Master Data Management For Collaborative Service Processes

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ABSTRACT

Master data form the basis for handling business processes. They describe business objects such as e.g. customers, articles or suppliers which are represented in information systems using data records. Today, many companies employ several business applications, each with its own datasets, to support their business processes. As a rule, this involves heterogeneous information systems whose master data are often neither current nor consistent between systems.
In the case of service processes, harmonized master data represent a prerequisite for comprehensive customer relationship management, cross- and up-selling opportunities and efficient handling of customer service requests. Benefit potentials of master data management are thus to be found in the improvement of customer service (e.g. through an integrated view on customer interactions and product configurations) as well as in cost savings (e.g. through consistent and error-free processes) and increased productivity (e.g. through time savings in the creation of master data due to the electronic distribution). Various software vendors such as SAP, Siebel and Oracle as well as providers of global data pools like SINFOS are developing innovative solutions for the cross-system and integrated distribution of product and customer master data.
This article describes the specific challenges of managing master data in service processes and outlines possible benefit potentials. It then presents conceptual approaches for the distribution of master data taking into account distributed and heterogeneous applications. Finally, the article illustrates how customer and product master data management supports innovative service processes based on the case study of Asea Brown Bovery (ABB).
Keywords: Master Data Management, Service Processes , Architectures

1. INTRODUCTION

Master data form the basis for business processes. In the context of business data processing, master data denote a company's essential basic data which remain unchanged over a specific period of time [1]. These will include, for example, customer, material, employee and supplier data. Inconsistent master data cause process errors and thus higher costs. In practice, however, master data frequently lack not only consistency but also immediacy as many companies use various applications to support their service processes [2]. Against this background, special solutions and standards are emerging for managing master data across system and corporate boundaries. Various software vendors such as SAP, Siebel and Oracle as well as providers of global data pools like SINFOS are currently developing innovative solutions for cross-system and integrated master data management. This article describes the specific challenges of managing master data in service processes and outlines possible benefit potentials. In addition, architecture alternatives for the distribution of master data are explained and illustrated by means of examples. Finally, the example of Asea Brown Boveri (ABB) is used to show that consistent master data lead to major process improvements. The article concludes with a summary and outlook.[1]

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2. MASTER DATA CHALLENGES IN SERVICE

A general challenge facing master data management – at both the intra-organizational and inter-organizational level – lies in ensuring data quality in terms of consistency and immediacy [3]. Obsolete (non-current) and inconsistent master data can lead to error-prone operations. Inefficient processes and therefore higher costs for manual corrections are the result. For this reason, inconsistent datasets often constitute an economic disadvantage for a company [4].
In the area of service, there are additional challenges to be considered alongside the general disadvantages of inconsistent master data:

- Customer service has to rely on information from upstream processes, in particular sales (customer master data, warranty agreements, product configurations, etc.) [5].
- The ability to present "one face to the customer" across various organizational units can only be achieved with standardized processes and unique customer identification [6].
- The increasing complexity of plant and machinery calls for specialist know-how on the part of service engineers. It is only with complete master data (e.g. product configuration, maintenance history, correct version of manuals) that engineers are able to perform repairs quickly and efficiently [7].
- Customer complaints and concerns need to be usefully evaluated if conclusions are to be drawn in respect of service quality, and the achievement of product improvements [8].

- Cross- and up-selling potentials cannot be realized if there is no cross-system view on the customer [9].
- A rapid response to customer inquiries (particularly in the case of call centers) requires up-to-date information and transparency across all customer contacts [10].

As a consequence, inconsistent master data in the area of service lead to incorrect decisions, reduced customer satisfaction and high costs in customer service [11].

Companies can tap into significant benefit potentials by reorganizing existing datasets into consistent and current, company-wide master data:

- Cost savings (e.g. through consistent and error-free processes) [12].
- Productivity increases (e.g. through time savings in creating master data due to electronic distribution) [13].
- Improvement in customer service and therefore increase in customer satisfaction (e.g. fewer disturbances and time delays thanks to consistent processes – by preventing media discontinuities) [12].
- Improved reporting (e.g. for the early identification of imminent disturbances or as the basis for contract negotiations based on consolidated master data) [14].

