



# OpenEdge SQL Performance Troubleshooting and Understanding Query Plans

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# **Executive Summary**

In this workshop we will take you through step by step interactive activities where you understand Query plans generated by OpenEdge SQL and demonstrate how important it is to understand query plans while working on performance related problems. In this Workshop you will learn

- Generating and understanding Query plans
- Identifying bad queries which are causing performance degradation
- Importance of statistics
- Troubleshooting common performance problems
- Solving problems using the query plan

## Preface

This guide is designed to quickly introduce you to the steps involved in identifying and fixing OE SQL performance problems using Query plans and understand different types of statistics and their role in helping OE SQL optimizer to generate better query plans.

## How to use this guide?

This guide is designed to flow from one chapter to the next, because each chapter requires knowledge built in previous chapters. You may decide to skip few chapters if you are aware of the concepts present those chapters. Throughout this workshop, we will be using JDBC client Squirrel for execution of queries.

## Prerequisite

This workshop requires basic knowledge on SQL.

## Chapter 1 – Why are we here?

Having knowledge of concepts presented in this workshop would really make a big difference when you deal with OE SQL in day to day life. Most of the time in this workshop, you will be working on your machine, understanding query plans and solving performance problems.

# Chapter 2 – Generating query plans

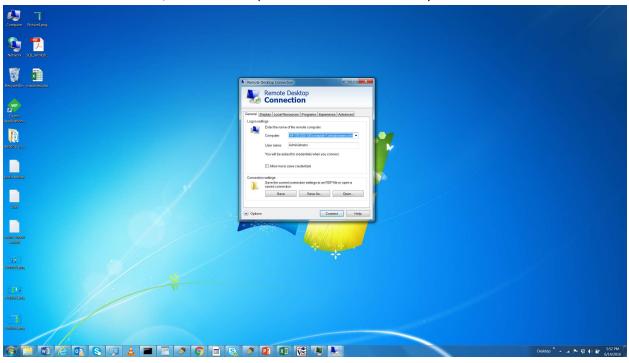
In this chapter, you will learn different ways to generate Query plan. Query plan is the execution strategy determined by SQL optimizer to complete the query. For example, for a query like below, one of query plan can be "Perform the Index scan of CustIdx on table pub.customer with custnum value as 10 and return the custname as the result".

SELECT CustName FROM Pub.Customer WHERE CustNum=10;

Connecting to VM:

Search for "mstsc" and select.



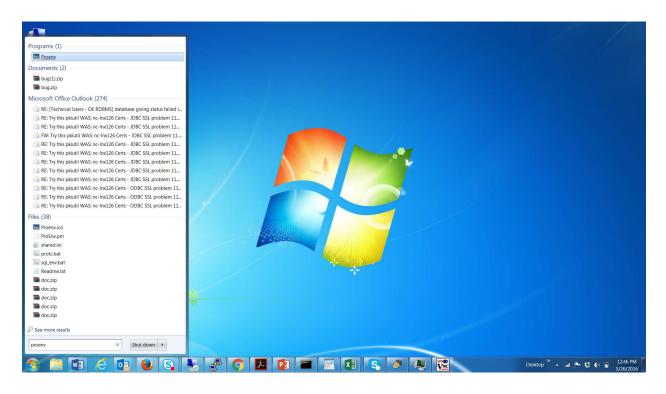


Enter the details of machine, user name and password which is allotted to you and click on connect.

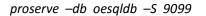
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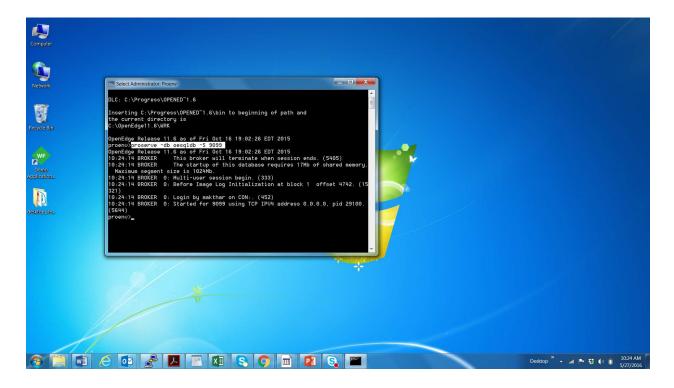
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a. Start the database and connect to the database using "Squirrel" as the SQL client. Step 1: Search for the "proenv" and press "Enter".

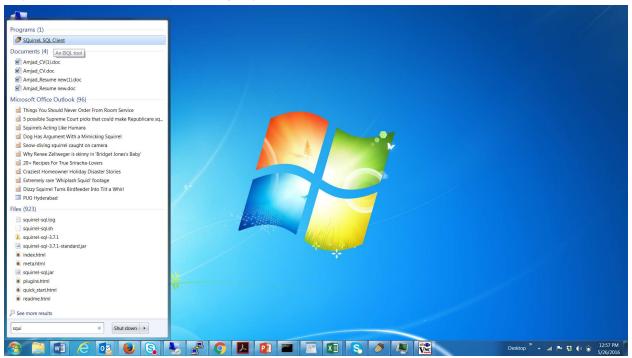


Step 2: Start the database using "proserve" command. This command accepts the database name and the port number where the database listens.





Step 3: Start SQuirrel client by searching "Squirrel".

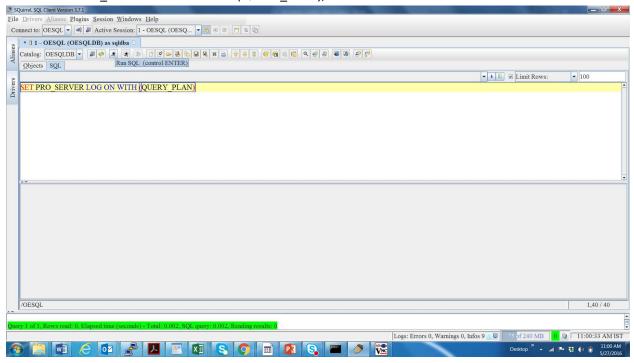


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Step 4: Double click on "OESQL" alias name and click on "Connect". User 'sqldba' is an existing user password for this user is "sqldba" (same as user name).

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Step 5: Enable server log to display query plans, by executing below mentioned command and then "Run" SET PRO SERVER LOG ON WITH (QUERY PLAN);



Step 6: Run the below query for which we want to see the query plan then "Run"

SELECT Custnum FROM Pub.Customer WHERE Custnum = 10;

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Step 7: Open the log file with name "SQL\_server\_X\_XXXX\_A.log" at location C:\OpenEdge\WRK

Step 8: Query plan using the System Table, Pub."\_Sql\_QPlan"

Run the below mentioned query in Squirrel window.

SELECT "\_Description" FROM Pub."\_Sql\_Qplan" WHERE "\_Pnumber"=(SELECT MAX("\_Pnumber") FROM PUB."\_Sql\_Qplan" WHERE "\_Ptype">0);

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Step 2-9: Create the below view which helps us in looking at the query plan with ease. Throughout this session we will be using this view to check the query plan.

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# Chapter 3 – Understanding different query operations from Query plan

In this chapter, most of the query operations are explained with examples. You need to execute below queries, where each query will demonstrate one or some set of query operations using query plans.

- a. Table scan
- b. Index scan
- c. Project
- d. Restrict
- e. Join
- f. Aggregation
- g. Sort
- h. Union
- i. TIDUNION
- j. Dynamic Index (DIDX)

#### Query 1 – Below query demonstrates "Project" and "Index Scan" operations.

SELECT Name, Address FROM Pub.Customer WHERE Name='Hoops';

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## Then run select on Qplan view to see the Query plan

## SELECT "\_Description" FROM Qplan;

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SELECT Name, Address FROM Pub.Customer WHERE City='Boston';

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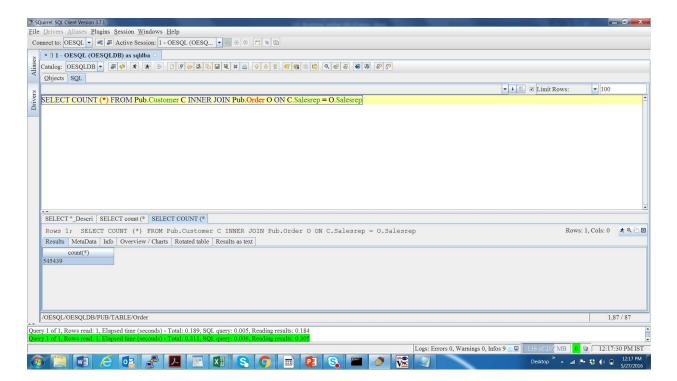
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Query 3 – Below query demonstrates demonstrate "Join" and "DIDX" operations.

