D74.3

Report on MSE standards promotion and transfer

M18 issue

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VERSION HISTORY

	NOTES AND COMMENTS
0.1	TABLE OF CONTENTS, DISCUSSION AND EARLY TEXT PARTS (MARCH 15)
0.2	FIRST COMPLETE TEXT VERSION (MARCH 28)
0.3	COMMENTS AND CHANGE PROPOSALS - MARCH 31
1.0	FINAL VERSION FOR PEER REVIEW (APRIL 08)

DELIVERABLE PEER REVIEW SUMMARY

ID	**Comments**	**Addressed (✓) Answered (A)**
1	The Executive Summary does not reflect completely the contents of the doc. It should be carefully revised and completed. The focus of the document should be on promotion and transfer of standards, and the focus of the Executive Summary should reflect it	Text modified
2	Section 2. The title of this section suggests a plan, but in the text of this section, it is not clear what is the plan.	A paragraph with the D743 plan added
3	Section 2. "For successful transfer of research results in standards, ….". Are these the objectives of the deliverable? Indeed, it is not clear what the objectives of the deliv are. This should be clarified in the very beginning of the deliverable, and Executive Summary.	Objectives explicitly identified, plan of D743 added
4	Section2. "The COPRAS study recommends…". Why COPRAS? Are there others? Why COPRAS was the one used in this deliverable ?	Text explaining COPRAS added in Section 2
5	Page 6. Footnotes 2 and 3 are the same. Remove the repetition.	Footnote 2 removed
6	Section 3. It is not sufficiently explained, and not clear indeed, what promotion was developed? This should be presented in synthesis, but with enough explanation to be clearly understandable.	Text added Section 3 on promotion (synthesis)
7	Section 3. "Promotion has been done…" Indicate what was done, when, by whom, for what purpose, etc etc.	See Item 6

8	Section 3. Motivation. "the objective of this workshop was to disseminate standardisation activities of…". Which concrete activities ? Enumerate and describe.	Text on concrete activities added
9	Section 3. Motivation. "The presented papers were devised…". Explain what this impacts MSEE in standardisation.	Explaining text added
10	Section 3.2."… three important proposals to develop standards…." Explain how this impacts in MSEE. Explain for each of the 3 bullets.	Explaining text added
11	Section 4. "Inn section 4.4 we present reasons why to transfer the …." - "Inn" should be "In" - "why to transfer" should be supported by appropriate requirement analysis (here in tis document, or from another deliverable).	'In' corrected Why to transfer: requirements analysis given in COPRAS, text added
12	Section 4.1 "… into a CEN standard". Justify why CEN and not any other standardisation body.	Text why CEN and on other SDOs added
13	Section 4.1."Further, we have studied in more detail which standards are actually…." Not clear. Standards that already exists and to be reused, or new ones ?	Text added
14	Section 4.2. 1st parag should be focused on project requirements analysis.	I understand that this is addressed with the goal of WP74
15	Section 4.2. "We look at the proposals and the proposers…." How does each bullet impact in MSEE ? Explain clearly.	Explanations added
16	Section 4.2. "The MSEE scientific committee…" Explain the reasons for it.	Explained
17	Section 4.3. After each bullet 1 and 2, include a sentence elaborating on the conclusions from the contacts done. What happened ? Anything relevant for MSEE ? At which level ? For what ? etc…	This is the present status of the dialogue with the SDOs
18	Section 4.4. The text is not clear.	Text slightly modified. Is it clear, David what do think?
19	Conclusions. Needs to be revised and further elaborated, to convincingly respond to the expected scope of the deliverable.	TBD
20	6. Annex. Why David Chen ? This should happen as a proposal for a NWI in CEN ?	Corrected

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Fig 1 *Modelling constructs and relationships at BSM level*

1. Executive Summary

Deliverable D 74.3 has two objectives namely to promote standardisation in MSEE and to transfer selected MSEE results into new standards.

