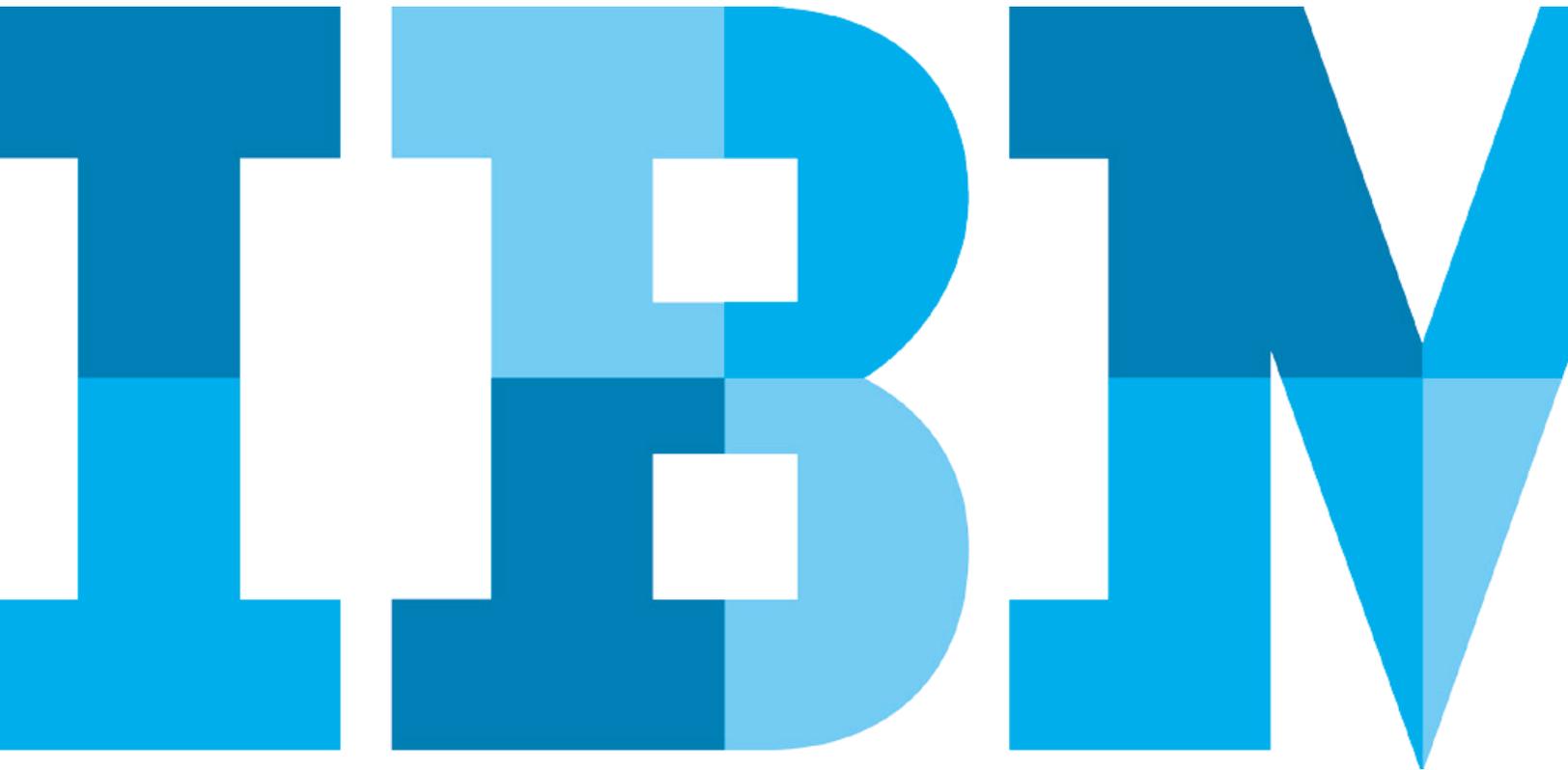# IBM Banking & Financial Markets Data Warehouse Model Support for Payments

Whitepaper

Introduction

Payment Industry Challenges

There are significant challenges for financial institutions in managing, reporting and analyzing the large amount of payments data originating from disparate sources. The payments industry is undergoing a significant level of change, with multiple drivers, including increased regulatory reporting requirements, standardization of frameworks/processes, technological advances and requirements for faster payment processing times, new payment methods and increased competition, with new types of payment service provider (PSP) entering the market.

