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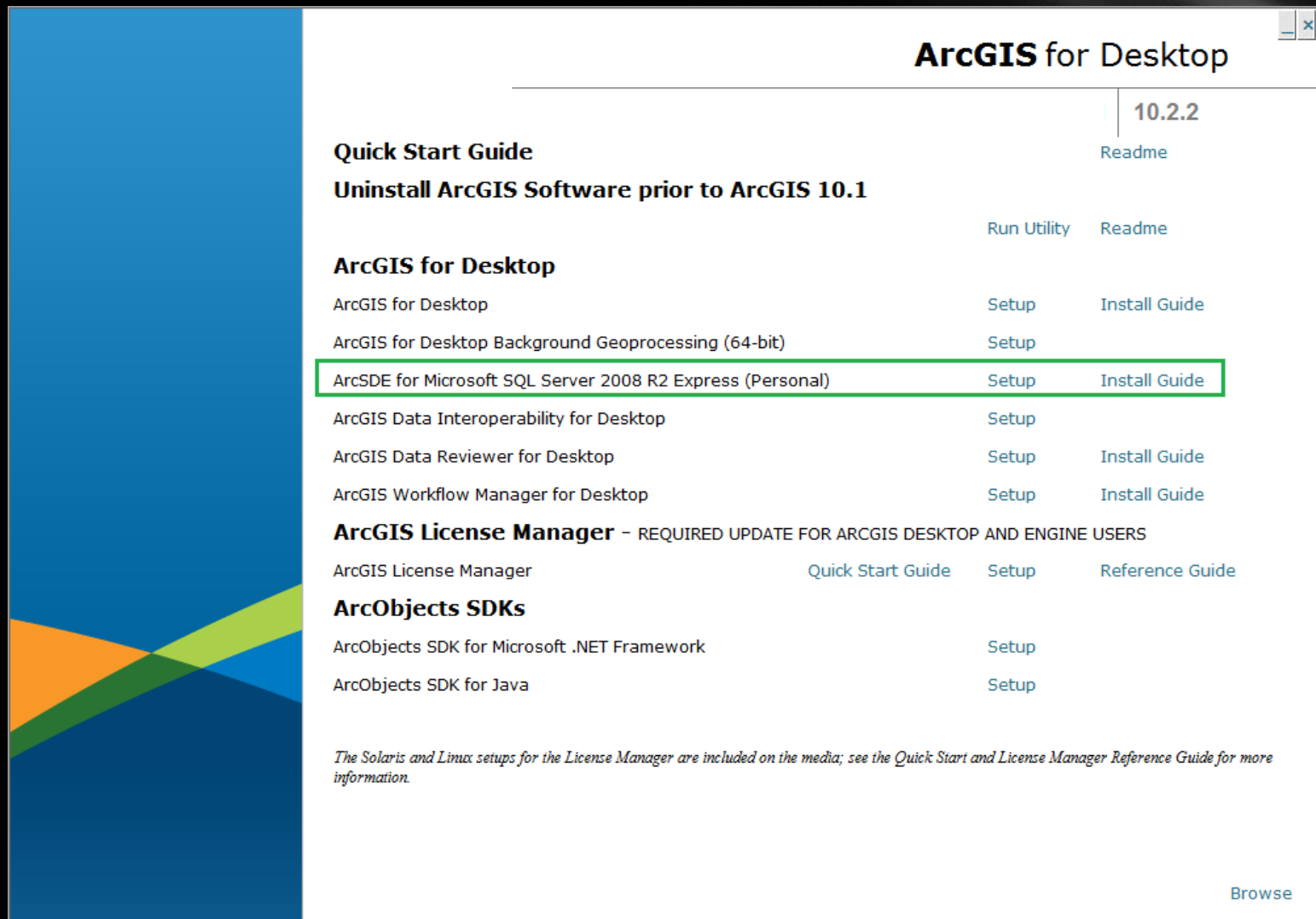
If you want to use historical archives in your geodatabase, replicate your data, access simple data using SQL, or concurrently edit data without locking it, you need to use ArcSDE geodatabases.

