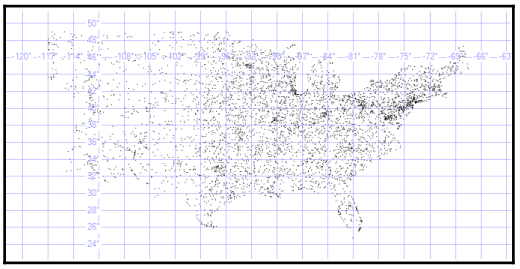
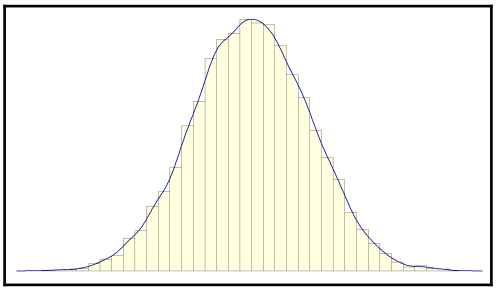
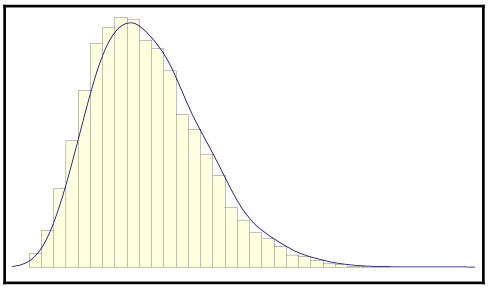
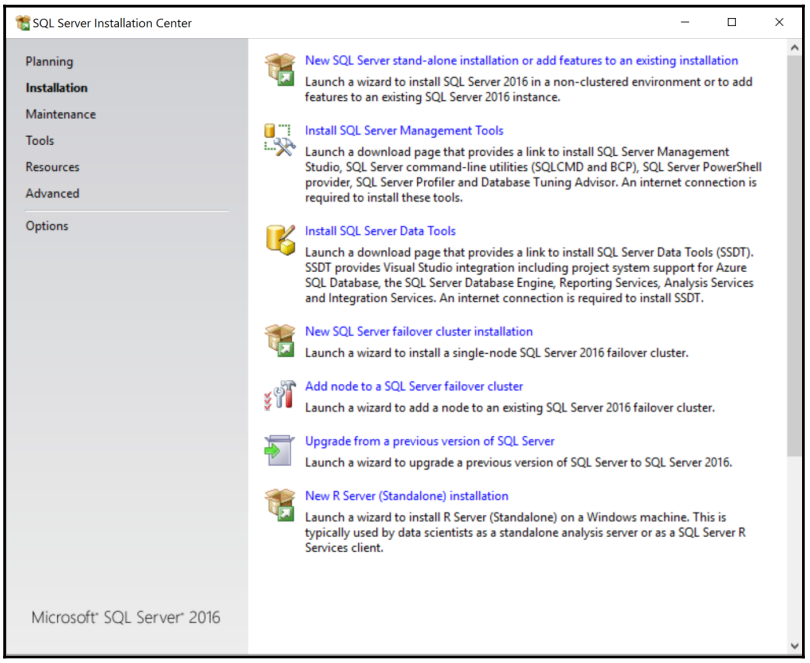
Chapter 2: Review of SQL Server Features for Developers

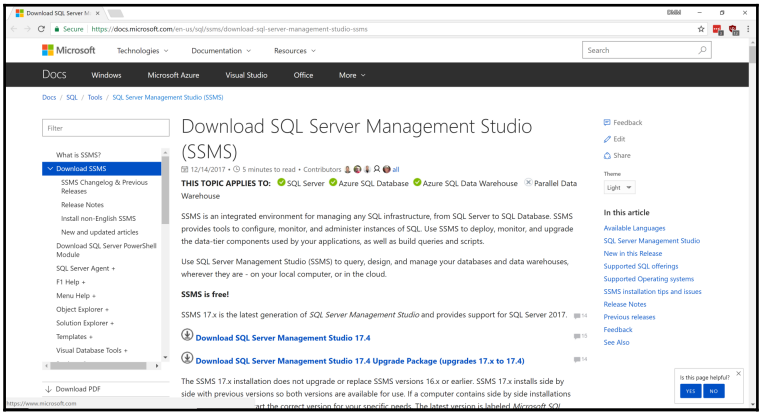


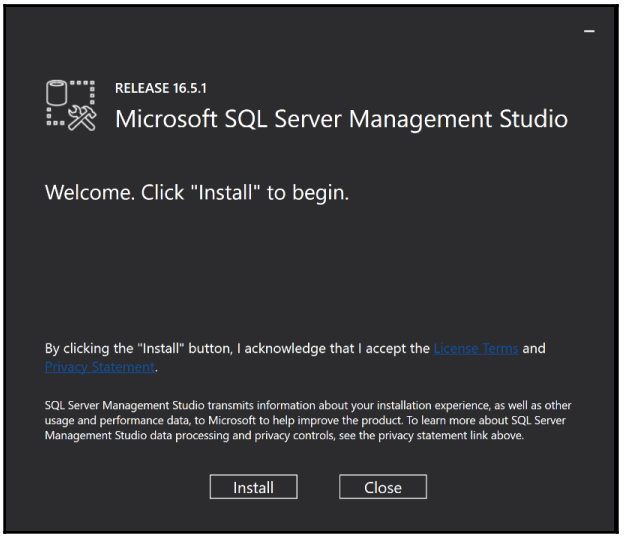


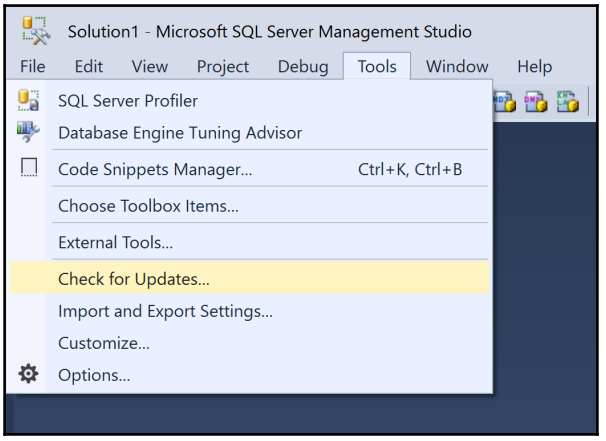


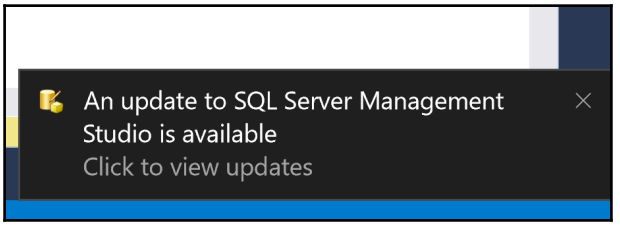
Chapter 3: SQL Server Tools

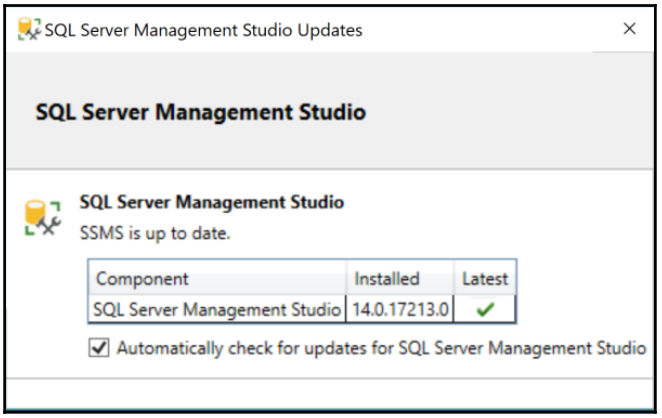


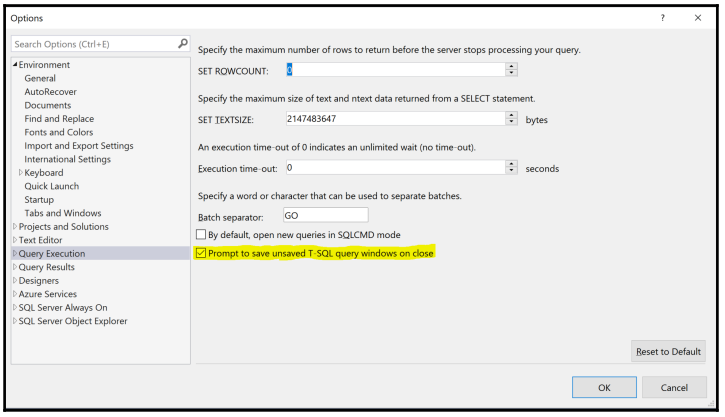


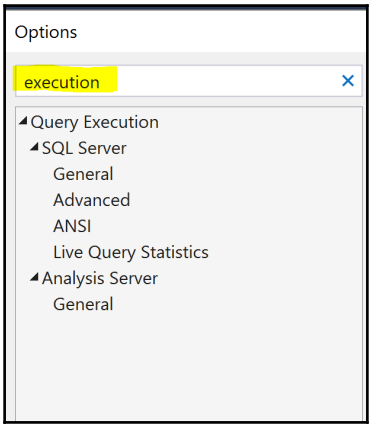

RELEASE 16.5.1
Microsoft SQL Server Management Studio
Welcome. Click "Install" to begin.
By clicking the "Install" button, I acknowledge that I accept the License Terms and Privacy Statement.
SQL Server Management Studio transmits information about your installation experience, as well as other usage and performance data, to Microsoft to help improve the product. To learn more about SQL Server Management Studio data processing and privacy controls, see the privacy statement link above.
Install
Close


Solution1 - Microsoft SQL Server Management Studio
File
Edit
View
Project
Debug
Tools
Window
Help
SQL Server Profiler
Database Engine Tuning Advisor
Code Snippets Manager...
Ctrl+K, Ctrl+B
Choose Toolbox Items...
External Tools...
Check for Updates...
Import and Export Settings...
Customize...
Options...

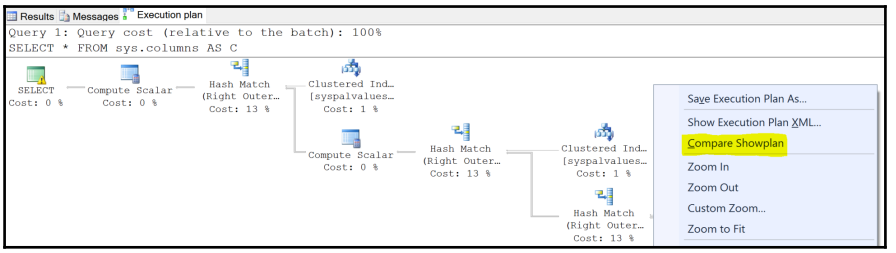

An update to SQL Server Management Studio is available
Click to view updates

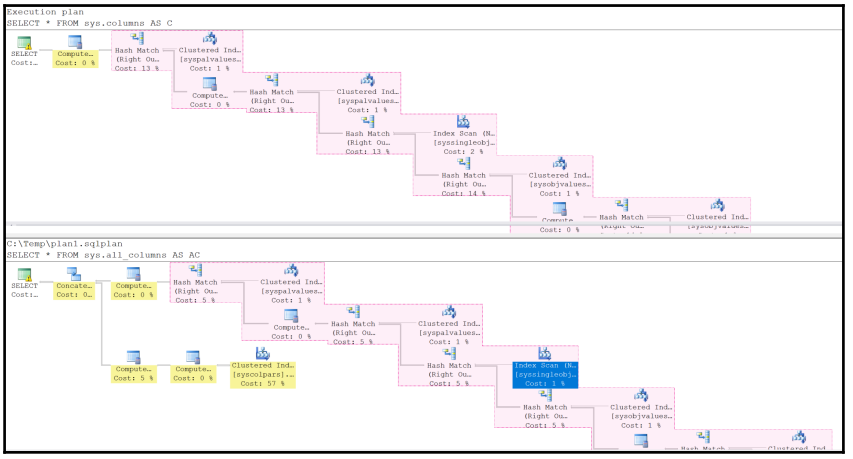

SQL Server Management Studio Updates
SQL Server Management Studio
SQL Server Management Studio
SSMS is up to date.
Component
Installed
Latest
SQL Server Management Studio
14.0.17213.0
Automatically check for updates for SQL Server Management Studio

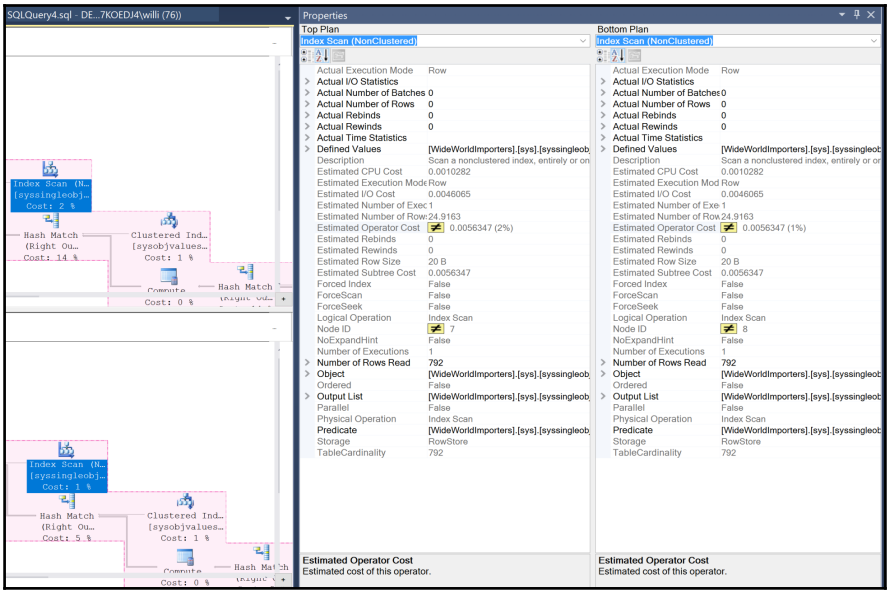

Options
Search Options (Ctrl+E)
Environment
General
AutoRecover
Documents
Find and Replace
Fonts and Colors
Import and Export Settings
International Settings
Keyboard
Quick Launch
Startup
Tabs and Windows
Projects and Solutions
Text Editor
Query Execution
Query Results
Designers
Azure Services
SQL Server Always On
SQL Server Object Explorer
Specify the maximum number of rows to return before the server stops processing your query.
SET ROWCOUNT: 0
Specify the maximum size of text and ntext data returned from a SELECT statement.
SET TEXTSIZE: 2147483647 bytes
An execution time-out of 0 indicates an unlimited wait (no time-out).
Execution time-out: 0 seconds
Specify a word or character that can be used to separate batches.
Batch separator: GO
By default, open new queries in SQLCMD mode
Prompt to save unsaved T-SQL query windows on close
Reset to Default
OK
Cancel

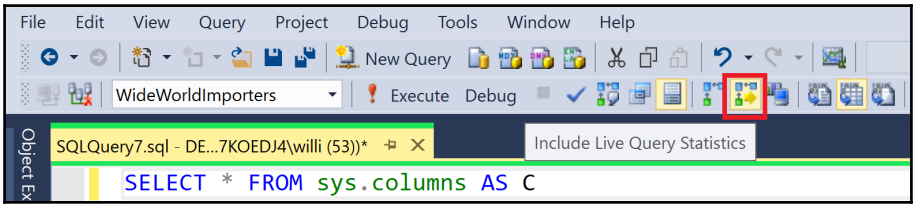

Options
execution
Query Execution
SQL Server
General
Advanced
ANSI
Live Query Statistics
Analysis Server
General

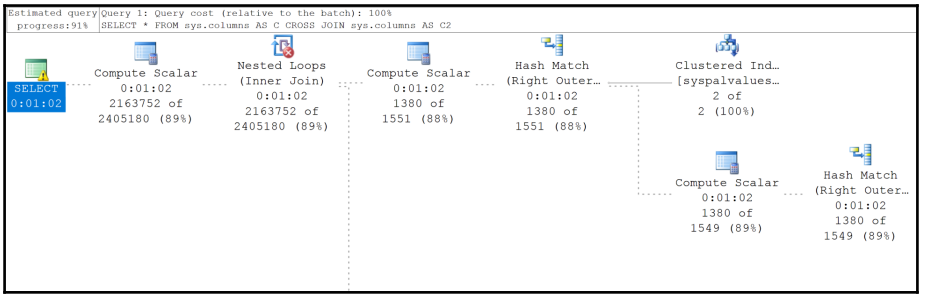
```sql
ALTER PROCEDURE [Integration].[GetOrderUpdates]
@LastCutoff datetime2(7),
@NewCutoff datetime2(7)
WITH EXECUTE AS OWNER
AS
BEGIN
    SET NOCOUNT ON;
    SET XACT_ABORT ON;
    -- Added comment, not saved
    SELECT CAST(o.OrderDate AS date) AS [Order Date Key],
           CAST(ol.PickingCompletedWhen AS date) AS [Picked Date Key],
           o.OrderID AS [WWI Order ID],
           o.BackorderOrderID AS [WWI Backorder ID],
           ol.[Description],
           pt.PackageTypeName AS Package,
           ol.Quantity AS Quantity,
           ol.UnitPrice AS [Unit Price],
           ol.TaxRate AS [Tax Rate],
           ROUND(ol.Quantity * ol.UnitPrice, 2) AS [Total Excluding Tax],
           ROUND(ol.Quantity * ol.UnitPrice * ol.TaxRate / 100.0, 2) AS [Tax Amount],
           ROUND(ol.Quantity * ol.UnitPrice, 2) + ROUND(ol.Quantity * ol.UnitPrice * ol.TaxRate / 100.0, 2) AS [Total Including Tax],
           c.DeliveryCityID AS [WWI City ID],
           c.CustomerID AS [WWI Customer ID],
           ol.StockItemID AS [WWI Stock Item ID],
           o.SalespersonPersonID AS [WWI Salesperson ID],
           o.PickedByPersonID AS [WWI Picker ID],
           CASE WHEN ol.LastEditedWhen > o.LastEditedWhen THEN ol.LastEditedWhen ELSE o.LastEditedWhen END AS [Last Modified When]
```

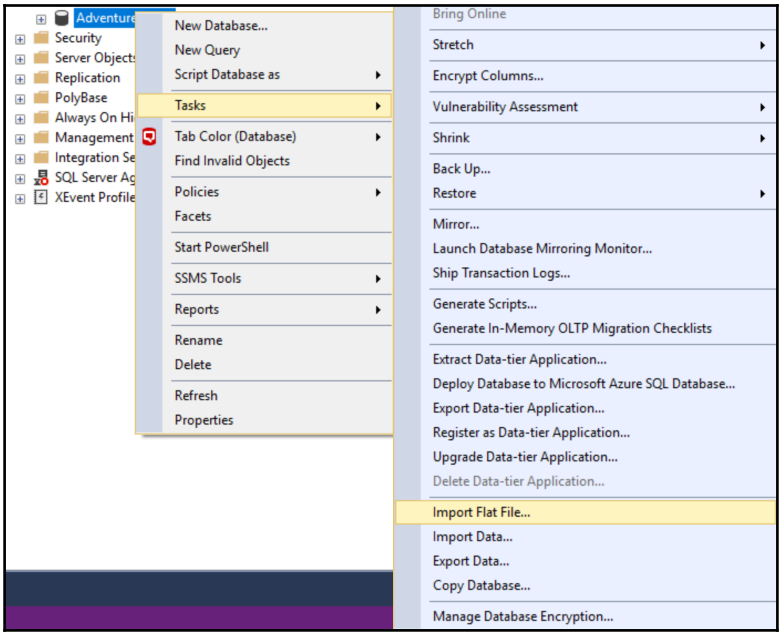


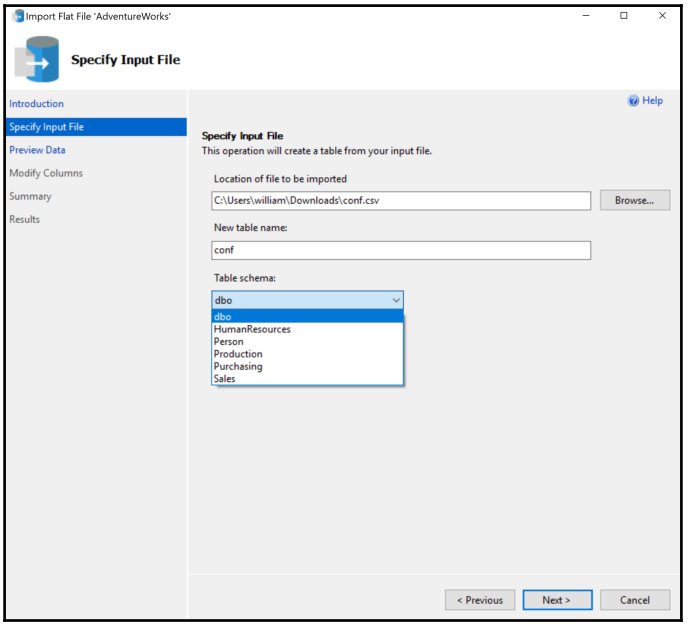


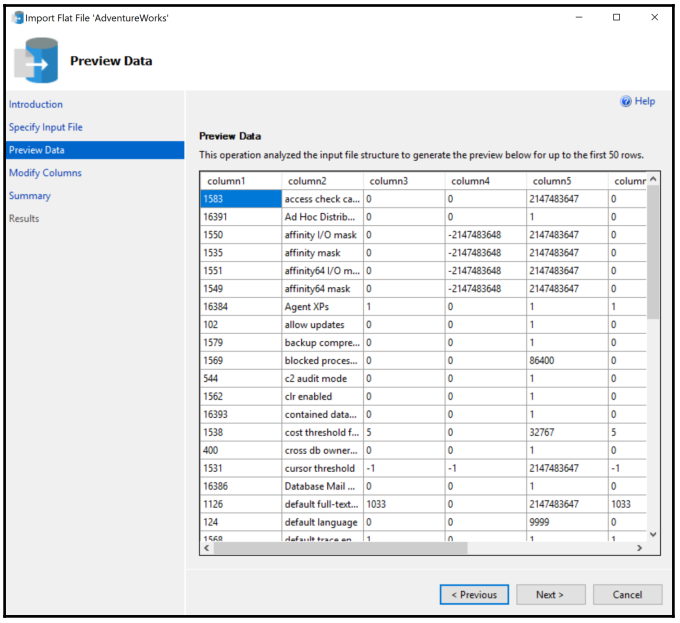

SQLQuery4.sql - DE...7KOEDJ4\willi (76))
Properties
Top Plan
Index Scan (NonClustered)
Bottom Plan
Index Scan (NonClustered)
Actual Execution Mode Row
Actual I/O Statistics
Actual Number of Batches 0
Actual Number of Rows 0
Actual Rebinds 0
Actual Rewinds 0
Actual Time Statistics
Defined Values
Description
Estimated CPU Cost 0.0010282
Estimated Execution Mode Row
Estimated I/O Cost 0.0046065
Estimated Number of Exec 1
Estimated Number of Rows 24.9163
Estimated Operator Cost 0.0056347 (2%)
Estimated Rebinds 0
Estimated Rewinds 0
Estimated Row Size 20 B
Estimated Subtree Cost 0.0056347
Forced Index False
ForceScan False
ForceSeek False
Logical Operation Index Scan
Node ID 7
NoExpandHint False
Number of Executions 1
Number of Rows Read 792
Object [WideWorldImporters].[sys].[syssingleob
Ordered False
Output List
Parallel False
Physical Operation Index Scan
Predicate
Storage RowStore
TableCardinality 792
Estimated Operator Cost (1%)
Estimated Operator Cost
Estimated cost of this operator.

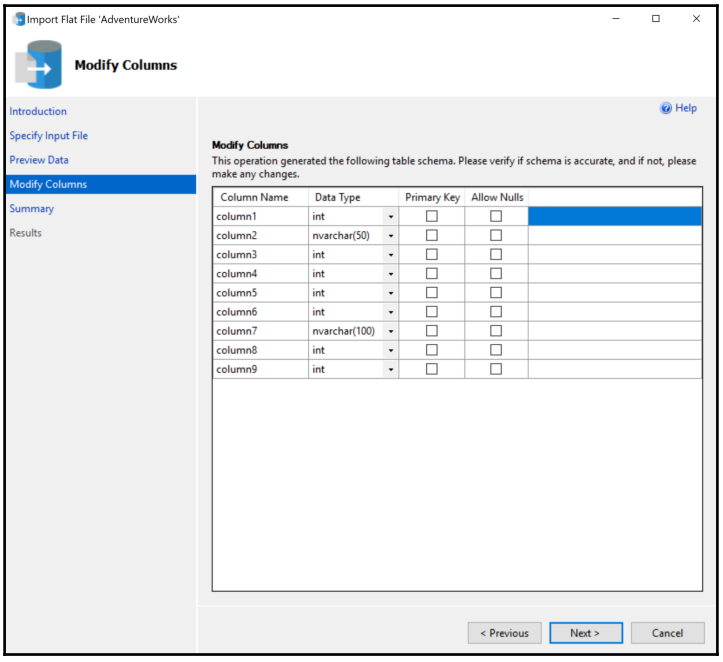

File Edit View Query Project Debug Tools Window Help
New Query
WideWorldImporters
Execute Debug
SQLQuery7.sql - DE...7KOEDJ4\willi (53))*
Include Live Query Statistics
SELECT * FROM sys.columns AS C

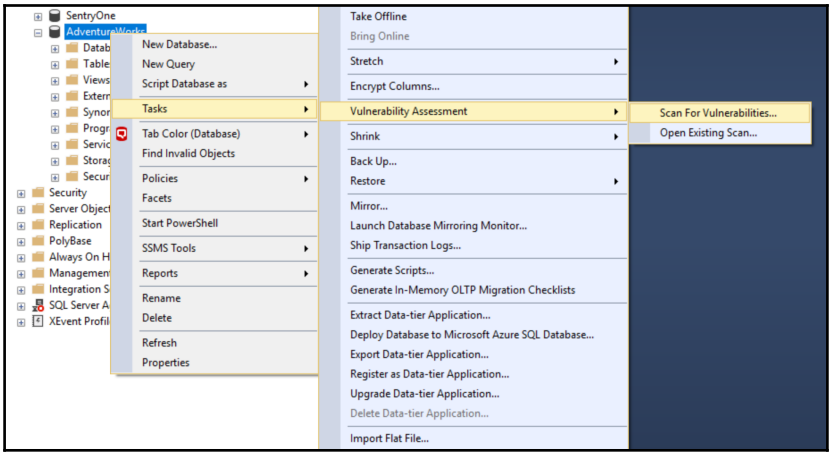

Estimated query progress:91%
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM sys.columns AS C CROSS JOIN sys.columns AS C2
SELECT 0:01:02
Compute Scalar 0:01:02 2163752 of 2405180 (89%)
Nested Loops (Inner Join) 0:01:02 2163752 of 2405180 (89%)
Compute Scalar 0:01:02 1380 of 1551 (88%)
Hash Match (Right Outer… 0:01:02 1380 of 1551 (88%)
Clustered Ind… [syspalvalues… 2 of 2 (100%)
Compute Scalar 0:01:02 1380 of 1549 (89%)
Hash Match (Right Outer… 0:01:02 1380 of 1549 (89%)

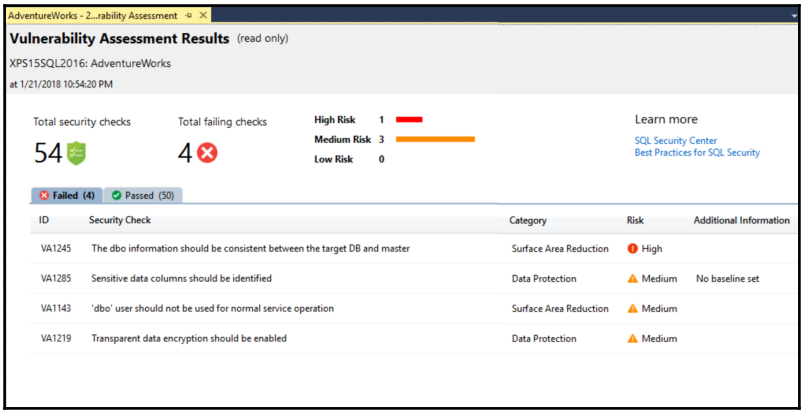

Adventure
Security
Server Objects
Replication
PolyBase
Always On Hi
Management
Integration Se
SQL Server Ag
XEvent Profile
New Database...
New Query
Script Database as
Tasks
Tab Color (Database)
Find Invalid Objects
Policies
Facets
Start PowerShell
SSMS Tools
Reports
Rename
Delete
Refresh
Properties
Bring Online
Stretch
Encrypt Columns...
Vulnerability Assessment
Shrink
Back Up...
Restore
Mirror...
Launch Database Mirroring Monitor...
Ship Transaction Logs...
Generate Scripts...
Generate In-Memory OLTP Migration Checklists
Extract Data-tier Application...
Deploy Database to Microsoft Azure SQL Database...
Export Data-tier Application...
Register as Data-tier Application...
Upgrade Data-tier Application...
Delete Data-tier Application...
Import Flat File...
Import Data...
Export Data...
Copy Database...
Manage Database Encryption...

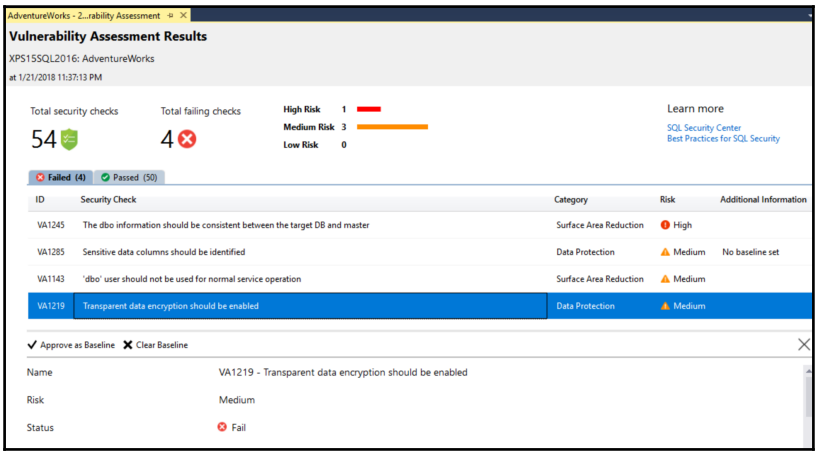

Import Flat File 'AdventureWorks'
Specify Input File
Introduction
Specify Input File
Preview Data
Modify Columns
Summary
Results
Help
Specify Input File
This operation will create a table from your input file.
Location of file to be imported
C:\Users\william\Downloads\conf.csv
Browse...
New table name:
conf
Table schema:
dbo
dbo
HumanResources
Person
Production
Purchasing
Sales
< Previous
Next >
Cancel

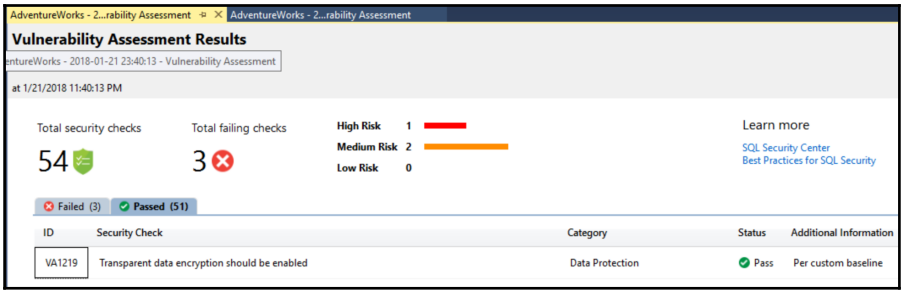

Import Flat File 'AdventureWorks'
Preview Data
Introduction
Specify Input File
Preview Data
Modify Columns
Summary
Results
Help
Preview Data
This operation analyzed the input file structure to generate the preview below for up to the first 50 rows.
column1 column2 column3 column4 column5 columr
1583 access check ca... 0 0 2147483647 0
16391 Ad Hoc Distrib... 0 0 1 0
1550 affinity I/O mask 0 -2147483648 2147483647 0
1535 affinity mask 0 -2147483648 2147483647 0
1551 affinity64 I/O m... 0 -2147483648 2147483647 0
1549 affinity64 mask 0 -2147483648 2147483647 0
16384 Agent XPs 1 0 1 1
102 allow updates 0 0 1 0
1579 backup compre... 0 0 1 0
1569 blocked proces... 0 0 86400 0
544 c2 audit mode 0 0 1 0
1562 clr enabled 0 0 1 0
16393 contained data... 0 0 1 0
1538 cost threshold f... 5 0 32767 5
400 cross db owner... 0 0 1 0
1531 cursor threshold -1 -1 2147483647 -1
16386 Database Mail ... 0 0 1 0
1126 default full-text... 1033 0 2147483647 1033
124 default language 0 0 9999 0
< Previous
Next >
Cancel

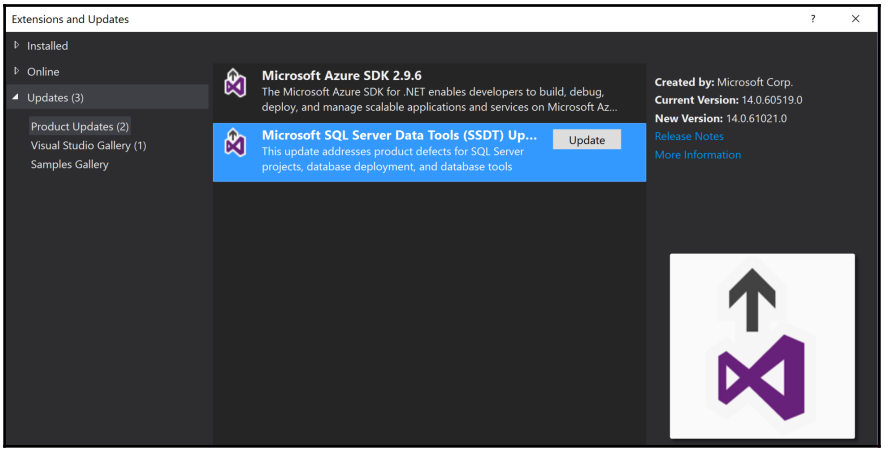

Import Flat File 'AdventureWorks'
Modify Columns
Introduction
Specify Input File
Preview Data
Modify Columns
Summary
Results
Help
Modify Columns
This operation generated the following table schema. Please verify if schema is accurate, and if not, please make any changes.
Column Name Data Type Primary Key Allow Nulls
column1 int
column2 nvarchar(50)
column3 int
column4 int
column5 int
column6 int
column7 nvarchar(100)
column8 int
column9 int
< Previous
Next >
Cancel

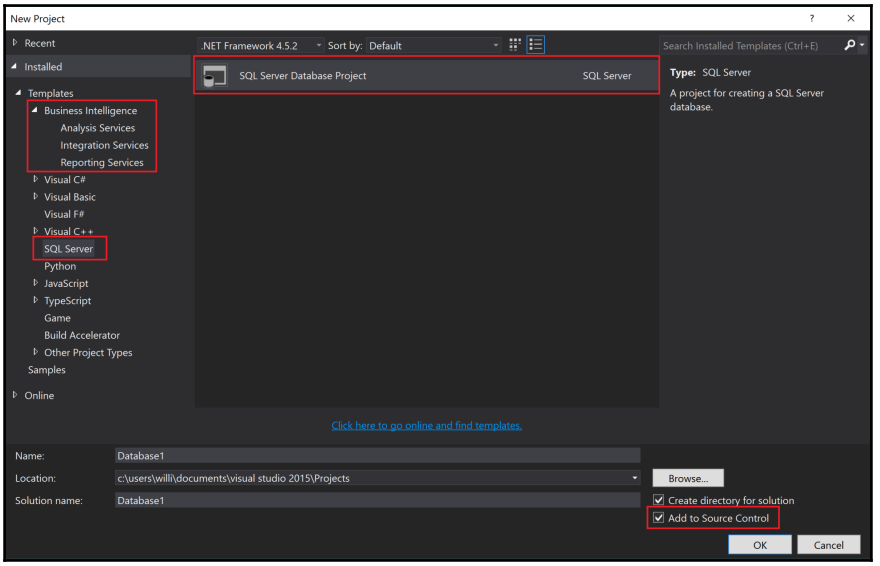

SentryOne
AdventureWorks
New Database...
New Query
Script Database as
Tasks
Tab Color (Database)
Find Invalid Objects
Policies
Facets
Start PowerShell
SSMS Tools
Reports
Rename
Delete
Refresh
Properties
Take Offline
Bring Online
Stretch
Encrypt Columns...
Vulnerability Assessment
Shrink
Back Up...
Restore
Mirror...
Launch Database Mirroring Monitor...
Ship Transaction Logs...
Generate Scripts...
Generate In-Memory OLTP Migration Checklists
Extract Data-tier Application...
Deploy Database to Microsoft Azure SQL Database...
Export Data-tier Application...
Register as Data-tier Application...
Upgrade Data-tier Application...
Delete Data-tier Application...
Import Flat File...
Scan For Vulnerabilities...
Open Existing Scan...

