Best Practices for Storing the ArcGIS® Data Reviewer Workspace in an Enterprise Geodatabase for SQL Server

An Esri® White Paper
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Introduction

ArcGIS® Data Reviewer, a data quality control management application, requires you to define a workspace when using a review session to store the anomalies found during the data review process. The software creates a new feature dataset and tables in the geodatabase that you have identified as your Reviewer workspace. The feature dataset includes point, line, and polygon feature classes, which contain error geometries for the features that have been written to the Reviewer table.

The Reviewer workspace can be stored in any existing geodatabase, including the production geodatabase, or a separate file or personal geodatabase created specifically for the data review process. When stored in an enterprise geodatabase, the Reviewer workspace supports versioning.

This white paper is intended to help database administrators establish the ArcGIS Data Reviewer workspace in an enterprise geodatabase for SQL Server®. The enterprise geodatabase uses ArcSDE® technology as the gateway between geographic information system (GIS) clients and SQL Server.

ArcSDE DBTUNE

DBTUNE storage parameters let you control how ArcSDE technology creates objects within a SQL Server database. You can determine such things as how to allocate space to a table or index, which filegroup a table or index is created in, and other SQL Server-specific storage attributes. They also allow you to specify one of the available storage formats for the geometry of a spatial column.

The DBTUNE storage parameters are stored in the DBTUNE table. The DBTUNE table, along with all other metadata tables, is created in the database when the Create Enterprise Geodatabase or Enable Enterprise Geodatabase tool is executed.

When a large number of database connections access the same files in the same location on disk, database performance is slower because the connections are competing with one another for the same resources. To reduce this competition, you can store database files in different locations on disk.

Thus, DBTUNE can be modified to store the Reviewer feature dataset and tables in separate data files across different locations on disk. This will reduce disk contention and improve database input/output (I/O).

Standard GIS storage recommendations favor keeping index and log files separate from vector and tabular business tables. For performance reasons, it is better to position the business, feature, and spatial index tables separately and position filegroup data files based on their usage pattern. For a multiversioned, highly active editing geodatabase,

database files of the VERSIONS filegroup may be separated and dispersed across available disks to avoid I/O contention.

Disk Configuration

Large production enterprise geodatabase systems should employ a hardware striping solution. Your best disk and data organization strategies involve spreading your data across multiple disks.

With data spread across multiple disks, more spindles actively search for it. This can increase disk read time and decrease disk contention. However, too many disks can slow down a query. There are two main ways of achieving striping: filegroups and redundant array of independent disks (RAID). You can also combine the two by creating filegroups within disk arrays. You can employ data segregation strategies; keeping tables from indexes or certain types of tables from other tables will improve performance and alleviate administrative burdens.

The suggested SQL Server optimal configuration is as follows:

- Disk 0—SQL Server/Application software
- Disk 1—master, model, msdb
- Disk 2—tempdb
- Disk 3—Log files
- Disk 4—Feature data tables
- Disk 5—Spatial index data tables
- Disk 6—Attribute data/Business tables
- Disk 7—SQL Server indexes

Reducing Disk I/O Contention

As a rule, you should create database files as large as possible, based on the maximum amount of data you estimate the database will contain, to accommodate future growth. By creating large files, you can avoid file fragmentation and gain better database performance. In many cases, you can let data files grow automatically; just be sure to limit autogrowth by specifying a maximum growth size that leaves some hard disk space available. By putting different filegroups on different disks, you can also minimize the physical fragmentation of your files as they grow.

To configure data and log files for best performance, follow these best practices:

- To avoid disk contention, do not put data files on the drive that contains the operating system files.

- Put the transaction log files and the data files on separate drives. This gives you the best performance by reducing disk contention between data and transaction log files.

- Put the tempdb database on a separate drive if possible, preferably on a RAID 10 or RAID 5 system. In environments in which there is intensive use of tempdb databases, you can get better performance by putting tempdb on a separate drive, which lets SQL Server perform tempdb operations in parallel with database operations.

- The RAID configuration that is best for your database files depends on several factors, including performance and recoverability needs. RAID 10 is the recommended RAID system for transaction log, data, and index files. If you have

budget restrictions, you can consider keeping the transaction log files in a RAID 10 system and storing the data and index files in a RAID 5 system.

For more information about RAID, see RAID Levels and SQL Server at http://technet.microsoft.com/en-us/library/ms190764(SQL.105).aspx and chapter 7, "Planning Fault Tolerance and Avoidance," by Charlie Russel and Sharon Crawford, from *Microsoft® Windows® 2000 Server Administrator's Companion* (Microsoft Press) at http://technet.microsoft.com/en-us/library/bb742464(en-us).aspx.

- Use partitioning on large tables. Partitioning lets you split a table across multiple filegroups by using partitions; you can place a subset of a table or index on a designated filegroup. This capability lets you separate specific pieces of a table or index onto individual filegroups and effectively manage file I/O for volatile tables. Partitions let you easily manage archival routines and data loading operations.