SELECT COUNT(\*) FROM Pub.Customer C INNER JOIN Pub.Order O ON C.Salesrep = O.Salesrep;



#### Now Check Query plan

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Query 4 – Below query demonstrates "Aggregation" operation.

SELECT Salesrep, COUNT (Ordernum) FROM Pub.Order GROUP BY salesrep;

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Rows 10; SELECT Salesrep, COUNT (Ordernum) FROM Pub.Order GROUP BY salesrep	Rows: 1, Cols: 0	* < 🖻 🗵
Results MetaData Info Overview / Charts Rotated table Results as text		
SalesRep count(Ordernum)		
RDR 397		
HXM 515 JAL 460		
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DKP 521		
GPE         570           DOS         505		
SLS 469		
BBB 468 Web 13		
Web 1.3		
/OESQL/OESQLDB/PUB/TABLE/Order	1,67	/ 67
Query 1 of 1, Rows read: 19, Elapsed time (seconds) - Total: 0.014, SQL query: 0.004, Reading results: 0.01		
Query 1 of 1, Rows read: 10, Elapsed time (seconds) - Total: 0.044, SQL query: 0.004, Reading results: 0.04	Logs: Errors 0, Warnings 0, Infos 9	DMICT
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#### Now check Query plan

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s	× 🗓 1 - OESQL (OESQLDB) as sqldba 🖸
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	SELECT COMMAND.
	PROJECT [21] ( HASH AGGREGATE [20] [ INTO TMPTBL00000120 ] (
	PROJECT [15]
	PUB.ORDER. [3](
	TABLE SCAN
	, PUB.ORDER.SalesRep , PUB.ORDER.Ordenmum
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	, PEXPR1
	, count (PEXPR2)
	GROUP BY (
	, PEXPR1
	/0ESQL/0ESQL/DB/PUB/TABLE/Order 1,33 / 33
One	y 1 of 1, Rows read: 10, Elapsed time (seconds) - Total: 0.044, SQL query: 0.004, Reading results: 0.04
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SELECT COMMAND. PROJECT [21] ( | HASH AGGREGATE [20] [ INTO TMPTBL00000120 ] ( | | PROJECT [15] ( | | | PUB.ORDER. [3]( |||| | , PUB.ORDER.SalesRep | | , PUB.ORDER.Ordernum 11) | , PEXPR1 | , count (PEXPR2) | | <mark>GROUP BY (</mark> 11) 1) , PEXPR1 , PEXPR2 )

## Query 5 - Below query demonstrates "Union" and "Sort" operations.

SELECT Country, City FROM Pub.Customer

UNION

SELECT Country, City FROM Pub.Supplier

ORDER BY Country, City;

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UNION							
SELECT Country, City FR	OM Pub.Supplier						
ORDER BY Country, City							
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**							
SELECT " Descri SELECT O	Country,						
-			a		all De	vs: 1, Cols: 0	100
	; SELECT Country, City FROM		Country, City FROM Pub.	Supplier ORDER BY Countr	cy, City Ro	vs: 1, Cois: 0	<b>X</b> C
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		CITY					
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Australia Austria Austria Finland Finland Finland Finland Finland Finland Finland Finland Finland	Sydney Innsbruck Salzburg Wien Aanekoski Alavus Espoo Forssa Hanko Helsinki Hyvinkaa Imatra Janisjarvi Kemi Kerava	CITY					,9 / 95

## Now check Query plan

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× 11-OESQL (OESQLDB) as sqldba 🖸	
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SELECT * FROM QPlan	â
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SELECT Country, SELECT * FROM QPlan SELECT Country, SELECT * FROM QPlan	
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SELECT COMMAND. PROJECT [34] distinct (	
SORT [1] IN TMPTBL0000012(	
UNION [10](	_
PROJECT[3](	
PROJECT [19] (         PUB.CUSTOMER. [2](	
TABLE SCAN	_
, PUB.CUSTOMER.Country	
, PUB.CUSTOMER.City     , PUB.CUSTOMER.rowid	
, PEXPR1	
, PEXPR2	
/OESQL	1,20 / 20
rery 1 of 1, Rows read: 100, Elapsed time (seconds) - Total: 0.024, SQL query: 0.015, Reading results: 0.009	
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	<sup></sup> 6/14/2016
SELECT COMMAND.	
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, PUB.CUSTOMER.Country	
, PUB.CUSTOMER.City	
, PUB.CUSTOMER.rowid	
)	
/ / ,	
, PUB.SUPPLIER.Country	
, PUB.SUPPLIER.City	
, PUB.SUPPLIER.rowid	
SORT BY (	
<pre>/ / , Sort project expression #0 == PEXPR1</pre>	

#### / / , Sort project expression #1 == PEXPR2

## Query 6 – Below query demonstrates TIDUNION operation.

## SELECT custnum, name, Address, City from pub.customer where custnum=10 OR name = 'Hoops';

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	e Drivers Aliases Plugins Session Windows Help		
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50			▼ ↓ E ⊮ Limit Rows: ▼ 100
Drivers	SELECT custnum, name, Address, City from pub.customer where cus	stnum=10 OR name = 'Hoops'	
Ā			
	SELECT "_Descri SELECT custnum,		
	Rows 2; SELECT custnum, name, Address, City from pub.c	customer where custnum=10 OR name = 'Hoops'	Rows: 1, Cols: 0 🛛 🖈 🔍 🖻 🗵
	Results MetaData Info Overview / Charts Rotated table Results as text		
	CustNum Name	Address Suite 415	City
	3 Hoops 10 Just Joggers Limited		Ramsbottom
	/OESQL/OESQLDB/PUB/TABLE/Customer		1,37/37
A.T.	ery 1 of 1, Rows read: 22, Elapsed time (seconds) - Total: 0.008, SQL query: 0.003, R	in the material of the	
	ery 1 of 1, Rows read: 22, Elapsed time (seconds) - Total: 0.008, SQL query: 0.005, Re		
		Logs: En	rors 0, Warnings 0, Infos 9 📃 136 of 189 MB 0 🕲 12:53:17 PM IST

