

Reading Execution Plans: The Deep Dive

for PASS Performance Virtual Chapter 4/26/12

Grant Fritchey

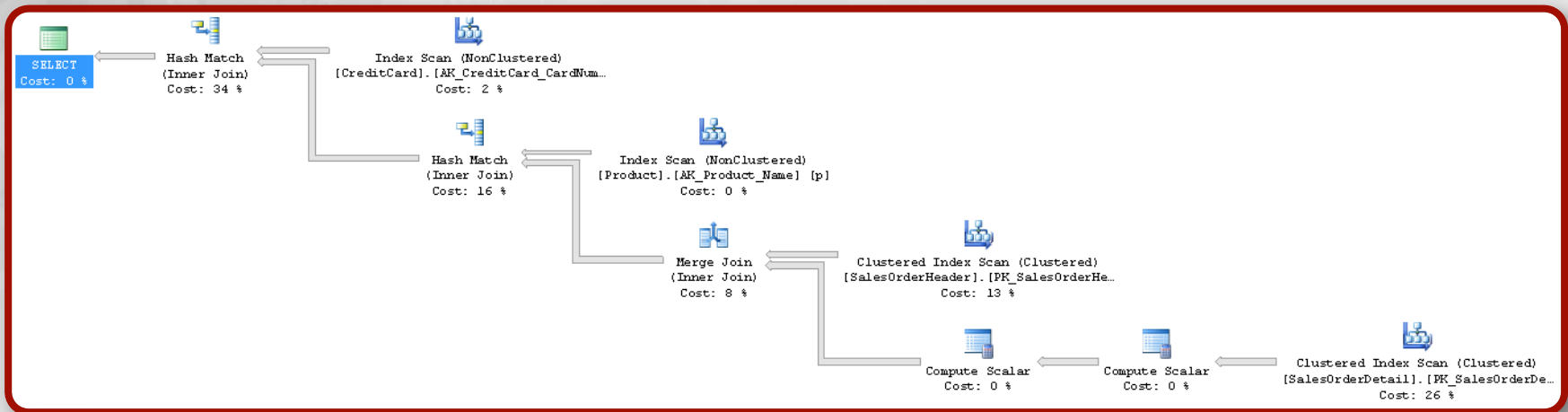
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A Query

```
SELECT soh.PurchaseOrderNumber,  
       soh.AccountNumber,  
       p.Name,  
       sod.OrderQty,  
       sod.LineTotal,  
       cc.CardNumber  
FROM   Sales.SalesOrderHeader AS soh  
       JOIN Sales.SalesOrderDetail AS sod  
         ON soh.SalesOrderID = sod.SalesOrderID  
       JOIN Production.Product AS p  
         ON sod.ProductID = p.ProductID  
       JOIN Sales.CreditCard AS cc  
         ON soh.CreditCardID = cc.CreditCardID
```

A plan



The Select Operator



SELECT

Cached plan size	80 B
Degree of Parallelism	1
Memory Grant	11304
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	4.10186
Estimated Number of Rows	94085.1

Statement

```
SELECT soh.PurchaseOrderNumber,
       soh.AccountNumber,
       p.Name,
       sod.OrderQty,
       sod.LineTotal,
       cc.CardNumber
FROM   Sales.SalesOrderHeader AS soh
       JOIN Sales.SalesOrderDetail AS sod
         ON soh.SalesOrderID =
            sod.SalesOrderID
       JOIN Production.Product AS p
         ON sod.ProductID = p.ProductID
       JOIN Sales.CreditCard AS cc
         ON soh.CreditCardID =
            cc.CreditCardID
```

Misc

Cached plan size	80 B
CompileCPU	31
CompileMemory	1344
CompileTime	31
Degree of Parallelism	1
Estimated Number of Rows	94085.1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	4.10186
Logical Operation	
Memory Grant	11304
Optimization Level	FULL
Physical Operation	
QueryHash	0x16EBDB430623D281
QueryPlanHash	0x5C4E2C781FF6D3B2
Set Options	ANSI_NULLS: True, ANSI_PADDING
ANSI_NULLS	True
ANSI_PADDING	True
ANSI_WARNINGS	True
ARITHABORT	True
CONCAT_NULL_YIELDS_NULL	True
NUMERIC_ROUNDABORT	False
QUOTED_IDENTIFIER	True
Statement	SELECT soh.PurchaseOrderNumber

Clustered Index Scan

Clustered

Clustered Index Scan (Clustered)

Scanning a clustered index, entirely or only a range.

Physical Operation	Clustered Index Scan
Logical Operation	Clustered Index Scan
Actual Number of Rows	121317
Estimated I/O Cost	0.915718
Estimated CPU Cost	0.133606
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	1.04932 (26%)
Estimated Subtree Cost	1.04932
Estimated Number of Rows	121317
Estimated Row Size	33 B
Actual Rebinds	0
Actual Rewinds	0
Ordered	True
Node ID	8

Object

[AdventureWorks2008R2].[Sales].[SalesOrderDetail].
[PK_SalesOrderDetail_SalesOrderID_SalesOrderDetailID]
[sod]

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].SalesOrderID, [AdventureWorks2008R2].
[Sales].[SalesOrderDetail].OrderQty,
[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].ProductID, [AdventureWorks2008R2].
[Sales].[SalesOrderDetail].UnitPrice,
[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].UnitPriceDiscount

Misc

Actual Number of Rows	31465
Actual Rebinds	0
Actual Rewinds	0
Defined Values	[AdventureWorks2008R2].[Sales].[SalesC
Description	Scanning a clustered index, entirely or o
Estimated CPU Cost	0.0347685
Estimated I/O Cost	0.507569
Estimated Number of Executions	1
Estimated Number of Rows	31465
Estimated Operator Cost	0.542338 (13%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	61 B
Estimated Subtree Cost	0.542338
Forced Index	False
ForceSeek	False
Logical Operation	Clustered Index Scan
Node ID	5
NoExpandHint	False
Number of Executions	1
Object	[AdventureWorks2008R2].[Sales].[SalesC
Ordered	True
Output List	[AdventureWorks2008R2].[Sales].[SalesC
Parallel	False
Physical Operation	Clustered Index Scan
Scan Direction	FORWARD
TableCardinality	31465

Merge Join



Merge Join
(Inner Join)

Merge Join

Match rows from two suitably sorted input tables exploiting their sort order.

