
White Paper

ProMatrix Data Server

ProMatrix Web Solutions LLC



PROMATRIX
WEB SOLUTIONS

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ProMatrix Data Server

Introduction - Executive Summary

As organizations grow, their need for remote access to enterprise data grows along with them. Branch offices, stores, customers, resellers, suppliers, salespeople and others may have legitimate needs to access and even help maintain an organization's centralized data.

With the advent of the Internet and broadband Internet access, all organizations that need to provide remote access to data can now do so affordably. Internet users access data remotely when they do online banking, buy a book at amazon.com or purchase tickets for the 8:00 p.m. showing of Hollywood's latest blockbuster. Remote data access using the Internet is not new, but the approaches that are being used to provide remote data access leave much to be desired and are fraught with serious deficiencies.

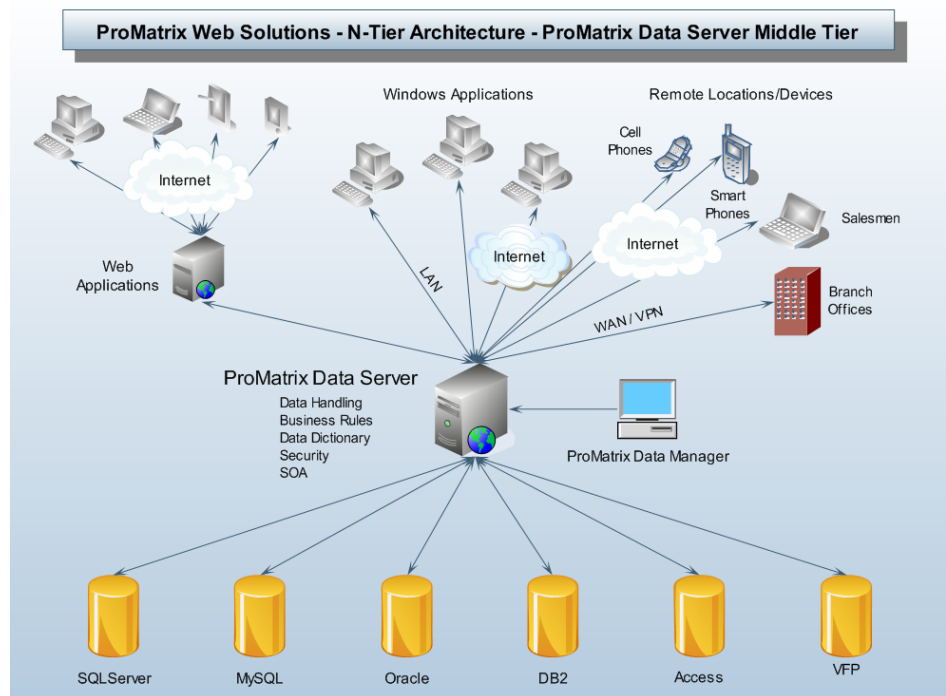
Problems

Unfortunately, the two-tier client-server application architecture being used by most organizations to provide remote access to data is not secure, scalable or reusable. Also, most remote access applications today are browser-based Web applications, and while browser interfaces are constantly improving and work well in many situations, today's browser interfaces do not provide the ease of use that Windows forms provide when it comes to displaying and maintaining complex data stores.

Remote Data Access Solution

A new day has dawned. ProMatrix Web Solutions (PWS) has developed an n-tier client-server solution for remote data access that is secure, scalable, reusable and affordable.

ProMatrix Data Server: The center-piece of the PWS solution is the ProMatrix Data Server (PDS), a middle-tier, XML Web Service that acts as the gateway between your data and remote applications. The PDS provides centralized and standardized secure access to data from any remote application. The PDS handles all aspects of data for remote applications. The PDS relieves remote applications from the need for data connections and data handling code. With the PDS, every remote application uses the PDS for data access and handling, regardless of the development platform (ASP.NET, PHP, etc.) used to create the remote application.



