



Embarcadero Delphi Conference

Produtividade e
Performance: Rapid SQL XE3
e DB Optimizer XE3



Fernando Rizzato - Embarcadero

- Embarcadero Database Products
 - ER/Studio
 - DB Change Manager
 - DB Artisan
 - DB Optimizer
 - Rapid SQL
- Produtividade com Rapid SQL
- Performance com DB Optimizer

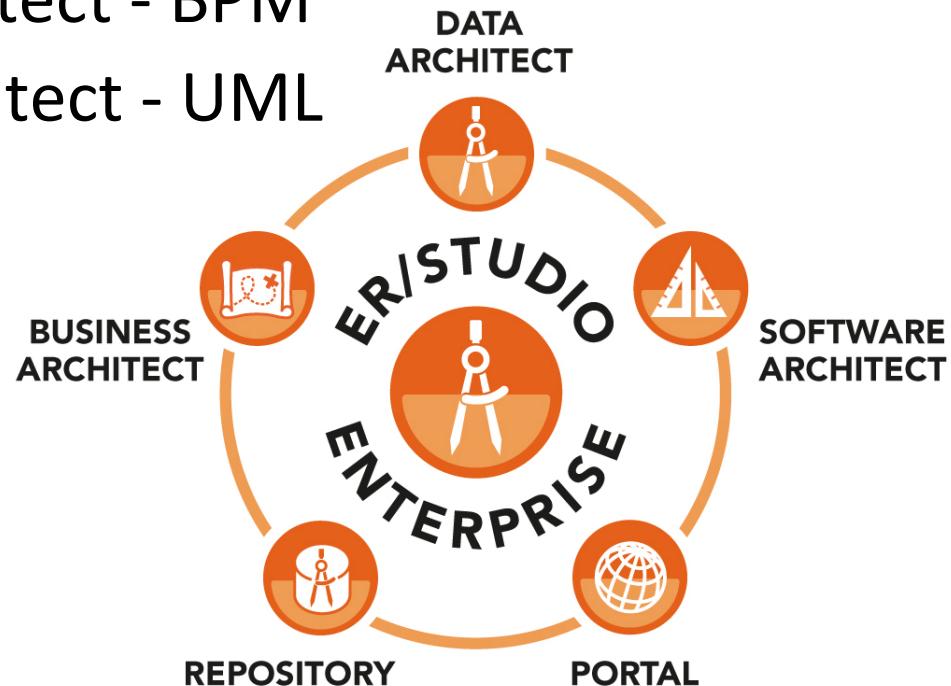


EMBARCADERO DATABASE PRODUCTS



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- ER/Studio Data Architect - Modelagem de Dados (*)
- ER/Studio Business Architect - BPM
- ER/Studio Software Architect - UML
- ER/Studio Repository
- ER/Studio Portal



(*) Hitachi HiRDB, IBM® DB2® 5.x, 6.x, 7.x, 8.x & 9.x for LUW, 5.x, 6.x, 7.x, 8.x & 9x for z/OS® & iSeries V4R5 and V5R2, IBM Informix® OnLine and SE, Informix 9.x dynamic server, InterBase® 4, 2007, 2009, Microsoft® Access 2.0, 95, 97 & 2000, Microsoft SQL Server 6.5, 7, 2000, 2005, 2008, Microsoft Visual FoxPro® 2, 3, 5, MySQL® 3.x, 4.x, 5.x, Netezza 4.6, 5.0, Teradata® V2R4, V2R5, V2R6, 12, Oracle® 7.3, 8.x, 9i, 10g & 11g, PostgreSQL 8.x, Sybase® Adaptive Server® Enterprise (ASE) 11.9.2, 12.x, 12.5 & 15.0, Sybase Adaptive Server Anywhere (ASA) 5, 6, 7, 8, 9 & 10, Sybase IQ 12.x, Sybase Watcom SQL

ER/Studio EcoSystem

The image displays the ER/Studio EcoSystem, a suite of tools for database modeling and management. It includes:

- Physical Model View:** Shows the "OrangeMart - data lineage.dm1 - Physical Model View: DB2UDB Prototype". The interface features a toolbar at the top, a navigation pane on the left listing various database objects like Logical, Main Model, and Tables, and a central canvas displaying a complex data model with entities such as ST ADMIN (Route of Admin), APP (Application), and APPLY_PRD.
- ER/Studio Portal:** A web-based portal at <http://webportal.embarcadero.com/ersportal/Dashboards?dashboard=explore>. It shows a navigation menu, a sidebar with projects like Samples, Adventure Works.DM1, and Adventure Works DW, and a main content area for a submodel detail report.
- Data Flow Model View:** An interface titled "Adventure Works - Data Flow Model View: Commodity Transformation Tool". It displays a flowchart with components like "Data Source", "Load", "Transform", and "Target", connected by arrows.

At the bottom of the interface, there are tabs for "IBM DB2 UDB 8.x", "Views = 0", "Tables = 26", and "Columns = 1". A status bar at the very bottom reads "For Help, press F1".

- Ferramenta multifuncional para gerenciar alterações no banco de dados a partir de uma interface única para diversos DBMS(*)
 - Comparação de Schema & Alteração
 - Gerenciamento de Configuração & Auditoria
 - Comparação de Dados & Sincronização

(*) IBM DB2 for LUW v8, v9, and v9.5, InterBase 2007, 2009, XE, Firebird 1.5, 2.0, Oracle 8i, 9i, 10g, and 11g, SQL Server 2000, 2005, and 2008, Sybase ASE 12.5 , 15, 15.0.1 and 15.0.2.

DB Change Manager



The screenshot displays the DB Change Manager 5.0 - Professional Edition interface across several windows:

