

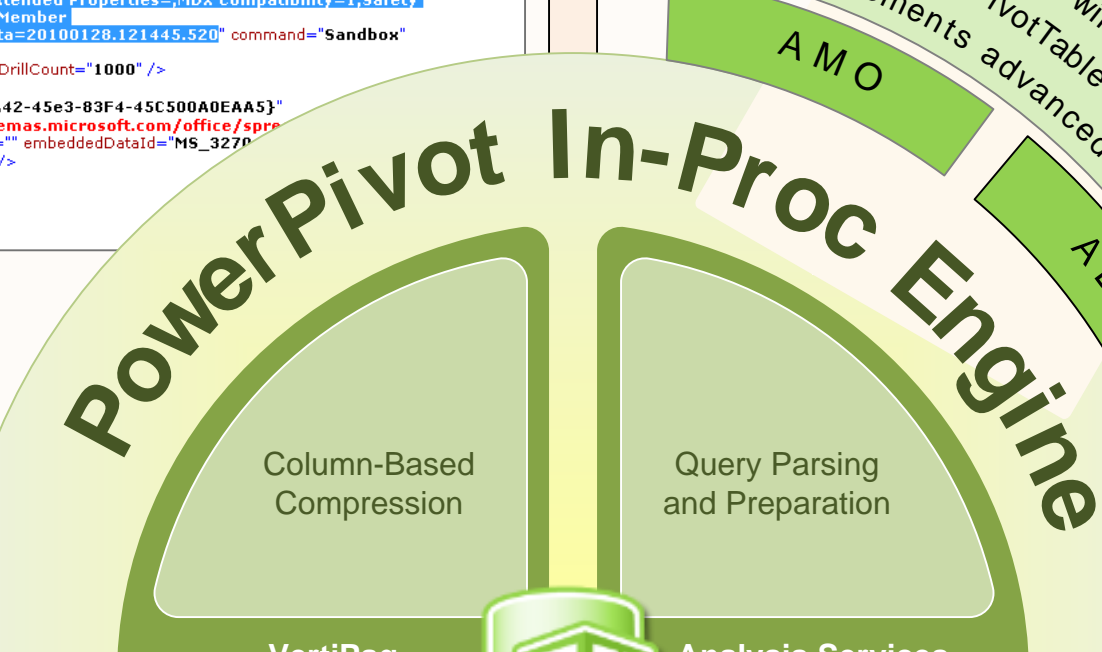
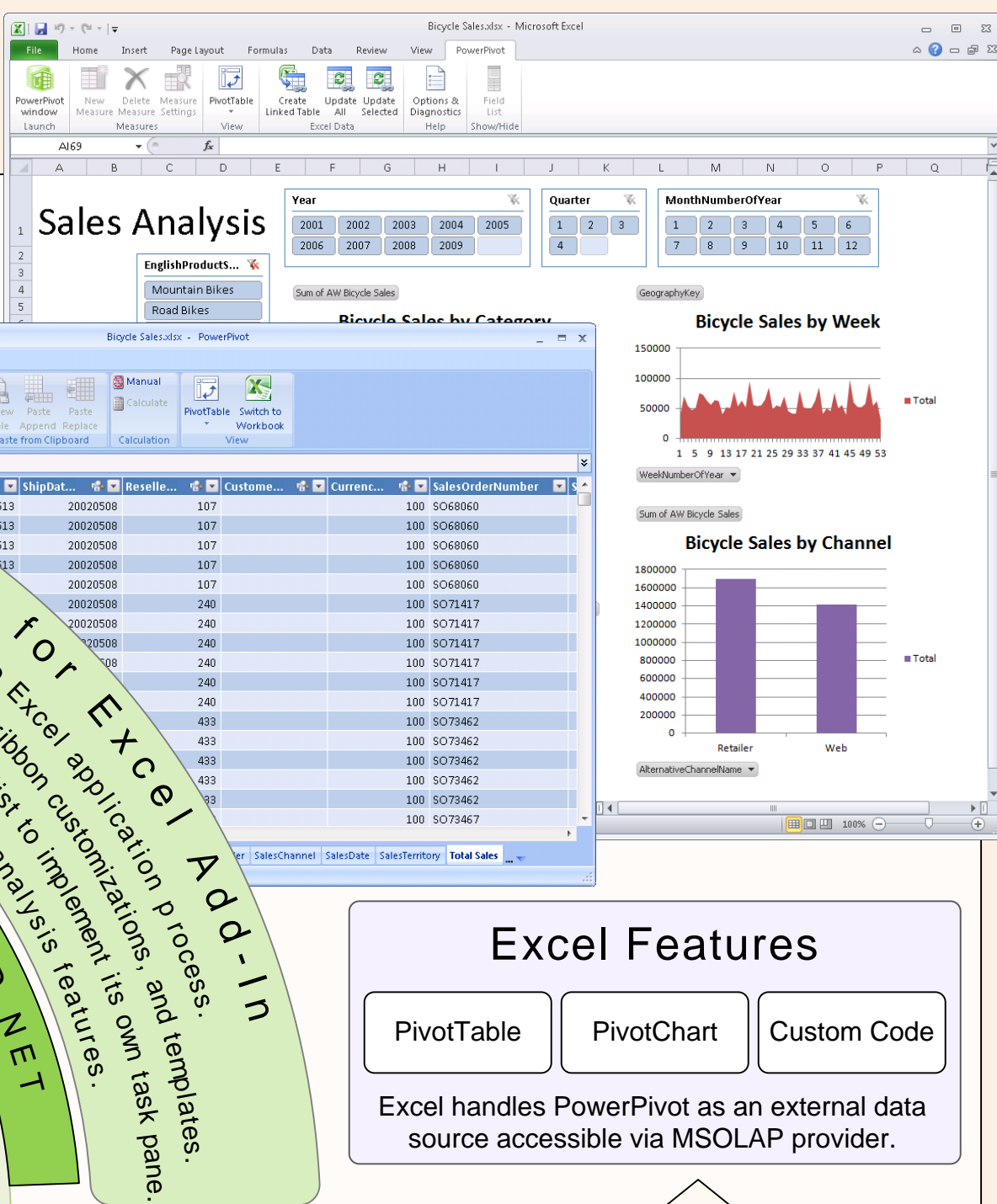
PowerPivot Client/Server Architecture

