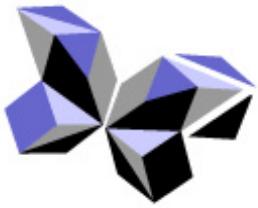

Digital Business Ecosystem

Contract n° 507953

Workpackage 20

DBE User Interfaces

Deliverable 20.5

Representative business models (M1) for SMEs in the catalyst region

Information Society Technologies

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Acronyms

BML - Business Modelling Language

BPR - Business Process Reengineering

CIM - Computation Independent Model

CWM - Common Warehouse Metamodel

J2EE - Java 2 Enterprise Edition

MDA - Model Driven Architecture (MDA)

MDD - Microsoft's Model Driven Development

MOF - Meta-Object Facility

OMG - Object Management Group

PIM - Platform Independent Model

PSM - Platform Specific Model

UCE - University of Central England, Birmingham, UK

Executive Summary

This report provides the DBE community with a series of BML 1.0 models relating to the regional engagements with the SME driver organisations. The models cover manufacturing (a strong industry in the West Midlands) tourism, location services, software development and the book industry (based on engagements with this industry by the UCE).

We have not adopted a uniform approach throughout these different models. We felt it important in some instances to provide models as best as we possibly could with less reflection on the bigger semantic picture. In other cases, such as the tourism industry, we focused on providing useful feedback to the consortium relating to the on-going development of the semantic layer in the DBE.[1] We tried through many off-line exercises[2] to create realistically meaningful models that would be both extensible and flexible for the tourism industry. The results contained here are meant to encourage further work on the semantic layer[3] since we believe that as the modelling capabilities mature, the BML will be unique in its industry for promoting affordable automated software service execution framed within the language of business requirements.

This report demonstrates work in progress. The partners involved in this work are committed to provide continued support, testing and development of the BML and related models and we believe we have the support of many of our driver SMEs to also engage in this process.

Apart from these general remarks, there is little else to report in an executive summary. The models speak for themselves and in that sense, the report is rather linear without structural highlights. In the first section, the introduction, we explain why semantic models are important and how they relate to the standards and approaches being adopted by the DBE (MDA and business modelling). This is followed by three sections covering industry specifics. The first is manufacturing, the second tourism and the third, covering in less depth the location based services, generic software development and the book industry case studies.

[1] Always from the perspective of service discovery and automating service execution. The decision to stay within the confines of these two aspects was based on practical considerations. This is what has been delivered by way of modelling tools and software support. We deliberately avoided speculation of the impact on the Evolutionary Environment, primarily because we did not have relevant expertise and that part of the project had not yet reached a level of maturity where it could be tried.

[2] I.e. by engaging with our SME drivers and other experts in this area with design walkthroughs that occurred outside the explicit engagement plan of this work package.

[3] We are aware that this is exactly what is being done in the SBVR work. We hope that some of our feedback will be useful in any decisions relating to the use of SBVR.

1. Introduction

1.1. Background and Motivation

Modelling helps in understanding underlying concepts and their features through a representation of the different processes and the relationships between them. These are based on certain views. Modelling has many advantages and in particular, modelling business applications is said to have the following advantages:

- Conveys the details and the understanding of the design by focusing on the specifics and the important features.
- Allows changes to be made easily and rapidly thereby enabling innovation possibilities.
- Enables key participants to convey their understanding of the operations through design iterations, helping to reach a consensus on the application model.
- Facilitates the discovery of gaps in the models. This is helpful when there are issues related to efficiency and effectiveness. Also enables the discovery of collaboration opportunities using model collaborations to fulfil the gaps or issues related to competencies discovered.

Models provide different levels of abstraction conveying key concepts. Accordingly the highest level conveys the logical purpose of the application without any to the implementation or the technology associated with it. At the lowest level the model provides a reference to a specific technology being used for the application.

Usage of predefined notations to represent details allows the possibility to introducing automation such as the creation of application code automatically from the model representations.

Models allow reusability and this capability helps in shortening the development time.

A ‘Business Model’ provides a simplified view of a business and is an abstraction of the complex reality of how a business functions. This view provides information to a software service developer to design and develop appropriate systems and services to support the business. It also provides the details of different system or service interactions, how and when they happen.

From these viewpoints the main motivations for doing business modelling have been stated in detail by Eriksson and Penker (2000). These are:

- To better understand the key mechanisms of an existing business
- To act as the basis for creating suitable information systems that supports the business
- To act as the basis for improving the current business structure and operation
- To show the structure of an innovated business
- To experiment with a new business concept or to copy or study a concept used by a competitive company e.g. benchmarking on the model level
- To identify outsourcing opportunities

Current search mechanisms include the search engines like Google and others. These certainly do not offer semantically rich search capabilities. The main purpose of the current BML implementation is to fundamentally support semantic search and to aid business interactions. An initial view on BML was that it was going to be used for Business Process on a different level. The BML modelling activity could be also considered as a business process re-engineering (BPR) exercise as it can help the SMEs to realise in a more formal way their processes and identify potential gaps, strengths and weakness.

A preliminary search on the internet failed to reveal any capabilities that would allow a BPR model to be developed while at the same time allowing a semantic definition of what a business does. Such a facility would allow a search of businesses using semantically rich descriptions. A search on the internet revealed no capabilities to allow to do a BPR and at the same time, define semantically what a business does and to use this to search businesses using semantically rich descriptions.

From this BML can offer
1 – BPR
2 – Semantic Description of your Business
3 – and can be used for searching (see Figure 16 page 45 for some examples)

In the current scenario if a business wishes to find other businesses for their business requirements they will need to explore their networks, the network of their networks, and also to try and search using the internet. Other alternatives are also possible but not rich enough. BML describes each SMEs networks and thus enables the process of finding businesses much better. This can bring potential to define applications of the so called “social software”.

One of the main points of using BML is also the use of ontologies. However ontologies have several important characteristics:

- They are very good for academic purposes as academics are interested in creating very rich ontologies in very specific domains.
- Creating wide domain based ontologies is difficult and they are typically outdated as soon as they are finished.

- On a practical level, different people will have different views and hence if they were to create the same domain ontology it will be different
- There is currently a debate as to whether there should be standardisation within ontologies.
- As ontologies are basically hierarchies, they are difficult to update and maintain. They can not adapt easily to evolving environments

The solution for this can be to get SMEs to create very small subsets of their own "domains". This would provide a better way for the SME to reuse the vocabulary on their BML models although there would not be any advantage to the user of the ontology. If that model is useful, the other SMEs could reuse the subsets of the ontologies. From this perspective, ontologies would be "Micro-ontolgies" (as in Microformats) [1] and the idea is to see which ones will "stick around"

From these perspectives, the Business Modelling Language (BML) provides a formal and semantic approach to understanding a business and doing business modelling. According to DBE Deliverable D15 (Corallo et al, 2005) "this business knowledge will be represented in a machine readable format in order to grant compatibility with future development in the model driven software development methodology. Integrating these set of information it results that BML framework should enable the business analyst to capture and represent in a machine readable form, the business knowledge and the requirements of a company as a starting point of a software development process; at the same time the BML framework would allow companies to create their own business description, in a machine readable format, allowing partners search activities in generic e-business scenario".

From an MDA framework perspective, BML is seen as a CIM language. From a conversation with Pierfranco Ferronato, DBE chief architect, "in compliance with the MDA approach, the BML has been conceived to be a Computational Independent model (CIM)."

The four levels in the BML are shown in Figure 1 below.

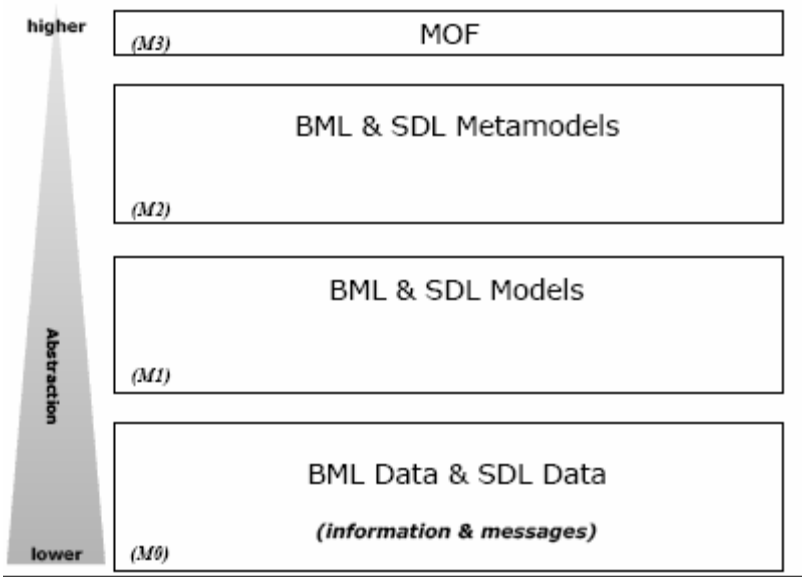

Figure 1 - Meta Model Layers

The main packages of the BML Metamodel are:

Organisation – aims to describe the whole organization, specifying the entities involved in the business, their resources and how they can interact.

Process – used to define the behavioural elements of an organization

Event – allows the description of events that influence the business behaviours, including rules about temporal ordering or partial ordering in the business activity cycle.

Location – provides for descriptions of geographical locations, business sites, geographical areas, volumes and perimeters, political subdivisions and boundaries, and logical connections between them.

Motivation – aims at describing the elements an organization analyses and settles on in order to make choices and define its action.

The focus in this report is to explore the aspects of business modelling using the MDA approach in order to fully make use of the advantages listed above and to describe models at generic levels (M1) for different industry domains – Tourism and Manufacturing.

1.2. BML and the MDA

In the past, modelling has primarily been used for communicating the meaning and the understanding of the design. In recent years however there is a push from the IT industry in particular towards automation of the software development process. To achieve this automation through modelling two major industry initiatives are in place. These are: Object Management Group's (OMG) Model Driven Architecture (MDA) and Microsoft's Model Driven Development (MDD) concepts of the Software Factory.

Microsoft's MDD defines a model-centric approach to development of software applications aligned to the model while OMG's MDA is an industry-wide initiative that

defines standards in modelling for software development. Wikipedia provides an useful view of MDA - “The basic idea is that the system functionality is defined as a platform-independent model (PIM), using an appropriate specification language and then translated to one or more platform-specific models (PSMs) for the actual implementation. To accomplish this goal, the MDA defines an architecture that provides a set of guidelines for structuring specifications expressed as models. The translation between platform-independent model and platform-specific models is normally performed using automated tools. The MDA model architecture relates multiple standards, including Unified Modeling Language (UML), the Meta-Object Facility (MOF), the XML Metadata interchange (XMI), and the Common Warehouse Metamodel (CWM).”

MDA comprises of four key stages. These are:

- Computation Independent Model (CIM): As stated previously the requirements are represented by using a model that is independent of the technology to be used. This model defines the specifications of functions within a business context, showing how the application is being used. The CIM typically uses three separate models: a Business Process Model, a Business Object Model, and a Requirement Model.

- Platform Independent Model (PIM): A PIM is a CIM with the computation details included but is independent to the implementation technology. Here the model is highly abstracted, emphasising the application logic. It describes what is needed, not how it is to be built, and uses highly generic processes to describe business requirements.

- Platform Specific Model (PSM): A PSM is a PIM with the implementation details added, and is designed for a particular platform, such as J2EE or Microsoft .NET. Design patterns particular to these technologies would typically be incorporated into the model, and the code can be generated for the target platform. The PSM can be built as a stand-alone model but within a full MDA approach is transformed from the PIM. Transformation from PIM can be to multiple targets, so there are typically many PSMs for one PIM in a heterogeneous environment.

- Code: The software code for the application is generated from the PSM.

The language for achieving transformation between different stages has recently been defined by the OMG. This is the Query View Transform (QVT) (ref)facility. Prior to this agreement, MDA vendors have used proprietary transformation languages such as Kennedy Carter(ref).

Figure 2 below shows how the MDA stages fit together.

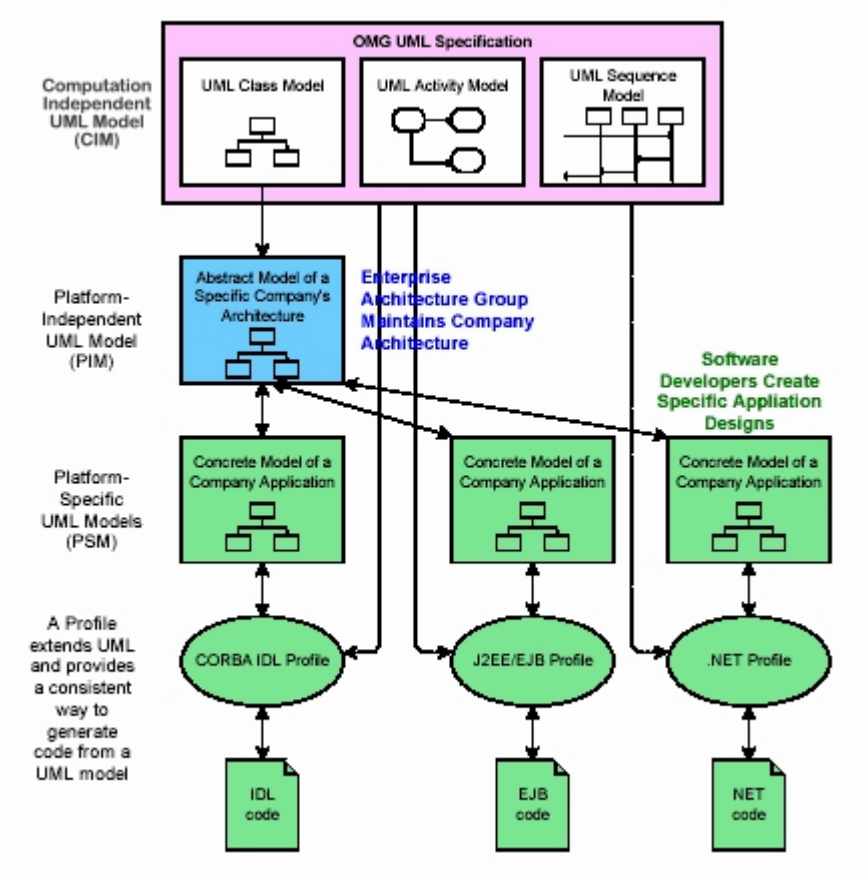

Figure 2 - MDA Stages (Source: http://www.enterprise-architecture.info/EA_Methods.htm)

The MDA languages follow a four-layer structure as shown in figure 3 below. The Meta Object Facility (MOF) is a top-level definition from which all other MDA models are derived. The lowest level is the actual software language that is used for coding and each higher level is a meta operation of the level below. From this structure it is meant that the model or language at any one level describes what the next lower level is capable of doing.