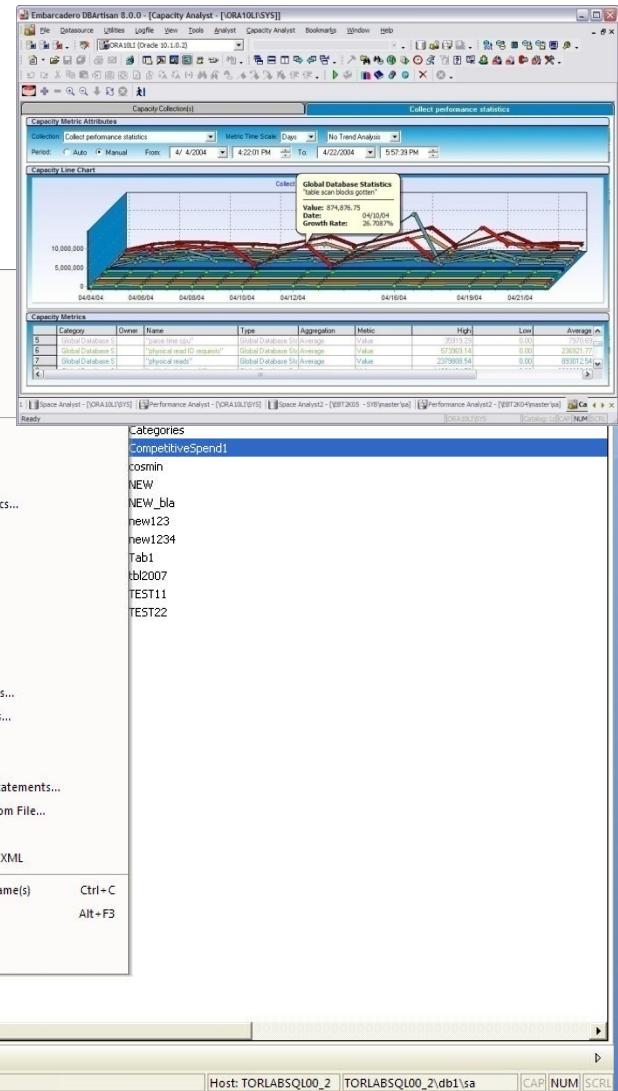
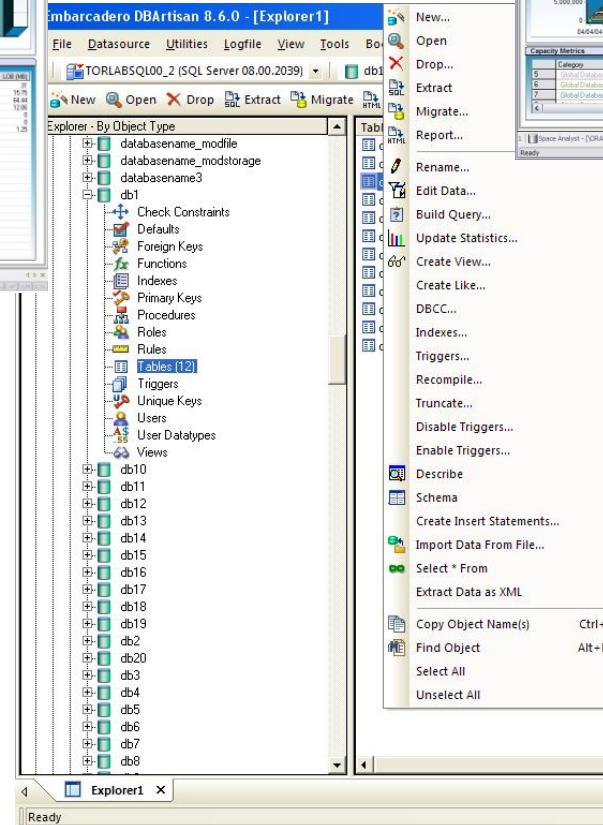
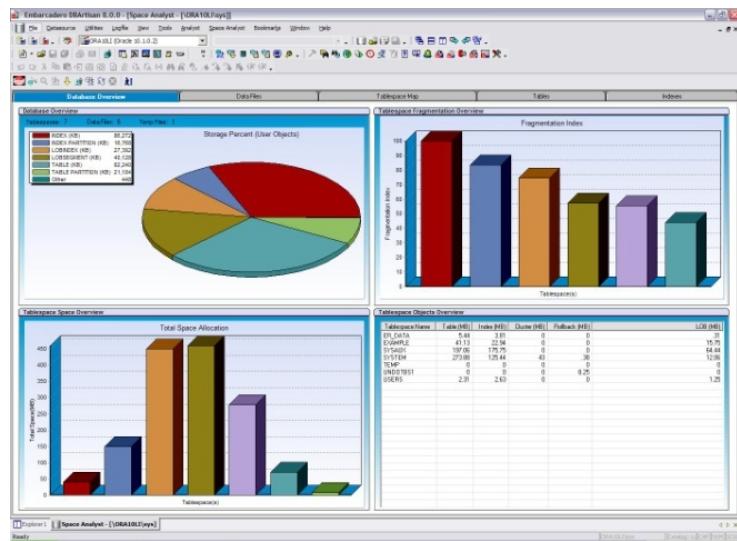
- Change Manager 5.0 - Professional Edition**: The main application window showing a tree view of "Managed Data Sources (22)" including IBM DB2 LUW, Microsoft SQL Server, Oracle, and Sybase ASE.
- *SQL Server Compliance Check**: A window showing a "Comparison Summary" for "Source: SQL Server Standard" and "Target: 3 Targets". It displays metrics: 11 Properties Matched (91.7%), 1 Properties Did Not Match (8.3%), and 0 Properties Not Found (0.0%).
- *Data Comparison-Job-1**: A window titled "Step 3: Pair databases, schemas, owners, tables, and columns between the source and target". It shows "Database Mapping" and "Table Mapping" sections. In the Database Mapping section, it lists pairs like EXTOMGL1501 to EXTOMGL1502, CommercialAdhoc to CommercialAdhoc, etc. In the Table Mapping section, it lists tables like dbo.Customer to dbo.Customer, dbo.Customer_Address to dbo.Customer_Address, etc.
- VMORA Config Compare: Archive to Live**: A window titled "Configuration Property Refinement". It shows a table with columns: Property, Source, Type, Operator, and Value. One entry is visible: "SQL Config Property Source" with Source "VMORA Config Archive...", Type "Static", Operator "equals", and Value "not equal".
- *Data Warehouse Standard**: A window showing a "Configuration Property Refinement" table. One entry is visible: "audit_file_dest" with Source "VMORA Config Archive...", Type "Static", Operator "pattern match", and Value "/dbdata/*".

- Ferramenta para administração de banco de dados heterogêneos, focada em disponibilidade, performance e segurança, disponível para os mais diversos DBMS(*)
 - Space Analyst
 - Capacity Analyst
 - Performance Analyst

(*) IBM DB2 for LUW v8, v9, and v9.5, IBM DB2 for z/OS® v8 and v9, InterBase 2007, 2009, XE, Firebird 1.5, 2.0, Oracle 8i, 9i, 10g, and 11g, SQL Server 2000, 2005, and 2008, Sybase ASE 12.5 - 15.0.3

DB Artisan

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- Ferramenta heterogênea com foco em maximizar a performance de banco de dados e aplicação, rapidamente descobrindo, diagnosticando e otimizando instruções SQL com problemas de performance (*).
 - SQL Profiling
 - SQL Tuning
 - Reporting
 - SQL Editing
 - Visual SQL Tuning (VST)
 - Index Analysis
 - Load Editor
 - Profile Details

(*) IBM DB2 for LUW v8, v9, and v9.5, IBM DB2 for z/OS® v8 and v9, InterBase 2007, 2009, XE, Firebird 1.5, 2.0, Oracle 8i, 9i, 10g, and 11g, SQL Server 2000, 2005, and 2008, Sybase ASE 12.5 - 15.0.3

DB Optimizer

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The screenshot displays four windows of the Embarcadero DB Optimizer tool:

- Top Left Window:** Shows a "Profile Session" chart for "TORLABORCL10g_1" database. The chart tracks "Active Sessions (avg)" over time (11:38:00 to 11:42:30) across various categories: ON CPU (red), System I/O (blue), User I/O (green), Cluster (light blue), Application (orange), Configuration (yellow), Commit (pink), Network (purple), Administrative (dark blue), Concurrency (light green), Scheduler (light orange), and Other (light pink). A red line highlights the "Max CPU" usage.
- Top Right Window:** Displays a "Profile Session" for "wg.sar". It shows a bar chart of "Active Sessions (avg)" over time, with a legend for ON CPU, System I/O, User I/O, Cluster, Application, Configuration, Commit, Network, Administrative, Concurrency, Scheduler, and Other. Below the chart is a table of "SQL Statements" and "Events" with their respective DB Activity (%) and User / Program Active (%).
- Bottom Left Window:** Shows the "SQL Optimization" interface for "SQL Project 2/cartesian.tun". It includes tabs for Overview, SQL, Events, Sessions, and Object I/O. The SQL tab lists statements and events with their DB Activity (%). The Events table shows details like "ON CPU", "direct path read temp", and "log file sync".
- Bottom Right Window:** Provides a detailed view of a tuning session for "SELECT 1". It shows a table of "Generated Cases" with columns for Statement, Name, Schema, Text, Tables, Views, Elapsed (s), Improved (s), Cases, Indexes, Statistics, Cost, Elapse...e (s), Result, R..., Physical Reads, Logical Reads, and Other Execution.