PWS RAD Application Development Tools: ProMatrix Web Solutions RAD application development tools make it possible to quickly and easily create professional Windows forms and browser interface

applications that use the ProMatrix Data Server for all data needs. The PWS RAD tools can cut remote application development time and costs by as much as 90%.

Middle-Tier Application Server Solution

If all the ProMatrix Data Server did was provide data connections and data handling between remote applications and your central databases, the PDS would pay for itself as soon as it was installed. However, the PDS does much more than that. The PDS is a middle-tier application server that in addition to data handling provides remote applications with:

- A fully-active data dictionary
- Centralized business rules logic
- Security: User access, menu, controls and fields
- Data validation
- Referential Integrity processing
- Management Tools: Audit trails, activity tracking

Because of all the things the ProMatrix Data Server can do, the PDS should become the centerpiece of your application development and data access technologies.

ProMatrix Web Solutions consultants can install and set up the ProMatrix Data Server for you. Our consultants can convert existing applications to use the PDS and create any new Windows and Web applications that you may need for remote data access.

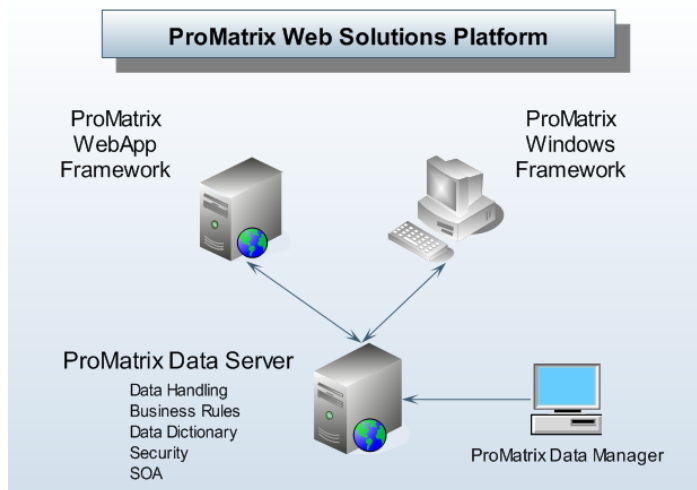
The remainder of this document describes the ProMatrix Data Server in detail and explains all that it can do for your organization.

ProMatrix Web Solutions Platform

To better understand the ProMatrix Data Server, you need to know about the ProMatrix Web Solutions Platform. The ProMatrix Web Solutions Platform is not just the ProMatrix Data Server. It is a set of applications designed to help you implement a secure, scalable, reusable and complete n-tier solution for accessing your enterprise data.

Briefly, the ProMatrix Web Solutions Platform includes:

- **ProMatrix Data Server (PDS):** The ProMatrix Data Server is a middle-tier, server-side, XML .NET Web Service that acts as the gateway between your data and the applications that access it. The PDS takes care of data connections and data handling and provides a great deal of invaluable data-related functionality.
- **ProMatrix Windows Framework (PWF):** The ProMatrix Windows Framework is used to create Windows applications that use the ProMatrix Data Server to access data over the Internet or locally. The main advantage of accessing data through a Windows application versus a browser interface is the flexibility in design and functionality provided by forms in a Windows application.
- **ProMatrix WebApp Framework (PWF):** The ProMatrix WebApp Framework is a collection of PWS development tools used to create browser-based Web applications (ASP.NET, PHP, etc.) that use the PDS to access data.



- **ProMatrix Data Manager (PDM):** The ProMatrix Data Manager is a Windows application built with the ProMatrix Windows Framework. The PDM is used by developers during PDS installation to set up data definitions and connections, data dictionary metadata, and business rules. After PDS installation, the data administrator can use the PDM to maintain the metadata and monitor PDS usage.

The Total Package

As you can see, the ProMatrix Web Solutions Platform is the total package.

The ProMatrix Data Server provides a data access tool that promotes security, scalability and reusability of everything related to data.

The ProMatrix Windows and WebApp Frameworks provide for quick development of robust, professional Windows and Web applications.

The ProMatrix Data Manager gives your data administrator a tool for maintaining and monitoring the ProMatrix Data Server.

