

Managing your data  
the XML way:  
Data transformation,  
exchange and integration

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# Managing your data the XML way: Data transformation, exchange and integration

## Executive Summary

Despite recent reversals of fortune for many e-Business and technology companies, the Internet is here to stay and e-business has become a way of life. Companies across all verticals continue to leverage the Internet as one of many ways to compete in a complex global market. In today's web-centric economy, more and more companies are doing business over the Internet and looking for solutions that allow them to leverage existing computing technology while streamlining their business processes. For many organizations, the holy grail of e-Business and Internet technologies is the ability to enable cost-effective business-to-business (B2B) transactions with trading partners that eliminates the inefficiencies of paper trails, duplicate data processing and re-keying of information. XML (eXtensible Markup Language) based technologies are quickly becoming the industry standard for integrating, transforming and flowing data and structured content over the Internet for business-to-business (B2B) transactions, e-Business, data exchange and integration initiatives.

Companies are increasingly calling on IT organizations to develop a network of relationships encompassing suppliers, business partners and internal activities that is accessible, integrated, scalable and resilient. To stay competitive, companies must be able to transform and exchange their business data freely and dynamically between their own systems and those of their business partners via the Internet. This involves the integration of many different corporate databases, applications, web sites and business partners.

But before B2B is even considered, an organization may have to deal with significant internal challenges in ensuring the interoperability of various systems and applications as well as the integration of various sources of critical business data. Corporate entities generate vast amounts of data everyday—transactional, inventory, product information, order status, sales and customer data, invoices, payments, business contacts, reports, statistical data, web access logs and so on. In most cases, data is stored and managed by various database systems. As businesses grow over time or rapidly evolve through mergers and acquisitions, they acquire many heterogeneous systems that may not easily communicate with one another.

In order for B2B to realize its potential, transactions between business partners must be conducted electronically in an interactive manner to eliminate tedious manual processes such as re-keying information. The challenge is that no two companies have the same database structure or format their data in the same way. The ways in which we store and process data are often so diverse that either the business partner would have to deliver the data in many different formats or the subscribers or recipients of the data would have to transform the data in order to use it effectively or adopt the same systems as the data publisher and a universal standard for data exchange.

The conventional method of electronically exchanging data is to write custom programs to generate and read data in a format agreed by two parties or a group of participants. When one partner needs to change their database or data structure, either the company will have to rewrite programs to meet the

agreed standards or all other partners who exchange data with this partner are forced to make changes to their own programs accordingly. Adapting to ongoing change results in very high maintenance costs. Companies also have to maintain skilled development personnel in-house or by outsourcing development.

Some large enterprises have implemented a more sophisticated solution called Electronic Data Interchange (EDI) through a specialized Value Added Network (VAN). The traditional EDI is not only extremely inflexible and expensive to implement, but also results in a high maintenance costs when adapting ongoing business changes. For small to medium sized businesses, this solution is beyond reach. Another major problem with traditional EDI is that it requires a unique solution for each pair of trading partners resulting in a high transaction cost.

XML presents a more current and efficient solution for data exchange through value-added transformation and via Internet or internal networks connected to enterprise databases in a secure environment. Rather than forcing data subscribers or receivers to adapt or transform the format the sender chooses, the data publisher or sender can deliver data in XML that the subscriber or business partner can easily retrieve, view and use for whatever purpose is required. This paper considers the role of XML and Java technologies in today's enterprise and provides an overview of DataMirror Corporation's XML software solutions including *Transformation Server for XML*, *DB/XML Transform* and *DB/XML Vision*.

## What is XML?

XML is a markup language that provides an open standard for describing documents containing structured information. The word "document" refers to both traditional text documents but also to any number of more complex XML data formats that contain structured information such as e-Business transactions, relational database schemas, object metadata and APIs.

XML is ideal for defining data elements and identifying structures on a web page or in business-to-business documents. XML uses a similar tag structure as HTML but whereas HTML defines how elements are displayed, XML defines what those elements contain. HTML uses pre-defined tags; XML allows tags to be defined by the data publisher or developer of the web page or application. Virtually any data items can be identified which allows web pages to function like database records and paves the way for a truly transactional Internet. XML is seen by many analysts as a key component of the web's transformation from a communication medium to a true data processing platform.

