PSYMBIOSYS

D6.5

Digital World Service Oriented Architecture and Semantic Mediators for Data Access First

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VERSION HISTORY

NBR	DATE	NOTES AND COMMENTS
1	13.02.2016	Initial version including all parts
2	29.02.16	Revision according to WP6 leader comments (Paolo Civardi)
3	04.03.16	Revision according to WP6 leader comments (Michele Sesana)
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DELIVERABLE PEER REVIEW SUMMARY

ID	Comments	Addressed (X) Answered (A)
1	Revision according to WP6 leader comments (Paolo Civardi)	X
2	Revision according to WP6 leader comments (Michele Sesana)	X
3	Revision according to WP6 leader comments (Michele Sesana)	X

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List of Figures

Document Acronyms

Acronym	Full Name/Explanation

Executive Summary

This deliverable presents the current development state of the Semantic Mediator Administration. The development process focussed on the implementation of a Semantic Mediation Layer for bi-directional access to product-item and lifecycle data. As a first outcome, the Layer ensures a unified access to data in context of Manufacturing Intelligence. Hereby, this module is working on the digital world side on the SOA connected world. It is composed to handle and overcome the data integration conflicts. The location of the Sematic Mediator Administration is in the module Digital World Manager in the PSYMBIOSYS architecture.

To enable the unified access to the data by humans as well as by PSYMBIOSYS components, a web based frontend has been developed. The web based frontend enables the configuration of data sources as well as the query of information. Hereby, the ontological description of data sources as well as a SPARQL query language lies the foundation to enable a high flexible, adaptable and robust communication stack. Moreover, the Semantic Mediator Administration implements in its backend the semantic mediation capabilities which ensures the data aggregation over the boundaries of different data sources.

The developed and provided Semantic Mediator Administration is a web application which bases on the Specific Enabler SEMed and is implemented in JAVA EE. The web application is accessible throw a web browser and therefore simplified the later on usage in different application domains. The provided *.war archive enables the deployment of the web application in an Apache Tomcat application server. The *.war file is available in the Intranet section of the PSYMBIOSYS website. The installation, configuration and usage is described in this document in detail.

The current provided functionality doesn't contain the possibility to forward information to other IT systems. This missing functionality will be included in the next release to enable the insertion of information in different PSYMBIOSYS modules directly. The set of implemented functionality will be increased through the continuous implementation and evaluation activities during the project. The final set of functionalities will be presented in D6.6 at M27

1   Introduction

This chapter will introduce the software release including the purpose of the software, the positioning of this deliverable in the context of the project and the applicable documents.

1.1   Introduction to the software release

Semantic Mediator Administration is a web application which offers a layer for semantic, virtual interoperability and integration specifically of item-level product lifecycle data. It facilitates a standards-based access to PLM data, for example through its support for the Open Group QLM Standard Open Messaging Interface (O-MI) and Open Data Format (O-DF). At the same time, it provides semantic interoperability for different kinds of common data sources like databases and file based repositories. It introduces a layer of semantics on top of existing syntactic data structure descriptions to avoid semantic integration conflicts and allows a scalable, efficient and comfortable interoperability of product data across all of the stakeholders and IT systems involved in digital factories.

The current release contains the web application Semantic Mediator Administration Overview. This web application includes the functionality of the proposed semantic data integration capabilities as well as a frontend for the configuration and usage of data sources.

1.2   Positioning of the deliverable in PSYMBIOSYS

This deliverable describes the first technical output of T6.3 which will strive to implement a Semantic Mediation Layer for bi-directional access to product-item and lifecycle data. The proposed solution introduce a layer which can ensure a unified access to data in context of Manufacturing Intelligence. For each of the target data sources, wrapper components will be configured and semantic descriptions of the data sources created.