Volumes of electronic payments are predicted to continue to grow globally, as traditional methods such as cash and check decline. Industry estimates suggest a 5-percent annual rise in volume worldwide, with greater growth in Asia Pacific and Latin America. For example, the number of electronic transactions rose from 240 billion in 2008 to 370 billion in 2013, and is forecast to rise to 550 billion by 2018[1].

For financial institutions providing payments services to their customers, revenues have returned to steady growth, as recovery from the financial crisis continues. The growth in the industry is forecast to continue over the next number of years. For example, global revenues are forecast to grow at 8 percent a year through 2018, at which point annual revenues will reach $2.3 trillion and account for 43 percent of all banking services revenues, compared to 34 percent in 2009[1].

In order to understand how a financial institution is positioned to meet these various challenges, it is important to have a means of bringing together and analyzing the underlying payments data.

Financial institutions can find it difficult to determine the level of costs and revenue generated from individual products and services provided to their customers, or to analyze the breakdown of such costs and revenue. This type of analysis is critical for the financial institution to determine charging models for their products and services, and also to benchmark against competitors in the market. An understanding of costs and allocation of overheads (such as IT, staff, and office costs) is critical to both Product Management and Business Operating Model decisions.

In an era where customers increasingly scrutinize the range of products, level of charges, and level of service offered by their financial institution, they are more likely to switch providers if their service expectations are not met. In order to ensure that they continue to attract and retain customers, it is important for the financial institution to closely monitor operational efficiency and service levels provided.

With the emergence of new Payment Service Providers (PSPs) in the market, the reliability and performance of payment services needs to be understood. The impact of increased competition has been a focus on reliability, consistency of service provision, and cost effectiveness. One advantage that financial institutions have over other types of PSP is the potential to integrate payments information with the rest of the financial institution's data to establish a customer 360-degree view and provide a better customer experience.

Advances in technology have enabled faster payment processing times, as well as new payment methods. This places greater focus on ensuring that payments are processed within set tolerance levels for both processing time and exception levels, which need to be measured against agreed thresholds, whether set by industry standard or individual customer service level agreement.

Payments data needs to be consolidated from various sources including operational systems, payment hubs/engines, and other PSPs/merchants). The legacy payment system data of many large financial institutions has become siloed, and frequently remains locked within a patchwork of disparate operational systems that have evolved over time. This can result from many factors including infrastructure, point solutions, technology restrictions and mergers of businesses.

There have been many technological advances over the past few years, which financial institutions are integrating to their businesses. These range across the entire architecture, impacting:

- at the customer side (use of mobile devices to pay for goods or make peer-to-peer payments)
- at the merchant side (point of sale Near Field Communications)
- within payments networks (such as increased standardization and faster payment execution times)
- within financial institutions' systems architecture (financial institutions are aiming for greater integration of data from disparate systems at an enterprise level, more frequent feeds of data into data warehouses, providing opportunities for more up-to-date information)

The regulatory landscape continues to evolve, and in the area of payments this has brought additional mandatory data capture and reporting requirements, which can vary across jurisdictions. There are a number of standardization initiatives running simultaneously, some of which are cross-border. Many of these regulations and directives, such as SEPA, have had a large impact on the industry over the past few years. All of these requirements place extra pressure on the limited resources of financial institutions to integrate and manage all of their data effectively, and to produce meaningful analysis at an enterprise level.

Figure 1. Forces affecting industry participants.

Using IBM Banking and Financial Markets Data Warehouse to Address Payments Challenges

IBM® Banking and Financial Markets Data Warehouse (BFMDW) is an extensive set of interconnected models, driven by financial-services-centered business requirements. These models accelerate the design of enterprise data warehouse business intelligence solutions.

A data warehousing implementation is a fundamental solution for the amalgamation of the large volume of payments transactional data that financial institutions need to store and analyze. Payments data gathered from across the financial institution can be consolidated into an enterprise repository, and integrated with the rest of the enterprise's business data. For example, customer experience analysis could be conducted giving a customer-centric view into their perception of the payments products and service levels as part of the overall business they perform with the financial institution. Similarly, payments data could be integrated with the profitability profile of the financial institution's entire product and service portfolio.

