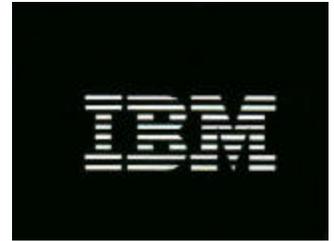


IBM Data Management
May 2003



Basel II Compliance: The Data Management Challenge

An IBM white paper that examines how IBM's Data Management solutions address the IT challenges of Basel II implementations

About this white paper

The New Capital Accord from the Basel Committee on Banking Supervision (“Basel II”) will effect sweeping changes in the way many financial companies collect and analyze data. This paper discusses the data management challenges that companies will face during Basel II implementations, and how IBM’s solutions (including IBM Banking Data Warehouse) can help financial companies meet those challenges.

Who should read this paper?

Business operations strategists, IT strategists, and senior executives in risk management and board management who are responsible for planning and implementing the data management infrastructure that will support Basel II compliance.

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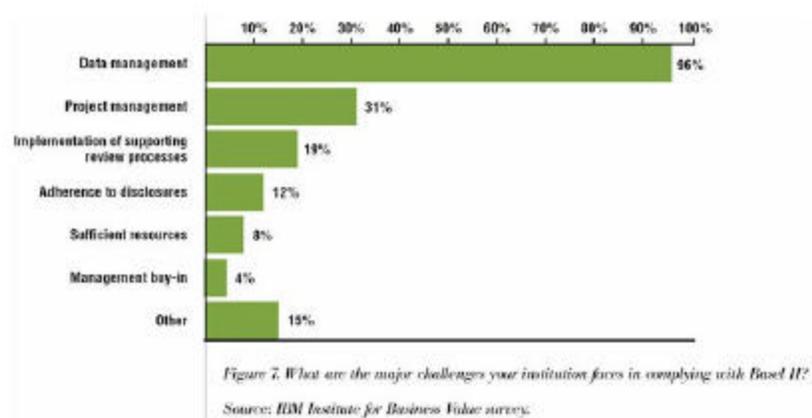
I. Executive summary: The New Capital Accord (“Basel II”)

In 2001, the Bank for International Settlements’ Basel Committee on Banking Supervision announced The New Capital Accord (heretofore known as “Basel II”) to address risk management practices for financial services companies in the international market. The Basel II Accord was crafted in large part as a response to the estimated \$12 billion lost in the financial markets since 1992, a figure attributed to poor risk management practices and fraud. While financial services companies will ultimately benefit from the implementation of the Basel II Accord’s risk management guidelines, for the immediate future their task is a daunting one: to collect and analyze two or more years’ worth of business data (which translates into many terabytes of data for some businesses) before the Basel II Accord takes effect on Dec. 31, 2006. Thus, many financial services companies will have to implement sweeping changes in their corporate data infrastructure to ensure such a system is operational prior to 2005.

The Basel II Accord mandates standardized measurements of credit risk, market risk, and operational risk among internationally active financial companies. However, within those guidelines are different levels of compliance which allow financial service companies to pursue advanced risk management practices that could potentially free up capital for investment. Thus, implicit in the Basel II Accord are tangible business benefits for financial companies beyond improved risk management practices. And astute companies have already noted that the data infrastructure needed to comply with the Basel II risk management guidelines could also be leveraged for International Accounting Standards (IAS) compliance as well as business intelligence applications like customer profitability analysis.

In the short term, however, most financial companies are focused on the data management issues of the Basel II Accord, as that will form the foundation of their enterprise-wide risk management system. Recently, IBM conducted a survey of 32 senior executives responsible for their companies’ Basel II

implementations and asked them about the process, including: What were the most important challenges they faced in complying with the Basel II Accord? Their response: 96% said that data management was a major challenge.



The data management challenge includes:

- Identifying the data required to drive the risk calculations and support Basel II reporting and analysis;
- Locating that data in operational systems spread out across the enterprise and, in some cases, incorporating it with third-party data;
- Understanding the structure of the data in the existing systems;
- Extracting and transforming data from operational systems to provide a consistent structure for the data warehouse environment;
- Cleansing the data to achieve a consistent and complete view of data needed for risk calculations, reporting, and analysis;
- Choosing a database management system that will store the historical view of the data, handle large volumes of data, scale if needed, and distribute data in a format that will enable analysis and reporting functions;

- Fast and reliable access to data by risk calculation engines and analytical tools;
- Storing of risk calculation and analytical results alongside the original data for subsequent reporting and optimization;
- Production of all regulatory reports in a format that can be viewed and verified in support of Pillars 2 and 3 of the Basel II Accord;
- On-line analytical processing (OLAP) capabilities to study the breakdown of the totals in the regulatory reports;
- Data mining to detect statistical patterns, predict behavior (e.g., probability of default), and identify anomalies in the data.

