Multidisciplinary Framework-Based Service Modeling Applied to Service Coursework and Business Planner Interaction

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Abstract--Launching new high-value-added services calls for systematic methodologies based on multidisciplinary framework enabling the transformation from service concept to real service. The collaboration of business planers from various kinds of service and the sharing and assignment among individuals/ organization, goods/infrastructure, technology/system require the establishment of a common framework and service modeling approaches based on multidisciplinary studies.

The present paper applies the service modeling approach proposed by the authors to service coursework for undergraduate, graduate and post-graduate carrier-track students from some universities. The analysis of planning process and results demonstrate the potential for application to various service areas.

The authors interviewed key service planner in real IT service businesses, with a focus on the service modeling processes and its results. The interviews confirmed the potential for application to actual service planning, and provided leads for refining the service modeling approach.

I. SERVICE SCIENCE APPROACHES AND THE NEED FOR MULTIDISCIPLINARY SERVICE MODELING

The creation of new high value-added services requires the synthesis of concepts from multiple disciplines and a system approach integrating the service realization [2]. To answer this demand, one of the authors developed the new concepts of

a) Service Classification Hierarchy according to Maslow's theory,
b) Service Providing & Usage Model,
c) Service Phase of Customer Participation,
d) Service Space for Value Shifting, and
e) Service Strategic Road Mapping,

integrated into a service concept framework sharable by service stakeholders of different backgrounds towards an effective road mapping technique [7][8][9][10][12]. These concepts and framework were constructed by abstracting the common concepts, elements and representative relations from the viewpoints of service marketing, management and engineering. Application included analysis of known success examples, collaborative knowledge creation, positioning strategy, prediction of advanced ICT services by means of using in undergraduate and graduate students class work, case studies, and industry association survey research.

The service providing and usage model (b) provides basic reference points to the service as a system for system approach studies. The authors think that multi-disciplinary service modeling is needed for the following reasons:

1) Any service system is an entanglement of people/organization, goods/infrastructure, information/system, causing a relatively simultaneous generation and consumption of the service product, and therefore the related knowledge must be multi-disciplinary.

2) There are many cases when new services are conceived by the co-operation of members from different fields or organizations, and therefore visualization becomes a first step to a shared framework.

3) In the service engineering and IT field, the service modeling approach has been already developed [1][3][15], however one still needs to better understand and study the present-stage role interaction of people, goods and information, as necessary step to precede the actual IT modeling.

For partial evaluation of the results from the present approach, we applied it in class-work at several universities and analyzed the method's validity, the results dependence on users' context, directions for improving the model's explanation, and the relation to other methods. Then, after one year, we performed action research reflecting the results of this analysis. For this purpose, we repeated the same survey in one of the universities and analyzed the new results, followed by interviews with service designers to evaluate the application to the data-center industry.

As to the service concepts c) and d) above, they are being discussed in a separate contribution at this Conference.

II. ELEMENTS OF THE SERVICE MODELING METHOD

The present modeling method [7] was proposed aiming to provide a familiar common initial discussion scope for teams with widely varying members' background: from business and service industry to engineering and manufacturing. In this section we will outline the re-arranged fundamentals, elements, relations between the elements, and standard representation image of the model. Further details can be found in past works cited above. The related concepts and theories are referred by abbreviations, as follows: Service Engineering [1] – SEng, Service Management [14] – SMgt, Service Dominant Logic [17] – SDL, Prism Model [4] – PRM, Knowledge Creation Theory [13] – KCT.

A. Fundamentals of the present model

(1) The basic axis is supplier – user (SEng).
(2) Tangible and intangible service contents is supplied from supplier to users via service channels (SEng).
(3) The role of manufactured goods is to become the service media and to deliver the knowledge encapsulated in them (SDL, KCT)
(4) The user (customer) becomes a co-producer of the service via interaction with the provider (SDL)
(5) The service manager and client exist as management elements on the provider and user sides, respectively

(PRM). Assuming service outsourcing, B2B2C is the standard.