Below is a suggested design to reduce disk I/O contention:

File Type	Database Activity	Move File to Disk With
Transaction log files	Frequent edits	Relatively low I/O
Transaction log files	Few or no edits	Moderate I/O
tempdb	Frequent edits	Low I/O but separate from transaction log files
master, model, msdb	Few edits	Moderate I/O
Data	Frequent edits	Relatively low I/O

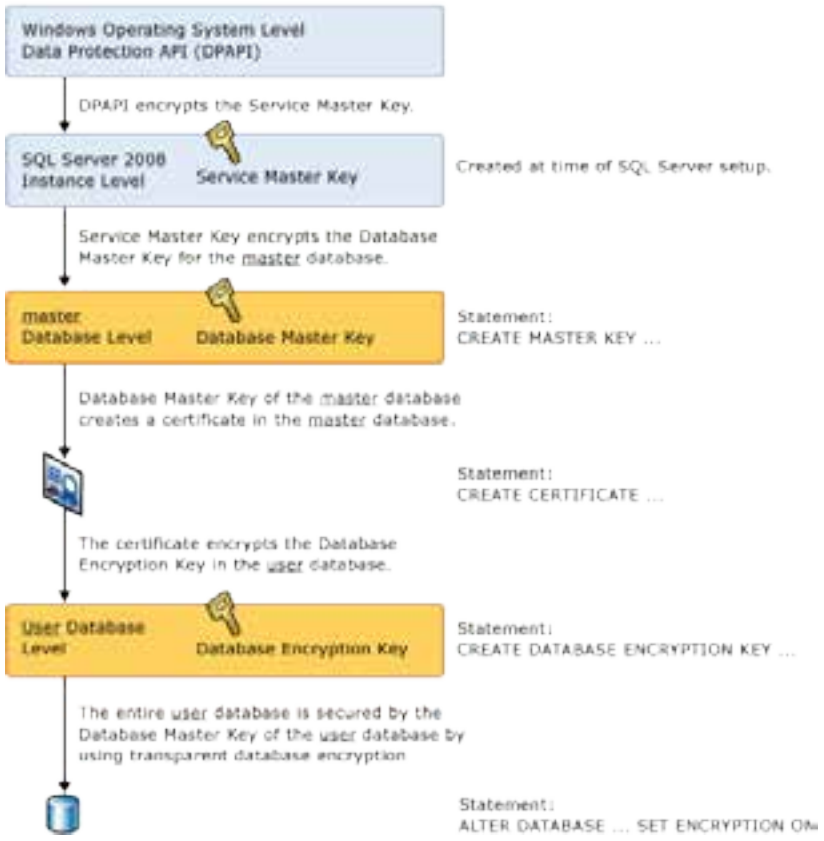
Transparent Data Encryption

The precautions you can take to help secure the database include designing a secure system, encrypting confidential assets, and building a firewall around the database servers. However, if the physical media (drives or backup tapes) are stolen, a malicious party can just restore or attach the database and browse the data. One solution is to encrypt the sensitive data in the database and protect the keys that are used to encrypt the data with a certificate. This prevents anyone without the keys from using the data, but this kind of protection must be planned in advance.

Transparent data encryption (TDE) performs real-time I/O encryption and decryption of the data and log files. The encryption uses a database encryption key (DEK), which is stored in the database boot record for availability during recovery. The DEK is either a symmetric key secured by using a certificate stored in the master database of the server or an asymmetric key protected by an extensible key management (EKM) module. TDE protects data "at rest," meaning the data and log files. It provides the ability to comply with many laws, regulations, and guidelines established in various industries. This enables software developers to encrypt data by using the Advanced Encryption Standard (AES) and Triple Data Encryption Standard (3DES) encryption algorithms without changing existing applications.

Database files are encrypted at the page level. The pages in an encrypted database are encrypted before they are written to disk and decrypted when read into memory. TDE does not increase the size of the encrypted database.

The following illustration shows the architecture of TDE encryption:



TDE Encryption Architecture

Learn more about TDE at http://msdn.microsoft.com/en-us/library/bb934049.aspx.

To use TDE, follow these steps:

- Create a master key.
- Create or obtain a certificate protected by the master key.
- Create a database encryption key and protect it with the certificate.
- Set the database to use encryption.

The SQL commands below can be used to configure TDE. You can choose the password for the master key, and when backing up the master key, you can choose the folder and file name.

