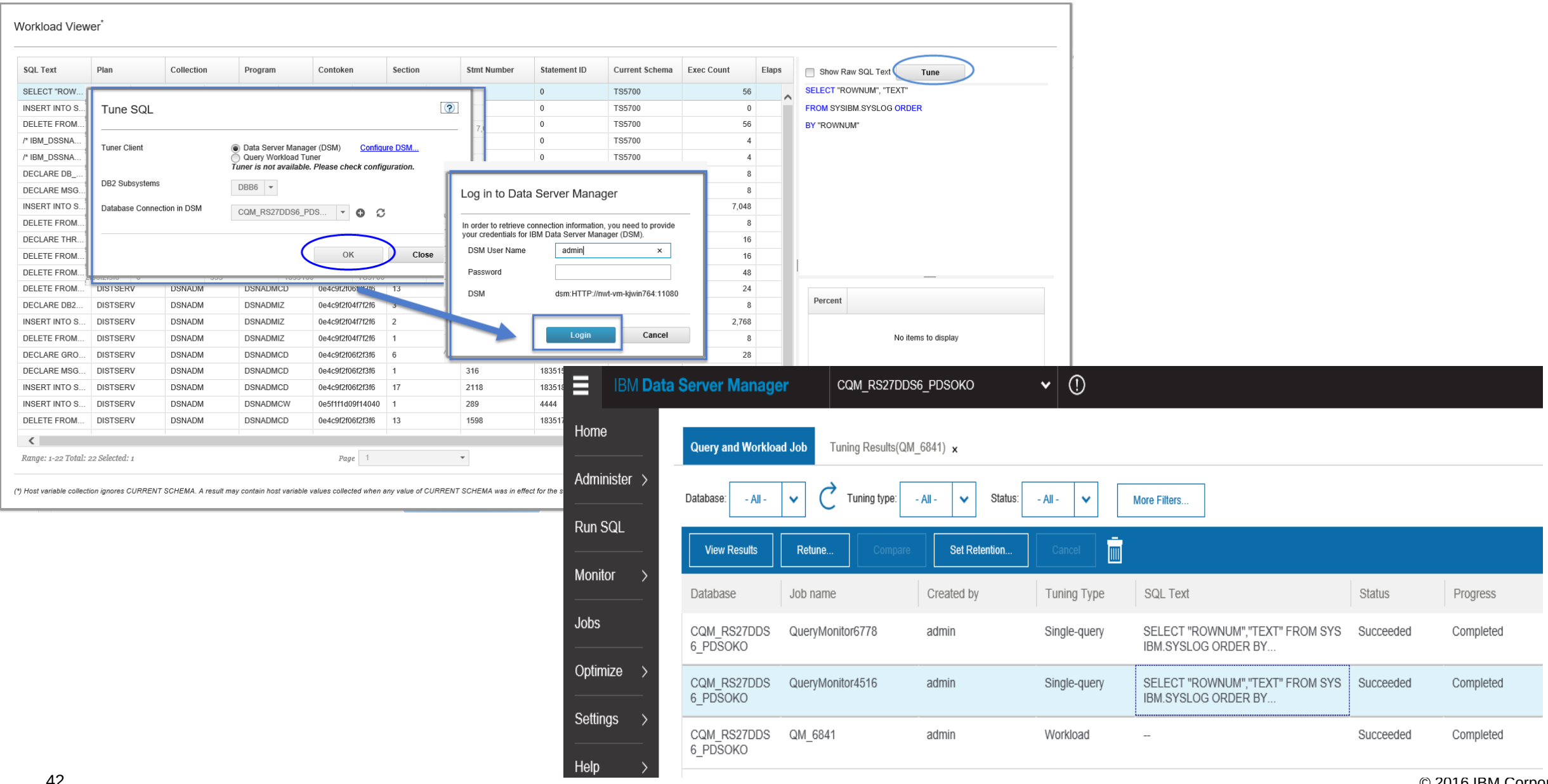
3 Analyze Hostvars details and identify candidate query

Tune or Tune all
For selectivity override analysis

- With parameter marker, high elapse time, CPU time, execution count etc.



