ECI² Europe invokes DB2 performance-tuning techniques; customer satisfaction ratings go off the charts

Moving its Easy Order and Easy Catalog offerings to SQL was only the first step; embracing the SQL query engine improves throughput by 30-40 percent.

Overview

- ■ *Solution-provider profile* **ECI² Europe**
  - ▪ Subsidiary of ECI²
  - ▪ Headquarters: Hoofddorp, The Netherlands
  - ▪ 10-year provider of industry-leading Internet order-management systems
  - ▪ Technology integration with 10+ business partners (SAP, Ariba, Oracle, I2, PeopleSoft, others)
  - ▪ 500+ suppliers and 2.5 million+ users throughout Europe
  - ▪ ASP model supports 225 000+ orders per week

- ■ *Challenge*
  Modernize database access methods
  - ▪ Extensive use of native I/O
  - ▪ 6 million+ lines of RPG code
  - ▪ Slow, inefficient queries
  - ▪ Scalability issues

- ■ *Solution*
  - ▪ Move to SQL data access model
  - ▪ Gain SQL tuning and query optimization skills
  - ▪ Code to support the use of SQE

- ■ *Solution-provider benefits*
  - ▪ Standardized componentry reduces development costs and streamlines delivery
  - ▪ Support for most European languages and currencies
  - ▪ Fast, stable, scalable software
  - ▪ Support for portals
  - ▪ Easy maintenance (ASP model)

- ■ *Customer benefits*
  - ▪ Strong connection between supplier and clients
  - ▪ Significant UI improvements
  - ▪ Many applications in one window
  - ▪ Connect many business processes
  - ▪ Web enablement
  - ▪ Very fast performance
  - ▪ Low-impact, low-cost start-up through ASP model

The most recent implementation of IBM® DB2® for i5/OS®, with its advanced SQL interface, is far superior to earlier offerings that, for many years, depended on a native I/O interface into the database. No IBM Business Partner understands this evolution better than ECI² Europe, a Dutch-based solution provider, and one of Europe's largest suppliers of e-commerce applications.

"Writing SQL statements to yield high-performing characteristics is not only an art, it is an evolving target. Getting help from IBM Rochester was critical to our developers who needed to build strong skills in writing efficient SQL code," says Eric Klaasse, technical director for ECI² Europe. He has been intimately involved in the 10-year evolution of the Internet offerings that support the parent company's (kærtSoftware bv) widely popular, RPG-based ERP solutions.

Constant challenge to improve DB2 performance

The SQL evolution began in 2004, when the ECI² Europe e-commerce solution, *Easy Order FrontOffice*, needed to be more versatile to meet the aggressive demands placed on the database by sophisticated Internet users. Like many solution providers that have long been loyal to the famous reliability of the IBM System i™ platform and its integrated database system, ECI² Europe originally implemented its database applications by using native file I/O. Therefore, ECI² Europe decided to embed SQL state-

ments in the RPG code that was generated in the IBM Integrated Language Environment® (ILE) to support new search capabilities and more precise results. However, embedding SQL in native I/O code to achieve new function has a tradeoff; it slows the search itself.

Because of the slow search results, in 2005, when ECI² Europe was planning a new e-commerce offering, *Easy Catalog*, Klaasse says they decided to build the catalog-management system on the SQL database model, instead of native file I/O (see Figure 1). ECI² Europe committed to build a highly normalized database to focus on query flexibility. This entailed the construction of a new development template that supported common error-trapping and simple version-management processes. However, despite the developers' best efforts, the SQL-modeled query searches were slower than ideal.

IBM Netherlands support personnel offered guidance to ECI² Europe developers, showing them how to rewrite the SQL and indexing methods to improve performance. However, the next release of the System i operating system, though bringing DB2 and SQL improvements, also slowed query throughput. That is when Patrick Palmans, on the IBM Netherlands technical support team, suggested that ECI² Europe send its developers to Sorrento to tap the knowledge of the DB2 experts from IBM Rochester, who regularly taught DB2 courses there.

