



SQL Server 2019

Durch die Augen eines Programmierers



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Meine Person- Thorsten Kansy

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Azure Cosmos DB



Mein Service- Ihr Benefit

- Individuelle Inhouse Trainings
- (Online on-demand) Projektbegleitung
- Beratung
 - Problemanalyse und Lösungen
 - Technologieentscheidungen



Agenda

- SQL Server & Tooling
- Intelligent Database
 - Intelligent Query Processing
 - In-Memory Database
 - Intelligent performance
- Neue Graph Features
- Java-Unterstützung
- SQL Server auf Linux
- Sicherheit
- Sonstiges

SQL Server & Tooling

The background image shows a wide city square under a cloudy sky. In the center stands a tall, dark monument featuring a statue of a soldier in a trench coat holding a flag aloft. The base of the monument is inscribed with Russian text: 'БОРУМ ЗА ВЛАСТЬ СОВЕТОВ НА ДАЛЬНЕМ ВОСТОКЕ 1917-1922'. To the left is a large, light-colored building with a sign on its roof that reads 'ШМАКОВСКАЯ'. To the right is a modern building with a glass facade and a glass pyramid on its roof. People are walking in the square, and several pigeons are on the ground. A dark blue horizontal bar is overlaid across the middle of the image, containing the white text 'SQL Server & Tooling'. At the bottom of the image, there is a solid dark blue bar with a small white horizontal line in the center.

SQL Server 2019

- Windows
- Red Hat Enterprise Server, SUSE Linux Enterprise Server & Ubuntu
- Docker

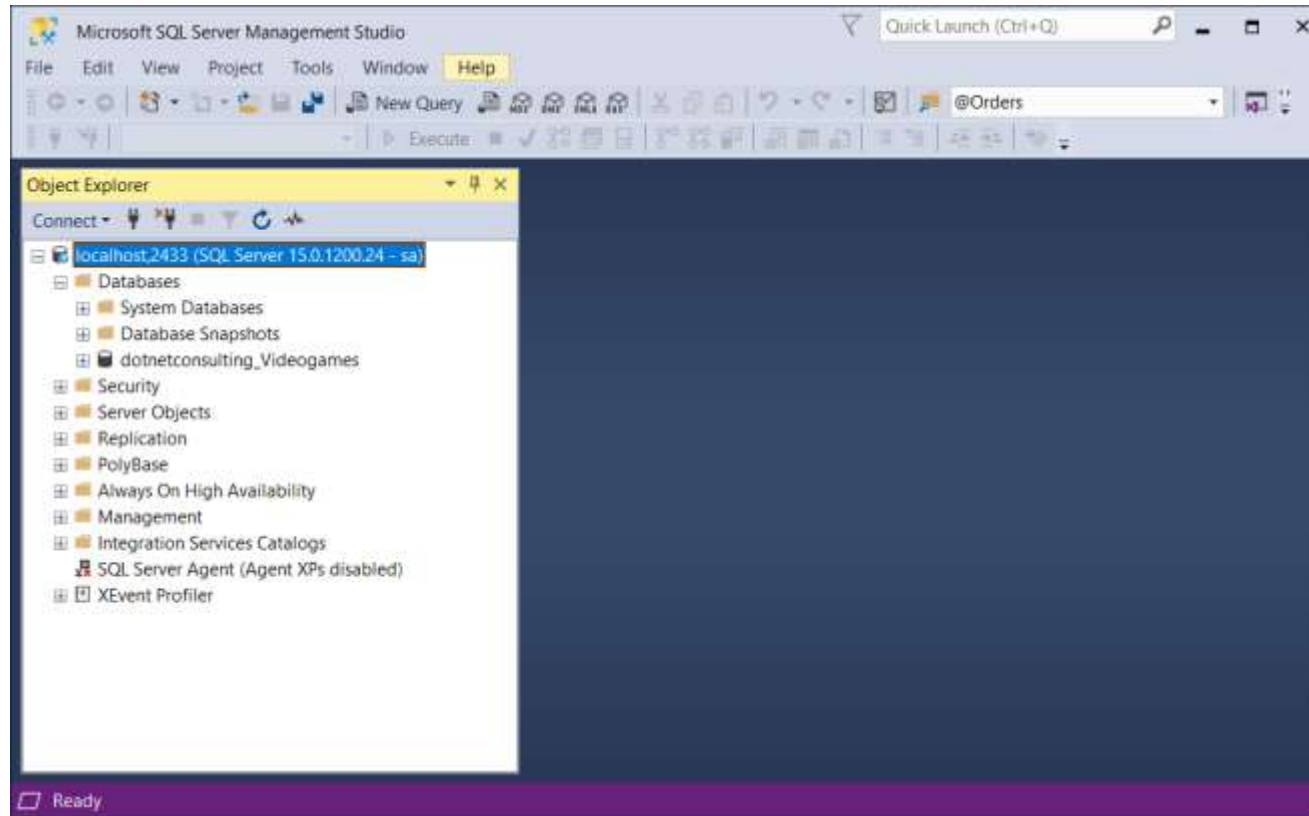
```
docker run -e ACCEPT_EULA=Y  
           -e SA_PASSWORD=P@ssw0rd99  
           -p 2433:1433  
           -d mcr.microsoft.com/mssql/server:2019-GA-ubuntu-16.04
```