Physical Operation	Merge Join
Logical Operation	Inner Join
Actual Number of Rows	121317
Estimated I/O Cost	0
Estimated CPU Cost	0.338556
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	0.338552 (8%)
Estimated Subtree Cost	1.95448
Estimated Number of Rows	121138
Estimated Row Size	80 B
Actual Rebinds	0
Actual Rewinds	0
Many to Many	False
Node ID	4

Where (join columns)

([AdventureWorks2008R2].[Sales].
[SalesOrderDetail].[SalesOrderID] =
([AdventureWorks2008R2].[Sales].
[SalesOrderHeader].[SalesOrderID])

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].[PurchaseOrderNumber],
[AdventureWorks2008R2].[Sales].

Misc	
Actual Number of Rows	121317
Actual Rebinds	0
Actual Rewinds	0
Description	Match rows from two suitably
Estimated CPU Cost	0.338556
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	121138
Estimated Operator Cost	0.338552 (8%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	80 B
Estimated Subtree Cost	1.95448
Logical Operation	Inner Join
Many to Many	False
Node ID	4
Number of Executions	1
Output List	[AdventureWorks2008R2].[Sale
Parallel	False
Physical Operation	Merge Join
Residual	[AdventureWorks2008R2].[Sale
Where (join columns)	([AdventureWorks2008R2].[Sale

Hash Join



Hash Match
(Inner Join)

Hash Match

Use each row from the top input to build a hash table, and each row from the bottom input to probe into the hash table, outputting all matching rows.

Physical Operation	Hash Match
Logical Operation	Inner Join
Actual Number of Rows	121317
Estimated I/O Cost	0
Estimated CPU Cost	0.664093
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	0.6641021 (16%)
Estimated Subtree Cost	2.6239
Estimated Number of Rows	97783.6
Estimated Row Size	128 B
Actual Rebinds	0
Actual Rewinds	0
Node ID	2

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].PurchaseOrderNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].AccountNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].CreditCardID,
[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].OrderQty, [sod].LineTotal,
[AdventureWorks2008R2].[Production].[Product].Name

Hash Keys Probe

[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].ProductID

Misc

Actual Number of Rows	121317
Actual Rebinds	0
Actual Rewinds	0
Defined Values	
Description	Use each row from the top input to build a hash table, and each row from the bottom input to probe into the hash table, outputting all matching rows.
Estimated CPU Cost	0.664093
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	97783.6
Estimated Operator Cost	0.6640999 (16%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	128 B
Estimated Subtree Cost	2.62612
Hash Keys Build	[AdventureWorks2008R2].[Production].[Product].Name
Hash Keys Probe	[AdventureWorks2008R2].[Sales].[SalesOrderDetail].ProductID
Logical Operation	Inner Join
Memory Fractions	Memory Fractions Input: 0, Memory Fractions Output: 0
Node ID	2
Number of Executions	1
Output List	[AdventureWorks2008R2].[Sales].[SalesOrderHeader].PurchaseOrderNumber, [AdventureWorks2008R2].[Sales].[SalesOrderHeader].AccountNumber, [AdventureWorks2008R2].[Sales].[SalesOrderHeader].CreditCardID, [AdventureWorks2008R2].[Sales].[SalesOrderDetail].OrderQty, [sod].LineTotal, [AdventureWorks2008R2].[Production].[Product].Name
Parallel	False
Physical Operation	Hash Match

The Pipe



Actual Number of Rows	118744
Estimated Number of Rows	94085.1
Estimated Row Size	151 B
Estimated Data Size	14 MB

Compute Scalar



Compute Scalar
Cost: 0 %

Compute Scalar

Compute new values from existing values in a row.

Physical Operation	Compute Scalar
Logical Operation	Compute Scalar
Estimated I/O Cost	0
Estimated CPU Cost	0.0121317
Estimated Number of Executions	1
Estimated Operator Cost	0.01214 (0%)
Estimated Subtree Cost	1.07359
Estimated Number of Rows	121317
Estimated Row Size	34 B
Node ID	6

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].SalesOrderID,
[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].OrderQty,
[AdventureWorks2008R2].[Sales].
[SalesOrderDetail].ProductID, [sod].LineTotal

Misc

Defined Values	[[AdventureWorks2008R2].[Sales].[SalesOr
Description	Compute new values from existing values
Estimated CPU Cost	0.0121317
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	121317
Estimated Operator Cost	0.01213 (0%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	34 B
Estimated Subtree Cost	1.06145
Logical Operation	Compute Scalar
Node ID	7
Output List	[AdventureWorks2008R2].[Sales].[SalesOr
Parallel	False
Physical Operation	Compute Scalar

