Service Oriented Cost Accounting

Utilization-based Accounting and Charging of IT Service Costs

Christopher Schwarz
Information Management
FH JOANNEUM Gesellschaft mbH
Graz, Austria
e-mail: Christopher.Schwarz@fh-joanneum.at

S.Schmidt, A.Sellner, E.Zinser
Information Management
FH JOANNEUM Gesellschaft mbH
Graz, Austria
e-mail: Erwin.Zinser@fh-joanneum.at

***Abstract*—Due to the immanent complexity of Information Technology Outsourcing (ITO) partnerships and their underlying service technology, a sustainable management proofs to be highly challenging and inefficient. Being confronted with multidimensional business relations and complex services meshes, the accounting and charging of service costs can be opaque and therefore incalculable. In this paper we propose a novel approach for service-oriented utilization-based cost accounting and cost charging. The presented model is based on a self-developed semantic service catalogue following the IT Service Management principles of the IT Infrastructure Library (ITIL). The derived results eventually enable IT service providers to offer highly innovative services with operational expertise and a contracted level of service quality at a predictable cost level. The illustrated "Proof-of-Concept" gives evidence of the practical relevance in service-oriented scenarios as well as the high flexibility and adaptability of the presented cost model.**

Keywords-component; Information Technology Outsourcing; Service Oriented Cost Accounting; IT Service Catalogue Management; Capacity Management

I. INTRODUCTION

Due to increasing competitive constraints and constantly changing market conditions, companies have to operate more and more flexibly in today's business. Therefore, companies often decide on IT outsourcing (ITO). ITO is defined as "the handling over to a third party management of IT/IS assets, resources, and/or activities for required results" [1].

Sharing a common understanding for service technology aspects and the related business processes as well as the presentation of accurate information about contemporary business activities are crucial factors for the overall performance in ITO relationships. Several software vendors try to address these challenges by providing a comprehensive set of outsourcing relationship management (ORM) applications. Nevertheless, contemporary software solutions suffer from technological restrictions in crucial domains including IT Service Management (ITSM) and Financial Management. From the perspective of service providers, the management of numerous customers and services as well as the service billing become critical issues due to non-transparent, multitenant service dependencies. Changes are difficult to cope with as a result of missing architectural agility, flexibility and adaptability. It is hardly possible to leverage actual software solutions to answer questions regarding the complex dependencies and relations of the enterprise-wide service and business information without significant manual processing of the information returned from conventional search results.

To manage the abovementioned complexity, Service Oriented Architectures (SOA), in combination with the principles of ITSM, provide a contemporary concept for designing flexible and adaptable IT infrastructure architectures. The guideline IT Infrastructure Library (ITIL) is the worldwide de-facto-standard for service management and contains broad and publicly available professional documentation of good practices on how to plan, deliver and support IT service features. Nevertheless the arising lack of transparency in complex service meshes and the multiple use of services in a heterogeneous system landscape require new concepts for measuring service utilization as a basis for pricing and charge calculation.

II. THEORETICAL FOUNDATION

SOA represents a methodology to increase flexibility and agility in organizations. [2] describe SOA as "considering a company as an accumulation of linked services that are available in the organization". Each application in a SOA contains several services, which, in combination, represent an entire business process [3]. The service consumer is offered the provider's IT services in terms of a service catalogue, which comprises all services that are actually available for the consumer [4]. Therefore, the principal task of SCM is to provide a central, actual and standardized source of information concerning active IT services [5]. The service catalogue contains an external, customer-oriented view and an internal, provider-related view, and includes service level information [6]. The service catalogue concept is used as the basis for the consumption-based accounting model as it illustrates provided IT services and their mutual dependencies including the required contracts.

According to ITIL the discipline of SLM is defined as "the process responsible for negotiating achievable service level agreements and ensuring that these are met". Service level objectives (SLO) that are mutually agreed on in service level agreements (SLA) define the expected quality and quantity of the provided IT services [7]. Therefore, SLAs build the basis for pricing and chargeback models [8]. SLAs specify the concrete liabilities and consequences in case of

SLA violation for both outsourcing parties [9]. Capacity Management ensures that operative and planned IT services match the actual and future requirements of an organization [10].