PowerPivot for Excel

Workbook File

- PowerPivot database is a custom binary part within the workbook file.
- When opening the workbook, Excel reads connections.xml, discovers the embedded data source (Data Source=EMBEDDED), and streams the PowerPivot database to the PowerPivot In-Proc Engine via the Microsoft OLE DB for Analysis Services (MSOLAP) provider.
- When saving the workbook, Excel reads the stream from the PowerPivot In-Proc Engine via the MSOLAP provider and writes the PowerPivot database to the workbook.

Excel Client



- ### Temporary Files
- The size of each VertiPaq_*.GUID folder corresponds to the PowerPivot data in memory.
 - The Temp folder structure corresponds to the native Analysis Services data folder structure.
 - IDF files correspond to the tables and columns that the user has imported into PowerPivot.
 - XML files correspond to object definitions for measure groups and measures.

- ### Data Import
- The Table Import Wizard communicates with the PowerPivot for Excel add-in to create the measure groups, measures, and other database objects for the selected tables, and then triggers the PowerPivot In-Proc Engine to load the data from the specified data sources.
- Users can choose to import data from any OLE DB or ODBC data source and, in many cases, PowerPivot for Excel can establish the table relationships automatically. However, PowerPivot will not automatically install all supported data providers:
- Analysis Services, PowerPivot workbooks and data feeds are supported out of the box.
 - SQL Azure connectivity is available via ADO.NET Data Provider for SQL Server.
 - Connectivity to Access, Excel workbooks, and data files is available via Microsoft Office 14 Access Database Engine OLE DB provider as part of the Office installation.
 - Third-party data sources require additional ODBC or OLE DB providers on the client.

