

TerraGate[®]

Version 6.6.1

Datasheet

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OVERVIEW

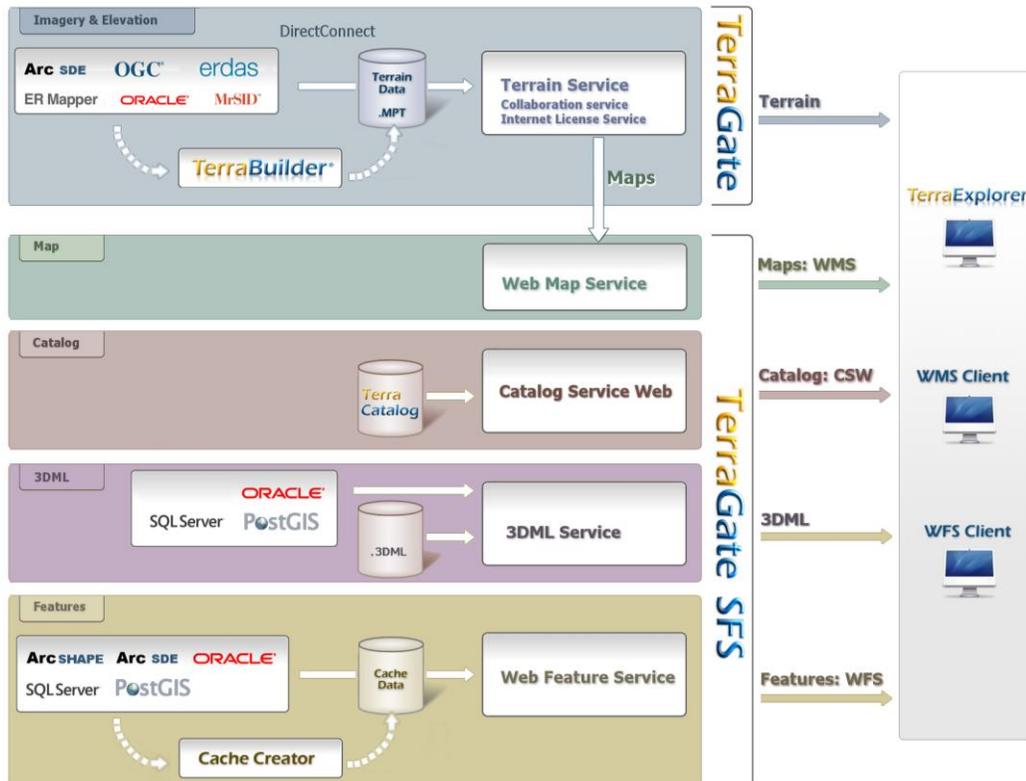
TerraGate supports the client-server data delivery requirements of Skyline's 3D visualization applications, enabling massive amounts of data to be efficiently streamed to thousands of concurrent users.

TerraGate's powerful network server technology delivers 3D geographic, mesh, map, and feature data to clients across the web, through a suite of services including:

- **Terrain Service:** Streams 3D terrain geographic data to TerraExplorer and WMS clients.
- **Web Feature Service (WFS):** Streams feature layers to TerraExplorer and WFS clients.
- **3D Mesh Layer Service (3DML):** Streams fully textured 3D city models merged in 3D Mesh Layer (3DML) databases to TerraExplorer clients.