The main results concerning promotion of standardisation described in this deliverable are:

- A standardisation workshop[1] organised by WP74 in the frame of the IFIP Working Conference IWEI 2013 at the University of Twente, including the contents of the papers and the main results of the discussion. Six papers have been presented:

Standardisation in Manufacturing Service Engineering (Martin Zelm and Guy Doumeingts),

Service Modelling Language and potentials for a new standard (David Chen),

An Approach to standardize a Service Life Cycle Management (Mike Freitag; Manuel Hirsch et.al),

Reference ontologies for manufacturing (R. Young, A-F Cutting-Decelle et.al),

Agents and Rules for the negotiation of Interoperability Solutions (Carlos Coutinho, Ricardo Goncalves et.al)

Open Business Model, Process and Service Innovation with VDML and ServiceML, (Arne Berre, Henk de Man et.al.)

- the approach towards new service standards of the Standards Development Organisations mainly CEN and DIN

The main results concerning the transfer of selected MSEE results into new standards is the choice of Service Modelling Language (SML) among the three selected topics, the two others being Service life cycle management and Ontology for assets. The main reason is the fact that SML is more mature compared to the two others candidates. We underline also that during the workshop at University of Twente, it appears that there was some similitudes between SML and the Value Driven Modelling Language (VDML) developed by SINTEF (N) and recognised by OMG. Hence, this offers an excellent opportunity for common work and mapping the two languages reinforces the chance for the selection as a standard

[1] http://www.utwente.nl/ewi/is/events/IWEI2013/workshops.html

2. Introduction and Plan of the deliverable D74.3

Standardisation means the creation and implementation of standards, a process built on voluntary cooperation among industry, academia, consumers, public authorities and other interested stakeholders. Standards complement the development of technical specifications and ease the implementation of innovative products and services. For successful transfer of research results into standards, early starting of the standardisation process in a project is important as well as a strong involvement of the partners in this process [2].

The results of the previous deliverable D74.1 have been concerned with '*Analysis and assessment of MSEE results from the standards viewpoint*'. We have elaborated and performed an online survey on standardisation with the project partners. The survey shows that 93% of the answers state a need to develop standards in MSEE field. The survey also provides some comments about the (global) domains where new standards could be developed. In parallel, we have elaborated the state of the art in standardisation, presenting an overview relevant standards in the chosen domains of MSEE namely in Enterprise Services, Enterprise Interoperability and Internet Technologies.

The objectives of the actual deliverable D74.3 are 1.) Promotion of standardisation and 2.) transfer of project results into upcoming standards

Standards promotion efforts aim to create a maximum of awareness of the objectives, and benefits of the project among its main target groups, research projects, standardization working groups and relevant industrial organisations. The related dissemination of standardisation results brings projects collaboration opportunities, and the ability to cooperate with a variety of specialists, thus benefiting from their own expertise.

To cope with the objective of promotion, we have organised a standards workshop at the IWEI 2013 Working Conference of IFIP to promote MSEE results. Knowledge on new standards can be spread and shared very successfully via workshops. Workshops allow besides presentations of scientific papers an in depth discussion on standards issues between project members and external experts leading to an improved common understanding and potential collaboration. We have gathered experts from outside the project to present their view on the key topics around Enterprise Services and to foster the exchange of knowledge.

The IWEI 2013 workshop, titled *'Standardisation for interoperability in the service-oriented enterprise*' was one of five workshops which were organised by MSEE WP74. The workshop proceedings including the results of the technical discussion will be published by ISTE/WILEY in July 2013. The promotion work is described in Section 3.

Second, we have started with the standardisation process, namely the transfer of research results into standards. COPRAS is a methodology about the interaction between research and standardisation, commonly elaborated by CEN, CENELEC, ETSI, the OpenGROUP and W3C in a European standardisation project. It has been strongly recommended as a key

[2] COoperation Platform for Research And Standards (COPRAS) , http://www.w3.org/2004/copras/

reference for future standardisation in the FInES cluster work. The COPRAS study recommends a typical standardisation process[3] with the first three steps:

- 1. To identify a market needs for a new standard which is recognized among a sufficient number of experts.
- 2. To Draft a set of requirements reflecting the view of the user of the future standard
- .3. To reach consensus among the project experts and the Standards Development Organisation (SDO) about the technical specification

COPRAS has been a unique European standardisation project to elaborate a methodology for early interaction between research and standardisation, commonly carried out by CEN, CENELEC and ETSI. The results of COPRAS have been highly recommended for use in the FInES Cluster.