## Now check the query plan

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SELECT "_Description" FROM Qplan	▲ ●
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SELECT "_Descri SELECT custum, SELECT "_Descri	
Rows 33; SELECT " Description" FROM Qplan	Rows: 1, Cols: 0 🖈 🔍 🖻 🗵
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Description	
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PROJECT [26] (	
TIDUNION [29] (	
PROJECT [37] (	
PUB.CUSTOMER. [34](	H
INDEX SCAN OF (	
Custom,	
(PUB.CUSTOMER.CustNum) = (10))	
U. PUB.CUSTOMER.rowid	
PUB.CUSTOMER.CusNum	-
PROJECT [45] (	
PUB_CUSTOMER_[42](	
INDEX SCAN OF (	
Name,	
(PUB.CUSTOMER.Name) = (Hoops))	
	•
/OESQL/OESQLDB/PUB/TABLE/Customer	1,33 / 33
Query 1 of 1, Rows read: 2, Elapsed time (seconds) - Total: 0.009, SQL guery: 0.005, Reading results: 0.004	
Query 1 of 1, Rows read: 5, Jupped time (seconds) - Total: 0.004, SQL query 0.002, Reading results: 0.002	
Logs: Errors 6, Warnings 0,	Infos 9 🖳 138 of 189 MB 0 🤪 12:57:16 PM IST
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SELECT COMMAND.
PROJECT [28] (
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| | | | <mark>| INDEX SCAN OF (</mark>
| | | | | | (PUB.CUSTOMER.CustNum)
| | | | )
| | | , PUB.CUSTOMER.rowid
| | | , PUB.CUSTOMER.CustNum
| | | ),
|  |  |  PROJECT [45] (
|  |  |  |  PUB.CUSTOMER. [42](
| | <mark>| | | INDEX SCAN OF (</mark>
| | | | | | (PUB.CUSTOMER.Name) =
| | | | )
| | | , PUB.CUSTOMER.rowid
| | | , PUB.CUSTOMER.Name
|||
||\rangle
| , PUB.CUSTOMER.CustNum
| , PUB.CUSTOMER.Name
| , PUB.CUSTOMER.Address
| , PUB.CUSTOMER.City
1)
```

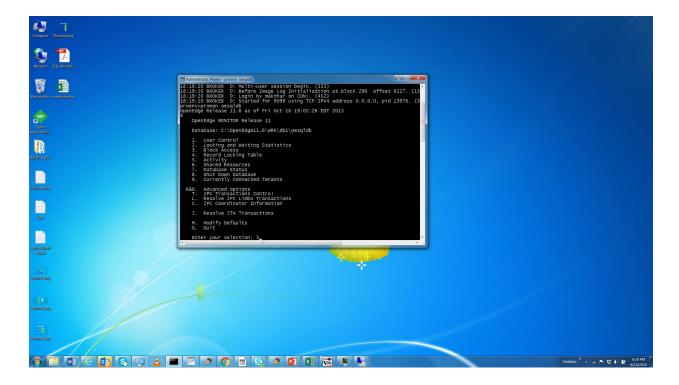
# Chapter 4 - Table Scan Vs. Index scan

In this chapter, you will be asked to run a simple query which does table scan and capture the number of IOs using promon utility. Then, you will be asked to create an index and run the same query again and check the number of IOs using promon utility. Then, we compare the number of IOs which took place in table scan versus index scan. In both the cases, we will look at query plan to confirm the query operation.

#### How to start promon?

Go to proenv window and type below command and select option 5. Option 5 will display the number of records read.

#### promon oesqldb



Check the number of DB Requests before running SQL query

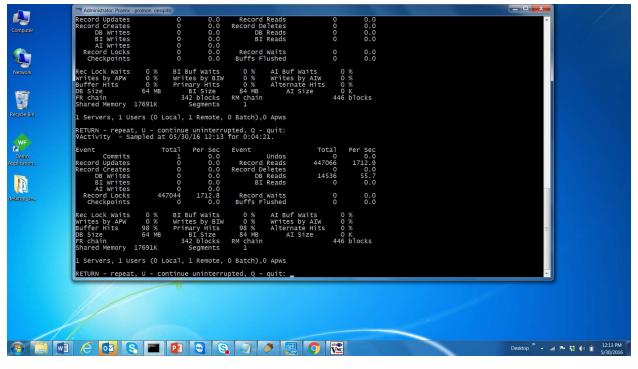
	Administrator: Proenv - promon oesqldb		
Computer	4. Record Locking Table 5. Activity 6. Shared Resources 7. Database Status 8. Shut Down Database	A	
Network	9. Currently Connected Tenants R&D. Advanced options T. 2PC Transactions Control L. Resolve 2PC Limbo Transactions C. 2PC Coordinator Information		
Ø	J. Resolve JTA Transactions		
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	Enter your selection: 5 PActivity – Sampled at 05/30/16 12:09 for 0:03:51.		
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	DB Writes         4         0.0         DB Reads         141         0.6           BI Writes         2         0.0         BI Reads         199         0.9		
dadatop_ite_	AI Writes 0 0.0 Record Locks 1333 5.8 Record Waits 0 0.0 Checkpoints 0 0.0 Buffs Flushed 0 0.0		
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Now, run the below query which results in table scan.

SELECT TOP 50 ItemNum, Price FROM Pub.OrderLine WHERE ItemNum=10 ORDER BY ItemNum;

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				ine where ItemNum = 10	Order by ItemNum		r	tows: 1, Cols: 0	A K C D
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Now, Check the number of Record read in promon.



Now check the query plan and confirm that it is doing Table Scan.

\_Description SELECT COMMAND. PROJECT [25] TOP 50 ( | SORT [24] IN TMPTBL00000024( | | RESTRICT [6] ( | | | | <mark>| TABLE SCAN</mark> ||||| | | , PUB.ORDERLINE.Itemnum | | | , PUB.ORDERLINE.Price |||)11 | | | (PEXPR1) = (10) | | | Evaluation callback list( | | | | col id# 4 |||) $||\rangle$ | | SORT BY ( | | , Sort project expression #0 == PEXPR1 1), | , PEXPR1

| ,PEXPR2 | ) ,PEXPR1 ,PEXPR2 )

Now, let us create an index on ItemNum column of Pub.OrderLine table.

	CREATE INDEX ItemNum ON Pub.OrderLine (ItemNum);
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	CREATE INDEX ItemNum ON Pub.OrderLine (ItemNum)
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Dri	
	/OESQL 1,48 / 48
A.T.	
Que	ery 1 of 1, Rows read: 0, Elapsed time (seconds) - Total: 11.727, SQL query: 11.727, Reading results: 0
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1	

CREATE INDEX ItemNum ON Pub.OrderLine (ItemNum);

Refresh the promon screen by pressing "Enter"

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1 Servers, 1 Users (O Local, 1 Remote, O Batch),O Apws RETURN - repeat, U - continue uninterrupted, Q - quit: ØActivity - Sampled at 05/30/16 12:17 for 0:00:02.		
Event     Total     Per Sec     Event     Total     Per Sec       SELECT TOP 50     Record Creates     0.0     Undos     0.0       Results     MetaDa     DB     Writes     0.0     Bit Reads     0.0       DB     Writes     0.0     DB     Reads     0.0       Itemmum     DB     Writes     0.0     Bit Reads     0.0       Id     50     Record Locks     0.0     Bit Reads     0.0       Id     50     Record Locks     0.0     Bit Filushed     0.0       I0     50     Rec Lock waits     0 %     Alternate Hits     0 %       I0     50     BS Size     64 MB     BI Size     0 %       I0     50     Shared Memory 17691K     Segments     1       I0     50     Iservers, 1 Users (0 Local, 1 Remote, 0 Batch),0 Apws       I0     50     Return - repeat, U - continue uninterrupted, Q - quit:	E E E	rs: 1, Cols: 0 🗶 🕤 🖬
/OESQL		1,84 / 84
Query 1 of 1, Rows read: 0, Elapsed time (seconds) - Total: 14.896, SQL query: 14.896, Reading results: 0 Logs: Errors 8, Warnings 0, Infos 9 🔤	146 of 190 MB 2	• • • •
	Desktop 🎽 🔺 all	▶ 😫 🕪 🗎 12:17 PM 5/30/2016

Now, run the same query again and check the number of records read and the time taken. SELECT TOP 50 ItemNum, Price FROM Pub.OrderLine where ItemNum = 10 Order by ItemNum;

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Now, check the number of records read.

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**Observation** – Did you observe the drastic change in the number of records read during Index scan when compared to Table scan? This difference is because, Index scan will have intelligence to read only the required records and skip all other records of a table.

# Chapter 5 - Join Methods

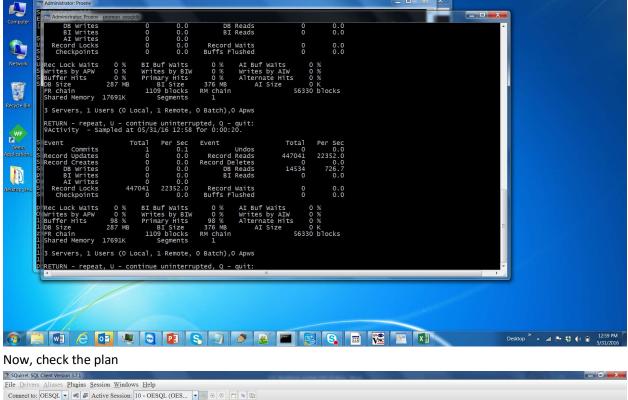
In this chapter, we will explain the different join methods used by OE-SQL and you will be learning what are "Good" join methods (Augmented Nested Loops and Merge Joins in OE world) and what is a "Bad" join method (Nested Loop). Basically, "Good" joins are the ones which uses physical index or Dynamic index on the right side of the join to evaluate the join conditions. Here, you will be asked to run a join query which results in "Bad" join and then, create an index and then, asked to run the same query again to see the "Good" join. We will check the join methods through query plans. You will also use promon utility to check the number of IOs in both cases. There can be cases where, SQL optimizer selects "Nested Loop Join" which might be better than other choices.

Nested Loop Joins:

Run the Below query which results in Nested Loop Join SELECT COUNT (\*) FROM Pub.Sitem si, Pub.OrderLine ol WHERE si.Price > ol.Price;

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Now check the number of DB Requests.



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||||
| | | , PUB.OL.Price
| | | , PUB.OL.rowid
| | | )
11)
| , count (*)
1)
, PEXPR1
```