By providing a common method for identifying data, XML effectively supports business-to-business transactions and is expected to become the dominant format for data transformation, exchange and integration. XML's core syntax became a World Wide Web Consortium (W3C) recommendation in 1998 and since then XML has rapidly taken the computing world by storm.

## Why is XML So Hot?

XML is extremely powerful because it not only relays the data that needs to be transported, it contains information, or metadata, about the data that it is sending. This means that the data is absolutely self-contained within one package. There is no need to agree on columns, rows or other data formats or syntax, because all that information is included with all XML documents. Whereas traditional HTML web pages are static and offer minimal interactivity, XML promises a more dynamic web experience by allowing richer and more dynamic content to be easily delivered and accessed by anyone via the Internet. XML was developed specifically to enable richly structured documents to be published and used over the web. XML can also be used for a wide range of business applications including web

authoring, intelligent searching and browsing, and content analysis and querying. The advantages of XML over HTML include: extensibility, structure, validation and loosely coupled architecture.

### Extensibility

Using XML, information publishers can define new tags and attribute names at will. Rather than being constrained to defining a particular set of data, XML is able to work with DTDs and Schema to define any number of documents that form a language of their own. Hundreds of thousands of specific document vocabularies have already been created using XML to meet the specific needs of various industries including financial, legal publishing and health care.

### Structure

XML was designed for maximum expressive power and is applicable to almost any data or document structure no matter how complex. With XML, document structures can be nested to virtually any level of complexity allowing the representation of database and object-oriented hierarchies.

### Validation

XML documents come with built in error and validity checking. XML documents may contain a description of its grammar for use by applications that need to perform validation of the information contained in the document before populating a database or executing a transaction. For example, the DTD or schema can be used to verify that all elements are correctly specified, in the right order, and that values fall within acceptable pre-determined ranges.

### Loosely Coupled Architecture

XML merely represents information and metadata about the information without specifying any specific way in which the data should be processed or putting any limitations on how the information may be handled or displayed. Because XML separates data from processing, it offers huge benefits for companies seeking a multi-platform, multi-datastore solution for enterprise application integration or B2B. XML documents, containing no processing specifications or limitations, can be freely exchanged across multiple platforms, databases and applications so long as the subscriber data stores and applications are XML-aware. Any system, mobile device or application that speaks XML can access and manipulate the data contained in the XML document at will. This makes XML ideal for enabling EAI and B2B e-Business where companies often face the challenges of mixed system environments. In the case of B2B, the data publisher does not need to know the details of how the data subscriber intends to process the information. For EAI, systems built on a loosely coupled XML integration framework are future-proof because changes to the computing environment will not affect XML data exchange.

### The Relationship Between Java and XML

Java technology and XML share several common features that make them ideal for developing web-based applications. These common features include platform independence, portability, reusability, global language support and support for open industry standards. Together the Java 2 platform and XML provide powerful tools for enabling businesses to more easily and cost-effectively share and exchange data in e-Business, enterprise application integration and B2B implementations. With the release of the Java API for XML Processing (JAXP), Sun Microsystems has provided core functionality for reading, manipulating and generating XML documents through pure Java APIs – interfaces by which a software program accesses an operating system. JAXP supports the latest XML standards including Document Object Model (DOM) level 2, XSL transformations (XSLT) and the W3C's XML 1.0 schema and document type definition (DTD) specification. The Java 2 platform's support for XML as a universal data format and the ability of JAXP to provide a standard way to integrate any XML-compliant parser with a

Java based application means that most client and server XML solutions will continue to be written in Java.

Companies investing in XML-based technologies should consider standards-based solutions that support Sun Microsystems' Forte for Java integrated development environment (IDE). The Forte for Java product is an ideal development environment for enterprise application developers to rapidly develop reliable, scalable and sophisticated XML-based applications such as corporate portals, B2B systems, enterprise database integration and electronic data interchange (EDI).

## Business Applications of XML

The unique capabilities of XML including vendor and system independence make it an ideal enabling technology for applications that require data to be communicated between two or more heterogeneous databases within the same company or beyond the walls of the organization to include business partners or regulatory bodies. XML is also an extremely powerful enterprise application integration tool for enabling data from a range of disparate data sources to power a variety of applications.