3. ARCHITECTURE APPROACHES FOR THE DISTRIBUTION OF MASTER DATA

To support distributed service processes, the underlying information systems first have to be integrated. This is a central prerequisite for exchanging master data across system boundaries. For the purposes of creating consistent (distributed) master data, it was possible to identify four architecture approaches on the basis of practical projects in collaboration with the Information Management Group (IMG, www.img.com) and following [15], while in practice a combination of different approaches is also possible. These four approaches can be classified according to two dimensions: (a) global master data attributes and (b) data creation and maintenance and/or distribution (cf. Figure 1):

- Global master data attributes [16] determine which attributes are to be standardized on a cross-system basis.
- The second dimension indicates whether data are to be created and maintained on a central or decentral basis. Central creation and maintenance ensures adherence to predefined processes, but is less flexible.

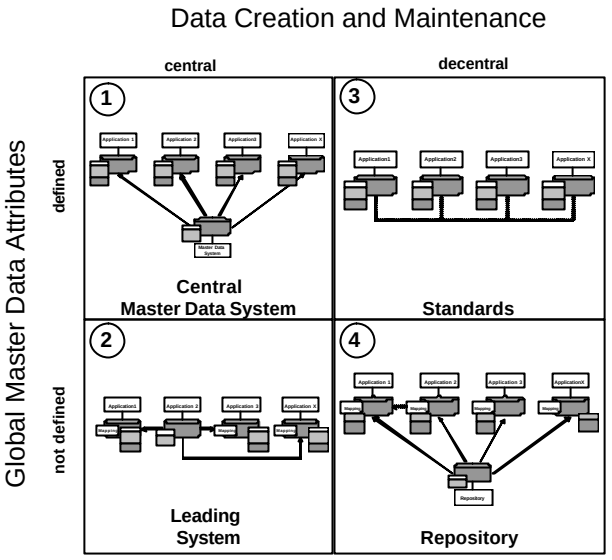


Figure 1: Classification of Architecture Approaches

3.1 Central Master Data System

With this approach, a master data system is set up which distributes global master data from one to the various applications. Consequently, all systems use the same master data, and the unique identification of master data is possible by means of a global primary key [17].

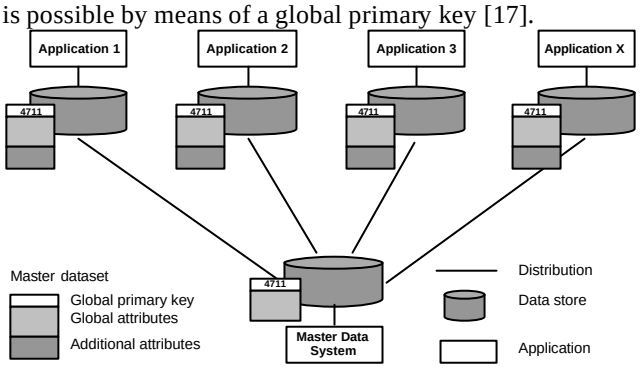


Figure 2: Central Master Data System

The approach of the central master data system has the advantage that the global attributes of a master dataset are always created in the central master data system. This ensures that data are always created in the same way and are unique. Additional (local) attributes which are not maintained in the central system must be completed in the receiving systems. The central master data system thus only transfers core master data. The central master data system and/or the underlying middleware manages the keys.

The distribution of master data is always initiated by the central system. As a rule, distribution takes place asynchronously (i.e. with a delay). Table 1 provides an overview of the characteristics of this approach (following [18], [19]).

