TIBCO Data Virtualization

A single solution to manage, govern and share all your data

With data the new competitive battleground, businesses that take advantage of their data will be the leaders; those that do not will fall behind. But gaining this advantage is a more difficult technical challenge than ever because your business requirements are ever-changing, and your data is more widely distributed on premises, and across the Internet of Things (IoT) and the Cloud. Traditional physical data integration via data warehousing and ETL is often too time-consuming, rigid, and costly to support your dynamic business needs.

There has to be a better way, and there is. It's data virtualization.

TIBCO Data Virtualization Java enterprise-grade middleware has a modular structure that supports all phases of data virtualization development, run-time, and management.

The TIBCO Data Virtualization Modules

Web UI is a self-service data provisioning and data catalog web user interface that gives you the power to search and find available data and create and publish your own views that best address your needs. These tailored views can then be consumed in your downstream apps.

Using the easy-to-use web interface, business analysts, data engineers, and developers can create datasets, perform complex SQL queries, manipulate data, and publish the result set. The intricate data processing workflows created are reliable, repeatable, and secure. The user-friendly graphical interface's drag and drop feature lets you do all of it with limited or no knowledge of SQL.

The data catalog provides a complete view into all securely accessible datasets, allowing you to understand what data is available for your use quickly. With the system's patented data virtualization engine, you can quickly and securely analyze on-premises and cloud datasets together through the data catalog's search and preview capabilities.

Studio is an agile modeling, development, and resource management tool that data-oriented developers use to model data, design and view data services, build transformations, optimize queries, manage resources, and more. Easy to learn and use, Studio's graphical modeling environment provides a flexible workspace where queries are created and tested, and a data services repository where completed objects are published. Studio also offers a rich set of transformations in addition to an easy-to-use transformation editor. Five languages complement Studio's graphical modeling capabilities: SQL, SQL Script, Java, XQuery, and XSLT.

Business Directory is a self-service data directory you can use to easily search, categorize, and consume IT-curated datasets developed using TIBCO Data Virtualization software. Easy dataset sharing and reuse helps accelerate good business outcomes while reducing IT workloads.

Discovery lets you go beyond simple data profiling to examine data, locate important entities, and reveal hidden relationships across distinct data sources. You can quickly build and display comprehensive entity-relationship (E-R) diagrams and data models so you can meet new business requirements faster and more easily.

Adapters provide a wide range of data source connectivity for databases, files, big data, cloud sources, packaged applications, and more. Beyond schema-to-schema-only connectivity, TIBCO Data Virtualization adapters integrate with data source optimizers to ensure more accurate queries and higher performance. The Data Source Tool Kit allows you to build additional custom adapters.

Cost- and Rules-based Optimizers used by the **Federation Engine** (either a massively parallel processing [MPP] execution engine or the classic, pushdown query execution engine) work directly with data source optimizers to maximize query performance. The Objects Repository lets you manage your data services throughout their lifecycle. Myriad fine-grained security capabilities, including authentication, authorization, and encryption safeguard delivery of authorized data only, no more, no less.

Granular workload management allows you to provide a more intelligent allocation of resources for important workloads. You can control memory usage, request length, row counts, and more, as well as avoid potentially problematic requests. These controls can be implemented for objects, user groups, servers, and/or cluster groups.

Flexible **Caching** options enable higher performance and greater uptime. Quality helps ensure you deliver the best data possible. And built-in **Governance** features provide complete visibility, traceability, and control.

Manager is the administrative console used to set up user IDs, passwords, security profiles, and view logs and server activity, and more.

Deployment Manager lets you quickly and easily migrate entire projects in a single step, including their resources, cache settings, server configurations, security profiles, and more across instances to simplify and automate your development lifecycle.

Active Cluster works in conjunction with load balancers to provide high availability and greater scale to meet your challenging service level agreements. Active Cluster simplifies complex operations management by automatically sharing resources, adjusting capacity on-demand, and more.

Deployment Options

TIBCO provides multiple options for deploying TIBCO Data Virtualization software. You can install and run it on-premises, in your private cloud environment, or at a public cloud provider such as Amazon AWS, Google Cloud Platform, and Microsoft Azure. TIBCO also provides TIBCO Data Virtualization software on the AWS Marketplace and Azure Marketplace to simplify and accelerate deployment.

Capabilities

TIBCO Data Virtualization software lets you integrate data with breakthrough speed and cost-effectiveness. With it, you can build and manage virtualized views and data services that access, transform, and deliver the data your business requires to accelerate revenue, reduce costs and risk, improve compliance, and more.