<https://hub.docker.com/r/microsoft/mssql-server-linux/>

SQL Server Management Studio 18

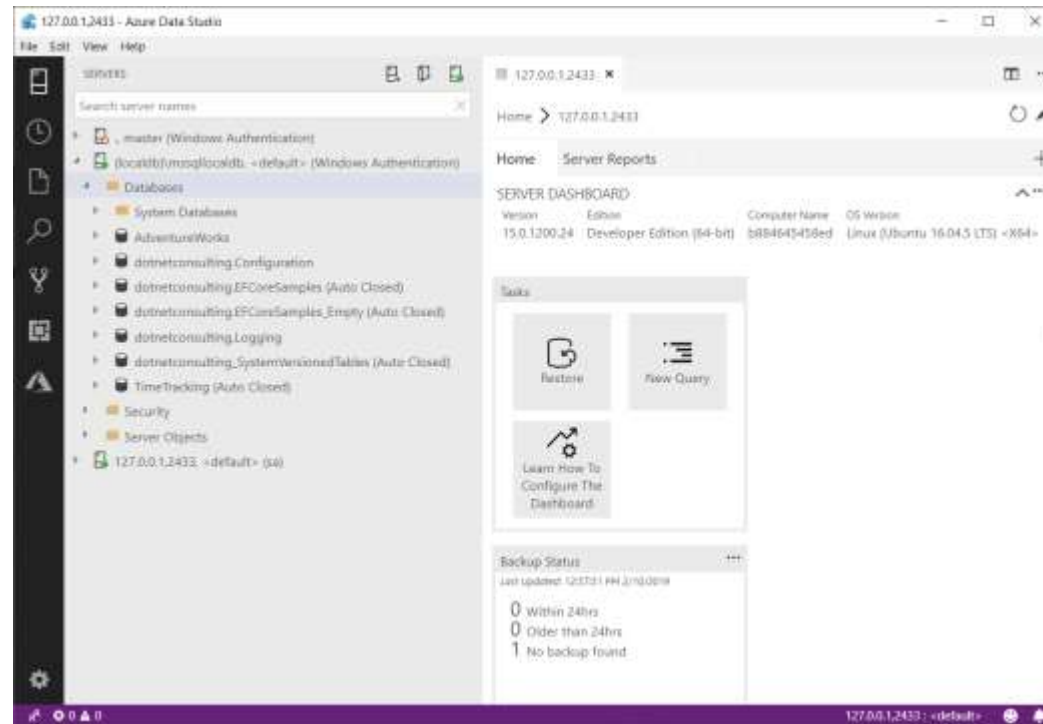
Windows only



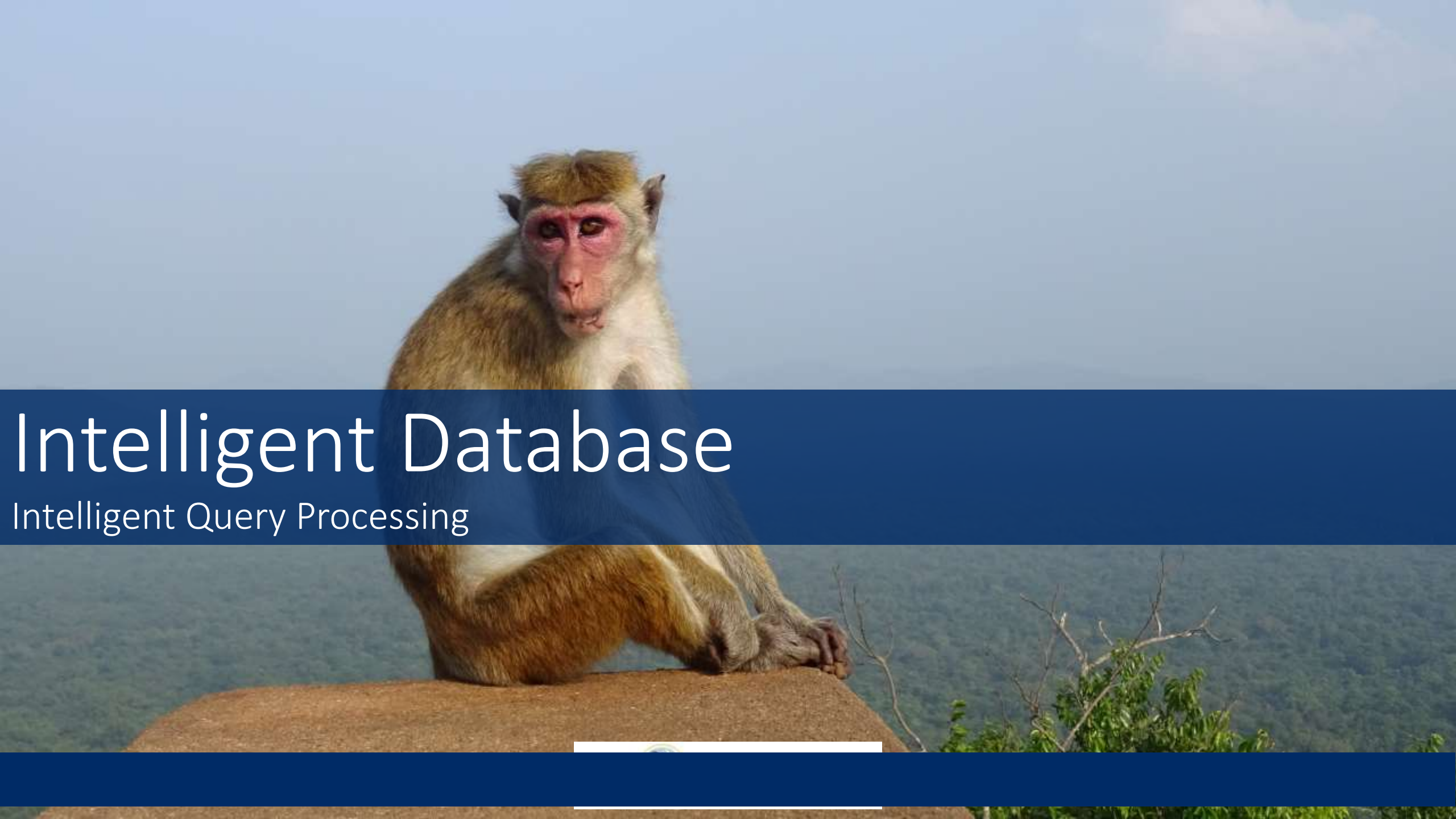
<https://docs.microsoft.com/en-us/sql/ssms/download-sql-server-management-studio-ssms>

Azure Data Studio

- Basiert auf Visual Studio Code
 - Windows
 - macOS
 - Linux



<https://docs.microsoft.com/en-us/sql/azure-data-studio>

A photograph of a brown monkey with a pinkish face, sitting on a large, reddish-brown rock. The monkey is looking towards the camera. The background consists of a clear blue sky and a dense green forest. A dark blue horizontal band is overlaid across the middle of the image, containing the title text.

Intelligent Database

Intelligent Query Processing

Intelligent Query Processing

- Approximate query processing
 - Schnellere Anzahl eindeutiger Werte, wenn diese nicht absolut präzise sein müssen
- Scalar UDF Inlining
 - Automatisches Einbetten von skalaren UDF in Abfrage

Nicht Entwickler Features:

Row mode memory grant feedback, Batch mode on rowstore, Table variable deferred compilation

Approximate query processing

Liefert schnellere Anzahl eindeutiger Werte, wenn diese nicht absolut präzise sein müssen

```
-- Eindeutige Werte zählen/schätzen  
SELECT APPROX_COUNT_DISTINCT([OrderQty]) AS Approx_Distinct_OrderKey  
FROM [Sales].[SalesOrderDetail];
```