(6) The related infrastructure is the service infrastructure on the provider side and the place of usage at the user side (PRM, KCT).

(7) Manufactured goods are included and used at the actual service scene relating to contents, channel, service infrastructure, according to equipment and space needs (DSL). Interaction with manufacturing industry must be taken into account.

(8) Use the modeling approach to locate items to be reinforced or improvement steps for increasing the added value of the service. Examples: Service contents (feature upgrade or better matching of demand and realization), service channel (quantitative characteristics such as volume, amplification, accessibility, and temporal characteristics such as frequency, response time, punctuality).

(9) In the same manner, use the modeling approach to initiate tradeoff analysis of resource investment among the concerned members. Example: improving the value of service frontend (including features) of service robots, while taking into account the interrelation (cause/effect, trade-off) of elements related to person/organization, goods/infrastructure, and information/system.

B. Modeling elements

The model is thought of as consisting of

1) The *Provider* and *Users* of the service,
2) *Contents* and delivery *Channel,*
3) *Goods,* which encapsulate *Knowledge,*
4) *Providing Manager* and *Providing Infrastructure* of the service,
5) *Place of Usage* and *Usage Client* of the service, and
6) *Manufactured Goods* as intermediary material.

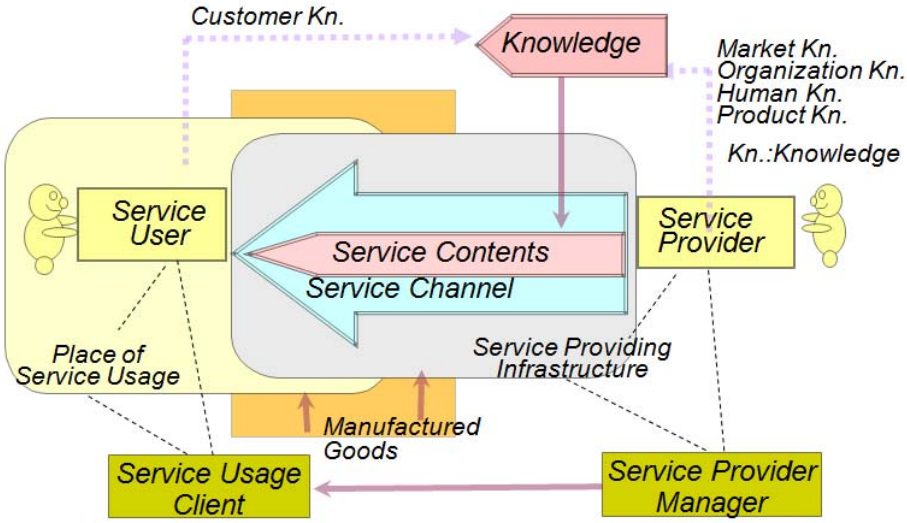

Fig. 1. Standard representation image of the modeling

C. Interrelationship of the modeling elements

(1) The *Knowledge* accumulated at the provider's side is encapsulated in the *Contents* being provided as service, and the reaction on the users' side is reflected as feedback to the *Knowledge*.

(2) The *Service Providing Manager* manages the *Providers* and the *Providing Infrastructure.*

(3) The *Service Usage Client* manages the *Users* and the *Place of Usage.*

(4) The *Service Providing Manager* provides business-level services to the *Service Usage Client*.

(5) The *Manufactured Goods* are included and used within the provider-usage aspect.

D. Standard representation image of the modeling

Figure 1 shows the standard form of the providing – usage service model introduced above.

III. METHOD OF SERVICE MODELING APPLICATION

The authors adopted this modeling approach in class-work with undergraduate, graduate and post-graduate carrier-track students in their charge at their respective universities. The results of the students' works on related themes were analyzed and are used below to discuss the student's general ideas regarding service business, as well as the validity and contents of the service modeling method involved.