SQE or CQE
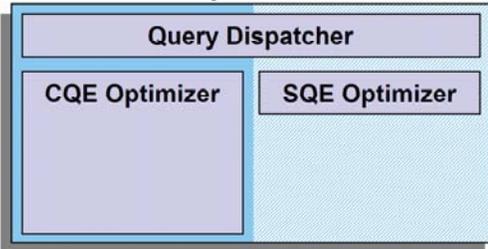
The original DB2 for i5/OS query engine is referred to as the *classic query engine* (*CQE*). The new engine first arrived in IBM OS/400® V5R2 and is referred to as the *SQL query engine* (*SQE*). Both engines sit side by side in the operating system. The long-term goal is to use SQE for all SQL requests. However, to minimize risk and deliver the benefits of SQE to the market sooner, IBM staged the delivery of SQE over several releases. Thus, CQE is still needed to support DB2 and SQL features that are not yet supported by SQE. For purposes of simplicity, the fact that there are two engines is transparent to the SQL developer. SQL requests are passed along to a single internal interface called the *query dispatcher*. With no special user programming, the query dispatcher's job is to determine if the new SQE can process the SQL request. If not, then the original CQE processes the request.

i5/OS V5R4 brings stronger SQL support

In 2006, IBM announced i5/OS V5R4, which offered significantly improved DB2 functions: better indexing, new graphical performance tooling and, most importantly, a much improved SQL query engine (SQE). (The SQE is very advanced; IBM holds five patents on various components of its design.)

Note: *See the side panel (top of this page) for an explanation of the SQE.*

As mentioned, the IBM Netherlands support team encouraged ECI[2] Europe to attend the IBM Forum in Sorrento, Italy, to see the new DB2 enhancements in i5/OS V5R4.

In particular, the ECI[2] team needed to understand how the SQE reacts to specific SQL statements. For example, there is extra intelligence in the SQE query optimizer to improve performance by creating automatic indexes that support the needs of frequently used queries. The SQE optimizer can also invoke the use of indexes that partially match recently-built temporary indexes, instead of recreating them from scratch.

The *Sorrento* kicks in

Rewriting the main portion of the Easy Catalog code, which is based on the SQL data model, causes the application to more effectively use strategies that benefit from the SQE — thus improving performance.

However, when much of the Easy Order code was similarly rewritten in an attempt to improve performance, application throughput actually degraded to unacceptable levels. To make matters worse, disk I/O doubled.

Klaasse explains that, when faced with these unexpected results, his team briefly struggled with what might be the problem, then the "Sorrento kicked in." The excellent training they had received at the IBM Forum helped them to recognize that the code, which was originally based on the native I/O model, suffered from the lack of an overarching indexing strategy. Thus, the system

built way too many temporary indexes… a problem that exaggerated its own inefficiency because the system duplicated these temporary indexes to a mirrored system. Designing an adequate indexing strategy brought the performance and I/O issues back under control.

DB2 workshop teaches best practices

Klaasse and his team maintained a relationship with the IBM Rochester support team, whom they had met at the Sorrento Forum. So, not surprisingly, the Rochester folks eventually recommended that ECI[2] Europe attend the highly popular *DB2 for i5/OS SQL Performance Workshop* that is taught at the IBM Product and Solutions Support Center in Montpelier, France.

Note: *This course is also taught in Rochester, Minnesota, and other countries. Visit:* **ibm.com**/servers/ eserver/iseries/service/igs/db2performance.html.

The DB2 for i5/OS experts from IBM Rochester, who teach this course, helped the ECI[2] Europe programmers gain an even better understanding of the best-practices coding techniques that affect query optimization and performance. In essence, they learned that, when issuing an SQL statement, you are telling the DBMS what to do, not how to do it — the SQL Optimizer decides how. The developers needed to understand what the query is asking, and equally important, what a particular SQL query optimizer can do.

