CA Plan Analyzer® for DB2 for z/OS

CA Plan Analyzer® for DB2 for z/OS (CA Plan Analyzer) improves DB2 performance by efficiently analyzing SQL and utilizing expert rules to offer SQL performance improvement recommendations.

Overview

Analyzing SQL statements and complex access paths to find the subset of statements that need database administrator (DBA) attention is a time-consuming process. As is reading and interpreting PLAN_TABLE output, or collecting statistics and dependency information to determine which access path DB2 has chosen and why. CA Plan Analyzer offers analysis capabilities that go beyond the plan and package level. Any SQL can be analyzed—from a single statement to an entire application. The product also helps determine how plans will perform in production by testing them before they go live. CA Plan Analyzer uses rules to evaluate the SQL statements and the underlying physical objects, and makes recommendations for improving performance.

Business value

CA Plan Analyzer provides clear recommendations for improving SQL performance. In addition, the product streamlines the development process by providing SQL performance recommendations to developers and showing how proposed changes to the application SQL will affect access paths.
Features

Mainframe 2.0

CA Plan Analyzer has adopted key Mainframe 2.0 features that are designed to simplify your use of CA Plan Analyzer and enable your staff to install, deploy and maintain it more effectively and quickly.

- **CA Mainframe Software Manager™**: CA Mainframe Software Manager (CA MSM) automates CA Plan Analyzer installation, deployment and maintenance and removes SMP/E complexities.
  - The **Software Acquisition Service** enables you to more easily move product installation packages and maintenance from CA Support Online directly to your mainframe environment and prepare them for installation.
  - The **Software Installation Service** standardizes CA Plan Analyzer installation, which includes a new, streamlined Electronic Software Delivery (ESD) method that allows CA Plan Analyzer to be installed using standard utilities. This service also provides standardized SMP/E product installation and maintenance via APARs and PTFs, and simplifies SMP/E processing through an intuitive graphical user interface and an intelligent Installation Wizard.
  - The **Software Deployment Service** enables you to more easily deploy CA Plan Analyzer in your mainframe environment.
  - **CA MSM Consolidated Software Inventory (CSI)** updates and infrastructure improvements add flexibility to CA MSM processing of CSIs and enable CA MSM to more effectively utilize CPU and system memory.

- **Installation Verification Program (IVP) and Execution Verification Program (EVP)**: As part of qualification for inclusion in the set of mainframe products from CA Technologies released every May, CA Plan Analyzer has passed stringent tests performed through the IVP and EVP to find and resolve interoperability problems prior to release. These programs are an extension of our ongoing interoperability certification initiative launched in May 2009.

- **Best Practices guide**: This guide provides information on CA Plan Analyzer installation, initial configuration and deployment to shorten the learning curve for staff who are responsible for the installation and management of this product.

- **Health Checker**: The Mainframe 2.0 Health Checker provides CA Plan Analyzer Health Checks that execute under the IBM Health Checker for z/OS. CA Plan Analyzer checks the setting of batch processor return code settings to help ensure that non-zero return codes are set so you are notified if errors occur.
What’s new in release r14.5 and r15

- **DB2 10 support:** CA Plan Analyzer runs in DB2 10 NFM (New Function Mode) with a converted catalog and in DB2 10 CM (Conversion Mode) and CA Plan Analyzer can retrieve and process SQL from a DB2 10 catalog.

- **DB2 10 EXPLAIN table creation:** EXPLAIN table user directed creation and auto-creation now supports the new DB2 10 format for the PLAN_TABLE and DSN_STATEMNT_TABLE during the EXPLAIN if the EXPLAIN tables are not present and must be created.

- **DB2 10 new columns and values:** DB2 10 new PLAN_TABLE columns and new values for existing columns have been added to EXPLAIN Historical Database reports. These values support new DDL and SQL syntax introduced in DB2 10.

- **Enhanced reports:** The reports that have been enhanced to display DB2 10 changes to the PLAN_TABLE include the EXPLAIN access path analysis report (short and long format), EXPLAIN compare access path analysis report, EXPLAIN access path filters (EXPLAIN options), query EXPLAIN database report (summary format), identify problem SQL access path filtering report, package EXPLAIN report.