The Problems with a 2-Tier Application Architecture

In the 2-tier client-server application architecture, a client application connects directly to data. This is the most common application architecture used today for remote access to data. As we said above, the 2-tier application architecture is not secure, scalable or reusable and is fraught with serious deficiencies.

Before we begin describing the ProMatrix Data Server in detail, it may help you to appreciate all the things the PDS can do for you if we first describe the problems with the 2-tier approach to data access.

Lack of Security

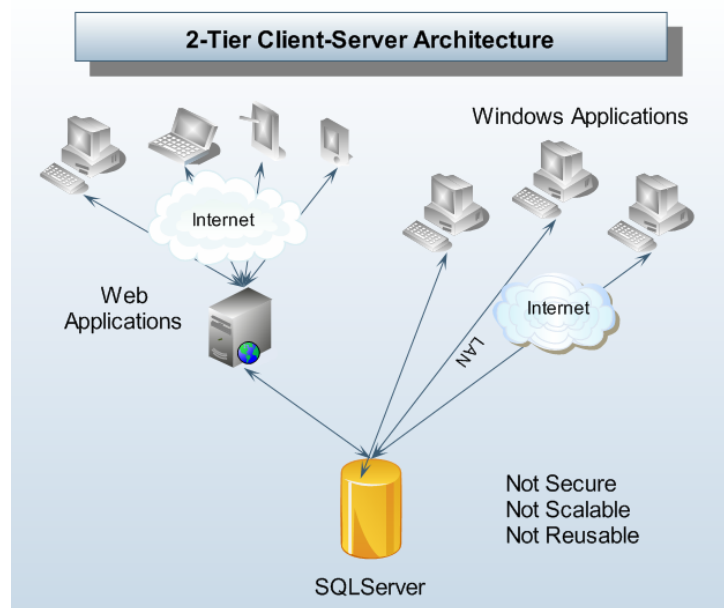
In the 2-tier client-server architecture, remote applications connect directly to data. In the typical case these days, remote applications use the Internet to access data in SQL Server, MySQL, Oracle and other central databases.

It is not prudent to directly expose critical data in backend databases to the Internet. However, in the rush to provide remote access to central data, many organizations have employed the 2-tier client-server architecture and have thereby exposed their critical data to Internet intrusions.

Not Scalable

Scalability refers to the ability of a computer system to handle an increasing work load by adding resources (e.g., additional hardware).

The Achilles heel of the 2-tier client-server architecture is its need to connect directly to the database server. Direct connection to the database server can severely limit the number of client applications that can simultaneously connect. It has been estimated that with a typical SQL Server installation, the server will not be able to accept more than 200 to 300 simultaneous connections.



Unfortunately, there is no good way to get around the connection limits of the 2-tier client-server architecture. Consequently, if a remote data access system must scale to accommodate more than, say, 300 users, the system should not be based on the 2-tier client-server architecture.

Reusability and Code Redundancy Issues

A software system that has reusability is a system in which important software components can be reused by other components. In a software system that has reusability, changes to a software component do not require changes to other components that use the changed component.

Code redundancy is closely related to reusability. A software system has code redundancy if different components of the system must have the same or similar code.

A software system that has reusability and no code redundancy is much easier and more economical to maintain when changes must be made.

The reusability of a software system based on the 2-tier client-server architecture is extremely limited. Examples of reusability and code redundancy issues inherent in the 2-tier client-server architecture include:

- Data handling and business rules code exists within the front-end, client application. Therefore, changes to the data handling and business rules code require all client applications to be modified and reinstalled. When business rules logic is in the client, it is difficult to reuse business rules among applications.
- Client applications must include data-source dependent code. There is no separation of the user interface and the database source. Changes to the data source require all client applications to be modified and reinstalled.
- Unique data handling and business rules code needs to be written for each different client application.
- The developer of each client application needs to maintain the data handling and business rules code in addition to the user interface code.

Performance Issues

In a 2-tier client-server architecture, the majority of the processing occurs on the client PC. In the case of a Web application, this can lead to an overload on the web server computer that hosts the web application.

