

> ANATOMY OF A PROGRESS[®] DATADIRECT[®] DRIVER

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INTRODUCTION

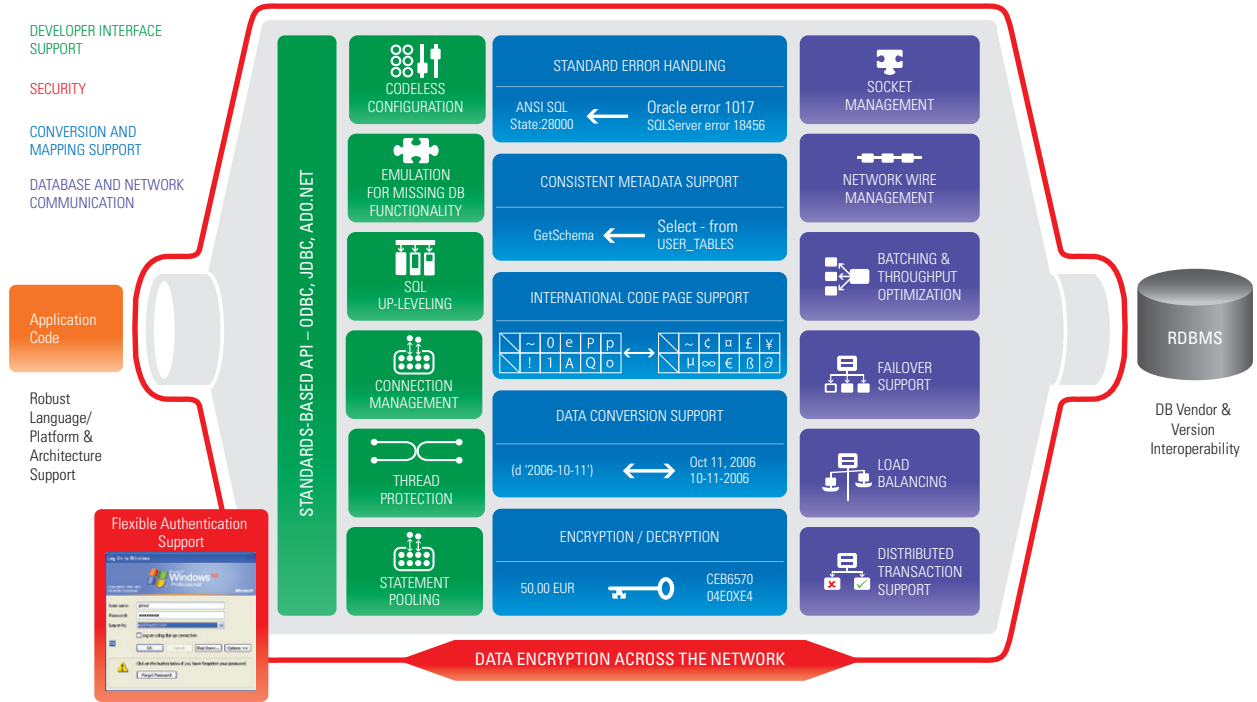
Database middleware plays a critical, often overlooked role in the success of your business applications. Progress® DataDirect Connect® drivers and providers provide an unparalleled set of features that provide critical development, runtime and production benefits. And Progress® DataDirect Connect® *for* ODBC is more than a driver. This comprehensive suite of ODBC for all major databases serves as data connectivity infrastructure or an interface.

Specifically, Progress DataDirect drivers and providers offer functionality that significantly reduces the development, testing and deployment effort required to build mission-critical applications. Many DataDirect capabilities can be leveraged without making any code changes, and DataDirect provides a number of interoperability features that allows you to easily manage multi-database environments. These DataDirect capabilities dramatically shorten the time it takes to deliver robust, reliable and great performing applications.

Here's a closer look at the driver components and their benefits.

CONNECT DRIVERS: A CLOSER LOOK

The diagram below shows the anatomy of a DataDirect Connect driver.



Connect Drivers: An anatomy map

As the diagram color key shows, the features comprise several basic functions: robust language, platform and architecture support (orange); developer interface support (green); conversion mapping support, database and network communication, and security.