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

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
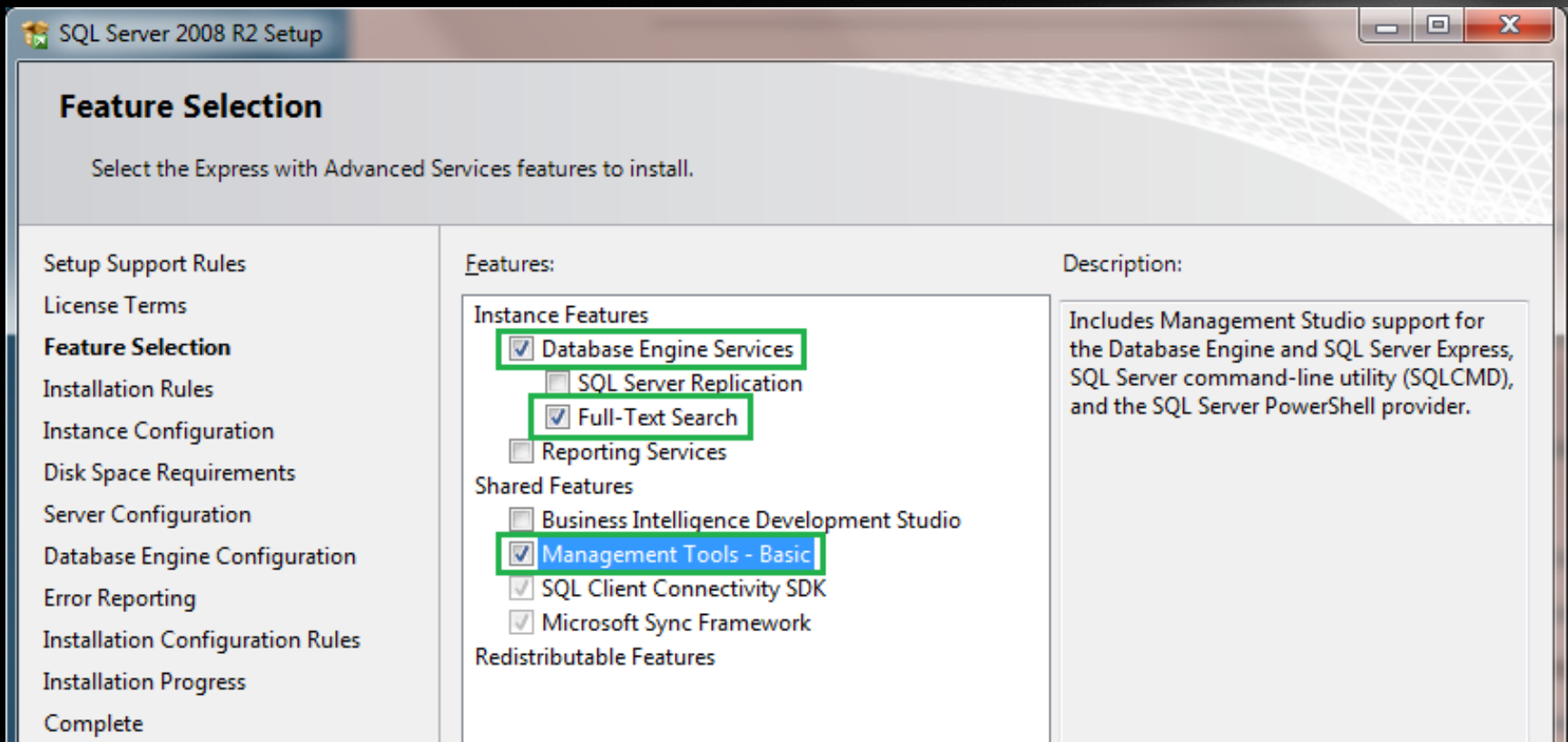
ArcSDE vs. Simple SQL Spatial