Development Environment

Self-service Data Catalog & Workbench

FEATURE	DESCRIPTION
SEARCH OPTIONS	Find datasets using simple Google-like searches as well as advanced parameterized searches.
BROWSE	Find datasets using attributes such as data type, format, category, and more.
DATA PREVIEW	Preview specific data included within datasets.
SECURITY	See only the datasets you're supposed to see based on your TIBCO Data Virtualization enforced security profile.
CONSUMPTION	Use your favorite analytic/BI tools to consume datasets using Business Directory access information.
CATEGORIZATION	Organize large and/or diverse datasets into user-defined or system categories.
COLLABORATION	Allow business users and IT to interact via comments to improve data quality and utilization.

BUSINESS METADATA EXTENSIONS	Add custom definitions, properties, links, and status codes to enrich IT metadata with business metadata that your business users understand.
BUSINESS METADATA DISPLAY OPTIONS	Present business metadata in a shared area, an existing properties tab, or a new custom tab.
PERSONALIZATION	Receive email updates of changes and comments for data you care about.
PROVISIONING	Register additional TIBCO Data Virtualization instances to expand your datasets.
REST API	Access Business Directory programmatically to expose datasets to additional consuming applications.

Modeling and Transformation

FEATURE	DESCRIPTION
GRAPHICAL DEVELOPMENT ENVIRONMENT	Graphically model data, design view and data services, build transformations, optimize queries, manage resources, and more.
AGILE DEVELOPMENT METHODOLOGY	Develop and refine views and data services iteratively.
INTROSPECTION	Automatically probe physical data sources and select desired resources. Optionally inspect data sources interactively.
DATA DISCOVERY	Reveal data relationships across disparate entities using formal keys and fuzzy matching.
BOTTOM-UP MODELING	Design views and data services by combining data from disparate systems without worrying about underlying source access and format complexity.
FLEXIBLE MODELING AND TRANSFORMATION METHODS	Create views and data services graphically or via scripting languages as appropriate. SQL, SQL script, XQuery, XSLT, and Java functions.
SQL	Use familiar SQL standards.
SQL SCRIPT	Implement stored procedures using a familiar scripting language.
XQUERY	Create complex XML structures using a graphical XQuery editor.
XPATH TRANSFORMATION	Establish arbitrary complex mapping of XML schema elements to XML output.
JSON QUERYING AND TRANSFORMATION	Query and transform JSON data from Web services into a relational format.
ANALYTIC FUNCTIONS	Use a full set of analytic functions such as CORR, COUNT, NTILE, STDDEV, and VARIANCE.

CONTRACT FIRST DESIGN	Build data services using preexisting WSDLs and schemas.
CONTRACT LAST DESIGN	Define the Java wrapper first and then develop WSDL.
QUERY PLAN	View query execution plan steps and details.
VIEWS DEPENDENCY GRAPH	Graphically display dependencies between data sources and views and data services.
PHYSICAL TABLE CREATION	Create and drop physical tables within a designated data source.

Metadata Repository

FEATURE	DESCRIPTION
COMPLETE REPOSITORY	Manage resources such as data sources, views and data services, and procedures throughout their lifecycles.
PUBLIC METADATA API	Deploy a web services metadata API for easy access and sharing.
SCHEMA CHANGE NOTIFICATION	Receive notice when data source schemas change.
SOURCE METADATA	Access the metadata of the physical data source.
OPEN API	Open access to TIBCO Data Virtualization system libraries to enable custom scripting and orchestration.

Version Control

FEATURE	DESCRIPTION
MIGRATION GUI	Add project folders directly to version control systems. Check-in and check-out folders or individual resources to track changes. Rollback revisions of folders or resources to prior versions.
RESOURCE LOCKING	Protect against inadvertent modifications and overwrites.
CHANGE HISTORY	Track changes made by users with annotations.
SOURCE CONTROL AND TRANSPORT	Manage artifacts and transports from development through production.
VERSION CONTROL SYSTEMS	Integrate directly with Apache Subversion and Git.

Federated Query Engine

FEATURE	DESCRIPTION
FEDERATION ENGINE	Join and aggregate data that is vertically and horizontally partitioned.
MASSIVELY PARALLEL PROCESSING (MPP) ENGINE	Enable multi-source, big data scale virtualization workloads that dynamically distribute the work across multiple processors
DATA SOURCE	Leverage data source optimizers to ensure query accuracy and maximize query performance.
COST-BASED OPTIMIZER	Use statistics to create an optimal query plan that reduces unnecessary data flow across the network.
RULE-BASED OPTIMIZER	Allow users to specify exactly how they want to run a particular query.
GRANULAR WORKLOAD MANAGEMENT	Control memory usage, request length, row counts, and more, as well as avoid potentially problematic requests. These controls can be implemented at the object, user group, server, and/or cluster group level.
SCHEDULING	Run queries based on set times.
ALERT TRIGGERS	Implement resource, event, and user-defined triggers. Use a published API to handle custom Java alerts.