A. Problem setting

After two lectures explaining the definition and classification of services, we introduced the model substance as outlined in section II above. As examples of a service related to a tangible manufactured product and a high-level intangible service we discussed the iTune + iPod musical entertainment service, and Japanese inn hospitality, respectively. Table 1 shows the modeling elements and their realizations in the service businesses used as examples.

TABLE 1. EXAMPLES OF SERVICE MODELING ELEMENTS

Model element	iTune+iPod music entertainment service	Kagaya Japanese inn hospitality service
Service provider	Retailers	Owner / Proprietress / Staff interacting with guests
Service user	Music listeners	Guests, families
Contents / Channel	Music / Network	Catering / Conduct
Knowledge	Usage frequency / history	Hospitality / Taste
Service manager	Retail shop manager / CEO	Proprietress / Director
Service infrastructure	iTS (iTunesStore) / server / PC	Inn facilities / Tray transporter RT / Kangaroo house
Usage client	None / cafés / car industry	None / Coordinator / Travel agent
Usage place	carrying iPod / one's room / car	Inn rooms
Manufactured goods	iPod, PC, network equipment	Utensils, telephones, interior items
Service-business achievements	World's bestseller among music entertainment equipment	29 years uninterrupted ranked overall number 1 in the "Japanese Hotels and Inns Professional's Choice" ranking

B. Participant student groups

A total of 88 students took part in the present modeling: 51 undergraduate (mostly third-year) students from an IT department of University A, 27 (including 15 foreign) MBA graduate students from University B, and 10 business-incubation carrier-track students from University C. The evaluation is based on their reports submitted during, immediately after, or a few days after the course, as well as the reports submitted one year later during a re-evaluation at University B with 35 (including 27 foreign) MBA graduate students.

Table 2 shows examples of the service modeling problems used, with some small differences between the individual universities. We extracted the necessary information from the respective answers and used it for the analysis below.

TABLE 2. EXAMPLED OF SERVICE-MODELING PROBLEM WORDING

(1)	Chose a service from your field of interest and describe it in terms of the model discussed in classes, referring to the lecture contents.
(2) University A University B University C University B (2nd time)	In respect to the chosen service: ・ Describe the IT technology used presently and the IT technology to be used in the future ・ Focus on one element which you consider important for productivity increase and for creating new customer value, and discuss its relation to the other elements in the model ・ Describe the part which you think will require the application of information technology in the future ・ Describe the present state of IT and service staff training and the respective parts that you think will need upgrade in the future
(3) University A University B University C University B (2nd time)	Comments to the lecture contents: ・ Describe, if possible, the expectations to service science and its potential Examples: Simplifying the introduction of new IT, advancing IT usage ・ From the lecture contents, identify the points you found particularly interesting (you may identify weak points, too) ・ Describe your expectations about the service modeling and other methods from the lectures ・ Which points from about the service modeling and other methods introduced in the lecture did you find interesting (you may identifying weak points, too)

IV. RESULTS OF SERVICE MODELING APPLICATION AND THEIR DISCUSSION

We used the results from the service modeling application to analyze the students' choices of theme and the reasons for such choices, as well as the modeling completeness as represented by the number of described elements, and to investigate the students' understanding of the relationship to IT and innovation.

A. Students' choice of service modeling theme and reasons for the choice

Table 3 shows the fields and service systems chosen by the students for the modeling, grouped according to the categories in the Classification Table of Industry Groups published by the Japanese Ministry of Economy, Trade and Industry. As visible from this table, retail, transportation/ logistics, internet services, education/research services, medical/care-giving services, restaurants/bars filled the top positions, occupying 60% of all 113 samples. These choices can be attributed to the students' experience in providing services in their part-time jobs (about 10%) or family businesses, as well as to their everyday service usage. The choices of the undergraduate and foreign students are widely distributed over all fields.

