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Enterprise Integration in Metadata Environment

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Abstract

Metadata play crucial role in enterprise interoperability between business, service and information layers. Metadata in different form, such as the abstract of system structure, aggregation of information, repository and semantic mediation play different role to achieve the integration interoperability, so each type of metadata contribute their value to enterprise integration. As misalignment within enterprise architecture has been ranked one of the top issues in recent 10 years, to cope with this common issue, we launched metadata based integration framework to enhance the visibility of enterprise alignment and use metadata configuration to construct the mapping between layer.

1 INTRODUCTION

Enterprise integration minimize the gap between business and IT to improve governance, agility and integrity. Two key processes were used to achieve this objective, the first process relates to how the enterprise goal can be achieved by impacting business process and its service components level, which we call “business semantic” or macro architecture. The second process follows one level below the first one called metadata mediation which called micro process, it constitutes the repository of metadata storing aggregated information and symbolic service information. Although there is dependency of micro process on macro process, the micro process integration should be initiated from the domain context analysis which proposed by H. Lee & J. Lee, so the three different forms of repositories (metadata, services and semantics) collaborate each other in creating the enterprise alignment between each layer in supporting macro architecture. Enterprise interoperability using common services is our focus, and metadata strategy is mandatory for common service, the fact that all of the organizations share the same service called common service which means they are all managed under the same rules which were developed using the top-down approach [1], [2].

In our recent research, componentization, metadata and business semantic are all the foundation in enterprise integration, we proposed component based validation, analysis, design and provisioning as our approach and metadata interoperability between business, service and information as our strategy.

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In our enterprise integration roadmap, we start from the decision-making process of business component selection to derive the service components and physical elements. In decision stage, group decision take each individual opinion and their role's weight under "political model driven" to validate either enterprise component or component required by a business scenario. Followed by the political model decision, we takes the validated components and continues the service component transformation, we term "rational model driven" and is grounded in objectives, alternatives, consequences and optimality. In this stage we use a parsing technique to analyze the use case and break into service components at an atomic level. We therefore, work on the micro process of component level interoperability and their aggregation. So once the vertical skeleton and service extension are built, the interoperability reflected from the business layer has the capability of integrating cross-organization and cross-geographical constraints, as fully transparent services become possible if each system or organization follows an industry standard by using metadata strategy and an industry framework.

2 LITERATURE REVIEW

C. Foste et al. indicated metadata has a key role to play in allowing systems to be built and automated. A management system composed of multiple distributed components implements a service such as content validation, transcoding, search or generation; and relies on metadata information to achieve success [3]. In our metadata strategy, service components derived from business use case are the mediation between business and technical element which integrate all business semantic, interfaces and technical configuration into a logical component, initially all the service components are in atomic level [4] [5] and these are achievable by metadata. This explain why we build the enterprise integration on top of metadata foundation. S. Melnik (1999) proposed a universal interface which avoids silos in models and languages, the generic interoperability framework developed to facilitate integration of heterogeneous information systems [6] and this is the foundation of our common services approach. Based on this common framework, we can build the component of both functional and non-functional by using industry standard.

DSouza specified the standard and common component as followed - to manage models of large scale, a coherent modeling architecture is required, with standard ways to describe shared concepts, rules, patterns, frameworks, mappings, and generators. [7]. M. Schmalz argued that database schema and application code can be efficiently derived from various types of schema representations, particularly the relational model, and supports comparison of a wide variety of schema and code constructs [8]. According to L. Yu et al., an obstacle to software reuse is the large number of major modifications that frequently have to be made as a consequence of dependencies within the reused software components. Component base implementation is the foundation in coping with this bottleneck [9].

Thus, the determination of Common Services and Composite Services is a use cases driven parsing process, the purpose of the parsing iteration process is trying to find out the common areas and dependency between services. The determination of

common component and service aggregation, as mentioned, is through the parsing process using use case driven model.

