Digital Business Ecosystem

Contract n° 507953

WP 21 DBE Architecture Requirements

Del 21.3 DBE Architecture High Level Specification

Project funded by the European Community under the “Information Society Technology” Programme

Contract Number: 507953

Project Acronym: DBE

Title: Digital Business Ecosystem

Version: 0.1

Deliverable N°: D21.3

Due date: 30th of April

Delivery Date: 5th of April

Short Description: high level specification of the DBE Architecture.

Partners owning: Soluta.net

Partners contributed: -

Made available to: Project Team

Versioning			
Version	Date	Name, organization	Description
01.00.00	05/03/05	Pierfranco Ferronato	First release

Quality check

1st Internal Reviewer: Andrea Nicolai, T6

2nd Internal Reviewer: Miguel Vidal, SUN

1 Table of Contents

2 List of Figures

3 DBE Conceptual Framework

The DBE is based on a P2P architecture that allows the ecosystem to be effectively pervasive and decentralised. There is no single point of failure and the ecosystem itself is owned by participant SMEs. The knowledge is spread across the supporting nodes through a P2P self healing architecture (ref. Figure 1 - DBE Conceptual Model below).

Services are described in both the technical and business point of view hence allowing semantic and business kind of search and discovery.

A distributed and decentralised knowledge base, collects usage information about the ecosystem behaviour in order to allow the evolutionary environment to create optimized service chain. The Evolutionary environment is expected to create new populations of services as a response to the ecosystem life.

The Intelligent Recommendation systems, by considering the populations of services and the knowledge base, is in charge of fulfilling business need in a push approach, as opposed to the regular pop approach. SMEs and their consuming services will specify business requirements via a natural based language and receive the most adequate service considering also the technical interface.