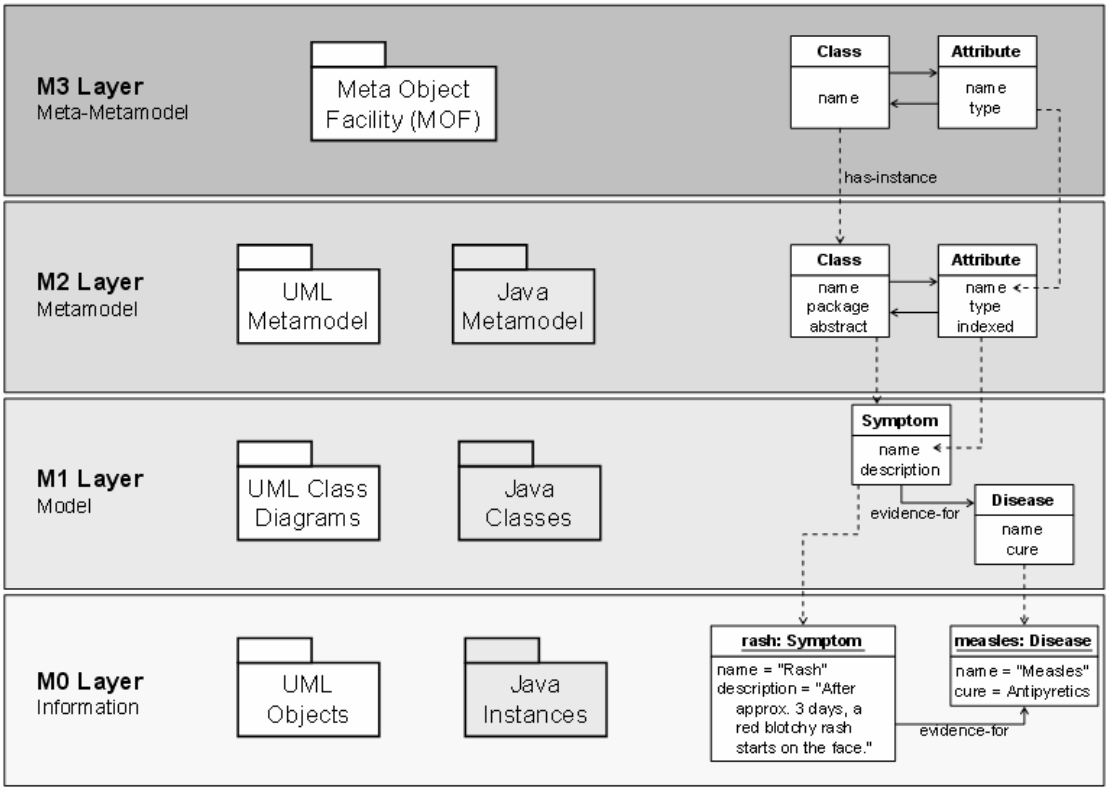

Figure 3 - Objects in the Meta-model Layers (Source: http://protege.stanford.edu/plugins/xmi/background.html)

1.2.2 The Need for Business Models

In the recent years the concept of Business Models has gained prominence. This has become a focus of research after the dotcom bubble has burst. Researchers have been keen to analyse what went wrong and what has made some of the dotcom firms succeed even though most of them failed. Business models have been used to explain the business logic of the firm for creating revenue.

According to Ovans (2000), a business model is defined as “the way to do business.” Also a business model is seen as a value chain architecture of the participants and revenue models (Timmers, 1998, 2000); and as a combination of revenue model, customer value concept and logistic model for a particular participant (Mahadevan, 2000). Business models provide details of the relationship existing between different actors participating in a commercial activity, the reasons for such relationships in terms of the benefits, details of the cost structure and the revenue flows (Elliot, 2002).

Alt and Zimmerman (2001) have presented a working definition of a business model and have identified six generic constituent elements that are the constituents of a business model. These are Mission, Structure, Processes, Revenues, Legal Issues and Technology.

- Mission provides a high level understanding of the nature of the business including the description of the product or services.
- Processes provide a detailed view on the value creation process.

- Structure determines the nature of the industry and the roles of the players. Process provides a detailed view on the value creation process.

- Revenues provide a view of the investment and financial needs. Legal issues in the form of regulations could influence the value creation process.

- Legal issues, in the form of regulations, could influence the value creation process.

- Technology influences the design of the business model.

Chesbrough and Rosenbloom (2002) have presented a similar definition along with the differences between a business model and strategy including the limitations of business models. The key constituents of the business model according to this definition are the:

- value proposition that is offered,
- The market segments served and the revenue generation mechanism adopted,
- structure of the value chain,
- The cost structure and the profit potential of providing the service,
- description of the value network and
- The competitive strategy.

In order to link the computing view and the business view of the business model, the five packages in the BML listed earlier can be seen as related to the key constituents of the business model described by Chesbrough and Rosenbloom (2002). This relationship is provided below:

- Organisation is related to the value network providing the details of businesses involved, their role, etc.
- Process and event are related to the value chain functions listing the process involved both internally and externally, actions that trigger initiation and termination of business processes, etc.
- Location is related to the physical locations of businesses and a description of value chain connections between them.
- Motivation is related to the value proposition offered, cost structure and profit potential, revenue generation, competitive strategy and market segment served.

Although, in the past, there has been some lack of understanding between the two terms clear linkages between business models and business strategy have been made by many researchers. Business strategy enables an appropriate selection and application of business models in order to differentiate the value proposition being offered by the firm (Elliot, 2002). Hence as the environment (both societal and task) changes new strategies are required to be implemented. For example new technologies inventions and innovations influence the emergence of new business models (Prahalad and Ramaswamy, 2000 and Venkatesh, 1999). As stated by Evans and Wurster (1997), "existing value chains will fragment into multiple businesses, each of which will have its own sources of competitive advantage." Also, operating business models and value chain partnerships undergo changes as time progresses. The revenue generation possibility of a successful model reduces over a period of time, as the value proposition declines and no longer remains distinctive (Westland and Clark, 1999). Hence it is important for businesses to keep a watch on new business opportunities that come along and position themselves to adopt a suitable change model to sustain successful performance for growth (Linder and Cantrell, 2000). Indeed development of strategies for sustainable performance and growth would require the understanding of such value plane relationships, innovation and knowledge sharing capabilities, customer needs, a technological roadmap, competitive and cooperative landscape as well as the alignment of business strategies for the construction of emergent and new business models.

1.2.3 BML/MDA Relationships

It can be observed from our discussion on the MDA that the relationship between the DBE BML and the MDA is more metaphorical than absolute. The MDA is an application development environment designed to generate application software from models and specifications to support the business requirements of an organisation. The MDA four-level model is in place for modelling the organisation for the purposes of generating executable software – and is designed for automated tool generators to generate appropriate applications.

The BML is designed as a specification language. Being stored in the semantic registry, its purpose is to inform run-time software, not to inform code generators.[4] The M0 level data of the MDA has no "interest" in its higher level specifications, and during the execution of application software the application environment would have little or no concern for the models that represented the application. The MDA metadata is of interest to tools and code generators. But the BML is different. The equivalent to the code generators is the run-time or execution environment of the applications accessing the DBE. The BML is a semantic description and to understand or gain proper access to the data level, the applications need to know the underlying semantics which is what should be represented at the higher levels. Given the nature of the BML semantic task, is it not clear that the idea of an M2, M1, M0 does in fact represent *the* required modelling levels, nor whether the language of platform independent to platform dependent models makes sense here unless the MDA language is taken metaphorically.

[4] Having said this, the BML is still represented in a language and so to a large extent the MDA metaphor is strikingly strong. It is expected that the BML should drive the generation of WSDL, but it represents much more than this.

1.3. Requirement of M1 Models

Introduction
The requirements for an M1 model are detailed in this section, but for a complete explanation of the key requirements, we refer you to the DBE BML specification (refer with a reference)

The requirements for the DBE BML are described here in simple terms and do not consider any additional requirements of the evolutionary environment or social science experimentation.

The BML M1 must:

- Solve or address a business concern
- Solve or address an information technology concern
- Be meaningful to the business concerns
- Be flexible and easy to setup and use by someone with the requisite skills
- Be sharable so that models and part models can be inherited
- Separate organisational (service discovery) from interactive (automated service execution) elements

We do not see it as a key requirement of the BML modelling language itself that it be readable by non-specialist trained business people. While it is clear that business domain experts (and when creating models for an organisation, business domain experts for and from that organisation) need to be involved in the modelling process (at M1 and M0) it is not clear that they need to in any sense become experts in the modelling language. This, we would hope, would be either in the domain of the application and package developers or hidden by a user interface capable of receiving business descriptions and converting them into the formal language (although it is uncertain in our mind whether the full richness of a BML language can be captured using such a tool)[5].

Service Discovery

A key feature of the DBE environment is the service discovery mechanism. From the current business domain perspective[6] the whole P2P architecture is an attractive feature of the DBE and a critical aspect of web services is service discovery. Organisations that expose their business services to the web services "community" need to be discovered.

The challenge has been well put in a UDDI Executive White Paper September 2000 (Walsh, 2002):
"In order to fully open the doors to these existing and potential B2B players, truly successful eCommerce requires that businesses be able to discover each other, make

[5] Many critiques of such a vision exist – a significant early example would be P.F. Strawson's "Introduction to Logical Theory "and "Subject and Predicate in Logic and Grammar".

[6] We always omit references to the evolutionary environment in this report, not because it isn't important, but because our focus is on both functionality currently available as well as functionality required by our SME drivers.

their needs and capabilities known, and integrate services using each businesses' preferred technology, Web Services, and commerce processes"

The paper then makes other interesting related points: The total e-business space is so much more than the supply/demand (assume this means the transactions of buying, selling, ordering, invoicing, delivering, paying etc.) side and includes product planning, production planning, design and manufacturing and stock information etc. Because it has not been possible for organisations to agree on interface standards, the real potential for e-business is not being met. The solution (proposed by the web services community) is to publish information about the services offered, define how they interact and by sharing this information to accelerate global B2B adoption.

UDDI has been used for web services location and discovery. But while this is true, care needs to be taken in considering the types of services being discovered.

1. Discover the firm
2. Discover the services and products bought/sold by the firm
3. Discover the technical services needed to implement transactions supporting the sale, purchase, engagement of product and services (and a host of other transactions).

This diversity of usage motivates our requirement for different types of models. Models as used by e-business collaboration efforts typically reflect a particular implementation or a particular agreement amongst participating organisations. This is considerably less flexible in vision and scope than the DBE. However, it should be observed that the driver SME implementations (if semantics has been considered at all) conform to the typical approach. The software supplier has a particular application that requires integration in a B2B environment. While this does not preclude the original DBE vision, it does mean that our initial implementations are likely to be less ambitious with more ambitious uses of the semantic layer hopefully growing through time and as the environment itself matures.

Experience with such B2B integration also indicates serious challenges for product and document format definitions, the former being the more difficult. Whereas a network of companies can agree with relative ease (although the programming may be more difficult) the layout of basic documents, the contents of product catalogues is a serious difficulty. Product code and description analysis and product information metadata can be almost impossible to reconcile. But the mutual intelligibility of product catalogue data[7] is a key requirement in many e-business scenarios including service location.

Service location requirements are mixed amongst our current SME drivers. For some, the supply chains using their existing software already exist or are established using personal contact and trust. Their principle concern is to network-enable their software products. For others who are engaged in providing a web-based solution without an existing customer base, the service discovery mechanism is very important to them. But in most cases, we have seen that an important requirement for the BML is to provide sufficient semantics to "direct" enquiring services to actually executable software services within the legacy applications to return sufficient detail to complete the service discovery requirements. For example, an organisation with a large number of locations would unlikely specify these

[7] And one could think of other important data elements of a similar nature – for example health and safety data to be shared across organisations.

directly in the BML, but would wish enquiring services to request this in real time from their legacy applications – and this service would still be a vital part of service discovery

We make one final point on the subject of service discovery. We have drawn some of our principles of the BML from the UDDI community. But to many, UDDI has failed (long before the main sponsors pulled the plug on the only global directory). We are aware that this is a mixture of technical flaws (many argued that the UDDI was technically insufficient for the job (reference)) and issues surrounding the true nature of SME business. It will be an ongoing challenge to the DBE community to understand whether SME organisations want or should even work in the world of automated service discovery. It also suggests that if the prevailing trend is to be suspicious of such an ecosystem, the DBE partners will need to patiently promote the DBE and its principles and to engage with “leader” organisations that see this as their way forward for business growth.