Compared to the undergraduate students, graduate students were more likely to choose solution services or restaurant/bar and tourist services, and their modeling themes in each field were more detailed, taking up as examples detective agencies, nursery schools, seniors-oriented businesses, or business solutions using the hard- and software infrastructure of GPS and SaaS. One can notice that they use their experience with hotel, restaurant and bar establishments as a base for more systematic engineering

analysis. This can be contributed to the strengthening of business and innovation thinking at the post-graduate level in Universities B and C. In particular, business-incubation students proposed very detailed examples of services with clear advantages. We think this reflects willingness on their side to consider new widely discussed services or services experienced in their respective companies.

TABLE 3. STUDENTS' CHOICE OF SERVICE MODELING THEME

Type of service	Link to MITI's Classification Table of Industries (2005 edition)	Number of related student works	Breakdown		
			University A IT department undergraduate students	University B (1st, 2nd time) MBA graduate students	University C Business incubation students
Retail	73. Commerce	11	6	5	0
Finances and insurance	74. Finance/insurance	1	0	1	0
Transportation and logistics	78,82,83.Transportation/logistics	9	5	4	0
Mobile phone service	86. Communications	6	2	4	0
Information / broadcasting services	87,88. Information/broadcasting	4	3	0	1
Services using the Internet	89.Internet-ralated services	10	6	3	1
Public services	91.Public etc.	3	0	3	0
Education / research services	92,93.Education / research	9	3	5	1
Medical / care-giving services	94-97.Health providers, health insurance, care-giving	9	5	4	0
Lease and rental services	96.Lending / borrowing things	3	1	2	0
Machine maintenance services	101.B2B services (machine repair)	2	0	0	2
Solution-providing services	101. B2B services (others)	5	0	4	1
Amusement services	102.Amusemsnt	7	4	3	0
Restaurant / bar services	103.Restaurants/cafés/bars	19	7	12	0
Lodging / tourism	104.Lodging business etc.	5	1	4	0
Daily life / childcare services	106.Other personal services	8	3	4	1
Crime prevention / security services	106. Other personal services	2	2	0	0
Totals:		**113**	**48**	**58**	**7**

B. Modeling completeness

In order to investigate the degree of modeling completeness, we counted the number of properly described model elements, and arranged them as shown in Table 4. The numbers in the table were obtained by considering the modeling diagrams in each report and classifying each element depending of how appropriate it was expressed as "Properly expressed" (marked "○") or, in cases with non-perfect descriptions, as "Partially expressed" (marked "Δ"), and summing up the numbers for each model element. The data includes all students from University A and those of the University B MBA students, who actually performed the modeling according to the method present here, or a total of 70 students. Eight cases were excluded, due to usage of other modeling methods or insufficient understanding.

Figure 2 shows the distribution of the 70 participating students (not including the second survey in University B) according to how many model elements they described satisfactorily. The conclusions that can be drown from Table 4 and Figure 2 can be itemized as follows:

TABLE 4: COMPLETENESS OF SERVICE MODELING

Model elements expressed		Number of model elements expressed			Comprehension percentage against the total of 70 students
		○ Properly expressed	Δ Partially expressed	○＋(Δ × 0.5)	
Total number		319	39	338.5	
Breakdown	Provider / User	68	2	69.0	98.6 %
	Contents / Channel	61	9	65.5	93.6 %
	Knowledge	36	6	39.0	55.7 %
	Service Manager	39	9	43.5	62.1 %
	Service Infrastructure	36	4	38.0	54.3 %
	Usage Client	24	6	27.0	38.6 %
	Place of Usage	37	2	38.0	54.3 %
	Manufactured Goods	20	1	20.5	29.3 %

(1) Except of two cases lacking details, the service *Provider* and *User* were properly identified in almost 100% of the models. Service *Contents* and *Channel* were correctly given in more than 90% of cases.

(2) While the Service Manager was well described in 50 – 60 % of all students' works, the comprehension of *Usage Client* was around 30%.