### Business-to-business integration

Transform data from any format to any format to transact with business and trading partners. Convert flat data into meaningful hierarchical information and flow this information across multiple platforms, databases, text-oriented and XML formats. Leverage the self-describing nature of XML to integrate data between business partners across intranets, extranets and the Internet.

### Regulatory compliance

Companies in many different industries including financial services and health care are often responsible to regulatory authorities that govern all aspects of the company's business operations. In order to comply with regulatory reporting and auditing requirements, many companies are required to regularly complete and submit hundreds of different paper forms. In many cases, information sent by these companies is still re-keyed manually into the regulatory body's information systems. XML-based systems for data exchange provide a standards-based means for automating the delivery of compliance information from regulated companies to the regulatory authority.

### Enterprise application integration

Transform data bi-directionally across the enterprise between back-office and front-end applications for a fully functional, data-rich infrastructure. Provide a link between application databases and XML to directly integrate applications at the data level. Convert data into an XML stream that other XML-oriented applications can easily understand. Integrate legacy applications with application server technology directly via the legacy application's database layer.

## Challenges of XML Adoption

Since its introduction, few technologies have been hyped as much as XML. But while XML is seen by many as a key e-Business / B2B enabler, it is really only the first step. XML tags provide a simple data format, but the intelligent defining of these tags and common adherence to their standard usage will

determine the real long-term business value of XML. Already there are several different XML schemas being promoted by different Industry coalitions or bodies including W3C, OASIS (Organization for the Advancement of Structured Information Standards) and BizTalk, as well as web sites that provide repositories (Biztalk.org and XML.org) for publishing and reviewing XML schemas.

Hundreds of XML standards have been created since the introduction of XML which raises the question of whether or not a standard for XML actually exists. XML standards are currently in flux.

The potential for creation of many different "proprietary" XML documents threatens to undermine the successful adoption of a true XML standard and hinder the widespread deployment of XML solutions across the enterprise.

## The Role of Data Integration Middleware

The successful adoption of XML for data transformation, exchange and integration depends on the support of integration middleware vendors who can provide out-of-the-box solutions for integrating existing or legacy systems that may not be XML aware and ensuring that users can easily and cost-effectively transform data between other data formats and XML as well as between different competing XML standards should this be necessary. The need for a certain amount of transformation between document formats is inevitable. XML-based integration middleware is necessary to enable users to freely and seamlessly flow and transform data between text, data and XML. This technology ensures that XML aware and non-XML aware systems can coexist, enabling companies to realize the full potential for XML data exchange and integration. XML-powered integration middleware has a role to play in brokering B2B data transactions between legacy applications and application server technologies to enable companies to tightly integrate all their systems into an cohesive infrastructure without requiring custom development or changes at the application layer.

## DataMirror Transformation Server for XML Product Overview

Transformation Server for XML is a flexible, scalable, high performance data integration solution that saves businesses implementation costs by providing real-time, out-of-the-box, programming-free integration between databases and XML. Transformation Server for XML allows businesses to communicate more effectively. Companies can integrate their data with partners, suppliers and employees via the Internet or private networks without the need for costly programming or changes to their computing systems or applications.

Transformation Server for XML allows businesses to leverage their existing systems and save time and resources by harnessing the power of Transformation Server's real-time data integration engine to capture, transform and flow data to the people who need it. The solution interfaces directly with source application databases, allowing businesses to enhance homegrown solutions and extend the functionality of their business applications. Transformation Server for XML detects business events such as purchase orders, order status and inventory levels to generate XML documents in real-time for delivery to any technology designed to accept XML.

DataMirror Transformation Server for XML streams database information in real-time from multiple databases including DB2 UDB, Oracle, Microsoft SQL Server and Sybase across UNIX, Linux, Microsoft Windows NT/2000, IBM OS/400 and OS/390. Users can integrate their systems with any JMS compliant message queue or application server technology such as MQ Series, Sonic MQ, BEA WebLogic, Sun Microsystems ONE, IBM WebSphere and Oracle 9i AS.

