Getting Started with SQL Spatial Databases

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About Terry

Work:

Research Cyberinfrastructure Analyst for OSU High Performance Computing Center – developing research "cloud" resources including ArcGIS Virtual Desktop Infrastructure with 100+ terabyte storage for OSU's research community.

Application Developer for OSU Facilities Information (2008-2014) – developed and integrated information solutions involving various spatial and non-spatial facilities data, utilizing database and web technologies. Deployed ArcGIS Server.

Education:

Certificate Geographic Information Systems, OSU 2014

B.S. Computer Science Major and Economics Minor, OSU 2007

Certifications:

Esri Certified Enterprise Geodatabase Management Associate 10.1

Esri Certified Web Application Developer Associate 10

Session Overview

- Review Esri Geodatabase Options
- Installing SQL Server 2008 R2 Express
- ArcSDE Geodatabase vs. Simple SQL Spatial Database
- SQL Spatial Queries in SQL Server Management Studio
- Impacts of ArcSDE Versioning
- Accessing SQL Server Express from other Applications
- Additional Considerations
- Additional Resources

Comparison of Geodatabase Types

A file geodatabase stores datasets in a folder of files on your computer. Each dataset is held as a file and can be up to 1 TB in size (and you can optionally configure a file geodatabase to store much larger datasets). File geodatabases can be used across platforms and can be compressed and encrypted for read-only, secure use.

A **personal geodatabase** stores its datasets in a Microsoft Access .mdb file on disk. The storage sizes of personal geodatabases are effectively limited to between 250 and 500 MB for the entire geodatabase and are only supported on Windows.

An **ArcSDE geodatabase**, sometimes also referred to as a multuser geodatabase, stores datasets in a number of optional DBMSs including the following:

- IBM DB2
- IBM Informix
- Microsoft SQL Server
- Oracle
- PostgreSQL

If you want to use historical archives in your geodatabase, replicate your data, access simple data using SQL, or concurrently edit data without locking it, you need to use ArcSDE geodatabases.

ArcSDE geodatabase options

There are two types of ArcSDE geodatabases:

- ArcSDE for SQL Server Express
 —ArcGIS for Desktop at the Standard and Advanced license levels, ArcGIS Engine, and ArcGIS Server Workgroup edition ship with SQL Server Express. You can install SQL Server Express, which is a lightweight, personal copy of SQL Server, and enable it to store geodatabases. With ArcCatalog, you can set up and administer a SQL Server Express instance as well as ArcSDE geodatabases, so you do not have to be a database administrator (DBA) to use these types of ArcSDE geodatabases.
- ArcSDE geodatabases licensed under ArcGIS for Server at the Enterprise level—In addition, ArcSDE can work in enterprise settings across a range of DBMSs using ArcSDE Enterprise geodatabases. ArcSDE Enterprise is purchased as part of ArcGIS for Server and typically requires DBA privileges and skills to set up and administer the underlying DBMS.

ArcGIS for Desktop Install Options

	Arc	GIS for	⁻ Desktop
			10.2.2
Quick Start Guide			Readme
Uninstall ArcGIS Software prior to ArcGIS	5 10.1		
		Run Utility	Readme
ArcGIS for Desktop			
ArcGIS for Desktop		Setup	Install Guide
ArcGIS for Desktop Background Geoprocessing (64-bit)		Setup	
ArcSDE for Microsoft SQL Server 2008 R2 Express (Perso	nal)	Setup	Install Guide
ArcGIS Data Interoperability for Desktop		Setup	
ArcGIS Data Reviewer for Desktop		Setup	Install Guide
ArcGIS Workflow Manager for Desktop		Setup	Install Guide
ArcGIS License Manager - REQUIRED UPDATE	FOR ARCGIS DESKTO	P AND ENGINE	USERS
ArcGIS License Manager	Quick Start Guide	Setup	Reference Guide
ArcObjects SDKs			
ArcObjects SDK for Microsoft .NET Framework		Setup	
ArcObjects SDK for Java		Setup	

The Solaris and Linux setups for the License Manager are included on the media; see the Quick Start and License Manager Reference Guide for more information.

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Installing SQL Server 2008 R2 Express

Follow the instructions in the ArcGIS for Desktop 10.x Help

At Feature Selection add a check to "Management Tools – Basic" to install the SQL Server Management Studio GUI and SQLCMD command-line tools

📸 SQL Server 2008 R2 Setup					x
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ArcSDE vs. Simple SQL Spatial

Here the ArcSDE_x and SqlSpatial databases are all stored on the same local SQL Server Express database, but SqlSpatial was not ArcSDE enabled.