(3) As to *Service Infrastructure* and *Place of Usage*, they were well represented in more than 50% of models.

(4) The role of *Knowledge* was properly described in more than half of the models, however *Manufactured Goods* were satisfactory analyzed in only about 30% of cases.

(5) At average, students identified properly 5.0 model elements with a distribution with two peaks.

First we consider the difference of (1), (2) and (3). It can be partially contributed to the relative easiness to understand the *Provider – User* axis of (1) from system engineering point of view. Other factors are that the roles and positioning of provider and usage stakeholders may not suffice as a base for identifying the management and infrastructure. Moreover, the observed difference may reflect the sometimes weak or non-existing role of *Usage Client*, depending on the type of service, in particular for B2B services.

As to (4), it may be that for the students, who had not yet studied knowledge economics, describing the rather intangible *Knowledge* contained in the service was a little high hurdle. Furthermore, one can conclude that their understanding of the distinction between the roles of *Manufactured Goods*, *Service Infrastructure* and *Place of Usage* was not enough yet.

This analysis may explain the peaks at 4 – 4.5 and 6 – 6.5 in the number of model elements properly identified per student in Figure 2. Still, from all 70 students, 28 students (40%) described well 6 and more model elements.

We intended to focus next on the difference between the undergraduate students from University A and the graduate students from University B, however the description completeness of the latter varied widely and was not suitable for comparison. As to the students from University C, they were not included in Table two due to their character strongly focused on business details.

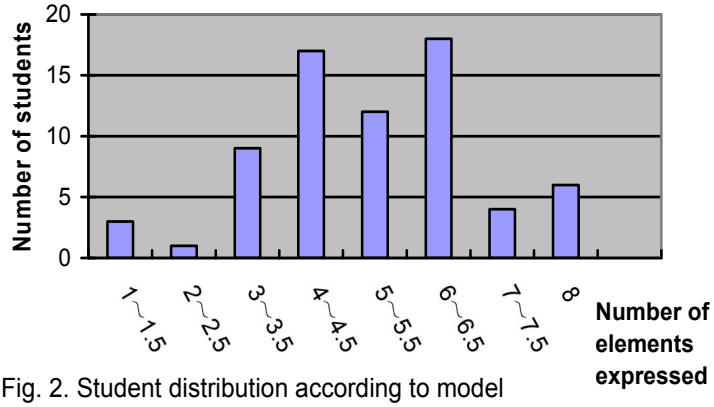

Fig. 2. Student distribution according to model element comprehension

C. Using the modeling to understand the relation to IT and innovation

In order to use the students' service modeling work to investigate how well they understand the relationship to important concepts, such as IT usage, service human resources training, efficiency increase, and customer satisfaction, we analyzed the presence or absence of discussion of these topics in each student's report and the student's comments about impression from the modeling. From this analysis, we made the following observations:

1) Among the students from all groups, about 60 -70 % commented on the relation to IT and innovation, and the same students, with a few exceptions, presented modeling of high completeness.
2) The students' expectations towards service research included wide selection of comments from "relevance to my graduation work theme", to "product features", and "personal response", as well as the service's "intangibility" and "response to complexity".
3) The impression from the modeling is visible from the following representative responses:
   - General evaluation of the modeling: "Formulating the service concept itself is very interesting.", "I became aware of various methods for service description", "I was able to express my own experience.", "I had a chance to consider in depth some everyday services."
   - Benefits of the modeling approach: "Seems useful as service description method.", "The organization based on the provider – supplier axis is easy to understand.", "The Japanese inn concept can be explained at a glance.", "There is potential for new discoveries and perceptions."
   - Potential of the modeling method: "Can be used to discuss the creation of new businesses or services.", "Becomes base for service systematization.", "A way to a method concerned with the growth of services for the user."
   - Problems with the modeling method: "It is not easy to express what is left after abstraction.", "It becomes easier to understand the structure and process, but on the way one becomes unable to follow", "Separate discussion of business conception and potential for implementation is needed."