The plan of D743 consists of

Section 1 presents the Executive Summary.

Section 2 provides an introduction to the topics addressed and an overview of the methods used.

Section 3 presents the promotion activities, the Standardisation Workshop at the IWEI 2013 conference, a dissemination presentation and communications with SDOs

Section 4 identifies three candidates for new standards and discusses the next steps

Section 5 presents the conclusion

3. Promotion of standardisation

In the reporting period, standardisation in MSEE has been promoted via a workshop titled 'Standardisation for interoperability in the service oriented enterprise' held at the IWEI 2013, Further, the work of the WP74 has been presented for dissemination at the MSEE General Meeting[4] and via communications with representatives from CEN and DIN (see Section 4.3)

3.1 Standardisation Workshop at IWEI 2013

Motivation

The objective of this workshop was to disseminate standardisation activities of the European project MSEE (Manufacturing Services Ecosystem) and to increase awareness of standards development in the frame of European projects with focus on the service oriented enterprise. The workshop addressed selected standardization topics in the field of Service Engineering, Service Lifecycle Management (SLM), Service Modelling, and Reference Ontologies for Enterprise Manufacturing).

Actions from the workshop have been 1.) the start of the Service Modelling Language (SML) standardisation process, 2.) the mapping of SML with the VDML language from OMG and 3.) the decision on preparation of standardisation of Service Lifecycle Management and of Reference Ontologies for Assets.

The presented papers were devised between three papers coming from members of MSEE and three papers coming from outside. Hence, a bi-directional stream of knowledge exchange between members of the MSEE project and other researchers is created, leading to an improved common understanding and to new collaborations. The impact on MSEE is to gain internal and external visibility of standardisation and its benefits for new solutions.

Workshop date and location.

The standardisation workshop was one out of five workshops held in collocation with the 5th International IFIP Working Conference on Enterprise Interoperability at the University of Twente, Enschede, Netherlands on March 26, 2013 from 08:30 – 12:30 hrs. Chaired by Martin Zelm and David Chen, the standardisation workshop was attended by 13 participants, (http://www.utwente.nl/ewi/is/events/IWEI2013/workshops.htm)

Workshop content: Abstracts of the papers presented

Standardisation in Manufacturing Service Engineering
Martin Zelm, Guy Doumeingts
INTEROP VLab, Belgium

[4] Guy Doumeingts, Martin Zelm *WP 74 Standardisation* , Presentation 20130208, Innsbruck

Product related service is a key element of any service-oriented manufacturing system. The paper presents methods to capture standardization knowledge in the European Integrated Project Manufacturing SErvice Engineering (MSEE), with the goal to initiate development of standards in the domain of manufacturing engineering services. For this purpose, a project internal survey has been performed to identify areas of potential standardization that can lead to future standards. With the survey, a coordinated follow-up within the project and subsequent external promotion are foreseen. An earlier involvement in the standardisation process is explored, since the normal standardisation process usually starts after completion of a development project and due to lack of funding is not any more supported by the developers.

Service Modelling Language and potentials for a new standard
David Chen
University of Bordeaux

This paper presents a service modeling language for the design and implementation of service system in a Virtual Manufacturing Enterprise (VME) environment. The proposed approach is developed under the frame of an ongoing FP7 European Integrated Project MSEE. A Model Driven Service Engineering Architecture (MDSEA) adapted from MDA/MDI acts as a framework for the proposed service modeling language. The paper focuses on the modeling language defined at BSM (Business Service Model) level which is presented in detail. Conclusions are given in the end of the paper.