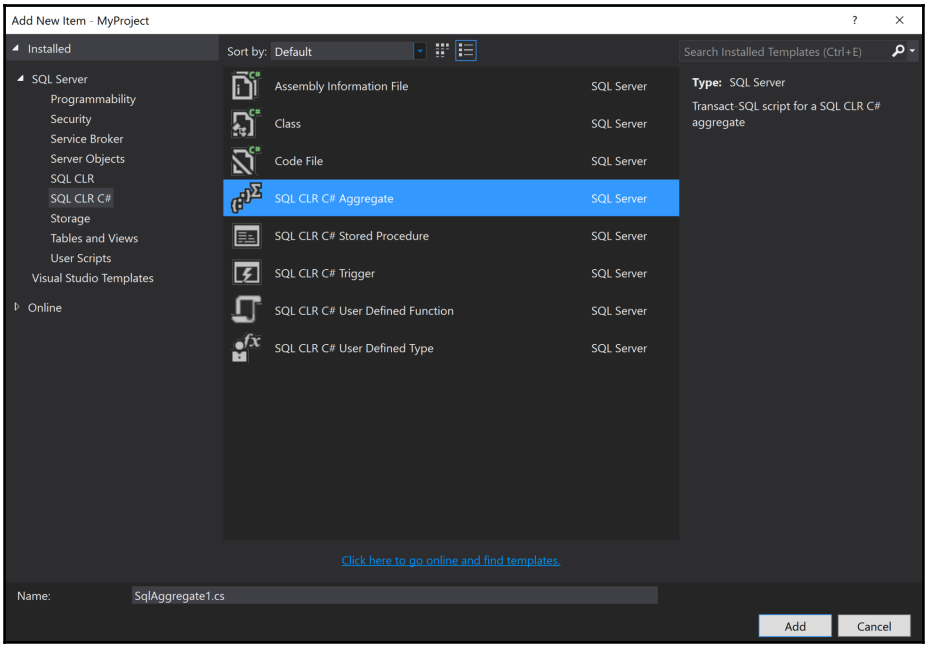

AdventureWorks - 2...rability Assessment
Vulnerability Assessment Results (read only)
XPS15SQL2016: AdventureWorks
at 1/21/2018 10:54:20 PM
Total security checks
54
Total failing checks
4
High Risk 1
Medium Risk 3
Low Risk 0
Learn more
SQL Security Center
Best Practices for SQL Security
Failed (4)
Passed (50)
ID
Security Check
Category
Risk
Additional Information
VA1245
The dbo information should be consistent between the target DB and master
Surface Area Reduction
High
VA1285
Sensitive data columns should be identified
Data Protection
Medium
No baseline set
VA1143
'dbo' user should not be used for normal service operation
Surface Area Reduction
Medium
VA1219
Transparent data encryption should be enabled
Data Protection
Medium

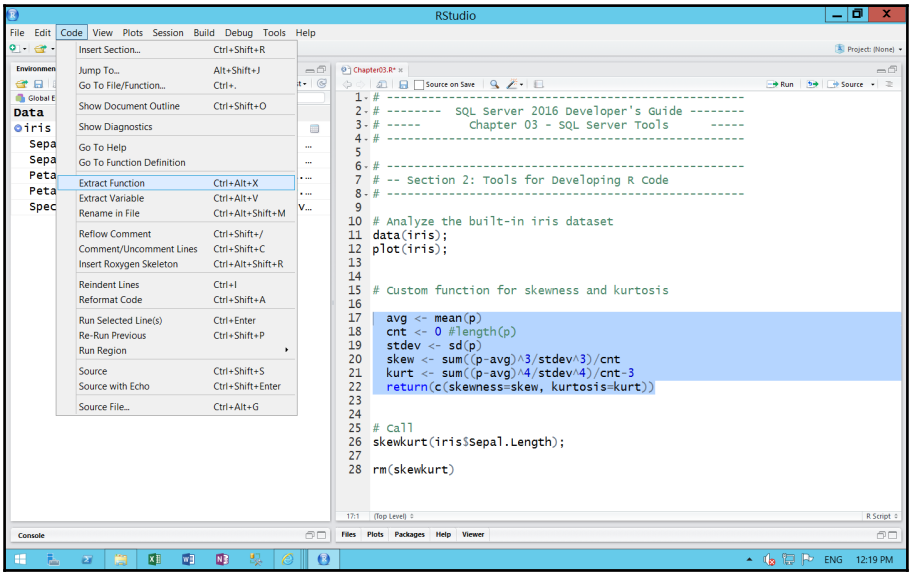

AdventureWorks - 2...rability Assessment
Vulnerability Assessment Results
XPS15SQL2016: AdventureWorks
at 1/21/2018 11:37:13 PM
Total security checks
54
Total failing checks
4
High Risk 1
Medium Risk 3
Low Risk 0
Learn more
SQL Security Center
Best Practices for SQL Security
Failed (4)
Passed (50)
ID
Security Check
Category
Risk
Additional Information
VA1245
The dbo information should be consistent between the target DB and master
Surface Area Reduction
High
VA1285
Sensitive data columns should be identified
Data Protection
Medium
No baseline set
VA1143
'dbo' user should not be used for normal service operation
Surface Area Reduction
Medium
VA1219
Transparent data encryption should be enabled
Data Protection
Medium
Approve as Baseline
Clear Baseline
Name
VA1219 - Transparent data encryption should be enabled
Risk
Medium
Status
Fail

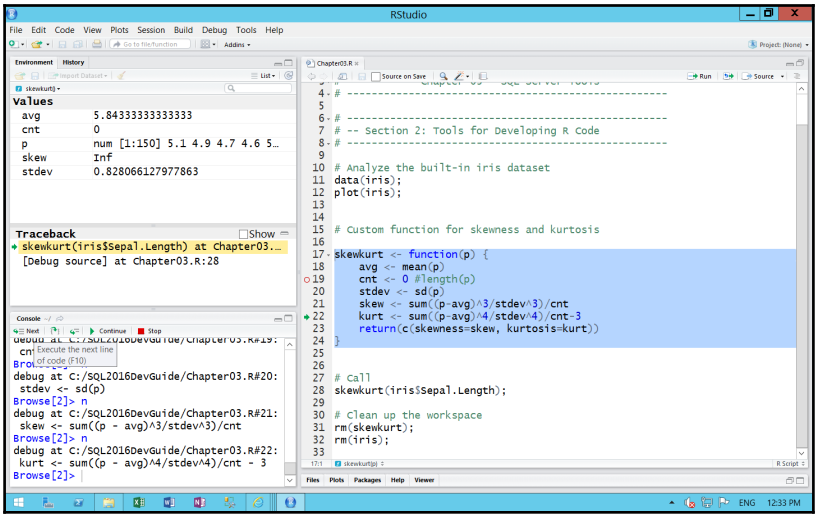

AdventureWorks - 2...rability Assessment
AdventureWorks - 2...rability Assessment
Vulnerability Assessment Results
ntureWorks - 2018-01-21 23:40:13 - Vulnerability Assessment
at 1/21/2018 11:40:13 PM
Total security checks
54
Total failing checks
3
High Risk 1
Medium Risk 2
Low Risk 0
Learn more
SQL Security Center
Best Practices for SQL Security
Failed (3)
Passed (51)
ID
Security Check
Category
Status
Additional Information
VA1219
Transparent data encryption should be enabled
Data Protection
Pass
Per custom baseline

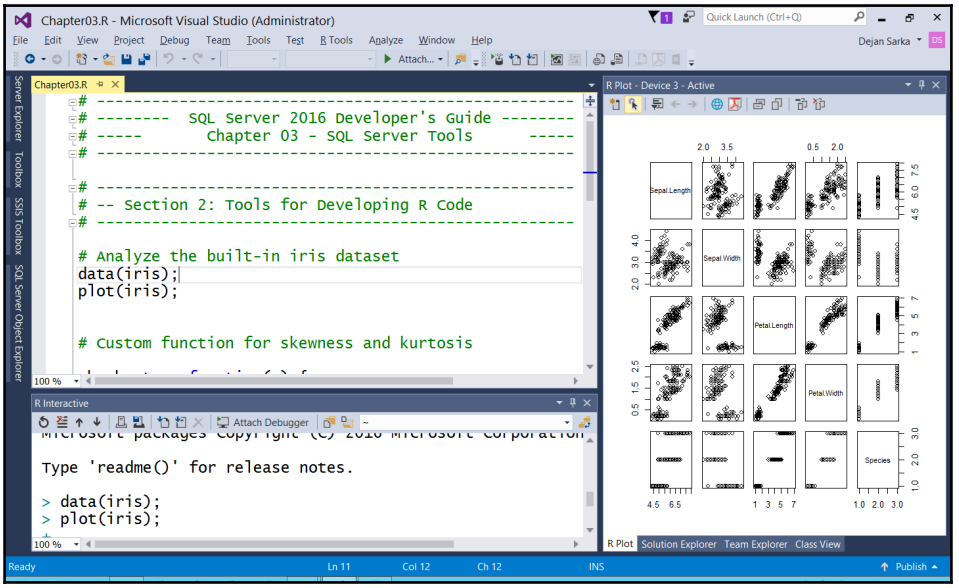

Extensions and Updates
Installed
Online
Updates (3)
Product Updates (2)
Visual Studio Gallery (1)
Samples Gallery
Microsoft Azure SDK 2.9.6
The Microsoft Azure SDK for .NET enables developers to build, debug, deploy, and manage scalable applications and services on Microsoft Az...
Microsoft SQL Server Data Tools (SSDT) Up...
Update
This update addresses product defects for SQL Server projects, database deployment, and database tools
Created by: Microsoft Corp.
Current Version: 14.0.60519.0
New Version: 14.0.61021.0
Release Notes
More Information

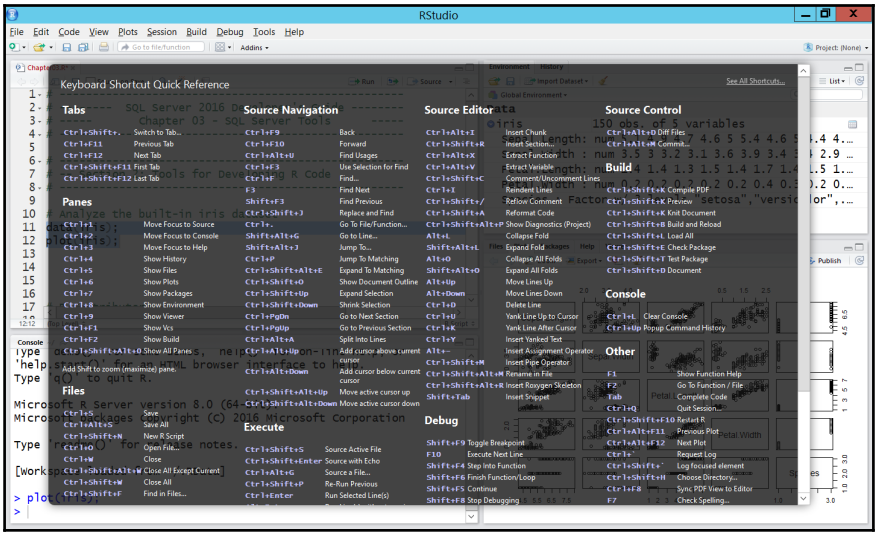

New Project
Recent
Installed
Templates
Business Intelligence
Analysis Services
Integration Services
Reporting Services
Visual C#
Visual Basic
Visual F#
Visual C++
SQL Server
Python
JavaScript
TypeScript
Game
Build Accelerator
Other Project Types
Samples
Online
.NET Framework 4.5.2
Sort by: Default
Search Installed Templates (Ctrl+E)
SQL Server Database Project
SQL Server
Type: SQL Server
A project for creating a SQL Server database.
Click here to go online and find templates.
Name: Database1
Location: c:\users\willi\documents\visual studio 2015\Projects
Solution name: Database1
Browse...
Create directory for solution
Add to Source Control
OK
Cancel

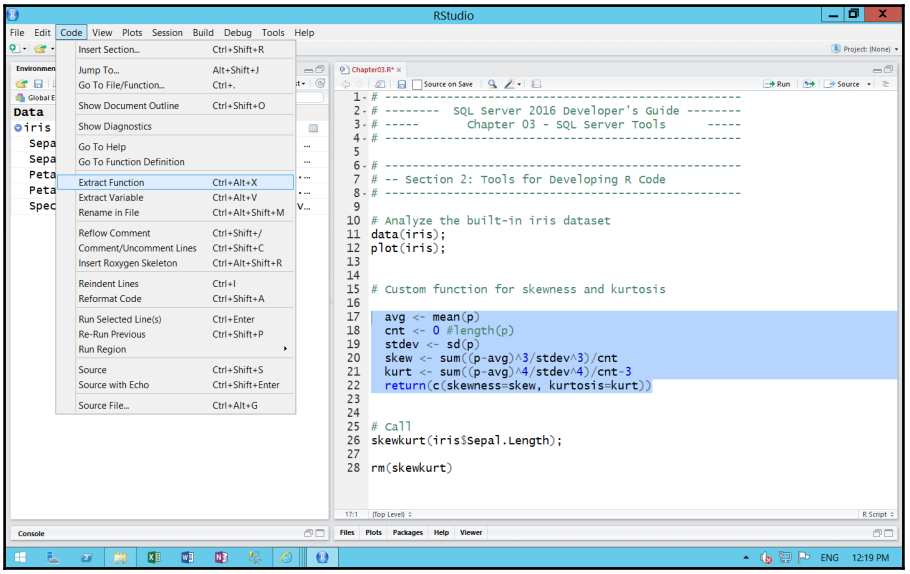

Add New Item - MyProject
Installed
SQL Server
Programmability
Security
Service Broker
Server Objects
SQL CLR
SQL CLR C#
Storage
Tables and Views
User Scripts
Visual Studio Templates
Online
Sort by: Default
Assembly Information File SQL Server
Class SQL Server
Code File SQL Server
SQL CLR C# Aggregate SQL Server
SQL CLR C# Stored Procedure SQL Server
SQL CLR C# Trigger SQL Server
SQL CLR C# User Defined Function SQL Server
SQL CLR C# User Defined Type SQL Server
Search Installed Templates (Ctrl+E)
Type: SQL Server
Transact-SQL script for a SQL CLR C# aggregate
Click here to go online and find templates.
Name: SqlAggregate1.cs
Add
Cancel


RStudio
File Edit Code View Plots Session Build Debug Tools Help
Insert Section... Ctrl+Shift+R
Jump To... Alt+Shift+J
Go To File/Function... Ctrl+.
Show Document Outline Ctrl+Shift+O
Show Diagnostics
Go To Help
Go To Function Definition
Extract Function Ctrl+Alt+X
Extract Variable Ctrl+Alt+V
Rename in File Ctrl+Alt+Shift+M
Reflow Comment Ctrl+Shift+/
Comment/Uncomment Lines Ctrl+Shift+C
Insert Roxygen Skeleton Ctrl+Alt+Shift+R
Reindent Lines Ctrl+I
Reformat Code Ctrl+Shift+A
Run Selected Line(s) Ctrl+Enter
Re-Run Previous Ctrl+Shift+P
Run Region
Source Ctrl+Shift+S
Source with Echo Ctrl+Shift+Enter
Source File... Ctrl+Alt+G
Chapter03.R*
# -------- SQL Server 2016 Developer's Guide --------
# ----- Chapter 03 - SQL Server Tools -----
# -- Section 2: Tools for Developing R Code
# Analyze the built-in iris dataset
data(iris);
plot(iris);
# Custom function for skewness and kurtosis
avg <- mean(p)
cnt <- 0 #length(p)
stdev <- sd(p)
skew <- sum((p-avg)^3/stdev^3)/cnt
kurt <- sum((p-avg)^4/stdev^4)/cnt-3
return(c(skewness=skew, kurtosis=kurt))
# Call
skewkurt(iris$Sepal.Length);
rm(skewkurt)
Console
Files Plots Packages Help Viewer
ENG 12:19 PM


RStudio
File Edit Code View Plots Session Build Debug Tools Help
Values
avg 5.84333333333333
cnt 0
p num [1:150] 5.1 4.9 4.7 4.6 5...
skew Inf
stdev 0.828066127977863
Traceback
skewkurt(iris$Sepal.Length) at Chapter03...
[Debug source] at Chapter03.R:28
# -- Section 2: Tools for Developing R Code
# Analyze the built-in iris dataset
data(iris);
plot(iris);
# Custom function for skewness and kurtosis
skewkurt <- function(p) {
avg <- mean(p)
cnt <- 0 #length(p)
stdev <- sd(p)
skew <- sum((p-avg)^3/stdev^3)/cnt
kurt <- sum((p-avg)^4/stdev^4)/cnt-3
return(c(skewness=skew, kurtosis=kurt))
}
# Call
skewkurt(iris$Sepal.Length);
# Clean up the workspace
rm(skewkurt);
rm(iris);
debug at C:/SQL2016DevGuide/Chapter03.R#20:
stdev <- sd(p)
Browse[2]> n
debug at C:/SQL2016DevGuide/Chapter03.R#21:
skew <- sum((p - avg)^3/stdev^3)/cnt
Browse[2]> n
debug at C:/SQL2016DevGuide/Chapter03.R#22:
kurt <- sum((p - avg)^4/stdev^4)/cnt - 3
Browse[2]>
ENG 12:33 PM


Chapter03.R - Microsoft Visual Studio (Administrator)
File Edit View Project Debug Team Tools Test R Tools Analyze Window Help
Dejan Sarka
Chapter03.R
# -------- SQL Server 2016 Developer's Guide --------
# ----- Chapter 03 - SQL Server Tools -----
# -- Section 2: Tools for Developing R Code
# Analyze the built-in iris dataset
data(iris);
plot(iris);
# Custom function for skewness and kurtosis
R Interactive
Attach Debugger
Type 'readme()' for release notes.
> data(iris);
> plot(iris);
R Plot - Device 3 - Active
Sepal.Length
Sepal.Width
Petal.Length
Petal.Width
Species
R Plot Solution Explorer Team Explorer Class View
Ready Ln 11 Col 12 Ch 12 INS Publish


RStudio
Keyboard Shortcut Quick Reference
Tabs
Panes
Files
Source Navigation
Execute
Source Editor
Debug
Source Control
Build
Console
Other


RStudio
File Edit Code View Plots Session Build Debug Tools Help
Insert Section... Ctrl+Shift+R
Jump To... Alt+Shift+J
Go To File/Function... Ctrl+.
Show Document Outline Ctrl+Shift+O
Show Diagnostics
Go To Help
Go To Function Definition
Extract Function Ctrl+Alt+X
Extract Variable Ctrl+Alt+V
Rename in File Ctrl+Alt+Shift+M
Reflow Comment Ctrl+Shift+/
Comment/Uncomment Lines Ctrl+Shift+C
Insert Roxygen Skeleton Ctrl+Alt+Shift+R
Reindent Lines Ctrl+I
Reformat Code Ctrl+Shift+A
Run Selected Line(s) Ctrl+Enter
Re-Run Previous Ctrl+Shift+P
Run Region
Source Ctrl+Shift+S
Source with Echo Ctrl+Shift+Enter
Source File... Ctrl+Alt+G
# -------- SQL Server 2016 Developer's Guide --------
# ----- Chapter 03 - SQL Server Tools -----
# -- Section 2: Tools for Developing R Code
# Analyze the built-in iris dataset
data(iris);
plot(iris);
# Custom function for skewness and kurtosis
avg <- mean(p)
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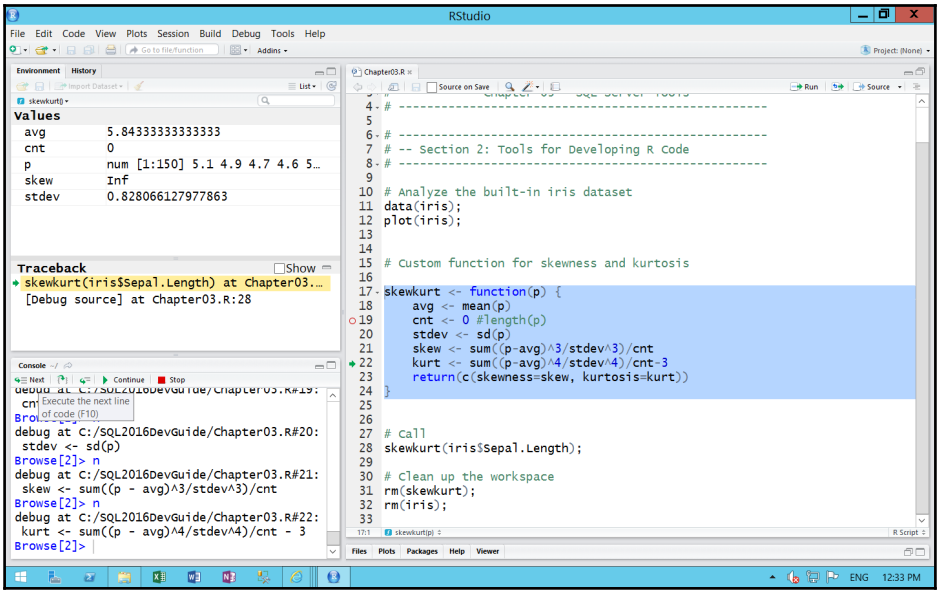
stdev <- sd(p)
skew <- sum((p-avg)^3/stdev^3)/cnt
kurt <- sum((p-avg)^4/stdev^4)/cnt-3
return(c(skewness=skew, kurtosis=kurt))
# Call
skewkurt(iris$Sepal.Length);
rm(skewkurt)
ENG 12:19 PM


RStudio
File Edit Code View Plots Session Build Debug Tools Help
Values
avg 5.84333333333333
cnt 0
p num [1:150] 5.1 4.9 4.7 4.6 5…
skew Inf
stdev 0.828066127977863
Traceback
skewkurt(iris$Sepal.Length) at Chapter03.…
[Debug source] at Chapter03.R:28
# Analyze the built-in iris dataset
data(iris);
plot(iris);
# Custom function for skewness and kurtosis
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stdev <- sd(p)
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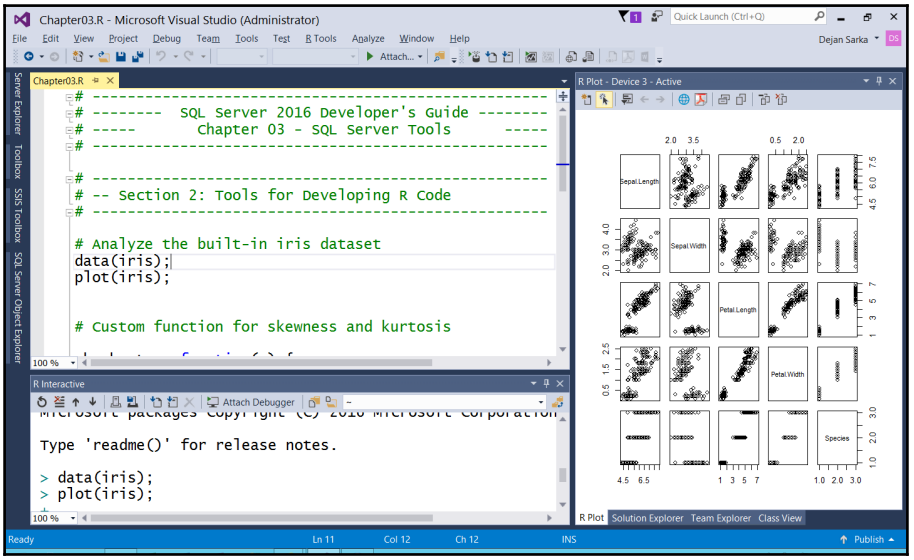
kurt <- sum((p-avg)^4/stdev^4)/cnt-3
return(c(skewness=skew, kurtosis=kurt))
}
# Call
skewkurt(iris$Sepal.Length);
# Clean up the workspace
rm(skewkurt);
rm(iris);
Browse[2]> n
debug at C:/SQL2016DevGuide/Chapter03.R#20:
stdev <- sd(p)
Browse[2]> n
debug at C:/SQL2016DevGuide/Chapter03.R#21:
skew <- sum((p - avg)^3/stdev^3)/cnt
Browse[2]> n
debug at C:/SQL2016DevGuide/Chapter03.R#22:
kurt <- sum((p - avg)^4/stdev^4)/cnt - 3
Browse[2]>
ENG 12:33 PM


Chapter03.R - Microsoft Visual Studio (Administrator)
File Edit View Project Debug Team Tools Test R Tools Analyze Window Help
Dejan Sarka
# -------- SQL Server 2016 Developer's Guide --------
# ----- Chapter 03 - SQL Server Tools -----
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plot(iris);
# Custom function for skewness and kurtosis
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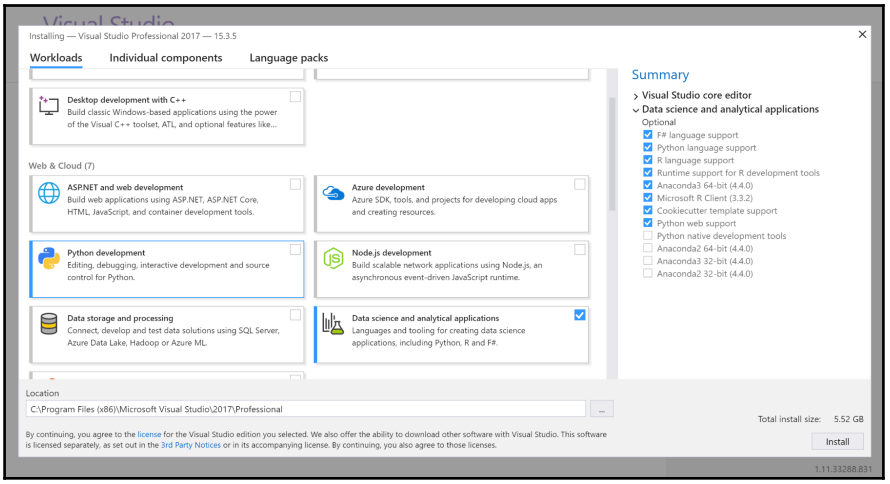
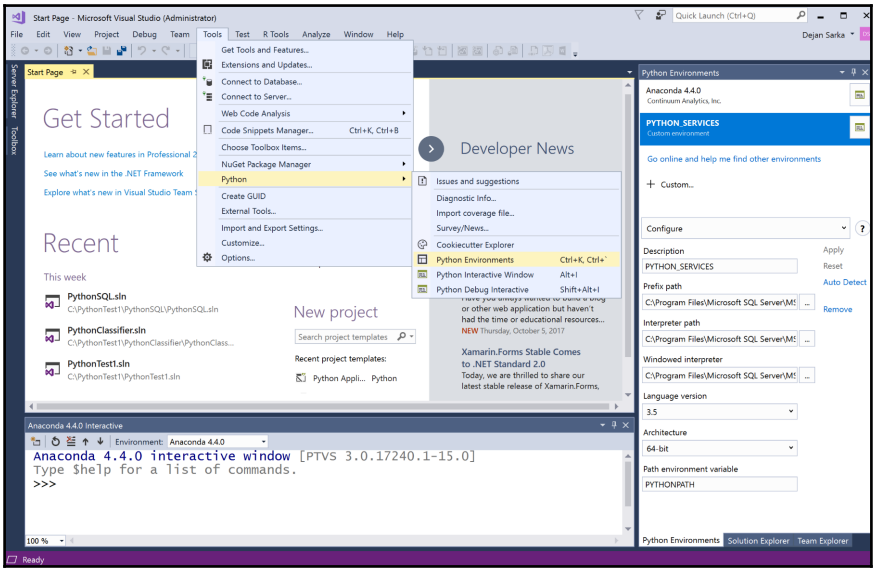
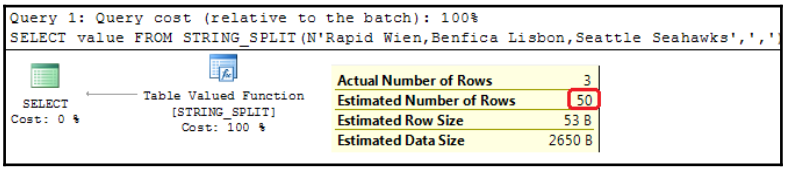
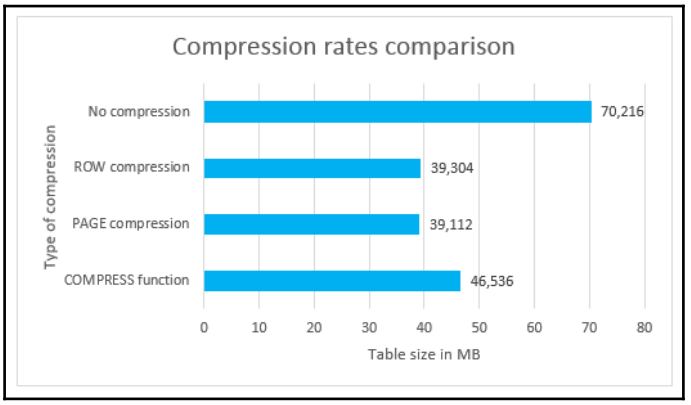
Type 'readme()' for release notes.
> data(iris);
> plot(iris);
R Plot - Device 3 - Active
Sepal.Length
Sepal.Width
Petal.Length
Petal.Width
Species
Ready Ln 11 Col 12 Ch 12 INS Publish

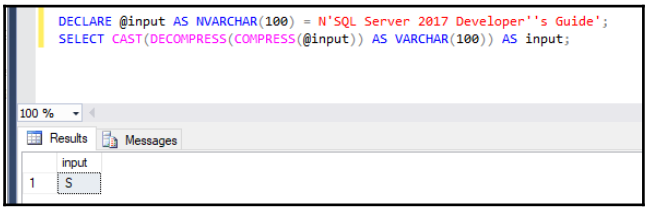

Installing — Visual Studio Professional 2017 — 15.3.5
Workloads
Individual components
Language packs
Desktop development with C++
Build classic Windows-based applications using the power of the Visual C++ toolset, ATL, and optional features like...
Web & Cloud (7)
ASP.NET and web development
Build web applications using ASP.NET, ASP.NET Core, HTML, JavaScript, and container development tools.
Azure development
Azure SDK, tools, and projects for developing cloud apps and creating resources.
Python development
Editing, debugging, interactive development and source control for Python.
Node.js development
Build scalable network applications using Node.js, an asynchronous event-driven JavaScript runtime.
Data storage and processing
Connect, develop and test data solutions using SQL Server, Azure Data Lake, Hadoop or Azure ML.
Data science and analytical applications
Languages and tooling for creating data science applications, including Python, R and F#.
Summary
Visual Studio core editor
Data science and analytical applications
Optional
F# language support
Python language support
R language support
Runtime support for R development tools
Anaconda3 64-bit (4.4.0)
Microsoft R Client (3.3.2)
Cookiecutter template support
Python web support
Python native development tools
Anaconda2 64-bit (4.4.0)
Anaconda3 32-bit (4.4.0)
Anaconda2 32-bit (4.4.0)
Location
C:\Program Files (x86)\Microsoft Visual Studio\2017\Professional
Total install size: 5.52 GB
Install
By continuing, you agree to the license for the Visual Studio edition you selected. We also offer the ability to download other software with Visual Studio. This software is licensed separately, as set out in the 3rd Party Notices or in its accompanying license. By continuing, you agree to those licenses.
1.11.33288.831

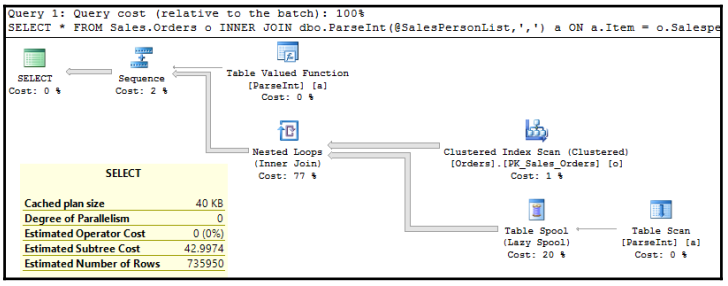

Start Page - Microsoft Visual Studio (Administrator)
Tools
Get Started
Recent
Developer News
New project
Anaconda 4.4.0 Interactive
Anaconda 4.4.0 interactive window [PTVS 3.0.17240.1-15.0]
Type $help for a list of commands.
>>>
Python Environments
Ready

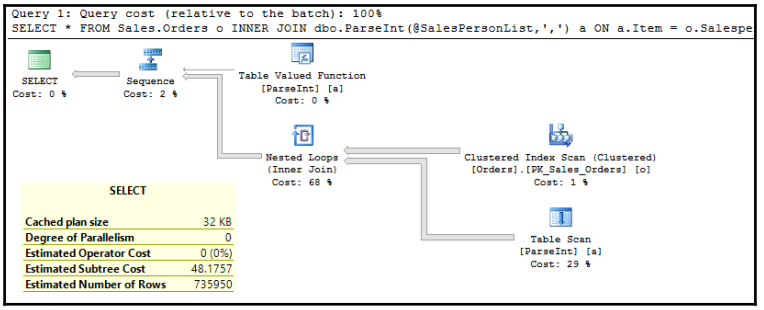
Chapter 4: Transact-SQL and Database Engine Enhancements

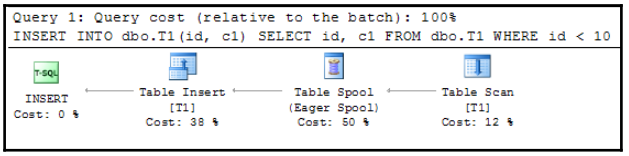


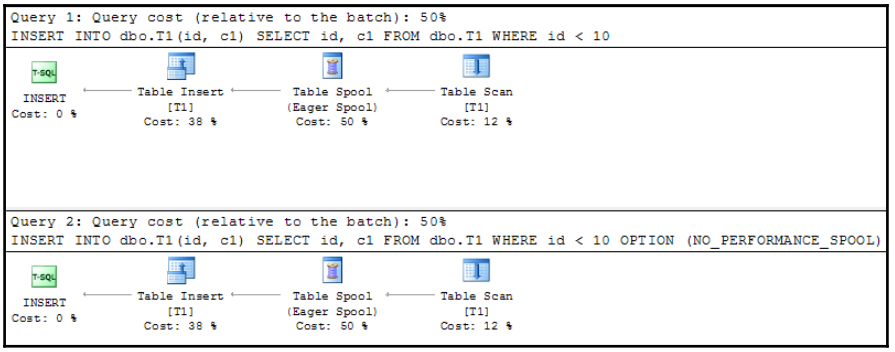


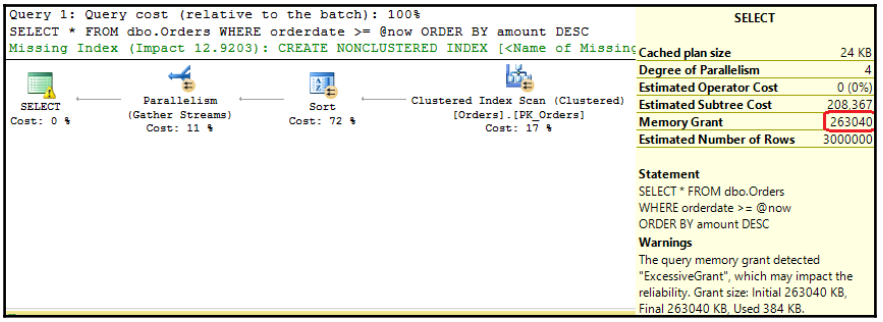





Query 1: Query cost (relative to the batch): 100%
SELECT * FROM Sales.Orders o INNER JOIN dbo.ParseInt(@SalesPersonList,',') a ON a.Item = o.Salespe
SELECT
Cost: 0 %
Sequence
Cost: 2 %
Table Valued Function
[ParseInt] [a]
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 68 %
Clustered Index Scan (Clustered)
[Orders].[PK_Sales_Orders] [o]
Cost: 1 %
Table Scan
[ParseInt] [a]
Cost: 29 %
SELECT
Cached plan size 32 KB
Degree of Parallelism 0
Estimated Operator Cost 0 (0%)
Estimated Subtree Cost 48.1757
Estimated Number of Rows 735950


Query 1: Query cost (relative to the batch): 100%
INSERT INTO dbo.T1(id, c1) SELECT id, c1 FROM dbo.T1 WHERE id < 10
INSERT
Cost: 0 %
Table Insert
[T1]
Cost: 38 %
Table Spool
(Eager Spool)
Cost: 50 %
Table Scan
[T1]
Cost: 12 %


Query 1: Query cost (relative to the batch): 50%
INSERT INTO dbo.T1(id, c1) SELECT id, c1 FROM dbo.T1 WHERE id < 10
INSERT
Cost: 0 %
Table Insert
[T1]
Cost: 38 %
Table Spool
(Eager Spool)
Cost: 50 %
Table Scan
[T1]
Cost: 12 %
Query 2: Query cost (relative to the batch): 50%
INSERT INTO dbo.T1(id, c1) SELECT id, c1 FROM dbo.T1 WHERE id < 10 OPTION (NO_PERFORMANCE_SPOOL)
INSERT
Cost: 0 %
Table Insert
[T1]
Cost: 38 %
Table Spool
(Eager Spool)
Cost: 50 %
Table Scan
[T1]
Cost: 12 %


Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount DESC
Missing Index (Impact 12.9203): CREATE NONCLUSTERED INDEX [<Name of Missing
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 11 %
Sort
Cost: 72 %
Clustered Index Scan (Clustered)
[Orders].[PK_Orders]
Cost: 17 %
SELECT
Cached plan size 24 KB
Degree of Parallelism 4
Estimated Operator Cost 0 (0%)
Estimated Subtree Cost 208.367
Memory Grant 263040
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC
Warnings
The query memory grant detected "ExcessiveGrant", which may impact the reliability. Grant size: Initial 263040 KB, Final 263040 KB, Used 384 KB.

```
<?xml version="1.0" encoding="utf-16"?>
<ShowPlanXML xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xsd="http
  <BatchSequence>
    <Batch>
      <Statements>
        <StmtSimple StatementCompId="2" StatementEstRows="3000000" StatementId="1"
          <StatementSetOptions ANSI_NULLS="true" ANSI_PADDING="true" ANSI_WARNINGS
          <QueryPlan DegreeOfParallelism="4" MemoryGrant="263040" CachedPlanSize="
            <ThreadStat Branches="1" UsedThreads="4">...</ThreadStat>
            <MissingIndexes>...</MissingIndexes>
            <Warnings>
              <MemoryGrantWarning GrantWarningKind="Excessive Grant" RequestedMemo
            </Warnings>
            <MemoryGrantInfo
                    SerialRequiredMemory="512"
                    SerialDesiredMemory="261096"
                    RequiredMemory="2432"
                    DesiredMemory="263040"
                    RequestedMemory="263040"
                    GrantWaitTime="0"
                    GrantedMemory="263040"
                    MaxUsedMemory="384"
                    MaxQueryMemory="702608" />
```

```
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount DESC
Missing Index (Impact 12.9203): CREATE NONCLUSTERED INDEX [<Name of Missing
```

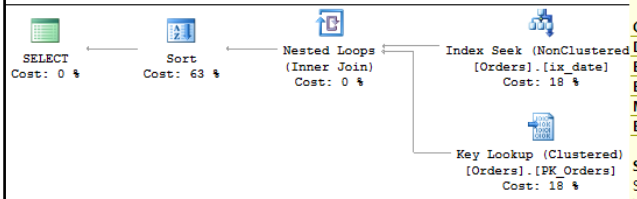
SELECT

Cached plan size	24 KB
Degree of Parallelism	4
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	208,367
Memory Grant	2432
Estimated Number of Rows	3000000

Statement

```
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC
OPTION (MAX_GRANT_PERCENT=0.001)
```

```
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= GETDATE() ORDER BY ar
```

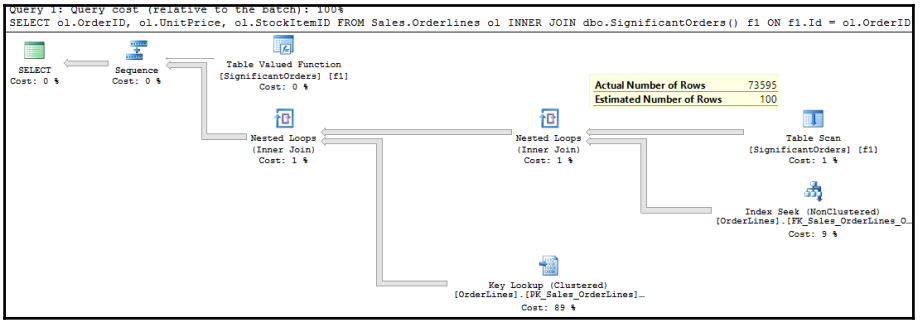


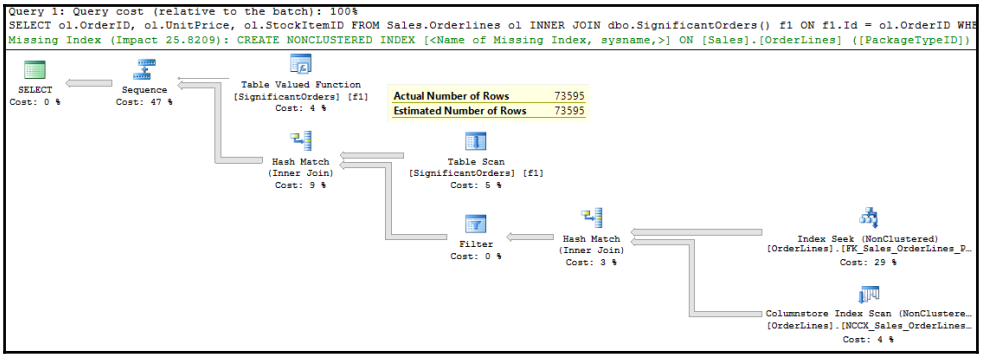
SELECT

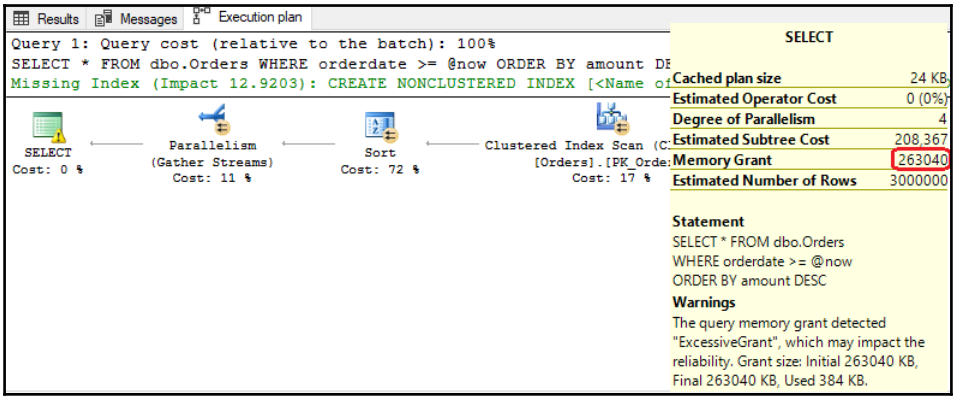
Cached plan size	32 KB
Degree of Parallelism	1
Estimated Operator Cost	0 (0%)
Estimated Subtree Cost	0,0179317
Memory Grant	1088
Estimated Number of Rows	1

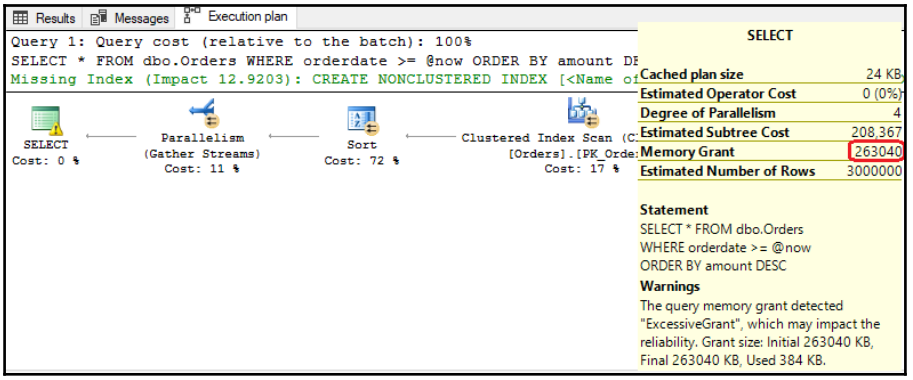
Statement

```
SELECT * FROM dbo.Orders
WHERE orderdate >= GETDATE()
ORDER BY amount DESC
```


Query 1: Query cost (relative to the batch): 100%
SELECT ol.OrderID, ol.UnitPrice, ol.StockItemID FROM Sales.Orderlines ol INNER JOIN dbo.SignificantOrders() f1 ON f1.Id = ol.OrderID
SELECT
Cost: 0 %
Sequence
Cost: 0 %
Table Valued Function
[SignificantOrders] [f1]
Cost: 0 %
Actual Number of Rows 73595
Estimated Number of Rows 100
Nested Loops
(Inner Join)
Cost: 1 %
Nested Loops
(Inner Join)
Cost: 1 %
Table Scan
[SignificantOrders] [f1]
Cost: 1 %
Index Seek (NonClustered)
[OrderLines].[FK_Sales_OrderLines_O...
Cost: 9 %
Key Lookup (Clustered)
[OrderLines].[PK_Sales_OrderLines]...
Cost: 89 %


Query 1: Query cost (relative to the batch): 100%
SELECT ol.OrderID, ol.UnitPrice, ol.StockItemID FROM Sales.Orderlines ol INNER JOIN dbo.SignificantOrders() f1 ON f1.Id = ol.OrderID WHE
Missing Index (Impact 25.8209): CREATE NONCLUSTERED INDEX [<Name of Missing Index, sysname,>] ON [Sales].[OrderLines] ([PackageTypeID])
SELECT
Cost: 0 %
Sequence
Cost: 47 %
Table Valued Function
[SignificantOrders] [f1]
Cost: 4 %
Actual Number of Rows 73595
Estimated Number of Rows 73595
Hash Match
(Inner Join)
Cost: 9 %
Table Scan
[SignificantOrders] [f1]
Cost: 5 %
Filter
Cost: 0 %
Hash Match
(Inner Join)
Cost: 3 %
Index Seek (NonClustered)
[OrderLines].[FK_Sales_OrderLines_P...
Cost: 29 %
Columnstore Index Scan (NonClustere...
[OrderLines].[NCCX_Sales_OrderLines...
Cost: 4 %


Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount DE
Missing Index (Impact 12.9203): CREATE NONCLUSTERED INDEX [<Name of
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 11 %
Sort
Cost: 72 %
Clustered Index Scan (C...
[Orders].[PK_Orde...
Cost: 17 %
SELECT
Cached plan size 24 KB
Estimated Operator Cost 0 (0%)
Degree of Parallelism 4
Estimated Subtree Cost 208.367
Memory Grant 263040
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC
Warnings
The query memory grant detected "ExcessiveGrant", which may impact the reliability. Grant size: Initial 263040 KB, Final 263040 KB, Used 384 KB.


Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount DE
Missing Index (Impact 12.9203): CREATE NONCLUSTERED INDEX [<Name of
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 11 %
Sort
Cost: 72 %
Clustered Index Scan (C
[Orders].[PK_Orde
Cost: 17 %
SELECT
Cached plan size 24 KB
Estimated Operator Cost 0 (0%)
Degree of Parallelism 4
Estimated Subtree Cost 208.367
Memory Grant 263040
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC
Warnings
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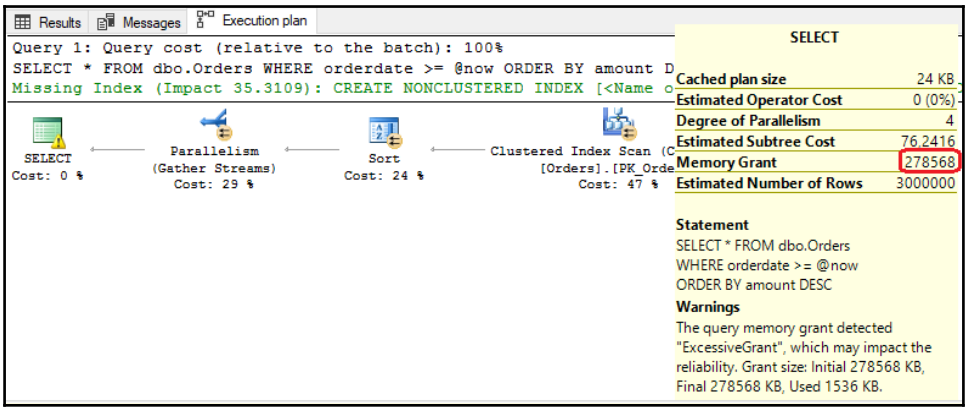
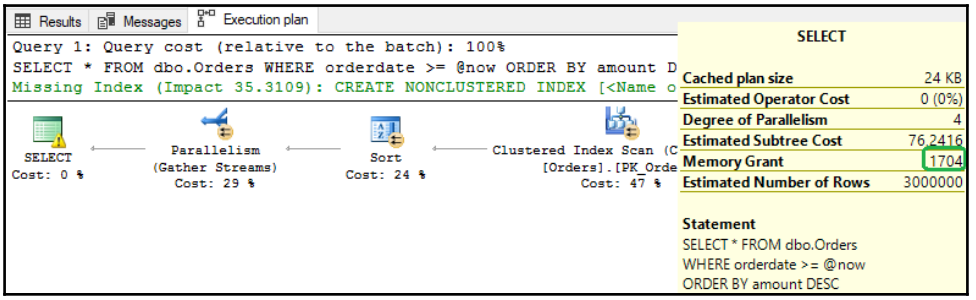
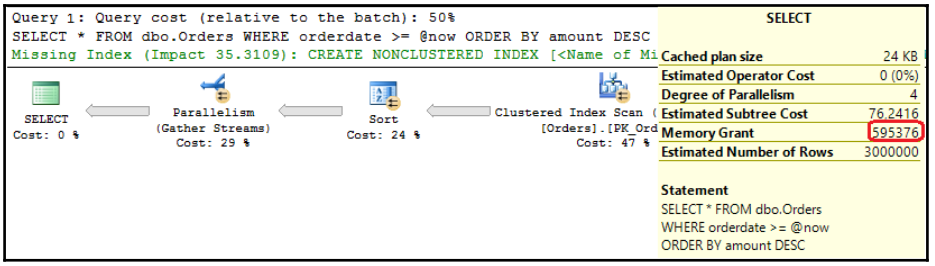
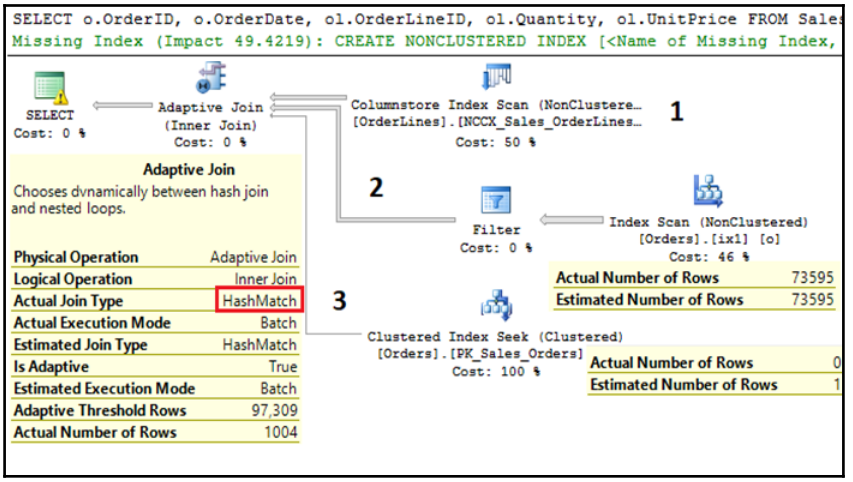
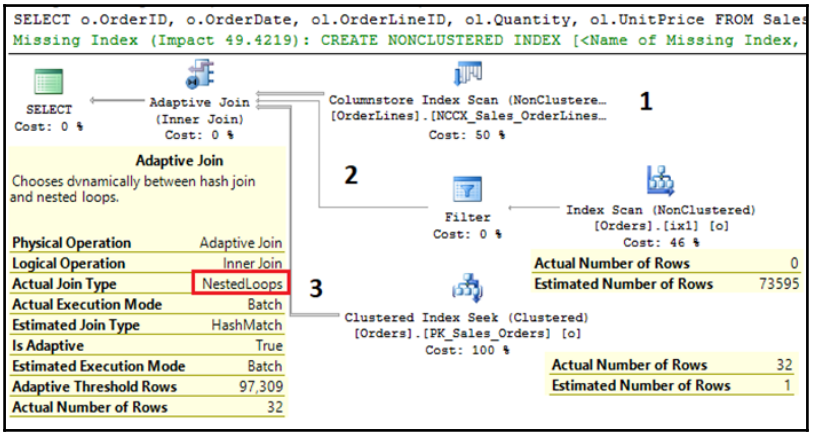
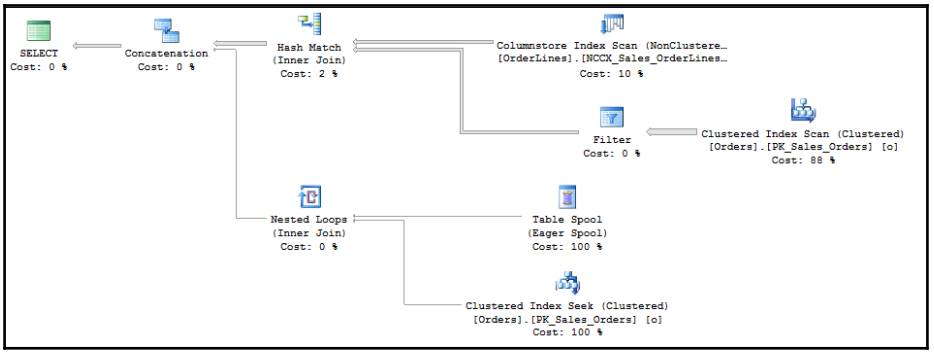

Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount D
Missing Index (Impact 35.3109): CREATE NONCLUSTERED INDEX [<Name o
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 29 %
Sort
Cost: 24 %
Clustered Index Scan (C
[Orders].[PK_Orde
Cost: 47 %
SELECT
Cached plan size 24 KB
Estimated Operator Cost 0 (0%)
Degree of Parallelism 4
Estimated Subtree Cost 76.2416
Memory Grant 278568
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC
Warnings
The query memory grant detected "ExcessiveGrant", which may impact the reliability. Grant size: Initial 278568 KB, Final 278568 KB, Used 1536 KB.

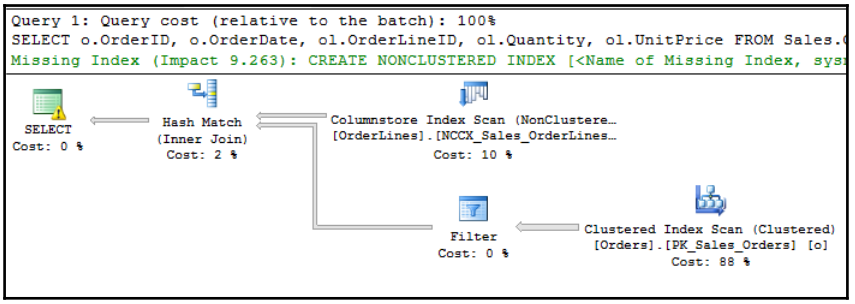

Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount D
Missing Index (Impact 35.3109): CREATE NONCLUSTERED INDEX [<Name o
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 29 %
Sort
Cost: 24 %
Clustered Index Scan (C
[Orders].[PK_Orde
Cost: 47 %
SELECT
Cached plan size 24 KB
Estimated Operator Cost 0 (0%)
Degree of Parallelism 4
Estimated Subtree Cost 76.2416
Memory Grant 1704
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC


Query 1: Query cost (relative to the batch): 50%
SELECT * FROM dbo.Orders WHERE orderdate >= @now ORDER BY amount DESC
Missing Index (Impact 35.3109): CREATE NONCLUSTERED INDEX [<Name of Mi
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 29 %
Sort
Cost: 24 %
Clustered Index Scan
[Orders].[PK_Ord
Cost: 47 %
SELECT
Cached plan size 24 KB
Estimated Operator Cost 0 (0%)
Degree of Parallelism 4
Estimated Subtree Cost 76.2416
Memory Grant 595376
Estimated Number of Rows 3000000
Statement
SELECT * FROM dbo.Orders
WHERE orderdate >= @now
ORDER BY amount DESC

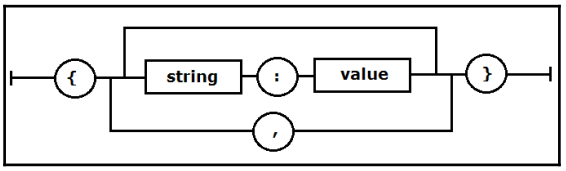

SELECT o.OrderID, o.OrderDate, ol.OrderLineID, ol.Quantity, ol.UnitPrice FROM Sales
Missing Index (Impact 49.4219): CREATE NONCLUSTERED INDEX [<Name of Missing Index,
SELECT
Cost: 0 %
Adaptive Join
(Inner Join)
Cost: 0 %
Columnstore Index Scan (NonClustere…
[OrderLines].[NCCX_Sales_OrderLines…
Cost: 50 %
1
2
Filter
Cost: 0 %
Index Scan (NonClustered)
[Orders].[ix1] [o]
Cost: 46 %
Actual Number of Rows 73595
Estimated Number of Rows 73595
3
Clustered Index Seek (Clustered)
[Orders].[PK_Sales_Orders]
Cost: 100 %
Actual Number of Rows 0
Estimated Number of Rows 1
Adaptive Join
Chooses dynamically between hash join and nested loops.
Physical Operation Adaptive Join
Logical Operation Inner Join
Actual Join Type HashMatch
Actual Execution Mode Batch
Estimated Join Type HashMatch
Is Adaptive True
Estimated Execution Mode Batch
Adaptive Threshold Rows 97,309
Actual Number of Rows 1004

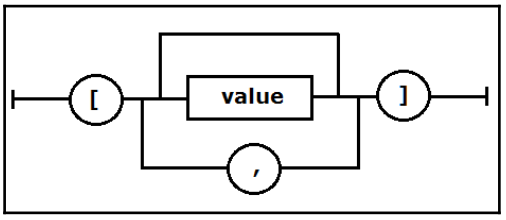

SELECT o.OrderID, o.OrderDate, ol.OrderLineID, ol.Quantity, ol.UnitPrice FROM Sales
Missing Index (Impact 49.4219): CREATE NONCLUSTERED INDEX [<Name of Missing Index,
SELECT
Cost: 0 %
Adaptive Join
(Inner Join)
Cost: 0 %
Columnstore Index Scan (NonClustere…
[OrderLines].[NCCX_Sales_OrderLines…
Cost: 50 %
1
2
Filter
Cost: 0 %
Index Scan (NonClustered)
[Orders].[ix1] [o]
Cost: 46 %
Actual Number of Rows 0
Estimated Number of Rows 73595
3
Clustered Index Seek (Clustered)
[Orders].[PK_Sales_Orders] [o]
Cost: 100 %
Actual Number of Rows 32
Estimated Number of Rows 1
Adaptive Join
Chooses dynamically between hash join and nested loops.
Physical Operation Adaptive Join
Logical Operation Inner Join
Actual Join Type NestedLoops
Actual Execution Mode Batch
Estimated Join Type HashMatch
Is Adaptive True
Estimated Execution Mode Batch
Adaptive Threshold Rows 97,309
Actual Number of Rows 32

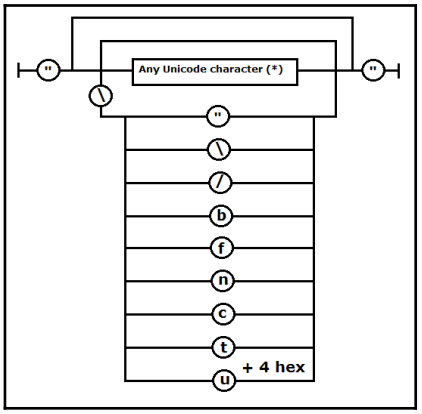

SELECT
Cost: 0 %
Concatenation
Cost: 0 %
Hash Match
(Inner Join)
Cost: 2 %
Columnstore Index Scan (NonClustere…
[OrderLines].[NCCX_Sales_OrderLines…
Cost: 10 %
Filter
Cost: 0 %
Clustered Index Scan (Clustered)
[Orders].[PK_Sales_Orders] [o]
Cost: 88 %
Nested Loops
(Inner Join)
Cost: 0 %
Table Spool
(Eager Spool)
Cost: 100 %
Clustered Index Seek (Clustered)
[Orders].[PK_Sales_Orders] [o]
Cost: 100 %


Query 1: Query cost (relative to the batch): 100%
SELECT o.OrderID, o.OrderDate, ol.OrderLineID, ol.Quantity, ol.UnitPrice FROM Sales.
Missing Index (Impact 9.263): CREATE NONCLUSTERED INDEX [<Name of Missing Index, sys
SELECT
Cost: 0 %
Hash Match
(Inner Join)
Cost: 2 %
Columnstore Index Scan (NonClustere…
[OrderLines].[NCCX_Sales_OrderLines…
Cost: 10 %
Filter
Cost: 0 %
Clustered Index Scan (Clustered)
[Orders].[PK_Sales_Orders] [o]
Cost: 88 %

Chapter 5: JSON Support in SQL Server







Results | Messages

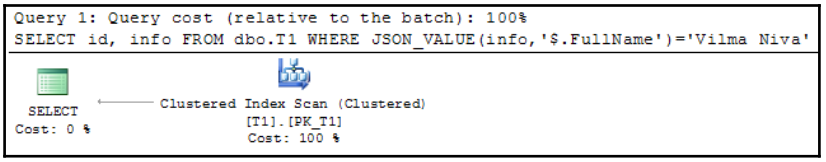
	BulkColumn
1	[{"PersonID":1,"FullName":"Data Conversion Only","LogonName...

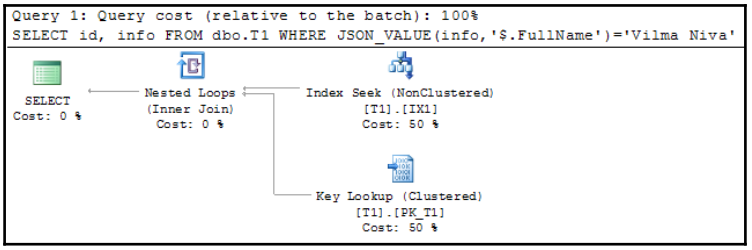
Results | Messages

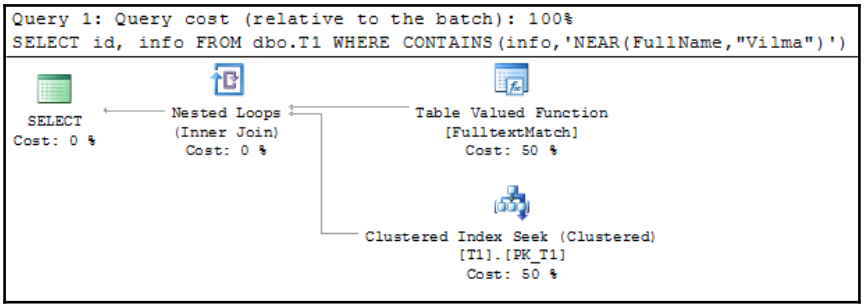
	key	value	type
1	0	{"PersonID":1,"FullName":"Data Conversion Only","Lo...	5
2	1	{"PersonID":2,"FullName":"Kayla Woodcock","Logon...	5
3	2	{"PersonID":3,"FullName":"Hudson Onslow","LogonNa...	5
4	3	{"PersonID":4,"FullName":"Isabella Rupp","LogonNam...	5
5	4	{"PersonID":5,"FullName":"Eva Muirden","LogonName...	5
6	5	{"PersonID":6,"FullName":"Sophia Hinton","LogonNam...	5
7	6	{"PersonID":7,"FullName":"Amy Trefl","LogonName":"...	5
8	7	{"PersonID":8,"FullName":"Anthony Grosse","LogonNa...	5
9	8	{"PersonID":9,"FullName":"Alica Fatnowna","LogonNa...	5
10	9	{"PersonID":10,"FullName":"Stella Rosenhain","Logon...	5

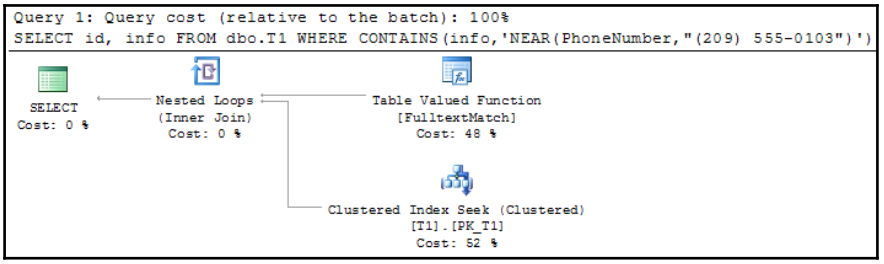
Results | Messages

	PersonID	FullName	PhoneNumber	FaxNumber	EmailAddress	LogonName	IsEmployee	IsSalesperson
1	1	Data Conversion Only	NULL	NULL	NULL	NO LOGON	0	0
2	2	Kayla Woodcock	(415) 555-0102	(415) 555-0103	kaylaw@wideworldimporters.com	kaylaw@wideworldimporters.com	1	1
3	3	Hudson Onslow	(415) 555-0102	(415) 555-0103	hudsono@wideworldimporters.com	hudsono@wideworldimporters.com	1	1
4	4	Isabella Rupp	(415) 555-0102	(415) 555-0103	isabellar@wideworldimporters.com	isabellar@wideworldimporters.com	1	0
5	5	Eva Muirden	(415) 555-0102	(415) 555-0103	evam@wideworldimporters.com	evam@wideworldimporters.com	1	0
6	6	Sophia Hinton	(415) 555-0102	(415) 555-0103	sophiah@wideworldimporters.com	sophiah@wideworldimporters.com	1	1
7	7	Amy Trefl	(415) 555-0102	(415) 555-0103	amyt@wideworldimporters.com	amyt@wideworldimporters.com	1	1
8	8	Anthony Grosse	(415) 555-0102	(415) 555-0103	anthonyg@wideworldimporters.com	anthonyg@wideworldimporters.com	1	1
9	9	Alica Fatnowna	(415) 555-0102	(415) 555-0103	alicaf@wideworldimporters.com	alicaf@wideworldimporters.com	1	0
10	10	Stella Rosenhain	(415) 555-0102	(415) 555-0103	stellar@wideworldimporters.com	stellar@wideworldimporters.com	1	0

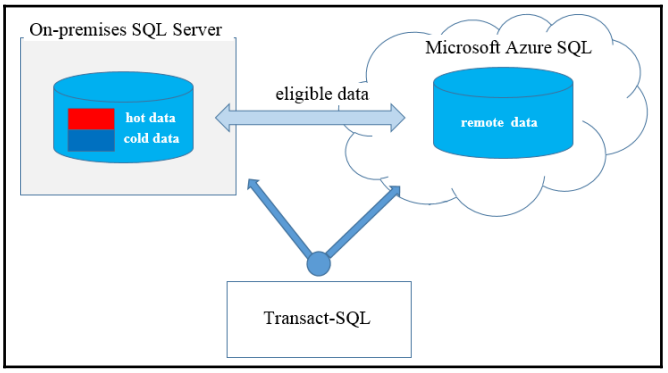

Query 1: Query cost (relative to the batch): 100%
SELECT id, info FROM dbo.T1 WHERE JSON_VALUE(info,'$.FullName')='Vilma Niva'
SELECT
Cost: 0 %
Clustered Index Scan (Clustered)
[T1].[PK_T1]
Cost: 100 %

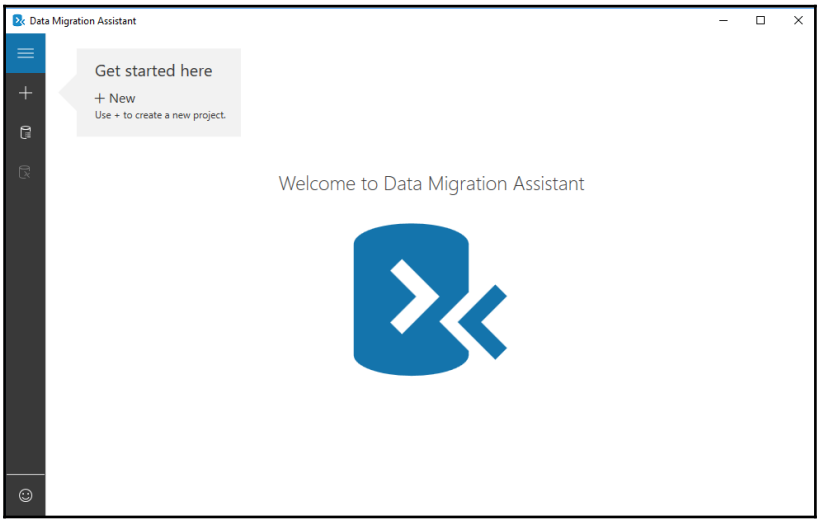

Query 1: Query cost (relative to the batch): 100%
SELECT id, info FROM dbo.T1 WHERE JSON_VALUE(info,'$.FullName')='Vilma Niva'
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Index Seek (NonClustered)
[T1].[IX1]
Cost: 50 %
Key Lookup (Clustered)
[T1].[PK_T1]
Cost: 50 %

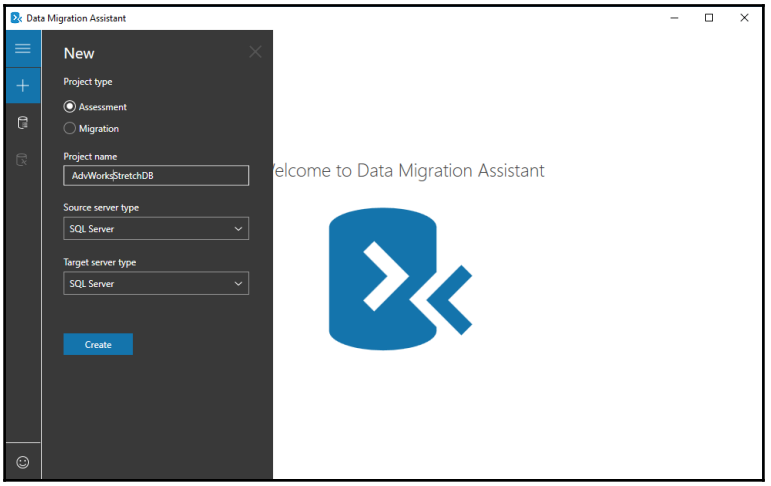

Query 1: Query cost (relative to the batch): 100%
SELECT id, info FROM dbo.T1 WHERE CONTAINS(info,'NEAR(FullName,"Vilma")')
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Table Valued Function
[FulltextMatch]
Cost: 50 %
Clustered Index Seek (Clustered)
[T1].[PK_T1]
Cost: 50 %

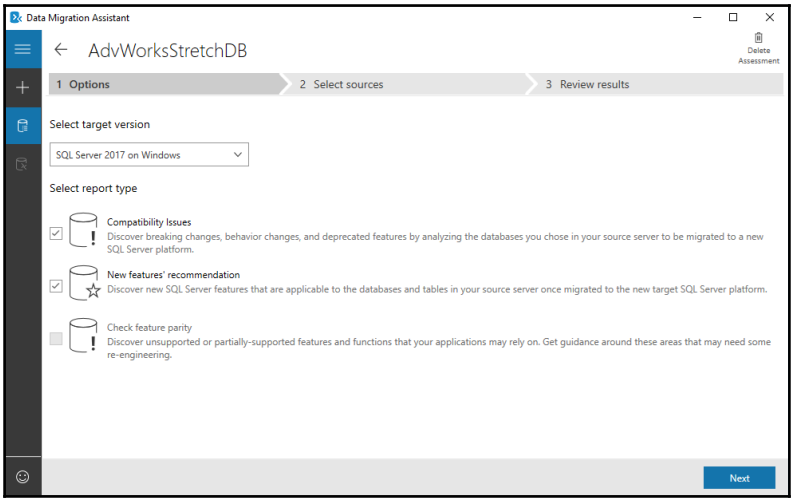

Query 1: Query cost (relative to the batch): 100%
SELECT id, info FROM dbo.T1 WHERE CONTAINS(info,'NEAR(PhoneNumber,"(209) 555-0103")')
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Table Valued Function
[FulltextMatch]
Cost: 48 %
Clustered Index Seek (Clustered)
[T1].[PK_T1]
Cost: 52 %

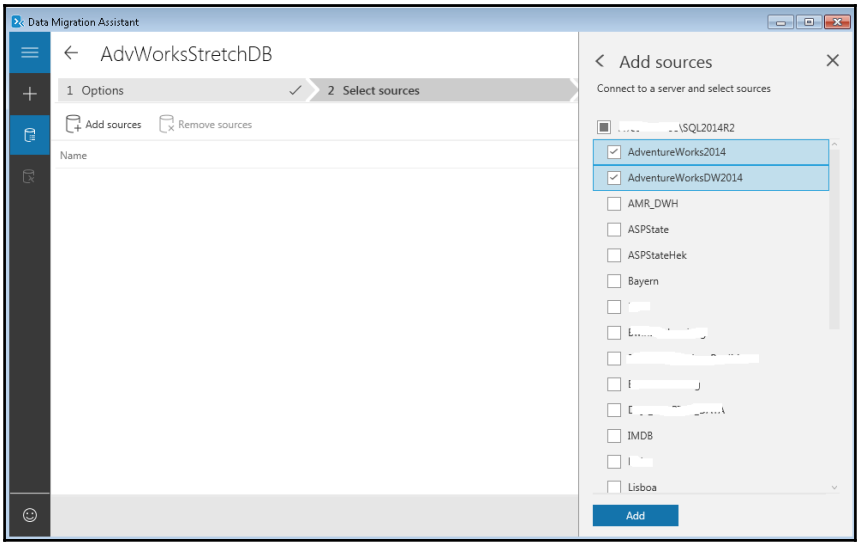
Chapter 6: Stretch Database

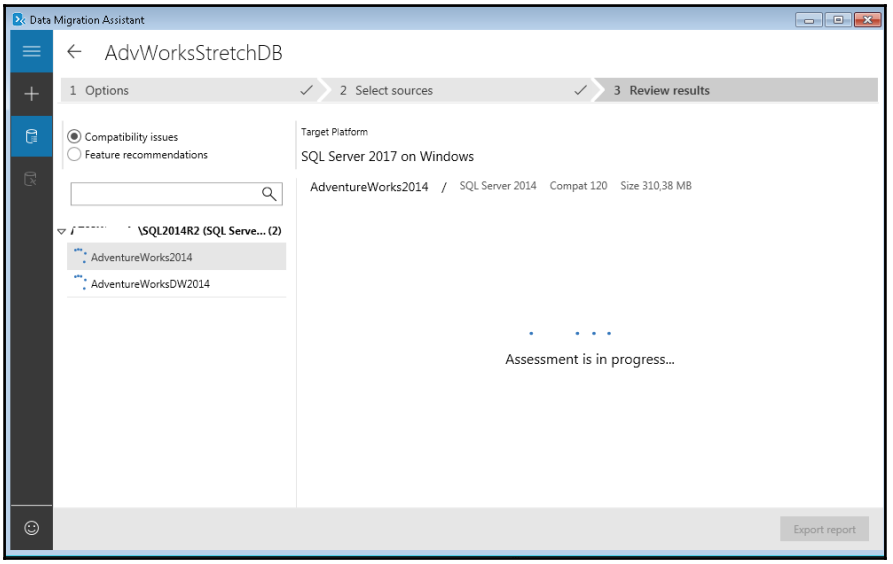


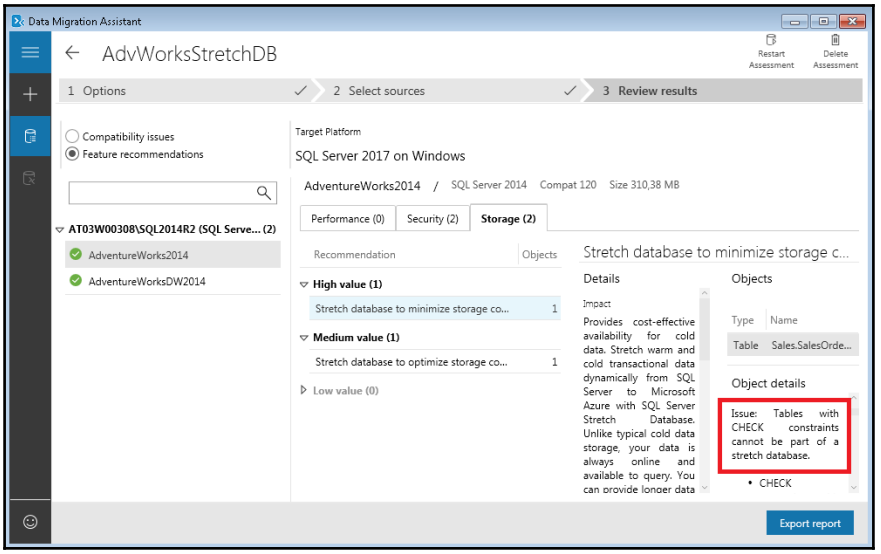


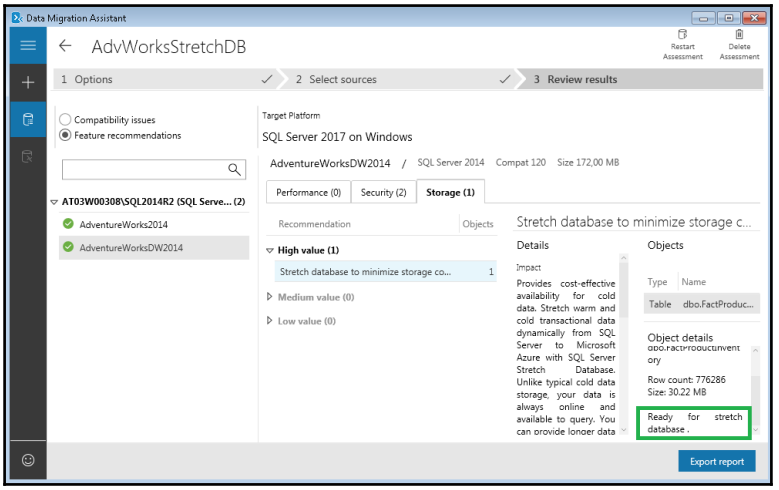

Data Migration Assistant
New
Project type
Assessment
Migration
Project name
AdvWorksStretchDB
Source server type
SQL Server
Target server type
SQL Server
Create
elcome to Data Migration Assistant

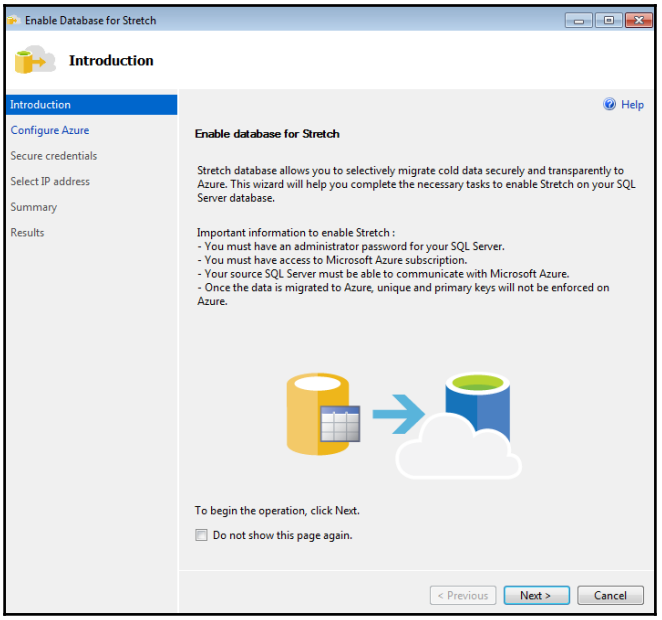

Data Migration Assistant
AdvWorksStretchDB
Delete Assessment
1 Options
2 Select sources
3 Review results
Select target version
SQL Server 2017 on Windows
Select report type
Compatibility Issues
Discover breaking changes, behavior changes, and deprecated features by analyzing the databases you chose in your source server to be migrated to a new SQL Server platform.
New features' recommendation
Discover new SQL Server features that are applicable to the databases and tables in your source server once migrated to the new target SQL Server platform.
Check feature parity
Discover unsupported or partially-supported features and functions that your applications may rely on. Get guidance around these areas that may need some re-engineering.
Next

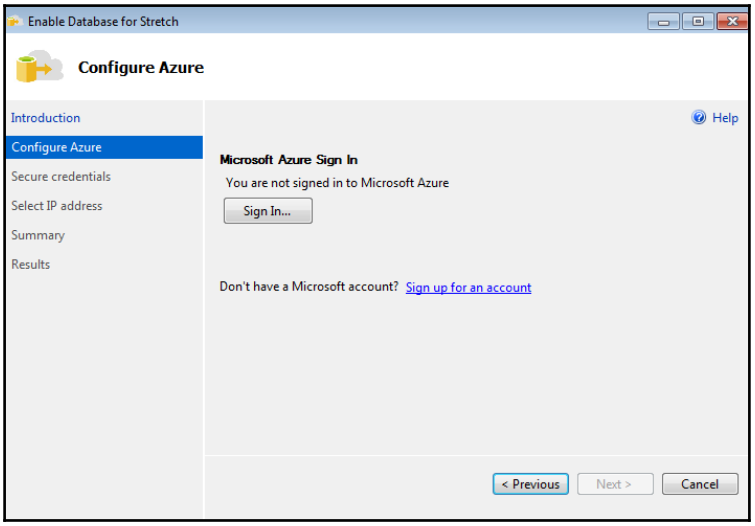

Data Migration Assistant
AdvWorksStretchDB
1 Options
2 Select sources
Add sources
Remove sources
Name
Add sources
Connect to a server and select sources
\SQL2014R2
AdventureWorks2014
AdventureWorksDW2014
AMR_DWH
ASPState
ASPStateHek
Bayern
IMDB
Lisboa
Add

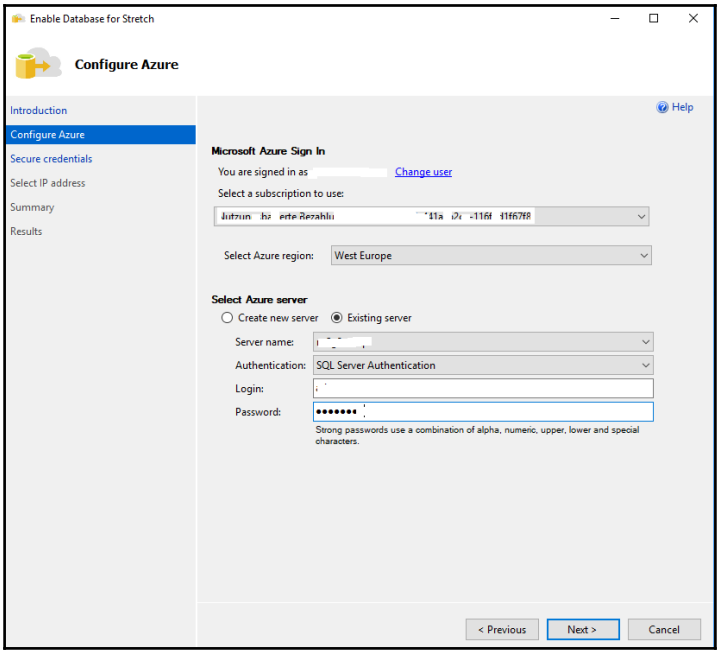

Data Migration Assistant
AdvWorksStretchDB
1 Options
2 Select sources
3 Review results
Compatibility issues
Feature recommendations
\SQL2014R2 (SQL Serve... (2)
AdventureWorks2014
AdventureWorksDW2014
Target Platform
SQL Server 2017 on Windows
AdventureWorks2014 / SQL Server 2014 Compat 120 Size 310,38 MB
Assessment is in progress...
Export report