D. Discussion summary

1) The choice of modeling theme diversifies with to the progress of student interest level from familiar everyday life → business → innovation → up to creating business advantages. Furthermore the interest changes from B2 over B2B to B2B2C in undergraduate, graduate and carrier-track students, in this sequence. This must be taken into account in the explanation of the model and

in the choice of examples.

2) In the modeling performed by the students themselves, naturally the provider – user axis is easily understandable, and 40% of all students describe correctly most model elements. As to the management-related elements, such as abstracting the service-related knowledge existing on the provider manger side, even with non B2B2C services, correct identification does not go over 50 – 60 %. This indicates the need for future integration of management points of view.
3) The students do not understanding how to distinguish well enough the service-related infrastructure (equipment), place of usage, and the manufacture goods directly related to providing and usage. This indicates the need for to improve their explanation as model elements.
4) Students, such as those with highly complete modeling, show awareness of the interrelationship with IT and innovation, and they express positive impression about the potential for service systematization or for application to services of their own immediate field of experience.
5) On the other side, there were opinions that applying the model is not easy once missing some of the explanations, and that putting the interest to the business model first weakens the motivation for application in some cases.

V. ACTION RESEARCH BASED ON THE RESULTS FROM THE TEST OF THE MODELING METHOD

Reflecting the results from the service modeling application and their discussion from the previous sections, one year later we undertook additional action research. It consisted of re-evaluating the modeling method, by carrying out again a similar survey in University B, and obtaining in interviews with service designers from the industry their assessment of the method's application in their actual service business. Here we will outline only the examples related to the data-center industry.

A. Modeling applications by the students and its results

The students group participating in the repeated modeling consisted of 35 MBA graduate students from University B (including 27 foreign students, which are mainly from China and other Asian countries supported by the related explanation in English), and the evaluation was performed as explained in Section III. However, we upgraded the lectures with additional explanations, reflecting the following action items:

(a1) Examples matching the students' background knowledge were included and the explanation of the management elements was improved.

- Using METI's technology map materials and the roadmap hierarchical framework, we explained the need of not only technology progress, but also of a clear service concept, for the achievement of the vision for the future.
- More clear statement was made that, in addition to the back-stage IT/system technology, one of services major needs is training / upgrade of front-stage service human resources, and that service managers taking into account the tradeoffs with other important elements are indispensible.

(a2) Explaining where necessary the relationship to other methods outside the scope of service realization:

- Examples for the development of the business environment related to the service realization.,
- Examples of the development of business environment and the related service concepts or service value development,
- Using service modeling element templates, and explaining through examples more clearly the elements' differences.

(a3) Rethinking as a model element the position of the manufactured goods related to the service

- In particular, making clear the focus on the manufactured goods related to the points where service user, place of usage, service contents and channel interface.
- Broadening the image of service-related manufactured goods, by explaining business examples using the service robots emerging in recent years in Japan

Table 5 presents, in the same format as Table 4, the level of completeness of the enhanced model (comprehension percentage) about the repeated model application. Here we picked up only the cases where the present modeling method was chosen, and summed up the various responses.

TABLE 5: CHANGED OF SERVICE MODELING COMPLETENESS (COMPREHENSION PERCENTAGE)

		Universities A+B total	University B (1st time)	University B(2nd time)	Difference
		70 students (including 8 foreign students)	19 students (including 8 foreign students)	26students (including 19 foreign students)	
Total number of described elements ○＋(Δ × 0.5)		338.5	77.0	182.5	
Comprehension percentage	Provider / User	98.6 %	100 %	100 %	same
	Contents / Channel	93.6 %	97.4 %	92.3 %	small decrease
	Knowledge	55.7 %	52.6 %	92.3 %	improved
	Service Manager	62.1 %	42.1 %	90.4 %	improved
	Service Infrastructure	54.3 %	31.6 %	88.5 %	improved
	Usage Client	38.6 %	28.9 %	78.8 %	improved
	Place of Usage	54.3 %	36.8 %	96.2 %	improved
	Manufactured Goods	29.3 %	15.8 %	69.2 %	improved