Application performance degrades quickly as the number of concurrent users increases. This is true even for large database servers. The chief reason is that each client requires its own connection and each connection requires CPU and memory. As the number of connections increases, the database performance degrades.

Windows Applications Installation

In the case of remote Windows applications, installation can become complicated. Every PC requires the correct ODBC drivers to be installed. Data connections need to be set up.

In short, the installation of 2-tier Windows applications requires a level of expertise that most PC users will not have.

2-Tier Windows vs. 2-Tier Web Applications

We should point out that the problems encountered with the 2-tier client-server architecture differ somewhat depending upon whether a remote application is Windows forms application or a Web application with a browser interface.

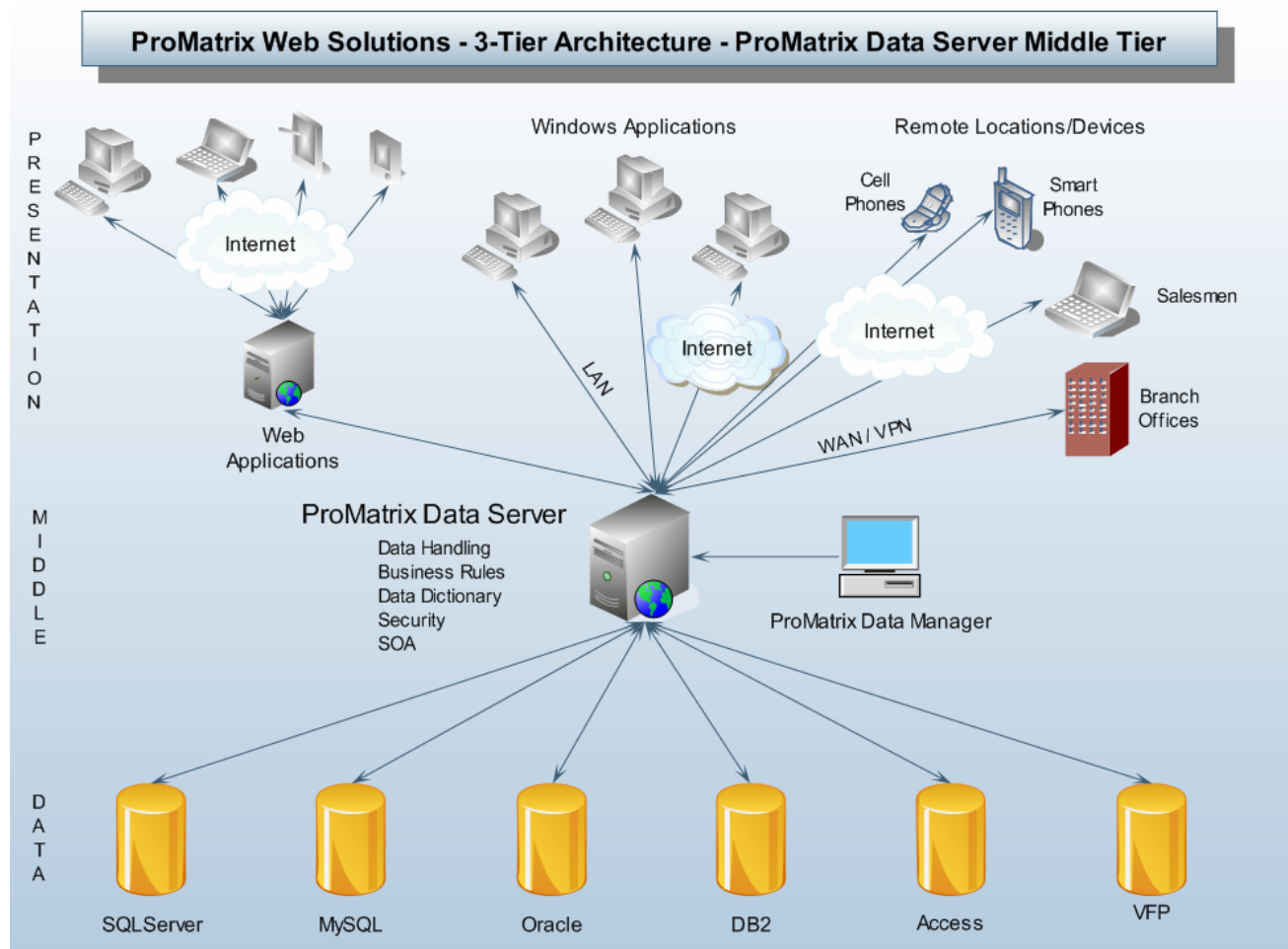
If the remote application is a Windows forms application, all of the problems described above apply.