TYPES OF CONNECT COMPONENTS

DEVELOPER INTERFACE SUPPORT	CONVERSION AND MAPPING SUPPORT	DATABASE AND NETWORK COMMUNICATION	SECURITY
Robust Language, Platform & Architecture Support	Standard error handling	Socket Management	Flexible Authentication Support
Standards Based API – ODBC, JDBC, ADO.NET	Consistent Meta-data Support	Network Wire Management	Data Encryption Across the Network
Codeless Configuration	International Code Page Support	Bulk, Batch & Throughput Optimization	
Emulation for Missing DB Functionality	Data Conversion Support	Failover Support	
SQL Up-Leveling	Encryption / Decryption	Load Balancing	
Connection Management		Distributed Transaction Support	
Thread Protection		DB Vendor & Version Interoperability	
Statement Pooling			

DEVELOPER INTERFACE SUPPORT

Robust Language, Platform & Architecture Support

Progress® DataDirect Connect® drivers provide unparalleled language, database (DB), platform and architecture support from single, trusted vendor to fulfill all of your DB connectivity needs:

- > Robust language support:
 - > Java, C#, C++, VB, etc
 - > PHP, Perl, Python, AJAX, etc.
- > Support for major DBMSs / platforms
 - > Oracle, SQL Server, DB2, Sybase, Informix, My SQL, Teradata, etc.
 - > Linux, UNIX, Windows, z/OS, iSeries

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- > Supports various frameworks—Spring, Hibernate
 - > Supports many application platforms
 - > Supports any architecture
 - > Batch, online
 - > SOA, event driven, etc.
 - > Any tier (client, Web / app server, etc.)

Standards-based API – ODBC, JDBC, ADO.NET

Progress DataDirect is the database middleware standards leader, providing consistent solutions that avoid proprietary hooks that lock you into a single DB vendor. This interoperability approach makes it easy for ISV developers to support multiple databases and for corporate developers to build applications consistently regardless of the database. Key features and characteristics include:

- > Consistent support for the standards
 - > DB vendors use proprietary extensions that hinder interoperability and lock you in
 - > DB vendors often lag support for latest specification release
- > Leader in standards development
 - > JDBC Expert group
 - > Co-founder of ODBC standard
 - > ANSI SQL Committee

How it works: DataDirect provides robust support for application languages, architectures & platforms supported. It converts standards-based API calls to proprietary DB wire protocol. It also provides consistent support for all DB vendors (Oracle, SQL Server, DB2, Sybase, MySQL, etc.) & DB versions (Oracle 9i, 10i, etc.)

Codeless Configuration

Progress DataDirect provides the ability to easily configure capabilities such as performance, security, failover without expensive code changes that reduce your application TCO:

- > DataDirect supports flexible, codeless configuration of DB and driver options
- > These options allow the driver to be tailored to the needs of the application
- > Configuration spans wide range of capabilities including performance, security, failover, connections, bulk load, etc.
- > Performance Wizard is provided that helps pre-configure the driver based on application characteristics

Emulation for Missing DB Functionality

Progress DataDirect drivers and providers *emulate* missing or inconsistent DB functionality, eliminating expensive application workarounds needed to fill the gap for missing DB features.

- > DataDirect emulates missing or inconsistent DB functionality, enabling developer consistency.
- > Functionality is implemented in the driver level that makes the DBs appear consistent to the application developer. This functionality includes:
 - > Scrollable cursors
 - > Ability to re-read data
 - > Auto-commit
- > Update for current of cursor
 - > Emulates metadata gaps
- > DB vendors don't provide this capability in their drivers, and the breadth of DataDirect emulation is unsurpassed

How it works: The application is abstracted from anomalies in the RDBMS. The DataDirect driver “emulates” missing functionality. No change is required in the DB configuration to enable emulation.

SQL Up-leveling

Progress DataDirect provides SQL up-leveling, which standardizes proprietary DB vendor implementations, providing a single way to interact with all DBs and DB versions.

- > Each database vendor implements certain functionality in proprietary format.
 - > Date and time literals
 - > Outer join syntax
 - > Scalar function syntax
 - > Invoking stored procedures
 - > Dynamic SQL Statement format corrections
 - > Empty string and null conversions
 - > Long character string insertion support
 - > Returning Standard SQL messages
 - > Using parameters within SQL statements and stored procedures
- > Proprietary SQL implementations impact the interoperability provided by standard-based APIs

How it works: Without SQL up-leveling the developer writes different code for different DBs and versions. With DataDirect SQL Up-leveling, the developer just writes a single standard version of SQL that works for all DBs and versions.

