



Banking Data Warehouse and the Sarbanes-Oxley Act

Whitepaper

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About this Paper

The purpose of this paper is to outline the components of the Banking Data Warehouse (BDW) and how they assist financial institutions to address the data modeling and data consolidation issues relating to the Sarbanes-Oxley Act.

This paper is divided into the following chapters:

Chapter 1, "**Data Integration and the Banking Data Warehouse**" summarizes the benefits of the BDW as a central data repository for the financial institution.

Chapter 2, "**BDW support for the Sarbanes-Oxley Act**" summarizes the enhancements to BDW v3.3 and how these address the issues raised by the Sarbanes-Oxley Act.

Chapter 3, "**Banking Data Warehouse Components**" outlines each of the BDW components.

Chapter 4, "**BDW Components and the Sarbanes-Oxley Act**" describes briefly an overall functional architecture for Sarbanes-Oxley and how each of the BDW components fit into this architecture.

Data Integration and the Banking Data Warehouse

Financial Institutions are facing a series of related risk and compliance challenges. These include:

- Sarbanes -Oxley Act
- Basel II
- IFRS / IAS

In an increasing competitive and regulatory environment, financial institutions need a single view of their business information.

All of these different regulatory initiatives require data to be collected, analyzed and reported in different formats and under different timescales. Much of the data needed for one regulatory regime may also be required for the other regimes. It is obvious that if the data collection can be performed only once and made available in integrated shared structures, then the task of producing multiple different analytical reports will be greatly simplified. Further, since all reporting will be sourced from the same data, then all business, regulatory and compliance reports will be consistent with each other.

The Sarbanes -Oxley Act (SOX) places particular and specific needs on the CEO and CFO of a business to ensure that the financial results they are reporting are accurate and available in a timely fashion.

Sarbanes-Oxley requires accurate and complete financial information, available in a timely fashion

Section 302 requires the CEO and CFO to state quarterly and annually that *inter alia*: the financial statements do not contain any untrue statements or omit any material facts that would make the statements misleading; the financial s tatements fairly present the financial position, cash flows and operations; that procedures and controls in the formation of the statements are in place and are capable of being audited. While such declarations are mitigated by a “to the best of their knowledge” clause, it is likely that a “if they didn’t know, they should have known” regime will be applied.

Section 404 requires that critical financial systems must be under strict controls and that the annual report must contain a statement signed by the CEO and CFO that any filings with the SEC are accurate. If such a statement is later proved to be false, then a jail term is a possibility. Section 408 requires the business to able to demonstrate at least every three years that no disclosures are missing or incomplete.

Existing data environments may not meet the standards required to support regulatory reporting

Section 409 requires that material events must be timely and accurately disclosed by the financial institution. Material events must be reported within 48 hours. A material event would include, for example, the bankruptcy of a large obligor or the collapse of an economy in which the financial institution has considerable investments.

All the above make it imperative that the financial institution maintains accurate business and operational data and that key performance and control indicators can be generated and monitored within short timescales. However, many financial institutions will be aware of some or all of the following issues in their existing data infrastructure:

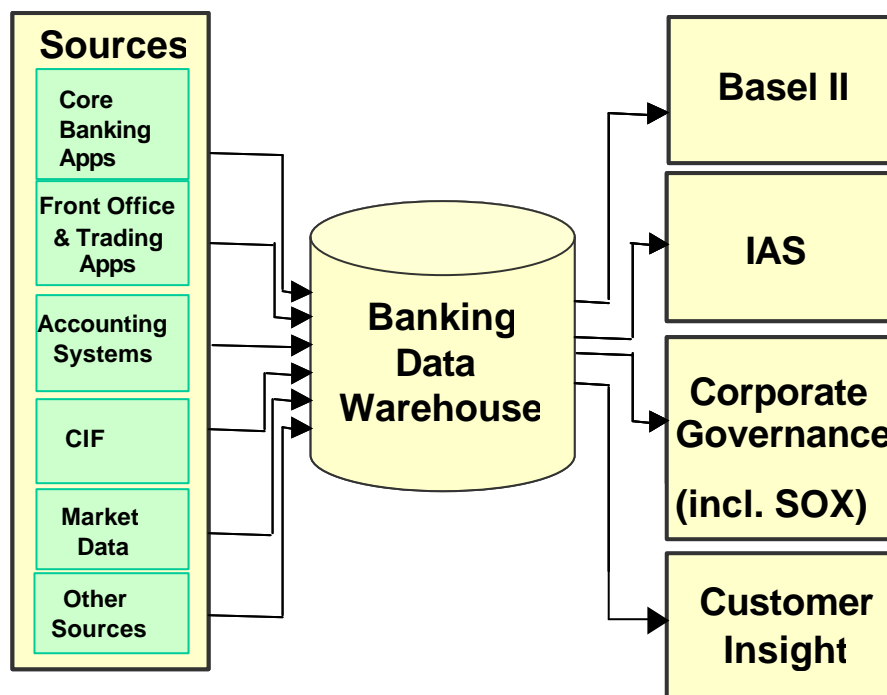
- Reliance on manual spreadsheets and other tools outside of an auditable data environment
- Inconsistencies in reporting definitions and calculation formulae
- Excessive length of time to collate data for existing reports resulting in slow end of period closure
- Inflexibility of existing data structures resulting in long delays to meet new requirements
- Limited insight into performance and predictability of the business, both end-to-end and enterprise-wide.
- Lack of data quality and integration