 Demo 

Scalar UDF Inlining

Automatisches Einbetten von skalaren UDF in Abfragen

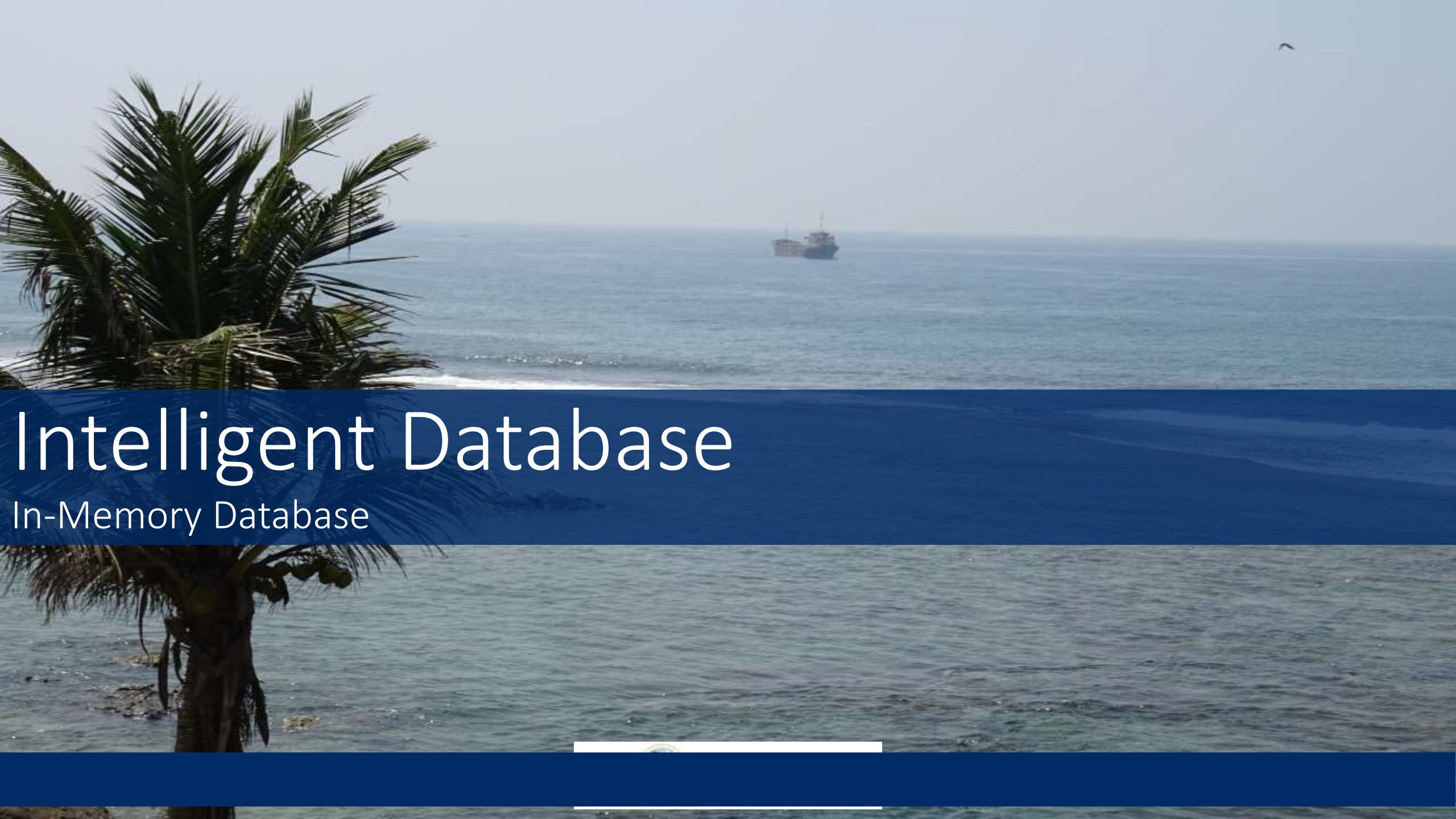
```
CREATE OR ALTER FUNCTION [dbo].[fnDivScore]
    ( @Punkte INT, @Div INT )
RETURNS INT
WITH INLINE = ON -- Dies ist der Standard, OFF deaktiviert Inlining
-- Für die gesamte DB ausschalten: ALTER DATABASE SCOPED CONFIGURATION SET TSQL_SCALAR_UDF_INLINING = OFF;
AS
BEGIN
    RETURN @Punkte / @Div;
END

-- Abfrage mit UDF
SELECT [dbo].[fnDivScore](Punkte, 1000), * FROM [dbo].[Highscores];
-- wird intern zu: SELECT Punkte / 1000, * FROM [dbo].[Highscores];
```



<https://blogs.msdn.microsoft.com/sqlserverstorageengine/2018/11/07/introducing-scalar-udf-inlining/>

 Demo 



Intelligent Database

In-Memory Database

In-Memory Database

Nicht Entwickler Features:

Memory-optimized TempDB metadata, Database Snapshots mit Memory-optimized filegroups, Hybrid Buffer Pool



Intelligent Database

Intelligent performance

Intelligent performance

- OPTIMIZE_FOR_SEQUENTIAL_KEY
 - Optimierung für sequenzielle Indizes (Identity, Sequenzen, Datetime, ...)