II. Basel II: The IT road ahead

There are many challenges along the road to Basel II compliance. A centralized data repository (in most cases a data warehouse) will need to be established to meet Basel II's strict guidelines for data consistency and reliability, not to mention the sheer volume of data involved. Robust ETL (extraction/transformation/loading) tools must be applied to source data, while data models will need to align with new risk management reporting needs. Heterogeneous platforms must be reconciled in some cases, operational data drawn from (and distributed to) disconnected geographies in others. And the final solution will need to evolve to meet changing requirements and a steady stream of new data.

Yes, the IT executives are right to worry about the data management implications inherent in the Basel II Accord.

But there is an alternative to going down this road alone: partnering with IBM. Our world-leading risk consultants can assist financial companies during the Basel II implementation, from Basel II readiness assessment to data warehouse development to advanced risk management reporting. In addition, there are over

250 consultants in IBM's Risk and Compliance practice who are specifically trained in the IT issues facing Basel II implementations.

On top of our consulting expertise, IBM now offers a solution that combines software and application design tools to help financial companies address the data management challenges of Basel II. At the heart of this solution is IBM's Banking Data Warehouse (BDW). Over 100 financial companies are using BDW right now. It has allowed these companies to get a data warehouse up and running quickly by utilizing pre-built data models and business solution templates designed specifically for the financial industry.

The engine driving BDW is IBM DB2 Universal Database, a scalable, open environment database perfectly suited to large business intelligence applications like companywide risk management reporting. Also included with BDW are data models, business solution templates, and OLAP tools that facilitate the deep, multidimensional analysis of data.

In 2002, IBM Banking Data Warehouse was enhanced to address the specific data management issues inherent in the Basel II Accord. In particular, the BDW data models have been extended to accommodate the data that financial companies must collect for Basel II compliance – data pertaining to customers, counterparties, exposures, and collateralization – as well as the reports that business users will generate from that data. And as the final pieces of the Basel II Accord are revealed, the BDW models will be further enhanced to enable banks to take advantage of advanced risk management initiatives.

An IBM Banking Data Warehouse solution encompasses the following components, which companies may also purchase individually:

- Basel II-specific data models and business solution templates
- DB2 Universal Database
- DB2 OLAP Server
- Ascential Software's ETL product suite

- IBM eServers: iSeries, pSeries, xSeries, zSeries
- IBM Storage hardware
- IBM Business Consulting Services

In short, IBM Banking Data Warehouse is the “umbrella” under which most of the components necessary for a Basel II implementation can be found. While some financial companies have elected to purchase BDW as an end-to-end solution, others have purchased specific components (e.g., the data models) needed to “fill the gaps” in their Basel II implementation.

In the following chapters, we’ll examine the data management challenges facing Basel II compliance, and how IBM’s solutions (including BDW) can help meet those challenges.

III. IBM DB2 Universal Database: The right foundation for now... and later

Basel II compliance at the advanced level could call for data analysis of a full economic cycle, normally regarded as seven years. In some cases, that translates into 70 terabytes of data! Only one relational database management system has a proven track record of handling data volumes that large: IBM DB2 Universal Database (UDB). DB2 UDB’s strengths play to the weaknesses that a Basel II implementation might expose in other databases: scalability, flexibility, and top performance at the multi-terabyte level.