## Key Product Features of Transformation Server for XML

### Real-time application event capture

Capture selected events such as purchase orders or inventory checks from any application at the database level and send them in a standard XML format for use across the enterprise and beyond. Transformation Server for XML supplies application server technologies with the real-time information they need to integrate disparate applications. Relevant information is shared as business events occur so that internal staff, suppliers, distributors and partners can act on the most up-to-date information at all times, streamlining operations while improving customer service levels.

### Zero programming

No programming is required to integrate applications with application servers, message queues, business-to-business or other XML-based technologies. Zero programming means no syntax to learn and no expensive programmers to hire. No changes to the source application code base are required, allowing existing infrastructures to run the way they always have. This saves businesses valuable implementation time and maintenance costs.

### Real-time XML streaming to message queues and application servers

Stream XML documents in real-time to message queues for guaranteed delivery to application servers, business-to-business exchanges or other XML-driven applications. By guaranteeing that messages reach their target destination, users ensure that information gets to the people who need it in real-time. Transformation Server leverages existing message queue and application server technology by allowing incompatible systems to integrate seamlessly with minimal resources.

### Unlimited flexibility

Out-of-the-box, drag-and-drop integration with leading databases ensures that any future changes to a company's computing environment can be easily accommodated by Transformation Server for XML without the need to bring in external expertise. Transformation Server for XML is guaranteed to be an invaluable component of a company's enterprise infrastructure for years to come. Businesses also have the flexibility to rapidly and easily make configuration changes and adapt as computing environments evolve, future-proofing their software investment.

## Transformation Server for XML Business Applications

### Business-to-business integration

Transform data in real-time between databases and XML to effectively communicate information to business partners. Tighten links between partners for an efficient and cost-effective supply chain.

### Enterprise application integration

Ensure data is continuously available to all applications regardless of platform, database or application-oriented data structure. Convert data into an XML stream that other XML-oriented applications can easily understand.

## Business intelligence

Capture, transform and flow data in real-time between multiple databases for replenishing data warehouses and data marts. Eliminate batch window restrictions and deliver up-to-the-minute data for real-time analytics.

## Customer relationship management

Integrate all computing systems and data stores across the business into the CRM backbone to empower users with real-time customer information such as inventory levels, delivery schedules and account status.

With end-to-end integration and out-of-the-box flexibility, Transformation Server for XML dramatically increases the flow of vital information across virtually any business environment.

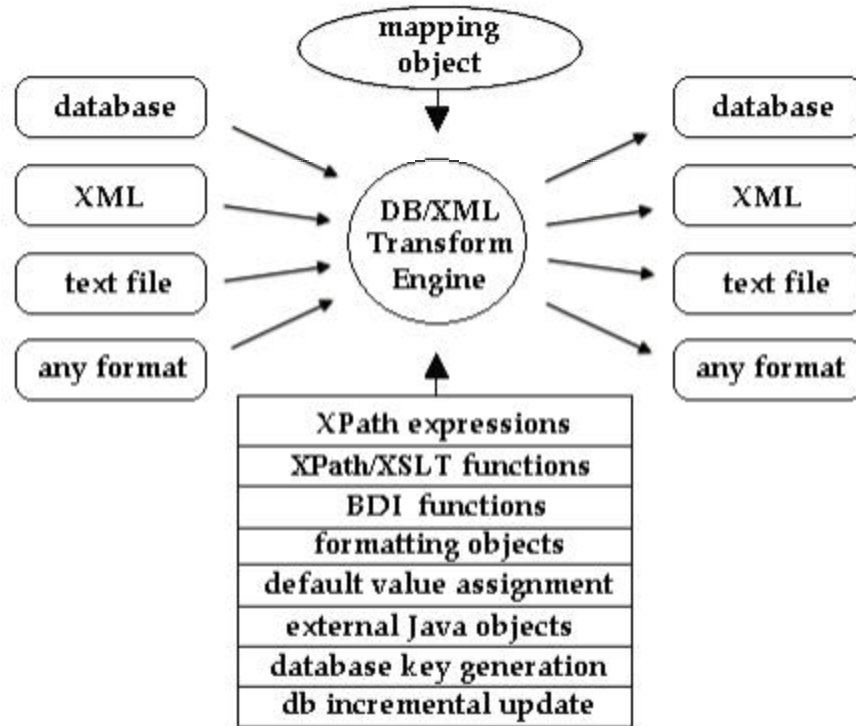
## DataMirror DB/XML Transform Product Overview