SQL Up-leveling Example

- > A SQL statement that select employees hired on October 11 or October 15, 2006 would use the following syntax
SELECT EmpName,
HireDate FROM EmpWHERE HireDate = {d '2006-10-11'} OR
HireDate = {d '2006-10-15'}

-
- > DataDirect's Oracle driver executes `SELECT EmpName, HireDate FROM Emp WHERE HireDate = 'Oct 11, 2006' OR HireDate = 'Oct 15, 2006'`
 - > DataDirect's SQL Server driver executes `SELECT EmpName, HireDate FROM Emp WHERE HireDate = '10-11-2006' OR HireDate = '10-15-2006'`

With SQL up-leveling, writes single standard version of SQL that works for all DBs and versions

Connection Management

Progress DataDirect drivers and providers support the ability to pool and manage connections resulting in better performance and system utilization.

- > DataDirect connection pooling increases performance and limits drag on system resources
 - > Connection pooling is implemented and managed by the driver without impacting the application code
- > DataDirect provides connection management capabilities
 - > Configurable pool options maximize pooling effect
 - > Ability to detect invalid connections
 - > Connection info can be used to prioritize work, trouble-shoot runaway queries
- > Ability to re-authenticate users enhances performance in Kerberos environments

How it works: The application code requests connection to DB. The application is completely abstracted from pooling logic: no application code required to leverage pool. DataDirect allocates connections from pool when available; otherwise new connections are created. DataDirect takes care of managing the pool. Connection pooling has no dependencies on the underlying RDBMS.

Thread Protection

DataDirect driver ensures calls to the DB are thread safe by leveraging the most efficient and safe threading model for the application. This flexible threading support, based on network transport & DB capabilities, helps ensure application stability.

- > DataDirect provides flexible threading support based on network transport and DB capabilities.
 - > SQLGetInfo information type provides thread information to the driver.
 - > Multiple models include fully threaded, thread support for connection model and option to serialize all requests.
 - > Threading capability ensures resource efficiency & application reliability.
- > Competitive drivers are known to fail threading tests.
 - > This results in application crashes and / or data corruption.

How it works: The application can determine the threading capability of network and server via call to the DataDirect driver. The DataDirect driver returns threading information to the application. The DataDirect driver ensures calls to the DB are thread-safe by leveraging the most efficient and safe threading model for the application.

Statement Pooling

Progress DataDirect drivers and providers support the ability to pool and manage statements, resulting in better performance and system utilization.

- > DataDirect statement pooling increases performance and limits drag on system resources
 - > Statement pooling is implemented and managed by the driver w/o impacting the application code

- > DataDirect provides statement pooling management capabilities
 - > Ability to pre-configure pool and control whether a statement is poolable
 - > Ability to configure the size of the pool
 - > Ability to monitor the state of the pool
- > DataDirect seamlessly manages the security aspects relating to statement execution

How it works: Frequently used SQL statements executed by the application enjoy performance benefits without modification to application code. DataDirect allocates connections from the pool when available; otherwise new connections are created. Statement pooling has no dependencies on the underlying DBMS.

CONVERSION AND MAPPING SUPPORT

Database drivers and providers play a key role in converting and mapping data formats, errors, meta-data and international code pages. DataDirect breadth of support, performance, reliability and level of standards-based interoperability for conversion and mapping support is unparalleled. Since virtually every interaction with the database relies on some conversion or mapping support, any performance or reliability issues can result in application failure or performance degradations. DataDirect has a proven track record of replacing inadequate alternatives thus ensuring application success.

The following features support conversion and mapping:

Standard Error Handling

Progress DataDirect drivers and providers map database-specific errors to ANSI standard messages, providing consistent error processing-- which reduces development cost and minimizes application errors.

- > DataDirect maps DBMS specific error to ANSI standard message
 - > Standard Error codes provide consistency that helps streamline coding effort
 - > Standard Error codes and standard error handling simplifies development effort and provides interoperability between database vendors and database versions
- > DB vendors only provide DB-specific error processing
 - > No motivation to provide interoperability with other DBs
- > **ADO.NET “Invalid Password” Example:**
- > “Invalid password” given by a user at connect time results in different error numbers and text
 - > Oracle returns Oracle error number 1017 with a message text of invalid username/password: logon denied
 - > Microsoft SQL Server returns SQLServer error number 18456 with a message text of Login failed for user “
 - > Sybase returns Sybase error number 4067 with a message text of Login failed because an incorrect password was supplied
- > DataDirect ADO.NET providers support a common ErrorCollection object, which eliminates discrepancies in processing errors
 - > Oracle does not provide an ErrorCollection object, which means different logic has to be used to retrieve an individual error
 - > DataDirect provides a standard ErrorCollection object for all DBs

How it works: The developer has to handle only the standard set of error codes. The DataDirect driver maps the DB-specific error codes using an ANSI standard SQLState mapping. The DBMS returns vendor-specific error codes that lock developers into a specific DB.