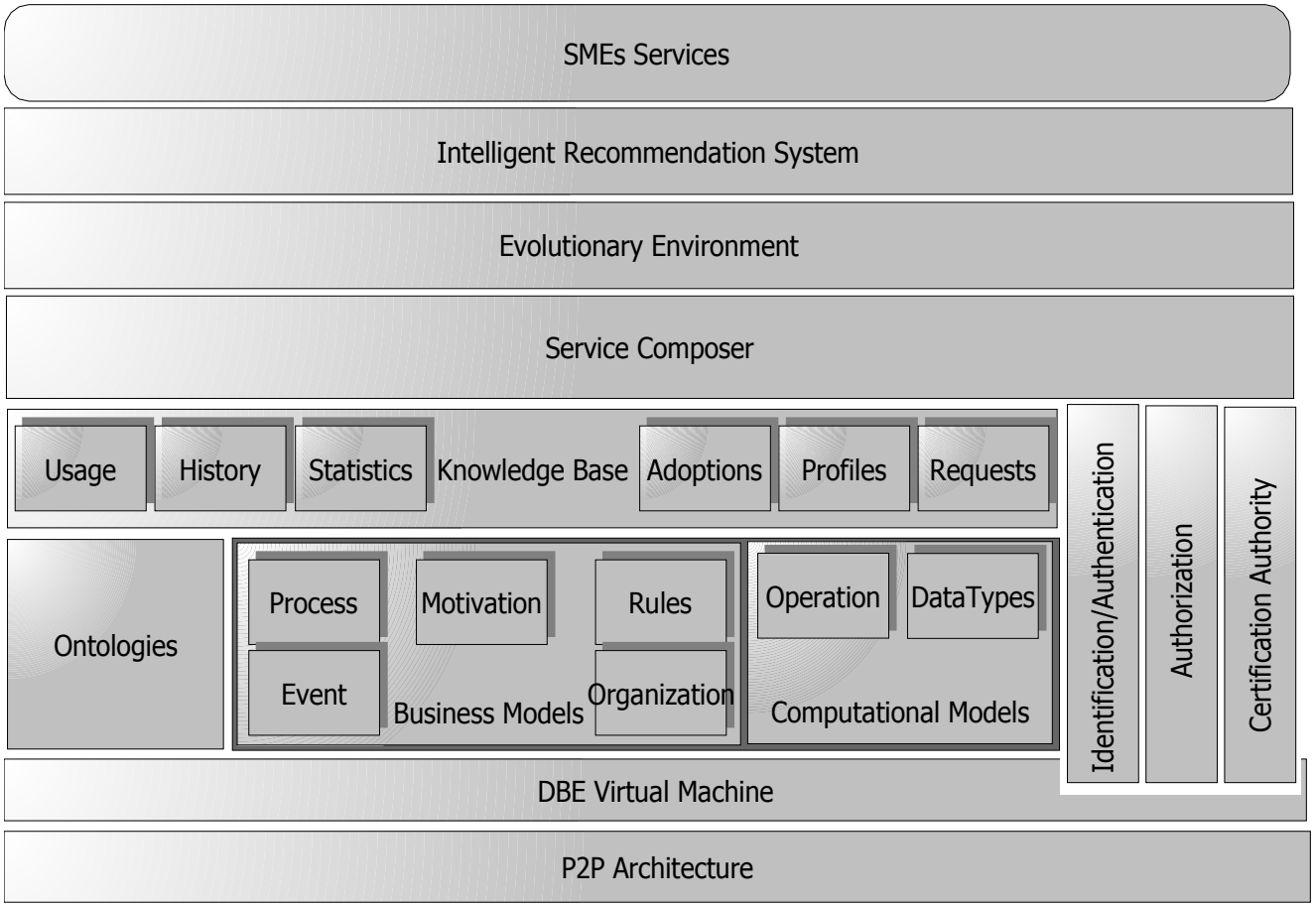

Figure 1 - DBE Conceptual Model

4 Service Composer

The Service Composer allows to browse the collected published service and to create a work-flow that can readily be executed and published as an atomic service. The chained nature of such new service will be completely transparent to the consumer application or user; a remote Transactional Work-flow Engine will take care of fetching linked services and to execute them using the transactional semantics.

An embedded mapping facility will help the adaptation of the different data types that might be adopted by the aggregated services.

The Composer can work in two modes: static/dynamic. The first will compose actual service instances, i.e. services identified by their models but also by their implementation. This means that the actual SME providing the service, is solved at composition time. The latter will allow the user of the Composer to work only with models of service and let the Work flow Engine decide at run-time which is the more convenient service to use. This last mode will also be used whenever, during the first mode, the chosen service is not available.

Thanks to the use of ontologies that add semantic information to services, the Composer and the Work-Flow Engine will able to identify the most appropriate services with great accuracy.

5 Framework of the DBE Service

Each service in the DBE is specified using a set of formal languages that aims at defining the business models as well as the technical interface in a platform implementation way. Thanks to the model driven approach adopted, business models can be transformed and mapped into platform specific models without specific user interventions. The family of languages adopted defines the service's DNA that fully specify the service and in addition it provides the ability to evolve and adapt.