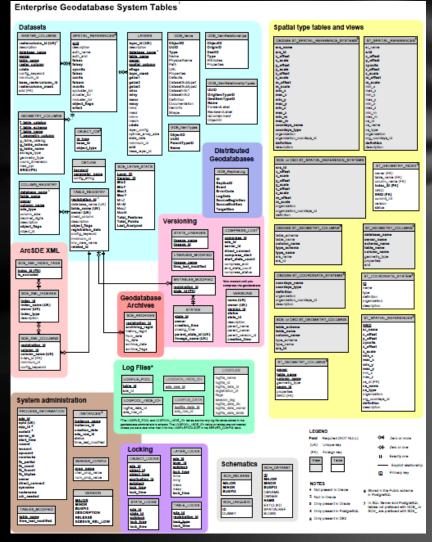
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"Empty" ArcSDE vs. Simple SQL Spatial

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Why all the tables in an ArcSDE GDB?

- Datasets
- Versioning
- Geodatabase Archives
- Distributed Geodatabases
- ArcSDE XML
- Spatial type tables and views
- System administration
- Locking
- Log Files
- Schematics

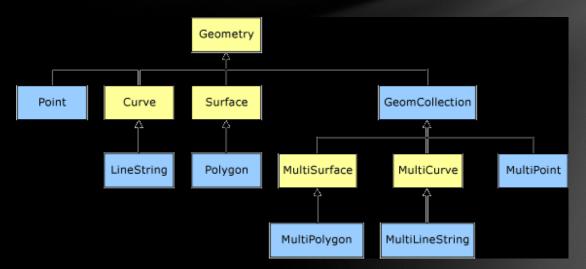


SQL Server Spatial Data Types

The geometry data type supports planar, or Euclidean (flat-earth), data. The geometry data type conforms to the Open Geospatial Consortium (OGC) Simple Features for SQL Specification version 1.1.0.

In addition, SQL Server supports the geography data type, which stores ellipsoidal (round-earth) data, such as latitude and longitude coordinates.

The figure below depicts the geometry hierarchy upon which the geometry and geography data types are based. The instantiable types of geometry and geography are indicated in blue.



http://msdn.microsoft.com/en-us/library/bb964711(v=sql.105).aspx

SQL Server OGC Geometry Methods

•STArea	 STEquals
•STAsBinary	 STExteriorRing
•STAsText	 STGeometryN
•STBoundary	 STGeometryType
•STBuffer	 STInteriorRingN
•STCentroid	 STIntersection
•STContains	 STIntersects
•STConvexHull	 STIsClosed
•STCrosses	 STIsEmpty
•STDifference	•STIsRing
•STDimension	 STIsSimple
•STDisjoint	•STIsValid
•STDistance	 STLength
•STEndpoint	 STNumGeometries
 STEnvelope 	 STNumInteriorRing

•ST	Nur	nΡα	bin	ts

•STOverlaps

STPointN

STPointOnSurface

STRelate

STSrid

STStartPoint

•STSymDifference

•STTouches

STUnion

•STWithin

•STX

•STY

SQL Server OGC Geography Methods

- •STArea
- •STAsBinary
- •STAsText
- STBuffer
- •STDimension
- •STDisjoint
- •STDistance
- •STEndpoint
- STGeometryN
- •STGeometryType
- •STIntersection

- •STIntersects
- •STIsClosed
- STIsEmpty
- STLength
- STNumGeometries
- STNumPoints
- STPointN
- STSrid
- STStartPoint
- STUnion