Table 1: Characteristics of a Central Master Data System

	Central Master Data System	Receiving Systems
Initial Data Creation	Global master data attributes	Additional attributes
Data Maintenance	Global master data attributes	Additional attributes
Data Storage	Global master data attributes	Global master data attributes and additional attributes
Master Data Distribution	Global master data attributes	-
Mapping	-	
Primary Key	Global primary key	
Availability of Master Data in the Receiving Systems	-	As a rule asynchronous with a delay

The advantage of this approach is central, standardized data creation. As a result, the linked applications all possess the same global master data. The disadvantage is that, as a rule, modified or new data are only available after a time delay.

Example. SINFOS (www.sinfos.org) provides a central data pool through which business partners can access product data. The unique key is based on the EAN number. Members can create master data in the SINFOS database and calibrate them with their own systems.

A central approach is also adopted by software vendors such as SAP with SAP Master Data Management (SAP MDM) or Siebel with Universal Customer Master (UCM), which provide solutions for company-wide master data pools ([20],[21]).

3.2 Leading System

With this approach, an existing system is defined as the leading system. This initiates the distribution of master data.

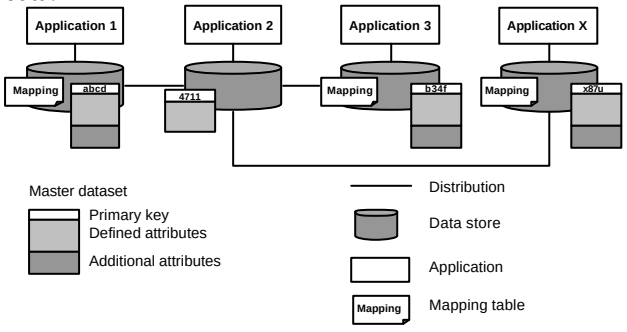


Figure 3: Leading System

In this case, the initial creation of master data always takes place in the leading system with the existing attributes present in the respective application (this corresponds to Application 2 in Figure 3). Nonetheless, this approach also permits the addition of local attributes in the receiving systems. The distributed data are held redundantly in all the systems involved, while as a rule individual datasets have different primary keys. Unlike the central master data system, mapping is required with this approach since no global attributes are defined which are the same in all applications. The mapping of attributes ensures correct transfer to the receiving systems. Normally, only those attributes which are required in the receiving system are transferred. Modifications in the datasets are usually distributed asynchronously. Table 2 summarizes the characteristics of this approach.

Table 2: Characteristics of a Leading System

	Leading System	Receiving Systems
Initial Data Creation	Defined master data attributes	Additional attributes
Data Maintenance	Defined master data attributes	Additional attributes
Data Storage	Defined master data attributes	Selected attributes of leading system and additional attributes
Master Data Distribution	Defined master data	-
Mapping	-	Decentral in every receiving systems
Primary Key	Different for each applicationn	
Availability of Master Data in Receiving System		with a delay (batch) or in real time (synchronous exchange)

One advantage with this approach is that the receiving systems remain independent and attributes can also be subsequently added. The integration of additional systems involves a high level of effort as additional interfaces are created and additional mapping has to be implemented.

Example. The Siebel Universal Customer Master (UCM) can either be implemented as a central master data system (cf. Section 3.1) or as an add-on for an existing Siebel CRM system. In the latter case, the CRM acts as the leading system for customer master data [21].

3.3 Master Data Harmonization via Standards

This approach involves the definition of company-wide standards which describe the structure of a master dataset. Global attributes are defined which have the same meaning in all applications. An integration layer ensures that a master dataset is structured in the same way in every system and that the creation of global attributes is mandatory. There is no mapping with this approach, so duplication is possible. This means, for example, that a customer could be created in several systems.

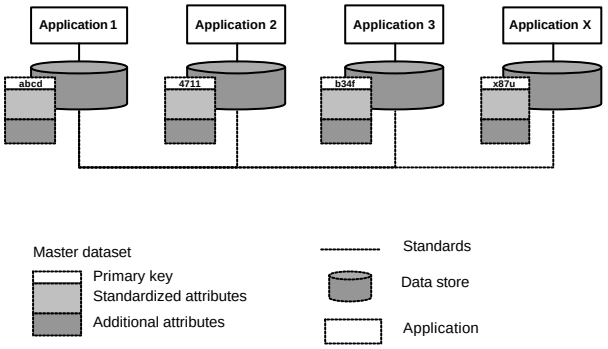


Figure 4: Maser Data Harmonization via Standards

With this approach, data storage, creation and maintenance are performed decentrally in the respective systems. At the same time, however, the standardization of global attributes ensures that a minimum of attributes is created on the one hand and, on the other, that they have the same meaning in each system. There is no actual data distribution and cross-system consistency check with this approach. In this case, data are called up when required.