- Um rico ambiente de desenvolvimento que simplifica a criação de instruções SQL
- Construção de queries, edição de objetos, projetos e controle de versão em banco de dados online ou repositórios de código offline
- Edição de SQL intuitiva, debug e ferramentas de otimização ajudam a criar código SQL de alta performance
- Um único ambiente totalmente integrado com suporte aos maiores DBMS do mercado (*)

(*) IBM DB2 for LUW v8, v9, and v9.5, IBM DB2 for z/OS® v8 and v9, InterBase 2007, 2009, XE, Firebird 1.5, 2.0, Oracle 8i, 9i, 10g, and 11g, SQL Server 2000, 2005, and 2008, Sybase ASE 12.5 - 15.0.3

Rapid SQL



- Embarcadero Rapid SQL 7.3.0 - [DDL Editor: Procedure dbo.CW_Test * - EBT2K04_SQL_SERVER\Northwindsa]

File Edit Datasource Project Debug Browse Logfile View Tools Query Bookmarks Window Help

EBT2K04_SQL_SERVER (SQL Server 08.0) Northwind

Explorer By Object Type

- Databases (18)
 - ca
 - distribution
 - drep
 - er
 - master
 - model
 - msdb
 - Northwind
 - Check Constraints
 - Defaults
 - Foreign Keys
 - Functions
 - Indexes
 - Primary Keys
 - Procedures (40)
 - dbo.Categories_Sel
 - dbo.CustOrderHist
 - dbo.CustOrdersDel
 - dbo.CustOrdersDrc
 - dbo.DW_Test
 - dbo.dt_address
 - dbo.dt_addresssourc
 - dbo.dt_addresssourcobj
 - dbo.dt_checkinobj
 - dbo.dt_checkoutobj
 - dbo.dt_checkoutobj
 - dbo.dt_checkoutobj
 - dbo.dt_displayobj
 - dbo.dt_displayobj
 - dbo.dt_dropproper
 - dbo.dt_dropproper
 - dbo.dt_generatear
 - dbo.dt_getobjwhp
 - dbo.dt_getobjwhp

1: SET QUOTED_IDENTIFIER ON
2: go
3: SET ANSI_NULLS OFF
4: go
5: IF OBJECT_ID('dbo.CW_Test') IS NOT NULL
6: BEGIN
7: DROP PROCEDURE dbo.CW_Test
8: IF OBJECT_ID('dbo.CW_Test') IS NOT NULL
9: PRINT '*** FAILED DROPPING PROCEDURE dbo.CW_Test ***'
10: ELSE
11: PRINT '*** DROPPED PROCEDURE dbo.CW_Test ***'
12: END
13: go
14: CREATE PROCEDURE dbo.CW_Test;1
15: @CategoryID int
16: AS
17: BEGIN
18: SELECT cl.CategoryID,
19: cl.CategoryName,
20: cl.Description,
21: cl.Picture,
22: cl.
23: FROM dbo.CategoryID : int
24: WHERE Cat CategoryName : nvarchar
25: AND Cat Description : ntext
26: RETURN(0) Picture : image
27:
28: END
29:
30:
31: go
32: CREATE PROCEDURE dbo.CW_Test;2
33: @CategoryID int
34:)

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Name Employee
Owner dbo
Type Tables

Column Name
EmployeeID
LastName
FirstName
Title
TitleOfCourtesy
BirthDate
HireDate
Address
City
Region
PostalCode
Country
HomePhone
Picture

Tables (30)

- CA_REPO_EAS_VERSION
- CTXSYS.DRSNUMBER\$
- CTXSYS.DRSOBJECT_A1
- CTXSYS.DRSPOLICY_TA
- DMSYS.DMSAPPLY_CO
- DMSYS.DMSAPPLY_CO
- DMSYS.DMSAPPLY_CO
- DMSYS.DMSATTRIBUTE
- DMSYS.DMSATTRIBUTE
- DMSYS.DMSCATEGORY
- GIM.CLIENT_YEAR_OF_BIRTH
- GIM.BROKER.BROKER_LAST_NAME
- GIM.BROKER.BROKER_FIRST_NAME
- GIM.CLIENT_TRANSACTION_ACTION
- GIM.CLIENT_TRANSACTION_PRICE
- GIM.CLIENT_TRANSACTION_NUMBER_OF_UNITS
- ? WHERE
- ? AND
- ? GROUP BY
- ? HAVING

Tables/Views DML

CLIENT

- ROWID
- CLIENT_ID
- CLIENT_FIRST_NAME
- CLIENT_LAST_NAME
- CLIENT_GENDER
- CLIENT_YEAR_OF_BIRTH
- CLIENT_TRANSACTION_STATUS
- CLIENT_STREET_ADDRESS
- CLIENT_POSTAL_CODE
- CLIENT_CITY
- CLIENT_STATE_PROVINCE
- CLIENT_PHONE_NUMBER
- CLIENT_HOUSEHOLD_INCOME
- CLIENT_COUNTRY
- BROKER_ID

CLIENT_TRANSACTION

- ROWID
- TRANSACTION_ID
- INVESTMENT_ID
- ACTION
- PRICE
- NUMBER_OF_UNITS
- TRANSACTION_STATUS
- TRANSACTION_SUB_TIMESTAMP
- TRANSACTION_COMP_TIMESTAMP
- DESCRIPTION
- BROKER_ID
- BROKER_COMMISSION

BROKER

- ROWID
- BROKER_ID
- OFFICE_LOCATION_ID
- BROKER_LAST_NAME
- BROKER_FIRST_NAME
- BROKER_MIDDLE_INITIAL
- MANAGER_ID
- YEARS_WITH_FIRM

1 SELECT GIM.CLIENT.CLIENT_FIRST_NAME,
2 GIM.CLIENT.CLIENT_LAST_NAME,
3 GIM.CLIENT.CLIENT_YEAR_OF_BIRTH,
4 GIM.BROKER.BROKER_LAST_NAME,
5 GIM.BROKER.BROKER_FIRST_NAME,
6 GIM.CLIENT_TRANSACTION.ACTION,
7 GIM.CLIENT_TRANSACTION.PRICE,
8 GIM.CLIENT_TRANSACTION.NUMBER_OF_UNITS
9 FROM GIM.CLIENT , GIM.BROKER , GIM.CLIENT TRANSACTION

QueryBuilder * (LAPTOP_VM.gim)

Create Table Wizard - Step 1 of 10

Properties

Specify the table properties.

Properties

Property	Value
Columns	
Indexes	
Constraints	
Storage	
IOT Properties	
Partition	
Comment	
Permissions	
DDL View	

Property

Value

Creation

Schema: GIM

Name: PERSON_INFORMATION

Table

Cache: Row Movement

Row Movement: 1

Parallel Degree: 1

Parallel Instances: 1

Percent Free: 100

Physical

Row Organization: HEAP

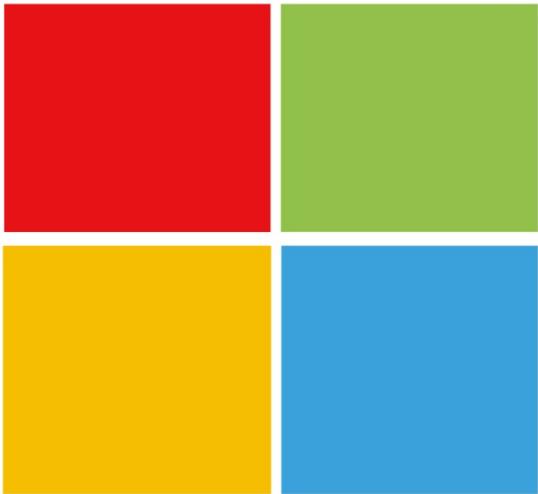
Logging: checked

Table Compression: 0

Row Movement

Specifies whether the database can move a table row. If you need static rows for data access, do not enable row movement.