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

"Empty" ArcSDE vs. Simple SQL Spatial

Why all the tables in an ArcSDE GDB?
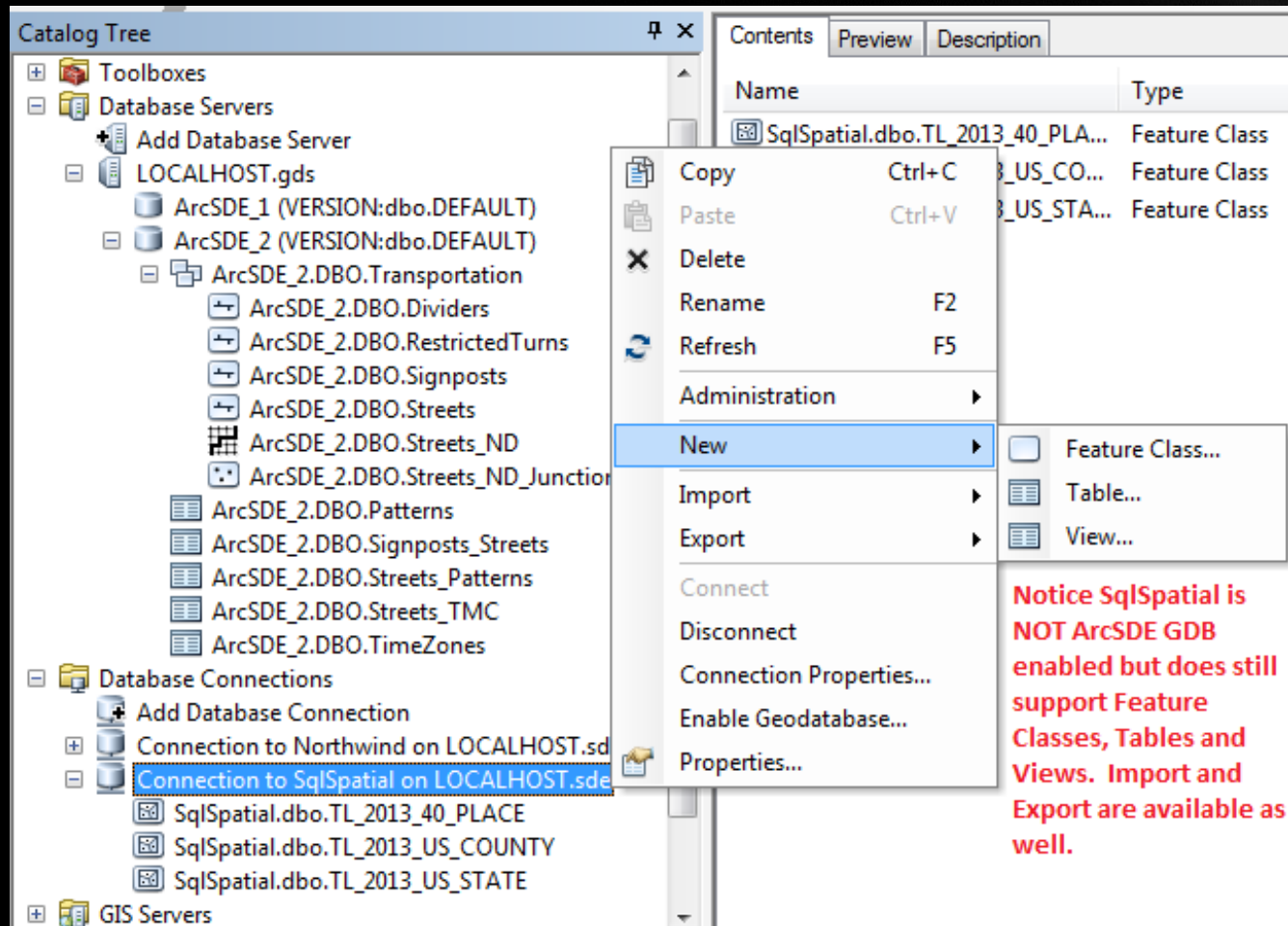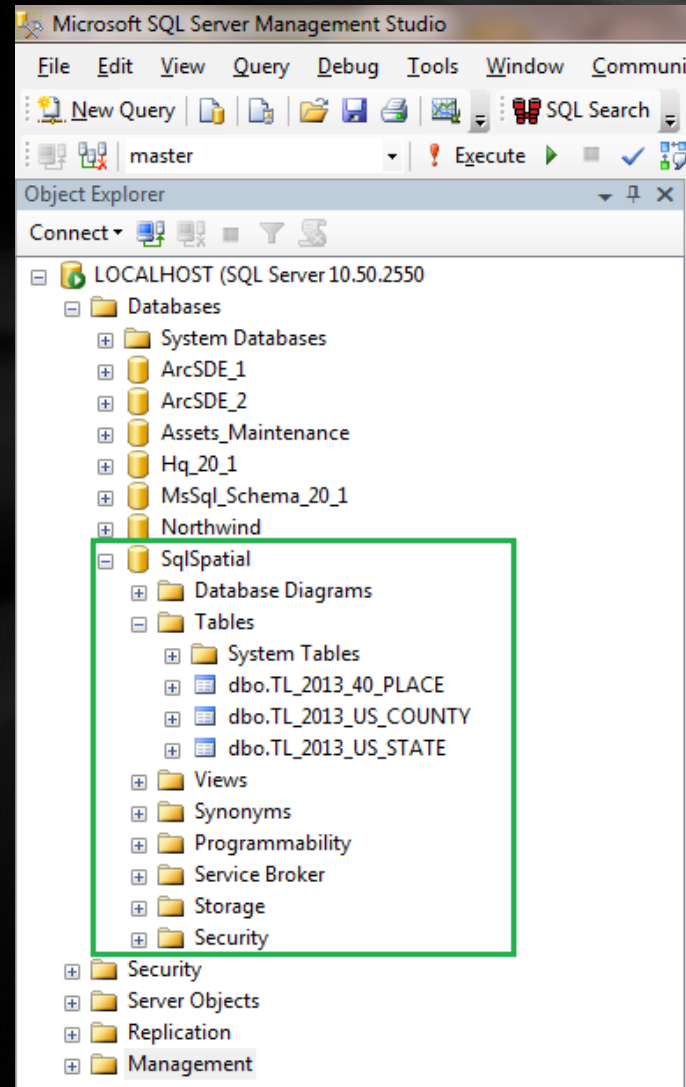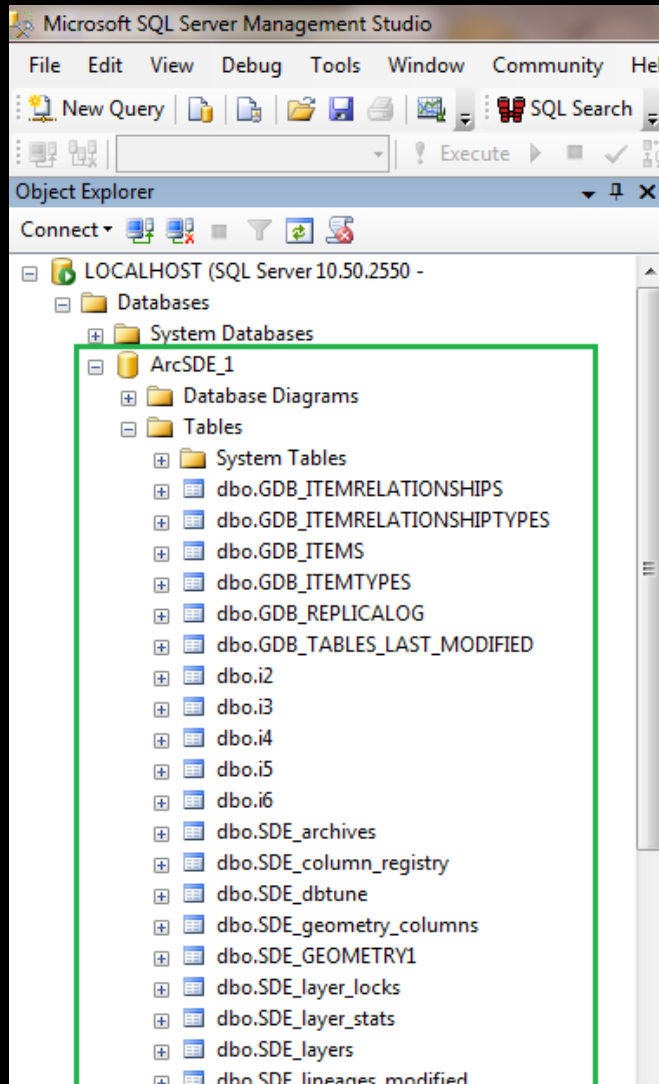
- Datasets
- Versioning
- Geodatabase Archives
- Distributed Geodatabases
- ArcSDE XML
- Spatial type tables and views
- System administration
- Locking
- Log Files
- Schematics
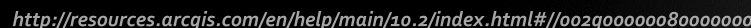
SQL Server Spatial Data Types