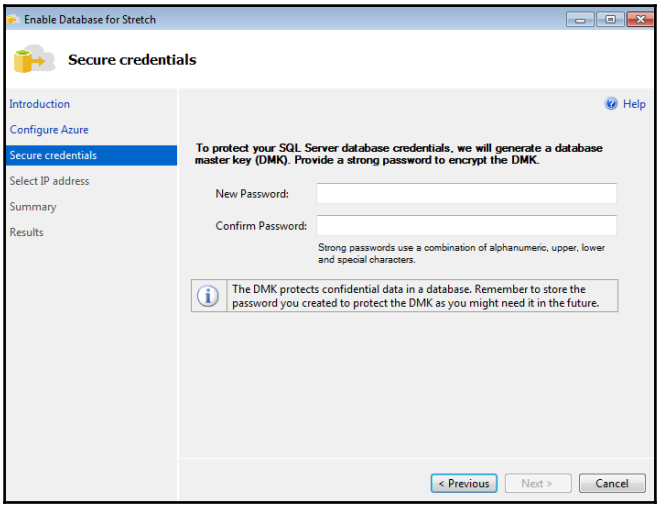

Data Migration Assistant
AdvWorksStretchDB
Restart Assessment
Delete Assessment
1 Options
2 Select sources
3 Review results
Compatibility issues
Feature recommendations
Target Platform
SQL Server 2017 on Windows
AdventureWorks2014 / SQL Server 2014 Compat 120 Size 310,38 MB
Performance (0)
Security (2)
Storage (2)
AT03W00308\SQL2014R2 (SQL Serve... (2)
AdventureWorks2014
AdventureWorksDW2014
Recommendation
Objects
High value (1)
Stretch database to minimize storage co... 1
Medium value (1)
Stretch database to optimize storage co... 1
Low value (0)
Stretch database to minimize storage c...
Details
Impact
Provides cost-effective availability for cold data. Stretch warm and cold transactional data dynamically from SQL Server to Microsoft Azure with SQL Server Stretch Database. Unlike typical cold data storage, your data is always online and available to query. You can provide longer data
Objects
Type
Name
Table
Sales.SalesOrde...
Object details
Issue: Tables with CHECK constraints cannot be part of a stretch database.
• CHECK
Export report

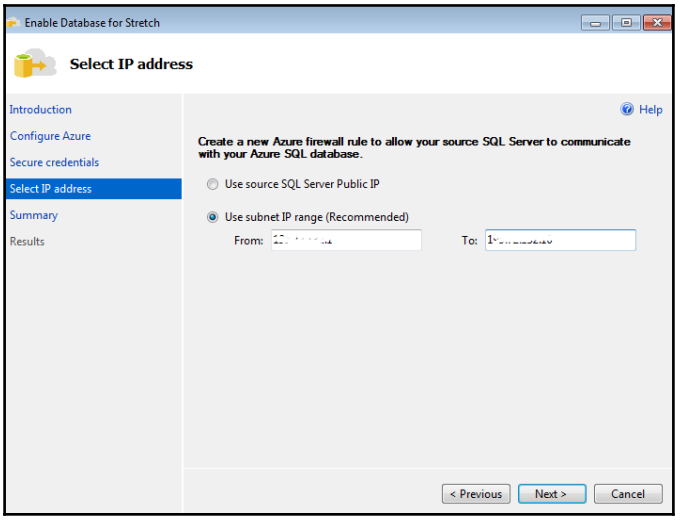

Data Migration Assistant
AdvWorksStretchDB
Restart Assessment
Delete Assessment
1 Options
2 Select sources
3 Review results
Compatibility issues
Feature recommendations
Target Platform
SQL Server 2017 on Windows
AdventureWorksDW2014 / SQL Server 2014 Compat 120 Size 172,00 MB
Performance (0)
Security (2)
Storage (1)
AT03W00308\SQL2014R2 (SQL Serve... (2)
AdventureWorks2014
AdventureWorksDW2014
Recommendation
Objects
High value (1)
Stretch database to minimize storage co... 1
Medium value (0)
Low value (0)
Stretch database to minimize storage c...
Details
Impact
Provides cost-effective availability for cold data. Stretch warm and cold transactional data dynamically from SQL Server to Microsoft Azure with SQL Server Stretch Database. Unlike typical cold data storage, your data is always online and available to query. You can provide longer data
Objects
Type
Name
Table
dbo.FactProduc...
Object details
Row count: 776286
Size: 30.22 MB
Ready for stretch database .
Export report

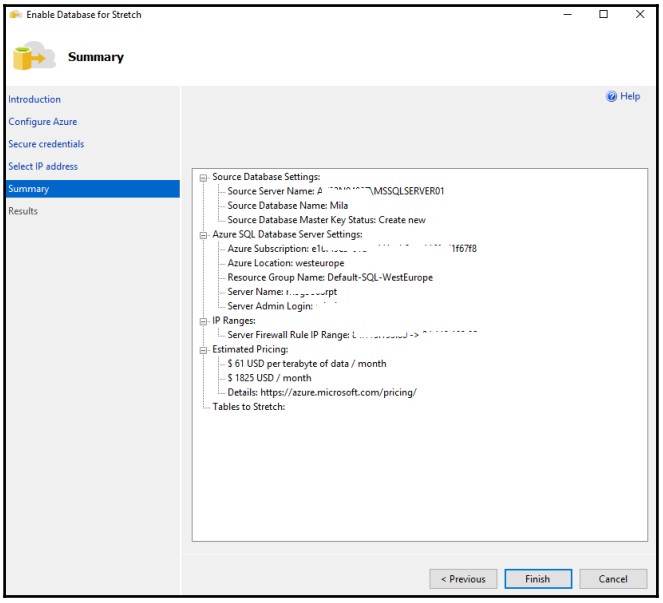

Enable Database for Stretch
Introduction
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
Enable database for Stretch
Stretch database allows you to selectively migrate cold data securely and transparently to Azure. This wizard will help you complete the necessary tasks to enable Stretch on your SQL Server database.
Important information to enable Stretch :
- You must have an administrator password for your SQL Server.
- You must have access to Microsoft Azure subscription.
- Your source SQL Server must be able to communicate with Microsoft Azure.
- Once the data is migrated to Azure, unique and primary keys will not be enforced on Azure.
To begin the operation, click Next.
Do not show this page again.
< Previous
Next >
Cancel

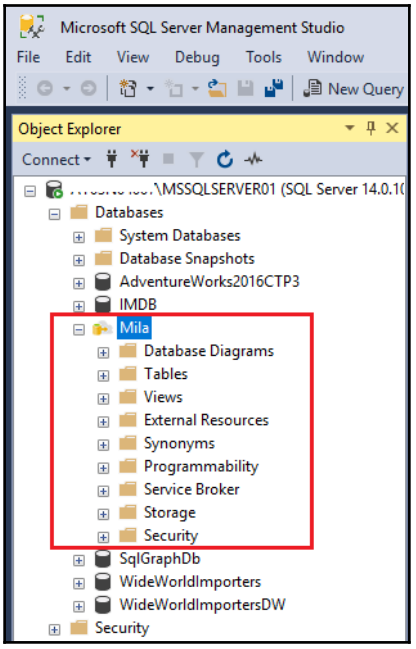

Enable Database for Stretch
Configure Azure
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
Microsoft Azure Sign In
You are not signed in to Microsoft Azure
Sign In...
Don't have a Microsoft account? Sign up for an account
< Previous
Next >
Cancel

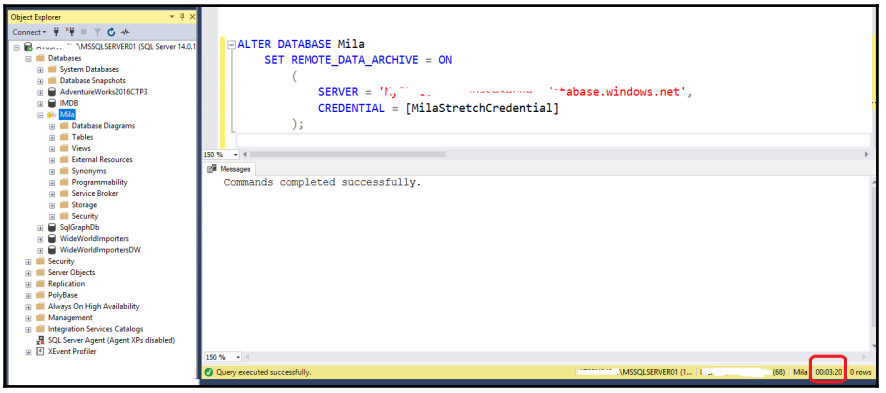

Enable Database for Stretch
Configure Azure
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
Microsoft Azure Sign In
You are signed in as
Change user
Select a subscription to use:
Select Azure region:
West Europe
Select Azure server
Create new server
Existing server
Server name:
Authentication:
SQL Server Authentication
Login:
Password:
Strong passwords use a combination of alpha, numeric, upper, lower and special characters.
< Previous
Next >
Cancel

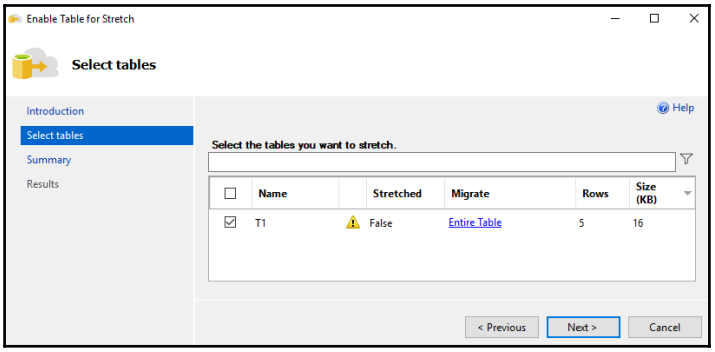

Enable Database for Stretch
Secure credentials
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
To protect your SQL Server database credentials, we will generate a database master key (DMK). Provide a strong password to encrypt the DMK.
New Password:
Confirm Password:
Strong passwords use a combination of alphanumeric, upper, lower and special characters.
The DMK protects confidential data in a database. Remember to store the password you created to protect the DMK as you might need it in the future.
< Previous
Next >
Cancel

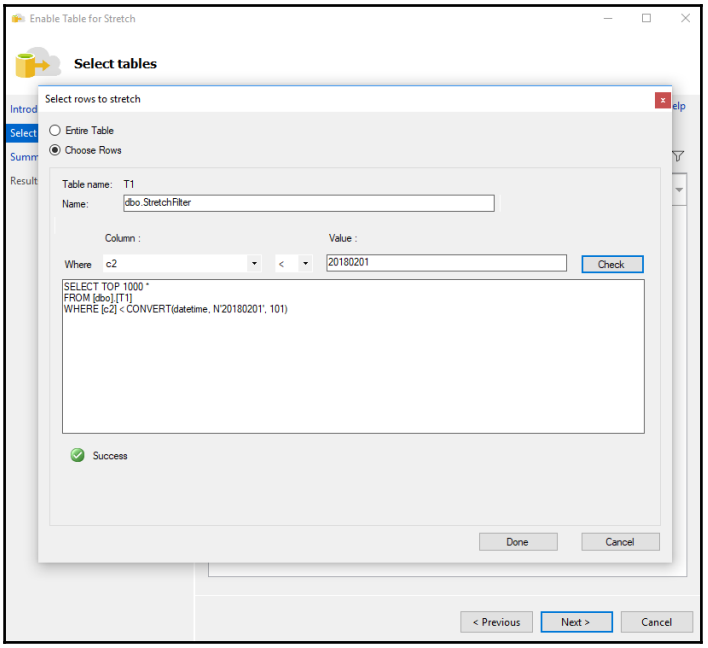

Enable Database for Stretch
Select IP address
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
Create a new Azure firewall rule to allow your source SQL Server to communicate with your Azure SQL database.
Use source SQL Server Public IP
Use subnet IP range (Recommended)
From:
To:
< Previous
Next >
Cancel

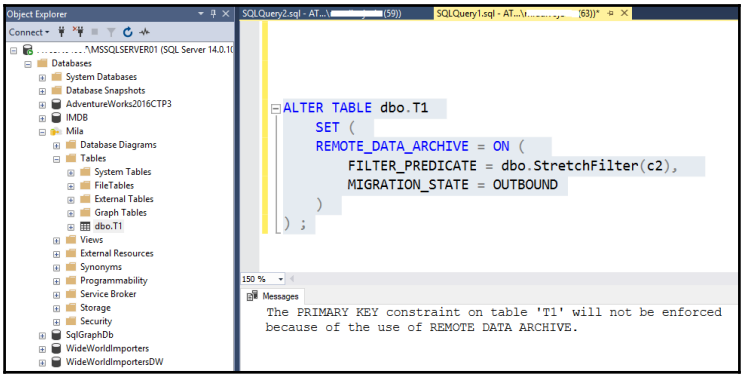

Enable Database for Stretch
Summary
Introduction
Configure Azure
Secure credentials
Select IP address
Summary
Results
Help
Source Database Settings:
Source Server Name:
\MSSQLSERVER01
Source Database Name: Mila
Source Database Master Key Status: Create new
Azure SQL Database Server Settings:
Azure Location: westeurope
Resource Group Name: Default-SQL-WestEurope
Server Admin Login:
IP Ranges:
Estimated Pricing:
$ 61 USD per terabyte of data / month
$ 1825 USD / month
Details: https://azure.microsoft.com/pricing/
Tables to Stretch:
< Previous
Finish
Cancel

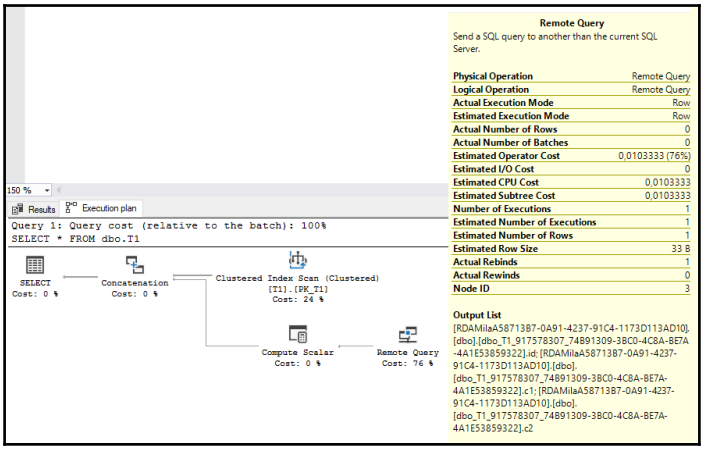

Microsoft SQL Server Management Studio
File Edit View Debug Tools Window
New Query
Object Explorer
Connect
\MSSQLSERVER01 (SQL Server 14.0.10
Databases
System Databases
Database Snapshots
AdventureWorks2016CTP3
IMDB
Mila
Database Diagrams
Tables
Views
External Resources
Synonyms
Programmability
Service Broker
Storage
Security
SqlGraphDb
WideWorldImporters
WideWorldImportersDW
Security

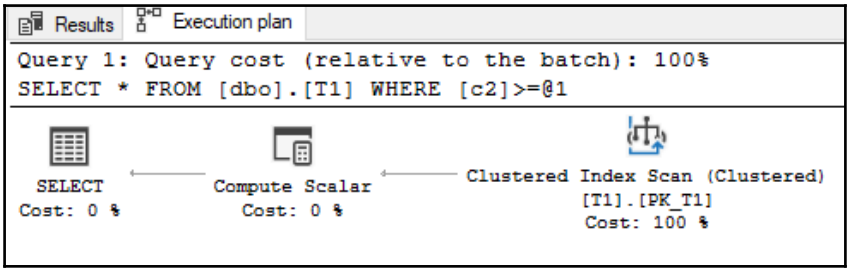

ALTER DATABASE Mila
SET REMOTE_DATA_ARCHIVE = ON
(
SERVER = '
CREDENTIAL = [MilaStretchCredential]
);
Messages
Commands completed successfully.
Query executed successfully.
00:03:20
0 rows

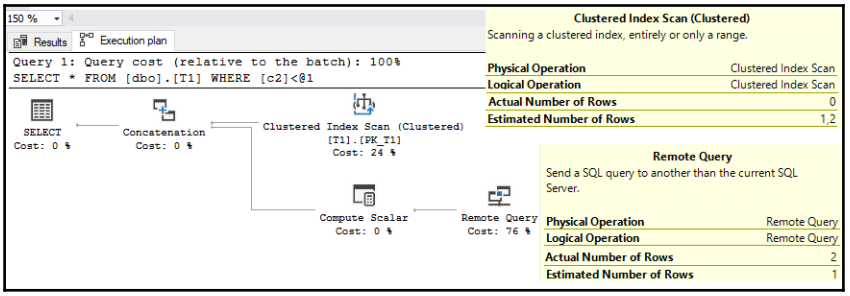

Enable Table for Stretch
Select tables
Introduction
Select tables
Summary
Results
Help
Select the tables you want to stretch.
Name
Stretched
Migrate
Rows
Size (KB)
T1
False
Entire Table
5
16
< Previous
Next >
Cancel

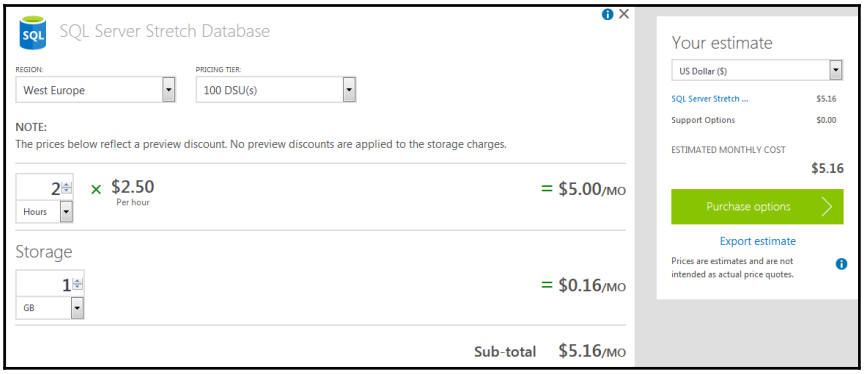

Enable Table for Stretch
Select tables
Select rows to stretch
Entire Table
Choose Rows
Table name: T1
Name: dbo.StretchFilter
Column :
Value :
Where c2 < 20180201
Check
SELECT TOP 1000 *
FROM [dbo].[T1]
WHERE [c2] < CONVERT(datetime, N'20180201', 101)
Success
Done
Cancel
< Previous
Next >
Cancel

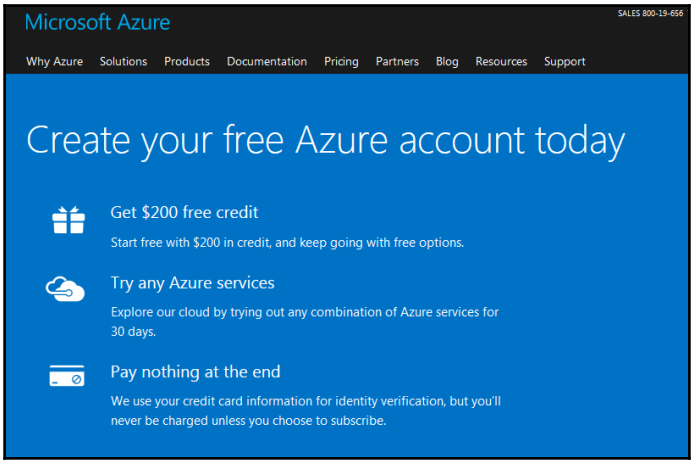

Object Explorer
Connect
Databases
System Databases
Database Snapshots
AdventureWorks2016CTP3
IMDB
Mila
Database Diagrams
Tables
System Tables
FileTables
External Tables
Graph Tables
dbo.T1
Views
External Resources
Synonyms
Programmability
Service Broker
Storage
Security
SqlGraphDb
WideWorldImporters
WideWorldImportersDW
SQLQuery2.sql - AT...
SQLQuery1.sql - AT...
ALTER TABLE dbo.T1
SET (
REMOTE_DATA_ARCHIVE = ON (
FILTER_PREDICATE = dbo.StretchFilter(c2),
MIGRATION_STATE = OUTBOUND
)
) ;
150 %
Messages
The PRIMARY KEY constraint on table 'T1' will not be enforced
because of the use of REMOTE DATA ARCHIVE.

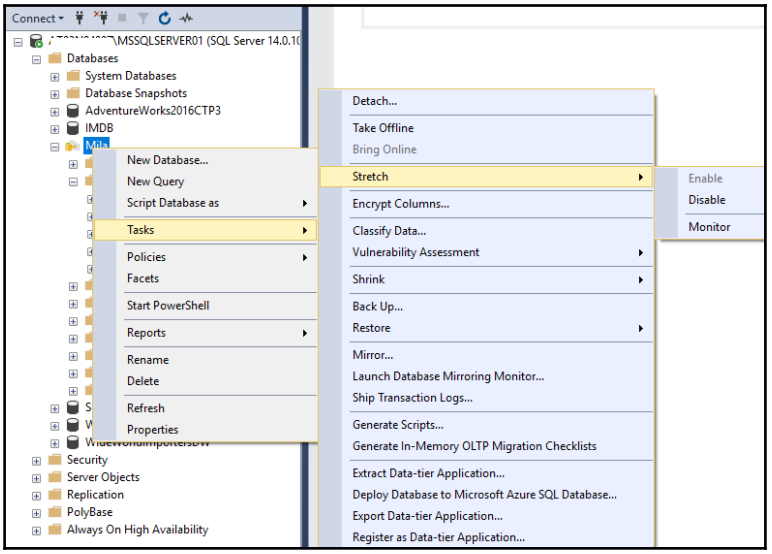

150 %
Results
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.T1
SELECT
Cost: 0 %
Concatenation
Cost: 0 %
Clustered Index Scan (Clustered)
[T1].[PK_T1]
Cost: 24 %
Compute Scalar
Cost: 0 %
Remote Query
Cost: 76 %
Remote Query
Send a SQL query to another than the current SQL Server.
Physical Operation Remote Query
Logical Operation Remote Query
Actual Execution Mode Row
Estimated Execution Mode Row
Actual Number of Rows 0
Actual Number of Batches 0
Estimated Operator Cost 0,0103333 (76%)
Estimated I/O Cost 0
Estimated CPU Cost 0,0103333
Estimated Subtree Cost 0,0103333
Number of Executions 1
Estimated Number of Executions 1
Estimated Number of Rows 1
Estimated Row Size 33 B
Actual Rebinds 1
Actual Rewinds 0
Node ID 3
Output List
[RDAMilaA58713B7-0A91-4237-91C4-1173D113AD10].[dbo].[dbo_T1_917578307_74B91309-3BC0-4C8A-BE7A-4A1E53859322].id; [RDAMilaA58713B7-0A91-4237-91C4-1173D113AD10].[dbo].[dbo_T1_917578307_74B91309-3BC0-4C8A-BE7A-4A1E53859322].c1; [RDAMilaA58713B7-0A91-4237-91C4-1173D113AD10].[dbo].[dbo_T1_917578307_74B91309-3BC0-4C8A-BE7A-4A1E53859322].c2

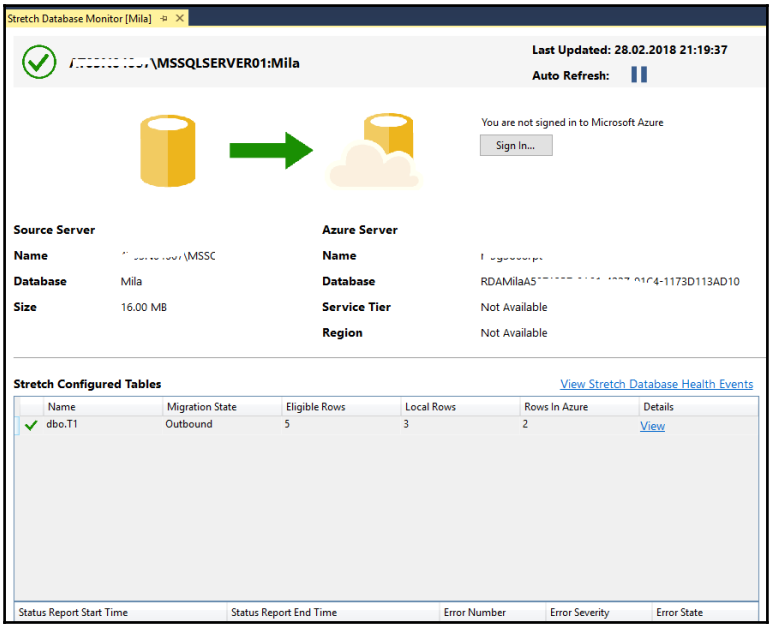

Results
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM [dbo].[T1] WHERE [c2]>=@1
SELECT
Cost: 0 %
Compute Scalar
Cost: 0 %
Clustered Index Scan (Clustered)
[T1].[PK_T1]
Cost: 100 %


150 %
Results
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM [dbo].[T1] WHERE [c2]<@1
SELECT
Cost: 0 %
Concatenation
Cost: 0 %
Clustered Index Scan (Clustered)
[T1].[PK_T1]
Cost: 24 %
Compute Scalar
Cost: 0 %
Remote Query
Cost: 76 %
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 0
Estimated Number of Rows 1,2
Remote Query
Send a SQL query to another than the current SQL Server.
Physical Operation Remote Query
Logical Operation Remote Query
Actual Number of Rows 2
Estimated Number of Rows 1


SQL Server Stretch Database
REGION:
West Europe
PRICING TIER:
100 DSU(s)
NOTE:
The prices below reflect a preview discount. No preview discounts are applied to the storage charges.
2
Hours
× $2.50
Per hour
= $5.00/MO
Storage
1
GB
= $0.16/MO
Sub-total $5.16/MO
Your estimate
US Dollar ($)
SQL Server Stretch ... $5.16
Support Options $0.00
ESTIMATED MONTHLY COST
$5.16
Purchase options
Export estimate
Prices are estimates and are not intended as actual price quotes.


Microsoft Azure
SALES 800-19-656
Why Azure
Solutions
Products
Documentation
Pricing
Partners
Blog
Resources
Support
Create your free Azure account today
Get $200 free credit
Start free with $200 in credit, and keep going with free options.
Try any Azure services
Explore our cloud by trying out any combination of Azure services for 30 days.
Pay nothing at the end
We use your credit card information for identity verification, but you'll never be charged unless you choose to subscribe.


Connect
\MSSQLSERVER01 (SQL Server 14.0.1
Databases
System Databases
Database Snapshots
AdventureWorks2016CTP3
IMDB
Mila
Security
Server Objects
Replication
PolyBase
Always On High Availability
New Database...
New Query
Script Database as
Tasks
Policies
Facets
Start PowerShell
Reports
Rename
Delete
Refresh
Properties
Detach...
Take Offline
Bring Online
Stretch
Encrypt Columns...
Classify Data...
Vulnerability Assessment
Shrink
Back Up...
Restore
Mirror...
Launch Database Mirroring Monitor...
Ship Transaction Logs...
Generate Scripts...
Generate In-Memory OLTP Migration Checklists
Extract Data-tier Application...
Deploy Database to Microsoft Azure SQL Database...
Export Data-tier Application...
Register as Data-tier Application...
Enable
Disable
Monitor

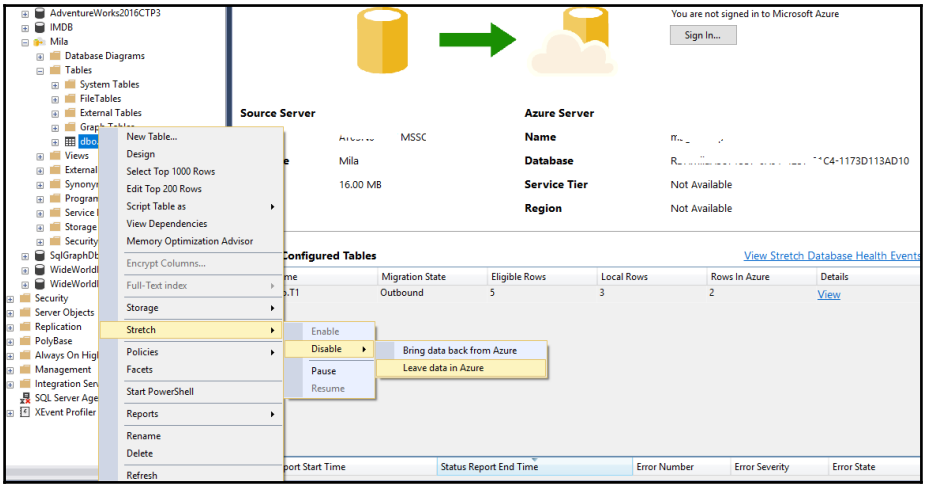

Stretch Database Monitor [Mila]
\MSSQLSERVER01:Mila
Last Updated: 28.02.2018 21:19:37
Auto Refresh:
You are not signed in to Microsoft Azure
Sign In...
Source Server
Name
Database
Mila
Size
16.00 MB
Azure Server
Name
Database
Service Tier
Not Available
Region
Not Available
Stretch Configured Tables
View Stretch Database Health Events
Name
Migration State
Eligible Rows
Local Rows
Rows In Azure
Details
dbo.T1
Outbound
5
3
2
View
Status Report Start Time
Status Report End Time
Error Number
Error Severity
Error State

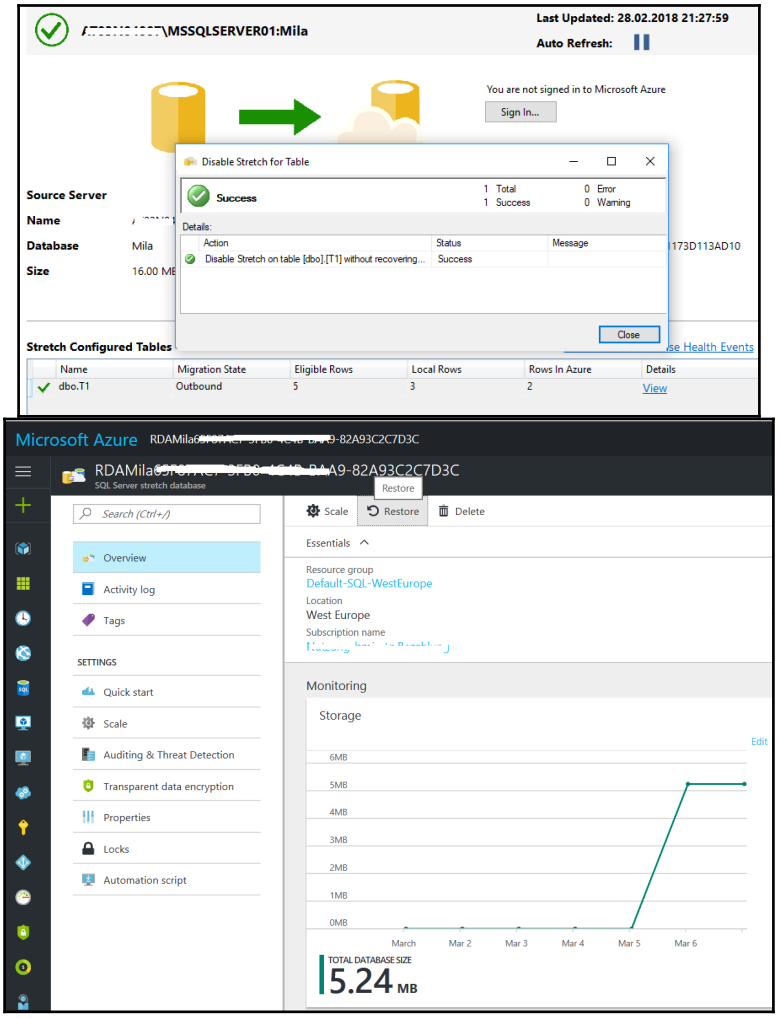
```
USE Mila;
SELECT * FROM sys.dm_db_rda_migration_status;
```

150 %

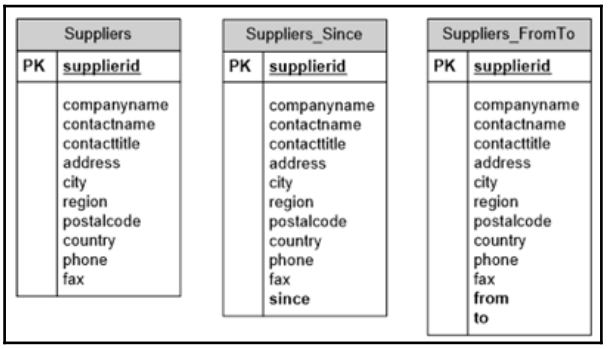
Results | Messages

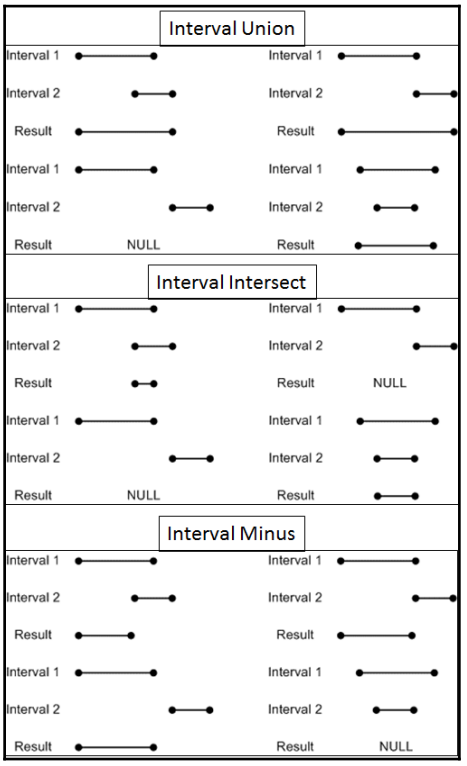
	table_id	database_id	migrated_rows	start_time_utc	end_time_utc	error_number	error_severity	error_state
1	917578307	8	0	2018-02-28 20:08:48.000	2018-02-28 20:09:21.110	NULL	NULL	NULL
2	917578307	8	0	2018-02-28 20:09:28.010	2018-02-28 20:09:28.010	NULL	NULL	NULL
3	917578307	8	0	2018-02-28 20:09:28.010	2018-02-28 20:10:08.407	1205	13	55
4	917578307	8	0	2018-02-28 20:10:09.407	2018-02-28 20:10:14.560	NULL	NULL	NULL
5	917578307	8	0	2018-02-28 20:10:28.027	2018-02-28 20:10:28.027	NULL	NULL	NULL
6	917578307	8	2	2018-02-28 20:10:28.027	2018-02-28 20:10:51.653	NULL	NULL	NULL
7	917578307	8	0	2018-02-28 20:10:51.653	2018-02-28 20:10:52.287	NULL	NULL	NULL
8	917578307	8	0	2018-02-28 20:11:03.033	2018-02-28 20:11:03.033	NULL	NULL	NULL
9	917578307	8	0	2018-02-28 20:11:03.033	2018-02-28 20:11:20.820	NULL	NULL	NULL
10	917578307	8	0	2018-02-28 20:11:38.040	2018-02-28 20:11:38.040	NULL	NULL	NULL
11	917578307	8	0	2018-02-28 20:11:38.040	2018-02-28 20:11:53.830	NULL	NULL	NULL
12	917578307	8	0	2018-02-28 20:12:13.050	2018-02-28 20:12:13.050	NULL	NULL	NULL

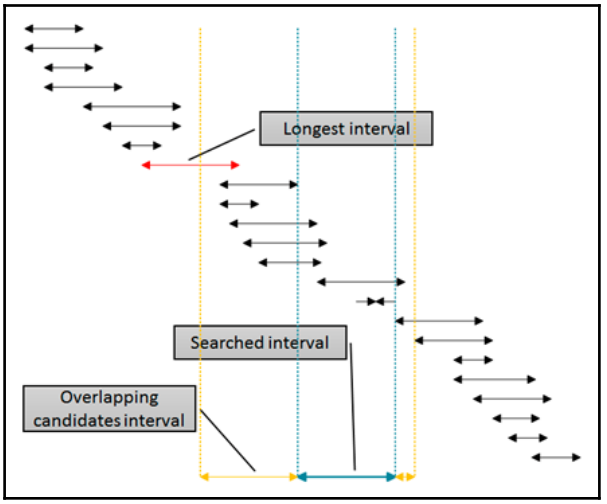


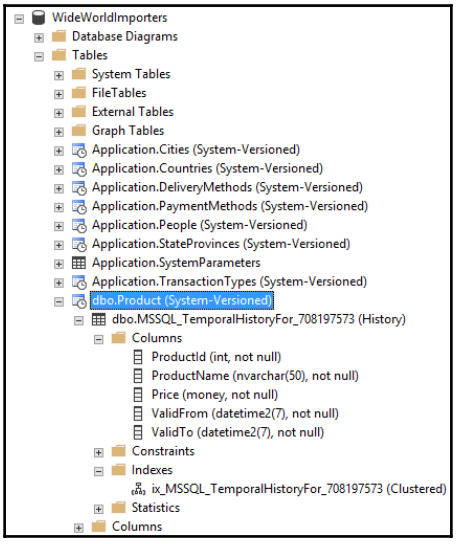

\MSSQLSERVER01:Mila
Last Updated: 28.02.2018 21:27:59
Auto Refresh:
You are not signed in to Microsoft Azure
Sign In...
Disable Stretch for Table
Success
1 Total
1 Success
0 Error
0 Warning
Details:
Action
Status
Message
Disable Stretch on table [dbo].[T1] without recovering...
Success
Close
Source Server
Name
Database
Mila
Size
16.00 MB
Stretch Configured Tables
Name
Migration State
Eligible Rows
Local Rows
Rows In Azure
Details
dbo.T1
Outbound
5
3
2
View
Microsoft Azure
RDAMila
82A93C2C7D3C
SQL Server stretch database
Restore
Search (Ctrl+/)
Scale
Restore
Delete
Overview
Activity log
Tags
SETTINGS
Quick start
Scale
Auditing & Threat Detection
Transparent data encryption
Properties
Locks
Automation script
Essentials
Resource group
Default-SQL-WestEurope
Location
West Europe
Subscription name
Monitoring
Storage
Edit
6MB
5MB
4MB
3MB
2MB
1MB
0MB
March
Mar 2
Mar 3
Mar 4
Mar 5
Mar 6
TOTAL DATABASE SIZE
5.24 MB

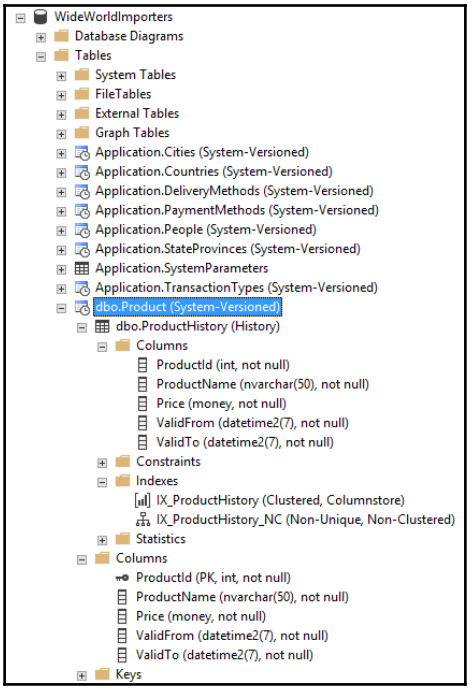
Chapter 7: Temporal Tables






Longest interval
Searched interval
Overlapping candidates interval

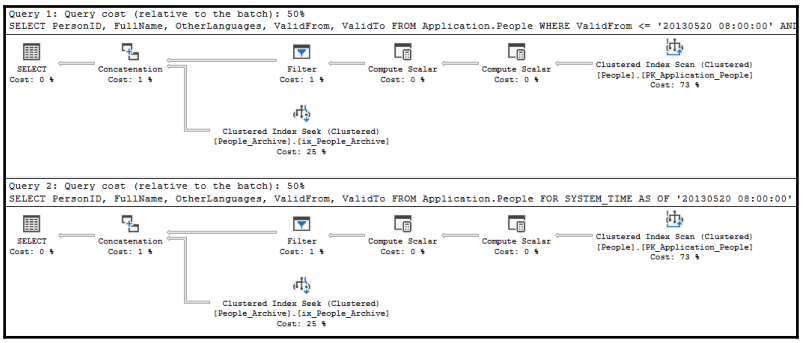

WideWorldImporters
Database Diagrams
Tables
System Tables
FileTables
External Tables
Graph Tables
Application.Cities (System-Versioned)
Application.Countries (System-Versioned)
Application.DeliveryMethods (System-Versioned)
Application.PaymentMethods (System-Versioned)
Application.People (System-Versioned)
Application.StateProvinces (System-Versioned)
Application.SystemParameters
Application.TransactionTypes (System-Versioned)
dbo.Product (System-Versioned)
dbo.MSSQL_TemporalHistoryFor_708197573 (History)
Columns
ProductId (int, not null)
ProductName (nvarchar(50), not null)
Price (money, not null)
ValidFrom (datetime2(7), not null)
ValidTo (datetime2(7), not null)
Constraints
Indexes
ix_MSSQL_TemporalHistoryFor_708197573 (Clustered)
Statistics
Columns