Back Next Finish Cancel Help



PRODUTIVIDADE E PERFORMANCE: RAPID SQL XE3 E DB OPTIMIZER XE3



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Performance tuning não é uma tarefa simples
É necessário experiência para fazer isso corretamente
Tuning em produção é caro e ... quase inevitável

Prevenção de Problemas

- Pegá-lo antes que cause interrupções

Resolução de Problemas

- Resolver rapidamente

Como podemos iniciar?

Clara identificação

- Saber como identificar problemas e onde ele está localizado

Acesso aos detalhes

- Prover informação suficiente para resolver o problema

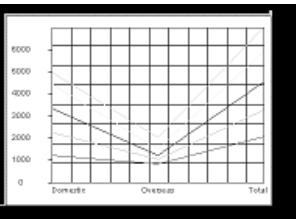
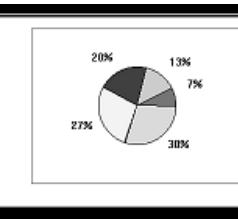
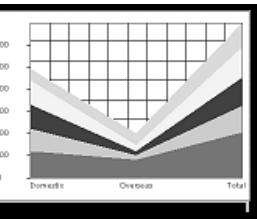
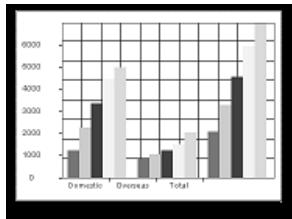
Gráficos

- Fácil de entender, fácil de comunicar e discutir

Primeiro passo: Gráficos!

“The humans . . . are exceptionally good at parsing *visual* information, especially when that information is coded by **color** and/or motion”

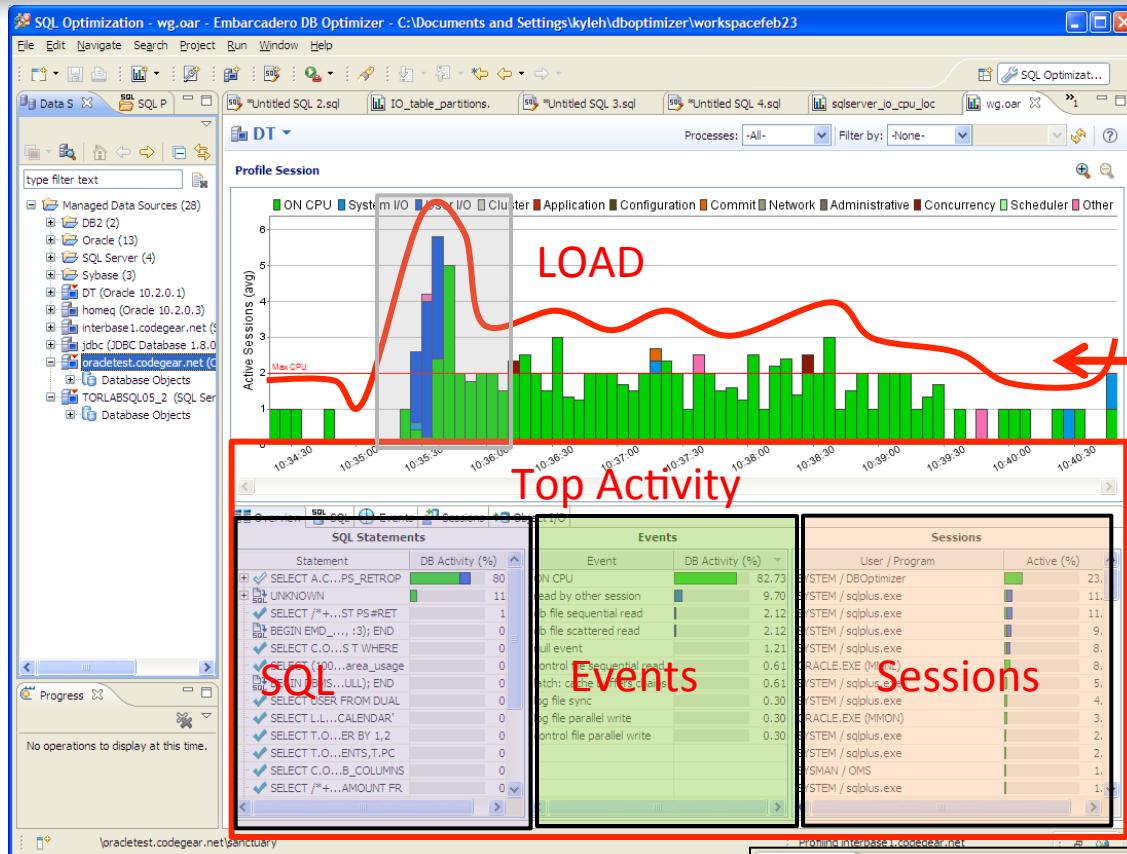
Knowledge representation in cognitive science. Westbury, C. & Wilensky, U. (1998)



Informações para Tuning

Complex Averages

Como abrir a caixa preta?



The screenshot shows the 'Profiling Details' dialog box for the SQL statement: 'SQL: SELECT COUNT(*) FROM (SELECT USERNAME FROM SYS.DBA_USERS WHERE DEFAULT_TABLESPACE='SYSTEM' OR TEMP...'.

The dialog has tabs for SQL Text, Events, Sessions, Children Details, and SQL Details. The SQL Details tab is selected, displaying detailed execution statistics.

SQL Identification	Optimizer and Outline	Parsing Statistics	Execution Statistics (total)	Execution Statistics (per execution)
SQL ID: 1143219105	Optimizer Mode: ALL_ROWS	Memory: 2793096	Fetched: 0.00	Fetched: 0.00
SQL Address: 698E7FD4	Parsing User ID: 5	Loads: 4	Executions: 1	Executions: 0.00
Child Address: 698E0898	Outline Category:	Invalidations: 0	Sorts: 0	Sorts: 0.00
Children: 1	Outline SID: 0		Disk Reads: 0	Disk Reads: 0.00
Plan Hash Value: 2069026503			Buffer Gets: 0	Buffer Gets: 0.00
Module: Executor.exe			Rows Processed: 0	Rows Processed: 0.00
Action:			CPU Time: 0.00	CPU Time: 0.00
SQL Operation Code: 3			Elapsed Time: 0.00	Elapsed Time: 0.00
Program ID: 101646				
Program Line #: 56				

1. Aplicação

- Código ineficiente?

2. Database

- Configurações corretas?

3. Hardware

- A máquina está subdimensionada?