The concrete set of wrappers, data sources and necessary user functions will be derived on basis of the overall WP6 and the corresponding needs of the use cases. The Semantic Mediator Administration is part of the Digital World Manager. Hereby, this module is working on the digital world side on the SOA connected world. It is composed to handle and overcome the data integration conflicts to enable as well as activate DW services. The location of the Sematic Mediator Administration in the PSYMBIOSYS Overall Architecture is shown in Figure 1.
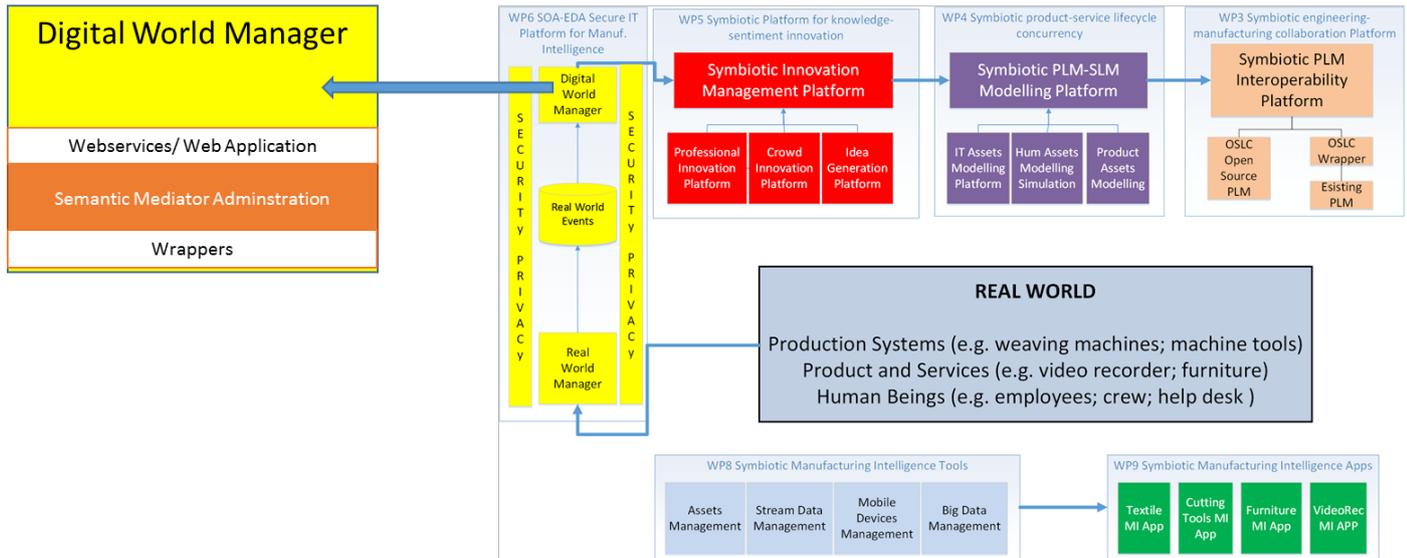
Figure 1 PSYMBIOSYS Overall Architecture

1.3   Applicable Documents

- PSYMBIOSYS DOW
- D9.1 describing the overall architecture

2 Name of the Software Component Released

This chapter focuses on the description of the software component released. The section starts summarising the overall information about the software released (description, overall data, functionalities and architecture), after that technical information are reported about architectural stack, technical manual for installation and licensing (including third parties components). Finally the user manual and conclusions and future steps close the chapter.

2.1 Software Description

2.1.1 Overall Data

Item	Value
Component Name	Semantic Mediator Administration
Software version	V0.1
Reference workpackage	WP6
Responsible Partner	BIBA
Contact person	Marco Franke, fma@biba.uni-bremen.de
Source control	http://demos.txt.it:8096/intranet/wp6/d6-5-first-prototype/semantic-mediator-adminitration/view (binary version)
Short Description	Tool for semantic data integration

2.1.2 Purpose of the tool

Semantic Mediator Administration contains a layer for semantic, virtual interoperability and integration of item-level product lifecycle data. It facilitates a standards-based access to PLM data, for example through the existing support for the Open Group QLM Standard Open Messaging Interface (O-MI) and Open Data Format (O-DF). At the same time, it provides semantic interoperability for different kinds of common data sources like databases and file based repositories.