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
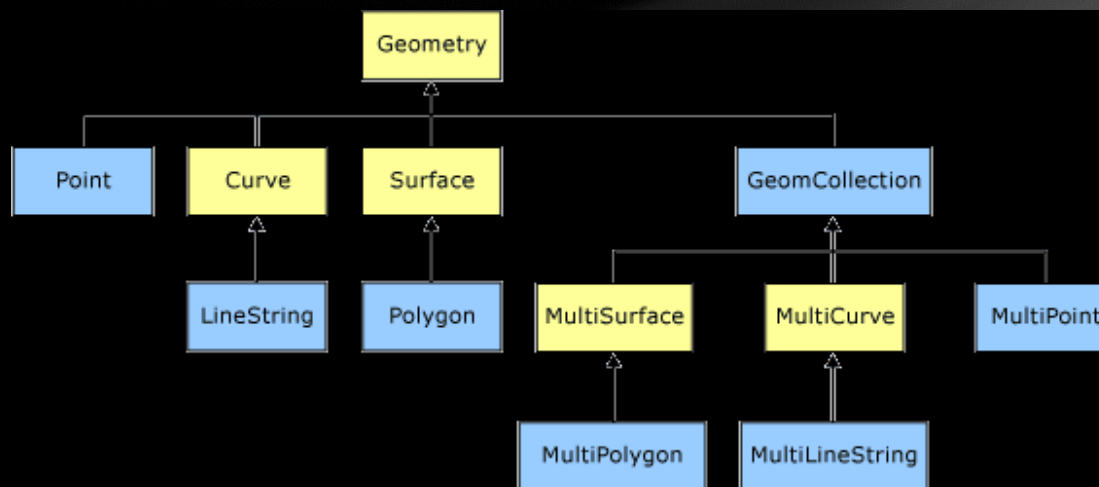
SQL Server OGC Geometry Methods

- STArea
- STAsBinary
- STAsText
- STBoundary
- STBuffer
- STCentroid
- STContains
- STConvexHull
- STCrosses
- STDifference
- STDimension
- STDisjoint
- STDistance
- STEndpoint
- STEnvelope

- STEquals
- STExteriorRing
- STGeometryN
- STGeometryType
- STInteriorRingN
- STIntersection
- STIntersects
- STIsClosed
- STIsEmpty
- STIsRing
- STIsSimple
- STIsValid
- STLength
- STNumGeometries
- STNumInteriorRing