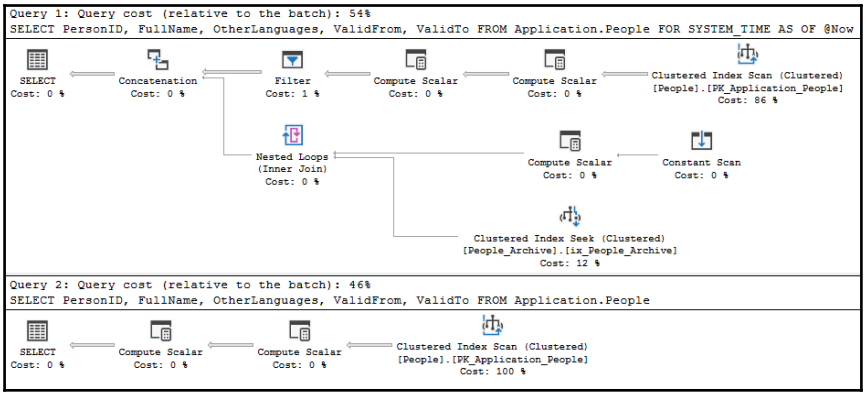


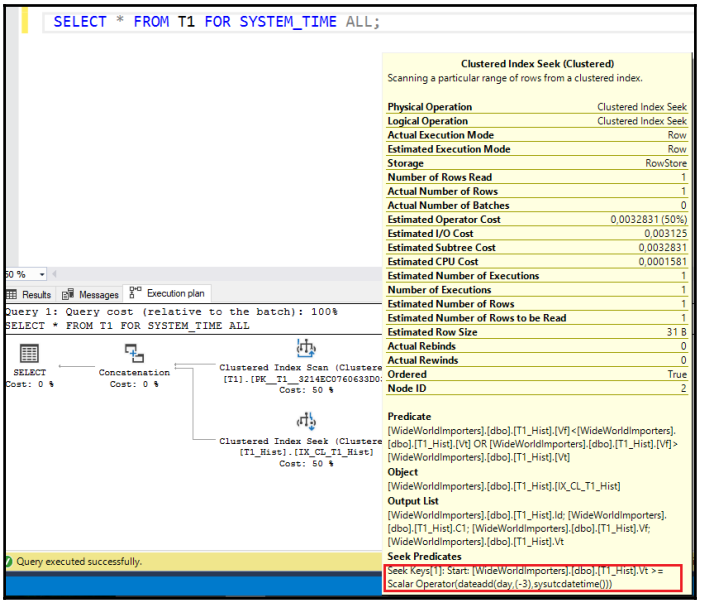
DepartmentID	Name	GroupName	ModifiedDate
1	Engineering	Research and Development	2008-04-30 00:00:00.000
2	Tool Design	Research and Development	2008-04-30 00:00:00.000
3	Sales	Sales and Marketing	2008-04-30 00:00:00.000
4	Marketing	Sales and Marketing	2008-04-30 00:00:00.000
5	Purchasing	Inventory Management	2008-04-30 00:00:00.000
6	Research and Development	Research and Development	2008-04-30 00:00:00.000
7	Production	Manufacturing	2008-04-30 00:00:00.000
8	Production Control	Manufacturing	2008-04-30 00:00:00.000
9	Human Resources	Executive General and Administration	2008-04-30 00:00:00.000
10	Finance	Executive General and Administration	2008-04-30 00:00:00.000
11	Information Services	Executive General and Administration	2008-04-30 00:00:00.000
12	Document Control	Quality Assurance	2008-04-30 00:00:00.000
13	Quality Assurance	Quality Assurance	2008-04-30 00:00:00.000
14	Facilities and Maintenance	Executive General and Administration	2008-04-30 00:00:00.000
15	Shipping and Receiving	Inventory Management	2008-04-30 00:00:00.000
16	Executive	Executive General and Administration	2008-04-30 00:00:00.000

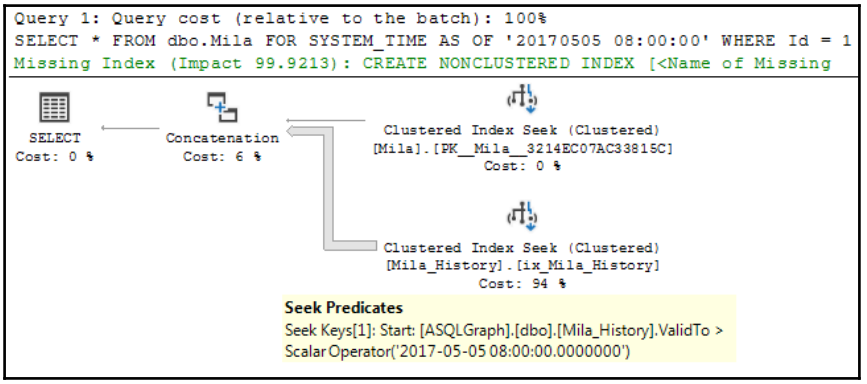
Displaying 10 Events

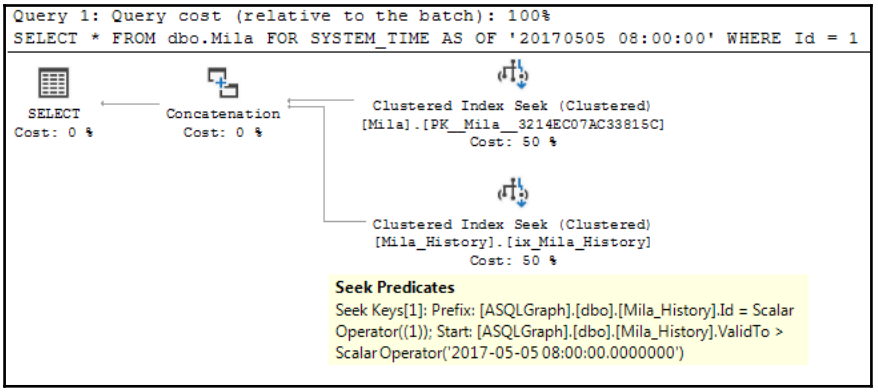
name	timestamp	statement
sql_statement_starting	2017-12-17 23:28:28.5382499	SELECT @@SPID
sql_statement_completed	2017-12-17 23:28:28.5382623	SELECT @@SPID
sql_statement_starting	2017-12-17 23:28:28.5418307	ALTER TABLE dbo.Product ADD Color NVARCHAR(15)
sql_statement_completed	2017-12-17 23:28:28.5429845	ALTER TABLE dbo.Product ADD Color NVARCHAR(15)
sql_statement_starting	2017-12-17 23:28:28.5433065	ALTER TABLE dbo.Product ADD Category SMALLINT NOT NULL CONSTRAINT DF_Category DEFAULT 1
sql_statement_completed	2017-12-17 23:28:28.5447483	ALTER TABLE dbo.Product ADD Category SMALLINT NOT NULL CONSTRAINT DF_Category DEFAULT 1
sql_statement_starting	2017-12-17 23:28:28.5447855	ALTER TABLE dbo.Product ADD Description NVARCHAR(MAX) NOT NULL CONSTRAINT DF_Description DEFAULT N'N/A'
sp_statement_starting	2017-12-17 23:28:28.5472037	UPDATE [dbo].[Product] SET [Description] = DEFAULT
sp_statement_completed	2017-12-17 23:28:28.6044360	UPDATE [dbo].[Product] SET [Description] = DEFAULT
sql_statement_completed	2017-12-17 23:28:28.6047962	ALTER TABLE dbo.Product ADD Description NVARCHAR(MAX) NOT NULL CONSTRAINT DF_Description DEFAULT N'N/A'

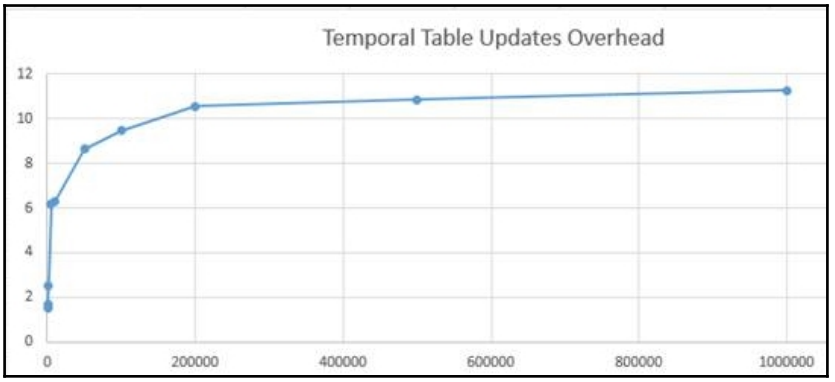


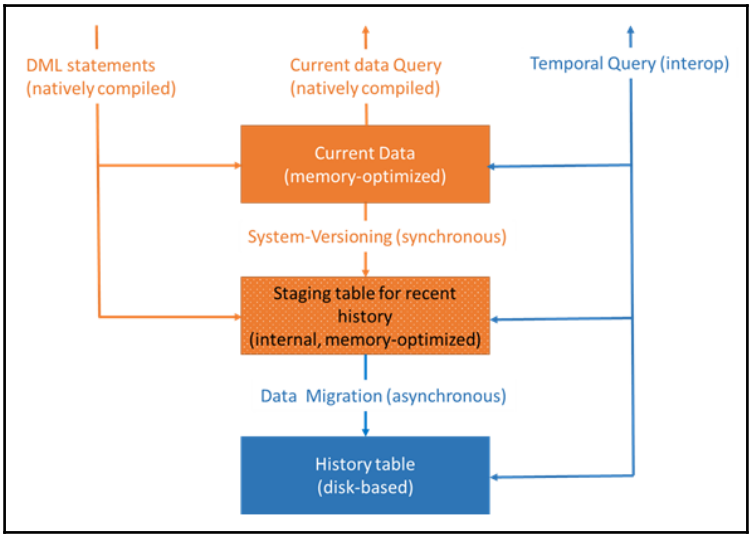


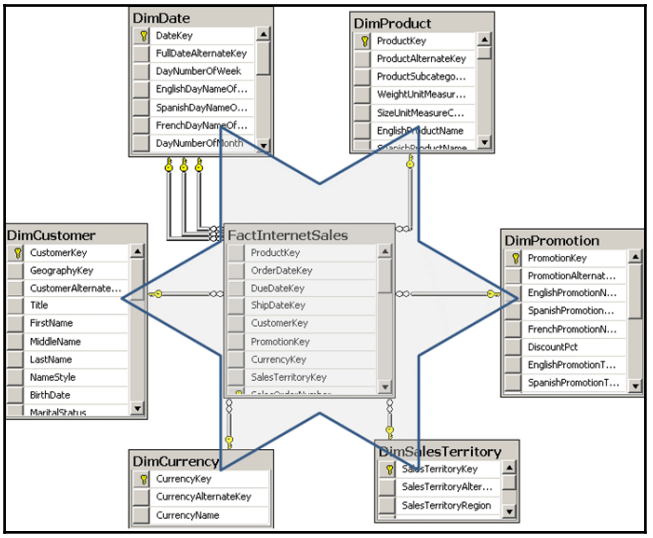

SELECT * FROM T1 FOR SYSTEM_TIME ALL;
Clustered Index Seek (Clustered)
Scanning a particular range of rows from a clustered index.
Physical Operation Clustered Index Seek
Logical Operation Clustered Index Seek
Actual Execution Mode Row
Estimated Execution Mode Row
Storage RowStore
Number of Rows Read 1
Actual Number of Rows 1
Actual Number of Batches 0
Estimated Operator Cost 0,0032831 (50%)
Estimated I/O Cost 0,003125
Estimated Subtree Cost 0,0032831
Estimated CPU Cost 0,0001581
Estimated Number of Executions 1
Number of Executions 1
Estimated Number of Rows 1
Estimated Number of Rows to be Read 1
Estimated Row Size 31 B
Actual Rebinds 0
Actual Rewinds 0
Ordered True
Node ID 2
Predicate
[WideWorldImporters].[dbo].[T1_Hist].[Vf]<[WideWorldImporters].[dbo].[T1_Hist].[Vt] OR [WideWorldImporters].[dbo].[T1_Hist].[Vf] > [WideWorldImporters].[dbo].[T1_Hist].[Vt]
Object
[WideWorldImporters].[dbo].[T1_Hist].[IX_CL_T1_Hist]
Output List
[WideWorldImporters].[dbo].[T1_Hist].Id; [WideWorldImporters].[dbo].[T1_Hist].C1; [WideWorldImporters].[dbo].[T1_Hist].Vf; [WideWorldImporters].[dbo].[T1_Hist].Vt
Seek Predicates
Seek Keys[1]: Start: [WideWorldImporters].[dbo].[T1_Hist].Vt >= Scalar Operator(dateadd(day,(-3),sysutcdatetime()))
50 %
Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM T1 FOR SYSTEM_TIME ALL
SELECT
Cost: 0 %
Concatenation
Cost: 0 %
Clustered Index Scan (Clustere
[T1].[PK__T1__3214EC0760633D0
Cost: 50 %
Clustered Index Seek (Clustere
[T1_Hist].[IX_CL_T1_Hist]
Cost: 50 %
Query executed successfully.


Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Mila FOR SYSTEM_TIME AS OF '20170505 08:00:00' WHERE Id = 1
Missing Index (Impact 99.9213): CREATE NONCLUSTERED INDEX [<Name of Missing
SELECT
Cost: 0 %
Concatenation
Cost: 6 %
Clustered Index Seek (Clustered)
[Mila].[PK__Mila__3214EC07AC33815C]
Cost: 0 %
Clustered Index Seek (Clustered)
[Mila_History].[ix_Mila_History]
Cost: 94 %
Seek Predicates
Seek Keys[1]: Start: [ASQLGraph].[dbo].[Mila_History].ValidTo > Scalar Operator('2017-05-05 08:00:00.0000000')


Query 1: Query cost (relative to the batch): 100%
SELECT * FROM dbo.Mila FOR SYSTEM_TIME AS OF '20170505 08:00:00' WHERE Id = 1
SELECT
Cost: 0 %
Concatenation
Cost: 0 %
Clustered Index Seek (Clustered)
[Mila].[PK__Mila__3214EC07AC33815C]
Cost: 50 %
Clustered Index Seek (Clustered)
[Mila_History].[ix_Mila_History]
Cost: 50 %
Seek Predicates
Seek Keys[1]: Prefix: [ASQLGraph].[dbo].[Mila_History].Id = Scalar Operator((1)); Start: [ASQLGraph].[dbo].[Mila_History].ValidTo > Scalar Operator('2017-05-05 08:00:00.0000000')


Temporal Table Updates Overhead
12
10
8
6
4
2
0
0
200000
400000
600000
800000
1000000


DML statements
(natively compiled)
Current data Query
(natively compiled)
Temporal Query (interop)
Current Data
(memory-optimized)
System-Versioning (synchronous)
Staging table for recent history
(internal, memory-optimized)
Data Migration (asynchronous)
History table
(disk-based)



- OLTP data

CUSTID	FULLNAME	CITY	OCCUPATION
17	Bostjan Strazar	Vienna	Professional

- OLTP data and DW SCD Type 1 after change

CUSTID	FULLNAME	CITY	OCCUPATION
17	Bostjan Strazar	Ljubljana	Professional

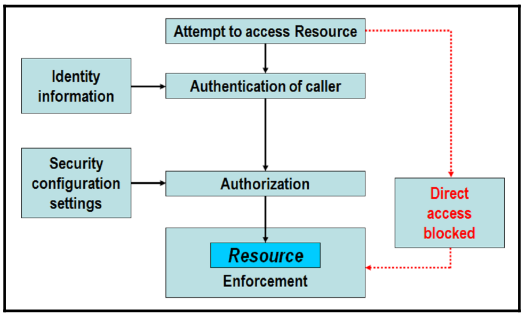
- DW SCD Type 2 after change

DWCID	CUSTID	FULLNAME	CITY	OCCUPATION	CURRENT
17	17	Bostjan Strazar	Vienna	Professional	0
289	17	Bostjan Strazar	Ljubljana	Professional	1

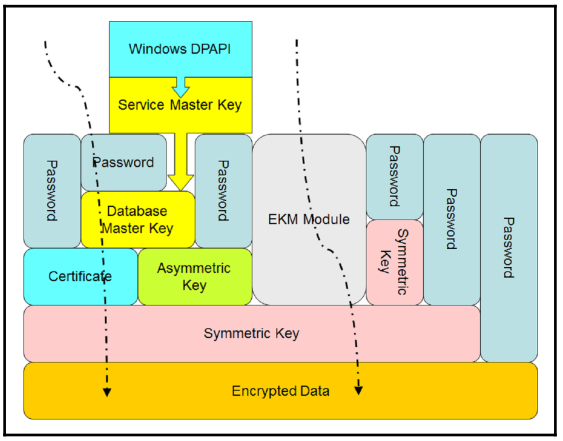
- DW SCD Type 1 & 2 after change

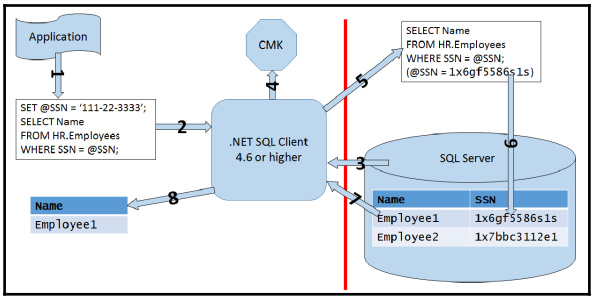
DWCID	CUSTID	FULLNAME	CITY	OCCUPATION	CURRENT
17	17	Bostjan Strazar	Vienna	Professional	0
289	17	Bostjan Strazar	Ljubljana	Management	1

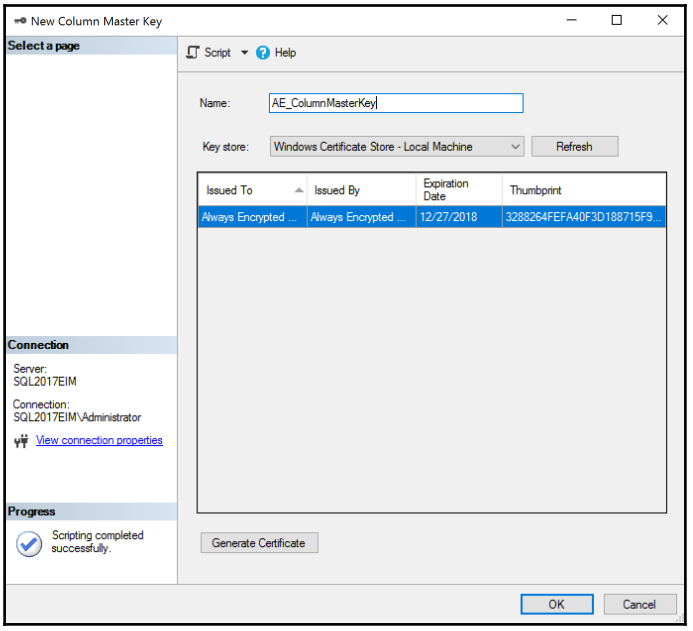
Chapter 8: Tightening Security



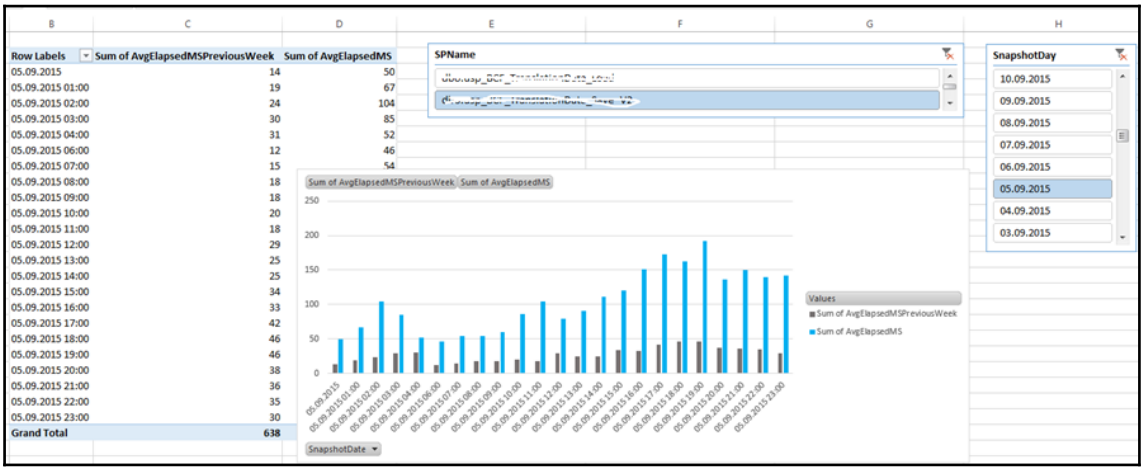
Principals	Permissions	Securables
Windows level		
• Groups • Domain user accounts • Local user accounts		
SQL Server level		
• Fixed server roles • SQL Server logins	• Grant – Deny – Revoke – Control – Create – Alter – Drop – Select – Insert – Update – Delete – Execute – Connect – Reference – Take ownership – View definition	• SQL Server logins and roles • Endpoints • Databases
Database level		
• Fixed database roles • Database users • Application roles		• Users and roles • Assemblies • Keys and certificates • Full-text catalogs and stoplists • Service Broker services, bindings, contracts, routes, and message types • Schemas – Tables – Views – Functions – Procedures – Types – XML schema collections – Service Broker queues – Synonyms



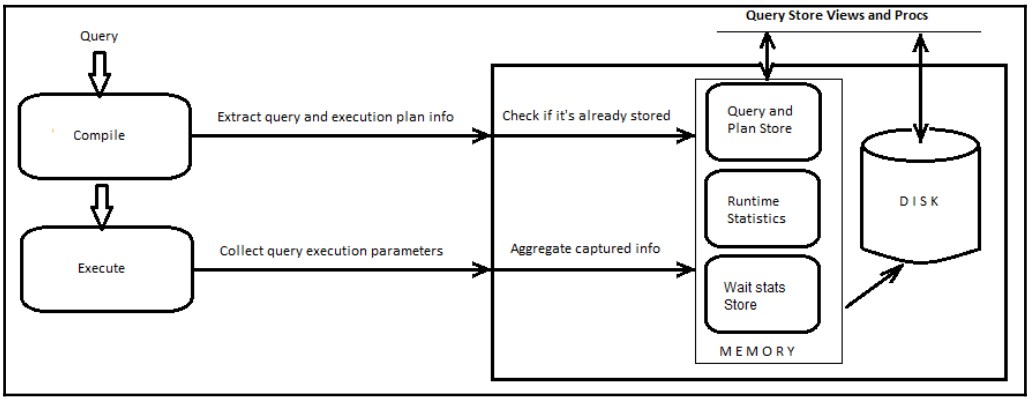

Application
CMK
SELECT Name
FROM HR.Employees
WHERE SSN = @SSN;
(@SSN = 1x6gf5586s1s)
SET @SSN = '111-22-3333';
SELECT Name
FROM HR.Employees
WHERE SSN = @SSN;
.NET SQL Client
4.6 or higher
SQL Server
Name
Employee1
Name
SSN
Employee1
1x6gf5586s1s
Employee2
1x7bbc3112e1
1
2
3
4
5
6
7
8

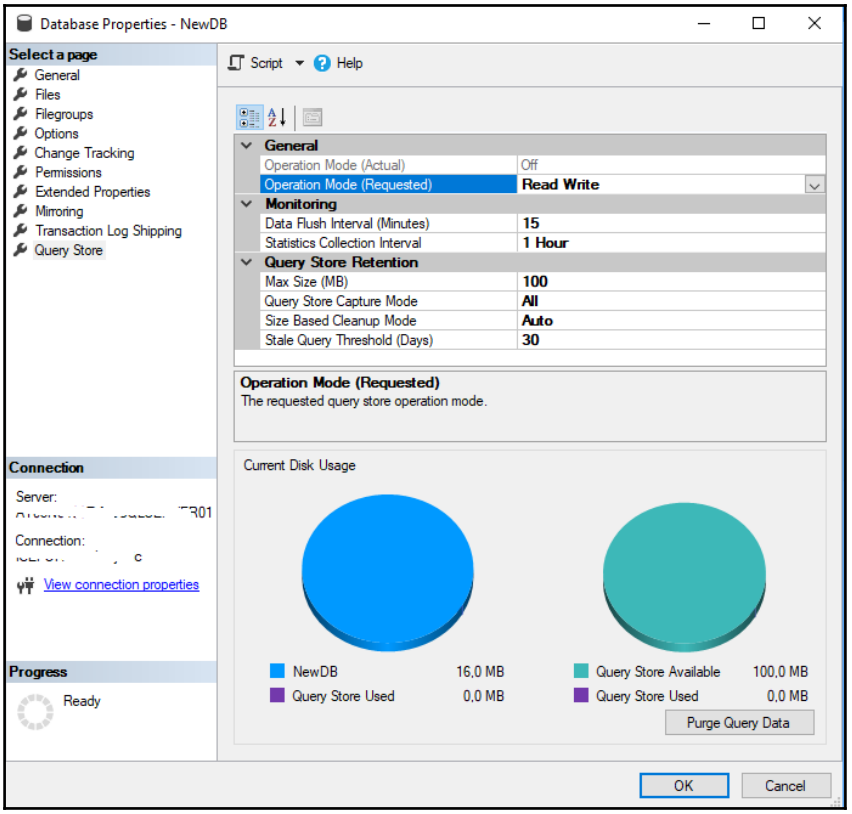

New Column Master Key
Select a page
Script
Help
Name:
AE_ColumnMasterKey
Key store:
Windows Certificate Store - Local Machine
Refresh
Issued To
Issued By
Expiration Date
Thumbprint
Always Encrypted ...
Always Encrypted ...
12/27/2018
3288264FEFA40F3D188715F9...
Connection
Server:
SQL2017EIM
Connection:
SQL2017EIM\Administrator
View connection properties
Progress
Scripting completed successfully.
Generate Certificate
OK
Cancel

Chapter 9: Query Store



Row Labels	Sum of AvgElapsedMSPreviousWeek	Sum of AvgElapsedMS
05.09.2015	14	50
05.09.2015 01:00	19	67
05.09.2015 02:00	24	104
05.09.2015 03:00	30	85
05.09.2015 04:00	31	52
05.09.2015 06:00	12	46
05.09.2015 07:00	15	54
05.09.2015 08:00	18	
05.09.2015 09:00	18	
05.09.2015 10:00	20	
05.09.2015 11:00	18	
05.09.2015 12:00	29	
05.09.2015 13:00	25	
05.09.2015 14:00	25	
05.09.2015 15:00	34	
05.09.2015 16:00	33	
05.09.2015 17:00	42	
05.09.2015 18:00	46	
05.09.2015 19:00	46	
05.09.2015 20:00	38	
05.09.2015 21:00	36	
05.09.2015 22:00	35	
05.09.2015 23:00	30	
Grand Total	638	





desired_state	desired_state_desc	actual_state	actual_state_desc	readonly_reason	current_storage_size_mb	flush_interval_seconds	interval_length_minutes	max_storage_size_mb
2	READ_WRITE	2	READ_WRITE	0	0	900	60	100

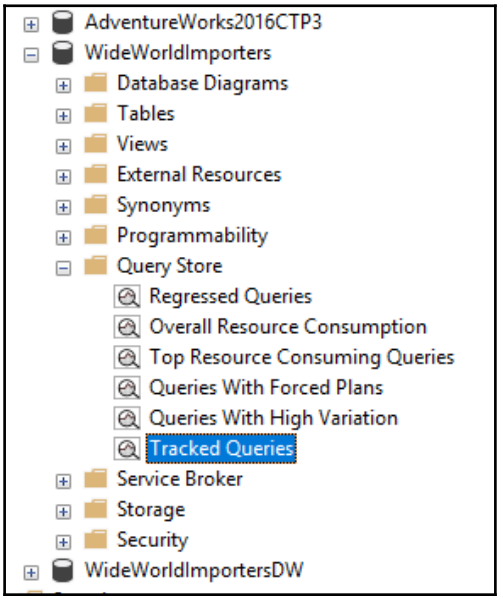
query_id	query_text_id	context_settings_id	object_id	batch_sql_handle	query_hash	is_internal_query	query_parameterization_type
1	1	2	0	NULL	0x855B1D2AFF9FD4A6	0	0

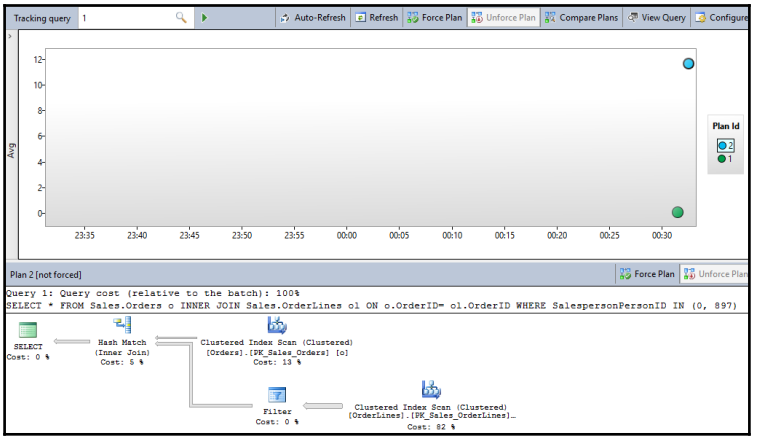
plan_id	query_id	plan_group_id	engine_version	compatibility_level	query_plan_hash	query_plan
1	1	0	14.0.1000.169	110	0xE743243FB9189904	<ShowPlanXML xmlns="http
2	4	0	14.0.1000.169	110	0x3C42727B6F21D1CA	<ShowPlanXML xmlns="http
3	3	0	14.0.1000.169	110	0xE2E1199F3FE566C6	<ShowPlanXML xmlns="http
4	2	0	14.0.1000.169	110	0x6FA179640875F159	<ShowPlanXML xmlns="http

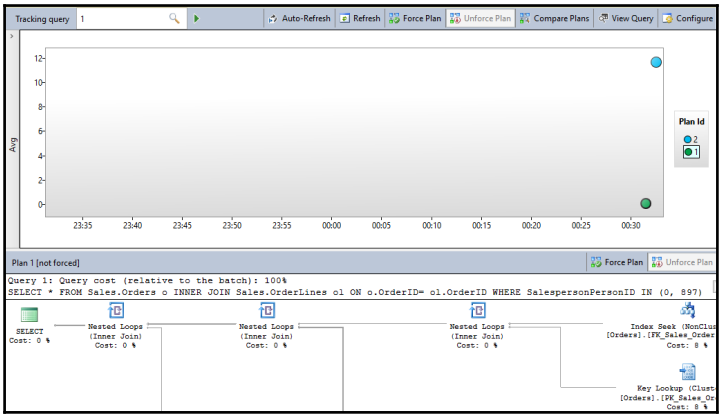
query_id	query_sql_text	qplan
1	SELECT * FROM Sales.Orders o INNER JOIN Sales.OrderLines ol ON o.OrderID = ol.OrderID WHERE SalespersonPersonID IN (0, 897)	<ShowPlanXML
2	SELECT * FROM sys.query_store_query	<ShowPlanXML
3	SELECT q.query_id, qt.query_sql_text FROM sys.query_store_query q INNER JOIN sys.query_store_query_text AS qt ON q.query_tex...	<ShowPlanXML
4	SELECT * FROM sys.query_store_plan	<ShowPlanXML

runtime_stats_id	plan_id	runtime_stats_interval_id	execution_type	execution_type_desc	count_executions	avg_duration	last_duration	min_duration	max_
1	1	1	0	Regular	98	79,2755102040816	66	65	221
2	2	8	0	Regular	1	4450	4450	4450	445
3	2	9	0	Regular	1	24473	24473	24473	244
4	2	10	0	Regular	1	8090	8090	8090	809
5	2	11	0	Regular	1	4934	4934	4934	493
6	3	12	0	Regular	1	14081	14081	14081	140

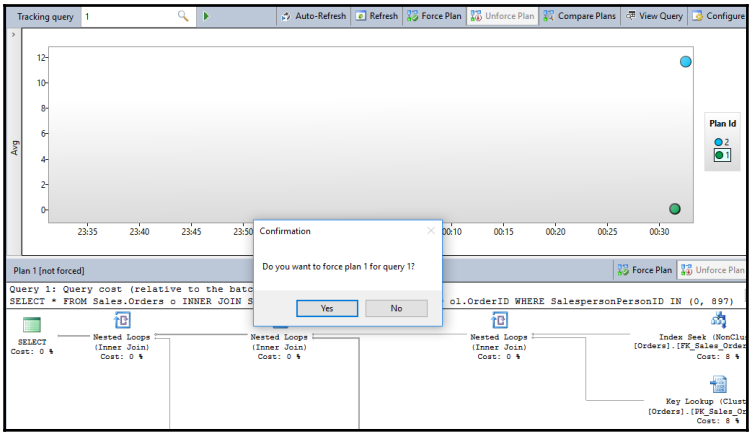
plan_id	query_id	plan_group_id	engine_version	compatibility_level	query_plan_hash	query_plan
1	1	0	14.0.1000.169	110	0xE743243FB9189904	<ShowPlanXML xmlns="http://schemas.microsoft.com...
2	1	0	14.0.1000.169	140	0x1D5497927C129D03	<ShowPlanXML xmlns="http://schemas.microsoft.com...

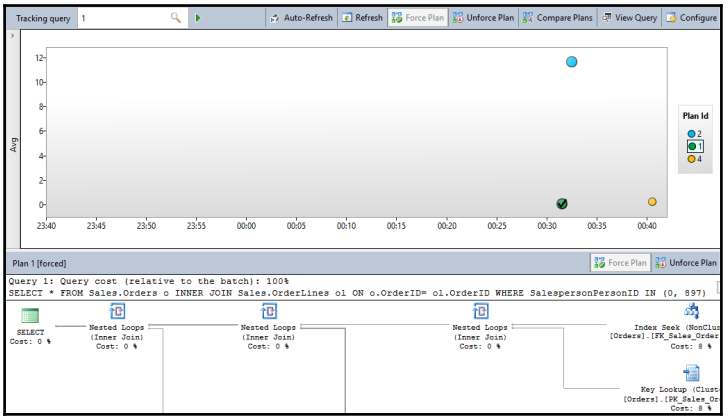


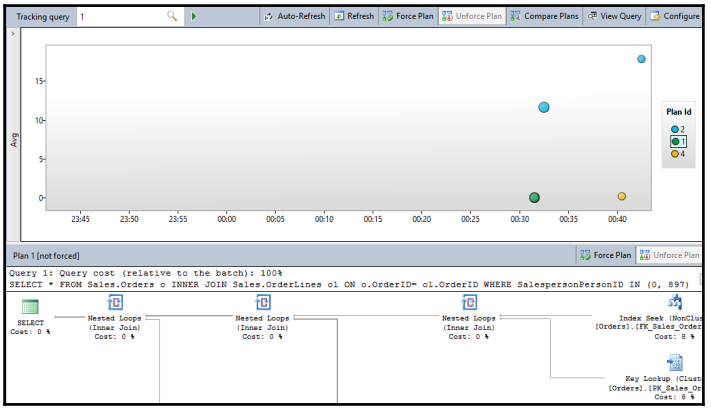


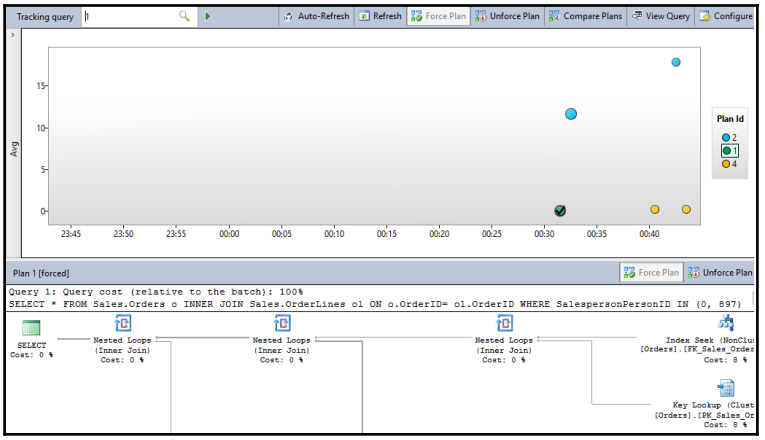


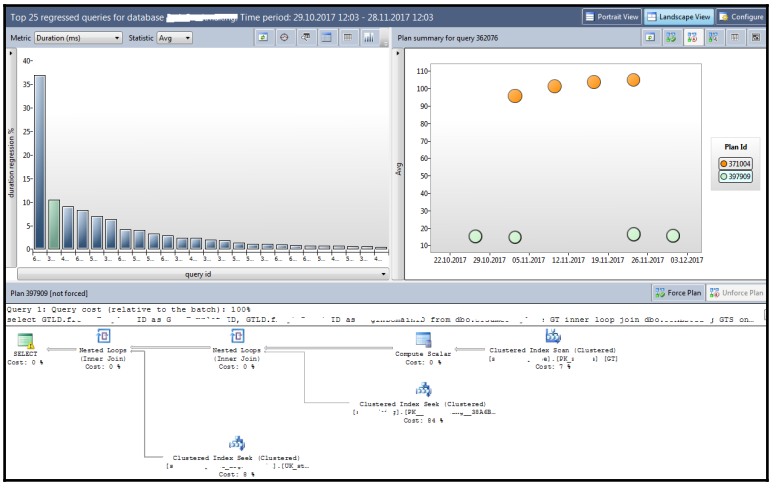
plan_id	avg_duration	avg_logical_io_reads	avg_cpu_time
1	80	4	80,3775510204082
2	52329	692	11690,06

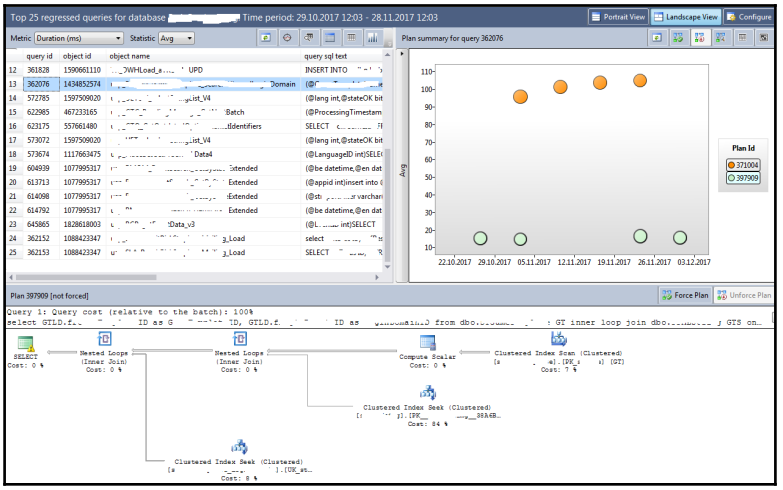

Tracking query
Auto-Refresh
Refresh
Force Plan
Unforce Plan
Compare Plans
View Query
Configure
Plan Id
Confirmation
Do you want to force plan 1 for query 1?
Yes
No
Plan 1 [not forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM Sales.Orders o INNER JOIN Sales.OrderLines ol ON o.OrderID= ol.OrderID WHERE SalespersonPersonID IN (0, 897)
SELECT
Nested Loops
(Inner Join)
Index Seek (NonClustered)
Key Lookup (Clustered)

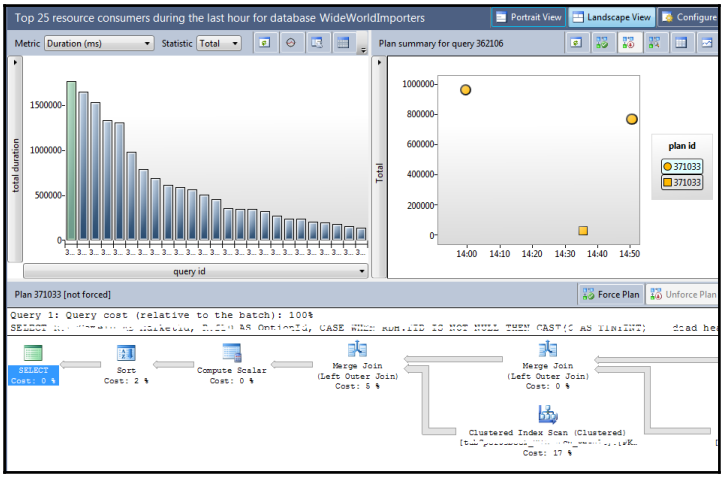

Tracking query
Auto-Refresh
Refresh
Force Plan
Unforce Plan
Compare Plans
View Query
Configure
Plan Id
Plan 1 [forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM Sales.Orders o INNER JOIN Sales.OrderLines ol ON o.OrderID= ol.OrderID WHERE SalespersonPersonID IN (0, 897)
SELECT
Nested Loops
(Inner Join)
Index Seek (NonClustered)
Key Lookup (Clustered)