Performance Optimization Algorithms and Techniques

FEATURE	DESCRIPTION
COMPLETE SET OF JOIN ALGORITHMS	Automatically rewrite the query to use the most efficient join strategy (for example, hash join, sort-merge join, distributed semi-join, data-ship join, union-join flip, nested-loop join, and others).
SINGLE-SOURCE JOIN GROUPING	Run data-reducing joins at the data source rather than bringing the data across the network.
PREDICATE PUSH-DOWN	Push WHERE clause predicates down into the underlying data source to reduce data at the source.
FULL AND PARTIAL AGGREGATE PUSH DOWN	Push aggregate functions down to source when applicable.
SERIALIZATION OR PARALLELIZATION OF JOIN OPERATORS	Determine the proper join order and join algorithms based on estimated cardinality and join results derived from data distribution histograms.
PROJECTION PRUNING	Eliminate all unnecessary columns from fetch nodes in a query tree.
CONSTRAINT PROPAGATION	Distribute filters to multiple branches of the query plan, allowing data reduction by a single filter to potentially occur in multiple data sources.
SCAN MULTIPLEXING	Reuse datasets that appear in multiple places in a single query plan.

EMPTY SCAN DETECTION	Detect logical conditions that would produce empty datasets, and then eliminate those parts of the query plan prior to processing.
REDUNDANT OPERATOR CROPPING	Eliminate redundant or extraneous operators within a complex multiple-operator query.
BLOCKING OPERATOR PREFETCHING	Proactively run parts of the query plan that must finish before other parts of the query plan can continue, thereby increasing the overall responsiveness of the query.
CONNECTION POOL SHARING	Share access to data sources to avoid bottlenecks.
RESULTS STREAMING	Stream data to consuming applications as results are processed at the underlying sources.
HYBRID MEMORY AND DISK USE	Balance memory and disk use for optimal performance.
NATIVE XML SUPPORT	Support XML internally for fast parsing and joins.
API	Expose the query execution plan via JDBC/ODBC.

Caching

FEATURE	DESCRIPTION
EVENT-BASED REFRESH	Refresh caches based on defined business rules.
SCHEDULED REFRESH	Refresh caches at set times.
MANUAL REFRESH	Refresh caches on demand as needed.
INCREMENTAL REFRESH	Refresh part of a cache.
FULL REFRESH	Refresh entire cache.
NATIVE BULK EXTRACT	Use native bulk EXTRACT functions in the source to extract data more efficiently than using SELECTs.
NATIVE BULK LOAD	Use native LOAD functions in destination-to-load and refresh caches more efficiently than using INSERTs.
PARALLEL LOAD	Use multiple threads to load caches in parallel.
CENTRALIZED CACHE TRACKING	Centrally track caching tables distributed across multiple data sources.
MULTI-TABLE CACHING	Avoid contention on cache refreshes, accelerate refresh speeds, and maintain non-stop availability using multiple tables per cache view.

Data Access

FEATURE	DESCRIPTION
DATABASES	Access popular databases via Open Database Connectivity (ODBC) and Java Database Connectivity (JDBC).
BIG DATA	Access Apache Hadoop through Apache Hive, Apache Impala, and Apache HBase.
MULTIDIMENSIONAL DATA	Access multidimensional data in SAP BW.
NOSQL AND CLOUD DATABASES	Access NoSQL and cloud database sources such as Amazon DynamoDB, Amazon Redshift, Cassandra, and MongoDB.
WEB SERVICES	Access SOAP over HTTP, XML over HTTP, and Java Message Service (JMS) services. A message pipeline allows interjection of custom logic during the web service request and response.
PACKAGED APPLICATIONS	Access SAP, Oracle E-Business Suite, Salesforce.com, and other applications using standard objects such as invoices, shipments, orders, customers, opportunities, and more.
SAAS APPLICATIONS	Access SaaS applications including Google Analytics, Microsoft Dynamics, and NetSuite.
COLLABORATION	Access collaboration apps such as email, Google Sheets, and Microsoft SharePoint.
SOCIAL MEDIA	Access social media sources such as Facebook, LinkedIn, RSS, and Twitter.
JAVA API	Access non-relational sources using custom procedures.
DATA SOURCE TOOL KIT	Access a set of libraries of services that can be imported into your preferred integrated development kit to facilitate and accelerate data adapter creation. Services include database mapping, data type mapping, syntax mapping, and function mapping. Together these services minimize custom code development.