analyze



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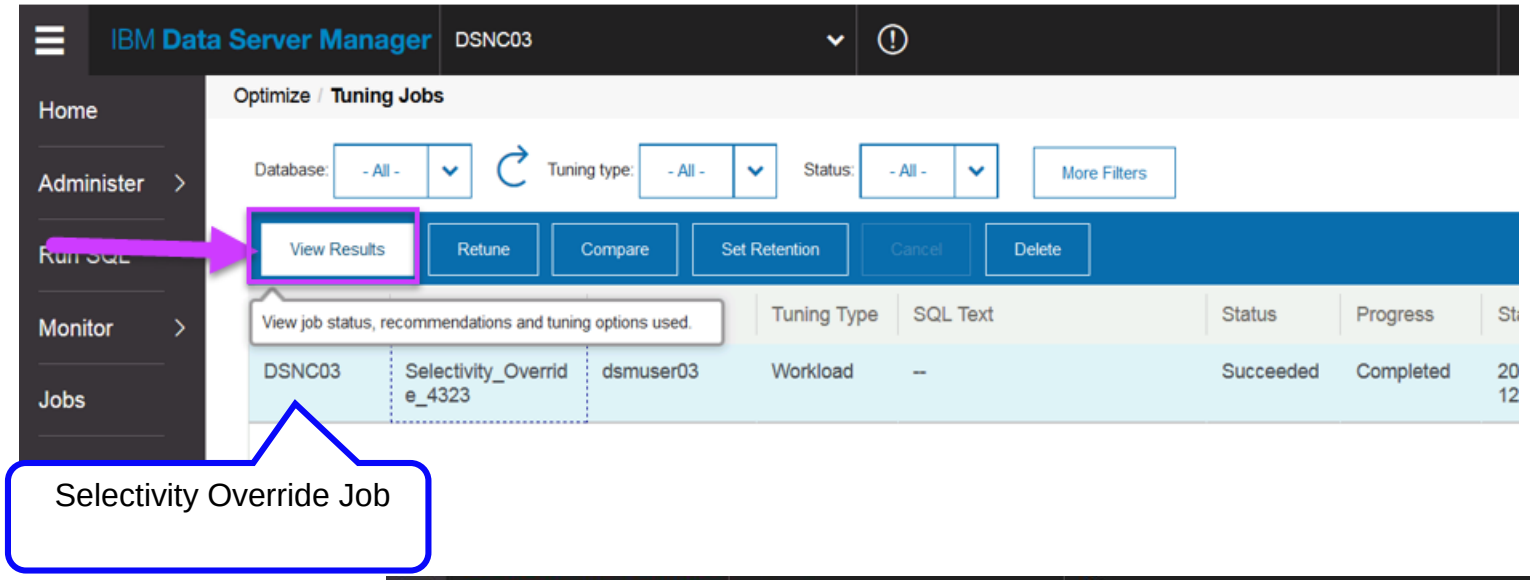
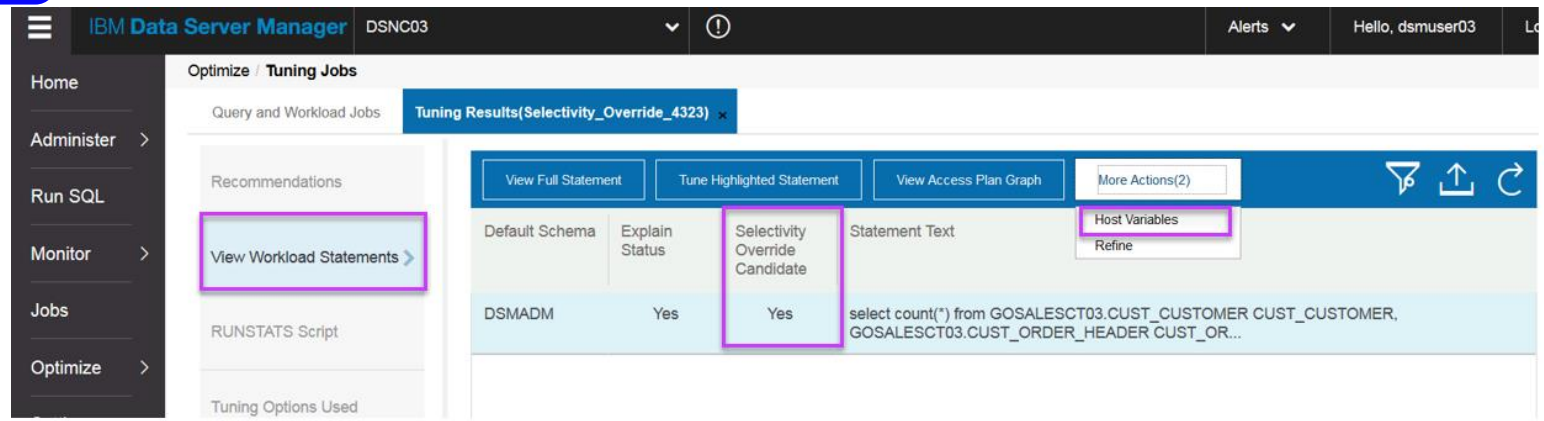
4 Tune selectivity override



