Paper 1050 — Customer Data Quality:
Building the foundation for a one-to-one customer relationship

Martin G. Shepard, Vice President of Marketing, i.d.Centric
100 Harborview Plaza, La Crosse, WI 54601-4051
(800) 551-9491 or (608) 788-9577

In today's competitive business environment, every day brings new challenges for customer acquisition and retention. To stay ahead, companies are turning to decision support solutions to help identify and manage their customer relationships. Solutions, such as data warehouses or data marts, provide a solid foundation of accurate information upon which they can base their decisions.

Accuracy is one of the biggest obstacles blocking the success of many data warehousing projects. In fact, according to a recent META Group survey, data quality is the number one challenge facing companies as they implement their data warehouses. META Group Program Director John Ladley estimates that, when building a data warehouse, 10 to 20 percent of the raw data used is corrupt or incomplete in some way. It is not unusual to discover that as many as half the records in a database contain some type of information that needs to be corrected.

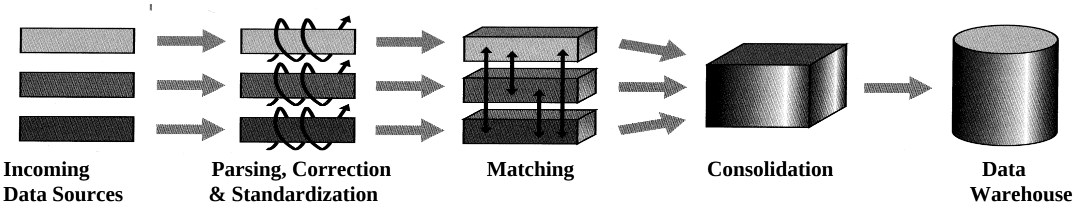
One of the most crucial areas of data quality is customer information. For the most accurate information to support your business, you will need to incorporate data quality into each critical step – extraction, transformation, consolidation, and maintenance. Data quality is especially important to accurate consolidation because it allows you to recognize and understand customer relationships. As a result, you can gain a clear picture of your customers, analyze their buying patterns, and predict future sales.

Which data is most important to your company?

Before you evaluate data quality solutions, you need to determine the type of data that is most important to your company. Will you focus primarily on customer information, or are you most concerned with data such as part numbers, prices, and product descriptions? Once you make this decision, you can choose the data quality products most appropriate for your applications.

In either case, you will find that most data quality and consolidation products fall into one of two categories: data-based solutions, which combine reference tables with sophisticated algorithms, and non-data-based solutions, which rely on algorithms alone. In data warehouses where customer data is essential, data-based software is more effective. This type of software features an extensive knowledge base of empirical data, which allows you to enhance and improve the quality of your information.

This paper will help you understand the foundation for building data quality into a data warehouse: parsing, correction, standardization, matching, and consolidation. You'll discover the principles and inherent problems of data quality and data consolidation, and the available solutions to help you manage them.



Data quality is achieved in three stages: cleansing, matching, and consolidation. In the data cleansing stage, the data is parsed, corrected, and standardized for accurate matching. In the matching stage, comparisons are made within and across your data sources to locate similar information. Finally, the matching data elements are consolidated and placed into a data warehouse, data mart, or other data storage method.

Parsing: Do you know what your data is?

Parsing is the first critical component in data cleansing. This process locates, identifies, and isolates individual data elements in your customer files. These components may include such data as a customer's first name, last name, title, company name, street address, city, state, or ZIP Code. Parsing makes it easier to correct, standardize, and match data because it allows you to compare individual components, rather than long strings of data.

Parsing the elements

There are several obstacles to parsing that may later hinder successful matching. Perhaps the most pervasive problem is discrepancies in the metadata – information about the data in your database. For example, the information in a field may not match its metadata profile. Inconsistent definitions and multiple data sources make it difficult to determine if fields possess the same characteristics from one source to the next.

Other obstacles include:

- *'Misfielded' data* – Data that is placed in the wrong field, such as name data in an address field.

- *Floating data* – Customer data that may be contained in different fields from record to record, resulting in data "floating" between fields.