If the application is a Web application located on a server that is local to the database server, the security and reusability issues can be mitigated somewhat. However, if there are multiple Web applications and Web applications that are not local to the database server, the security and reusability issue will apply.

Advantages of the Middle-Tier ProMatrix Data Server

The problems associated with the 2-tier client-server architecture are eliminated with a 3-tier client-server architecture that includes a middle tier responsible for data handling and business rules logic.

In a 3-tier client-server architecture, the system is divided into three tiers: the presentation (interface) tier, the middle-tier application server, and the data tier. The key component in this architecture is the middle-tier application server, which contains the system's data handling and business logic code.



The ProMatrix Data Server is the middle tier in a 3-tier design. The PDS is responsible for data handling and the implementation of business rules logic. Further, the PDS provides extensive additional functionality that can be used by any front-end client application that can access the PDS.

Security

The ProMatrix Data Server enhances data security in the following ways:

- The ProMatrix Data Server provides its own security mechanisms for authorizing every transaction between a remote client application and the PDS.

- The ProMatrix Data Server provides remote data access using the HTTP protocol, allowing the use of either SSL certificates (HTTPS) or a VPN.
- A ProMatrix Data Server middle-tier application server isolates the code that interacts with databases onto a server computer (or server farm). Only the PDS needs to access the databases. No web application or Windows workstation needs direct access to the databases, which improves overall security. Since remote applications do not have direct access to databases, it is more difficult for a remote application to obtain unauthorized data.
- The PDS provides a physical barrier between the remote applications and the databases. Physical separation of remote applications, the PDS and the databases allows additional firewalls and security checks to be implemented.
- Business logic is more secure when it is placed on a more secure central server.

Scalability

The key 3-tier benefit that the ProMatrix Data Server provides is improved scalability since the PDS can be deployed on many machines.

Also, every client no longer must connect to the database. Only the PDS connects to databases.

3-Tier designs can scale up to extremely large systems. “Large” refers to the number of users, the number of client applications, the size of the databases, the structure of the network, and all other size issues for an application. As the number of users or processing needs grow, the number of computers and the processing power in the computers can grow as needed. With the middle tier deployed on many machines, the database server no longer needs connections to every client.

With the PDS, the use of the database server resources is greatly reduced. Since only the PDS communicates directly with the database and since the PDS uses connection pooling, the number of simultaneous database connections is greatly reduced and the number of client applications that can use the system simultaneously is greatly increased.

The ProMatrix Data Server improves scalability even more when deployed with load balancing and web farms.

Reusability and Code Redundancy

The ProMatrix Data Server improves reusability and reduces code redundancy in the following ways:

- Because a single installation of the ProMatrix Data Server (and its metadata) can be used by any Web Service-aware application, all of these applications can:
 - Share a single data dictionary.
 - Share the same business rules code.
 - Share the same data, whether local or remote, without any data-specific code in the application.
 - Share all of the above from any computer, anywhere in the world.
- Because data handling and business logic are implemented in the ProMatrix Data Server, there is no duplicated effort among the front-end client applications.
- Changes to business logic only need to be updated in the PDS and do not have to be distributed to all the clients.
- The same PDS can be used by any front-end (Windows or Web) that is written in a Web Service compatible language. Therefore, any front-end that can create and consume data in XML format can use the PDS.
- The PDS separates the front-end (user interface) and the database source. Therefore, changes to the data tier do not affect the front-end.