- Go to View Workload Statements, you can see the query is Selectivity Override Candidate

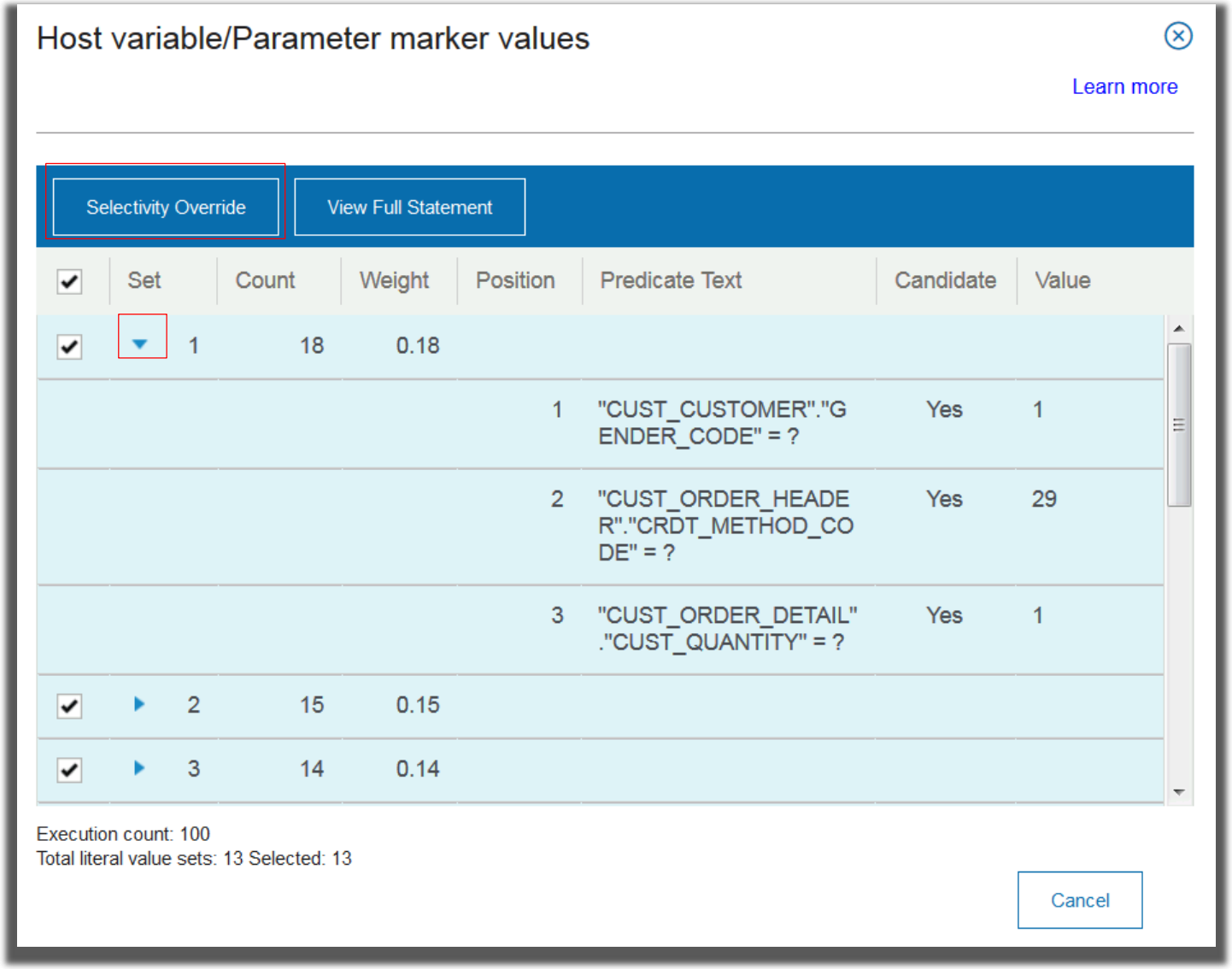


- Then, select Host Variables

optimize

Review analysis

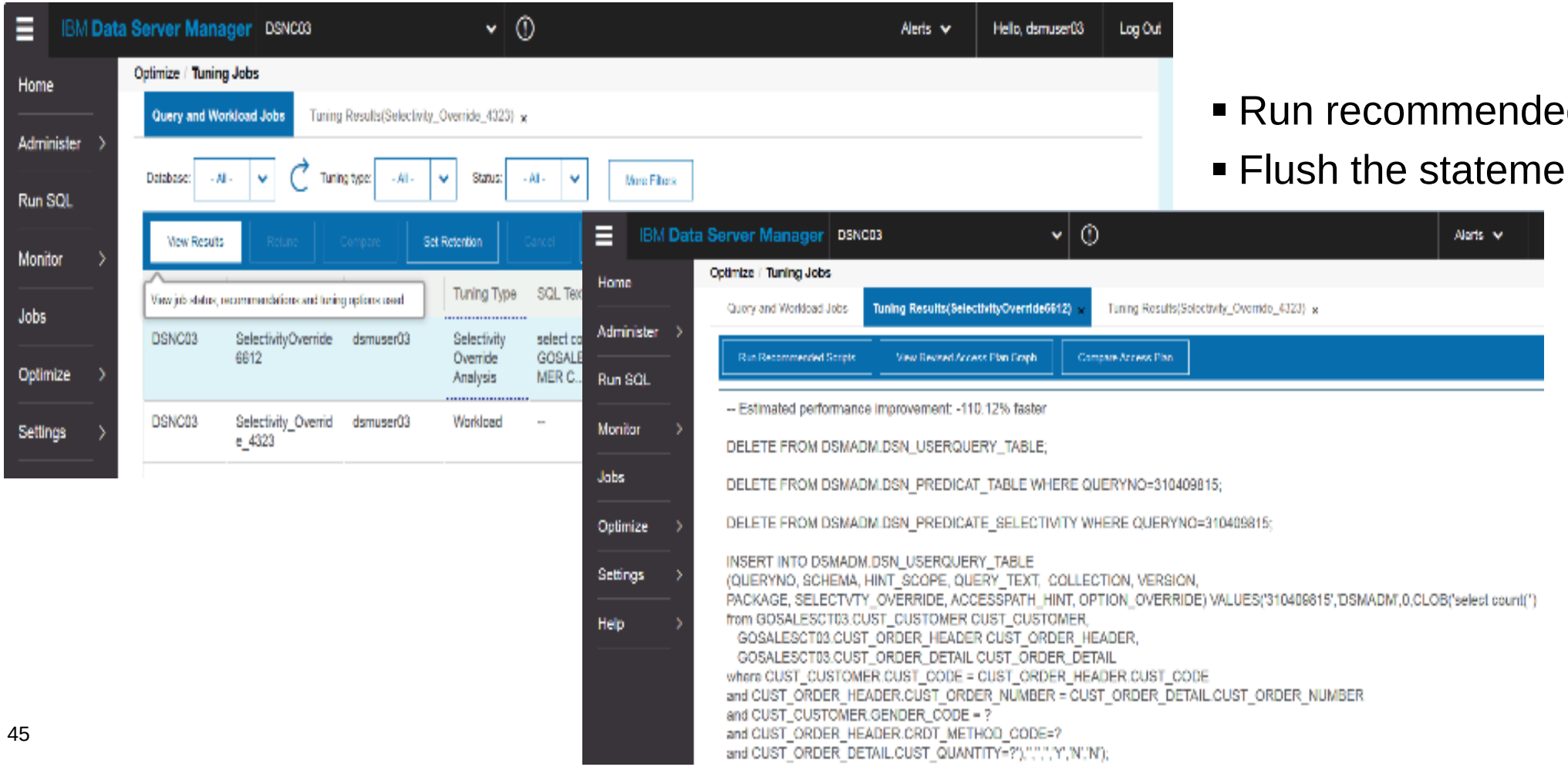
- In this dialog, you can see:
  - parameter markers distribution
  - Weight of each parameter marker value set
- Select the sets (all) for Selectivity Override analysis
- Click Selectivity Override