These services are among the range of services provided by the two components which comprise the TerraGate server technology: TerraGate Terrain Streaming Server Component and TerraGate Spatial Framework Services (SFS) Component. Each of these components exposes different TerraGate services (as outlined below) and has its own management tool from which the user can configure and monitor these services:

- TerraGate Terrain Streaming Server Component provides the following services:
 - **TerraGate Terrain Service** - Streams 3D geographic data from terrain databases (MPT) or directly from the original sources through the DirectConnect extension.
 - **TerraGate Internet License Service** - Provides advanced SkylineGlobe Viewer API functionality to authorized TerraExplorer Viewers that are embedded in SkylineGlobe web applications.
 - **TerraGate Collaboration Service** - Hosts TerraExplorer Collaboration sessions to which multiple users can connect and work together in the 3D environment.
- TerraGate Spatial Framework Services (SFS) Component provides the following services:
 - **Web Feature Service (WFS)** - Streams feature layers from databases or pre-cached layers to TerraExplorer or OGC WFS clients, providing remote clients with read-write access to edit and save changes to the data source.
 - **Web Map Service (WMS/WMTS)** - Streams Skyline terrain databases (MPT) and raster layers to any OGC WMS client. Web Map Tile Service (WMTS) serves georeferenced map tiles (for increased speed and reduced bandwidth requirements).
 - **3DML Service** – Streams 3D Mesh Layer (3DML) databases created from PhotoMesh city models together with classification layers, individually modeled layers, and BIM datasets, to remote TerraExplorer clients.
 - **Catalog Service: Web (CSW)** - Provides web interface to TerraCatalog, a catalog database that stores, organizes and manages connections to raster, feature, and 3DML layers.



TerraGate Architecture

TerraGate suite is compliant with the following OpenGIS Implementation Specifications:

- OpenGIS® Web Feature Service (WFS) Implementation Specification
- OpenGIS® Web Feature Service Transactions (WFS-T) Implementation Specification
- OpenGIS® Web Map Service (WMS) Implementation Specification
- OpenGIS® Web Map Tiling Service (WMTS) Implementation Specification
- OpenGIS® Catalog Service: Web (CSW) Implementation Specification

PRODUCT MAIN FEATURES

Terrain Service

- 3D data streaming over private networks or the Internet.
- Serves massive terrain databases (MPT files) created by TerraBuilder.
- Serves unprocessed, fused terrain project (TBP) to remote TEP and WMS clients using TerraGate DirectConnect.
- Optimized for low-bandwidth conditions.
- Designed for easy scalability.
- Uses TCP/IP protocols. Enable SSL (Secure Socket Layer) protocol.

- Works with firewalls and proxy servers.
- Takes full advantage of multi-processor server hardware.
- Efficient handling of massive data sets.
- Terrain data size limited only by disk media.
- Managed through the TerraGate Manager tool.
- Distributed TerraGate Network enables remote TerraExplorer users to fly on a single project managed by dispersed TerraGate servers.

Internet License Service

- Provides SkylineGlobe Viewer API functionality to authorized TerraExplorer Viewers that are embedded in SkylineGlobe web applications.

Collaboration Service

- Provides hosting services for collaboration sessions between TerraExplorer users.

Web Feature Service

- Manages and streams layers of features, including polylines, polygons and points.
- Streams from shapefiles, SQLite files, the Oracle database, SQL server database, PostGIS and ArcSDE servers.
- Provides OGC Web Feature Service (WFS) interface to other applications.
- Creates a cache on the server for high-performance streamed data.
- Allows data cache to be pre-configured for an entire layer or created dynamically per request. Using a cache helps the SFS reduce loads from slower data sources such as ArcSDE or Oracle.
- Dynamic cache – Cache is created gradually in response to user requests for sections of data.
- Scalable to serve out data to a large number of users (SFS Cluster).
- Auto-refresh mechanism can be set to active when a layer is updated.
- Ability to mark each cache tile data with an expiration time.
- Stores each layer's cache in three different detail levels for better optimization.
- Optimized to handle a high number of requests per server.
- Web-based management system to define the data sources, layers, and cache settings. Efficient handling of massive databases. No size limitation.
- Supports advanced queries from TerraExplorer and other WFS clients.
- Divides query results into several replies to enable queries on large data sets
- Read-write access allows editing of data source (WFS-T).

Web Map Service WMS/WMTS

- Provides OGC Web Map Service (WMS) interface to TerraGate terrain databases.