The needs for regulatory reporting are the needs of the business

The key, then, is to ensure that data is collected and stored in a manner usable by all current and future business and regulatory requirements. This is not a trivial goal to attain, but there is a major upside – achieving a high quality data infrastructure is also exactly what is needed to run the business efficiently and profitably and is also what is required to fulfil other regulatory requirements in addition to Sarbanes-Oxley.

The Banking Data Warehouse is an enterprise-wide data architecture for a consolidated view of business data

The IBM Banking Data Warehouse (BDW) is a design for such an enterprise data integration environment. BDW version 3.3 has comprehensive support for Sarbanes-Oxley integrated with the business data of banking. Many financial institutions are now using BDW to support common and consolidated data requirements across all aspects of their business as represented below.



With BDW 3.3 as the underlying architecture, the financial institution can leverage all the advantages of an integrated data hub

The benefits of using the BDW as the financial institution's data integration hub containing a single consolidated view of data include:-

- Integrated business and compliance information
- Increased flexibility to address new requirements
- Faster response to new requirements
- Ability to track historical changes
- Ability to show data as at a point in time
- Ability to better leverage data across lines of business
- Increased consistency in data usage
- IT cost savings due to a reuse of population, storage and reporting components

More information on the Basel II aspect of BDW may be found in the Whitepaper:-

Banking Data Warehouse Support and the International Convergence of Capital Measurement and Capital Standards: A revised Framework (BDW33027)

More information on the IFRS / IAS aspect of BDW may be found in the Whitepaper:-

Banking Data Warehouse Support for International Financial Reporting Standards (IFRS) including the International Accounting Standards (IAS) (BDW33035)

Additional information on BDW can be found in the **BDW General Information Manual**.

These documents may be requested by emailing the IBM Financial Services Solution Centre: fssc@ie.ibm.com

BDW support for the Sarbanes-Oxley Act

BDW 3.3 is just the latest step of a constant evolution of best-practice data warehouse models for financial institutions

The Banking Data Warehouse (BDW) has been in existence for over a decade, and has been installed as a core data infrastructure component in many financial institutions worldwide, ranging from private banks and credit unions through retail and commercial banks and even central banks. All of these institutions have been able to reuse the stable data structures of the BDW to help achieve their particular business aims, and the experiences of those engagements have been used to broaden the BDW scope with real-world solutions.

A Sarbanes-Oxley solution built on proven foundations

The most recent release of the Banking Data Warehouse, BDW 3.3, has been specifically enhanced with content to support Sarbanes-Oxley. This ensures that financial institutions can take advantage of the BDW's established and tested data warehouse architecture while addressing their specific Sarbanes-Oxley requirements - when a financial institution uses BDW to address their Sarbanes-Oxley needs, they are building on a proven foundation.

BDW 3.3 support for Sarbanes-Oxley concentrates on the requirements for the filing of 10-Q and 10-K reports with the U.S. Securities and Exchange Commission (SEC). A 10-Q is a quarterly report submitted by all public companies to the SEC in which firms are required to disclose relevant information regarding their financial position. A 10-K is a report required annually by the SEC that is a comprehensive summary of a company's performance. SOX has reduced the regulatory filing period for 10-Q reports from 90 days to 45 days and the regulatory filing period for 10-K reports from 120 days to 60 days.

