Business Objects
an SAP® company

DEVELOPING A UNIVERSAL APPROACH TO CLEANSING CUSTOMER AND PRODUCT DATA

CONTENTS

DATA QUALITY: WHAT'S THE PROBLEM?

Data quality has always been an important issue for companies, and this is even more the case today. Business and legislative pressures coupled with the explosion in the amount of data created by organizations is leading to increased corporate attention on improving the quality and accuracy of business data.

This paper reviews current industry problems concerning data quality, and takes a detailed look at how companies are addressing quality problems with customer, product, and other types of corporate data. It explains why data quality projects often evolve into master data management projects, and discusses how master data can be extracted from unstructured business content and integrated into traditional corporate data systems.

The paper looks at the role of data cleansing tools in helping improve data consistency and accuracy, and explains why companies need to take an enterprise-wide approach to data cleansing and data quality management. Products and use cases from Business Objects, an SAP company, are used in the paper to demonstrate how vendors are supporting data cleansing, and to illustrate how customers are using such capabilities.

THE COST OF POOR DATA QUALITY

There has been a steady stream of articles in the press about the impact of poor data quality on the business ever since companies began building data warehouses and examining the quality of data flowing into them. Here are some early examples:

> "The survey showed that estimates of poor information quality costs vary from one to 20% of total company revenues. This disparity in cost estimation existed not only from company to company but among senior information technology managers within the same organization."
>
> – Andrea Malcolm, "Poor Data Quality Costs 10% of Revenues, Survey Reveals," *ComputerWorld*, July 1998.

Author: Colin White, BI Research

"The Data Warehousing Institute (TDWI) estimates that poor quality customer data costs U.S. businesses a staggering $611 billion a year in postage, printing, and staff overhead."

– Wayne W. Eckerson, "Data Quality and the Bottom Line," *TDWI Report Series*, 2002.

More recent articles show the situation has not improved:

"Poor data quality costs the typical company at least 10% of revenue; 20% is probably a better estimate."

– Thomas C. Redman, "Data: An Unfolding Quality Disaster," *DM Review*, August 2004.

"Companies are investing billions of dollars in CRM applications and data integration projects to gain a better view of their customers – only to discover that conflicting data makes them blind. Gartner estimates that more than 25% of critical data within large businesses is somehow inaccurate or incomplete. And that imprecise data is wreaking havoc."

– Rick Whiting, "Hamstrung By Defective Data," *InformationWeek*, May 2006.

Although nobody disputes that poor data quality has a significant financial impact on companies, the figures in these articles are so variable and so imprecise that there is a risk of reader fatigue when discussing data quality issues at this superficial level of detail. Maybe this is why so many reports show that a high percentage of organizations feel they have a data quality problem, while at the same time indicating that an equally large number of organizations are also doing little about it.

The problem is that "data quality" is a vague term that means different things to different people. Before data quality problems can be discussed in detail, data quality must be defined more precisely.

WHAT IS DATA QUALITY?

A useful definition of *quality* can be found in the ISO 8402 specification, which defines quality as, "The totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs." If we apply this definition to data, then it means that data quality is dependent not only the characteristics of the data itself, but also on the business context in which it is used, i.e., on the business processes and business users that employ it.

This is somewhat analogous to product quality. All product manufacturers have quality assurance programs, but no product is ever 100% perfect, or 100% safe. The degree to which a customer can accept a less than perfect or safe product will depend on the type of customer buying the product, and on how the product will be used. The quality and safety of a product, however, is also dependent on how much money a manufacturer is willing to spend to develop and produce the product, which in turn is dependent on how much money a customer is willing to pay for it.

All of these factors apply equally to providing and supporting data quality.

MEASURING DATA QUALITY

While researching ISO 8402, I came across an excellent 1994 paper by Robert Walker, chairperson of the Association for Geographic Information (AGI) Standards Data Quality Working Group. He had this to say about the quality of data:

"Clearly, quality issues vary depending on the type of data and the purpose to which it is put. The criteria that are widely used for assessing data quality are as follows:

Lineage: This covers the ancestry of the dataset. It describes the source material from which the data was derived and the methods of derivation. The description of the source material should include details of editions and dates of that source material and any ancillary information used for updates. The methods of derivation should include details of the operations used, the logical processes (for example, algorithms and transformations) and details of any subsequent processing used in producing the final digital data.

