

Combining Actual Trends in Software Systems for Business Management

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Abstract: This paper presents, at a conceptual level, the first stage of the author's research in the field of software systems for business management. It is an attempt to define the connection between Master Data Management, Service Oriented Architectures and Complex Event Processing in creating an agile infrastructure, types of master data integration and management solutions. It also outlines the minimum stages needed for the development of a Master Data Management system.

Key words: Master Data Management, Service Oriented Architectures, Complex Event Processing, Business Intelligence

INTRODUCTION

A Service Oriented Architecture (SOA) may provide benefits such as promoting re-use, the ability of combining services in order to create new composite applications, the use of decoupled services through a standard interface, supplying the technological approach in order to develop solutions of Business Intelligence (BI). Implementing Master Data Management (MDM) into SOA strategy ensures data consistency, alignment of information resources of the organization, correct dissemination of information within/outside the organization, ensuring all the potential benefits of SOA initiatives. Complex event processing (CEP) is a technology based on rules that group information in real time from systems, databases and applications distributed in order to provide benefit for the BI solution.

1. THE INFLUENCE OF SOA AND CEP OVER MDM

SOA may provide benefits, such as promoting re-use, the ability of combining services in order to create new composite applications, the use of decoupled services through a standard interface, supplying the technological approach in order to develop solutions of Business Intelligence (BI). The SOA reference architecture is presented in figure 1.

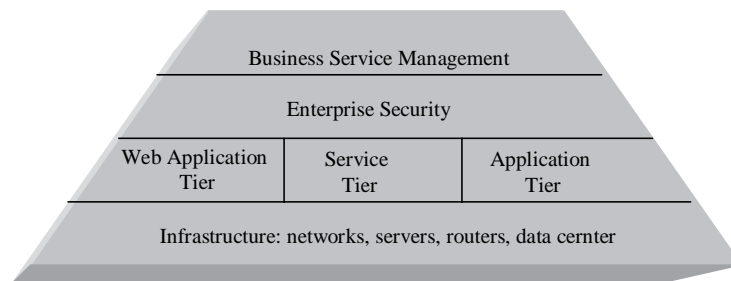


Figure 1. SOA Reference Architecture

The implementation of a MDM solution is a result of the need to ensure data consistency and accuracy, alignment of information resources of the organization, correct dissemination of information within/outside the organization, ensuring that data have semantic relevance for the beneficiaries. Thus, MDM solve data conflicts that cannot be solved by integrating technologies, eliminating data redundancy and inconsistency especially in complex organizations with multiple geographical units and IT systems. Figure 2 outlines the reasons why the organizations mentioned above should consider implementing a MDM solution.

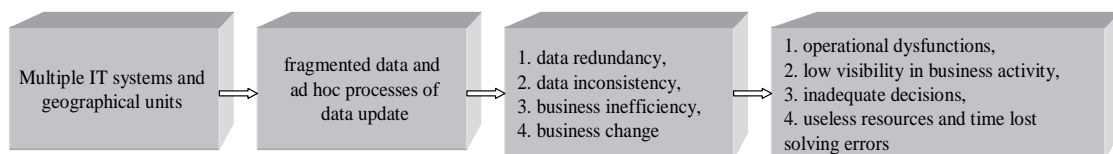


Figure 2. The need to implement a MDM solution

Taking into account the tendency that organizations have of using SOA architecture, in creating a MDM solution there must be taken into account the need for *SOA semantic concordance*. Elimination of point-to-point interfaces and replacing them with service-based integration minimizes the impact of changes resulting from integration of partners and clients, leading to the creation of a nimble MDM system. A nimble MDM system provides data quality, correspondence, and other MDM functionalities, such as data or business services available for external entities. MDM must be able to manipulate extensible types of data (XML, HTML, PDF, e-mail) and to present the master data model as part of the simplified data model of the enterprise.[2].

SOA increases the agility of information systems by the use of the same service in different contexts. The service adapts its behavior based on its master data, especially configuration data. When master data are duplicated within the systems, data integration is provided by SOA through XML. The Enterprise Service Bus use improves updates between master data repositories and operating systems. This operation is possible only if the MDM instrument is compatible with *SOA technology standards*, especially XML Scheme and web services.

Data service integration and exchange by SOA is made through special vocabulary of data content and data structure provided by MDM. MDM represents practically a component of the data service level . Through the supplied functions, such as aligning master data between multiple systems, departments, and partners, and providing processes, policies and procedures that would ensure clean and consistent information as new information is added and updated, MDM makes available for organizations platforms of master information services. Considering these platforms, the developers of composite services and applications will focus on business functionality and not on data access and update.

SOA connects people, processes, and information by integrating systems and providing a platform to develop new functionality. MDM provides the information management component – ensuring that critical information assets is aligned internally and across the value chain and delivered to people and systems alike in real time. SOA augmented with MDM provides IT organizations the tools to boost productivity and cut application development costs [1].