- *Extraneous information* – The data may contain irrelevant or blank fields.

- *Atypical words* – Records may include ethnic, multicultural, and hyphenated names; unusual titles; abbreviated business names; industry-specific acronyms; etc.

- *Inconsistent structures and formats* – Operational, purchased, and exchanged data sources may be formatted differently from each other or from the data warehouse.

Inconsistent field formats

Correction: How do you know your data is accurate?

Once you've parsed your data, you are ready to begin the next phase of the data cleansing process – correction. Customer information is the most difficult type of data to cleanse and validate. If your data comes from a variety of sources, you may encounter:

- <u>Variations</u> in abbreviations, formats, etc., because of individual preferences of the person entering the information

- <u>Misspellings</u> caused by phonetic similarities during telephone data entry

- <u>Outdated information</u> due to name and address changes

- <u>Transpositions</u> resulting from keying errors

Correcting the elements

The only way to intelligently correct and verify your data is to use software that references a reliable secondary data source. In many instances, correction is used only to prepare data for matching – the original records remain unchanged.

For instance, some neighborhoods have "vanity" city names (i.e., "Hollywood" versus "Los Angeles") or "alias" street names (i.e., "Valley View Mall" versus "Highway 16"). Some residents living there may prefer to use one city or street name over the other, and therefore may be more likely to respond to an offer bearing the name they prefer. However, by recognizing that both names refer to the same location, you have a better chance of identifying matches. By correcting the data, you can locate matches while still respecting clients' preferences.

Standardization: Is your data ready for matching?

Standardization, the next step in data cleansing, allows you to arrange customer information into a preferred and consistent format. Some of the biggest challenges for accurate standardization of customer data include:

- *Inconsistent abbreviations* – such as International Harvester, Intl. Harvester, Interntl. Harvester, Internatl. Harvester

- *Unusual titles* – for example Graduate, Realtor Institute (GRI); Specialist in Residential Appraisal (SRA); and Member, Appraisal Institute (MAI)

- *Misspellings and variant spellings* – i.e., Kwik, Quik, Quick

Software solutions that integrate secondary data sources perform more effective standardization, and allow you to make business decisions with confidence. For example, some software is certified to standardize addresses using the most widely accepted data source – the U.S. Postal Service's National Directory. While standardization improves matching, Gartner Group Analyst Kevin Strange stresses, "It is important to create separate fields of standardized information and not to overwrite the original data."

When cleansing certain types of data (names, business names, professional titles, etc.), "match standards" will facilitate more successful matching.

Standardizing the elements

Match standard — typical representations of a data element — can only be assigned by sophisticated standardization software.

Match standards

Some software can also standardize other customer information, such as pre-names, post-names, titles, and business locations (“Doctor” to “Dr.,” “Junior” to “Jr.,” “Floor” to “Flr.,” etc.). It may also identify genders, based on empirical name data, to give you a better understanding of your customers for one-to-one marketing.

Matching: Can you find the duplicates in your data?

Matching allows you to identify similar data within and across your data sources. This is the ‘heart’ of data warehousing. Using cleansed information and match standards, you can eliminate duplicate representations and consolidate all information about each individual customer. This will help you to:

- Truly “see” each customer, and generate accurate data about them
- Enhance response rates of marketing promotions
- Reduce the risk of offending customers with repeat offers
- Identify trends and patterns to accurately target new prospects

One of the greatest challenges in matching is creating a system that incorporates your “business rules” – criteria for determining what constitutes a match. These business rules will vary from one organization to another, and from one application to another. In one instance, you may require that name and address information match exactly.

Matching records

In another, you may accept wider address variations, as long as the name and phone number match closely. Some additional challenges to matching business-to-business data include:

- Company mergers, acquisitions, or corporate name changes
- Relationships between divisions, subsidiaries, and parent corporations
- Business acronyms (i.e., NASDAQ or NYNEX)
- Initialisms – the first letter of one or more words in a title or phrase that are

sounded one by one (i.e., AT&T or CIA)

Consolidation: You’ve matched your data – now what?