Accuracy: This is the closeness of the topic data associated with an object or feature, to the true values, or values that are accepted as being true. It is usually recorded as a percentage correctness for each topic or attribute.

Currency: This is the level at which the data is current (as opposed to the date of the last update).

Logical consistency: This is the fidelity of data in relation to the data structures.

Completeness: This is a measure of the correspondence between the real world and the specified dataset. It includes a statement of the rules for including or excluding items from the dataset."

Although these comments concerned geographic data, the attributes of lineage, accuracy, currency, logical consistency, and completeness apply equally to all forms of data, regardless of its type or source. To maintain data quality, organizations need to constantly monitor and measure these attributes as a part of an ongoing *data quality program*.

COMPONENTS OF A DATA QUALITY PROGRAM

Figure 1 (courtesy of Business Objects) illustrates the main tasks of a data quality program.

The first task is to *measure* and *analyze* (or *profile*) the data to determine the type and number of defects that may exist. This step provides the knowledge required to develop a strategy to improve the quality of the data. Once this has been done, the next task is to *cleanse* (parse, standardize, and correct) the data. This requires parsing it into its individual components, standardizing data formats and values based on internal and industry business definitions and rules, and applying cleansing algorithms to remove syntactical or semantic data errors. At this stage in the process, additional data elements can be added as required to the data to *enhance* its information content.

Data associated with a business process may come from a variety of different sources, and although the data may be consistent and correct for any given source, merging it with other sources can lead to duplicate records, and redundant or inconsistent data elements. The role of the *match* and *consolidate* tasks is to resolve and remove this duplicate, redundant, and inconsistent data.

Once the data has been cleansed, enhanced, consolidated, and merged, it is ready for use. The quality of the data, however, must be *monitored* and *profiled* on a continuing basis to measure its accuracy, currency, consistency, and completeness.

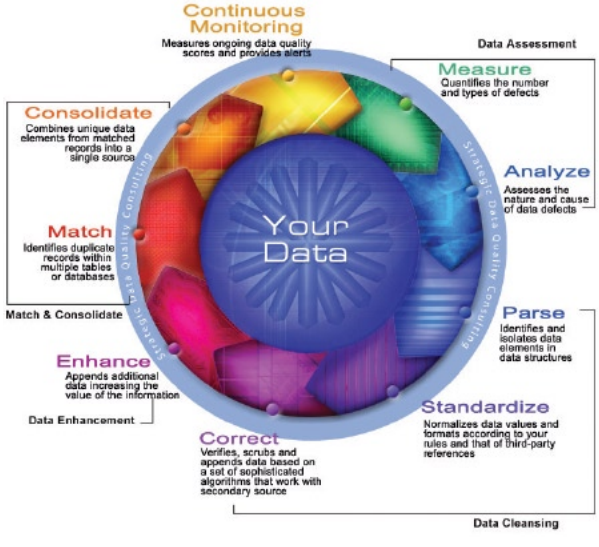


Figure 1: Components of a Data Quality Program [Source: Business Objects]

A BUSINESS PROCESS PERSPECTIVE TO DATA QUALITY

IT staff usually think of data quality initiatives in terms of individual applications. From a business perspective, however, the problems caused by poor data quality typically surface in the business processes of the organization. Examples include:

- Wasted marketing efforts and costs
- Customer dissatisfaction
- Shipment, delivery, and billing errors
- Excess inventory
- Incorrect financial statements
- Delays in new product introduction

To improve data quality, IT staff must change their application-specific approach to data quality initiatives, and align them instead with key corporate business processes, such as customer marketing and supply chain optimization, and underlying business entities like customer and product. This alignment helps improve data consistency across application systems, which in turn simplifies data integration tasks, such as building an integrated product catalog or creating a single view of the customer.

An example of the business case for approaching data quality improvement from a business process and business entity perspective can be found in a reply to an April 2006 Business Intelligence Network blog ("Surprise! Poor Data Quality Costs a Lot of Money") by David Loshin:

> "At Shell, the business thought it was selling 20,000 product combinations to 20,000 commercial customers, and was actually selling 5,000 products to 6,000 customers! It can be seen that the potential for cost saving in a situation like that was significant."