Weitere (nicht Entwickler Features):

Forcing fast forward and static cursors, Resource governance, Resource governance, Resource governance, Concurrent PFS updates, Scheduler worker migration

OPTIMIZE_FOR_SEQUENTIAL_KEY

Optimierung für sequenzielle Indizes (verhindert „last page insert contention“)

```
CREATE TABLE [dbo].[ErrorLog](  
[ErrorLogID] [int] IDENTITY(1,1) NOT NULL  
...  
CONSTRAINT [PK_ErrorLog_ErrorLogID] PRIMARY KEY CLUSTERED  
( [ErrorLogID] ASC )  
    WITH ( OPTIMIZE_FOR_SEQUENTIAL_KEY = ON )  
)
```



<https://techcommunity.microsoft.com/t5/SQL-Server/PAGELATCH-EX-waits-and-heavy-inserts/ba-p/384289>

 Demo 



Graph Features



Neue Graph Features

- CONNECT-Einschränkung
 - Einschränken, welche Nodes mit Edges verbunden werden können
- SHORTEST_PATH-Prädikat
 - Kürzester Pfad zwischen zwei Nodes
- MERGE-Anweisung (Upsert)
 - Merge-Statement für Nodes & Edges

Connect-Einschränkung

```
-- People dürfen People folgen
CREATE TABLE [dbo].[Follows](
    Since DateTime2 NOT NULL DEFAULT(GETDATE()),
    CONSTRAINT People_to_People CONNECTION ([dbo].[People] TO [dbo].[People])
)
AS EDGE;

-- People dürfen Pets besitzen (aber nicht umgekehrt)
CREATE TABLE [dbo].[Owns]
(
    [Since] DATETIME2 NOT NULL DEFAULT(GETDATE()),
    CONSTRAINT People_to_Pets CONNECTION ([dbo].[People] TO [dbo].[Pets])
) AS EDGE;
```

 Demo 

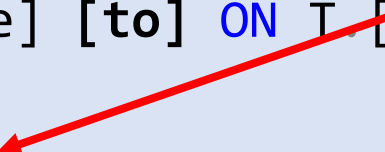
SHORTEST_PATH-Prädikat

```
SELECT
    pFrom.Id,
    pFrom.[Name]
    LAST_VALUE(pTo.[Name]) WITHIN GROUP (GRAPH PATH)
    STRING_AGG(pTo.[Name], '->') WITHIN GROUP (GRAPH PATH)
    COUNT(pTo.Id) WITHIN GROUP (GRAPH PATH)
    AS StartNode,
    AS FinalNode,
    AS [Edges Path],
    AS [Level]
FROM
    [dbo].[People] pFrom,
    [dbo].[People] FOR PATH pTo,
    [dbo].[Follows] FOR PATH follows
WHERE
    MATCH(SHORTEST_PATH(pFrom(-(follows)->pTo)+))
    -- '+' : Maximale Pfadlänge, '{1,m}' : Pfadtiefe 1 bis m
AND pFrom.[Name] = @form;
```

 Demo 

Merge-Anweisung

```
MERGE [dbo].[Follows]
USING
(
    (SELECT * FROM @follower) AS T
    JOIN [dbo].[people] [from] ON T.[fromName] = [from].[Name]
    JOIN [dbo].[people] [to] ON T.[toName] = [to].[Name]
)
ON MATCH ([from]-(Follows)->[to])
WHEN NOT MATCHED THEN INSERT ($from_id, $to_id)
    VALUES ([from].$node_id, [to].$node_id)
WHEN NOT MATCHED BY SOURCE THEN DELETE
```



 Demo 

A photograph of a forest with large trees and a blue overlay containing the text 'Java Unterstützung'. The image shows a dense forest with many trees, some with thick trunks and others with thinner branches. The leaves are green, and the sky is visible through the canopy. A blue horizontal band across the middle of the image contains the text 'Java Unterstützung' in white. Below this band, there is a white horizontal line.