- Unique data handling and business rules code does not need to be written for each different front-end client.
- Data handling and business rules code can be modified without making changes to the front-end. The front-end can also be modified without making changes to the middle-tier.
- The PDS reduces the knowledge required of the developer. The developer only needs to focus on the application-specific functionality of the front-end.
- Front-end client applications do not need their own data-source specific code. Every front-end client application can use the same code to access data through the PDS - regardless of the platform on which the client application was developed.

Performance:

The ProMatrix Data Server makes load balancing possible. The ProMatrix Data Server relieves the computers that run client applications from data handling and business logic processing.

Because the PDS includes functionality that is commonly provided by database servers, processing can be offloaded from the database servers to the PDS.

In the front-end clients, data is retrieved through the PDS without the use of data source connections. This avoids the problem of reduced performance occurring when connections are shared by multiple users.

Windows Applications Installation

Since connections are not used in the front-end, ODBC drivers do not need to be installed on the client PC. Further, connections do not need to be set up on the client PC.

Installing a Windows application that uses the PDS requires no special expertise. Anyone who can install a desktop Windows application can do it.

Data Validation

Since all data updates go through the ProMatrix Data Server, the PDS can ensure that only valid data is allowed to be updated in the database and the risk of a rogue client application corrupting data is removed. Further, the PDS has unique functionality designed to facilitate data validation.

Improved Availability

Mission-critical applications can make use of redundant ProMatrix Data Servers and redundant database servers. With redundant servers, it is possible to architect an application so that it can recover from network or server failures.

Service-Oriented Architecture

The ProMatrix Data Server brings a service-oriented architecture (SOA) to your application environment. SOA is the preferred software architecture for enterprise computer systems.

Additional Functionality - Fully-Active Data Dictionary

Typically, the middle-tier in a 3-tier client-server architecture is responsible for data handling and business logic. However, the ProMatrix Data Server provides much more functionality for client applications than data handling and business logic.

The key to the additional functionality provided by the ProMatrix Data Server is its fully-active data dictionary. The PDS data dictionary is the repository for metadata and business logic.

The benefits and features of the PDS data dictionary are described in detail in the section “

PDS Data Dictionary - Benefits and Features” on page 10.

Additional Functionality - Security

The ProMatrix Data Server can be used to provide user access security for client applications. Authorized users can be given User IDs and Passwords in the PDS via the ProMatrix Data Manager, and client applications can then use the User IDs and Passwords to authorize access.

The PDS is also capable of defining menu, field and controls security by user.

If the client application is created using the ProMatrix Windows Framework, the application will already have the mechanisms needed for user access authorization, menu security, field security and controls security.

ProMatrix Data Server - A Closer Look

The ProMatrix Data Server is a middle-tier, server-side, XML .NET Web Service that acts as the gateway between data and the applications that access it. The PDS takes care of data connections, data handling, and business logic and provides a great deal of invaluable data-related functionality.

Benefits of an XML Web Service

An XML Web Service is the ideal vehicle to link client applications to data for the following reasons:

- XML Web Services are the building blocks of a Service-Oriented Architecture, which is the preferred software architecture for enterprise computer systems.
- XML Web Services are the fundamental components in the move to distributed computing on the Internet.
- Open standards and the focus on communication and collaboration among people and applications have created an environment where XML Web Services are becoming the platform for application integration and interoperability, both externally and internally.
- XML Web Services can be used by an application regardless of where they reside or how they are implemented.
- XML Web Services allow applications written in different languages and on different platforms to communicate with each other through established Internet protocols.
- By leveraging the Internet as a communication channel for applications and services, XML Web Services enable you and your customers to use the Internet as a true business platform.

ProMatrix Data Server Data Handling Methods

The ProMatrix Data Server's data handling functionality includes data retrieval, updating and deletions.

A client application can use the PDS' data handling capabilities by simply calling methods of the PDS. Data is exchanged between a client application and the PDS in the XML format.