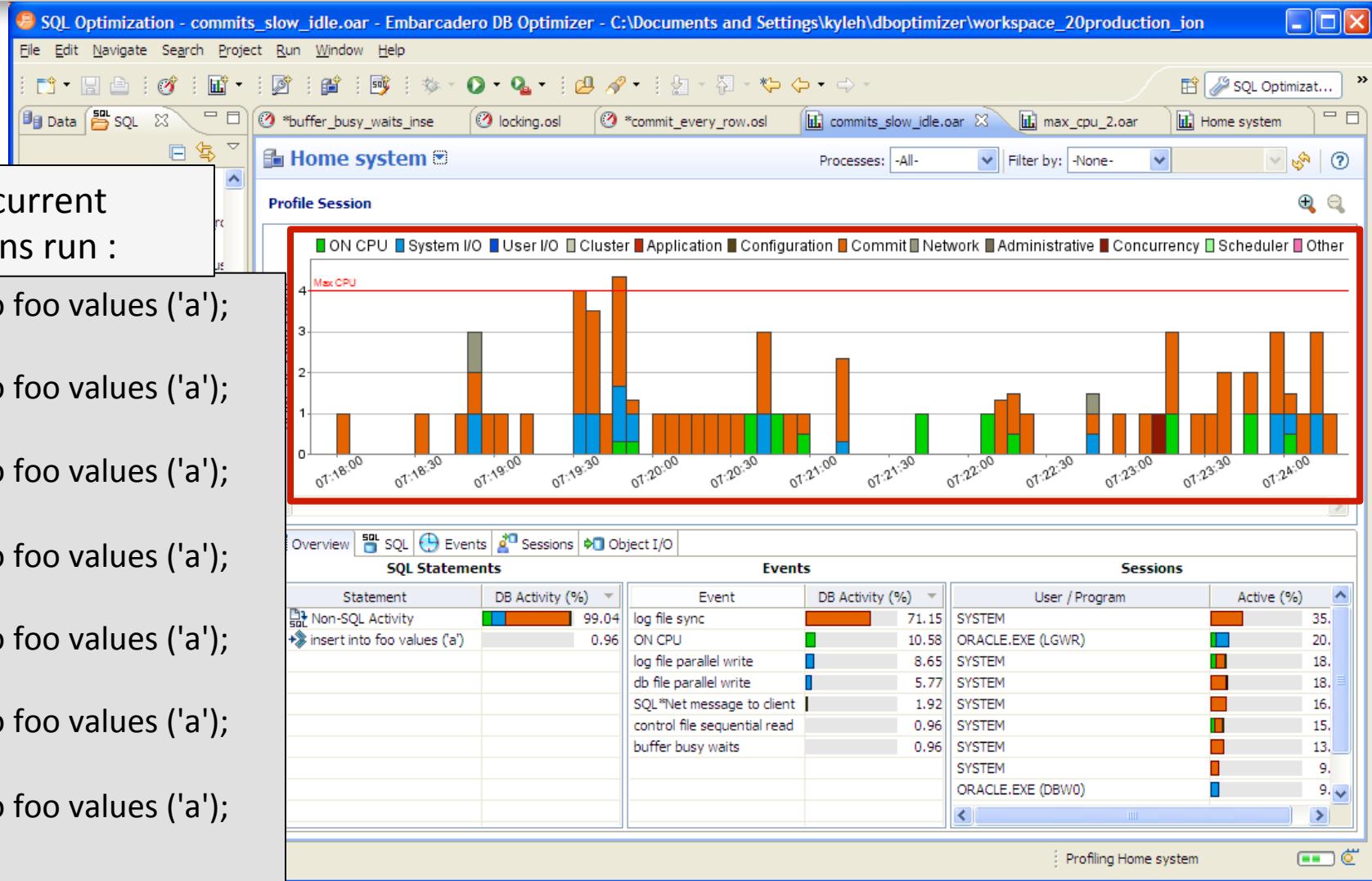
4. SQL

- Instrução SQL ineficiente?

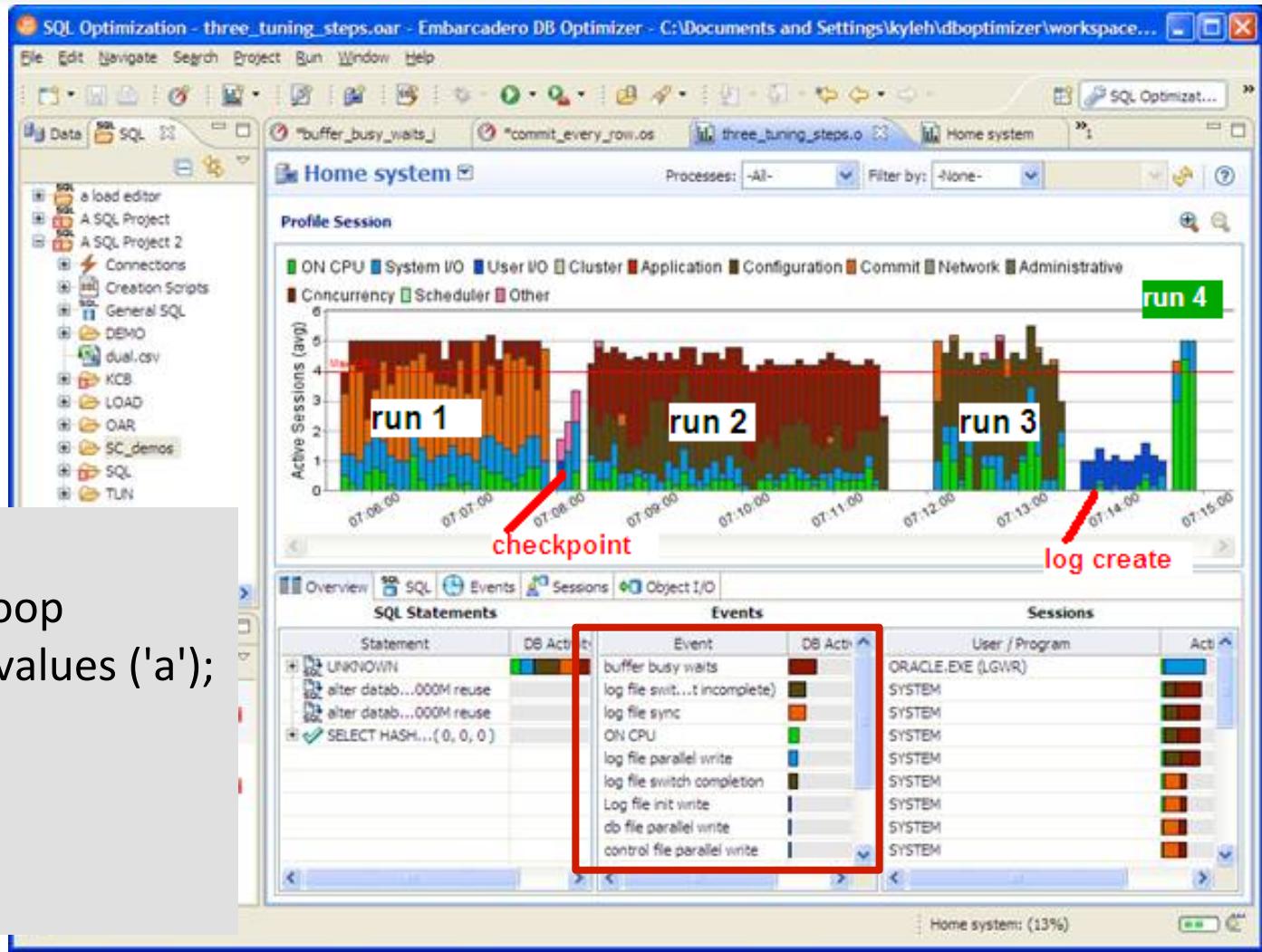
Qual o tipo de problema?

O Load Chart responde esta questão e ajuda com a solução!