Data Delivery

FEATURE	DESCRIPTION
DATABASE OBJECTS	Publish views for consumption through ODBC, JDBC, and ADO.NET.
WEB SERVICES	Publish data services in the form of WSDL for consumption using SOAP or SOAP over JMS. A message pipeline allows interjection of custom logic during the web service request and response.
REPRESENTATIONAL STATE TRANSFER (REST)	Publish data services in the REST format. REST CREATE, READ, UPDATE, and DELETE functions are supported.
OPEN DATA (ODATA) PROTOCOL	Publish data services in the OData format.

JSON	Publish JSON, including more formatting capabilities for XML-to-JSON translation, for both procedures and table outputs.
BI TOOL INTEGRATION	Create temporary tables in BI tools to store filters for visualizations or reports.
DDL SUPPORT FOR CLIENT APPLICATIONS	Support client applications that create tables using DDL statements via JDBC/ODBC/ADO. CREATE TABLE, CREATE TABLE AS SELECT, and CREATE TEMP TABLE syntax. Multiple physical data sources mappings are supported for each published database to avoid conflicts between users when creating tables.

Security

FEATURE	DESCRIPTION
POLICY-BASED SECURITY	Apply authentication, authorization, and encryption rules via policies.
SINGLE SIGN-ON	Sign on once to access all integrated data sources and consuming applications.
ROW-LEVEL AUTHENTICATION	Control access to specific rows via granular permissions.
COLUMN-LEVEL AUTHENTICATION	Control access to specific columns via granular permissions.
AUTHENTICATION TYPES	Support basic, pass-through, Kerberos, SAML, and NTLM.
COLUMN MASKING	Implement column masking rules to hide, replace, or obfuscate portions of a column's value depending on a user's level of access.
SSL OVER HTTP WITH SUPPORT FOR MUTUAL AUTHENTICATION	Mutually authenticate published services, web services data sources, and Oracle databases. Certificate-based authentication and Web Services Security (WSS) authentication are supported.
PASS-THROUGH	Use an existing user ID and password and pass through to TIBCO Data Virtualization for authentication.
LIGHTWEIGHT DIRECTORY ACCESS PROTOCOL (LDAP)	Use security profiles from LDAP to authenticate user access to protected data sources.
PLUGGABLE AUTHENTICATION MODULE	Use third-party systems for authentication.
ENCRYPTION	Encrypt passwords and data in motion via TLS.
ACCESS MANAGEMENT	Use TIBCO Data Virtualization software as the system of record for security roles and profiles.

Governance

FEATURE	DESCRIPTION
DATA LINEAGE	Trace lineage from multiple data sources to a single data consumer.
COLUMN LINEAGE API	Access column lineage via an API.
WHERE-USED	Trace where-used from a single data source to multiple data consumers.
LOGGING	Track system and/or user activity.
STANDARDS ENFORCEMENT	Implement internal and industry data standards.
OPEN API	Open access to TIBCO Data Virtualization system libraries to enable custom scripting and orchestration.

Data Quality

FEATURE	DESCRIPTION
STANDARDIZATION AND CONFORMATION	Create views and data services that conform to agreed standards.
ENRICHMENT AND AUGMENTATION	Extend views and data services with additional data.
VALIDATION	Validate datasets with users prior to publishing views and data services.
OBJECT REUSE	Share views and data services to ensure consistent data definitions.

Management Environment

Management

FEATURE	DESCRIPTION
MANAGEMENT CONSOLE OPTIONS	Access the management console through TIBCO Data Virtualization Studio or a web browser.
USER SETUP	Set up user and group profiles.
SECURITY	Enable multiple forms of security to increase data protection.
SCHEDULING	Schedule TIBCO Data Virtualization activities flexibly.

DEPLOYMENTS	Manage tasks related to development, management, configuration, and versioning.
REAL-TIME SYSTEM INDICATORS	Monitor critical system metrics and tune for optimal performance including memory usage, query plans for currently running and past requests, data sources, and caches.
USAGE METRICS	Deliver usage activity detail to your reporting tool of choice via an open API.
SIMPLE NETWORK MANAGEMENT PROTOCOL	Allow monitoring by third-party systems via SNMP API.