ITIL does not recommend a specific charging model for IT service provision. Existing literature proposes different charging models (e.g. per user, per transaction, subscription-based, depending on service volume). When choosing a charging model, a simple and transparent cost calculation has to be ensured [8] [11]. Furthermore, different pricing models for IT services are in existence (e.g. Price = Costs (+ Profit Margin), Opportunity Costs) [12]. [13] states that classical cost accounting systems are usually not suitable for the calculation of IT service costs, as general expenses are increasing and direct costs are declining. Therefore, activity-based accounting has to be considered, whereby general expenses are distributed according to the costs-by-cause principle.

III. Related Work

Specific literature on service oriented cost accounting currently is rather scarce, usually focusing on theoretical approaches. One approach is represented by [14], who mainly concentrates on the design and creation of an HTML-based service catalogue by means of the IT architecture and ITSM Tool ADOit®. The cost calculation and pricing for the defined services are implemented by means of a product- and process-oriented cost accounting [14]. Another related work [15] focuses on the design of a service-oriented cost model for Internet Service Providers (ISP) called COSMOS to create transparency for understanding ISP costs. A rather mathematical-focused IT service charging approach is defined by [16], who describes services as a mesh of “used”- and “support”-relationships represented in a service graph.

With respect to the aforementioned related approaches, diverse weaknesses can be identified. Firstly, most of the approaches focus on internal service charging and do not consider external cost accounting in case of outsourcing relationships. Secondly, outsourcing is often considered from a customer’s point of view, whereby specific difficulties concerning service cost accounting are not shown from the service provider’s perspective. Thirdly, the necessity of utilization-based accounting is often theoretically mentioned as important for ensuring cost transparency. Unfortunately, no practical approaches for measuring and determining utilization are presented. Furthermore, the complex dependencies of services are often left out of consideration.

For these reasons, we have developed a service-oriented cost accounting model with a special focus on ORM that particularly considers the IT service provider’s point of view and the management of complex service meshes.

IV. Practical Implementation

A. *Cost differentiation according to cost types & maturity*

The developed cost accounting model differentiates between the cost types shown in table 1 [5]. Cost assignment is often ambiguous as many costs can either be charged as direct, indirect or variable costs. Moreover, the cost accounting model distinguishes between one-time costs, periodic costs as well as per-unit costs. According to the cost maturity type, either the time factors (e.g. month) and/or the unit factor (e.g. kWh) has to be considered for calculating costs for a specific period.

TABLE I. Cost types considered in the accounting model

Cost Accounting Model	
Cost Type	**Example**
Direct costs	Services (e.g. Hardware, Software, Acquisition costs)
	Service Activities (e.g. Installation, Support)
	Contracts (e.g. MTC, UC, SLA, OLA, Licenses)
Indirect costs	Infrastructure costs (e.g. Rental fees, Network costs)
	Personnel costs (e.g. for PR and Marketing)
Variable costs	E.g. General infrastructure costs, Personnel hours/days

B. *Developing a consumption-based cost structure*

The most important concept for the service-oriented cost accounting model is the consumption-based calculation and charging of costs. Every resource has a certain amount of capacity, represented by capacity types (e.g. RAM) and capacity units (e.g. Megabyte). These capacities are consumed by services. The costs are calculated on the basis of these consumed capacity units. Besides the calculation of service costs, the capacity information builds the basis for placement recommendations of new services. As exemplified in Fig. 1, the total capacity units of a service have to be identified. Afterwards, it is determined, if Service A can fulfil the required capacity amount for all linked services.