DataMirror DB/XML Transform provides a powerful engine for bi-directional data transformation between XML, database and text formats. It has the unique ability to transform and flow data between an unprecedented range of formats including: database to XML, XML to database, database to text, text to database, text to XML, XML to text, database to database, XML to XML and text to text. With comprehensive data transformation capabilities and out-of-the-box flexibility, DB/XML Transform allows companies to effectively communicate information across their enterprise and beyond. The software's powerful, bi-directional data transformation engine and unique ability to transform hierarchical data make it ideal for building corporate portals, e-Business and business-to-business applications, data exchange and database integration solutions.

## How It Works

Enterprise data is typically structured as repeating sets of hierarchical entities such as those stored in a relational database. Traditional transformation engines often scale up very well but lack flexibility and cannot deal with hierarchical data. Emerging XML technologies like DB/XML Transform provide an excellent vehicle for developing a new generation of scalable and flexible transformation engines.

For XML-based transformation engines, both DOM and SAX models have great limitations in handling enterprise data, scalability and flexibility. DataMirror's unique Streamed XML transformation technology takes the advantages of both SAX and DOM models and intelligently applies them globally or locally, wherever it is required, to best achieve the desired results. Our unique streamed processing model provides not only the best performance and scalability while maximizing flexibility.



**Figure:** Architecture for DB/XML Transform’s XML-based data transformation engine with unique streamed XML transformation technology. Please note that the messaging mechanism is not shown in the diagram and will not be discussed here.

The data input source can be a database, XML document or text stream. DB/XML Transform’s functionality can easily be extended to other data sources such as EDI and WML through customized data readers. The same is true for the target or output formats. The mapping object acts as a traffic cop and directs the proper flow of the stream from source to target. The DB/XML Transform engine processes the data from the input stream and writes it to the output stream according to the mapping rules. During this transformation process, data format, structure as well as the data itself can be manipulated and re-organized on the fly. With DB/XML Transform’s XML based transformation engine and visual object mapping tools, companies can achieve excellent performance and scalability with maximum flexibility.

## Key Features of DB/XML Transform

### Hierarchical data transformation

Transform hierarchical data between database and XML, database and database, and between XML and XML. Read and map databases to and from XML according to their hierarchical relationships.

## Bi-directional, multi-database data transformation

Transform and flow data bi-directionally between database, XML and text formats in any combination to leverage all information across your enterprise. Transform data from database to XML, XML to database, database to text, text to database, text to XML, XML to text, database to database, XML to XML, and text to text. Through XML, data can be transformed from any format to any other format for powerful distributed data applications.

## Relationship hierarchy reconstruction

Maintain relationships of data by reconstructing the hierarchy and mirroring the relationships in the original database. Automatically format a flat query result into a hierarchical structure on-the-fly, allowing administrators to easily configure and map data transformations.

## Streamed XML transformation

Ensure high performance, scalability and maximum flexibility through the DM/XML Transform engine's intelligent application of both SAX and DOM models globally or locally, wherever it is required to achieve desired results.

## Customizable rules and data manipulation

Manipulate the data itself as well as data structure or format to generate unique key values required by the database; incrementally update databases, add extra fields required by the target, assign fixed or dynamic default values to fields, completely change data structures, apply formatting rules to data and much more.

## Support for XPath expressions and functions

DB/XML Transform's XML-based object-mapping model defines the data model for the target. The XPath expressions and functions are used to map the data source for cross-level object mapping as well as mixed mapping between element and attribute. Built-in XPath and complex expression mappings. DB/XML Transform also has built-in complementary functions to XPath and XSLT such as date formatting, string conversion and obtaining system date and time; and database-specific extensions for generating key values using the database's stored procedures and sequences as well as Java objects.

## Open architecture

DB/XML Transform's open architecture enables users to plug in Java objects for complex processing requirements such as data validation and translation with lookup tables. In addition, DB/XML Transform's open Application Programming Interface (API) class libraries and documentation enable third-party applications to easily configure DB/XML Transform and execute operations. This enables users to seamlessly integrate DB/XML Transform with enterprise applications and leverage the product's powerful transformation engine.