Gathering the payments data together into a single consolidated hub facilitates the analysis and reporting of current, priority requirements, but also provides the flexibility to adapt to additional or changing requirements in the future.

Key advantages to a data warehouse solution to managing payments data include:

- integrated enterprise payments data for a single view of the impact on the provision or facilitation of payments services on the financial institution
- historic record of payments data both at transaction and aggregated level, which facilitates supervisory and auditor review of the data along with supporting the analysis of trends and stressed scenario testing
- consolidated enterprise business data for the analysis of payments data across lines of business and customer portfolios
- provision of aggregated design structures for the capture of summarized or calculated payments data to facilitate downstream query and analysis
- streamlined query and application access of the data from one consistent hub

The data warehouse model design of BFMDW also supports the segregation of information into data marts/star schema structures, to address specific analytical topics. This facilitates the storage of topic-based information that is in a more accessible format for data querying while also providing a consolidated access point for aggregated information. BFMDW is deployable on multiple Data Base Management Systems (DBMS) and is not restricted to specific hardware or software environments.

BFMDW Components

Business Terms

The vocabulary of the business is represented in a structured format as the Financial Services Data Model (FSDM).

Atomic Warehouse Model (AWM)

Comprehensive logical data model containing the predefined data warehouse structures required to store all financial services data in an efficient layout for historical and atomic data.

Dimensional Warehouse Model (DWM)

Comprehensive logical data model containing the predefined data warehouse structures required to store all financial services data in an efficient layout for analytics.

Supportive Content & Project Scopes

Captures non-reporting requirements in a particular domain and relate those to the data warehouse model entities, relationships and attributes. Project scopes define a business issue in terms of a set of items within a data warehouse project.

Analytical Requirements

Reporting requirement specifications providing subject-oriented definitions of the reporting and analysis requirements of an organization. Over 160 predefined business reporting requirements templates addressing the common business reporting and analysis requests from risk, finance, compliance, CRM and line-of-business users.
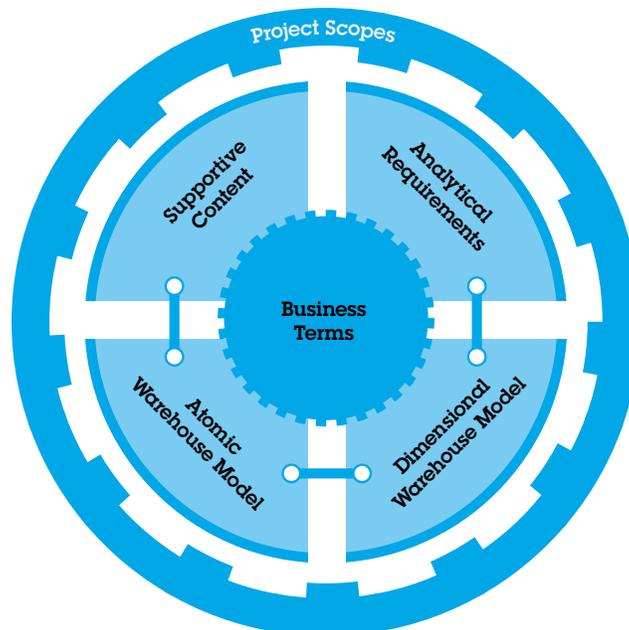

Figure 2. BFMDW components

BFMDW Support for Payments

BFMDW is a design for an enterprise data integration environment. BFMDW can be used to design and develop an enterprise data warehouse to bring together an integrated view of the financial institution's data relevant to supporting the analysis of payments data.

The advantage to bringing together all of the financial institution's data into a data warehouse is that a wide range of analysis can be carried out in a consistent way for the enterprise, providing the ability to compare or aggregate data from across the enterprise as required.