- Provides OGC Web Map Service (WMS/WMTS) interface to TerraGate terrain databases and raster layers.
- WMTS serves locally stored, pre-rendered tiles that do not require image manipulation or geo-processing.
- Outputs Imagery and Elevation layers.
- Outputs raster data in JPEG and PNG formats.
- Scalable to serve out data to a large number of users (SFS Cluster).
- Optimized to handle a high number of requests per server.
- Web-based management system to define the data sources and layers.
- Efficient handling of massive databases. No size limitation.

3D Mesh Layer Service

- Delivers multi-resolution and stream-optimized 3D Mesh Layers databases (3DML), to remote TerraExplorer clients.
- Streams from 3DML folders containing 3DML files and from the Oracle Spatial, SQL, and PostgreSQL servers.

Web Catalog Service

- Uses OGC Catalog Service: Web (CSW) protocol.
- Delivers published TerraCatalog layers to remote applications.
- Remote users can query the Catalog Service by text or geographic properties.
- Raster, feature, and 3DML data are served to the client by their respective services.
- “Publish” property determines which layers are exposed to the client.
- Customizable filter limits the catalog items exposed to the client.
- Service managed using the Skyline TerraCatalog database.

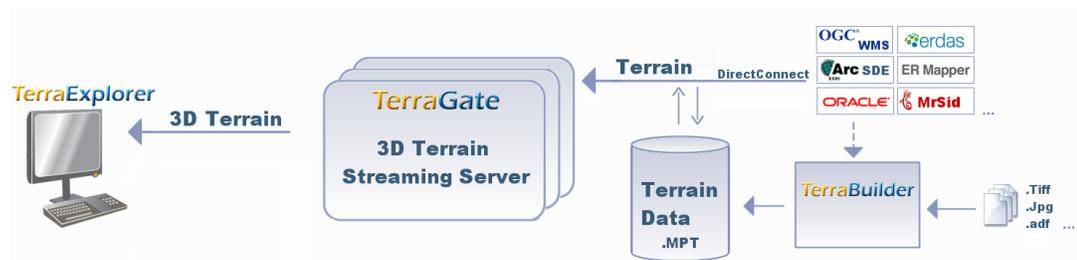
TERRAIN SERVICE

The TerraGate Terrain Service is a powerful network data server technology designed to stream 3D geographic data in real-time. The Terrain Service client-server model is optimized to handle thousands of concurrent users accessing virtually unlimited sized databases in low-bandwidth situations, giving each user uninterrupted viewing. TerraGate achieves this by allowing the client to quickly receive low-resolution scenes around the current location, and then requesting high-resolution information based on the user's current speed and direction, while allowing for real-time changes in navigation.

The Terrain Service provides the platform for launching applications created with Terra development and editing tools. In conjunction with **TerraBuilder**, **TerraDeveloper**, and **TerraExplorer Pro**, the Terrain Service makes the digital Earth accessible, and enables a geo-referenced backdrop for clients' web-based applications.

The Terrain Service differs significantly from video streaming technology in that it works seamlessly across variable bandwidths on the Internet and is not affected by latency or breaks in connectivity. Once

users have received the initial scene in low-resolution, they can begin accessing the 3D environment without waiting for entire frames of data to display. This breakthrough technology displays seamless 3D graphics for a smoother and more enjoyable user experience.



TerraGate Terrain Service Architecture

The Terrain Service can stream from two sources:

- From terrain data stored in Skyline optimized terrain databases (MPT)
- From the original sources directly through the DirectConnect project

Terrain Database (MPT)

The terrain database (MPT) is a compressed, multi-resolution, stream-optimized file. The MPT database includes all source information and applied manipulations in the TerraBuilder project. The terrain database is used locally or published by TerraGate to Internet or Intranet users.

DirectConnect Extension

TerraGate DirectConnect, enables you to stream a published TerraBuilder project, built from optimized and native source data. The DirectConnect component employs advanced mechanisms to build data on-demand, and leverage cache technology for performance and scalability optimizations.