Once you’ve located the matching records in your data, you can identify relationships between customers and build a consolidated view of each. This critical component of successful one-to-one marketing allows you to gain a clearer understanding of your customers. “One-to-one marketing allows organizations to better serve the customer at every point of contact,” according to Susan North, Epsilon’s vice president of new business development. When you base marketing, telemarketing, sales, customer service, and accounting decisions on clean and accurate data, you can more easily retain customers by anticipating their needs.

Consolidating records

There are two methods for consolidation, both of which are essential for most data warehousing and one-to-one marketing applications. The first consolidation process combines all of the data on any given customer using all of the available data sources. The second process – customer relationship identification – reveals links between your customers.

There are two common types of customer relationship identification: householding and business grouping. Typically, householding links consumer records that contain the same address and last name. Business grouping combines business records that share such information as company name, address, department, or title.

By identifying the characteristics and buying habits of a group or household, you can create special offers and better target direct marketing efforts. As you combine your data on each customer, you will need to determine priorities between data sources and specific data fields. For example, some records may contain more complete information, but may be from an unreliable source (see the ‘Consolidation Systems’ section on page 15).

Data cleansing solutions: What are you going to do about it?

As previously mentioned, most data quality tools fall into one of two categories: data-based and non-data-based. Both systems allow you to reformat your data, but data-based systems go a step further.

Data-based solutions combine reference tables with sophisticated algorithms. In most cases, this type of solution deals better with the challenges posed by customer-centric data warehousing applications. By accessing the empirical data in their reference tables, these solutions can intelligently parse, correct, and standardize your critical customer information, rather than simply format it.

Non-data-based solutions rely on algorithms alone. These solutions can handle less-challenging data, such as product names, part numbers, or test scores.

In either case, you should choose a data integrity solution that includes:

- Customizable standardization options

- The ability to retain original data and save corrected information
- Flexible output options

Data-based systems: Best for customer data

For customer-centric data warehouses, the most effective systems use empirical information. They provide the foundation for logically consolidating multiple, diverse databases.

The best systems for address cleansing use the National ZIP+4 Directory developed by the U.S. Postal Service (USPS). They are designed with high-speed engines that are certified as being 99 percent or more accurate. By leveraging the USPS' multi-million dollar, multi-year investment, they offer the most comprehensive source for address parsing, correction, and standardization.

The most effective data-integrity software can also parse names, titles, business locations, business names, and financial terms such as trustee, retired, and deceased. By using empirical data and user-modifiable tables, these systems can more accurately locate 'floating,' unfielded, or incorrectly parsed data. Because they are founded on actual data, you can properly process ethnic, hyphenated, or atypical names; and recognize business name and location data.

Non-data-based software vs data-based software

Data-based software can provide additional information for a more complete customer view. This information may include gender codes, salutations, and data for demographic coding (i.e., geo-census codes, county codes, and county names). When choosing data-based data-cleansing systems, look for the ability to:

- Recognize formal and informal street names, mail-to and ship-to addresses (i.e., Post Office Box and street address in the same record), and vanity city names
- Minimize users' learning curve using a significant base of pre-defined data – you should not need to train the product
- Flag outdated or invalid address data (i.e., rural-route address converted to '9-1-1' address, or a nondeliverable address)
- Access and modify reference tables
- Assign match standards

Each of these cleansing components are essential for successful matching and consolidation.

Matching and consolidation solutions: How will it all come together?

Effective matching and consolidation rely on accurate data. If your data consists of unparsed data strings, you are in danger of missing many matches or of erroneously consolidating different customers. However, corrected and standardized data in discrete fields allows most matching systems to successfully detect:

- Transposed, missing, or extra characters
- Transposed words
- Phonetic errors
- Acronyms and abbreviations

Matching Systems

There are several varieties of matching systems available, each offering a different way to arrive at a match:

- *Key-code matching* performs identical comparisons using the first few characters in one or more fields. This primitive method is rarely practiced because it uses only a small sub-set of the data, which can result in many false matches.