optimize

5 View results and deploy the selectivity profile

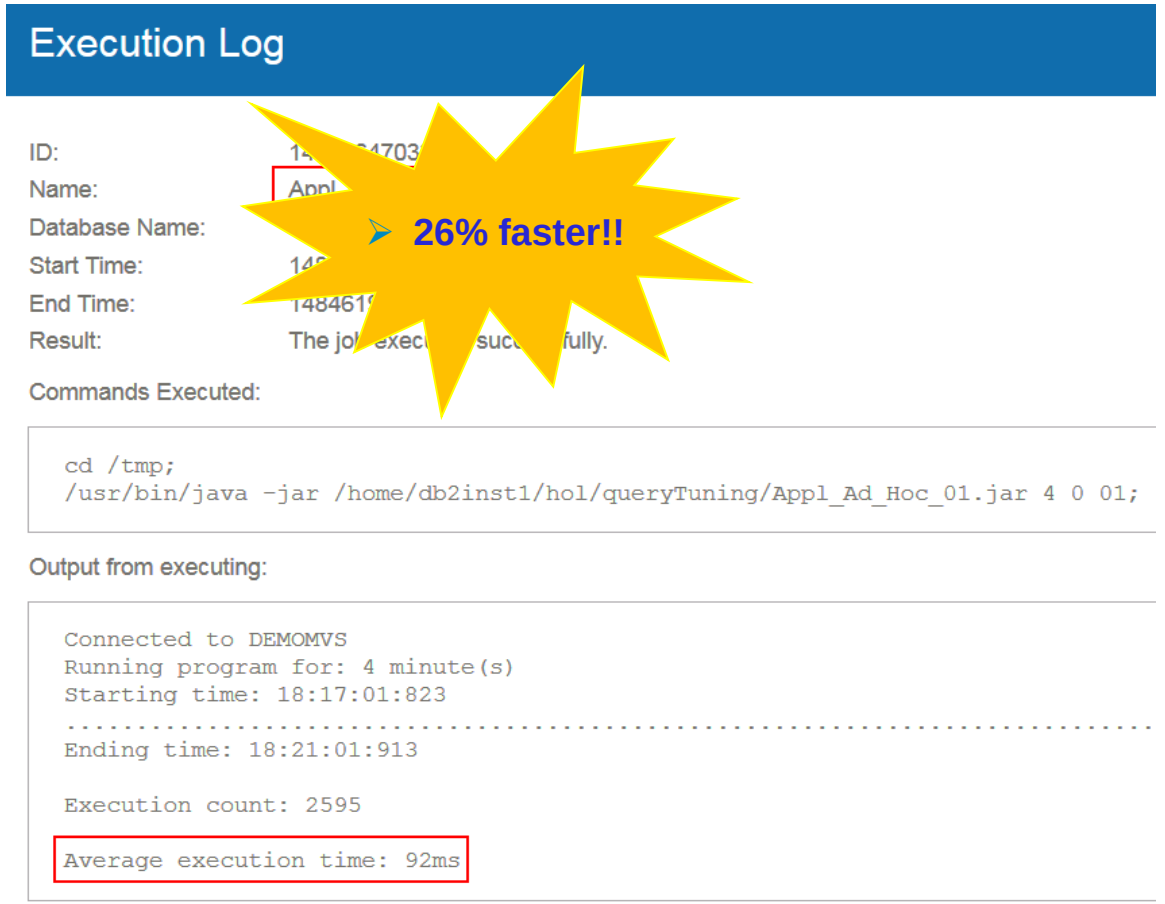
- A selectivity override analysis job is created
  - Click View Results when it is completed