Both new and existing elements are combined to define and understand the reporting implications arising from Sarbanes-Oxley

More than 900 measure and dimension elements have been added to BDW 3.3 to support the specific values and the breakdown of those values for 10-Q and 10-K reports as required by Sarbanes-Oxley. These new measure and dimension elements have been fully integrated with pre-existing BDW elements to construct new templates upon which 10-Q and 10-K reports can be constructed. This enables the quick development of Sarbanes-Oxley reports that reuse the same measures and dimensions as the normal business reports required by the financial institution.

The BDW addresses major requirements of Sections 302 and 404 of Sarbanes-Oxley

Reporting templates for Sarbanes -Oxley in BDW 3.3 include:

- Sarbanes -Oxley Act Analysis
- SOX Balance Sheet Analysis
- SOX Cash Flow Analysis
- SOX Change In Shareholders Equity Analysis
- SOX Statement Of Income Analysis
- SOX Financial Statements Notes Analysis
- SOX Management Discussion And Analysis

The Data Collection and Reporting capabilities of BDW are also applicable outside of a SOX context

Non-SOX Financial Institutions

The changes in BDW 3.3 are not just of interest to financial institutions in countries and institutions that are required to implement Sarbanes -Oxley, but to any organization that wants to improve the capability of their business management systems.

Financial institutions using BDW are building on a best of breed foundation that addresses asset and liability management, profitability, risk, customer relationship management and compliance requirements using IBM's market leading research and technology delivered as an open architecture.

Banking Data Warehouse Components

The Banking Data Warehouse (BDW) is a proven, stable foundation for a compliance data warehouse

IBM's Banking Data Warehouse (BDW) enables financial institutions to build data warehouse solutions to suit their specific needs. BDW has the flexibility to enable the creation of a range of data warehouse solutions from departmental data marts to enterprise-wide data warehouses.

The full range of typical business issues are already encapsulated within the BDW

The BDW comprises a proven, flexible and scalable data warehouse technical infrastructure to address critical business reporting and analysis needs:

- Profitability
- Relationship Marketing (CRM)
- Regulatory Compliance
- Risk
- Asset and Liability Management

Data within the BDW is usable for many different applications

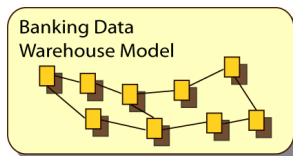
The BDW comprises several component models, each of which addresses a particular aspect of business intelligence development:

- Banking Data Warehouse Model (BDWM)
 - entity-relationship data warehouse model
- Business Solution Templates (BST)
 - capture and specification of reporting requirements
- Application Solution Templates (AST)
 - capture and specification of non-reporting requirements

These BDW content models form the cornerstone components of a financial institution's development of a customized data warehouse and business intelligence environment. The BDW environment may be integrated with the bank's existing data mart or business information warehouse reporting environments, or may be used as a blueprint to upgrade the existing data infrastructure. It may also be integrated with other data applications such as data miners or decision support to provide a complete solution for the storage of consolidated historical data to fulfill information requirements.

The component models and the benefits that they provide are listed in greater detail in the remainder of this document.

Banking Data Warehouse Model (BDWM)



The BDW Model provides a well architected set of data structures for both data consolidation and data reporting

The BDW Model is an entity relationship data model that provides the consolidated historical and atomic data needed for a data warehouse. It is a business intelligence infrastructure supporting multiple lines of business and analytical functions within medium to large financial institutions. The aim of this shared infrastructure is to provide a data integration hub that will reduce the development and operational costs in providing business intelligence functionality to the myriad of front and back office organization units. This is made possible by gathering the data into a single data integration hub, and then using that single source of truth for business intelligence development across many areas. The organization can then focus on managing the implementation of consistency of definition, transformation, and distribution of the data used for business intelligence across the lines of business.

Any specific data and business requirements of the financial institution can be customized into the BDW

IBM provides a default physical database design, generated from the logical entity relationship data model. This physical data model incorporates IBM's vast experience in implementing data warehouse databases for the financial services sector, and could be implemented as is, to show how a data warehouse database should work. It is more likely though, that it will be customized further by a data warehouse design team of experts comprised of senior warehouse architects and database administrators, so as to ensure optimal configuration for the financial institution's data distribution and performance characteristics.