Key Metrics for Payments

Payments analytics are crucial to financial institutions in providing clarity in a number of key areas of their business. In order to ensure that the financial institution is positioned to meet the challenges of the large-scale changes occurring in the industry, and to attract and retain key customers, there are some key indicators that should be monitored. These include metrics in the areas of product and service profitability, operational efficiency, evolving industry trends, risk management and regulatory compliance. BFMDW can help address these requirements by providing a set of predefined Analytical Requirements, which define reporting requirements within each of these areas listed in Figure 3.

Key Metric	BFMDW Analytical Requirement
Costing service offerings, measuring profitability	• Payment Volume and Cost Revenue • Payment Service Profitability
Assessing operational efficiency	• Payment Service Performance • Payment Service Reliability • Payment Service Provider Analysis
Recognizing trends and anticipating demand for services and products	• Payment Limit Exception Analysis • Customer Experience Analysis
Detecting fraud and reducing risk	• Payment Origin and Destination • Payment Card Fraud Analysis • Payment Card Merchant Analysis
Meeting regulatory requirements and standardization initiatives	• High Value Outward Payment • Inward Payments • Inward Payment Rate Tolerance • Inward Payments Volume • Inward Payment User Activity

Figure 3. Key metrics for payments

Within the BFMDW integrated model set, these requirements are mapped to predefined data warehouse structures in the Atomic & Dimensional Warehouse Models (AWM & DWM), providing an understanding of the path to implementation. They are also mapped to Business Terms/FSDM, which links the common, enterprise-wide business terminology of data requirements, supporting an understanding of context.

Analytical Requirements

BFMDW provides extensive coverage for the management of payments data, enabling integration with the rest of the financial institution's data such as customer, product or geographical region, to provide a basis from which to produce complex analysis and reports.

Costing Service Offerings, Measuring Profitability

It is critical to financial institutions to have the ability to analyze the costs involved in offering payment services to their customers, and to understand the revenue that is generated from these products and services.

A comparison of this analysis over time periods allows recognition of trends (for example in terms of payment types, methods or currencies), which is useful in anticipating future demand and in informing decisions around product offerings.

BFMDW provides the following Analytical Requirements, which can be used as reporting templates:

- Payment Volume and Cost Revenue
- Payment Service Profitability

The type of information that a financial institution would benefit from extracting from their payments data would typically include:

- Amount of revenue generated from payment charges and fees
- Comparison of payment transaction processing costs, actual versus budget
- Volume of payment transactions included in fixed price agreements, and volumes transactions outside of agreed thresholds
- Losses incurred by the financial institution due to payment processing exceptions or fraud, which resulted in refunded fees or compensation paid to customers
- An analysis of the profitability of payment services provided to customers, comparison against budget, and across time periods

It is important to have the ability to evaluate the drivers for the cost and revenue measures in order to inform decisions around product and service pricing. An insight into of the allocation of costs and revenue is critical to understanding the drivers of profitability. For example, the allocation of revenue to the Organization Unit responsible for generating the business, or the allocation of costs based on factors such as headcount, office space occupied or IT resource usage.

This analysis can also be broken down in a number of ways in order to provide cost & revenue comparisons - for example across payment transaction types, source & clearing channels or organization units. Through reviewing trends over time, this information can be used to support decisions regarding the rationalization or expansion of payments services, systems or operations.

Assessing Operational Efficiency

Performance of payment processing services is an area of particular interest to financial institutions and their customers, as competition in the industry increases, and new Payment Service Providers (PSPs) enter the market.

Faster payment processing times is a key objective for the industry as it develops the capability for near real-time payment systems, and financial institutions implement the changes necessary to provide these services to their customers.

Resilience and reliability of payment services are likely to impact directly on customer's satisfaction levels and retention rates.

BFMDW provides the following Analytical Requirements to address these types of reporting requirements:

- Payment Service Performance
- Payment Service Reliability
- Payment Service Provider Analysis

These specifications are designed to analyze key metrics in the area of:

- Measurement of the levels of straight through processing (STP) versus manual interventions in payments processing
- Payment processing exception levels monitored against tolerance levels, whether specifically agreed customer thresholds or industry benchmarks
- Analysis of the reasons for exceptions, and the cost of manual interventions
- Trend analysis over time to ensure that service levels are improving

In evaluating the efficiency and reliability of the payments service, this measurement data can be categorized using dimensions such as:

- Channels, Systems, and Organization Units involved (for example, for comparison purposes: to identify problem areas, or to inform decisions on rationalizing fragmented services)

- Causes of payment processing exceptions (for example, to inform system or process improvement initiatives)
- Payment types, methods & service levels (for example, in comparison of processing times against agreed service levels for key customers)

Recognizing trends and anticipating demand for services and products

Customers require their Payment Service Provider to offer new products and services as the market evolves, therefore being aware of changing trends and demands is key to customer retention. Analysis of traditional and newly emerging payment types and service providers to identify changing customer trends can guide the evolution of products & services.