Execution of transaction services

It is in the area of semantic representation of trading relationships for the purpose of increased software automation that the BML becomes interesting. A major purpose for the business semantics is to provide a means for business level descriptions to “influence” software based transaction service execution.

To achieve this, a number of important requirements must be met. We will not go into detail on these, because they are already covered in many other DBE publications, including the DBE architecture specification(ref). However, some of the points we list here, based on our work with the driver SMEs, are new. The BML must:

- Provide a link from the business specification to the technical interface specifications (the DBE technical interface specifications have their own MDA like structure).
    - provide mechanisms for indicating the bottom level of the model hierarchy in such a way that this may either contain data (in its raw form) or instructions (where the data will be returned on executing the instructions) or mixtures of both.
- Enable cross organisational definitions that represent the agreements of documents, processes or workflow, transactions, contracting, pricing and so on.
- Provide for multiple sets of these cross organisational definitions as organisations engage in a multitude of different services with different clusters of organisations.
- Provide a flexible model capability that caters for general rules and models as well as individual overrides, extensions and modifications without requiring the need to construct brand new M1 models to achieve it.
- Enable common access to all levels of the modelling hierarchy (M2, M1, M0 – or its equivalent in a different metaphor) by software needing to interpret the models to afford automation.
-

- The potential to represent mixed models, where different layers are represented on the same model (as would a mathematics text that contains a mixture of object language and meta language as part of an overall argument).[8]
- It would appear that some of the information in the BML is actually stored as a single "record" of data at M0 (for example, organisation name, telephone number) others a set of M0 data (e.g. each class of chalet in a tourist resort) and others merely attribute specifications that have no values assigned until execution time (e.g. the definition of a ski booking form). These differences need to be made clear in the modelling language.

This list is not complete, but it does contain the most critical points we have identified in trying to construct useful M1 models to provide semantics for software automation.

1.4. Modelling – The role of industry and industry independent models

Many researchers have shown interest in defining the types or taxonomies of business models and have used different approaches to doing this. This investigation of the different types aims to provide an overview of the models identified by some of researchers and illustrate the broad range of applicability to different industries. The identification of the business models have been based on the following factors:

Commonly shared characteristics of business functions and processes

- Industry types
- Nature of interaction with customers

To begin with, Alt and Zimmermann (2001) have identified two broad categories of Business Models to cover the aspects of E-Business. These are Business-to-Consumer (B2C) models and Business-to-Business (B2B) models. These being very broad in nature have led other researchers to identify different sub-types of B2C models. Roussel et al (2000) have identified six sub-types in the B2C category while Timmers (1998) using the analysis of Porter's Value Chain has identified eleven sub-types in the B2B category. These are presented in the two columns of table 1 below:

B2C Models	**B2B Models**
Content Sites	E-Shops
Portals	E-Procurement
Direct-Sell sites	E-Malls
Brick and click E-Tailers	E-Auctions
Dotcom E-Tailers	Virtual communities
E-Marketplaces	Collaboration platforms

[8] We are less sure on this point – its viability or necessity may depend ultimately on the overall DBE meta-model

	Third-party marketplaces
	Value-chain integrators
	Value-chain service providers
	Information brokerage
	Trust and other third-party services

Table Sub-types for B2C and B2B models based upon Porter's Value Chain

The B2C models are primarily influenced by the use of Internet while the B2B models are based on the types of business process and value-chain integrations. Under the E-Business model category influenced by the usage of Internet and Information Technology, Weill and Vitale (2001) have identified eight sub-types of models. These are:

- Content provider
- Direct to customer
- Full service provider
- Intermediary
- Shared infrastructure
- Value-net integrator
- Virtual community
- Whole of enterprise/Government

Linder and Cantrell (2000) have identified business model types by focusing on the following two aspects of the business dimension:

- Core profit making activity
- Relative position on the price/value chain continuum

The models identified are:

- Price models
- Convenience models
- Commodity-plus models
- Experience models
- Channel models
- Intermediary models
- Trust models
- Innovation models

Using a similar approach adopted by Linder and Cantrell (2000), based on the source of revenue and role the firm plays in the value chain, Rappa (2001) has identified nine business model types and its sub-types. These are:

- Brokerage models
- Advertising models
- Infomediary models
- Merchant models
- Manufacturer models
- Affiliate models
- Community models
- Subscription models
- Utility models

Internet and Information Technology has certainly enabled the traditional business models to evolve into new ones. Retail Banks have evolved into Internet Banks and High Street Stores have evolved into Internet Stores with a capability of selling more types of products than their High Street counterparts. The different business model types presented above clearly indicate that business models have a loose association to the types of industry that are adopting them but as the business models are based on the value chain analysis it is also felt that some models are more appropriate for certain industry types than others.

2. Models for Manufacturing

2.1. Introduction

This section discusses the development of the BML models for Manufacturing (Factory) domain.

2.2. Structure of the Models

The Factory (manufacturing) model describes the functioning of some of the important aspects of running a small to medium sized industrial business. In particular the model focuses on the following characteristics:

- Purchase orders
- Sales orders for standard items
- Customer sales payment
- Purchase order payment
- Warehouse picking and packing
- Good received update

Rather than develop one single model the entire system has been divided into sub-packages (sub-diagrams) as detailed in the list above. This was done in order to aid comprehension during the building process. However, it is intended that the individual sub-packages (or sub-diagrams) will be combined into one large model in the near future. Such a combination will be useful for training purposes in order to evaluate whether people reading the model prefer to work with the full blown model or with individual sub-packages of the model.

2.3. Status of the current BML Manufacturing Model

The intention is to further refine the Factory (manufacturing) model to include such things as:

- Scrap management (important as we move to a more environment friendly world)
- Non-standard item order
- Design for non-standard items
- Other interesting manufacturing related models relating to industries associated with our SMEs.

Once the extra features have been added to the Factory model and all aspects of the model have been linked the resultant diagram(s) will be large and complex.

As yet the Factory model has not been validated by industrial representatives. This process will take place in the future.

Generic BML Models

In an attempt to create a generic ‘Factory’ or ‘Manufacturing’ model, the experience of lecturing personnel was used to ascertain what information would be needed to be included in an BML editor diagram.

Initially, ideas were collated and hand-drawn in an attempt to identify roles, commitments and information flows through various departments in a Manufacturing organisation. Once done, these were created in the Eclipse environment.

In the Factory model it has been assumed that the factory is an independent manufacturer rather than a conglomerate of factories all working under one umbrella. However, it can be seen that the individual departments of an industrial manufacturer could be interpreted as being individual businesses and as such it would be possible to build a model of the different roles a manufacturing business plays. This would enable a model to be developed to show the network relationship between the Sales Department and the other functioning departments of an industrial business. It is also possible that the manufacturer is a member of a trade association and if this was the case a network view could be developed.

Each functional area of the generic Factory model has been broken down into an individual model although these will be combined at a later stage.

The diagram has been created using DBE Studio, and focuses mainly on the Organisation, Process and Location packages.

Organisation package

In the 'Organization' package in the BML editor, it could be suggested that the structure of the Factory model is as follows:

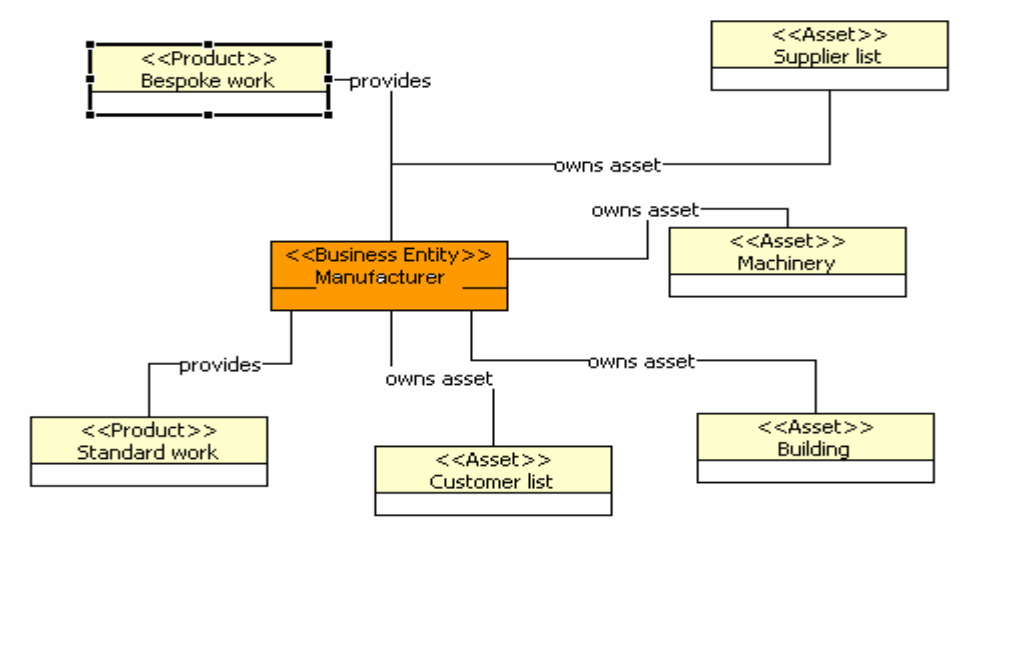

Figure 4 - Organisational Package

It is assumed that the 'Factory' Business Entity will 'own' a number of assets and provide a number of services or products. As a general rule, it is assumed that the Factory model will own the following Asset lists:

- Building,
- Machinery,
- Supplier list,
- Customer list.

These lists will detail the assets the Factory owns; the physical Building and Machinery assets are those the company has, whilst the Customer and Supplier lists contain the information and details the firm has compiled.

In addition, the products that the Factory model manufactures is summarised as:

- Standard work, and
- Bespoke work.

In the generic model it is assumed that the types of work created by the 'Factory model' falls into one of the two categories. These two categories will cover aspects such as 'contract work', 'stock work', 'call-off work' etc.

These suggestions are not meant to be the full compliment of assets and work, but will be confirmed with contact with live SME's.

Process package

Figure 5 below shows the **Sales Order process**. The sales process could be made via a number of different ways including telephone conversations, face-to-face conversations, fax orders, email, or through e-commerce. A number of different transactions result from the Sales Order process including:

- Order confirmation – this results in the Customer Sales Order Form being produced of which copies are sent to the customer, Accounts Department for billing purposes, and the Warehouse copy for order picking and delivery.
- Order modification – this results in a change to one or more items on the original order. New copies of the updated order will be required to be sent to the Customer, Accounts and Warehouse.
- Order cancellation – this results in new forms being sent to the Customer, Accounts and the Warehouse.

The 'Manufacturer' has the role of the 'Sales Department' in 'Customer Sales Order Activity'. The 'Customer Sales Order Contract' establishes the commitment of the manufacturer as the supplier of the goods, by the 'Sales Order' that fulfils the transaction 'Order Confirmation'. The 'Customer' has the role of 'Orderer' that fulfils the transaction 'Order Confirmation'.

The 'Customer' may, at a later stage in the process but before the order has been delivered, request a modification to the items being ordered (i.e. the addition of new items, the deletion of some items, or the change in number of a particular order). This will result in the 'Order Modification' transaction being fired. Further, the 'Customer' may request that the order is cancelled provided that the order has not been delivered (cancellation after delivery would require a different process). This results in the 'Order Cancellation' transaction being fired. See Figure 5 for example.

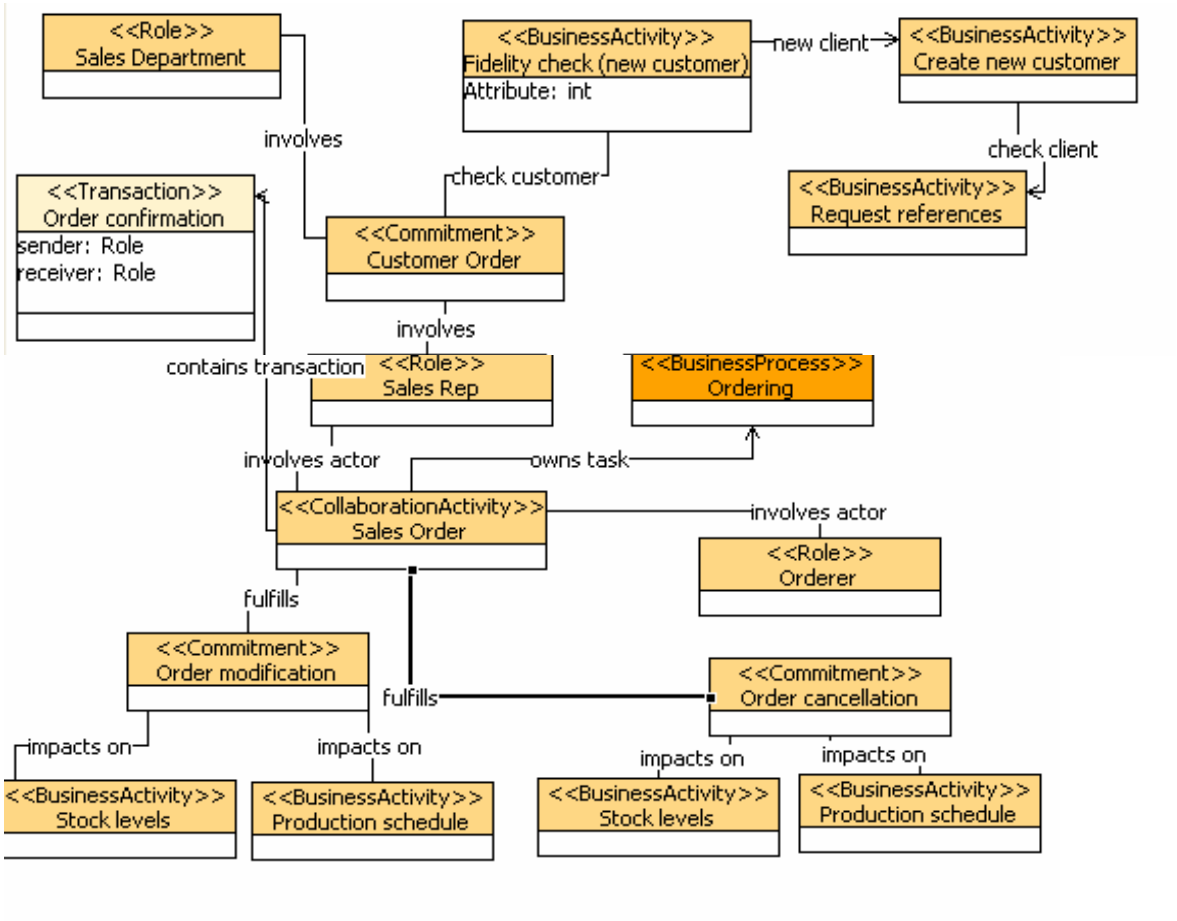

Figure 5 - Process Package

Figure 6 below shows the **Customer Order Payment**. A number of different transactions result from the Customer Order Payment process including:

- Order delivered – results in the Customer Order Invoice being produced.
- Payment Confirmation – this results in Customer Order Payment Receipt being produced
- Customer Payment – this is the actual payment transaction where the money is transferred.