For projects whose source data is constantly being updated or modified, TerraGate DirectConnect provides the ability to serve terrain databases defined by the TerraBuilder project file (TBP), eliminating the need for time-consuming re-creation of complete MPT files. A DirectConnect project can be optimized by referencing MPT source files, which are pre-processed optimized versions of the respective sources in their native formats.

TerraGate DirectConnect maintains a remarkable performance level by applying a multi-caching approach. Creating a separate cache file for each native source boosts performance as each cache can be pre-compiled separately according to the coordinate system, and manipulation parameters of its source file. Areas in a DirectConnect project that are compiled out of multiple sources are stored in an independent cache file. A new version of the cache file is created whenever changes are introduced to the project.

Support for multi-core and multi-computer processing can be utilized to provide scalability and accelerate the publishing of massive data sets.

With TerraGate DirectConnect, TBP terrain databases can be made available for 3D browsing to remote TerraExplorer clients using the TerraGate terrain service. The same terrain databases can also be served to WMS/WMTS clients with TerraGate SFS WMS/WMTS service.

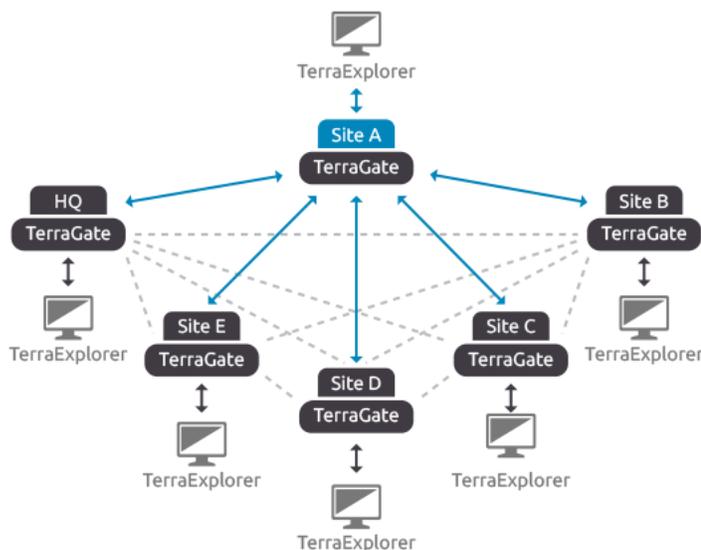
Fusers

A TerraBuilder Fuser (or “Fuser”) is an application that allows TerraBuilder DirectConnect to utilize the resources of the computer, on which it is running, for the on-demand generation of a virtual 3D terrain database. Local or remote fusers operate as copies of TerraBuilder on the client machines, adding their resources to the streaming of data to TerraGate via the DirectConnect component. TerraBuilder fusers can also be used to share the workload of MPT creation simultaneously between several computers and multi-CPU platforms.

Federated TerraGate Network

Skyline’s federated geospatial network comprises a cluster of geographically distributed TerraGate servers (nodes) that share each other’s geographic data to provide a harmonized terrain database. Each node provides data for a different geographic area and manages database caches for sections handled by other TerraGate servers. When users fly through a project, the local node can access the other nodes and seamlessly integrate the unique data they serve into the consolidated terrain.

This distributed data concept enables the data for each area of operation to be managed by those who know it best, while integrating it into the master project for all users. There is no need to send all data to a central repository, or to rebuild or recompile the entire dataset to add or update data. When data in a specific area is added or modified, users automatically get the latest updates. Remote caching capabilities allow continued access to the remote node’s data when the network connection is broken.



TerraGate Federated Network

INTERNET LICENSE SERVICE

The TerraGate Internet License Service provides advanced SkylineGlobe Viewer API functionality to authorized TerraExplorer Viewers that are embedded in SkylineGlobe web applications. Using this service you can dramatically enhance the user experience by enabling users to dynamically add and edit 2D, 3D, and advanced elements to the 3D world and load imagery, elevation, and feature layers.