- STNumPoints
- STOverlaps
- STPointN
- STPointOnSurface
- STRelate
- STSrid
- STStartPoint
- STSymDifference
- STTouches
- STUnion
- STWithin
- STX
- STY

SQL Server OGC Geography Methods

- STArea
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- STSrid
- STStartPoint
- STUnion

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

SSMS – Spatial Results Tab

ArcSDE Register As Versioned & Enable Archiving generate SQL Views
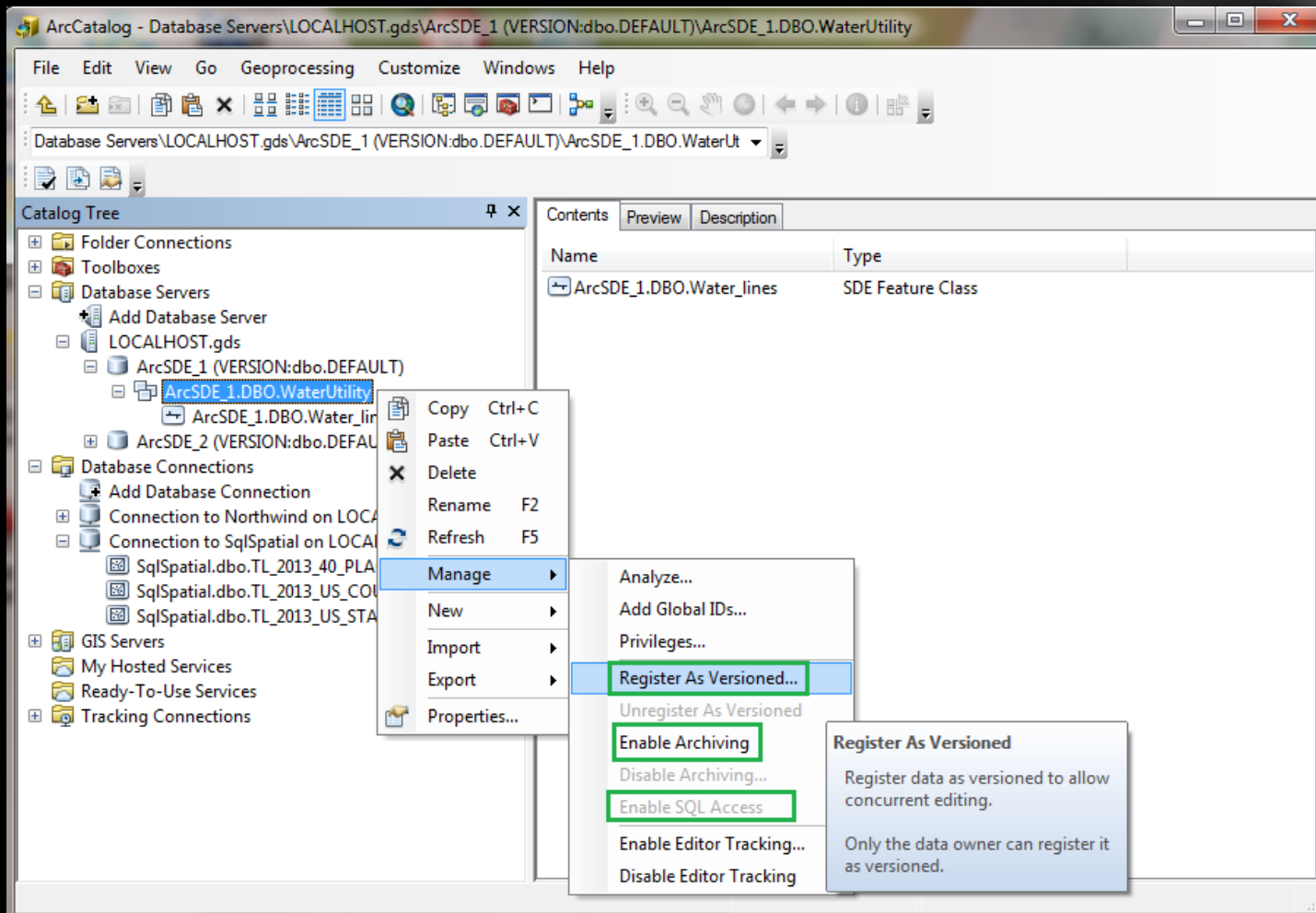
ArcSDE Versioning created SQL View:
Merge base & delta tables, Edit triggers