> *"Our decision to modernize by using SQL has allowed us to deliver robust flexibility and excellent performance. Our developers have less support and maintenance issues, too. But, the most important benefit is the spectacular speed of development, which makes us not only more competitive, but also quite cost-effective in delivering new functions."*
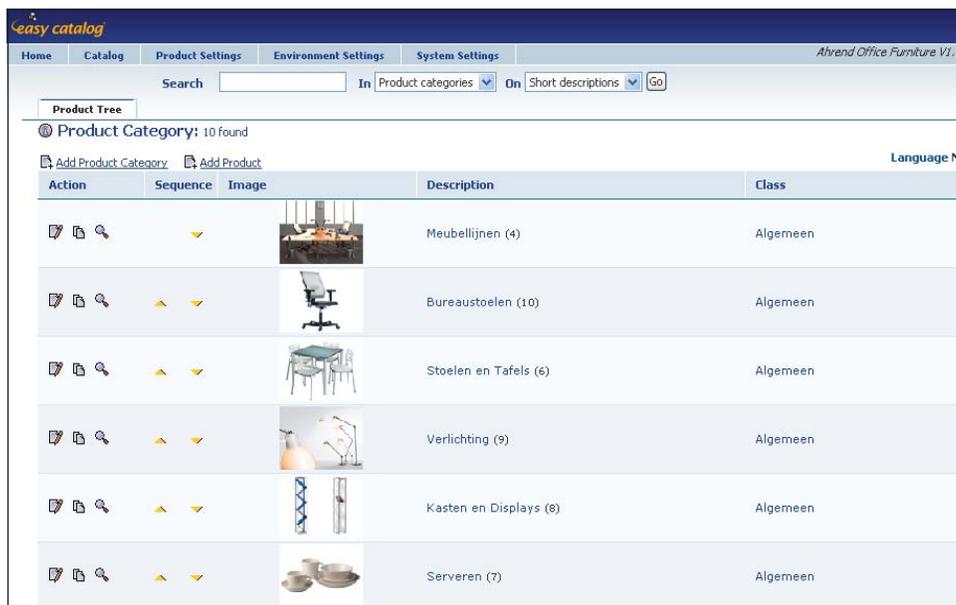>
> – Eric Klaasse, Technical Director, ECI[2] Europe

Figure 1. Easy Catalog rapidly presents product trees.

Using optimization-feedback tools

After the DB2 performance workshop, the ECI² Europe team was armed with a new, highly targeted SQL-tuning perspective. The reality is that indexes are extremely important in SQL-based applications; but, creating the optimal indexes is time-consuming. However, the resulting code runs fast, scales effortlessly, and transitions smoothly from one DB2 release to the next. Klaasse's team used the query optimizer and several graphical DB2 performance tools in IBM Systems Director Navigator for i5/OS to streamline their e-commerce applications — with some dramatic results to show for the effort, including the following benefits:

- The detailed database monitor provides a mechanism for tracing the SQL requests and for determining when the SQE is not used. Similarly, the database monitor summarizes the data for identical queries, thus minimizing the overhead of capturing the information.

- ECI² Europe aggtessively uses the new SQL Plan Cache toolset (which stores access plans and associated statistics for active and recently-run SQL statements) to perform detailed performance

analysis without the overhead of running a database monitor.

- The SQE automatically gathers column statistics and stores them with the table (to provide a minimal source of information about the data when no indexes exist.

- The new system-wide Index Advisor makes it much easier to determine which indexes to create so that performance can improve, without activating any tools.

- In regard to indexing, the ECI² Europe code was reviewed for frequently used statements . Visual Explain is the tool of choice for this, allowing them to build more ideal indexes. This effort alone boosts the performance of these statements by 60 to 80 percent.

Ultimately, the ECI² Europe code was rewritten to take advantage of the LIKE clause, materialized query tables (MQTs) and other performance-related enhancements. Klaasse and his team also discovered the ignore_derived_indexes parameter in the query-options file (QAQQINI). This parameter produces a major performance boost by more frequently using the SQE, which contains a mix of SQL and non-SQL objects. After all the changes were made to Easy

Catalog, one ECI² Europe customer switched to i5/OS V5R4 and benefited from an immediate boost in performance of 30 to 40 percent.

Embracing strategic technology

Rian Faay, director of sales and marketing for ECI² Europe, explains that the company has always been committed to adopting the latest technologies on the System i platform. This has included the move away from the native I/O method to the SQL data-access model, which is the strategic IBM mechanism for interacting with data that resides in DB2 for i5/OS tables.

ECI² Europe has also adopted other technologies, the most popular being its implementation of an application-service provider (ASP) model to deliver solutions to its clients. The ASP model lets ECI² Europe always deliver its latest software version — each time the user signs on from a browser. Backup, replication, mirroring and failover techniques (none of which the customer has to be concerned with), are carefully designed and governed for all ASP-delivered applications. The company's two large System i models work in conjunction with sophisticated routers and firewalls.

Klaasse's team is now incorporating PHP hypertext preprocessor technology with its RPG code to more easily connect to Internet-based banking systems where security and encryption are of paramount importance — and where open-source PHP application code already exists. These types of functions are much harder to build in RPG. PHP, which is a widely popular browser-interface scripting language, allows control of the application to slip out of the RPG environment and into the PHP arena, and then to return to the RPG environment.