- Run recommended scripts
- Flush the statement cache

6 Compare against baseline

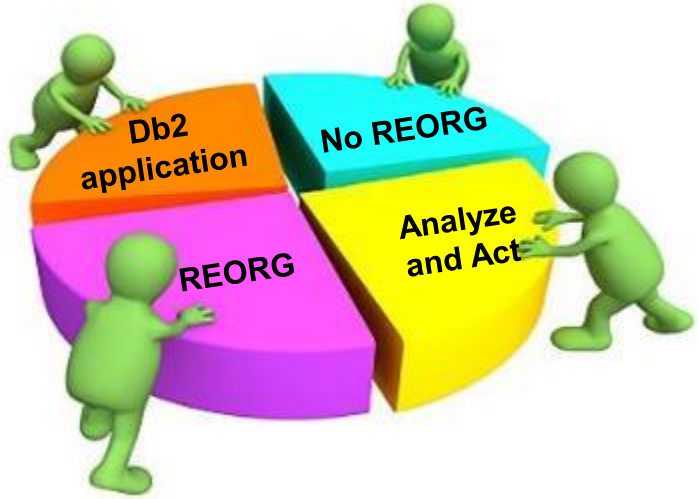
- Run the test application again run after Selectivity Override analysis
- Average execution time for this application is: 92ms
- *Improvement of 26%*
- *On an already well-tuned query!!*



apply

Move from reactive to proactive to predictive results

- Db2 performance depends on “health” of Db2 objects
  - Often, a REORG is done on Db2 application objects whether needed or not, affecting resources and availability
  - The best REORG is the one you don’t perform



- Consider the following:
  - Granular query monitoring and analysis at object level:
  - Ability to detect, apply intelligence and decide best action for object:
    - Perform REORG if performance will improve
    - Skip REORG if determined no performance benefit

- Aligning data management with application needs
  - Hands-free performance monitoring tied into maintenance actions
  - Improves application performance, reduce system and IT resources

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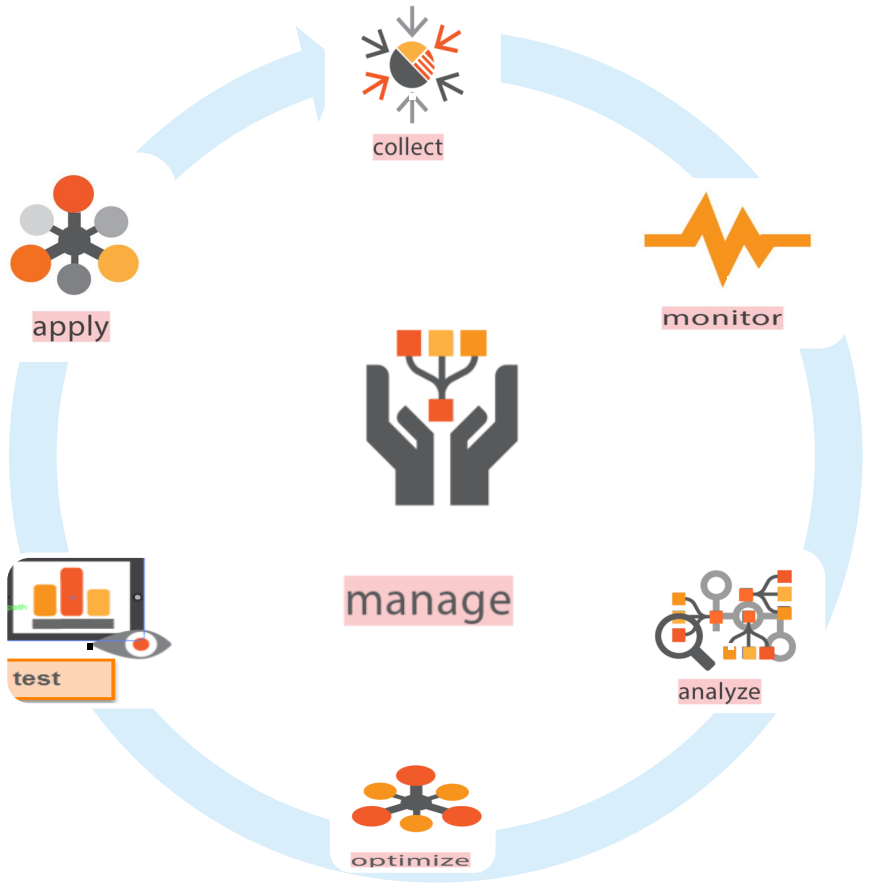
IBM delivers complete Db2 performance management

- Reduce costs of Db2 for z/OS and applications
  - Improve performance of all package applications
  - Tune performance of query warehouse
- Identify and solve faster closing the loop on problem resolution
- Replace ad-hoc methods with integrated solutions for scalable, robust approach to performance management
- Improve performance and time to resolution by up to 50%
- Speed Db2 and application migration with comprehensive comparison capabilities



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