Consistent Metadata Support

Progress DataDirect drivers and providers support a common metadata interface for disparate database implementations. This reduces development cost by providing a single view of database metadata.

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- > DataDirect provides a consistent mechanism for working with metadata that minimizes development effort and ensures interoperability.
 - > DataDirect normalizes the metadata provided by the DBMS and emulates missing information.

How it works: The DataDirect driver returns metadata in a consistent fashion. It also emulates missing or inconsistent metadata from the DBMS. The DBMS then returns vendor-specific metadata that locks developers into a specific DB.

International Code Page Support

Progress DataDirect provides unsurpassed coverage for code page conversion between the database and the application--which provides the reliability you need to meet the demanding needs of international implementations. Specifically, DataDirect provides:

- > Highly reliable conversion for scenarios where the application code page differs from the DB code page
- > Unsurpassed code page support
- > Full UNICODE support

How it works: The application code is not affected by code page used by the DB. DataDirect converts the code page values from the client to the server. The database can use code page of choice without affecting application.

Data Conversion Support

Progress DataDirect provides robust conversion of proprietary database formats to all native language types. This provides a critical, base-level operation that is required for reliable and efficient applications.

- > DataDirect handles all data conversions between proprietary DBMS format and all the native language data types
- > Conversion algorithms are optimized to minimize the number of conversions and data copies
- > Extensive testing of various scenarios ensures optimal performance and reliability

How it works: The application interaction with driver / DB is completely abstracted from individual data formats in the DB. The DataDirect driver load handles conversion to and from standards format and DB format. No special DBMS configuration is required to enable data conversion.

Encryption / Decryption

Progress DataDirect provides standards-based encryption support for protecting data in flight. This capability is managed entirely by the driver, which eliminates impact to your application.

How it works: The application code is not affected by encryption/decryption effort. DataDirect drivers handle encryption/decryption using standards and support the encryption capability provided by the RDBMS. No special DBMS configuration required to enable data conversion.

DATABASE AND NETWORK COMMUNICATION

DataDirect pioneered database driver communication by introducing ODBC access that does not rely on the native database client: our wire protocol architecture. This architecture forms the foundation for the performance and scalability advantages that DataDirect provides over less-optimal alternatives. Our Type 4 JDBC drivers and 100% managed ADO.NET providers also leverage this wire protocol design. In addition to this unique architecture, our drivers include a range of features that support high performance applications including failover support, load balancing and distributed transaction support.

Socket Management

Progress DataDirect efficiently manages the physical TCP/IP socket interaction, providing robust wire contention resolution that ensures great performance. Specifically, DataDirect drivers:

- > Manage the physical socket interaction by using TCP/IP calls
- > Provide wire contention resolution by efficiently managing requests over the network-- synchronization methods are designed to minimize the amount of code locking so that concurrency is not inhibited at the cost of thread safety

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- > Support both cursor and stream-based protocols – for stream-based DBs and efficiently interleaves update statements that are paired with fetched results
 - > Incorporate extensive multi-threading tests into its standard test suite, which ensures thread safety as well as optimal performance

How it works: The socket management effort is abstracted from the application. The DataDirect drive provides control interaction to the network via the socket. The standard wire protocol is then leveraged by the DataDirect driver for interaction with the DB.

Network Wire Management

Progress DataDirect management of packet-based network communication provides unsurpassed packet transport, network round trips and data buffering optimization. Specifically:

- > DataDirect optimizes how data is sent across the network to the database (and how it is received) based on TCP/IP, database protocol and network variables.
- > DataDirect buffers the database query results received from the network into the application buffer.
- > DataDirect mitigates network round trips by combining multiple steps in a single round trip where possible.
- > DataDirect provides flexible configuration options to optimize network wire communication based on the application needs. (This can be pre-set using the Performance Wizards.)
- > DataDirect performs extensive testing to ensure optimal performance and reliability.

How it works: The application is completely shielded from the network communication that is managed by the driver. DataDirect provides optimal network management. The standard wire protocol is leveraged by the DataDirect driver for interaction with the DB.

Bulk, Batch, and Throughput Optimization

The Progress DataDirect ability to batch queries results in optimal performance and maximum throughput. DataDirect provides a database independent bulk load capability that allows you to efficiently work with large amounts of data. DataDirect provides:

- > The ability to batch queries to achieve maximum throughput
- > Multiple batch mechanisms based on the capabilities of the DBMS
- > DataDirect Bulk Load, an independent, standards-based implementation to efficiently move large amounts of data into and out of relational databases

How it works: The application executes the batch update.

