



Microsoft®  
**SQL Server**™ Code Name “Denali”

Technical White Paper

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**Applies to:** SQL Server Code Name “Denali”

**Summary:** This paper provides an overview of the new features, benefits, and functionality in Microsoft SQL Server Code Name “Denali”.

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## Background

The data explosion is happening at every level across every imaginable device, application and individual. According to Gartner, information volume is growing worldwide at a minimum rate of 59% annually<sup>1</sup> with 15% of that data as structured data<sup>1</sup> and the rest comprised of new complex data types. And while data is predicted to grow 44 times over the next decade<sup>2</sup> the number of IT Professionals is only growing at 1.4 times.

The IT ecosystem is faced with balancing the proliferation of applications, globalization, increasingly powerful commodity hardware, demand for accessible insights, and new form factors such as the cloud, appliances and mobile devices. And they have to do this with an uptime and level of compliance that is simply expected. These converging trends create greater challenges for IT to deliver rich, interactive experiences across the organization with secure, real-time access to data inside and outside the firewall all while paramount pressure is put on IT to conserve budgets and resources through this explosive growth.

## Introducing SQL Server Code Name “Denali”

A key component of the cloud-ready information platform, SQL Server Code Name “Denali” will help organizations unlock breakthrough insights across the organization as well quickly build solutions and extend data across on-premises and public cloud backed by mission critical confidence.

- **Mission Critical Confidence** – Enable mission critical performance and availability at low TCO.
- **Breakthrough Insight** – Unlock new insights with rapid data exploration and visualization across the organization.
- **Cloud on Your Terms** – Create and scale business solutions fast, on your terms from server to private or public cloud.



Figure 1: Cloud On Your Terms

<sup>3</sup> "The End of the Database as We Know It – noDISK, noSQL, Cloudy", Donald Feinberg, Gartner IT Symposium, October 2010

<sup>2</sup> IDC: 2010 Digital Universe Study

## Mission Critical Confidence

The next wave of SQL Server investments further help protect an organization's infrastructure – getting you the nines and performance you need at the right price, especially for mission critical workloads. When you make a bet on Microsoft, you get more than a trusted platform; you get a trusted business partner and trusted ecosystem of experienced vendors.

## Required 9's and protection

### SQL Server AlwaysOn

The new integrated high availability and disaster recovery solution provides redundancy within a datacenter and across datacenters to help enable fast application failover during planned and unplanned downtime. AlwaysOn delivers a suite of new capabilities

- SQL Server AlwaysOn Availability Groups is a new feature that greatly enhances the capabilities of Database Mirroring and helps ensure availability of application databases. Availability Groups provides an integrated set of options including automatic and manual failover of a group of databases, support for up to four secondaries, fast application failover and automatic page repair.
- SQL Server AlwaysOn Failover Cluster Instances enhance SQL Server Failover Clustering and support multi-site clustering across subnet which helps enable cross-datacenter failover of SQL Server instances. Fast and predictable instance failover is another key benefit which helps ensure fast application recovery.
- SQL Server AlwaysOn Active Secondaries enable secondary instances to be utilized for running report queries and backup operations which helps eliminate idle hardware and improve resource utilization.
- SQL Server AlwaysOn Connection Director Capabilities:
  - Multi-subnet failover: This improvement enables faster client connection failover for AlwaysOn in multi-subnet scenarios. Now client applications can failover across multiple subnets (up to 64) almost as fast as they can failover within a single subnet.
  - Read-Only Intent: This improvement is a big step in our connectivity story for Readable secondaries, which is accepted really well by our customers, both at PASS as well as earlier SDRs. This improvement gives the customers a way to control the type of workloads that run on their HA servers and efficiently manage their resources.
- SQL Server AlwaysOn AutoStat auto-creates and updates temporary statistics needed for queries running on the readable secondary. These temporary statistics are stored in TempDB therefore no physical changes are required in the user database. This allows the optimizer to generate optimal query plans on secondary replica as it would do on the primary replica and it does not require any user intervention.

### Windows Server Core Support

SQL Server is supported on Windows Server Core. By running SQL Server on Windows Server Core the OS patching can be reduced significantly which greatly reduces planned downtime.