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```
USE master
GO
/* Verify master key */
SELECT * FROM sys.symmetric_keys WHERE name LIKE '%MS_DatabaseMasterKey%'
GO

/* if there are no records found, then it means there was no predefined Master Key.
 To create a Master Key, you can execute the below mentioned TSQL code. */

/* Create master key */
CREATE MASTER KEY ENCRYPTION BY PASSWORD = 'rev$$@admin';
GO
/* Backup master key */
OPEN MASTER KEY DECRYPTION BY PASSWORD = 'rev$$@dmin';
GO
BACKUP MASTER KEY TO FILE = 'D:\mssqlbackup\master\masterkey.mk'
    ENCRYPTION BY PASSWORD = 'rev$$@dmin';
GO

/* Create Certificate */
CREATE CERTIFICATE rev_cert WITH SUBJECT = 'REV Server Certificate';
GO

/* Verify Certificate */
SELECT * FROM sys.certificates where [name] = 'rev_cert'
GO

/* Backup certificate */
BACKUP CERTIFICATE rev_cert TO FILE = 'D:\mssqlbackup\master\rev.cer'
   WITH PRIVATE KEY (
         FILE = 'D:\mssqlbackup\master\rev.pvk',
         ENCRYPTION BY PASSWORD = 'rev$$@dmin');
GO

USE rev
GO
/* Create Encryption key */
CREATE DATABASE ENCRYPTION KEY
   WITH ALGORITHM = AES_256
   ENCRYPTION BY SERVER CERTIFICATE rev_cert;
GO

/* Encrypt database */
ALTER DATABASE revdb SET ENCRYPTION ON;
GO

/* Verify Encryption */
SELECT
DB_NAME(database_id) AS DatabaseName
,Encryption_State AS EncryptionState
,key_algorithm AS Algorithm
,key_length AS KeyLength
FROM sys.dm_database_encryption_keys
GO
SELECT
NAME AS DatabaseName
,IS_ENCRYPTED AS IsEncrypted
FROM sys.databases where name ='revdb'
GO
```

Step 1: Create Data Files

The following table has the recommended filegroups to be created for storing the Reviewer features and table.

FILEGROUP	ArcSDE_PARAMETER
REV_BDATA	Business table
REV_BINDEX	Business table index
REV_FDATA	Feature table
REV_FINDEX	Feature table index
REV_SDATA	Spatial index table
REV_SINDEX	Spatial index table index
REV_ADATA	Adds table (versioned)
REV_AINDEX	Adds table index
REV_DDATA	Deletes table (versioned)
REV_DINDEX	Deletes table index

The following script can be used to add filegroups through SQL Server Management Studio.

```
USE MASTER
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_BDATA]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Bdata01', FILENAME =
N'C:\mssql\data\revdb\rev_Bdata01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_BDATA]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_BINDEX]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Bindex01', FILENAME =
N'C:\mssql\data\revdb\rev_Bindex01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_BINDEX]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_FDATA]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Fdata01', FILENAME =
N'C:\mssql\data\revdb\rev_Fdata01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_FDATA]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_FINDEX]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Findex01', FILENAME =
N'C:\mssql\data\revdb\rev_Findex01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_FINDEX]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_SDATA]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Sdata01', FILENAME =
N'C:\mssql\data\revdb\rev_Sdata01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_SDATA]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_SINDEX]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Sindex01', FILENAME =
N'C:\mssql\data\revdb\rev_Sindex01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_SINDEX]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_ADATA]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Adata01', FILENAME =
N'C:\mssql\data\revdb\rev_Adata01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_ADATA]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_AINDEX]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Aindex01', FILENAME =
N'C:\mssql\data\revdb\rev_Aindex01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_AINDEX]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_DDATA]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Ddata01', FILENAME =
N'C:\mssql\data\revdb\rev_Ddata01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_DDATA]
GO
ALTER DATABASE [REVDB] ADD FILEGROUP [REV_DINDEX]
GO
ALTER DATABASE [REVDB] ADD FILE(NAME = N'rev_Dindex01', FILENAME =
N'C:\mssql\data\revdb\rev_Dindex01.NDF' , SIZE = 1, MAXSIZE = 800, FILEGROWTH = 1) TO FILEGROUP
[REV_DINDEX]
GO
```

By setting the data files' initial size to 1 MB, there is no delay in the creation of the filegroups; to avoid fragmentation, you can resize the data files.

```
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Bdata01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Bindex01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Fdata01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Findex01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Sdata01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Sindex01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Adata01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Aindex01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Ddata01’, SIZE = 400MB )
ALTER DATABASE [REVDB] MODIFY FILE ( NAME = N’rev_Dindex01’, SIZE = 400MB )
```

Verify filegroups and data files:

```
EXEC sp_helpdb revdb
GO
```

Step 2: Create Rev User

The following scripts can be used in Microsoft SQL Server Management Studio to create a new database user to store the Reviewer feature dataset and tables; grant the appropriate permissions.

Create user and schema:

```
USE REVDB
GO
CREATE USER [rev] FOR LOGIN [rev]
GO
CREATE SCHEMA [rev] AUTHORIZATION [rev]
GO
ALTER USER [rev] WITH DEFAULT_SCHEMA=[rev]
GO
```

Grant privileges:

```
USE REVDB
GO
EXEC sp_droprolemember 'gis_data_creator', 'rev'
GO
EXEC sp_droprole 'gis_data_creator'
GO
CREATE ROLE gis_data_creator AUTHORIZATION dbo
GO
GRANT CREATE TABLE TO gis_data_creator
GO
GRANT CREATE PROCEDURE TO gis_data_creator
GO
GRANT CREATE VIEW TO gis_data_creator
GO
EXEC sp_addrolemember 'gis_data_creator', 'rev'
GO
```

Verify role:

```
EXEC sp_helprolemember 'gis_data_creator'
GO
```

Verify role permissions:

```
select dp.NAME AS principal_name,
 dp.type_desc AS principal_type_desc,
 o.NAME AS object_name,
 p.permission_name,
 p.state_desc AS permission_state_desc
 from sys.database_permissions p
 left OUTER JOIN sys.all_objects o
 on p.major_id = o.OBJECT_ID
 inner JOIN sys.database_principals dp
 on p.grantee_principal_id = dp.principal_id
 where dp.NAME = 'gis_data_creator'
GO
```

Verify user permissions:

```
select USER_NAME(p.grantee_principal_id) AS principal_name,
 dp.type_desc AS principal_type_desc,
 p.class_desc,
 OBJECT_NAME(p.major_id) AS object_name,
 p.permission_name,
 p.state_desc AS permission_state_desc
from sys.database_permissions p
inner JOIN sys.database_principals dp
on p.grantee_principal_id = dp.principal_id
where USER_NAME(p.grantee_principal_id) = 'rev'
```

Associate login rev with user rev:

```
USE REVDB
GO
EXEC sp_change_users_login 'update_one','rev','rev'
GO
EXEC sp_helpuser 'rev'
GO
```

Step 3: Modify DBTUNE

To modify DBTUNE, it's necessary to export it into a text file and then make the modifications. After the updates to the text file are made, export the new DBTUNE from the text file.

Export the dbtune file before making any modification.

```
sdedbtune -o export -f dbtune_exp.sde -u sde -p sde -i sde:sqlserver:mcsdbsrv –D revdb
```

Copy ***dbtune_exp.sde*** to ***dbtune_rev.sde***.

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Create a new DBTUNE keyword following the steps below:

- Copy the ##DEFAULTS keyword and paste it at the end of the *dbtune_rev.sde* file.
- Rename it ##REVIEWER and change the filegroup name for the appropriate parameters.

```
dbtune_rev.sde

##REVIEWER
A_INDEX_RASTER    "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_INDEX_ROWID     "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_INDEX_SHAPE     "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_INDEX_STATEID   "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_INDEX_USER      "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_INDEX_XML       "WITH FILLFACTOR = 75 ON REV_AINDEX"
A_STORAGE         "ON REV_ADATA"
B_INDEX_RASTER    "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_INDEX_ROWID     "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_INDEX_SHAPE     "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_INDEX_TO_DATE   "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_INDEX_USER      "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_INDEX_XML       "WITH FILLFACTOR = 75 ON REV_BINDEX"
B_STORAGE         "ON REV_BDATA
D_INDEX_ALL       "WITH FILLFACTOR = 75 ON REV_DINDEX"
D_INDEX_DELETED_AT  "WITH FILLFACTOR = 75 "ON REV_DINDEX"
D_STORAGE         "ON REV_DDATA"
F_INDEX_AREA      "WITH FILLFACTOR = 75 ON REV_FINDEX"
F_INDEX_FID       "WITH FILLFACTOR = 75 ON REV_FINDEX"
F_INDEX_LEN       "WITH FILLFACTOR = 75 ON REV_FINDEX"
F_STORAGE         "ON REV_FDATA"
GEOMETRY_STORAGE  "GEOMETRY"
GEOMTAB_PK        "WITH FILLFACTOR = 75 ON REV_FINDEX"
GEOMTAB_STORAGE   "ON REV_FDATA"
I_STORAGE         "ON REV_FDATA"
S_INDEX_ALL       "WITH FILLFACTOR = 75 ON REV_SINDEX"
S_INDEX_SP_FID    "WITH FILLFACTOR = 75 ON REV_SINDEX"
S_STORAGE         "ON REV_SDATA"
END
```

If your database only stores the Reviewer repository, you can edit ##DEFAULTS; otherwise, create a new configuration keyword as described above.

- Import the modified ***dbtune_rev.sde*** file.

```
sdedbtune -o import -f dbtune_rev.sde -u sde -p sde -i sde:sqlserver:mcsdbsrv –D revdb
```

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Step 4: Configure SQL Server Parameters

It is recommended that you use the following parameter values when creating a SQL Server database:

SQL Server Parameters for Reviewer

Parameter Name	Value
Server Memory: Use AWE to allocate memory	Enabled
Processors: Boost SQL Server Priority	Enabled
Security SQL Server and Windows Authentication mode	Enabled
Connections: Maximum number of concurrent connections	0 = unlimited
Connections: Allow remote connections to this server	Enabled

Step 5: Configure ArcSDE Parameters

You need to configure the MAXBLOBSIZE and TCPKEEPALIVE parameters for the ArcSDE geodatabase used as the Reviewer workspace. The MAXBLOBSIZE value is -1 by default. However, if you are using SQL Server or another enterprise DBMS, make sure that this value is set to -1 and the TCPKEEPALIVE value is set to TRUE. This command should be used from the command prompt of a machine where ArcSDE is installed.