The PDS provides the following data handling methods:

- **CopyRecord** - When passed the information that identifies the record to be copied, the specified record is retrieved, copied, default values are placed in the fields, and the copied record is returned as an XML string.
- **DeleteRecord** - When passed the information that identifies the record to be deleted, the specified record is retrieved and then deleted. The VPM RI engine handles the cascading of deletions through related tables. Audit Trail records are also produced.
- **NewRecord** - When passed the information that identifies the data source for which the record is to be created, the record is created, default values are placed in the fields, and the record is returned as an XML string.

- **RetrieveData** - When passed the information that identifies the record or records to be retrieved, the specified record or records are identified and then returned as an XML string.
- **SaveRecord** - When passed the record to be saved as an XML string, record-level field validation is performed and the record is saved to its data source. The VPM RI engine handles the cascading of changes to FK fields in related tables. Audit Trail records are also produced.

ProMatrix Data Server Data Dictionary Methods

The ProMatrix Data Server data dictionary contains extensive metadata and useful functions that can be accessed and used by client applications. The PDS provides methods that a client application can call to access metadata and to execute functions.

The PDS provides the following useful data dictionary-related methods.

- **FieldValidation** - When passed the information that identifies the field to be validated and the value to be validated, the value is validated based on the validation criteria stored in the PDS data dictionary. An XML string is returned that identifies whether or not the value is valid.
- **RetrieveFieldDescriptions** - When passed the information that identifies the field for which the field's data dictionary information is to be returned, the field's data dictionary record is found and returned as an XML string.
- **RetrieveFieldDDRRecords** - When passed the information that identifies the table, view, or CursorAdapter for which the field data dictionary information is to be returned, the field data dictionary records for all fields in the table, view or CursorAdapter are found and returned as an XML string.
- **RetrieveFieldHelp** - When passed the information that identifies the field for which the field help data dictionary information is to be returned, the field help data dictionary record is found and returned as an XML string.
- **RetrieveTVDDRRecord** - When passed the information that identifies the table, view, or CursorAdapter for which the table, view, or CursorAdapter data dictionary information is to be returned, the data dictionary record is found and returned as an XML string.
- **UserValidation** - When passed a User ID and Password, returns an XML string that identifies whether or not the User ID and Password are valid. A User ID can be passed without a Password, in which case an XML string is returned that identifies whether or not the User ID is valid.

ProMatrix Data Server Business Rules Logic

The ProMatrix Data Server provides predefined mechanisms for defining and coding business rules logic.

The ProMatrix Data Server includes a Business Rules class with predefined methods in which code can be entered to enforce business rules related to maintaining an application's data. The Business Rules class method give provide a place to code application-level business rules that aren't tied to specific data elements.

The PDS data dictionary holds record-level code and field-level code to define data-level business rules for specific data elements.

In addition, business rules logic can be coded into the PDS as needed.

PDS Data Dictionary - Benefits and Features

The ProMatrix Data Server provides an extensive data dictionary that maintains metadata. The PDS data dictionary is fully active, which means that metadata can be retrieved and used by client applications.

The PDS data dictionary provides the following functionality to enhance client applications:

- Audit Trail record creation occurs when a new record is saved, a modified record is saved, or a record is deleted. The data dictionary determines which fields are tracked in the audit trail and when audit trail records are created.
- Business rules are enforced through record-level and field-level code that is saved in the data dictionary tables or in methods of a business rules class.
- Creates new and copied records based on criteria specified in the data dictionary.
- Default values:
 - Are placed in fields in new and copied records.
 - Can be a sequential key value, a GUID value, or determined by custom code.
 - Can be filled-in when the record is created or when the record is saved.
- Data Integrity (field validation)
 - Field-level - A PDS method can be called to validate the value of any field.
 - Record-level - When the PDS method that saves records is called, individual field values can be validated at that time.
 - Predefined methods of validation exist so that most validation can be accomplished without writing any code.
- Referential Integrity is enforced for foreign keys on updates and deletions.
- Field Descriptions (labels) can be returned by the PDS to be used in the client application.
- Field Picklist definitions can be returned by the PDS to be used in the client application.
- Field Help text can be returned by the PDS to be used in the client application.
- Test-to-Live functionality allows for easy switching between “test” and “live” data when the PDS has been fully implemented and ready to go live.
- When a record is saved a duplicate primary key check can be performed by the PDS instead of the database if desired.
- Field-level data dictionary records can be returned by the PDS so that any information that is stored in those records can be used in the distributed/remote application.
- Table-level data dictionary records can be returned by the PDS so that any information that is stored in those records can be used in the client application.
- The PDS data dictionary allows for:
 - Business rules code to be database (data store) agnostic, removing the need to write code that is specific to the database.
 - Business rules code for different databases to be maintained in a single location.
 - Business rules code to be moved out of the distributed/remote application, removing the need to write code that is specific to the front-end (language).