## Augmented Nested Loop Joins:

#### Now, in order to get ANL join, create an index on Pub.OrderLine table

CREATE INDEX PriceIdx ON Pub.OrderLine (Price);

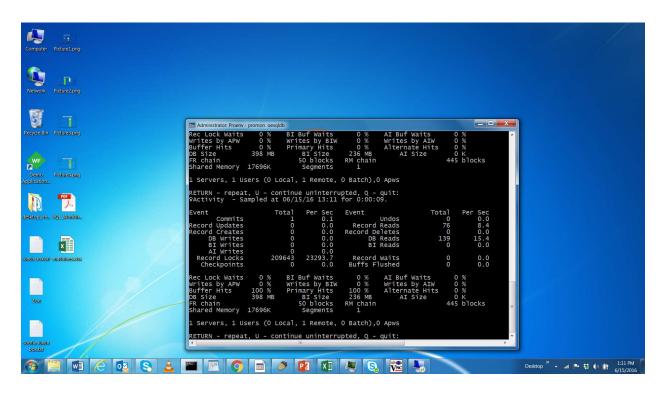
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	y 1 of 1, Rows read: 1, Elapsed time (seconds) - Total: 0.685, SQL query: 0.001, Reading results: 0.684	=
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## Now, run the same query again. This time, it takes ANL.

#### SELECT COUNT (\*) FROM Pub.Sitem si, Pub.OrderLine ol WHERE si.Price > ol.Price;

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	Rows 1; SELECT COUNT (*) FROM Pub.Sitem si, Pub.OrderLine ol WHERE si.Price > ol.Price Rows: 1, C	Cols: 0 🗶 🔍	88	
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## Check the number of DB requests



## Check the query plan

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	PUB.SI. [1](	
	TABLE SCAN	
	U , PUB.SI.Price	
	, PUB.SLrowid	
	(PEXPR1) > (PEXPR3)	
	above defines ANL left side keys <relop> right side keys.</relop>	
	PROJECT [19] (	
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1111)
| | | , PUB.OL.Price
| | | , PUB.OL.rowid
|||
||\rangle
| , count (*)
1)
, PEXPR1
)
```

**Observation:** Did you observe the drastic difference in number of records read? It is because, right side of the join in ANL has the index scan, which reads only the required records from that table.

Augmented Nested Loop joins with Dynamic Index:

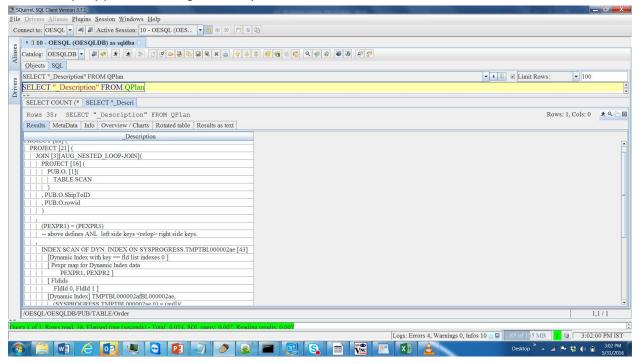
When there is no index available for join, then SQL creates Dynamic Index during the runtime on the Right Side Table of Join. This join is called as ANL with DIDX (DIDX stands for Dynamic Index). This is also called as Hash Join.

Run the below query (Note that, there is no index available on ShipToId column of Pub.Order or Pub.ShipTo).

SELECT COUNT (\*) FROM Pub.Order o, Pub.Shipto s where s.ShipToId = o.ShipToId

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z SELECT COUNT (*) FROM Pub.Order o, Pub.Shipto s where s.ShipToId = o.ShipToId	▼ ↓ E 🗹 Limit Rows: ▼ 10	0
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SELECT COUNT (*		
Rows 1; SELECT COUNT (*) FROM Pub.Order o, Pub.Shipto s where s.ShipToId = o.ShipToId	Rows: 1, Cols:	
Results MetaData Info Overview / Charts Rotated table Results as text	Rows. 1, Cols.	
count(*)		
1286		
/OESQL/OESQLDB/PUB/TABLE/Order		1,78 / 78
		*,107.70
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#### Check the query plan, it should generate Dynamic Index.



#### \_Description

SELECT COMMAND.						
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JOIN [3][AUG_NESTED_LOOP-JOIN](						
PUB.O. [1](						
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, PUB.O.ShipToID						
, PUB.O.rowid						
)						
,						
(PEXPR1) = (PEXPR3)						
above defines ANL left side keys <						
,						
INDEX SCAN OF DYN. INDEX ON SYSPROGRES						
[Dynamic Index with key == fld lis						
[ Pexpr map for Dynamic Index data						

```
PEXPR1, PEXPR2 ]
| | | | [ Fldids
| | | | FldId 0, FldId 1 ]
| | | [Dynamic Index] TMPTBL00000011BL00
| | | | (SYSPROGRESS.TMPTBL00000010.0)
|  |  |  |  PROJECT [19] (
| | | | PUB.S. [2](
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| | | | | | custnumshipto, - F
| | | | , PUB.S.ShipToID
| | | , PUB.S.rowid
| | )
| , count (*)
| )
, PEXPR1
)
```

# **Chapter 6 - Aggregations**

In this chapter, we will explain the different aggregation methods used by OE-SQL and then, you will be asked to run a query which results in "Hash Aggregation". Then, we will create an index and run the same query which now results in "Stream Aggregation". Basically, "Hash aggregation" uses "Hash Table" to group the same column values, whereas, "Stream Aggregation" uses the "Index scan" operation on the grouping columns and thus does not require any "Hash Table" to group the same column values. We will compare the difference between these two aggregation methods in terms of execution time and the reason behind this difference. All this will be done by analyzing the query plan for both the cases.

Hash Aggregation:

Run the below query which results in Hash Aggregation. SELECT LineNum, COUNT(LineNum) FROM Pub.OrderLine GROUP BY LineNum ORDER BY LineNum ;

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	6 22016
	7 1216
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| | | , PUB.ORDERLINE.Linenum
|||
| | , count (PEXPR1)
| | | )
11)
| | SORT BY (
/ / , Sort project expression #0 == PEXPR1
1),
| , PEXPR1
| , PEXPR2
1)
, PEXPR1
, PEXPR2
)
```

Now, create an index on LineNum column of table Pub.OrderLine. CREATE INDEX LineNumIdx ON Pub.OrderLine(LineNum);

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Oue	Query 1 of 1, Rows read: 0, Elapsed time (seconds) - Total: 0.054, SQL query: 0.054, Reading results: 0					
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# Now, run the same query again.

SELECT LineNum, COUNT(LineNum) FROM Pub.OrderLine GROUP BY LineNum ORDER BY LineNum ;

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Now, check the number of records read.