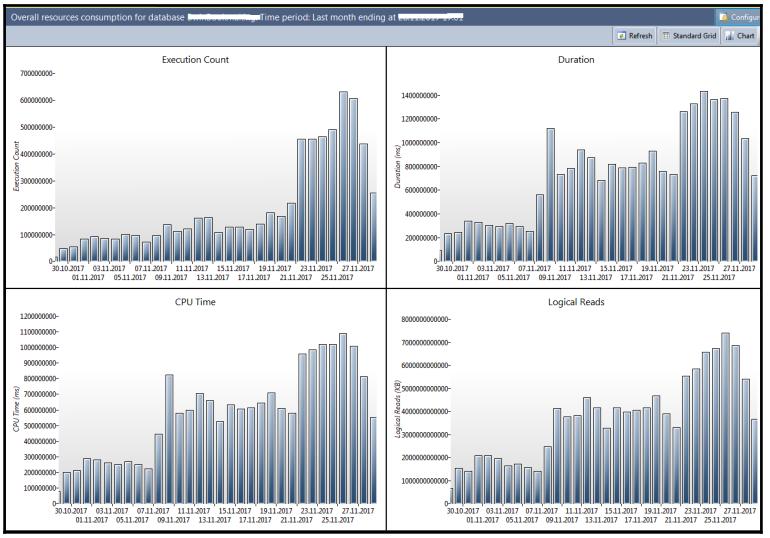

Tracking query
Auto-Refresh
Refresh
Force Plan
Unforce Plan
Compare Plans
View Query
Configure
Plan Id
Plan 1 [not forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM Sales.Orders o INNER JOIN Sales.OrderLines ol ON o.OrderID= ol.OrderID WHERE SalespersonPersonID IN (0, 897)
SELECT
Nested Loops
(Inner Join)
Index Seek (NonClustered)
Key Lookup (Clustered)

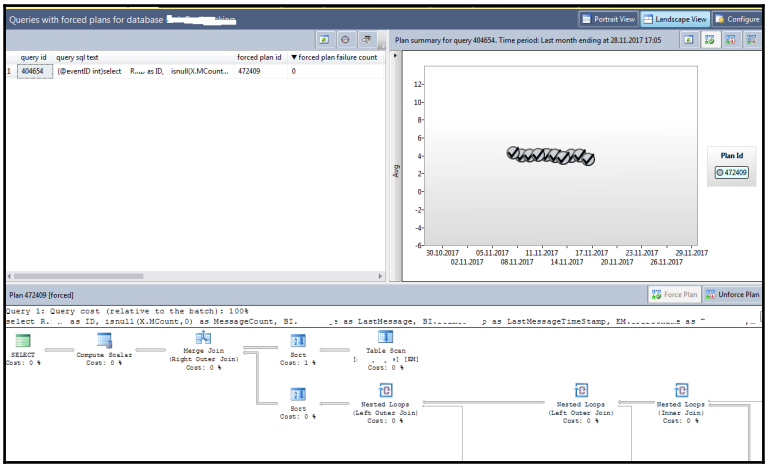

Tracking query
Auto-Refresh
Refresh
Force Plan
Unforce Plan
Compare Plans
View Query
Configure
Avg
Plan Id
2
1
4
Plan 1 [forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT * FROM Sales.Orders o INNER JOIN Sales.OrderLines ol ON o.OrderID= ol.OrderID WHERE SalespersonPersonID IN (0, 897)
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Index Seek (NonClu
[Orders].[FK_Sales_Order
Cost: 8 %
Key Lookup (Clust
[Orders].[FK_Sales_Or
Cost: 8 %

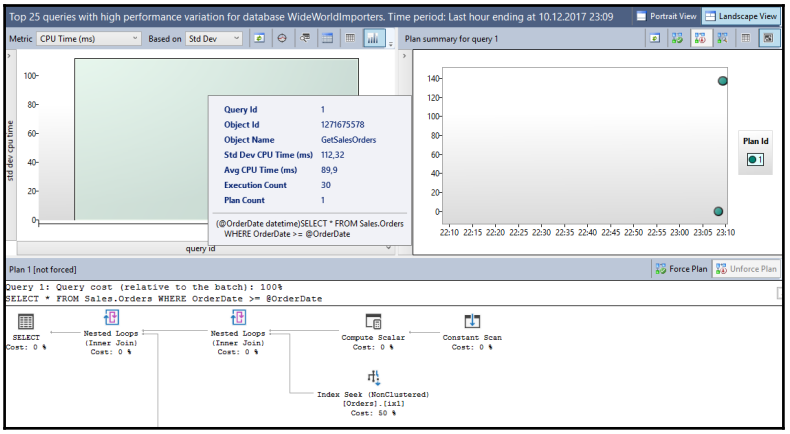

Top 25 regressed queries for database
Time period: 29.10.2017 12:03 - 28.11.2017 12:03
Portrait View
Landscape View
Configure
Metric
Duration (ms)
Statistic
Avg
Duration regression %
query id
Plan summary for query 362076
Avg
Plan Id
371004
397909
Plan 397909 [not forced]
Force Plan
Unforce Plan
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Compute Scalar
Cost: 0 %
Clustered Index Scan (Clustered)
Cost: 7 %
Clustered Index Seek (Clustered)
Cost: 84 %
Clustered Index Seek (Clustered)
Cost: 8 %


Top 25 regressed queries for database
Time period: 29.10.2017 12:03 - 28.11.2017 12:03
Portrait View
Landscape View
Configure
Metric
Duration (ms)
Statistic
Avg
query id
object id
object name
query sql text
Plan summary for query 362076
Plan Id
371004
397909
Plan 397909 [not forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT
Nested Loops
(Inner Join)
Compute Scalar
Clustered Index Scan (Clustered)
Clustered Index Seek (Clustered)


Top 25 resource consumers during the last hour for database WideWorldImporters
Portrait View
Landscape View
Configure
Metric
Duration (ms)
Statistic
Total
Plan summary for query 362106
total duration
Total
query id
plan id
371033
371033
Plan 371033 [not forced]
Force Plan
Unforce Plan
Query 1: Query cost (relative to the batch): 100%
SELECT
Sort
Cost: 2 %
Compute Scalar
Cost: 0 %
Merge Join
(Left Outer Join)
Cost: 5 %
Merge Join
(Left Outer Join)
Cost: 0 %
Clustered Index Scan (Clustered)
Cost: 17 %

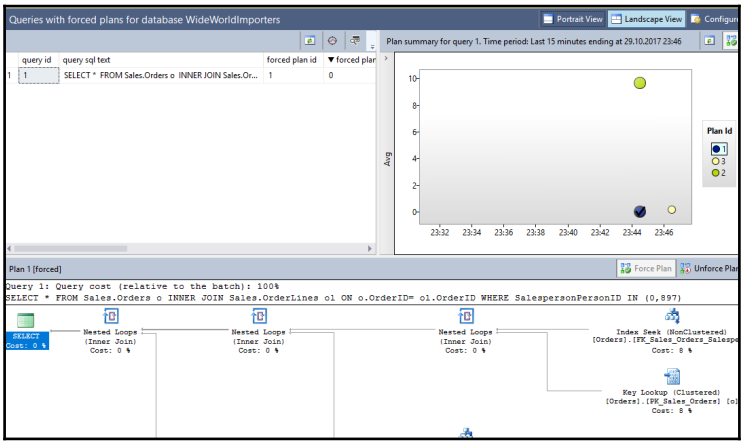

Overall resources consumption for database
Time period: Last month ending at
Configure
Refresh
Standard Grid
Chart
Execution Count
Execution Count
Duration
Duration (ms)
CPU Time
CPU Time (ms)
Logical Reads
Logical Reads (KB)

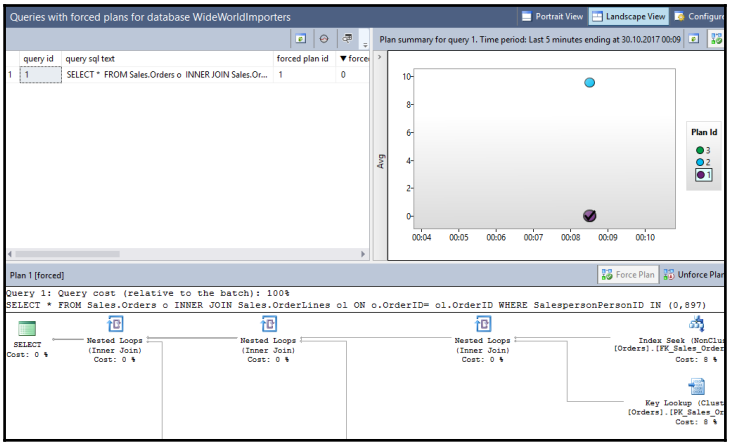

Queries with forced plans for database
Portrait View
Landscape View
Configure
query id
query sql text
forced plan id
forced plan failure count
404654
472409
0
Plan summary for query 404654. Time period: Last month ending at 28.11.2017 17:05
Avg
Plan Id
472409
Plan 472409 [forced]
Force Plan
Unforce Plan
SELECT
Compute Scalar
Merge Join
(Right Outer Join)
Sort
Table Scan
Sort
Nested Loops
(Left Outer Join)
Nested Loops
(Left Outer Join)
Nested Loops
(Inner Join)



name	type	reason	valid_since	last_refresh	state
PR_1	FORCE_LAST_GOOD_PLAN	Average query CPU time changed from 0.03ms to 10...	2017-10-29 13:08:09.7466667	2017-10-29 13:08:09.7466667	{"currentValue":"Active","reason":"AutomaticTuni...

reason	score	query_id	regressed_plan_id	recommended_plan_id	command
Average query CPU time changed from 0.03ms to 10.2ms	100	1	2	1	exec sp_query_store_force_plan @query_id = 1, @plan_id = 1





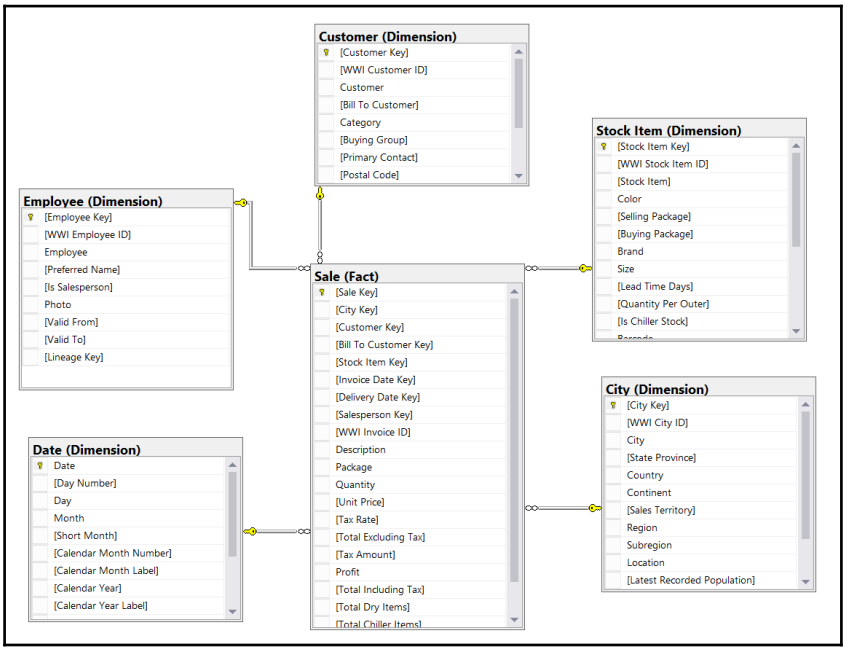
wait_stats_id	plan_id	runtime_stats_interval_id	wait_category	wait_category_desc	execution_type	execution_type_desc	total_query_wait_time_ms
28	2	1	3	Lock	0	Regular	7648
40	2	1	15	Network IO	0	Regular	1671

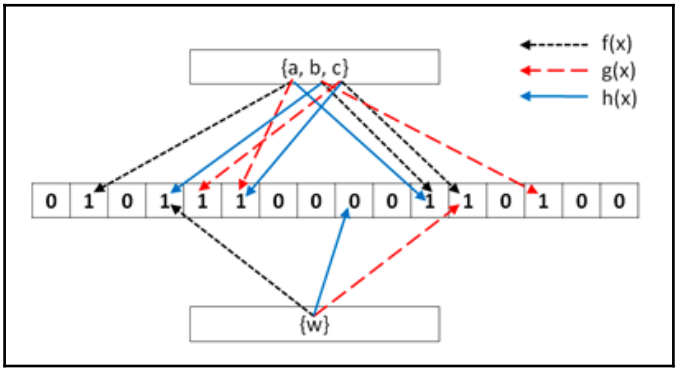
waiting_task_address	session_id	exec_context_id	wait_duration_ms	wait_type	resource_address	blocking_task_address	blocking_session_id	blocking_exec_context_id	resource_description
0x0000026B8011D848	52	0	1	ASYNC_NETWORK_IO	NULL	NULL	NULL	NULL	NULL

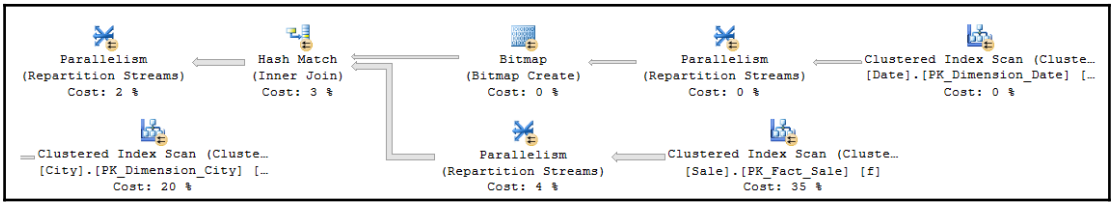
waiting_task_address	session_id	exec_context_id	wait_duration_ms	wait_type	resource_address	blocking_task_address	blocking_session_id	blocking_exec_context_id	resource_description
0x0000026B8011D848	52	0	579	LCK_M_S	0x0000026B6F39F180	NULL	53	NULL	pagelock fileid=3 pageid=1544 dbid=5 subresource...

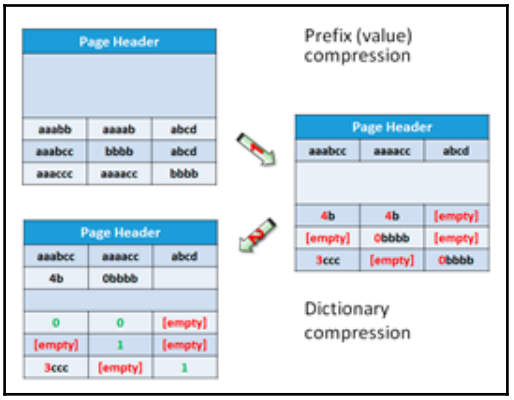
runtime_stats_id	plan_id	runtime_stats_interval_id	execution_type	execution_type_desc	count_executions	avg_duration
1	1	1	3	Aborted	1	2171616
2	1	1	0	Regular	9	4895207.22222222
3	1	2	0	Regular	1	5002603
4	2	2	4	Exception	8	7754

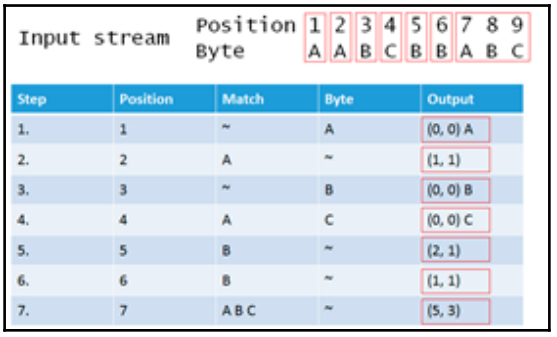
Chapter 10: Columnstore Indexes



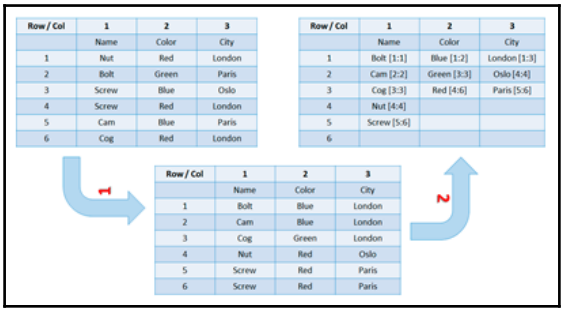


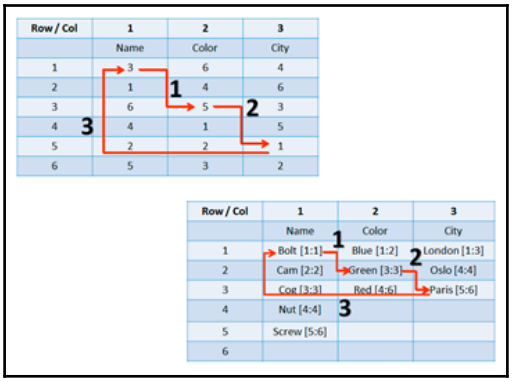


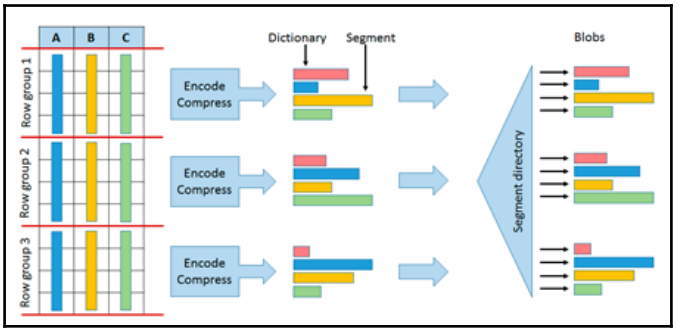


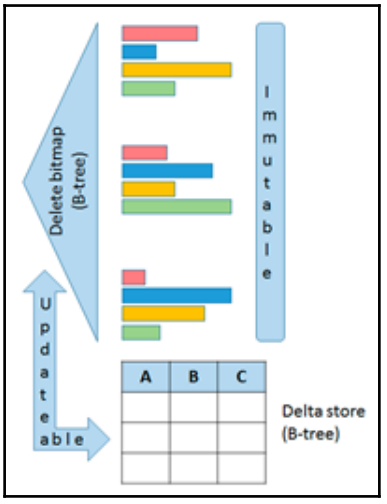


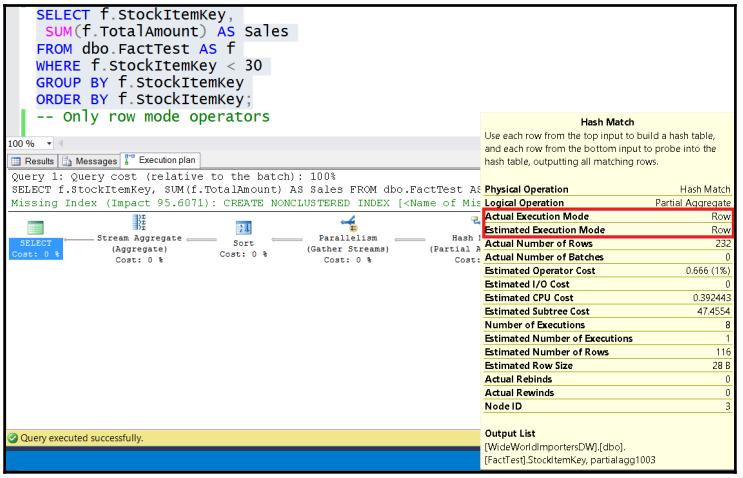
Step	Position	Match	Byte	Output
1.	1	~	A	(0, 0) A
2.	2	A	~	(1, 1)
3.	3	~	B	(0, 0) B
4.	4	A	C	(0, 0) C
5.	5	B	~	(2, 1)
6.	6	B	~	(1, 1)
7.	7	A B C	~	(5, 3)

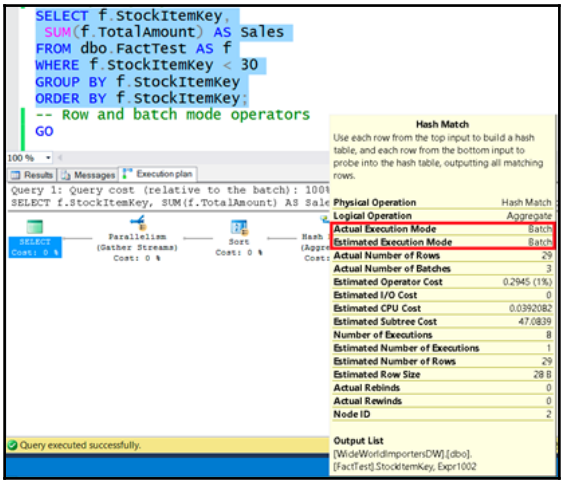


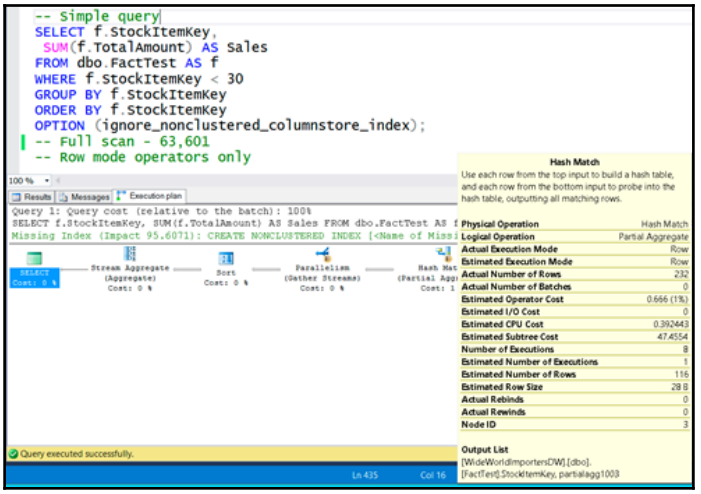

Row / Col
1
2
3
Name
Color
City
1
2
3
Bolt [1:1]
Blue [1:2]
London [1:3]
Cam [2:2]
Green [3:3]
Oslo [4:4]
Cog [3:3]
Red [4:6]
Paris [5:6]
Nut [4:4]
Screw [5:6]

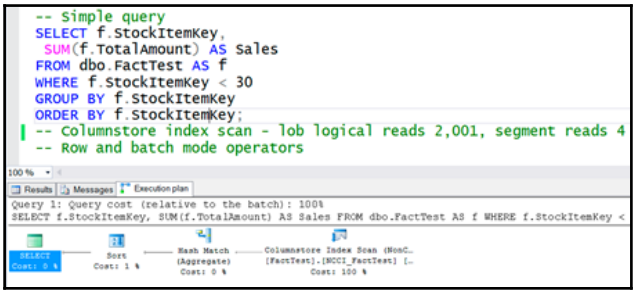

A
B
C
Row group 1
Row group 2
Row group 3
Encode
Compress
Dictionary
Segment
Blobs
Segment directory

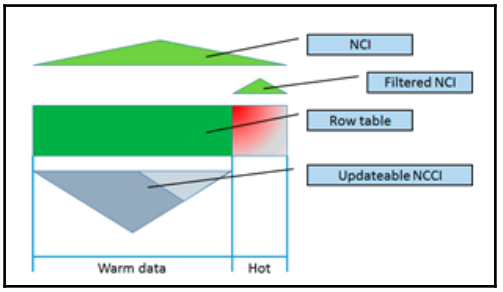

Delete bitmap
(B-tree)
Immutable
Updateable
A
B
C
Delta store
(B-tree)

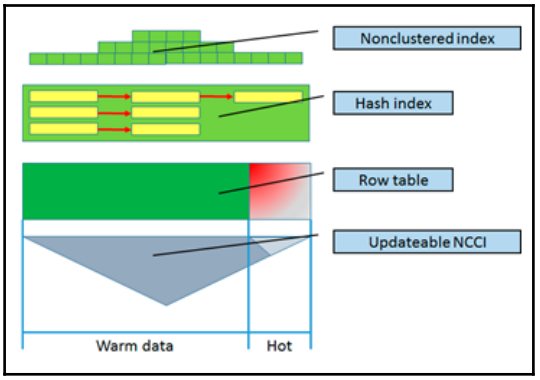

SELECT f.StockItemKey,
SUM(f.TotalAmount) AS Sales
FROM dbo.FactTest AS f
WHERE f.StockItemKey < 30
GROUP BY f.StockItemKey
ORDER BY f.StockItemKey;
-- Only row mode operators
100 %
Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT f.StockItemKey, SUM(f.TotalAmount) AS Sales FROM dbo.FactTest AS
Missing Index (Impact 95.6071): CREATE NONCLUSTERED INDEX [<Name of Mis
SELECT
Cost: 0 %
Stream Aggregate
(Aggregate)
Cost: 0 %
Sort
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 0 %
Query executed successfully.
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 Partial Aggregate
Actual Execution Mode Row
Estimated Execution Mode Row
Actual Number of Rows 232
Actual Number of Batches 0
Estimated Operator Cost 0.666 (1%)
Estimated I/O Cost 0
Estimated CPU Cost 0.392443
Estimated Subtree Cost 47.4554
Number of Executions 8
Estimated Number of Executions 1
Estimated Number of Rows 116
Estimated Row Size 28 B
Actual Rebinds 0
Actual Rewinds 0
Node ID 3
Output List
[WideWorldImportersDW].[dbo].
[FactTest].StockItemKey, partialagg1003


SELECT f.StockItemKey,
SUM(f.TotalAmount) AS Sales
FROM dbo.FactTest AS f
WHERE f.StockItemKey < 30
GROUP BY f.StockItemKey
ORDER BY f.StockItemKey;
-- Row and batch mode operators
GO
100 %
Results
Messages
Execution plan
Query 1: Query cost (relative to the batch): 100%
SELECT f.StockItemKey, SUM(f.TotalAmount) AS Sale
SELECT
Cost: 0 %
Parallelism
(Gather Streams)
Cost: 0 %
Sort
Cost: 0 %
Query executed successfully.
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 Aggregate
Actual Execution Mode Batch
Estimated Execution Mode Batch
Actual Number of Rows 29
Actual Number of Batches 3
Estimated Operator Cost 0.2945 (1%)
Estimated I/O Cost 0
Estimated CPU Cost 0.0392082
Estimated Subtree Cost 47.0839
Number of Executions 8
Estimated Number of Executions 1
Estimated Number of Rows 29
Estimated Row Size 28 B
Actual Rebinds 0
Actual Rewinds 0
Node ID 2
Output List
[WideWorldImportersDW].[dbo].
[FactTest].StockItemKey, Expr1002


-- Simple query
SELECT f.StockItemKey,
SUM(f.TotalAmount) AS Sales
FROM dbo.FactTest AS f
WHERE f.StockItemKey < 30
GROUP BY f.StockItemKey
ORDER BY f.StockItemKey
OPTION (ignore_nonclustered_columnstore_index);
-- Full scan - 63,601
-- Row mode operators only
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 Partial Aggregate
Actual Execution Mode Row
Estimated Execution Mode Row
Actual Number of Rows 232
Actual Number of Batches 0
Estimated Operator Cost 0.666 (1%)
Estimated I/O Cost 0
Estimated CPU Cost 0.392443
Estimated Subtree Cost 47.4554
Number of Executions 8
Estimated Number of Executions 1
Estimated Number of Rows 116
Estimated Row Size 28 B
Actual Rebinds 0
Actual Rewinds 0
Node ID 3
Output List
[WideWorldImportersDW].[dbo].[FactTest].StockItemKey, partialagg1003
Query executed successfully.


-- Simple query
SELECT f.StockItemKey,
SUM(f.TotalAmount) AS Sales
FROM dbo.FactTest AS f
WHERE f.StockItemKey < 30
GROUP BY f.StockItemKey
ORDER BY f.StockItemKey;
-- Columnstore index scan - lob logical reads 2,001, segment reads 4
-- Row and batch mode operators


NCI
Filtered NCI
Row table
Updateable NCCI
Warm data
Hot




```
-- Simple query
SELECT f.StockItemKey,
 SUM(f.TotalAmount) AS Sales
FROM dbo.FactTest AS f
WHERE f.StockItemKey < 30
GROUP BY f.StockItemKey
ORDER BY f.StockItemKey;
-- Columnstore index scan - lob logical reads 82, segment reads 4
-- Row and batch mode operators
```

100 %

Results | Messages | Execution plan

```
Query 1: Query cost (relative to the batch): 100%
SELECT f.StockItemKey, SUM(f.TotalAmount) AS Sales FROM dbo.FactTest AS f WHERE f.StockItemKey
```

SELECT Cost: 0 % — Sort Cost: 1 % — Hash Match (Aggregate) Cost: 49 % — Columnstore Index Scan (Clus… [FactTest].[CCI_FactTest] [f] Cost: 50 %

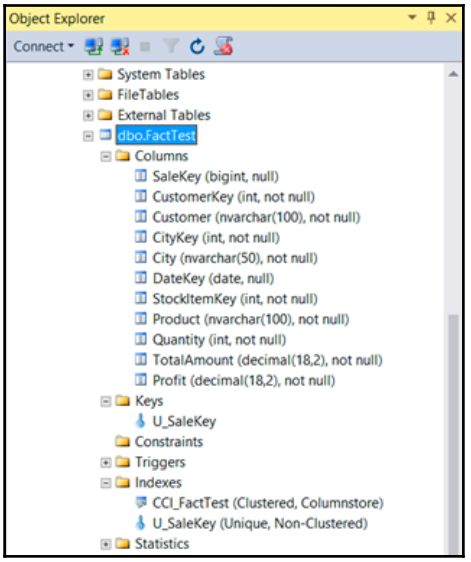
```
-- Point query
SELECT CustomerKey, Profit
FROM dbo.FactTest
WHERE CustomerKey = 378;
```

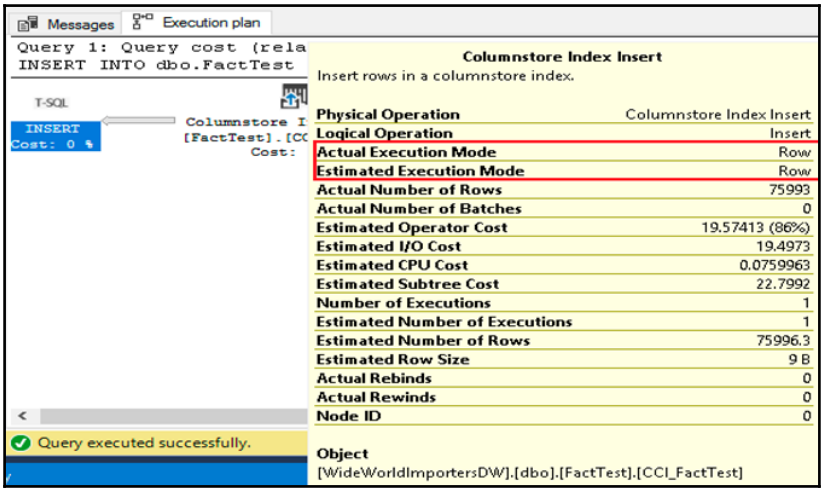
100 %

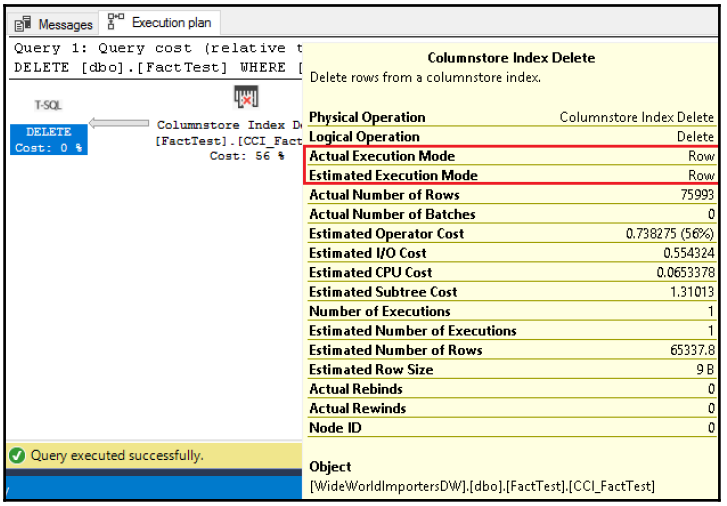
Results | Messages | Execution plan

```
Query 1: Query cost (relative to the batch): 100%
SELECT [CustomerKey],[Profit] FROM [dbo].[FactTest] WHERE [CustomerKey]=@1
```

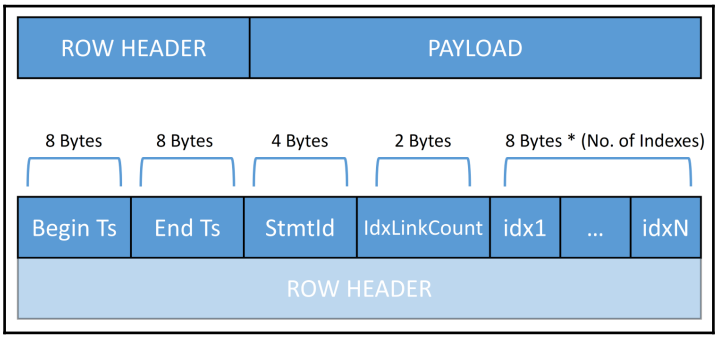
SELECT Cost: 0 % — Index Seek (NonClustered) [FactTest].[NCI_FactTest_Cus… Cost: 100 %

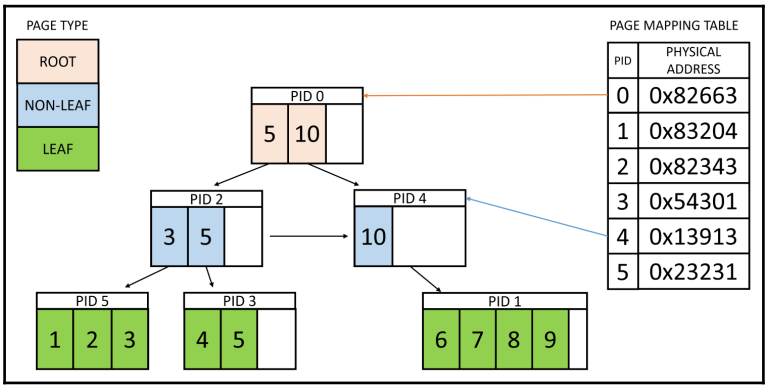

Object Explorer
Connect
System Tables
FileTables
External Tables
dbo.FactTest
Columns
SaleKey (bigint, null)
CustomerKey (int, not null)
Customer (nvarchar(100), not null)
CityKey (int, not null)
City (nvarchar(50), not null)
DateKey (date, null)
StockItemKey (int, not null)
Product (nvarchar(100), not null)
Quantity (int, not null)
TotalAmount (decimal(18,2), not null)
Profit (decimal(18,2), not null)
Keys
U_SaleKey
Constraints
Triggers
Indexes
CCI_FactTest (Clustered, Columnstore)
U_SaleKey (Unique, Non-Clustered)
Statistics

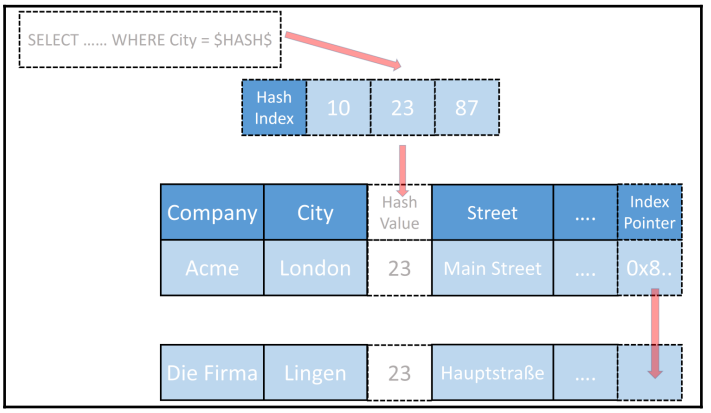

Messages
Execution plan
Query 1: Query cost (rela
INSERT INTO dbo.FactTest
T-SQL
INSERT
Cost: 0 %
Columnstore I
[FactTest].[CC
Cost:
Query executed successfully.
Columnstore Index Insert
Insert rows in a columnstore index.
Physical Operation Columnstore Index Insert
Logical Operation Insert
Actual Execution Mode Row
Estimated Execution Mode Row
Actual Number of Rows 75993
Actual Number of Batches 0
Estimated Operator Cost 19.57413 (86%)
Estimated I/O Cost 19.4973
Estimated CPU Cost 0.0759963
Estimated Subtree Cost 22.7992
Number of Executions 1
Estimated Number of Executions 1
Estimated Number of Rows 75996.3
Estimated Row Size 9 B
Actual Rebinds 0
Actual Rewinds 0
Node ID 0
Object
[WideWorldImportersDW].[dbo].[FactTest].[CCI_FactTest]

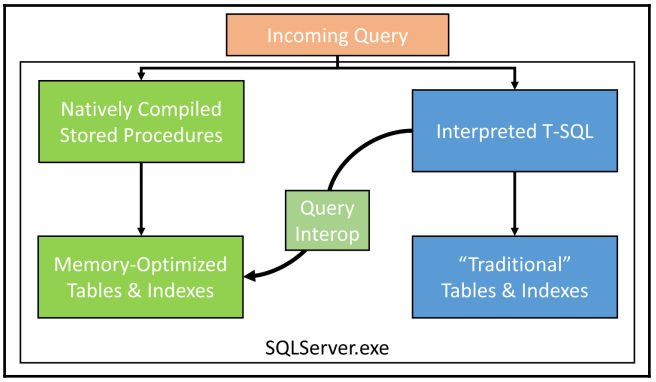

Messages
Execution plan
Query 1: Query cost (relative t
DELETE [dbo].[FactTest] WHERE [
T-SQL
DELETE
Cost: 0 %
Columnstore Index D
[FactTest].[CCI_Fact
Cost: 56 %
Query executed successfully.
Columnstore Index Delete
Delete rows from a columnstore index.
Physical Operation Columnstore Index Delete
Logical Operation Delete
Actual Execution Mode Row
Estimated Execution Mode Row
Actual Number of Rows 75993
Actual Number of Batches 0
Estimated Operator Cost 0.738275 (56%)
Estimated I/O Cost 0.554324
Estimated CPU Cost 0.0653378
Estimated Subtree Cost 1.31013
Number of Executions 1
Estimated Number of Executions 1
Estimated Number of Rows 65337.8
Estimated Row Size 9 B
Actual Rebinds 0
Actual Rewinds 0
Node ID 0
Object
[WideWorldImportersDW].[dbo].[FactTest].[CCI_FactTest]

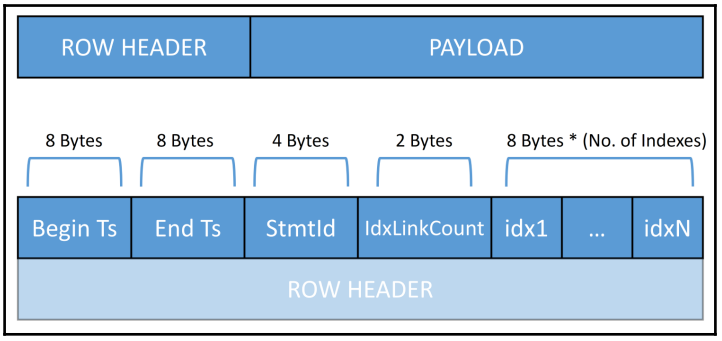
Chapter 11: Introducing SQL Server In-Memory OLTP

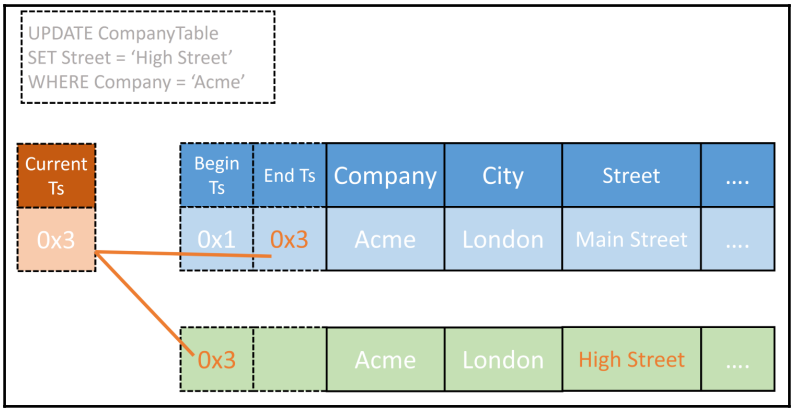






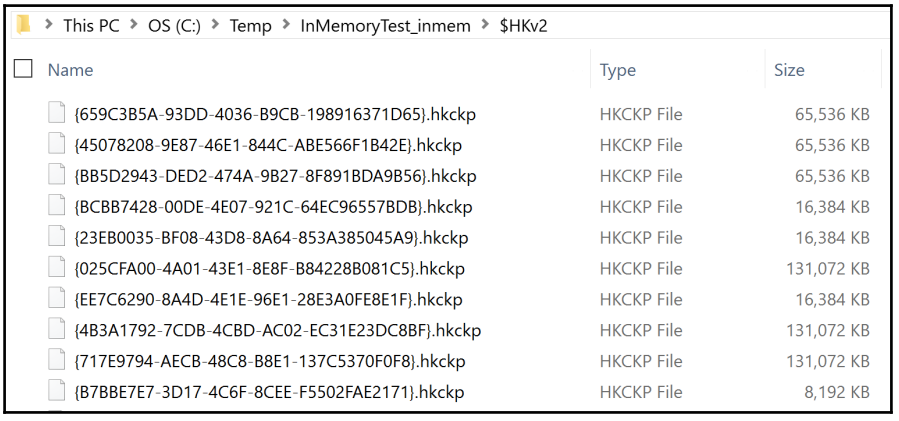

Incoming Query
Natively Compiled Stored Procedures
Interpreted T-SQL
Query Interop
Memory-Optimized Tables & Indexes
"Traditional" Tables & Indexes
SQLServer.exe

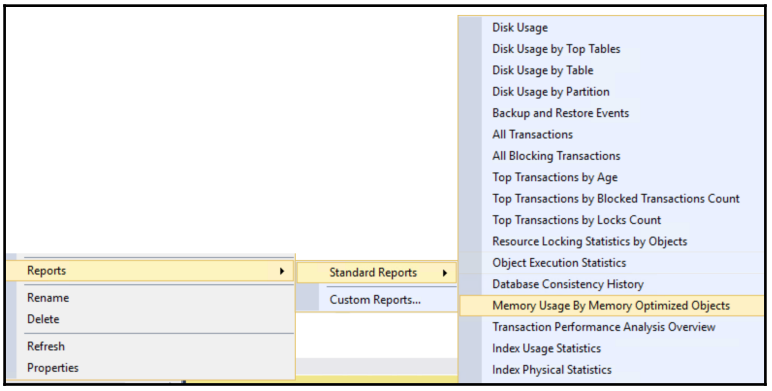

ROW HEADER
PAYLOAD
8 Bytes
8 Bytes
4 Bytes
2 Bytes
8 Bytes * (No. of Indexes)
Begin Ts
End Ts
StmtId
IdxLinkCount
idx1
...
idxN
ROW HEADER


UPDATE CompanyTable
SET Street = 'High Street'
WHERE Company = 'Acme'
Current Ts
0x3
Begin Ts
End Ts
Company
City
Street
....
0x1
0x3
Acme
London
Main Street
....
0x3
Acme
London
High Street
....