Active Cluster

FEATURE	DESCRIPTION
FLEXIBLE CLUSTER DEPLOYMENT	Expand capacity and improve availability simply by adding new nodes to an existing cluster or adding new clusters.
ACTIVE-ACTIVE CLUSTERING	Distribute TIBCO Data Virtualization workloads across cluster nodes in conjunction with load balancers.
SHARED CLUSTER CACHE	Improve overall cluster performance by coalescing redundant data source hits and reducing data latency.
REPLICATED METADATA REPOSITORY	Replicate metadata across clusters to simplify management.
RESTORE CLUSTER NODES	Restore cluster nodes using Web Manager, cluster_util script, or API.

Deployment Manager

FEATURE	DESCRIPTION
RESOURCE MIGRATION	Migrate or promote (create/update/delete) artifacts from one TIBCO Data Virtualization instance to another.
CACHE SETTING MIGRATION	Migrate or promote cache table names, caching methods, refresh method, and cache policies and schedules.
SERVER CONFIGURATION MIGRATION	Replicate server configurations, for example, enabling and disabling triggers.
USER/GROUP MIGRATION	Migrate or promote user and group IDs, security profiles, and other user and group information.

Supported Platforms

TIBCO DATA VIRTUALIZATION STUDIO CLIENTS	SERVER	JVM
• Microsoft Windows	• CentOS • Cisco Unified Computing System • Oracle Linux and Red Hat compatibility mode • Red Hat Enterprise Linux AS • SUSE Enterprise Linux • Microsoft Windows • Solaris	• 64-bit

Data Source Adapters

STANDARD DATA SOURCE ADAPTERS	
• Apache Drill • Apache Hive • Apache Impala • Apache Spark • Custom Java procedure • Cloudera CDH • CDH Hive • CDH Impala • Data direct mainframe • Elasticsearch • Files (cache, delimited, and XML) • Greenplum • Hbase • Hortonworks HDP • HSQLDB • IBM DB2 • IBM DB2 z/OS • Informix • LDAP • Local File Storage • Microsoft Access • Microsoft Excel	• Microsoft SQL Server • MySQL • Netezza NPS • Oracle • Odata • PostgreSQL • SAP HANA • Splunk • Sybase • Sybase IQ • Teradata • TIBCO ComputeDB • TIBCO Data Virtualization • TIBCO Streaming • Vertica • WSDL • XML (flat files over HTTP)

GENERAL PURPOSE ODBC AND JDBC DATA SOURCE ADAPTERS	CRM AND ERP ADAPTERS
• Custom JDBC adapter • JDBC-ODBC Bridge	• Microsoft Dynamics CRM (on-premises and online) • Microsoft Dynamics 365 • Microsoft Dynamics GP • Microsoft Dynamics NAV • NetSuite CRM • NetSuite ERP • Oracle EBS • Salesforce.com • Siebel

DATA SOURCE TOOL KIT

- Software Development Kit for Data Source Adapter Development

MARKETING AUTOMATION ADAPTERS

- Google Adwords
- Google Analytics
- HubSpot
- Marketo
- Oracle Eloqua

COLLABORATION ADAPTERS

- Email
- Google Apps
- Google Sheets
- Microsoft Active Directory
- Microsoft SharePoint (on-premises and online)
- Microsoft SharePoint Excel services

SAP ADAPTERS

- SAP Netweaver
- mySAP Business Suite
- SAP BW
- SAP Business Explorer (BEx)

NOSQL AND CLOUD DATABASE ADAPTERS

- Amazon DynamoDB
- Amazon RedShift
- Amazon S3
- Azure Data Lake Storage
- Azure Cosmos DB
- Cassandra
- Couchbase
- Google BigQuery
- HBase
- MarkLogic
- MongoDB
- Snowflake

SOCIAL MEDIA ADAPTERS

- Facebook
- LinkedIn
- RSS
- Twitter

Additional Technical Specifications

DELIVERY INTERFACES

- ADO.NET
- ODBC
- Hadoop
- JDBC
- REST
- SOAP

SECURITY PROTOCOLS

- Base64
- Kerberos
- NTLM
- SAML
- SSL
- WS-Security

CACHE REPOSITORIES

- Amazon Redshift
- Apache Hive
- File
- Google BigQuery
- Greenplum
- HSQLDB
- IBM DB2

- SOAP and JMS TIBCO Enterprise Message Service
- SOAP and JMS Sonic MQ

- Microsoft SQL Server
- MySQL
- Netezza
- Oracle
- PostgreSQL
- SAP HANA
- SingleStore
- Snowflake
- Sybase ASE
- Sybase IQ
- Teradata
- TIBCO ComputeDB
- Vertica