The 'Manufacturer' has the role of the 'Accounts Department' in 'Customer Order Payment Record'. The 'Customer' has the role of 'Payee' that fulfils the transaction 'Customer Payment'.

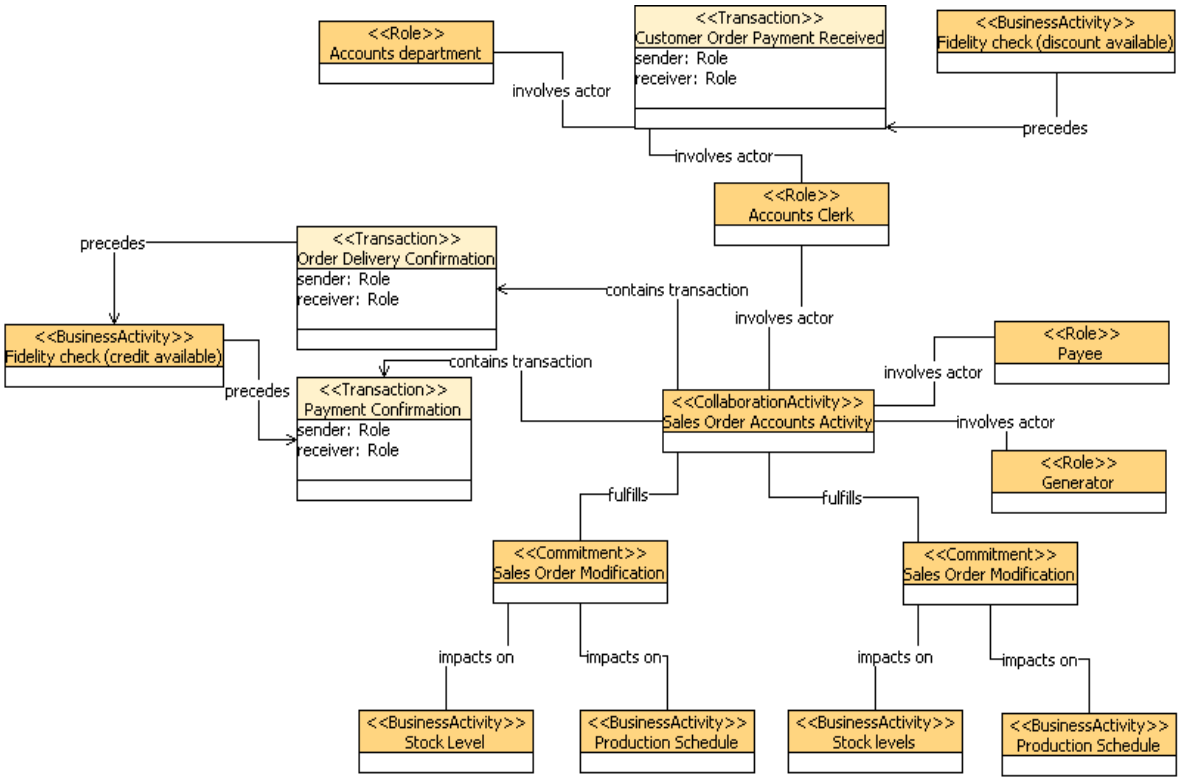

Figure 6 - Order Process Package

Figure 7 below shows the **Purchase Order process**. The purchase process could be made via a number of different ways including telephone conversations, face-to-face conversations, fax orders, email, or through e-commerce. A number of different transactions result from the Purchase Order process including:

- Order confirmation – results in the Purchase Order Note being produced of which a copy is sent to the Accounts Department for subsequent payment once the order has been received. A copy is also sent to the Warehouse for subsequent checking of delivered goods against the order.
- Order modification – results in a change to one or more items on the original order. New copies of the updated order will be required to be sent to the Accounts and Warehouse.
- Order cancellation – results in new forms being sent to the Accounts and the Warehouse.

Each of theses transactions will have an effect on the stock levels in the Warehouse and possible discounts on purchases.
The 'Manufacturer' has the role of the 'Purchase Department' in 'Purchase Order Activity'. The 'Purchase Order Contract' establishes the commitment of the manufacturer as the purchaser of the goods, by the 'Purchase Order' that fulfils the transaction 'Order Confirmation'. The 'Selected Supplier' has the role of 'Supplier' that fulfils the transaction 'Order Confirmation'.

The 'Purchase Department' may, at a later stage in the process but before the order has been delivered request a modification to the items being ordered (i.e. the addition of new items, the deletion of some items, or the change in number of a particular ordered). This will result in the 'Order Modification' transaction being fired. Further, the 'Purchase Department' may request that the order is cancelled provided that the order has not been delivered (cancellation after delivery would require a different process). This results in the 'Order Cancellation' transaction being fired.

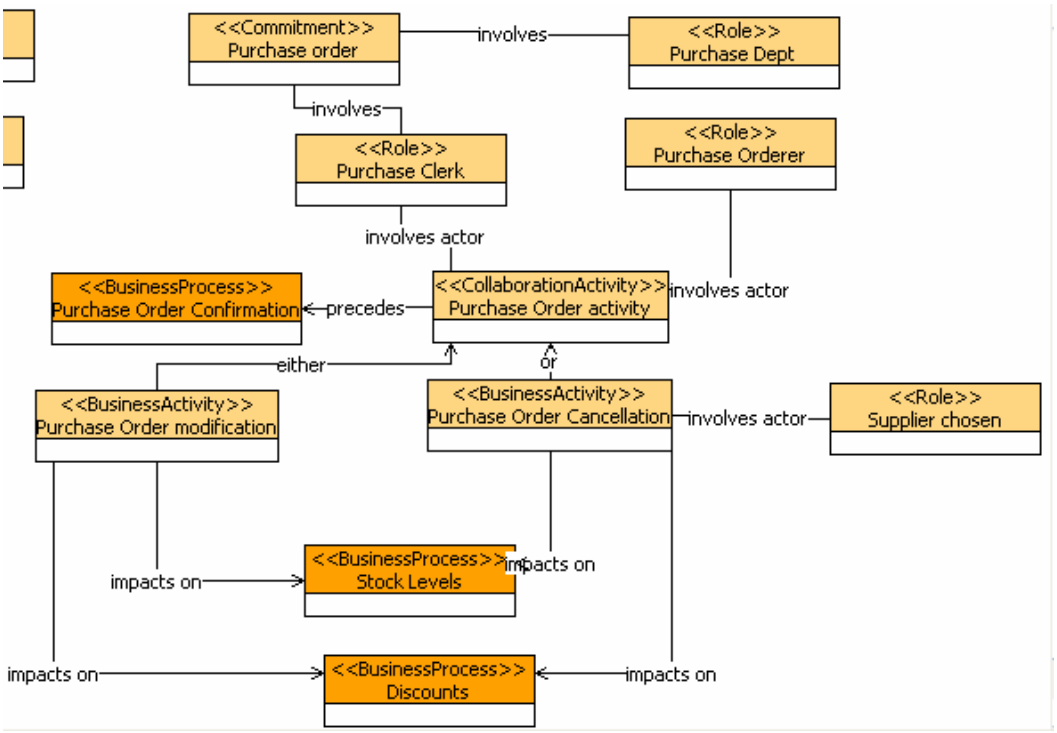

Figure 7 - Purchase Order Process

There will be a diagram created to show the **Purchase Order Payment**. Only a single transaction results from the Purchase Order Payment process namely:

- Purchase Order Payment – this results in the Purchase Order Cheque (or other form of payment) and covering letter being produced.

The 'Manufacturer' has the role of the 'Creator' in 'Purchase Order Accounts Activity'. The 'Accounts Department' has the role of 'Payee' that fulfils the transaction 'Purchase Order Payment'.

This diagram will be provided at a later date.

Figure 8 /below shows the **Warehouse Picking and Packing process**. A number of different transactions result from the Warehouse Picking and Packing process including:

- Picking Confirmation – this results in the Warehouse Picking Note being produced which will provide the picker with a complete list of items required, their locations, and then number of each item required.
- Picking Complete Confirmation – once the order picking has been completed this transaction is started and, on completion, results in the Packing Note being produced.

- Packing Complete Confirmation – this results in the Delivery Note being produced.

This process has a direct impact on the stock levels in the Warehouse and the need to initiate a Purchase Order in the immediate future. There is also a direct impact upon the Customer Order Invoice being created and sent to the Customer as well as an impact on the actual delivery process (Customer Delivery Process).

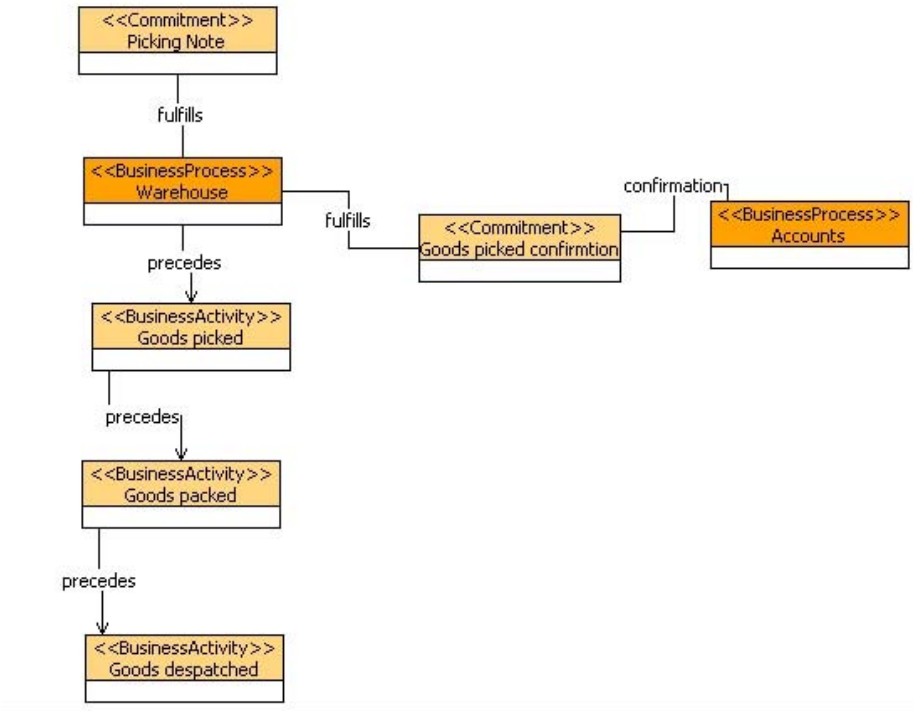

Figure 8 - Picking Process

The following diagram shows the **Goods Received Warehouse Update process**. A single transaction results from the Goods Received Warehouse Updater process namely:

- Goods Received Confirmation – this results in the Goods Received Check Result being sent to the Accounts Department to initiate payment. The stock levels are also updated.
- The Back Order Check business process is initiated which uses fidelity rules to determine if the current goods delivery will satisfy any outstanding back orders. If so the back order could be processed by using the standard Customer Order Process.

The Purchase Order Goods Received Warehouse Activity has a direct impact on the stock levels in the Warehouse and the need to initiate a Purchase Order in the immediate future. There is also a direct impact upon whether a Customer Order Invoice should be created and sent to the Customer as well as an impact on the actual delivery process (Customer Delivery Process).

The ‘Manufacturer’ has the role of the ‘Warehouse Department’ in ‘Picking and Packing Activity’.