Within organizations, systems and people permanently generate events. CEP helps organizations to capture, correlate, and analyze events in real time. CEP has an emergent technology for the building and management of information systems, and allows events information to circulate through all levels of organization IT infrastructure so that they are found and understood in terms of impact on top level managerial objects and business processes and real time action may be taken. MDM provides for the events master data that describe relations between the entities that are acting during the event. The CEP engine extracts information from a MDM application by the means of data services. In order to cope with the thousands of events permanently generated within the organization, the MDM system must include high-speed cache distributed by multiple nodes that would provide contextual master information and allow CEP engine to analyze and apply rules to events. Data processes within a CEP application may be coordinated in MDM.

If correctly integrated, these actual trends - SOA, MDM, CEP and BI - may provide a strong infrastructure for the clients to build solution for a better visualization of business activities, understanding opportunities, and acting in order to achieve competition advantage on the market. We point out in Figure 3 that the relationship between SOA, on one hand, and CEP, MDM and BI, on the other hand, is an inclusion relationship in the way that CEP, MDM and BI are parts of the Service Tier of SOA.

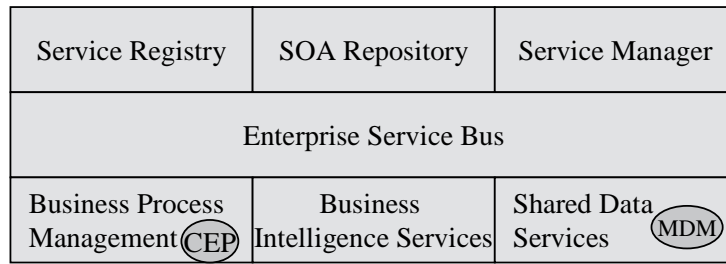


Figure 3. The Service Tier

2. MASTER DATA INTEGRATION AND MANAGEMENT SOLUTION TYPES

MDM Initiatives are oriented towards three great directions: 1. Gaining a cross-enterprise perspective for better business intelligence or customer intelligence; 2. Improving transaction management; and 3. Building a master data foundation for service-oriented architectures, ensuring consistent referential data for building composite applications and information services.

MDM systems can be "federated," "integrated," or "hybrid" reflecting a combination of the first two fundamental architectures. These three types of system characteristics are as [2]:

- Federated MDM - cross references key identifying information from participating systems to implement a registry-style solution. The main benefit of a federated solution is non-intrusiveness on participating systems that maintain their original context.
- Integrated MDM - stores all master data information from all participating systems in a centralized MDM repository. This centralized repository houses the "gold copy" of all master data information. The main benefit of the integrated approach is that it provides the most complete, accurate, and consistent single view of master data.
- Hybrid MDM - stores common data elements from participating systems creating a "light gold copy" of the master data, while disparate elements are referenced from their original system of record. The benefit and drawback of the hybrid solution is the partial combination of the federated and integrated benefits.

There are three main techniques for integrating and managing master data: master data identity registry, master data integration hub and enterprise master data management. An integration technique or a combination of techniques within a hybrid solution may be used. The master data identity registry technique uses an identity management application to create and maintain a repository for interrelating master data across business transaction applications. A master data integration hub propagates master data changes between disparate business transaction applications. Although the propagation process is normally done asynchronously, data delivery is guaranteed. Enterprise master data management meets all of the requirements of an MDM system.

In developing their systems, companies may use an evolutionary approach from identity registry to hub integration and then to a complete MDM company solution. In the end, the MDM company solution is generally used to manipulate multiple business entities, providing additional capabilities, such as master data modeling and master data management. MDM for the company is a complete solution, which needs a lot of resources and implementation effort, and is considered a multi-annual strategic initiative. Within a MDM company system, all master data are maintained and published through the means of MDM applications. MDM applications are systems that modify a global master data repository based on the demand for update from users or applications.

As seen in Figure 4, a MDM environment must make the connection between four elements: 1) a global master data repository and the associated metadata; 2) master data services that include a large range of capabilities; 3) MDM applications that maintain the global master data repository through the means of data services; 4) BI applications and

business transactions build on service-oriented interfaces that consume and update information from the global master data repository. The Master Data Store represents the system of record for enterprise-wide master data. Information about the system of record is documented and maintained in the Master Metadata Store. As master data is created and maintained, Master Metadata Store business rules ensure that the master data conforms to the business practices of the organization.