- *Soundexing* detects phonetic similarities, such as ‘f’ and ‘ph’ or Quick and Kwik. These errors often result from data received over the telephone, particularly with data that can’t be standardized. However, soundexing is inadequate as a sole solution because it can only detect phonetic errors.

- *Similarity matching* – also referred to as ‘fuzzy matching’ – can identify matches by computing a degree of likeness between two discrete components. Because identical matches are not required, it can adjust for spelling, phonetic, typo-graphical, and transpositional errors.

  Similarity matching is widely considered the best matching method. It is especially valuable for data that cannot be standardized, such as last names, business names, and house numbers.

  Similarity matching

- *Weighted matching* can be used in conjunction with soundexing or similarity matching. It allows you to indicate the relative importance of fields that determine a match.

Special purpose algorithms, which are extensions of similarity matching, apply exception logic (‘if/then’ rules) to traditional match rules. There are four categories of special purpose algorithms:

- *Special-case field logic* customizes matching techniques for specific fields. For example, these algorithms are used to identify matches between acronyms or initialisms and their full business names, or numeric components within names.

Special-case field logic

- *General-case field logic* applies additional match logic when it encounters certain anomalies, such as blank fields. In comparing discrete components, it allows you to specify when blank fields should be considered matches against fields that contain data.

- *Special-case multi-field logic* adjusts weighting, which depends on the data found in specific sets of fields. When householding, for instance, this method would assign a higher value to the ‘name’ field when the address is an apartment complex and the ‘unit number’ field is blank.

- *General-case multi-field logic* performs a second match when it encounters specific anomalies, regardless of the fields in which they are found. For example, it could search for elements with low parse-confidence scores, concatenate them, and compare the resulting data strings.

A *combined approach* – incorporating similarity, weighting, and special purpose algorithms – is usually best. As many as six to ten levels of matching may be necessary for complete data consolidation or maintenance.

When using a combined approach, you need the flexibility to modify business match rules. This is important as the reliability of certain data may vary between records and sources. For instance, people who move often have unreliable contact data. When this happens, your combined solution should provide the flexibility to use alternate fields as match criteria, such as social security number, credit card numbers, account numbers, and date of birth.

Consolidation Systems

The data cleansing and matching processes lead to one end result: accurate data consolidation. To build on this foundation, you’ll need a flexible consolidation solution to combine existing operational data and maintain incoming data feeds.

Some key components of proven consolidation solutions allow you to:

- *Prioritize incoming data sources*. In-house databases are usually more reliable than purchased or rented data because they tend to be more up-to-date.

- *Prioritize fields*. Fields that have been cleansed and verified tend to be more reliable than those that have not. Again, the source and recency are important considerations.

- *Maintain sources of original data*. Complete metadata allows you to trace data errors or discrepancies back to the source.

- *Identify unreliable or missing data*. Once identified, if it is economically feasible, you can request information directly from the customer or from a valid outside source.

Depending on the scope of your project, you may wish to approach consolidation one step at a time. If you don’t have the resources to build an enterprise data warehouse, you may choose to start with a data mart. With each small success, you will gain expertise, confidence, and continued support for completing your data warehouse.

Don’t overlook the foundation

As you implement your data warehouse, don’t overlook its foundation – data integrity – which is essential for quality matching and consolidation. It is critical to first determine which data is important, and to choose the most appropriate cleansing tools. When working with customer data, a data-based solution is best.

With a variety of matching solutions available, look for one that combines different types of matching algorithms. This will allow you to more
accurately locate, understand, and target your customers.

By building parsing, correction, standardization, matching, and consolidation into your system, you can meet your goals, which may enable you to:

- Make better and more immediate marketing decisions
- Increase market share
- Increase revenue
- Increase profitability
- Detect fraud more accurately
- Improve customer support
- Ensure clean feeds to on-line analytical processing (OLAP) and data-mining tools
- Implement your solution faster than building your own
- Understand your customers
- Guarantee the success of your project

The best course of action is to choose tools that offer the flexibility and accuracy your project demands. By implementing these tools, you will secure a solid foundation for building one-to-one customer relationships.