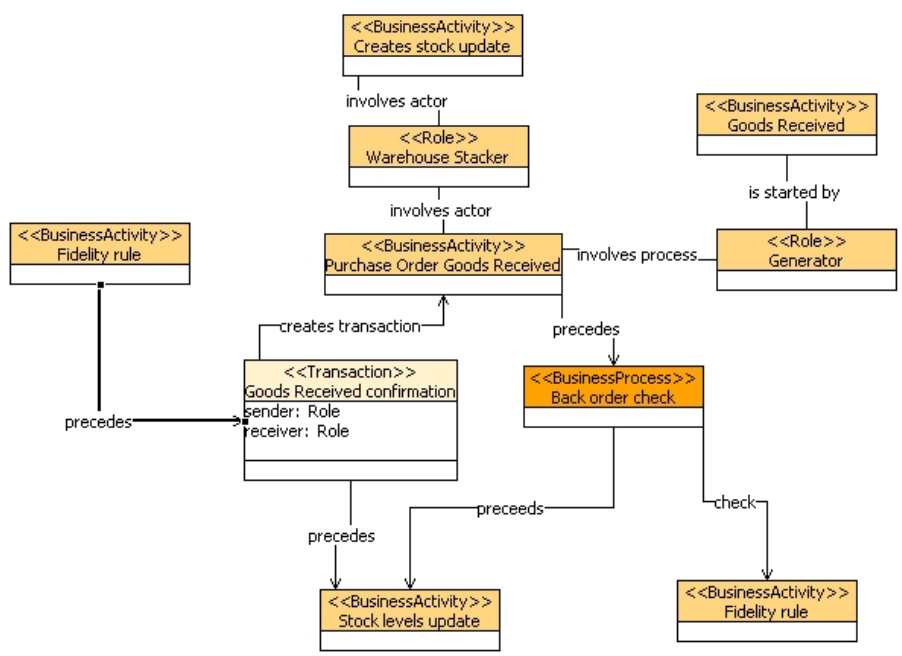

Figure 9 - Goods Received Process

Following the diagram in the D15.1 modelling document (ref), it could be suggested that the ‘location’ of a manufacturing company could be suggested as in the diagram below.

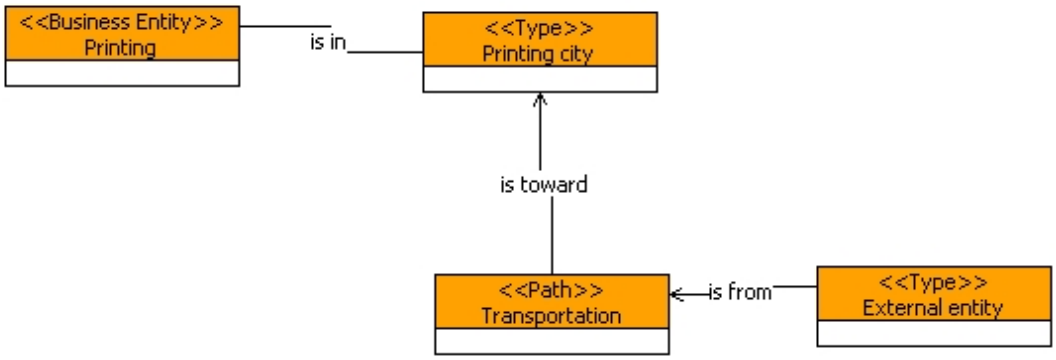

Figure 10 - Location Package

Here, the printing manufacturing company is located within its home city, with transportation to various external entities. It was suggested that the external entities that would interact with the printing company would be:

- Transport providers – these are likely to be transportation carriers that would deliver goods and services both into and from the manufacturing company.
- Business Associations – most manufacturing companies are involved with a number of business associations. In terms of a printing company, examples could

be the DTI (Department of Trade and Industry), and the BPIF (British Printing Industries Federation).

- Suppliers – the will be primarily the companies that supply components and raw materials to the manufacturing company.
- Customers – these are the entities that will generate profitability for the company.
- Scrap merchants – Most manufacturing companies may deal with hazardous or non-environmentally friendly waste products. These entities will remove this waste from the manufacturing company.

These five entities are expected to cover all aspects of interaction with the manufacturing company.

3. Models for Tourism

3.1. Introduction

The tourism industry is a huge industry to address in a single modelling task. It comprises a significant diversity of sub-industries and cross over into other industries such as agriculture and transport[9]. We take, for the purpose of this document, tourism and travel industries as synonymous.

The aim of this section is to provide an M1 model for a fragment of the tourism industry based on one of our driver SME applications, although much of our thinking and work leading up to the model has been driven by models specified by the Open Travel Alliance and ontologies produced in the SATINE project.

Model acceptance is also a complex issue. Models are accepted on the basis of use, the position of dominant market players and specifications from standards organisations. It is not easy to predict what will happen in the standards process with regards to which standards will emerge as acceptable and popular. Given this, it will be necessary to create models and to update them on an on-going basis..

3.2. Issues confronting tourism model

The points raised in this section have resulted from attempts to create realistic models for the tourism industry and from visits and discussions with SME drivers. It represents an overview of where we see future developments of the BML model, perhaps through an extended version of BML, will more adequately support the types of model we were attempting to create.

Aspects of the model are closely related to the individual organisations registering services to the DBE. In particular, information about the organisation, their products and services.

Aspects of the model belong to a “contract” of several organisations – i.e. a community model. For example, agreed business processes, agreed document formats, service types (e.g. types of hotel accommodation) and other classes and their attributes that groups of organisations decide to share.

It could be argued that aspects of the SSL are shared in that a number of organisations could get together to agree on a set of formats (methods, parameters) even though these may not be directly supported by the organisations legacy systems without translation.

[9] As the UK was reminded during the foot and mouth scare a few years ago.

There is a general requirement to define a double level model at M1. This requirement has come about when we have recognised that the tourism industry is huge and that different organisations that are trading will need to share different parts of one or more models without needing to define or redefine a whole model. Models also need to be extensible as new players join a supply-chain but the model extension needs to be dynamic in the sense that software already working with the existing model needs to be able to deal with the extended model without code change.

An example of the previous point is probably simpler in the service discovery search. The different attributes that might be required will depend on the model, but the model should be extensible and the search engine should be able to “grow” with the extension of the model (on the assumption of being able to provide attribute level searching).

The second level model at M1 would involve instances of the M1 meta-model as defined. It is at this level that particular types of services, facilities and capabilities would be defined. For example, the fact that a resource allocation asset was a business feature supported by the model, that it contained certain attributes as would the case when making a booking against a resource that requires allocation. At the M0 level, one would define that it is a chalet that one can book against and provide values for the attributes defined in the second tier M1 model. Thus it would be possible for different organisations to have different feature descriptions that could fit into the same model.

The models need a rich set of relationship types such as support for inheritance.

Models need to be able to inherit from other models.

An organisation may need to link to several models based on different arrangement with different trading partners and as importantly, need to be able to take part of a model to form part of the model being created.

It would appear that in many cases the required data to be accessed at M0 will more naturally reside on the organisation’s server (legacy application) and therefore the most natural M0 representation is some form of semantics (a description) to represent this fact, along with a way to link it with the SDL. Given that in any community based BML representation, different instances of this metadata will have different interface definitions the mapping of these therefore becomes another important factor (although strictly speaking could be done at the organisational end and not within the BML).

A quick example from one of the SME drivers would suffice as an example of the above points. A number of different organisations within the tourist industry trade together. The SME driver’s client owns chalets, and supports a number of different services including those that involve direct transactional relationships with other people and organisations.

It is easy to recognise that each organisation in this supply chain has an individuated BML that describes their organisation and the services and products they offer. But it is also easy to see that certain definitions pertinent to this particular trading agreement (which would also be applicable to new comers and maybe sharable to other supply-chain groups) is community based. An actual set of processes agreed between various partners in the supply-chain group and ontologies dealing with attribute structures they agree to share are examples of such shared data.

But beyond this, there is also a need to model the types of players in the chain and the types of roles and relationships that exist and then to instantiate these particular relationships, roles etc. by the organisations and individuals involved. For example, this particular supply chain may assign a role of "additional_service_provider" to a main organisation such as the chalet owner. At one level, these relationships need to be defined, but at another, before M0 data (using current terminology) is considered it may be necessary to specify specific attributes, methods etc. that are shared within this particular arrangement being defined. Then at M0, these attributes are given their data. So at M2 the possibility of defining roles and relationships is given, but at M1, the system doesn't immediately force immediately to model the actual roles and their corresponding attributes to be modelled, but can model general entities and roles and relationships that can be extended by instances as the community grows. In the example above, a chalet may have a relationship with a ski-resort that represents booking chalet guests on a course, but this relationship requires attributes of day, and course level against each person. A new similar relationship with another ski-resort only requires day, course level and number of people arriving to take that level. This example illustrates the need to enable more flexible design where there is a need to extend the model but all that is available is a facility to copy and modify. In addition, this type of structure is more complex than simple inheritance.

Within the above discussion on M1 models, there are a lot of different dimensions that need separating. There are sector based dimensions contrasting with interaction pattern based dimensions[10] (reference the paper, not a footnote), time based dimensions, data verses pointers to data and so on. It is not the purpose of this report to sort and solve these issues, but our experience to date indicates that as the DBE matures, the requirements for on-going research and development of the semantics will become central.

3.3. Basic Models Identified

Within the tourism industry a number of generic models were identified, some are sourced from the SATINE project and others from different sources relating to the tourism or modelling industry. These are outlined below:

1. People and organisations (together referred to as "party") and their relationships

[10] A term suggested by Tim Romberg in his paper "Separating interaction patterns from product & service descriptions as two orthogonal aspects".

2. Relationships involve travel booking agents, hotels, insurance companies, finance companies, hotels and other accommodation organisations, service industries such as restaurants, leisure activity companies, sight-seeing companies, transport (of varying types).

3. Relationships can be grouped into roles and different role relationships will require different attributes, methods and sub-models that can be inherited from very general party models.
4. Traveller preferences

5. Products and services available and consumed within the party relationships. Some of these services and products will require sub-models and special classes that can be inherited from very general models. Products and services include the transactional and process models needed to support them, such as availability, ordering, agreements, payment, cancellation, amendment and so on.

6. If the model is to include the whole supply chain then it will include supply side products and services and delivery models.

7. Travel program, catalogue and promotion models.

The model requirements can become considerably more complex than is represented in this list. For example, the air-travel industry uses complex models for catering, fuel supplies, staffing and so on, but it is expected that semantic representation of these models is outside the scope of early DBE projects.

3.4. Basic Entity Example

Our basic entities will belong to organisations, people, locations, accommodation, transport, facilities (such as special services) and support services. Rules within this industry are quite complex. For example “People” are required when booking services, however on a travel booking we note the following:

- The primary travel person may not be the person who books or pay for the travel arrangements.
- They may book but not pay
- Or they may book and pay.
- Primary travellers frequently add other people to their travel booking (partners, children, colleagues etc.).
- Our use of booking includes flight, hotels and other services.

- In some cases, full person details of all travellers are required for the booking (e.g. flights) but in other cases (such as hotels) only the primary travel person details are required.
- Travel preferences are very complex in practice.

Much can be shared from general models (e.g. information about people and organisations, their relationships are common business modelling requirements that need extending for travel) but the degree to which these common model structures can be shared in the DBE in practice, has yet to be determined.

It is safe to assume that most of the complexities will be contained within the legacy applications although we are unsure of the extent to which some of this type of semantics needs to be coded into a central semantic registry, especially to enable automated service execution. This will in some respects depend on the sophistication of the legacy applications accessing the DBE and decisions amongst the partners in any given circle of influence.

The model shown in Figure 11 illustrates a model for a live system installed by one of the SME Drivers, with the addition of the caravan park, which is not in the original system.

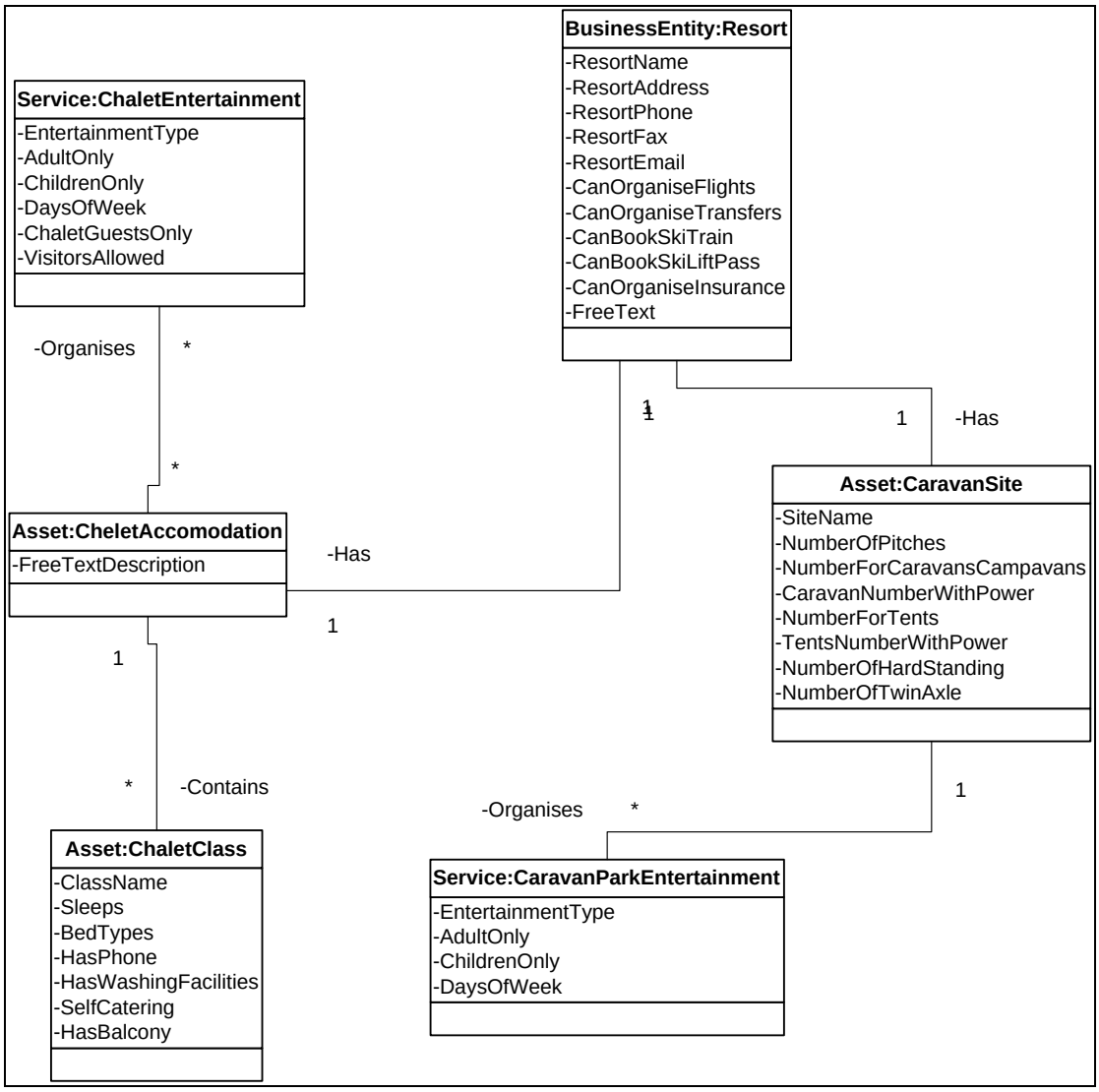

Figure 11 - Model for Tourism Organisation

In order to construct such a model, a number of key decisions have to be made; decisions whose answers might differ considerably within one organisation to another. Examples are:

- How detailed does the representation need to be? For example, do we need to specify each chalet or only the various types of chalet?