Data quality initiatives to correct problems like those at Shell can only succeed, however, if an organization understands its business processes, and the data and data quality required by those processes. In this way, actual data quality can be measured against required data quality, and a business case built to address those data quality issues that provide the best return on investment. Unfortunately, this understanding is severely lacking in many companies.

Data Quality Problems by Business Entity

A TDWI survey published in an April 2006 research report on data quality ("Taking Data Quality to the Enterprise through Data Governance" by Philip Russom) showed that customer and product data are the two main types of business entity that are especially susceptible to quality problems. Surprisingly, as can be seen in Figure 2, financial data came third in the table of results. Customer and product are two of the main components of the *master data* of an organization.

Type of Business Data	Percentage of Respondents
Customer Data	74%
Product Data	43%
Financial Data	36%
Sales Contract Data	27%
Data from ERP Systems	25%
Employee Data	16%
International Data	12%
Other	10%

Source: TDWI

Figure 2: Business Entities Susceptible to Data Quality Problems

The Role of Master Data

Master data is defined as data about the key business entities of an organization. Examples include customer, product, organizational structure, and chart of accounts. A common question about master data is, "What is the difference between master data and reference data?" Some people take the position that they are the same thing, but it can be argued that not all reference data is master data. For example, lookup and code tables that are used to encode information, such as state names and order codes, are not strictly master data tables.

The dividing line between master data and reference data is not always clear-cut. One solution is to break master data into two types: *master reference* data and *master business entity* data. Master reference data has well-defined and simple data structures, has simple keys and governance rules, is often standardized (U.S. state codes, for example), involves only a few applications, and is reasonably stable.

Master business entity data, such as customer and product, on the other hand, is usually ill-defined, has complex data structures and relationships, requires compound and intelligent keys and complex governance rules, is not usually standardized, involves many applications, and changes frequently.

Does this distinction really matter? When developing data quality management and master data management systems, it does. Cleaning and managing master reference data is a reasonably easy job. Cleaning master data, on the other hand, is a complex task and requires data cleansing tools that are specifically designed for that purpose.

As companies begin to realize that they must focus data quality efforts on specific business processes and business entities, the ability to manage master data becomes increasingly important. This is why many data quality initiatives often evolve into master data management projects. The Business Intelligence Network recently published a report ("The Pillars of Master Data Management: Data Profiling, Data Integration and Data Quality") by David Loshin that discusses this topic in detail and is recommended reading.

TYPES OF DATA INVOLVED IN MANAGING DATA QUALITY

A data quality program involves many different types of data. The data may be current or historic, detailed or summarized, and may have a structured, unstructured, or semi-structured format. It may consist of master business entity or master reference data, or activity data created by business transaction (order entry, billing, shipping), BI (reporting, analytics), planning (budgeting, forecasting), and collaborative (e-mail, blogging) applications. All of this data must be structurally and semantically consistent with its associated technical and business rules. One of the main objectives of a data quality program is to assess and correct data consistency and accuracy problems caused by applications that do not fully enforce those rules.

Most data quality initiatives focus almost exclusively on structured data, which represents only a fraction of the data that exists in an organization. There is, however, increasing interest in leveraging the value of unstructured data in both master data and business intelligence applications. This is especially the case for customer and product data, which may be managed in unstructured files, or encapsulated in a single field with a structured file or database. To be useful this unstructured data must be cleansed and transformed into a semi-structured (XML, for example) or structured format.

Cleansing and transforming unstructured data improves operational efficiency and can add significant value to existing decision-making applications. Examples of applications here include:

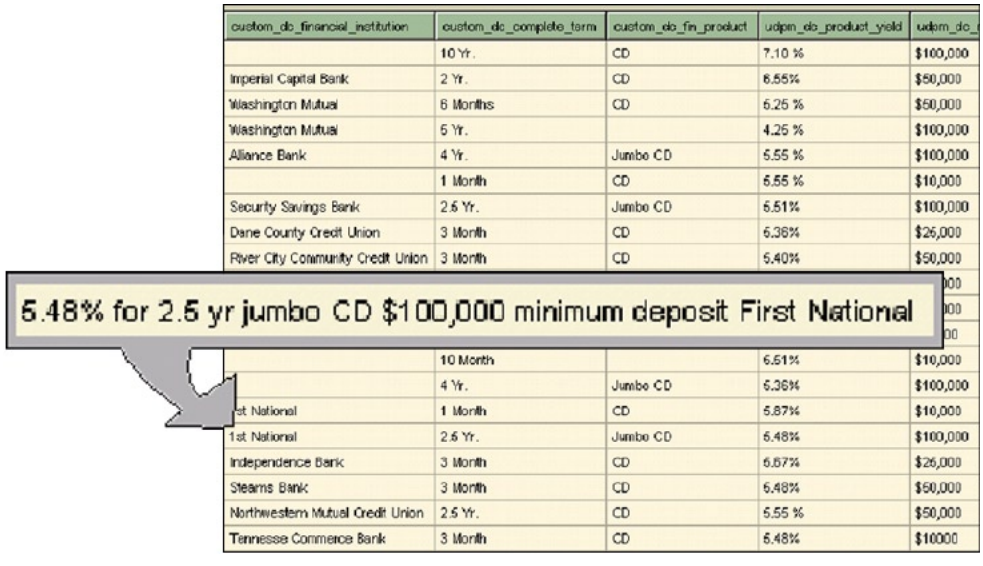
- Customer and market intelligence—Internet Web pages
- Customer sentiment and complaint analysis—Web logs (blogs) and customer support center call records
- Product safety and quality analysis—service center records
- Product master data management—product catalogs
- Legal discovery—e-mails and instant messages

CLEANSING CUSTOMER AND PRODUCT DATA

Every company struggles with the enormous amount of customer and product data that is represented in a variety of ways across disparate systems or departments. A product name such as *LIGHT BULB-120 VOLT 100 WATT* may be entered multiple times with different capitalization, spelling, abbreviations, and punctuation. Adding to this issue is the problem of supporting multiple languages in today's global marketplace where suppliers and customers are providing data in languages other than English. These problems are causing considerable business inefficiency and are leading to costly mistakes being made. Solving these problems, therefore, can provide significant business benefit.

Product Data Example

Figure 3 illustrates how unstructured data describing financial product offerings can be decomposed into separate data elements, and then used to populate a product table. The original unstructured data could come from a Web page or a product catalog, but in some cases may simply be encoded in a single field of a structured database record.



custom_dlo_financial_institution	custom_dlo_complete_term	custom_dlo_fin_product	udpm_dlo_product_yield	udpm_dlo_
	10 Yr.	CD	7.10 %	$100,000
Imperial Capital Bank	2 Yr.	CD	6.55%	$50,000
Washington Mutual	6 Months	CD	5.25 %	$50,000
Washington Mutual	5 Yr.		4.25 %	$100,000
Alliance Bank	4 Yr.	Jumbo CD	5.55 %	$100,000
	1 Month	CD	5.55 %	$10,000
Security Savings Bank	2.5 Yr.	Jumbo CD	5.51%	$100,000
Dane County Credit Union	3 Month	CD	5.36%	$26,000
River City Community Credit Union	3 Month	CD	5.40%	$50,000
	10 Month		5.51%	$10,000
	4 Yr.	Jumbo CD	5.36%	$100,000
st National	1 Month	CD	5.87%	$10,000
1st National	2.5 Yr.	Jumbo CD	5.48%	$100,000
Independence Bank	3 Month	CD	5.67%	$26,000
Stearns Bank	3 Month	CD	5.48%	$50,000
Northwestern Mutual Credit Union	2.5 Yr.	CD	5.55 %	$50,000
Tennesse Commerce Bank	3 Month	CD	5.48%	$10000

Figure 3: Cleansing Unstructured Product Data

In this example, the customer wants a data quality solution to parse, standardize, and cleanse the financial data, and to identify the financial institutions that are offering certificates of deposit (CD). They also want information about *maturity* (3 months, 1 year, etc.) and the *type* of CD being offered (CD, Jumbo CD, etc.), and wish to standardize the values for *yield* and *minimum deposit*.

These types of data cleansing operations can be used for all types of unstructured information. To date, most companies have focused on customer data, but many are now beginning to process product and other types of data.

Customer data is usually easier to deconstruct and clean than product data. Although there are variations in people names, company names, titles, phone numbers, and addresses, customer data records are reasonably consistent in the number of data elements involved. This is mainly due to the fact that most countries have standardized name and address formats. This is not the case for product data, which is more variable, and involves a wider range of industry standards. Some of these standards are very specific, while others are global in nature.