The results in Table 5 demonstrate improved modeling completeness both within University B, and when compared to the parent data set including both Universities A and B, in spite of the increased number of foreign students. From this it can be concluded that the present modeling method can express the elements of various services and meets the expectations of high analyzing potential regarding IT or human resource excellence.

B. Discussion of the service planers interviews

In addition to the work with students, we performed direct interviews or discussions with service planners about several service examples, such as data center service and music entertainment service applying robots, as follows:

(b1) Interviews about their service industry experience, participation in the planning of service business conception, service team composition and marketing, service conception and analysis methods

(b2) Analysis by the authors of the service value shift in the industry and describing the service elements in the modeling

(b3) Meeting again to explain the modeling materials, and extracting from the interviews the present state and needs of service needs shift and service structure, the potential for using the model for conceiving new services, and further necessary conditions

Below we present service modeling results and their evaluation based on one example from the data center (DC) service industry, discussed in interviews with one experienced department-head-level service designer from Company A.

As outline of the results from the analysis (b2), we present in Table 6 the shift of data center (DC/iDC) service business and its value, while Table 7 shows the data service business of Company A.

TABLE.6 OUTLINE OF THE SERVICE BUSINESS AND VALUE SHIFT OF DATA CENTER (DC/IDC) SERVICES

Background and value of business service	*S1:Fisrt generation from mid 1985*	*S2:Second generation from mid 1990*	*S3:Third generation from start of 2000ies*	*S4:Next generation From 2010*
Shift of business environment	*Privatization of NTT,*	*Focusing on main business, rise of Internet*	*2001 9/11 attacks, 2006 Tokyo earthquake, 2007 Personal Info. Protection*	*Green IT, SOX Law related business, service-oriented model*
Shift of technology	*Mainframe-centered model*	*Client-server distributed model → shift to iDC*	*Full usage of Web/ASP Mobile phones & equipment*	*Use of SaaS/Web2.0, Container DC(MS/Sun) Crowd computing*
Service business strategy	*Large computing centers, renting-out*	*Housing service (taking physical charge of customers' servers / racks)*	*Hosting service (rental) , disaster prevention, SLA contracts → Total management service*	*On demand through virtualization Service (small-step investments) IT damage insurance*
Other related industries	*Computer makers*	*Software PKG makers, → Network equipment makers too*	*SIer, rental server businesses, network providers included*	*Appli. Provider such as Salesforce.com*
Place of service usage	*Specialized office work usage*	*Network usage in the office*	*Personal or mobile use*	*Increased usage by small and mid-size businesses*
Service needs	*Use of resources not available within the company*	*Network usage outside the company → cutting equip. investment*	*Outsourcing of ope. & Mgmt. → Cut of TCO, easily HQ., reliability & expandability*	*Improving the business environment Cutting electric power consumption*
Participation level of service users	*Use of fixed-form providing service*	*Use only the needed amount of company-owned and network equipment resources*	*Answering customer demand for added value → from owning to usage*	*Transformation into business partnerships Flexible response in dialogue with customers*

TABLE 7 DATA-CENTER (DC/IDC) BUSINESS OF COMPANY ATOWARDS "MOST ADVANCED APPLICATIONS AND MOST TRUSTED PLATFORMS –SAAS SERVICE" －THE SHIFT OF SERVICE MODELING ELEMENTS