Measurement of customer experience with the financial institution's services over time can provide valuable insight into their relationship with the financial institution, and serves to monitor levels of satisfaction. Measures might include payment STP levels, exception and complaint resolution times.

Limit violations can have significant implications for financial institutions, including operational and credit risk impacts. Application of limits in payment processing, and limit breaches causing exceptions need to be monitored over time - analyzing past events might help predict and mitigate against future limit breaches. Various types of limits might apply, including customer arrangement credit limits or periodic value, volume or currency limits. Drilling into this information to examine the types of limits that are being breached, as well as the reasons for the limit violations, might provide useful indicators for a changing financial climate for individual customers or groups of customers in specific industries.

BFMDW provides the following Analytical Requirements, which can be used as reporting templates:

- Payment Limit Exception Analysis
- Customer Experience Analysis

Useful aggregation points in evaluating the above analysis include:

- Limit Type & Reason, Violation Severity (for example, credit limit, regulator imposed, resulting in restricted customer privileges)
- Payment Service Type (for example, bulk payments, managed interfaces to payment channels)
- Geographic Area or Market Segment (for example, compare customers across region/segment)
- Industrial Classification (primary economic activity of the organization, for example, retail trade)
- Correspondent Banks and Intermediaries, Payment Service Providers (recognize significant changes in the market)

Detecting fraud and reducing risk

In an effort to prevent fraud and to comply with regulatory requirements, additional data is now required for payment transactions. This includes information regarding the roles of multiple parties involved in payments, such as "ultimate" originators and beneficiaries of payments, intermediaries and correspondent banks and other payment service providers involved in the process

BFMDW provides the following Analytical Requirement, which can be used a reporting template:

- Payment Origin and Destination

This Analytical Requirement provides opportunities for analysis to support increasing regulation around the movement of funds, which requires greater monitoring of payments, particularly those potentially involving restricted (embargoed) persons or countries, or in controlled currencies.

Analysis of location information, both geographical area and electronic addresses, supports requirements to track the origin and destination of payments. Other useful analyses include comparisons of the levels of domestic & cross-border payments, same currency & cross-currency payments. This can be used in the recognition of regional trends (for example, growth or decline in mature established markets or in developing markets), anticipation of demand, and the identification of new opportunities in emerging markets, payment methods or currencies.

BFMDW provides the following Analytical Requirements, which can be used as reporting templates:

- Payment Card Fraud Analysis
- Payment Card Merchant Analysis

Payment Card Fraud Analysis examines the risk associated with fraudulent use of payment cards, with emphasis on suspicious transactions, credit checks and limit violations. Payment Card Merchant Analysis focuses on the arrangements that a financial institution has with merchant organizations, and reports on the authorization and processing of payments transactions using payment cards.

Drilling down into these analyses can support investigations into potentially fraudulent payment transactions emanating from a specific channel, fraud loss bearer, geography, merchant or industry sector, in order to quantify metrics such as the level of card usage, suspicious transactions, credit checks, verification times and limit excesses.

Meeting regulatory reporting requirements and standardization initiatives

Regulatory controls continue to evolve, requiring ever-increasing capabilities to monitor and report on the movement or attempted movement of funds. There is also increased impetus to standardize payment products, which are being accelerated by international initiatives to bring greater integration of payments processes and infrastructure.

An example of a large-impact standardization initiative is the Single Euro Payments Area (SEPA) - a European Union payments integration initiative, whose objective is to develop a set of harmonized payment schemes and frameworks for electronic euro payments within the euro area.