Java Unterstützung

Java Unterstützung

SQL Server 2016: R

SQL Server 2017: Python

SQL Server 2019: Java

OS	Java Version
Windows	1.10
Linux	1.8

Datenaustausch (SQL Server => Java) via Array

Java language programmability extensions

```
SQL Copy

DECLARE @myClassPath nvarchar(30)
DECLARE @param1 int

SET @myClassPath = N'<my path>/program.jar'
SET @param1 = 3

EXEC sp_execute_external_script
    @language = N'Java'
    , @script = N'<packageName>.<ClassName>.<methodName>'
    , @input_data_1 = N'<Input Query>'
    , @params = N'@CLASSPATH nvarchar(30), @param1 INT'
    , @CLASSPATH = @myClassPath
    , @param1 = @param1
```



<https://docs.microsoft.com/en-us/sql/advanced-analytics/java/extension-java?view=sqlallproducts-allversions>



<https://docs.microsoft.com/en-us/sql/advanced-analytics/java/howto-call-java-from-sql?view=sqlallproducts-allversions>

SQL Server auf Linux

A photograph of a steam locomotive, painted in blue and orange, on a rocky track. The locomotive has a large black smokestack and is positioned in front of a red building. The sky is clear blue. A dark blue horizontal band is overlaid across the middle of the image, containing the text "SQL Server auf Linux".

Datenbank Replikation

- Replication Support
 - Transactional
 - Snapshot
 - Merge
- Rollen
 - Publisher
 - Distributor
 - Subscriber

Sonstiges

- Microsoft Distributed Transaction Coordinator
- Always On-Verfügbarkeitsgruppe in Docker-Containern mit Kubernetes
- OpenLDAP-Unterstützung für AD-Drittanbieter
- Machine Learning unter Linux



Sicherheit



SQL Server-Konfigurations-Manager

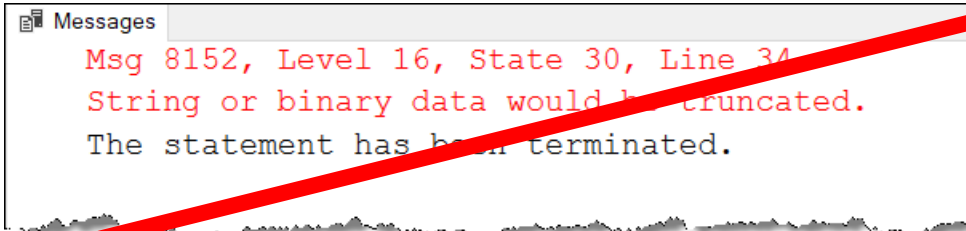
- SSL/TLS-Zertifikate verwalten
- Anzeigen und Überprüfen der auf einer SQL Server-Instanz installierten Zertifikate
- Anzeigen von bald ablaufenden Zertifikaten
- Bereitstellen von Zertifikaten auf Computern, die Always On-Verfügbarkeitsgruppen angehören (auf dem Knoten, auf dem sich das primäre Replikat befindet)
- Bereitstellen von Zertifikaten auf Computern, die einer Failoverclusterinstanz angehören (auf dem aktiven Knoten)



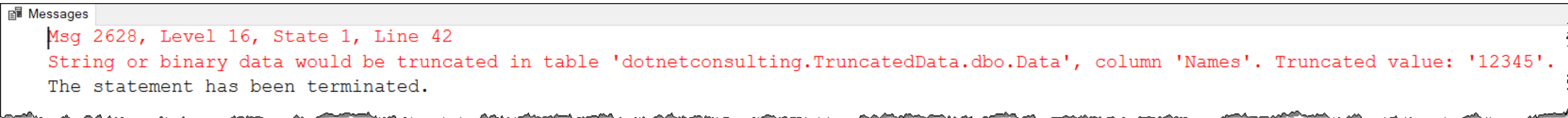
Sonstiges

Truncation error message

Brauchbare Meldung WO und WELCHE Daten abgeschnitten wurden



Msg 8152, Level 16, State 30, Line 34
String or binary data would be truncated.
The statement has been terminated.