DataDirect controls the batch update capabilities based on the application configuration. The DBMS then returns information via the driver, based on the update status.

Failover Support

Progress DataDirect drivers and providers manage the ability for an application to failover to alternate database servers, which reduces development and infrastructure cost.

- > DataDirect provides the ability to failover connection attempts.
- > Application failover provides additional options that include extended failover and select failover support.
- > The DataDirect failover capability is managed by the driver with no impact to the application or DB.
- > Costly DB failover technology (e.g., Oracle RAC, MSFT Cluster Server is not required.)
- > DataDirect failover is implemented in a standard way with consistent messages.

How it works: The application interaction with driver / DB is completely abstracted from load balancing capability. The DataDirect driver manages failover. No special DBMS configuration or environment (e.g., Oracle RAC) is needed to enable client failover.

Load Balancing

Progress DataDirect provides client-side load balancing of application requests to multiple database servers. This reduces development effort and enables efficient usage of system resources.

- > DataDirect provides client-side load balancing that distributes workload so that no one server is overwhelmed with connection requests
 - > Oracle tnsnames.ora and Oracle RAC are both supported

How it works: The application interaction with driver / DB is completely abstracted from load balancing capability. The DataDirect driver load balances connection requests based on random algorithm. No special DBMS configuration is required.

Distributed Transaction Support

Progress DataDirect provides highly reliable, standards-based distributed transaction support that ensures data integrity and reliability with minimal development effort.

- > XA Protocol transaction managers such as Microsoft Transaction Server (MTS) and Java Transaction API (JTA) are supported.

How it works: The application submits an update request. The DataDirect driver works in conjunction with transaction manager to commit / rollback transactions. DBMS returns the status of individual update.

Database Vendor and Version Interoperability

Progress DataDirect provides a single installation package that does not require database vendor client libraries. This eliminates the cost and problems associated with native client deployment and versioning issues. In particular,

- > A single installation package supports all versions, decreasing development, testing and deployment complexity.
- > Side-by-side installation support allows multiple versions of DataDirect to run on the same machine, eliminating impact on other applications when changes are required.

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- > Single installation plus non-dependency on native DB clients eliminates client versioning issues.

SECURITY

Progress DataDirect drivers and providers provide authentication and encryption functionality that makes it easy to secure your sensitive business applications. DataDirect provides database connectivity that can help make your single sign-on (SSO) initiative successful. DataDirect also allows you to protect data in-flight between the application and the database without making costly application code changes.

Key features include:

Flexible Authentication Support

Progress DataDirect provides Kerberos-based support for user authentication. This can be used as the basis for a robust and trusted single sign-on (SSO) implementation.

- > DataDirect supports multiple authentication mechanisms
 - > Kerberos authentication
 - > UserID/password
 - > Client authentication
- > Kerberos provides standards-based, OS independent mechanism for Single Sign-On
 - > Active Directory and MIT Kerberos KDC
 - > Secure authentication
 - > Simplifies user administration
 - > Satisfies auditing requirements
- > DataDirect differentiators include
 - > Delegation of Credentials enhances application security by allowing credentials to be passed through the application stack
 - > Re-authentication provides efficient pooled connection re-usage by reassigning the active user

Data Encryption across the Network

Standards-based protection of in flight data managed by the driver handles all encryption support—eliminating impact on the application.

- > Progress DataDirect provides standards-based mechanism for encrypting data in flight—all encryption management is handled by the driver without requiring changes to application code.
- > Data encryption protects against router vulnerabilities, packet sniffing and SQL injection attacks
- > Data encryption is key in scenarios where information is transmitted over the internet, data is highly sensitive or encryption is necessary to support government or industry compliance

How it works: The application code is not affected by use of encryption. DataDirect negotiates the client side work involved with the SSL handshake sequence of events. DataDirect supports the encryption capability provided by the RDBMS.

DB Vendor & Version Interoperability

Progress DataDirect provides a single installation package that does not require database vendor client libraries, which eliminates the cost and problems associated with native client deployment and versioning issues.

- > Single installation package support for all versions decreases development, testing and deployment complexity.
- > Side-by-side installation support allows multiple versions of DataDirect to run on the same machine. eliminating impact on other applications when changes are required.
- > Single installation plus non-dependency on native DB clients eliminates client versioning issues.