1. Problemas na Aplicação

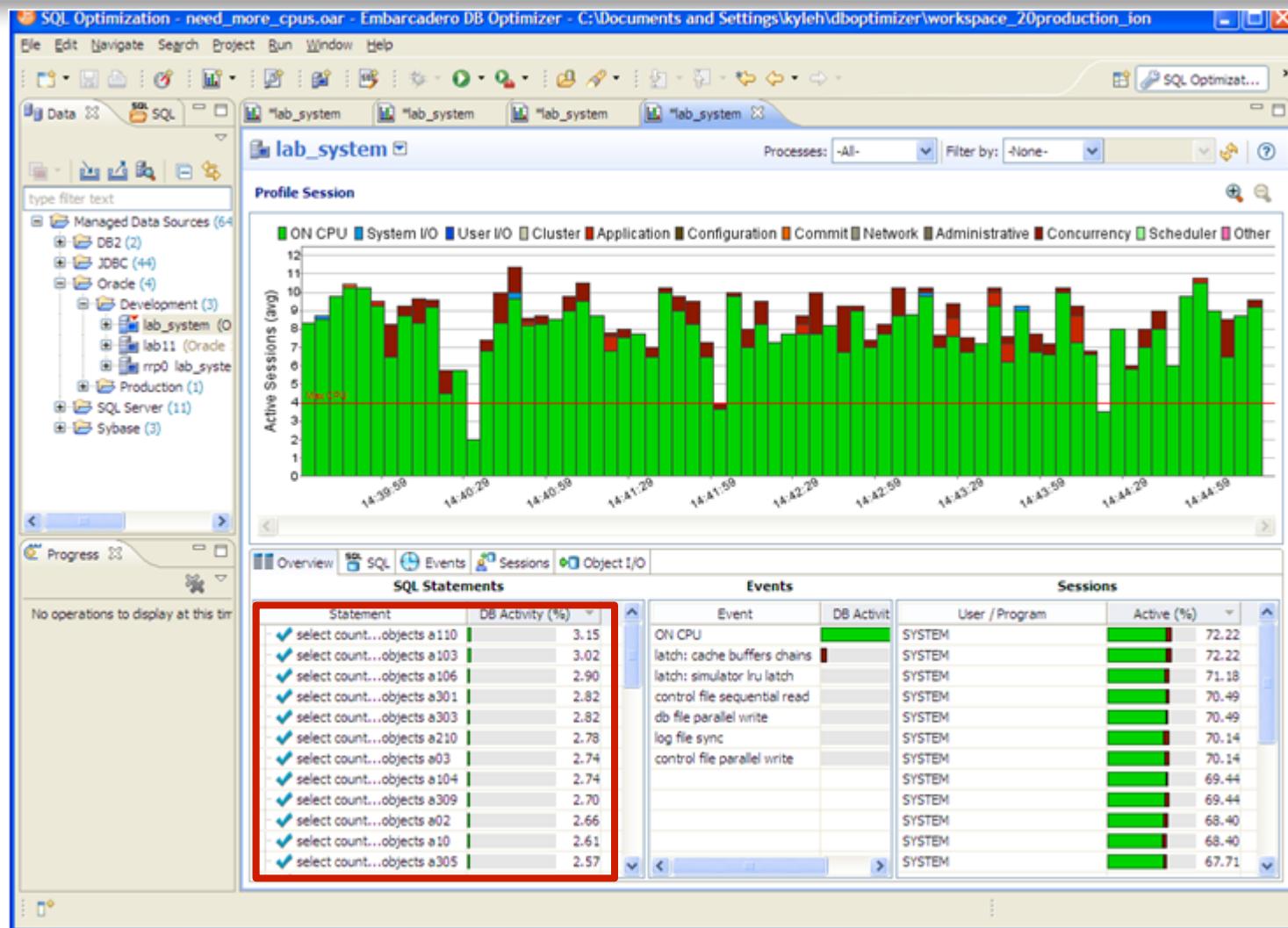


2. Problemas no Banco de Dados

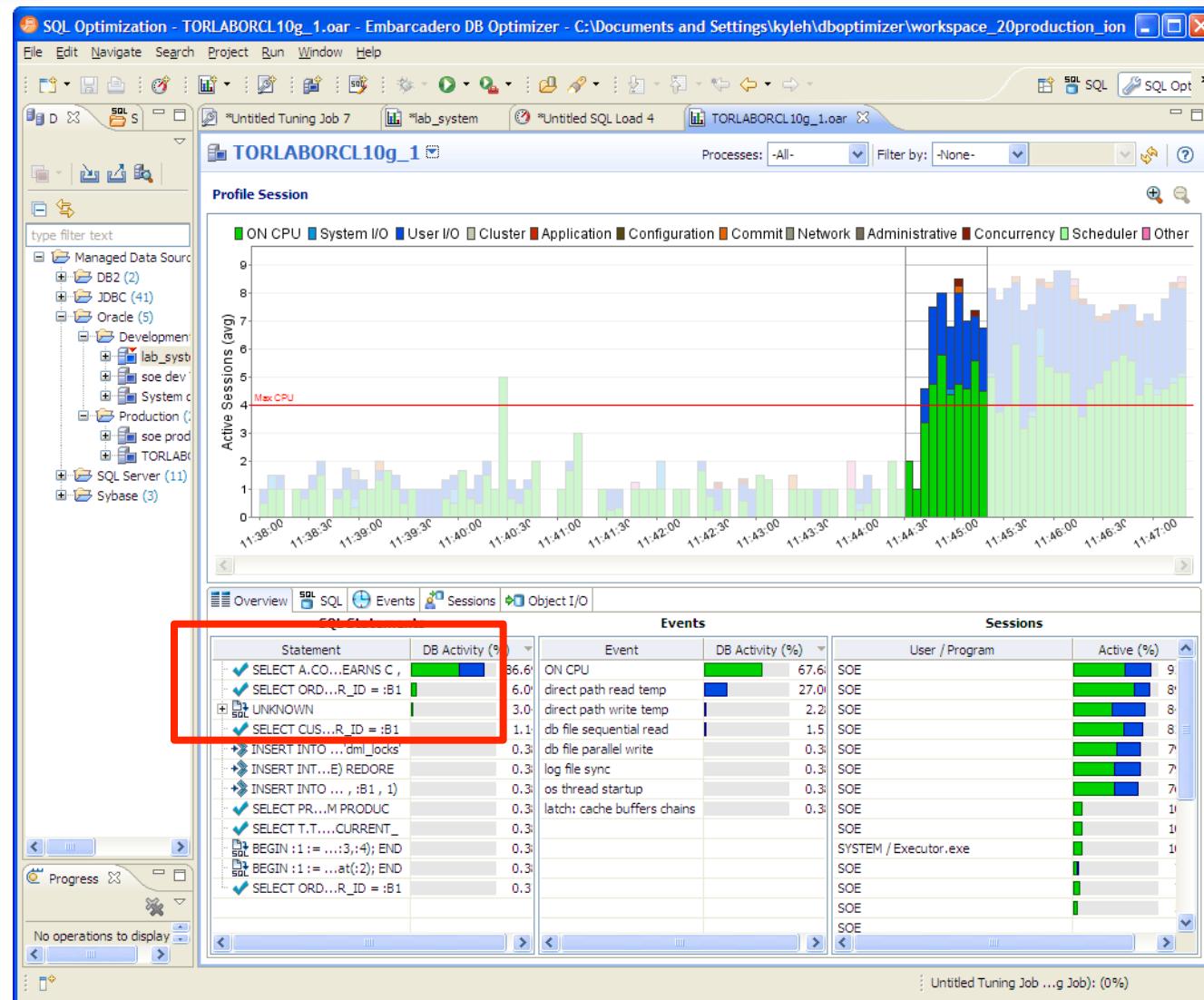


```
begin
  for i in 1..1000 loop
    insert into foo values ('a');
  end loop;
end;
/
Commit;
```

3. Máquina Subdimensionada



4. SQL Necessita Otimização



Visual SQL Tuning

Max Rows Returned

One to one



Min(A,B)

One to many



Max(A,B)



Many to many



(A*B) /min(ndv(A),ndv(B))

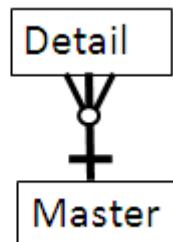
Cartesian

Cartesian

(A*B)



Diagram
Default
Orientation



VST – melhor ordem de execução

Considerando estas 3 tabelas, qual é a melhor ordem para o Join?

```
SELECT COUNT (*)
FROM
    b2 b,
    c2 c,
    a2 a
WHERE
    b.val2 = 100 AND
    a.val1 = b.id AND
    b.val1 = c.id;
```

```
graph TD; A[A2 (a)] --- B[B2 (b)]; B --- C[C2 (c)];
```

Predicate Filter

A blue arrow points from the WHERE clause of the SQL query to the join condition between B2 and C2 in the execution plan diagram.