The BDW Model contains the data structures needed by a financial institution to support business intelligence issues such as profitability and risk calculations, customer relationship management and regulatory reporting.

Business Solution Templates (BST)



The BDW also contains the Business Solution Templates (BSTs) which provide templates for the most common types of query and analysis required by a financial institution across different business areas.

BSTs capture common reporting requirements for financial institutions and implements them through shared reusable measures and dimensions

The BSTs have three main components:

- 1600+ reusable financial measures
- 370+ reusable financial dimensions
- 90 groupings of the above measures and dimensions into configurable Business Solution Templates.

Standard measures include, for example, the key performance indicators (KPIs) for a financial institution e.g. Number of Customers, Total Amount Of Funds Under Management, Number Of Transactions. Of particular significance to a Sarbanes-Oxley application would be measures such as Share Capital, Retained Earnings, Long Term Debt, Liabilities Of Discontinued Operations and Total Equity To Assets.

All elements are fully defined and reused in many contexts

Each measure is fully defined and may be used either in its own right, or as a component contributing to a formula, which itself may contribute to larger formulae. Where the measure is used in a formula, it is provided with a context sensitive calculation attribution e.g. in one formula, the measure may be summed into the total, whereas in another, it may need to be subtracted from the total. This reuse of measures ensures conformity of business measure use across the organization and is a key aid in the metadata management activities of a business intelligence environment within an organization.

Measures only become useful when they are compared against each other under different headings. For example, Total Comprehensive Income compared over the last twelve monthly periods, Total Credit Extension Commitment Amount within each of several geographical regions. The BST dimensions provide the headings under which measures may be broken down and compared. Almost 400 industry standard dimensions are supplied, with each and every member fully defined. As with the measures, calculation contribution attributions are provided to show how measures are aggregated along the dimension.

BDW 3.3 Business Solution Templates

| | | | | |
|--|--|--|--|---|
| <p>Relationship Marketing</p> |  | <ul style="list-style-type: none"> •Customer Interaction Analysis •Customer Investment Profile •Individual Customer Profile •Wallet Share Analysis | <ul style="list-style-type: none"> •Customer Complaints •Delinquency Analysis •Customer Loyalty •Market Analysis | <ul style="list-style-type: none"> •Campaign Analysis •Cross Sell Analysis •Customer Attrition •Customer Behavior •Lead Analysis |
| <p>Profitability</p> |  | <ul style="list-style-type: none"> •Transaction Analysis •Activity Based Costing Analysis •Insurance Product Analysis •Investment Arrangement Analysis | <ul style="list-style-type: none"> •Profitability Analysis •Channel Profitability •Customer Lifetime Value •Customer Profitability •Location Profitability | <ul style="list-style-type: none"> •Product Profitability •Product Analysis •Organization Unit Profitability •Performance Measurement •Business Procedure Performance |
| <p>Risk</p> |  | <ul style="list-style-type: none"> •Interest Rate Risk Analysis •Credit Risk Profile •Credit Risk Assessment •Credit Risk Mitigation Assessment •Asset Securitization Analysis •Operational Risk Assessment | <ul style="list-style-type: none"> •Outstandings Analysis •Portfolio Credit Exposure •Security Analysis •Liquidity Risk •Collections Analysis •Insurance Risk Profile | <ul style="list-style-type: none"> •Authority Profiling •Credit Risk Analysis •Debt Restructuring •Involved Party Exposure •Location Exposure •Non Performing Loan •Operational Risk Loss Analysis |
| <p>Asset & Liability Management</p> |  | <ul style="list-style-type: none"> •Interest Rate Sensitivity •Liquidity Analysis •Short Term Funding Management •Financial Management Accounting | <ul style="list-style-type: none"> •Capital Allocation Analysis •Capital Procurement •Credit Loss Provision •Funds Maturity Analysis •Income Analysis | <ul style="list-style-type: none"> •Net Interest Margin Variance •Structured Finance Analysis •Equity Position Exposure •Position Valuation Analysis |
| <p>Compliance</p> |  | <ul style="list-style-type: none"> •European Central Bank Reporting •Financial Capital Adequacy Analysis •Structure Of Regulatory Capital •Foreign Financial Account Analysis •Suspicious Activity Analysis •Transaction Activity Analysis SOA Balance Sheet Analysis SOA Cash Flow Analysis SOA Statement Of Change In Shareholders' Equity Analysis SOA Statement Of Income Analysis | <ul style="list-style-type: none"> Balance Sheet Portfolio Basis Approach Analysis Balance Sheet Classified Approach Analysis Balance Sheet Order Of Liquidity Approach Analysis Balance Sheet Net Assets Approach Analysis Cash Flow Direct Analysis Cash Flow Indirect Analysis Sarbanes Oxley Act Analysis (SOA) | <ul style="list-style-type: none"> Cash Flow Direct Financial Institution Analysis Cash Flow Indirect Financial Institution Analysis Income Statement By Function Analysis Income Statement By Nature Analysis Income Statement Financial Institution Approach Analysis Statement Of Changes In Equity Analysis |