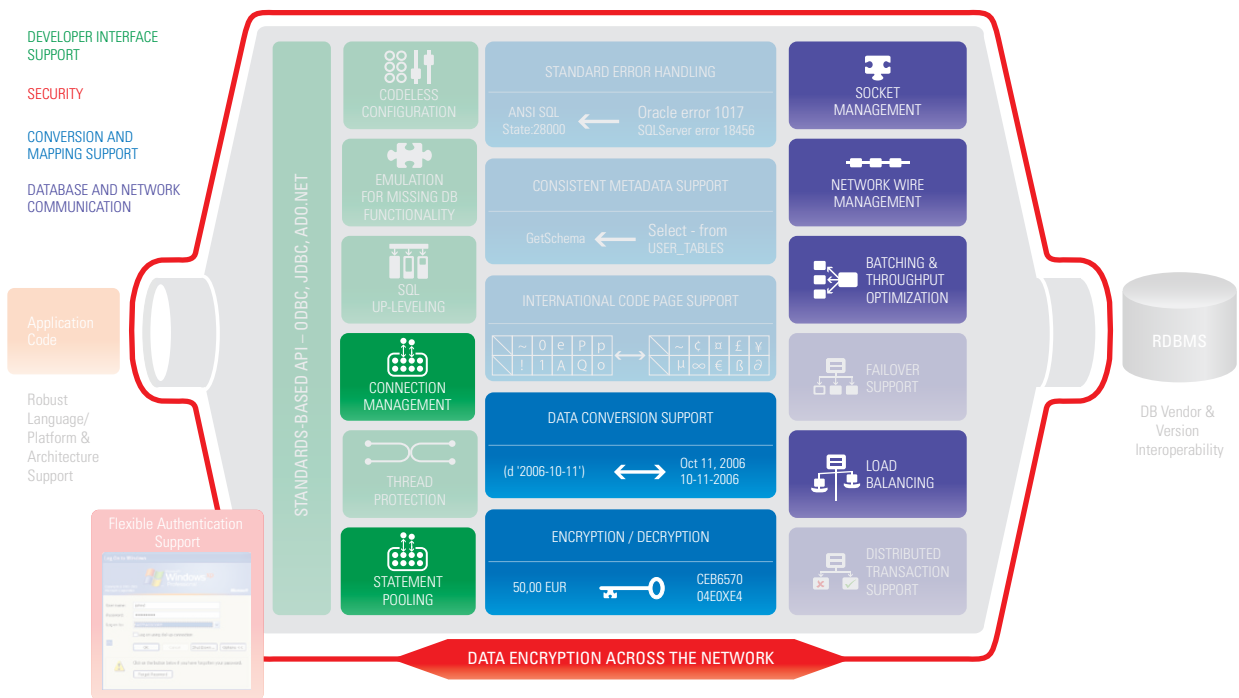
CONCLUSION: DATADIRECT DRIVER BENEFITS

In conclusion, here is an overview of the four main benefits—performance, reliability, developer productivity, and robust applications—of

DataDirect Connect drivers and the Direct Connect for ODBC suite of drivers, which serve as connectivity infrastructure or interfaces.