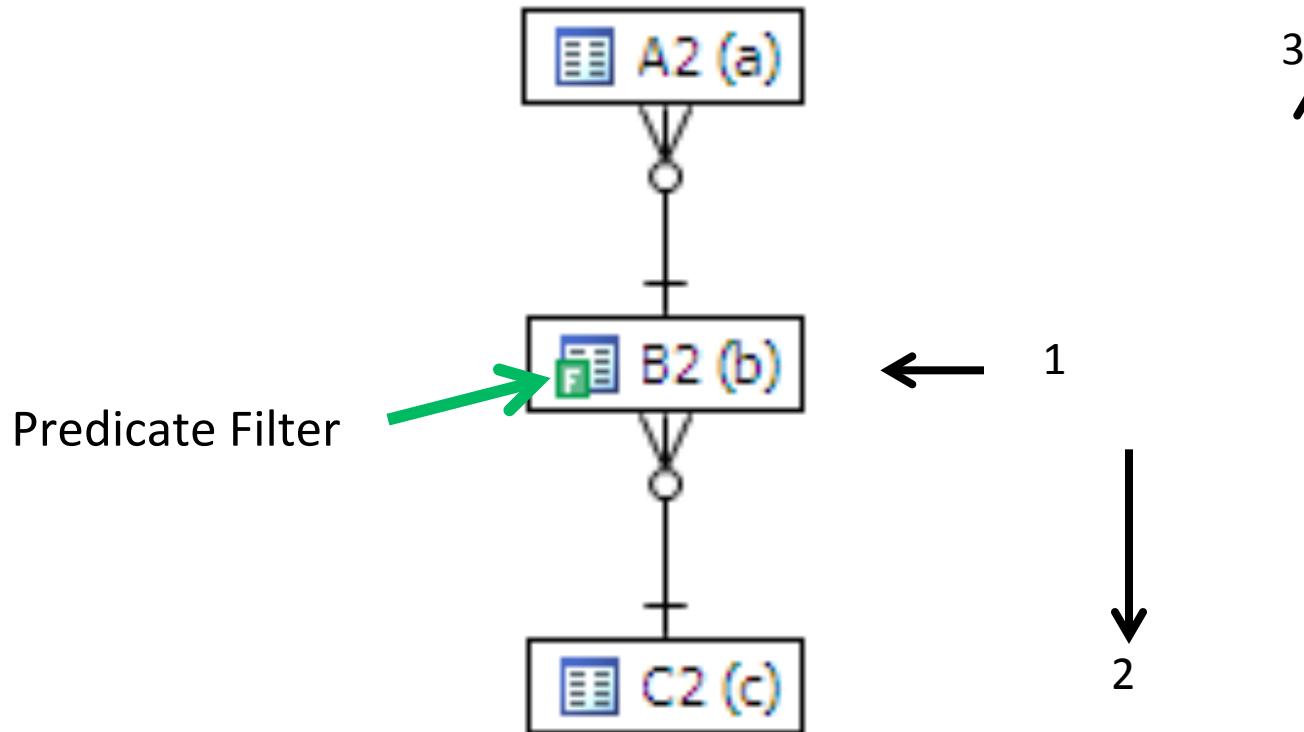
Below the execution plan are tabs for Index Analysis, Table Statistics, Column Statistics And Histograms, and Outlines. The Index Analysis tab is selected.

Collect and create indexes



Index Name	Table Owner	Table Name	Column Name	Index Type
A2_I	SYSTEM	A2	VAL1	Normal
B2_V2	SYSTEM	B2	VAL2	Normal
C2_I	SYSTEM	C2	ID	Unique
B2_I	SYSTEM	B2	ID	Unique
B2_V1	SYSTEM	B2	VAL1	Normal

VST – melhor ordem de execução



B -> C -> A

Relacionamento One to One

Unique keys on both ends of the join:

```
SELECT COUNT (*)
FROM
    investment_type it,
    office_location ol
WHERE investment_type_id =
office_location_id;
```

The most rows returned
is

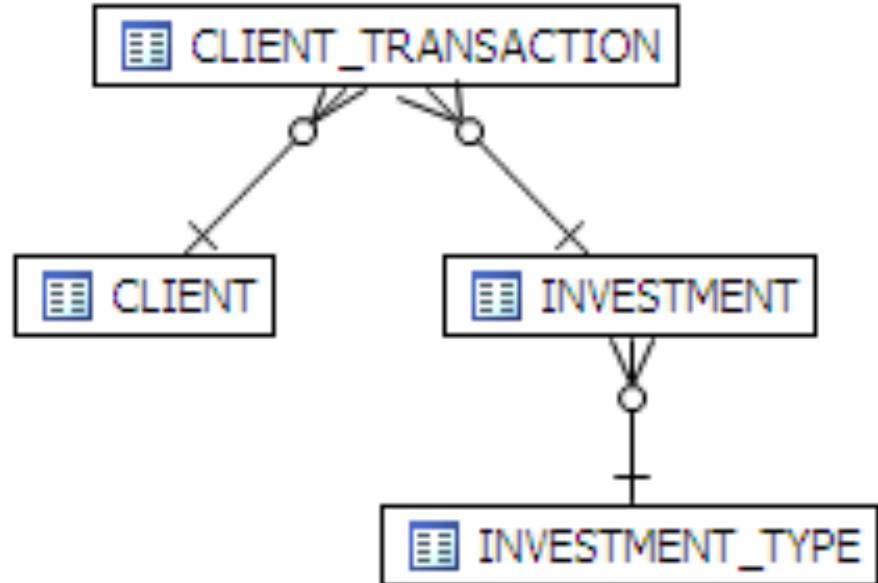
$$\text{Min}(A,B)$$

Where A is the rows in
the first table and B is the
rows in the second table



Relacionamento Um para Muitos

```
SELECT
    ct.action,
    c.client_id,
    i.investment_unit,
    it.investment_type_name
FROM
    client_transaction ct,
    client c,
    investment_type it,
    investment i
WHERE
    ct.client_id = c.client_id
AND
    ct.investment_id =
    i.investment_id AND
    i.investment_type_id =
    it.investment_type_id and
    client_transaction_id=1
```



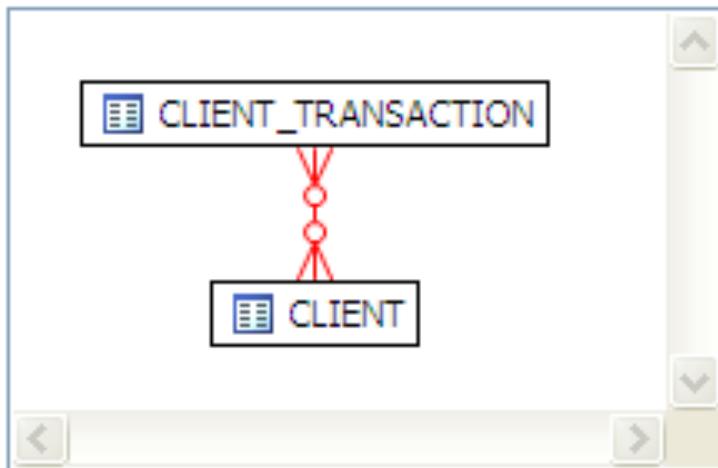
The most rows returned
is

$$\text{Max}(A, B)$$

Where A is the rows in
the first table and B is the
rows in the second table

Relacionamento Muitos para Muitos

```
select *
from client_transaction ct,
     client c
where
ct.transaction_status=c.client_marital_status
;
```



The most rows returned is

$$(A * B) / \min(ndv(A), ndv(B))$$

Where A is the rows in the first table and B is the rows in the second table
And "ndv" is "number of distinct values"