The Semantic Mediator Administration enables the abstraction from the data level to an information level. This feature enables the exchangeability of data sources without changing on top IT infrastructure like data driven services. Moreover, it enables a robust interface for information querying. An information could be queried over the boundaries of heterogeneous data sources.

2.1.3 Summary of Functionalities

The purpose of the tool is to enable a semantic data integration over the boundaries of different data sources. In consequence, the main functionalities are defined by:

1. Wrappers to connect a specific kind of data source
2. Specific data sources can be connected via the creation of a configuration
3. Ontological description of the information model
4. Information model will be generated through the connected data sources
5. A derivate of SPARQL to enable a high flexible querying mechanism
6. Web service to deliver information as O-MI/O-DF

The QLM Web Service is ready as Java Servlet but not contained in the current binary package. The necessity of this module for the use cases hasn't been clarified yet. In the positive evaluation, the configured QLM Web Service will be available in the next release.

2.2 Technical Information

2.2.1 Internal Architecture

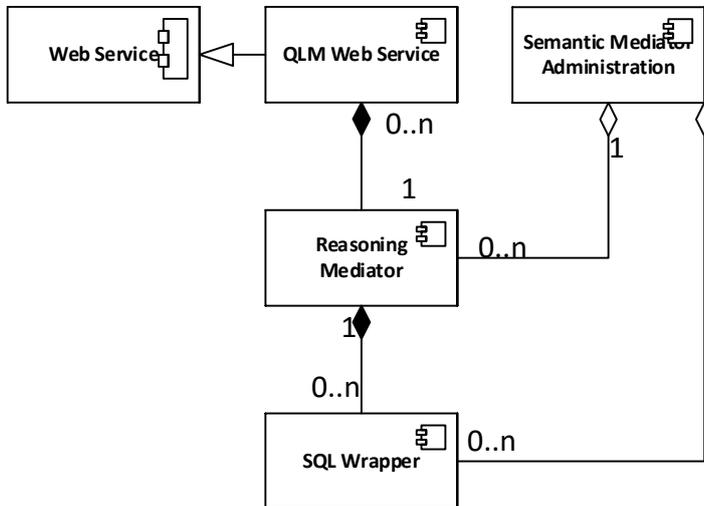The internal architecture is shown in the following figure and is based on the Specific Enabler SEMed.

Figure 2 Architecture of the Semantic Mediator Administration

The overall architecture consists of for type of components.

Integration Services
Components of this type realize interfaces to request information by the Semantic Mediator. Up to now, there is a graphical user interface and a web service to interact with the Semantic Mediator. Both types of interfaces enable formulating of SPARQL queries so that information requests can be resolved.

Semantic Mediator
This component is the core of Semantic Mediator Administration and implements the mediator functionality. In this role, the Semantic Mediator is connected to all data sources via wrappers and has the capabilities to calculate the logical view on basis of all connected data sources. For this purpose, it does not need a federated schema or single data model to operate – new data sources can be integrated or removed quickly and flexibly.

Wrapper
Components of this type implement the functionality to link a data source to an instance of the Semantic Mediator. In so doing, the linkage between a data source and a wrapper is done via a configuration file. There is no need of implementing interfaces to bind a data source to a wrapper. In consequence, there are different kinds of wrappers to bind specific kinds of data sources. For example, there is a SQL Wrapper which can be connected to each type of SQL database. Each developer has the opportunity to implement own wrappers. For this purpose, each wrapper must extend the abstract java class "DataSource".