BFMDW provides the following Analytical Requirements, which can be used as reporting templates:

- High Value Outward Payment
- Inward Payments
- Inward Payment Rate Tolerance
- Inward Payments Volume
- Inward Payment User Activity
- Outwards Payments

BFMDW provides the underlying data structures to support SEPA analytical reporting. A specific set of report templates provides analysis of all outbound and inbound payments within time period and value range. These templates can be used to design and develop reporting capability incorporating payment volumes and value ranges, rate tolerance and the level of activity of users processing the payments.

Atomic Warehouse Model

The Atomic Warehouse Model (AWM) provides the design structures to capture atomic operational payment detail from the actual transactions, source and target accounts, and related parties (including customers, originators/beneficiaries and service providers). The information is captured at a fine grain of detail so it can be summarized or aggregated as required for downstream analysis.

This flexible structure can easily be expanded for capturing new characteristics and types of payment data, and is fully integrated with the rest of the financial institution data for risk, compliance, profitability and relationship marketing.

The model encompasses the complex interrelationships between the core data concepts such as Events (including payment transactions), Locations (both geographic and electronic), Arrangements (such as accounts or payment service arrangements) and Involved Parties (such as Customers, Financial Institution, Intermediaries/Correspondent Banks, Payment Service Providers, Ultimate Beneficiaries & Originators). This supports the requirement to track the roles of multiple Involved Party's for a given payment.

Payments can be classified in many different ways including payment transaction type, method, direction and status of payment, and reason for any exception in the processing. Summary entities are designed to hold aggregated data (such as volume and value of payments) for defined measurement periods.

Accounting support within the AWM provides a means of reflecting the hierarchical nature of the chart(s) of accounts of the financial institution. These structures can be adapted to support the tracking of both monetary and non-monetary standings.

The allocation of costs and revenues associated with payment products and services can be configured to allow the cost and revenue amounts to be distributed in a way that reflects the business allocation. For example, the allocation of revenue to the organization unit that manages the customer relationship.

Mappings are provided from the Analytical Requirements to the AWM, identifying the elements of the data model that are relevant, and giving a fast path to the elements that need to be supported in a physical implementation.

Figure 4 represents a subset of the specific payments support included in the AWM, at a summarized level. The complete AWM contains a normalized set of attributed entities and their complex interrelationships.
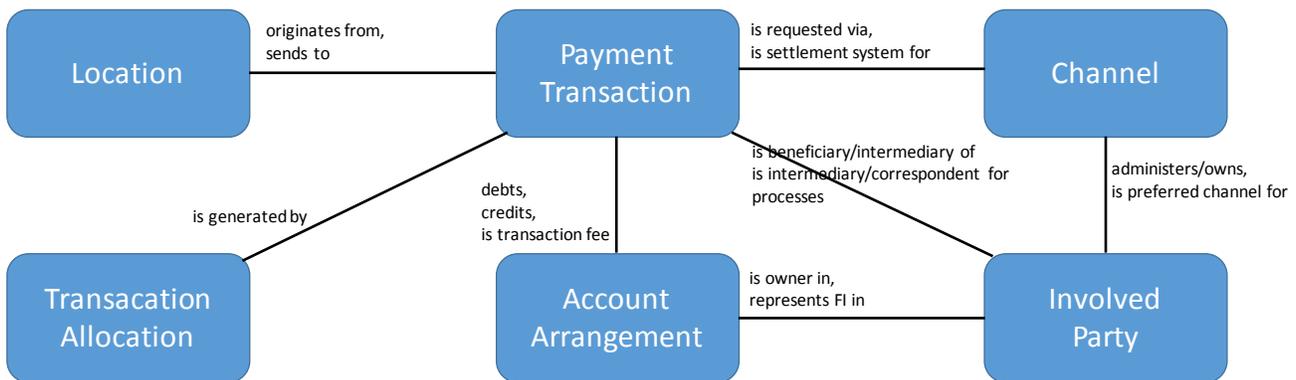
Figure 4. Conceptual level diagram representing a subset of the specific payments support included in the AWM

Dimensional Warehouse Model

The Dimensional Warehouse Model (DWM) provides the link to the predefined logical data warehouse structures, which are derived from the Business Terms/FSDM and the Analytical Requirements. DWM content can be derived from the atomic data represented in the AWM (the integrated data structures to capture the payments transactional data and aggregated reporting detail).