Dimensions are reused in several BSTs, thereby enforcing conformity of dimensions used in different analysis areas. This enables uniformity of reporting and the ability to cross reference measures from different areas of analysis; e.g. comparing profitability to risk measures across the same geographical and temporal breakdowns.

A BST is a pre-grouping of measures and dimensions taken from the available pools of measures and dimensions that capture an analytical need in a given business area; e.g. Balance Sheet Analysis, Involved Party Exposure, Customer Profitability, Credit Risk Assessment. The supplied sets of templates, measures and dimensions may be fully customized and/or new elements created in order to exactly reflect the needs of a particular financial institution.

BSTs achieve conformity of measures and dimensions across the financial institution

All measures and dimensions of the BSTs are mapped to a set of BDWM entities and attributes that will support implementation of that particular data requirement. This identifies the data warehouse subset needed to drive their non-reporting data needs.

The complete set of BDW 3.3 Business Solution Templates are shown above, with those of special significance to Sarbanes-Oxley highlighted.

Application Solution Templates (AST)



The Application Solution Templates provide scoping of the data required to address non-reporting requirements

The Application Solution Templates (ASTs) are designed to capture data requirements for non-reporting applications – for example, credit risk engines or data mining applications. In this, they contrast with the BSTs which capture reporting requirements.

The set of ASTs in BDW 3.3 concentrate on data requirements for regulatory compliance issues such as Pillar 1 of Basel II and IAS/IFRS. The list of ASTs include:

- Credit Risk - Standardized Approach
- Credit Risk - Internal Ratings Based (IRB)
- Probability of Default (PD)
- Loss Given Default (LGD)
- Exposure At Default (EAD)
- Effective Maturity (M)
- Expected Loss (EL) And Provisions
- Securitization Framework
- Operational Risk
- IAS Measurement

Each AST gives a complete breakdown of the data requirements of each data component, as defined in the relevant regulatory documentation.

Each AST contains a definition reference into the regulatory documents and is mapped to a set of BDWM entities and attributes that will support implementation of that particular data requirement. This identifies the data warehouse subset needed to drive their non-reporting data needs.

BDW Project Views



The BDW Project Views provide a filtered view across the data mart and data warehouse structures

The BDW Project Views are a series of business subject area views which span across all BDW components . The BDW Project Views give users of the BDW a very clear understanding of the data coverage required in the Business Solution Templates for specific business requirements.

BDW 3.3 includes an extensive set of Project Views that capture aspects of various regulatory regimes such as Sarbanes -Oxley, Basel II, IAS/IFRS and other issues such as Anti-Money Laundering.

Project view are usually anchored on a particular BST or AST , but only selects from that BST/AST the subset of measures and dimensions specifically needed to address the particular data requirement. The scope of each BDW Project View can then be extended to include the relevant pre-defined mappings that exist between the BST/AST and the BDW Models.