Analysis Services Clients

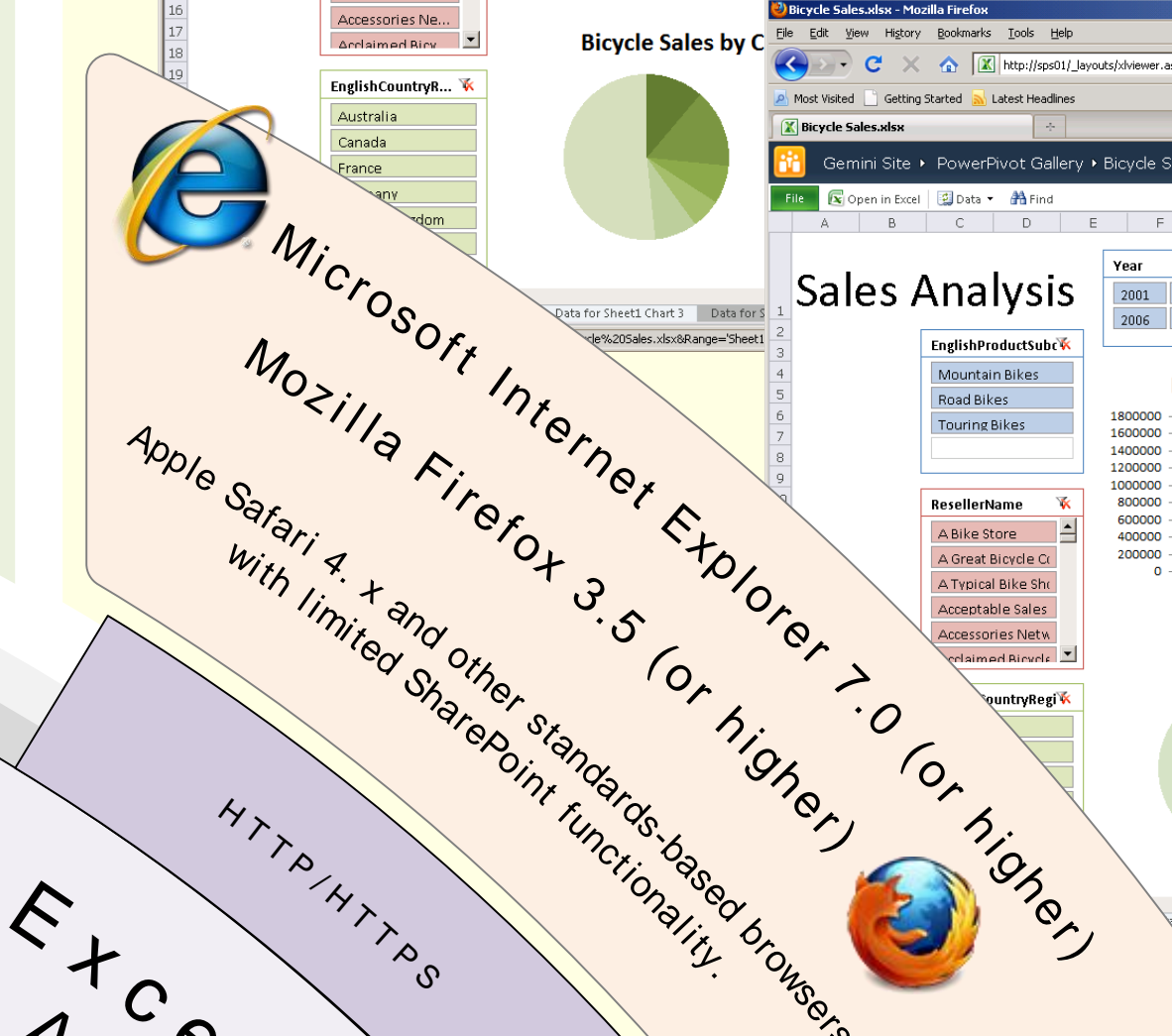
Workbooks as a Data Source

- Clients can access shared PowerPivot workbooks like an Analysis Services cube by specifying the workbook URL as the data source.
- With SQL Server 2008 R2 Reporting Services and PowerPivot for SharePoint installed in the same SharePoint farm, users can use the New Report option in a PowerPivot Gallery to launch Report Builder and start a new report that uses a shared PowerPivot workbook as a data source.
- SQL Server Management Studio (SSMS) can connect to a shared PowerPivot workbook, which can be helpful for troubleshooting and diagnosing connection problems, but Microsoft does not support the use of SSMS for administration of Analysis Services on a SharePoint server.
- Excel clients access shared PowerPivot workbooks in the same way by using the MSOLAP provider.