†The percentage reduction in patching and OS reboots can be as much as 50-60% in certain environments depending on the server roles that are enabled and the type of patches that are applied.

### **Database Recovery Advisor:**

This feature has introduced significant user experience enhancements to the ways DBAs can now restore databases using SQL Server Management Studio. Capabilities include a visual timeline that presents the backup history of the database and the available points in time to which the user can restore the database, algorithms to streamline identifying the right sets of backup media to get the database back to a specific point in time, and page restore dialog in SSMS to do page-level restores of the database.

### **High Availability for StreamInsight:**

The new StreamInsight capabilities address key customer needs for high availability management. The next on-premise release provides customers with:

- Resilient against planned and unplanned downtime with new checkpointing capabilities
- Facilitates predictive modeling and pattern matching with user-defined stream concept
- Improved monitoring and administration with performance counters
- Easier development with support for nested event type structures and new LINQ statements.

In addition, developing StreamInsight applications now becomes easier with new developer features. In particular, scenarios with statistical and predictive models over event data are significantly easier to realize. Existing installations will benefit from an upgrade to the newest release through the enhanced monitoring and manageability functionality such as performance counters.

## **Blazing-fast performance**

### **In-Memory Column Store (“Apollo”)**

“Apollo” introduces column store technology to the database engine, making SQL Server the first of the major general-purpose database systems to have a true column store. Apollo brings together the VertiPaq technology that was developed in Analysis Services (and is the crucial foundation for PowerPivot) and a new query execution paradigm called batch processing to provide truly astonishing speed up for common data warehouse queries. In test scenarios customers have experienced approximately 100x improvements in star join and similar queries.

### **Full-Text Search Performance Overhaul**

FTS in SQL Server Code Name “Denali” brings magnitudes of performance and scale advances with significantly improved query execution and concurrent index update mechanisms. Full-text search now includes properties scoped searches without requiring developers to maintain file properties (such as Author Name, Title, etc...) separately in the database. Developers can now also benefit with improved NEAR operator that allows them to specify distance in-between as well as the order of words. In addition to these exciting changes, Full-text Search has revamped all language word-breakers to latest Microsoft editions and includes support for two more languages in Czech and Greek.

### **Table Partitioning up to 15,000**

Support growing data warehousing with table partitioning that now scales to 15,000 partitions. This new expanded support helps enable large sliding-window scenarios which will streamline maintenance of large sets within filegroups that need data switched in and out per the needs of the data warehouse.

## **Extended Events enhancements**

Enhancements to Extended Events dramatically streamline functional and performance troubleshooting with new profiling information and a new user interface. Enhancements include flexible event selection, logging, and filtering with Extended Events.

## **Organizational security & compliance**

### **Audit Enhancements**

Enhancements to SQL Server auditing capabilities bring added flexibility and usability for auditing across the SQL Server environment, help making it even easier for organizations to meet compliance policies.

- SQL Audit for all editions allows organizations to expand the benefits of SQL Server Audit from Enterprise edition to all editions for more thorough auditing practices across SQL Server databases enabling audit standardization, better performance and richer features.
- User-Defined Audit allows the application to write custom events into the audit log to allow more flexibility to store audit information.
- Audit Filtering provides greater flexibility to filter unwanted events into an audit log.
- Audit Resilience delivers the ability to recover auditing data from temporary file and network issues.

### **Default Schema for Windows Groups:**

Database schema can now be tied to Windows Group rather than individual users to increase database compliance. It eases administration of database schema, decreases the complexity of database schema management through individual Windows users, prevent errors of assigning schema to the wrong users when users changes groups, avoids unnecessary implicit schema creation, and greatly reduces the chance of query errors when wrong schema being used.

### **User-Defined Server Roles:**

User-Defined Server Roles increase flexibility, manageability, and facilitate compliance towards better separation of duties. It allows creation of new server roles to suit different organizations that separate multiple administrators according to roles. Roles can also be nested to allow more flexibility in mapping to hierarchical structures in organizations. It also helps prevent organizations to use sysadmin for database administration.