```
sdeconfig -o alter -v MAXBLOBSIZE=-1 -i <service> -u sde -p <sde_password>
sdeconfig -o alter -v TCPKEEPALIVE=TRUE -i <service> -u sde -p <sde_password>
```

For more information, see the ArcSDE Administration Command Reference.

Step 6: Set Reviewer Workspace Location

You need to create an administrator database connection when the Reviewer workspace is stored in an enterprise geodatabase. Create a database connection in ArcCatalog™ with the rev user; this will be the Reviewer workspace location.

In ArcMap™, click the Reviewer Session Manager button on the Data Reviewer toolbar.

- To set the Reviewer workspace location, click Browse.
- Navigate to the database connection created in ArcCatalog.
- Click New to create a new Reviewer session.

The Reviewer Workspace Properties dialog box appears.

Reviewer Workspace Properties

- Choose an option for the spatial reference.

  a. Use Default Spatial Reference (WGS-84)—This option sets the Reviewer dataset's spatial reference to GCS_WGS_1984. This is the default spatial reference for ArcMap if you have no data in the table of contents.
  b. Use Active Data Frame Spatial Reference—If data is loaded in ArcMap, this option is the default and the ideal option to use. This will ensure that the Data Reviewer dataset's spatial reference matches your data's spatial reference.
  c. Browse To Spatial Reference—When used, the New Spatial Reference wizard appears. Choose the spatial reference you want to use with the Reviewer feature dataset.

- Choose the configuration keyword.

  You can use the default configuration keyword or select the ##REVIEWER configuration keyword created in step 3.

- Click OK.

  This automatically creates the Reviewer feature dataset and tables. The ID and Name fields are automatically populated in the Session area.

- Optionally, type a custom name for the current Reviewer session in the Name text box.

  By default, the name matches the ID.

- If you are working with a versioned enterprise database, click the Reviewer Dataset Version drop-down arrow and choose the version to be used.

- Click Start Session.

  The button appears to be selected, and its name changes to End Session.

- Click Close.

Step 7: Register the Feature Dataset and Tables as Versioned

After the new session is created, the rev user must register the following as versioned in ArcCatalog:

- RevDataset (feature dataset)
- RevBatchRunTable table
- RevCheckRunTable table
- RevTableConfig table
- RevTableLocation table
- RevTableMain table

Step 8: Use Data Compression

Row and page compression for tables and indexes enables you to save storage space by reducing the size of the database. Data compression has the drawback of increasing CPU usage because the data must be compressed and decompressed when being accessed. You cannot use data compression with system tables, and only the Enterprise and Developer editions of SQL Server support data compression.

You can configure data compression on the following:

- Clustered tables
- Heap tables (which are tables without a clustered index)
- Nonclustered indexes
- Indexed views
- Individual partitions of a partitioned table or index

There are three forms of data compression you can use with SQL Server 2012: row-level, Unicode, and page-level compression.

For more information on heaps, go to http://msdn.microsoft.com/en-us/library/hh213609(v=SQL.110).aspx.

Row-Level Compression
Row-level compression works by using more efficient storage formats for fixed-length data.

Row-level compression uses the following strategies to save space:

- Storing fixed-length numeric data types and CHAR data types as though they were variable-length data types

- Not storing NULL or 0 values

- Reducing metadata required to store data

Although it does reduce the amount of space that data uses, row-level compression does not provide the storage improvements of page-level compression. The advantage of row-level compression is that it requires less CPU usage than page-level compression. You use the following syntax to compress a table by using row-level compression:

```
ALTER TABLE tableName REBUILD WITH (DATA_COMPRESSION=ROW)
```

For example, to rebuild all partitions of the rev.TableA table of the REVDB database by using row compression, use the following query:

```
USE [REVDB]
ALTER TABLE [rev].[TableA] REBUILD PARTITION = ALL
WITH (DATA_COMPRESSION = ROW)
```

You use the following syntax to configure an index with row-level compression:

```
ALTER INDEX indexName ON tableName REBUILD PARTITION ALL WITH
(DATA_COMPRESSION=ROW)
```

For more information on row-level compression, go to http://msdn.microsoft.com/en-us/library/cc280576(v=sql.110).aspx.

Unicode Compression

Unicode compression enables the database engine to compress Unicode values stored in page or row compressed objects. You can use Unicode compression with the fixed-length nchar(n) and nvarchar(n) data types. Unicode compression is automatically used when you enable row and page compressions.

For more information on Unicode compression, go to http://msdn.microsoft.com/en-us/library/ee240835(SQL.110).aspx.

Page-Level Compression

Page-level compression compresses data by storing repeating values and common prefixes only once and then making references to those values from other locations within the table. When page compression is applied to a table, row compression techniques are also applied. Page-level compression uses the following strategies:

- Row-level compression is applied to maximize the number of rows stored on a page.
- Column prefix compression is applied by replacing repeating data patterns with references.
- This data is stored in the page header.
- Dictionary compression scans for repeating values and then stores this information in the page header.

The benefits of page compression depend on the type of data compressed. Data that involves many repeating values will be more compressed than data populated by more unique values. You use the following general syntax to apply page-level compression:

```
ALTER TABLE name REBUILD WITH (DATA_COMPRESSION=PAGE)
```

For example, to rebuild all partitions of the rev.TableA table of the REVDB database by using page compression, use the following query:

```
USE [REVDB]
ALTER TABLE [rev].[TableA] REBUILD PARTITION = ALL
WITH
(DATA_COMPRESSION = PAGE)
```

You use the following syntax to configure an index with page-level compression:

```
ALTER INDEX indexName ON tableName REBUILD PARTITION ALL WITH
(DATA_COMPRESSION=PAGE)
```

For more information on page-level compression, go to http://msdn.microsoft.com/en-us/library/cc280464(v=sql.110).aspx.

If tables or indexes are partitioned, you can configure compression on a per-partition basis. If you split a partition by using the ALTER PARTITION statement, the new partitions will inherit the data compression attribute of the original partition. If you merge two partitions, the resultant partition will have the compression attribute of the destination partition. Although compression does allow more rows to be stored on a page, it doesn't alter the maximum row size of a table or index. You can't enable a table for compression if the maximum row size and the compression overhead exceed 8,060 bytes. The default compression setting for indexes is NONE, and you must specify the compression property for indexes when you create them. Nonclustered indexes do not inherit the compression property of the table, but clustered indexes created on a heap inherit the compression state of the heap. Data compression applies only at the source, so when you export data from a compressed source, SQL Server will output the data in uncompressed row format. Importing uncompressed data into a target table enabled for compression will compress the data.

For more information on data compression, go to http://msdn.microsoft.com/en-us/library/cc280449(v=sql.110).aspx.

You can configure compression by using the preceding Transact-SQL statements or from SQL Server Management Studio by using the Data Compression Wizard on either tables or indexes. You can use the Data Compression Wizard to add and remove compression.

To use the Data Compression Wizard to change the compression settings for both tables and indexes, perform the following steps:

1. In SQL Server Management Studio, right-click the table or index you want to compress, choose Storage, and then select Manage Compression.
2. On the Welcome To The Data Compression Wizard page, click Next.

3. On the Select Compression Type page, you can choose to use the same compression type for all partitions or choose among Row, Page, and None on a per-partition basis. Click Calculate to determine the difference between current space usage and compressed usage.

4. On the Select An Output Option page, choose whether to create a script, to perform the operation immediately, or to perform the option according to a schedule. Click Next and then click Finish to complete the wizard.

For more information on Data Compression Wizard, go to http://msdn.microsoft.com/en-us/library/cc280496(v=SQL.110).aspx.

Estimating Compression

The best way to determine the benefits of compression on an object is to use the sp_estimate_data_compression_savings stored procedure. The benefits of compression depend on factors such as the uniqueness of data. The sp_estimate_data_compression_savings stored procedure is available in the Enterprise edition of SQL Server only.

The syntax of the stored procedure is as follows:

```
sp_estimate_data_compression_savings[ @schema_name = ]
'schema_name', [ @object_name = ]
'object_name', [@index_id = ] index_id,[@partition_number = ]
partition_number,
[@data_compression = ] 'data_compression'
```

For example, to configure an estimate of the compression benefits of using row compression on the rev.TableA table in the REVDB database, execute the following Transact-SQL statement:

```
USE REVDB;
GO
EXEC sp_estimate_data_compression_savings 'rev', 'TableA', NULL,
NULL,
'ROW';
GO
```

To configure an estimate of the compression benefits of using page compression on the same table, execute the following Transact-SQL statement:

```
USE REVDB;
GO
EXEC sp_estimate_data_compression_savings 'rev', 'TableA', NULL,
NULL,
'PAGE';
GO
```

For more information about SP_ESTIMATE_DATA_COMPRESSION_SAVINGS, go to http://msdn.microsoft.com/en-us/library/cc280574(v=sql.110).aspx.

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You can use the SQL script below to list the rev user tables and indexes and generate the SQL statements to set page compression for the tables and indexes.

```
/*------------------------------------------------------------------------
-- Verify REV Schema Storage
------------------------------------------------------------------------*/
USE [revdb]
GO
/*------------------------------------------------------------------------
--List all tables
------------------------------------------------------------------------*/
SELECT USER_NAME(o.uid) [owner], o.name,o.id,o.type,o.status
FROM sysobjects o
WHERE USER_NAME(o.uid) = 'rev'
AND o.type <> 'S' and o.type = 'U'
ORDER BY o.name,o.type;
GO
/*------------------------------------------------------------------------
--List all indexes
------------------------------------------------------------------------*/
SELECT USER_NAME(o.uid) [owner], OBJECT_NAME(i.id) [table], i.name
[index],o.type [type]
FROM sysindexes i inner join sysobjects o ON i.id = o.id
WHERE USER_NAME(o.uid) = 'rev'
AND o.type <> 'S' and o.type = 'U' and i.indid = 1
ORDER BY USER_NAME(o.uid),OBJECT_NAME(i.id),i.name;
GO