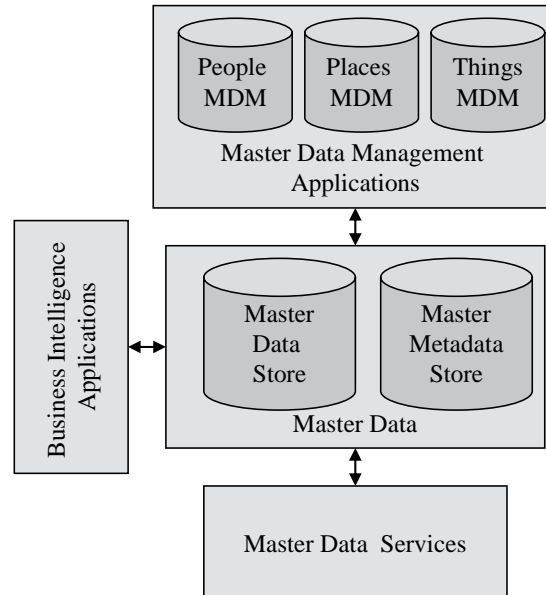


Figure 4. MDM Components

3. STAGES FOR THE DEVELOPMENT OF A MDM SOLUTION

A MDM solution may be created or purchased. It is created when companies already have a data repository or a dominant system that contains an important set of integrated master data, shared by some important operating systems of the organization, or a technology can be purchased in order to rapidly build a MDM solution. The main stages needed for the creation of a MDM solution, suitable for a Service Oriented Architecture and providing quality master data entities for CEP are the following (figure 5)[5]:

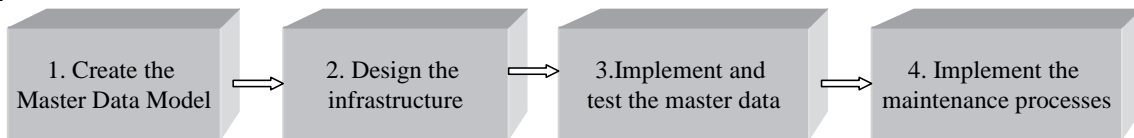


Figure 5. The main stages for the creation of a MDM solution

1. **Create the Master Data Model**, by: a) identifying sources of master data may start with identifying company's important business entities and grouping them into the following categories: people (customers, employees, suppliers, partners etc.), things (products, finances, assets), places (locations and geographic points of interest), other key entities (those sets of cohesive reference data that are of interest to the enterprise). Each enterprise sets its own important business entities according to the available resources and the development approach adopted. b) Identifying the producers and consumers of the master data. c) Collecting and analyzing metadata about your master data. These objectives must be achieved by a team made by the owners of each master-data source, the architects responsible for the MDM systems, and representatives from the business users of the master data. The team must set the method of translation from current data sources to the master data model and agree to purchase or build the toolset that creates

the master lists by cleaning, transforming, and merging the source data and must be set the infrastructure for the use and update of master lists.

2. Design the infrastructure. In designing the infrastructure there must be taken into account the availability, reliability and scalability of infrastructure. The infrastructure must allow applications to access master data and provide processes that would ensure good master data management. The infrastructure must provide capabilities for: a) Matching using fuzzy logic to match and standardize master data based on the business' predefined matching rules; b) Manipulation for data movement and tweaking. In addition, it provides basic workflow for matching, cleansing, and standardizing data as well as enforcing data survivorship rules; c) Modeling & retrieval enables the business to modify the MDM with limited or no IT involvement.

3. Implement and test the master data. This stage represents an interactive process that needs human investigation in order to verify the accuracy of current data sources transformation into master data. For the transformation of data sources the instrument chosen at stage 1 is to be used and transition is made based on the master data model. No instrument can ensure 100% correct transformation, therefore human investigation is needed for setting the configuration of transformation instruments, so that errors leading to useless master data are corrected. According to the solution chosen for the implementation, changes may or may not occur into systems that produce, maintain, or consume master data when a new master data source is added. This means that the implementation may be done starting from a single entity or from all the entities of master data identified in stage 1.

4. Implement the maintenance processes. Any implementation includes people, processes and instruments to ensure data quality, integration and management services. For each data there is a data steward who is responsible for ensuring the quality of the master data. The MDM infrastructure should include tools that help the data steward recognize issues and simplify corrections. The data steward should have the possibility to: a) review data so that possible data errors are identified and corrected; b) allow manual change and correction of matching, rules, and users' management; c) ensure hierarchy management that would allow creation of master data hierarchy based on industry, geography, income and organization.

CONCLUSIONS AND FUTURE WORK

The final objective of many organizations is to create a real time organization that would lead business and market. Combining SOA, MDM, CEP and BI allows organizations to be connected in real time, at each level, in processing daily activity and making strategic decisions. Besides, this combination provides agility in identifying and applying new solutions that have the advantage of being correct real time data on products, clients and providers of the company, ensures that this information are correctly coordinated and used within the organization in order to reach business objectives. Choosing and creating a MDM solution that would take into account the organizational demands, SOA and CEP represents an essential condition in creating an agile infrastructure of Business Intelligence and in reaching the potential benefits of technology. Every organization must set its own strategy for the implementation of the MDM solution and take into consideration the effort to be made, the needed resources and the time for the implementation.

Future research will include the opportunity to integrate these actual trends in different kinds of organizations and the creation of a system of metrics for measuring the integration impact.

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