Scalability

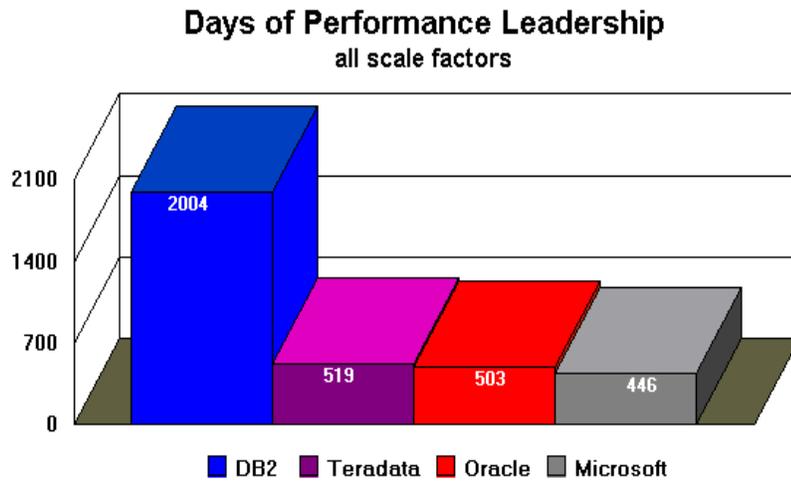
DB2 UDB offers virtually linear scalability and can operate on configurations using unbalanced server nodes. So, should financial companies decide to add new hardware in the future (a very real scenario given that Basel II’s data requirements are likely to increase over time), they can still leverage their existing hardware investment with DB2 without compromising performance.

Flexibility

DB2 UDB gives financial companies the widest range of choices for their data management infrastructure. IBM's world-leading database runs on all major operating systems – Linux, UNIX, Windows, OS/390, OS/400 – and the leading market applications, from ETL tools to ERP systems to end-user reporting applications. This gives financial companies the flexibility they need to build a Basel II solution based on their existing investments and skill sets.

Performance

The TPC-H benchmarks are the de facto measurements for business intelligence performance. Yet with so many database vendors claiming TPC-H leadership at some point or another, how do you differentiate one from the pack? By choosing the database that's been the leader the longest. The chart below shows that DB2 has held the TPC-H leadership position for 2,004 days since the TPC-H benchmarks were first introduced -- nearly four times longer than the next competitor.



And IBM recently published the first TPC-H benchmarks in history at the 10 TB level. Currently holding two of the top five TPC-H results at the 100 GB level as well, DB2 UDB is a proven business intelligence performer from top to bottom.

Built-in business intelligence

DB2 UDB features an open development architecture that allows financial companies to add business-specific or analytic logic to the database through standard SQL calls. For Basel II compliance, this means that risk calculations can be implemented within the database engine's core, rendering the calculations available to other applications. And new features in DB2 UDB leverage our relationship with analytic vendors like SAS Institute to enable complex mining models to be run in the database server environment. Again, this is a benefit to Basel II implementations, where companies may wish to perform tasks like applying scoring models (such as the probability of default) to all the customers in a data warehouse.

IV. Getting the data ready for Basel II reporting

Extracting data from various sources, cleaning the data for risk analysis, and loading it into a centralized data store or data warehouse are some of the biggest challenges facing financial companies on the road to Basel II compliance. It's a crucial step, as any shortcomings in the ETL (extraction/loading/transformation) process can undermine the success of your Basel II implementation.

IBM recommends the Enterprise Integration Suite from Ascential Software as the ETL solution of choice. Resold by IBM, the Enterprise Integration Suite is an industry-leading software suite available as part of IBM's Banking Data Warehouse solution. The Ascential suite addresses all of the key ETL challenges facing Basel II implementations: data profiling, data quality and cleansing, data transformation to and from the centralized data repository, and metadata management. In addition, the Enterprise Integration Suite shares the same strengths as DB2: flexibility and scalability.

The Ascential suite will help you meet these data management challenges:

- Assessing data content/structure, mapping data integration paths, and identifying missing data elements;
- Transforming data from different sources into a standardized format suited to your risk calculation/ reporting needs;
- Data delivery from source systems to the centralized target environment, and from the target environment to individual data marts (and back again);
- Creating a data audit trail, with consistent metadata that will allow internal and external auditors to re-create the numbers in their reports.

In addition, IBM can help financial companies take advantage of eXtensible Business Reporting Language (XBRL) standards for Basel II reporting. XBRL would provide a number of benefits for risk management reporting, including:

- streamlined collection and consumption of Basel II reports;
- ease of data analysis;
- accuracy, currency and compatibility of data.

V. Where will we store all this data?

Basel II compliance will require at a minimum a data store or data warehouse to house the hundreds of gigabytes – and in most cases, terabytes – of business data required for risk analysis and reporting. Companies may also wish to go one step further and create an enterprise data warehouse to extend reporting and analysis to areas of their business beyond risk management.

IBM Business Consulting Services (BCS) can help financial companies in both scenarios. We offer a proven methodology for building operational data stores and data warehouses for the financial industry, based on years of experience in customer engagements. In fact, over 100 financial companies are already using IBM's Banking Data Warehouse solution right now. Whether the objective is a

data store or a data warehouse, the same key issues arise for both in Basel II implementations: flexibility, availability, and scalability.