/*------------------------------------------------------------------------
--Table page compression
--Example:
/*
ALTER TABLE REV.REVTABLELINE
REBUILD WITH (DATA_COMPRESSION = PAGE);
GO
*/
------------------------------------------------------------------------*/
--Generate script to set table page compression:
SELECT 'ALTER TABLE ' + USER_NAME(o.uid) + '.' + o.name + ' REBUILD WITH
(DATA_COMPRESSION = PAGE);' [TXTSQL]
FROM sysobjects o
WHERE USER_NAME(o.uid) = 'rev'
AND o.type <> 'S' and o.type = 'U'
ORDER BY o.name,o.type;
GO

/*------------------------------------------------------------------------
--Index page compression
--Example:
/*
ALTER INDEX R125_pk
ON REV.REVTABLELINE
REBUILD WITH ( DATA_COMPRESSION = PAGE ) ;
GO
*/
------------------------------------------------------------------------*/
--Generate script to set index page compression:
SELECT 'ALTER INDEX ' + i.name + ' ON ' + USER_NAME(o.uid) + '.' +
OBJECT_NAME(i.id) +
       ' REBUILD WITH ( DATA_COMPRESSION = PAGE );' [TXTSQL]
FROM sysindexes i inner join sysobjects o ON i.id = o.id
WHERE USER_NAME(o.uid) = 'rev'
AND o.type <> 'S' and o.type = 'U' and i.indid = 1
ORDER BY USER_NAME(o.uid),OBJECT_NAME(i.id),i.name;
GO
```

Compression and TDE

Encryption of the database file is performed at the page level. The pages in an encrypted database are encrypted before they are written to disk and decrypted when read into memory. TDE does not increase the size of the encrypted database.

SQL Server 2012—Transparent Data Encryption (TDE)

Encrypted data compresses significantly less than equivalent unencrypted data.

If TDE is used to encrypt a database, backup compression will not be able to significantly compress the backup storage.

SQL Server 2012—Data Compression

Step 9: Verify Storage

Run the SQL queries below to verify that the Reviewer dataset was created under the correct FileGroups:

```
USE REVDB
GO
```

List filegroups and data files:

```
EXEC sp_helpdb revdb
GO
```

List filegroup data files:

```
EXEC sp_helpfilegroup 'PRIMARY'
GO
```

List tables by filegroup:

```
SELECT USER_NAME(o.uid) [Owner],
 OBJECT_NAME(i.id) [Table Name],
 FILEGROUP_NAME(groupid) AS [Filegroup Name]
 FROM sysindexes i inner join sysobjects o
 ON i.id = o.id
 WHERE i.indid IN (0, 1) AND OBJECTPROPERTY(i.id, 'IsMSShipped') = 0 AND
 USER_NAME(o.uid) = 'rev'
 ORDER BY 1,3,2
GO
```

List indexes by table and filegroup:

```
select 'owner'=user_name(o.uid)
,'table_name'=object_name(i.id),i.indid
,'index_name'=i.name ,i.groupid
,'filegroup'=f.name ,'file_name'=d.physical_name
,'dataspace'=s.name from sys.sysindexes i
,sys.sysobjects o,sys.filegroups f
,sys.database_files d, sys.data_spaces s
where objectproperty(i.id,'IsUserTable') = 1
and i.id = o.id
and f.data_space_id = i.groupid
and f.data_space_id = d.data_space_id
and f.data_space_id = s.data_space_id
and user_name(o.uid) = 'rev'
order by object_name(i.id),i.name,f.name
go
```

If any tables or indexes are stored in the wrong filegroup, use ALTER TABLE and ALTER INDEX to change the filegroup (see Books Online for SQL Server 2012 at http://msdn.microsoft.com/en-us/library/ms130214.aspx).

Also, in Management Studio, you can re-create the DDL script of tables and indexes. Then within *create script*, you can modify the filegroup parameter and re-create the

tables and indexes in the correct filegroups. This is particularly useful when tables are empty and you are allowed to re-create database objects.

Step 10: Grant Permissions and Verify Roles

Grant permissions to the rev tables through the schema.