A typical information flow starts from the wrappers via the Semantic Mediator to a front end component which could be an Integration Service or a Forwarding Service. To start the information flow, an information request is required. This request is represented as an SPARQL query and is triggered by one of the frontend modules.

The available package implements a semantic data integration approach for data sources which represent its information in SQL databases.

Table 1 Semantic Mediator

 Modules

Type	Component	Description
Integration Services	QLM Web Service	Front end to resolve information requests. Returns the result as O-MI message
Integration Services	Web Service	Front end to resolve information requests
Integration Services	Semantic Mediator Administration	Web application which enables the configuration of wrappers and invoke SPARQL queries against the Reasoning Mediator
Semantic Mediator	Reasoning Mediator	Middleware to enable an information request over more than one data source
Wrapper	SQL Wrapper	Wrapper which is able to transform the data of a SQL database into an ontological view

2.2.2 Technological stack

Item	Value
Nature	Web application
System requirements	It depends on the data sources to be aggregated
Programming Language	Java
Development Tools	Eclipse EE
Additional Libraries	JAXB, ZK, SQL Connectors
Application Server	Apache Tomcat 7
Databases	MySQL, MySQL Lite
I/O formats	O-MI/O-DF, Web Services

2.2.3 Technical Manual

The technical Manuel focusses on the installation and on the configuration of data sources. The information querying is possible via SPARQL queries but are not part of this manual. Installation

Preparation

Before installing the tool, please install Java 7 SDK (SE Development Kit 7 (32 Bit) and the application server Apache Tomcat. After both tools have been installed, configure and start Apache Tomcat. In most cases you can start tomcat through running the *.bat in Windows or *.sh scripts in the bin folder of Apache Tomcat.

Setup

Semantic Mediator Administration is available as source code. Load *.war from the WP6 folder of PSYMBIOSYS Intranet. Before, the *.war could be deployed, the access rights of the tomcat shared folder has to be adapted that a web application can store data in this folder. The folder will be used to store a SQL Lite database (if the user choose to use it) and the wrapper configurations. The wrapper configurations contains different files which are located a fixed folder structure. The storage location cannot be changed. The web application can only works in the case of the right folder permissions.

After you changed the folder rights, you could start deploying the tool. For that purpose, please start a web browser and open the URL: http://127.0.0.1:8080/manager/. The specific URL and port could be different on your computer. This opens the Tomcat Web Application Manager. After you entered your credentials you can install SemanticMediatorAdministration.war as web applications. For that purpose, please upload each module via the Browse and Deploy button of the Tomcat Web Application Manager which is shown in Figure 3.
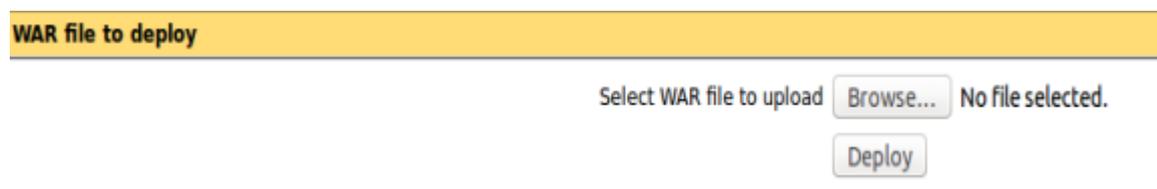
WAR file to deploy

Select WAR file to upload Browse... No file selected.

Deploy

Figure 3 Upload of a Web Application

After the uploading has been finished you can start the web application in each web browser but we recommend to use the Microsoft Internet Explorer.

2.2.4 Licensing

The final licence model is not defined yet. The implementation of additional wrappers and the corresponding usage of external libraries will have a significant influence of the right licence model. The current set of external libraries includes e.g. the Apache Licence version 2.0 and the LGPLv2 licences which requires an open source licence model. Moreover, the MySQL Wrapper uses the MySQL Connector including a GPL licence. In consequence, the overall solution will be a GPL compatible license if the MySQL Wrapper will be essential part of the overall solution.