Table 3: Characteristics of Master Data Harmonization via Standards

	Standard/ Integration Layer	**Receiving Systems**
Initial Data Creation	Supports creation by stipulating attributes	Global master data attributes plus additional attributes
Data Maintenance	-	Global master data attributes plus additional attributes
Data Storage	-	Global master data attributes plus additional attributes
Master Data Distribution	No master data distribution with this approach.	
Mapping	-	
Primary key	Different for each application	
Availability of Master Data	Access to current data via integration layer	

Redundant data storage means that the receiving systems remain independent and availability is high. The downside of this approach is the problem of duplication and the fact that consistent master data cannot be ensured.

Example. Big companies define usually a group-wide "master dataset" for product information. This set contains attributes with descriptions which are valid for all companies belonging to the group. In addition, it provides the basis for all new systems, projects and solutions.

3.4 Repository System

With this approach a cross-system repository is implemented for all the data involved. This centrally stored table contains the assignments of the various master datasets to their source systems. If, for example, an application needs data on a customer, it sends a query to the repository and receives the answer as to which system holds the data on this customer. In another step the data are then called up direct from the appropriate system. This is shown as an example in the cases of Applications 1 and 2 in Figure 5. The accessing system is responsible for mapping the data.

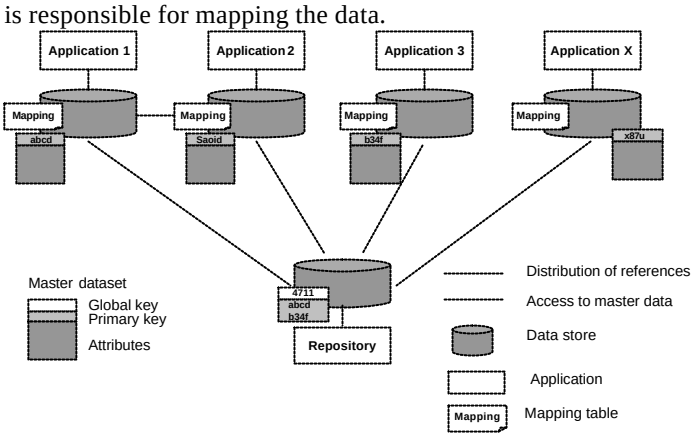


Figure 5: Repository

The datasets are created and maintained decentrally in the individual applications with this approach. Data storage is decentral in the connected systems. There is no data distribution in this scenario. Data access is initiated by the accessing system. Usually, the primary keys of the master data in the individual applications differ. The repository possesses a global key to each dataset and manages all the primary keys of the individual applications under it. Changes in the master datasets are immediately available with each access. This approach is used typically in the case of very large datasets. Table 4 summarizes the features of this approach.

Table 4: Characteristics of a Repository

	Repository	**Connected Systems**
Initial Data Creation	Global key	Data are created decentrally, but in addition the primary key is sent to the repository system so that a global assignment can be performed.
Data Maintenance	-	Data maintenance is performed decentrally
Data Storage	Only information on where which data are stored	All master data attributes of the respective system
Master Data Distribution	There is no data distribution. Only references are distributed.	-
Mapping	-	Mapping takes place in the accessing system
Primary Key	Global key	Different for each application

	Repository	Connected Systems
Availability of Master Data	-	Changes are immediately available with each access

The advantage of the repository approach is that the autonomy of the applications is retained and there is only minor dependency on a central system. The disadvantage on the other hand is that the data are created and modified decentrally according to different processes.