In 2005, ECI² Europe also adopted NewLook technologies (from Look Software) to replace its back-office
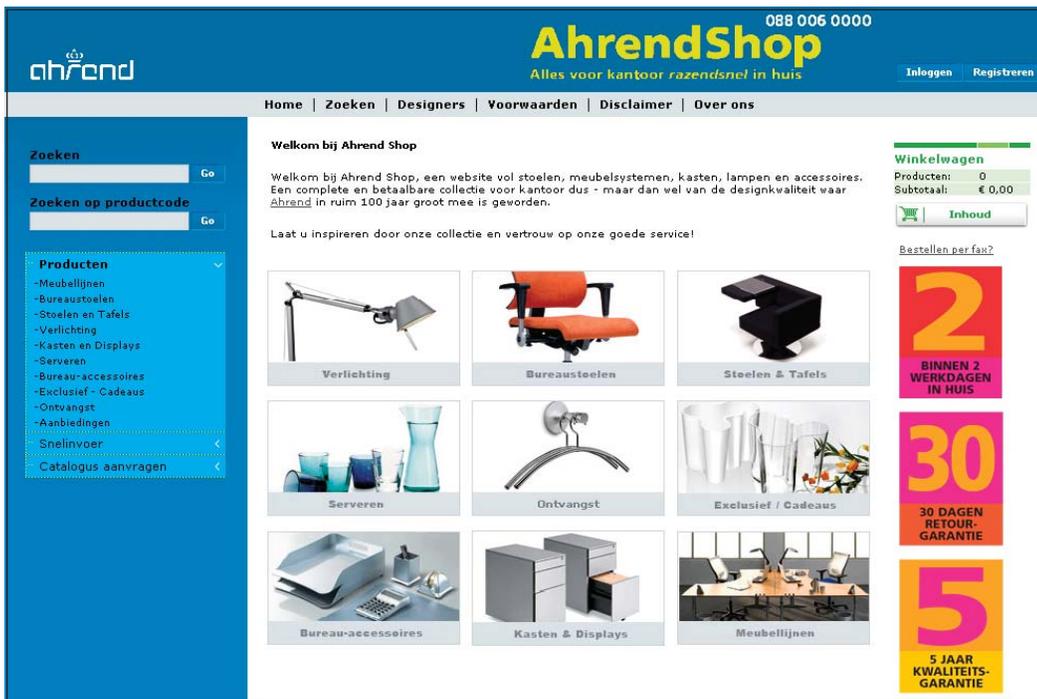
Figure 2. Easy Order can show images as well as product details.

green screens that have graphical (HTML-based) user interfaces with Active-X controls to render a similar look to the Easy Order and Easy Catalog offerings.

Making the SQL decision for the customer's sake

Faay sums up the ECI² Europe experience with SQL, "Although the implementation was initially difficult, there were never any showstoppers and IBM was always there to help us through the challenges. In fact, we even went to Rochester with our newly written SQL code. Mike Cain, who is on the IBM Rochester DB2 support team, and some other DB2 experts there, evaluated our software to determine whether our implementation of the performance techniques were ideal. This trip proved to be as valuable to use as the two previous courses we took in Sorrento And Montpelier.

"Now, our SQL code is not only more robust than the native I/O, it is fast, scalable and much easier to maintain," says Faay. "The intense training and assistance we have received from the DB2 experts in IBM Rochester has allowed us to deliver robust, flexible applica-

tions, without compromising on performance (see Figures 2 and 3). And because DB2 is integrated with the i5/OS operating system, our developers have less support and maintenance issues. But from a marketing perspective, the most important benefit of using the i5/OS SQL model is the spectacular speed of development that we now enjoy, which allows us not only to be more competitive, but which is also quite cost-effective in delivering new functions."

Klaasse adds, "The DB2 enhancements that are included with i5/OS V5R4 make the size of the database irrelevant — our e-commerce applications are significantly more scalable, with no concern for throughput issues. This is super-important for Web applications where the volume of users can spike at any time." Klaasse mentions one last point, which is probably the most important validator for all the effort that went into focusing so intently on the quality of the SQL code that drives the ECI² Europe Internet offerings, "I'd say that our customer satisfaction numbers have moved pretty close to the upper edge, you just can't get much better than that."