2.3 User Manual

The Semantic Mediator Administration can request information over a wide range of heterogeneous data sources. To connect a data source to the Semantic Mediator Administration, a wrapper configuration has to be created. The creation of a wrapper configuration requires a couple of steps and is described in detail in the 2.3.1.1.

After you created one or more wrapper configurations you can query information over these data sources. For that purpose, open the link "Predefined Query" of the main page. There, you could insert a new SPARQL query or use existing ones to query information. The query result will be shown on the same view at the bottom.

2.3.1.1 Configure a wrapper via Semantic Mediator Administration

This section describes the configuration of an existing SQL data source via the Semantic Mediator Administration. For that purpose, the proceeding is presented on basis of screenshots in the right order.

After opening the Semantic Mediator Administration link, the web applications starts and request the credentials for login. You can login yourself by clicking on the login button.
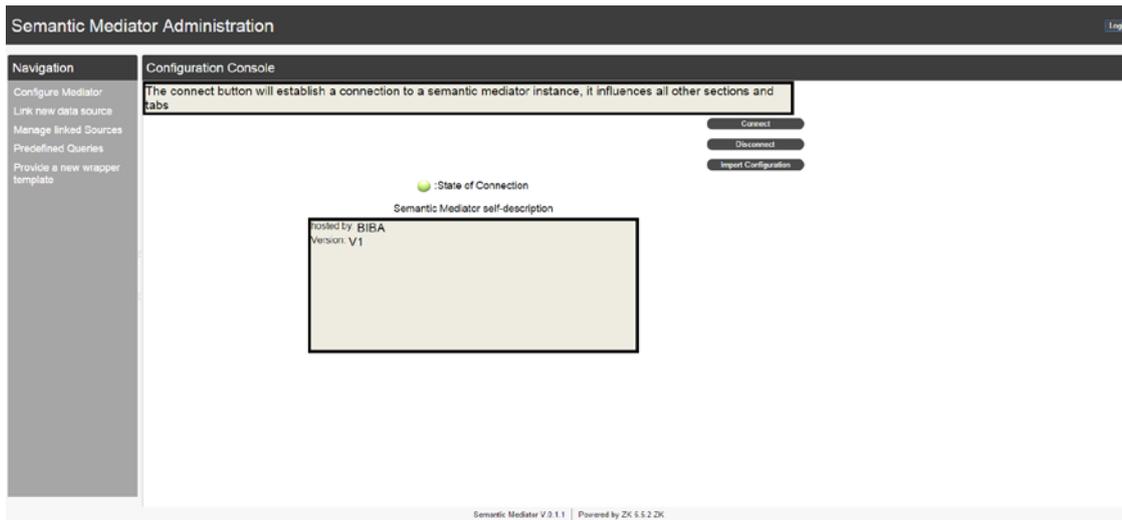
Figure 4 Login to Semantic Mediator Administration