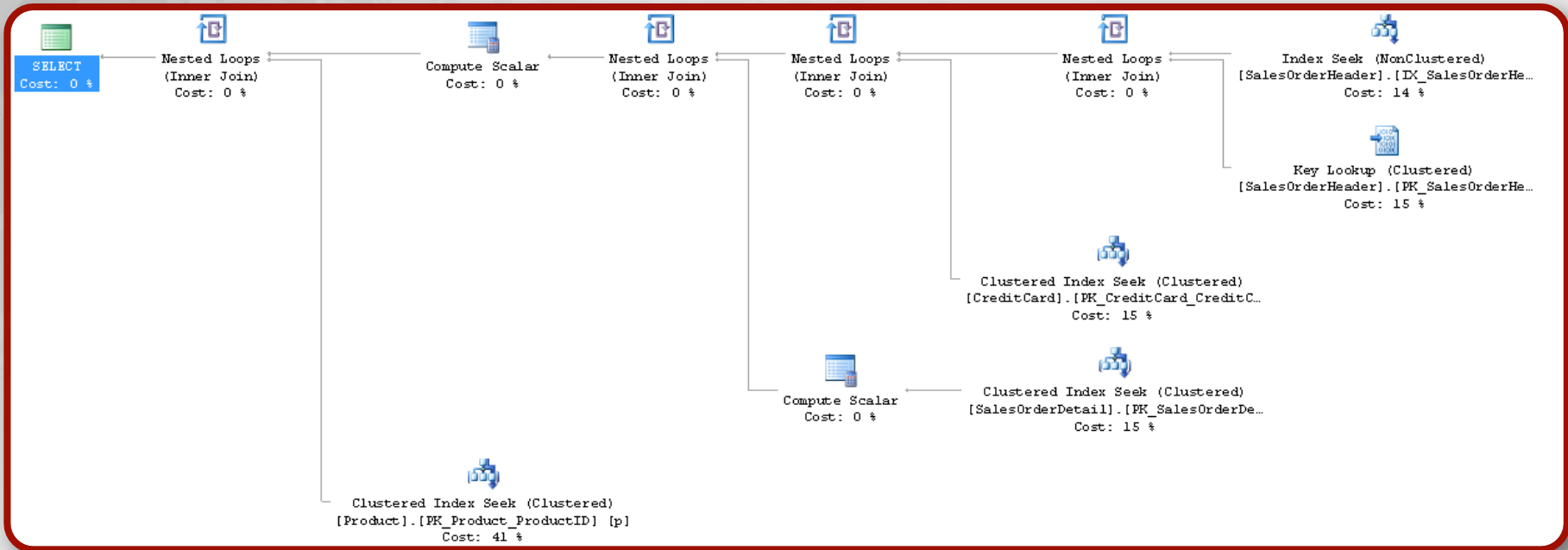
An Entirely New Query

```
SELECT soh.PurchaseOrderNumber,  
       soh.AccountNumber,  
       p.Name,  
       sod.OrderQty,  
       sod.LineTotal,  
       cc.CardNumber  
FROM   Sales.SalesOrderHeader AS soh  
       JOIN Sales.SalesOrderDetail AS sod  
         ON soh.SalesOrderID = sod.SalesOrderID  
       JOIN Production.Product AS p  
         ON sod.ProductID = p.ProductID  
       JOIN Sales.CreditCard AS cc  
         ON soh.CreditCardID = cc.CreditCardID  
WHERE  soh.CustomerID = 24624
```

An Entirely New Query

```
SELECT soh.PurchaseOrderNumber,  
       soh.AccountNumber,  
       p.Name,  
       sod.OrderQty,  
       sod.LineTotal,  
       cc.CardNumber  
FROM   Sales.SalesOrderHeader AS soh  
       JOIN Sales.SalesOrderDetail AS sod  
         ON soh.SalesOrderID = sod.SalesOrderID  
       JOIN Production.Product AS p  
         ON sod.ProductID = p.ProductID  
       JOIN Sales.CreditCard AS cc  
         ON soh.CreditCardID = cc.CreditCardID  
WHERE  soh.CustomerID = 24624
```

A New Plan



The Select Operator 2



SELECT	
Cached plan size	48 B
Degree of Parallelism	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.0229918
Estimated Number of Rows	4.26098

Statement

```
SELECT soh.PurchaseOrderNumber,
       soh.AccountNumber,
       p.Name,
       sod.OrderQty,
       sod.LineTotal,
       cc.CardNumber
FROM   Sales.SalesOrderHeader AS soh
       JOIN Sales.SalesOrderDetail AS sod
         ON soh.SalesOrderID =
            sod.SalesOrderID
       JOIN Production.Product AS p
         ON sod.ProductID = p.ProductID
       JOIN Sales.CreditCard AS cc
         ON soh.CreditCardID =
            cc.CreditCardID
WHERE  soh.CustomerID = 24624
```

Misc	
Cached plan size	48 B
CompileCPU	8
CompileMemory	784
CompileTime	8
Degree of Parallelism	1
Estimated Number of Rows	6.11728
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.0293188
Logical Operation	
Optimization Level	FULL
Parameter List	
Column	@CustomerID
Parameter Runtime Value	(24624)
Physical Operation	
QueryHash	0x8E396FDF66EFB92D
QueryPlanHash	0xB59D62C89889557C
Reason For Early Termination Of State	Good Enough Plan Found
Set Options	
Statement	SELECT soh.PurchaseOrderN

Index Seek



Index Seek (NonClustered)

Index Seek (NonClustered)

Scan a particular range of rows from a nonclustered index.