- **DB2 9 pair-wise join access type support:** Several reports now support a new DB2 9 value in the ACCESSTYPE column of the user PLAN_TABLE indicating dynamic pair-wise index scan access. The reports supporting the new value are EXPLAIN access path analysis report (short format and long format), EXPLAIN compare access path analysis report, EXPLAIN access path filters (EXPLAIN options), query EXPLAIN database report (summary report), and identify problem SQL (EXPLAIN problems report).

- **DB2 9 index on expression support:** DB2 9 indexes on expressions are now supported in the SQL Dependency Analysis report and SQL and physical rule reports.

- **DB2 9 clone table support:** DB2 9 cloned objects are now supported in the SQL Objects Dependency report and physical rules.

- **DB2 9 Universal Table Space (UTS) support:** DB2 9 Universal Table Space (UTS) support is now provided in the SQL Dependency Analysis report and physical rules.

- **DB2 9 extended indexes support:** DB2 9 extended indexes are now supported. The statistic reports (new format) now support new extended indexes, histogram statistics, and duplicated/reversed cluster indexes. Two new statistic report areas support the new extended indexes of Index Expression, XML Index, XML Document-ID Index and Node-ID Index.

What’s new in release r14

- **New compare versions cost compare report:** The new Compare Versions Cost Compare report helps you quickly detect and analyze packages where performance degradation or
improvement exists. The report provides a hierarchical format, indented by group (collection), object (package), and statement level. The object and statement levels display access path change indicators, SQL text change indicators, and SQL cost. The SQL cost is displayed in new, old, and SQL cost difference format for the possible cost categories of milliseconds, service units, and total cost. The new report can be accessed from Quick Explain, Explain Strategy, Explain Profile, and Compare Explain Versions.

- **Plan query stability for current EXPLAIN**: DB2 9 introduced plan query stability for packages that lets you maintain up to three package copies in the catalog directory, so that a prior access path can be restored when needed. The CA Plan Analyzer current EXPLAIN takes plan query stability into account by matching on the BIND timestamp in the access path in the user’s PLAN_TABLE with what is bound in the catalog.

- **Future EXPLAIN support for host language-sensitive SQL**: CA Plan Analyzer can now perform future EXPLAIN processing on packages that contain precompiler host language-sensitive syntax (for example, COBOL precompiler undelimited column names that contain embedded dash characters).

- **Native stored procedure support**: CA Plan Analyzer now supports bind card generation for packages associated with native stored procedures.

- **New EXPLAIN support for users without SYSADM authority**: You can now use a stored procedure to perform EXPLAIN processing. By using a stored procedure, users without the authority to execute SQL can still use CA Plan Analyzer to perform EXPLAIN processing on that SQL.

- **Expert system rules**: The expert system rules have been enhanced and updated for new capabilities added in the most recent DB2 versions.

**Other key features**

CA Plan Analyzer provides:

- **SQL statement sources**: CA Plan Analyzer analyzes a specific application or tracks a group of logically related items over time, evaluating changes in SQL statements and access paths that affect performance. Its advanced analysis services can analyze SQL from many sources, including:
  - **SQL statements**: Specific SQL statements from an SQL editor or file.
  - **Plans and packages**: SQL in a given plan or package, or groups of plans/packages.
  - **Catalog objects**: SQL that access a given database, table space, table, index, view, synonym, alias or column.
  - **Query SQL**: SQL queries from either IBM’s Query Management Facility (QMF) or CA Report Facility.
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- **DBRMLIB**: SQL from a DBRM member of a DBRM library.
- **Dynamic SQL**: Any dynamic SQL, such as those captured by CA Detector® for DB2 for z/OS (CA Detector).

- **Advanced EXPLAIN services**: This product’s Explain Services describes the SQL access paths chosen by DB2 in clear, easy-to-understand terminology. As such, the product eliminates the need to understand cryptic and encoded PLAN_TABLE output, catalog statistics, DB2 optimizer documentation and object dependency trees when determining what access path DB2 has chosen and why.

- **User modes**: The depth of the information displayed can be tailored to your employees’ unique skill levels. Novice Mode provides a simplified interface by allowing just plan or package SQL source types, whereas Expert Mode allows for all SQL source types. The long access path report provides a very detailed sentence format EXPLAIN report for new users. As your users become more familiar with both CA Plan Analyzer and DB2 performance topics, you can use Expert Mode to customize the level of detail provided.