An Approach to standardize a Service Life Cycle Management
Mike Freitag[*]; David Kremer*, Manuel Hirsch**, Martin Zelm***
[*] Fraunhofer IAO, Germany, **DITF Denkendorf, Germany, ***INTEROP-VLab Belgium

Servitization is a grand challenge for manufacturing companies to extend their business. As main result this paper presents an approach to standardize Service Lifecycle Management in order to support manufacturing companies to develop their services on a systematic way. Companies might benefit from this approach, as it indicates how relevant characteristics have to evolve in order to take the next steps in the servitization process and what challenges have to be regarded when it comes to the conditions for service innovations. However, the result of this paper still remains an approach that needs to be validated in practice

Reference ontologies for manufacturing
R Young*, N Hastilow*, M Imran*, N Chungoora* Z Usman* and A-F Cutting-Decelle**
*Loughborough University, UK, **CODATA France

There is a clear need for improved semantic communication to support information sharing across engineering groups and their systems in manufacturing industry and standards should play a large part in this. However, for standards to be effective in supporting the wide range of information required by manufacturing industry, they too would benefit from an interoperable base upon which they are defined. This paper presents ideas towards the development of a reference ontology for manufacturing which could provide a basis for the validation of the interoperability compliance either between systems or between standards

Agents and Rules for the negotiation of Interoperability Solutions
Tiago Santos, Carlos Coutinho, Adina Cretan, Miguel Beca, Ricardo Jardim-Goncalves
Uninova Lisbon, Portugal

Competitiveness in the specialised and diversified global markets keeps pushing enterprises to abandon their traditional product centrism and instead concentrate their efforts in very narrow specialisation fields, relying on networks of other providers that are able to fulfil their needs towards the development of complete solutions. In that vision, given the heterogeneity of the globalised collaborations and the constant demand for change, innovation, and compliance to more exigent rules and the adoption and definition of standards, it becomes very difficult for enterprises to cope with the pace of change. This paper proposes the effort to develop a standard implementation of a framework based on agents and rules to achieve solid and stable integration of solutions using proven standards, via the use of a strong and formal negotiation mechanism. This negotiation will be the basis for increasing the enterprise interoperability in the supply chain for the development of solutions.

Open Business Model, Process and Service Innovation with VDML and ServiceML
Arne J. Berre*, Henk de Man**, Yannick Lew* and Brian Elvesæter*
*SINTEF, Norway**, Cordys, Netherlands

The NEFFICS platform combines an open innovation social media platform with a business modeling and operations platform. Together this provides a foundation for cloud-based open business model innovation, process innovation and service innovation for networked enterprises. Business model innovation is supported with a basis in a business model cube framework with six views, where each view is supported by a corresponding diagram view from the Value Delivery Modeling Language (VDML). VDML has now been proposed for further standardisation within OMG. Process innovation is supported by VDML activity diagrams with options for mappings to BPMN and CMMN. Service innovation is supported by the Service Modeling Language (ServiceML) which shares the core collaboration models of VDML for role modeling and value networks together with business SoaML, according to the five views of the AT ONE service innovation methodology.

3.2 Workshop discussion highlights

The main benefit of the workshop has been to demonstrate the usefulness of standards to improve interoperability in service oriented manufacturing eco systems. In the discussion following the presentation of the workshop papers three important proposals to develop standards have been launched

1. A proposal from David Chen[5], University of Bordeaux was made to turn the Service Modelling Language developed by UB1 into a European standard. This language is addressing the important area of semantic interoperability. The SML has similarities with the standard for Constructs for Enterprise Modelling CEN/ISO 19440 developed in CEN TC 310WG1. The WG Convenor David Chen is responsible for MSEE SP1

[5] David Chen: *Service Modelling Language and potential for a new standard*. IWEI 2013 Workshop

hence the same workgroup could take over the New Work Item.. There is a need for it and a standard does not exist today

2. There are similarities between the MDSEA based Service Modelling Language and the Value Driven Modelling Language (VDML). Hence, this offers an excellent opportunity for common work along the VDML work, and mapping the two languages. This needs resources and participation and can be done by Arne Berre and and David Chen.
3. A Proposal made in the paper of Mike Freitag[6], IAO to standardise Service Life Cycle Management as well as from Manuel Hirsch, DITF proposing a Reference Ontology for Assets.