SSMS – Spatial Method STAsText() Used to Decode Shape Geometry

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SSMS – Spatial Results Tab

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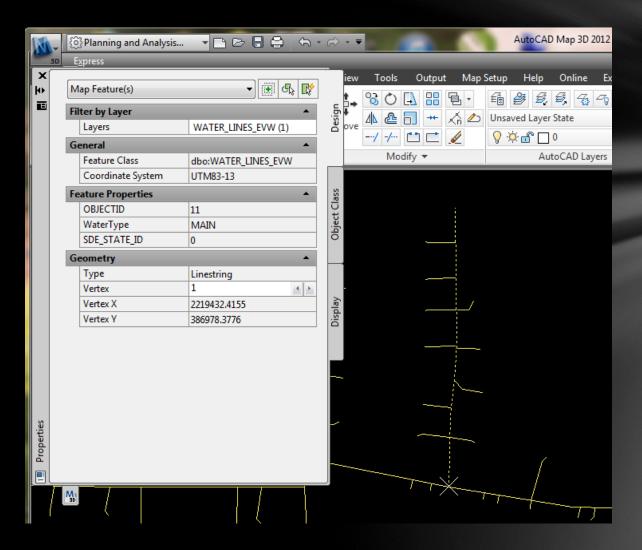
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WaterType (nvarchar(255), null)	3	407	SRV	0	LINESTRING (2219363.1933636656 386991.95881786407, 2219359.0152656347 386974.84983173065)	0x216900000114FE230	0
SHAPE (geometry, null)	4	315	SRV	0	LINESTRING (2218866.3460736815 386781.23919599387, 2218871.7370618209 386790.77089674614, 221	0x21690000010403000	000
SDE_STATE_ID (bigint, null)	5	3	MAIN	0	LINESTRING (2219156.3314865045 387032.544521932, 2219432.4154940578 386978.37763575645)	0x21690000011458266	SE: E
E Triggers	6	410	SRV	0	LINESTRING (2219528.5080016577 386962.74385142163, 2219526.3533744551 386947.51864000683)	0x216900000114C5320	064
 ✓ v7_delete ✓ v7 insert 	7	26	SRV	0	LINESTRING (2219442.8541602581 387181.57588264724, 2219458.6947945612 387164.83553056035, 221	0x21690000010403000	000
y v7_insert	8	292	SRV	0	LINESTRING (2219163.5539273433 386832.99388404744, 2219183.2737297695 386831.03132788476)	0x2169000001145817E	7
	9	29	SRV	0	LINESTRING (2219446.6287150304 387316.25600777211, 2219389.4764557271 387315.77874765097, 221	0x21690000010403000	00()
Generation Statistics	10	152	SRV	0	LINESTRING (2219159.0883798995 387191.18376376911, 2219211.0269431742 387188.21584683517, 221	0x21690000010403000	000
E D Synonyms	11	95	SRV	0	LINESTRING (2218675.9880042742 386979.05912572355, 2218668.0411483324 386931.99345634977, 221	0x21690000010403000)00
🕀 🧰 Programmability	12	318	SRV	0	LINESTRING (2218932.639684211 386828.52340006479, 2218939.0504861223 386839.56422557862, 2218	0x21690000010403000	- 10
🕀 🧰 Service Broker	13	255	MAIN	0	LINESTRING (2218843.008324868 386978.37763575645, 2218843.008324868 386781.90858006536)	0x2169000001140ECA1	_
🕀 🧰 Storage	14	27	SRV	0	LINESTRING (2219444.6052590166 387246.34172279609, 2219389.8713047518 387245.88465327711, 221	0x2169000010403000	
🕀 🧰 Security	15	319	SRV	0	LINESTRING (2218976.0906770593 386780.08622689405, 2218989.9451338877 386784.00393917313, 221	0x2169000010404000	_
	16	299	SRV	0	LINESTRING (2219027.5891264766 386978.37763575645, 2219026.3377313656 386902.042524468, 22190	0x2169000010403000	- 8
Official Assets_Maintenance	17	150	SRV	0	LINESTRING (2219148.573276185 387105.38313203555, 2219210.5851763966 387096.72830130567, 2219	0x2169000010403000	
⊕ Hq_20_1 ☐ Mq_51 Scheme 20.1	18	30	SRV	0	LINESTRING (2219446.6349753868 387315.50639462855, 2219471.2132790317 387315.71164141205, 221	0x21690000010403000	- 10
	19	316	LAT	0	LINESTRING (2218932.6394704529 386780.41416015744, 2218932.639684211 386828.52340006479)	0x216900000114F52AD	- 10
	20	167	SRV	0	LINESTRING (2219160.7171191638 387425.05478831619, 2219218.8835011977 387425.41606887762, 221	0x21690000010403000	
Gerrity	21	405	SRV	0	LINESTRING (2219434.5108849118 387073.22040328232, 2219382.8209676328 387079.30966138805, 221 LINESTRING (2219843.008324868.386843.22694790666, 2218877.6168688843.386843.12521817128)	0x21690000010403000	
Server Objects	→	414	SHV	0			•

AutoCAD Map SQL Spatial Connection to SQL View



Excel Data Connection From SQL Server or Microsoft Query (ODBC)

X 🚽	5-6												S. Spensor
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8				Import data for a Query Wizard an									
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Additional Considerations

- ArcSDE Personal licensed for up to 3 simultaneous users
- SQL Server Express & ArcSDE Personal won't work for Databases over 10GB
- Workflows involving lots of raster processing or use of lots of temporary intermediate datasets may be better suited to file-based datasets.
- Workstation Hardware Requirements for ArcGIS for Desktop + SQL Server Express. SQL Server Express uses 1GB RAM and 1 CPU core.
- Your organization may not allow local database servers or local data storage
- If data will be accessed by more than one person or by web applications the database should be on an IT-managed server, not your local workstation
- For ArcSDE versioning, archiving and shared data consider need for regular database backups
- Consider the need for a Database Administrator with expertise in managing a shared database server

Additional Resources

Modeling Our World, Second Edition: The Esri Guide to Geodatabase Concepts

Chad Cooper ArcUser Article in ArcUser #56

http://www.esri.com/news/arcuser/0112/real-time-updating-of-arcsde-through sql.html

geometry Data Type Method Reference

http://msdn.microsoft.com/en-us/library/bb933973(v=sql.105).aspx

geography Data Type Method Reference

http://msdn.microsoft.com/en-us/library/bb933802(v=sql.105).aspx

SQL Tutorial: <u>http://www.w3schools.com/sql/</u>