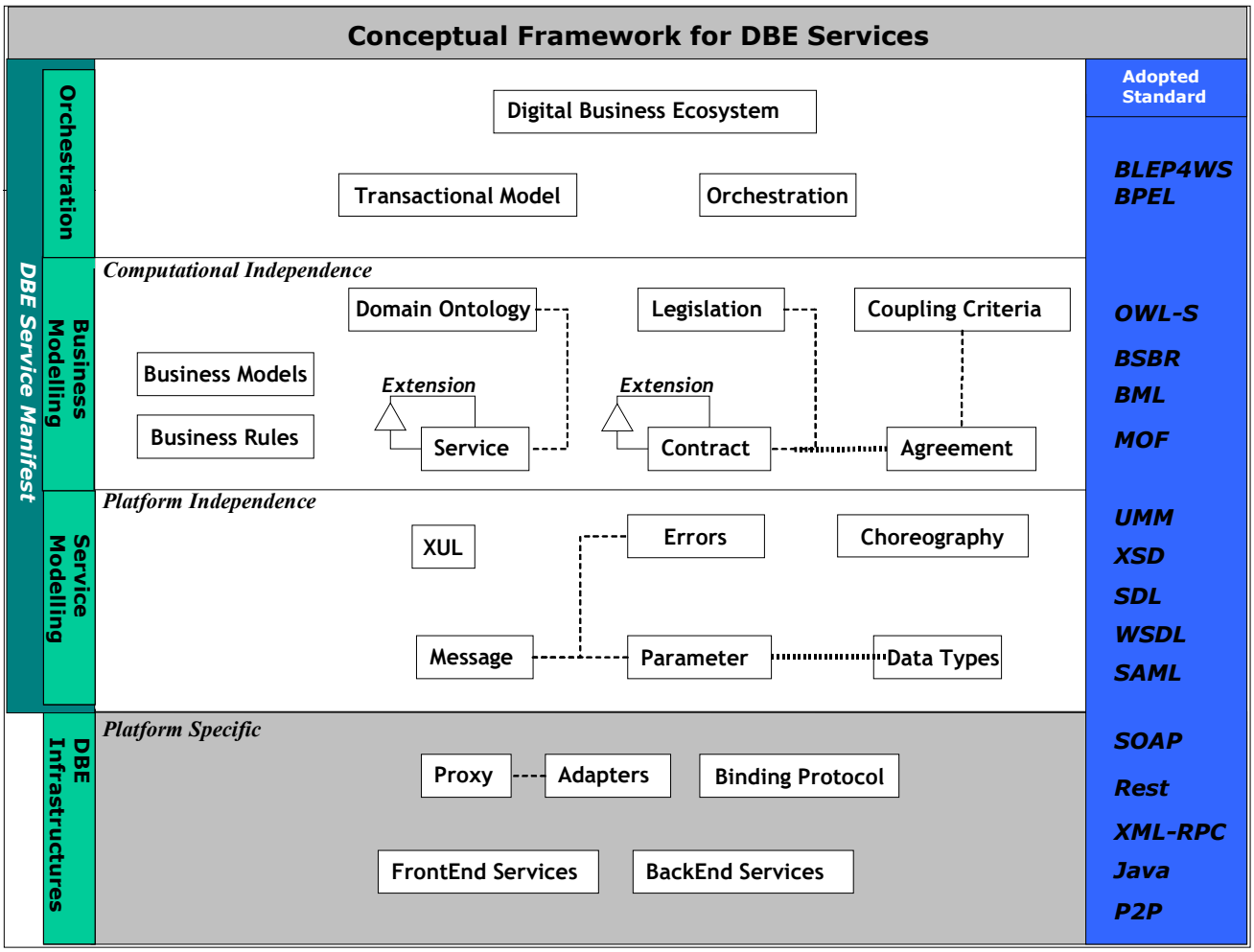

Figure 2 - Conceptual Framework for DBE Services

6 Network Topology

Every structural component of the DBE is decentralised, such approach potentially allows the ecosystem to be self healing and survive technical, network and political failures (ref. Figure below).

The entire specification is Free Libre and Open Source, so are the reference implementations provided in the scope of the DBE project. At the same time the DBE provides all the Security features to guarantee SMEs that their services are secure and that the Intellectual Property is protected. It is worth mentioning that the DBE is Open, not the business services that it delivers.

The technical architecture eases the entire integration and adoption process by providing an infrastructure at both sides of the pipe in a consumer-provider point of view. Services already residing in legacy systems can quickly become DBE enabled, thanks to the decoupling schema provided by the Service Oriented Architecture (SOA) and the Model Driven Architecture (MDA, ref. Figure below).

The DBE offers a wide set of basic structural and business services to ease the creation of an effective B2B environment. Payment, information carriers, identification, accounting, billing, ticketing have been designed and implemented.

Given the meta service and meta modelling approach followed in the project, there is not a single model or a service that can not be replaced or enhanced. No pre defined or immutable behaviour is coded in the DBE.