The above standards will impact MSEE in future solutions of Servitisation Modelling and for the Service Lifecycle Management (SLM) Toolbox.

University of Bordeaux has a long standing experience in Enterprise Modelling, architectures and modelling tools. Fraunhofer IAO have high technical capabilities in developing engineering services and testing via their ServLab environment. DITF are experts for the Open Manufacturing Service modelling and virtualisation method to capture knowledge, ICT, and organisational aspects of development processes within manufacturing ecosystems.[7]

3.3 Further promotion activities

The activities planned will be matched with that of MSEE dissemination plan for conferences. Standards oriented Workshop are considered.

[6] Mike Freitag, Manuel Hirsch et al: *An approach to standardize Service Lifecycle Management*, IWEI 2013 Workshop

[7] MSEE FP7 Integrated Project, Description of Work

4. A proposal for Standardisation Process

The standardisation process means for instance to transform research results into standards to create new ones. This process often occurs with a delay with regard to the pace of the development in a project, simply because validated, research results exist only at the end of the project. If the standardisation process starts late in the project, it is usually impossible to complete the final standard, because the necessary resources are no more available. On the other hand, if the process starts too early, the research results may change and make it necessary to modify or even withdraw a standard. The goal is to keep the delay between research and standardisation small and to optimise the available expert resources[8]..

A requirements analysis why to transfer research results into standardisation is for instance given in the COPRAS Report, Section 3 *'Your project and interfacing with standards bodies'*

Inn Section 4.4 we present reasons why to transfer the Service Modelling Language obtained in SP 1 into a CEN Standard.

4.1 Recall of previous work

The goal of WP74 has been to identify actual standards used in MSEE work and elaborate standards needed in the future. In the first deliverable D741, we have presented standards or standards groups proposed in the survey by the partners and reported the state of the art.

Further, we have studied in more detail which standards are actually used or have been referenced in the project deliverables D11x and D12x. Two categories of standards have turned to be important for MSEE, first, a category of standards for Enterprise Frameworks and Architectures for Service Concepts, a second a category of standards for service modelling languages. Further, there are existing standards used in MSEE and candidates for new standards. We will consider here only the second category.

CEN as the European standards organisation is the first priory choice for a European project. National standards have country limited acceptance and shorter lifetime, they are often documented in local language. Industry standards (for instance from the OMG) or open source standards have been considered.

4.2 Standards proposals and proposers

From on-going project work documented in the deliverables, from collaboration among the partners and from papers prepared for the IWEI 2013 Standardisation Workshop, three

[8] COPRAS Study [COPRAS, 2005],

proposals for future standards have been identified. They concern Service Modelling Language, Service Lifecycle Management and Reference Ontology for Assets.

We look at the proposals and the proposers UB1, IAO and DITF

1. Service Modelling Language: There is no language international standard for the modelling of service system. Most of existing enterprise languages can be reused to model part of a service system. But concepts of those modelling techniques need to be integrated and mapped one to another in order to cover the whole modelling requirements for service system engineering (Chen[9] 2013). In addition a more detailed description is presented in the ANNEX. An SML standard will improve and stabilize future solutions of Servitisation Modelling impacting MSEE .

2. Service Lifecycle Management (SLM) A standard for Categories of Service Life Cycle Management does not exist today, the standard could follow the proposed SLM Framework. The benefit for the practitioner is that Service oriented enterprises could seamless collaborate by using similar interoperating services. An SLM standard will enable common solutions to control the Service Lifecycle with a uniform concept.