3 INTEGRATION FRAMEWORK

To cope with the enterprise integration issue, our priority is a parallel process between architecture strategy and implementation roadmap, we proposed four steps META (Method-Evaluation-Technique-Application) approach, the approach applies the strategy (Method) of vertical integration to business decomposition (Evaluation), so once the component is evaluated and validated, we can apply parsing and aggregation (Techniques) in component based implementation and to achieve enterprise and industry virtualization (Application). Among these four stages, two key processes were used to achieve this integration objective. The first process relates to how the enterprise goal can be achieved by impacting business process and its service components, which we call "business semantic." This process comply with the concept of "separation of concerns" of service-oriented enterprises to impact all of the above elements, it decompose the business block into business component; move forward to a service component through the business modeling process; the reason componentization needed to be the first priority is because visibility and traceability requirements [10]. The second process follows the first one is called "metadata collaboration". It constitutes the repository of metadata storing information and its process in coordinating message between service and data; it thus supports the upper layers, which is the first process, by repository synchronization. The details of these areas and stages are shown in Figure 1.

As mentioned above, the approaches being used in this paper include: i) four stages framework in the enterprise integration life cycle, strategic framework, political validation, rational validation and micro process design, and service provisioning. These are all the key stages in enterprise integration life cycle, as enterprise interoperability is built on the foundation of validation processes of decision, design and provisioning stages. A full virtualization environment, which is our objective, needs to be built on top of the foundation of component design and service transformation process in order to apply the vertical enterprise integration approach to this final stage which is the goal of our research work. The standardization of metadata technology and common services and components are all requirements within this framework [11] [12] [13]. ii) two process in building vertical interoperability which includes: "business semantic injection" which was working on the gap between strategic direction, business, process and service; and "information metadata" which is based on the application of existing metadata theory and repository solution [14]. The integrated solution of coherence of approaches plays skeleton in vertical integration addresses the enterprise gap and is expected to provide further insights into micro process integration across enterprise layers [15].

4 INTEROPERABILITY MODEL FRAMEWORK

To extend the concept of metadata interoperability by using a mathematical model, we take the output from each layer denoted by a capitalized alphabetical letter (**D**: direction, **B**: business, **P**: process, **S**: service, **I**: information). In decision and analysis stage, the alignment interoperability between B, S and I is formed with micro referential integrity occurs in each layer with a loosely-coupled alignment between b-s-i, where D and P are no more exist as they became part of B and S individually, the reasons are: 1) the ontology allows architects to apply d-b as a business-driven top-down approach or p-s as a service-driven bottom-up approach, however metadata is needed to coordinate the service layer by metadata repository. 2) the concatenation between B-S-I in micro process forms a reuse foundation within enterprise and industry, the standard metadata framework within industry share the repository for those common components (business, service and information) for enterprise to implement and integrate within the industry, so the service virtualization become possible. Micro process interoperability is the key in component based integration, and this concept is shown in Figure 2.

The micro process integration was initiated by the domain context analysis process, the reason is each domain analysis produces one or many service dimension which requires support from metadata and component coherence, this differentiate our approach from conventional approach as usually in conventional design, either the micro process is missing or they are not appear in the early stage.

5 SEMANTIC METADATA ANALYSIS

The semantic analysis concept was applied in supporting the theory of vertical integration, so the analysis of the scenario and the semantic extraction of noun and verb form the common components in process, object and interface as domain asset [16]. The semantic analysis extract noun and verb from atomic services and form lists like this, in the semantic repository, noun list store customer name, id, phone, account number, status and verb list store, open account (type), check non-exist (db), create account (type), credit check (code). Once the semantic analysis work is done and both verb and noun list are stored in semantic repository, an asset validation of common objects need be done before further development in vertical (downward) direction, asset validation is a process for duplicate check, merge and final decision before all of these common objects become valid to stay in semantic repository for reuse. The three different types of repositories (metadata, services and semantics) collaborate each other; the strategy of “enterprise vertical integration” was based on the processes which build up these repositories in early stage, and the methods in achieving inter-operability between repositories in later stage, the fact that all of the organizations share the same service means they are all managed under the same rules which were developed using the top-down approach. As all of the organizations share a common protocol to communicate their semantic rules, the integration effort can be eliminated and interoperability can be enhanced through this topology once the semantic communication has been fully developed [17], [18]. Each service component was a

unique common component which performs a well-defined, specific task inside a particular business area; the critical process of “semantic injection” and “metadata aggregation” enabled the service component’s capability in mediating the inter-operability of each vertical element in coping with each business change or adds-on in a fast development environment. The governance of operability between business and IT need to configure existing services within a newly configured active map in each change which is the selected business components in achieving a particular business activity, this need to be done by using graphic mode, however in case that existing service component cannot provision full function of a new business requirement and need to develop new service component, this need be done in a design mode with manual linkage to business process and metadata repository.