Supporting Standards

Many organizations create their own hierarchical product codes, while others follow industry standards where possible. Supply chain efficiency can be gained by appending industry standard product codes to product descriptions. A common master product identifier shared by all suppliers makes it much easier to support roll-up and drill-down reports and analyses based on a family of products. Well-known standards include:

- United Nations Standard Products and Services Code (UNSPSC)
- Export Control Classification Number (ECCN—used by the import/export and transportation industries
- International Organization for Standardization (ISO)
- National Stock Number Codes (NSN)—used by the military

It is very important, therefore, that data cleansing tools provide support for these standards.

Supporting National Languages

Whether an organization has customers, suppliers, or products in the United States, Europe, Asia, or any combination of countries, it is important that the level of data quality is the same across all data stores, and it is vital to be able to trust the data, regardless of what language the original data is in. Equally important is the ability to present data in local languages, and to be able to tailor data quality program rules to suit a specific language or region.

Organizations that deal with global information often need to adjust data fields for unique regional attributes and relationships. In some countries there are titles and relationships that may not be known in the English language. Sonya Gonzalez *viuda de* Martinez, for example, translates to Sonya Gonzalez *widow* of Martinez. In this case, the text *widow of* might not be recognized properly by the organization if it is just processing standard first and last name elements. This could be important for a banking institution that is trying to disburse the funds of a will to the correct Sonya Gonzalez.

Another example is parsing vendor information for paying invoices. An input string in Portuguese could read *Computadoras Brasileiras Incorporadas representante autorizado de Microsoft*. The text *representante autorizado de* is the equivalent to authorized agent for (in this case, Microsoft). What exists here is a business relationship between Computadoras Brasileiras Incorporadas and Microsoft, and this understanding is crucial if a payment is to be made payable to the right party.

It is important when dealing with international data to have a data quality solution that is Unicode-enabled, and that recognizes international characters other than those found in the English language. By applying data quality globally, organizations have a more complete view of customer and product information, which improves business decisions, customer service, and supply chain management.

THE ISSUE OF INCREASING COMPLEXITY

Corporate data is created and managed by many different business processes (see Figure 4) and in most companies the applications supporting those business processes have been developed over many years. Some involve legacy applications on centralized mainframes, while others employ distributed computing technologies, such as client/server computing, Web-based computing, or Web services. Some are developed in-house, while others use packaged solutions from applications vendors or software-as-a-service (SaaS) vendors. Company acquisitions and mergers add to the application mix. These applications have usually been developed and deployed independently of each other, without any notion that one day the data they create and manage may be used by other applications for other purposes.

It is this complex and unmanaged environment that has led to many of the data quality problems that exist today, and given the huge growth in the data being generated both inside and outside of companies, application complexity and data quality is likely to steadily get worse unless companies pay more attention to enforcing data quality and evolve to support a universal approach to managing data cleansing and data quality management.

A Universal Approach to Data Quality Management Is Required

The trend by organizations toward a services-oriented architecture (SOA) for building new applications and integrating existing ones reduces point-to-point application connections and eases application integration. It also encourages developers to think in terms of supporting business processes as a set of services, rather than as a package of monolithic applications.

The SOA approach supports any task that can be defined as a service. This concept not only applies to business process tasks, but also to data and system management tasks as well. This enables the tasks associated with a data quality program to be deployed as a set of services that can be called dynamically by applications (see Figure 4). This allows business rules for data quality enforcement to be moved outside of applications and applied universally at a business process level, rather than at the individual application level. These services can be called *proactively* by applications as data is entered into an application system, or *reactively* by batch data quality management tools after the data has been created. Single-record rule enforcement can be done proactively, whereas rule enforcement that spans records, databases, and applications systems will typically be done reactively.