Physical Operation	Index Seek
Logical Operation	Index Seek
Actual Number of Rows	1
Estimated I/O Cost	0.003125
Estimated CPU Cost	0.0001583
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	0.0032833 (14%)
Estimated Subtree Cost	0.0032833
Estimated Number of Rows	1.14634
Estimated Row Size	11 B
Actual Rebinds	0
Actual Rewinds	0
Ordered	True
Node ID	5

Object

[AdventureWorks2008R2].[Sales].[SalesOrderHeader].
[IX_SalesOrderHeader_CustomerID] [soh]

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].SalesOrderID

Seek Predicates

Seek Keys[1]: Prefix: [AdventureWorks2008R2].[Sales].
[SalesOrderHeader].CustomerID = Scalar Operator
((24624))

Misc

Actual Number of Rows	1
Actual Rebinds	0
Actual Rewinds	0
Defined Values	[AdventureWorks2008R2].[Sales].(S
Description	Scan a particular range of rows from
Estimated CPU Cost	0.0001583
Estimated I/O Cost	0.003125
Estimated Number of Executions	1
Estimated Number of Rows	1.14634
Estimated Operator Cost	0.0032833 (14%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	11 B
Estimated Subtree Cost	0.0032833
Forced Index	False
ForceSeek	False
Logical Operation	Index Seek
Node ID	5
NoExpandHint	False
Number of Executions	1
Object	[AdventureWorks2008R2].[Sales].(S
Ordered	True
Output List	[AdventureWorks2008R2].[Sales].(S
Parallel	False
Physical Operation	Index Seek
Scan Direction	FORWARD
Seek Predicates	Seek Keys[1]: Prefix: [AdventureWo
TableCardinality	31465

Nested Loop Join



Nested Loops
(Inner Join)

Nested Loops

For each row in the top (outer) input, scan the bottom (inner) input, and output matching rows.

Physical Operation	Nested Loops
Logical Operation	Inner Join
Actual Number of Rows	1
Estimated I/O Cost	0
Estimated CPU Cost	0.0000069
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	0.0000069 (0%)
Estimated Subtree Cost	0.0075901
Estimated Number of Rows	1.64575
Estimated Row Size	61 B
Actual Rebinds	0
Actual Rewinds	0
Node ID	4

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].SalesOrderID,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].PurchaseOrderNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].AccountNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].CreditCardID

Outer References

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].SalesOrderID

Misc

Actual Number of Rows	3
Actual Rebinds	0
Actual Rewinds	0
Description	For each row in the top (outer) input
Estimated CPU Cost	0.0000178
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	4.26098
Estimated Operator Cost	0.0000177 (0%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	151 B
Estimated Subtree Cost	0.0230891
Logical Operation	Inner Join
Node ID	0
Number of Executions	1
Optimized	False
Outer References	[AdventureWorks2008R2].[Sales].(S
Output List	[AdventureWorks2008R2].[Sales].(S
Parallel	False
Physical Operation	Nested Loops

Key Lookup



Key Lookup (Clustered)

Key Lookup (Clustered)

Uses a supplied clustering key to lookup on a table that has a clustered index.

Physical Operation	Key Lookup
Logical Operation	Key Lookup
Actual Number of Rows	1
Estimated I/O Cost	0.003125
Estimated CPU Cost	0.0001581
Number of Executions	1
Estimated Number of Executions	1.146341
Estimated Operator Cost	0.0034251 (15%)
Estimated Subtree Cost	0.0034251
Estimated Number of Rows	1
Estimated Row Size	57 B
Actual Rebinds	0
Actual Rewinds	0
Ordered	True
Node ID	7

Object

[AdventureWorks2008R2].[Sales].[SalesOrderHeader].
[PK_SalesOrderHeader_SalesOrderID] [soh]

Output List

[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].PurchaseOrderNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].AccountNumber,
[AdventureWorks2008R2].[Sales].
[SalesOrderHeader].CreditCardID

Seek Predicates

Seek Keys[1]: Prefix: [AdventureWorks2008R2].[Sales].
[SalesOrderHeader].SalesOrderID = Scalar Operator

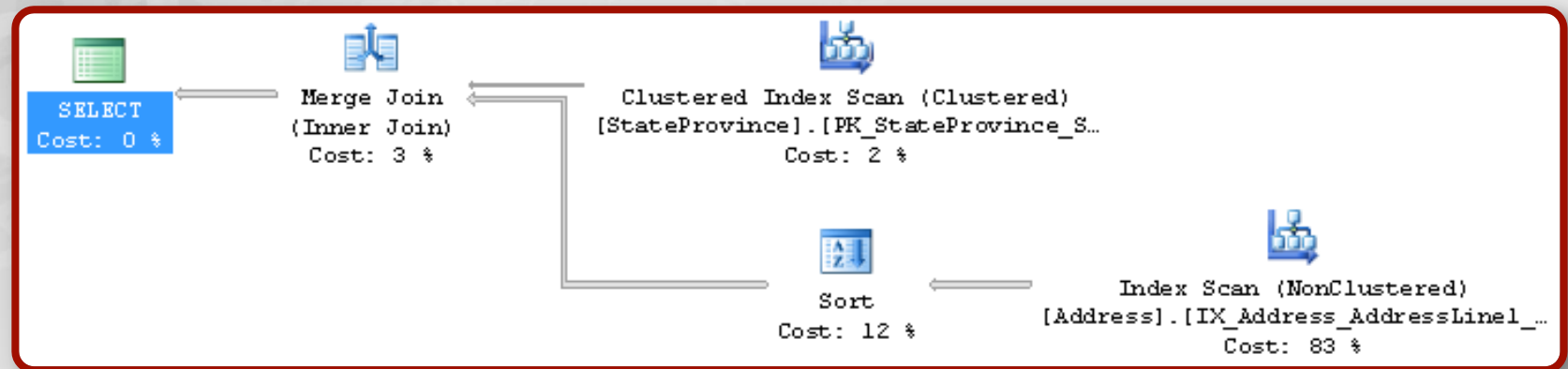
Misc

Actual Number of Rows	1
Actual Rebinds	0
Actual Rewinds	0
Defined Values	[AdventureWorks2008R2].[Sales]
Description	Uses a supplied clustering key to
Estimated CPU Cost	0.0001581
Estimated I/O Cost	0.003125
Estimated Number of Executions	1.146341
Estimated Number of Rows	1
Estimated Operator Cost	0.0034251 (15%)
Estimated Rebinds	0.146341
Estimated Rewinds	0
Estimated Row Size	57 B
Estimated Subtree Cost	0.0034251
Forced Index	False
ForceSeek	False
Logical Operation	Key Lookup
Lookup	True
Node ID	7
NoExpandHint	False
Number of Executions	1
Object	[AdventureWorks2008R2].[Sales]
Ordered	True
Output List	[AdventureWorks2008R2].[Sales]
Parallel	False
Physical Operation	Key Lookup
Scan Direction	FORWARD
Seek Predicates	Seek Keys[1]: Prefix: [AdventureV
TableCardinality	31465