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# Now, check the query plan

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| , PEXPR1
/ , count (PEXPR1)
| | GROUP BY (
11)
1)
, PEXPR1
, PEXPR2
)
```

**Observation:** Did you notice the drastic difference in number of records read? In fact, in case of Stream Aggregation, it did not even read a single record. It is because, all the details which were required by query were already present in Index itself.

# Chapter 7 - What happened to my subquery?

In this chapter you will learn how subqueries are transformed into other basic query operations by running below two queries containing subqueries and analyzing query plans generated. Knowing query transformations is important in troubleshooting the performance problems.

### Let us start with simple co-related subquery

SELECT COUNT (\*) FROM Pub.Customer C WHERE EXISTS (SELECT O.CustNum FROM Pub.Order O WHERE C.CustNum = O.CustNum);

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s	SELECT COUNT (*) FROM Pub.Customer C WHERE EXISTS (SELECT O.CustNum FROM Pub.Order O WHERE C.CustNum = O.CustNum) 🔹 1 🗉 🗵 Limit Rows: 🔹 100
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Q	
	SELECT COUNT (*
	Rows 1; SELECT COUNT (*) FROM Pub.Customer C WHERE EXISTS (SELECT O.CustNum FROM Pub.Order O WHERE C.CustNum = O.CustNum) Rows: 1, Cols: 0 🗷 🔍 🗋
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	count(*)
	1117
	/OESQL/OESQLDB/PUB/TABLE/Order 1,44 / 44
A.T.	
	ry 1 of 1, Rows read: 68, Elapsed time (seconds) - Total: 0.01, SQL query: 0.003, Reading results: 0.007 ry 1 of 1, Rows read: 0, Elapsed time (seconds) - Total: 0.049, SQL query: 0.012, Reading results: 0.037
	y Tori, Nows read-1, Elapsed time (seconds) - Total: 0.066, SQL query, 0.004, Reading results 0.062
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SELECT COMMAND. PROJECT [55] ( | PROJECT [54] ( | | PROJECT [53] distinct ( | | | <mark>JOIN</mark> [48][AUG\_NESTED\_LOOP-JOIN] | | | | RESTRICT [10] ( | | | | | | <mark>JOIN</mark> [31][AUG\_NESTED\_LOOP-JOIN] | | | | | | | [RHS-SORTED(-ASC-DUPS) ]( | | | | | | | PROJECT [26] ( | | | | | | | | PUB.O. [3]( | | | | | | | | | INDEX SCAN OF ( | | | | | | | | | CustOrder, - FIRST) 

```
| | | | | | | , PUB.O.CustNum
| | | | | | , PUB.O.rowid
| | | | | | | ,
| | | | | | | -- above defines ANL left side keys <relop> right side keys.
| | | | | | | ,
| | | | | | | PROJECT [30] distinct (
| | | | | | | PROJECT [22] (
| | | | | | | | PUB.C. [23](
| | | | | | | | | INDEX SCAN OF (
| | | | | | | | | CustNum,
| | | | | | | | | | | (PUB.C.CustNum) = (null))
| | | | | | | , PUB.C.CustNum
| | | | | | | , PEXPR1
| | | | | , PEXPR3
| | | | | | GROUP BY (
| | | | | | , PEXPR3
||||||||
| | | | , PEXPR1
| | | | , PEXPR2
| | | | | | \rangle
| | | |
|  |  |  |  (0) < (PEXPR1)
||||
| | | ,
| | | -- above defines ANL left side keys <relop> right side keys.
| | | ,
| | | | PUB.C. [1](
| | | | | | CustNum,
| | | | | | | (PUB.C.CustNum) = (null))
||||||
| | | , PUB.C.rowid
||||
|||
||\rangle
| , count (*)
1)
, PEXPR1
)
```

# Let us look at second subquery transformation

SELECT CustNum, Name, Address FROM Pub.Customer C WHERE NOT EXISTS (SELECT O.CustNum FROM Pub.Order O WHERE C.CustNum = O.CustNum);

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A	Objects SQL						
92	SELECT CustNum, Name, Address FROM Pub.Customer C WHERE NOT EXIST	(S (SELECT O.CustNum FROM Pub.Order O WHERE C.CustNum = O.Cust)	Num) 💌 🕂 🗒 🗹 Limit Rows: 💌 100				
Drivers							
Q	SELECT CustNum, Name, Address FROM Pub.Customer C WHE	RE NOT EXISTS (SELECT O.CustNum FROM Pub.Order O V	VHERE C.CustNum = O.CustNum)				
	A. 7.						
	SELECT CustNum,						
	Rows 3; SELECT CustNum, Name, Address FROM Pub.Custor	mer C WHERE NOT EXISTS (SELECT O.CustNum FROM Pub.C	Order O WHERE C.CustNum = O.CusRows: 1, Cols: 0 🛛 🖈 🔍 🖻 🔟				
	Results MetaData Info Overview / Charts Rotated table Results as text	t]					
	CustNum Name	Address					
	2107 Maruti	Hyderabad, India					
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	2109 Mannura	Deini, india					
A.7	/OESQL/OESQLDB/PUB/TABLE/Customer		2,1/2				
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SELECT COMMAND.				
PROJECT [63] (				
PROJECT [62] distinct (				
<mark>JOIN</mark> [55][AUG_NESTED_LOOP-JOIN]				
[RHS-SORTED(-ASC-DUPS)](				
<mark>  OUTER JOIN</mark> [33][AUG_NESTED_LOOP-JOIN][OJ SQL Gen]				
PUB.C. [25](				
CustNum, - FIRST)				

```
| | | | | | , PUB.C.CustNum
| | | | | | , PEXPR1
| | | | | ,
| | | | | | -- above defines ANL left side keys <relop> right side keys.
| | | | | | ,
| | | | | | PROJECT [28] (
| | | | | | PUB.O. [5](
| | | | | | | | INDEX SCAN OF (
| | | | | | | | CustOrder,
| | | | | | | | | (PUB.O.CustNum) = (null))
| | | | | | , PUB.O.CustNum
| | | | | | , PUB.O.rowid
| | | | | | | \rangle
| | | | , count (PEXPR3)
| | | | , PEXPR1
| | | | | GROUP BY (
| | | | | , PEXPR1
| | | | | | | \rangle
||||||
| | | , PEXPR1
| | | , PEXPR2
||||
| | |
|  |  |  <mark>| (0) = (PEXPR1) [Null-Null EQ]</mark>
|||
11,
| | | -- above defines ANL left side keys <relop> right side keys.
11,
|  |  |  PROJECT [53] (
| | | PUB.C. [3](
| | | | | CustNum,
| | | | | | (PUB.C.CustNum) = (null) [Null-Null EQ])
||||
| | | , PUB.C.CustNum
| | | , PUB.C.Address
| | | , PUB.C.rowid
|||
11)
| , PEXPR3
| , PEXPR4
| , PEXPR5
| , PEXPR6
1)
, PEXPR1
, PEXPR2
, PEXPR3
```

# **Chapter 8 - Importance of Statistics**

In this chapter, you will learn the different types of Statistics available in OE-SQL and their importance in generating good query plans to have better performance. Basically, statistics provides insights on table, index and column data which will be used by OE-SQL optimizer to come up with optimal query plans.

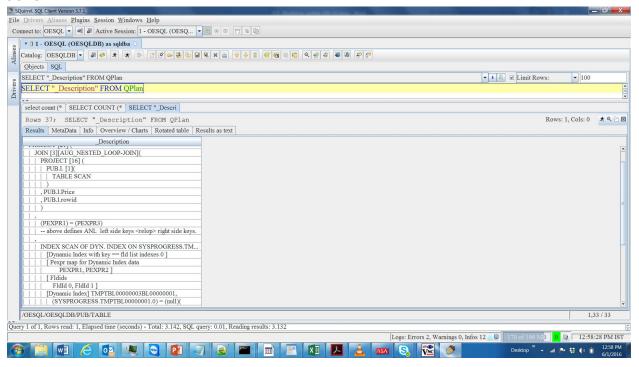
a. **Importance of Table statistics** – To explain the importance of these statistics, you need to run provided join query and check the number of IOs using promon utility. And then, you need to run the table statistics command on tables used by the provided join query and run the same query again to verify the difference between number of IOs took place with former case.

#### Execute the following query and check the time taken for execution.

SELECT COUNT (\*) FROM Pub.Item I, Pub.OrderLine\_Large OL where I.price = OL.ExtendedPrice;

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Drivers	SELECT COUNT (*) FROM Pub.Item I, Pub.OrderLine_Large OL WHERE I.price = OL.ExtendedPrice	<u> </u>
р		
	select count (* SELECT COUNT (*	
	Rows 1, SELECT COUNT (*) FROM Pub.Item I, Pub.OrderLine Large OL where I.price = OL.ExtendedPrice Rows: 1, Cols: 0	* Q 🖂 🗷
	Results MetaData Info Overview / Charts Rotated table Results as text	
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	ry 1 of 1, Rows read: 37, Elapsed time (seconds) - Total: 0.014, SQL query: 0.011, Reading results: 0.003 ry 1 of 1, Rows read: 1, Elapsed time (seconds) - Total: 3.142, SQL query: 0.01, Reading results: 3.132	<u>^</u>
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Now, check the query plan. You can notice that, DIDX is created on the large table and this caused query to run slower.



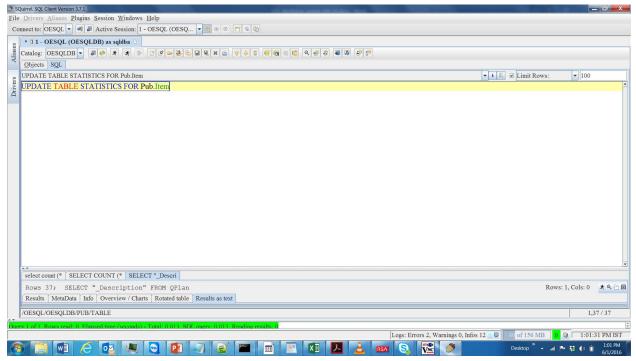
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SELECT COMMAND.					
PROJECT [22] (					
PROJECT [21] (					
JOIN [3][AUG_NESTED_LOOP-JOIN](					
, PUB.I.Price					
, PUB.I.rowid					
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[Dynamic Index with key == fld lis					
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```
| | | | | )
| | | , PUB.OL.ExtendedPrice
| | | | , PUB.OL.rowid
| | | | )
| | | |
| | |
| | |
| | |
| | , count (*)
| )
, PEXPR1
)
```