When a web page attempts to use advanced TerraExplorer SkylineGlobe Viewer API from TerraExplorer Viewer, an authorization request is sent to the Internet License service. TerraExplorer Viewer then receives permission to execute the advanced API.

The Internet License requires Terrain Service to be installed. It uses the server settings, as defined by the TerraGate component, for communicating with clients.

COLLABORATION SERVICE

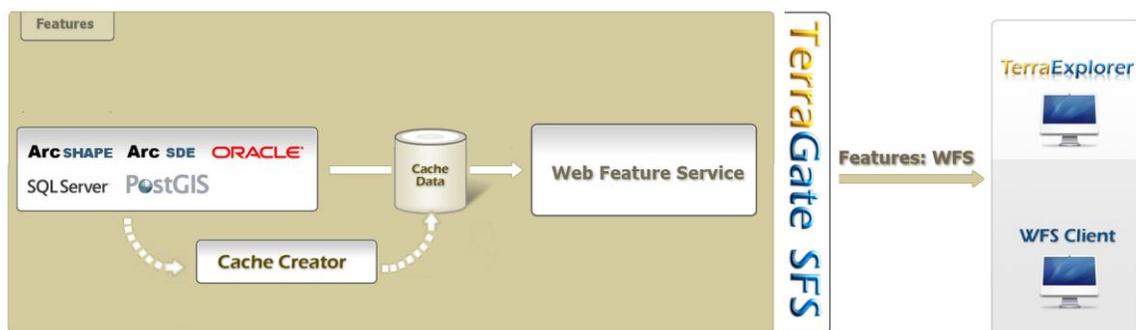
The TerraGate Collaboration service provides hosting services for collaboration sessions between TerraExplorer users. Using the collaboration tool in TerraExplorer users can create collaboration sessions and invite remote participants to share the 3D experience.

WEB FEATURE SERVICE (WFS)

The TerraGate SFS Web Feature Service serves feature layers of polylines, polygons and points to all TerraExplorer and OGC WFS client applications. It also supports advanced spatial and attribute queries from TerraExplorer and other WFS clients. With TerraGate's support for WFS-T (Web Feature Service-Transactional), remote clients can create, delete, and update feature data and save changes directly to the data source. All clustered servers are simultaneously updated with any data source edits. WFS can stream from shapefiles, SQLite files and from the Oracle, SQL server, PostGIS and ArcSDE databases.

WFS has several sub-systems that are individually responsible for handling streaming requests from several different sources. It is optimized for streaming to TerraExplorer clients.

WFS uses a cache sub-system in order to greatly improve the efficiency of the whole system. Cache is created gradually and dynamically, in response to user requests for new sections of the data. For slower data sources where optimized performance is required, entire layers can also be pre-cached, eliminating requests to the data store and allowing faster streaming.



Web Feature Service Architecture

Input Formats

- Oracle Spatial
- ESRI ArcSDE server
- SQL server 2008
- PostgreSQL/PostGIS
- ESRI shapefile (*.shp)
- SQLite database file