Browser-Based Clients

Excel Services gives users the ability to view shared PowerPivot workbooks in a Web browser, any time and at any place with network connectivity:

- Similar performance and most of the features as the Excel client.
- Users cannot modify PivotTables or PivotCharts, but can sort, filter, and expand or collapse areas of PivotTables and PivotCharts and work with slicers.
- Excel Services requests processing from a PowerPivot server in the farm, and renders the workbook directly on the front-end server.
- SharePoint users do not require high-bandwidth network connections because these users retrieve only HTML-rendered processing results when accessing shared PowerPivot workbooks.
- Workbooks can be locked down for server-only viewing by adding the users to the SharePoint Viewers group or a custom group with View Only permissions.
- If multiple browser users work with the same PowerPivot workbook, they all access the same workbook loaded once on the server.



Operating Systems

- Windows 7
- Windows Server 2008 R2
- Windows XP SP3
- Windows Vista
- Windows Server 2003
- Windows Server 2008
- Apple Mac OS X Snow Leopard
- UNIX/Linux 8.1

Timer Jobs, Health and Usage Data Collection

- PowerPivot Data Refresh Timer Job**: Determines if a data refresh job needs to be scheduled and executed.
- PowerPivot Setup Extension Timer Job**: Verifies that installed PowerPivot components are up-to-date and running and checks for PowerPivot components that need to be patched after SQL Server patching runs.

PowerPivot for SharePoint

PowerPivot System Service

- Uses Microsoft ADOMD.NET to communicate with an Analysis Services instance. Also performs the following tasks:
 - Manages the application database.
 - Monitors server health.
 - Coordinates client requests for load balancing.
 - Collects usage data.
 - Performs automatic data refreshing for PowerPivot workbooks.

Service Applications

- Windows Communication Foundation (WCF)-based Channel Transport for communication with PowerPivot System Service in local SharePoint farm.
- HTTP Transport for communication with traditional SQL Server Analysis Services as well as PowerPivot Web Service in remote SharePoint farms.
- TCP Transport for communication with traditional SQL Server Analysis Services.

Excel Calculation Services

- Local Workbooks (Data Source=EMBEDDED or Data Source=http://local_site/wbk.xlsx)
- Remote Workbooks (Data Source=http://remote_site/wbk.xlsx)
- Traditional Analysis Services Cubes (Data Source=SSAS_Server_Name)