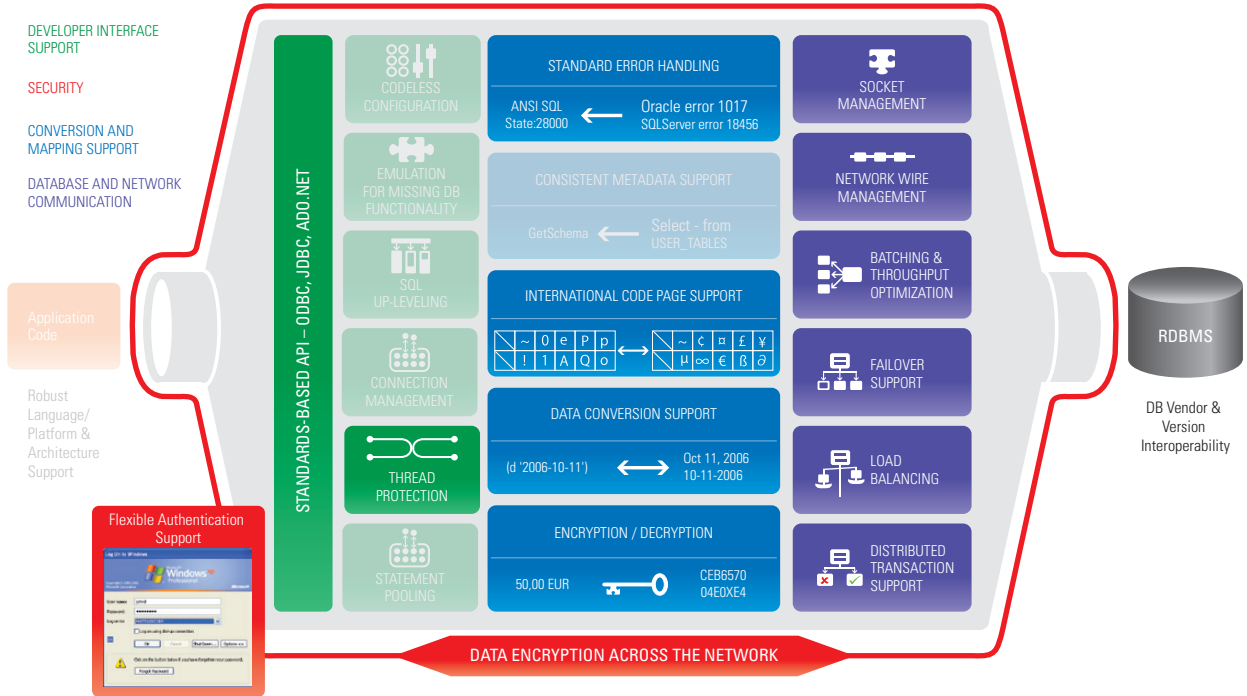
PERFORMANCE

Progress DataDirect drivers and providers provide the industry’s best performance and scalability. DataDirect achieves this via a unique wire protocol architecture that delivers great application performance and scalability while minimizing the impact on costly CPU, memory and network resources.



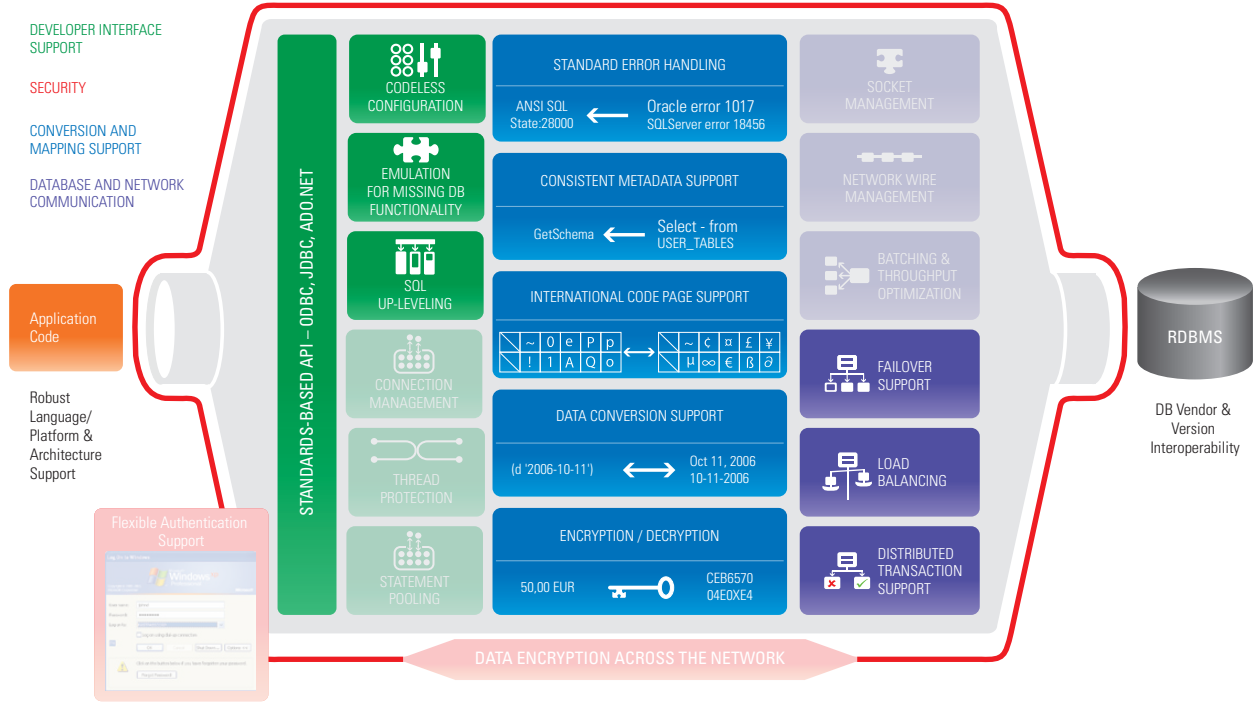
RELIABILITY

Application reliability is crucial to the success of your business. Progress DataDirect provides unparalleled database driver and provider reliability based on its technical architecture and extensive, automated testing suite. DataDirect eliminates the issues that many customers have encountered using drivers and providers from other vendors.