Stored Procedure

```
IF (SELECT OBJECT_ID('spAddressByCity')
    ) IS NOT NULL
    DROP PROCEDURE dbo.spAddressByCity ;
GO
CREATE PROC dbo.spAddressByCity @City NVARCHAR(30)
AS
    SELECT a.AddressID,
           a.AddressLine1,
           a.AddressLine2,
           a.City,
           sp.[Name] AS StateProvinceName,
           a.PostalCode
    FROM   Person.Address AS a
           JOIN Person.StateProvince AS sp
           ON a.StateProvinceID = sp.StateProvinceID
    WHERE  a.City = @City ;
```

The Plan



Sort



Sort

Sort

Sort the input.

Physical Operation	Sort
Logical Operation	Sort
Actual Number of Rows	434
Estimated I/O Cost	0.0112613
Estimated CPU Cost	0.0060321
Number of Executions	1
Estimated Number of Executions	1
Estimated Operator Cost	0.026708 (12%)
Estimated Subtree Cost	0.207121
Estimated Number of Rows	434
Estimated Row Size	177 B
Actual Rebinds	1
Actual Rewinds	0
Node ID	2

Output List

[AdventureWorks2008R2].[Person].
 [Address].AddressID, [AdventureWorks2008R2].
 [Person].[Address].AddressLine1,
 [AdventureWorks2008R2].[Person].
 [Address].AddressLine2, [AdventureWorks2008R2].
 [Person].[Address].City, [AdventureWorks2008R2].
 [Person].[Address].StateProvinceID,
 [AdventureWorks2008R2].[Person].
 [Address].PostalCode

Order By

[AdventureWorks2008R2].[Person].
 [Address].StateProvinceID Ascending

Misc

Actual Number of Rows	434
Actual Rebinds	1
Actual Rewinds	0
Description	Sort the input.
Distinct	False
Estimated CPU Cost	0.0060321
Estimated I/O Cost	0.0112613
Estimated Number of Executions	1
Estimated Number of Rows	434
Estimated Operator Cost	0.026708 (12%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	177 B
Estimated Subtree Cost	0.207121
Logical Operation	Sort
Memory Fractions	Memory Fractions Input: 1, Memory
Node ID	2
Number of Executions	1
Order By	[AdventureWorks2008R2].[Person].
Output List	[AdventureWorks2008R2].[Person].
Parallel	False
Physical Operation	Sort

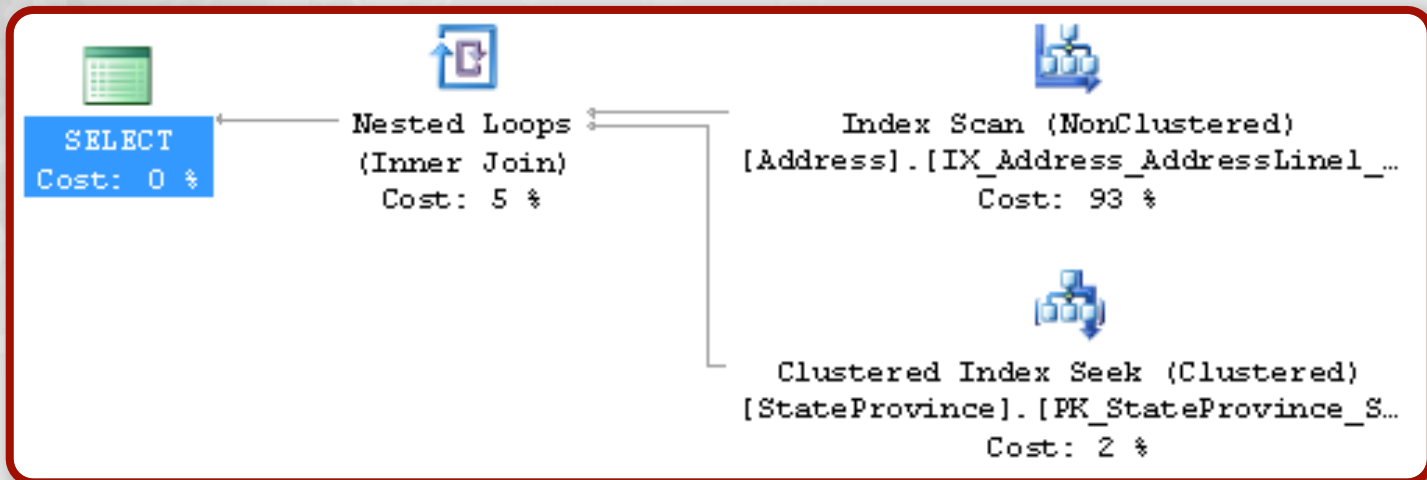
The Select Operator 3



SELECT	
Cached plan size	32 B
Degree of Parallelism	1
Memory Grant	6656
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.218273
Estimated Number of Rows	353.978
Statement	
<pre> SELECT a.AddressID, a.AddressLine1, a.AddressLine2, a.City, sp.[Name] AS StateProvinceName, a.PostalCode FROM Person.Address AS a JOIN Person.StateProvince AS sp ON a.StateProvinceID = sp.StateProvinceID WHERE a.City = @City; </pre>	

Misc	
Cached plan size	32 B
CompileCPU	74
CompileMemory	344
CompileTime	77
Degree of Parallelism	1
Estimated Number of Rows	353.978
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.218273
Logical Operation	
Memory Grant	6656
MissingIndexes	
Optimization Level	FULL
Parameter List	@City
Column	@City
Parameter Compiled Value	N'London'
Parameter Runtime Value	N'London'
Physical Operation	
QueryHash	0x6D09B759A0382ABB
QueryPlanHash	0x83B6639C4E926FC8
Reason For Early Termination Of State	Good Enough Plan Found
Set Options	ANSI_NULLS: True, ANSI_PADDING
Statement	SELECT a.AddressID, a.Addr

The Plan?