- Related to the previous question, which data elements in our application space need to be exposed to the DBE and which are superfluous to the semantic representation? It is clear that we don't have to model everything. For example, it may be sufficient to model the fact that the holiday organisation organises holiday insurance, but at the level of the DBE does not need to specify the types of insurance policies, the costs of the policies or details of terms and conditions. Likewise for child entertainment. It may be sufficient to mention that this is supported without requiring entries detailing the particular entertainment activities organised during a particular time-period.

- Which of the searchable (and accessible, during e-business transactions) data can be stored within the semantic registry and which needs to be access at runtime within the legacy applications?
- How generic can we make the model to fit other similar situations?

Decisions like these indicate why it is, in our view, unwise to construct M1 models externally to the organisations involved in using them – they need to be established in the concrete because the modelling environment does not provide sufficient flexibility to create generic models.

In the model in Figure 11 above, a decision was made to store information about the chalets only at type level. The resort has a large number of chalets, but there are only about six types – being a mixture of size and comfort. The legacy application keeps details of each chalet including individual chalet telephone numbers and transaction details of the parties who have and are staying and booked to stay in them. This level of detail is deemed too granular for the purposes of the BML, but may be required for automating a booking service (because it may be necessary to provide an allocation based on consumer preference – this is an interesting challenge).

The legacy application also stores detailed information about bookable items. These include the transfers, flights, ski trains, ski hire, insurance and ski-lift passes. Each of these items is represented as individual classes in the legacy application model – within an inheritance hierarchy containing BookableItem and TwoWayJourney.

It also contains a complex subsystem dealing with pricing including age discounts. Pricing is not part of the model because pricing is extremely varied by season, number of people, class of chalet, type of pitch (e.g. surcharge for awnings) age discounts, promotions and sometimes last minute deals. The model does contain a set of attributes in the resort class that provides information about the bookable and other services available to the client.

To accommodate pricing, some mechanism is needed to link a pricing entry in the BML to a call to the legacy application, where a dialogue (with agreed data formats) can be initiated to determine price.

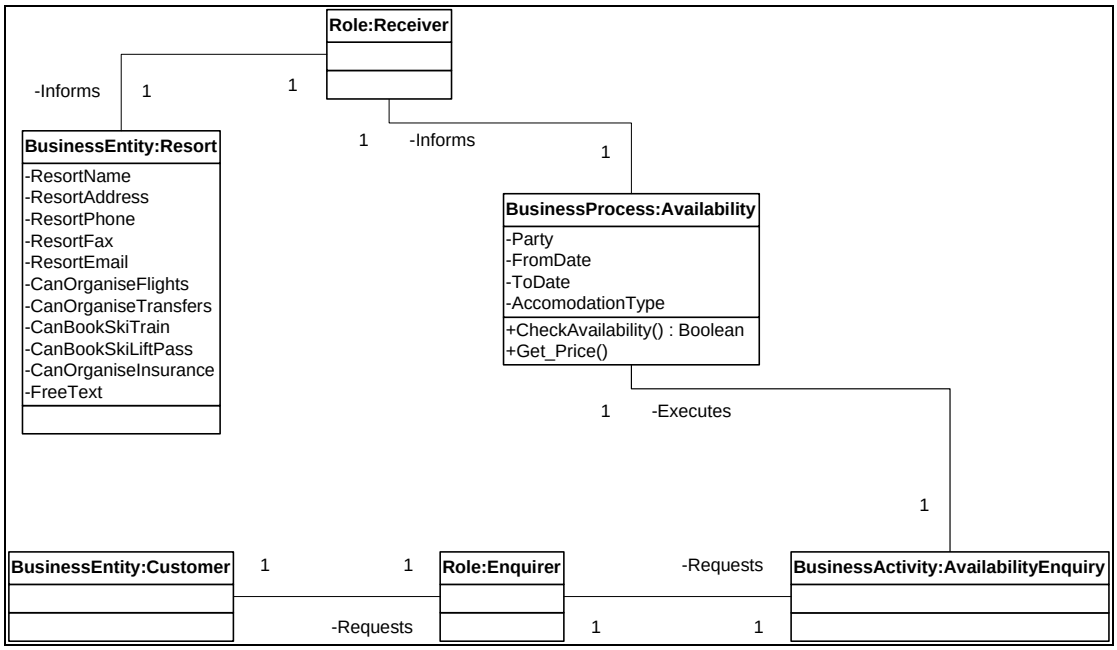

Figure 12 - Availability and Pricing Enquiry

In Figure 12 the activity of generating an availability and price check is modelled[11]. To actually achieve both, a link will be necessary to the legacy application via the modelled operations “CheckAvailability” and “CheckPrice”. The attributes shown will be typically what will be required of the parameters to these methods – but they are complex parameters. The party information could be an XML structured document detailing each of the people staying, along with their ages. If the resort had specialised services such as catering, information about dietary requirements might be needed here too. The challenge is that each bookable item has its own attributes (inheritance means that there are some shared attributes and methods) but somehow these differences need to be specified here in a generic way that would enable instances to cater for the individual requirements. For example, one resort may have restaurants of different grades, each described in detail. Another may have several restaurants, but general types described. Others may have big-hall catering included in the price. Others might have mixtures of the two. Some may have different types of entertainment as activities or as facilities. In either case, they might be free, some might be chargeable, and some timetabled, others always available. Some resorts may have entertainment for different sectors of the resort, some that are common across certain sectors (e.g. chalet only, caravan park only, joint). And resorts with these different varieties may all trade with a common group of booking agents and facilities providers who are connected together in the DBE. This information matters because it could impact both pricing and for attracting clientele.

The modelling challenge is to determine cardinality of instances. The semantics of this model provides a picture of what happens with some basic information about the attributes stored against availability. But it is perfectly reasonable to consider a more demanding requirement where certain relationship types need to be defined (such as “Providing Lessons” but the BML needs to contain specific information relating to the lessons held between different service providers and potentially different attributes (the example

[11] Unfortunately we couldn’t remove the cardinality tags and the navigation arrows would not copy across into Word. The cardinality tags are to be ignored and the arrow directions are reasonably obvious – they reside on the labelled end.

mentioned previously is where one ski training company require individual names booked, hence will have this declared in the BML, whereas another just requires the numbers attending).

This example provides another interesting requirement for the BML – where the M0 data is itself metadata. For example, a declaration that the booking course relationship between this hotel and that ski school has “Person Name; Person Existing Experience Level; Course Required; Course Level; Date; Time” but the M0 data will never hold actual peoples names and their experiences, course requirements etc.

4. Other Generic Models

4.1. Introduction

The following paragraphs outline a number of other small BML models that have been developed.

4.2. Location Based Services

Location Based Services (LBS) give the opportunity to users, especially users of mobile terminals such as Personal Digital Assistants (PDAs) or mobile phones, to query and receive information (or services) related to their location. Typical scenarios for LBS are the search for restaurants nearby; finding addresses; directions; finding information about tourist attractions or any other type of information related to Points of Interest (POIs).

With its capabilities, namely peer-to-peer architecture and semantic descriptions/queries, the DBE is an attractive platform for developing software and information services to support LBS type of applications. For example, with the DBE the potential scenario is not simply to find, for example, “Indian restaurant, Poscode:LE112BT” but to search in more structured ways such as “Indian Restaurant, Postcode:LE11BT, Meal Deal < £8, Special Food: Channa Batura , Wine: Red Rioja < £10, Date:Today”.

SMEs are often local businesses and key players in the local economy. With the increased demand for more powerful mobile devices, LBS are expected to become a major business opportunity area for SMEs to promote and automate their business[12]. A typical example of this type of service is an SME that advertises in the Yellow Pages. The Yellow Pages in turn provides services to other service providers (i.e. Google Maps) that provide map information plus business locations to end-users searching for local information.

However, due to the size and complexity of such applications and the number of business tiers involved (SMEs, content aggregators, map providers, web portals, etc.), the content tends to be very static (i.e. simple information address, telephone, business activity) and do not reflect what might be the day-to-day differentiation aspects of the business such as daily specials, offers, etc.

[12] “Local Search” Panel discussion at the Where 2.0 Conference 2005
http://www.itconversations.com/shows/detail801.html

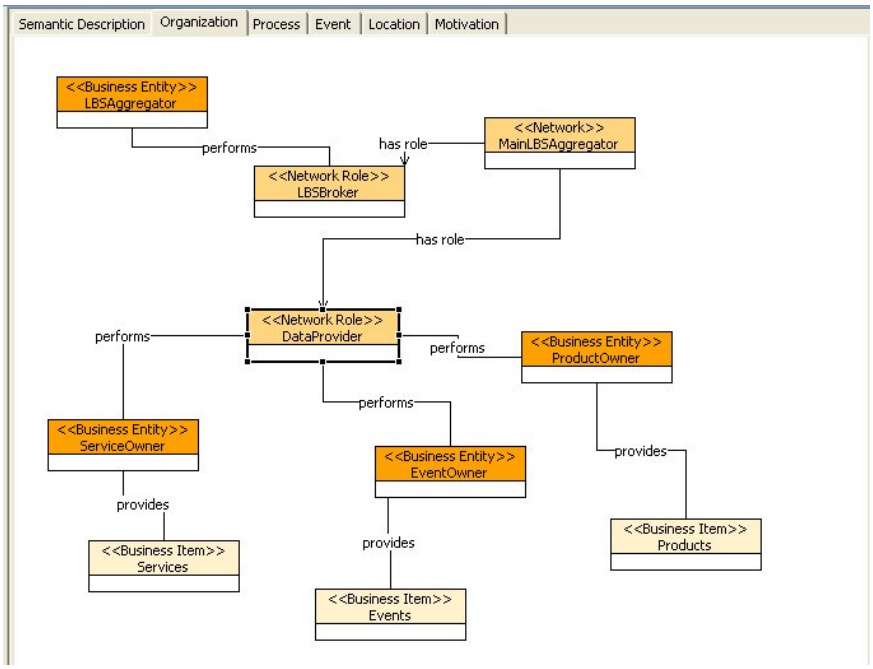

Figure 13`- LBS Model

Figure 1 presents a hypothetical model for an LBS[13] Aggregator/Broker using a typical Client/Server configuration type of architecture. The content Aggregator receives data from the DataProviders such as Products, Services and Events. The LBS Aggregator/Broker plays the role, on the network, of concentrating the incoming data at one point where the end-customers can access it.

"Products" could refer to some form of tangible business artefact (i.e. a "Widget" provided by a business entity (i.e. a small shop)), whereas "Services" could refer to intangibles. Events refer to special events, such as concerts, conferences, etc, as used by Upcoming[14], or any public activity that is time bound but is not specifically a product or service. Products/Services/Events within this context will be referred to as LBS Artefacts[15].

SMEs are the owners of the content (Products/Services/Events) and as such they need to be able to push or publish their content to the aggregator. The SSL part of the BML model can provide the detailed technical information on how the different parties could interact with the Aggregator/Broker at the technical level.

[13] The "S" in LBS refers to "Service", as it is the traditional way to refer to such systems. However we would like to extend this definition to anything that can be published.