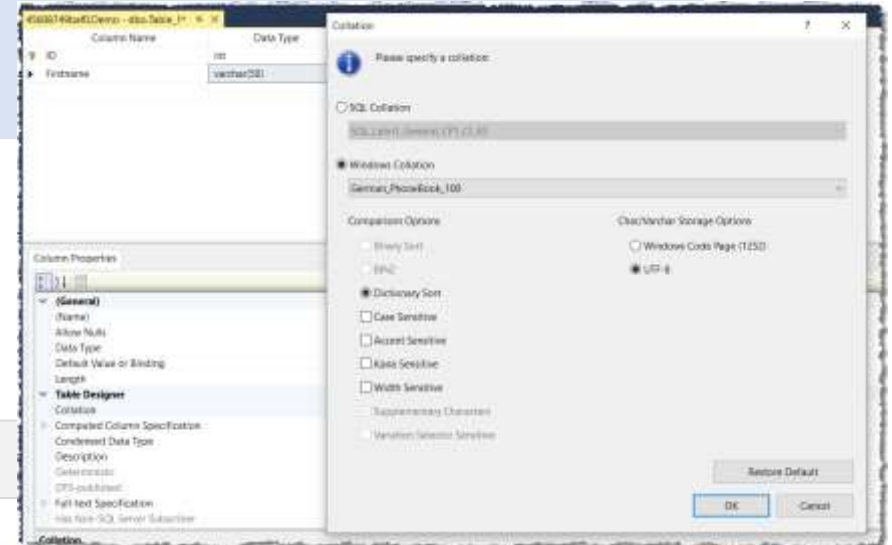
Msg 2628, Level 16, State 1, Line 42
String or binary data would be truncated in table 'dotnetconsulting.TruncatedData.dbo.Data', column 'Names'. Truncated value: '12345'.
The statement has been terminated.

 Demo 

UTF-8 Unterstützung

Seit 2009 die meistverwendete Codierung im WWW

```
CREATE TABLE dbo.DemoTable  
(  
    ID int NOT NULL IDENTITY (1, 1),  
    Firstname varchar(50) COLLATE German_PhoneBook_100_CI_AI_SC_UTF8 NULL  
) ON [PRIMARY];
```

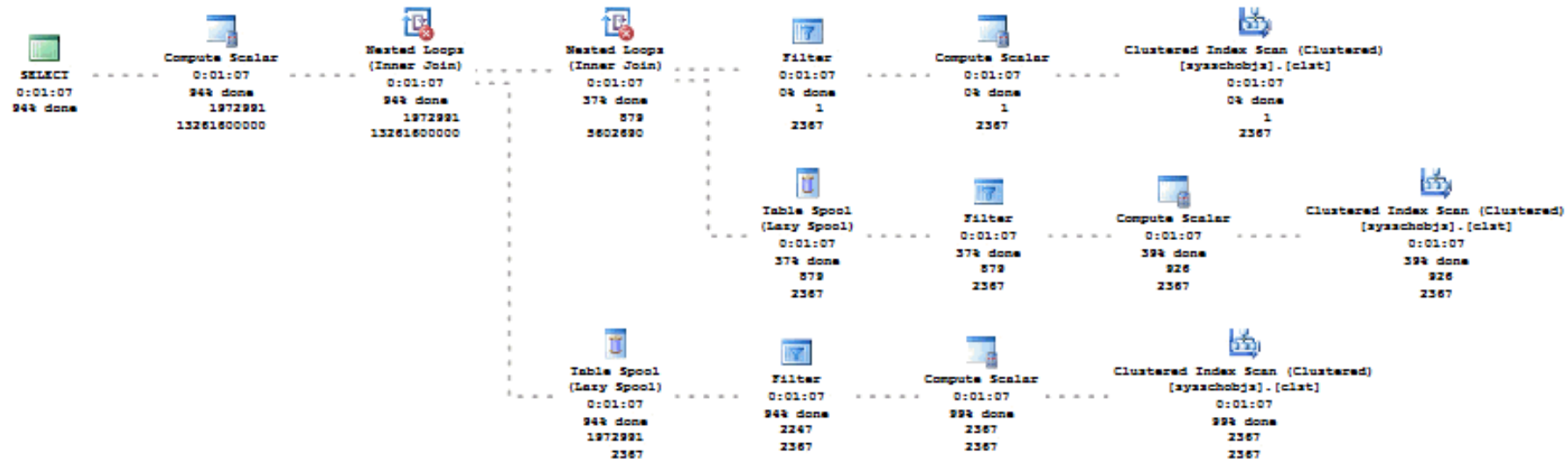


<https://en.wikipedia.org/wiki/UTF-8>

 Demo 

Lightweight query profiling infrastructure

- Seit SQL Server 2014 SP2 // SQL Server 2016 SP1
 - Aktivierung via Trace Flag 7412
- 2% Overhead
- Ab SQL Server 2019 automatisch aktiv