3. Reference Ontology for Assets: Formal semantics – namely ontologies – are considered to be key drivers for standardization, as ontological elements can be used to capture, structure, and further elaborate explicit as well as implicit knowledge within a certain domain. The resulting ontologies can support, bridge and align (product-) service ideation, engineering, and operation (Hirsch, 2012 [10]). This represents a definite improvement compared to individual semantics

The proposers: University of Bordeaux has a long standing experience in Enterprise Modelling, architectures and modelling tools. Fraunhofer IAO have high technical capabilities in developing engineering services and testing via their ServLab environment. DITF are experts for the Open Manufacturing Service modelling and virtualisation method to capture knowledge, ICT, and organisational aspects of development processes within manufacturing ecosystems.[11]

4.3 Discussions with CEN and DIN

Contacts have been made with the goal to explore which Standards Development Organisations (SDOs) have the best potential for common dissemination and collaboration. It is ongoing work, final results are not yet available.

[9] D. Chen: *Service Modelling Language and potentials for a new standard*, IWEI 2013 Workshop, to be published at ISTE / Wiley
[10] Mike Freitag, Manuel Hirsch et.al: *An approach to standardize Service Lifecycle Management*, IWEI 2013 Workshop, to be published at ISTE / Wiley
[11] MSEE FP7 Integrated Project, Description of Work

1. The Commiteé de Normalisation Européenne (CEN) [12] has published two European Norms (EN) on terminology of services, one for the construction sector and one for industrial products, namely

EN 16310:2013 Engineering services - Terminology to describe engineering services for buildings, infrastructure and industrial facilities

EN 16311:2013 Engineering services - Terminology to describe engineering services for industrial products

In addition there are Working Groups for the manufacturing industry, namely CEN TC319 on Maintenance Services, and CEN TC395 on Engineering Consultancy Services and CEN TC389, Standards on Innovation Management and Open Innovation.

Contact points have been John Ketchell CEN Strategic adviser, Cinzia Missiroli, coordinator Service Standards at CEN-CENELEC

Conclusion: We will consider the above standards, which seem to be focused on existing concepts of enterprise ecosystems.

2. DIN the German Industry Standards has a department for Service Standards addressing three groups standards in the sectors Consumer services, Economy services and Health services. [13] The work methodology is user driven e.g. forming a sufficient interest group of stakeholders and obtain consensus on a specification to be standardised. The work scope includes creation of German National Norms as well as acceptance/approval of European / International standards from CEN/ISO in Germany. Interestingly, there are Norms for Asset Management, and Services in Engineering, they are however constrained to the construction sector. Contact point is Daniela Rickert, coordinator Service Standards at DIN.

Conclusion: We will analyse with the partners IAO and DITF potentials of a collaboration with DIN

4.4 Why Service Modelling Language

The Service Modelling Language (SML) developed under MSEE is made of a set of constructs which are presented with additional details in the Annex SML has been inspired from existing enterprise modelling languages. The language and its constructs have been elaborated at the three modelling levels of the Model Driven Service Engineering Architecture (MDSEA) SML has similarities with the VDML a service language of OMG, a mapping will improve the common understanding and usability. There is no language

[12] Cincia Missiroli: *European Standardisation System*. CEN-CENELEC 2011, trade.ec.europa.eu/doclib/html/147828.htm

[13] DIN Normenauschuss Dienstleistungen NADL; Jahresbericht 2011 (Service Standards Annual Report 2011), www.nadl.din.de/

international standard for the modelling of service system. SML could fit as a New Work Item into the scope of the existing working group CEN TC 310 WG1. David Chen is the SML development manager in MSEE and at the same time the convener of CEN TC 310 WG1.

4.5 Next work

The Service Modelling Language (SML) appears to be best suited as a candidate for the standardisation process in MSEE. We ask the MSEE Coordination Committee for a decision approving further work. If approved, the next step will be to elaborate the acceptance in the CEN working group TC310WG1 and to install SML as a NEW Work Item as result of the voting for acceptance.

5. Conclusion

For the dissemination of standards work in MSEE we have held a standardisation workshop at the IWEI 2013 on March 26, with contributions from inside and outside of the MSEE project. In this workshop, we have received three proposals to develop new service oriented standards.