ENTERPRISE SERVICE BUSES

- OpenMQ
- Sonic MQ
- Enterprise Message Service

DIRECTORY SERVICES

- Active Directory
- Azure Active Directory
- Oracle Directory Server Enterprise Edition
- Novell eDirectory
- TIBCO Data Virtualization

DATA SHIP SOURCES AND TARGETS

- Greenplum
- IBM DB2
- Microsoft SQL Server
- Netezza
- Oracle
- PostgreSQL
- Sybase IQ
- Teradata
- Vertica

WEB SERVICES PROTOCOLS

- .NET
- OData
- REST and JSON
- SOAP
- WSDL
- WSI
- XPath
- XQuery
- XSLT
- XML (flat files or over HTTP)

SOFTWARE DEVELOPMENT STANDARDS

- SQL 92 and 99
- Unicode
- JDK
- J2EE
- JNDI

Learn more about TIBCO Data Virtualization at https://www.tibco.com/products/data-virtualization or contact us for more information today https://www.tibco.com/contact-us

Global Headquarters
3307 Hillview Avenue
Palo Alto, CA 94304
+1 650-846-1000 TEL
+1 800-420-8450
+1 650-846-1005 FAX
www.tibco.com

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TIBCO EBX Master Data Management

A single solution to manage, govern, and share all your data

TIBCO EBX software is an all-in-one solution for managing your organization's data—master, reference, and meta—on premises or in the cloud (private/private cloud or as a SaaS solution). It is agile, model-driven, multidomain, smart, and scalable — and has defined the master data management market for over two decades. The EBX solution manages all your shared data, so you can use it to better support your key business processes and strategic initiatives.

Capabilities

Your organization is capturing more data than ever, but that doesn't necessarily mean it's of high quality. EBX capabilities support handling large data volumes and ensuring accuracy and consistency.

Collaborative Workflow

- **Conditions.** Define conditional rules between workflow tasks
- **Custom emails.** Customize HTML emails for end users
- **Deadlines & reminders.** Configure deadlines on tasks and auto reminders
- **Error management.** View errors, re-launch/reallocate/delete workflows
- **Inbox.** View and open tasks, sort and search
- **Monitoring.** View current and completed workflows
- **Notifications.** Email notifications on allocated or offered tasks
- **Parallel workflows.** Launch parallel sub-workflows

- **Priority management.** Define priorities for each workflow task
- **Server tasks**. Configure tasks executed on the server (scripts)
- **Task library.** Use prebuilt-tasks (create record, version, access data, others)
- **User tasks.** Configure task for end users (individual or group)
- **Workflow dashboard.** Check each workflow status and history
- **Workflow designer.** Use a browser-based workflow modeling tool
- **Workflow engine.** Use a fully integrated workflow engine

Data Authoring

- **API.** Develop custom UI services using EBX Java API
- **Auto-generated UI.** Dynamically generate the user interface from the data model
- **Browse data.** View datasets, tables, and hierarchies
- **Custom layout.** Reconfigure auto-generated web forms layout
- **Grid edit.** View a spreadsheet-like edition of data in tables
- **Mass update.** Apply data updates on record selection or search
- **Microsoft Excel export.** Export Excel spreadsheets (xls, xlsx, csv)
- **Microsoft Excel import.** Import multi-sheet Excel documents with mapping
- **Mobile applications.** Support mobile and tablet devices (iOS, Android)
- **Multidomain.** Browse all data assets with one unique front-end
- **Multimedia.** Link to resources including images, maps, videos, docs
- **Permalinks.** Copy, paste, and email direct links to any data
- **Perspectives.** Configure data-driven applications by user role
- **Search.** Use simple, multi-criteria, or fuzzy search on any object
- **Simple import/export.** Import & export data in CSV, XML formats
- **Tabs.** Organize groups of fields in tabs
- **Views.** Configure and share custom views with filters
- **Visualization.** Visualize relationships between data
- **Web components.** Integrate any part of the UI in third-party portals, web apps
- **Web forms.** Auto-generate forms for data entry

Data Distribution and Geographical Federation

- **Clustering.** Expose a cluster for real-time data access
- **Encryption API.** Encrypt data at synchronization time

- **Geographical federation.** Distribute instances across regions
- **Hot deployment.** Add slave instances on the fly in a D3 cluster
- **Master/slave sync.** Synchronize a master instance with many slaves
- **Transactional.** Use two-phase commit on sync between instances