- **Explain profile**: This feature simplifies and streamlines the EXPLAIN process by allowing a DBA to define the profiles of EXPLAIN options. An EXPLAIN profile provides predefined screens of EXPLAIN options, helping to expedite the EXPLAIN process and to enhance user productivity.

- **Plan EXPLAIN options**: CA Plan Analyzer uses the information present in the DB2 PLAN_TABLE to provide a detailed explanation of current plan information. It can also predict the access path choices if the plan were rebound by passing SQL statements to DB2 for an immediate EXPLAIN using current catalog statistics. For non-catalog SQL, you specify the isolation method (CS, RR, RS or UR) for the DB2 analysis.

- **Explain plans during development**: Developers can perform EXPLAIN processing on a production DB2 subsystem for a plan or package that resides on the test subsystem, without moving the item. The product enables them to tune applications during development testing with knowledge of how they will perform on the production subsystem. If production information is not available, projected statistics can be used to predict SQL performance.

- **Access path analysis**: Enhanced Explain analysis includes the access path chosen and the factors that led to its choice, including DB2 catalog statistics and physical object metrics. The output is presented in several easy-to-read reports.

- **Performance recommendations**: CA Plan Analyzer goes beyond DB2 EXPLAIN analysis with an Expert Rules System that governs SQL syntax, physical design, plan design and use of predicates. Triggered rules are displayed along with recommendations on resolving the flagged items.
- **Historical database services**: CA Plan Analyzer can save the SQL source, EXPLAIN data and expert system rules violation information into the CA Plan Analyzer Historical Database for reporting and comparison against modified SQL sources. Information can be presented online or in batch reports.

![The CA Plan Analyzer EXPLAIN display](image)

**FIGURE A.**
New user EXPLAIN mode

- **Compare EXPLAIN versions**: Old and new versions of SQL, SQL costs and EXPLAIN data can be compared, highlighting changes that may be of performance concern. Differences in the SQL text are shown, as are differences in DB2 SQL costs or chosen access paths, even when the SQL is unchanged. This is ideal for those situations where a migration to a new version of DB2 requires a rebind of many or all plans. The compare options—cost margin milliseconds (ms), cost margin service units (su) and cost margin timerons (tm)—allow you to compare SQL costs and set a threshold to trigger notification when a cost change that is outside of the threshold has taken place.

- **SQL problem reports**: The Explain Problem Report identifies the access methods used most frequently by an organization’s SQL, the most costly SQL statements, statement types frequently used and objects referenced. The Rule Problem Report identifies SQL sources that have triggered an expert system rule in the CA Plan Analyzer Historical Database.
Expert rules system: CA Plan Analyzer performance evaluation uses an Expert Rules System containing more than 200 rules gathered from the industry’s foremost DB2 experts. You can update these rules to implement specific standards in your organization. By updating threshold values and activating or deactivating specific rules, you can create custom rule sets for each of application area or DB2 subsystem. These rules cover four distinct areas:

- **SQL rules**: Indicate possible problems in the way the SQL has been coded. For example, SQL rules can identify a poorly coded SQL that is not taking advantage of an existing index.

- **Physical design rules**: Highlight possible problems with the DB2 objects referenced by the SQL. For example, physical design rules can identify indexes with an excessive leaf distribution.

- **Plan rules**: Identify possible problems with the options used to bind plans and packages.

- **Predicate rules**: Indicate problems with the predicates coded in the SQL. Incorrectly coded predicates and incorrectly defined predicate operands are among the most common coding errors that adversely influence access path choice. Predicate rules will highlight Stage 1 and Stage 2 predicates and show whether they are indexable.

FIGURE B. Expert system rules

In this image, CA Plan Analyzer shows a SQL statement that has violated rule #73.
- **Manage catalog statistics**: During an EXPLAIN, statistics stored in the DB2 catalog are used to determine the optimal access path. The Statistics Manager component of CA Plan Analyzer allows you to easily specify new values for selected catalog statistics, eliminating hours of manual calculations.
  - **Update statistics**: Move production statistics to test subsystems to see how a new or modified application will perform in production. In addition, this creates a set of statistics for a test environment when no production statistics exist.
  - **Temporary changes**: Carry out “what if” projections, then commit or roll back the changes. For example, you can change the cardinality of a table and propagate it to dependent objects to evaluate the effect on the access path selection.