	Current LSN	Operation	Context	Transaction ID	Log Record Fixed Length	Log Record Length	Previous LSN	Flag Bits	Log Reserve	AllocUnitId	AllocUnitName
1	00000058:00001a35:0005	LOP_COMMIT_XACT	LCX_NULL	0000:002700d3	80	84	00000058:00001a35:0001	0x0002	90	NULL	NULL
2	00000058:00001a35:0004	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d3	62	116	00000058:00001a35:0003	0x0002	74	72057594048544768	dbo.DiskBasedTable.PK_
3	00000058:00001a35:0003	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d3	62	128	00000058:00001a35:0002	0x0002	74	72057594048479232	dbo.DiskBasedTable.NCL
4	00000058:00001a35:0002	LOP_INSERT_ROWS	LCX_HEAP	0000:002700d3	62	132	00000058:00001a35:0001	0x0002	178	72057594048413696	dbo.DiskBasedTable
5	00000058:00001a35:0001	LOP_BEGIN_XACT	LCX_NULL	0000:002700d3	76	124	00000000:00000000:0000	0x0002	9436	NULL	NULL
6	00000058:00001a33:0005	LOP_COMMIT_XACT	LCX_NULL	0000:002700d2	80	84	00000058:00001a33:0001	0x0002	90	NULL	NULL
7	00000058:00001a33:0004	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d2	62	116	00000058:00001a33:0003	0x0002	74	72057594048544768	dbo.DiskBasedTable.PK_
8	00000058:00001a33:0003	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d2	62	128	00000058:00001a33:0002	0x0002	74	72057594048479232	dbo.DiskBasedTable.NCL
9	00000058:00001a33:0002	LOP_INSERT_ROWS	LCX_HEAP	0000:002700d2	62	132	00000058:00001a33:0001	0x0002	178	72057594048413696	dbo.DiskBasedTable
10	00000058:00001a33:0001	LOP_BEGIN_XACT	LCX_NULL	0000:002700d2	76	124	00000000:00000000:0000	0x0002	9436	NULL	NULL
11	00000058:00001a31:0005	LOP_COMMIT_XACT	LCX_NULL	0000:002700d1	80	84	00000058:00001a31:0001	0x0002	90	NULL	NULL
12	00000058:00001a31:0004	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d1	62	116	00000058:00001a31:0003	0x0002	74	72057594048544768	dbo.DiskBasedTable.PK_
13	00000058:00001a31:0003	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d1	62	128	00000058:00001a31:0002	0x0002	74	72057594048479232	dbo.DiskBasedTable.NCL
14	00000058:00001a31:0002	LOP_INSERT_ROWS	LCX_HEAP	0000:002700d1	62	132	00000058:00001a31:0001	0x0002	178	72057594048413696	dbo.DiskBasedTable
15	00000058:00001a31:0001	LOP_BEGIN_XACT	LCX_NULL	0000:002700d1	76	124	00000000:00000000:0000	0x0002	9436	NULL	NULL
16	00000058:00001a2f:0005	LOP_COMMIT_XACT	LCX_NULL	0000:002700d0	80	84	00000058:00001a2f:0001	0x0002	90	NULL	NULL
17	00000058:00001a2f:0004	LOP_INSERT_ROWS	LCX_INDEX_LEAF	0000:002700d0	62	116	00000058:00001a2f:0003	0x0002	74	72057594048544768	dbo.DiskBasedTable.PK_

	Current LSN	Operation	Context	Transaction ID	Log Record Fixed Length	Log Record Length	Previous LSN	Flag Bits	Log Reserve	AllocUnitId	AllocUnitName
1	00000058:00001a4f:0002	LOP_HK	LCX_NULL	0000:00000000	28	152	00000000:00000000:0000	0x0000	0	NULL	NULL
2	00000058:00001a4f:0001	LOP_HK	LCX_NULL	0000:00000000	28	88	00000000:00000000:0000	0x0000	0	NULL	NULL
3	00000058:00001a4e:0001	LOP_END_CKPT	LCX_NULL	0000:00000000	136	136	00000058:00001a4c:0001	0x0000	0	NULL	NULL
4	00000058:00001a4d:0001	LOP_XACT_CKPT	LCX_BOOT_PAGE_CKPT	0000:00000000	24	28	00000000:00000000:0000	0x0000	0	NULL	NULL
5	00000058:00001a4c:0001	LOP_BEGIN_CKPT	LCX_NULL	0000:00000000	96	96	00000058:00001a37:002c	0x0000	0	NULL	NULL
6	00000058:00001a4b:0002	LOP_HK	LCX_NULL	0000:00000000	28	152	00000000:00000000:0000	0x0000	0	NULL	NULL





Transaction Performance Analysis Overview

[InMemoryTest]

SQL Server

This report helps you identify bottlenecks in your database and provide assistance to migrate them to In-Memory OLTP. The estimated migration effort is based on the SQL Server 2014 feature set. To begin, choose an option from below to see the report.

This server has been continuously operating since 18/12/2016 15:47:13

Tables Analysis

Stored Procedure Analysis

Recommended Tables Based on Usage

[InMemoryTest]

SQL Server

The following chart contains the top candidate tables for memory optimization based on the access patterns of your workload. The horizontal axis represents decreasing effort of memory optimization, while the vertical axis represents increasing benefits of memory optimization in your workload.
You should prioritize the tables in the top right corner of the chart for memory optimization.

Select number of Tables:
5
10
15
20
25
30

Details for [InMemoryTest].[dbo].[DiskBasedTable]

SQL Server

This report provides the details of your table's performance statistics over the period of time you monitored the instance with Transaction Performance Collection Set. This report includes the access characteristics of your queries on the table, and the detailed contention statistics including information on latches and locks.

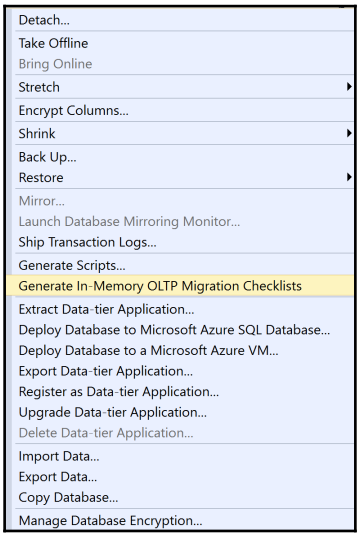
		Latch Statistics		Lock Statistics		
Table Name	% of total waits	Page latch wait count	Average wait time per latch wait (ms)	Page lock count	Page lock wait count	Average wait time per lock wait (ms)
dbo.DiskBasedTable	100.00	1	3	9471648	0	0

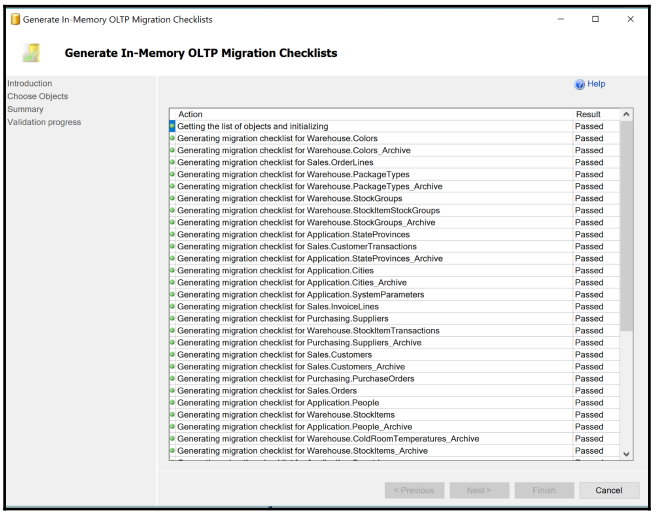
Table Name	Index Name	% of total accesses	Total Singleton Lookup	Total Range Scans	Recommended In-Memory Index Type
dbo.DiskBasedTable		100.00	0	3	NONCLUSTERED
dbo.DiskBasedTable	NCL_IDX	0.00	0	0	NONCLUSTERED
dbo.DiskBasedTable	PK__DiskBase__1788CC4D0B8DD1D1	0.00	0	0	NONCLUSTERED

Table Name	Number of Migration Blockers

See information for all user tables in database: InMemoryTest

Chapter 12: In-Memory OLTP Improvements in SQL Server 2017

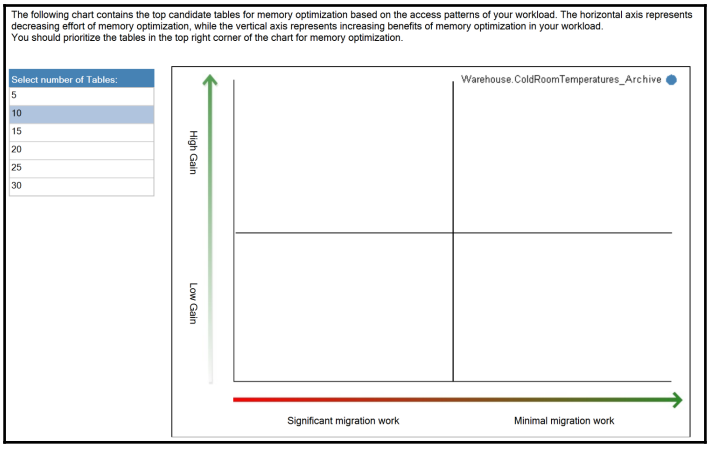




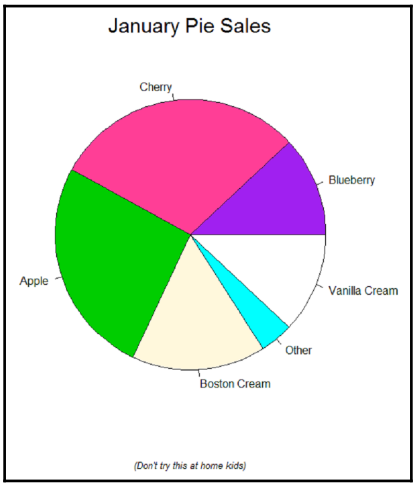
Memory optimization checklist for [WideWorldImporters].[BuyingGroups]

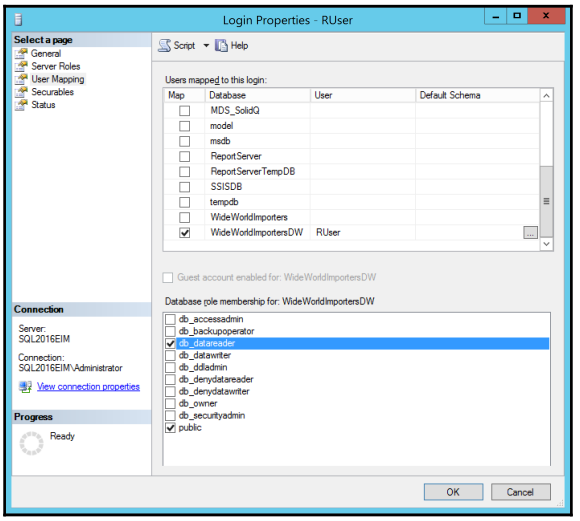
Description	Validation Result
No unsupported data types are defined on this table.	Succeeded
No sparse columns are defined for this table.	Succeeded
No identity columns with unsupported seed and increment are defined for this table.	Succeeded
Supported foreign key relationships are defined on this table but the table cannot be migrated through the memory-optimization wizard. To migrate this table as well as the other tables involved in the FOREIGN KEY references, first remove the FOREIGN KEYs, then migrate the tables using the memory-optimization wizard, and finally add the FOREIGN KEY references to the migrated memory-optimized tables.	Failed: More information
- FK_Sales_BuyingGroups_Application_People: Foreign Key on this table (referencing Application.People)	
- FK_Sales_Customers_BuyingGroupID_Sales_BuyingGroups: Foreign Key as primary table (referenced by Sales.Customers)	
- FK_Sales_SpecialDeals_BuyingGroupID_Sales_BuyingGroups: Foreign Key as primary table (referenced by Sales.SpecialDeals)	
No unsupported constraints are defined on this table.	Succeeded
No unsupported indexes are defined on this table.	Succeeded
No unsupported triggers are defined on this table.	Succeeded
Post migration row size does not exceed the row size limit of memory-optimized tables.	Succeeded
Table is not partitioned or replicated.	Succeeded

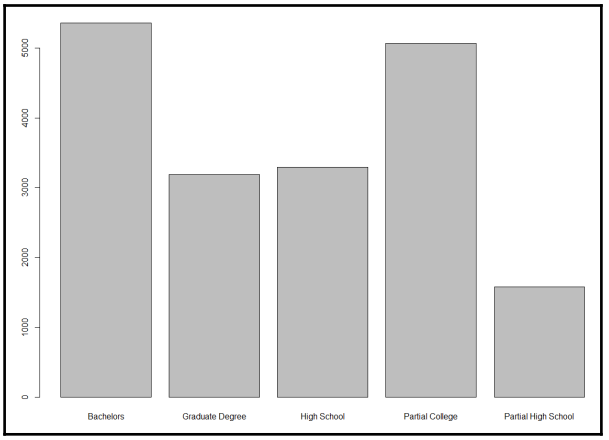
- Disk Usage
- Disk Usage by Top Tables
- Disk Usage by Table
- Disk Usage by Partition
- Backup and Restore Events
- All Transactions
- All Blocking Transactions
- Top Transactions by Age
- Top Transactions by Blocked Transactions Count
- Top Transactions by Locks Count
- Resource Locking Statistics by Objects
- Object Execution Statistics
- Database Consistency History
- Memory Usage By Memory Optimized Objects
- Transaction Performance Analysis Overview
- Index Usage Statistics
- Index Physical Statistics
- Schema Changes History
- User Statistics

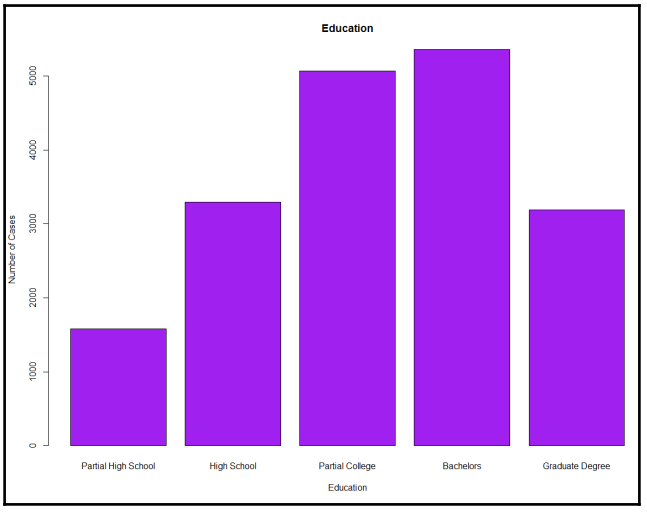

The following chart contains the top candidate tables for memory optimization based on the access patterns of your workload. The horizontal axis represents decreasing effort of memory optimization, while the vertical axis represents increasing benefits of memory optimization in your workload.
You should prioritize the tables in the top right corner of the chart for memory optimization.
Select number of Tables:
5
10
15
20
25
30
Warehouse.ColdRoomTemperatures_Archive
High Gain
Low Gain
Significant migration work
Minimal migration work

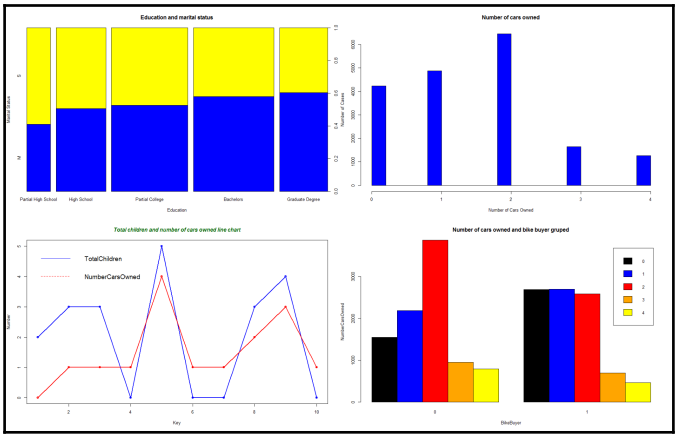
Chapter 13: Supporting R in SQL Server

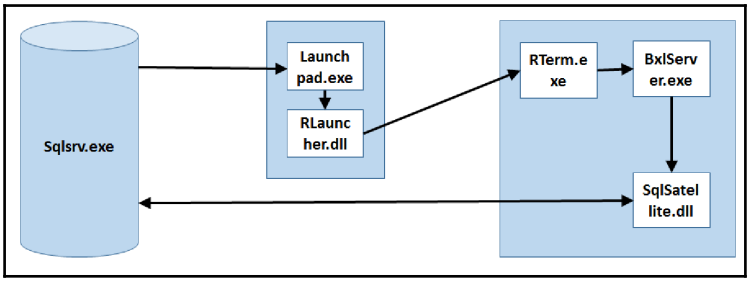


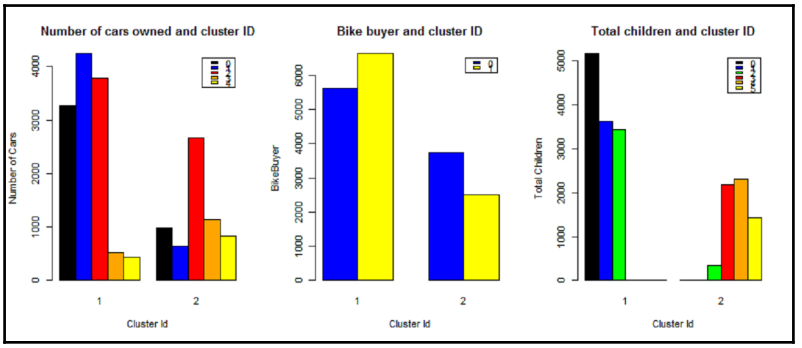



0
1000
2000
3000
4000
5000
Bachelors
Graduate Degree
High School
Partial College
Partial High School


Education
Number of Cases
0
1000
2000
3000
4000
5000
Partial High School
High School
Partial College
Bachelors
Graduate Degree
Education

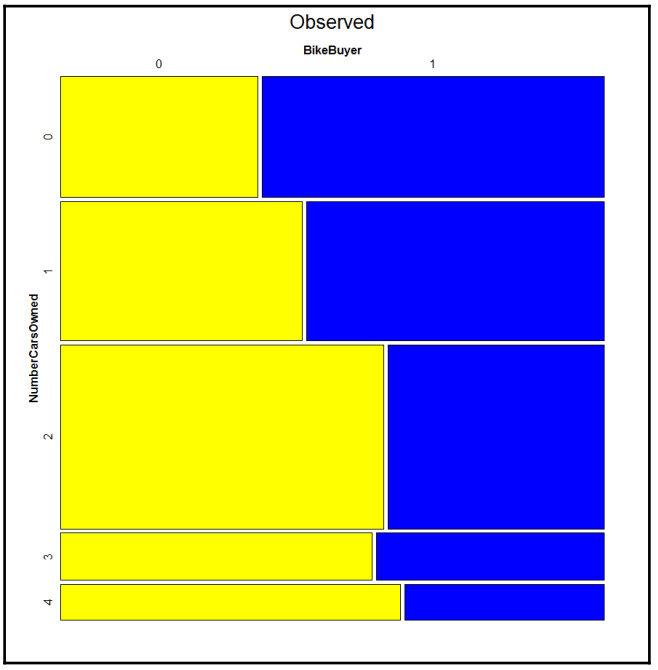

Education and marital status
Partial High School
High School
Partial College
Bachelors
Graduate Degree
Education
Number of cars owned
Number of Cars Owned
Total children and number of cars owned line chart
TotalChildren
NumberCarsOwned
Key
Number of cars owned and bike buyer gruped
BikeBuyer

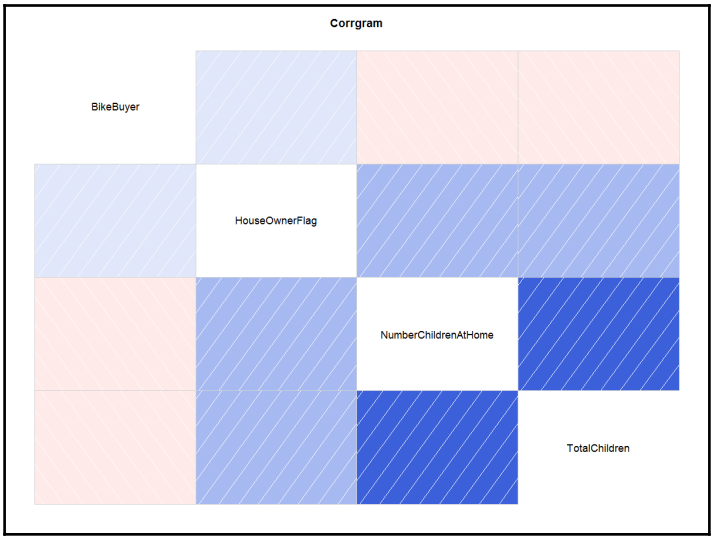

Sqlsrv.exe
Launch pad.exe
RLaunc her.dll
RTerm.e xe
BxlServ er.exe
SqlSatel lite.dll

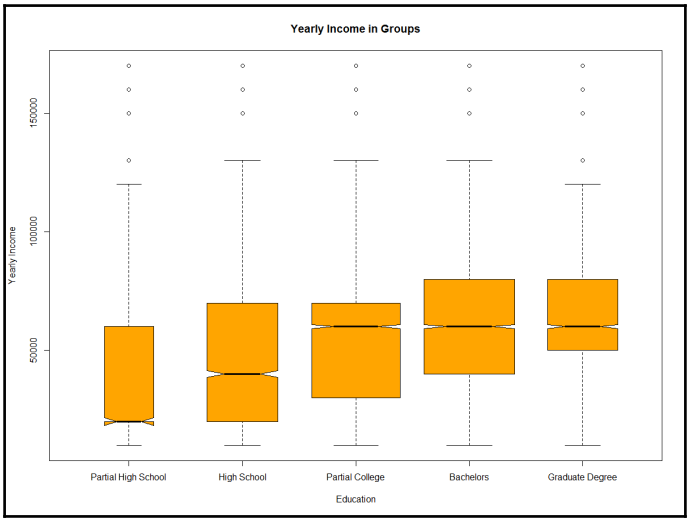

Number of cars owned and cluster ID
Number of Cars
Cluster Id
Bike buyer and cluster ID
BikeBuyer
Cluster Id
Total children and cluster ID
Total Children
Cluster Id

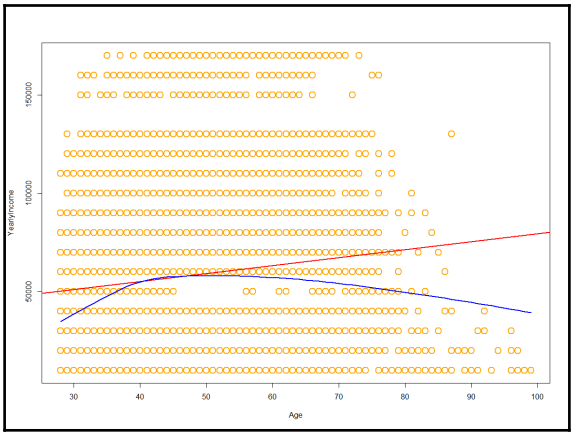
Chapter 14: Data Exploration and Predictive Modeling with R

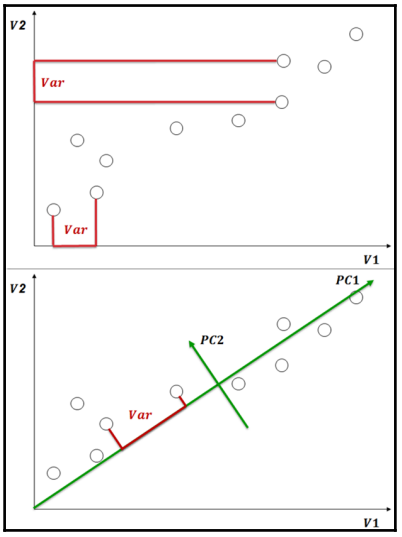
DF	Chi-squared Value									
1	0.004	0.02	0.15	0.46	1.07	1.64	2.71	3.84	6.64	10.83
2	0.10	0.21	0.71	1.39	2.41	3.22	4.60	5.99	9.21	13.82
3	0.35	0.58	1.42	2.37	3.66	4.64	6.25	7.82	11.34	16.27
4	0.71	1.06	2.20	3.36	4.88	5.99	7.78	9.49	13.28	18.47
5	1.14	1.61	3.00	4.35	6.06	7.29	9.24	11.07	15.09	20.52
6	1.63	2.20	3.83	5.35	7.23	8.56	10.64	12.59	16.81	22.46
7	2.17	2.83	4.67	6.35	8.38	9.80	12.02	14.07	18.48	24.32
8	2.73	3.49	5.53	7.34	9.52	11.03	13.56	15.51	20.09	26.12
9	3.32	4.17	6.39	8.34	10.66	12.24	14.68	16.92	21.67	27.88
10	3.94	4.86	7.27	9.34	11.78	13.44	15.99	18.31	23.21	29.59
Probability	0.95	0.90	0.70	0.50	0.30	0.20	0.10	0.05	0.01	0.001
	Not significant							Significant		

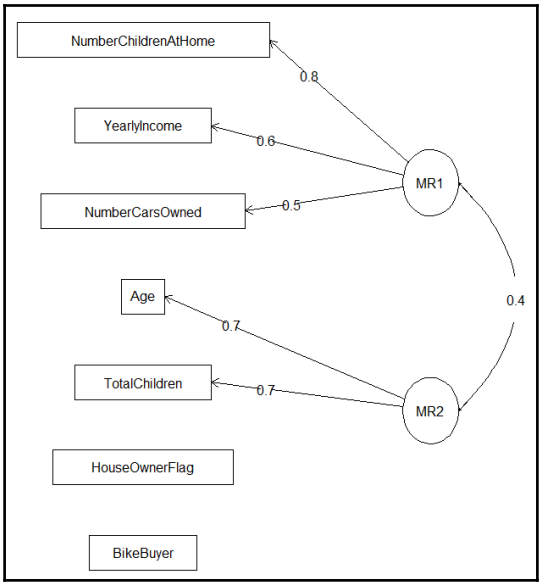


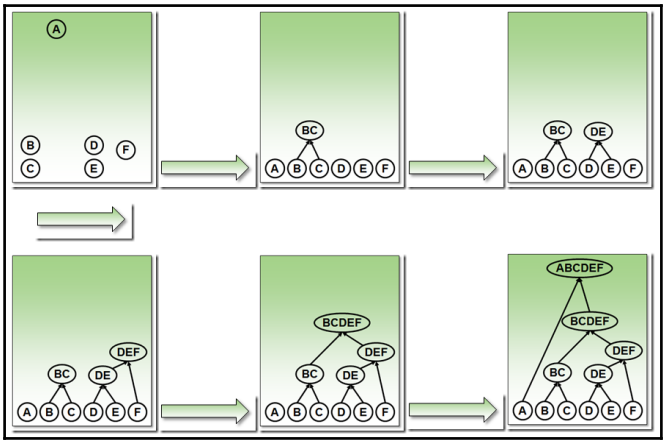

Corrgram
BikeBuyer
HouseOwnerFlag
NumberChildrenAtHome
TotalChildren

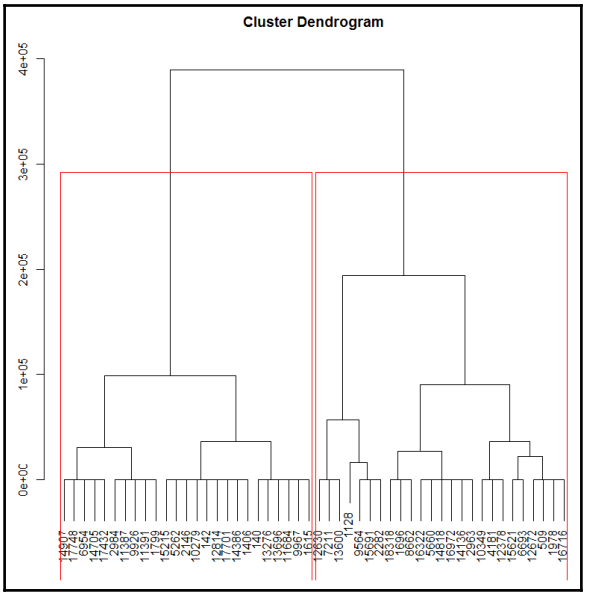

Yearly Income in Groups
Yearly Income
150000
100000
50000
Partial High School
High School
Partial College
Bachelors
Graduate Degree
Education

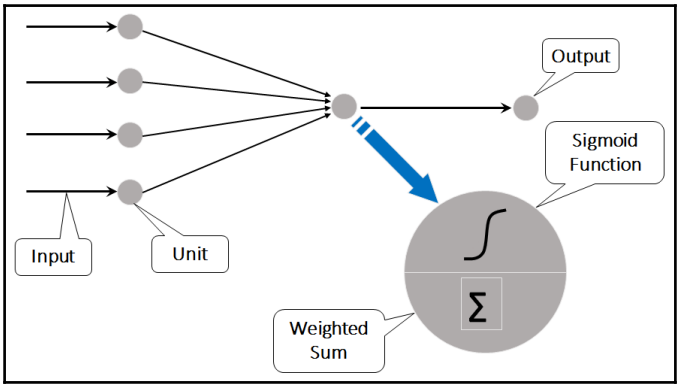

150000
100000
50000
Yearlyincome
30
40
50
60
70
80
90
100
Age

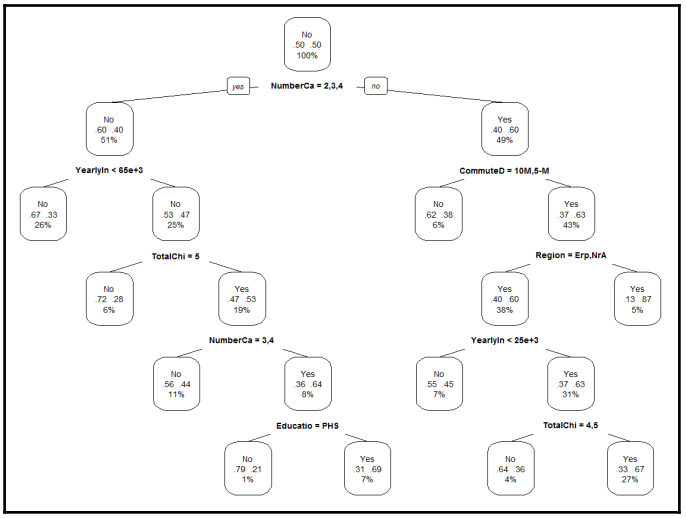

V2
Var
Var
V1
V2
PC1
PC2
Var
V1

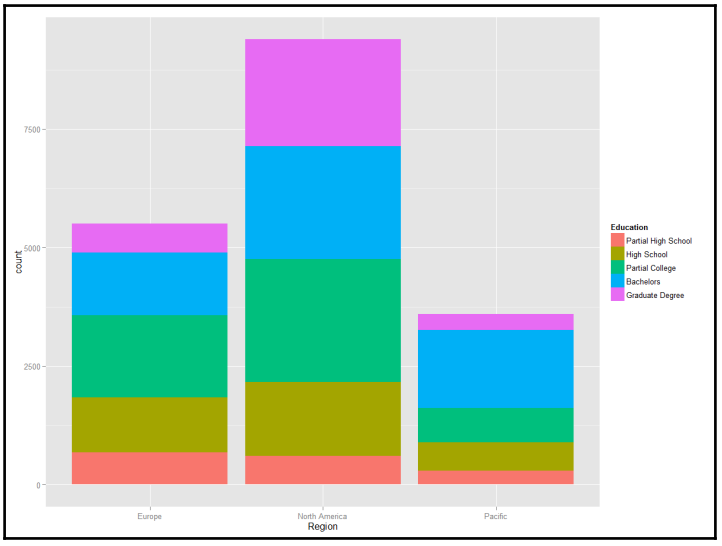

NumberChildrenAtHome
YearlyIncome
NumberCarsOwned
Age
TotalChildren
HouseOwnerFlag
BikeBuyer
MR1
MR2
0.8
0.6
0.5
0.7
0.7
0.4

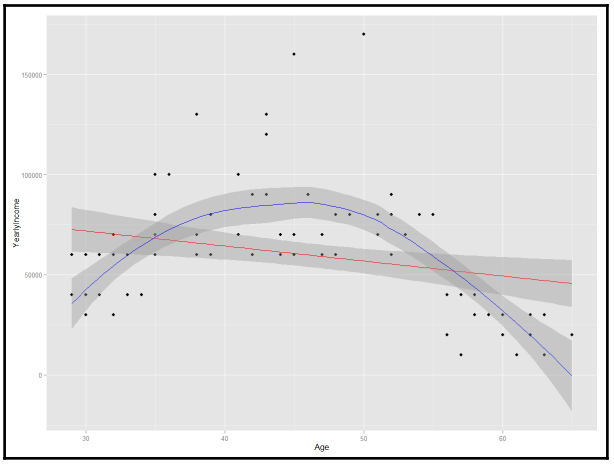

A
B
C
D
E
F
BC
DE
DEF
BCDEF
ABCDEF

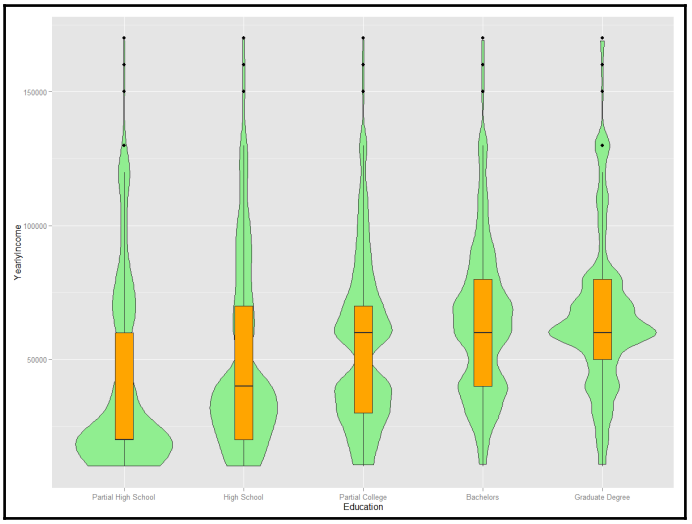

Cluster Dendrogram
4e+05
3e+05
2e+05
1e+05
0e+00

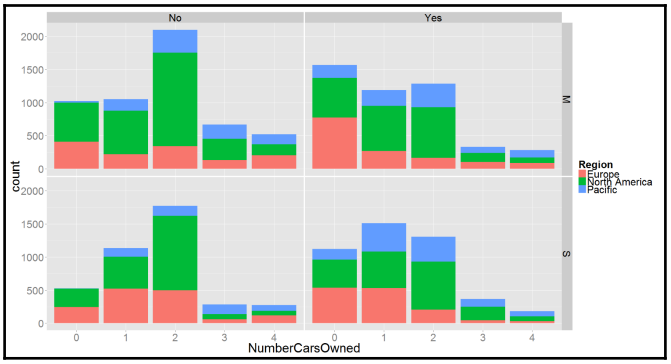

Output
Sigmoid Function
Input
Unit
Weighted Sum
∫
Σ


No
.50 .50
100%
yes
NumberCa = 2,3,4
no
No
.60 .40
51%
Yes
.40 .60
49%
YearlyIn < 65e+3
CommuteD = 10M,5-M
No
.67 .33
26%
No
.53 .47
25%
No
.62 .38
6%
Yes
.37 .63
43%
TotalChi = 5
Region = Erp,NrA
No
.72 .28
6%
Yes
.47 .53
19%
Yes
.40 .60
38%
Yes
.13 .87
5%
NumberCa = 3,4
YearlyIn < 25e+3
No
.56 .44
11%
Yes
.36 .64
8%
No
.55 .45
7%
Yes
.37 .63
31%
Educatio = PHS
TotalChi = 4,5
No
.79 .21
1%
Yes
.31 .69
7%
No
.64 .36
4%
Yes
.33 .67
27%

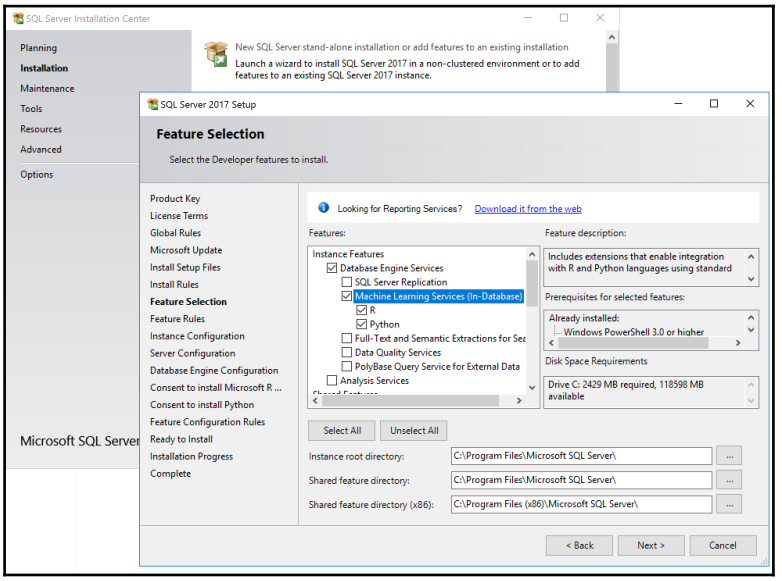

7500
5000
2500
0
count
Europe
North America
Pacific
Region
Education
Partial High School
High School
Partial College
Bachelors
Graduate Degree