### **Contained Database Authentication:**

Contained Database Authentication increases compliance by allowing users to be authenticated directly into user databases without logins. User information for login (username and password) is not stored inside master database but user databases directly. It is very secure because users can only perform DML operations inside the user databases and not database instance level operations. It also reduces the need to login to the database instance and avoid orphaned or unused logins in the database instance. This feature is used in AlwaysOn to facilitate better portability of user databases among servers in the case of server failover without the need to configure logins for all database servers in the cluster.

### **SharePoint Active Directory:**

Help secure end user data analytics with built-in IT controls, including new SharePoint and ActiveDirectory security models for end user reports published and shared in SharePoint. Enhanced security models provide control at row and column levels.

## **Peace of Mind**

### **Distributed Replay**

Simplify application testing and minimize errors with application changes, configuration changes, and upgrades using new Distributed Replay. This multi-threaded replay utility provides the ability to simulate production workload scenarios testing after upgrade or configuration changes ultimately leading to protected performance during changes.

## **Breakthrough Insight**

SQL Server will help customers unlock exciting new insights with self-service pervasive data discovery across structured, unstructured and cloud data sources backed by IT management and insight, credible consistent data and large-scale data warehousing and analytics solutions.

## **Rapid Data Exploration**

### **Reporting Services Project “Crescent”**

Microsoft makes self-service reporting a reality by providing a highly interactive, web-based data exploration, visualization, and presentation experience to users of all levels—from business executives to information workers. Now anyone can create a report in just seconds, transform the “shape” of data with a single click, add powerful timed animation sequences to quickly identify trends or anomalies, and make a more convincing case through rich presentation of discovered insights.

Project “Crescent” is an interactive data exploration and visual presentation experience targeted at Information Workers who need access to their business data but don’t have the technical knowledge to write their own queries or specialized knowledge around reporting. Built on top of the BI Semantic Model, which provides a user friendly view of the data, Project “Crescent” gives the user a powerful yet simple to use experience for telling stories with their data.

### **PowerPivot Enhancements**

Microsoft delivers breakthrough insights to organizations by empowering users, of all levels, to access and integrate data from virtually any source, create compelling reports and analytical applications, and easily collaborate and share insights using familiar tools in Microsoft® Excel® 2010 and Microsoft SharePoint® 2010. IT organizations can manage these solutions with complete oversight, driving operational efficiencies and increasing adoption and use of business intelligence throughout the company.

Microsoft brings even more functionality to the award winning capabilities of PowerPivot. Customers plow through mounds of data in a familiar way at lightning-fast speeds in Excel and

also leverage the new advanced analytic capabilities such as the ability to create KPIs, Rank, Perspectives, Hierarchies and sophisticated business logic. The new version of PowerPivot also extends the powerful functionalities of DAX (Data Analysis Expressions) giving end users the power of building sophisticated analytical solutions with the familiarity of Excel like functions.

### **Full-Text Statistical Semantic Search**

Enable T-SQL developers to bring deep insight to the organization within non-structured data files stored in the SQL Server database by uncovering previously undiscovered relationships across stored files. FTS Semantic Search extracts statistically relevant 'key phrases' and based on these phrases 'similarity across documents' as structured data made available through new TSQL rowset functions. Together with FileTable, Semantic Search makes non-structured documents first class citizens of a relational database allowing developers to manipulate them together with structured data in any set operations.

## **Scalable & Managed Self-Service BI**

### **BI Semantic Model**

SQL Server Code Name "Denali" Analysis Services introduces the BI Semantic Model, a single model for users with multiple ways of building business intelligence (BI) solutions. This means:

- Continued support for the powerful online analytical-processing (OLAP) technologies that make SQL Server Analysis Services indispensable to BI specialists.
- Tools for IT professionals and developers who are familiar with dealing with data in rows and columns.
- Support for a spectrum of BI solutions that span personal, team, and corporate contexts

With the BI Semantic Model organizations can scale from small personal BI solutions to the largest organizational BI needs. BI Semantic Model is one model for all end user experiences – reporting, analytics, scorecards, dashboards, and custom applications and offers developers flexibility of modeling experiences, richness to build sophisticated business logics and scalability for your most demanding enterprise needs.