[14] http://upcoming.org

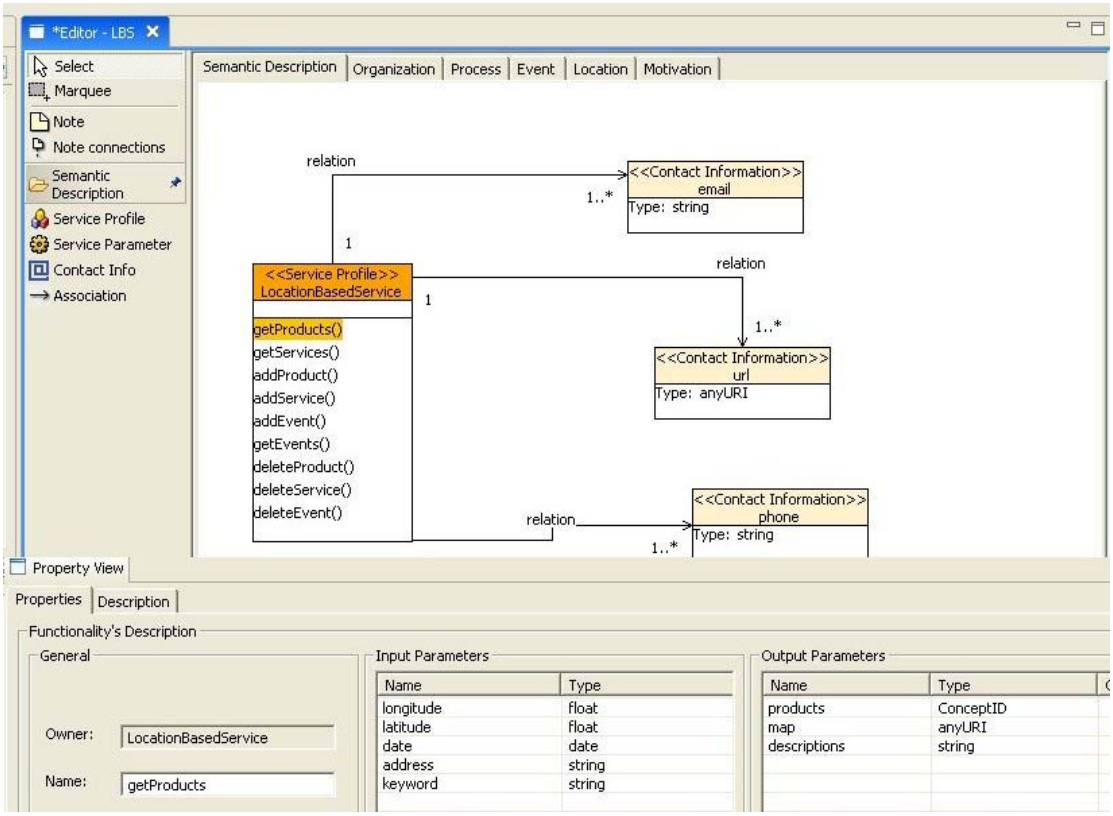

Figure 14 - SSL Part

Figure 14 displays a hypothetical SSL part of the BML for LBS Aggregator/Broker. The Service Profile contains the required technical description, clustered as LBS Products, Services and Events (LBS Artefacts) and operations such as “get”, “add”, “delete” to query for LBS artefacts and also to add/update LBS artefacts from the different LBS artefacts providers.

The core asset of such Aggregators/Brokers is ultimately the SME (or other users) created content. The Aggregator/Broker generates revenue by adding value to the content and centralising, managing and structuring the content. Monetization can also happen by having content creators pay a fee for aggregating their content. A typical supply chain can be represented as follows:

Content Creators (SMEs/Users)
Content Scrapping (Scraping???)(i.e. search engines, googleBot, slurp)
Publish to Aggregator (i.e. Yellow Pages)
Aggregation (Centralised)
Distribution and Delivery (Web, Paper, etc)

In such scenarios, the DBE can play an important role by integrating the different IT systems of the different SMEs and Aggregators/Brokers to ensure that their information is always up-to-date.

4.3. Generic Software Development SME

As part of our activities with the SME Drivers, we have developed a generic model to describe a Software Development SME. As with any modelling task, it is possible to create large and complex models that try to capture every single detail of a given view of the world. In this case, we have focused on provided the most simplistic model that can represent meaningfully the differences between different Software Dev. SMEs.

Within this model, we have included the most common features that we found among our pool of SMEs. From a generic perspective, the Software can have the following differentiators:

- Software Development
    - As a Product
    - As a Service
    - Bespoke
    - Support (Not included)
- Training
- Skills
- Achievements
- Clients
- Associations

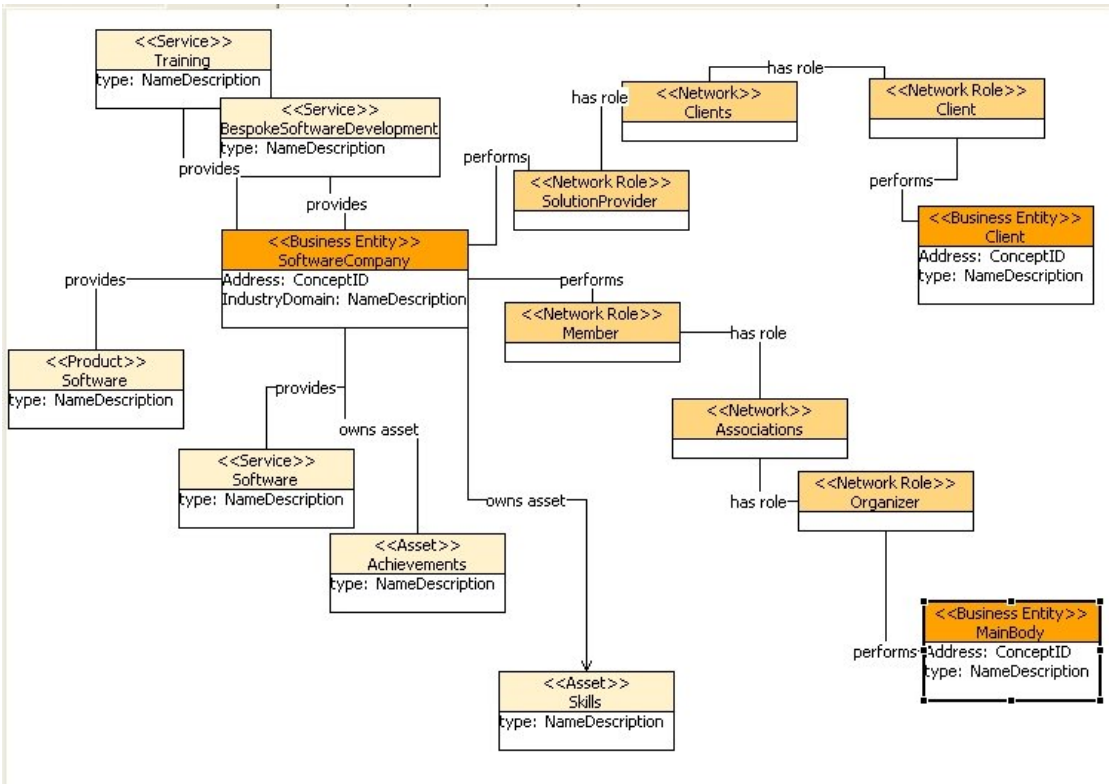

Figure 15 - Generic Software Development

The Software Dev. SME and Bespoke Soft Dev. refer to any type of generic or specific software development activities. It might be necessary to distinguish between software as a "Product" (such as packaged software), software as a "Service" (such as a Web Service or a DBE service and also other types of software services such as "Content Management Server Customization and Hosting").

A Software Dev. SME will have Achievements (i.e. awards, grants, etc), Skills (i.e. "C++", "Java", "Lisp", "Web Site Development") and will be part of different networks (i.e. "British Computer Society"). Also, part of a network will be past and current clients and the addresses of the different Business Entities (the SME itself, clients and partnerships organizations).

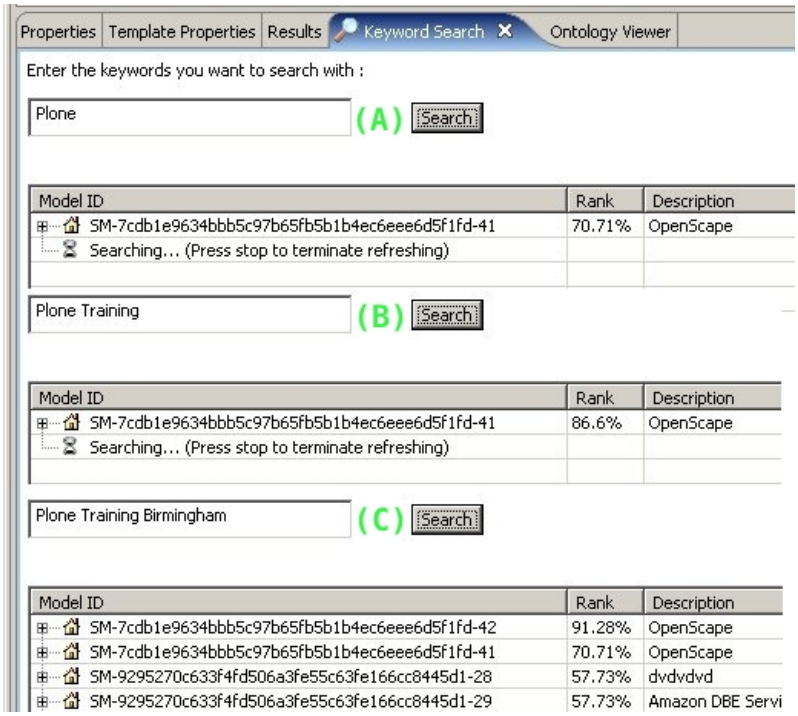

Figure 16 - Search

Figure 16 shows an example of the search functionality that this BML model provides. By adding M0 Data (Training = "Plone" and Address="Birmingham) and publishing it on the DBE as a Yellow Page type of service (simple location), we can provide effective queries.

4.4. Book Industry Case Study[16]

The two previous examples have shown examples from specific business areas such as software development, and also the BML conceptual model of an LBS Aggregator/Broker. This section presents a more generic model related to the "Book Industry" as a whole. Again, the scope of this section is not to model with a great deal of granularity all the possible details of the industry, but to just generalise enough so that different actors within the industry can be differentiated at the BML M1/M0 model level.

[16] The Book industry case study was developed in cooperation with the team at Technical University of Crete (TUC)

We had the opportunity to interview (informally) four different industry actors who helped us to understand and gain some general knowledge of the book industry. The interviewees were:

- A librarian from a public library
- A sales representative/accounts manager from a major book shop chain and distributor
- A University administrator in charge of book purchasing and stocks.
- A "Print Farmer"[17] freelancer.

"Print Farm" refers to the idea of a freelancer that receives a piece of work that needs to be printed and "farms" out the physical printing to one of its list of print shops, always looking for the best deal for its customer.

After the interviews, we were able to roughly structure the industry onto six different types of business actors within the full supply chain:

- Authors
- Publishers
- Booksellers
- Distributors
- Wholesalers
- Shops (Retail)

Authors

For example, a possible BML model from an author is shown in Figure 17. Authors have a set of published works (modelled as "Products"); and they could potentially offer other types of "Services", such as "Freelance Writing" (i.e. news paper articles), "Public Speaking" and so on. A BML model for Authors has elements in common with the rest of the industry actors/supply chain and, therefore, need a very different one. As part of their networks, authors are under the "radar" of publishers and often one author will have deals with one specific publisher.

[17] On this deliverable, the BML model for Manufacturing is related to the print industry.

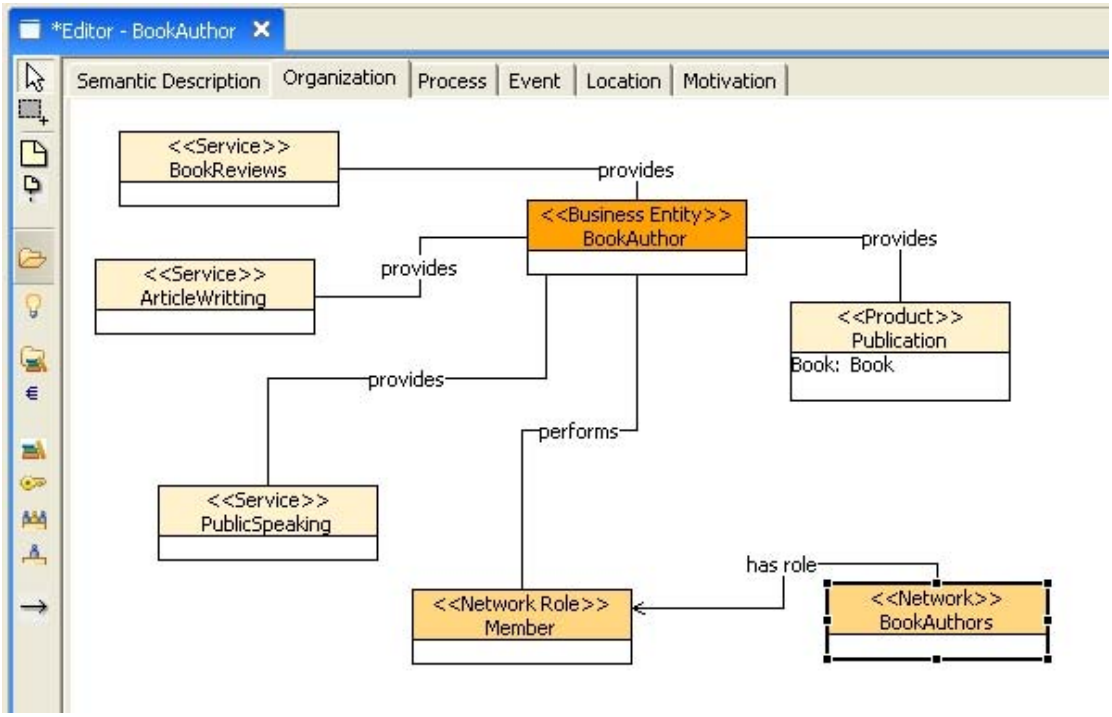

Figure 17 - Author Model

Publishers

Publishers are the ones who deal with the authors and produce the goods as a finished product (books, etc). Publishers often have print facilities, otherwise they have to outsource the production process and any extras that might be included with the books (such as CD-Roms, DvDs, etc).

Most publishers tend to specialise by topics (i.e. academic, fiction, etc) and also by authors. Authors seek to have a “deal” with a publisher and, therefore, they will be part of the publisher’s network. As they are the ones that print the book, publishers also have the option of giving away free samples of their stock. For instance, during our interviews, the university administrator mentioned that lecturers at the university sometimes received free samples from publishers who deal with the topics that they teach.