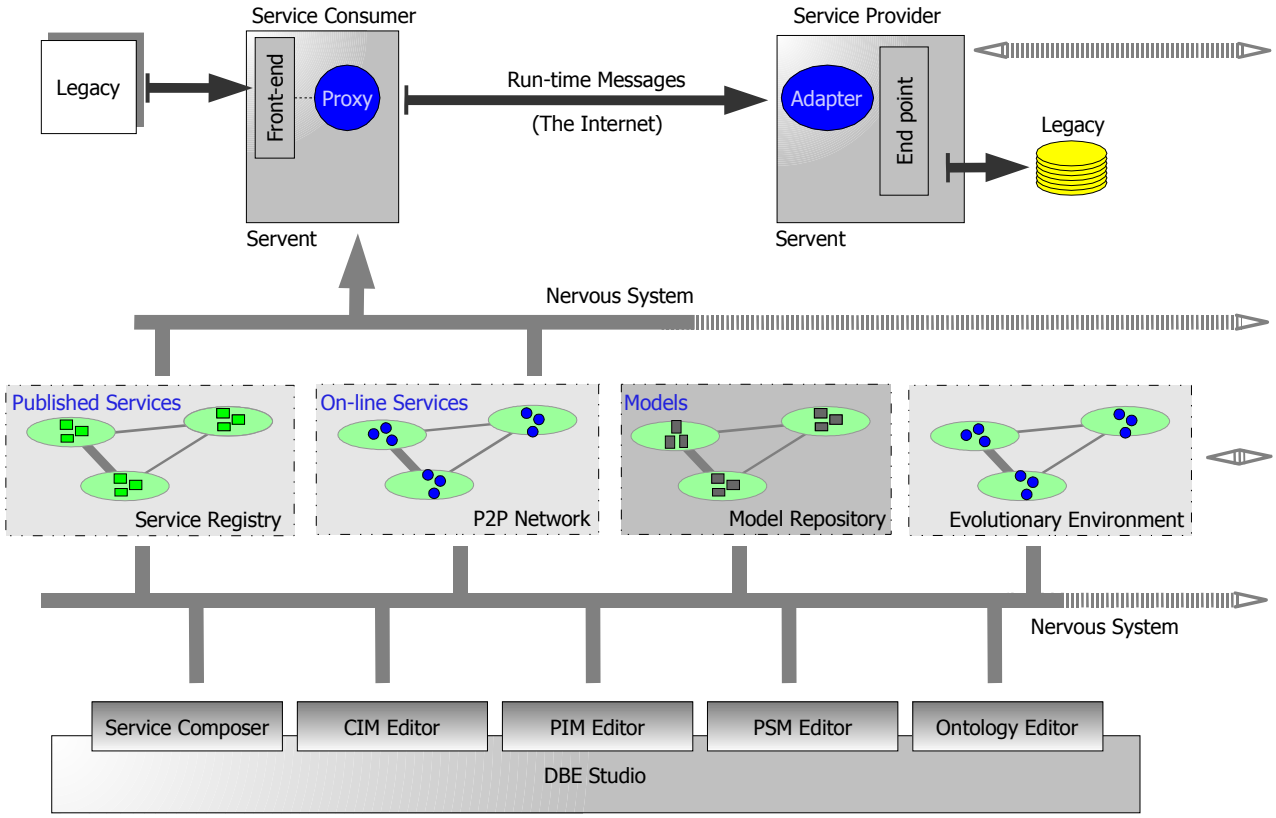

Figure 3 - Network Topology

7 The Integration Process

Adopting the DBE requires no development effort, just a declarative approach is needed. Services are described by creating a set of technical and business models with the DBE Studio, the system will then take care of generating all the required structural code to embed it in the ecosystem (Ref. Figure below). SMEs, using the most convenient technology, have to integrate their service with the DBE functional interface; the DBE is not invasive not enforcing the adoption of yet another middle-ware. Shortly after the service registration, the community will be able to search, investigate and consume the new service.

The open nature of the DBE allows communities and other SMEs to take advantage of already existing service models and specifications, hence reducing the digital divide of SMEs. The decentralized model and service repository will be the base for fast service's evolution and adaptation.