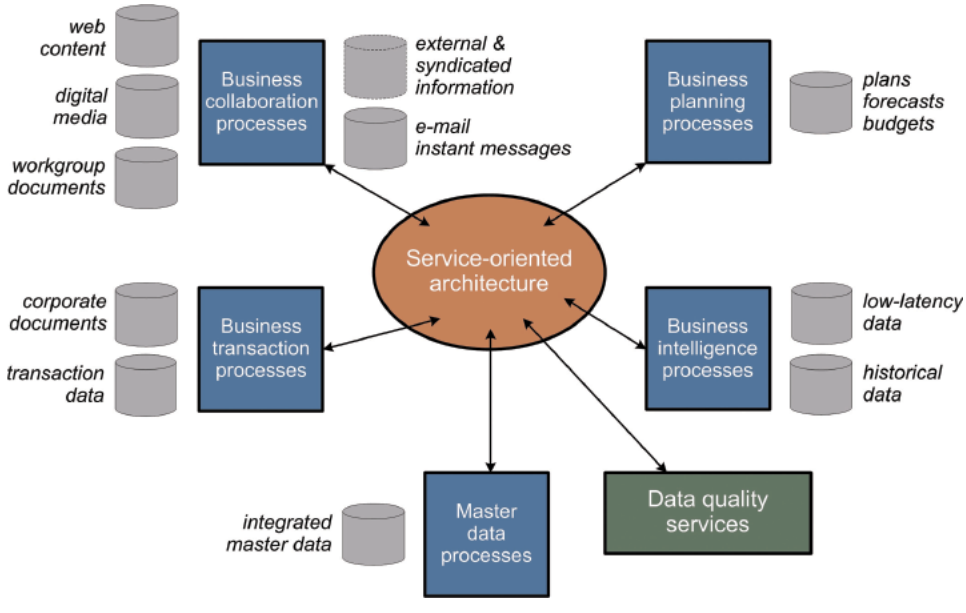


Figure 4: An SOA Can Enable a Universal Approach to Data Quality Management

BUSINESSOBJECTS ENTERPRISE INFORMATION MANAGEMENT

Business Objects is an industry-leading provider of business intelligence (BI) and business performance solutions. These solutions are delivered in the form of an integrated decision-processing platform (see Figure 5) containing a set of BI and enterprise performance management (EPM) tools and applications, together with an underlying information management capability known as BusinessObjects™ Enterprise Information Management (EIM).

The objective of EIM is to provide customers with a flexible solution for building an enterprise-wide data integration and data quality management environment.

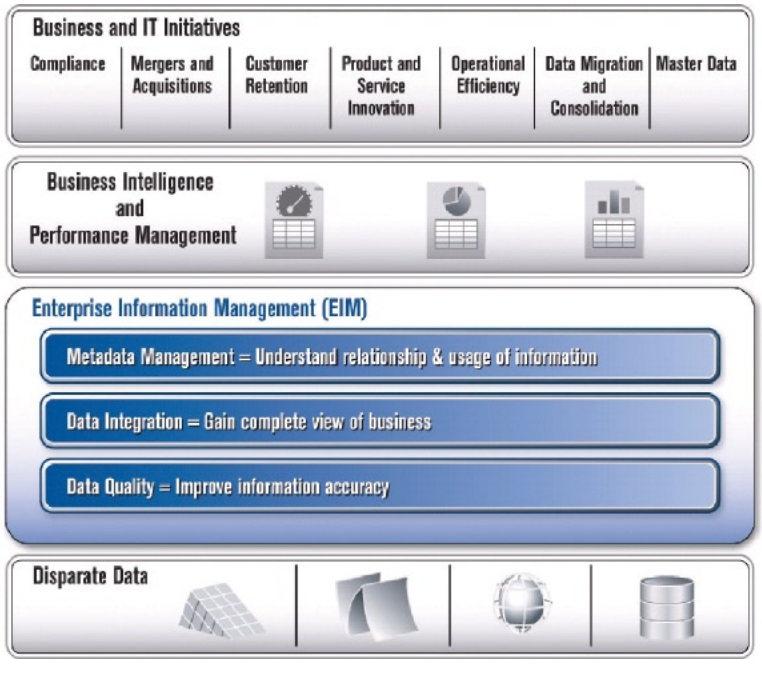


Figure 5: The Business Objects Decision Processing Platform

As illustrated in Figure 5, EIM supports the three key components of information management:

1. **Data integration**—a set of tools and packaged solutions for enterprise data consolidation and federation. This component includes a batch-oriented ETL product (BusinessObjects Data Integrator), an enterprise information integration tool for on-demand data access to a variety of data sources (BusinessObjects Data Federator), and a set of packaged data integration solutions (BusinessObjects Rapid Marts™) for enterprise applications such as Oracle, PeopleSoft, and Siebel.
2. **Data quality**—a component for the profiling, cleansing, enhancement, matching, consolidation, and monitoring of data (BusinessObjects Data Insight XI and BusinessObjects Data Quality XI). This component is described in more detail below.
3. **Metadata management**—a component that collects and unifies metadata from BI objects, ETL products, relational databases, modeling tools, and third-party solutions. IT staff and business analysts use a thin-client Web interface to explore metadata and gain a better understanding of the metadata used in projects, to support impact analysis, and to report on metadata and data lineage (BusinessObjects Metadata Manager).