Publishers can also play any of the other roles on the supply chain (such as bulk sell which might be typical role of a Distributor) and even sell direct to customers via catalogues or e-commerce (individuals buy directly from their websites or via partners such as Amazon and others). Publishers also have out-of-stock print services. An example of a publisher is Oxford University Press (http://www.oup.com/) or Random House (http://www.randomhouse.co.uk/)
.

Distributors

Distributors are often big warehouses that keep large stocks from specific publishers, trading with the rest of the supply chain (but not end-consumers). Distributors deal mainly with the large scale logistics of the supply chain. Distributor examples are Macmillan Distribution (http://www.macmillandistribution.co.uk/) or Littlehampton Book Services (http://www.lbsltd.co.uk/)

BookSellers
Booksellers are similar to distributors, with the difference that they often have a “Retail” space where potential buyers can go and inspect and buy books. Booksellers are more “end-consumer” friendly and can act just like in a normal book shop offering retail space. However, they are often located on business parks and not on shopping malls or on the high street in the city/town. From this perspective, they are not a normal book retailer. Booksellers might be specialised in specific sectors for different customer segments (i.e. libraries).

The difference between booksellers and publishers is clear. However, within the whole industry’s supply chain there are too many overlaps in terms of what services are offered. For example, wholesalers can be similar to distributors, however, they can deal more directly with end-retailers and book orders can take place as bulk buys of single titles. More information about Booksellers and the book industry in general can be found at the Booksellers Association website (http://www.booksellers.org.uk/)

Differentiators
The main differentiators within the industry are perhaps not the books themselves but the added-value services that each actor is able to provide to their clients. For instance, during our interviews it became clear that that pricing (i.e. discounts) is a factor on the decision of where to buy the books; and so is the level of personal service provided by the seller and the level of automation (electronic stock control, payment, etc).

For instance, the University Administrator preferred one supplier over the others due to the personal service: a personal account manager from the supplier delivered the books personally and helped with classification, bar coding and integration onto the IT system of the university.

Business to Business electronic systems and protocols to automate ordering, payment, order tracking, also play a very important role. Proprietary systems like BACS (http://www.bacs.co.uk), pubEasy (http://pubeasy.com/), EDI (http://en.wikipedia.org/wiki/Electronic_Data_Interchange) or BATCH (http://www.batch.co.uk) are widely use but not all actors offer the these services.

Also, clients can have different ways to remotely access the book catalogue, order checking/status, etc, with tools such as Telnet, Ftp, bespoke applications or graphical remote terminals systems such as Citrix or XWindows.

Another differentiation factor is the level of specialization. For instance, some booksellers might deal mainly with public libraries whereas others might deal only with university libraries, scientific publication or fiction.

To summarize, potential differentiators within the industry are:

- Main Industry Actors
    - Authors
    - Publisher
    - Distributor
    - Book seller

    - Whole seller
- Free Samples
- Publication Type
    - (Scientific, Fiction, etc)
- Publishers Network
- Prices/Awards won
- Distributors Network
- Book Sellers Network
- Distribution Network
    - i.e. National/International
- Reader Services
    - (i.e. Reading guides, clubs, etc)
- Online Retail Shop
- Whole Seller Network
- Retail Space
- Warehouse Services
    - Forwarding Depots
    - Storage
- Personalised Services
    - Personal Account Manager
    - Onsite delivery
        - Cataloguing/classification/transport
- Book Services
    - Book Covers
    - Bar coding
    - Tagging
    - etc
- Electronic Services
    - BACS
    - EDI
    - PubEasy
    - ….
    - Remote Access
        - Ftp, Telnet, Web, Citrix, etc
- Discounts
- Out-Of-Stock

- Print Facilities
- Bulk buy
    - Minimum
    - Discounts

A potential model that reflects all these differentiators is shown in Figure 18.

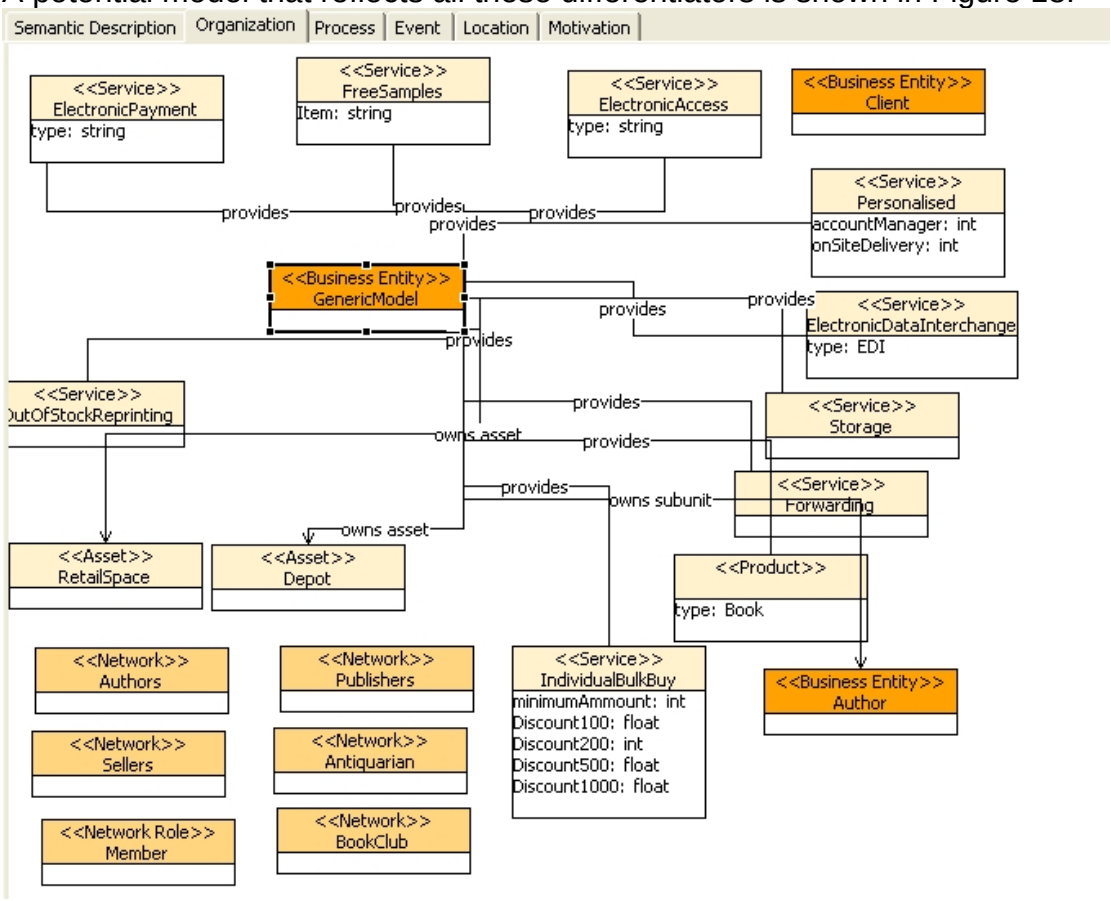

Figure 18 - Book Publisher Model

5. Designing and Implementing BML Models

The creation of BML models is a task that requires several steps, and several levels of expertise. From our experience with BML, and in practical terms, three (potentially four) levels of expertise are required:

- Business domain expertise
- BML Metamodel expertise
- Familiarity with the DBE tools

First of all, business domain experts should be ideally a group of SME's within the same business domain. SME's can provide invaluable feedback about how their industry work and what are the most representative aspects of their businesses. It is not possible to capture all the different aspects of the industry using BML and only the most generic and relevant ones should be modelled.

At the other side of the equation, a business analyst who has experience with BML (and therefore experience with the tools such as the BML Editor/DBE Business Analysis within the DBE Studio) is required. While simple BML models are not difficult to implement and understand, it is important to notice that full awareness of the BML 1.0 Metamodel is necessary to implement comprehensive models. The main role of the business analyst is as a "translator", translating the knowledge of the SME into a useful BML M1 model.

'D15' defines a series of elicitation techniques such as interviews, observations or prototyping that can be used to gather the requirements for BML modelling. We have used a combination of those described on the deliverable throughout the work described on this deliverable. D15 also defines a document template that mimics the BML 1.0 structure designed in order to help SME's to picture their business from a BML 1.0 viewpoint.

SMES are not expected to know with great level of the detail the BML 1.0 metamodel. The role of the document template defined in D15 is to provide SME's with a way to describe their business in a BML 1.0 "way". In addition to the document template, we have borrowed some techniques from Information Architecture (IA) to make the process defined by the document template more visual and collaborative.

From an information science perspective, BML models are a kind of information model that rationalizes in a semantic way the "*Why's? How's? Where's?* and *Whose With?"* of an SME, increasing potentially the '*findability*'[18] properties of the SME software/knowledge services and of the SME itself.

[18] http://en.wikipedia.org/wiki/Findability

For designing collaboratively BML 1.0 with SMEs we have used very simple processes and techniques borrowing ideas from existing techniques such as Card Sorting[19] and Class-Responsibility-Collaborator (CRC) Cards[20] that make the process of modelling (any modelling) more collaborative and visual.

Initially, we emailed out to the SME's the template described in D15 in order to kick-start the process and to give the business analyst an initial overview of what the SME's thought of themselves in terms of BML. Once the templates were returned, a meeting was organized with the SME's in order to discuss the template and extend it if were appropriate.

To facilitate the discussion, simple cards (i.e. Post-it type notes) were used to map out all the possible instances of BML elements in the model and make them visible and "tangible"(see Figure 19). The cards could contain any of the elements defined in the BML metamodel, without any specifically arrangements in terms of the packages described by the BML metamodel.

Figure 19. Table full of BML "Elements" as Post-it Notes

Additional information already available related to the company such as website print-outs, leaflets/catalogues or anything relevant were also brought to the table (literally) in order to identify new potential BML elements.

Together with the SME, the business analyst tried to identify the structure of the information presented on the table and come out, together with the SME, with a potential model that was representative of the SME. This technique (open-ended arrangement) contrasting with the first (filling a template, fixed/closed) was performed in order to expand the design space of potential elements that could go in the BML and encourage

[19] http://www.syntagm.co.uk/design/cardsort.shtml

[20] http://alistair.cockburn.us/crystal/articles/ucrcc/usingcrccards.html

discussion. The first technique required more structure as it was performed by the SME, whereas during the second, the business analyst structured the session.

At this stage, the business analyst could start creating the BML model on the computer. However, we also found that an extra step that helped, like in any modelling activity, was to create the model on a large white board (Figure 20).

Figure 20. BML Model on a whiteboard

After the agreed model was entered on the BML Editor, the SME was contacted again for further inspection and discussion of the model. With the current status of the BML tool chain delivery, also technical experts were consulted informally in order to discuss the more technical aspects of the BML (such as SSL).

6. Conclusion

This work has been primarily focussed on the development of BML models using BML1.0 for two areas, namely Manufacturing, and Tourism.

The BML M1 Manufacturing models have been derived by staff involved in the project that have industrial experience. These models may be considered as generic models since they are not based upon any specific manufacturing sector or any particular company. At some stage in the future, when suitable SMEs have been identified, these models will need to be populated. Such population of the models may lead to the generic model being refined to make them fit the idiosyncrasies of a specific industry type of specific company. We do, however, believe that the models developed form an excellent platform from which to work.

Tourism is a very large industry covering significant diversity of sub-industries, and as such it is difficult to address all of these in a single modelling task. The Open Travel Alliance models produced in the SATINE project have been influential in the development of the current BML M1 models that have been created with the current driver SMEs in the West Midlands. These models have been developed along the lines of a 'community model', where several organisations form a contract for agreeing , for example, business processes, agreed document formats, service types, and other classes and attributes the organisations agree to share. Further models will need to be created and updated on an on-going basis.

The BML modelling process has identified a number of factors. The modelling process is itself a complex process that requires time and dedication if it is to be done correctly.

On the positive side the following were identified:

- It was possible to construct models for all packages forming part of BML.
- It was possible to model quite complex processes particularly within the manufacturing process. However, it was felt that paper models needed to be developed before attempting to transfer the model to the BML software tool.

On the negative side the following points were identified:

- There was initially some difficulty in accessing the knowledge base at Lamia. Initially it was not possible to access or save any models which caused considerable delay in the modelling process. This has now been resolved.
- The use of Eclipse not allowing models to be saved meant that models had to be built over and over. This caused a considerable waste of time and effort. This is now being resolved.
- Printing the models from within the BML tool is still an issue. It has been necessary to use screen shots and paste them into word rather than printing a complete model. Only being able to use screen shots makes it difficult to link the various shots together to form a single neat diagram.

- Individual processes, some quite complex, were modelled. However, it is a little difficult to build large complex models due to the size of the screen and having to continually scroll around the screen to find bits of the model that may be related. It would also be nice to be able to take the individual processes and to combine them to form one large model of an organisation.

- It was felt that the modelling process for the manufacturing sector benefited from the development of paper models prior to embarking upon using the BML software modelling tool. This was due to the size and complexity of some of the processes and is related to the point above. It was caused in the first place due to the inability to save and edit models using the software.

- There is a need for a good training package for BML modelling to ensure the tool can be used easily. This becomes more important when SMEs are expected to take on the modelling process themselves.

- Recognition that the tourism industry is very large and that different organisations will need to share different parts of one or more models without needing to define or redefine a whole model has lead to the conclusion that it will be necessary to the definition of a double level model at M1. Further, the models need to be extensible as new companies join, but these extensions need to be dynamic to allow the already existing software to continue to work but to also take into account the extended model.

- Models need to be able to inherit from other models.

Although the report concentrates on two major areas models have also been built for Location Based Services, and the Book Industry case study. These models help to show that BML is applicable to a very wide range of industry sectors

The work undertaken demonstrates the work in progress. The partners involved are committed to the process of BML modelling and believe many of the SME drivers will engage further in the process.

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