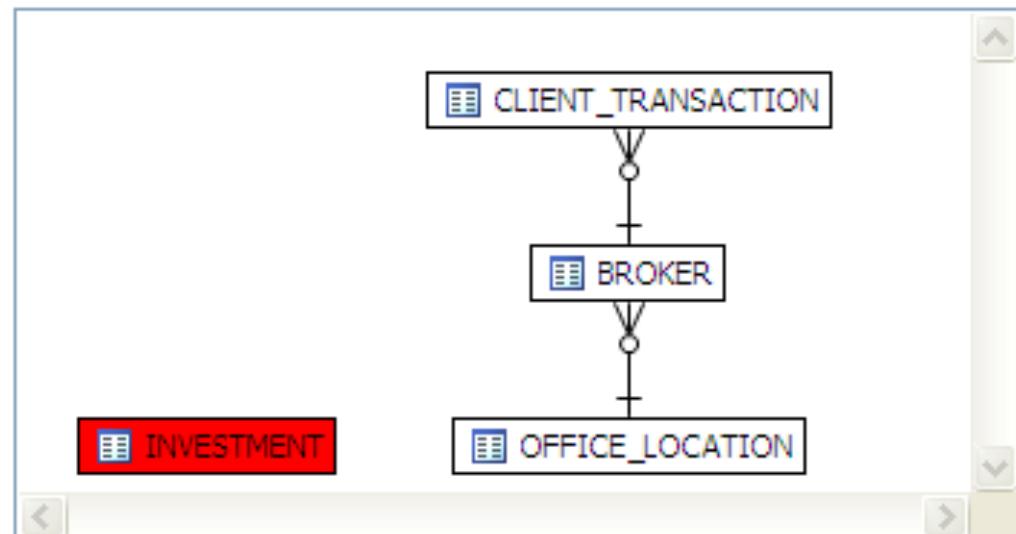
Produtos Cartesianos

```
SELECT
  A.BROKER_ID BROKER_ID,
  A.BROKER_LAST_NAME BROKER_LAST_NAME,
  A.BROKER_FIRST_NAME BROKER_FIRST_NAME,
  A.YEARS_WITH_FIRM YEARS_WITH_FIRM,
  C.OFFICE_NAME OFFICE_NAME,
  SUM (B.BROKER_COMMISSION) TOTAL_COMMISIIONS
FROM
  BROKER A,
  CLIENT_TRANSACTION B,
  OFFICE_LOCATION C,
  INVESTMENT I
WHERE
  A.BROKER_ID = B.BROKER_ID AND
  A.OFFICE_LOCATION_ID = C.OFFICE_LOCATION_ID
GROUP BY
  A.BROKER_ID,
  A.BROKER_LAST_NAME,
  A.BROKER_FIRST_NAME,
  A.YEARS_WITH_FIRM,
  C.OFFICE_NAME;
```

The most rows returned is

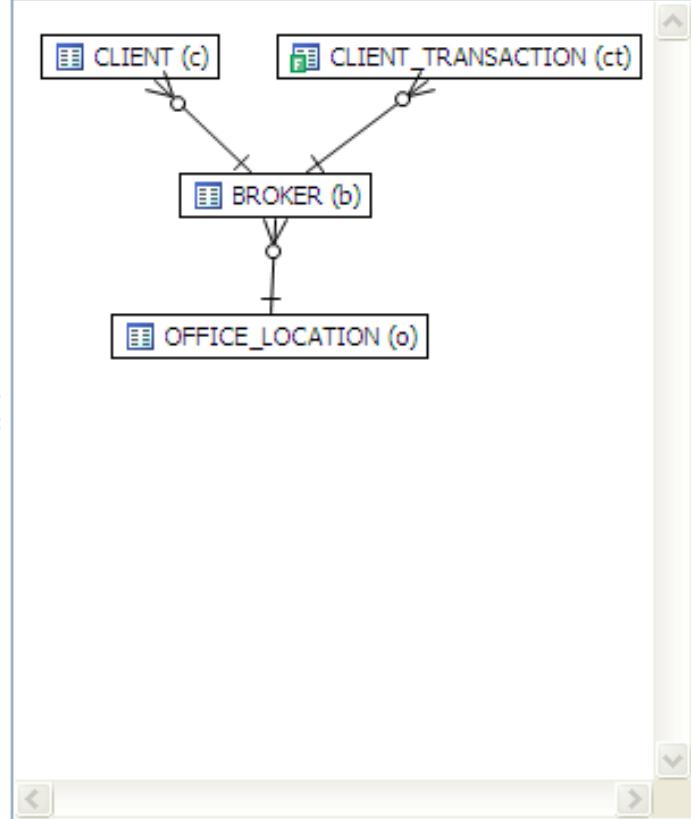
$$(A * B)$$

Where A is the rows in the first table and B is the rows in the second table



VST – Cartesiano Implicito

```
SELECT
    c.client_first_name,
    c.client_last_name,
    ct.action,
    ct.price,
    b.broker_last_name,
    b.broker_first_name,
    o.office_name
FROM
    client_transaction ct,
    client c,
    broker b,
    office_location o
WHERE
    ct.price > 100 AND
    b.broker_id = ct.broker_id AND
    c.broker_id = b.broker_id AND
    o.office_location_id = b.office_location_id
```



Algo esta errado:
Client tem*um* broker e
Um client_transaction tem *um* broker

Índices são mostrados em todas as tabelas (incluindo queries e sub-queries)

1. Green

- used in the query

2. Blue

- usable but not used by optimizer in this case

3. Orange

- suggest to create

4. Grey

- exist on table but not usable in this query as it is written

Índice Faltante

```
SELECT *
FROM
    client_transaction ct,
    client c
WHERE
    ct.transaction_status = c.client_marital_status AND
    c.client_first_name = 'Brad'
```

The diagram illustrates a relationship between two entities: **CLIENT_TRANSACTION** and **CLIENT**. A line connects the two boxes, with a red circle at each end, indicating a many-to-many relationship.

Below the code and diagram, there are tabs for Index Analysis, Table Statistics, Column Statistics And Histograms, and Outlines. The Index Analysis tab is selected.

Collect and create indexes

	Index Name	Table Owner	Table Name	Column Name	Index Type
<input checked="" type="checkbox"/>	IDX_CLIENT_0	SYSTEM	CLIENT	CLIENT_FIRST_NAME	Normal
<input type="checkbox"/>	CLIENT_STATUS	SYSTEM	CLIENT	CLIENT_MARITAL_STATUS	Normal
<input checked="" type="checkbox"/>	CLIENT_BROKER	SYSTEM	CLIENT	BROKER_ID	Normal
<input checked="" type="checkbox"/>	CLIENT_PK	SYSTEM	CLIENT	CLIENT_ID	Unique
<input checked="" type="checkbox"/>	CLIENT_TRANSACTION_BROKER	SYSTEM	CLIENT...ACTION	BROKER_ID	Normal
<input checked="" type="checkbox"/>	CLIENT_TRANSACTION_CLIENT	SYSTEM	CLIENT...ACTION	CLIENT_ID	Normal
<input checked="" type="checkbox"/>	CLIENT_TRANSACTION_INVESTMENT	SYSTEM	CLIENT...ACTION	INVESTMENT_ID	Normal
<input checked="" type="checkbox"/>	CLIENT_TRANSACTION_PK	SYSTEM	CLIENT...ACTION	CLIENT_TRANSACTION_ID	Unique

This index has no effect on the statement execution.

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- **Canais Mundiais**

- Embarcadero Developer Network - <http://edn.embarcadero.com>
- Diretório de MVP's - <http://www.embarcadero.com.br/mvp-directory>
- Documentação dos Produtos - <http://docs.embarcadero.com>
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- CodeRage 7 - <http://www.embarcadero.com/coderage>



(11) 5643-1333



atendimento@embarcadero.com.br

Obrigado!

Fernando Rizzato

Lead Software Consultant, Latin America

fernando.rizzato@embarcadero.com



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