Now, let us update the table statistics for the 2 tables involved in the join.

#### UPDATE TABLE STATISTICS FOR Pub.Item;



# UPDATE TABLE STATISTICS FOR Pub.OrderLine\_Large;

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Need to Reconnect to the database in order to see the effect of Table Statistics. For this, go to the "Session" tab of Squirrel client and click on "Reconnect".

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Select SQL Ctrl+Shift-S	
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select count (* SELECT Remove Quotes Ctrl+Alt+Shift-Q	
Rows 37; SELECT Convert to StringBuffer	Rows: 1, Cols: 0 ★ 🔍 🖻 🗵
Results MetaData Infc Escape Date	
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# Now, run the same query again and notice the time difference.

SELECT COUNT (\*) FROM Pub.Item I, Pub.OrderLine\_Large OL where I.price = OL.ExtendedPrice;

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Now, check what caused the change in execution time by almost half!! For that, let us check the query plan

### this time for this same query.

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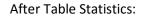
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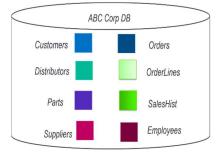
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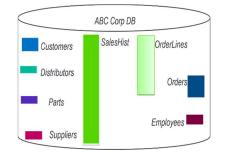
### **Observation:**

We can clearly notice that, having table statistics helped SQL Optimizer to select the join order which is more optimal. That is, SQL optimizer, now identified that creation of Dynamic Index on the Large table amounts to excessive cost, hence, it selected the join order where the Large table is kept on left side and Dynamic Index is created on smaller table.

#### Before Table Statistics:







b. **Importance of Index statistics** - To explain the importance of these statistics, you need to run provided join query and check the number of IOs using promon utility. And then, you need to run the index statistics command on tables used by the provided join query and run the same query again to verify the difference between number of IOs took place with former case.

Now, let us see how index stats effects the performance of a query.

Table Pub.OrderLine\_Large already has following 2 indexes.

- i) LineNum\_Large created on LineNum column
- ii) OrderNum\_Large created on OrderNum colum.

Now, run the below query.

SELECT TOP 1 ItemNum, OrderNum FROM Pub.OrderLine\_Large WHERE LineNum=1 AND OrderNum=10 ORDER BY ItemNum;

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# Now, check the number of Records read

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Now, check the query plan. We can notice that it selected index which is created on LineNum column of Pub.OrderLine\_Large table.

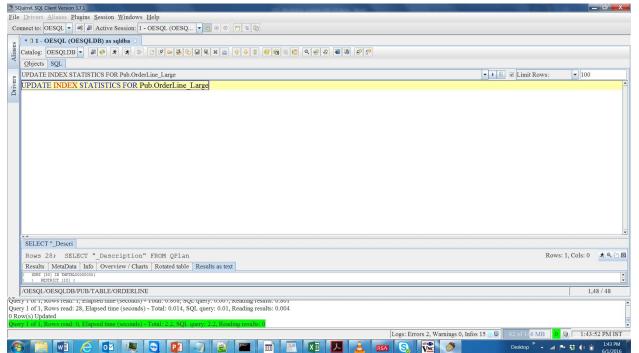
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/ / , Sort project expression #0 == PEXPR1
1),
| , PEXPR1
| , PEXPR2
1)
, PEXPR1
, PEXPR2
)
```

Now, update the Index Statistics for table Pub.OrderLine\_Large.

UPDATE INDEX STATISTICS FOR Pub.OrderLine\_Large;



# Reconnect to Database in order to get the effects of Index Statistics

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		Goto Previous Results Tab	Ctrl+Shift-Comma	
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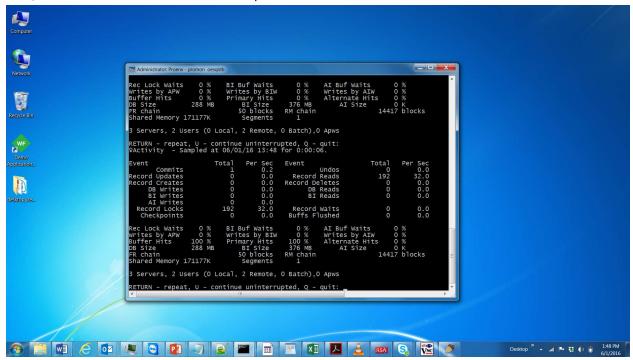
#### Now, run the same query again.

# SELECT TOP 1 ItemNum, OrderNum FROM Pub.OrderLine\_Large WHERE LineNum=1 AND OrderNum=10 ORDER

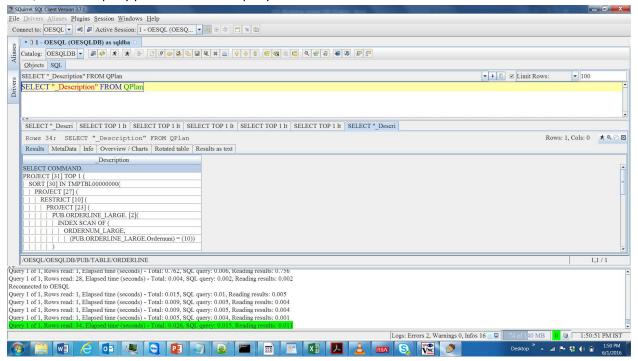
#### BY ItemNum;

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Now, check the number of Records Read in promon Window.



Now, check the query plan for this same query.

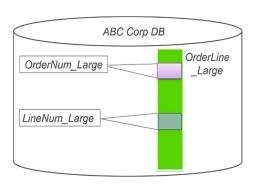


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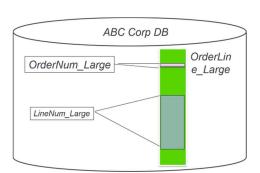
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| , PEXPR1
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, PEXPR1
, PEXPR2
)
```

Observation:

What caused the dramatic improvement in query execution time and number of records read!!! With the help of index statistics SQL Optimizer could differentiate and compare the costs of two different indexes and selected the index on OrderNum (OrderNum\_Large) as it contains more number of unique values and hence filters more rows.