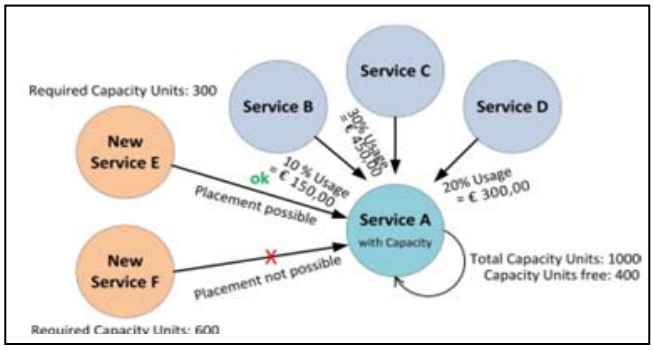

Figure 1. Capacity planning for comsumption-based cost calculation

Fig. 2 illustrates the service catalogue’s structure used in the developed cost accounting model. A service package comprehends the scope of service that is specified for a customer. It is composed of different service modules, which can be chosen by the service customer. Thus, the service package acts as a container for service modules and combines them in order to meet the customer’s individual requirements.

SLAs are linked to the service module in the business service catalogue. Service elements are located in the technical service catalogue and define technical services or components, which are essential for the technical implementation of the service. Service elements can have mutual dependencies or can be linked to different service modules, respectively. MTCs and OLAs are linked to service

elements. Furthermore, service activities (e.g. software installation, maintenance) are related to service elements. Life lines describe the service dependencies of the customer's business service. To calculate the total service price for the customer, the costs of each service module are summed up on the service package level.

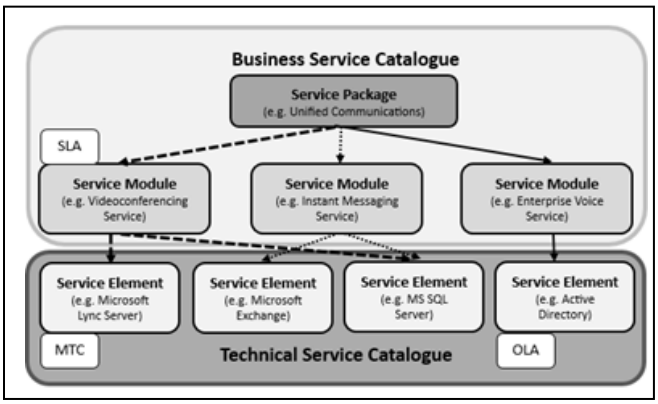

Figure 2. Service Catalogue Structure including Package Life Lines

C. *Designing the service catalogue data model*

The implementation of the service catalogue bases on a hierarchical database model developed by [17]. As the development of a service oriented cost accounting model is the goal of this paper, we only focus on the accounting-specific part of the database model. The relevant database objects "CapacityItem", "CostItem" and "UtilizationItem" represent the core structure for implementing the cost accounting logic. The "CapacityItem" entity and the related outriggers "CapacityType" (e.g. RAM) and "Capacity Unit" (e.g. Megabyte) represent available service capacities and determine, where costs incur. The entity "CapacityItem" is related to service items by means of an Entity-to-Entity-Relation in the "RelationFact" table, which is basically used for the life line implementation. Thus, it is possible, to add capacities to service elements, service activities and contracts, and to determine, where capacities are assigned and, subsequently, where costs can incur. The entity "Cost Items" is used to consider financial aspects in the service catalogue. Its subordinate tables represent the three different forms of incurring costs:

- Cost accounting items define the cost type, the cost maturity and interval as well as the cost center. For determining costs for consumed capacities, the cost accounting items are related to the respective capacity items by means of an "Entity-to-Entity" relationship.
- Cost charging items are linked to service packages, service modules and SLAs, and define the price the consumer is charged.
- Cost Penalty Items represent penalties that have to be paid in case of SLA violation.

The Entity "UtilizationItem" determines the degree of capacity utilization by a service item and defines, where and to what extent capacities are used. Therefore, the utilization item is linked to the service item by an "Entity-to-Entity"-relation. As a result, the capacity consumption of sold business services can be identified and the costs, which are stored as cost accounting items, can be apportioned throughout the service mesh.