SharePoint Timer Service

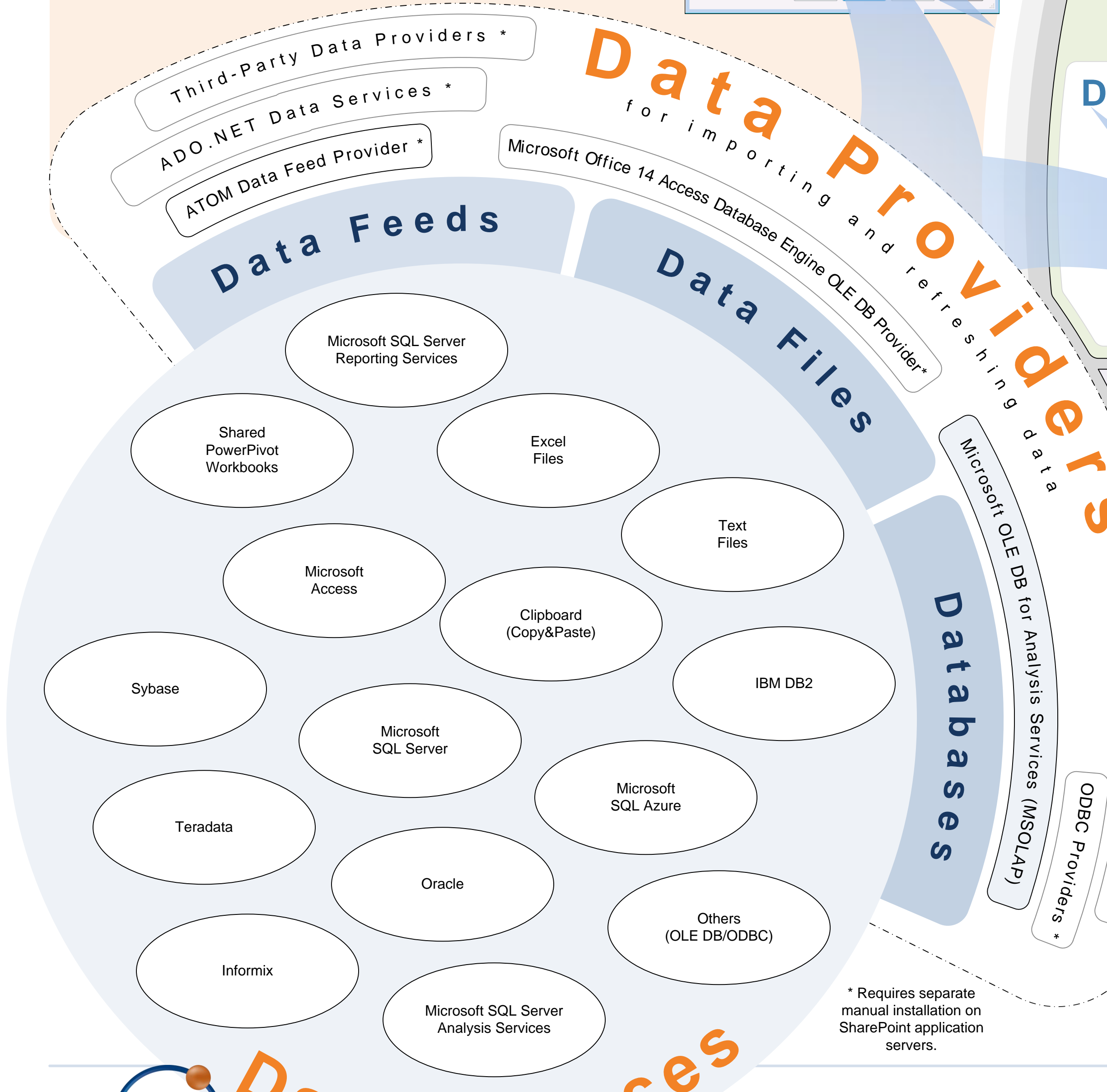
Runs built-in and custom jobs to automate farm maintenance. PowerPivot adds timer jobs to collect and process PowerPivot usage data, refresh data in shared workbooks, gather health statistics, and update the Management Dashboard workbook. (Windows Service)

SharePoint Tracing Service

PowerPivot uses the Unified Logging Service (ULS) API to collect usage and trace information in SharePoint usage and trace logs. The Tracing service maintains these logs. (Windows Service)

Usage and Health Tracking

By default, PowerPivot tracks query usage as well as load, unload, and connection events.



Data Refresh

For Data Refresh to succeed the required data providers must be present on the PowerPivot application server and the data sources used in the workbooks must be accessible from the SharePoint farm.

- PowerPivot Data Refresh timer job determines if a data refresh job needs to be scheduled and executed by the PowerPivot System Service.
- A PowerPivot workbook can have multiple schedules (overridden at the data source).
 - Per job for Windows authentication
 - Per data source for non-Windows authentication (e.g. SQL authentication)
- Refresh credentials are stored in Secure Store Service:
 - Unattended data refresh account.
 - Personal Windows user credentials for data refresh.
 - Database (non-Windows) credentials for external data sources.