After you have entered your credentials (standard is username: 1; password: 1) you can start configuring your wrapper configuration. For this purpose, click on the menu entry "Link new data source" to choose which kind of data source you want to connect.
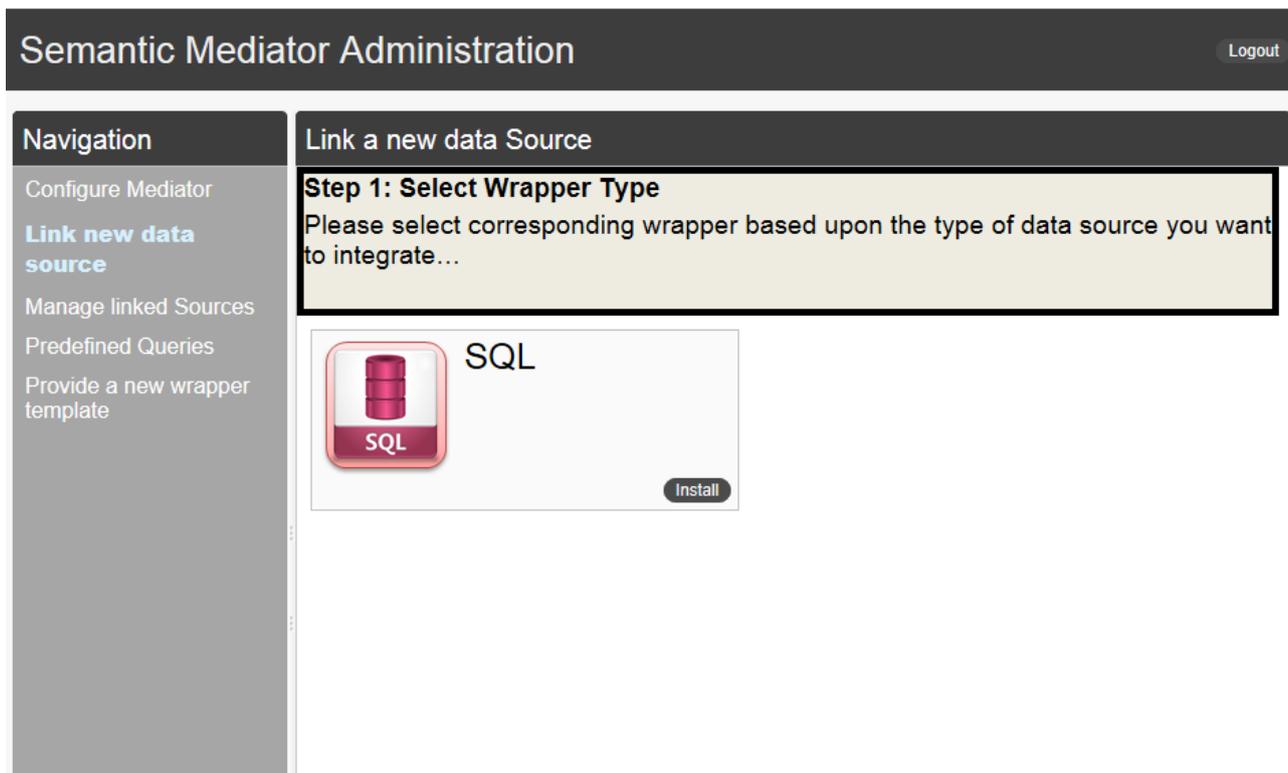

Figure 5 List of available data source wrappers

Finally, it opens the current configuration of the wrapper. This configuration can be edited and saved later on. An example of an editable wrapper configuration is given in the following figure**Fehler! Verweisquelle konnte nicht gefunden werden.**.
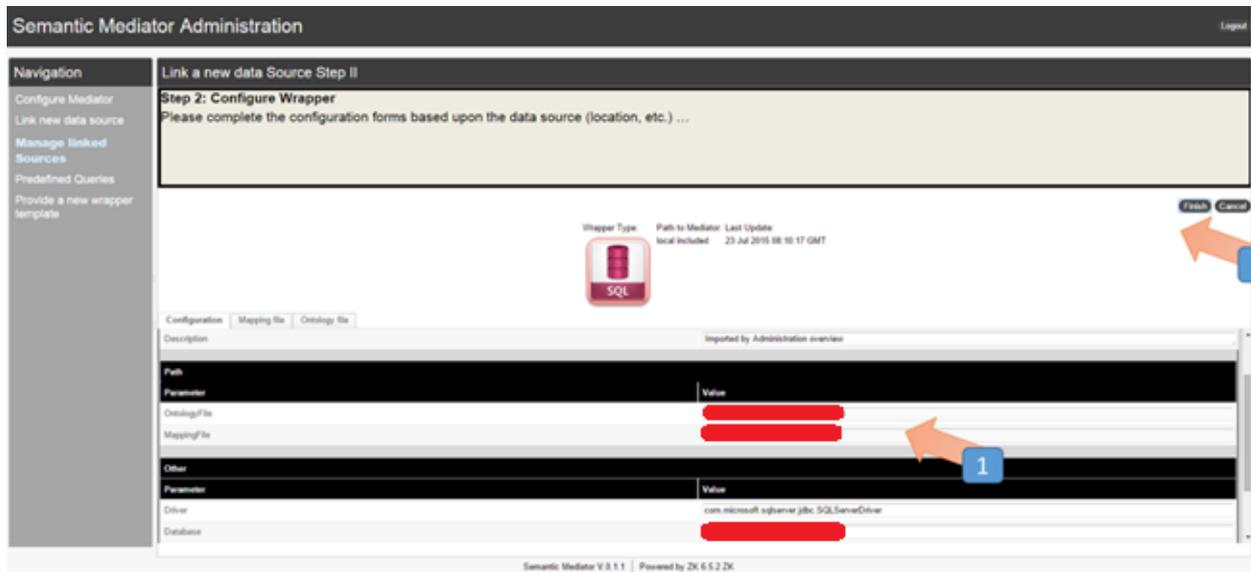