 Demo 

sys.dm_db_page_info DMV

Details über Seiten in der Datenbank abrufen

```
-- Pre SQL Server 2019
DBCC TRACEON(3604);
GO
DBCC PAGE(dotnetconsulting_Videogames, /* Database */ 1, /* Page */ 1, 0);

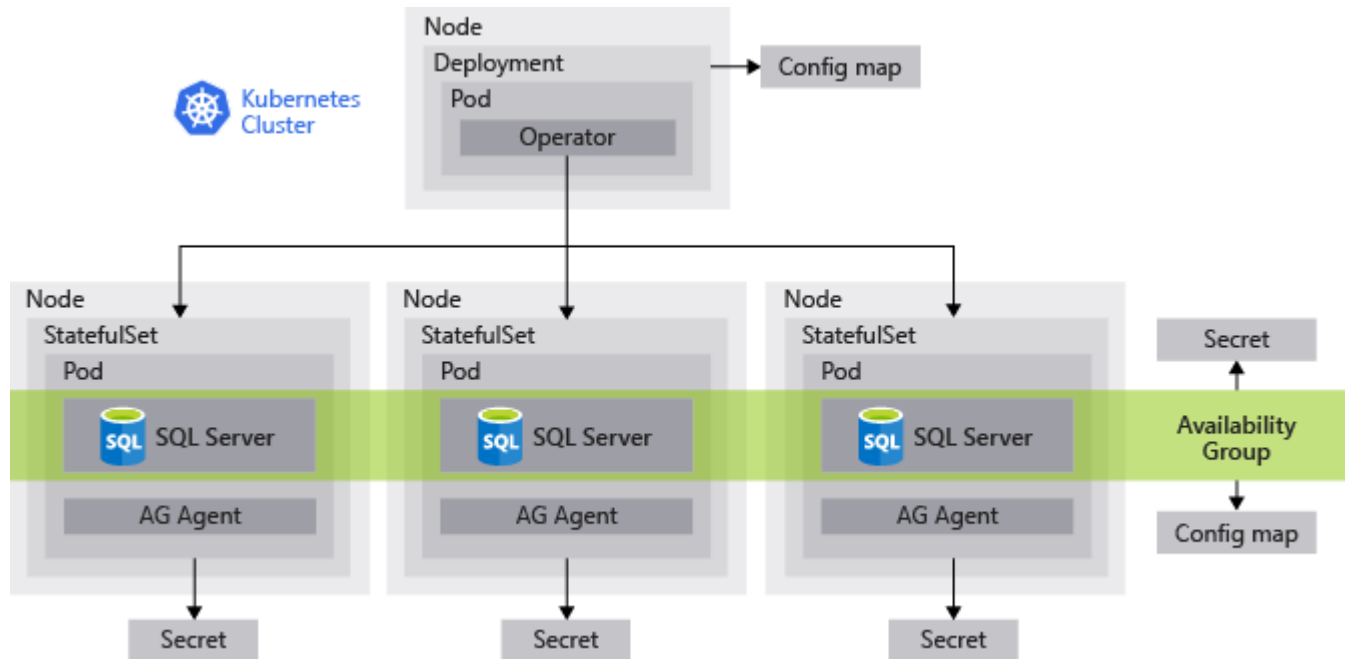
-- SQL Server 2019
SELECT * FROM sys.dm_db_page_info(/* Database */ 1, /* Page */ 1, 0, 'DETAILED');
```



<https://docs.microsoft.com/en-us/sql/relational-databases/system-dynamic-management-views/sys-dm-db-page-info-transact-sql?view=sqlallproducts-allversions>

Hochverfügbarkeit

High Availability & Disaster Recovery on containers in Kubernetes



<https://cloudblogs.microsoft.com/sqlserver/2018/12/10/availability-groups-on-kubernetes-in-sql-server-2019-preview/>

Secure Enclaves

- Spezieller geschützter Speicherbereich (RAM)
 - Windows 10 Ent, Windows Server DataCenter, Windows Server 2019
- Always Encrypted
 - Ermöglicht mehr als Gleichheit (bei deterministic Encryption)
 - LIKE
 - Gleichheit (bei randomized Encryption)
 - In-place Encryption

Daten werden serverseitig in der Secure Enclave verarbeitet



<https://docs.microsoft.com/en-us/sql/relational-databases/security/encryption/always-encrypted-enclaves?view=sqlallproducts-allversions>

Fragen? Jetzt oder später!



www.dotnetconsulting.eu

Links



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