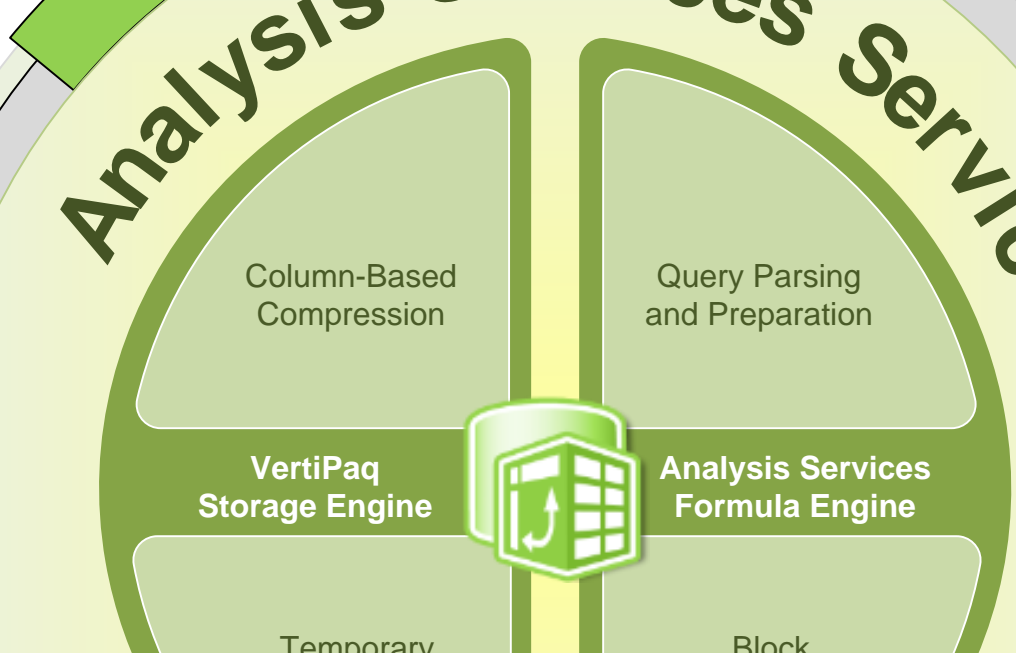
Secure Store Service

Provides secure storage and mapping of credentials for connecting to external systems. PowerPivot uses Secure Store Service to store:

- Unattended data refresh account.
- Personal Windows user credentials for data refresh.
- Database (non-Windows) credentials for external data sources.

(Web Service)

Analysis Services Service in VertiPaq Mode



Databases

- PowerPivot maintains a separate database per service application to store:
 - An Instance Map of state information for loaded or cached databases.
 - Data refresh schedules and refresh history per workbook.
 - Usage information about connection statistics, query response times, and server health.
- PowerPivot Application Database
- Central Administration Content Database
- SharePoint Management Dashboard workbooks
- SharePoint Content Databases

SharePoint Configuration Database

Stores configuration and site mapping information for the entire server farm, including PowerPivot settings for service configuration and data refresh parameters.

PowerPivot Dashboard Processing Timer Job

Updates each PowerPivot Management Dashboard workbook based on the data in the PowerPivot application database.

PowerPivot Health Statistics Collector Timer Job

Collects CPU and memory utilization statistics for PowerPivot components and imports the data into the PowerPivot application database.

SharePoint Usage Data Import Timer Job

Collects usage information from PowerPivot components and imports the data into the SharePoint logging database.

SharePoint Usage Data Processing Timer Job

Processes the usage data from the SharePoint logging database and imports the normalized data into the PowerPivot application database.

SharePoint Logging Database

Aggregates usage and health data from SharePoint log files as well as from Windows Event Log, performance counters, SQL Server, and other sources and provides a variety of pre-defined SQL views for querying and reporting.

About PowerPivot Poster

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Summary: This poster illustrates the PowerPivot client and server architecture. It shows how PowerPivot integrates with Microsoft Office Excel 2010 on the client and with SharePoint on the server, provides details about how various client types can access shared PowerPivot workbooks in a SharePoint farm, and describes how the SharePoint and PowerPivot Web applications and services interact with each other. It gives a detailed overview of the processes running on front-end servers, application servers and required databases. This poster also lists the various OLE DB providers that PowerPivot can use to import data from a data source and that SharePoint administrators may have to install on servers to support automatic data refreshing.

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