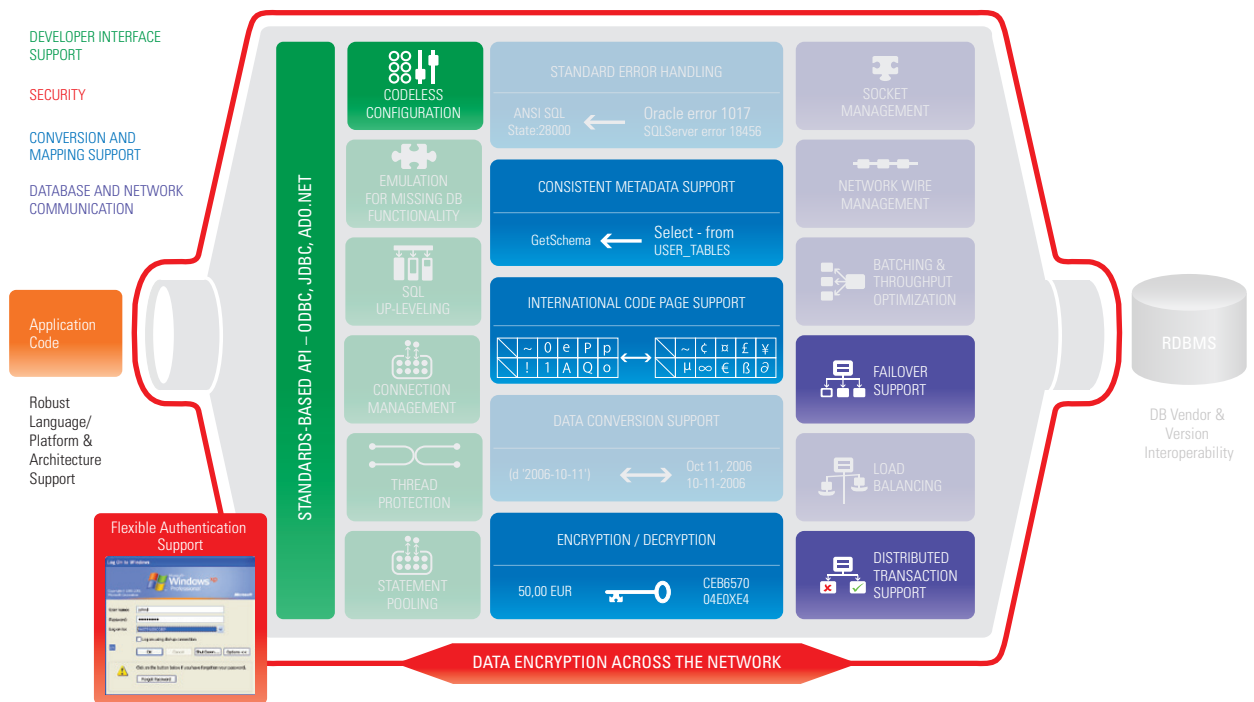
DEVELOPER PRODUCTIVITY

Developer productivity is critical to reducing your IT costs and to deliver your applications on-time within budget. Progress DataDirect provides many features that make it easy to build data-driven applications, and DataDirect provides unmatched interoperability and standards-based support that translates directly to developer ease of use.



ROBUST APPLICATIONS

IT organizations are called upon to build and deploy robust applications; user expectations have increased significantly with the advent of community-based applications like Facebook. It is imperative that developers have the proper tools that allow them to build robust applications with minimal effort. Progress DataDirect drivers and providers provide critical infrastructure support that eliminates tedious application code and makes it easy to build robust applications.





PROGRESS SOFTWARE

Progress Software Corporation (NASDAQ: PRGS) is a global software company that enables enterprises to be operationally responsive to changing conditions and customer interactions as they occur. Our goal is to enable our customers to capitalize on new opportunities, drive greater efficiencies, and reduce risk. Progress offers a comprehensive portfolio of best-in-class infrastructure software spanning event-driven visibility and real-time response, open integration, data access and integration, and application development and management—all supporting on-premises and SaaS/cloud deployments. Progress maximizes the benefits of operational responsiveness while minimizing IT complexity and total cost of ownership.

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