Model element	*S1:Fisrt generation from mid 1985*	*S2:Second generation from mid 1990*	*S3:Third generation from start of 2000ies*	*S4:Next generation From 2010*
Service provider	*Info. processing engineers*	*SE operator (Direct use by customer)*	*Service engineers*	*Management SE*
Service user (end user)	*Enterprise staff , Specialized experts*	*Enterprise staff (including network)*	*Enterprise departments (office / mobile workers)*	*Management departments (including individual use)*
Contents (HW/SW) Channel	*Office processing features, Data transmission lines*	*Housing (physical charge) , Mail, WWW, Internet lines*	*Hosting (Renting-out resources) /ASP, web model, BB network lines*	*On demand / service oriented model*
Service manager	*Computer center business operators*	*DC business operators(commu. & computer makers)*	*DC business operators (including network and IT providers)*	*DC business operators (shift to business partnerships)*
Service infrastructure	*Mainframe centered model*	*Distributed client-server model / Internet lines*	*Disaster prevention, Security feasibility, /ASP model PKG*	*Green IT, Sustainable business mode facilities*
Usage client	*None → info. system biz. from the same group*	*Enterprises from the same company group*	*NW. business, SIer & rental server business operators*	*Application. Provider ?*
Place of usage	*Department specialized in office work*	*Network environment in the office*	*Office & Mobile work environment, Personal use*	*Virtual office environment*
Knowledge	*Usage time*	*Usage history*	*Disaster response & obstruction security*	*Energy, management, viruial technologies*
Manufactured goods (Interaction points with customer)	*Terminals for usage*	*Office PC*	*PCs, advanced terminals, mobile PCs, mobile phones*	*Wireless PC?*
Business Achievements			*"2008 IDC Department General Achievement Grand Prix"*	

The interview results (b3) are shown below.

TABLE 8. RESULTS FROM SECOND SERVICE-MODELING INTERVIEW

Present state and essentials of service needs shift and service structure	- "In the DC business, due to the rather advanced overcrowding (visualization) by SaaS (Software as a Service), the wisdom of the rather high outsourcing rate of hard- and software became questionable." - "The direction of service needs shift changes vehemently, and at present one cannot sufficiently follow it, however, one must still understand the near future by outlining a long-term concept." - "The concept of service design is not established well enough. In my department there are many engineers, and therefore the topic is frequently being postponed, but in spite of this, formulating a clear concept is necessary."
Potential of the present modeling for conceiving new services	- "As the number of customer request for DC usage business or service proposals is increased, new ideas became necessary to get advantage over the competitors, and it became important to get innovation hints hidden in different fields. The present method may support such cross-usage. For example, ideas how to raise the service profitability can be conceived at the service usage place (environment) together with partner companies." - "Describing and consulting past examples , as well as describing services based on a clear concept of the future business are very important. It seems necessary for present-state analysis, too."
Further requirements to the present modeling	- "The customer does not need many diagrams, a relation to product turnover is needed" - "A relationship is needed to other business widely used proprietary and open model diagrams"

VI. CONCLUSION AND OPEN ISSUES FOR FUTURE WORK

In order to evaluate the validity of the inter-disciplinary service modeling proposed by the authors, they carried out student theme-work testing at several universities, accompanied partially by action research, as well as interactive discussion and interviews with service planers from the industry. The conclusions of this research can be summarized as follows:

1) From the service modeling results of the some 100 students from the three universities, we found that, with rising the students skills in applying the method, they can apply it to various fields or industries, and it can provide common-scope material for the discussion of the relationship of IT, human resources training, and customer value with the service.
2) We confirmed, through discussions with service designers from the industry, that the present method is appropriate for getting a global view of the service value, corresponding to the business environment and the shift of relationship between the structural elements of the data center service industry, and that the modeling has potential for practical use, as a common cognitive base of teamwork towards conceiving the growth and structure of future services.

As open issues for future work one can point out (1) organizing the various service innovation examples in library form, (2) explaining the relationship with modeling in the IT field, and (3) discussing the link to positioning strategy planning (e.g. relation to the Service Classification Hierarchy according to Maslow's theory[6], which is the item a. in the section I.

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