- **Reporting services**: CA Plan Analyzer provides a variety of reports that enable you to understand both the results of the analysis and details of the DB2 objects, and identify problem SQL. Information can be presented online or in batch reports.
  - **Plan, DBRM and package reports**: These reporting facilities generate catalog-based reports detailing SQL statements, bind parameters, rebinding parameters and user authorizations, in addition to other information. All reports support Distributed Data Facility (DDF) locations.
  - **Object reports**: The object reporting facility gives you the ability to view a list of plans or packages based on object dependencies, database, table space, table, index, view, synonym, alias or column. From the online reports, you can drill down to the SQL statement where additional reports, including access path and predicate analysis can be generated. All reports support Distributed Data Facility (DDF) locations.
  - **SQL statement reports**: These reports allow you to report on SQL from the catalog, based on statement type and SQL syntax elements. From the online reports, you can drill down to the SQL statement where additional reports, including access path and predicate analysis can be generated.
  - **Problem reports**: Problem Plans/Packages Reports search plans and packages for nine different problem conditions, including plans and packages that use Repeatable Read or Uncommitted Read for isolation level, ones that are Invalid or Inoperative or those that are bound with EXPLAIN (NO). SQL Problem Reports identify the access methods used most frequently by an organization’s SQL, the most costly SQL statements, statement types frequently used and objects referenced.
• **Integration**: To work more efficiently, you can take advantage of the interface between CA Plan Analyzer and other CA Database Management Solutions for DB2 for z/OS.
  
  — **CA Detector**: CA Detector integration enables captured SQL statements to be passed directly to CA Plan Analyzer for EXPLAIN analysis and suggestions for improving SQL performance. CA Plan Analyzer shares a common database of performance data, ensuring the greatest possible return on tuning efforts. CA Detector can feed this database with the dynamic SQL and execution statistics it collects, so CA Plan Analyzer can explain this SQL and display the execution statistics.
  
  — **CA SQL-Ease® for DB2 for z/OS**: This product shares the same Explain Engine, including expert systems rules and EXPLAIN database as CA Plan Analyzer.

• **Plan table maintenance**: This facility gives you the ability to easily set up optimization hints in a user's plan table. The optimization hints can then be bound into a plan or package to override the access paths generated by the DB2 optimizer.

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**Delivery approach**

CA Services provides a portfolio of mainframe services delivered through CA Technologies internal staff and a network of established partners chosen to help you achieve a successful deployment and get the desired business results as quickly as possible. Our standard service offerings are designed to speed deployment and accelerate the learning curve for your staff. CA Technologies field-proven mainframe best practices and training help you lower risk, improve use/adoptions and ultimately align the product configuration to your business requirements.

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**Benefits**

CA Plan Analyzer improves DB2 performance by efficiently analyzing SQL and offering performance improvement recommendations that leverage expert rules. It reduces the time and effort involved in SQL analysis by analyzing groups of SQL statements and providing in-depth SQL reports.

This product also helps determine how plans will perform in production by analyzing a test plan on the production DB2 subsystem. When CA Plan Analyzer processes SQL, rules are used to evaluate the SQL statements and the underlying physical objects. If a rule exception is triggered, CA Plan Analyzer displays the rule in a report, followed by clear recommendations for improving performance.
What’s more, CA Plan Analyzer streamlines the development process by providing SQL performance recommendations to developers, and showing how changes to the application SQL will impact access paths. This helps you reduce test time and eliminate the performance surprises that occur when applications are moved into production.

The CA Technologies advantage

CA Technologies has 30 years of recognized expertise in robust, reliable, scalable, and secure enterprise-class IT management software. CA Plan Analyzer for DB2 for z/OS is a key component of the Mainframe 2.0 initiative from CA Technologies to change the way the mainframe is managed forever by helping you maximize the value of our mainframe products and by providing a simplified experience and innovative solutions that deliver value quickly and flexibly.