BUSINESSOBJECTS DATA INSIGHT XI

BusinessObjects Data Insight XI is a data profiling tool that handles the data assessment task (see Figure 1) of a data quality program. It is used to monitor, measure, analyze, and report on the quality of data stored in relational database systems and flat files. It helps users gain visibility and a detailed understanding of the data quality defects in the source data. Key features of Data Insight XI include:

- Flexible processing models that can process source data in place or after extracting it into BusinessObjects Data Insight
- Automatic discovery of business rules and relationships
- Support for data redundancy profiling, drill-down frequency distributions, cross-column and cross-table comparisons, and pattern recognition
- Allows users to establish thresholds and set up automated alerts to notify if analysis results exceed a specific quality metric

- Graphical and dashboard reports (using Crystal Reports®) that provide summary profiles, frequency distributions, and referential integrity information
- An open metadata repository that allows the tool to be used by custom-built applications
- Scheduling of profiling tasks to run any time without operator intervention

The knowledge gained from Data Insight XI concerning existing data quality issues can be used to develop a detailed strategy for cleansing and correcting data defects using BusinessObjects Data Quality XI.

BUSINESSOBJECTS DATA QUALITY XI

BusinessObjects Data Quality XI handles the data cleansing, enhancement, matching, and consolidation tasks of the data quality program shown in Figure 1. The main facilities provided by Data Quality XI include:

- Parsing and standardizing customer and other types of operational data
- Correcting data based on supplied and user-defined dictionaries and business rules
- Appending additional information such as phone numbers to provide a more complete set of data
- Matching data to build data relationships, and identify and remove duplicate records
- Consolidating data to create a single view across databases

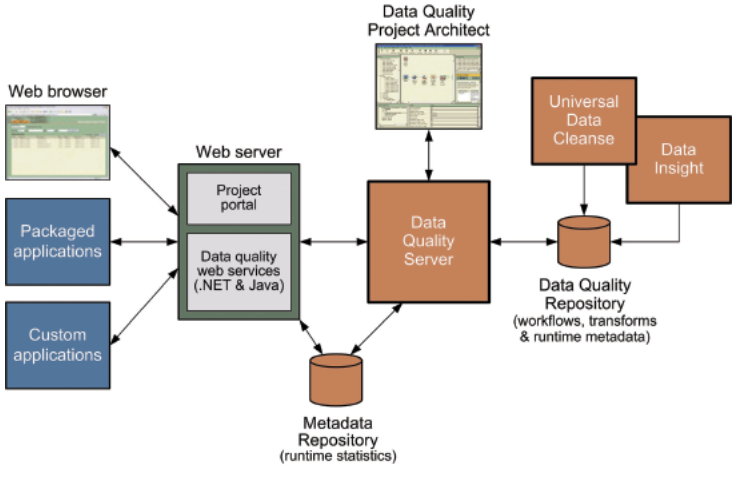


Figure 6: BusinessObjects Data Quality XI

At the heart of Data Quality XI is a data quality server (see Figure 6) that executes *workflows* and *workflow transforms* to carry out data quality management tasks that have been defined using the provided GUI-driven *project architect*. These workflows can be called dynamically as a Web service, run as a standalone batch job, or integrated with external systems and applications, such as SAP, Informatica, Oracle, PeopleSoft, and Siebel.

The capability of Data Quality XI to call a data quality workflow as a Web service in an SOA environment enables the workflows to be used dynamically by an organization's operational business processes and the quality of information to be checked, in-flight, as it flows between systems and applications.

Support for Web services and an SOA environment in Data Quality XI allows data quality software services to be shared by multiple business processes. Separating data quality rules from the processes that use them improves flexibility and makes it possible for the rules to be dynamically maintained to meet changing business needs.