Data Integration

- **API.** Full Java API to integrate additional services
- **Auto-generated services.** Dynamically generate services from data model
- **File import/export.** Import or export files in CSV, XML formats
- **JMS.** Publish/subscribe to/from JMS queues
- **Mapping.** Map between source systems and data model
- **Microsoft Excel.** Import or export multi-sheet Excel spreadsheets
- **Native SQL access.** Query your data assets in native SQL
- **RDBMS connector.** Import and export data from/to any RDBMS in SQL
- **REST data services.** Auto-generate web services (RESTful/JSON)
- **SOAP data services.** Auto-generate web services (SOAP/WSDL)
- **Standard interfaces.** Support OpenAPI Specification
- **Transformation.** Use complex transformation rules for file import

Data Matching and Merging

- **Batch matching.** Match large datasets in batch mode
- **Cleansing.** Cleanse data with pre-built procedures
- **Crosswalk.** Match and link records for registry creation
- **Decision trees.** Flexibly define how records are matched to each other
- **False negative protection.** Reduce false negatives with two-level matching
- **Match in UI.** Perform matching inside data authoring UI in real time
- **Matching algorithms.** Use included library of matching algorithms
- **Matching on any object.** Add matching rules to any table or field in a model
- **Merge record.** Merge (or simulate) suspect records with pivot
- **Multifactor matching.** Configure matching policies on multiple fields

- **Real-time matching.** Perform matching at the point of entry
- **State machine.** Use full state management of records (golden, suspects, others)
- **Stewardship.** Use full stewardship user interface for reviewing and merging duplicates
- **Survivorship.** Enforce auto merge rules on duplicates
- **Trust framework.** Use best record/fields based on trusted source configuration

Data Modeling

- **Browser-based modeling.** Allow collaboration between business and IT users
- **Complex hierarchies.** Support any type of hierarchy
- **Computed fields.** Auto-calculate values based on business rules
- **Cross-domain relationships.** Link between master data domains
- **Data model versioning.** Keep track of your data model enhancements over time
- **Graphical rendering.** Display data model relationships across multiple domains
- **ID management.** Define simple or composite keys with auto-generated IDs
- **Inherited fields.** Show inheritance values across any level of relationship
- **Many-to-many links.** Define complex cardinalities between objects
- **Mixed-model support.** Design relational and object-oriented data models
- **Model extensions.** Enrich data models by adding properties and constraints to data model elements
- **Model lifecycle management.** Fully control data model versions
- **Multi-language.** Use metadata in any language (UTF-8)
- **Publish on the fly.** Publish model changes without redeploying
- **Reusable types.** Define reusable and documented data types
- **Templates.** Provide domain-specific data model templates
- **Workflow.** Manage data model changes with an EBX workflow
- **XML schema.** Natively support the XML schema standard

Data Quality

- **Business rules.** Use rules/scripting language and editor for complex validation control
- **Data types validation.** Support standard or custom data types

- **External controls.** Call external services for third-party validation
- **Profiling.** Profile data with prebuilt procedures
- **Validation API.** Develop additional controls with Java API
- **Validation controls.** Use min/max values, patterns, list of values
- **Validation reports.** View error reports with interactive correction

Data Security & Business Roles

- **Enterprise directory.** Integrate with third-party directories (LDAP, AD)
- **Field-level security.** Configure access rights down to the field level
- **HTTPS/SSL.** Use SSL encryption of user interface and services
- **Permission rules.** Add specific filters at record level based on rules
- **Permissions on datasets.** Configure access rights for each dataset
- **Permissions on domains.** Configure access rights for each data domain
- **Roles and users.** Define user groups, combine roles for users
- **Single sign-on.** Integrate with third-party SSO systems
- **Web Service Security.** Support HTTP-authentication and WSSE

Digital Asset Management

- **Edit metadata.** Edit all metadata and tags associated with your digital assets
- **Integration.** Support multiple storage systems, API for advanced integrations
- **Library of digital assets.** Create and manage libraries of digital assets
- **Upload assets.** Upload (or mass-upload) documents and media
- **Version control.** Manage multiple versions of your digital assets
- **View digital assets.** View digital assets in the user interface

Graph Visualization

- **Auto/manual layout.** Use tools to automatically arrange nodes for improved readability
- **Customization.** Configure how nodes and links in a graph are rendered, including images usage
- **Data lineage.** Use primary graph types to sketch horizontal, vertical, conceptual, or regulatory data lineages
- **Data structure.** Organize relationships using a model-oriented view