This dimensional data repository holds sufficient and complete data to meet the needs of business user analysis. Dimensional models are easily understood by business users. They are optimized for data querying rather than for transactional speed, and their structure makes it is easier to extend them to support new data requirements.

Analysis of payments events is supported in the DWM through a set of Aggregate Facts that have been developed based on each of the payments-related Analytical Requirements listed above.

A set of Conformed Dimensions have been defined to describe reusable aggregation paths for measures across multiple Facts. These common dimensions include parties, locations, products & services, and these are reused extensively across the DWM, allowing a financial institution to combine their data for flexible reporting purposes.

For example, in the analysis of service levels, the Payment Service Performance fact entity tracks a different set of metrics to those measured by the Payment Service Reliability fact entity, but they share many dimensions such as Channel, Arrangement and Customer.

Figure 5 represents a subset of the DWM entities and relationships involved in the assessment of operational efficiency for payments support. The complete DWM contains star-schema-style dimensional data structures organized around fact entities that support Analytical Requirements.
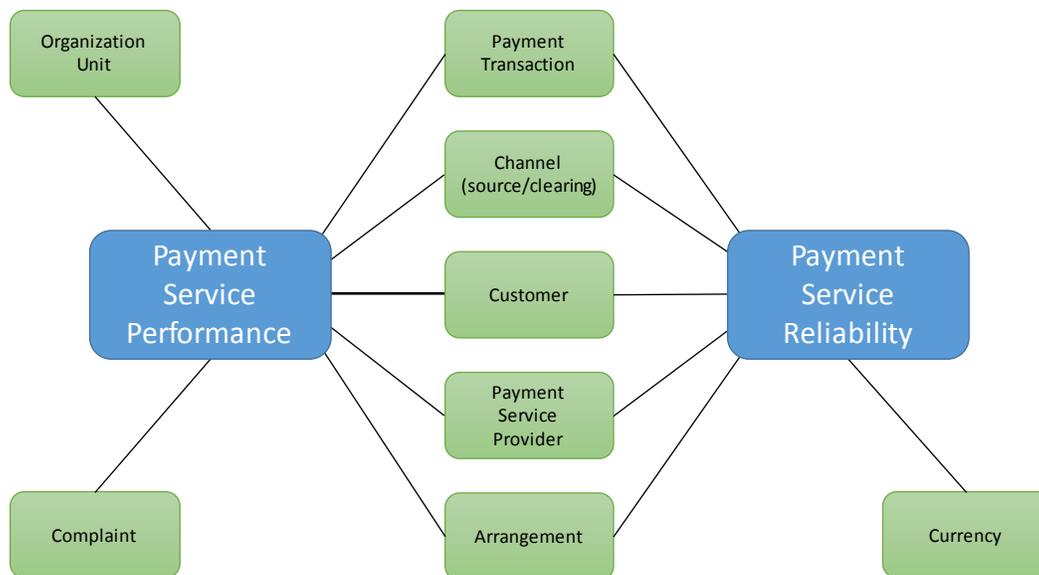

Figure 5. A subset of the DWM entities and relationships involved in the assessment of operational efficiency for payments support.

Business Terms

The business terms component in IBM Banking Data Warehouse is delivered as the Financial Services Data Model (FSDM). Business Terms represent the vocabulary of the business in a structured business language format using IBM InfoSphere™ Information Governance Catalog.
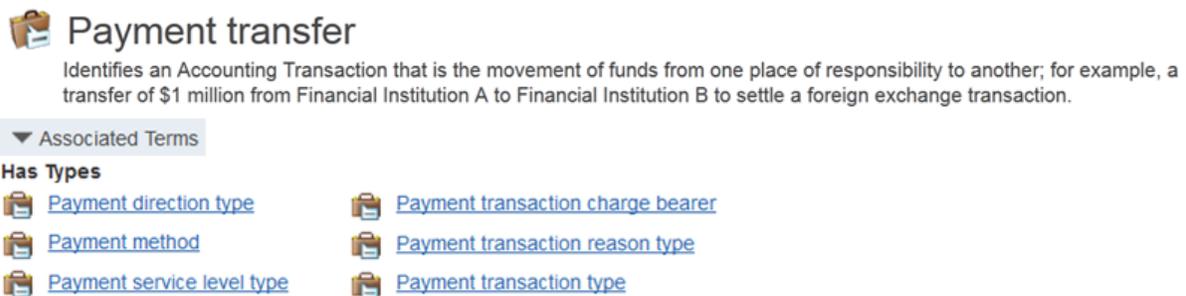
This common business terminology provides the thread to tie together all of the data contained in the various BFMDW component models. The content of the other models is mapped to this common set of Business Terms, which ensures a consistent definition of the data items, and a common understanding across the enterprise.