AutoCAD Map SQL Spatial Connection to SQL View
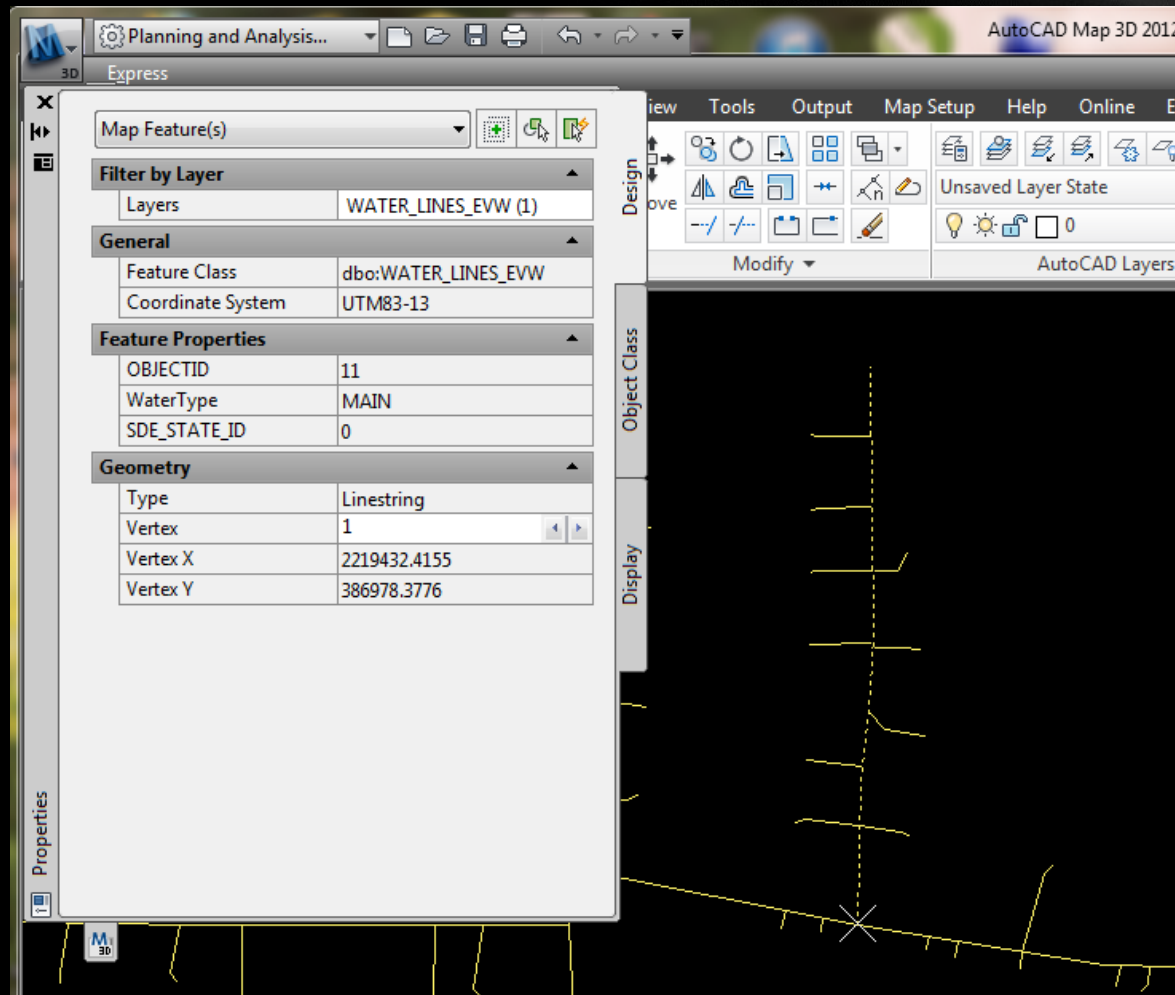
Excel Data Connection From SQL Server or Microsoft Query (ODBC)