## Exclusive Tree-structured Query technology

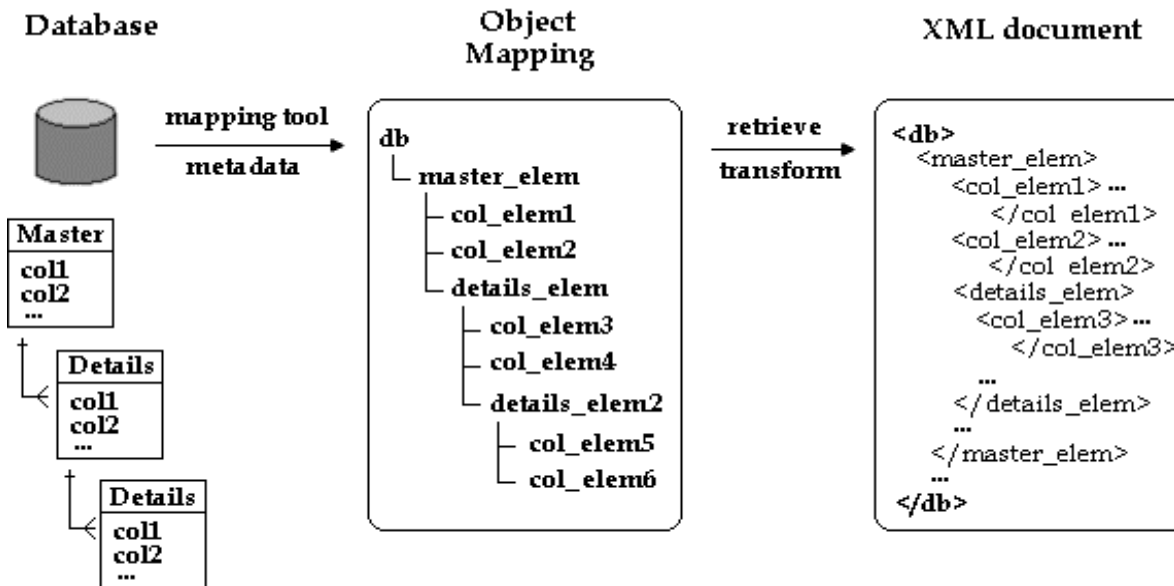
Tree-structured Query Technology in XML is exclusive DataMirror technology that makes it extremely easy to define and execute complex queries. It was developed in response to the need for a query language to effectively use data transferred in XML documents that was as mature and full-featured as SQL. Tree-structured Query provides a powerful solution that enables query-in-and-structured-XML-out without the need to write custom code.

To transform data and generate reports, companies have typically written custom coded programs. These programs cannot be easily shared or reused by different applications or systems. This means that enterprises have to write and maintain a program for each usage scenario and any time the computing environment changes. Custom programs developed in-house lack the ability of keeping pace with the changing needs of enterprise systems. Developers have to constantly re-write the report generator program to adapt to changes. The result is a very high on-going maintenance cost.

Another issue enterprises often encounter in the generation of reports is that complex queries can cause considerable overhead on server resources, significantly slowing down key business processes and in the worst case scenario, resulting in system downtime. To overcome these potential problems, some companies summarize the data at off-peak times after normal business hours. While this batch process resolves the resource problem for production servers, it creates a new problem: the data used to generate reports is stale and out-of-date.

### The DataMirror approach

To solve these problems, software engineers at DataMirror have developed a unique technology called Tree-structured Query Technology, based on a tree model and object mapping techniques. With Tree-structured Query Technology, you can define very complex queries and execute them in a most efficient way. XML is ideal for structuring the retrieved data and preserving the relationships of the data. We have combined our innovative query techniques with the power of XML into our Tree-structured Query Technology, which automates the creation of hierarchical data in XML format.



**Figure:** DataMirror Tree-structured Query Technology is exclusive to DB/XML transform and DB/XML Vision.

The Tree-structured Query Technology is based on the relational model of the source database and the tree model of the target XML document. Both models provide a means to define the relationships of data. The core concept of Tree-structured Query Technology is to transform the relationships of data, or hierarchical data, from the relational model to the tree model. The result is an XML document that contains data and relationships of the data which is a snapshot of your database.