The Select Operator 4



SELECT	
Cached plan size	24 B
Degree of Parallelism	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.193818
Estimated Number of Rows	1.66667

Statement

```
SELECT a.AddressID,
       a.AddressLine1,
       a.AddressLine2,
       a.City,
       sp.[Name] AS StateProvinceName,
       a.PostalCode
FROM   Person.Address AS a
       JOIN Person.StateProvince AS sp
       ON a.StateProvinceID =
       sp.StateProvinceID
WHERE  a.City = @City;
```

[-] Misc	
Cached plan size	24 B
CompileCPU	4
CompileMemory	288
CompileTime	4
Degree of Parallelism	1
Estimated Number of Rows	1.66667
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.193818
Logical Operation	
[-] MissingIndexes	
Optimization Level	FULL
[-] Parameter List	@City
Column	@City
Parameter Compiled Value	N'Mentor'
Parameter Runtime Value	N'Mentor'
Physical Operation	
QueryHash	0x6D09B759A0382ABB
QueryPlanHash	0x6FCB975E2BA13982
Reason For Early Termination Of State	Good Enough Plan Found
[-] Set Options	ANSI_NULLS: True, ANSI_PADDING:
Statement	SELECT a.AddressID, a.Add

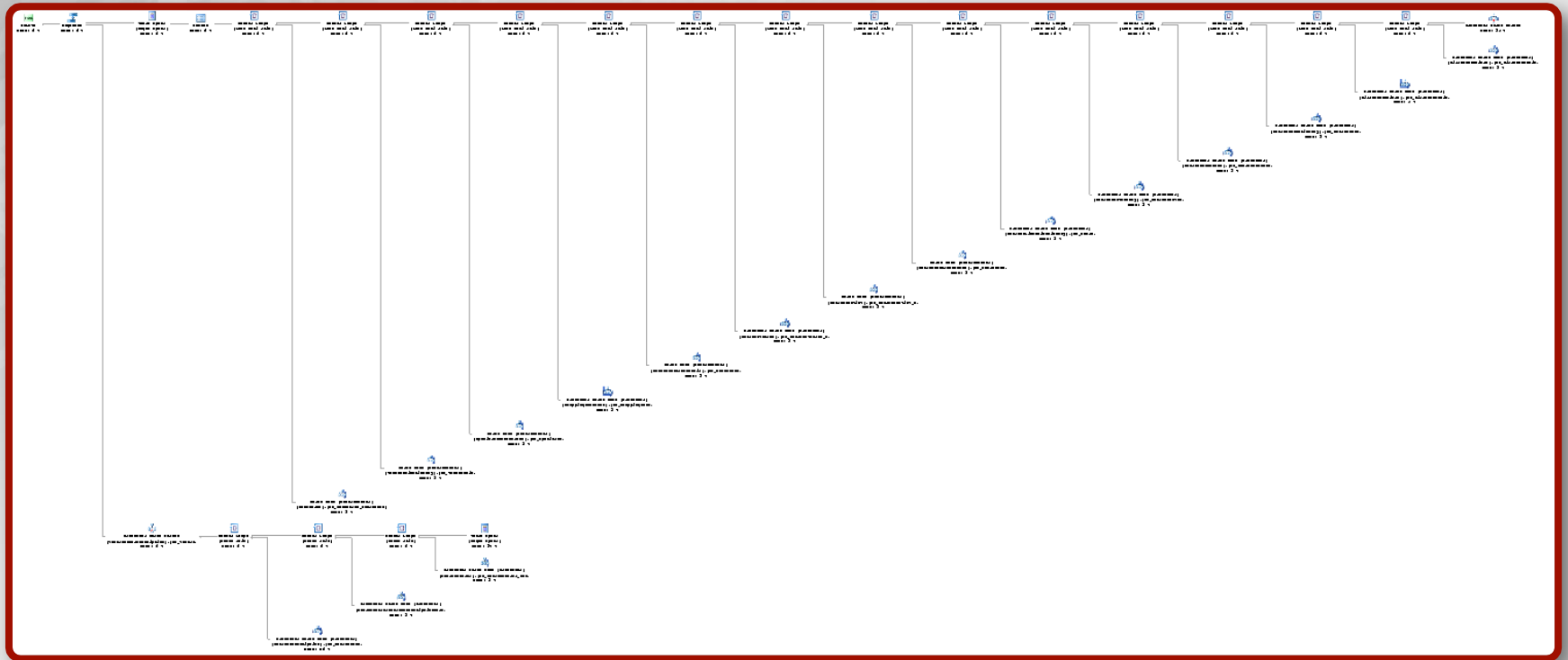
Delete Query

BEGIN TRAN

DELETE FROM Production.Product
WHERE ProductID = 3343

ROLLBACK TRAN

The Plan



Delete Operator



DELETE	
Cached plan size	144 B
Degree of Parallelism	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.123303
Estimated Number of Rows	1
Statement	
DELETE [Production].[Product] WHERE [ProductID]=@1	

☐ Misc	
Cached plan size	144 B
CompileCPU	23
CompileMemory	1632
CompileTime	23
Degree of Parallelism	1
Estimated Number of Rows	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.123303
Logical Operation	
Optimization Level	FULL
☐ Parameter List	@1
Column	@1
Parameter Compiled Value	(3343)
Parameter Runtime Value	(3343)
Physical Operation	
QueryHash	0xD5A4810664483BD6
QueryPlanHash	0xC099CC826DFD17DD
Reason For Early Termination Of State	Good Enough Plan Found
☐ Set Options	ANSI_NULLS: True, ANSI_PA
Statement	DELETE [Production].[Produ

Assert



Assert

Assert

Used to verify that a specified condition exists.