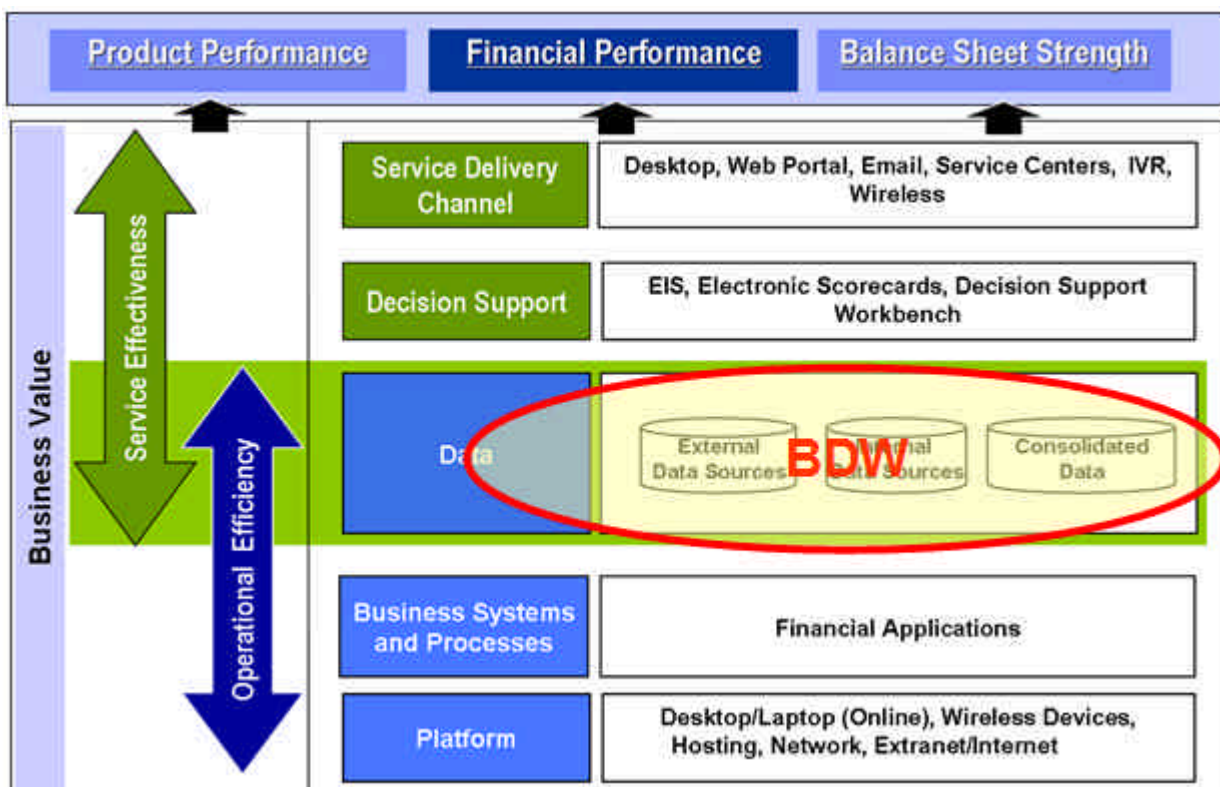
BDW Components and the Sarbanes-Oxley Act Architecture

BDW provides a set of integrated models to address all aspects of a data warehouse structure for Sarbanes-Oxley

The BDW components work together as a set of complementary content models that are aimed at solving distinct management information business requirement and data architectural issues. The separate model components are delivered within an architectural structure known as the Information FrameWork. Within the Information FrameWork, elements of a model in one cell are mapped to corresponding elements in other cells; e.g. a data mart base measure may be mapped to a BDW Model attribute that is the source for the data to be loaded into the data mart. This maps the information required by a business user (measure) to the data storage maintained by a technical user (database attribute). By pre-solving problems such as these, the financial institution is left free to concentrate on the real management information and business intelligence issues:

- sourcing the data
- defining how it should be transformed and aggregated
- improving data quality management within the organization

The figure below shows a standard Sarbanes -Oxley architecture as defined by IBM. This architecture outlines the six tiers of functionality needed to support Sarbanes -Oxley



The IBM SOX architecture provides a complete framework for all Sarbanes-Oxley projects

The data warehouse is the consolidation point for all the necessary data as it is extracted from potentially many different sources

The BDW components are designed to provide a financial institution with the means of building the most extensible and effective Sarbanes-Oxley data structures

The IBM SOX architecture provides a complete framework for all Sarbanes-Oxley projects. Within that framework, the BDW provides the infrastructure required to implement the Data Level. Data from external sources, internal sources and consolidated data can all be held within a database installation built from the reusable BDWM data structures.

- The BDW Model (BDWM) provides the design for the enterprise data store
- The Business Solution Templates (BST) define the requirements for Sarbanes-Oxley reporting.
- The mappings from the BST elements to the BDWM identify which particular elements of the enterprise data model will be needed for SOX purposes.
- The BDW Project Views provide a filtered view across the BDW. Specific views address specific Sarbanes-Oxley requirements.



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