- **Data value.** Show each and every connection as a node with classic graph view
- **Encapsulation.** Use domain or data classification-oriented view to encapsulate nodes
- **Layered.** Use generation-oriented view to show distance/ hops from the first node

Hierarchy Management

- **Any hierarchy types.** Support balanced, unbalanced, ragged
- **Custom hierarchies.** Customize how hierarchy nodes are rendered
- **Derived hierarchies.** Render hierarchies on the fly based on relationships
- **Explicit hierarchies.** User-define hierarchies for an existing dimension
- **Filter.** Define filtering criteria at any level of a hierarchy
- **High performances.** Use Ajax technology for managing large hierarchies
- **Multi-parent support.** Attach/detach nodes to/from multiple parents
- **Prune mode.** Filter nodes that have at least one child
- **Recursive hierarchies.** Use hierarchies based on parent/ child relationship
- **Relational hierarchies.** Use hierarchies based on links between objects
- **View and edit.** View trees, move/edit nodes
- **Wide & deep hierarchies.** Manage any number of levels and nodes without limitation

KPIs and Dashboards

- **Alerts.** Send real-time notifications and kick-off workflows
- **API.** Create your own indicators
- **Dashboard.** Set, visualize, and analyze KPIs with rich and interactive graphs
- **Email.** Share reports and scorecards by email
- **File export.** Export data in CSV, XML, and Excel
- **Flexible configuration.** Set computation frequency, lookback period, boundary conditions, and thresholds
- **Indicators library.** Monitor data and workflows with pre-built indicators
- **Native SQL access.** Query indicator results in SQL
- **Security & permissions.** Enforce and secure fine-grained access

ML/AI Metadata and Classification

- **Integrated model operationalization (modelOps).**
- **Predictive output of any AI model.** Deploy, manage, audit, analyze
- **Synchronization of AI/ML metadata.**
- **Data classification.** Call custom AI/ML models

Mobile Capabilities

- **Access any data.** Create menus to access any data domain managed in EBX software
- **Approvals.** Approve changes in workflows with full history and comments from your phone
- **Browse and view data.** Browse datasets and hierarchies with custom views, sort criteria
- **Digital assets.** View digital assets attached to any of your data
- **Favorites.** Manage favorites and share records with colleagues
- **Native iOS/Android app.** Download from the App Store or by side loading
- **Search.** Search on exact criteria or Google-like fuzzy queries
- **Workflow on the go.** Manage your workflow inbox with native notifications

New Metadata Repository (coming soon)

- **Auto-alignment.** Automatically align your metadata with your data
- **Business glossary.** Manage definitions and synonyms of business terms
- **Classification and lineage.** Use machine learning to classify metadata assets and build data lineages
- **Compliance and control.** Identify critical data elements, document definitions, and report on compliance; Manage entitlements and provision access to data with governed workflows
- **Context-aware.** Adapt definitions to business contexts and user profiles
- **Data quality KPIs.** Track key data quality indicators on all your metadata
- **Discovery and extraction.** Automate metadata harvesting from your on-premises or cloud systems
- **Governance.** Define ownerships and responsibilities on data
- **Metadata store.** Consolidate all your business and technical metadata in a single central place
- **Search and collaboration.** Search across the entire data catalog; Collaborate with social features including comments, ratings, and tags
- **Visualization.** Visualize relationships between metadata

Platform Compatibility

- **Application server.** Tomcat and other application servers are supported and may be selected according to customer standards
- **Browser UI.** Edge/Internet Explorer, Chrome, Firefox, and Safari
- **Cloud databases.** Azure SQL Server, AWS RDS, Oracle Database Cloud Service
- **RDBMS for persistence.** SQL Server, Oracle, or PostgreSQL

Version Control

- **Compare and merge.** Three-way compare and merge with conflict detection
- **Future versions.** Manage future version of data using data spaces
- **Native SQL access.** Query the full history in native SQL
- **Past versions.** Keep track of past "as of" versions
- **Record-level history.** Keep track of all updates at dataset and record levels
- **Roll-back.** Roll-back data values at any point of time, at record level
- **Sandbox/playground.** Create ad-hoc versions for testing new ideas
- **Staging.** Manage staging versions for data import
- **View & search history.** View and search datasets, tables, and fields

Learn more about TIBCO EBX master data management at https://www.tibco.com/products/tibco-ebx-software or contact us for more information today https://www.tibco.com/contact-us

Global Headquarters
3307 Hillview Avenue
Palo Alto, CA 94304
+1 650-846-1000 TEL
+1 800-420-8450
+1 650-846-1005 FAX
www.tibco.com

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