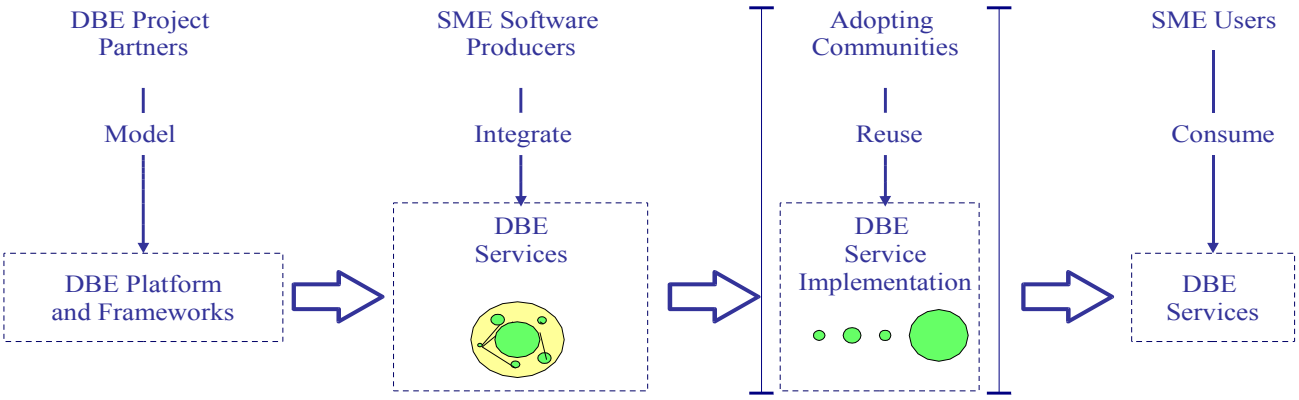

Figure 4 - DBE adoption process (adapted with permission from ISUFI)

8 Evolutionary approach to define the functional reference mode

Demanding to a centralized functional reference model to solve the problem of interoperability, with a suggestion like "you have to agree on **this** common model", is a short-sighted approach that leaves behind the actual hardest issues in business to business. This is a classical " chicken and egg" dilemma that the DBE is addressing with a rather new approach: instead of assuming that services will converge beforehand to a common functional model, or enforcing the compliance to reference centralized data model, the DBE is supporting an evolutionary and competing approach to functional modelling.

The classical Service Oriented Architecture (SOA) for addressing the Business to Business (B2) requirement is underestimating the impact of enforcing a unique functional models. It is not realistic to force business partners, and especially competitors, to comply to a unique data schema or service model. In B2B the standards cannot be enforced, not even if defined by a commission or by a standards body. There are complex mechanisms that allow standards to emerge and become de-facto, and that motivate IT and business communities to adopt them. Also, having the support of industrial "titans" helps in the adoption process. As a general consideration, it is relevant to note that often "good" standards are not necessarily in a better position to emerge[1].

The DBE, in addition to the classical infrastructures found in regular SOA implementations, provides access to a repository of models where all the functional models used by services are published. Any SME who wishes to join the community can create, reuse or modify any pre-existing models found in the repositories. Unlike a regular SOA registry, which is a flat catalogue of unrelated models, the DBE repository relates models by extension, evolution, copy and modification in order to track usage and the adoptions. Such relations help the SME make the best choice when deciding which models to adopt for his service; the number of times a model has been adopted, the maturity of the specification (it is a function of the number of ancestors), and the number of related business relations will affect the decision.

It is expected that reference functional models will emerge in a natural way, under the same laws that regulate standards adoption outside the DBE, but at a faster pace. The project's goal is to replicate in a digital environment the natural selection process.