Fig. 3 illustrates the cooperation of service items, capacity items, utilization items and cost items in the data model. Capacity of a service item is consumed by the service item itself or by related service items. The SI possesses available capacities and, therefore, is related to a capacity item (CAPI). The utilization item (UI) defines the amount of capacity that is consumed by the SI. To determine all costs for consumed capacities, one or more cost accounting items are linked to the respective capacity items. Due to the fact that service items are assigned the respective capacity consumption by utilization items, the costs, which are gathered by cost accounting items, can proportionally be distributed over the service mesh. The costs for SI 1 results from its 30% own utilization (CAPI 1). The total costs for SI 2 are calculated as follows:

Total costs (SI 2) = Own consumption (CAPI 2) + Indirect consumption (CAPI 1)

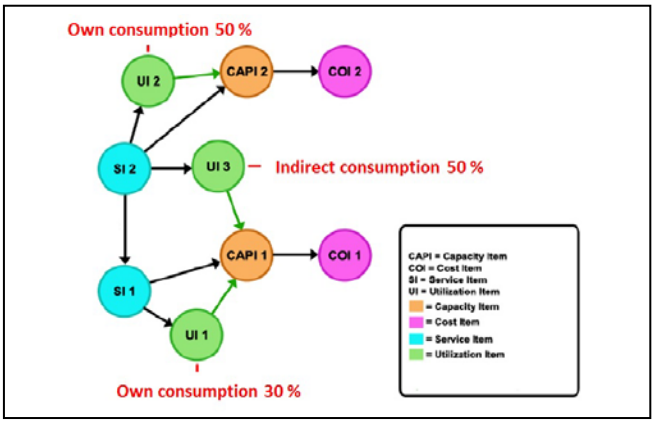

Figure 3. Exemplary cost calculation for a service item

As the indirect consumption of a capacity is related to a service, the composition of a service's costs becomes obvious. By means of the life line it is possible, to determine the commercial background for the proportional assignment of utilized capacities and the associated costs. All costs, which are indirectly linked to a service due to their dependencies to other services, can be calculated by means of the life line and the utilization information. Thus, the costs for one service module are calculated based on the proportional costs of the service's subordinated service items, which build the life line of the service module. To record the calculated costs, the service module is linked to a capacity item of type "Service", to which, in the following, a cost item containing the calculated service module is assigned. The type "Service" means that the capacity item represents the service performance of the service module, which is assigned to the service module with a 100% utilization. As a result, also the service provision costs of the service module are identified to 100%. The total costs for one service package are calculated by summing up the costs of all related service modules.

V. PROOF OF CONCEPT

In the following proof of practicability, service customers are provided a data center platform for the operation of virtualized Operating System Environments (OSE) on a rental concept. Service charging is done monthly and bases on proportional as well as on usage-bound costs. The intended contribution margin for the service charging against the customer amounts to 40 %.

Fig. 4 illustrates the service mesh for the realization of the virtualization platform. For the required datacenter, two physical servers, one central storage and one collectively used Internet access are used. The three hardware devices are cooled by a mutually utilized air conditioning system. The two servers have individual maintenance.