**Before Index Statistics** 



After Index Statistics

c. Importance of Column statistics – There are 2 flavors of column statistics, one which just updates column statistics for columns which has index on them and the other one, which collects column statistics for all the columns of the table. We will use the flavor which collects statistics for all the columns to explain the importance of these statistics. You need to run provided join query and check the number of IOs using promon utility. And then, you need to run the column statistics command on tables used by the provided join query and run the same query again to verify the difference between number of IOs took place with former case.

First, let us check if the Table Statistics exists for the tables which we will be using in our example query to demonstrate the importance of column statistics. If you think, table and index statistics are enough, then you may need to re-think about this perspective after this illustration.

Below query checks if the table statistics are present for tables, Pub.Order\_Medium, Pub.OrderLine\_Medium and Pub.POLine\_Medium.

SELECT \* FROM Pub."\_SysTblStat" WHERE "\_TblId" IN (SELECT "\_File-Number" FROM Pub."\_File" WHERE"\_File-Name" LIKE '%medium%');

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We can notice that each table has same number of rows (19716).

Now, let us run the below query to see the effect of column statistics.

SELECT COUNT (\*) FROM Pub.OrderLine\_Medium OL, Pub.POLine\_Medium PO, Pub.Order\_Medium O WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum < 4 AND PO.Qty > 1;

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Aliases	
A	Objects SQL
50	SELECT COUNT (*) FROM Pub.OrderLine_Medium OL, Pub.POLine Medium PO, Pub.Order_Medium O WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.Order 💌 4 🖪 🗷 Limit Rows: 💌 100
Drivers	SELECT COUNT (*) FROM Pub.OrderLine Medium OL, Pub.POLine Medium PO, Pub.Order Medium O
Ð	WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum < 4 AND PO.Qty > 1;
	SELECT COUNT (* SELECT COUNT (*
	Rows 1; SELECT COUNT (*) FROM Pub.OrderLine Medium OL, Pub.POLine Medium FO, Pub.Order Medium O WHERE OL.ItemNum=FO.ItemNum AND O.OrRows: 1, Cols: 0 🖈 🔍 🗇
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	count(*)
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	/OESQL/OESQL/DB/PUB/TABLE/POLine 1.21/21
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```
Now, check the query plan.
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\_Description

-----SELECT COMMAND. PROJECT [53] ( | PROJECT [52] ( | | JOIN [5][AUG\_NESTED\_LOOP-JOIN]( | | | JOIN [3][AUG\_NESTED\_LOOP-JOIN]( | | | | PROJECT [42] ( | | | | | | TABLE SCAN  $| | | | | | | \rangle$ | | | | , PUB.OL.Itemnum | | | | , PUB.OL.Ordernum | | | | , PUB.OL.rowid  $| | | | | \rangle$ | | | || | | | (PEXPR3) < (4) | | | | Evaluation callback list( | | | | | | colid# 3  $| | | | | \rangle$ ||||| | | ,

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| | | | | PROJECT [46] (
| | | | | | | <mark>PUB.PO.</mark> [2](
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| | | | | , PUB.PO.Qty
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| | | | ) | | | | | ) | , count (\*) | ) , PEXPR1

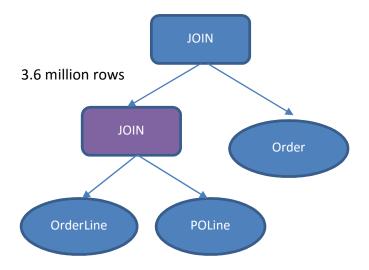
#### **Reason for Slower execution:**

If we analyze, the intermediate join (between Pub.OrderLine\_Medium and Pub.POLine\_Medium) produced around 3.6 million rows!!!

SELECT COUNT(\*) FROM Pub.OrderLine\_Medium OL, Pub.POLine\_Medium PO

WHERE OL.ItemNum=PO.ItemNum AND OL.LineNum<4 AND PO.Qty>1;

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Aliases	
A	Objects SQL
10	SELECT COUNT (*) FROM Pub.OrderLine Medium OL, Pub.POLine Medium PO WHERE OL. ItemNum=PO.ItemNum AND OL.LineNum < 4 AND PO.Qty > 1
Drivers	SELECT COUNT (*) FROM Pub.OrderLine Medium OL, Pub.POLine Medium PO
Dr	WHERE OL.ItemNum=PO.ItemNum AND OL.LineNum < 4 AND PO.Qty > 1;
	SELECT COUNT (*
	Rows 1; SELECT COUNT (*) FROM Pub.OrderLine_Medium OL, Pub.POLine_Medium PO WHERE OL.ItemNum=PO.ItemNum AND OL.LineNum < 4 AND PO.QtRows: 1, Cols: 0
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	ery 1 of 1, Rows read: 85, Elapsed time (seconds) - Total: 0.019, SQL query: 0.01, Reading results: 0.009 ery 1 of 1, Rows read: 1, Elapsed time (seconds) - Total: 1.241, SQL query: 0.023, Reading results: 1.218
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Now, run the column statistics for the 3 tables involved in the query. UPDATE ALL COLUMN STATISTICS FOR Pub.Order\_Medium; UPDATE ALL COLUMN STATISTICS FOR Pub.OrderLine\_Medium; UPDATE ALL COLUMN STATISTICS FOR Pub.POLine\_Medium;

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### You need to Reconnect to see the effect of Column Statistics.

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### Now, run the same query again.

SELECT COUNT (\*) FROM Pub.OrderLine\_Medium OL, Pub.POLine\_Medium PO, Pub.Order\_Medium O WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum < 4 AND PO.Qty > 1;

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👷 SELECT COUNT (*) FROM Pub.OrderLine_Medium OL, Pub.POLine_Medium PO, Pub.Order_Medium O WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.Order • 1 📃 🖄 Limit Rows: • 100
SELECT COOK () PROM PubOrderLine_Medium OL, Pub Poline_Medium PO, PubOrder_Medium O
WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum < 4 AND PO.Qty > 1;
SELECT COUNT (*
Rows 1; SELECT COUNT (*) FROM Pub.OrderLine_Medium OL, Pub.POLine_Medium PO, Pub.Order_Medium O WHERE OL.ItemNum=PO.ItemNum AND O.OrdKows: 1, Cols: 0 🛪 🔍 🗋
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Query 3 of 3, Rows read: 0, Elapsed time (seconds) - Total: 0.147, SQL query: 0.147, Reading results: 0 Reconnected to OESOL
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# Now, check the query plan.

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JOIN [65][AUG_NESTED_LOOP-JOIN](							
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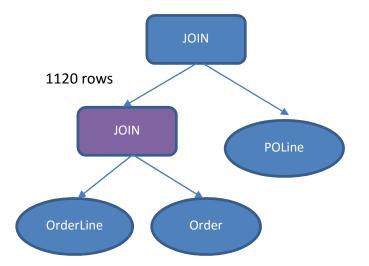
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### Reason for faster execution:

We can notice that, due to column statistics in place intermediate join is now between Pub.Order\_Medium and pub.OrderLine\_Medium which produces 1120 rows and that is why it is much faster.

# SELECT COUNT(\*) FROM Pub.OrderLine\_Medium OL, Pub.Order\_Medium O WHERE O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum<4;

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	SELECT COUNT (*) FROM Pub.OrderLine_Medium OL, Pub.Order_Medium O WHERE_O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL LineNum < 4
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**Observation:** Having column statistics helped SQL Optimizer to come up with more optimal join order which made the overall query execution much faster. For instance, with the help of column statistics in place, SQL Optimizer could identify that, filter on OrderNum of table Pub.Order can filter more number of rows, because it has more number of unique values and selected this table as part of the intermediate join.

## Chapter 9 – What goes into Statistics?

In this chapter you will learn what is inside the statistics and how this information helps SQL Optimizer to come up with optimal query plans.