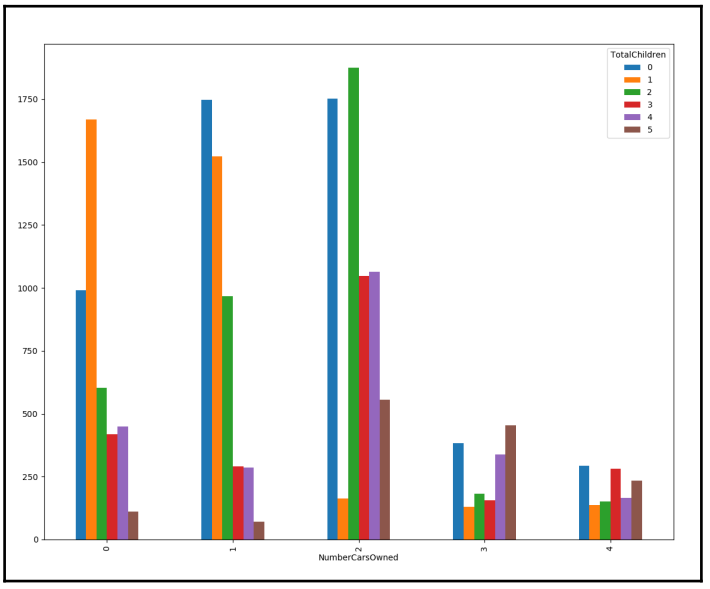

150000
100000
50000
0
Yearlyincome
30
40
50
60
Age

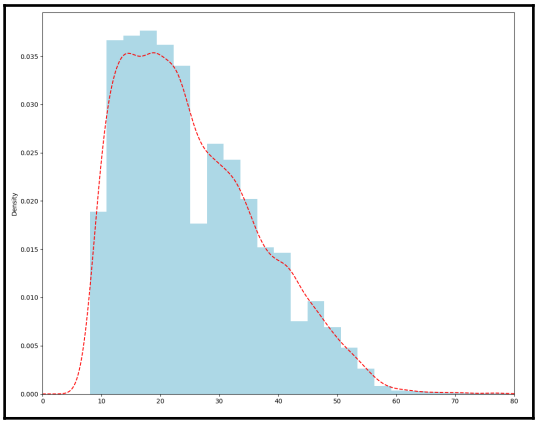

150000
100000
50000
Yearlyincome
Partial High School
High School
Partial College
Bachelors
Graduate Degree
Education

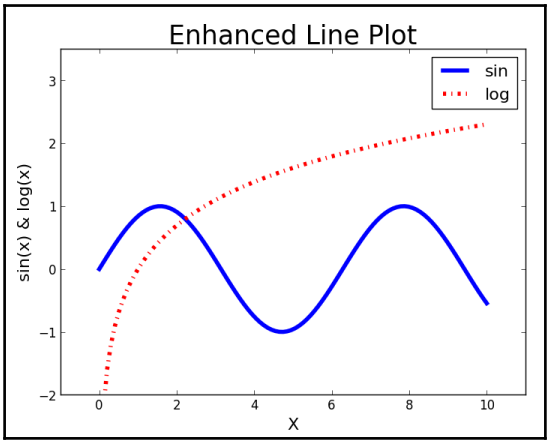

No
Yes
M
S
count
2000
1500
1000
500
0
0
1
2
3
4
NumberCarsOwned
Region
Europe
North America
Pacific

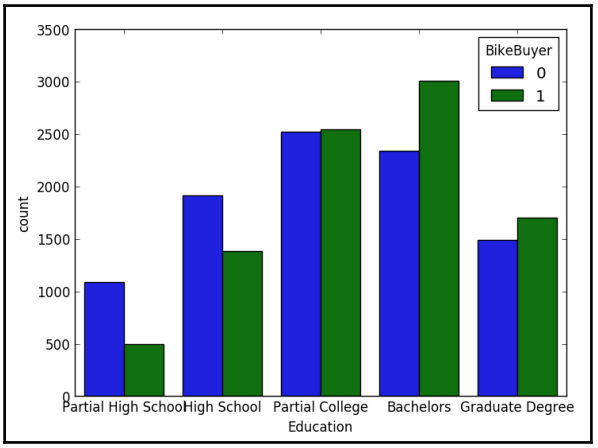
Chapter 15: Introducing Python

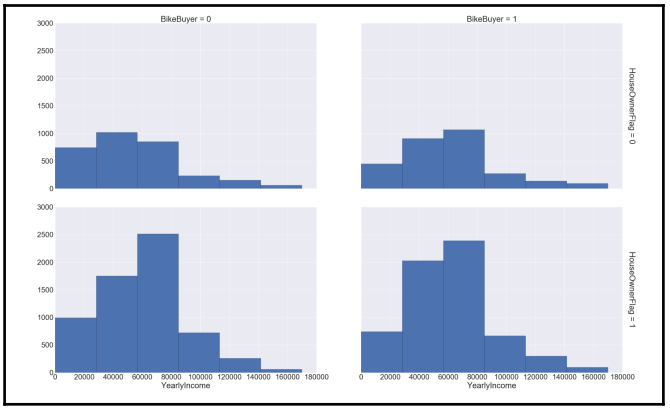


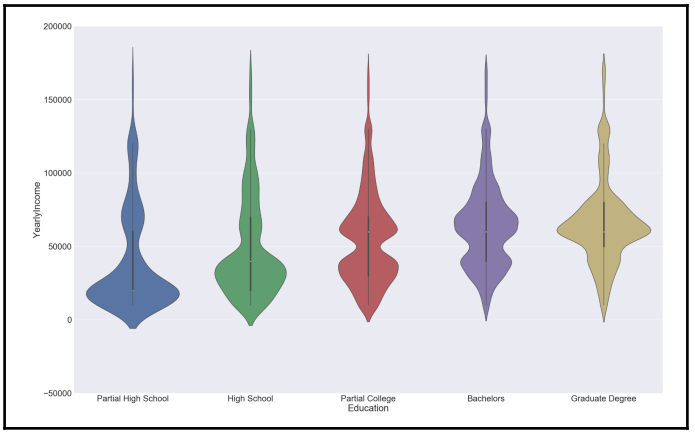


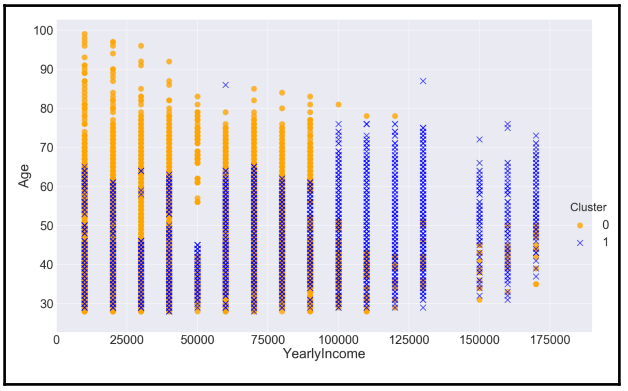

Density
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0
10
20
30
40
50
60
70
80


Enhanced Line Plot
sin
log
sin(x) & log(x)
X
3
2
1
0
−1
−2
0
2
4
6
8
10

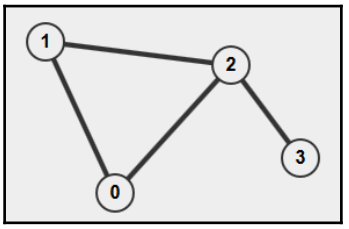

BikeBuyer
0
1
count
3500
3000
2500
2000
1500
1000
500
0
Partial High School
High School
Partial College
Bachelors
Graduate Degree
Education

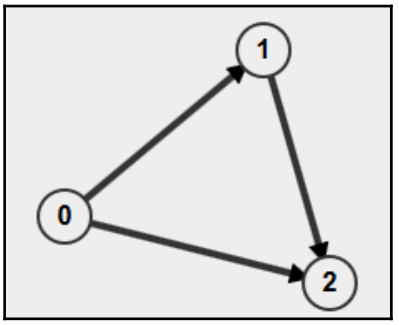

BikeBuyer = 0
BikeBuyer = 1
HouseOwnerFlag = 0
HouseOwnerFlag = 1
YearlyIncome
YearlyIncome

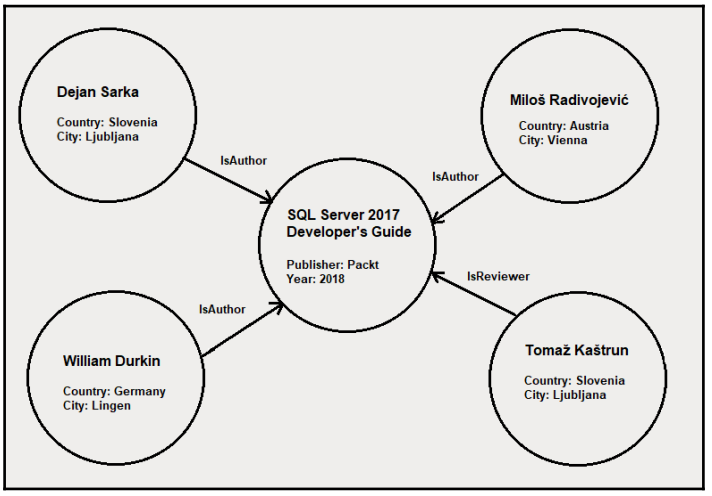

YearlyIncome
Partial High School
High School
Partial College
Education
Bachelors
Graduate Degree

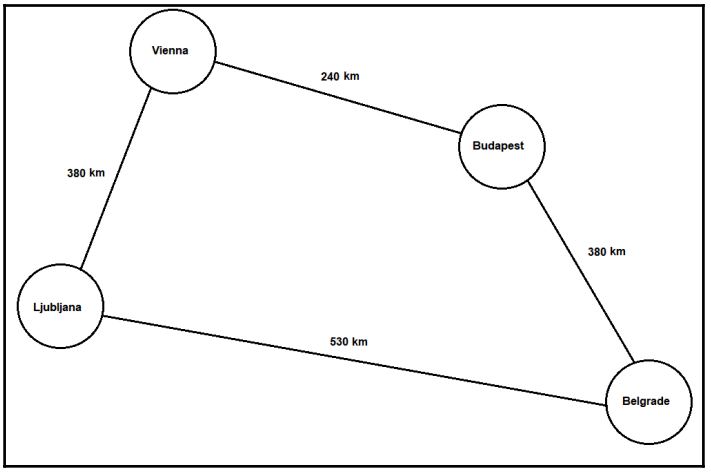

Age
YearlyIncome
Cluster
0
1

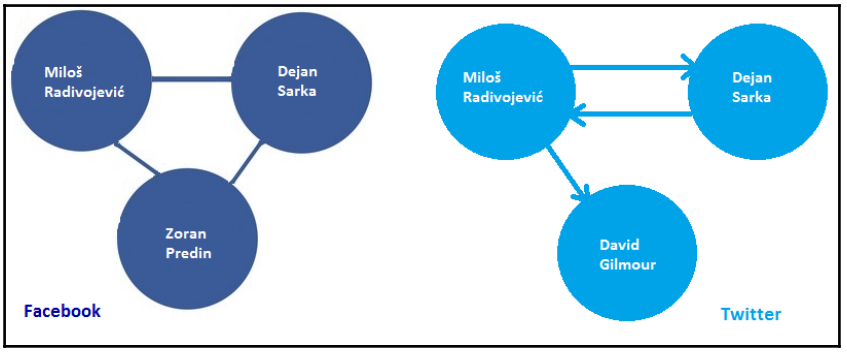
Chapter 16: Graph Database

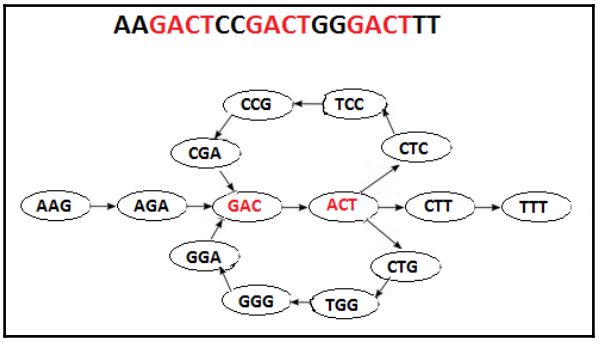


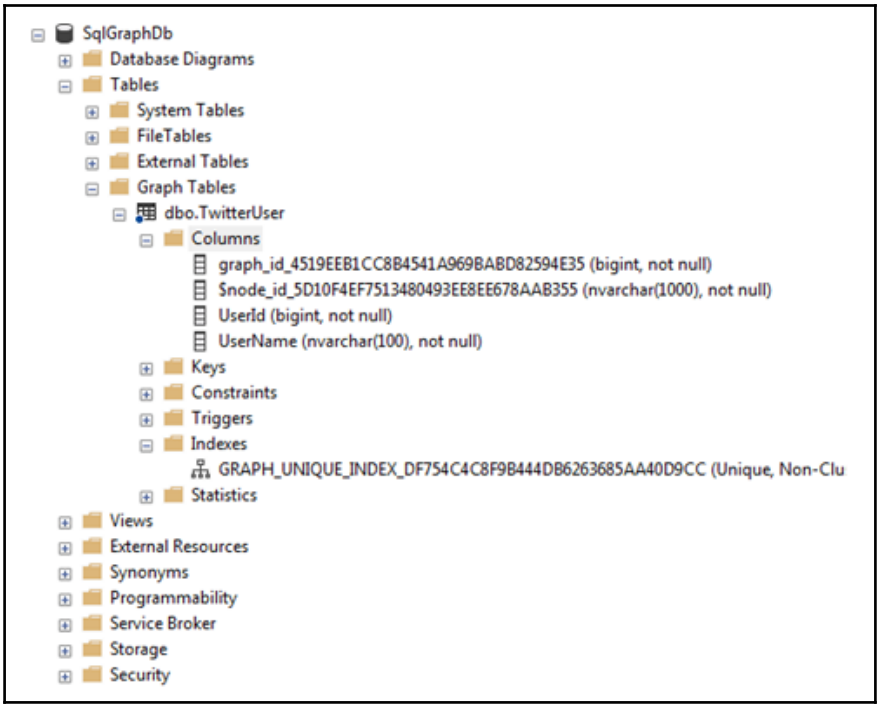





Vienna
240 km
Budapest
380 km
380 km
Ljubljana
530 km
Belgrade

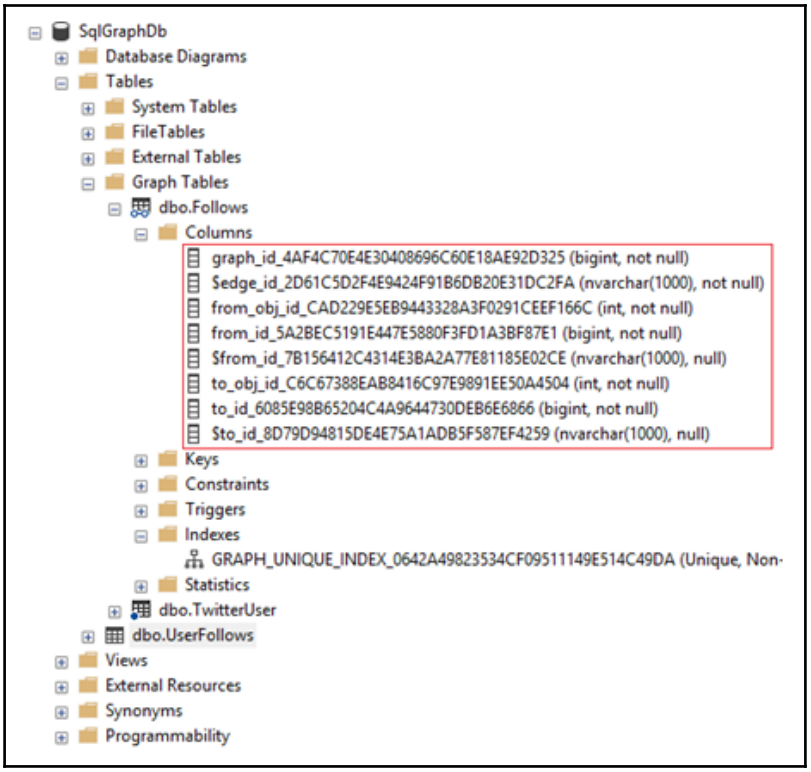

Miloš Radivojević
Dejan Sarka
Zoran Predin
Facebook
Miloš Radivojević
Dejan Sarka
David Gilmour
Twitter

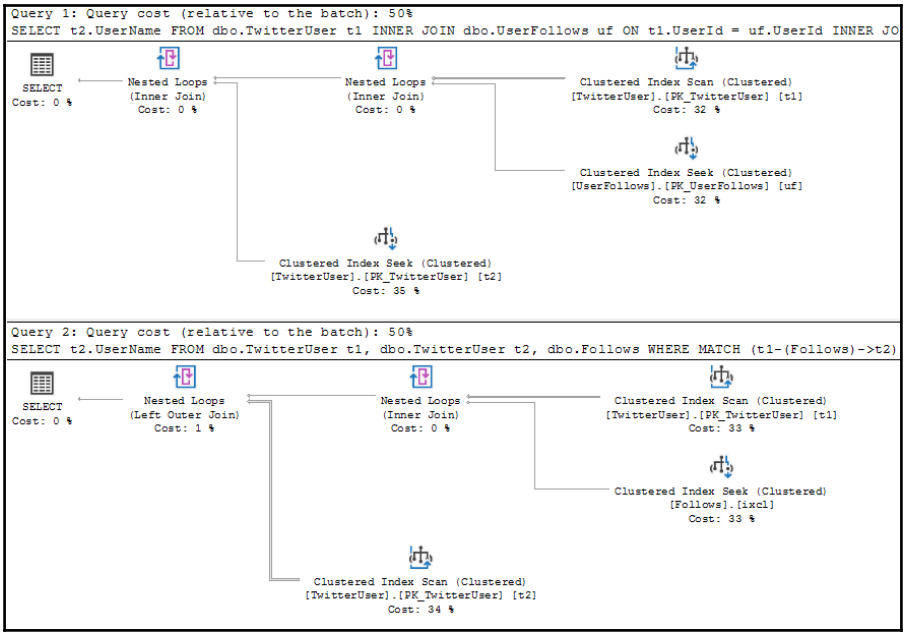

AAGACTCCGACTGGGACTTT
CCG
TCC
CGA
CTC
AAG
AGA
GAC
ACT
CTT
TTT
GGA
CTG
GGG
TGG

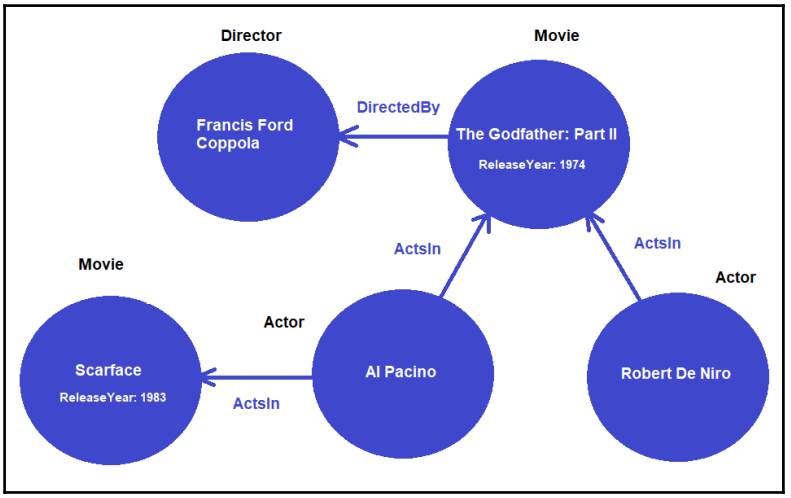


Results | Messages

	$edge_id_DC27A899D70B4CEDA19F8853E2ACB74A	$from_id_AB9D1120867F467A8FF5A25A3BF06EBD	$to_id_1B1C52A3AD0340DA8041F1DDEF8F4BAA
1	{"type":"edge","schema":"dbo","table":"Follows","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
2	{"type":"edge","schema":"dbo","table":"Follows","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
3	{"type":"edge","schema":"dbo","table":"Follows","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
4	{"type":"edge","schema":"dbo","table":"Follows","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":4}
5	{"type":"edge","schema":"dbo","table":"Follows","id":4}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}
6	{"type":"edge","schema":"dbo","table":"Follows","id":5}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
7	{"type":"edge","schema":"dbo","table":"Follows","id":6}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
8	{"type":"edge","schema":"dbo","table":"Follows","id":7}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":5}
9	{"type":"edge","schema":"dbo","table":"Follows","id":8}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
10	{"type":"edge","schema":"dbo","table":"Follows","id":9}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
11	{"type":"edge","schema":"dbo","table":"Follows","id":10}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}
12	{"type":"edge","schema":"dbo","table":"Follows","id":11}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
13	{"type":"edge","schema":"dbo","table":"Follows","id":12}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
14	{"type":"edge","schema":"dbo","table":"Follows","id":13}	{"type":"node","schema":"dbo","table":"TwitterUser","id":4}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}


SqlGraphDb
Database Diagrams
Tables
System Tables
FileTables
External Tables
Graph Tables
dbo.Follows
Columns
graph_id_4AF4C70E4E30408696C60E18AE92D325 (bigint, not null)
$edge_id_2D61C5D2F4E9424F91B6DB20E31DC2FA (nvarchar(1000), not null)
from_obj_id_CAD229E5EB9443328A3F0291CEEF166C (int, not null)
from_id_5A2BEC5191E447E5880F3FD1A3BF87E1 (bigint, not null)
$from_id_7B156412C4314E3BA2A77E81185E02CE (nvarchar(1000), null)
to_obj_id_C6C67388EAB8416C97E9891EE50A4504 (int, not null)
to_id_6085E98B65204C4A9644730DEB6E6866 (bigint, not null)
$to_id_8D79D94815DE4E75A1ADB5F587EF4259 (nvarchar(1000), null)
Keys
Constraints
Triggers
Indexes
GRAPH_UNIQUE_INDEX_0642A49823534CF09511149E514C49DA (Unique, Non-
Statistics
dbo.TwitterUser
dbo.UserFollows
Views
External Resources
Synonyms
Programmability

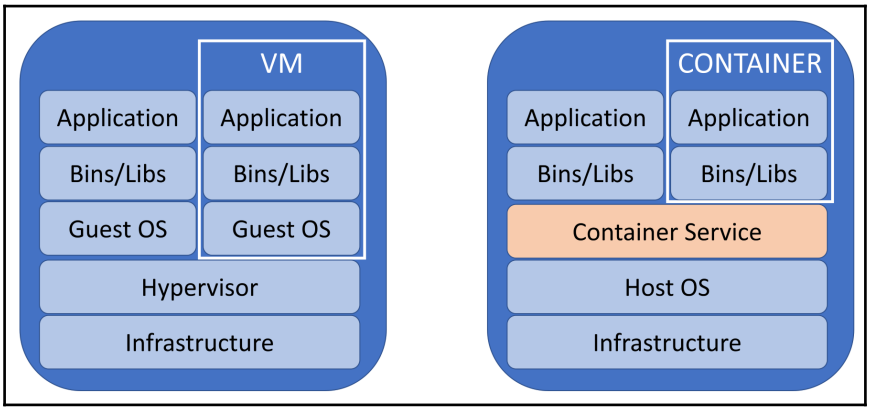

Query 1: Query cost (relative to the batch): 50%
SELECT t2.UserName FROM dbo.TwitterUser t1 INNER JOIN dbo.UserFollows uf ON t1.UserId = uf.UserId INNER JO
SELECT
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Nested Loops
(Inner Join)
Cost: 0 %
Clustered Index Scan (Clustered)
[TwitterUser].[PK_TwitterUser] [t1]
Cost: 32 %
Clustered Index Seek (Clustered)
[UserFollows].[PK_UserFollows] [uf]
Cost: 32 %
Clustered Index Seek (Clustered)
[TwitterUser].[PK_TwitterUser] [t2]
Cost: 35 %
Query 2: Query cost (relative to the batch): 50%
SELECT t2.UserName FROM dbo.TwitterUser t1, dbo.TwitterUser t2, dbo.Follows WHERE MATCH (t1-(Follows)->t2)
SELECT
Cost: 0 %
Nested Loops
(Left Outer Join)
Cost: 1 %
Nested Loops
(Inner Join)
Cost: 0 %
Clustered Index Scan (Clustered)
[TwitterUser].[PK_TwitterUser] [t1]
Cost: 33 %
Clustered Index Seek (Clustered)
[Follows].[ixcl]
Cost: 33 %
Clustered Index Scan (Clustered)
[TwitterUser].[PK_TwitterUser] [t2]
Cost: 34 %


Director
Movie
Francis Ford Coppola
DirectedBy
The Godfather: Part II
ReleaseYear: 1974
ActsIn
ActsIn
Movie
Actor
Actor
Scarface
ReleaseYear: 1983
ActsIn
Al Pacino
Robert De Niro

Results | Messages

	$edge_id_82B10CC57A7F4034B3A776DB66C2B5E4	$from_id_ABB33B8DFD9E4E03947F36F0F902E354	$to_id_EBE5DA36BD8D41F781ACCEE81EF5A6A0
1	{"type":"edge","schema":"dbo","table":"Follows","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
2	{"type":"edge","schema":"dbo","table":"Follows","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
3	{"type":"edge","schema":"dbo","table":"Follows","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
4	{"type":"edge","schema":"dbo","table":"Follows","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":4}
5	{"type":"edge","schema":"dbo","table":"Follows","id":4}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}
6	{"type":"edge","schema":"dbo","table":"Follows","id":5}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
7	{"type":"edge","schema":"dbo","table":"Follows","id":6}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
8	{"type":"edge","schema":"dbo","table":"Follows","id":7}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}	{"type":"node","schema":"dbo","table":"TwitterUser","id":5}
9	{"type":"edge","schema":"dbo","table":"Follows","id":8}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
10	{"type":"edge","schema":"dbo","table":"Follows","id":9}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}
11	{"type":"edge","schema":"dbo","table":"Follows","id":10}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}
12	{"type":"edge","schema":"dbo","table":"Follows","id":11}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}
13	{"type":"edge","schema":"dbo","table":"Follows","id":12}	{"type":"node","schema":"dbo","table":"TwitterUser","id":3}	{"type":"node","schema":"dbo","table":"TwitterUser","id":2}
14	{"type":"edge","schema":"dbo","table":"Follows","id":13}	{"type":"node","schema":"dbo","table":"TwitterUser","id":4}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}
15	{"type":"edge","schema":"dbo","table":"Follows","id":29}	{"type":"node","schema":"dbo","table":"TwitterUser","id":0}	{"type":"node","schema":"dbo","table":"TwitterUser","id":1}

Chapter 17: Containers and SQL on Linux

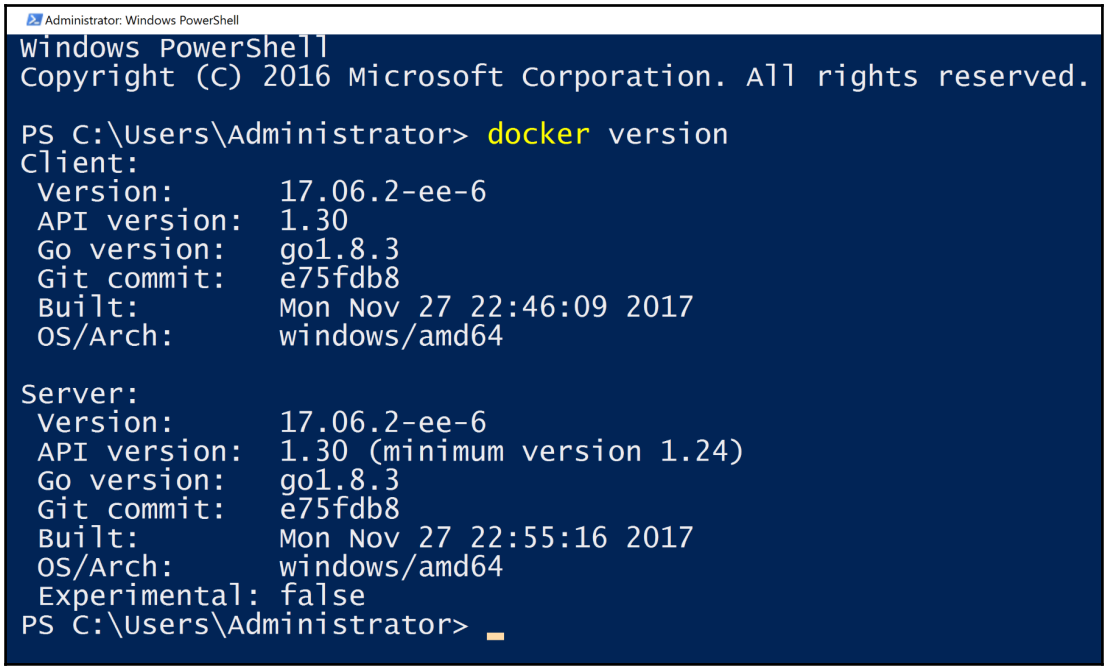



```
PS C:\Users\Administrator> Install-Module -Name DockerMsftProvider -Force

NuGet provider is required to continue
PowerShellGet requires NuGet provider version '2.8.5.201' or newer to interact with
NuGet-based repositories. The NuGet provider must be available in 'C:\Program
Files\PackageManagement\ProviderAssemblies' or
'C:\Users\Administrator\AppData\Local\PackageManagement\ProviderAssemblies'. You can
also install the NuGet provider by running 'Install-PackageProvider -Name NuGet
-MinimumVersion 2.8.5.201 -Force'. Do you want PowerShellGet to install and import the
NuGet provider now?
[Y] Yes  [N] No  [S] Suspend  [?] Help (default is "Y"): Y
PS C:\Users\Administrator> Install-Package -Name docker -ProviderName DockerMsftProvider

Name                           Version          Source           Summary
----                           -------          ------           -------
Docker                         17.06.2-ee-6     DockerDefault    Contains Docker EE for u


PS C:\Users\Administrator> _
```


Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2016 Microsoft Corporation. All rights reserved.
PS C:\Users\Administrator> docker version
Client:
Version: 17.06.2-ee-6
API version: 1.30
Go version: go1.8.3
Git commit: e75fdb8
Built: Mon Nov 27 22:46:09 2017
OS/Arch: windows/amd64
Server:
Version: 17.06.2-ee-6
API version: 1.30 (minimum version 1.24)
Go version: go1.8.3
Git commit: e75fdb8
Built: Mon Nov 27 22:55:16 2017
OS/Arch: windows/amd64
Experimental: false
PS C:\Users\Administrator>

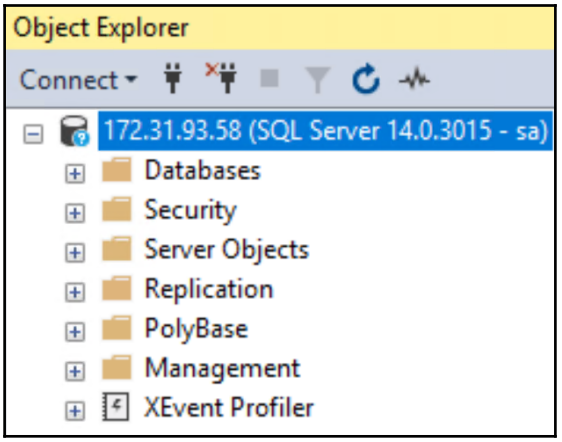

Administrator: Windows PowerShell
PS C:\Users\Administrator> docker search microsoft/mssql
NAME DESCRIPTION
D
microsoft/dotnet Official images for .NET Core for Linux an...
microsoft/aspnet ASP.NET is an open source server-side Web ...
microsoft/mssql-server-linux Official images for Microsoft SQL Server o...
microsoft/aspnetcore Official images for running compiled ASP.N...
mono Mono is an open source implementation of M...
microsoft/mssql-server-windows-express Official Microsoft SQL Server Express Edit...
microsoft/aspnetcore-build Official images for building ASP.NET Core ...
microsoft/mssql-server-windows-developer Official Microsoft SQL Server Developer Ed...
microsoft/azure-cli Official images for Microsoft Azure CLI
microsoft/dynamics-nav Official images for Microsoft Dynamics NAV...
microsoft/oms Monitor your containers using the Operatio...
microsoft/cntk CNTK images from github.com/Microsoft/CNTK...
microsoft/mssql-tools Official images for Microsoft SQL Server C...
microsoft/dotnet-nightly Preview bits of the .NET Core CLI
rsmoorthy/mssql MSSQL Database (version SQL2000)
microsoft/mmlspark Microsoft Machine Learning for Spark
militellovinx/mssql-server-linux microsoft/mssql-server-linux with mssql-to...
awaragi/prometheus-mssql-exporter prometheus-mssql-exporter
mondora/sandman2-mssql Docker image for running sandman2 to get a...

```
PS C:\Users\Administrator> docker pull microsoft/mssql-server-windows-express
Using default tag: latest
latest: Pulling from microsoft/mssql-server-windows-express
3889bb8d808b: Downloading  2.703MB/4.07GB
449343c9d7e2: Downloading  3.244MB/1.304GB
a336350523ea: Download complete
2c12ef99f411: Download complete
8ebb28bb3276: Waiting
3bb8431b46ce: Waiting
a4a938096b3c: Waiting
656eb837f7e6: Waiting
a3d536b0e79d: Waiting
a0aec5f46615: Waiting
64a0f6512541: Waiting
b900d04a68bd: Waiting
```

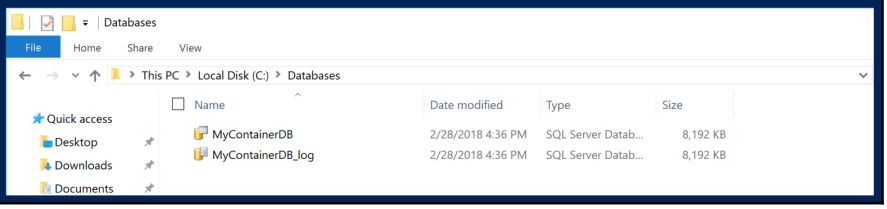
```
PS C:\Users\Administrator> docker images
REPOSITORY                                  TAG                 IMAGE ID            CREATED
microsoft/mssql-server-windows-express      latest              1986b8a8f950        6 weeks ago
PS C:\Users\Administrator> _
```

```
PS C:\Users\Administrator> docker ps
CONTAINER ID        IMAGE                                       COMMAND                  CREATED             STATUS              PORTS                     NAMES
e485f7dc4759        microsoft/mssql-server-windows-express      "powershell -Comma..."   2 minutes ago       Up About a minute   0.0.0.0:12345->1433/tcp   MyFirs
PS C:\Users\Administrator> _
```

```
            "IPAddress": "",
            "IPPrefixLen": 0,
            "IPv6Gateway": "",
            "MacAddress": "",
            "Networks": {
                "nat": {
                    "IPAMConfig": null,
                    "Links": null,
                    "Aliases": null,
                    "NetworkID": "7875ce9196e7ad91efff616035c577defcf9e5286da5fdd756b9288e37c4579e",
                    "EndpointID": "fec99e72bb285d3272ce2ac49f2e47a2bb53ff4d96b6228ad72b98861737f2d3",
                    "Gateway": "172.31.80.1",
                    "IPAddress": "172.31.93.58",
                    "IPPrefixLen": 16,
                    "IPv6Gateway": "",
                    "GlobalIPv6Address": "",
                    "GlobalIPv6PrefixLen": 0,
                    "MacAddress": "00:15:5d:da:a0:fb",
                    "DriverOpts": null
                }
            }
        }
    }
]
PS C:\Users\Administrator> _
```




```
PS C:\Users\Administrator> docker stop MySQLContainer
MySQLContainer
PS C:\Users\Administrator> docker rm MySQLContainer
MySQLContainer
PS C:\Users\Administrator> docker ps
CONTAINER ID        IMAGE                                   COMMAND                  CREATED             STATUS
5e923be3e2ce        microsoft/mssql-server-windows-express  "powershell -Comma..."   17 minutes ago      Up 17 minutes
PS C:\Users\Administrator>
```



```
PS C:\Databases> docker build -t testimage .
Sending build context to Docker daemon  16.78MB
Step 1/7 : FROM microsoft/mssql-server-windows-express
 ---> 1986b8a8f950
Step 2/7 : RUN powershell -Command ('new-item -path c:\ -name Databases -itemtype directory')
 ---> Running in 9145748c86c1


    Directory: C:\


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         3/5/2018   5:54 PM                Databases


 ---> 60476cc23aba
Removing intermediate container 9145748c86c1
Step 3/7 : COPY MyContainerDB.mdf C:\\Databases
 ---> 011ece420550
Removing intermediate container 4727f0b862d6
Step 4/7 : COPY MyContainerDB_log.ldf C:\\Databases
 ---> c85f79e0d0b3
Removing intermediate container b058819075c5
Step 5/7 : ENV sa_password P$sw0rd!
 ---> Running in 0ea5e7707e7f
 ---> 148786b2982f
Removing intermediate container 0ea5e7707e7f
Step 6/7 : ENV ACCEPT_EULA Y
 ---> Running in ea28bc466e45
 ---> 18e06e420fcb
Removing intermediate container ea28bc466e45
Step 7/7 : ENV attach_dbs "[{'dbName':'MyContainerDB','dbFiles':['C:\\Databases\\MyContainerDB.mdf','C:\\Databases\\MyContainerDB_log
df']}]"
 ---> Running in d64ea53e4c53
 ---> 909e0aa0c537
Removing intermediate container d64ea53e4c53
Successfully built 909e0aa0c537
Successfully tagged testimage:latest
PS C:\Databases>
```

```
PS C:\Databases> docker run -d -p 12346:1433 --name testcontainer testimage
d3bd38d00d594012da2586fcbfe28817d521ef05bee6d62791f16021d305ab33
PS C:\Databases> docker ps
CONTAINER ID        IMAGE                                 COMMAND                  CREATED             STATUS              PORTS
d3bd38d00d59        testimage                             "powershell -Comma..."   18 seconds ago      Up 15 seconds       0.0.0.0
f3aa4f652733        microsoft/mssql-server-windows-express   "powershell -Comma..."   2 hours ago         Up 2 hours          0.0.0.0
PS C:\Databases>
```

```
sql@ubuntu:~$ sudo apt-get install -y mssql-server
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  gdb gdbserver libbabeltrace-ctf1 libbabeltrace1 libc++1 libc6-dbg libcc1-0 libcurl3 libjemalloc1 libpython-stdlib libpython2.7-minimal
  libpython2.7-stdlib libsss-nss-idmap0 libunwind8 python python-minimal python2.7 python2.7-minimal
Suggested packages:
  gdb-doc clang python-doc python-tk python2.7-doc binutils binfmt-support
The following NEW packages will be installed:
  gdb gdbserver libbabeltrace-ctf1 libbabeltrace1 libc++1 libc6-dbg libcc1-0 libcurl3 libjemalloc1 libpython-stdlib libpython2.7-minimal
  libpython2.7-stdlib libsss-nss-idmap0 libunwind8 mssql-server python python-minimal python2.7 python2.7-minimal
0 upgraded, 19 newly installed, 0 to remove and 2 not upgraded.
Need to get 174 MB/185 MB of archives.
After this operation, 974 MB of additional disk space will be used.
Get:1 https://packages.microsoft.com/ubuntu/16.04/mssql-server-2017 xenial/main amd64 mssql-server amd64 14.0.3022.28-2 [174 MB]
32% [1 mssql-server 18.1 MB/174 MB 10%]
```

```
sql@ubuntu:~$ sudo /opt/mssql/bin/mssql-conf setup
Choose an edition of SQL Server:
  1) Evaluation (free, no production use rights, 180-day limit)
  2) Developer (free, no production use rights)
  3) Express (free)
  4) Web (PAID)
  5) Standard (PAID)
  6) Enterprise (PAID)
  7) Enterprise Core (PAID)
  8) I bought a license through a retail sales channel and have a product key to enter.

Details about editions can be found at
https://go.microsoft.com/fwlink/?LinkId=852748&clcid=0x409

Use of PAID editions of this software requires separate licensing through a
Microsoft Volume Licensing program.
By choosing a PAID edition, you are verifying that you have the appropriate
number of licenses in place to install and run this software.

Enter your edition(1-8): _
```

```
Enter the SQL Server system administrator password:
Confirm the SQL Server system administrator password:
Configuring SQL Server...

Created symlink from /etc/systemd/system/multi-user.target.wants/mssql-server.service to /lib/systemd/system/mssql-server.service.
Setup has completed successfully. SQL Server is now starting.
sql@ubuntu:~$
```

```
sql@ubuntu:~$ systemctl status mssql-server
● mssql-server.service - Microsoft SQL Server Database Engine
   Loaded: loaded (/lib/systemd/system/mssql-server.service; enabled; vendor preset: enabled)
   Active: active (running) since Mon 2018-03-05 04:58:58 PST; 4min 56s ago
     Docs: https://docs.microsoft.com/en-us/sql/linux
 Main PID: 2533 (sqlservr)
   CGroup: /system.slice/mssql-server.service
           ├─2533 /opt/mssql/bin/sqlservr
           └─2553 /opt/mssql/bin/sqlservr
```

```
sql@ubuntu:~$ sqlcmd -S localhost -U SA -P 'P4ssw0rd!'
1> SELECT name FROM sys.databases
2> GO
name
--------------------------------------------------------------------------------
master
tempdb
model
msdb

(4 rows affected)
1>
```