### **Rendering to Microsoft Office Word & Excel Open XML formats**

In SQL Server Code Name "Denali", Reporting Services reports can now be exported in the new Microsoft Office document formats first introduced in Office 2007 for Word and Excel. Reports can be delivered interactively – by users selecting the format of their choice, sent directly to users via subscriptions, as well as delivered programmatically. The new rendering capabilities also take advantage of the new document formats such as increased column and row limits within Excel and generally smaller file sizes.

### **Reporting Services End User Alerting:**

End User Alerting increases information worker productivity by providing reliable data alerts. The Alert checks for data changes in the background and sends an Alert Message. The Alert is triggered based on a data condition set by the IW. IWs tailor these data conditions to their own needs, thus increasing responsiveness to data changes that matter to them. For SQL

Server Code Name “Denali”, End User Alerting provides a new tool to increase IW productivity when working with Reporting Services reports published to SharePoint.

### **Reporting Services SharePoint Integration Enhancements:**

These capabilities provide an improved SharePoint integration platform for SQL Server Code Name “Denali” Reporting Services and the self-service BI features like Project “Crescent” and End User Alerting. Additionally, it helps reduce the TCO for SharePoint administrators by consolidating Reporting Services administration, configuration, and management capabilities into SharePoint 2010 Central Administration Portal and PowerShell scripting. IT can now enable reporting capabilities to all Information Workers in the organization by using a single switch and manage it like any other SharePoint feature.

## **Credible, Consistent Data**

### **Data Quality Services**

A completely new service to SQL Service, Data Quality Services (DQS) helps round out end to end data management for organizations. DQS provides knowledge-driven tools customers can use allow data stewards to create and maintain a Data Quality Knowledge Base which helps improve data quality and ease data management. Specifically, customers can gain confidence in data quality by using organizational knowledge to profile, cleanse, and match data. Data Quality Services can be run as a standalone tool or integrated with Integration Services (SSIS). For SQL Server Code Name “Denali”, customers will be able to access the Windows Azure Marketplace DataMarket as a source of 3rd party data to help validate and cleanse data in a data quality project.

### **Master Data Services Enhancements**

Master Data Services (MDS) continues to make it easier to manage master data structures (object mapping, reference data, and dimensions and hierarchies) used in data integration operations. With new Entity Based Staging you can now load all members and attribute values for an entity at one time. Additionally the Explorer and Integration Management functional areas of the Master Data Manager Web application have been updated with a new Silverlight® look and feel. You can now add and delete members more quickly, as well as move members in a hierarchy more easily. Additionally, the new MDS Add-in for Excel democratizes data management so data management applications can be built directly in Excel by information workers. You can use this add-in to load a filtered set of data from your MDS database, work with the data in Excel, and then publish the changes back to the MDS database. If you are an administrator, you can also use the add-in to create new entities and attributes.

### **SQL Server Integration Services Enhancements**

SQL Server Integration Services (SSIS) helps lower the barriers to getting started with data integration by allowing organizations of all sizes to operationalize their commitment to information with capabilities that increase efficiency and improve productivity related to information management efforts.

- New features include usability enhancements, deployment and administration enhancements, new reports for troubleshooting package operations, comparing and merging packages, and easier access to samples and tutorials. Integration Services has

a new DQS Cleansing transform that integrates with the Data Quality Services Data Quality Knowledge Base.

## Cloud on Your Terms

The next wave of SQL Server investments will offer organizations the agility to quickly create and scale solutions that solve challenges and fuel new business opportunity from server to private or public cloud linked together with common tools for optimized productivity and cutting-edge developer technologies—build once, deploy and manage wherever.

## Optimized productivity

### SQL Server Developer Tools Code Name “Juneau”

SQL Server Developer Tools Code Name “Juneau” unifies the development experience for database development with a single powerful environment for database development across Database, BI and web and supports SQL Server and SQL Azure. Streamline application development with a single environment for developing DB, BI, and web solutions across on-premise and cloud environments.