## Benefits of Tree-structured Query Technology

### Automatically create XML documents containing hierarchical data from any database

We're all familiar with query result sets that contain flat data retrieved from relational databases. With this flat output, you have to write many lines of code to do the subsequent processing for each scenario. With Tree-Structured Query technology implemented in DB/XML Transform, the query results are automatically structured as hierarchical data in XML format, preserving all data relationships and eliminating redundant data. This makes the subsequent processing and use of the data extremely easy and flexible.

### Data transformation from XML documents to database

In a business-to-business environment, data interchange is the norm. You receive XML documents from your business partners or another business unit within your own organization and you want to automatically save the data from those XML documents to your database with your special requirements. If the XML documents are created using Tree-structured Query technology, they contain not only data but also the relationships of the data. This lets you map the objects between your XML document and database with value added transformation rules, and update your database accordingly.

### Customizable object mapping between database objects and XML elements

Some tools generate XML documents with fixed tags and do not allow users to add their own tags. DB/XML transform allows users to choose customized tags or element names for their XML documents and map the objects between the source and target in any way they wish. Users can define and save custom object mapping rules for later use. DB/XML Transform will automatically structure the data of query results to XML documents based on the custom object mapping.

### Automate complex query processing

Tree-structured Query technology provides a tool for automating the query-in-and-structured-XML-out process. You can retrieve complex data by simple mouse clicks. You can also use it on a scheduled basis in batch processing mode.

### Support for XML standard

All XML documents created using DB/XML Transform's Tree-structured Query technology are fully compliant to W3C's XML 1.0 standard. It automatically generates valid DTDs to ensure that XML documents are well formed and valid.

## DataMirror DB/XML Vision

DB/XML Vision is a cost-effective, scaled-down version of DB/XML Transform for simple database to XML conversion projects. DB/XML Vision automatically creates XML documents containing hierarchical

data from any database for B2B applications, EDI, database integration and conversion. Its powerful Tree-Structured-Query tool offers you the unique feature of query-in-and-structured-XML-out with no need to write any code to structure your result set.

DB/XML Vision is intended for use by database application developers, e-business application developers, software consultants, database users, system architects, system analysts, business analysts, IT managers, and anyone who works on database related projects. DB/XML Vision fully supports W3C's standard XML 1.0 recommendations, and automatically generates valid DTD. The product is incredibly easy to use, easy to implement and requires no extensive learning curve

DB/XML Vision is available free-of-charge for evaluation. The evaluation edition does not enable users to save custom mappings or alter XML document element names. These features are only enabled by licensing the DB/XML Vision product. The fully functional edition enables users to save and reload tree-structured query definitions, export table contents or query result sets to delimited or positional text format with customizable rules, and customize object mapping between database and XML documents.

## Conclusion

Wise investments in XML and Java technologies, as well as XML-powered integration middleware like DataMirror DB/XML Transform, can effectively future-proof your business against many of the pitfalls of changing information systems, best-of-breed applications and multi-platform computing environments. Moreover, XML promises to provide a powerful tool for building bridges between your organization and your business partners and suppliers that help you achieve significant business returns. The next generation of XML solutions will enable true real-time data exchange between diverse systems both in-house and beyond to encompass business partners and suppliers. An effective XML-based enterprise application integration and B2B strategy can help your business realize new operational efficiencies while enhancing service levels and maximizing partnership and revenue opportunities. New EAI and B2B tools that support open standards like XML and Java are well worth evaluating. Thorough testing and proof-of-concept will determine whether these technologies are a good fit with your organization's data infrastructure.

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## About DataMirror Corporation

DataMirror (Nasdaq: DMCX; TSE: DMC) delivers solutions that let customers integrate their data across their enterprises. DataMirror's comprehensive family of products unlocks *The experience of now™* by providing advanced real-time capture, transform and flow (CTF) technology that gives customers the instant access, integration and availability they demand today across all computers in their business.

Over 1,500 companies use DataMirror to integrate their data. Real-time data drives all business. DataMirror is headquartered in Toronto, Canada, and has offices worldwide. DataMirror has been ranked in the Deloitte and Touche Fast 500 as one of the fastest growing technology companies in North America.



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