Output Formats

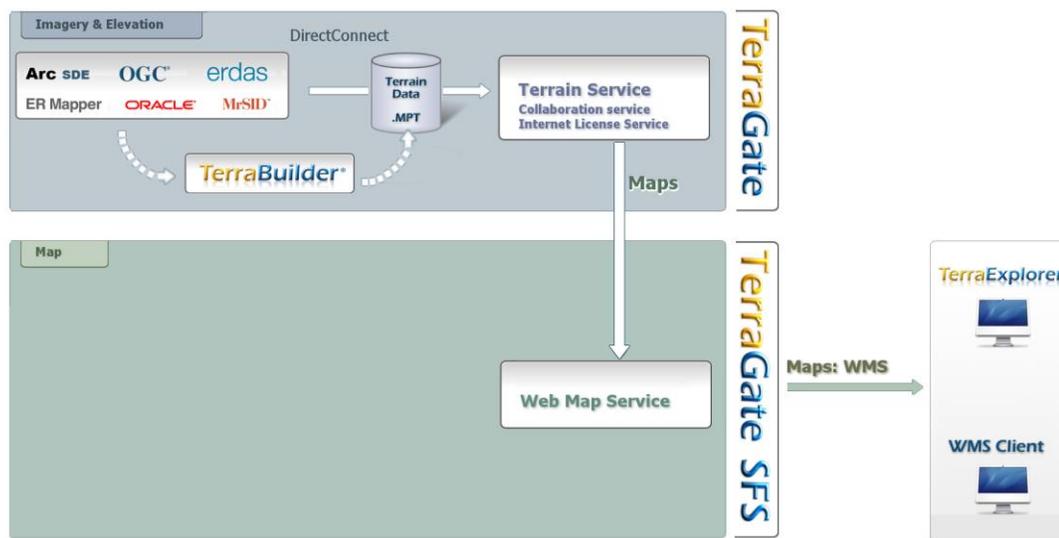
- Standard WFS data block
- Scrambled and compressed data block

SFS CacheCreator

One of the components of the WFS is the SFS CacheCreator. The SFS CacheCreator takes a single layer as its input and creates a cache that the WFS can directly use. This “pre-prepared cache” option is the most efficient and fastest way to serve incoming data requests. The cache can also be moved or shared between multiple servers.

WEB MAP SERVICE (WMS/WMTS)

The TerraGate SFS Web Map Service serves Skyline terrain databases (MPT) and raster layers to any application that reads the standard OGC WMS/WMTS protocol. Each request for map data is transferred from the WMS/WMTS Service to the TerraGate Terrain Service. The Terrain Service fetches the data from terrain databases (MPT files) or builds the blocks of data using the DirectConnect component. The data is then returned to the WMS/WMTS Service, converted to a standard WMS/WMTS result and sent to the client application. Supported imagery and elevation formats include JPEG (signed 8 bit) and PNG (unsigned 16 bit). WMS can stream from TerraGate and from the Oracle Spatial, SQL server, PostGRE SQL and ArcSDE databases.



Web Map Service Architecture

3D MESH LAYER (3DML) SERVICE

The TerraGate SFS 3DML Service serves multi-resolution and stream-optimized 3D Mesh Layers databases (3DML), to remote TerraExplorer clients. 3DML Service can stream from 3DML folders and from the Oracle Spatial, SQL, and PostgreSQL servers. 3DML databases can be created either in TerraBuilder CityBuilder by merging layers of 3D mesh city models (generated by TerraBuilder PhotoMesh), together with classification layers, and other model layers or in TerraExplorer using the Make3DML tool on point layers with individually referenced 3D model files.

WEB CATALOG SERVICE (CS-W)

The TerraGate SFS Web Catalog Service (CS-W) provides web interface to TerraCatalog, a catalog database that stores, organizes and manages connections to raster, feature, and 3DML layers. TerraCatalog maintains detailed information about its layers including type, dimension, dates, tags, metadata, and custom data, enabling clients to easily query the remote catalog for the specific published layer required for a TerraBuilder or TerraExplorer project. The raster, feature, and 3DML data are then served to the client by their respective services:

- **Feature** layer > SFS WFS
- **Mesh** (3DML) layer > SFS 3DML service
- **Terrain databases (MPT) and raster** layers > TerraGate Terrain Service

MANAGEMENT TOOLS

TerraGate Manager

TerraGate Manager is a management and configuration tool that enables the user to control and monitor the services included in the TerraGate Terrain Streaming Server component: Terrain Service, Internet License Service and Collaboration Service. From TerraGate Manager, you can do all the following:

- Start and stop the Terrain Service and Collaboration Service.
- Monitor server performance and statistics.
- Change configurations (IP address, port).
- Add and remove terrain database directories.
- Control the IP addresses that can perform remote administration.
- Connect TerraGate to TerraCatalog, a catalog database.
- Add, remove, and search for TerraBuilder fusers.
- Set cache settings.
- Set TerraGate security parameters that determine how TerraGate handles connection requests from remote clients.
- Assign terrain database aliases.