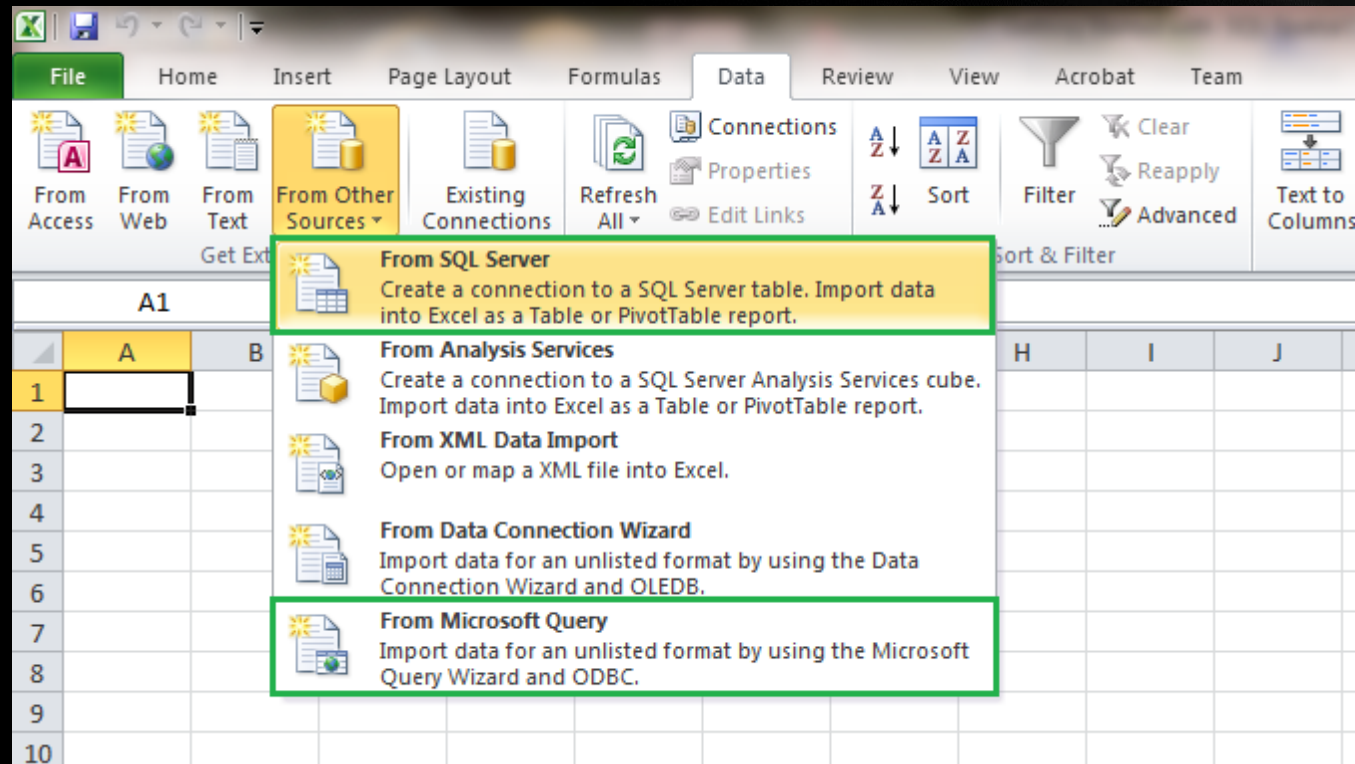
Additional Considerations

- 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: http://www.w3schools.com/sql/