BUSINESSOBJECTS UNIVERSAL DATA CLEANSE

The data cleansing process of BusinessObjects Data Quality XI standardizes data to ensure a consistent record format, and corrects data based on classification dictionaries and business rules. Prior to the current release, the product provided cleansing transforms that focused primarily on customer data. Data Quality XI now includes a Universal Data Cleanse (UDC) add-on option that allows user-defined transforms and their associated dictionaries and business rules to be created for cleansing other types of data (unstructured product data, for example). Key features of the data cleansing capability include:

- Identifies, standardizes, and corrects global data for over 190 countries
- Provides international name (firm and person, prefix, title) parsing packages for numerous countries
- Identifies customer information (addresses, phone numbers, social security numbers, dates) and verifies that it is properly formatted
- Allows users to add custom dictionaries and rules to parse and standardize other data elements, such as part numbers, product codes, purchase orders, SKUs, customer identification numbers, and so forth
- Handles free-form text up to 8,000 characters in size and parses it into appropriate structured data fields

User-defined dictionaries can be populated interactively using the project architect, or can be bulk loaded from an XML file. The bulk load capability is useful for loading industry standard product codes and classifications, weights and measures tables, international language translation tables, and data classifications identified using BusinessObjects Data Insight XI.

Product Data

An important use case for UDC is the cleansing, matching, and consolidation of structured and unstructured product data. A goal for a manufacturer, for example, may be to improve the consistency between item descriptions on a Web site and those in product catalogs. To achieve consistency, the company would parse the item descriptions on the Web site and in the catalogs, understand the relationships between the items, and use the results to correct the item entries in each location to make them consistent.

One Business Objects customer uses this approach to reconcile data for 140,000 products that are managed in 11 different data repositories. These techniques could also be extended to support the reconciling of product data for integration into a single master data management system.

Multinational Data

Another scenario for UDC is for the processing of multinational data. For an increasing number of organizations, it is important to be able to create intelligent and standardized parsing processes, regardless of what language the original data is in. Equally important is the ability to present data in local languages. UDC is Unicode-enabled, supports mixed language product descriptions, and incorporates language-specific lexicons for colors, sizes, and weights. It is, therefore, ideally suited for cleansing data in companies whose operations span many different countries.

SUMMARY

Companies today cannot operate effectively, or compete successfully, unless they give their users timely access to accurate and consistent information. The three key words here are *timely*, *accurate*, and *consistent*.

The problem is that many organizations don't know how consistent or accurate their data is, or how much poor data quality data is costing them. This is because these organizations don't consider data quality requirements from the perspective of individual business users and processes. Data quality is not an all or nothing concept. Different users need different levels of data quality, and it is essential to categorize data by business needs and required data quality service levels. It is important to profile and constantly monitor data to ensure that it is satisfying those service levels, and to rapidly correct any deficiencies that are degrading service levels.

Organizations also want to ensure that data quality processes are scalable and sharable, and provide the flexibility to allow users to dynamically change business rules based on business needs and context.

It is important that data quality tasks are not buried in individual applications, but are implemented instead as a set of services that can be used by any application from anywhere in the organization. This approach ensures that business processes obey a set of common business rules, and permits data quality service levels to be adjusted without directly affecting existing applications. It enables a data quality program to be deployed in a phased approach, one business process at a time, and allows applications to be migrated to a common data quality approach in an orderly fashion.

Executives have a lot at stake when it comes to data quality and the tough corporate compliance environment that we live in today. It is crucial, therefore, that data quality, like data integration, be viewed from an enterprise perspective. Business Objects is a company that recognizes this need and, through its EIM solutions, is addressing that need.

ABOUT BI RESEARCH

BI Research is a research and consulting company whose goal is to help companies understand and exploit new developments in business intelligence and business integration. When combined, business intelligence and business integration enable an organization to become a smart and agile business. For more information, visit www.bi-research.com

ABOUT BUSINESS OBJECTS

As an independent business unit within SAP, Business Objects transforms the way the world works by connecting people, information and businesses. Together with one of the industry's strongest and most diverse partner networks, the company delivers business performance optimization to customers worldwide across all major industries, including financial services, retail, consumer-packaged goods, healthcare and public sector. With open, heterogeneous applications in the areas of governance, risk and compliance; enterprise performance management; and business intelligence; and through global consulting and education services, Business Objects enables organizations of all sizes around the globe to close the loop between business strategy and execution.

For more information on Business Objects enterprise information management solutions, please call us at +1 866 681 3435 or visit www.businessobjects.com/eim.

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