6 CONCLUSION

The concept of “enterprise vertical integration” covered many aspects of technology and knowledge which we already discussed, the issue was from misalignment of business and IT, so the business context and semantics cannot effectively impact IT development and cause all development, change and maintenance very difficult. Metadata coordination in component based design is the first step we like to propose to achieve both of our architecture strategy and integration roadmap. The lack of interconnectivity between context, semantics, service and data is the tactical issue with the clear implication that enterprise architecture needs a robust micro-mechanism of semantic messaging and metadata to coordinate across layers. In this way the strategic direction will then have an opportunity to impact the business process to streamline successful services and information components.

The nature of “enterprise vertical integration” differentiate itself from traditional integration from what we saw was not “architecture layer”, instead we saw how business context and semantics transform into service component and communicate with metadata through micro componentization process, this transformation totally change our concept from previous layer-to-layer integration to components’ collaboration. The enterprise integration life cycle consists validation, analysis, design and virtualization. Enterprise interoperability is built on the foundation of metadata and component based design, we applied both macro and micro process in constructing the foundation, we further aggregate the component into common component and aggregation services. This encompasses component-based design and interconnectivity, transformation of service aggregation through rule-based design, service provisioning in a particular dimension and service virtualization.

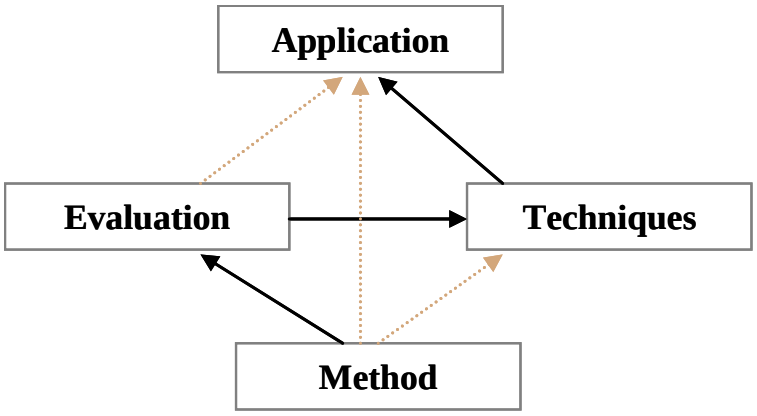

Figure 1 – META approach

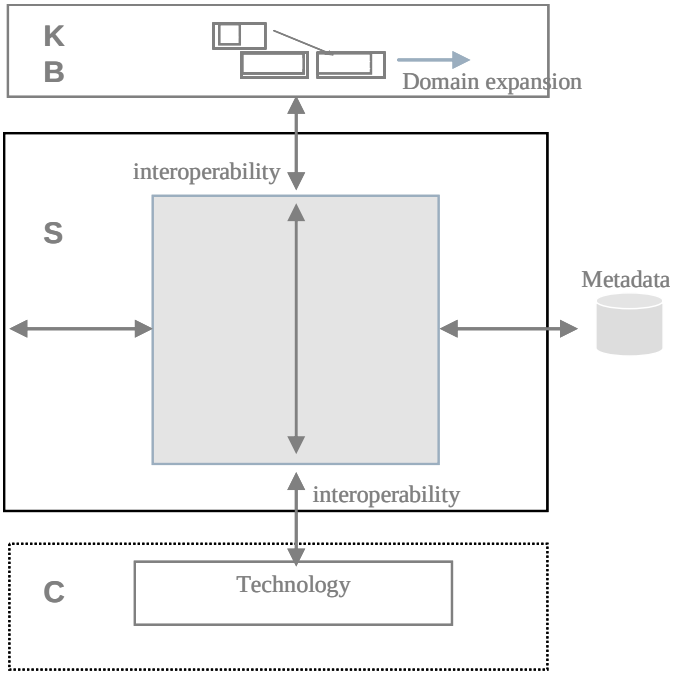

Figure 2 – Enterprise Integration Framework of K-B-S-C metadata alignment

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