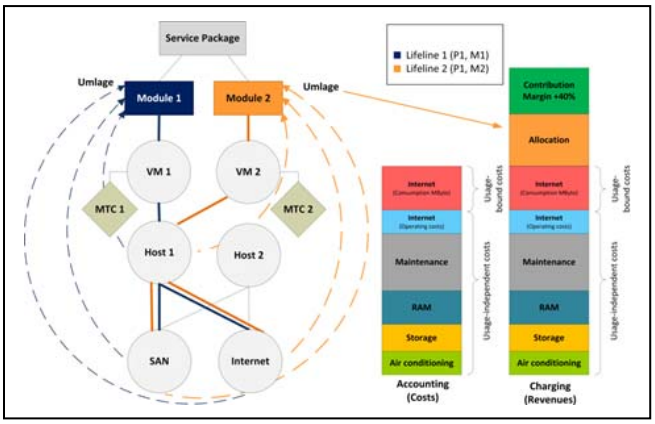

Figure 4. Example - Service Mesh and Cost Accounting/Charging

For service charging, all costs, which occur throughout the life line of a service package, and a contribution margin have to be considered. The example shows that different cost types (e.g. direct costs, direct usage-bound costs, general expenses caused by indirect/direct service dependencies) can be calculated. According to the algorithms for the distribution of general expenses and costs caused by direct or indirect service dependencies, costs for the required infrastructure are calculated. Costs/Unit per month for one-time-costs are calculated by dividing the one-time costs by total capacity and depreciation. The total service package costs are calculated based on the sum of service charges for related service modules. The costs per service module are deduced by the number of required VMs as well as the respective apportioned costs of the underlying IT infrastructure. The real consumption values are extracted out of monitoring systems and are recorded in the "Utilization item" table fields. The apportionment of indirect costs can be implemented by means of utilization items. Besides the cost accounting, several key performance indicators (KPI) (e.g. capacity placement recommendation, Break-Even Point Analysis, Service Performance Indicators) can be deduced by means of the developed cost accounting model.

VI. CONCLUSION

As the presented service-oriented cost accounting model is integrated in and based on a semantic service catalogue concept, commercial information, service dependencies and, as a result, complex service meshes with multi life line relations can be managed. By means of life lines, it is identified, which sold business service causes a service item's capacity utilization. Thus, transparent capacity planning, optimal resource utilization and forecasting as well as decision support become possible. Modeling relations between services and capacities as well as the related cost elements, respectively, represent the key aspects of the accounting model. In this context our future work and further research will be focused on the use of Semantic Web Technologies, most importantly the ability to infer implied information.

[1] Willcocks, Leslie und Kern, Thomas. 1998. IT outsourcing as strategic partnering: the case of the UK Inland Revenue. European Journal of Information Systems. 1998, Bd. 7, 1.

[2] A. Paschke and M. Bichler, "Knowledge representation concepts for automated SLA management," Decision Support Systems, no. 46(1), p. 187–205, 2008.

[3] M. Kloppmann, D. König, G. Pfau und M. Scheible, „Von singulären Web Services zu integrierten SOA-Plattformen: Die Evolution serviceorientierter Architekturen und Anwendungen," in IT: Technologien, Lösungen, Innovationen, Heidelberg Berlin, Springer Verlag, 2007, p. 7–22.

[4] M. Beims, IT Service Management in der Praxis mit ITILv3, Hanser Verlag, 2008.

[5] OGC, ITIL V3 - Service Design - Best Practice, London: The Stationery Office, 2007, p. 301.

[6] F. Victor, Optimiertes IT-Management mit ITIL, Wiesbaden: Vieweg, 2005.

[7] C. Simons, IT Service Management mit ITIL V3 - Pocketguide, BoD - Books on Demand, 2010.

[8] J. McGovern, O. Sims, A. Jain and M. Little, Enterprise Service Oriniented Architectures: Concepts, Challanges, Recommendations, Dordrecht, Niederlande: Springer-Verlag, 2006.

[9] T. Gründer, IT-Outsourcing in der Praxis - Strategien, Projekt-management, Wirtschaftlichkeit, Berlin: Erich Schmidt Verlag, 2004.

[10] J. v. Bon, Foundations of IT Service Management Based on ITIL V3, Zaltbommel: Van Haren Publishing, 2007.

[11] R. Addy, Effective IT Service Management, Berlin Heidelberg: Springer-Verlag, 2007.

[12] M. G. Bernhard, H. Mann, W. Lewandowski and J. Schrey, IT-Outsourcing und Service-Management: Praxisbeispiele - Strategien - Werkzeuge, Düsseldorf: Symposion Publishing, 2003.

[13] A. Gadatsch, Masterkurs IT-Controlling, Wiesbaden: Vieweg, 2006.

[14] B. Lindenthaler, IT-Services und ASP: Design und Erstellung eines Service-Katalogs für Application Service Provider, Wien: Masterarbeit Universität Wien, 2008.

[15] P. Reichl, P. Kurtansky, J. Gerke and B. Stiller, The design of a generic service-oriented cost model for service providers in the Internet (COSMOS), Wien/Zürich.

[16] H. Kunde, "SOO (Service Orientierte Organisation)," 2009. [Online]. Available: http://www.service-orientierte-organisation.de/.

[17] G. Wagner, Semantik ITSM, Graz: FH Joanneum Graz, 2012