> **Example:** SME 'C', a supplier of cleaning services for hospitals, before exposing its services in the DBE, might be interested in investigating which is the most used technical specification in its own business domain on similar activities (e.g. generic or hotel cleaning services). The exploration could show that there are two main clusters of adoption, one around the specification 'SA' (defined by SME 'A') and one around specification 'SB' (defined by SME 'B'). At this point SME 'C' can decide whether to adhere to the first specification, hence creating competition with the second, or vice versa. Deciding to adopt –for example— specification 'SB' will eventually facilitate the migration of those customers who are already using it.
> As an alternative, it can decide to go its own way by creating specification 'newSC', probably an improved extension of the ones already adopted. It may believe that the quality of service provided, the underlying

[1] As the famous "Betamax" vs "VHS" standard in the late '70. VHS was a later player in the home video market and provided a less recording quality than Betamax, but was cheaper and more supported than Betamax. VHS ended up being the "standard".

business model, the presence in the region and the price schema are much more convenient relative to its competitors, and it may believe that it is able to create a new cluster of adoption around a new technical specification.

9 Where is 'Business' in Web Service?

In regular Web Service implementations, services are described from a computational viewpoint; the UDDI registries describe services in rather a cryptic way from a business perspective. WSDL with its messages, types, errors, ports and so forth, is a language meaningful only to IT people and does not help SMEs managers and directors to find the proper business partners. In fact, given two services with identical computational descriptions, the underlying business model and offer might be completely different.

One might ask where the business is in the Web Services; the only fields in UDDI where descriptions and business specification could be added are unstructured and free text based hence not computable.

In DBE services, in addition to the regular computational viewpoint, are augmented with business descriptions using a computational independent modelling approach. Such a rich model helps to describe locations, business models, type of offer, contracts, pricing and discount schemas which are completely missing in the technical description. In order to provide a flexible way to describe such models, the DBE has created an ad-hoc business language called the Business Modelling Language (BML), that in addition to being XML based and hence computable, be expressed also in a natural language (the Business Semantic for Business Rules, BSBR) for easy comprehension and creation by the business people. Both the BML and the BSBR are being defining inside the Object Management Group[2] which guarantee Open Standard and ease of adoptions thanks to the compliance with the Model Driven Architecture[3]. The DBE partners, working in such specifications, are OMG Influencing members and are working closely with OMG.

Thanks to such rich semantic models, a Recommendation system provided by the DBE is able to support SMEs in the search for partners or suppliers.

[2] OMG, www.omg.org

[3] MDA ww.omg.org/mda

10 Research Areas

P2P architecture	P2P data replication strategy, efficient and fast search mechanism
Recommendation	Recommendation systems based on business models and rules
Decentralised file system	Decentralised Internet based file system with decentralised FAT
Natural language based modelling editor	A "word processor" based approach to business and computational modelling, the Editor has not to depend on a specific metamodel
Contract negotiation	Automatic contract negotiator and business agreement creator
Automatic Service Composition	An automatic process for creating computational service chains from business chains specification
Model transformation	Run-time model transformation based on OMG-QVT specification
JMI2.0 and implementation	Based on the MOF2.0 OMG specification, the JMI2.0 specification and reference implementation has to be developed
P2P simulators	Create a P2P simulator that, based on P2P implementation strategy, derive the corresponding network map in order to predict behaviours and topologies

Table 1DBE related research Areas

11 Glossary

Term	Description
M2	MDA layer that references to MOF models (e.g. UML, CWM, EDOC, BML, SDL...)
M3	MDA layer that references to MOF language
MDA	Model Driven Architecture
MOF	Meta Object Facility
OMG	Object Management Group (www.omg.org)
P2P	Peer to peer
PIM	Platform Independent Model
PKI	Public Key Infrastructure
Proxy	Executable Java object that can be distributed over the Internet. It is usually a mediator to the actual remote service that provides the required functionality.
PSM	Platform Specific Model
RUP	IBM© Rational Unified Process®, or RUP®, http://www-306.ibm.com/software/awdtools/rup/
SDL	Service Definition Language: a language for the definition of a Platform Independent Model (PIM) of the service interface
Service Proxy	Ref. Proxy
SM	Ref. Service Manifest
Smart Proxy	Ref. Proxy
Super node	In P2P technology it represents a node of the network (a remote server). In the DBE there are several kind of super nodes: KB, FADA, DSS.
UDL	Universal Design Language
UI	User Interface
UML	Unified modelling Language
User Interface	Graphical User Interface
UUID	Universal Unique Identifier
VAS	Value Added Service: a service that is the aggregation of other services.
X509	It is a standard that makes it possible to identify someone or something on the Internet.
XMI	XML metadata Interchange
XML	Extensible Markup Language
XP	Extreme Programming http://www.extremeprogramming.org/