Figure 6 Updating of Created Configuration

Each configuration needs at least a mapping file and an ontology file. The ontology describes the concepts and properties of the information which should be accessible of the data source. The ontology file must be stored as a RDF/XML file. The mapping file assigns ontology concepts and properties to data source schema elements. The mapping mechanism is based on the Open source tool SEMed and could be read through its user manuals.

2.4 Conclusions and Future plans

The access to the data beyond the different data sources is possible now through the opportunity of creating SPARQL queries and resolving it. The information exchange requires the usage of SPARQL queries by not information scientist in the uses cases. To enable the applicability of this querying approach, the process for creation of queries have to be simplified significantly. For that purpose, the future development tasks foresees the integration of a query builder into the tool.

Apart of the future frontend capabilities, the backend has to be also extended to achieve the full integration in the PSYMBIOSYS overall architecture. The current state is that the result of an information query is just shown as an ontology in a view of the Semantic Mediator Administration and cannot be forwarded. The forwarding of the aggregated information as ontology to other PSYMBIOSYS modules is an open issue and is required for bidirectional communication flows. Moreover, the Semantic Mediator Administration requires an API which allows the usage of the Mediator as an Ontology Based data source from external tools like the IBM data integration solution. Both tasks are included in the future development plan to achieve a seamless integration.

In addition, the Semantic Mediator Administration web application shall combine the real world information to the product lifecycle management. For that purpose, the Semantic Mediator Administration could be capable to transfer real world information as Linked Lifecycle Data

(OSLC) to Product Lifecycle Management tools. This development task is optional and relies on the specific requirements of the uses cases. Currently, the Semantic Mediator Administration is located in the Digital World Manager which has no direct connection to an OSLC data source.

To achieve access to all relevant digital world information, the specific data sources of the use cases will be connected through the implementation of additional wrappers and therefore connect them to the Semantic Mediator Data Administration.

In summary, the next release of Semantic Mediator Administration is going to include the following additional capabilities:

1. Query Builder as additional view
2. Forwarding service as additional module for bidirectional communication
3. API to work as a data source
4. Wrappers for the use case specific data sources

The instantiation of the Semantic Mediator Administration and the configuration of the wrappers for the use cases specific data sources and the successful executed integration tests will be reported in the deliverable D9.3 "Integrated and Tested platforms and services including mobile Final" at M33. The Task 6.3 implements the Semantic Mediator Administration and has reached at M12 a prototypical state. No effort is allocated in Task 6.3 (see GANT chart of DOA) during the period M13-M18. In consequence, the integration phase will be start at M18. As the outcome, the integration task cannot be published in D9.2 at M18 rather will be published in D9.3 at M33.