TerraGate SFS Manager

The Spatial Framework Services (SFS) Manager is a management and configuration tool allowing the user to use a browser web interface to control and monitor the services provided by the SFS component: Web Feature Service (WFS), Web Map Service (WMS/WMTS), 3DML Service, and Web Catalog Service (CS-W). From SFS Manager, you can do all the following:

- Monitor server status and performance.
- Configure SFS server settings (e.g., public URL, server name and title, cache directory, authorization mode).

- Modify and add user names, passwords, and permissions.
- Connect SFS to data sources it will be using (e.g., Oracle Spatial, ArcSDE, shapefiles).
- Modify local server settings.
- Define streaming layers from the data sources.

The screenshot shows the TerraGate SFS Manager web interface. The main content area is titled 'SFS Information' and contains the following details:

Status	Started (Stop)
Name	SFS
Version	6.0.0.287 (64 bit) (Download latest version of SFS CacheCreator)
Client Access URL	http://AT-PC/SFS/streamer.ashx
Latest Message (View all messages)	Error: Unexpected error occurred at 7/11/2011 12:19:45 PM
Catalog Status	Disconnected (Connect)

Below this is a 'Monitor for: AT-PC' section with a table showing performance metrics:

Name	Last minute	Last hour	24 hours	Total	Average block size (kb)
Total Requests (from data source, from cache)	0 [0,0]	0 [0,0]	0 [0,0]	695 [182,513]	
Data Transfer (mb)	0.00	0.00	0.00	18.06	
BaseGlobe_Secured.Lmpt_1	0 [0,0]	0 [0,0]	0 [0,0]	0 [0,0]	0.00
BaseGlobe_Secured.Lmpt_2	0 [0,0]	0 [0,0]	0 [0,0]	0 [0,0]	0.00
border_2	0 [0,0]	0 [0,0]	0 [0,0]	0 [0,0]	0.00
border_3	0 [0,0]	0 [0,0]	0 [0,0]	0 [0,0]	0.00

TerraGate SFS Manager

SYSTEM REQUIREMENTS

TerraGate System Requirements

- **Operating System** - Windows Windows® Server 2003 SP2 / 2003 R2 SP2 / 2008 SP 2 / 2008 R2 /2012.
- **Processor** - Pentium Dual-Core or equivalent (4 or 8 cores recommended). TerraGate works best in a multi-core environment and can utilize multiple CPU's and hyper-threaded processors.
- **System Memory** - 2 GB of RAM plus additional 2 MB per concurrent user. Running TerraBuilder Fusers requires additional resources.
- **User Privileges** - Administrator privileges required for installation and configuration.

TerraGate SFS System Requirements

- **Operating System** – Windows® Server 2003 SP2 / 2003 R2 SP2 / 2008 SP 2 / 2008 R2 /2012.
- **Browser** - Microsoft Internet Explorer (7 and higher), Firefox (3 and higher), or Google Chrome (All versions). Required only for accessing SFS Web Administration.
- **Processor** - Pentium Dual-Core or equivalent (4 or 8 cores recommended). TerraGate SFS works best in a multi-core environment and can utilize multiple CPU's and hyper-threaded processors.
- **Memory (RAM)** - 1 GB of RAM (2 GB or more recommended)
- **User Privileges** - Administrator privileges required for installation and configuration.
- **Additional Software** –
 - Microsoft Internet Information Services IIS6, IIS7, IIS8 with .Net 4.0.
 - **Optional** (in order to connect to the Oracle Spatial data source): Oracle Client 11.1.0.6.20 and ODP.NET 2.111.6.20.



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