Physical Operation	Assert
Logical Operation	Assert
Actual Number of Rows	0
Estimated I/O Cost	0
Estimated CPU Cost	0.0000045
Estimated Number of Executions	1
Number of Executions	1
Estimated Operator Cost	0.0000045 (0%)
Estimated Subtree Cost	0.0915323
Estimated Number of Rows	1
Estimated Row Size	15 B
Actual Rebinds	0
Actual Rewinds	0
Node ID	3

Output List

[AdventureWorks2008R2].[Production].
[Product].ProductID, [AdventureWorks2008R2].
[Production].[Product].ProductModelID

Misc	
Actual Number of Rows	0
Actual Rebinds	0
Actual Rewinds	0
Description	Used to verify that a specified condition
Estimated CPU Cost	0.0000045
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	1
Estimated Operator Cost	0.0000045 (0%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	15 B
Estimated Subtree Cost	0.0915323
Logical Operation	Assert
Node ID	3
Number of Executions	
Output List	
Parallel	
Physical Operation	
Predicate	
Startup Expression	

Predicate

```
CASE WHEN NOT [Expr1060] IS NULL THEN (0) ELSE  
CASE WHEN NOT [Expr1061] IS NULL THEN (1) ELSE  
CASE WHEN NOT [Expr1062] IS NULL THEN (2) ELSE  
CASE WHEN NOT [Expr1063] IS NULL THEN (3) ELSE  
CASE WHEN NOT [Expr1064] IS NULL THEN (4) ELSE  
CASE WHEN NOT [Expr1065] IS NULL THEN (5) ELSE  
CASE WHEN NOT [Expr1066] IS NULL THEN (6) ELSE  
CASE WHEN NOT [Expr1067] IS NULL THEN (7) ELSE  
CASE WHEN NOT [Expr1068] IS NULL THEN (8) ELSE  
CASE WHEN NOT [Expr1069] IS NULL THEN (9) ELSE  
CASE WHEN NOT [Expr1070] IS NULL THEN (10) ELSE  
CASE WHEN NOT [Expr1071] IS NULL THEN (11) ELSE  
CASE WHEN NOT [Expr1072] IS NULL THEN (12) ELSE  
CASE WHEN NOT [Expr1073] IS NULL THEN (13) ELSE  
NULL END END END END END END END END END  
END END END END
```

Close

Table Spool



Table Spool
(Eager Spool)

Table Spool

Stores the data from the input into a temporary table in order to optimize rewinds.

Physical Operation	Table Spool
Logical Operation	Eager Spool
Actual Number of Rows	0
Estimated I/O Cost	0
Estimated CPU Cost	0.0000501
Number of Executions	1
Estimated Number of Executions	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0.0458663
Estimated Number of Rows	1
Estimated Row Size	15 B
Actual Rebinds	1
Actual Rewinds	0
Node ID	2

Output List

[AdventureWorks2008R2].[Production].
[Product].ProductID, [AdventureWorks2008R2].
[Production].[Product].ProductModelID