The proposal for a semantic standard Service Modelling Language (SML) is advanced beyond a new idea. The standardisation process can be started in the near future in the working group CEN TC310WG1 depending on an approval by the MSEE Management

Contacts with Standards Development Organisations have started and will be enhanced together with promotion activities being part of the overall dissemination plan.

6. ANNEX

Description of the Service Modelling Language proposed as a New Work Item (NWI) in CEN TC 310/WG1[14]

The Service Modelling Language proposed for standardization is containing an outline of a service (system) modelling language to support service system engineering in Virtual Manufacturing Enterprise (VME) environment . The proposed service modeling language makes use of existing relevant enterprise modeling techniques as a basis with necessary adaptations and extensions. Service is usually seen as interactions between customers and service provider. The language aims at modeling both service and service system that provides services.

It has been considered that no single existing language can represent all of the various aspects that need to be described in modelling service and associated service system in a VME environment. The service modelling language developed under MSEE has defined a set of constructs which were inspired from existing enterprise modelling languages. A Model Driven Service Engineering Architecture (MDSEA) adapted from MDA/MDI acts as a framework for the proposed service modelling language. Adopting a Model Driven Approach (MDSEA) allows model transformations and reengineering based on models.

The proposed Service modelling language provides a set of modelling constructs defined at three modelling levels of MDSEA. At Business System Modelling (BSM) level, service and service system are modelled at conceptual level which is independent from particular technologies used for implementation. At the Technology Independent Modelling (TIM), the model gives detailed specifications of the structure and functionality of the service system that still do not propose particular technological details. At Technology Specific Modelling (TSM) level, the model combines the specification in the TIM model with details that specify how the system uses a particular type of technology (such as for example IT platform, Physical Means or Organisation with Human profile). Figure 1 gives an outline on main modelling constructs defined at BSM level.

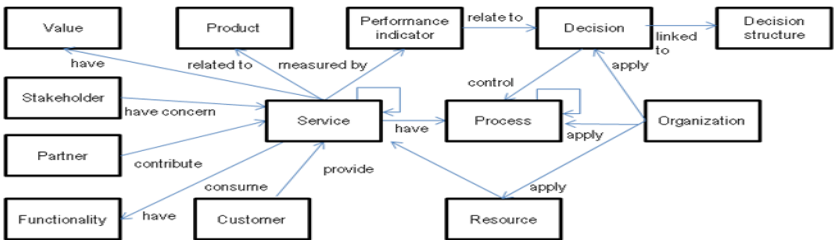

Figure 1: *Modelling constructs and relationships at BSM level*

[14] Author David Chen, UB1

The proposed service modelling language is consistent to EN/ISO 19440 standard in the domain of enterprise modelling. The set of constructs defined can be either represented by templates or graphical representations or both. This language supports, through the use of templates, the integration of existing modeling techniques. Model information captured and collected using a particular language/tool can be mapped to templates which are neutral.

The proposed service modelling language (constructs and templates) can be considered as a basis for future possible standardisation. There is no language international standard for the modelling of service system. Most of existing enterprise languages can be reused to model part of a service system. But concepts of those modelling techniques need to be integrated and mapped one to another in order to cover the whole modelling requirements for service system engineering.

From standardization view, it could envisage to:

- adopt MDSEA as a standard service modelling architecture under which modelling language can be developed
- develop metamodel of service modelling constructs at the three modelling levels under MDSEA
- map service modelling constructs to existing relevant enterprise modelling techniques

Relevant Standards Development Organisations and Abbreviations of used terms:

CEN	Commité Européen de Normalisation
CENELEC	European Committee for Electrotechnical Standardisation
DIN	German Institute of Industry Standards
ETSI	European Telecommunication Standards Institute
IERC	European Research Cluster on the Internet of Things
IEC	International Electrotechnical Commission
ISO	International Organisation for Standardisation
NIST	National Institute of Standards and Technology
OMG	Object Management Group
SDO	Standards Development Organisation
SML	Service Modelling Language
SLM	Service Lifecycle Management
VDML	Value Delivery Modelling Language