- New Visual Studio based IDE comes standalone or integrated (source control, unit testing, etc...), is released with SQL Server Code Name “Denali”, on the web, and with Visual Studio vNext and is designed for both database and BI developers
- Improved experience for database developers includes declarative, model-based development, integrated tools with modern language services, ability to work connected and offline with local testing, and offers SQL Server edition-aware targeting (SQL Server, SQL Azure...).
- Improved experience for SSIS developers for data flow design, undo/redo, and human readable packages.

### Data-tier Application Component (DAC) Framework

Introduced in SQL Server 2008 R2, Data-tier Application (DAC) support across SQL Server and Visual Studio helps IT and developers to more easily define and contain the schemas and objects required to support an application, then deploy, import, and export DACs more easily across on-premises and public cloud.

- Additional supported objects Permissions, Role Memberships, Synonym, CLR System types: Hierarchy ID, Geometry, and Geography, Spatial Index, and Statistics

### Data-tier Application Component (DAC) Parity with SQL Azure

SQL Server Code Name “Denali” and SQL Azure will offer ‘anywhere support’ for moving a DAC database between SQL Server databases across server, private cloud or SQL Azure. This enables customers to build once and deploy and manage anywhere which leads to unprecedented flexibility across IT and dev. Import and export services in the DAC framework enable archiving and migration scenarios between on-premise and cloud database servers. The new export service in the DAC framework will extract database schema as well as data and

serialize it into a new logical and open archive format – a .bacpac file. Users will then be able to import the .bacpac archive into another database server.

### **PowerShell 2.0 Support**

This improvement expands on the PowerShell support delivered in SQL Server 2008 by leveraging Windows PowerShell 2.0 allowing DBAs to take advantage of the latest PowerShell features and offers the flexibility to use SQLPS.exe for all SQL and related automation scenarios.

## **Extend any data, anywhere**

### **Beyond Relational Enhancements**

- **FileTable**

FileTable builds on FILESTREAM to bring Win32 namespace support and application compatibility to the file data stored in SQL Server. Countless applications maintain their data in two worlds – documents, media files and other unstructured data in file servers and related Structured Metadata in relational systems. FileTable helps the barrier to entry for customers who have files on servers which currently run Win32 applications while removing the issues caused by maintaining two disparate systems and keeping them in sync.

- **Full Globe Spatial Support**

SQL Server Spatial enhancements include circular arcs on the ellipsoid (industry firsts for relational database systems), support for full globe spatial objects, functional parity of geography and geometry data types, and spatial indexes performance.

### **Greater interoperability**

SQL Server Code Name “Denali” helps customers extend heterogeneous environments by connecting to SQL Server and SQL Azure applications with support for additional industry standard APIs across varied platforms.

- Microsoft Driver for PHP for SQL Server is designed to enable reliable, scalable integration with SQL Server for PHP applications deployed on the Windows platform.
- Connectivity for Java provides secure and highly available connectivity from java applications to SQL Server for enterprise customers.
- Microsoft JDBC Driver for SQL Server provides connectivity for Tier 1 enterprises and mission critical Java applications to SQL Server.

### **SQL Server Express Local Database Runtime (LocalDB):**

In SQL Server Code Name “Denali”, SQL Server Express will feature a new version, SQL Server Express Local Database Runtime (LocalDB). LocalDB is a new lightweight version of Express that has all its programmability features, yet runs in user mode and has a fast, zero-configuration installation and short list of pre-requisites.

## Conclusion

SQL Server Code Name “Denali” is a significant product release that helps customers continue to build and support mission critical environments, now with more confidence and efficiency out of the box. New tools and enhancements enable breakthrough insight across all levels of the organization while cloud-ready technologies for application symmetry across server, private and public cloud helps customers stay agile for the future.

This white paper provides only an overview of the key new features, benefits, and functionality in SQL Server Code Name “Denali.”

### For more information:

<http://www.microsoft.com/sqlserver/>: SQL Server Web site

<http://www.microsoft.com/denali> SQL Server Code Name “Denali”

<http://technet.microsoft.com/en-us/sqlserver/>: SQL Server TechCenter

<http://msdn.microsoft.com/en-us/sqlserver/>: SQL Server DevCenter

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