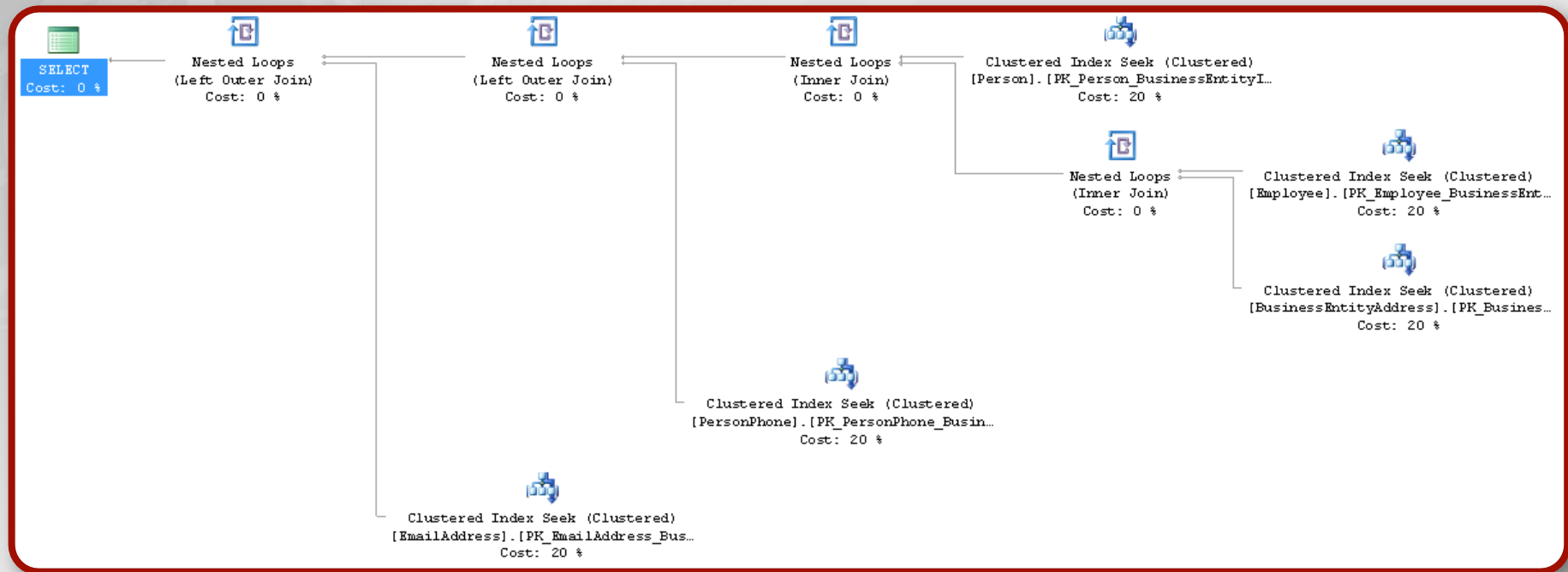
Misc

Actual Number of Rows	0
Actual Rebinds	1
Actual Rewinds	0
Description	Stores the data from the input
Estimated CPU Cost	0.0000501
Estimated I/O Cost	0
Estimated Number of Executions	1
Estimated Number of Rows	1
Estimated Operator Cost	0 (0%)
Estimated Rebinds	0
Estimated Rewinds	0
Estimated Row Size	15 B
Estimated Subtree Cost	0.0458663
Logical Operation	Eager Spool
Node ID	2
Number of Executions	1
Output List	[AdventureWorks2008R2].[Proc
Parallel	False
Physical Operation	Table Spool

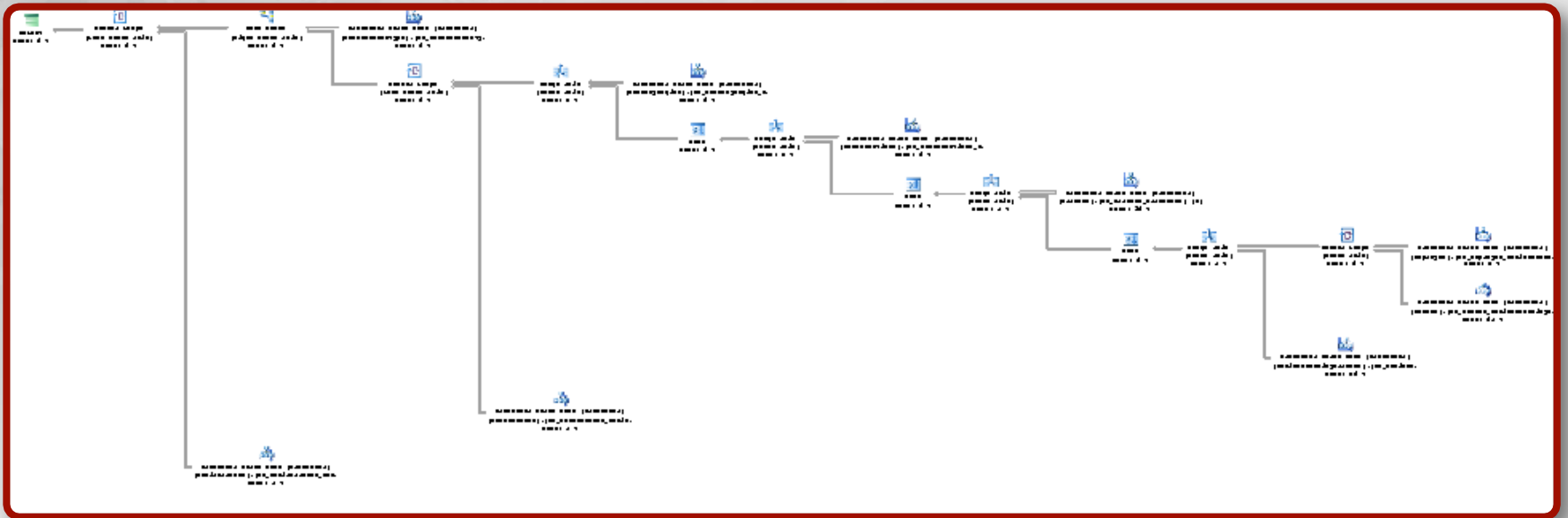
A View

```
SELECT ve.FirstName,  
       ve.LastName,  
       ve.BusinessEntityID  
FROM   HumanResources.vEmployee AS ve  
WHERE  ve.BusinessEntityID = 221
```

View Execution Plan



The Real Plan



A little XML

```
WITH XMLNAMESPACES(DEFAULT N'http://schemas.microsoft.com/sqlserver/2004/07/showplan'),
QueryPlans AS
(
  SELECT RelOp.pln.value(N'@PhysicalOp', N'varchar(50)') AS OperatorName,
  RelOp.pln.value(N'@NodeId', N'integer') AS NodeId,
  RelOp.pln.value(N'@EstimateCPU', N'decimal(10,9)') AS CPUCost,
  RelOp.pln.value(N'@EstimateIO', N'decimal(10,9)') AS IOCost,
  dest.text
  FROM sys.dm_exec_query_stats AS deqs
  CROSS APPLY sys.dm_exec_sql_text(deqs.sql_handle) AS dest
  CROSS APPLY sys.dm_exec_query_plan(deqs.plan_handle) AS deqp
  CROSS APPLY deqp.query_plan.nodes(N'//RelOp') RelOp (pln)
)

SELECT qp.OperatorName,
       qp.NodeId,
       qp.CPUCost,
       qp.IOCost,
       qp.CPUCost + qp.IOCost AS EstimatedCost
FROM   QueryPlans AS qp
WHERE  qp.text LIKE 'SELECT * FROM HumanResources.vEmployee AS ve'
ORDER BY EstimatedCost DESC
```

What To Look For

- ⦿ First Operator
- ⦿ Warnings
- ⦿ Most Costly Operations
- ⦿ Fat Pipes
- ⦿ Extra Operations
- ⦿ Scans

Resources

🕒 [Scarydba.com/Resources](https://www.ScaryDBA.com/Resources)

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Questions?

How would you...?

What happens when...?

Why does...?

When do I...?