Flexibility

IBM offers a wide range of servers for all the major operating systems: Linux, UNIX, Windows, OS/390 and OS/400. Even non-IBM hardware is an option thanks to DB2's flexibility. Whether companies are creating a new data store/warehouse, or expanding an existing one, IBM can help you get there using your existing infrastructure.

Availability

The requirements of Basel II reporting will place some heavy demands on data access: real-time reporting, data distribution to and from data marts, etc. The right hardware must be a proven performer at high data volumes, have failsafe features, and integrate smoothly into the enterprise's data infrastructure – the very definition of an IBM server.

Scalability

Scalability plays an important role in the development and subsequent maintenance of any Basel II reporting solution. Many companies are looking at a phased implementation initially: building a solution to address the minimum requirements set forth by the Basel II Accord, and later expanding the solution to address advanced risk calculations. As companies adopt a broader view of data, and as historical data accrues, the data store/warehouse must grow to accommodate more data while still providing optimal accessibility. That's why IBM's Banking Data Warehouse features "built in" scalability features, allowing financial companies to build one solution subject area at a time, adding more subjects as time and budget permit. BDW can literally grow as your implementation grows, providing the ability to handle very complex queries – such as those involving hundreds of tables – when the time comes.

However, most companies will wish to prevent their data warehouse from growing unnecessarily large where possible. With the aid of DB2 Information Integrator, infrequent queries that require live production data or occasional data can be shifted to a federated style. This capability effectively “shrinks” the size of the data warehouse by removing the need to store all of the data in the data warehouse for such “just in case” scenarios that require rarely used data elements.

DB2 Content Manager can also play an important role in the storage of data for risk management reporting. Content Manager provides an enterprisewide content management infrastructure that allows financial companies to seamlessly manage large collections of disparate data types – text-based documents, images, Web pages, rich media – and make them quickly accessible to end users for analysis and reporting. Content Manager also integrates this data with existing enterprisewide applications, including those from Siebel, SAP, PeopleSoft, and other IBM Business Partners.

VI. BDW data models: The very models of efficiency for Basel II

Before risk management reporting can begin, financial companies will need to map their data out to Basel II-specific data models. While some companies may choose to construct their own data models, there is an alternative: using IBM’s pre-built financial data models. The cornerstone of BDW is its data models: the Financial Services Data Model (FSDM) and the Banking Data Warehouse Model (BDWM). These have been specifically designed to address the business intelligence needs of financial companies, based on years of experience in IT engagements. The data models have been extended to now address the unique needs of the Basel II Accord. In developing these data models, the goal was to provide financial companies with a pre-built set of models that can quickly be implemented and customized. The BDW data models address four key areas of business intelligence: risk, relationship marketing, profitability, and asset/liability management.

BDWM provides the historical and atomic data required for a shared infrastructure to support multiple business and analytic functions. Financial companies can choose to implement a data warehouse infrastructure using the BDWM as is, or modify the models to address specific data distribution and performance needs.

The Financial Services Data Model is a fully defined metamodel of the business data concepts and business data items used by financial institutions. FSDM is designed to provide a metamodel architecture with data item definitions in terminology familiar to non-IT business users.

VII. How do we get the data to the people who need it?

Once you've moved all the data to a centralized data server, cleaned it, and stored it in the appropriate data models, the challenge is to deliver that data to end users for risk management reporting. Basel II reporting will require fast access to timely, accurate data across an enterprise (which may encompass different geographies). In addition, financial companies may wish to deliver the reporting results back to the operational data store (or data warehouse) for future analyses. Keeping the end-user reporting environment independent of the central data server is crucial, especially as financial companies look to upgrade their reporting environment to address advanced risk management capabilities.

IBM recommends data marts for departmental risk management reporting. Data marts provide "safe havens" of information in the Banking Data Warehouse infrastructure, housing risk models that can be amended or replaced over time without affecting the integrity of the data warehouse. This is important for Basel II implementations, both for those financial companies that adopt a phased implementation approach that calls for more advanced risk models in later stages, as well as in the event of new risk guidelines introduced by amendments

to the existing Basel II Accord. Data marts also reduce the load on operational systems while ensuring consistency of information across the enterprise. IBM offers a wide array of data mart servers, allowing companies to run DB2 in the operating system of their choice: Linux, UNIX, zOS, OS/400 or Windows NT. All of IBM's servers are highly scalable, proven performers designed to work well in heterogeneous environments.