Example. A typical example of a repository is the Global Registry of the Global Commerce Initiative (http://www.gci-net.org/). The Global Registry is an international database containing information on which article is stored in which master data pool worldwide. Access to the concrete master dataset is then performed in the respective master data pool [22].

4. CENTRAL MASTER DATA MANAGEMENT AT ABB

An example of a central master data solution (cf. Section 3.1) is the portal solution ATURB@WEB, which supports the service process at ABB [23]:

ABB is world leader for boosting diesel and gas engines in the output range above 500 kilowatts by means of exhaust turbochargers. Over 180,000 ABB turbochargers (to boost the output of diesel engines) are in active operation worldwide on ships, in power stations, locomotives as well as heavy-duty construction and mine vehicles.

Up until 1989, ABB Turbo Systems - the headquarter in Baden (CH) - collected all information on its turbochargers (with theoretically 182 million configurations) in an index register which was distributed to the service centers in the form of roll film. Obsolete data, the lack of access to inventories, etc. led to delays and additional process costs for repair work. Whenever there was a turbocharger to be serviced or repaired anywhere in the world, the service center determined the specification and serial number of the turbocharger. They then sent an inquiry to the headquarter – usually by telephone, telex or telefax. The staff at the headquarter looked up the appropriate drawings and established manually which part was needed and whether it was available from the central warehouse. The distributed master database was detrimental to service quality.

Through various projects over the course of 12 years, ABB Turbo Systems arrived at an internet-based portal solution, ATURB@WEB. Staff now have real-time access to information which was previously difficult to extract. This information includes amongst others

- the current specification of the turbocharger and the type of installations in which it is used,
- the operating manual,
- the next scheduled service dates,
- the maintenance history including previous specification changes and part numbers of the spares required for every turbocharger,
- all information on spare parts plus
- service reports.

For the ABB turbocharger business, the ATURB@WEB solution is an important basis for its services. The central management of master data with the new solution has enabled ABB to exploit potentials in service handling such as e.g. cutting back its spare parts inventories by 12%.

5. SUMMARY AND OUTLOOK

This article highlights the specific challenges relating to the management of master data in service processes. Harmonized master data offer benefits such as higher customer satisfaction or enhanced process efficiency. The architecture approaches derived from practical projects describe how master data in distributed application landscapes can generally be distributed to support service processes. Today, concrete solutions from various software vendors already exist to secure the quality of master data in respect of their consistency and immediacy. The products offered by software vendors – Siebel (Universal Customer Master), SAP (Master Data Management) and Oracle (Customer Data Hub) – largely follow the approach of a central master data system and are primarily focused on the intra-organizational application and on customer master data. In view of the fact that solutions are very recent, the approaches of the various vendors still show significant inefficiencies [24]:

- Incomplete functionality
- Inadequate support in the case of data sources from third-party providers
- Lack of support and advice

As a rule, inter-organizational master data pools also follow the central approach, but tend to be specific to the industry and are primarily focused on product master data [25]. SINFOS and WorldWide Retail Exchange (WWRE), for example, concentrate on the retail sector.

Despite the various architecture approaches and the solutions from software vendors for managing master data, tools alone are not sufficient for the “trouble-free” exchange of master data objects between different systems. The correct interpretation (semantics) of the data exchanged still has to be secured at the organizational level [26]. The associated processes for data harmonization, cleansing, creation, maintenance and phase out must also be defined. This is the reason why it is difficult to realize an inter-organizational exchange of master data. Political and organizational discussions come to the fore and make a high level of coordination effort necessary between the parties involved [27]. In future, however, international standards such as BMECat, e.g. for the exchange of product catalogs, should facilitate inter-organizational collaboration [28].

REFERENCES

[1] Rosenberg, J. M., *Dictionary of Computers, Information Processing & Telecommunications*, 2nd ed., New York: John Wiley & Sons, 1987.

[2] Bijesse, J., Higgs, L., McCluskey, M., *Service Lifecycle Management (Part 1): The Approaches and Technologies to Build Sustainable Competitive Advantage*, Atlanta: AMR Research, 2002.