A fully-active data dictionary greatly enhances the development of client applications. Because of its data dictionary, the PDS can perform processes that would otherwise need to be coded in client applications. When client applications need metadata, the PDS can provide it.

ProMatrix Data Manager

The ProMatrix Data Manager (PDM) was briefly described earlier in this document. The PDM is such a valuable and useful component of the ProMatrix Web Solutions Platform that we would like to provide additional details about what it does.

The ProMatrix Data Manager is a Windows application built with the ProMatrix Windows Framework. The PDM is used by developers during PDS installation to set up data definitions and connections, data dictionary metadata, and business rules. After PDS installation, the data administrator can use the PDM to maintain the metadata and monitor PDS usage.

During the setup of the ProMatrix Data Server, the ProMatrix Data Manager is used to:

- Create data definitions and connections to access local or remote data.
- Set up the data dictionary information used to provide:
 - Audit Trails
 - Default Values
 - Business Rules
 - Field Validation
 - Field Labels
 - Field Picklist Definitions
 - Field Help
 - TestToLive functionality for testing during PDS setup.
 - Referential Integrity

After the PDS is set up and running in production, the ProMatrix Data Manager can be used to modify data dictionary information.

The ProMatrix Data Manager is also the gateway to the Administrative Tools related to the functioning of the PDS. Via the PDM, you can do the following.

- **Audit Trail:** You can view the audit trail and produce audit trail reports.
- **Activity Tracking:** You can view the activity tracking log and produce activity tracking reports.
- **Errors:** You can view the errors log and produce errors reports.
- **PDS Parameters:** You can define settings that are used by the PDS at runtime.
- **User Security:** Set up users for access to client applications and to the PDS. A valid User ID and Password combination must be passed to the PDS methods to prevent unauthorized usage.

Conclusion - How ProMatrix Web Solutions Can Help

If you have taken the time to read this document up to this point, you should have a good understanding of how the ProMatrix Web Solutions Platform and specifically the ProMatrix Data Server can benefit you in accessing your enterprise data remotely. A new day has truly dawned. You will not find anything like the ProMatrix Web Solutions Platform anywhere else.

The biggest challenge facing the use of computers today is the security and access of data. Before micro-computers, data on mainframes was centralized, secure and accessible by many users. With the PC age, data became distributed, isolated, insecure, not easily accessed and vulnerable to loss.

The goal of ProMatrix Web Solutions is to solve the security and data access dilemmas that have plagued computer users for decades. PWS brings an easily implemented and extremely cost-effective solution to this problem that can be tailored to the needs of every organization - no matter how large and no matter how small.

ProMatrix Web Solutions does not just sell software and walk away. PWS consultants are available for every aspect of the implementation of a remote data access system based on the ProMatrix Web Solutions Platform. Our consultants are available for:

- ProMatrix Data Server installation and set up.
- Conversion of existing applications to use the PDS.
- Creation of new client Windows and Web applications that use the PDS.
- Training of your staff to use the PDS and PWS application development tools.

PWS Windows Demo Application

If you would like to see an application that uses the ProMatrix Data Server in action, visit www.promatrixwebsolutions.com and download the PWS Windows Demo application. The demo uses a ProMatrix Data Server running on a computer in our office to access data. You'll be amazed at how easy it is to install the demo and access data over the Internet

Contact Us

The first step in making the ProMatrix Web Solutions Platform work for you is to contact us and request a proposal. You can reach us in any of the following ways:

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