**First let us see about Table Statistics.** The System Table involved in this is, Pub."\_SysTblStat". Let us see what goes into this table when we update the Table statistics. Go to Squirrel window, and check for this table structure.

Click on "Objects" Tab (just beside the SQL Tab).

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Look for Pub."\_SysTblStat" and click on it. Notice the columns of this table.

Columns we are interested in are "\_Tblld" & "\_Value". Column "\_Tblld" denotes the Table Identifier for which Table Statistics are collected and column "\_Value" denotes the number of rows the table contains.

Now, go back to "SQL" Tab and run the below query to see table statistics information of table Pub.Order\_Medium. The number 19716 denotes the table cardinality and other value denotes the timestamp when table statistics ran last time.

SELECT \* FROM Pub."\_SysTblStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Order\_Medium');

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**Now, let us see what goes into Index Statistics.** The System Table which is used in this is, Pub."\_SysIdxStat". Check what goes into this system table when we update Index Statistics.

First, see that the index statistics are not present for table Pub.Customer

# SELECT \* FROM Pub."\_SysIdxStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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#### Now, let us run the index statistics for this table, Pub.Order.

UPDATE INDEX STATISTICS FOR Pub.Customer;

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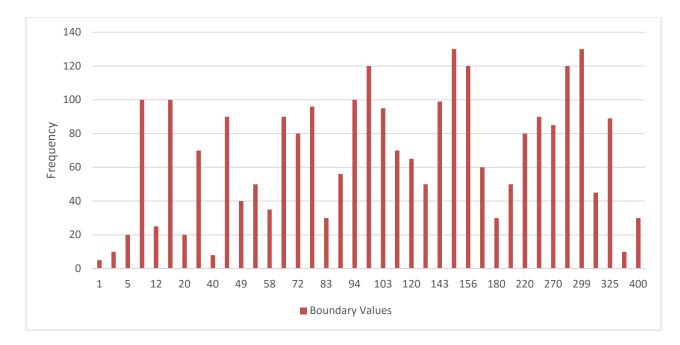
Now, run the same query again to see what went into Index Statistics System Table, Pub."\_SysIdxStat".

SELECT \* FROM Pub."\_SysIdxStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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We can notice that, there are 3 indexes, each containing 5 or more than 5 properties. Property value "5" denotes number of unique values, property "6" denotes the number of levels in index, property "7" denotes the number of blocks this index occupied, property "8" denotes size of the index in bytes and property "11" denotes the max dup (highest number of duplicate values that SQL found).

**Now, let us check what goes into Column Statistics.** The system table involved in this is, Pub."\_SysColStat" and various system tables specific to data type of column, such as Pub."\_SysIntStat" or Pub."\_SysNumStat". These System tables basically represents Histogram which stores information about column data. Table, Pub."\_SysColStat" stores the number of unique values in each bucket (there will be total 40 buckets as of OpenEdge 11.6) and systable pub."\_Sys



Sample histogram might look like below

Bucket	1	2	3	4	5	6	7	 39	40
Number									
Unique	1	3	5	8	12	15	20	 380	400
count									
Boundary	5	10	20	100	25	100	20	 10	30
value									

First, check that the column statistics are not present for table Pub.Customer.

SELECT \* FROM Pub."\_SysColStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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## And check the table Pub."\_SysIntStat" for integer columns of Pub.Customer table.

SELECT \* FROM Pub."\_SysIntStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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Now, update the column statistics for table Pub.Customer.

### UPDATE ALL COLUMN STATISTICS FOR Pub.Customer;

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Now, run the same query to check what went into Pub."\_SysColStat" and Pub."\_SysIntStat" tables.

SELECT \* FROM Pub."\_SysColStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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# SELECT \* FROM Pub."\_SysIntStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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# SELECT \* FROM Pub."\_SysnVarCharStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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SELECT \* FROM Pub."\_SysnumStat" WHERE "\_Tblid" = (SELECT "\_File-Number" FROM Pub."\_File" WHERE "\_File-Name" = 'Customer');

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Here, "\_Attribute' represents the bucket number of histogram and "\_Value" represents the boundary value of that bucket.

### Chapter 10 - SQL hints

In this chapter you will learn different hints which are supported by OE-SQL and their importance in troubleshooting the performance problems.

a. NoExecute – Useful in cases, where you just want to check the query plan and do not want to execute the actual query. For example, you know some queries are running very slow and you want to know what is the plan used by such queries quickly. Below example will show the usage of "NoExecute".

SELECT COUNT (\*) FROM Pub.POLine PO, Pub.OrderLine\_Large OL where PO.ItemNum = OL.ItemNum AND PO.LineNum=OL.LineNum NOEXECUTE;

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## Now, you can check the query plan.

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b. No reorder – Useful when you suspect that the join order used by SQL optimizer is not efficient and want to validate the query plan/execution time by forcing SQL optimizer to choose specified join order. Below example will show the usage of "No reorder".

Let us use the same query as the one we used to illustrate the effect of column statistics

SELECT COUNT (\*) FROM Pub.OrderLine\_Medium OL, Pub.POLine\_Medium PO, Pub.Order\_Medium O {NO REORDER}

WHERE OL.ItemNum=PO.ItemNum AND O.OrderNum=OL.OrderNum AND O.CustNum < 2 AND OL.LineNum < 4 AND PO.Qty > 1;

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Now, if you check the query plan, it uses the given join order instead of re-ordering to create the best possible plan.

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c. Index hints – Useful when you suspect that the index selected by SQL optimizer is less optimal than the index which you expect would perform better. You can specify the index which should be used by SQL optimizer using "Force Index Hints". Below example will show the usage of "Force index hint".

SELECT COUNT (\*) FROM Pub.OrderLine\_Large WHERE LineNum=3 AND OrderNum=10;

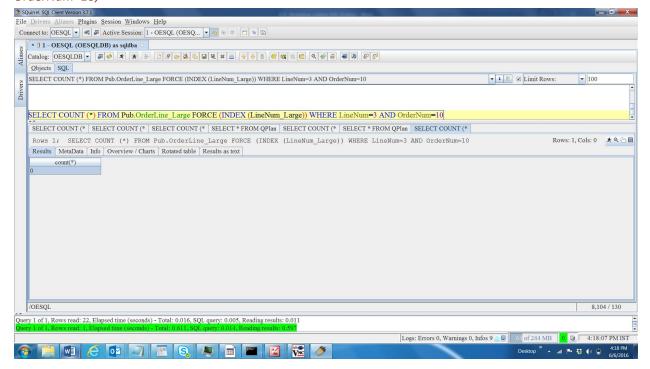
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Now, check the query plan. It selected index, OrderNum\_Large.

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#### Now, run the same query with force index hints.

SELECT COUNT (\*) FROM Pub.OrderLine\_Large FORCE (INDEX (LineNum\_Large)) WHERE LineNum=3 AND OrderNum=10;



### Now, check the query plan.

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47 · · · ·	8,1/2/
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## Chapter 11 – Puzzles

In this chapter you will be given two queries having performance problems which performs bad. You are supposed to solve these two performance problems by understanding the reason for bad performance and tuning your database, such that these queries performs better. Note that, obvious way of executing all type of statistics on all the involved tables is not allowed here (This will help us to understand the reason behind the slowness of the query).

#### Important Note:

Below queries might take more than couple of minutes to complete the execution, so make sure to execute the QUERY\_TIMEOUT command, so that query aborts after 60 seconds.

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#### SET PRO\_CONNECT QUERY\_TIMEOUT 60

Query 1: Below query performs very bad, how do you tune your database to make sure that, it performs better?

select top 30 po.price, po.qty, po.itemnum, po.linenum from pub.poline\_large po, pub.orderline\_large ol where po.linenum=ol.linenum and po.itemnum = ol.itemnum order by po.price, po.qty;

Query 2: Below query performs very bad, how do you tune your database to make sure that, it performs better?

select count (\*) from pub.order\_10k O, pub.orderline\_10k ol, pub.customer\_10k c where ol.country=c.country and o.custnum=c.custnum and o.ordernum < 2;