12 References

[BML metamodel]: Angelo Corallo ed others, “BML Metamodel v0.1”, 2004
[BML metamodel2]: Angelo Corallo ed others, “Work Package 15 DBE Business Modelling Language v2.0.1”, 2004
[BMLWS2003]: P. Dini, T. Kuusisto, A. Corallo, P.Ferronato, N. Rathbone, “Toward a semantically rich BML for the automatic composition of WS”, 2003
[COOPER]: Alan Cooper, “The Inmates are Running the Asylum”, 2003
[DBE]: F.Nachira, E. Chiozza, H.Ihonen, M.Manzoni, F. Cunningham, “TOWARDS a NETWORK OF DIGITAL BUSINESS ECOSYSTEMS”, 2002
[EvE]: “Evolutionary Environment Architecture Requirements”, Gerard Briscoe, Intelligent Systems and Network Group Department of Electrical and Electronic Engineering Imperial College London, May 2005.
[FER04]: Pierfranco Ferronato, “DBE Core Scoping Architecture”, 2004
[FRK]: D.S.Frankel, “Model-Driven Software Development”, MDA Journal, www.bptrends.com, 2004
[GORDON] S. Gordon and D. Whitley (1993), Serial and Parallel Genetic Algorithms as Function Optimizers, International Conference on Genetic Algorithms. S. Forrest, ed. Morgan Kaufmann.
[HS2002]: Peter Herzum, Oliver Sims, “Business Component Factory”, 2002
[Keller]: Wolfgang Keller, “The pitfalls of Meta-Systems and Business Rules”, www.objectarchitects.de, 2004
[MDA]: OMG, Architecture Board ORMSC, “Model Driven Architecture (MDA)”, ormsc/2001-07-01, July 9, 2001
[MDAF]: D.S.Frankel, “Model Driven Architecture Applying MDA to Enterprise Computing”, Addison Wesley, 2003
[MDAGuide]: OMG, “MDA Guide Version 1.0.1”, http://www.omg.org/docs/omg/03-06-01.pdf, 2003
[MDAK]: Anneke Kleppe, Jos Warmer, Wim Bast, “MDA Explained”, Addison-Wesley, 21st April 2003
[MOF1]: OMG, “Meta Object Facility (MOF) Specification”, v1.3 March 2000, 00-04-03.pdf
[OPAL]: A.Formica, M.Missikoff; Ontology Validation in OPAL, Proc. Of the Int. Conference on Web Services (ICWS), L.J.Zhang (Ed.), pp.198-202, LasVegas, Nevada, Jun 2003.
[QML]: “WP17: Composer, D17.1: Recommender”, DBE Deliverable, Technical University of Create, 15/02/2005
[SIMS94]: Oliver Sims, “Business Objects”, McGraw-Hill, ISBN: 0077079574, October 1, 1994
[SOL04]: “DRAFT_SMSoftwareModel”, Soluta.net, G.Montanari, V.Trentin, 2005/01/02
[STU04]: “Service_Manifest_Conceptual_Model_V3”, Salzburg Technical University, C. Masuch / 2004-05-03, internal DBE document
[TA]: “SIXTH FRAMEWORK PROGRAMME PRIORITY 2.3.1.9. Networked Business and Governments, Annex I - Description of Work”, IST - 2002 – 507953, 29.10.2003
[TIMBML]: Tim Romberg, “Very Simple BML”, paper, 2004
[TIMH]: Tim Romberg, “Hotel – Corporate client scenario”, paper, 2004
[ZIFA87]: "A Framework for Information Systems Architecture." John A. Zachman. IBM Systems Journal, vol. 26, no. 3, 1987. IBM Publication G321-5298. 914-945-3836 or 914-945-2018 fax.
[WP 21] DBE Architecture Requirements

- end of document -