VIII. Risk management reporting

The goal of the Basel II Accord is to improve the risk management reporting of internationally active financial companies. More accurate reporting, based on a broader view of business data, will help companies identify and balance their risk (both internal and external) with the proper safeguards. Because the level of risk management reporting outlined in the Basel II Accord is more comprehensive than current requirements, many financial companies will need to purchase upgrades to their existing reporting tools or "roll their own" reports. Again, IBM offers a proven, pre-built alternative: IBM business solution templates designed specifically for Basel II risk management reporting.

IBM has developed over fifty Business Solution Templates (BSTs) that address the most common reporting needs facing financial companies, e.g., security analysis, involved party exposure, credit risk analysis, and customer profitability. The BSTs are comprised of three main components:

- 771 re-usable financial measures, including key performance indicators like number of customers, total amount of funds under management, number of transactions, etc. Each measure is fully defined and can be used as a standalone measure or as part of a larger formula;
- 310 financial industry-standard dimensions;
- 57 configurable OLAP templates drawn from combinations of the these measures and dimensions.

The BSTs can be customized and new templates created to address additional reporting needs. Also, new measures and dimensions may be added and incorporated into the existing BSTs.

Combined, the Financial Services Data Model, Banking Data Warehouse Model and Business Solution Templates found in IBM Banking Data Warehouse address the following data management issues:

- business metadata definitions and standardization;
- OLAP requirements and database generation;
- OLAP definition of higher level-derived measure calculations;
- design of a central data store or data warehouse;
- an “open” infrastructure for mapping data sources and targets.

IX. On-line analytical processing (OLAP) and data mining

On-line analytical processing plays a key role in risk management. Financial companies will need to perform multi-dimensional analysis of their business data to determine where, and to what extent, their capital is at risk.

IBM offers two OLAP solutions, available individually or as part of a total BDW solution: IBM DB2 OLAP Server and IBM OLAP Miner. DB2 OLAP Server is based on the popular Essbase OLAP Server, known for its ability to provide “speed of thought” response times and handle advanced calculations. OLAP Miner extends the value of DB2 OLAP Server by allowing business users to detect statistical deviations in various business areas. Under the BDW infrastructure, the data marts attached to the centralized data warehouse are in effect OLAP cube data marts built from quick-start templates. These templates address specific reporting solutions required under Basel II, including credit risk, market risk, interest rate risk, and structure of capital. Note that the templates also address reporting solutions beyond the scope of Basel II, including relationship marketing and profitability.

Data mining can also play an important part in a risk management solution, helping financial companies predict possible bankruptcies or loan defaults. BDW supports data mining functionality, including IBM DB2 Intelligent Miner for Scoring (to determine probability of default, for example) and data mining

software from SAS Institute, an IBM Business Partner. In addition, DB2 data mining extenders enable the BDW solution to detect anomalies and potentially risky situations. For example, data mining could be used to identify patterns of at-risk behavior in areas such as major construction loans, money laundering, or other instances where large amounts of money are on the move.

X. Choosing the right guide down the road to Basel II compliance

Partnering with experienced consultants can remove much of the risk inherent in a complex project like meeting Basel II compliance. IBM Business Consulting Services can provide financial companies with experts in risk strategy, Basel II readiness assessment, and risk engine development, as well as all of the IT services normally associated with a data warehouse implementation. In addition, financial companies that wish to extend functionality beyond the traditional range of BDW can enlist IBM consultants to help them:

- explicitly calculate the credit risk on a specific exposure
- explicitly summarize exposures for the one counterpart
- analyze concentration risk
- calculate Value at Risk (VaR)

XI. Leveraging your Basel II implementation for IAS compliance

While internationally active financial companies are currently focused on Basel II compliance, other potentially sweeping industry changes loom on the horizon. In particular, new International Accounting Standards (IAS) will need to be met by financial companies in the European Union by 2005. The data management infrastructure provided by IBM Banking Data Warehouse can also be leveraged to address the data aspects of the new IAS code, specifically:

- IAS 30: Disclosures in the financial statements of banks and similar financial institutions
- IAS 32: Financial instruments – disclosure and presentation
- IAS 37: Provisions, contingent liabilities and contingent assets
- IAS 39: Financial instruments – reconciliation and measurement



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