[3] Schindewolf, S., Gupta, S., "*More Than Technology*", *SAP INFO*, No. 107, pp48-50, 2003.

[4] Vosburg, J., Kumar, A., "Managing dirty data in organizations using ERP: lessons from a case study", *Industrial Management & Data Systems*, No. 1, pp21-31, 2001.

[5] Hall, R., *Why Integrate CRM To Back-end Systems?*, http://www.greaterchinacrm.org/eng/content_details.jsp?contentid=1254&subjectid=26, 2004.

[6] SAP, "Integration for Customer Value", *look@sap si*, Issue 1, 2003.

[7] CIMdata, *Product Lifecycle Management*, Ann Arbor (MI): CIMdata Inc., 2002.

[8] Rosemann, M., Bassir, M., *Customer Relationship Management*, http://www.leonardo.com.au/files/crm-e.pdf, SAPIENT College, 2000.

[9] Zornes, A., *META Group Market Review: Customer Data Integration, 2003/04*, Stamford: META Group Inc., 2003.

[10] Case, K., Lochner, R., *Customer Service: A Holistic Approach*, Special White Paper Supplement to KMWorld, www.kmworld.com, 2001.

[11] Itelligence, SAP Master Data Management, http://www.itelligence.de/en/774.php, 2004.

[12] Joshi, M., Subrahmanya, V., *Global Data Synchronization*, Bangalore: Wipro Technologies, 2003.

[13] Alt, R., Fleisch, E., Österle, H., "Electronic Commerce and Supply Chain Management at ETA Fabriques d'Ebauches SA", *Journal of Electronic Commerce Research*, Vol. 1, No. 2, 2000.

[14] Kelly, R., Fritsch, M., *Improved Effectiveness with Information Consolidation*, http://download-west.oracle.com/owparis_2003/40266.doc, 2002.

[15] Schwinn, A., Schelp, J.: "Data Integration Patterns", Abramowicz, W., Klein, G. (Eds.): *Business Information Systems*, Colorado Springs: 2003.

[16] CRM Market Watch, "Market Dynamics: Customer Data Integration Applications: Part Two", *Computerwire*, No. 28, pp2-13, 2003.

[17] Date, C.J., *An Introduction to Database Systems*, 7th ed., Reading, Massachusetts: Addison-Wesley, 2000.

[18] ECR, *Inter-Operability of EAN compliant Data Pools*, www.ean.ch, 1999.

[19] Solid Information Technology, *Solid SmartFlow Data Synchronization Guide*, www.solidtech.com, 2003.

[20] Wittebrock, T., *Master Data? Everyone Needs it, but No-one Wants to Maintain it*, Walldorf: SAP AG, 2003.

[21] Siebel, *Siebel Universal Customer Master*, San Mateo (CA): Siebel Systems Inc., 2003.

[22] Global Commerce Initiative, *Global Master Data Synchronisation Process*, Global Commerce Initiative: Global Data Synchronisation Group, 2001.

[23] Senger, E.: *Fallstudie ABB Turbo - Portallösung ATURB@WEB zur Unterstützung des Service- und Verkaufsprozesses der ABB Turbo Systems AG*, St.Gallen: Institut für Wirtschaftsinformatik, Universität St. Gallen, 2003.

[24] . White, A., Hope-Ross, D., *SAP's MDM Shows Potential, but Is Rated 'Caution'*, Stamford: Gartner Inc., 2003.

[25] White, A., Jimenez, M., *WWRE, SINFOS Members: Don't Overspend to Synchronize Data*, Stamford: Gartner Inc., 2003.

[26] Schreiber, Z., *Semantic Information Architecture: Creating Value by Understanding Data*, www.dmreview.com, 2003.

[27] Demarest, M., *The Politics of Data Warehousing*, Beaverton: DecisionPoint Applications Inc., 2001.

[28] Halpern, M., Knox, R., *PDE is still an Engineering and Production Challenge*, Stamford: Gartner Inc., 2003.