```
USE [revdb]
GO
EXEC sp_droprolemember 'rev_editor', 'giseditor'
GO
```

```
EXEC sp_droprole 'rev_editor'
GO
EXEC sp_addrole 'rev_editor', 'rev'
GO
GRANT DELETE ON SCHEMA::[rev] TO [rev_editor]
GRANT EXECUTE ON SCHEMA::[rev] TO [rev_editor]
GRANT INSERT ON SCHEMA::[rev] TO [rev_editor]
GRANT SELECT ON SCHEMA::[rev] TO [rev_editor]
GRANT UPDATE ON SCHEMA::[rev] TO [rev_editor]
GO
EXEC sp_droprolemember 'rev_viewer', 'gisviewer'
GO
EXEC sp_droprole 'rev_viewer'
GO
EXEC sp_addrole 'rev_viewer', 'rev'
GO
GRANT SELECT ON SCHEMA::[rev] TO [rev_viewer]
GO
```

Verify role:

```
EXEC sp_helprolemember rev_editor'
GO
EXEC sp_helprolemember rev_viewer'
GO
```

Verify role permissions:

```
select dp.NAME AS principal_name,
 dp.type_desc AS principal_type_desc,
 o.NAME AS object_name,
 p.permission_name,
 p.state_desc AS permission_state_desc
 from sys.database_permissions p
 left OUTER JOIN sys.all_objects o
 on p.major_id = o.OBJECT_ID
 inner JOIN sys.database_principals dp
 on p.grantee_principal_id = dp.principal_id
 where dp.NAME in ('rev_editor','rev_viewer')
GO
```

Tips for Granting Permissions

Grant a user select, update, insert, and delete privileges to the RevAdminCustomFields and RevAdminDescriptions tables if the user has privileges to add custom fields to the Reviewer Table and to add customized error descriptions using the Reviewer Session Manager Advanced properties.

Step 11: Configure Log File Tables

Enterprise geodatabases use log file tables to maintain lists of selected records. Records are written to log file tables for later use by the application whenever a selection of a specific size is made, a reconciliation or post on a versioned database is performed, or a disconnected editing checkout is done in a client application. The log file tables store the ObjectIDs of the selected features so they can be redisplayed. This allows faster analysis and processing of information.

In ArcGIS, by default, log file tables are used if the selection set contains 100 or more records. This selection threshold of 100 features is set in the registry. It can be changed; however, Esri does not recommend doing so. There is no proven performance reason for changing it, and doing so could even cause performance problems. Thus, log file tables store feature selections in ArcMap that have more than 100 records for each connected ArcSDE editor/viewer user.

Log file options are set using specific parameters in the SERVER_CONFIG and DBTUNE tables (sde_server_config and sde_dbtune in a SQL Server database). Parameters in these tables are altered using the sdeconfig and sdedbtune commands, respectively.

In SQL Server, one table is created in tempdb in the format ##SDE_SESSION<SDE_ID>. This table is truncated when the connecting application deletes its log files, and the table is dropped when the session disconnects. When using the default setting, users do not require CREATE TABLE permission in the database for the session table to be created in tempdb.

The DBTUNE SESSION_TEMP_TABLE parameter must be set to 1 (true) to allow the session-based log file table to be created in tempdb. If you change the SESSION_TEMP_TABLE parameter to 0 (false), the SDE_LOGFILES, SDE_LOGFILE_DATA, and SDE_SESSION<SDE_ID> tables will be created in the connecting user's schema; hence, the user requires CREATE TABLE permission.

Learn more about ArcSDE log file tables at resources.arcgis.com/en/help/main/10.2/index.html#/What_are_ArcSDE_log_file_tables/002q00000011000000/.

Step 12: Create ArcSDE Users

The example below shows how to create an editor and viewer ArcSDE user.

Editor User

```
USE master
GO
EXEC sp_addlogin N'giseditor', 'gis$editor', @logindb, @loginlang
GO
```

Create user:

```
USE [revdb]
GO
CREATE USER [giseditor] FOR LOGIN [giseditor]
GO
```

Grant privileges:

```
USE [revdb]
GO
EXEC sp_addrolemember N'rev_editor', N'giseditor'
GO
```

Viewer User

```
USE master
GO
EXEC sp_addlogin N'gisviewer', 'gis$viewer', @logindb, @loginlang
GO
```

Create user:

```
USE [revdb]
GO
CREATE USER [gisviewer] FOR LOGIN [gisviewer]
GO
```

Grant privileges:

```
USE [revdb]
GO
EXEC sp_addrolemember N'rev_viewer', N'gisviewer'
GO
```

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Replication

You can use geodatabase replication to replicate the Reviewer workspace (one-way, two-way replication) but you can create *new* Reviewer sessions only in the parent geodatabase *or* only in the child geodatabase.

Conclusion

You can reduce disk contention and improve database I/O by storing the ArcGIS Data Reviewer workspace in different locations on disk. However, this practice alone does not guarantee optimal database performance, and additional tuning tasks may be needed.

Learn more about the recommended tuning tasks at resources.arcgis.com/en/help/main/10.2/index.html#/Minimize_disk_I_O_contention_in_SQL_Server/002q00000021000000/.

For more information on ArcGIS Data Reviewer, visit esri.com/software/arcgis/extensions/arcgis-data-reviewer/index.html or e-mail datareviewer@esri.com.

Access blogs, forums, downloads, and more, from the ArcGIS Resource Center at resources.arcgis.com/en/communities/data-reviewer/.

- You can access other resources at ArcGIS 10.2 for Desktop Help: resources.arcgis.com/en/help/main/10.2/#/Welcome_to_the_ArcGIS_Professional_Help_Library/00qn0000001p000000/
- Esri Support (support.esri.com)

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