Business Terms describe business concepts in a top-down manner, from the most abstract to the most specific. There is extensive coverage for payments terminology built into the Business Terms, within the core data concepts such as events and involved parties. These terms cover both the descriptive data and also the classifiers, which are used as aggregation points (dimensions) in the analysis of payments data.

Mapping from the data items in the Analytical Requirements to the common Business Terms allows for reuse of existing definitions, and supports conformity across the organization, which ensures that data which originates from multiple sources can be brought together into a data warehouse and analyzed or aggregated as required. Common definitions of terms such as geographic location, organization unit and payment transaction type, including the level of granularity at which these codes are applied, facilitates cross-enterprise analysis.

For example, a set of Business Terms which classify payments is part of a hierarchical structure of terms within Transactions, which in turn is part of the Events concept.

Figure 6 shows the business term Payment Transfer, with a sample set of its associated terms, including Payment Method and Payment Transaction Reason Type.

Figure 6. An example of a Business Term.

Supportive Content

Supportive Content is a method of mapping external business standard terms to the Business Terms component. This helps business users to understand how external business terms are represented in the models. For example, requirements arising from the Single Euro Payments Area (SEPA) initiatives can be represented by structured groupings of data elements, such as Bank-To-Bank Direct Debit/Credit Transfer Rulebooks. SEPA rulebook taxonomy is supported in the BFMDW Supportive Glossary and is mapped to the Atomic Warehouse Model.

The benefit of such a hierarchy is in logically organizing the data requirements into cohesive groupings, and in translating data requirements into their support in the data warehouse model. Financial institutions use BFMDW to understand the availability of data in their data stores, and can then use this mapping to trace back from the Supportive Content through the layers of their information architecture, to assess any possible data gaps.

Project Scopes

Project scopes select the specific subset of elements needed to address a particular set of data or reporting requirements. Each BFMDW project scope can then be extended to include the relevant pre-defined mappings that exist between the Analytical Requirements, Supportive Content, and the Atomic and Dimensional Warehouse Models as required.

Project Scopes are the method by which business issues are captured within a data warehouse implementation project. A project scope defines the business issue in terms of a set of items, possibly from several different constituent models, within a data warehouse instance. Users of the data warehouse can create their own project scopes to support their project requirements.

An example of a BFMDW project scope is Payment Analysis, in which the payments-relevant data elements are mapped to the data warehouse. This supports the scoping of payments reporting and analysis requirements and supportive content, and automatically selects the most appropriate data warehouse entities and attributes that support those requirements. This can be customized over time as additional reporting requirements are identified.

Conclusion

By providing a comprehensive design for amalgamating all of a financial institution's data, BFMDW provides multiple perspectives at the enterprise level, including an integrated payment service or customer-centric view of the information. This insight is important in supporting the management of customer relationships, and ensuring that the balance between profitability and service excellence is maintained.

BFMDW provides an enterprise design model for the capture and integration of business information from all lines of business, providing a full view of the financial institution's data. It offers an integrated solution to viewing enterprise data, with an emphasis on reuse, so that elements of solutions developed for specific business areas such as payments, risk or relationship marketing can be reused or extended for new projects, reducing development and implementation time.

BFMDW promotes an open architecture, which allows financial institutions to implement the data warehouse using their own portfolio of software. BFMDW can help financial institutions create a physical data warehouse architecture that is tightly integrated with the logical environment, facilitating the communication of requirements between business and IT.

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[1] McKinsey & Company: "Global Payments 2014: A Return to Sustainable
Growth Bring New Challenges", September 2014